المجلّة الذَّوْلية للعُلوم والتقنية
International Science and Technology Journal

ISTJ

المعهد العالي للمهن الشاملة - قمينس

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International Science and Technology Journal

ISTJ

عدد خاص
Special Issue

المؤتمر الثاني للعلوم الطبية والتقنية

2nd Conference on Medical & Technological Sciences

15 - 16 / jULY 2018   2018 يوليو 16-15

عدد خاص

بالمؤتمر الثاني للعلوم الطبية والتقنية بمدينة قمينس

تنظيم المعهد العالي للمهن الشاملة– قمينس

وبرعاية العديد من مؤسسات التعليم العالي والشركات الخاصة والعامة

تحت شعار (توعية – تثقيف – تعليم)

المؤتمر الثاني للعلوم الطبية والتقنية

2nd Conference on Medical & Technological Sciences

تحت إشراف مركز العلوم والتقنية للبحوث والدراسات

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يومي الأحد والاثنين (15 – 16 /07/ 2018م) بمقر المعهد العالي للمهن الشاملة– قمينس

في هذه المجلة...............

✔ لا تعبر الآراء التي تنشـر في هذه المجلة إلا عن رأي أصــحابها، ولا تمثل بالضرورة عن وجهة نظر المجلة أو هيئة تحريرها.

✔ يتحمل المؤلفين كامل المسـؤولية القانونية والأدبية على ما ورد في أوراقهم من بيانات و معلومات.

✔ المجلة تقوم بالتحقق من أن الورقات غير منشورة سابقاً تحت نفس العنوان ولا تتحمل مسؤولية نشر بقية المحتويات للورقة.

✔ حقوق الطبع والنشـر محفوظة للمجلة، ولا يسـمح بإعادة طبع أو نسـخ أي جزء من المجلة بأي شكل أو وسيلة إلا بأذن مسبق.

المؤتمر الثاني للعلوم الطبية والتقنية

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كلمة العدد

الحمد لله رب العالمين حمداً كثيراً على نعمته التي أنعم الله بها علينا و ألهمنا و وفقنا لإنجاز هذا العمل. والصلاة والسلام على معلم البشرية سيدنا محمد صلى الله عليه وعلى آله وصحبه وسلم تسليماً.

إنه لمن دواعي سرورنا أن نشهد بتوفيق من الله صدور **هذا العدد** من **المجلة الدولية للعلوم و التقنية** والذي خصص لنشر الأوراق العلمية التي تم عرضها في المؤتمر الثاني للعلوم الطبية و التقنية الذي عقد **بمدينة قمينس الأبية** و الذي مكّن البحّاث المهتمين في مجال العلوم الكهربائية و الالكترونية و علوم الحاسب الآلي من عرض أخر أبحاثهم العلمية ونشرها على صفحات هذه المجلة لتوفير و إعطاء المعلومة والنتيجة الصحيحة لطلاب العلم و المعرفة.

ومن هذا المنطلق فإن هيئة تحرير المجلة تجدد حرصها الدائم على استمرارية صدور المجلة برصانة و منهجية في البحث العلمي وذلك بإتباع الأساليب العلمية المحكّمة في تقييم البحوث العلمية المقدمة من الأساتذة و البحّاث.

وبهذه المناسبة يسر هيئة التحرير بالمجلة أن تثمن عالياً جهود جميع البحّاث و الأساتذة المهتمين الذين لم تثنهم الصعاب و لم تؤثر فيهم الظروف الشديدة التي تمر بها بلادنا الحبيبة على تقديم كل ما لديهم من جهد للبحث العلمي واختاروا صفحات هذه المجلة لنشر أبحاثهم و أوراقهم العلمية، كما لا يفوتنا أن نتقدم بجزيل الشكر و العرفان لكل من ساهم في إنجاح هذا المؤتمر القيّم من لجنة تحضير و استقبال ولجان تنظيمية أخرى وكذلك لكل من ساهم في تحرير و مراجعة البحوث المقدمة للمؤتمر وتقييمها بأسلوب علمي مميز .

هيئة التحرير

جدول المحتويات:

المؤتمر الثاني للعلوم الطبية والتقنية

2nd Conference on Medical & Technological Sciences

منظومة المرشد الطلابي الالكتروني

كاتب البحث : علاء الدين محمد سالم الدرولى

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ملخص

يستهدف هذا النظام طلبة الجامعات والمعاهد العليا حيث يقوم بتوضيح وترشيد الطالب بالأقسام والتخصصات والمواد ذات الأسبقية وكذلك المواد العامة والتخصصية وكذلك يتيح للطالب معرفة نتائج المواد بالمعدلات الكترونيا وكذلك يحتوى جزء منها على بيانات الخريجين وإمكانية سحب ذلك ورقيا.

ويمكن تحويل هذا النظام إلى تطبيق هاتفي يتيح للطلبة الموجودون في أماكن بعيدة من استعماله بجميع مميزاته بدون الحاجة إلى مرشد متخصص.

قد تم في هذا البحث تجميع جميع المواد المقررة وتوحيد ارقام المواد وعمل الاسبقية للمواد مع اكتشاف اخطاء في الاسبقية وتصحيحها وكذلك تجميع بيانات جميع الطلبة الدارسون حاليا والخريجون من سنوات قديمة إلى الان وربط النظام شبكيا مع مكتب الدراسة والامتحانات وقسم التسجيل وقسم شؤون الخريجون لتحديث بيانات الطالب الذي بدوره فقط يضع الرقم الدراسي لمعرفة أي معلومة تهمه أو طباعة أي ورقة مثل افادة مؤقتة او اثبات مستوى او كشف الدرجات يتم اظهارها في المكتب او القسم المختص للتصديق عليها . ومنا هنا كانت النتيجة ممتازة عند تجربتها في المعهد العالي للمهن الشاملة / قمينس بحيث تم ايصال خدمات للطالب بدون الذهاب الى القسم المختص ووضح للطالب قوانين القبول والأقسام والتخصصات والمواد مع الاسبقية لمساعدته في تنزيل المواد .

Abstract

This system is aimed at students of universities and higher institutes where it clarifies and rationalizes the student in sections, majors and materials of precedence as well as general and specialized materials, as well as allows the student to know the results of the materials electronically, as well as part of it contains the data of graduates and the possibility of withdrawing it in paper.

This system can be converted to a telephone application that allows students in remote locations to use all its features without the need for a specialized guide.

In this research, all the required materials have been collected, the number of materials has been consolidated, the priority of the materials has been discovered, errors have been discovered in the precedence and rectification of the data, and the data collected by all students currently studying and graduates from old years have been compiled and linked to the Office of Study and Examinations. In turn, only put the number of the school to know any information of interest or print any paper, such as a temporary statement or proof of the level or disclosure of grades are shown in the office or the section for ratification.

Here, the results are excellent in the experience of the Higher Institute of Comprehensive Occupations, so that the services of the student were delivered without going to the concerned department. He explained to the student the admission laws, sections, specialties, and materials with the thesis to help him download the materials.

Keywords :VB (Visual Basic),RDBMS(Relation database management system),UML(Unified Modeling Language),SDM(System Development Methodology).

المقدمة

في الجامعات والمعاهد العليا الليبية يكون الطالب في حيرة من امره حين يقوم بالدخول في مجال التعليم العالي وتزداد حيرته حينما يقوم باختيار التخصص او اختيار المواد

International
Science and Technology
Journal
المجلة الدولية للعلوم والتقنية

عدد خاص بالمؤتمر الثاني
للعلوم الطبية و النقنية
يوليو July 2018

والأسبقية الخاصة بالمواد وكذلك متابعة مسار مواده من حيث النتائج والمعدل الفصلي والمعدل التراكمي مما يضطر الطالب دائم التردد على قسم الشؤون العلمية او مكتب الامتحانات للحصول على المعلومة.

وعندما زادت كمية الاستفسارات وزاد الحمل على الإدارات وعدم القدرة على تلبية جميع رغبات الطالب تم توفير أستاذ مرشد ليكون لمجموعة طلاب مما كلف الإدارة نفقات أكثر وصعوبة توفير الكوادر البشرية.

و في وقتنا هذا كان من الضروري الاستفادة من إمكانيات الهائلة لأجهزة الحاسوب من حيث السرعة في البحث وكذلك السرعة في الاستجابة والقدرة الكبيرة في تخزين كميات كبيرة من البيانات والعلوم الحديثة في هندسة البرمجيات والبرامج الخاصة بادرة قواعد البيانات ولغات البرمجة الحديث[1] ، فلذا سوف أقوم في بحثي هذا إنشاء منظومة متكاملة خاصة بالإرشاد الطلابي وتلبية جميع رغباتهم وتوضيح المسار الخاص بالدراسة واستبدال الكادر البشرى بالمرشد الالكتروني يكون متاح لجميع الطلبة.

عرض المشكلة :عدم معرفة الطالب الجديد التخصص المرغوب والمواد الموجودة.

1.   عدم معرفة الأسبقية الخاصة بالمواد التخصص .

2.   صعوبة متابعة الطالب المقيد لمسار نتائجه والباقي من مواده والمعدل العام والتراكم .

3.   الطالب الخريج يجد صعوبة ووقت طويل في معرفة المعدل النهائي وكذلك إمكانية سحب الإفادة ورقيا.

4.   كثرة التعامل الورقي مما يسبب ضياع للأوراق والوقت .

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[1] د.محمد محمد الهادي ، تكنولوجيا المعلومات وتطبيقاتها ، مكتبة الإسكندرية .

5.   اخذ وقت طويل في عمليات البحث عن الطالب أو المادة أو النتيجة .

أهمية البحث :

تكمن أهمية البحث في إنتاج منظومة الكترونية متكاملة تحتوى على جميع حلول للمشاكل السابقة وكذلك إنشاء قاعد بيانات كبيرة تحتوى على جميع بيانات الطلبة والمواد ونتائج المواد والأسبقية للمواد والتخصصات مما يمكن للباحث استخراج المعلومات بعد معالجة البيانات وكذلك استخراج المعرفة بعد معالجة المعلومة كمعرفة التخصص الأكثر رغبا ونسبة النجاح في أي تخصص والإقبال الجيد أو السيئ للتخصصات الموجودة   المؤسسة العلمية أيآ كانت .

مع العلم بأنه سيكون أول نظام الكتروني في الإرشاد الطلابي على مستوى المؤسسات التعليمية العليا في الجامعات او المعاهد العليا الليبية .

تم تجربة النظام فعليا في المعهد العالي للمهن الشاملة قمينس وهو يعتبر أول نظام من هذا النوع لأنه مازال حتى ألان يتم إرشاد الطلاب وتلبية رغبات الطالب وتساؤلاته بطرق يدوية وبشرية وهذا هو الجديد في الموضوع لأنه نظام مرن يمكن تطبيقه على الانترنت أو باستخدام تطبيق هات في للطلاب الدارسون من مناطق بعيدة .

ما هي المنهجيات المستخدمة في التحليل وتصميم النظم ؟

يُشبِّه الكثير من المتخصصين عملية تحليل وتصميم نظم المعلومات بعمل المهندس المعماري، فكما هو الحال بالنسبة للمهندس المعماري الذي يستخدم التصميم المعماري كخلاصة لمتطلبات المنزل. فإن خبراء نظم المعلومات يمتلكون أساليب بناء لتمثيل متطلبات النظام وتصميمه بأسلوب مشابه لأسلوب عمل المهندس المعماري. ويتباين حجم

مشروع بناء نظام المعلومات من مشروع فردي (لمستخدم واحد) إلى مشروع نظام للمعلومات يستخدم من قبل آلاف الأفراد في المنظمات الكبيرة (لعشرات المستخدمين)، وترتب على هذا الحجم الكبير لمشاريع نظم المعلومات بروز العديد من القيود النظرية والعملية التي واجهت خبراء تصميم نظم المعلومات، ومن ثم أصبح مدى ودرجة تعقيد مشاريع نظم المعلومات أكبر بكثير من قابلية مُصمم واحد أو حتى فريق واحد. من هنا فإن بناء نظام معلومات كبير وفاعل بشكل سليم يستلزم اعتماد مداخل نظامية ملائمة تسمح بتجزئة المشكلة المعقدة إلى عدد من المشاكل الأقل تعقيدا ومن ثم يتيح الفرصة لعدد من خبراء بناء النظام بالعمل معا في المشروع. والحقيقة التي يجب إقرارها هنا هي أنه كلما توسع حجم النظام وزادت درجة تعقيده تزيد أيضا عدد الجهات المشتركة في تصميمه وبناءه وقد يستلزم مشروع نظام المعلومات مشاركة جميع الأطراف ذات العلاقة بتطبيقات النظام إلى جانب خبراء التصميم والبناء.

لقد تم ابتكار مجموعة من الأدوات لتوثيق مستلزمات تصميم وبناء نظام المعلومات (متطلبات النظام، الخصائص الوظيفية له، بدائل التصميم وغيرها من الجوانب ذات العلاقة)، وأطلق عليها اصطلاح " الأساليب الهيكلية Structured Techniques "، وهذه الأساليب تعتمد في جميع مراحل عملية تحليل وتصميم وبناء النظام، يضاف إلى ذلك أنه تم دمج هذه الأساليب في إطار مدخل اكبر أطلق عليه " منهجية بناء النظام" System Development Methodology ". وهذه المنهجية في جوهرها تمثل إطارا يتألف من مجموعة من الإرشادات، الأدوات والأساليب الخاصة بكيفية إدارة تطبيق المعرفة والمهارات لبناء النظام. فبالإضافة إلى الأدوات المهيكلة (tructured Tools)، فإن هذه المنهجية تصف من هم المشاركون في عمليات التحليل والتصميم والبناء وما هي أدوارهم، مراحل البناء، مراكز القرار والأشكال والمُخططات المستخدمة لتوثيق النظام.

وبناء عليه فقد صممت هذه التقنية لتزويد الطالب او الباحث او المبرمج بمثل هذه القاعدة العلمية، لأن هدفه هو مُساعدتهم ليكونوا هم المستفيدين النهائيين بحيث يُمكنهم أن يقترحوا ويشتركوا في تصميم وبناء وتطوير نظم المعلومات. وضمن هذا التصور جاءت التقنية متضمنا المراحل الخاصة بتحليل وتصميم نظم المعلومات في إطار دورة حياة النظام. وقد تم استخدام في البحث منهجية بناء النظام (SystemDevelopment Methodology) للوصول إلى الشكل النهائي للنظام، حيث يشتمل على سبعة فصول:

تناول الأول: على دراسة جدوى نظم المعلومات من خلال توضيح مفهوم دراسة جدوى نظم المعلومات، بيان أهميتها، المتطلبات التي تسبق دراسة جدوى نظم المعلومات، مشاكل دراسة الجدوى وتحديد الخطوات التي تنجز من خلالها دراسة جدوى نظم المعلومات.

وتضمن الفصل الثاني: تحليل نظام الارشاد الطلابي بالتركيز على الأبعاد الخمسة الأساسية لمفهوم نظم المعلومات وهي تحليل هدف نظم المعلومات، تحليل عناصر نظم المعلومات (تحليل مُخرَجات نظم المعلومات، تحليل مدخلات نظم المعلومات، تحليل عمليات المعالجة في نظم المعلومات وتحليل التغذية العكسية)، تحليل المستلزمات الضرورية لإدارة وتشغيل نظم المعلومات (تحليل المستلزمات المادية لنظام المعلومات، تحليل المستلزمات البرمجية لنظام المعلومات،تحليل المستلزمات البشرية لنظام المعلومات وتحليل المستلزمات التنظيمية لنظام المعلومات)، تحليل الأنظمة الفرعية في نظام المعلومات وتحليل علاقات التكامل في نظام المعلومات.

وركز الفصل الثالث: على تشخيص مشكلات نظام الارشاد الطلابي ومعالجتها من خلال تحديد مشكلات نظام المعلومات الحالي ومن ثم تحديد بدائل حل المشكلات وتقويمها باستخدام الأنواع المختلفة من دراسات الجدوى الفنية، الجدوى العملية، الجدوى الاقتصادية، الجدوى القانونية، الجدوى السياسية وصولا الى التوصية بالبديل الأنسب.

وركز الفصل الرابع: وبهدف الى تصميم نظام الارشاد الطلابي فقد تناول الفصل الرابع إعداد مواصفات نظام المعلومات المُقتَرَح بدءاً من مواصفات المدخلات، مواصفات المخرجات، مواصفات عمليات المعالجة ، مواصفات الأفراد العاملين، مواصفات الأجهزة والمعدات ومواصفات البرمجيات.

ويغطي الفصل الخامس الآلية المعتمدة في تصميم نظام الارشاد الطلابي فيما يتعلق بتصميم مُخرَجَات نظام المعلومات، تصميم مدخلات نظام المعلومات تصميم عمليات المعالجة، تصميم نظام الاستعلام وتصميم نظام قاعدة المعلومات.

ويستعرض الفصل السادس عملية اختبار نظام الارشاد الطلابي وتطبيقه من خلال بيان كيفية اختبار النظام ، تهيئة الأفراد العاملين لتطبيق نظام المعلومات الجديد والانتقال إلى تطبيق النظام الجديد.

وأخيرا يتناول الفصل السابع جهود ما بعد تطبيق نظام الارشاد الطلابي والمتمثلة في تقويم وصيانة نظام المعلومات[2].

مكونات النظام الجديد:

1_ ملفات النظام:

جدول رقم (1) **المواد الدراسية** وهى تتكون من :

عدد الساعات	عدد الوحدات	الاسبقية	الفصل الدراسي	التخصص	اسم المادة	رقم المادة
2	2	اسس برمجة	الثالث	برمجة	البرمجة بلغة ++C	CT303

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www.arabmoheet.net/System analysis ²

جدول رقم (1) عبارة عن جدول يحتوى على حقول التي تخص بيانات المواد مع عينة من البيانات الحقيقة المستخدمة في المعهد العالي للمهن الشاملة قمينس ، والتي هي جزء رئيسي من قاعدة البيانات التي يتكون منها نظام الارشاد الطلابي.

جدول رقم (2) **النتائج** وهى تتكون من :

المعدل العام	المعدل الفصلي	الفصل الدراسي	رقم المادة	رقم الطالب
3.0	2.1	الثالث	CT303	101

جدول رقم (2) عبارة عن جدول يحتوى على حقول تخص نتائج الطلبة الدارسون حاليا وهى جزء من قاعدة البيانات الخاصة بالنظام وذلك لاستخدامها في اظهار نتائج أي طالب كاستفسار او بشكل ورقى.

جدول رقم (3) **الطلبة الخريجين** وهو يتكون من الحقول التالية:

سنة التخرج	سنة الالتحاق	المعدل	النتيجة	التخصص	القسم	اسم الطالب	رقم الطالب
ربيع2 003	خريف 2000	69	جيد	آلات كهربائية	تقنية الهندسة الكهربائية والالكترونية	أسامة سالم	1137

جدول رقم (3) عبارة عن جدول يحتوى على حقول تخص بيانات الطلبة الخريجين من سنوات قديمة حتى الان وهى جزء إضافي في منظومة الارشاد الطلابي وممكن اظهارها على الشاشة او بشكل ورقى.

2ـ واجهات النظام الجديد:

الشكل رقم (1) يوضح الشاشة الرئيسية للنظام

في الشكل رقم (1) وهى تمثل الشاشة الرئيسية للنظام حيث يقوم الطالب الذي لديه رقم دراسي بتسجيل الدخول فيتم تمكين الأزرار التي تمكنه من الدخول إلى نتائج المواد بالإضافة الى جميع الخيارات ماعدا شاشة الخريجين ، اما الطالب الجديد فيستطيع معرفة التخصصات والمواد عن طريق زر دليل الطالب واللوائح وشروط القبول لدى المؤسسة المراد التسجيل لديها ، أما الطالب الخريج ليس لديه إلا شاشة الخريجين لمعرفة معدل النجاح والنتيجة وتاريخ التخرج .

الشكل رقم (2) يوضح دليل الطالب في النظام الجديد

في الشكل رقم (2) يوضح شاشة دليل الطالب الذي من خلاله يدخل الطالب الجديد او الدارس لمعرفة الأقسام والفصول الدراسية مع المواد في كل فصل بالأسبقية الخاصة بالمواد لمساعدته عند تنزيل المواد.

الشكل رقم (3) شاشة الخريج

الشكل رقم (3) يوضح الشاشة الخاصة بالخريج حيث يقوم بإدخال الرقم الدراسى فتظهر له النتيجة بالمعدل العام .

وهذا جزء من النظام الجديد ويحتوى على العديد من الشاشات كما تم شرحه مسبقا.

طريقة العمل في النظام المقترح :

1. انشاء قاعدة بيانات(RDBMS) تحتوى على مجموعة جداول وهى (جدول بيانات الطالب ، جدول بيانات المواد، جدول بيانات النتائج، جدول الطلبة الخريجين ،جدول المستخدمين).

2. تصميم الشاشات والأكواد باستخدام لغة (Vb.Net 2010).

3. وضع صلاحيات للدخول إلى النظام بحيث يفرق بين الطالب الجاد او القديم،

4. يوجد بعض الخيارات متاحة لجميع الطلبة النظاميين والجد التي ليست لديهم نتائج.

5. تصميم شاشة للطلاب الخريجون للدخول عل بياناتهم وسحب ايفادتهم .

6. الطلبة القدامى يستطيعون فتح جميع النوافذ وذلك بتمييزهم بالأرقام الدراسية الخاصة بهم اما الجدد فيتم فتح فقط نافذة شروط القبول في المؤسسة والأقسام والتخصصات والمواد مع الاسبقية.

7. استعمال احد المنهجيات الخاصة بتحليل المشروع وهى (UML) لغة النمذجة .

التقنيات المستخدمة البرمجية والمادية :

1. جهاز حاسوب رئيسي (Server).

2. جهاز حاسوب فرعى (client).

3. شاشة عرض كبيرة تكون متاحة للطالب لعرض المعلومات التى يحتاجها .

International
Science and Technology
Journal
المجلة الدولية للعلوم والتقنية

عدد خاص بالمؤتمر الثاني
للعلوم الطبية و النقنية
يوليو 2018 July

المجلة الدولية للعلوم والتقنية
International Science and Technology Journal
ISTJ

4. لغة برمجة (VB.NET) .

5. برنامج إدارة قواعد البيانات العلائقية (RDBMS) .

النتائج:

1. الارتقاء بالمستوى العام للطالب وإضفاء الثقافة الالكترونية حتى لغير المختصين بمجال الحاسوب.

2. تسهيل وإيصال جميع الخدمات الدراسية من حيث الارشاد الدراسي للطالب وتمكينه من توفير جميع الإجابات التي يستفسر عنها الطالب.

3. تخفيف الأعباء عن الإدارات والأقسام.

4. توفير عدد الكوادر التي تعمل في مجال الترشيد الطلابي.

5. أمكانية سحب أي نموذج فيما يخص الطالب من افادات او إثبات مستوى او كشق درجات دون الحاجة للذهاب إلى الادارة المختصة.

6. السرعة العالية في الاداء من حيث سرعة إعطاء المعلومة وسحب التقارير وتلبية جميع الاستفسارات والاستفادة من قاعدة البيانات في عملية الربط بين الاقسام والإدارات المختصة بشؤون الطلبة.

المؤتمر الثاني للعلوم الطبية والتقنية

2nd Conference on Medical & Technological Sciences

الاستنتاج:

نستخلص من البحث بأنه يمكن استغلال التقنيات الحديثة من برامج ومعدات في تسهيل العملية التعليمية بالنسبة للجامعات والمعاهد العليا ويمكن تعميم هذا النظام أيضا على مؤسسات التعليم العام وإيصال المعلومة والفائدة والخدمة للطالب بشكل سهل وسريع. هذا البحث يمكن تطبيقه إذا توافرت فقط الإرادة والدعم ولا يحتاج إلى امكانيات ضخمة ولكن يمكن استخدام التقنيات المتاحة في ليبيا.

التصور المستقبلي :

امكانية تطوير النظام بحيث يصبح عبارة عن تطبيق هات في متاح للطلبة الذين من ضمن المؤسسة التعليمة بحيث يقدم التطبيق جميع الخدمات المذكورة عن بعد.

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المؤتمر الثاني للعلوم الطبية والتقنية

2nd Conference on Medical & Technological Sciences

استخدام منهجية PPDIOO في تصميم المشاريع التقنية لشبكات الحاسب الآلي

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الملخص

لا يخفى علي احد مدى الانتشار الواسع والتطور المستمر في مجال تقنية المعلومات بشكل عام وشبكات الحاسب الآلي بشكل خاص، وقد ساهم هذا الانتشار في عمل ثورة الكترونية في عدة مجالات (الاقتصادية، المالية، الطبية، وباقي المجالات الاخرى)، ونظرا لعدم وجود خطة واضحة واستراتيجية متبعة في تصميم شبكات الحاسب الآلي، تم التركيز في هذه الورقة على منهجية PPDIOO الخاصة بشركة Cisco لكي تكون هذه المنهجية بمثابة الاستراتيجية الواضحة والقواعد السليمة والمتينة التي يجب علي المهندسين و مختصي شبكات الحاسب الآلي اتباعها لكي يقوموا بتصميم شبكة حاسب الي متكاملة وقابلة للتوسع والتطور المستمر، ايضا تساعد هذه الورقة طلبة مشاريع تخرج قسم الشبكات بالكليات والمعاهد العليا من التصميم الجيد والمتكامل لمشاريع تخرجهم بالشكل السليم الخالي من الاخطاء.

تم في هذه الورقة تقسيم مراحل انشاء شبكة الحاسب الآلي إلى ستة اجزاء بعدد مراحل المنهجية (ست مراحل) وقمنا بإضافة بعض النقاط المهمة والضرورية لكل مرحلة من

مراحل المنهجية حتي تصبح هذه المنهجية منهجية متكاملة شاملة لتصميم جميع شبكات الحاسب الالي ، بالإضافة الي تسهيل ومساعدة طلبة مشاريع تخرج قسم الشبكات في معرفة كل نقطة من النقاط الرئيسة في كل باب من ابواب كتاب المشروع. وفي ختام المشروع تم عمل استبيان شامل لمعرفة مدى ملائمة هذه المنهجية في تصميم المشاريع التقنية الخاصة بشبكات الحاسب الآلي وتحليل هذه النتائج للوصول الي النتائج المرجوة من استخدام هذه المنهجية.

Abstract

Without doubt the Extensive outreach and continuous development in information technology generally and special in computer networks, where it has contributed in make huge revolution in various fields (economic, financial, medical, and other fields),also there is no clear strategic and plan to design computer networks, This paper focuses on Cisco's PPDIOO methodology to be a clear strategy and sound and robust rules that engineers and computer network professionals must follow to design a scalable and scalable computer network. Continuous evolution, also help students of this paper projects networks colleges and higher institutes section of good integrated design projects for graduate graduated in proper free of errors. In this paper , The stages of establishing were divided into 6 parts as the number of stages of the methodology (6 stages). some important and necessary points were added for each stage of the methodology so that this methodology becomes a comprehensive integrated methodology for the design of all computer networks. Graduation projects of the networks department in the knowledge of each of the key points in each section of the project book. At the end of the project we conducted a comprehensive questionnaire to determine the suitability of this methodology in the design of technical projects for

computer networks and analyze these results to reach the desired results from using this methodology.

الكلمات الدليلية: منهجية PPDIOO ، منهجية لتصميم شبكات الحاسب الالي ، اهم منهجيات تصميم الشبكات ، PPDIOO Lifecycle .

1- المقدمة

لا يخفى على احد مدى التباعد الكبير بين المنهجيات والابحاث التي تعنى بتصميم المشاريع التقنية الخاصة بشبكات الحاسب الالي، ومدي التطور الكبير والمستمر في مجال شبكات الحاسب الالي وانتشارها في جميع المجالات المختلفة. حيث نلاحظ قلة هذه المنهجيات والابحاث بالمقارنة بهذا التطور الكبير، لهذا السبب تم التركيز في هذه الورقة علي توظيف منهجية PPDIOO الخاصة بشركة Cisco في تصميم المشاريع التقنية لشبكات الحاسب الآلي لما توفره هذه المنهجية من مرونة ودقة وشمولية في تصميم المشاريع التقنية المختلفة. حيث تساعد هذه الورقة وبشكل كبير مهندسي و مختصي شبكات الحاسب الآلي على تصميم مشاريع تقنية متكاملة وقابلة للتوسيع والتطوير المستمر في جميع المراحل المختلفة ، كذاك تساعد هذه الورقة طلبة مشاريع تخرج قسم الشبكات بالكليات والمعاهد العليا من التصميم الجيد والمتكامل لمشاريع تخرجهم بالشكل السليم الخالي من الاخطاء.

2- عرض المشكلة

المشكلة الرئيسة التي تم معالجتها في هذه الورقة هو الشح الكبير والواضح في المنهجيات الخاصة بتصميم شبكات الحاسب الالي، ومما يعانيه كل من مصممي شبكات الحاسب

الآلي و طلبة مشاريع التخرج قسم الشبكات في الكليات والمعاهد التقنية في ايجاد منهجية واضحة ومتكاملة تعنى ببناء المشاريع التقنية لشبكات الحاسب الالي سواء كانت هذه المشاريع صغيرة او كبيرة او متوسطة ، ايضا الصعوبة الكبيرة التي تواجه طلبة مشاريع التخرج وخصوص المشاريع التقنية من ايجاد منهجية واضحة تتضمن جميع المراحل التي تمر بها بناء شبكة حاسوبية اسوة بالمنهجيات الخاصة بتطوير البرمجيات (الشلال و النماذج و التطوير المتزايد و التطوير الحلزوني و تطوير التطبيقات ...الخ).

3- أهداف الورقة

نستطيع تلخيص أهم الاهداف الرئيسة لهذه الورقة كالاتي:-

1-التعريف الجيد بأهم منهجيات شركة **Cisco** المستخدمة في تصميم شبكات الحاسب الالي.

2-التعريف الجيد بمنهجية **PPDIOO** الخاصة بتصميم شبكات الحاسب الالي.

3-أضافة بعض النقاط المهمة في كل مرحلة من مراحل المنهجية حتي تصبح اكثر تلائم في تصميم المشاريع التقنية الشبكات الحاسوبية.

4-مساعدة مهندسو الشبكات في تصميم شبكات الحاسب الالي ذات كفاءه عالية وقابلة للتطوير المستمر.

5-مساعدة طلبة مشاريع التخرج قسم الشبكات في الكليات والمعاهد التقنية في تصميم مشاريع تخرجهم .

4- أهم منهجيات تصميم شبكات الحاسب الالي لشركة Cisco

تملك شركة Cisco اكثر من منهجية لتصميم شبكات الحاسوب منها :-

1- . Prepare, Plan, Design, Implementing, Operate, Optimize (PDIOO)

2-) Intelligent Information Network (IIN.)

3- Service-Oriented Network Architecture (SONA)

5-منهجية PPDIOO

منهجية PPDIOO وهي منهجية تم إنتاجها من شركة Cisco سنة 2005 حيث تعتبر من افضل المنهجيات المستخدمة في تصميم شبكات الحاسوب (الكبيرة، المتوسطة، الصغيرة) وهي اختصار ل ,Prepare, Plan, Design, Implementing Operate, Optimize

حيث تحتوى هذه المنهجية على ست مراحل أساسية تعمل على أساس دورة الحياة the Network PPDIOO lifecycle كما هو موضحة في شكل رقم 1
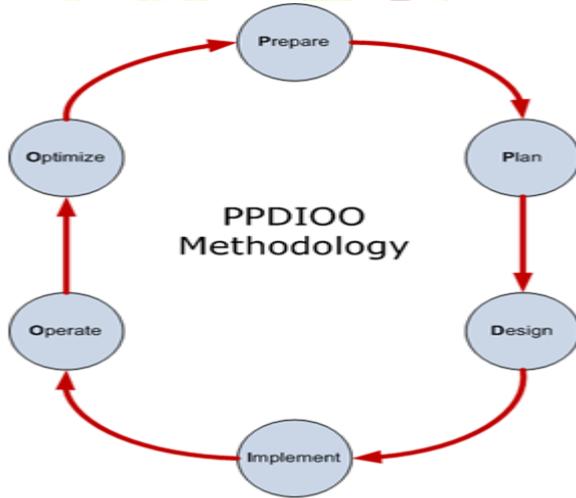
شكل رقم .1. يوضح PPDIOO Lifecycle [6]

أهم مميزات منهجية PPDIOO

1- خفض تكلفة المشروع.

2- وتحسين الحركة التجارية.

3- سرعة الوصول إلى التطبيقات والخدمات.

4- تحديد متطلبات التقنية والتحقق منها.

5- التخطيط الجيد للبنية التحتية للشبكة .

6- تصميم شبكة متكاملة ومرنة.

7- السرعة في انجاز المشاريع.

8- تخفيض مصاريف التشغيل.

5- **مراحل منهجية PPDIOO**

6-1- **مرحلة التحضير (Prepare Phase)**

وهي مرحلة يتم فيها التحضير الفعلي للمشروع من حيث جمع المعلومات و مقابلة المسؤولين داخل المؤسسة ودراسة المستندات والخرائط والفهم الجيد للنظام ،وبالتالي تحديد المشاكل و الاهداف الرئيسة للمشروع ، كما يتم في هذه المرحلة تحديد التقنية التي سوف تستخدم في المشروع.

أهم نقاط هذه المرحلة :-

1- مقدمة عن المشروع .

2- المنهجية المستخدمة في كتابة المشروع (**PPDIOO**).

3- نبذة عن المؤسسة .

4- أقسام المؤسسة .

5- الهيكل التنظيمي للمؤسسة .

6- الوضع الحالي للشبكة داخل المؤسسة.

7- مشاكل النظام الحالي .

8- أهداف المشروع .

9- التقنية المستخدمة (لحل مشاكل المشروع).

10- تاريخ التقنية.

11- انواع التقنية المستخدمة .

12- مميزات التقنية المستخدمة .

6-2- مرحلة التخطيط (Plan phase)

بعد الانتهاء من مرحلة التحضير والفهم الجيد للنظام تأتي مرحلة التخطيط والتي تعتبر من أهم المراحل ، حيث يتم فيها تحديد المتطلبات وجميع العناصر الرئيسة (hardware, software) ، وبالتالي حل جميع المشاكل وتحقيق الأهداف المرجوة، ومن اهم نقاط هذه المرحلة:-

1- تحديد متطلبات الكيان المادي (hardware) للمشروع.

2- تحديد متطلبات الكيان المعنوي(software) للمشروع.

3- تحديد عدد الاجهزة المراد استخدامها في المشروع.

4- تحديد الخدمات والادوار الرئيسة التي يقوم بها النظام.

5- تحديد المستخدمين المستفيدين من النظام.

6- تحديد المدة الزمنية اللازمة لكل مرحلة من مراحل المشروع بفضل استخدام احد برامج ادارة المشاريع.

7- تحديد المدة الزمنية التي يستغرقها المشروع بالكامل.

8- تحديد التكلفة التقريبية للمشروع بالكامل (**people, software, hardware)**.

6-3- مرحلة التصميم (Design phase)

في هذه المرحلة نقوم بتصميم الشبكة الحالية داخل المؤسسة وكذلك الشبكة المتوقع إنشاءها، حيث يتم توضيح الشبكة بالصور والخرائط، او عن طريق صور حقيقية من داخل المؤسسة ، حيث يستخدم في هذا المرحلة التصميم الهرمي للشبكة **Hierarchical Network Models** كما هو موضح في شكل رقم 2
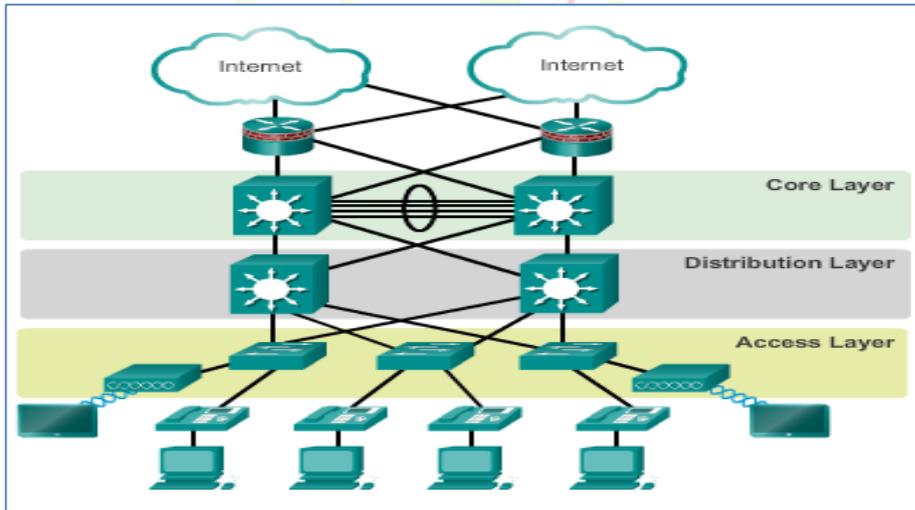
شكل رقم .2. يوضح الشكل الهرمي للشبكة (Hierarchical Network Models) [5]

أيضا في مرحلة التصميم نستخدم بعض البرامج التي تساعد علي تصميم ال topologies المختلفة للشبكة ومن اشهر هذه البرامج :-

● برنامج **Microsoft Visio**

يعتبر هذا البرنامج Microsoft Visio من احد برامج مجموعة Microsoft windows Office، ويستخدم هذا البرنامج في انشاء الرسوم البيانية والتخطيطية، وإضافة الاشكال Shapes المختلفة ، ويوفر البرنامج مجموعة كبيرة من الاشكال التي يتم تنظيمها في لوحات، وتمثل هذه الاشكال العناصر التخيلية والعناصر في العالم الحقيقي مثل الشبكة والأثاث والجداران والأبواب وغيرها من العناصر .

أهم نقاط هذه المرحلة :-

1- البرامج الذي تم استخدامها في عملية التصميم والرسم.

2-اشكال توضح الوضع الحالي للشبكة .

واذا كان هناك computers ,switches, routes, يفضل استخدام (Hierarchical Network Models).

3-أشكال توضح الوضع المقترح للشبكة.

واذا كان هناك computers, switches, routes يفضل استخدام (Hierarchical Network Models).

4-رسم خرائط توضح اماكن جميع عناصر الشبكة داخل المؤسسة .

5-رسم خرائط توضح كيفية ربط المباني مع بعضها .

6-4- مرحلة التنفيذ (Implement phase)

وفيها يتم التطبيق الفعلي للتقنية المستخدمة وعمل الاعدادات اللازمة للأجهزة وتطبيق الجانب العملي للمشروع.

ملاحظة:-

يمكن الاستعانة ببرامج المحاكاة المختلفة مثل ..... Packet tracer,Vmwae,ESXI,GNS3, مع الاجهزة الحقيقة داخل الشبكة.

واهم نقاط هذه المرحلة هي:

1-التعريف ببرامج المحاكاة اذا تم استخدمها في المشروع.

2-اعدادات(configuration) الكيان المادي (اجهزة الشبكات المختلفة).

3-اعدادات الكيان المعنوي (انظمة التشغيل).

4-تفعيل الخدمات المختلفة التي تلبي احتياجات الزبون.

6-5- مرحلة التشغيل (Operate phase)

حيث يتم في هذه المرحلة التشغيل الفعلي للنظام ، والتأكد بان الشبكة تعمل بالشكل الصحيح ، وان النظام يقوم بجميع المهام المحددة مسبقا دون أي تقصير

ويمكن استخدام احد البرامج التالي في هذه المرحلة :-

● برنامج **OPNET** هي كلمة مختصرة لـ: **Optimized Network Engineering Tool**

هو البرنامج الأوسع انتشاراً، والمفضّل لدى العديد من الدارسين والباحثين.

OPNET IT Guru هو واحد من أهم برامج محاكاة شبكات الكمبيوتر وشبكات الاتصالات عموماً، وهو أيضاً، واحد من أعقد وأصعب برامج المحاكاة.

اهم مميزاته:-

1-واجهة محببة للمستخدم **User Friendly** .

2-سهل الاستخدام بالمقارنة مع البرامج الأخرى.

3-متوافق مع الشبكات اللاسلكية .

4-تمثيل سهل للشبكات.

5-مناسب جداً للباحثين في الحقل الأكاديمي وللشركات المشغلة للشبكات **Network Operators**.

6-درجة عالية في دقة نتائج المحاكاة.

7-الربط مع إكسل لتحليل النتائج ورسمها بحسب حاجات المستخدم.
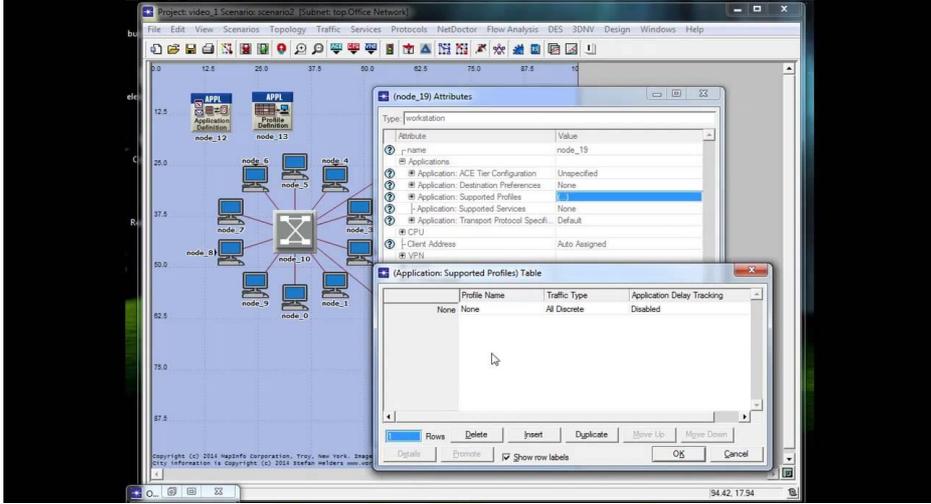
شكل رقم .3. يوضح الواجهة الرئيسية لبرنامج Opnet

● برنامج PRTG network monitor

وهو برنامج احترافي هام جدا لمسؤول الشبكة حيث يعمل على مراقبة وتحليل الشبكة ويعتبر هذا البرنامج بمثابة سيرفر متكامل افتراضي لتتبع ومراقبة وتحليل أنشطة الشبكة، وبقوم البرنامج باكتشاف المشاكل ومعرفة حجم البيانات المنتقلة داخل الشبكة، ويعرض لك تقارير مفصلة ورسم توضيحي للشبكة الخاصة بك.
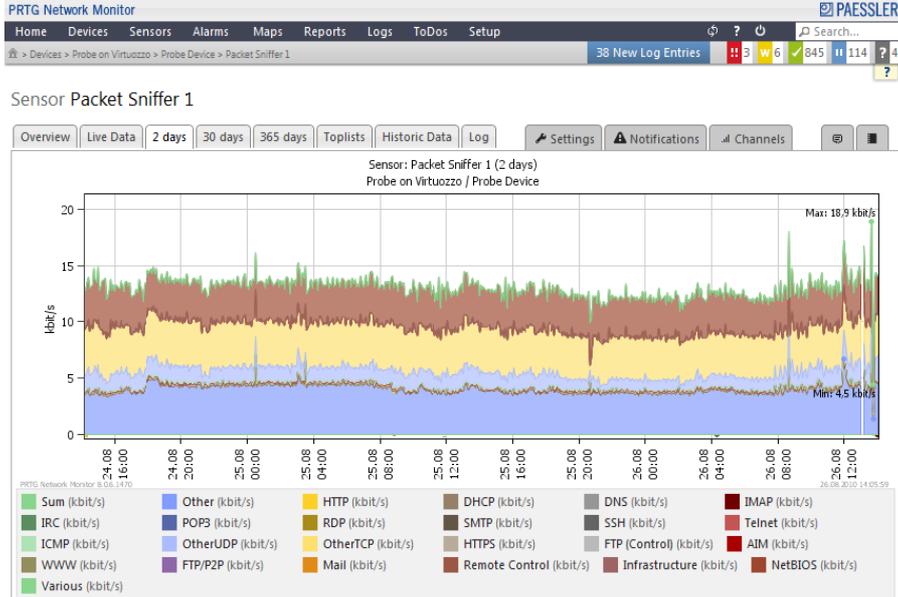
شكل رقم.4. يوضح الواجهة الرئيسية لبرنامج PRTG

● برنامج Axence nvision

وهو برنامج مجاني احترافي يساعد علي تحليل ومراقبة وإدارة الشبكة الخاصة بك ، حتي يقوم البرنامج بمسح الشبكة بشكل تلقائي ويكشف لك جميع الاجهزة المتصلة بها والبيانات الكاملة عنها، ومراقبة استهلاك البيانات من قبل كل جهاز واكتشاف الاجهزة التي تستهلك قدر كبير من البيانات وغيرها من المعلومات.
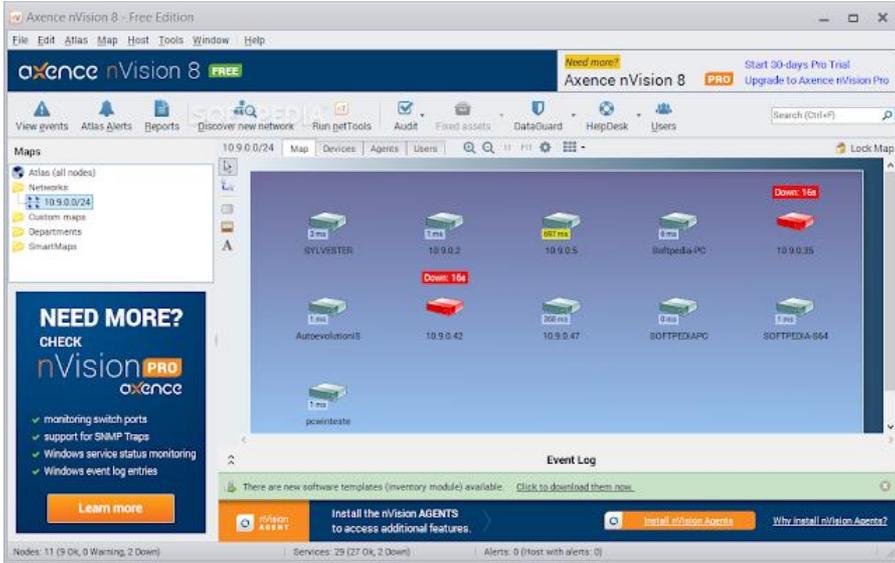
شكل رقم.5. يوضح الواجهة الرئيسة لبرنامج Axence nvision

أهم نقاط هذه المرحلة :-

1-التشغيل الفعلي للشبكة داخل المؤسسة.

2- التأكد من عمل جميع الاجزاء المادية داخل الشبكة.

3- عمل نسخ احتياطية للأجهزة والبرامج داخل المؤسسة.

4-نبذة عن البرنامج المستخدم لمراقبة وإعطاء النتائج الخاصة بالشبكة.

5-المراقبة المستمرة لأداء الشبكة.

6- تحليل النتائج .

7- الاستنتاجات .

8- التوثيق الكامل للشبكة داخل المؤسسة.

6-6- مرحلة التحسين (Optimize phase)

وهذه المرحلة خاصة بعمل التحسينات اللازمة للشبكة لكي تزيد من الاداء وتواكب التطوير المستمر في عالم تقنية المعلومات حتي تصبح الشبكة صالحة لفترات طويلة.

أهم نقاط هذه المرحلة :-

1- اقتراح التحسينات الدورية للشبكة.

2- التوصيات.

3- متطلبات التحسينات الدورية.

6- جمع البيانات

ولكي يتم معرفة ما اذا كانت هذه المنهجية فعالة وذات جودة تم اجراء بعض المقابلات الشخصية ومجموعة من الاستبيانات علي حوالي ستين شخص من طلبة واساتذة ممن لهم علاقة بتصميم شبكات الحاسب الالي، حيث طرحنا عشرين سؤال تتعلق بالمنهجية واهم مراحلها ومميزتها وعيوبها وتم اخذ العينات وتحليلها.

7- تحليل النتائج

وبعد عملية جمع البيانات وتحليلها ودراستها تم عرض نتائج لأهم عشر اسئلة موجودة في الاستبيان عن طريق مخططات توضح نتائج كل سؤال ومدي رضا الطلبة بالنسبة المئوية وكانت الاسئلة كالاتي :-

1-8- السؤال الاول:- مدى رضاك على استخدام منهجية PPDIOO في تصميم المشاريع التقنية لشبكات الحاسب الآلي ؟

وكانت نتيجة السؤال كما هي موضحة في شكل رقم 6 مع ملاحظة ان كافة النتائج تم صياغة بالنسبة المئوية
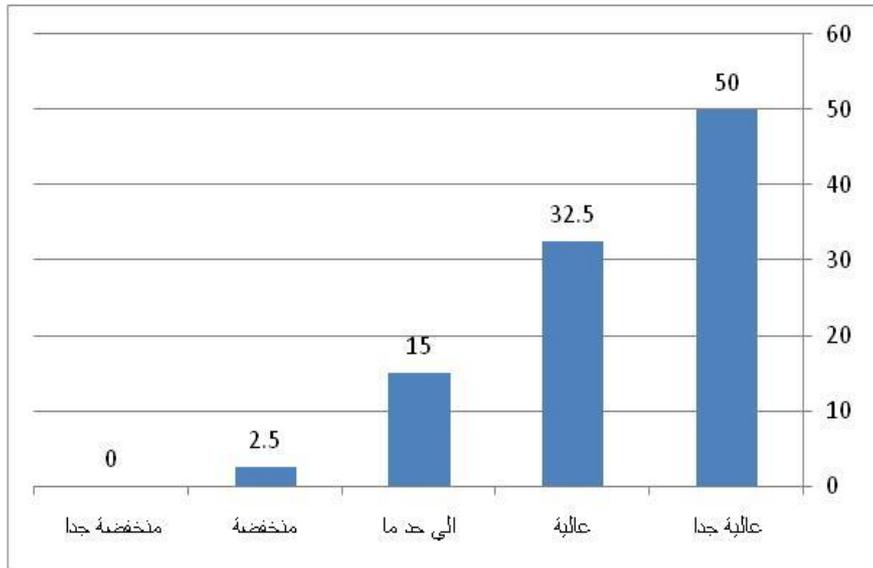
شكل رقم.6. يوضح نتائج السؤال الاول

حيث ان الارقام الموجودة فوق المخططات تشير الي النسبة المئوية للإجابات الموجودة في الاستبيان التي تم اخذه من حوالي 60 شخص، يعني من حوالي 60 شخص 50% كان رضاهم علي السؤال الاول عالية جدا وحوالي 32.5% كانت رضهم علي السؤال

الاول عالية وحوالي% 15 كانت اجابتهم الي حد ما وحوالي 2.5% منخفضة و 0% منخفضة جدا.

8-2- السؤال الثاني:- هل المنهجية المستخدمة سلسة وسهلة الاستخدام ؟

وكانت نتيجة السؤال كما هي موضحة في شكل رقم 7
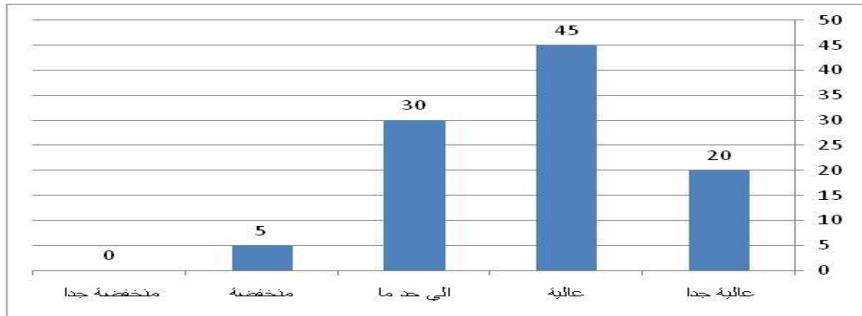
شكل رقم .7. يوضح نتائج السؤال الثاني

السؤال الثالث:- هل المنهجية تغطى جميع جوانب المشروع ؟

وكانت نتيجة السؤال كم هي موضحة في شكل رقم 8
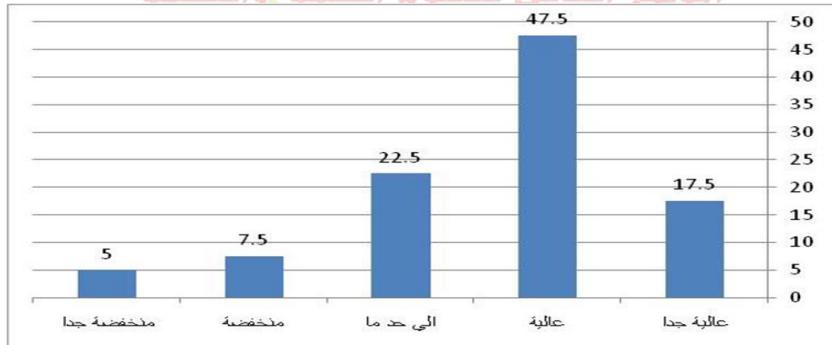
شكل رقم .8. يوضح نتائج السؤال الثالث

السؤال الرابع:- هل المنهجية مناسبة لجميع المشاريع التقنية ؟

وكانت نتيجة السؤال كما هي موضحة في شكل رقم 9
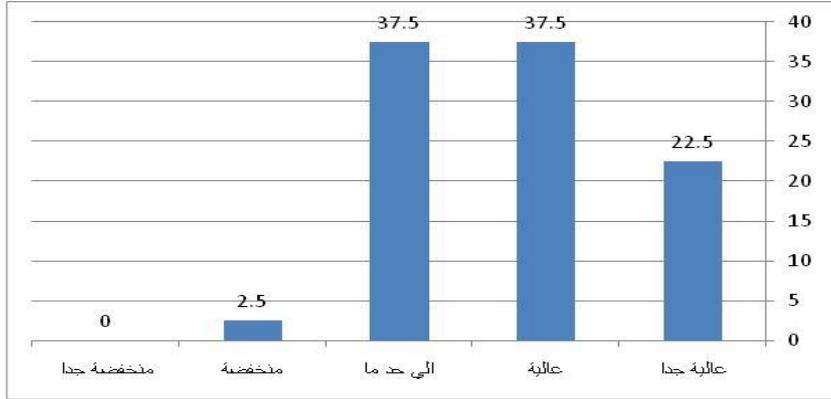
شكل رقم.9. يوضح نتائج السؤال الرابع

8-3- السؤال الخامس:- هل المنهجية تقلل الزمن اللازم لـ إنجاز المشروع ؟

وكانت نتيجة السؤال كما هي موضحة في شكل رقم 10
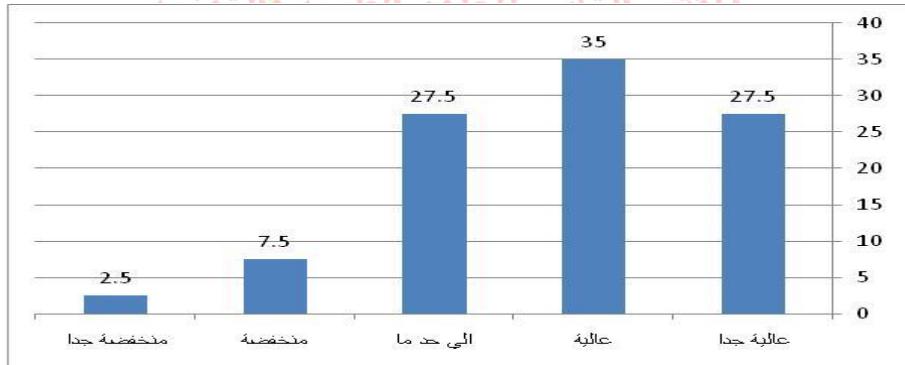
شكل رقم .10. يوضح نتائج السؤال الخامس

8-4- السؤال السادس:- صعوبة تطبيق المنهجية على المشاريع الكبيرة ؟

وكانت نتيجة السؤال كما هي موضحة في شكل رقم 11
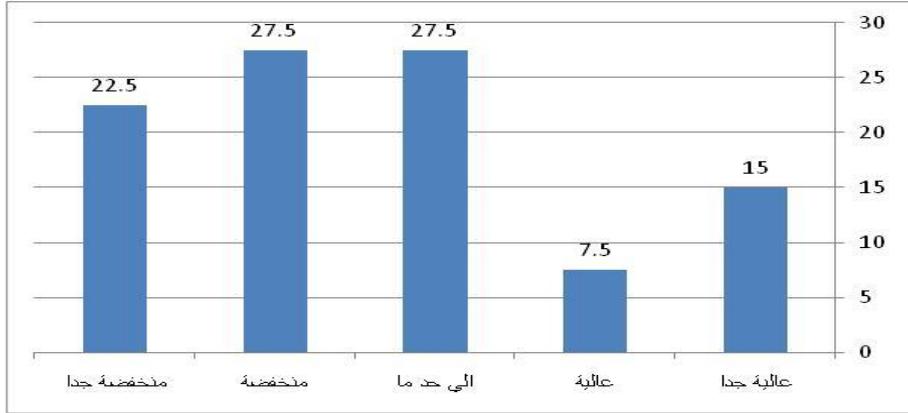
شكل رقم.11. يوضح نتائج السؤال السادس

السؤال السابع:- يجب إلغاء بعض النقاط من بعض مراحل المنهجية ؟

وكانت نتيجة السؤال كما هي موضحة كما في شكل رقم 12
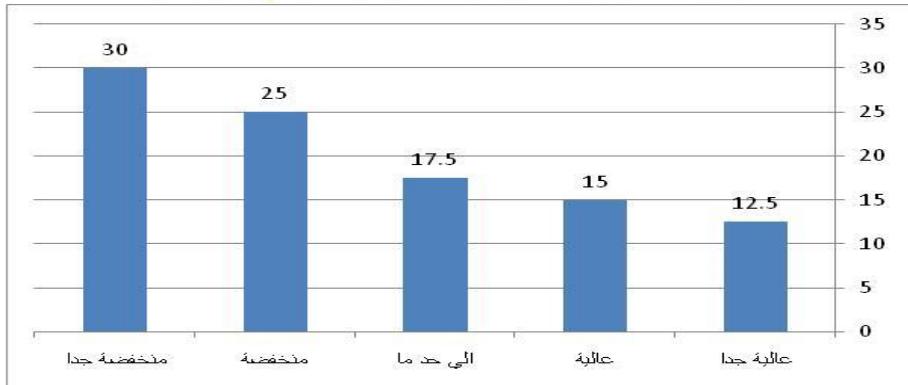
شكل رقم .12. يوضح نتائج السؤال السابع

8-5- السؤال الثامن:- يجب إلغاء بعض مراحل المنهجية ؟

وكانت نتيجة السؤال كما هي موضحة في شكل رقم 13
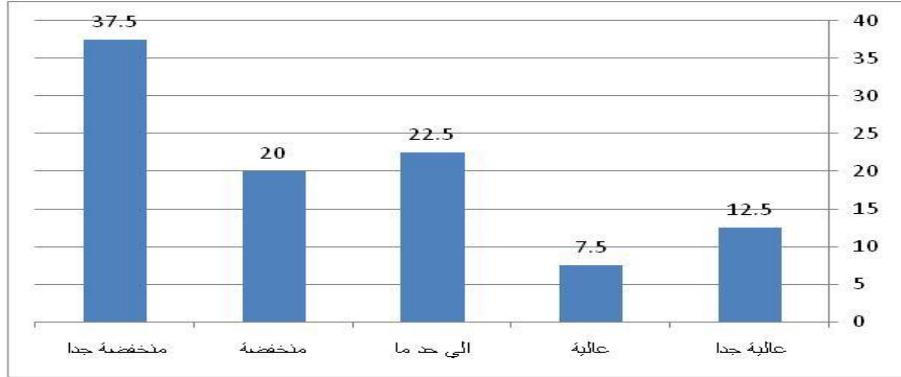
شكل رقم .13. يوضح نتائج السؤال الثامن

8- الخلاصة

في هذه الورقة تم حل مشكلة كبيرة تواجه كلا من مصممي شبكات الحاسب الالي وطلبة تخرج قسم الشبكات بالكليات والمعاهد العليا، تتلخص في عدم وجود منهجية واضحه لتصميم شبكات الحاسب الالي بشكل بسيط ومتكامل، بعد ما تم جمع المعلومات من اكثر من ستين شخص وتحليلها اتضح وبدون أي شك ان هذه المنهجية التي تم توظيفها في تصميم المشاريع الخاصة بشبكات الحاسب الالي ذات كفاءه عالية وقدرة كبيرة علي انجاز المشاريع التقنية المختلفة، كذلك تساعد علي توفير الكثير من الوقت والجهد اللازم لإكمال المشاريع المختلفة، لذا فان هذه المنهجية سوف تكون الاساس المتين والقاعدة السليمة التي سوف تبنى عليها المشاريع المختلفة الخاص بشبكات الحاسب الالي، وهذا ما لاحظنا اثناء اعتماد هذه المنهجية داخل قسم الشبكات بالمعهد العالي لتقنيات الحاسوب– بنغازي

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استخدام نمط التصميم Model–View–Controller (MVC) في تطبيقات ومواقع الويب على شبكة المعلومات العالمية

خالد فرج عثمان

أحمد سالم رجب

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الملخص :

شهد عالم التطبيقات و مواقع الويب تطوراً كبيراً واصبحت تلعب دورا رئيسيا في كافة المعاملات والخدمات عامة ، وازداد توسعاً مما جعل شركات التطوير والابحاث باستحداث تقنيات لدعم تطوير التطبيقات والمواقع على شبكة الإنترنت بشكل مستمر .

في هذه الورقة تم دراسة نمط التصميم Model–View–Controller (MVC) الذي أطلق من قبل شركة ميكروسوفت، والتي تعتمد معمارية النمط على فصل البيانات عن واجهة الاستخدام وفقا لمكوناتها الثلاثة الرئيسية المستقلة عن بعضها، والتي تضمنت في الإصدارات الجديدة في إطار العمل في صفحات الخادم النشطة (ASP.Net Framework) مما أعطى تحسنا في تطوير تطبيقات الويب بشكل موسع، و أتيح للمطورين العمل بسهولة ومرونة مقارنة بالطرق التقليدية لتطوير تطبيقات الويب، كما أنه يحسّن القدرة و المحافظة على التطبيق وقابلية التوسع وتحسين الاداء والصيانة عند العمل مع قواعد البيانات العلائقية و واجهات الاستخدام، كما يدعم العمل على لغات برمجية مختلفة، كما دعمت العمل مع كافة التقنيات الجديدة و أبرزها (RAZOR Pages) علاوة على تحسينها في التعامل مع رفع الملفات والتي كانت إحدى المعوقات عند العمل مع خادم الويب، والتي كانت من الأهداف الرئيسية لهذا البحث.

Abstract :

The web applications has developed significantly , it has become a major part of all sort of general services , and had expanded to make research development companies to develop new technologies for support development of applications and websites continuously.

In this paper presents a design pattern for the web application, this model based on Model-View-Controller (MVC), which was developed by Microsoft. The architecture has several other useful components separated data from View according with three main components which included in the latest versions of the ASP.Net framework, it has improved the development of web applications ، as well as developers have been able to work easily and flexibly compared with traditional ways of developing web applications. It is also improves facilitates the maintenance web application when worked with relational databases and user interfaces, also supports work on different programming languages, and new technologies such (RAZOR Pages), furthermore easily use files upload, which was one of the Improvements when working with web server with MVC that was one of the main objectives of this paper.

1. المقدمة :

من خلال دراسة تطبيقات ومواقع الويب على شبكة المعلومات العالمية هناك صعوبات تواجه المطورين بشكل مستمر في بناء وتطوير التطبيقات، ومن المشاكل الأساسية في هذه التطبيقات آليه استرجاع البيانات من قواعد البيانات وعرضها على صفحات الويب و تطوير واجهة المستخدم الرسومية Graphics User Interface (GUI) وعلاقتهما المباشرة مع البيانات لعرضها، ومن إحدى حلول هذه المشاكل استخدام نمط التصميم (MVC) الذي يمثل الحل للتطبيقات الويب، ومن هذا السياق تم التطرق في هذه الورقة

إلى استخدام نمط تصميم لفصل البيانات عن واجهة المستخدم –Model–View Controller والتي تعرف باسم نمط التصميم (MVC) والتي تتعامل مع واجهة الاستخدام (GUI).

حيث تم استخدامه منذ أواخر السبعينيات ونشأته في مشروع (Smalltalk) الخاص بشركة (Xerox PARC) الخاصة بالتطوير والأبحاث، والتي استخدمت مفهوم (MVC) لربطها بالمفاهيم الخاصة بمشروع (Smalltalk) على التطبيقات مثل الشاشات والأدوات البرمجية، وحيث هذه المفاهيم مناسبة بشكل خاص على تطبيقات ومواقع الويب (.Freeman, A 2013).

وفي سنة 2007 وبالتحديد في شهر أكتوبر أعلنت شركة ميكروسوفت رسميا عن إطلاق منصة جديدة للتطوير تحت اسم (MVC) والتي اعتمدت بشكل أساسي على تقنية صفحات الخادم النشطة Active Server Pages (ASP.net) الخاصة بتطوير وبرمجة المواقع والتطبيقات على شبكة المعلومات العالمية كاستجابة مباشرة للتطور السريع للتقنيات التي تتعامل مع الخادم والعميل (Server–Side) عبر شبكة الإنترنت، وايضاً كحل للمشاكل التي تواجه تطبيقات الويب التقليدية والتي تعرف بـ (Web Forms) (.Dykstra, T 2013).

حيث أن مفهوم عمل صفحات تطبيقات الويب يعتمد بشكل أساسي على مبدأ الخادم والعميل (Clint–Server Methodology) حيث أن تقنية (ASP.net) والتي لا تختلف طريقة عملها عن أي مفهوم آخر لبرمجة تطبيقات صفحات الويب، فآلية العمل تبدأ بطلب من المستخدم والتي تعرف (Client Request) عبر المتصفح إلي الخادم عن طريق بروتوكول نقل البيانات (HTTP) حيث يقوم الخادم باستقبال الطلب وتمريره إلى صفحة تشغيل (ASP.net) والتي تقوم بترجمة الصفحة وتحويلها إلى استجابة بواسطة المكتبات

وإطار العمل (Net Framework.) التي تتعامل معها والتي تنتج صفحة بصيغة (HTML) لكي يتم التعرف عليها من قبل المتصفح وتحويلها إلى استجابة للمستخدم (Evjen, B. and Others 2010).
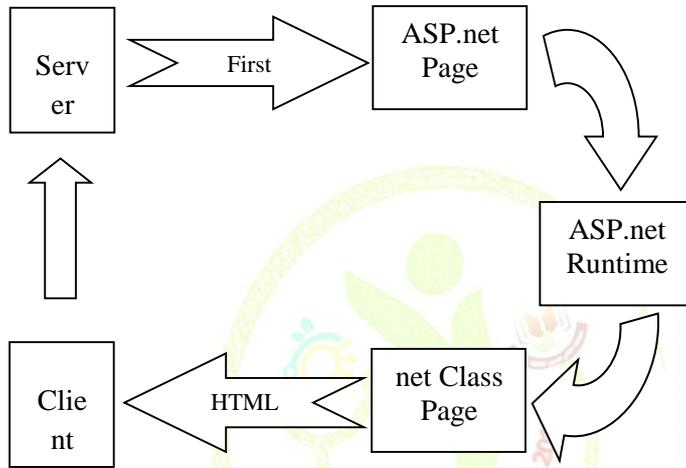
الشكل رقم (1) آلية عمل صفحات الويب بتقنية (ASP.net)

(Darie, C. and Barnett ,W. 2008)

2. المشكلة :

من المتعارف عليه أن كافة التطبيقات والمواقع على شبكة المعلومات العالمية تحتوي على بيانات موجودة في قواعد بيانات علائقية أو غير علائقية، وحيث أن معظم التطبيقات تعرض تلك البيانات على واجهة المستخدم، ومن هذا المنطلق هناك مشاكل محتملة قد تحدث نتيجة العلاقة المباشرة بين البيانات وعرضها، وبمعنى آخر المشكلة تظهر في استرجاع البيانات وعرضها في صفحات الويب، ونستخلص التالية :

▪ أي تغيير في هيكلية البيانات سواء قاعدة بيانات العلائقية او غير العلائقية يحدث تغيير في طريقة عرضها في صفحة الويب .

▪ أي تغيير في عرض البيانات ينتج عنه تغيير في هيكلة البيانات.

▪ لعرض نفس البيانات بطريقتين مختلفتين، فأننا سنحتاج لعمل طريقتين مختلفتين لاسترجاع البيانات كلا على حدى.

▪ القصور في رفع أكثر من ملف معاً من واجهة المستخدم إلى خادم الويب.

3. معمارية نمط التصميم (MVC):

يعتبر نمط التصميم (MVC) ضمن منصة (.Net Framework) وتحتوي على ثلاثة عناصر أساسية في بنيتها، وهي Model–View–Controller .
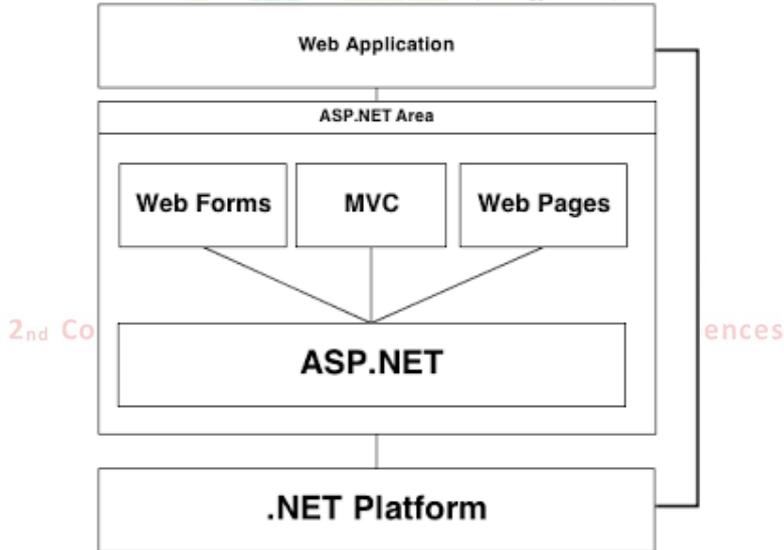
الشكل رقم (2) منصة العمل NET. مع نمط التصميم (MVC)

العنصر الأول (Model):

وهو العنصر المسؤول الأول عن البيانات في التطبيق وعلى تنفيذ القواعد التي تحكم التعامل ومعالجة البيانات بشكل مباشر .

العنصر الثاني (View):

العنصر المسؤول على طريقة عرض البيانات في واجة المستخدم أو صفحة الويب.

العنصر الثالث (Controller):

العنصر المسؤول والمتحكم في قبول وتغيير المدخلات ، و المسؤول عن المعاملات بين العنصر (Model) و العنصر الثاني (View) (Galloway 2013).
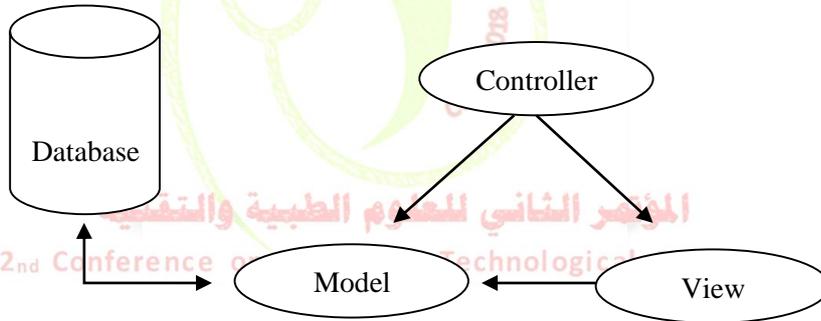
الشكل رقم (3) نمط التصميم (MVC) (Freeman, A. 2013)

كما يتضح في الشكل (3) يمكن استخدام نمط التصميم (MVC) في تطبيقات الإنترنت، وذلك تبدأ العملية من خلال العنصر (Controller) المسؤول عن مراقبة المدخلات واستقبالها من مستخدم تطبيق الويب، ثم يقوم بمعالجة القيم المدخلة، و يقوم بإرسالها إلى

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العنصر (Model) هو المؤول بدوره عن القيام بعملية تحديث البيانات أو رفض تحديثها بسبب الأخطاء، ثم يقوم بتبليغ العنصر (Controller) والذي يتسبب في تحديث البيانات في العنصر (View) الذي بدوره يقوم بقراءة البيانات مباشرة من العنصر (Model) وإخراجها مرة أخرى إلى متصفح الويب الخاص بالمستخدم عند عدم وجود أية معالجة للبيانات (Freeman, A. 2013).

بمعنى آخر اذا كانت المدخلات تتطلب تحديث او تغيير في بيانات العرض، يأتي دور (Controller) بإخطار العنصر (View) الذي يقوم بتحديث عرض البيانات من العنصر (Model) وإخراجها لصفحة الويب الخاصة بالمستخدم (2018) Microsoft .

4. دور نمط التصميم في رفع الملفات على خادم الويب:

يعتبر رفع الملفات من واجهة المستخدم لجهاز العميل (Client Computer) إلى خادم الويب عملا شائعا في العديد من المواقع وتطبيقات الويب، وتستخدم في نطاق واسع في البريد الإلكتروني وشبكات التواصل الاجتماعية و ما الى ذلك، هناك مجموعة متنوعة من المكونات الخاصة برفع الملفات في نمط التصميم (MVC)، فقد تحتاج إلى تحميل عدة ملفات في آن واحد أو كل ملف على حدة، وكذلك التعامل مع الملفات بحجمها الصغير والكبير، وبالتالي قد يلجا المطور لاختيار المكون الذي يعتمد على السرعة والوثوقية وتلبية المتطلبات الخاصة بالتطبيق.

أثناء عملية رفع الملفات في نمط التصميم سيتم التعامل مع العنصر (View) و العنصر (Controller) اللذين سيتفاعلان مع بعضهما، والتي سوف تتم بالطريقة التالية:

تبدا آلية رفع الملفات عن طريق المستخدم الزائر لصفحة الويب من خلال استخدام أداة رفع الملفات، والتي توجد في واجهة الاستخدام والتي تمثلها العنصر (View)، بعد ذلك يتم اختيار الملف المراد رفعه، عند بدء مرحلة الرفع تقوم أداة الرفع بطلب (Post) وإرساله

إلى الخادم، ثم يقوم إطار العمل صفحات الخادم النشطة (ASP.Net Framework) بتخزين كافة الملفات في ذاكرة الخادم أو القرص الصلب استناداً إلى حجم الملف الذي تم رفعه، وللتعامل مع الطلب يأتي دور نمط التصميم (MVC) عن طريق العنصر (Controller) الذي يحدد طريقة الإجراء المناسبة مع الطلب وأسلوب معالجته بتخزين الملف على القرص الصلب، أو بتحديث قاعدة البيانات عن طريق خاصية (Controller.Request) ، وفي النهاية يقوم نمط التصميم بإرسال الاستجابة إلى العميل من خلال (Controller.Response) .

1.4 التعامل مع رفع الملفات المتعددة :

من الحلول التي قدمها نمط التصميم (MVC) بقبول مجموعة من الملفات أثناء عملية الرفع في الوقت نفسه حتى لو كانت بنفس الاسم من خلال إجراء أسلوب تخزين الملفات داخل مصفوفة، مقارنة بالأسلوب المتبع التقليدي يتم رفع كل ملف على حدة مما يحتاج إلى اختيار كل ملف ورفعة، ويكون غير ملائم كسهولة استخدام، وبالأخص عند رفع الكثير من الملفات بأحجام كبيرة، أو اللجوء إلي استخدام أدوات مساعدة خارج بيئة إطار عمل صفحات الخادم النشطة التي تدعم أوجه القصور في رفع الملفات المتعددة (Aurigma, 2018) .

5. استخدام تقنية كائن إطار العمل (Entity Framework) مع نمط التصميم (MVC) :

تعتبر تقنية (EF) وسيلة أساسية للتفاعل بين التطبيق وقواعد البيانات العلائقية، والتي تعمل في البيئة المنفصلة (Disconnect) ، وهو إطار مفتوح المصدر مع إطار العمل (ADO.Net).

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باستخدام نمط التصميم (MVC) و تقنية (EF) يمكنك إنشاء تطبيق ويب يوفر واجهة استخدام للتعاون مع قاعدة البيانات بمرونة، حيث أن الطريقة التقليدية للوصول إلى البيانات العلائقية تستخدم بواسطة إطار العمل (ADO.Net) المتضمنة داخل (NET. Framework) لأداء العمليات (CRUD) والتي تعني العمليات الأساسية التي تجرى على قواعد البيانات (Create ,Read ,Update , Delete) حيث أن هذه العمليات تستغرق وقتا وجهدا في الكود البرمجي لأنها تحتاج الى كتابة استعلامات لجميع العمليات مع إنشاء عملية اتصال بقاعدة البيانات، مما أدى إلى طرح شركة ميكروسوفت تقنية (EF) في إصدار إطار العمل (3.5) للتعامل مع البيانات (Lerman, J. and Others (2012).

مما جعل العمل أكثر توافقية وتكاملا مع نمط التصميم (MVC) علاوة على ذلك جعلت كتابة جمل استعلام (Structure Query Language) للتعامل مع قواعد البيانات أكثر سهولة و وفرت التعامل مع لغة الاستعلام التكاملية (Language-Integrated Query)

6. دور صفحات (RAZOR) في نمط التصميم (MVC):

اطلقت شركة ميكروسوفت سنة 2011 جمل ترميز (RAZOR) وهي ليست لغة برمجية، ولكن تتضمن العمل على خادم الويب في صفحات الخادم النشطة على عكس لغة الترميز (HTML)، التي لا تتطلب العمل على خادم الويب (Server-Side) ، ويدعم كلا اللغتين سي شارب ولغة الفيجوال بيسك، مما أعطت العمل مع نمط التصميم (MVC) توافقية وسهولة في كتابة الكود البرمجي مع صفحات لغة الترميز (HTML) ، حيث أن (RAZOR Pages) هو جزء من إطار عمل (NET Framework.) المصمم خصيصاً لإنشاء تطبيقات الويب و تمنحك بيئة ملائمة لأدوات تقنية (ASP.Net) ونمط التصميم

(MVC) مع سهولة التعلم ومرونة في الاستخدام، وتمكن الصفحات التي تعمل بجمل (RAZOR) داخل صفحات (HTML) دون تعقيد (Chadwick 2011).

حيث عند طلب العميل صفحة الويب، يقوم خادم الويب باستقبال الطلب، ثم يقوم بتنفيذ جمل ترميز (RAZOR) أولاً، قبل إرسال صفحة (HTML) إلي العميل، ويتم تنفيذ التعليمات البرمجية على الخادم الذي لا يمكن القيام به في متصفح العميل، وينشأ كود ديناميكي لمحتوى لغة (HTML) بشكل سريع قبل إرسالها للمتصفح، ما يميز عمل نمط التصميم (MVC) مع جمل الترميز (RAZOR) هو إنشاء قالب داخل ملف واحد يكون خليطا من كود لغة الترميز مع الكود البرمجي في مكان واحد فقط مما ينشئ ملفا بامتداد (VBHTML) , (CSHTML) عكس الطريقة التقليدية بالعمل مع (Web Forms) التي تعتمد على فصل الكود البرمجي عن جمل الترميز .

7. مقارنة بين صفحات الويب التقليدية (Web Forms) مع نمط التصميم (MVC) في تقنية (ASP.Net):

من خلال استخدام نمط التصميم (MVC) بمقارنة مع استخدام صفحات الويب التقليدية (Web Forms) تم إيجاد عدة فورقات بينهما، مما يساعد المطورين في بناء وتطوير تطبيقات الويب، ومن أهم الفروقات بين نمط تصميم (MVC) و صفحات الويب باستخدام تقنية (ASP.Net) (2017 .Choudhary, J).

جدول رقم (1) المقارنة بين صفحات الويب التقليدية و نمط التصميم (MVC).

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MVC	Web Forms
تركز على فصل البيانات، ولا يوجد أي كود برمجي ثابت في أي صفحة عرض.	تسند إلى وجود الكود البرمجي داخل صفحة العرض ما يتطلب كتابة الكود في كل صفحة على حدة.
يستقبل العنصر (Controller) الطلب ثم يقوم بتنفيذ الطلب.	تستقبل الصفحة مباشرة الطلب (Request) ثم يتم تطبيق الكود بداخل الصفحة بخادم الويب.
توفير أدوات خاصة بلغة (HTML Helpers) وكذلك مع أدوات الخادم (Server Controls)	يجب استخدام أدوات الخادم (Server Controls)
لا يوجد (ViewState) لإدارة البيانات.	تعتبر (ViewState) وسيلة في إدارة البيانات داخل الصفحة مما يجعل تحميل الصفحة بطيئا.
سهولة الاستخدام مع اللغات البرمجية النصية	معقدة في التعامل مع اللغات البرمجية النصية
إنشاء طرق عرض جزئية قابلة لإعادة الاستخدام.	تكوين أدوات استخدام لكل عرض.

8. النتائج والاستنتاجات من دراسة استخدام نمط التصميم (MVC) في تطبيقات و مواقع الويب:

بعد ما تم التطرق إلى الفروقات بين نمط التصميم (MVC) وصفحات نماذج الويب (Web Forms) والتي أظهرت اختلافا جوهريا عند استخدام نمط التصميم (MVC) مما أتيح للمطورين عند استخدامها في تطوير تطبيقات الويب الحصول على النتائج والمزايا التالية (Brainvire 2016):

1.8 السرعة في تطوير التطبيق :

يمنح نمط التصميم (MVC) إمكانية التطوير السريع لتطبيقات الويب، المطورون يعملون بطريقة

متوازية، حيث يمكن العمل كل جزء على حدة دون أي إخلال في التطبيق، أي يمكن أن يعمل أحد المبرمجين على العنصر (View) بينما الاخر يعمل على العنصر (Controller) لإنشاء تطبيق ويب، ويمكن إتمام التطبيق الذي تم تطويره باستخدام (MVC) أسرع من التطبيقات المبرمجة بالطريقة التقليدية.

2.8 التعامل مع التطبيقات المتزامنة:

يمكن لنمط التصميم (MVC) بالتعامل مع اللغات البرمجية النصية ودمجها معا مثل لغة (Java Script) و (jQuery) وعلاوة على ذلك التعامل مع الملفات وجميع أنواع المتصفحات، وكذلك تطبيقات سطح المكتب التزامنية وغير التزامنية.

3.8 السهولة في تعديل وتحديث التطبيق:

اغلب تطبيقات الويب تتطلب بدرجة أولى تغيير واجهة المستخدم بشكل مستمر، وهذا يتطلب إجراء تغيرات في تطبيق الويب مثل التنسيقات والخطوط والالوان .. الخ، بما فيها دعمها للهواتف الذكية والأجهزة اللوحية، فأن اضافة أية واجهة استخدام جديدة أمر مرن وسهل للغاية، بسبب العنصر (Model) الذي لا يعتمد على العنصر (View) مما لا يؤثر أية به.

4.8 استرجاع البيانات دون تنسيق:

من خلال التعامل مع نمط تصميم (MVC) يمكنك استرجاع البيانات دون أي تنسيق واستدعاء البيانات في أية واجهة استخدام لعرضها، حيث من الممكن تنسيق البيانات باستخدام أدوات لغة (HTML).

5.8 التوافق مع منصة التطوير Search Engine Optimization (SEO)

يدعم نمط تصميم (MVC) صفحات وتطبيقات الويب التي تتعامل مع منصة التطوير (SEO)

التي تختص في بإظهار الموقع الإلكتروني في محركات البحث غير المدفوعة، حيث من السهولة

استخدام نمط التصميم (MVC) للتعامل مع عناوين مواقع مناسبة (URLs) لزيادة الزيارات.

9. التوصية:

من خلال انتشار تطبيقات الويب و خدمات الويب بكافة أنواعها ومع حاجة المستخدمين في ضمان استخدام تقنيات سهلة الاستخدام والتطوير، دائما يلجأ المطورون في البحث لتحسين واجهة استخدام مواقع الويب لتوفير بيئة ملائمة للمستخدمين تضمن تقديم خدمات بجودة عالية .

ولهذا نوصي عند العمل في بناء تطبيقات الويب الجديدة باستخدام نمط التصميم (MVC) الذي سيوفر سهولة الاستخدام والصيانة لفريق العمل، لأنه من الصعب تغيير تطبيق ويب من الطريقة التقليدية (Web Forms) إلى نمط التصميم (MVC) بسبب اختلاف منهجية الاستخدام في الطريقتين، وهذا يجعل التفكير في التغيير خطوة صعبة لدى فريق التطوير، ولهذا عند بناء موقع أو تطبيق جديد يستخدم نمط التصميم (MVC)

10. الخاتمة:

نمط التصميم (MVC) يعتبر أسلوبا ونهجا كبيرا لبناء التطبيقات البرمجية، فمن السهل العمل على هذا النمط التصميمي، حيث يقدم مزايا عديدة يمكن من خلالها تطوير كافه المشاريع بسهولة، مع تكلفة أقل وضمان وقت أقل وتحكم كامل دون تعقيد، ولا يعتبر بديلا عن نماذج صفحات الويب التقليدية ولكنها تقنية في إصدار إطار العمل(Net. Framework) الخاص بشركة ميكروسوفت.

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علاوة على ذلك لديه قدرة كبيرة لإدارة العديد من واجهات الاستخدام، مما يجعل هيكلية النمط التصميمي (MVC) من بين أفضل أنماط التصميم لتطوير تطبيقات الويب، ونتيجة لذلك، أغلب المؤسسات تبحث عن تطوير وتحسين تطبيقات الويب على أساس بنية نمط التصميم (MVC) لمزايا التكلفة والوقت، وهناك العديد من شركات تطوير البرمجيات تعمل على تقديم خدمات ودعم لهذا النمط، لتطوير تطبيقات الويب التي تلبي جميع متطلبات العملاء.

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البحوث باللغة الإنجليزية

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Arduino sun tracker system

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Abstract– This Paper describes the design of a Sun tracker which use an electronic optic sensor (solar cell) and a small low-cost electronic control circuit. The sensor is a two-cell pyramid which is mounted on the tracker plane .The control circuit tracking is an electronic circuit which process the information from the photo sensor and controls the tracker orientation. It called an Arduino microcontroller which consistes of multiple input units, multiple output units and microprocessor. The tracksub circuit control the motion of the mechanical drive system (servo motor) .The control circuit unit is an Arduino Uno device these circuits is sense the input signal from the photocell and process by microcontroller and finally make a decision to the output .the output connected with a servo motor to rotate the panal to the sun position.

When faced a way from the sun the device searches in the correct direction until the pyramid can see the sun The microcontroller is programed by c + + computer language operating . This sun tracker is relatively easy to install although the system requiers initial orientation, the accuracy of the setup procedure is not critical the control unit has a low component count and, all components are low cost types.

الخلاصة – تصف هذه الورقة تصميم جهاز تعقب الشمس الذي يستخدم جهاز استشعار بصري إلكتروني (خلية شمسية) ودائرة تحكم إلكترونية صغيرة منخفضة التكلفة. جهاز الاستشعار عبارة عن هرم يتكون من خليتين ، ويتم تثبيته على جهاز التعقب. دائرة التحكم عبارة عن دائرة إلكترونية تعالج المعلومات من المستشعر (الحساس) وتتحكم في اتجاه المحرك . ويسمى متحكم اردوينو الذي يتألف من وحدات الإدخال متعددة ، وحدات الإخراج متعددة ومعالج دقيق. تتحكم الدائرة الالكترونية في حركة نظام الدفع الميكانيكي (محرك سيرفو). وحدة دائرة التحكم هي جهاز (اردوينو أونو) هذه الدائرة تحسس إشارة الدخل من الخلايا الضوئية وتعالج البيانات بواسطة متحكم دقيق ، وأخيرا يؤخذ القرار إلى الإخراج .المخرج متصل بمحرك سيرفو لتدوير panal إلى موقع الشمس.عندما يواجه المرء طريقًا من الشمس ، يبحث الجهاز في الاتجاه الصحيح حتى يتمكن الهرم من رؤية الشمس .يتم برمجة وحدة التحكم الدقيقة عن طريق تشغيل لغة الكمبيوتر c. + + من السهل نسبيا تركيب جهاز تعقب الشمس هذا على الرغم من أن النظام يتطلب التوجه المبدئي ، فإن دقة عملية الإعداد ليست مهمة ، حيث أن وحدة التحكم لديها عدد مكون منخفض ، وجميع المكونات هي أنواع منخفضة التكلف .

1. INTRODUCTION

Solar energy is considered as a source for production of electrical Energy without environment contamination yet this energy is not utilized to its full capability because the dominant source of energy now a days is oil which is at present cheaper than energy.

However this situation is likely to change in future. One of the ways for direct conversion of sun light into electric power is by a process which is called the photo - voltaic effect this kind of conversion process does not

depend on heat absorption. The behavior is accounted for by the fact that the photons for solar light transfer their energy directly to electrons without an intermediate thermal step.

Sun tracker can significantly improve the efficiency of any solar Energyconversionplant whether a photo-voltaic or a thermal conversion Type. It is highly cost effective in photo-voltaic energy systems because of the high cost of photo - voltaic cells. Tracking flat plate photo voltaic arraysprovide about ⅓ more power than fixed arrays [1]. See Figure (1).
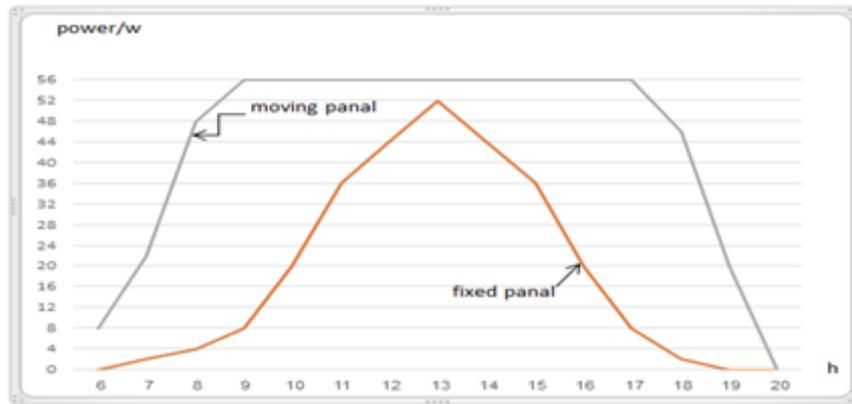
Fig .1 Silicon solar cell power curves
(──── Fixed panal ──── tracker panal) [1]

1.1 Analog control sun tracker:

An analog control sun-tracker consist of (3) parts as shown in Figure (2).

i) Photo sensor unit   ii) Control circuit   iii) Drive unit
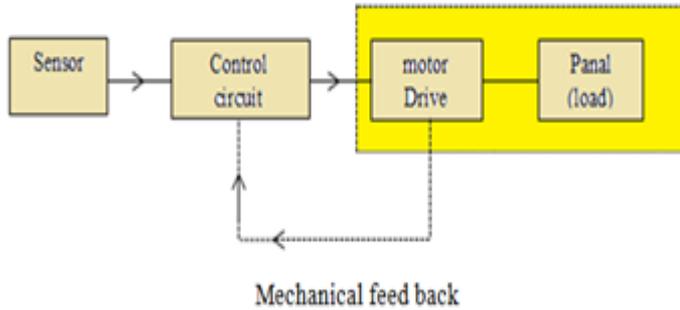
Fig.(2) Block diagram of a sun tracker system

2. POSITION OF THE SUN

The sun rises due east and sets due west, so that the altitude of the sun at solar noon on these days equals 90º minus the latitude. At the summer and winter solstices, the altitude at solar moon has increased or decreased by the declination of the earth (23.5º)as shown in Figure (3).
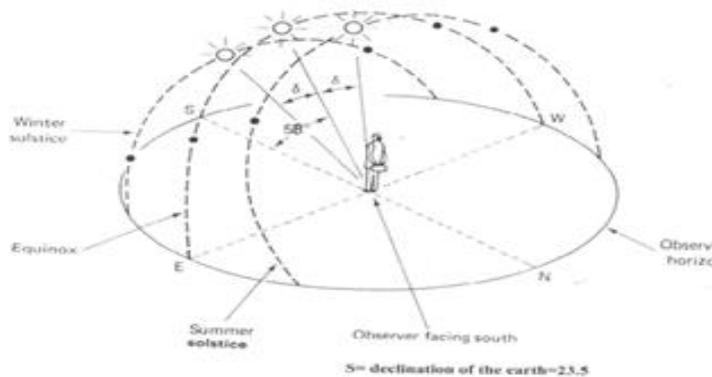
Fig.(3)   Apparent motion of the sun relative to Benghazi observer
at latitude 32 in the north hemisphere.[12]

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3. PRIMARY SENSOR:

The primary sensor this tracker is a two-side pyramid with a solar cell mounted on each face solar cells are used as shown in Figure (4).because of the pyramid sensor has a wide acceptance angle [135 degrees]. The two pairs of solar cells in the sensor pyramid are wired series opposing Figure (5).they are used as two independent differential light sensors each solar cell acts as a highimpedance current source load to the other, resulting in high sensitivity. The output voltage of the sensor undergoes a large voltage swing with a small difference in cell insulation.[3][4]

.

Fig (4) .Series opposing sensor   Fig (5) . Primary sensor
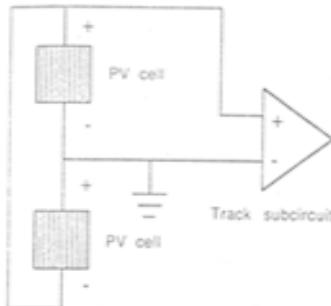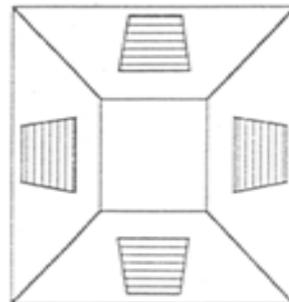
Conduction   pyramid [3][4]

4. CONTROL CIRCUIT UNIT

The control circuit consists of electronic circuits which process the information from the photo sensor and controls the tracker orientation. It called an Arduino microcontroller it consist of input unit, output unit and microprocessor as shown in Figure (6). [11] .

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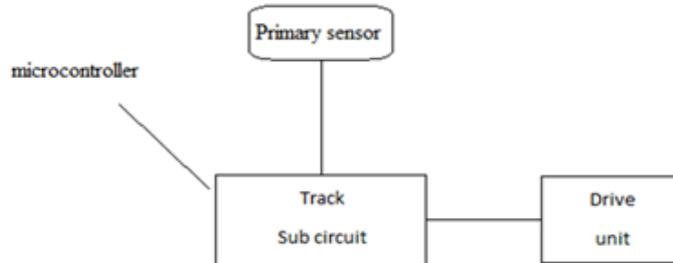
Fig (6) .Block diagram of control circuit

4.1 Track Sub Circuit

The control circuit unit is shown in Figure (7). It is an Arduino Uno this circuit is sense the input signal, process and take the decision to the output.
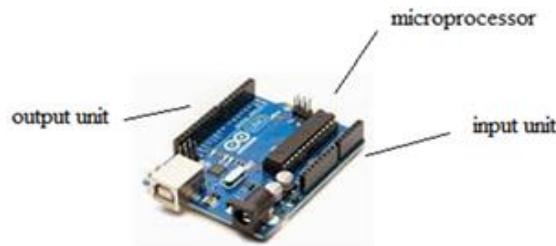
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Fig (7) the control circuit unit [11]

5. DRIVE UNIT

A simple servo motor is an electrical device shown in Figure (8). which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is

AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. [10].

Fig (8) Simple Servo motor [10]

Servo motor works on PWM (Pulse width modulation) Prin-
-ciple means its angle of rotation is controlled by the duration of applied pulse to its Control PIN.

This degree of rotation can be controlled by applying the Electrical Pulse of proper width, to its Control pin. Servo checks the pulse in every 20 milliseconds. Pulse of 1 ms (1 millisecond) width can rotate servo to 0 degree, 1.5ms can rotate to 90 degree (neutral position) and 2 ms pulse can rotate it to 180 degree show Figure (9). [10]
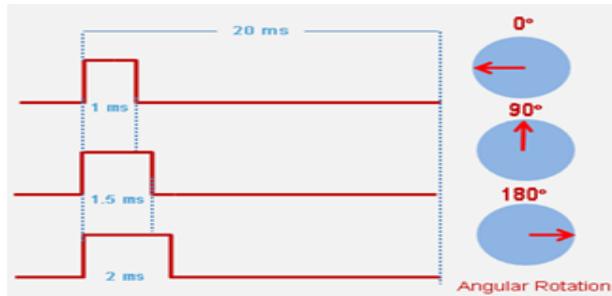
Fig (9) Angular rotation controlled by the duration of applied pulse [10]

5.1 Advantages of Servo motors

1. **Positioning** – Since steppers move in precise repeatable steps, they excel in applications requiring precise positioning
2. **Speed Control** – Precise increments of movement also allow for excellent control of rotational speed for process automation and robotics.
3. **Low Speed Torque** - Normal DC motors don't have very much torque at low speeds. A Stepper motor has maximum torque at low speeds, so they are a good choice for applications requiring low speed with high precision.

6. DESIGN AND OPERATION

This sun tracking system consists of three stages as shown in the block diagram Figure (6). it consists of primary sensor unit , control circuit unit (track sub circuit) , and Driver unit , the control circuit unit is an electronic circuit which process the information from the primary sensor unit (photo sensor) and controls the tracker orientation.this device is a microcontroller(Arduino microcontroller) it consist of input unit , output unit and microprocessor .

The track sub circuit controls the motion of the mechanical drive system and is usually controlled by the primary sensor which consist of two side pyramid with a solar cell mounted on opposite face placed on the surface of the tracker and connected to the control circuit (microcontroller).It provides information on the relative position of the sun.

We measured the characteristic of the cell (V_{oc} and I_{sc}) in dark and under light using a 100 w electric lamp light at a distance of 0.5 m from the cell. Where:-

"V_{oc} " is the open circuit voltage of solar cell "primary sensor"

" I_{sc} " is the short circuit current of solar cell "primary sensor"

The results are shown in table (1).

Table (1) Measured values of solar cell characteristic, V_{oc} open - circuit voltage and I_{sc} short - circuit current.

	I_{SC}	V_{oc}
Dark	0.2 μ A	8.4mv
Light	1.78 mA	3.0 v

The direction of movement is controlled by the track sub circuit which consistsof software to control the input signal.

The output of microcontroller is connected to the drive unit which consists of servomotor this is because when we connected the motor at the same point the voltage in this point is zero volt until the microcontroller is switch.

An Arduino microcontroller is used as input voltage comparator by Arduino software C + + language operating and by connecting the two photo sensor V_1 " the signal " and V_2 " the reference " 3 V to be analysis to the microcontroller . If the input voltage v1 is slightly greater than the reference voltage the microcontroller quickly switches to its maximum positive outputand when the input voltage is less than the reference voltage the microcontroller switches to its maximum negative output. In this way microcontroller act as a positive output or negative output drive to the servo motor.

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The microcontroller provides the positive signal voltage and the negative signal voltage which is applied to the motor.

When the input signal from microcontroller is positive the output signal is positive this signal let voltage signal on the output pin ispositive, and when the input signal is negative this signal let the voltage signal on the output is negative.

7. Test of The Control Circuit

The control circuit unit is shown in Fig. (6.4) It is an Arduino Uno this circuit is sense the input signal, process and take the decision to the output. This is the overall control circuit unit about azimuth direction. It is the important part of sun tracker system, because it controls the movement of the panel by the signal which comes from the sensors. In [+5 v] the motor rotates in one direction and when it is about [- 5 v] it rotates in the other direction. Normally the tracker is controlled by the pyramid detector. It operates in track mode when moving to find the sun, and in the wait mode if the pyramid output voltage is within the dead zone of the control circuit.

8. Arduino code

```
#include <Servo.h>
Servo horizontal;
intservoh = 180;
intldrlt = 0;
intldrld = 2;
```

```
void setup()
{
Serial.begin(9600);
horizontal.attach(9);
pinMode(ldrlt, INPUT);
pinMode(ldrld, INPUT);
}
void loop()
{
intlt = analogRead(ldrlt);
intld = analogRead(ldrld);
inttol=0;
intavt = (lt + ld) / 2;
intdhoriz = avl - avr;
if (tol>dhoriz || dhoriz>tol)
  {
if (avl>avr){
servoh = --servoh;

if (servoh< 0){
servoh = 0;
        }
    }
```

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```
else if (avl<avr){
servoh = ++servoh;
if (servoh> 169){
servoh = 169;
            }
        }
else if (avl == avr){
        }
horizontal.write(servoh);
  }
delay(50);
}
```

9. DISCUSSION AND CONCLUSIONS

A small proto type model was used for building and testing the tracking system to reduce the cost however the difference with a full scale system will be in the size and power or the motors and in the drive unit which interfaces the motor to the tracking electronic.

The tracking system constructed in this paper is simple and reliable. It can be used as tested for flat plate or moderate ratio systems. The device can be adapted for higher precision tracking by using imaging electro optic sensors and would then be applicable to any point focus solar energy system. This tracker can be applied to large-scale photo voltaic power stations each solar array would have its own independent control unit.

This sun tracker is relatively easy to install although the system requires initial orientation, the accuracy of the setup procedure is not critical the control unit has a low component count and, all components are low cost types. See Figure (10).

Fig(10).Complete module project

10. ACKNOWLEDGMENTS

helped me to complete this study.

Finally, we would like to extend our thanks to all friends for their help

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AUTOMATIC TEMPERATURE AND HUMIDITY CONTROLLED FAN BY ARDUINO UNO IN PROTEUS

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Abstract— This paper focuses on how the speed of fan can be controlled, based on both temperature sensor and humidity sensor. It is a part of smart home application where a fan will gradually increase its speed if the temperature or humidity is increased. In fact we all know now days we are moving rapidly toward automation which becomes one of the trending and hot topics. Basically in this paper an effort has been done to control fan speed according to the change on temperature and humidity. In this paper an effort has been done to work with two scenarios, the first scenario is about a system that will get the temperature from a temperature sensor and it will control the speed according to the temperature, set by the user. the second scenario is about a system that will get the humidity percentage from a humidity sensor and will control the fan according to the percentage of humidity. In this paper, microcontroller forms the processing part, which firstly senses the temperature and the controller then compares the data with both the set temperature and set humidity.

Keywords— Liquid Crystal Display (LCD), Sensor Microcontroller, Speed, Temperature, Humidity.

الملخص

تركز هذه الورقة على كيفية التحكم في تشغيل وسرعة مروحة كهربائية ، هذا العمل يتم على أساس مستشعر درجة حرارة ومستشعر رطوبة. وهو جزء من اجزاء تطبيقات المنزل الذكي حيث ستزيد المروحة من سرعتها تدريجيا إذا زادت درجة الحرارة أو الرطوبة. في الواقع ، نعلم جميعًا هذه الأيام أننا نتجه بسرعة نحو ما يُعرف بـ (الأتمتة Automation)

التي أصبحت واحدة من الموضوعات الرائجة مؤخراً. بشكل أساسيّ في هذه الورقة تم بذل جهد للتحكم في سرعة المروحة وفقا للتغير في درجة الحرارة والرطوبة. تم في هذا الورقة بذل جهد للعمل مع اثنين من السيناريوهات Two Scenarios، السيناريو الأول هو عن نظام سيحصل على درجة حرارة غرفة من جهاز استشعار درجة الحرارة وسيتحكم في السرعة وفقًا لزيادة او نقصان درجة الحرارة ، التي يحددها المستخدم. السيناريو الثاني هو عن نظام سيحصل على نسبة الرطوبة من جهاز استشعار الرطوبة وسيتحكم في المروحة وفقًا لنسبة الرطوبة. في هذه الورقة ، يقوم المتحكم الدقيق الموجود بلوحة الاردوينو بتشكيل جزء المعالجة، الذي يستشعر في المقام الأول درجة الحرارة وجهاز التحكم ثم يقارن البيانات مع كل من درجة الحرارة المحددة ونسبة الرطوبة.

INTRODUCTION

Electric fan is one of the most popular electrical devices due to its cost effectiveness and low power consumption advantages. It is a common circuit and widely used in many applications. It is also one of the most sensible solutions to offer a comfortable and energy efficient. In fact, fans have been long used and still available in the markets. Fan can be controlled manually by pressing on the switch button. Where in this method, any change in the temperature or humidity will not give any change in the fan speed. Except the usage change the speed of the fan which is manually. So, an automatic temperature and humidity control system technology is needed for the controlling purpose in the fan speed according to the temperature or humidity changes.

Problem Statement

In fact, home appliance such as fans need to be operated manually with the help of regulators and with variation of temperature or humidity, thus requires a repeatedly extra effort for regulating the fan speed. To reduce this effort and to add more comfort, it is intended in this paper to design an "Automatic Temperature and Humidity Controlled Fan" to overcome

and solve this issue.

COMPONENTS OF FAN SPEED CONTROL SYSTEM BASIS ON TEMPERATURE AND HUMIDITY

The Arduino is the brain of the system. It accepts inputs from the temperature sensor (LM35) or humidity sensor (DHT22) which allows for the measurement of the room temperature, then the microcontroller will give the action to adjust the suitable fan speed. LCD is selected to display the fan speed and room temperature. Figure 1, the first scenario illustrates the automatic temperature fan speed process by Arduino Uno, if the current temperature is greater than the set temperature, the controller turns ON the fan and the set speed will be proportional to the difference between the set temperature and the current temperature. If the current temperature is less than the set temperature, the fan will be turned OFF. The fan's speed will change according to the temperature as shown in block diagram in figure 1.

LM35 Temp Sensor → Arduino Uno R3 → LCD Display

Arduino Uno R3 → Fan

Input   Process   Output
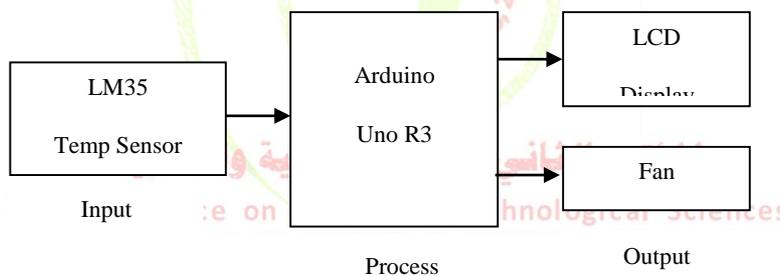
Fig 1. Block Diagram of Fan Speed System according to the change on temperature

In the second scenario, the fan system according to the change on humidity of an area. If the humidity rises to 75% or more then the fan will be ON and when it falls down, the fan goes OFF. See figure 2, the block diagram according to the change in humidity.
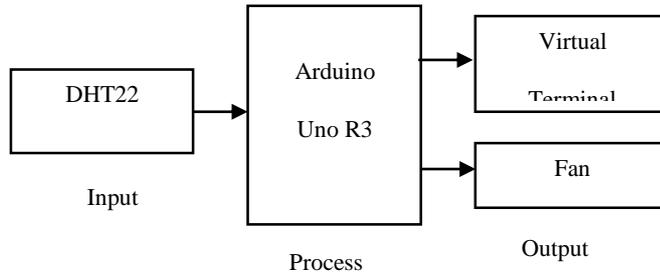
Fig 2. Block Diagram of Fan Speed System according to the change in humidity

Microcontroller and Arduino Uno R3

A microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decode written instructions and convert them to electrical signals.

The microcontroller will then step through these instructions and execute them one by one. As an example of this, a microcontroller could be used to control fan speed according to the temperature of the room. There are different types of microcontrollers, and this paper focuses only on the Arduino Uno Microcontroller (ATMega328) where it is shown below in figure 3.
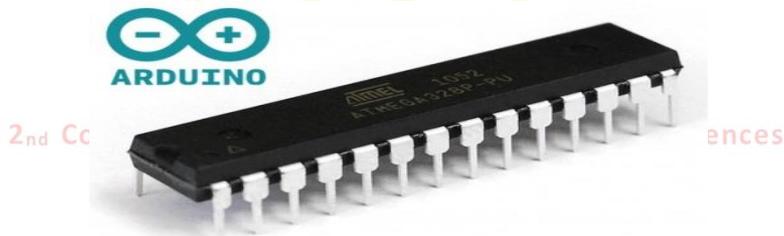
Fig 3. Arduino Uno Microcontroller ATMega328

Temperature Sensor LM35

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C). It can measure temperature more accurately than a using a thermistor. The sensor circuitry is sealed and not subject to oxidation. The LM35 generates a higher output voltage than thermocouples and may not

require that the output voltage be amplified. the LM35 is a 3-pin device (like a transistor) which converts temperature into analog voltage. This sensor requires an ADC (Analog-to-Digital) module in order to convert the analog voltage into digital data. The LM35 temperature sensor shown in figure 4 has the following features (from the datasheet) [1]&[2]:

- Directly Calibrated to the Kelvin Temperature Scale
- 1°C Initial Accuracy Available
- Operates from 400 μA to 5 mA
- Less than 1-Ω Dynamic Impedance
- Easily Calibrated
- Wide Operating Temperature Range
- 200°C Overrange
-

Fig 4. Temperature Sensor LM35

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Humidity Sensor DHT22
The DHT22 is a basic, low-cost humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data [3]. See figure 5 which shows the humidity sensor DHT22.

Fig 5. Humidity Sensor DHT22

Table 1, shows the most important technical details of humidity sensor (DHT22) that is selected in this paper.

Table 1 .Technical Specifications for DHT22

Model	DHT22
Power Supply	3.3.- 6 Volts
Output Signal	digital signal via single-bus
Operating Range	humidity 0-100% RH
Sensing Period	Average: 2s
Dimensions	14*18*5.5 mm

Liquid Crystal Display (LCD)

This component is specifically manufactured to be used with microcontrollers, which means that it cannot be activated by standard IC circuits. It is used for displaying different messages on a miniature liquid crystal display. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. See figure 6 , the liquid crystal display that is selected in this project.
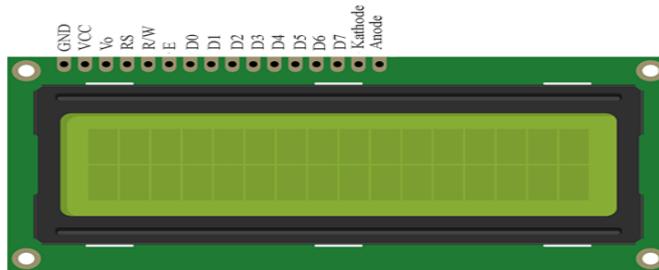
Fig 6. LCD Display Screen

In this LCD each character is displayed in $5x7$ pixel matrix. This LCD has two registers, namely, Command and Data[4].

Arduino Uno R3

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. Figure 7 shows the Arduino Uno platform.
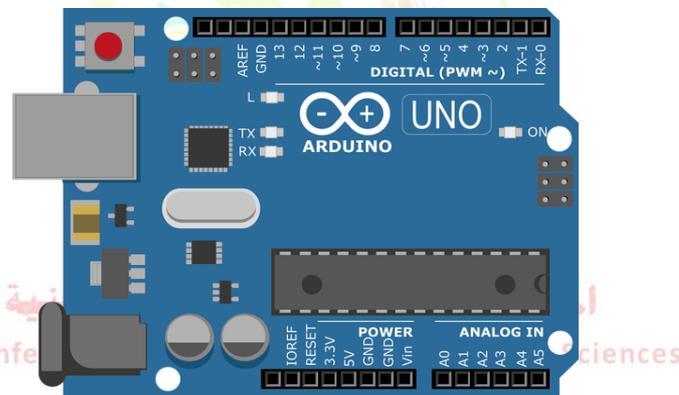
Fig 7. Arduino UNO R3 platform

Proteus 8 Cad Software Tool

The Proteus is an electronic circuit design software tool which includes a schematic capture, simulation and PCB, or (Printed Circuit Board) Layout modules. Proteus tool is ahead in simulating the circuits containing the micro controllers where we can simulate the circuit by uploading the hex code to the Micro-controller where as Multism can't do this. Figure 8 shows the proteus software tool.

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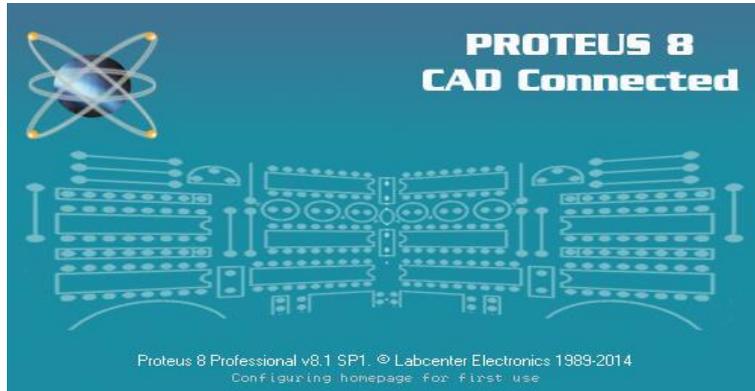
Fig 8. The Proteus Design Suite

Proteus Visual Designer allows Arduino programs to be written with simple flowcharting methods and Arduino shields to be placed on the schematic with a mouse click. The entire Arduino system can then be simulated, tested and debugged in software [5].

Diode

The diode is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other. See figure 9 that illustrates the diode component.

Fig 9. The Forward and Reverse Biased Diode

The most common function of a diode is to allow an electric current to pass in one direction (called the diode's forward direction), while blocking it in the opposite direction (the reverse direction). As such, the diode can be viewed as an electronic version of a check valve. This unidirectional

behavior is called rectification, and is used to convert alternating current (AC) to direct current (DC) [6].

FAN SPEED CONTROL CIRCUIT DESIGN IN PROTEUS SOFTWARE TOOL ACCORDING ON TEMPERATURE

This scenario describes how the speed of fan is controlled by output from microcontroller, with the change in room temperature. The control circuit of fan speed system shown in figure 10. It shows LM35 , LCD and Fan connection with Arduino Uno R3 in Proteus and when temperature is $> 25^0$ C the Fan is ON.

Fig 10. LM35, LCD and Fan ON with Arduino Uno in Proteus

The control circuit of fan speed system shown in figure 11, which shows LM35 , LCD and Fan connection with Arduino Uno R3 in Proteus and when temperature is $< 25^0$ C the Fan goes OFF.

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Fig 11. LM35, LCD and Fan OFF with Arduino Uno in Proteus

Microcontroller and Arduino Uno R3 Code Program

The algorithm is as following:

1. #include<LiquidCrystal.h>
2. int A=0;
3. int B;
4. int sensorpin=A0;
5. int fan= 13;
6. int min_temp=15;
7. LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
8. void setup() {
9. lcd.begin(16, 2);
10. pinMode(fan,OUTPUT);

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11. }
12. void loop()
13. {
14. A=analogRead(sensorpin); // *get the temperature*
15. B=(A/2);
16. if (A< min_temp) // *if temperature is lower than minimum temperature*
17. {
18. digitalWrite(fan, LOW);
19. lcd.setCursor(0,0);
20. lcd.print("FAN IS OFF");
21. }
22. if(A > min_temp)
23. {
24. digitalWrite(fan, HIGH);
25. lcd.setCursor(0,0);
26. lcd.print("FAN IS ON");
27. }
28. }

The LCD is used to measure and observing the changes of temperature values. Furthermore, the temperature sensor senses the room temperature and displayed it on the LCD screen. The speed of the fan is controlled according to the room temperature changes.

FAN CONTROL CIRCUIT DESIGN IN PROTEUS SOFTWARE TOOL ACCORDING ON HUMIDITY OF AN AREA
The second scenario describes control of the humidity of an area. The control circuit design uses a fan and here a DC motor selected as a fan for simplicity. If the humidity rises to 75% or more then the fan will be ON and when it falls down, the fan goes OFF. DHT22 is selected as a humidity sensor. Circuit of fan speed system according on humidity is shown in figure 12. This scenario shows DHT22 , Virtual Terminal and fan connection with Arduino Uno R3 in Proteus Tool to monitor and control the humidity of room when it is larger than 75% the fan is ON.
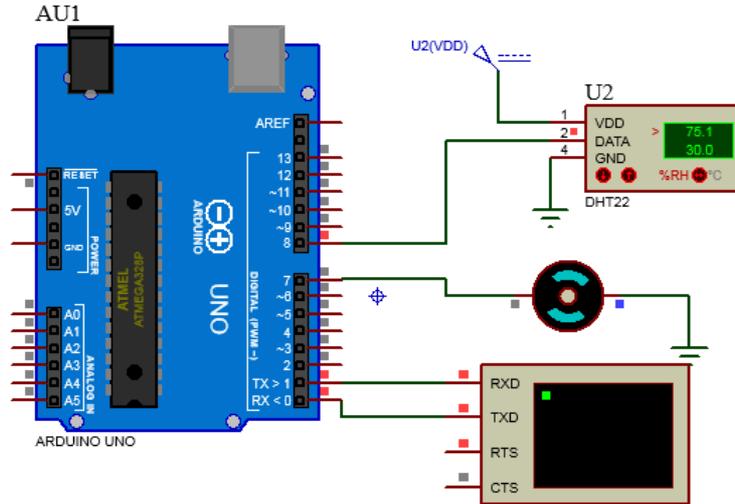
Fig.12. DHT22 ,Virtual Terminal & Fan connection with Arduino in Proteus Tool

The DHT22 humidity sensor is connected successfully to Arduino Uno. When the humidity rises more than the threshold value the fan works until it becomes lower than the threshold value. The process is automated and simulated in Proteus 8 tool. The increasing and decreasing is done manually. Connection, coding, and simulation demonstrated. The Arduino code is as following:

```
1. #include "DHT.h"
2. #define DHTPIN 8
3. #define DHTTYPE DHT22
4. DHT dht(DHTPIN, DHTTYPE);
5. int FAN=7;
6. void setup() {
7.  Serial.begin(9600);
8. pinMode(FAN, OUTPUT);
9. }
10. void loop()
11. {
```

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12. float h = dht.readHumidity();
13. Serial.println(h);
14. if (h>=75)
15. {
16. digitalWrite(FAN,HIGH);
17. }
18. else
19. {
20. digitalWrite(FAN,LOW);
21. }
22. delay(500);
23. }

Once the humidity is less than 75% the fan is switched OFF as shown in figure 13.
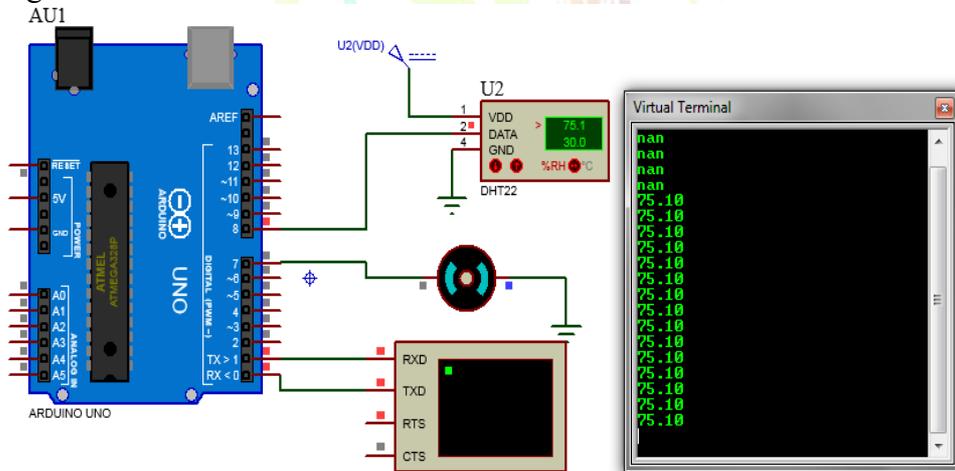
Fig 13. Humidity is 75.10 on virtual terminal which mean the Fan is automatically goes ON

RESULTS AND CONCLUSION

In this paper an effort has been done to design, program and simulate a fan speed control system to adjust the room temperature and humidity by Arduino in proteus tool. The temperature sensor function is to sense the

room temperature and the humidity sensor to sense the room air humidity. Besides this, the microcontroller to control the fan speed using the fan speed in rpm and the Arduino was successfully programmed using C/C++ Language to compare temperature with standard temperature, set fan speed and their values displayed on LCD in first scenario and humidity percentage displayed on virtual terminal in the second scenario.

As conclusion, the system which designed in this work was perform very well, for any temperature change and any variating in humidity percentage. On the other hand, reliability is one of the key factors when one is considering of designing a new device. The same applies for temp automation systems or humidity automation circuits. If there is no error detection or correction in a system, there is no way to find out if a command got through to the device it was intended unless you can physically see or touch the machine. In other words if the controller does not get the acknowledge in a specified time window it deploys a retransmission thus, our temp automation system can be considered as reliable system and humidity automation circuit strongly can be a reliable.

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Design and Techniques for EEPROM

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Abstract—we present the design and test results for a radiation hardened by design 2 k Byte EEPROM fabricated in acommercially available 0.5µm CMOS process. The EEPROM will be used in a small on-chip memory to store key instrument parameters and simple control programs for a microcontroller compatible with Martian surface temperatures on the low end (−125_C) and standard industrial temperature on the high end (+85_C). The EEPROM has shown radiation to lerance up to 60 krad. The EEPROM is written with *p*FET hot-electron injection and erased with tunneling. Writing is byte-addressable and erasing is performed on the whole array at the same time. The EEPROM test chip consumes a maximum 56.7mW during Operation.

الملخص

نحن نعرف ان اهم جزء فى جهاز الحاسوب بعد المعالج هى الذواكر الرئيسية (RAM _ CACHE_ROM) فلذا كان الاهتمام الاكبر هو امكانية رفع مستوى الذواكر الوسيطة لأنها الاقرب للمعالج ، لكن المشكلة في ان كلما زاد حجم الذاكرة قلت سرعته والمشكلة الثانية فى ان الذاكرة (ROM) هي للقراء فقط واستعماله محدود فى الجهاز .

فلذا سوف يوضح البحث امكانية تطوير الذاكرة (ROM) بحيث تكون قادرة على اعادة الكاتبة بكل محدود دون التأثير على الملفات الرئيسية التي تحتويها الخاصة بتشغيل

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الجهاز ، فلذا تم تطوير الذاكرة الى المراحل التالية :

1. PROM (Programmable Read−Only Memory)

2. EPROM(Erasable Programmable Read−Only Memory)

3. EEPROM(Electrically Erasable Programmable Read−Only Memory)

في هذه الدراسة سيتم التركيز على النوع الاخير لما لها من اهمية في امكانية اعادة برمجة الذاكرة ومسحها كهربيا وإعادة كتابة الذاكرة وتعديل في الملفات الرئيسية مما يساعد على تطوير سرعة الجهاز بصفة عامة .

ومن ضمن نتيجة هذا البحث هي تجربة هذه الذاكرة تحت تأثير طاقة كهربية بنسب معينة سوف يتم تناولها في البحث وتحت درجة حرارة معينة كذلك وبهذا يمكننا من تعديا إي شريحة الكترونية بطريقة ناجحة دون الحاجة إلى الرجوع للشركة الأم المصنعة

1_ INTRODUCTION

The integration of analog components with complex digital blocks allows for true single chip solutions to complex problems. A general form of this concept is a mixed-signal microcontroller and a key component to making a true single chip component is nonvolatile memory for program storage. Of the many forms of nonvolatile memory, the most versatile from a user standpoint is electrically erasable programmable memories (EEPROM). We achieve system-on-chip integration by designing an EEPROM that will be placed on the same die with a full-featured radiation-tolerant microcontroller in a commercially available 0.5 µm CMOS process. Rad-Hard-by-Design (RHBD) is a strategy for designing

CMOS integrated circuits for tolerance to the ionizing radiation environments encountered in spaceflight. Radiation tolerance is achieved

by circuit and layout techniques instead of employing special rad-hard CMOS fabrication processes. Most commercial manufacturers of integrated circuits are reluctant

to invest in the development of radiation tolerant integrated circuits because the market for such devices is very small. Although many commercially available circuits are sufficiently radiation tolerant for specific applications, it is often necessary to add radiation shielding and protection circuitry to guard

Against single event latch-up. RHBD enables designers to improve performance, lower cost, and reduce risk by systematically designing application specific integrated circuits that are radiation tolerant by design instead of serendipity. By using a commercial CMOS process, rapid, low cost prototyping and

The small volume production required for space applications can be done via the MOSIS service, or other prototype service.

2_BACKGROUND

EEPROMs can be roughly divided into two categories:

Charge trapping devices and floating gate devices. Charge trapping devices use a layer of charge-trapping dielectric such as silicon nitride (e.g., MNOS [1], SNOS [2] and SONOS [3],

[4]) to store information, and are intrinsically radiation tolerant since the nobilities of electron and hole are similar in nitrides; as electron-hole pairs are generated due to ionizing radiation,

They are swept out of the insulator, leaving negligible trapped charge [5]. A floating gate MOSFET uses an electrically isolated material such as polysilicon to store charge indefinitely [6]. The only path for electrons is through the oxide surrounding the isolated material. Typically, floating gate transistor are *n*FETs.

However, *n*FETs are more sensitive to total ionizing dose (TID) radiation

because of the induced leakage path along the edge of the source and drain terminals. There are techniques to mitigate these effects [7], but the resulting transistors are significantly larger than minimum sized transistor. The

increase is transistor size also results in a necessary increase in the floating gate area. The increase in area will in turn make the cell more sensitive to total dose exposure [8]. In order to keep the memory cell area and radiation sensitivity to a minimum, we implemented the memory cell using a floating

gate pFET. The choice of using a pFET based memory cell also allowed us to use impact ionization for programming; something not possible with the nFET due to the lightly doped drains in this process.

3_MEMORY ARCHITECTURE

We had no information on the inherent immunity to single event upset of our memory cell, but clearly the supporting control and sense circuitry might be susceptible to transient effects. Therefore the memory was configured with a 2-bit error detection/single bit error correction code per byte,

Resulting in a 13-bit code word for each 8 bits of information. The error detection and correction logic is implemented as part of the memory interface in the microcontroller and not

Contained in the memory block. In addition, well regions were isolated with continuous guard bands to prevent radiation induced latch up.

The EEPROM is organized in 32 banks of memory blocks. Figure 1 shows the memory architecture. Each bank consists of 64 memory bytes; each byte consists of 14 memory cells; and each cell is responsible for storing one bit. Among the 14 bits, eight of them are used to store one byte of data, five for The Error Detection and Correction (EDAC) bits, and one bit is left unused. Row lines span across the array, connecting the bytes

horizontally. Column lines connect the bits vertically. The row decoders and the bank decoders select one particular memory byte for accessing. The most significant 6 bits of the address select a row, and the last 5 bits select a column. 32 sets of column lines are multiplexed into one set of bit lines by the column decoder. Each of the 14 bit lines is connected to an individual sensing/driving element for readout and programming.
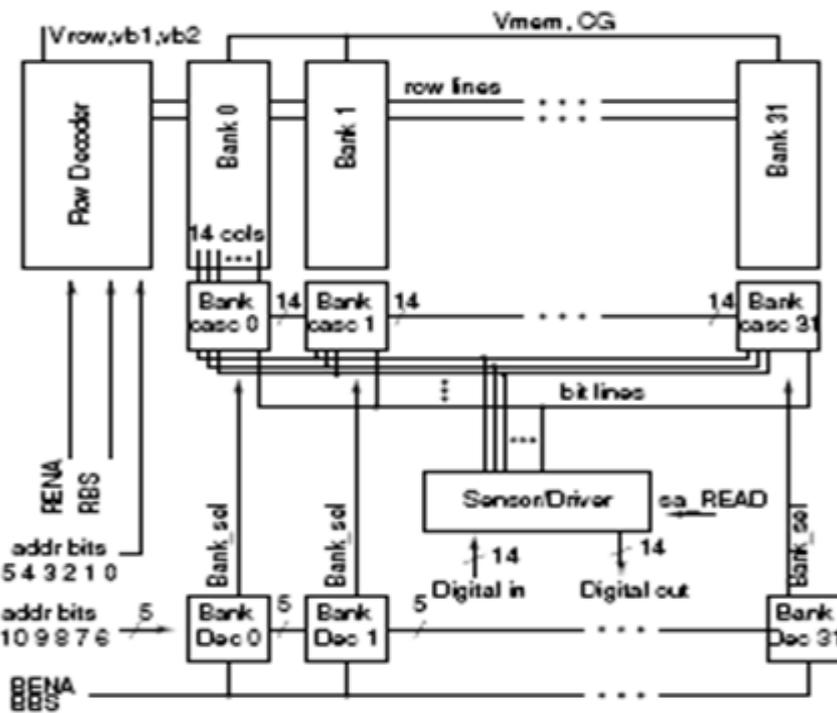
Fig.1. Overview of the rad*hard EEPROM [2]

4_MEMORY CELL

Each memory cell stores one bit and consists of two *p*FETs connected in series. Figure 2 shows one memory cell. Select transistor M1 serves as a switch during both read and erase operations and as a current source for

the write operation. M2 serves as the readout transistor for the floating gate (the gate of M2). The gate oxide of M2 serves as the portal for the electrons during both write and erases operations. The floating gates of all memory cells are capacitive coupled to a global control gate (CG). The current flows from the transistors onto the column line where it is sensed by a current comparator to Generate digital outputs.
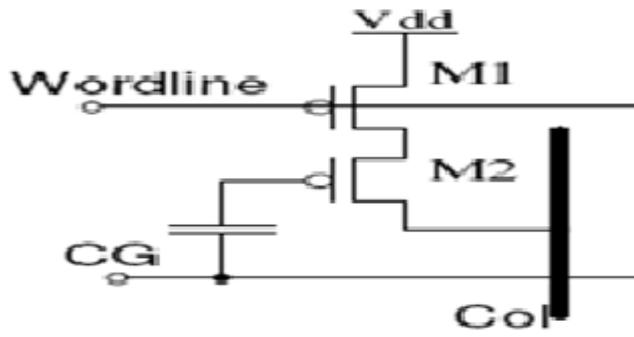
Fig.2. Memory Cell [4]

A. Floating Gate Physics

Hot-electron injection is a common method for programming a floating gate structure and has been extensively described in the literature [5], [9], [10]. Impact-ionized hot carrier injection occurs in MOSFETs when two conditions are satisfied: a large lateral electric field, EL, along the channel to increase the probability of impact-ionization to produce high energy electrons, and a large vertical electric field, EV, across the gate oxide to sweep these hot electrons over the oxide barrier onto the floating gate.

Efficient injection requires that both conditions are present (EL and EV are large). For above-threshold operation, a large electric field exists in the channel pinch-off region [5], which is depleted of carriers. The potential at the pinch-off point is VG −VTH. The voltage drop across the pinch-off region is VP = VD−VG+VTH, and EL = VP /LP where VG, VTH and LP

are the gate voltage, threshold voltage and pinch-off region length, respectively. For an ordinary *n*FET biased in saturation, where the gate voltage is below the drain voltage (VG < VD), EL is large, but the vertical field EV = (VG − VD)/tox is negative and repels the electrons away from the floating gate.

On the other hand, for a higher gate voltage EL is lower, reducing generation. In other words, we cannot satisfy both conditions at the same time for a regular *n*FET. Thus, special process techniques such as split-gate or source-side-injection have been used [11]. For an ordinary *p*FET, it is relatively easy to achieve a high EL and a small but positive EV under normal operation. The injection efficiency is not very high but sufficient for floating gate programming.

B. B. Current-limited pFET Hot-Electron Injection for Witting

The condition for *p*FET hot-electron injection is set up for M2 during a write operation. An important feature for the memory cell circuit is the constant current provided by the select transistor M1 through the channel during injection. Electrons are injected onto the floating gate, making the gate voltage of M2 lower, and as a result the channel current increases quadratic ally. The increased channel current results in an increased gate current, and therefore a more rapid voltage drop on the gate, leading to positive feedback. Although this seems to be an advantage for us, two factors makes this unrealistic: firstly, the current consumption is exorbitantly large and secondly, due to the finite conductance of the clamping circuit that holds the voltage at the drain during

Programming, the VSD for the *p*FET will decrease, reducing the injection efficiency, leading to an under-programmed gate voltage.

In our design, M1 limits the channel current during the write operation with a bias voltage on the word line supplied by the row decoder. As the gate voltage of M2 drops, the source voltage of M2 drops as well. The gate voltage drops until the injection process is complete, with a controlled

current consumption. This method of using *p*FET injection in a stable negative-feedback fashion has lead to many successes in the

Literature, especially adaptive floating gate elements in imagers [10] and comparators [12], [13].

Table (1) .Memory Cell Voltages

	Read	Write	Erase
Vdd	3.3 V	9 V	15 V
WL (sel)	1V	6.5 V	9 V
WL (dis)	5 V	9 V	9 V
CG	0 V	5 V	0 V
Columm	1.5 V	0 V	High- Z

C. C. 2k-byte Memory Radiation Test

Results from TID testing on a full EEPROM array (2 k x13 b) showed that our decision to use a more sensitive sense amplifier improved TID tolerance. After initial programming, the part operated properly up to an exposure of 60 krad. However, numerous read errors occurred after exposure to 62 krad. Functionality was restored if we then erased and reprogrammed the part. The part remained fully functional after exposure to an additional 40 krad. A second cycle of erase, reprogram, and 40 krad exposure was then performed and the part continued to function correctly. The pattern we used is random with 14205 bits programmed with a one and 14467 bits programmed with a zero. Before erasure, all bits are written to ensure no extra charge remains on the floating gate. We then placed the chip under bias in the radiation chamber. For each radiation step, we read out the data with multiple controls gate voltages, and recorded the range of the control gate voltage that gave correct data. As shown in Figure 7, the error in written bits set an upper limit to the control gate voltage, and the error in erased bits set a lower limit to the control gate voltage. As the

dosage increases, the two limits approach each other and at 60 krad, no control gate voltage yields error-free result. Based on the data in Figure 7, we choose a nominal control gate voltage of 1.65V to maximize radiation tolerance.
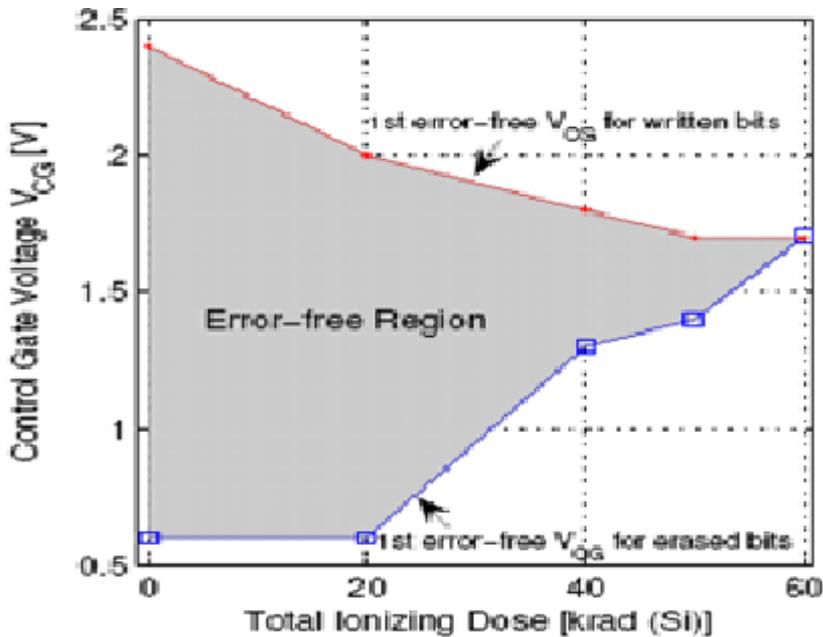
Fig.3. As usage Increases the Error Gap Closes [10]

5_D. Endurance

In the endurance test and subsequent high temperature data retention tests, the chips were programmed with a checker-board pattern. One chip (no. 30) had no errors after 2000 Erase/Write cycles. In the following, the numbers after the cycle denotes the number of error bits. Consecutive numbers separated by commas are the error bits measured repeatedly every one minute.

• 3k cycles: 2, 1, 1, 1.
• 4k cycles: 154, 116, 105, 95.
• 5k cycles: 1159, 958, 891, (after 24hr) 110, 116.
• 6k cycles: 2730, 2442, 2257.
• 7k cycles: 13737, 6333, 5330, (400us write) 69, (200us write) 3960.

The accumulation of electrons in the oxide with repeated programming and erasing is known to change the electric field during injection, and thus reduces the efficiency for injection [5]. Our experiments show some recovery with elapsed time.

As seen in the 7k cycles experiment, we significantly reduce error bits with twice the amount of programming duration.

However, as the number of cycles goes higher, it takes more programming time to write effectively.

6_E. Data Retention

A chip was programmed on 3/30/2005. Its data remains intact as of 8/24/2005 after storage at room temperature. In order to determine the long term data retention, we have also

Begun accelerated data retention testing. We can accelerate the effective time by increasing the temperature. The relationship is given by the Arrhenius equation

$$A(T) = \exp\left[\frac{-E_a}{K} \left(\frac{1}{T} - \frac{1}{T_0} \right) \right] \quad (1)$$

Where A (T) is the temperature acceleration factor, T is the temperature in Kelvin, T0 is the reference Temperature, k is the Boltzman Constant and Ea is the activation Energy.

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7_CONCLUSION

We have designed, fabricated and begun initial testing of a 2 k by 13 bit memory EEPROM in a commercial 0.5 μm CMOS process. The area of the memory block is 2.0mm by 1.6 mm. RHBD methodologies were used to improve the radiation tolerance. The memory has been tested and found to be fully functional over the Martian surface temperatures on the low end (−125_C) and standard industrial temperature on the high end (+85_C). Memory access times are measured to be 200 μs/byte for a write, 200 ns/byte for a read, and 3 s for full array erasure.

Total dose testing has found complete data retention up to 60 krad of exposure. Radiation tolerance can be increased further by erasing and reprogramming the contents. While this memory block has been designed for use in a RHBD microcontroller, the base technology can be partitioned into smaller memory sizes to hold configuration data for other ASIC applications.

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Design of Temperature Controllers Using Labview

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الملخص :

تعتبر الحرارة من أهم المتغيرات في أي عملية تشغيلية، سواء كان ذلك في المعامل الصغيرة أو في المنشآت الصناعية الكبيرة. نظرا للطبيعة الفيزيائية المعقدة لهذا المتغير والعوامل الخارجية الكثيرة التي تؤثر فيه، فقد تم إعطاءه أهمية كبيرة جدا من جانب طرق القياس والتحكم. حيث تم توظيف التقنيات الحديثة في هذا المجال ، فتم استعمال المجسات الصغيرة سريعة الاستجابة والعالية الدقة في تحسس الحرارة، وكذلك استخدام مرسلات الإشارة الذكية والتي تعتمد نظرية عملها علي المعالجات الدقيقة، حيث يمتاز هذا النوع من مرسلات الإشارة بإمكانية توصيله مع أنواع مختلفة من مجسات الحرارة ،وأيضا بإمكانية إرساله إشارات تقليدية ورقمية في نفس الوقت، ومن مزايا هذا النوع أيضا سهولة برمجته وإعداده للعمل وذلك باستخدام أجهزة برمجة محمولة. وفيما يتعلق بمجال التحكم، فقد تم استخدام أجهزة تحكم متقدمة تعتمد نظرية عملها على المعالجات والمتحكمات الدقيقة ،وأيضا تم توظيف البرمجيات المتقدمة في حل الكثير من المشاكل المتعلقة بالحرارة. وفيما يتعلق بجانب عناصر التحكم الأخيرة، فقد تم استخدام معدات حرارة يتم التحكم فيها عن طريق تقنيات حديثة تعتمد على الكترونيات القدرة من أجل الحصول على نتائج أدق وأفضل. وهذا البحث مثال عملي لدائرة تحكم في الحرارة، حيث تم فيه توظيف بعض من

التقنيات الحديثة من أجهزة وبرمجيات من أجل التحكم في درجة الحرارة لمنظومة مصغرة والاستفادة منها في الحياة العملية.

Abstract

Temperature is one of the most important variables in any manufacturing process, ranging from small plants to huge industrial facilities. Due to complexity of temperature and variety of external factors influencing this variable, a great concern has been given to its measurement and control methods.

The advanced technology has been greatly involved in measurement and control of the temperature. For sensing and measuring the temperature, fast acting, high accuracy sensors in addition to microprocessor based smart temperature transmitters have been used. This type of transmitters features compatibility with assorted types of sensing elements as well as it could transmit analog and digital signals simultaneously; Another advantage of this type of transmitters is simplicity in configuration and set up process using dedicated hand held communicators. Control-wise, microcontroller based control devices have been used. Also sophisticated software programs have been implemented in solving a lot of temperature related problems. Regarding final control elements, fully controlled power electronics based temperature equipments have been used. This type of equipments features power saving and accurate results.

This paper demonstrates a practical temperature control loop, in this loop some of the modern applicable techniques have been implemented to measure and control the temperature so that it would be practically and safely useful in the real life.

Keywords: Smart Instruments, PID Control, Ardinuo & Labview.

1. Introduction

In industrial plants, variety of process variables need to be monitored and

controlled, the target is, the final product is made in accordance to the applicable standards economically and safely. Process variables involve but not limited to, level, pressure, flow and temperature.

During manufacturing, all of process variables must be within the specified limits. Otherwise, final product quality might be impaired or safety hazard could arise. In general, monitoring and controlling of process variables consist of the following components:

a-   Sensing Devices: Characteristic and output of sensing devices is a direct function of the measured variable. Output of sensing devices could be in the form of electrical, pneumatic or hydraulic signals.

b-   Indication & Recording Devices: Function of these devices is to receive the signal from sensing device and display it in a scaled format either as instantaneous or plotted value with time.

c-   Control Devices: Function of control devices is to receive an input signal from the sensing device and compare it against a desired set point. Error between the input signal and the set point is processed and the resultant is an output correction signal.

d-   Final Control Elements: These devices receive output signal from control devices and carryout the required correction action.

If, for any reason, the process variable becomes out of control. An alarm is announced, and subsequent tripping action is activated by safety devices, shutting down the whole process.

2. Objectives

• Demonstrating a PID temperature control loop using Labview software.

• Studying the relationship between the temperature and the flow rate.

• Applying a protection circuit with the aid of Labview.

3. PID Control

PID (Proportional Integral Derivative) control is a widely used control method. It has huge advantage in the fields of control engineering. After a long period of engineering practiced, it has developed a complete program

of control methods and a typical structure. PID controller has simple structure, excellent stability, reliable performance and convenient adjustability. PID, as its name implies, utilizes the proportional, the derivative and the integral to work out controlled quantity based on the system errors. These three elements are mutually independent and have respective functions. Users can choose many combinations of the three based on the process requirements. The transfer function of a standard PID controller is generally written in this way [Dingyu Xue et al, 2007]:

$$G(s) = K_p + K_i \frac{1}{s} + K_d s$$

$$= K_p \left(1 + \frac{1}{T_i s} + T_d s \right) \qquad \qquad 1$$

Where Kp is the proportional gain, Ki is the integral gain, Kd is the derivative gain, Ti is the integral time constant and Td is the derivative time constant. As a linear controller, it according to a given value r(t) and the actual output value y(t) to control deviation e(t), the deviation in proportion, integral, and differential through linear combination constitute control u(t), to control the controlled object. For the output of the controller input relations is shown as [Dingyu Xue et al, 2007]:

$$u(t) = K_p \left[e(t) + \frac{1}{T_i} \int_0^t e(t) dt + T_d \frac{de(t)}{dt} \right] \qquad 2$$

Where u(t) is the output of PID controller, e(t) is the input. Figure 1 shows the theory controller in a feedback loop and figure 2 shows the effect of PI control on the process.

The PID controller is really very simple in operation. The PV [y(t)] is subtracted from the SP [r(t)] to create the Error [e(t)]. The error is simply multiplied by one, two or all of the calculated P, I and D actions (depending which ones are turned on). Then the resulting "error x control actions" are added together and sent to the controller output [u(t)] to final control elements in the plant to perform the required correction action.
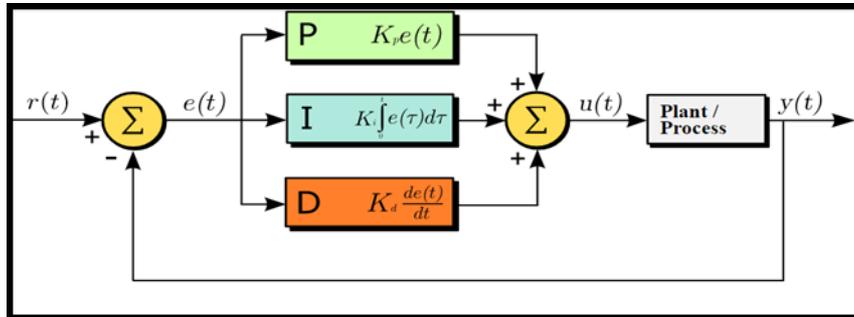
Fig.1. Theory of a PID controller in a feedback loop
[www.wikipedia.org/wiki/pid_controller September 2016]
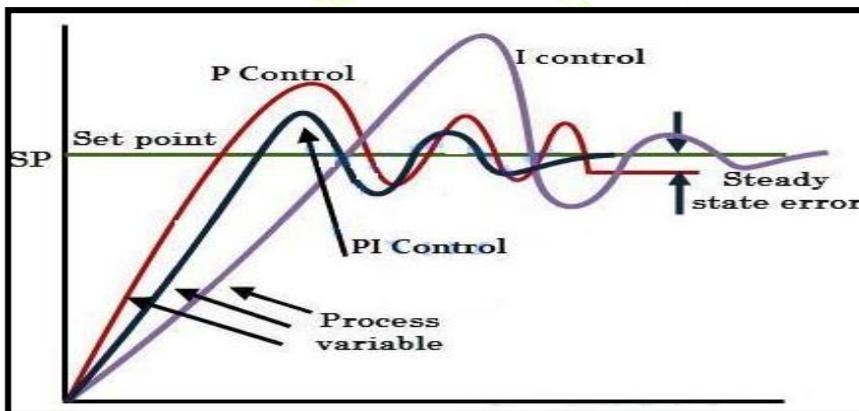
Fig.2. PI control effect on process [www.electricaltechnology.org Sep 2016]

4. PRACTICAL WORK

4.1 Hardware Description

The general objective of this control loop is to implement the Labview software in measuring; monitoring, controlling the temperature of a water heater supplying hot water to a customer at a desired preset temperature and protecting the system against overheat. Another concept demonstrated in this loop, is the relationship between the temperature and the flow rate. The water heater is the heart of the hardware system, it is used as a

reservoir for the water as well as heating up and maintaining the water temperature at the desired set point entered & controlled by the Labview software.

The total capacity of the water heater is **"10 Liters"**, and it is entirely insulated to minimize heat loses. The water heater is equipped with two heater elements, each one is **"1500 Watts"** rated and is independently controlled by the software through the switching circuit, each heater element is protected by thermostatic switch, this switch is set at **"80 °C"** , the switch has two functions: first is protecting the heater and the customer against uncontrolled overheat by generating an alarm in the Labview, which in turn will turn off the power of the switching circuit, the second function of the thermostatic switch is to prevent the water from reaching the boiling point **"100 ºC"** at which, the water will evaporate. Water is fed to the heater through isolation and check valves, the latter is used as a one way valve preventing water from escaping in case of shortage of water supply, hence protecting the heater elements from damage. The discharge flow rate through the water heater is controlled by manually operated flow control valve, at the end of the charge line there is an electrically operated normally close solenoid valve which is used to cut water supply to the customer and allow more residence time to heat up the water in case of the water temperature has fallen to unacceptable limit "**Set Point-15ºC**", the system is also provided with ON/OFF switch to operate the solenoid when desired by the customer (the valve will open only when the S.P is reached). The system is also equipped with a vent valve at the discharge line, this valve is used to vent the system manually in case the over protection circuit has activated. The water heater is also equipped with a temperature indicator in the range of "**-20 to +120 °C**" and a 3-wire resistance temperature detector "RTD" type Pt-100, which is used to measure the temperature inside the water heater and it transmits an equivalent electrical signal in the range of "Ohms" to a smart temperature transmitter(Model "3144" made by EMERSON) which in turn sends an electrical signal in the range of 4-20mA (0-100 ºC) to the analog input # 0 of the Arduino interface module across 0-250 ohms resistor. The Arduino module converts the analog signal to a digital signal so that it can be utilized by Labview software, the Labview executes the program and sends output

signals to the final control elements through Arduino and the switching circuit to maintain the desired temperature. Figure 3 shows the general layout of the control loop.
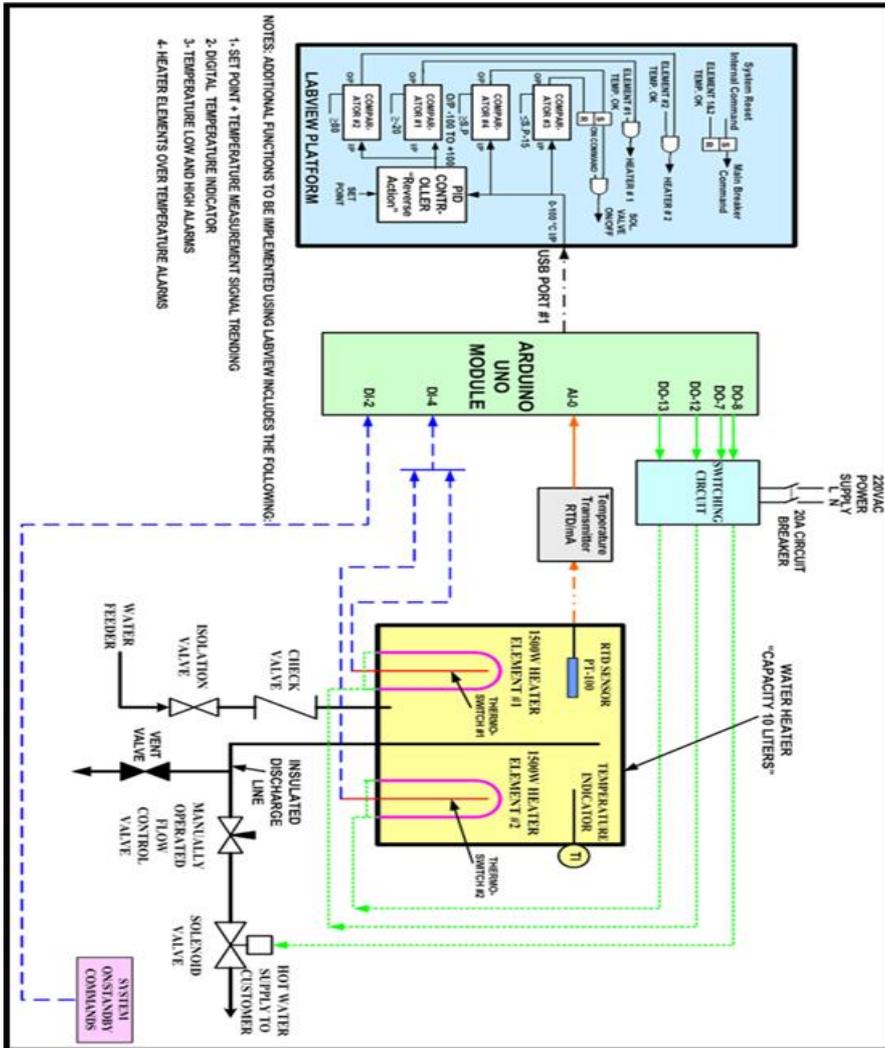

Fig.3. Temperature Controller using Labview General Layout

4.2 Software Description

The explanation of the software program is combined in conjunction with the following the logic block diagram (Figure 4), block diagram (Figure 5) and the front interface panel (Figure 6).

The temperature of water heater is fed to Lavview through Arduino analog input channel # 1(**Block #1)** in the range of 1-5 Volts and then forwarded to the scaling circuit (**Block #2)** where it is converted into engineering values in the range of (0-100°C), the scaled input/output signals are related by the following mathematical equation [www.omega.com, 2016]:

$$\mathbf{Y = MX + B} \qquad\qquad 3$$

Where:

Y = the output signal or engineering units.

M = the slope or the scale factor.

X = the input signal (millivolts, volts, etc).

B = the offset.

Let's apply the above equation to our case.

M= 100-0/5-1= 100/4 =25 °C/Volt.

X= varying from 1 to 5 volts.

B=-25 (since the output starts at 1 volt, there is an offset. We calculated a value of 25 °C/Volt, therefore, 1V = -25)

$\mathbf{Y_{1volt}}$= 25x1 + (-25)= 0°C

$\mathbf{Y_{5volt}}$= 25x5 + (-25)=100°C

The output of the scaling circuit (SC) is branched into four; the first branch is fed to the Low/High Alarming Circuit (Block #3) where the signal is compared against alarm Set Points entered through the Front Panel for annunciation purposes. The second branch from the SC is fed to (Block #17) for trending together with the controller Set Point & Output. The third branch is fed as a Process Variable (PV) to the PID controller where it is compared against a set point signal (Entered manually through the Face Plate), the error between the controller where it is compared against a set point signal (Entered manually through the Face Plate), the error between the two signals is further processed through a PID function (Block #5) and

an output corrective signal is transmitted to the final control devices (The heater elements) in the form of ON/OFF signals through comparison circuit #2 (**Block #7**) and digital output channels #12 & 13 (**Block #8**) to perform the required corrective action.

The selected controller is a PID (Proportional Integral Derivative), reverse action type (i.e. increase in input signal → decrease in output signal). Additional parameters and commands entered to the controller are the sampling rate control (**Block # 6**) and the controller initialization (**Block #5**), the former specifies the sampling rate (set at 260mS) that the VI acquire information and the controller loop cycle time [www.labviewforum.de/thread-RS-Flip-Flop. September 2016] and the latter specifies whether to reinitialize the internal parameters, such as the integrated error, of the controller. This command is to be set TRUE if the application must stop and restart the control loop without restarting the entire application [Labivew PID and Fuzzy Logic Toolkit User Manual 2009].

The fourth branch of the SC is fed to comparison circuit #1 (**Block #10**) then the output ON/OFF signal is fed to the S-R Flip Flop latching circuit (**Block #11**) and finally to the digital output channel #8 (**Block #12**). **Blocks #9, 10, 11 & 12** all contribute to control operation of the solenoid valve. The last part of the software is the protection circuit. Signals from the thermostatic switches are connected in series to digital input channel #4 (**Block #13**) and then to the latching circuit #1 (**Block #14**). As long both switches are healthy, the output from digital output channels #7, 8, 12 &13 will be enabled.

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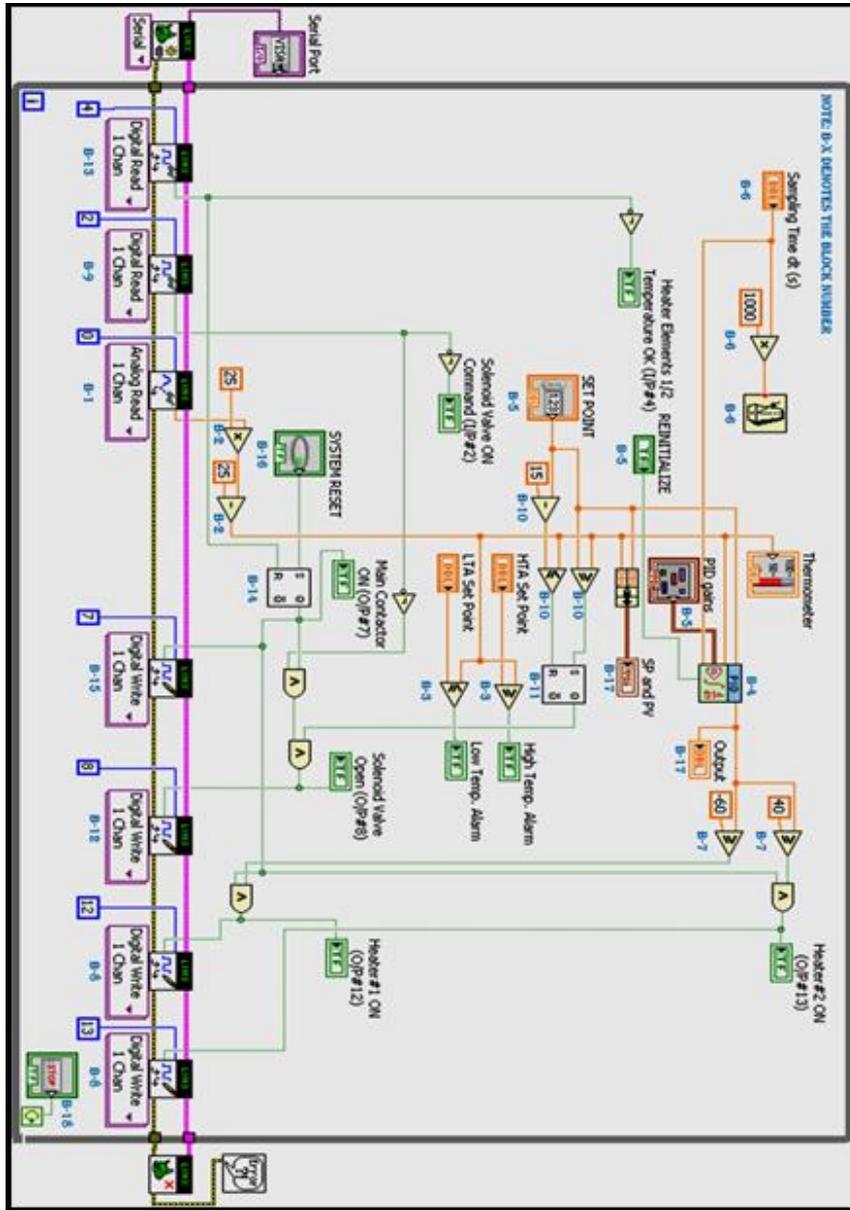
Fig. 4. Software Logic Block Diagram

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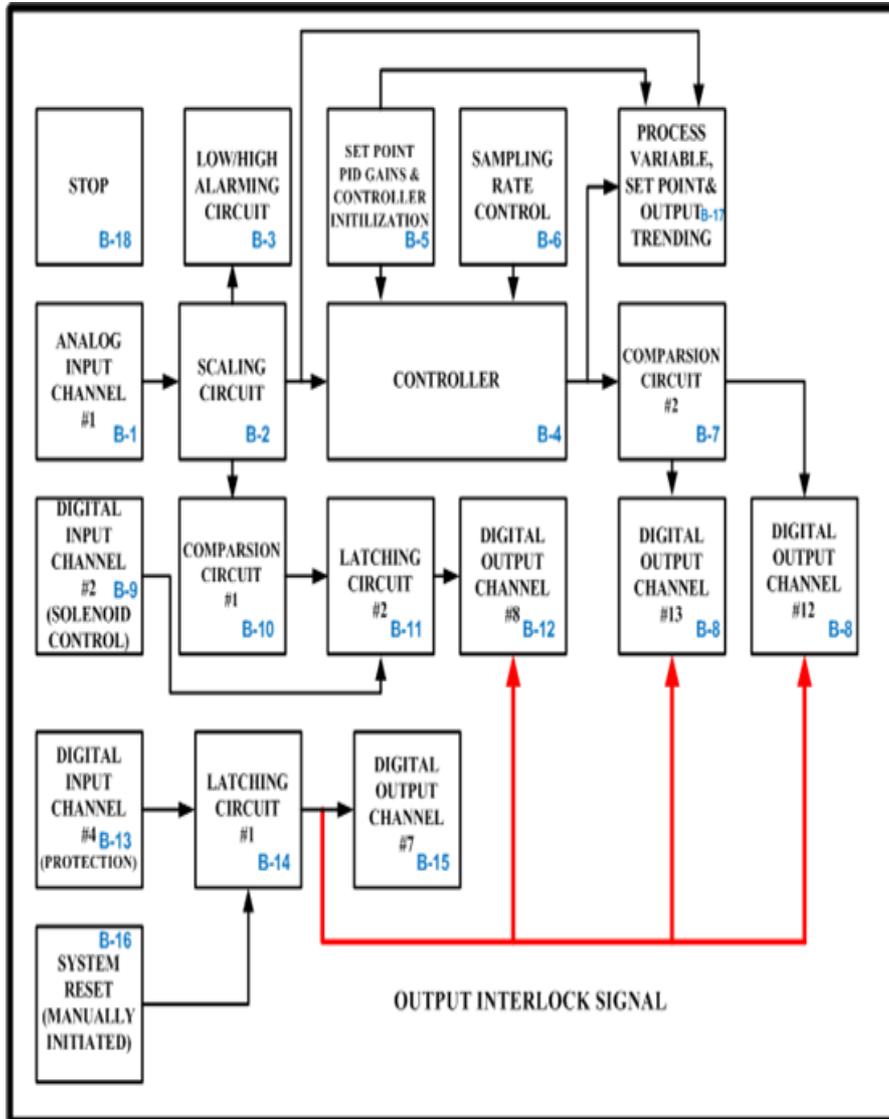
Fig.5. Software Block Diagram
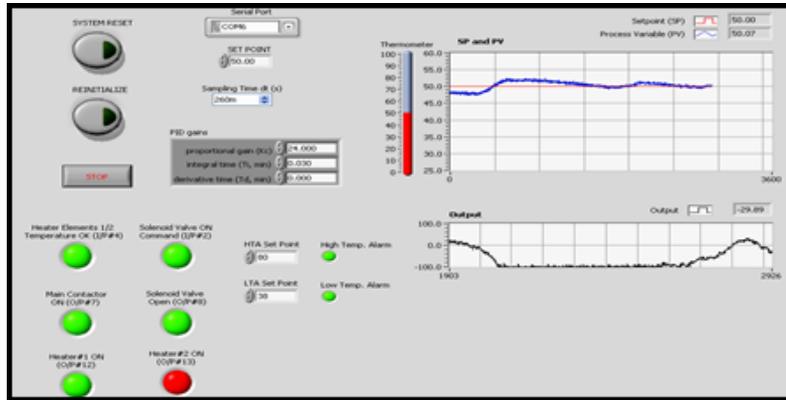
Fig.6. The VI Front Panel

If any of the switches is activated, all digital output channels will be disabled tripping the whole system. The system could only be restarted when all trip signals are cleared and the SYSTEM RESET push button is reset.

5. RESULTS and DISCUSION

5.1 Objective One

Measuring, monitoring and controlling the temperature of a water heater using Labview software and the associated equipment. For control purposes, a PID controller function block has been implemented in Labview. To demonstrate the effect of the different PID tuning parameters on the process, a real practical example has been carried out. In this example both the controller set point and the water discharge flow rate have been set and maintained at "**55 ºC**" and **"0.271 Liter/Minute"** respectively. In the first case, all tuning parameters were zeroed and in the subsequent tests, the PID parameters were introduced one by one, in each case, a different process behavior has been observed and recorded. Figures 7 to 10 illustrate the obtained results in all cases.

Note: The heaters switching points has been configured as follows:

a-   **Heater 1: ON** when O/P ≥ -20%; **OFF** when O/P < -20.

b-   **Heater 2: ON** when O/P ≥ 80%; **OFF** when O/P < 80.

Case 1; S.P =55ºC, All Tuning Parameters Equal to Zero:
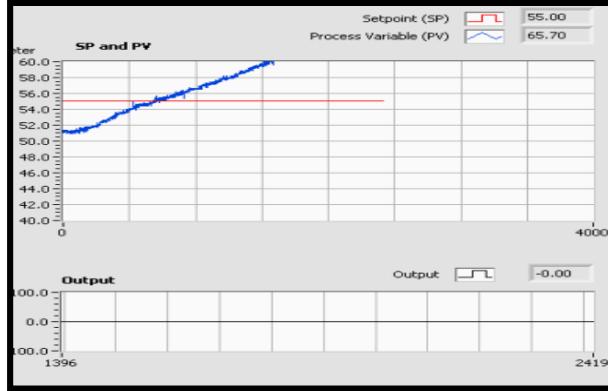
Fig.7. Case 1; PG, I, D = 0

Case 2; S.P =55ºC, Prop. Gain =33%, Integral =0min, D=0min:
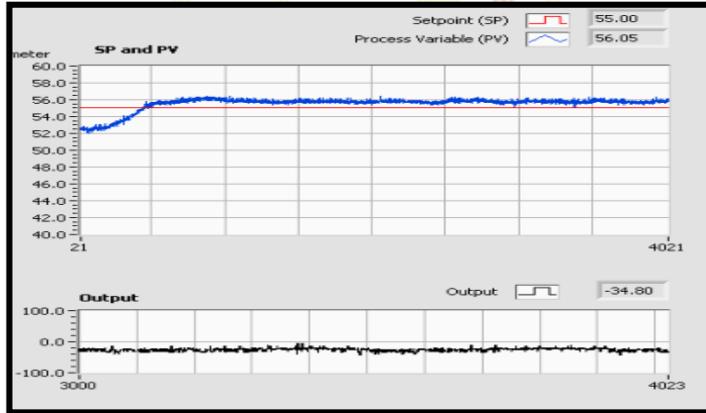
Fig.8. Case 2; PG=33%, I, D = 0min

Case 3; S.P =55ºC, Proportional Gain =30%, Integral =0.03min, Derivative =0min:
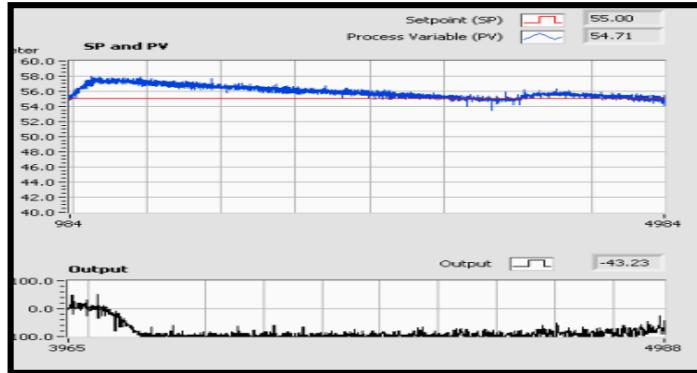
Fig.9. Case 3; PG = 30%, I = 0.03min, D = 0min

Case 4; S.P=55ºC Proportional Gain =30%, Integral =0.03min, Derivative =0.004min:
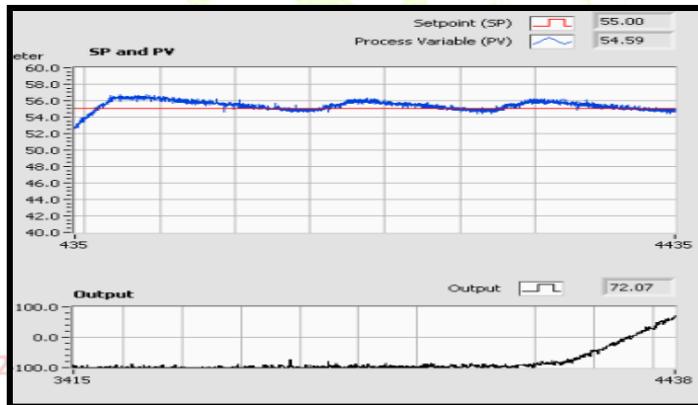
Fig.10. Case 4; PG = 30%, I = 0.03min, D = 0.004min

In case 1, it was clear that the process variable (PV) exceeded the set point and continued on rising without any change in the controller's output signal, the test had been continued for about six minutes and then interrupted manually for water saving. Theoretically, the controller output action should be ON-OFF, when the "PV" exceeds or falls below the set point.

In case 2, the PV exceeded the set point and settled at about one degree centigrade "**56 ºC**" above the set point (The steady state error offset).

In case 3, the PV was oscillating steadily (between "**56**" and "**54.59**" deg C). It is clear that the overall performance of the system was improved and the offset between PV & SP had reduced when adding the integral time.

In case 4, it took longer time for the PV to stabilize and oscillate between "55.8" and "54.71" deg C. It is clear from the graph that both PV and O/P signals are fluctuating heavily. The higher the derivative value had been introduced, the heavier the fluctuation had been observed.

5.2 Objective Two

The major concern is the effect of the discharge flow rate on water temperature. For this purpose, many tests have been carried out. The set point has been maintained at **55ºC** and in each case the flow rate has been set at different values using the manually operated flow control valve.

Case 1; Zero Flow Rate (Manually operated flow control valve is closed): Figure 11 shows that the PV and set point at steady state temperature are almost coincided with very little offset, the controller's ouput signal is proprtional to the PV and one heater is running interruptily to compensate for temperature losses with time. In figure 12, a little amount of derivative time =0.030min was added for about "**3.5 minutes**" and then set back to "**0**". It is clear from the graph that the controller output is fluctuation very heavily during this added time. In fact, throughout all this study, it was obvious that adding more derivative time during tuning, causes heavy disturbance to the controller's output thus, the overall process behavior. During investigation of this problem, so many control examples in Labview library have been checked and found all not applying any derivative time value for tuning; it could be due to software restraints.
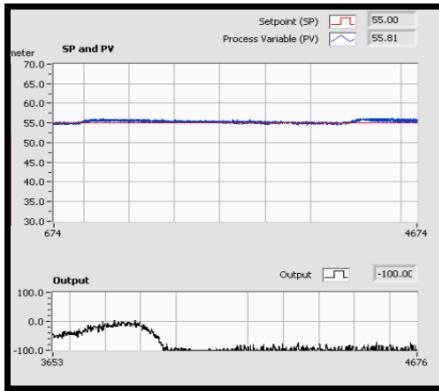
Fig.11. Case1a; FR = 0, PG = 42%, I = 0.03min, D = 0
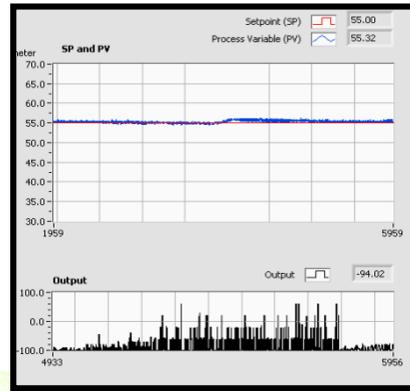
Fig.12. Case1b; FR = 0, PG = 42%, I = 0.03min, D = 0.03min

Case 2; Flow Rate=0.79Liter/Min, P Gain=45%, I=0.03min, D=0min:
Figure 13 shows that the PV is cycling between "55.9" and "54.3" degrees centigrade respectively, the duration of the PV and O/P cycles is becoming shorter.
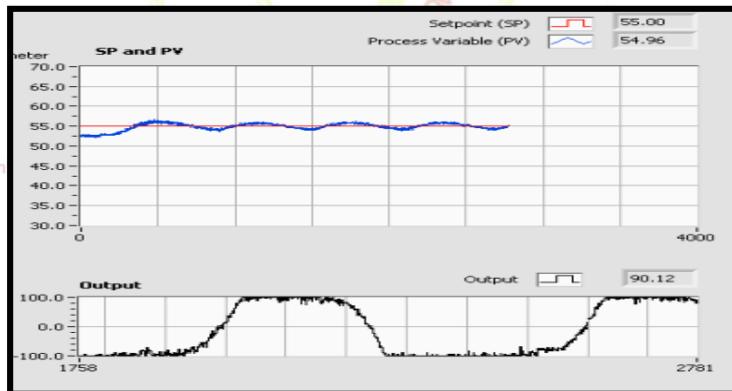
Fig.13. Case 2; FR=0.79 L/Min, PG = 45%, I = 0.030min, D = 0min

Case 3; Flow Rate= 1.287 L/Min, P Gain= 35, I=0.30min, D=0min:

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Figure 14 shows that the PV is cycling between "**55.2**" and "**53.4**" degrees centigrade respectively, it is becoming clear now that the overall behavior of the PV is shifting downwards the set point.
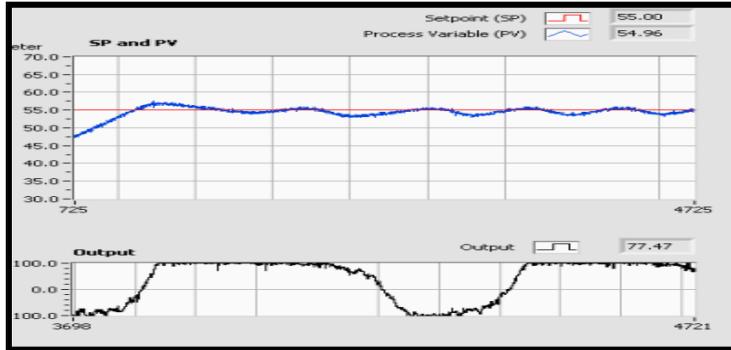
Fig.14. Case 3; FR=1.287 L/Min, PG = 35%,   I = 0.030min, D = 0min

Case 4; Flow Rate= 1.58L/Min, P Gain= 35%, I=0.30min, D=0min:
Figure 15 shows that both PV and the set point are almost coincided. At this point both heaters are continuously ON running at maximum rated power so that they can maintain the required set point.
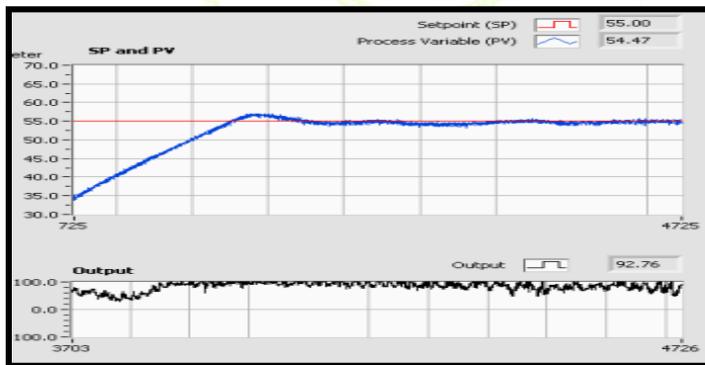
Fig.15. Case 4; FR=1.58 L/Min, PG = 35%,   I = 0.30min, D = 0min

Case 5; Flow Rate >2L/Min, P Gain=37%, I=0.025min, D=0min:

In case 5, the solenoid valve shut down switching point has been set to"**50 ºC"** and the flow rate has been increased more than "**2Liter/Minute"**. From the graph it can be seen that the overshoot period is very short and the temperature is decreasing rapidly until it falls below "**50 ºC"**. At this point, the solenoid valve closes and the temperature rises gradually repeating the cycle. Although both heaters were continuously ON but they were not able to compensate for the load demand.
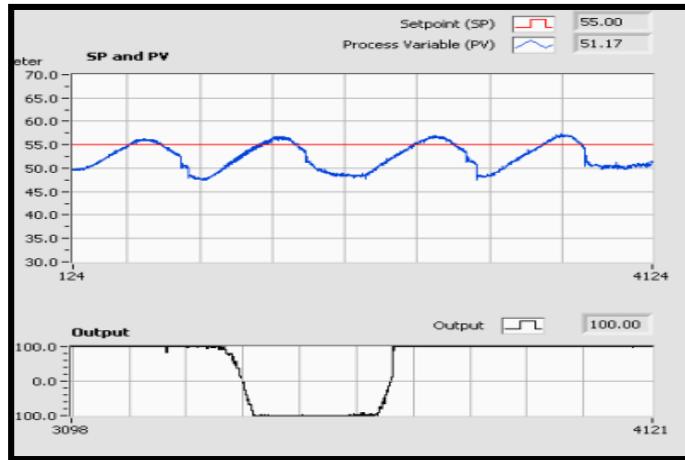
Fig.16. Case 5; FR >2 L/Min, PG = 37%,
I = 0.030min, D = 0min

5.3 Objective Three

In this objective, the over-temperature protection is demonstrated. In this test, both of the thermostatic switches' temperature setting and the controller set point had been adjusted to "**60 ºC"** and "**80 ºC"** respectively. During the test, the PV exceeded "**60 ºC"** and continued on rising until the alarm (**Heater Elements 1/2 Temperature Not OK**) had announced and the system tripped immediately. Recorded tripping point was about "**78 ºC"**. To decrease water temperature, trapped water had

been drained manually using the vent valve. After few seconds, water temperature began to decrease until it fell below "**75 ºC**". At this point, the alarm had cleared.

Obtained results in figure 17 are justified as follows:

1- Both sensing elements of the thermostatic switches had been pulled out about "4cm" from their respective thermowells. The reason is to keep thermostatic switches away from the heaters power lines.

2- This pulled out area has been exposed to surrounding ambient temperature.

3- The test had been carried out during night-time and the surrounding ambient temperature was below "**20 ºC**".

4- All above factors had caused the thermostatic switches not to activate at the exact setting.

5-
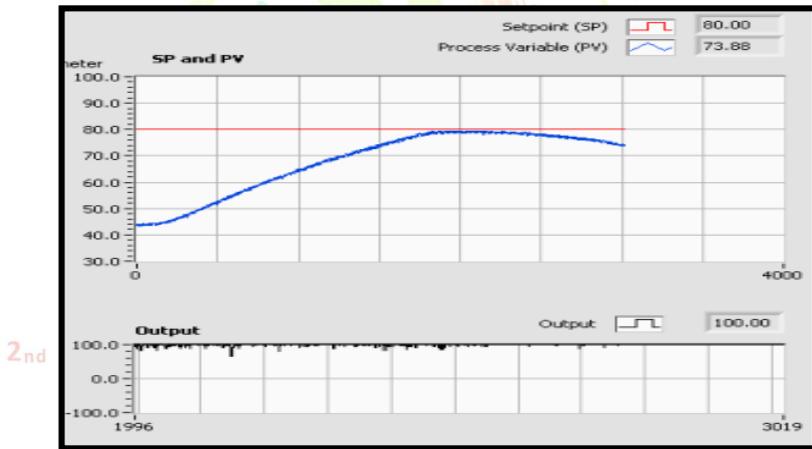
Fig.17. Over -Temperature Protection Test

6. CONCLUSIONS:

With the aid of both the hardware and software it was possible to demonstrate a simple temperature control loop using familiar software such as Labview. Labview is a powerful tool for dynamic simulation and

real time process control purposes. In spite of the huge capabilities of Labview and Control & Fuzzy Package (VER 2013) used in this study, there was no Flip Flop function block found in this version. The SR Flip Flop used in the logic block diagram was imported from the internet [labviewforum, 2016].

Regardless to all encountered problems related to Arduino Uno, it has been proved that it is practical tool for small control loops. One of the Arduino Uno limitations, it has no analog output port (i.e. 4-20mA, 0-10V, 1-5V, etc) which is indispensable part in most of control loops.

The relationship between the discharge flow rate and the heating capacity is inversely proportional. As the flow rate increases, the ability of the water heater to maintain the required temperature set point decreases. At higher flow rates, higher rated heating elements are required, extra heaters to be added or the water heater overall capacity to be reduced.

Further research and study is still required regarding heavy disturbance caused by adding derivative time to the process when using Labview.

Calculating the proper PID tuning values/implementing more advanced auto tuning methods to the controller instead of using the traditional Trial and Error tuning method. Using advanced methods leads to better results and save much time.

Attention has to be paid not to exceed the maximum contacts rating and the allowable switching intervals when using relays for switching purposes,

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Evaluation and improvement of AC Short Distance Transmission line utilisation using Static Series Synchronous Compensator (SSSC)

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Abstract

The performance of an AC transmission line is an important factor that affects the performance of a power system because the transmission line consists of resistance, capacitance and inductance parameters that are distributed over its length. These parameters cause losses due to the reactive power component so the losses need to be reduced effectively, as a consequence, the performance can be highly increased. Therefore, in order to improve the efficiency, it is necessary to use an efficient solution that can provide reactive power compensation. The reactive power compensators form FACTS devices made of power electronic components which have been developed rapidly over the last decade. The paper studies characteristics of a generic transmission system , evaluation the power flow and hence determination the maximum power transfer possible. Also, to develop fundamental frequency model of a Static Series Synchronous Compensator (SSSC) and determine the best location and rating of the SSSC to maximise the utilisation of the grid system.

الملخص

أداء خط نقل التيار المتردد يعتبر عامل مهم ويؤثر على أداء نظام الطاقة لأن خط النقل يتكون من مقاومات، مكثفات وملفات موزعة على طول الخط. هذه المعاملات تسبب فقد في الطاقة المنقولة بسبب القدرة الغير فعالة التي يمكن ان تتكون وبالتالي فإن الفقد يحتاج إلى تخفيض فعال ، وبالتالي يمكن زيادة الأداء بشكل كبير. و لتحسين الكفاءة، من الضروري استخدام حل يمكن أن يوفر تعويضًا فعالًا عن الطاقة المفقودة. الأنظمة المرنة لنقل الطاقة المترددة (Flexible AC Transmission Systems, FACTS) تستخدم

للتحكم في الطاقة الغير فعالة، حيث انها مصنوعة من الكترونات القوى (Power Electronics) وتم تطويرها بسرعة على مدار العقد الماضي. تقوم الورقة بدراسة خصائص نظام النقل العام وتقييم تدفق الطاقة وبالتالي تحديد الحد الأقصى لنقل الطاقة. كذلك ، لتطوير نموذج تردد أساسي لمعوض متزامن متسلسل ثابت (Static Series Synchronous Compensator, SSSC) وتحديد أفضل موقع وتصنيف للـ (SSSC) لتعظيم الاستفادة من نظام الشبكة.

Key words: AC Transmission Line, FACTS Technology, Static Series Synchronous Compensator (SSSC).

INTRODUCTION

FACTS technology enables power grid owners to increase existing transmission network capacity while maintaining or improving the operating margins necessary and the existing power system stability, as a consequence, consumers can be provided by more power at lower investment cost and less bad effects on the environment because there will not need to build new power system plants, transmission lines, transformers, etc. Therefore, FACTS contribute so many benefits to power system because the power transfer capabilities and system voltage stability can be increased efficiently. Thus, it is so significant to continue developing the power electronics devices (semiconductor devices) and methods of connecting FACTS with each other (combination of FACTS devices). Hence, semiconductor devices need to be more efficient within higher operation range and lower manufacturing cost by improving them to carry higher operating current and voltage.

Furthermore, by developing methods of controlling FACTS devices combinations, the capacity and flexibility of power transmission systems can be increased with more stability and security. There are different types of FACTS devices such as Static Var Compensators (SVC's), the most important FACTS have been used for number of years to improve the performance of transmission systems by resolving dynamic voltage problems, and Static Compensator (STATCOM) also widely used today

to compensate reactive power, support and regulate area of load voltage levels. Series FACTS such as Thyristor Switched Series Capacitors (TSSCs), Thyristor Controlled Series Capacitors (TCSCs) and Static Synchronous Series Compensators (SSSCs) have a broad range of application to increase the load capacity of power systems. They can be spread out in short and long distance transmission systems to improve transient stability [1].

1. CONCEPT OF AC TRANSMISSION SYSTEMS

Transmission systems are greatly needed for interconnecting power system networks where power plants and load centres need to be widely interconnected for supplying electricity [2]. As transmission transfer capability increases, the cost of electricity decreases because possibilities of interconnecting high number of generators can be increased effectively. Due to the presence of reactive power in ac power system, it is so important to generate or absorb an amount of the reactive power depending on needs of the power system including lagging or leading conditions.

2.1 THEORY OF SHORT TRANSMISSION LINES

The transmission lines of the given generic grid can be considered as short lines because their lengths are less than 80 km. The shunt capacitance for a short line is negligible because it is high compared to the reactance and resistance; therefore, the total series impedance is (R + jXL). Figure 1 (a) shows that the equivalent circuit of a short transmission line including the total series impedance, the sending end voltage (V_S), and receiving end voltage (Vr) and a load. In order to analysis of a Transmission line yielding power flow equations relating the real power to load angle and reactive power flow to voltage profile, Figure 1 (b) shows the phasor diagram of a Transmission line [1][3].

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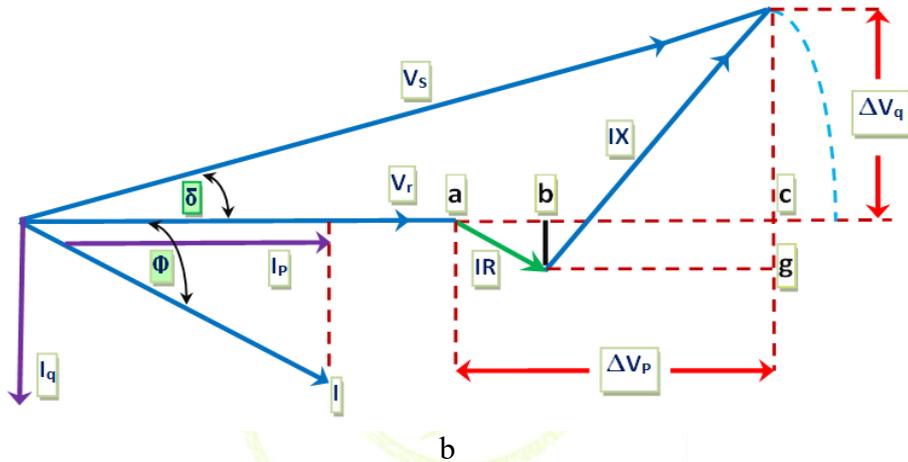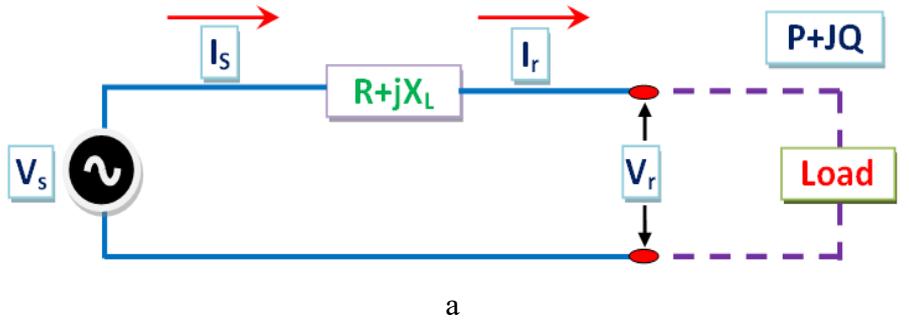
Figure 1: a) A short Transmission line equivalent circuit.   b) The phasor diagram
of a short Transmission line [7]

2. FLEXIBLE   AC   TRANSMISSION   SYSTEMS   (FACTS)
TECHNOLOGY

The IEEE definition of FACTS controllers are defined as "a power
electronic based system and other static equipment that provide control of
one or more AC transmission system parameters. The quality and
reliability of AC power system need to be highly increased due to
electricity demand continues increasing rapidly. There are many issues
need to be taking into account including environmental concerns by
increasing the efficiency of the current power system in order that
minimizing as much as possible rebuilding new power plants. FACTS

devices may be a vital solution to optimize the new power networks as well as the existing networks. The following benefits of installing FACTS devices including:

1- Dynamic reactive power compensation.
2- Steady-state and transient stability enhancement.
3- Voltage regulation.
4- Power transfer capacity increase.
5- Three-phase voltage balancing.
6- Reduced transmission losses [2].

FACTS technology gives reliable opportunities for controlling current and corresponding power through a transmission line under normal and contingency conditions at an acceptable cost. These opportunities arise through the ability of FACTS Controllers to control the interrelated parameters that govern the operation of transmission systems including series impedance, shunt impedance, current, voltage, phase angle, and the damping of oscillations at various frequencies below the rated frequency [3].

The above definition shows that FACTS are based on static devices (power electronics based), not mechanical devices that have many disadvantages compared to FACTS such as little high-speed response to control signals and limited cycle life. FACTS can be categorised as follows:

1- Shunt Controllers that act in shunt to power system (Shunt Compensators)
2- Series Controllers that adjust series reactance or voltage (Series Compensators)
3- Both Shunt and Series Controllers with power system.

3.1 SERIES COMPENSATION

In series compensation, the FACTS device is connected in series with the AC power system to work as a controllable voltage source. Due to presence of series inductance in the transmission line (especially when it is long) between the sending and receiving ends, a high voltage drop can be occurred. This voltage drop can be compensated when amount of the inductance is decreased by connecting an amount of capacitance in series

which can be achieved by using a series compensator. On the other hand, series capacitive compensation is to decrease the overall effective series transmission impedance from the sending end to the receiving end. The types of series compensators as follows:

1- Thyristor Controlled Series Capacitor (TCSC) or Thyristor Controlled Series Reactor (TCSR).
2- Thyristor Switched Series Capacitor (TSSC) or Thyristor Switched Series Reactor (TSSR).

3- Figure (2) shows Static Synchronous Series Compensator (SSSC) [4].
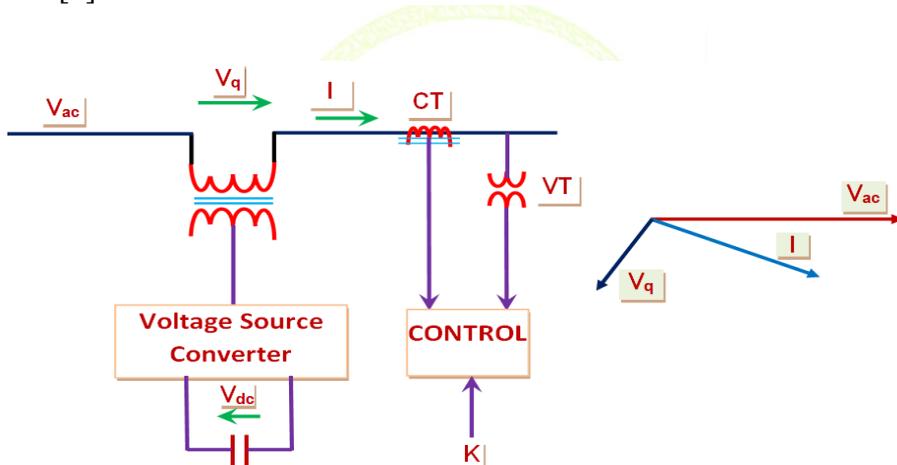
Figure 2. SSSC, operated as a series capacitive compensator [1]

The Static Synchronous Series Compensator (SSSC) is a FACTS device able to supply and absorb reactive power. It consists of a high power, voltage source inverter (VSI) with the dc terminals connected to a capacitor and ac terminals in series with the transmission line via an interface transformer. By changing the firing angle of the inverter the capacitor voltage can be increased or decreased to control the amplitude and direction of the SSSC voltage [3] [6].This technology is high efficient with low cost because it is self-regulating by varying its reactive power output according to the variations in transmission line current. Therefore, it is primarily used to reduce the high transfer reactance, as a consequence,

the transmission system transfer capability and voltage stability can be increased effectively. When the magnitude of the injected voltage (Vq) is made proportional to that of the line current (I), a series compensation equivalent to that provided by a series capacitor at the fundamental is obtained. The phasor diagram shows that the voltage across the series capacitor forces the opposite polarity voltage across the series line reactance to increase by the magnitude of the capacitor voltage. The injected voltage source can be defined by equation (1).

$$V_q = -JKXI \qquad\qquad\qquad (1)$$

(K) = (X_C/X_L) = (V_q/I_{XL}), K is the degree of series compensation {continuously variable over the range $(0<K<1)$} and X_C is the impedance of the series capacitor (Effective compensating impedance). The operation of SSSC can be explained using a simple circuit diagram shown in Figure (3).
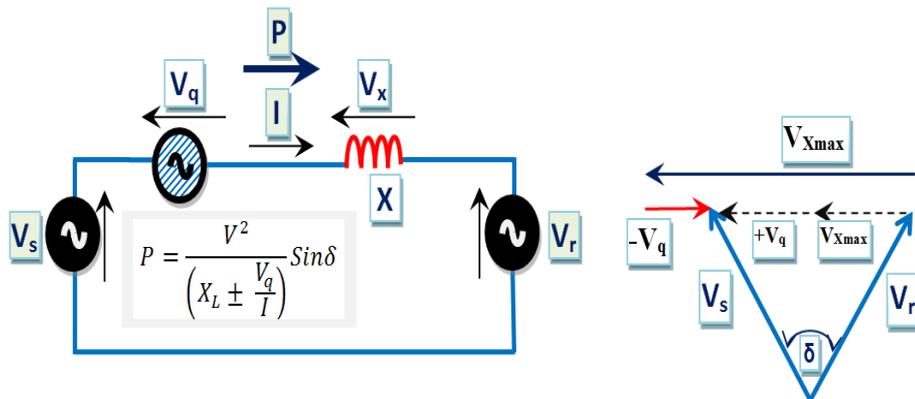
Figure 3. Two machine model series compensator and Phasor diagram [8]

The SSSC is modelled with an AC voltage source whose output voltage has 90^0 phase lead or lag to the line current [4] [6]. By implementing the SSSC the line reactance can be changed by injecting an AC voltage which its magnitude and direction can be controlled. The effective line reactance between two ends is the difference between the line reactance and the injected reactance. The effective transmission impedance with series

capacitive compensation is given by:

$$Xeff = X - Xc \quad or Xeff = (1 - K)X \qquad (2)$$
$$Xeff = X_L - X_q \qquad (3)$$

The active and reactive power flow is expressed by the following equations.

$$P_q = \frac{V_s V_r}{X_{eff}} Sin\delta \text{ , and}$$
$$Q_q = \frac{V_s V_r}{X_{eff}} (1 - Cos\delta) \qquad (4)$$

The compensating reactance (X_q) is defined to be negative when the SSSC operates in inductive mode, and positive when the SSSC operates in capacitive mode.

The active power equation when the SSSC is connected in series with the line can be derived the following procedures.

The injected voltage can be expressed by the following equation.

$$\overline{V_q} = V_q\{\overline{I}/|\overline{I}|\}e^{\mp j190} \qquad (5)$$

The active power through the transmission line can be expressed by following equation.

$$P_q = \frac{V^2}{X_L\left(1 - \frac{V_q}{IX_L}\right)} Sin\delta \qquad (6)$$

The voltage across the line, V_L is equal to I_{XL}. So, the active power can be expressed by the following equation.

$$P_q = \frac{V}{X_L} Sin\delta \frac{1}{\left(1 - \frac{V_q}{V_L}\right)} \qquad (7)$$

From the vector diagram in Figure 2 (b), the voltage across the line can be expressed by the following equation.

$$V_L = V_q + 2V sin\frac{\delta}{2} \qquad (8)$$

Inserting the equation (7) into the equation (8) and arranging it , the following equation can be derived.

$$P_q = \frac{V^2}{X_L} Sin\delta + \frac{V}{X_L} V_q Cos\left(\frac{\delta}{2}\right) \qquad (9)$$

In case of SSSC operation, it is possible to transmit a real power through the line when the phase difference between the sending end and the receiving end is zero. Also, the transmitted power can be negative when injecting voltage is inductive [5].

3. Configuration of a generic grid

The generic grid system is shown in Figure (4) is viewed as a single phase diagram consists of an AC source, three transmission lines and three loads. The whole system is connected to the source via busbar (1), load (1) is connected via busbar (2) and loads (2 & 3) are connected via busbar (3). The parameters of the components of the system are tabulated in Tables (1) and (2).
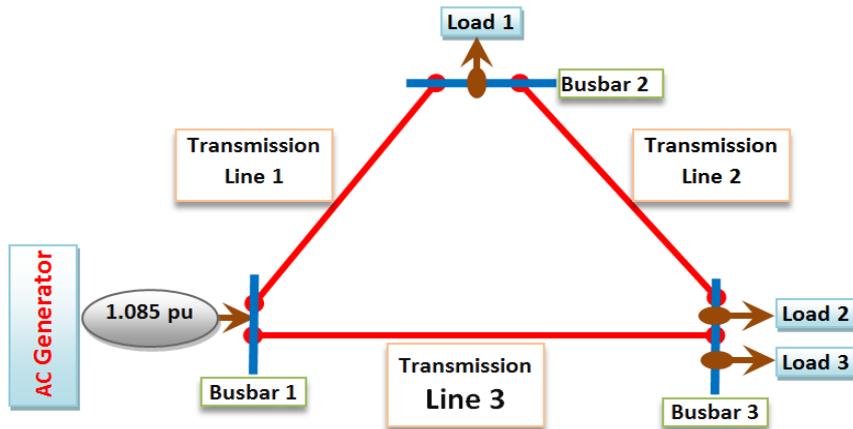
Figure 4. Generic Transmission system (Base kV=275,Base MVA=100)

Table 1. Parameters of the transmission lines

Line	R $\left(\frac{\Omega}{Km}\right)$	L $\left(\frac{mH}{Km}\right)$	C $\left(\frac{\mu F}{Km}\right)$	Length(Km)
1	0.02	1.0350	0.01152	62
2	0.03	1.0350	0.01152	25
3	0.03	1.0350	0.01152	39

Table 2. Load data for the generic system

Description	Apparent power (pu)	Power factor
Load 1	5.98	0.95
Load 2	6.12	0.98
Load 3	1.89	0.97

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Table 3. Load combinations

	Configuration 1	Configuration 2	Configuration 3
Load 1	On	On	On
Load 2	On	Off	On
Load 3	On	On	Off

4. POWER FLOW ANALYSYS

In order to carry out the power flow analysis of the given system the following calculations need to be done:

1- The calculations are based on common bases of {MVA base = 100 MVA} and {KV base=275 KV}.
2- Accordingly, the common current and impedance bases of each line.
3- The impedances of the lines including the reactance, capacitance and resistance.
4- The active and reactive powers of the loads are shown in Table (4).
5-

Table 4. the calculated power values

	Active power(MW)	Reactive power(MVar)
Load 1	568.1	186.73
Load 2	599.76	121.8
Load 3	183.33	45.95
Total	1351.19	354.48

5. SIMULATION

The given generic grid needs to be simulated by using MATLAB/Simulink Software in order to determine the values of currents of the transmission lines for every configuration, as a consequence, these values can be compared with the thermal limits of the transmission lines. The following Tables (5), (6) and (7) present the measured values in per-unit for each configuration without implementing any type of FACTS devices. Before starting the simulation, the parameters of the system components such as the source, loads and Transmission lines need to be calculated. The

parameters of the loads and lines are previously calculated but those of the source can be calculated as follows:

The short circuit level is [50 pu], therefore, the short circuit reactance of the source (X_{SC}) is equal to [1/50 = 0.02 pu] and the short circuit resistance (R_{SC}) is equal to [(X_{SC}) / (X/R)], where (X/R) ratio can be selected as 10, yields (R_{SC}) = [0.002 pu]. Therefore, the short circuit impedance of the source (Z_{SC}) in per-unit is [0.002 + j 0.02] and accordingly, the current and voltage at busbar (1) can be calculated based on a given supply voltage (VS) of [1.085 pu] as shown in Figure (5).
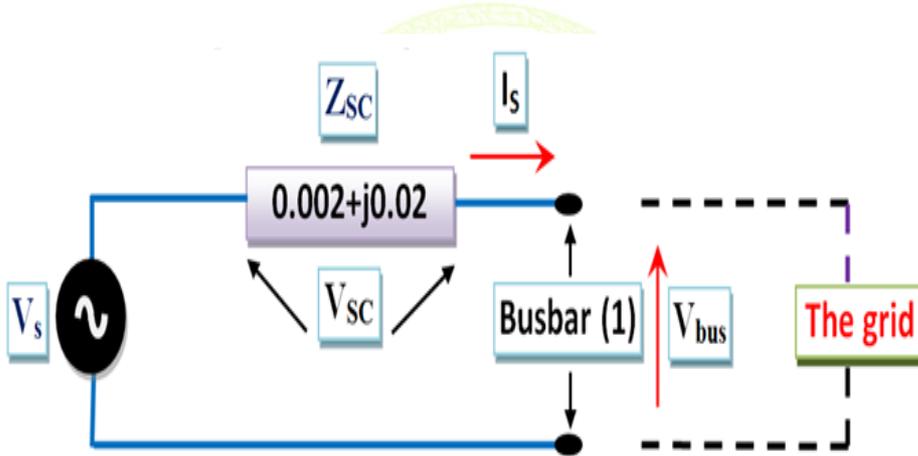
Figure 5. An AC source equivalent circuit

From the above circuit, [V_{bus} = V_S - V_{SC}], where

(I_S) = [(1.085) / (0.002 + j0.02)] = 12.49 $\underline{/-32.70}$

and [V_{SC} = I_S * Z_{SC}] = 0.251 $\underline{/51.60}$

yielding, V_{bus} = 0.949 $\underline{/-11.95}$

6.1 SIMULATION WITHOUT IMPLEMENTING FACTS DEVISES

6.1.1 CONFIGURATION 1

In this configuration all the loads are ON as shown in Figure (6), and the values were measured.
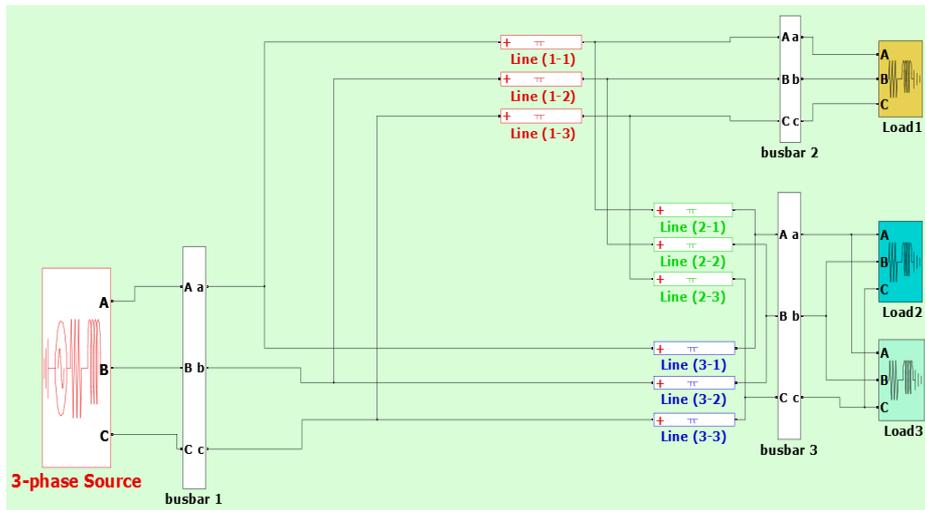
Figure 6. The MATLAB/Simulink circuit for configuration 1 without using FACTS devices

According to the measured values, line (2) is completely unloaded because it carries about [8.2 %] of its thermal limit, and line (1) is unloaded because it carries about [62 %]of its thermal limit but line (3) is overloaded because it carries about [52 %] more than its thermal limit. The consumed active powers by the loads is [10.96 pu] which is less than the supplied power by [1.172 %] and the consumed reactive power is [2.873 pu] which is less than that of the source by [31.6 %]. The supplied current is more than the summing of the load currents by [102.64 %].

The percentage of voltage drops from the sending and receiving ends of the lines (1) and (3) are [5.36 %] and [5 %] respectively; while the voltage at the receiving end of line (2) is more than that at the sending end by

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[0.35 %]. In addition, values of the currents of the lines (1) and (3) at the sending ends are less than those at the receiving by [1.03 %] and [0.37 %] respectively; while the current at the receiving end of line (2) is less than that at the sending by [8.5 %].

6.1.2   CONFIGURATION 2

In this configuration loads (1) and (3) are ON while (2) is OFF. According to the measured values, line (1) carries about [44.3 %] of its thermal limit, line (2) carries about [45.38 %] of its thermal limit and line (3) carries about [82.56 %] of its thermal limit. The consumed active powers by the loads is [7.179 pu] which is less than the supplied power by [0.71 %] and the consumed reactive power is [2.2206 pu] which is less than that of the source by [12.92 %]. The supplied current is less than the summing of the load currents by [1.5 %].

The percentage of voltage drops from the sending and receiving ends of the lines (1) and (3) are [3.56 %], [2.59 %] respectively; while the voltage at the receiving end of line (2) is more than that at the sending end by [0.995 %]. In addition, values of the currents of the lines (1) and (3) at the sending ends are more than those at the receiving by [1.58 %] and [0.78 %] respectively; while the current at the receiving end of line (2) is less than that at the sending by [0.93 %].

6.1.3   CONFIGURATION 3

In this configuration loads (1) and (2) are ON while (3) is OFF. According to the measured values, line (1) carries about [57 %] of its thermal limit, and line (2) carries about [18.962 %] of its thermal limit but line (3) is overloaded because it carries about [32.34 %] more than its thermal limit. The consumed active powers by the loads is [10.04 pu] which is less than the supplied power by [0.99 %] and the consumed reactive power is [2.649 pu] which is less than that of the source by [27 %]. The supplied current is less than the summing of the load currents by [1.061 %].

The percentage of voltage drops (losses) between the sending and receiving ends of the lines (1) and (3) are [4.73 %], [4.2 %] respectively; while the voltage at the receiving end of line (2) is more than that at the sending end by [0.58 %]. In addition, values of the currents of the lines (1)

and (3) at the sending ends are less than those at the receiving by [1.14 %] and [0.45 %] respectively; while the current at the receiving end of line (2) is less than that at the sending by [2.86 %].

6.2 SIMULATION WITH FACTS DEVICES

In order to increase the performance of the system, Static Synchronous Series Compensator (SSSC) is implemented in the given generic grid system. For each configuration, the currents and voltages of the lines, the loads and the source were measured. The best location of the compensator can be identified by checking amount of the impedance of the lines, where line (1) has impedance higher than that of line (2), thereby; the best location may be between the source and line (1) which can be evaluated and simulated by using MATLAB/Simulink.

The impedance of line (1) can be reduced by increasing amount of the effective compensating impedance (X_C) which can be injected by the compensator. Therefore, the value of (X_C), the injected voltage (V_q) and the rating of the power flow controller (S_{qmax}) can be calculated as follows:

1- According to the measured values, line (1) in configuration (1) is carrying current of [61.94 %] of a thermal limit of [8 pu], and line (3) is overloaded by [152 %] of a thermal limit of [5 pu]. The first value needs to be reduced while the other needs to be increased, and since the location of the compensator likely to be installed before line (1), the value of the degree of series compensation; (K), can be equal to [61.94 % - 100 %] = 38.1 %. Thus, (38.1 %) =(Xc/X_L), where (X_{Ltotal}) is the summing of the reactance of lines which is equal to [0.542 pu], yielding, (Xc) = [0.02064 pu] and accordingly the injected voltage:

$$(V_q) = [I_{max} * X_{Ltotal}] = [8 * 0.02046] = [0.16\ pu]$$

In accordance with this value, the circuit can be simulated and the value of the line currents can be checked and identified whether they are more or less than the thermal limits. For more safety, the current values will be maintained to be less than the thermal limits, i.e. the injected value can be less than [0.16 pu].

2- The power flow controller can be calculated as follows:

$$(S_{qmax}) = [I_{max} * V_q] = [8 * 0.16] = 1.28 \text{ pu} \Rrightarrow 128 \text{ MVA}$$

In Fact, the value of the injected voltage was calculated by taking the value of the reactance of line (1) and the same value of (K),yielding (V_q) of [0.11113 pu] which was used and accordingly the circuit simulated. The current of line (3) was more the thermal limit, therefore, when taking the total value of the transmission lines, the value of the injected voltage became more reasonable.

6.2.1 CONFIGURATION 1

In this configuration all the loads are ON as shown in Figure (7), and the values have been measured.
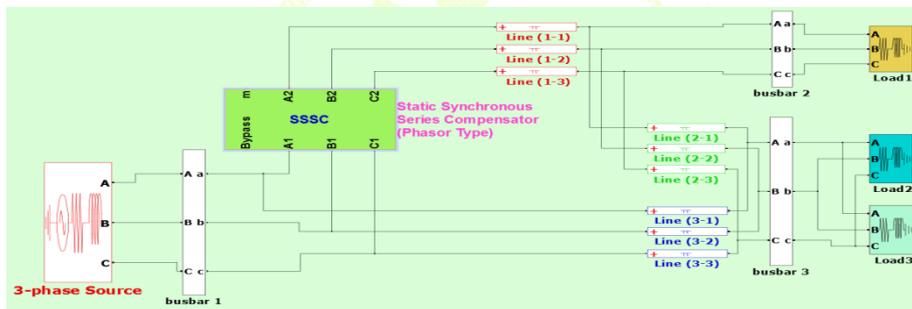
Figure 7. The MATLAB/Simulink circuit for configuration 1 with using SSSC

According to the measured values, line (1) carries about [100 %] of its thermal limit, and line (2) carries about [50.22 %] of its thermal limit but line (3) became not overloaded because it carries about [100 %] of its thermal limit. The consumed active powers by the loads is [11.569 pu] which is less than the supplied power by [1.54 %] and the consumed reactive power is [3.037 pu] which is less than that of the source by [16.6 %]. The supplied current is less than the summing of the load currents by [0.88 %].

The percentage of voltage drops (losses) between the sending and receiving ends of the lines (1), (2) and (3) are [7.9 %], [0.37 %] and [3.6 %] respectively. In addition, values of the currents of the lines (1), (2) and (3)

at the sending ends are less than those at the receiving by [0.66 %], [0.08 %], [0.67 %] respectively.

6.2.2 CONFIGURATION 2
According to the measured values, line (1) carries about [81.2 %] of its thermal limit, and lines (2) and (3) are unloaded because they carry about [14.8 %] and [28.94 %] of their thermal limits respectively. The consumed active powers by the loads is [7.531 pu] which is less than the supplied power by [1.21 %] and the supplied reactive power is less than that consumed by the loads by [9.3 %]. The supplied current is less than the summing of the load currents by [1.45 %].

The percentage of voltage drops between the sending and receiving ends of the lines (1) and (2) are [5.66 %], [1.5 %] respectively; while approximately, there are not losses in line (3). In addition, values of the currents of the lines (1), (3) at the sending ends are less than those at the receiving by [0.77 %] and [4.08 %] respectively; while for line (2) the current at the receiving end is less than that at the sending end by [4.5 %].

6.2.3   CONFIGURATION 3
According to the measured values, lines (1), (2) and (3) carries [94.6 %], [39.48 %] and [78.7 %] of their thermal limits respectively. The consumed active powers by the loads is [10.571 pu] which is less than the supplied power by [1.4 %] and the consumed reactive power is less than that of the supplied by the source by [9.85 %]. The supplied current is less than the summing of the load currents by [0.973 %].

The percentage of voltage drops between the sending and receiving ends of the lines (1), (2) and (3) are [7.12 %], [0.084 %] and [2.86 %] respectively. In addition, values of the currents of the lines (1), (3) at the sending ends are less than those at the receiving by [0.67 %] and [0.86 %] respectively; while for line (2) the current at the receiving end is less than that at the sending end by [0.20 %].

6.   CURRENT FLOW EVALUATION
The current flows from the source towards the loads through the transmission lines where each line has a thermal limit. As number

of the loads increase, the current increases until reaches its thermal limit. Figure (8) shows the characteristics of the flowing currents in the lines for each configuration with and without using a SSSC compensator.

From the above figure, without using SSSC, the flowing currents are not utilized properly for the entire system in each configuration and line (3) is overloaded while the others are not. However, when SSSC is used the currents are utilized properly in each configuration and the flowing currents are not more than their thermal limits.

SYSTEM LINE UTILISATION WITH & WITHOUT USING (SSSC) COMPENSATOR

Configuration No. ⇒	1	2	3	1	2	3
LINE (1)	62%	44.30%	57%	100%	81.20%	94.60%
LINE (2)	8.20%	45.38%	18.96%	50.22%	14.80%	39.48%
LINE (3)	152%	82.56%	32.34%	100%	28.94%	78.70%

Without SSSC   With SSSC
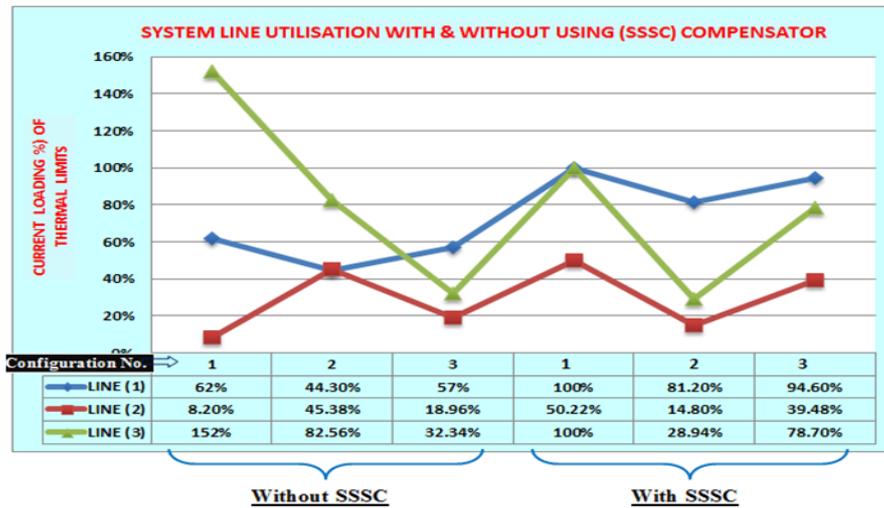
Figure 8. The currents in each line with/without SSSC for configuration 1, 2 and 3

7. CONCLUSION

The given generic grid system has been simulated by using Matlab/Simulink so that performing a load flow study for different combinations of loads. Consequently, power and current flows in each line have been analysed in order to evaluate the line loading. After simulating the circuit, the results were tabulated for each configuration with and without using a SSSC compensator and accordingly the results were discussed. From the discussions; the worst case that if line (3) is loaded for

a long term or additional loads likely to be connected to the grid, damage to the line followed by power system interruptions might be occurred because this current will cause the line to be heated more than the design considerations. The losses of the system were increased but the flowing current was distributed over the lines effectively which means that the power utilization of the system was improved.

The location of the SSSC was obtained to maximise the utilisation of the grid system, moreover, enhance the transfer capacity of an existing system particularly during contingency operation. For this system, the SSSC acted as a capacitive component causing the total impedance of the system decrease and accordingly the flowing currents were increased and distributed properly over the system. In fact, performance of system was improved without changing or adjusting the parameters of the power source because the improvement has been occurred by reducing the effective reactance of the lines with small injected voltage compared to the power station. Furthermore, the stability of the system increased because the busbar voltages did not vary so much from the supplied voltage.

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2nd Conference on Medical & Technological Sciences

Green Technologies and Energy Management as Influential Issues in the Environmental in Libyan Society

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Abstract

  With the rapid development of technology, homes and institutions have become full of electronic devices such as computers, mobile phones and printers. It was necessary to have concepts and solutions to ensure that they do not adversely affect the environment in the community. Therefore, the concept of g (Green Information Technology) or green computing (Green Computing). In this paper, green computing has been introduced as a modern concept of sustainable development because of its importance in preserving the environment and presenting the solutions and technologies used, their objectives and basic components, and their important role in environmental sustainability. By answering the following questions: What is green computing and what are its components and objectives? Where the researchers conducted a field study directed to the faculty members of the University of Benghazi to measure the awareness of the culture of green computing in the Libyan society, and the proportion of the use of green computing techniques well. At the end of the study, the results of the study showed accurate and satisfactory rates of good awareness of the dangers of non-management of energy consumption and the widespread use of green computing techniques. Through these results, recommendations and initiatives have been reached to activate this concept in our society. The most important of these are the launching of awareness programs on the concepts of sustainable development, in particular the techniques and software of green information technology, through the use of various media, the development and upgrading of faculty members and

support research and development programs in the field of The application of green information and communication technology, awareness raising among all segments of the information and communication society on the importance of energy conservation, the Implementing projects for the reuse and disposal of electronic waste in a safe manner and the use of recycled computers and old phones.

Keywords Green technology, green computing, environmental sustainability.

الملخص

نظرا لما يشهده العالم من تطور في التكنولوجيا ، حيث امتلأت البيوت و المؤسسات بالأجهزة الإلكترونية من حاسبات و هواتف نقالة وملحقاتهن ، فكانت الضرورة لظهور مفاهيم وحلول لتقليل من الضرر الناتج عن أستخدامها على البيئة المحيطة في المجتمع. ولذلك نتج مفهوم تكنولوجيا المعلومات الخضراء أو الحوسبة الخضراء. وفي هذه الورقة تم تقديم الحوسبة الخضراء كمفهوم حديث من مفاهيم التنمية المستدامة نظرا لأهميتها في الحفاظ على البيئة وعرض الحلول والتقنيات المستخدمة واهدافها ومكوناتها الاساسية، ودورها المهم في الاستدامة البيئية، من خلال الإجابة على التساؤلات الآتية: ما هي الحوسبة الخضراء وما هي مكوناتها واهدافها؟ حيث قامت الباحثتان بإجراء دراسة ميدانية موجهه لأعضاء هيئة التدريس بكليات جامعة بنغازي لقياس مدى الوعي بثقافة الحوسبة الخضراء في المجتمع الليبي، ونسبة استخدام تقنيات الحوسبة الخضراء بشكل جيد. وفي نهايتها أظهرت نتائج الدراسة نسب دقيقة ومرضية تدل على وعي جيد بمخاطر عدم ادارة استهلاك الطاقة كما لوحظ انتشار استخدام تقنيات الحوسبة الخضراء. ومن خلال هذه النتائج تم التوصل إلي توصيات ومبادرات لتفعيل هذا المفهوم في مجتمعنا.

Introduction

Preserving the environment is not only about the cleanliness and preservation of trees, but also about technical issues that contribute to

environmental pollution. Therefore, the concept of Green Technology, which aims to achieve environmental sustainability, is to harness new technologies that reduce energy use, reduce waste and save time and effort. , And is not a source of chemical emissions and has several areas including: green computing, green energy, green buildings and green economy, green chemistry, green nanotechnology. [1]

As gas emissions increase and are a major contributing factor to global warming, it is the duty of institutions in our country and society as a whole to set a new agenda that focuses on addressing environmental issues and adopting environmentally sound practices, helping to build a green society and economy. The green economy means all economic activities related to reducing fuel use, reducing pollution, emitting gases, increasing energy efficiency, recycling materials and developing new sources of energy.

The green computing concept began in 1992, after the US Environmental Protection Agency launched Energy Star, which means energy efficiency in the device, an international standard for energy efficiency for consumer products[9].

Green computing is concerned with the study and practice of sound design, manufacture, use and disposal of computers and all associated subsystems, such as display devices, printers, storage devices, networks, communication systems, and electronic devices in general efficiently and effectively. The objectives of green computing are similar to green chemistry; they reduce flammable materials, increase recyclability and have many benefits, such as making computers as energy efficient as possible, and designing algorithms and systems for the efficiency of computer technologies[5].

The study Problem

The increase in the use of modern technologies has had a great impact on the environment. This increase has led to the emergence of a number of environmental problems due to the high proportion of waste during production and consumption. The consumption of energy used is very high. Therefore, Contribution of pollution and global warming to serious proportions cannot be ignored, and therefore many studies have paid attention to this area through public opinion polls aware of these problems and the applications associated with their solution, including these studies Tunku Badariah (2013) and colleagues study AG The results showed that the majority of students surveyed had little or no idea of green computing and most of the related aspects[12]. Hence, the problem of studying this study is to measure the level of awareness of the green computing culture in Libyan society and the use of green computing techniques in our society.

Objectives of the study

To contribute to reducing the environmental problems of rapid technical development, the aim of this study was to highlight the concept of green computing and its characteristics, objectives and presentation of solutions and techniques used.

Study questions

The focus of our study is to answer the following questions:

• What is green computing and what are its components and objectives?

• What is the extent of awareness of the green computing culture in Libyan society?

• Are green computing techniques well used?

The importance of studying

The importance of this study is to spread the concept of green computing and information technology in addition to educating individuals in the

community and sectors working in the country about the importance of green computing and how we can activate it through a field study by conducting a survey through a research questionnaire and extracting results from which we were able to answer our questions in the research.

Methodology of the study

In order to answer the second axis, we conducted a case study of a sample of faculty members at the University of Benghazi to participate in answering a research questionnaire on the society's awareness of the culture of green computing, Data collection and analysis followed by subsequent presentation of results, on the basis of which we have reached a set of proposed recommendations.

Framework of the study

The framework of the present study is:

Thematic Framework: This includes understanding the concept of green computing, its components and objectives, measuring the awareness of the green computing culture in society, and the use of green computing techniques.

Spatial and Human Framework: The present study was applied to faculty members at Benghazi University colleges.

Time framework: The present study was conducted during the period from 1/9/2017 to 10/11/2017.

Literature Review

The field of green computing has received considerable attention among researchers because of its importance in preserving the environment from the effects of technological development. This field has been studied in many areas: Swati Aggarwal, Monika Garg, Pramod Kumar (2012) And the techniques and methods by which energy can be conserved. In his study

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results, green computing techniques show a basic economic and environmental solution, and there is increasing awareness of their use in the field of technology.

In the same field, Tunku Badariah (2013) and colleagues conducted a study to explore the case of Malaysian university students about their knowledge of green computing. The sample consisted of 208 students from ICT and non-ICT from Malaysian General University, General knowledge about various aspects of green computing. The results indicated that the majority of students surveyed had little or no idea of green computing and most of the aspects associated with it [12].

Dr. Mostafa Gad Al-Haq (2012) mentioned the concept of green information technology and its importance and presented examples of its various applications, and then touched on the new in the field of environmentally friendly technologies [4].

In another study (2012) Kumar Dookhitram and his colleagues mentioned their research on a sample of students at a university on green computing. The main objective of the study was to determine the level of awareness of students regarding green computing. The results indicated that students have a moderate awareness about green computing but their daily practices The principles of green computing are not. However, it was clear that students wanted to embrace green computing for the benefit of the environment and its future. [11]

Because the future work in the field of green computing depends on the research work in the academic community, this research was an important contribution as a field study from the reality of Libyan society, and it is worth mentioning that there is a need for further research in this specialty, especially in the academic sector.

Green computing concept

Green Computing, or Green Information Technology, or the sustainability of Computer Information Technology, is the study and practice of designing, manufacturing, using, and disposing of computers and mobile phones. And their accessories efficiently and effectively with minimal impact or damage to the environment. Interest in this regard has increased in the current century due to the arrival of pollution and global warming rates to dangerous proportions that can not be ignored [5].

The concept of green computing takes the following directions:

1) Green design and green manufacturing:

This trend is supposed to be done by manufacturers and suppliers are keen on them, so that the components of computers or phone and accessories are environmentally friendly and economical in the use of energy. Reducing the use of environmentally hazardous materials and using plants to the lowest possible capacity while avoiding carbon emissions should be considered, and the product life should be considered with the possibility of replacing its components when maintenance and development are needed instead of replacing the entire product.

2) Green Use:

• Use portable devices that consume five percent of the power used by desktops [3].

• Shut down computers and mobile phones when we are away from them for a long time or at least choose Sleep Mode [3].

• Control the wasted power by the power management feature of the device. Some experts are also recommending the purchase of multi-core

processors, where manufacturers such as Intel are keen to use energy more efficiently than previous processors [3].

• Be careful to select environmentally friendly devices and accessories that usually come with the Energy Star logo, since devices with this label consume 70% less energy than a computer without the label.

• Improve software and increase efficiency to reduce the need for computer resources [3].

3) Green rotation:

Computer system components and accessories are recycled to reduce the spread of harmful substances such as lead, mercury and hexahedral chromium. The disposal of electronic waste can be summed up in the following: Rationalize the consumption of electronic devices and do not rush to new ones except when needed, re-maintenance of electronic devices, the search for products and devices green and long life [2].

Green computing objectives

Here we find the answer to the question why green computing? And why talk about it and put this concept as the objectives of green computing and its role in sustainable development are concentrated in the following:

- The main objective is to find ways to produce technology that does not harm or depletion of the Earth's natural resources[1].
- Green technology means the alternative source of technology that reduces the use of fuel and the least damage to animals, humans and plants, as well as damage to the world[1].
- In addition to reducing the use of hazardous materials,

improving energy efficiency during the life of the product and enhancing recyclability or degradation of products and plant waste [1].

- Optimize the use of computers and mobile phones as efficiently as possible, design algorithms and systems that improve the efficiency of computer technologies[5].

Green computing techniques:
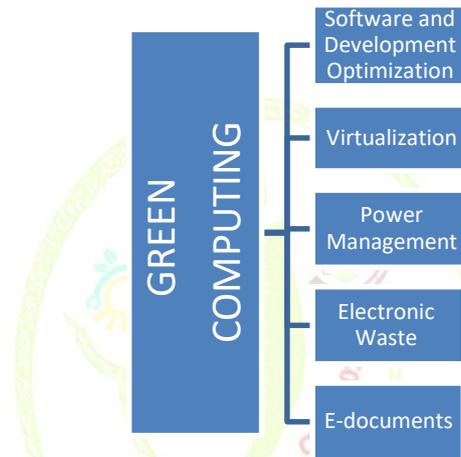
Fig.1. Green computing techniques

As we mentioned earlier, the application of the concept of green computing has more than one direction and each of them has technologies and applications that achieve the basic goal of preserving the environment, including:

• Software and Development Optimization

The cost of implementing software and applications is still large and consumes computer and power resources. One of the most important solutions is the use of a central server, which reduces the energy consumed because it supports more than one user at the same time [2].

There are several programs that can be used on a personal level to control the amount of environmental pollutants caused by each person. For example, mobile phone software or car navigation devices to calculate the carbon emission rate generated by the use of the vehicle by setting a certain monthly level of harmful emissions not exceeded. Other programs are designed to use indoor and office electricity and others to help buy more environmentally friendly products and other software that cover several environmental aspects that can help reduce the percentage of pollutants in the environment.

• **Virtualization**

Computer virtualization refers to the abstraction of computer resources, a system administrator could combine several physical systems into virtual machines on one single, powerful system, thereby unplugging the original hardware and reducing power and cooling consumption[9].

Table (1) Virtualization levels

Network	Applications	Infra-structure	Storage	Server	Name	level
None	Dedicated	Fixed	Inside the computer	PC	Local	level one
LAN	Participation	Fixed	File Server / DB server	Client /Server	Logical	Second Level
WAN	Participation	Virtual	Extended SAN	Server virtualization	Data Center	The third level
Internet	software system	Virtual	Cloud platform	Cloud platform	Cloud	fourth level

• **Energy Management**

The operating systems provide several features that allow to automatically pause components such as monitors and hard drives after

certain periods of inactivity. In addition, there is a Hibernate system, where most components (including the CPU and RAM) are shut down. In addition to the Advanced Energy Management settings through the BIOS or through the OS control panel. There are several ways to conserve power in computers and mobile phones [9]:

- Powering off Computing Devices.
- Using Power Saving Modes.
- Use the LCD screen.
- Use devices that have an energy star mark.
- Check the battery type when purchasing.
- Reduce the screen brightness.
- Cancel the screen saver.
- Cancel applications that are not being used.
- Remove the power socket from the device.
- Turn off the charger.

• E-documents

The use of electronic services provides for dealing with paper documents and reduces the size of printed papers. Electronic books have become more widespread, which is supposed to reduce paper waste and also preserve the environment by reducing logging and forests, which can absorb polluting gases.

• Electronic waste disposal

Electronic waste is one of the most important things that negatively affect the environment. Because electronic devices consist of toxic substances and do not decompose when disposed of Therefore, disposal of electronic waste is very important, because disposal in ways that are not studied causes health and environmental problems [2], and the most famous methods of disposal of e-waste:

- reuse

The use of old equipment must be continued as long as it meets the required requirements, which in turn will reduce the negative impacts of disposal at the landfill [2].

- Refurbish old appliances

It is possible to replace or change component parts of electronic devices, which in turn reduces the cost of purchasing a new device. It is also possible to donate these devices to charities and schools if they do not fit current needs. [2].

- Recycling (Recycle)

When it is impossible to renew or reuse electronic devices, the recycling option appears. The recycling of these devices is a very difficult process because electronic devices contain dangerous substances such as carbon, mercury and other toxic and non-decomposing materials.

Burying computers or mobile phones and their components produces harmful chemicals that may seep into water networks. How much it burns causes toxic gases that pollute the air and threaten human life. So we have to recycle them in special ways to extract their constituent materials for reuse and benefit [2].

Field study

• Society and sample of the study

The study population consists of faculty members (males and females) at Benghazi University, where a diverse sample was chosen. The researchers were keen on different scientific disciplines from the faculties of the university, namely: Information Technology, Engineering, Arts, Pharmacy, The number of faculty members in each faculty as shown in Table (2):

Table (2) Study Population

number	college
35	information technology
208	Engineering
275	Arts
115	the pharmacy
Total: 633	

The percentage of responses was (64), which is a reasonable percentage that the researcher can analyze the data in light of which the percentage of loss (36) includes samples not received responses and samples excluded due to lack of data collection required, as shown in Table (3):

Table (3) Distributed Forms

Forms	number	percentage
Distributor	100	100,00%
The recipient	64	64,00%
Losses	36	36,00%

In view of the total number of the study population and the number of faculty members in each of the colleges within the framework of the study, the researchers tried to distribute the forms in an appropriate manner but due to some obstacles including the lack of cooperation of some members, in addition to the period of mobility experienced by the Faculty of Information Technology where (12) The College of Pharmacy was the proportion of participation (4) because the period in which the questionnaire was distributed was the period of leave of the semester, while the Faculty of Arts reached 27%, and the Faculty of Engineering took the ratio (21) due to the presence of faculty members because of studing.

• **Study tool**

In order to achieve the objectives of the study and answer the questions raised, the researchers formed a questionnaire questionnaire consisting of (24) paragraphs distributed on three axes: personal information, the extent of awareness of the culture of green computing, the use of green computing techniques, where the questionnaire questions were evaluated and evaluated by Number of faculty members. As previously explained, the number of forms under study was (100) form, which was distributed personally to some faculty members. Others designed the form using

GOOGLE FORMS and extracted data through GOOGLE SHEETS to form the required statistics and relationships. Results.

• Characteristics of the study sample

Table (4) shows the analysis of demographic data related to the study:

Table (4) Characteristics of the Sample

	variable				Repetition
Age	Less than 30				0
	31-40				32
	41-50				20
	51-60				8
	More than 61				4
Gender	Male				32
	Female				32
College	**Information Technology**	Software engineering	1	1.6%	12
		Computer Science	8	12.5%	
		Design of computer systems	3	4.7%	
	Engineering	General Section	1	1.6%	21
		Electrical and Electronic Engineering	4	6.3%	
		Architecture and urban planning	14	21.9%	
		Industrial Engineering and Manufacturing Systems	1	1.6%	
		Mechanical engineering	1	1.6%	
	Arts	History	4	6.3%	27
		Philosophy	10	15.6%	
		Archaeology	1	1.6%	
		English	1	1.6%	
		Libraries and Information	5	7.8%	
		Sociology	2	3.1%	
		psychology	4	6.3%	
	Pharmacy	Pharmacology and Toxicology	4	6.3%	4
Degree	Assistant Lecturer				32
	lecturer				12

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	professor	6
	Assistant Professor	10
	Co-professor	4
Years of Experience	Year	5
	From one to five years	17
	From 5 to 10 years	9
	More than 10 years	33

Results

By analyzing the results of questionnaire study, has been reached the following relationships:

– The extent of awareness of the concept of green computing in comparison with the data of the scientific degree of the faculty member.

In terms of Figure (2) and Table (5), we conclude that faculty members with a higher degree of awareness of the concept of green computing (83.3%).
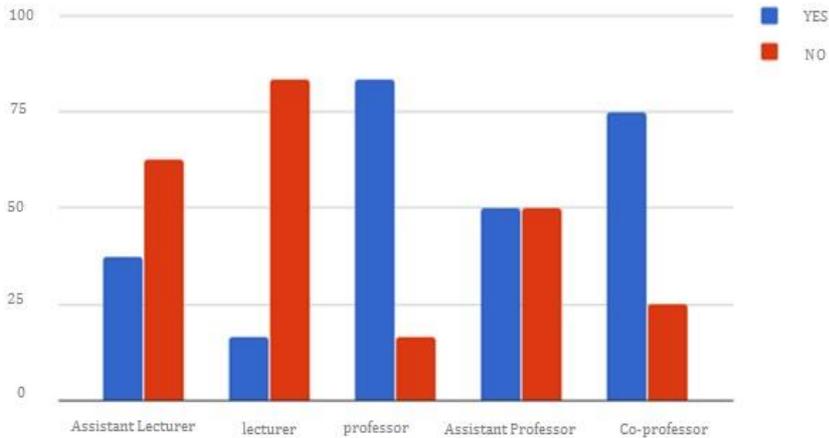

Fig.2. The scientific degree of faculty member

Table (5) The scientific degree of faculty members   and awareness of the concept of green computing

Degree	Total	Yes		No	
		number	Ratio	number	Ratio
Assistant Lecturer	32	12	37.5%	20	62.5%
lecturer	12	2	16.7%	10	83.3%
professor	6	5	83.3%	1	16.67
Assistant Professor	10	5	50%	5	50%
Co-professor	4	3	75%	1	25%

−   The extent of awareness of the concept of green computing in comparison with the age data of the faculty member.

In terms of Figure (3) and Table (6), we conclude that faculty members aged (61 years) had the highest level of awareness of the concept of green computing by 100%, followed by faculty members aged between (31-40) (43.75%), according to the members included in the study sample.
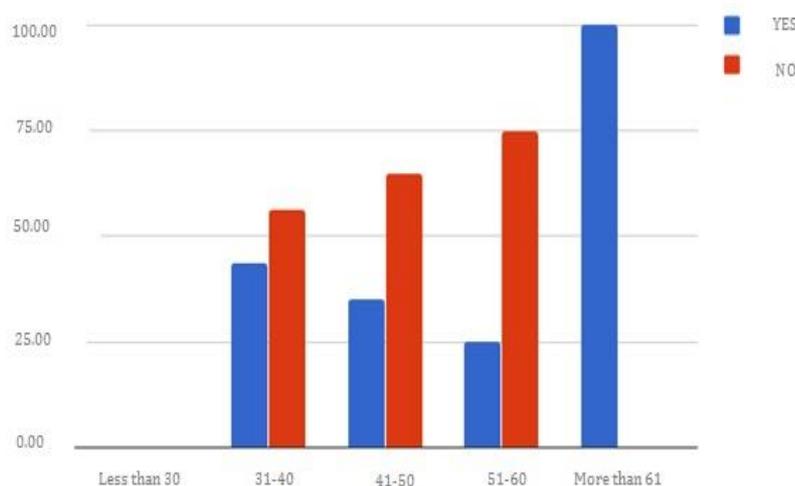

Fig.3. The age of faculty member

Table (6) The age of faculty member and awareness of the concept of green computing

Age	Total	Yes		No	
		number	Ratio	number	Ratio
Less than 30	0	0	0%	0	0%
31-40	32	14	43.75%	18	56.25%
41-50	20	7	35%	13	65%
51-60	8	2	25%	6	75%
More than 61	4	4	100%	0	0%

- The extent of awareness of the concept of green computing in comparison with the data of the colleges to which a member of the faculty.

As shown in figure (4) and table (7), as indicated by the results and statistics of the questionnaire, the highest percentage of respondents (yes) were members of the Faculty of Information Technology (66.66%).


Fig.4. The college of faculty member

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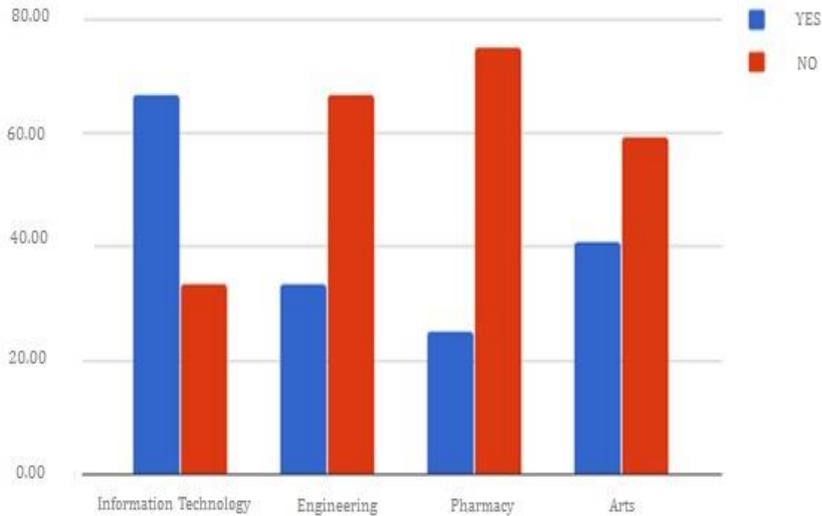
Table (7) The college of faculty member and awareness of the concept of green computing

college	Total	Yes		No	
		number	Ratio	number	Ratio
Information Technology	12	8	66.66%	4	33.33%
Engineering	21	7	33.33%	14	66.66%
Pharmacy	4	1	25%	3	75%
Arts	27	11	40.74%	16	59.25%

Conclusion

For the concept of green computing, the study showed that it was not known as a scientific term and accurately according to the sample studied. In practice, the use of green computing techniques and its spread and concern by some, such as reducing paper printing except for necessity, To complete the work or put it on hibernation, as for how to get rid of old electronic devices was the trend to apply the concept of recycling known. We also found that there is a general interest in energy conservation by disconnecting the charger for both computer and mobile phone. In terms of using energy management options we get a satisfactory result that shows good awareness of the dangers of non-management of energy consumption. As for the use of the Internet and the use of its applications as a technology of green computing technologies we get good results for the use of the Internet and its applications.

Based on our analysis of the results of the questionnaire, we reached the following recommendations:
1. Launching awareness programs on the concepts of sustainable development, in particular green IT technologies and software, using various media.
2. Develop and raise the efficiency of faculty members and support research and development programs in the field of green ICT application.
3. Increase awareness among all segments of the information and communication society about the importance of rationalizing

energy consumption.

4. Implementing projects for the reuse and disposal of electronic waste in a safe manner and the use of recycled computers and old phones.

5. We hope that the Libyan authorities will adopt these recommendations and issue regulations and laws that support the application of the concepts of sustainable development, in particular, green technology and IT software as an environment-friendly technology.

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2nd Conference on Medical & Technological Sciences

HEART BEAT DETECTION OVER SERIAL MONITOR USING ARDUINO MEGA

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Abstract— This paper focuses on how the heartbeat of human can be monitored, based on a pulse sensor. In this paper an effort has been done to design Heart Beat Detection and Monitoring System using Arduino Mega so that enable us to detect the heart beat using the Pulse Sensor and will show the readings in BPM (Beats Per Minute) on the serial plotter screen connected to it. Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Keywords— Liquid Crystal Display (LCD), Sensor Microcontroller, Speed, Temperature, Humidity.

الملخص

تركز هذه الورقة على كيفية مراقبة نبضات قلب الإنسان وإجراء تخطيط استنادًا إلى جهاز استشعار نبض القلب متصل بلوحة اردوينو. في هذا البحث تم بذل جهد لتصميم نظام يتم فيه كشف ضربات القلب ببرمجة Arduino Mega بحيث يمكننا من عرض لنبض القلب باستخدام جهاز استشعار Pulse وسوف تظهر القراءات بوحدة BPM (نبضة كل دقيقة) على شاشة الراسمة المتسلسلة المتصلة بجهاز حاسوب محمول. تم تصميم دائرة جهاز استشعار نبض القلب لإعطاء الإخراج الرقمي وذلك عند وضع الإصبع على مستشعر صغير. عندما يعمل كاشف ضربات القلب ، يومض مصباح LED بالتناغم مع كل دقة

قلب. يمكن توصيل هذا الإخراج الرقمي بالمتحكم الدقيق مباشرة لقياس معدل نبضات القلب (BPM). هذا النظم يعمل على مبدأ تعديل الضوء عن طريق تدفق الدم من خلال الإصبع في كل نبضة.

INTRODUCTION

In this paper an effort has been made to design low-cost system which measures and monitors the heart rate of human by clipping sensors on one finger and then displaying the results on serial screen interface. Miniaturized heart rates monitor system based on a microcontroller. The paper explains how Arduino mega can be used to analyze heart beat rate signals in real-time over serial monitor.

Problem Statement

In fact, Heart disease is one of the main causes of death in many countries, it accounted for over 12 million deaths worldwide. Let us remember the old truism that prevention is better than cure. Basis on this, and to overcome the problem author will build and connect KY-039 Heartbeat Sensor to an Arduino Mega microcontroller. Building a simple cardiac monitor will allow us to measure the electrical activity of the heart in real time, thus the system is continuously monitoring human heart and in case of any abnormal in the heart beat rate the heartbeat detection according to Arduino mega will immediately inform you to concerned doctors or even relatives about the condition of the patient and abnormal details over serial plotter.

COMPONENTS OF HEARTBEAT MONITORING SYSTEM

To build a circuit with Arduino to monitor your heart rate using an infrared LED and detector, Basically the idea is that the infrared LED shines the infrared up into your skin and as blood travel through your veins the light is reflected back down and detected by the infrared detectors so

once somebody put his finger across the LED detector then he should observe heart rate and that information is also transmitted to the PC when we processing sketch. The required components are:

1. KY-039 Heartbeat Sensor.
2. Sensor wire with a clip.
3. Breadboard.
4. Arduino Mega.
5. Personnel Computer.
6. Connecting wires.

Figure 1 explains the system when detects heartbeat and that information according to Arduino mega is transmitted to PC when we processing sketch and saving data.
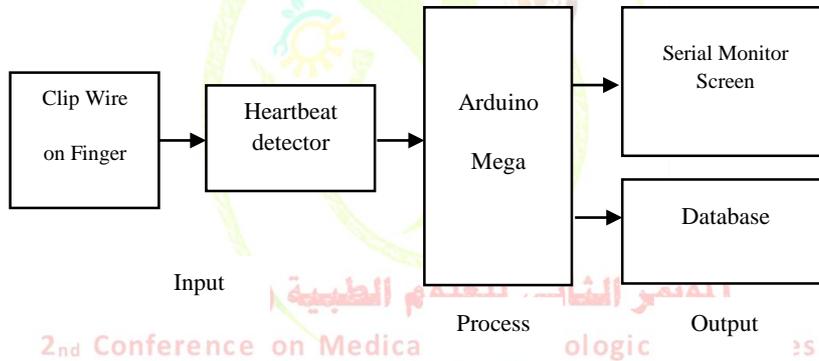

Fig 1. Block Diagram of Heartbeat Sensor using Arduino Monitor

Microcontroller and Arduino Mega

A microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decode written instructions and convert them to electrical signals. The microcontroller will then step through these instructions and execute them one by one. As an example of this a microcontroller could be used to analyze heart beat rate signals in real-time over serial monitor. There are different types of microcontroller, this paper focuses only on the Arduino mega Microcontroller

(ATMega2560) where it is shown below in figure 2 [1].

Fig. 2 Arduino Mega Microcontroller ATMega2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button as shown in figure 3.
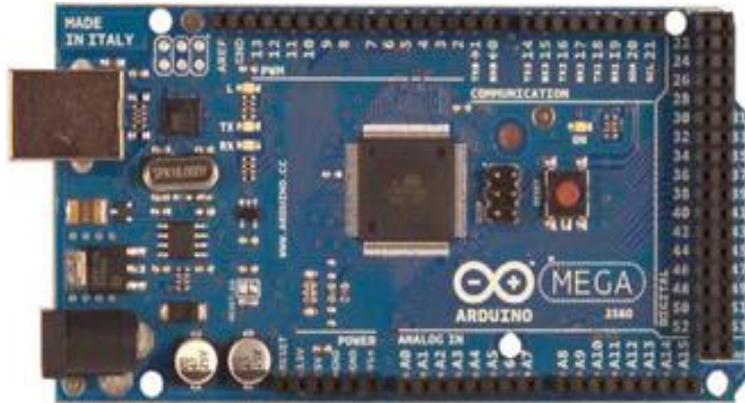

Fig. 3 Arduino Mega Microcontroller ATMega2560

The Mega 2560 Arduino Board has the following features : Microcontroller: *ATmega2560*. Operating voltage: *5V*. Input limit voltage:

6-200V. Recommended input voltage: *7-12V*. 54 digital I/O pins (15 can be used as PWM). 16 analog inputs. DC current for each I/O pin:*40 mA* DC current per pin 3.3V :*50 mA* 4 UARTs (serial ports). Flash memory: *256 kB*. EEPROM: *4 kB*. SRAM: *8 kB*. Clock Frequency: *16MHz* [1][6].

Heartbeat Sensor Features

The Heart beat sensor is designed to give digital output of heart beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse. This paper uses bright infrared (IR) LED and a phototransistor to detect the pulse of the finger, a red LED flashes with each pulse. Figure 4 shows the heartbeat sensor KY-039 which support the microcontroller to measure and monitor the heart rate of human[2].
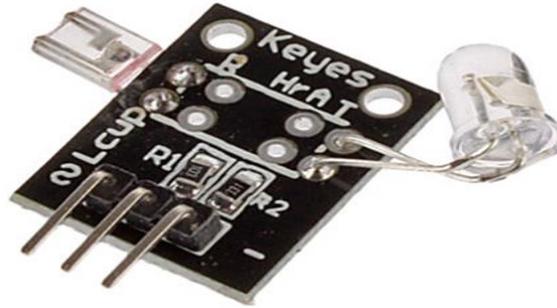

Fig. 4 Heartbeat Sensor KY-39

Pulse monitor works as follows: The LED is the light side of the finger, and phototransistor on the other side of the finger, phototransistor used to obtain the flux emitted, when the blood pressure pulse by the finger when the resistance of the photo transistor will be slightly changed. When running the program the measured values are printed. The heartbeat sensor has the following features :

- Heart beat indication by LED
- Compact Size
- Working Voltage +5V DC
- Instant output digital signal for directly connecting to microcontroller.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started [3].

Arduino Accessors

The accessors that selected in this circuit is USB cable to connect with PC and three wires to connect through the heartbeat sensor. Figure 5 shows the USB cable which is connected to PC and three wires that connect the heartbeat sensor with the Arduino mega.
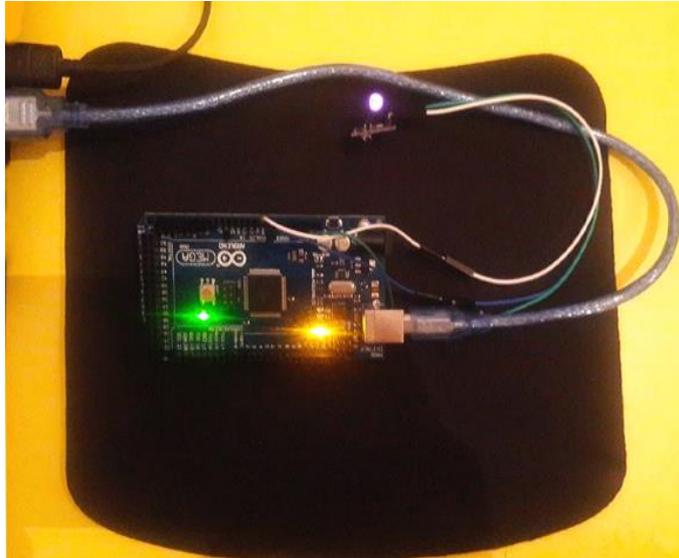

Fig. 5 Arduino Mega Accessors (USB cables and wires)

Human Heart Rate

The heart rate is the rate at which the heart beats and affected by the expansion of the arterial wall with each every beat. The most prominent areas for the pulses are wrist (Radial artery), neck (Carotid-artery), inside of the elbow (Brachial artery), behind the knee (Popliteal artery) and ankle joint (Posterior artery). The HR changes according to age and the physical and psychological impacts on the body. Higher pulse rate indicates the

presence of abnormality in the body which can also be caused by other reasons such as anxiety, anger, excitement, emotion, and heart disorders. Figure 6 illustrates the structure of the heart and blood flow.
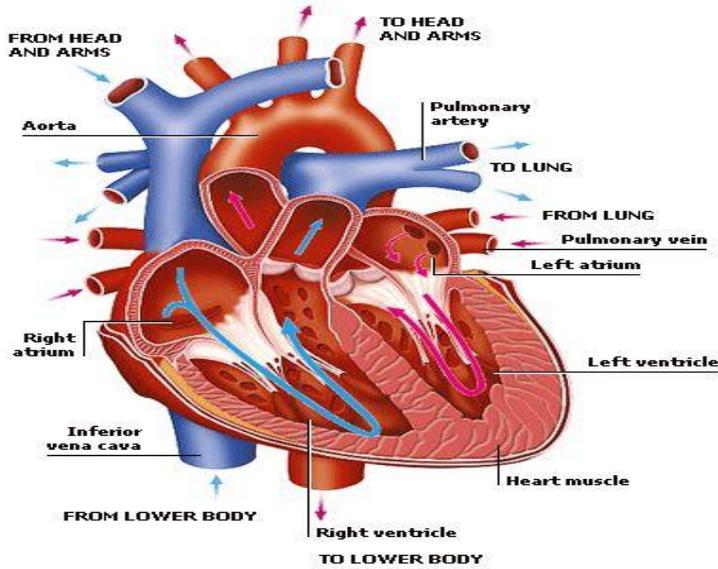

Fig. 6. Structure of the heart and blood flow

The pulse rate of an individual can help in determining various problems within the body, but it cannot be used lone to diagnose an abnormality. The average heart rate is about 72 bpm for sedentary males and 80 bpm for sedentary females but these rates are often significantly different for trained athletes [4][5].

Heartbeat Detection Monitor Implementation Circuit Using Arduino Mega Board

This section describes how the heart rate is monitored by output from microcontroller. Figure 7 shows the circuit of measuring and monitoring heartbeat rate.
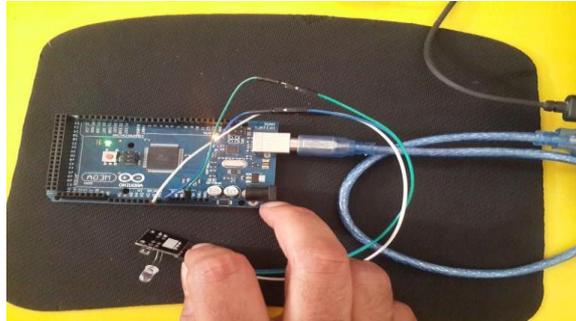
Fig. 7. Measuring and monitoring heartbeat rate

The circuit measures and monitors the heart rate of human by clipping sensors on one finger and then displaying the results on serial screen interface. Miniaturized heart rates monitor system based on a microcontroller. It explains how Arduino mega can be used to analyze heart beat rate signals in real-time over serial monitor.

The step by step procedure of measuring and monitoring heartbeat rate

1. First, connect USB cable into Arduino board.
2. Click properties then Device Manager.
3. Select ports (COM 6).
4. Go to Arduino software , select board then click Mega.
5. From Arduino software IDE select PORT then COM6.
6. Copy the code to Arduino IDE then do COMPILING and click UPLOAD.
7. Now, wire connection : - pin , + pin , s pin
8. The first - pin to GND of Arduino.
9. + pin to 5 v of Arduino.
10. S to A0 of Arduino
11. Finally open serial monitor from Arduino IDE and touch the sensor by your thumb.

Arduino Mega Code Program
The algorithm is as shown in figure 8 which shows the Arduino Mega Code Program

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Fig. 8. Arduino mega code program

Heartbeat Sensor Code Program

The code is as shown in IDE, see figure 9:
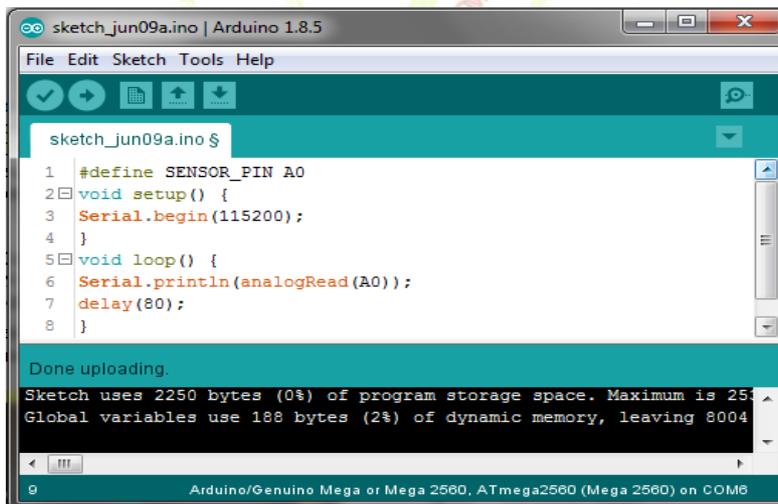
Fig. 9. Heartbeat sensor code program

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Once the circuit has been built as discussed, codes have been uploaded into the Arduino mega then the project is ready for testing. When we carried out implementations and testing the following results were obtained.

RESULTS

First scenario is that heart rate was obtained using the pulse sensor to determine the accuracy of the project's circuit. The circuit is supplied by 5V power. For accurate reading as much as possible, the finger or the wrist needs to be placed close to sensor. The output result as an ECG in the Serial Plotter was represented to a certified doctor to determine its accuracy. The certified doctor examined the signal shown in figure 10. Heart rate results in serial plotter divide by 10. An electrocardiogram (ECG) is a test which measures the electrical activity of heart to show whether or not it is working normally. An ECG records the heart's rhythm and activity on a moving strip of paper or a line on a screen.
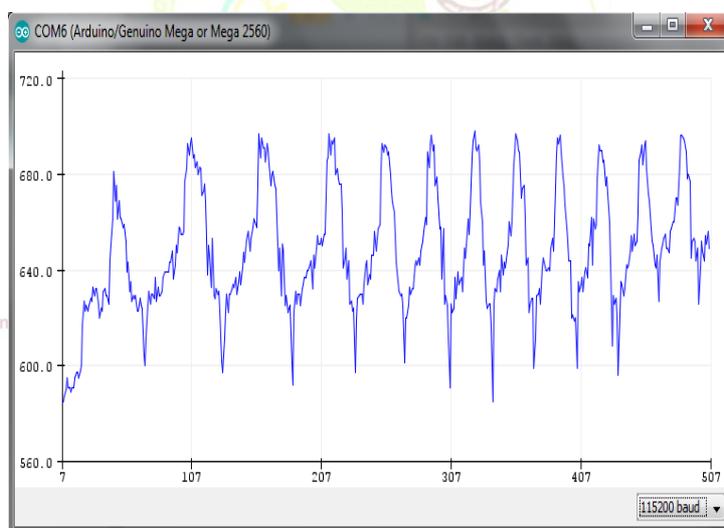
Fig. 10. Heart rate results via serial plotter

In the second scenario, results were outputted via the Serial Monitor as shown in figure 11 below. The pulsed calculated manually and divide by 10.
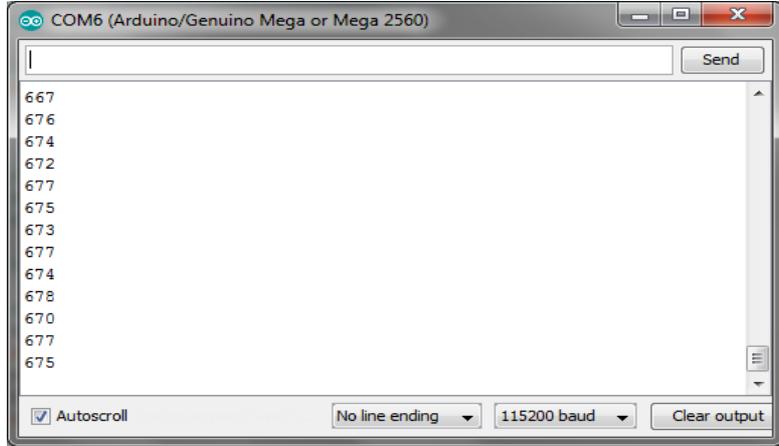
Fig. 11. Heart rate results via serial monitor

To determine the accuracy by comparing the manual with Serial Monitor value. Hence, the Relative Error was calculated as following:

Relative Error = (70 – 68) / 70 = 2.85%, which means an accuracy of 97.15%.

CONCLUSIONS

A pulse sensor which considered as an infrared sensor that has a response to variations in light intensity instead was used. The heart beat detection and monitoring system using Arduino Mega enables us to detect the heart beat which shows the readings in BPM (Beats Per Minute) on the serial plotter screen connected to it (68 BPM). Heart beat sensor gives digital output of heart beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. This digital output was connected successfully to microcontroller directly with relative error 2.85% which means very good accuracy result.

On the other hand, this paper succeeded in achieving many of its proposed goals. These accomplishments can be summarized as:

1. Reading vital signs signals.
2. Process these vital signs signals.
3. Heart rate measuring and monitoring system.
4. Use of relatively low cost and low power hardware components.

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How can Expert System helps in Teaching Computer Science?

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Abstract

An expert system is a computer program designed to simulate the problem solving behavior of a human who is an expert in a narrow domain or discipline. Expert systems are used in several areas of life, such as medicine, engineering, chemistry, education, libraries and information. In education, expert systems are used in various kinds of artificial intelligence and education projects, e.g. intelligent tutoring systems, intelligent learning environments, adaptive hypertext systems.The purpose of this paper is to build an expert system in education, to guide and help students through learning C programming language, and to present concepts, methods, and issues necessary for understanding the education field. This system is supposed to help students in the learning process, it is also designed to help teachers in the process of student assessment. We use two methodologies to represent the knowledge base of this system, they are frames and rules.

Introduction

According to [11], the expert systems are considered one of the Artificial Intelligent(AI) applications. There are many fields which use expert systems to solve problems in their applications like: medicine, personnel screening, engineering, libraries, chemistry, information, and education. Expert systems are tools that can be used to improve human performance. AI is one of the fields of computer science, which is the science that makes the machine does tasks that require human intelligence, tasks which require reasoning, and they have the ability to learn from their mistakes.

The term AI was first introduced in 1956, and the first conference of

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AI organized in the same year by John McCarthy and some researchers, at Dartmouth College in New Hampshire. John McCarthy developed the LISP programming language which became famous in the field of AI. In 1959, Newell and some researchers developed a program called General Problem Solver (GPS) that can solve many types of problems like: proving theorems, playing chess and solving complex puzzles. In early 1960s, the researcher Edward Feigenbaum presented the concept of learning in AI field. Linguistic problem solver 'STUDENT' and learning program 'SHRDLU' were a major contribution to the development of artificial AI.[19] "The program STUDENT considered every sentence in a problem description to be an equation and processed the sentences in a more intelligent manner.".[15]. The 'SHRDLU' has two features:

The first is the ability to make assumptions.

The second is the ability to learn from already solved problems.

The Technology of expert system(ES) was presented in the period of (early 1970s – mid 1980s).[16]. "ES technology is the first truly commercial application of the research and development work carried out in the AI field."[19].

According to [19], Fiegenbaum developed the first successful ES DENDRAL, it was a program used to simulate an expert chemist's analysis and decision-making capability. A number of expert systems were found in different domains like: geological exploration, medical diagnosis etc. They used the same concepts used in DENDRAL.

The concept of 'frame' that was proposed by Minsky in 1975, helps in a structured representation of scenarios and objects.[16]. The concept of 'script' that was proposed by Roger Schank in 1972.[19]. The result of appearing two concepts 'frame' and 'script' helped to develop a practical applications using expert systems.[19]. According to [11], Software tools exist to help designers to build a special-purpose expert system with minimal effort. Expert systems are built on knowledge, containing rules to be applied to solve a problem.

"Expert systems were found to be ideal for integrating different programs in a domain resulting in the development of decision support systems."[19]. According to [12], an expert system shell is a software that uses domain knowledge to be entered, to provide the reasoning capability,

and user interface. The shell has an:-

- Empty Knowledge Base,
- User Interface.
- Inference Engine.

The expert system can explain the reasoning used in the conclusion, it also can provide valuable learning experiences. According to [17], the paper surveys the development of Expert system through a literature review and classification of articles from 1995 to 2004 as a basis, exploring the expert system methodologies and applications during that interval.

The methodologies and applications of expert system are attracting much attention and efforts, both academic and practical, examples of application like: teaching or training

ES is used in Nigeria as a tool in teaching and learning process to facilitate teaching and learning process [21]. This paper suggests that effective introduction of ES in the teaching and learning process in the Nigerian educational system can be adopted since its advantages over traditional chalk-talk method are innumerable.

A number of researchers have investigated the use of ES in accounting, auditing and tax. Today, expert systems exist in many forms, from medical diagnosis to investment analysis and from counseling to production control.

The Fields of Expert Systems, They are: Agriculture, Chemistry,Computer systems, Geometrics, Lower, Geology, Engineering, Information Management, Medical, Designing, Electronics, Accountancy.

Objectives

The objectives of this study are:

- To propose an architecture to build an expert system in the field of education.
- To help the students at university level in their department; or any student, to learn the concepts of computer programming languages.
- To compare the solution of a student by a solution of a system.
- To measure and calibrate a student's solution method with a method of a system.

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- To evaluate the results of the student's progress due to her/his interaction with the system.
- To make the learning operation more easy.
- To give the student the opportunity to make his own choices for studying, and not just follow an organized pattern.
- To reduce the number of human experts.
- To check on the student skills and their background in computer.

Expert Systems

Expert systems are built on knowledge containing rules to be applied to solve a problem.[11]. Expert systems perform many tasks that could not be executed by human experts. "Expert systems are designed to solve complex problems by reasoning about knowledge.".[4]. " Expert systems were among the first truly successful forms of AI software.".[4].

The expert system has two features:-
- Processing a knowledge.
- Simulating the human reasoning.

One important feature of an expert system is its ability to provide users with an explanation of the reasoning employed to reach a conclusion. In addition, expert systems can work with incomplete or unavailable information.

An expert system is a computer application that requires human expertise. It uses human knowledge to solve problems which require human intelligence. The expert system represents the knowledge from human as data within a computer, these data in turn can be used to solve problems.

Expert System Components

The expert system has three main components:
1. The knowledge base.
2. The inference engine.
3. The user interface.

Figure (1) illustrates the interaction sequence between expert system and user.
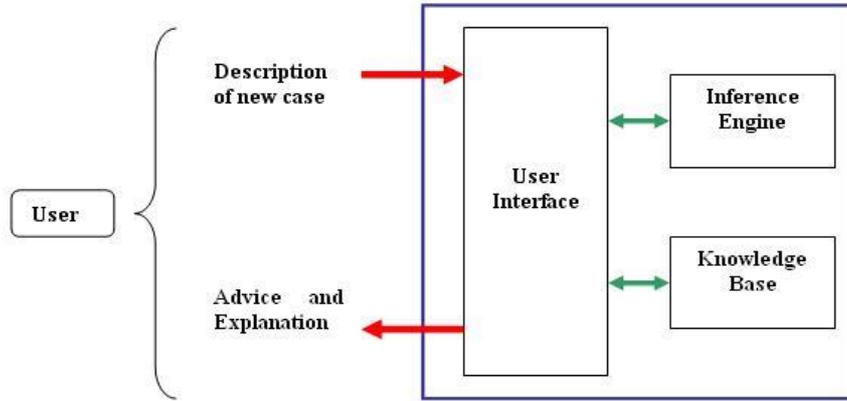
Figure 1:ES block diagram.

Methodology

According to [11], there are five of the most common techniques used in the development of an expert system which are:

- Object –attribute-value triplets
- Rules
- Semantic networks
- Frames
- Logic

This work uses the frames and rules technologies.

Rules

According to [16], rules can be defined as if-then structure, that give information or facts, they provide description to solve problems, and are easy to create and understand. Rules consist of two parts, the 'if' part is called antecedent, and the 'then' part is called consequent.

According to [11], there is a list of types of rules:

- Relationship.
- Recommendation
- Directive
- Strategy
- Heuristic

Frames

According to [11], a frame is a data structure with typical knowledge about a particular object, they are an application of object-oriented programming for expert systems. The first to propose frames was Marvin Minsky in the 1970s. The frame has a name and properties, each property has a specific value. A frame also includes an optional field called a class, a class frame represents the general characteristics of some set of common objects.

A knowledge engineer or an expert enters rules in the knowledge base. Each new rule adds some new knowledge, and makes the expert system smarter. We combine between rules and using frames to create our expert system. Most frame-based expert systems allow us to use the rules to evaluate information contained in frames. The frame is one of the ways to represent the knowledge in our system.

Development of Expert System

According to [11], the development of an expert system is the highly iterative process, this process consists of six phases, they are:

1. Assessment: identifying the problem and its requirements by the knowledge engineer and domain expert.
2. Knowledge acquisition: collecting the knowledge from experts.
3. Design: building a system structure based on the knowledge collected.
4. Testing: evaluating the structure of the system and its knowledge.
5. Documentation: the process of keeping the information needed to facilitate using and understanding the system.
6. Maintenance: reformulation of system specifications based on major system requirement changes.

Figure (2) shows the phases of expert system development:
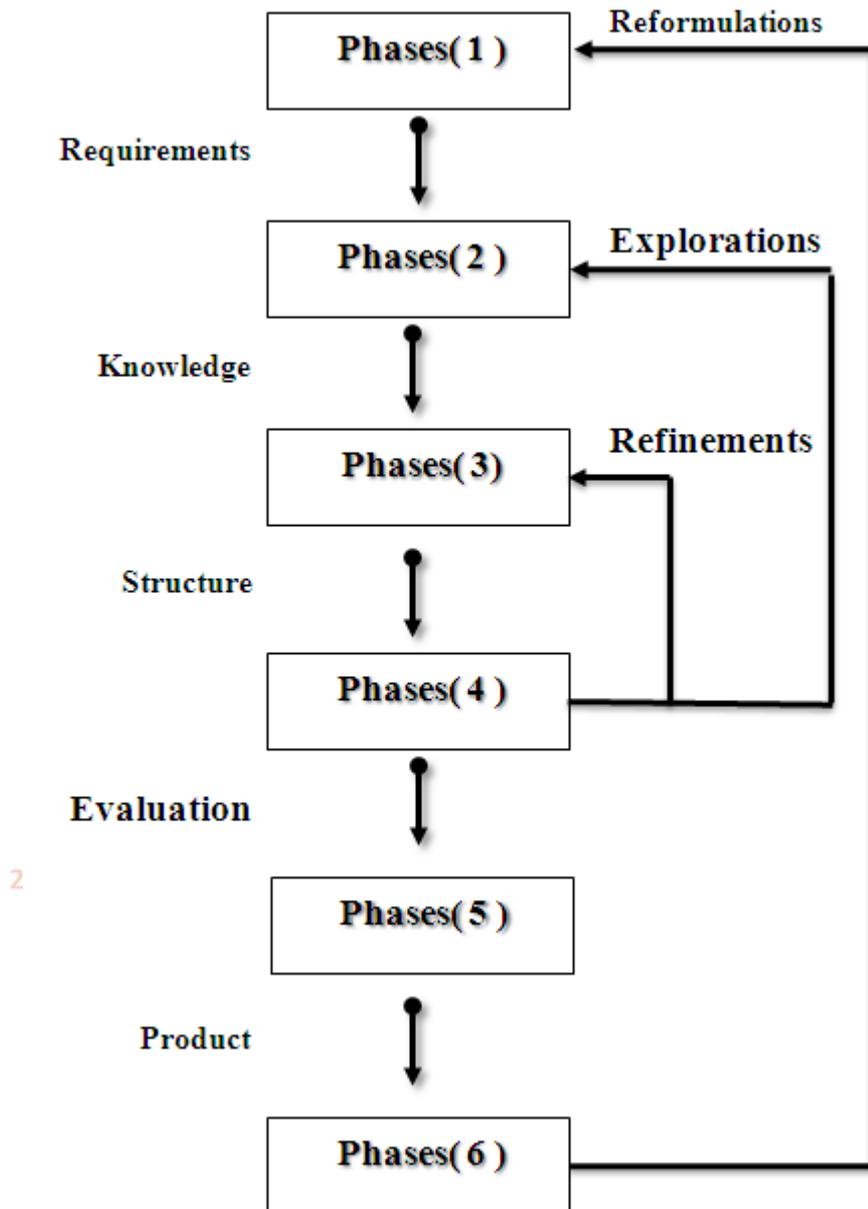
Figure 2: Phases in Expert System Development.

According [21], expert system is very useful in teaching courses in developed countries like:

- Engineering.
- Mathematics.
- Earth sciences.
- Distance tutorial lessons.

"Expert system has a lot of benefits especially to the students, trainers and educational institutions."[21]. According to [21], the expert system assists students in their learning. It allows students(users) to ask a question on how, why, and what format. An expert system is able to make students to prepare their answers without the help of a teacher, and the expert system can give the reasons for the answers, to make a student both more confident of the answer, this feature is useful for teaching engineering students to monitor student's progress. The students can learn by the repeated use of the concept. Expert system has been used in several fields of study including computer animation, computer science, engineering, language (Expert System in Language Teaching), and business study. Expert system is also used as a tool in teaching mathematic related subjects. The expert systems check on the student skills and their background in computer usage. Expert systems are practical tools to be used as intelligent job aids to make decision making easy in tasks like:

- Judging student projects.
- Diagnosing learning problems.
- Identifying and classifying performance problems.
- Helping consumers to decide to choose one of alternatives.

In education, expert systems are used in [8]:

1. Educational planning and decision making ability, manage student records, student counseling, and special education programs.
2. Teacher training and education, specifically, identifying training needs and using computer assisted instruction to teach information and skills.
3. Intelligent tutoring systems that guide students through instruction according to their individual strengths and weaknesses.

"Building Expert Systems in Training and Education was written to give instructional systems designers a look into incorporating experts systems into instructional design. The book attempts to demonstrate the process of developing small- scale expert systems that instructional designers can run from desktop computers."[7].

Expert system gets information from the Knowledge Base and communicates with the student in the same way that a human tutor would do [10]. The student can review a previous concept at any time. The student is not also forced to follow the system's way of teaching, but can make his own choices for studying. For example, one can jump to complex concepts without having have had a look at simpler ones. The student can check his\her knowledge level after having studied a learning page by doing the test specified at the end that page. Any time a student has finished the study of a particular learning page, he\she can take an appropriate test. The questions of the test are presented one at a time. The student can answer each question independently and in his own sequence. In case the student gives a wrong answer to a question, he\she can try it again.

An expert system is used as a teaching tool because it is equipped with the features which allow users to ask questions of how, why and what format. The expert system provides the answers or examples to of operation of learning. Expert system is useful for the students and the teachers, it helps in guiding the students in a better way.

The modern networks allow us to run educational programs on computers. Because the computers can be used to solve problems like the ones present in education and training by building expert systems. Expert systems as computer assist instruction systems for nursing education and training. Expert systems technology proved to be a tool for education and training of nursing professionals and students.

Building expert systems in training and education has a function to help designers of the components of a problem to enter the knowledge to an expert system shell.[21].

In the education field, many of the expert system's applications are using techniques from adaptive hypertext and hypermedia [21]. Most of these systems assist students by using techniques that give the knowledge to students and test their ability to learn. Such systems are used on the

web. Web based expert systems can provide a learning system at anytime from anyplace where internet is provided. Agent based expert system helps users by finding materials from the web, and it can diagnose the users problems and give the results of them. The important contribution of Artificial intelligence in computer-based education is to provide knowledge-based access to resources. The history of educational system shows that each generation of education shows an increased use system of artificial intelligence and expert systems to improve educational activities. Expert system can be used in several fields of study including computer animation, computer science , engineering , language (Expert System in Language Teaching), and business study. It can be used also as a tool in teaching mathematic related subjects. The systems aid practices better than the teaching side, and they are used in support of other learning like teaching activities for example the problem based learning (PBL).

The education expert system can help students in their department for some courses. "To help the students and the tutors in our Department, we constructed an intelligent e-learning system to assist learning and teaching in the context of the course of Artificial Intelligence "[10].

Follow the next steps to build an expert system [5]:

- Extract the knowledge from different sources.
- Present the extracted knowledge to experts in the final form.
- Analyze the extracted knowledge.
- Make the architecture of the educational expert system.
- Develop the system.
- Test the system to check the validity by trying it with some students.
- Correct any faults.

We can benefit from the previous steps to help us in designing an educational expert system [21]. Expert system can be used to act as a teaching tool for non-experts. The expert system is designed to provide solutions, advice, and suggestions to common errors.

The education expert system communicates with students in the same way that human tutor would do.[10].

"Education is an investment for the future of society. To develop

society educators need to achieve the best education for every individual through providing every appropriate means for the particular individual."[6].

"Like a human expert, such a computer system can extract additional information from a user by asking questions related to the problem during a consultation. It can also answer questions asked by a user about why certain information is needed. It can make recommendations regarding the problem or decision at the end of a consultation, and it can explain the reasoning steps gone through to reach its conclusions when asked by a user (Mockler and Dologite, 1992)."[15].

"Ability of expert system to adaptively adjust the training for each particular student on the bases of his/her own pace of learning is another feature that makes expert system more demanding for students. This feature present by Zorica Nedic, Vladimir Nedic, and Jan Machotka in 2002 for teaching engineering students. It should be able to monitor student's progress and make a decision about the next step in training."[20].

According to [22], SCHOLAR is first intelligent tutoring program, it was presented in 1970,"This program attempted to engage the student in a mixed-initiative dialogue on South American geography."[22]. The student can communicate with the program through a sequence of questions and their answers in natural language.

System Architecture

The expert system is called knowledge based system,

According to [10], the general architecture of education expert system shown in figure (3.1), consists of five units:

1. Identification Unit(IU): "the student initially subscribes to the system. During subscription some personal settings are saved. After subscription the student can, at any time, enter the system through the IU."[10].
2. Student Model(SM): contains all information about students.
3. Tutoring Unit(TU): is responsible for the teaching process.
4. Evaluation Unit(EU): is used to evaluate student's progress due to their interaction with the system.

5. Virtual Agent(VA): is used to motivate the students and improve system's effectiveness.

The stereotypes are used to set up an initial profile for each student. "the system can use that profile for adaptation. The choice of the stereotype is achieved by using a questionnaire that gets information about student's knowledge, preferences and goals. This information is saved to the SM, which can later be updated by acquiring new information."[10]. The ES contributes in deciding upon the knowledge level of a student.
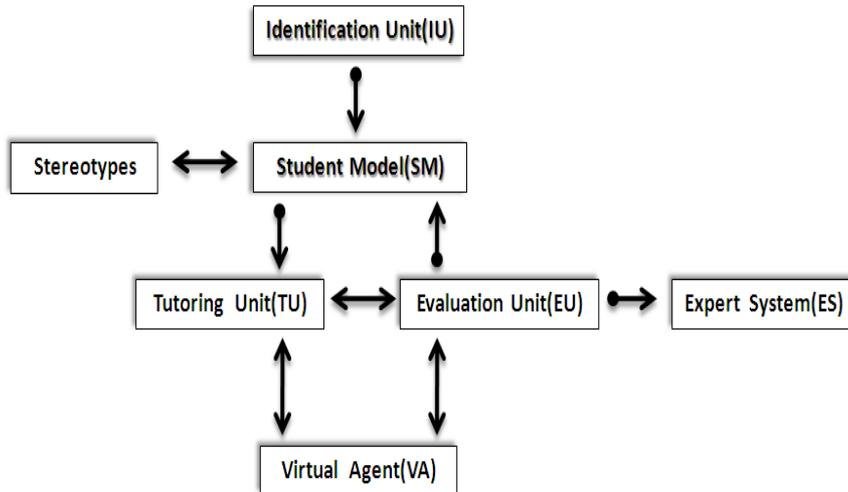
Figure 4: The architecture of education expert system adapted from[10].

According to [21], the student can learn and understand by repeated use of the concept. "The expert system takes on the tutoring function that is, presenting a series of screens of information, test questions and feedback. Expert systems are also excellent in instructional design, decision making, planning, controlling, and collaboration with both the student and trainer. It reduces explanation where a trainer has difficulties in illustrating concepts."[21].

According to [15], the most challenging part of building an expert system is testing it. The basic motivation behind testing is to control performance, efficiency and quality of the knowledge base.

Requirements

When we write a program of this project, we want to know all the

requirements, and we must select a technology that is used in the project, we want to know all recommendations. To do this project we should follow these steps:

- Specify the problem and define the scope of the system.
- Collect some information about the computer's languages from different sources such as the (C) programming language.
- Acquire the knowledge from the experts, this step is very important in building an expert system, it is called the knowledge acquisition step.
- The quality of knowledge base depends on the level of success achieved in the knowledge acquisition step.
- Provide the concepts of (C) programming language to students to help them in their departments,
- Evaluate the students, and their progress due to their interaction with the system, the evaluation is achieved through testing.

Determined Frames and their Attributes

The frame has a name and properties, each property has a specific value. A frame also includes an optional field called a class, a class frame represents the general characteristics of some set of common objects. Look at the following figures that show the frames of system:

Frame Student
Name : string Password : string Number : integer
Search( ) Add( ) Enter_system( )

Frame Expert_System
Concept : string Question: string Answer :string Student_answer: string
Main ( ) Test _answer( ) Result( )

Figure 5: Student Frame   Figure 6: Expert_System Frame

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يوليو July 2018

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Frame Concept
Lesson: string Data : string
Show _date ( )

Frame Knowledge
Rules: string Condition :string Action : string
Load_code ( )

Figure7 : Concept Frame   Figure 8: Knowledge Frame

Frame Question
Question: string Answer-data :string Error : string
Question _data( ) Question _ answer( ) Question _ result( )

Figure 9: Question Frame

Domain Knowledge

The domain knowledge of the system is structured in a tree-like diagram. Expert systems are required not only to solve the knowledge but also to validate and manipulate this knowledge. The basic role of an expert system is to replicate a human expert and replace him/her, the information must be transferred from human expert into knowledge base. In figure (4.6) the knowledge base is represented by a tree of attributes. The domain knowledge tree. It consists of subsections level, it is displayed a knowledge. Every educational system contains a knowledge base.
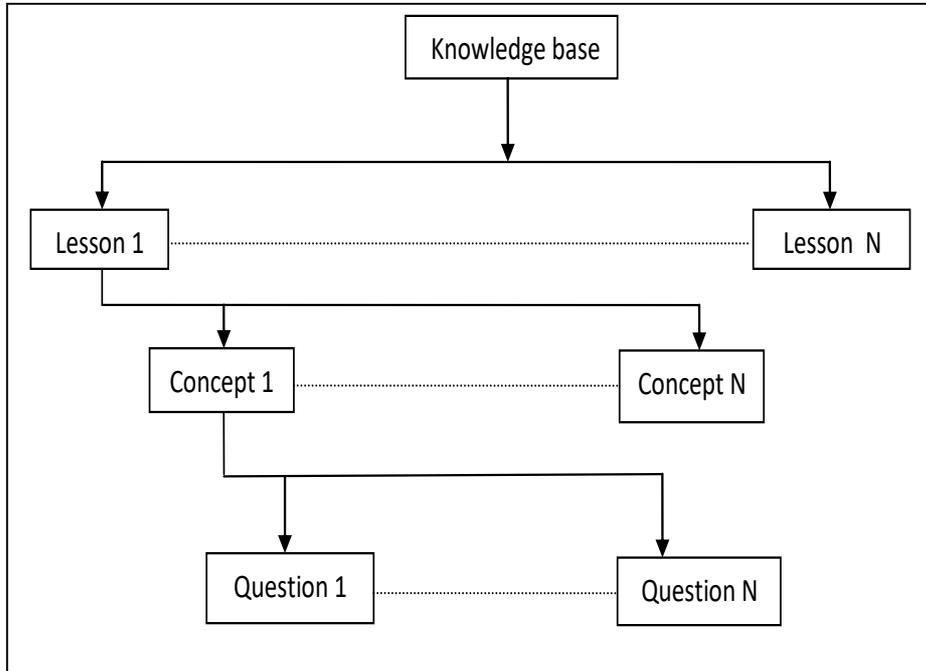
Figure (10):The knowledge base

From the tree, the student can choose a lesson. Each lesson corresponds to a learning page. Each learning page deals with a number of concepts. Each concept is linked to the corresponding concept page. Each learning page has a test. Each test consists of a number of questions that examine the concepts.

Structure Architecture

After determining the knowledge base, we design an architecture of system, where it shows in figure (11), in the architecture, the knowledge base consists of three units:

Student Model

The student model represents the learner's emerging knowledge

and skills. Information such as learning preferences, past learning experiences and advancement may also be relevant in adapting the teaching process. It may also record the learner's errors and misconceptions. The student's knowledge processes, known as diagnostics, analyzes the behavior of the student. The student model is the model that is responsible for keeping all the knowledge that the system has about any particular student. From this, we can extract aggregated knowledge about all the students. The system uses the model to gather initial data from any new student and subsequently identifies that particular student. There are many parameters about the student that the student model needs to be aware of: the student's personal data, current knowledge, learning strategies, goals and desired ways to reach them. All these functions of discovery, storage, and updating are provided by the Student's model. The student must look at the lessons to learn about the concepts of C programming language

. **Expert System Model**

The Expert System model contributes in deciding upon the knowledge level of a student. The main goals of expert system model are:

- To evaluate student's progress due .
- To increase his/her interaction with the system.
- To motivate the students.
- To improve system's effectiveness.

Question Model

The question model is responsible for the teaching process. A student can select a learning goal from the domain knowledge tree. The information is then presented to the student. The information consists of concepts and examples. The students should answer the tests, there are some tests about the course of C programming language.
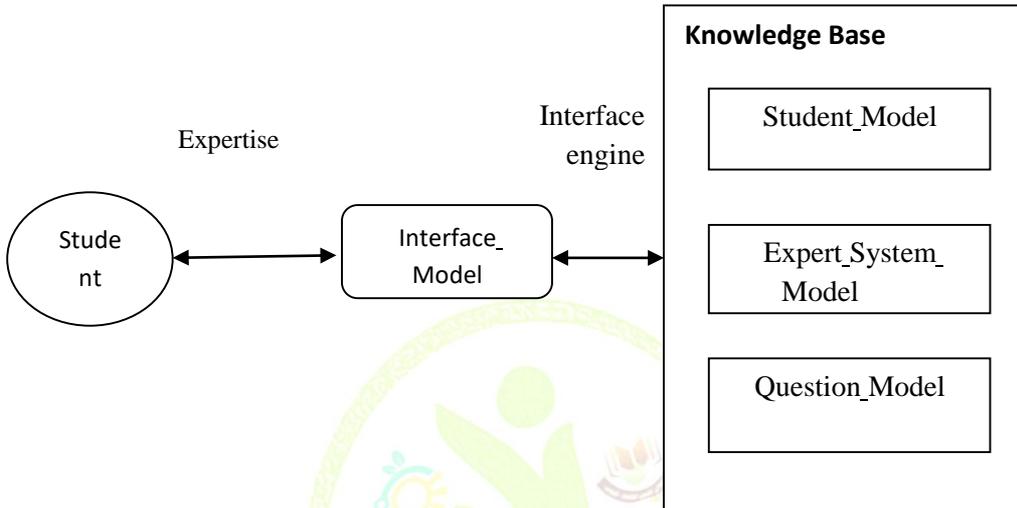
Figure4The architecture of Educational Expert System: 7.

System Implementation

After the knowledge base is ready, knowledge base is converted to rules. This phase is the actual building of the expert system. We divide the work in this phase to some steps as follows:

- Choose the language to write the code for this system.
- Define the user interface.
- The effort and the time should be known from the team of work.
- Know every decision for all conditions.

The acceptability of an expert system depends on the quality of the user interface, which gives the student the ability to interact with the system. Initially, the student enters to the system, during the access some personal data are saved, after that the student manages to enter the system. The expert system involves the organizing way for this type of education

program, shows the text on screen then there are some tests about each lesson, students can answer the tests, then the result is shown, if the answer is wrong, the correct one is shown, finally it evaluate the student knowledge. The costs of expert systems vary considerably and often include post-development costs such as training and maintenance.

Interface Design

We determine a system design program, that was Visual Basic 6.0. It is considered one of the simple languages and a more suitable one where you can build a design of using interface for these applications. A good interaction between the user and the expert system is critical for proper use of the expert system, and the design of the user interface regulates this interaction. The interface designer is a programmer. A choice of the user interfaces that meets the needs of both experienced and users. An initial screen of expert system. It contains a picture that shows the convey of the system, at the top of picture there is a name of the expert system. in addition to some information about the system at the bottom of picture. The next screen contains information about the student like his\her name, and a password. If the student does not find his\her name then he\she can register his\her information with a click on the register button. For the purpose of security he/she cannot enter to expert system if he/she does not register into the system. The next screen will be shown, it contains three boxes, the student will write his/her data(name, number, and password), after that a student should press the add button to save his/her data. There are some buttons, each button has the name of the lesson in the main screen. If a student presses on one of the last buttons , another screen will be shown that contains data of the selected lesson, he/she can choose the language of the lesson i(Arabic/English). And there is the test a button when a student presses on this, a new screen will be shown, it would contain some questions about the concepts in that lesson, there are instructions on each screen, the student can follow them to answer the questions.

A help screen is provided for students forget info about all other screens. The student can simply select the name of screen.

After the coding stage, the human expert system evaluates the

expert system and gives feedback\critique to the knowledge engineer.

The user's interface passes data back and forth between the user and the expert system. It is a part of the expert system program that is visible to the user. Through the interface the expert system asks the user questions. The system can also test the user. The expert system needs information to make an interface.

Result

Expert systems represent a new approach for dealing with important and difficult education problems. In this work we build an education expert system to learn a programming language. We select the C programming language because every student in the computer department must have studied it. This system is designed to motivate the students and to improve the system's effectiveness. The systems performs simulations in the best way and aids practices better than for the teaching side. The student can repeat the lesson more than once if he/she needs to understand the concepts. In this type of system, the student can use the analysis the reasoning operation. Expert systems must check on the student skills and their background in computer usage.

There are three phases to build an education expert system: (a) learning, (b) testing, (c) evaluation. The initial step is to know user needs, the expert preforms that task. In order for the educational technology. To be successful the system must be approved by students and teachers, it must be appropriate for students. Every educational system contains a knowledge base. The students can learn with the help of using a knowledge base.

The evaluation process is an important process of building an educational expert system, the evaluation process is more complex than for other software environments.

System Evaluation

Evaluation is crucial for improving expert system design and performance. The evaluation of the expert system is very important and difficult. the evaluation of system depends on the goals of system. There are a number of evaluation methods that include interviews,

questionnaires, observation, system logging, user diaries, laboratory experiments and field trials. We have used a questionnaire to evaluate this system. We distributed some of these questionnaires on some of the students in the lab, and some of teachers. Most of them say the system gives a good course, and the tests (make them more better) gives them a better chance to pass the exams. We asked them to find the answer of following questions:

- does the system give good knowledge?
- Is that knowledge easy to understand?.
- Is the interface given offer a good explain?
- Are the questions in the tests clear, extensive, and unambiguous?

Student Evaluation

According to [10], in the educational systems, one of the most important functions is the students evaluation. The students' evaluation refers to the knowledge level of a student after studying the lessons.

Each answer of a student for a question consists of some items, shown in table (1), where the Serial_no means the number, which the expert system gives to the student, when he/she uses the system, Student_no means the Student number, Tries_no means the number of tries to answer the question, Times means the time which the student spends to answer the question, Result_status means the status of result (Correct/Wrong). Look at the table (5.1) shows an example:

Table 1: Date of Answers

Serial_no	Student_no	Tries_no	Time/S	Result_status
1	24	1	1	Correct
2	35	2	1.5	Wrong
3	34	1	1	Correct
4	33	1	0.5	Correct
5	45	2	2	Wrong
6	55	1	3	Wrong

From the table (1), we can compare the answers of students by the correct answer, and we look at other items of the table to make an evaluation, to know the quality of the information that is provided to the

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student.

Conclusion

The paper discusses in detail all the steps which were taken by the knowledge engineer in building the expert system. In fact, the building of a system is a very effective way to present the expert with all the possible cases and capture a much wider scope of their knowledge. The purpose of expert system is not to replace human experts, but to make their knowledge and experience more widely available and permit non-experts to work better.

This work shows that expert systems are very important in the field of education. They are becoming a useful teaching tool for some courses like engineering education, accounting and management. This work shows that expert systems may be used as an assistor or substitute for the teacher, and it is a friendly interactive way to in courage students and motivate them to study. The expert system provides an independent learning way for students, where a student can be judged on their progress to help their learning pace. Expert systems guide students in learning, to make it easier and better. The students can replace the traditional chalk-talk method by using expert systems in education.

We summarize the result in the following steps:

- This expert system represents the human experience in the field of education, it helps the experts, and it helps the people that cannot ask for expert advice to learn about concepts.
- The user interface is connecting between the students and the expert system, and it uses it to make an easy connection.
- This expert system is used via questions and answers.
- The system is good for students but not for teachers, in future work it should be adaptive for teachers.

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2nd Conference on Medical & Technological Sciences

Deploying VoIP Technology Instead of PSTN

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Abstract: This paper aims to define the VOIP technology in addition to presenting a vision for the design, installation and operation of the SIP Proxy Server service in Libya Phone Company. The connectivity methods of the Libyan telephone company using fiber optics and VPN technology will be compared to each other in order to secure safe and reliable transmission to the data of customers who subscribe to the network service through assigned tunnels. Also with the rapid growth of the Internet and the increase of load on the network in terms of users and service providers, there are many ways to connect sites to ensure quality of service QoS and traffic security and the number of call, in this study OPNET simulator used to simulate the proposed solutions for the VOIP. From the results . it can see the integrated use of Fiber Optic and VPN to ensure the quality of services and connections used by SIP for the performance and quality of service tested in evolutionary view has not been used for Fiber Optic Faster in connection than to VPN and is safe

Keywords: Voice over internet protocol; OPNET; Quality of service; HLC; Virtual private network; Fiber-optic

الملخص

تهدف هذه الدراسة إلي تعريف تقنية VOIP اضافة الى تقديم تصور لمشروع تصميم و تركيب و تشغيل خدمة SIP Proxy Server في شركة هاتف ليبيا في مقارنات طرق التوصيل الربط الشبكي لشركة هاتف ليبيا باستخدام الـ Fiber Optics لتؤمن نقل سريع للبيانات الى ان تتطور الى تقنية الـ VPN لتؤمن نقلاً آمناً وموثوقاً لبيانات الزبائن

المشتركين في خدمة الشبكة التي تمر عبرا رزم البيانات ضمن الأنفاق (Tunnel) المخصصة.

و مع النمو المتسرع لشبكة الانترنت و زيادة الحمل علي الشبكة من حيث المستخدمين و مزودات الخدمة ،يوجد فرق من حيث طرق التوصيل من حيث ضمان جودة الخدمة QoS و تأمين حركة المرور و عدد المكالمة ، تم استخدام برنامج المحاكاة OPNET للحصول علي نتائج تحليل ومحاكاة التقنية VOIP باستخدام تقنية جديدة الـ VPNومقارنتها مع التقنية الربط باستخدام الـ Fiber Optics .

1. INTRODUCTION

Voice over IP [1], also known as IP Telephony and VoIP, the technology began in 1995 when a small company called 'Vocal Tec' showed that the possibility of transferring phone calls Over IP packets easily be divided into two main groups: closed systems and open systems [2]. The first group includes programs such as Skype and the famous Cisco protocol (SCCP) [3]. The other group includes open standards based on SIP, H.323, LAX2 protocols. VOIP is data in Real-Time and is transferred via Internet using protocol (RTP) consists of data and the control the control part is managed by protocol (RTCP) and the packet is transferred using a set of UDP / IP / RTP protocols. There are two types of networks:

- Voice Networks: in which the conversion of the reserved circuit and routing during communication is always in the same path [4].
- Data networks: Based on a switchbox, the information is divided into packets and each packet can be transmitted by a different path.

1.1 VOIP Rules and Standards

- Internet Engineering Task Force (IETF): The Standards Authority for Internet Protocols and Services the IETF mission [1] make the Internet better for work through high-quality production and related technical documents that affect the design, use and management of the Internet.
- International Telecommunication Union (ITU): Is an international organization within the United Nations system where the government and

the private sector coordinate the global telecommunications network and services? Its main task is to include the radio spectrum segmentation and [1] connect subscribers to the public network between different countries to allow international telephone calls, considering the implementation of teleconferencing as a function similar to that of the UPU for postal services.

1.2 Protocol: H.323

Is a set of standard protocols emanating from a system developed by ITU-T to provide audio-visual communication sessions using packet-based packages? This protocol is used in most popular applications such as NetMeeting, which is part of the ITU-T H.32x series of protocols It also handles multimedia connections over ISDN, PSTN or SS7, 3G mobile networks and H.323 standard addresses controlled calls and [5-7] signals, control, multimedia transport, control and bandwidth control from point-to-point and from m

1.3 Session Initiation Protocol (SIP)

Is an IP protocol that is used to initiate, modify and terminate VOIP phone calls? IETF has developed this protocol and has been published as an RFC 3261 protocol. Initially SIP is a protocol designed to be independent behind the Transport layer. It can also work on TCP and UDP protocols. SIP relies on the SDP protocol to perform negotiation to determine the SIP encoding. It supports session descriptions that allow participants to agree on a set of compatible media types. This protocol itself provides reliability and does not depend on TCP Reliability It also supports user movement through the establishment of agents and redirect requests for the current user includes services provided by SIP: User location; Create the connection; User Availability; User capabilities; Dealing with calls.

1.4 PSTN vs. VOIP

The importance of VOIP technology has been introduced as an alternative to the traditional public switched telephone network (PSTN). It has reduced the cost of communication, especially the international ones. It is easy to use as it uses internet methods and offers additional features and

services that make it easier for the user to communicate effectively. The world does not need two networks, the Internet and the PSTN network and it want to focus on the Internet only as it is very fast provides voice and image communication and messaging.

2. VOIP SERVICE FOR LIBYA PHONE

The network is designed to link the headquarters of Libya Telecom Company in Tripoli with the company's branch in Benghazi using fiber optic and to support the VOIP communication service as a means of connecting voice conversations over the Internet [6]. To ensure the management of data traffic and the exploitation of Internet presence within the network ,the study will use VPN which the main function is remote access. The default network is the same as the internet network, but its characteristics have been used to be confidential in the process of transferring data and maintaining the confidentiality of information and security Abbreviations and Acronyms because the data is transmitted on the Internet and is open all over the world.

2.1 Scenario 1

WAN is primarily a WLAN that connects the headquarters of a Libyan telephone company consisting of 2 routers to transform the network from WLAN to WAN using a Fiber Optics cable or optical fiber. It is used to transfer Internet service between countries and transmit data through this cable at the speed of light. This cable is used in WLAN networks only on a limited scale to use VOIP technology for wireless communication between employees and reduce the cost of local and international communications between the company's branches in terms of cost and speed of fiber optics.

2.2 Scenario 2

WAN is primarily a WLAN that connects the headquarters of a Libyan telephone company consisting of 2 routers to transform the network from WLAN to WAN using VPN technology and the VPN is the connection of two devices or two networks together via the Internet, a protocol-based technology where typically, the process of creating a private connection between two computers through an intermediate network, such as the

Internet, is called the transfer of data over a security path (tunnelling) where this path is created between the two computers directly (Figure 1).
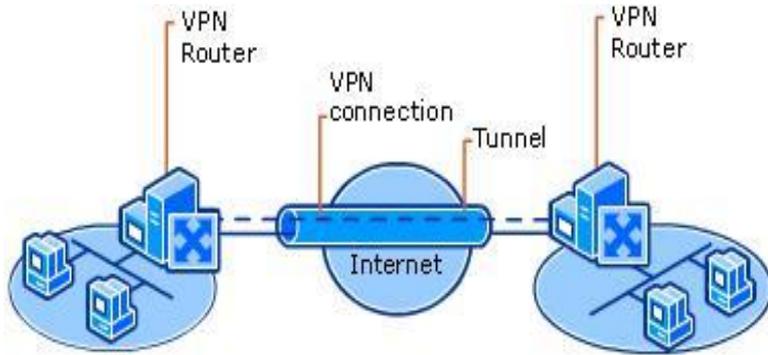

Figure 1: Tunneling path in the VPN.[6]

The main idea is to build a private "Tunnel" between the two devices. The VPN Tunnel is a private encrypted file that is exchanged between the two devices that decrypt when receiving information from the other side of the default tunnel after the firewall has disconnected any unauthorized connection from the system administrator or network administrator of the company or its branch.

This technology requires the device to be connected to the Real IP Address service, which is a feature obtained from the Internet service provider you enter on the Internet, which is to obtain the Public IP Address for your device remains constant in all cases, even if the connection is disconnected and reconnected And has contributed to reducing the cost of transferring information between companies and institutions between branches away from the headquarters and the user who wants access to information available in the home computer.

3. Results and Discussion

The result of a comparison between the global statistics the Simulation of the VOIP Scenario1 Using Fiber Optic and Scenario2 for VOIP Network Using VPN. Statistics collected and Analysis such as Jitter, End-To-End Delay (Sec), Traffic Received And Sent (Byte/Sec), Download And Upload Packet (Byte/Sec).

3.1 Global Statistics

Figure 2 shows the time necessary for a complete message until arrive to the target starting from the moment of transmit the first bit by the source. in scenario 1 using the fiber optics the biggest delay of the traffic is 0.95×10^{-5} sec Due to Fiber Optics effect External factors. Also the data packet delay In scenario 2 using the VPN It reached to 0.94×10^{-5} sec . from Figure 2 also the total delay over 50 m/s this is contrary to the recommendations of the International Federation and this happened because a the bandwidth was less in size of the data sent.
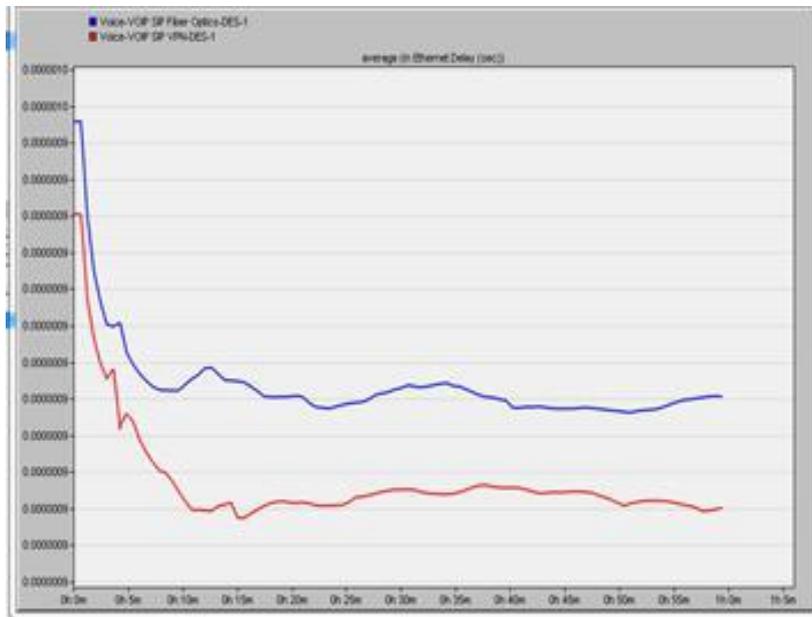

Figure 2: Ethernet delay.

in Figure 3, in order to know the real time needs to send a complete massage starting from the first moment of transmission until it reach it is distension using fiber optic the biggest delay was 0.001 sec, also in the 2nd scenario the data delay using VPN was about 0.077 sec because the bandwidth was less than data size.
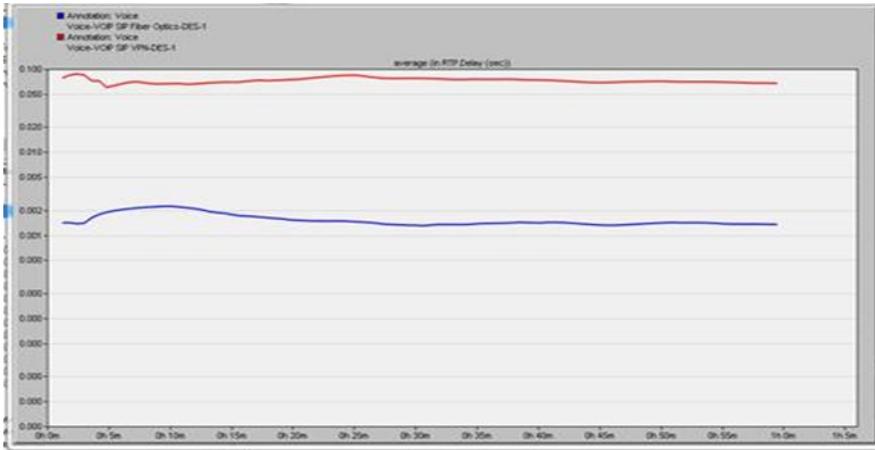
Figure 3: RTP Delay voice.

In Figure 4 there are delay in several voice sessions for RTP protocol .in the 1st scenario using fiber optic there were no variation in voice sending time delay in the other hand a delay of 0.44×10^{-4} ms when using VPN and no stability in traffic because of weakness of the internet with an increase in the number of users causing transmission delay.

Figure 4: RTP jitter voice.

In Figure 5 there is a delay in the various voice packets for RTP Traffic Received and Sent. In the case of transmission and reception, which is used to verify the time of communication in sending and receiving voice data? delay of sending and receiving for the first packet in the first scenario using Fiber Optics is Sending in sec 39.75 was received at the second party in sec 39.75 There was no delay in sending and receiving data packets and audio. Also note that the difference in delay sends and receiving data in the second scenario using VPN reached 37.14 sec where it was received in sec 37.80 if there is no receipt in the same second for reasons of several weaknesses Runt with increasing number of users causing transmission instability.
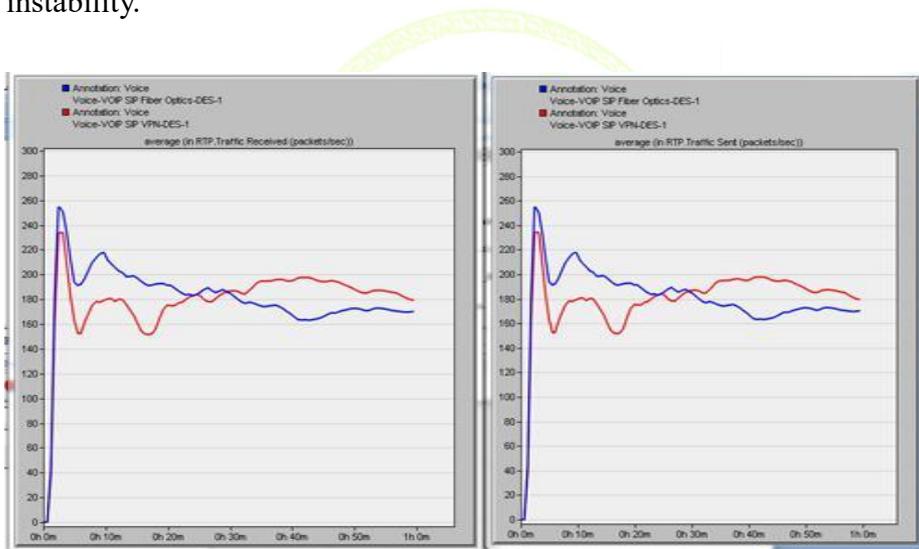

Figure 5: RTP traffic received and sent.

In Figure 6 For SIP Call Setup Time To see which time In which time contact was made who got the call confirm the call where the scenario is 1 Using the Fiber Optics In the duration of 0.02 sec also in scenario 2 using the VPN has reached 1.05 sec which concludes that the delay using SIP. The VPN connection is higher. My Internet weakness causes or the number of connections in the network it was larger than the frequency band which caused delays in the preparation of the call.

Figure 6: SIP call setup time.

Wireless LAN load showed in Figure 7. To know the router's ability to distribution of traffic within headquarters the company is in Tripoli and Benghazi for all tracks that can access destination than the one can conclude the basic services are based within the company's headquarters in Tripoli reached to 42.6 sec and also note in bssid2 for the company's headquarters in Benghazi connect to 42.6 sec and the more the number of users increased the load inside the company.
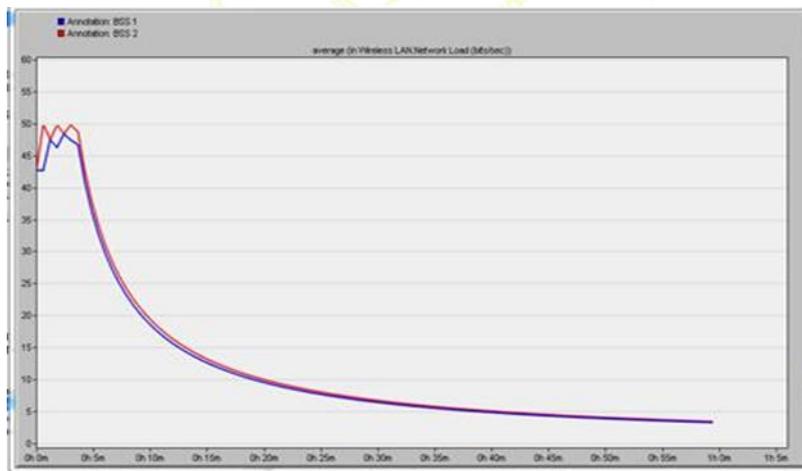

Figure 7: Wireless LAN load.

3.2 Node Statistics

In Figure 8, SIP UAC Calls Connected Number of all calls. As well as requests Incoming calls where the scenario 1 using Fiber Optics Connection event from Manager Tripoli to number 1 Of calls in the second and Manager Benghazi 9 calls in the second. In the other hand the number of calls in scenario 2 using the VPN A connection occurred from Manager Tripoli There are 1 number of calls per second And Benghazi Manager 9 calls in the second which show the number of calls in Contact the Tripoli Manager It was less, according to the demand of employees.
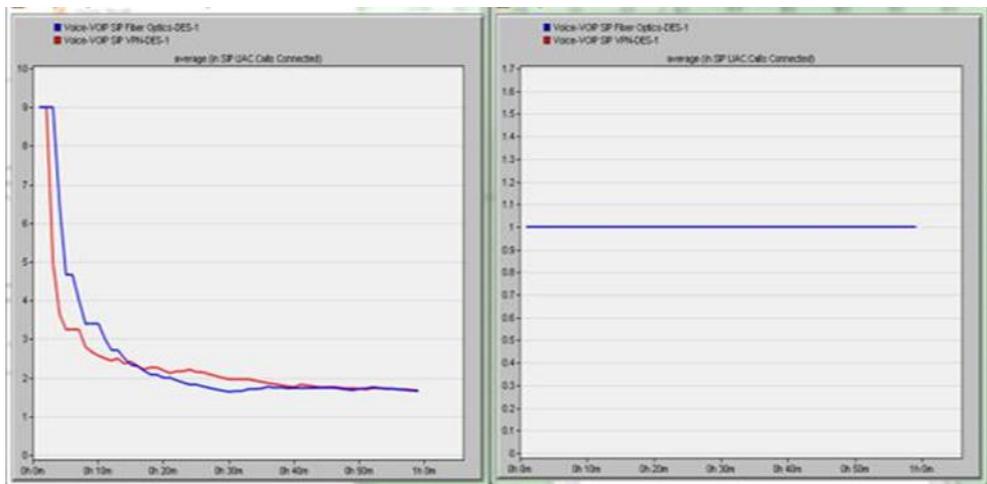
Figure 8: SIP UAC Number of all calls

In Figure 9 the statistics sip UAC call two sessions to know the duration of each call in time i got a confirmation call to time which got disconnected confirmation where scenario 1 is using fiber optics a connection has occurred from manager Tripoli to manager Benghazi in the period of 59.02 sec to a time termination of the connection in the period of 106.0 sec it is also noted that delay in scenario 2 using the VPN the 124.0 sec period reached an end time the connection duration is 108.1 sec in which the delay using sip in the VPN connection the higher my reasons for the weakness of the internet or the number of connections in the network was larger than

the frequency bandwidth causing a delay call setup.

Figure 9: SIP UAC call duration.

4. Conclusion

The paper conducted some tests on VOIP to assess the quality of service of communication for various types of traffic sources. The integrated use of Fiber Optic and VPN to ensure the quality of services and connections used by SIP for the performance and quality of service tested in evolutionary view has not been used for Fiber Optic Faster in connection than to VPN and is safe in terms of the confidentiality of information sent inside the Tunnel And the possibility of developing from the audio connection to the establishment of video conferences video conference and benefit from the existence of technology for VOIP and development to become meetings within the company through its branches through video conference video remote can not solve the process of personal appearance of the person, but A modern way to see and hear the user using high-tech communication, where they cross geographical barriers, or move from one place to another and provide materially in terms of expenses and costs the company.

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Investigation of Transformer Protection in Power Grid

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Abstract

This paper studies power transformer protection methods. Power transformers are widely used on electric grid and forming an important and active part of any active grid. Transformer is not only an expensive equipment, but in case of total failure, it will take long time to be fixed or replaced. Full protection is essential to keep power transformer working properly for long term without stopping. The simulated results of the power transformer in the grid were presented and discussed. The proposed grid was studied by running Etap software power package, to study the performance of transformer in normal load conditions, also the response to fault conditions. Differential protection was selected as the most appropriate technique with the transformer.

1. INTRODUCTION

Power system protection is valid in electrical engineering that is responsible with the dealing of various problems (such as automatic tripping and it works with the purpose that the faulted area could be made isolated from the system in the minimum shortest period so the fault cannot interrupt the sustainability and stability of the whole system. Transformer is an important element in the power systems. Transformer is the interconnection link between two different voltage levels. The power transformer is an essential electrical component that requires a process of continuous monitoring and a method of fast protection. Although the power transformer is expensive but it is an

essential element in the performance of power system effectively [1]. There are many sizes and types of power transformer:

1- Step up

2- Step down

3- Autotransformer

4- Grounding

Figure (1) Medium power transformers (cgglobal, 2016)

The fundamental component used for the protection of the system is a sensor isolating) associated with the power systems. That is used for the identification of the fault; and another device is used to initiate the tripped signal to the Circuit Breaker. The sensor could either be a Current Transformer (CT) or a Voltage Transformer (VT) or it could be a combination of both. Other types of sensors include buchholz, oil temperature gauge etc.; they are used with the purpose for initializing the tripping relays. The basic function of transformer is to convert the generated voltages into convenient voltages, as the convent voltages are

used for the consumption and transmission purpose [1].

2. TRANSFORMER FAULTS

Transformer faults are clustered into six classes. Differential protection technique is used to prevent or eliminate these faults from damaging the internal parts of the transformer [2]. Transformer faults classification are:

- Winding and terminal faults.
- Core faults.
- Tank and transformer accessory faults.
- On-load tap changer faults.
- Abnormal operation conditions.
- Sustained or uncleaned external faults.

The estimated proportion of faults as a result of all the causes is illustrated in the figure (2) below [2].

| CATEGORY	percentage
Winding and terminal faults.	60.00
Core faults	20.00
Tank and transformer accessory faults.	10.00
On-load tap changer faults.	10.00
Total faults	**100.00**
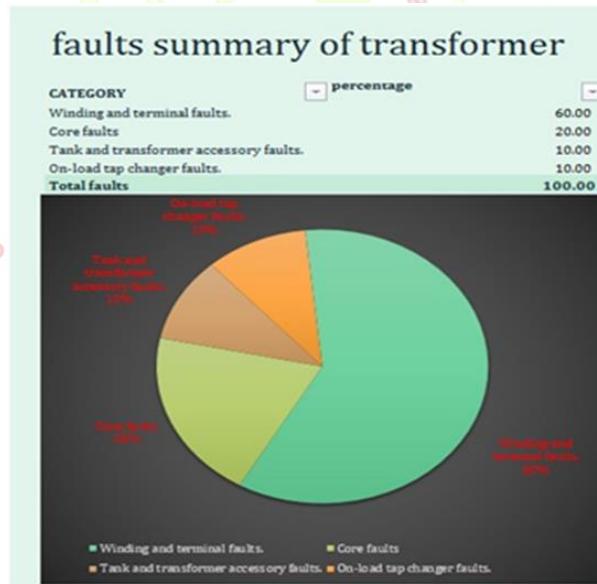
Figure (2) Transformer fault statistics (Baker, 2012)

3. OVERLOADS

An overload is an overcurrent confined to normal current paths in which there is no insulation breakdown.

- **Sustained overload** is commonly caused by installing excessive equipment such as additional lighting fixtures or too many motors. Overloading mechanical equipment breakdown such as failed bearings also causes sustained overloads.

Temporary overloads, occur frequently and common causes include temporary equipment overloads such as a machine tool taking also deep of a cut, or simply the starting of an inductive load for example a motor or transformer. "Since temporary overloads are by definite harmless, overcurrent protective devices must not open or clear the circuit". It is important to realize that fuse elected must have sufficient time-delay to allow transformer to start and temporary overloads to subside

1. SYSTEM FAULTS

The system short-circuit produces relatively intense rate of heating of the display adapter, and increases the copper loss in proportion to the current default per of the unit [3]. Typical for external short circuits adapter can withstand without damage, if the current is limited only by referred to the reactance of autonomy in the table (1).

Table (1) Faults duration of current

Transformer reactance	Faults current (Multiple	Permitted fault duration (seconds)
4	2	2
5	2	2
6	1	2
7	1	2

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4. COMPONENTS OF TRANSFORMER PROTECTION

1) Circuit Breakers
2) Fusing Control transformers.
3) Zones of Transformer Protection.
4) Buchholz relay

5. INTERNAL AND EXTERNAL FAULTS IN POWER TRANSFORMER

1) External Faults

In the case of external faults, it must be cut adapter if other protective device designed to work for such defects, it may fail to operate in a predetermined time. For external faults, time overcurrent graded relays are employed as backup protection. In addition, in the case of overload conditions for long periods, the life of transformer will be reduced [3].

2) Internal Faults

The primary protection of transformer is meant for internal faults. Internal faults are classified into two groups which are:

Short circuits in the winding transformer and communications. These are electrical malfunctions of a serious nature is likely to cause immediate harm [3].

Incipient faults initially, such defects minor in nature, but can develop slowly in large errors. Such defects are not detectable in the voltage unbalanced filter or existing plants and, therefore, protection devices designed for use in MAS circuit conditions are not able to detect this type of error [3].

3) Through Faults

Through faults could have an impact on both transformer and its protection scheme, depending on their severity, frequency, and affect

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a good duration, through faults currents can cause mechanical transformer damage, even though the fault is somewhat limited by the transformer impedance. For transformer differential protection, current transformer mismatch and saturation could produce operating currents on through faults. This must be taken into consideration when selecting the scheme, current transformer ratio, relay sensitivity, and operating time. Differential protection schemes equipped with restraining windings offer better security for these through faults [3].

1)High Voltage Disturbance in Power Transformer

They are two kinds of the high voltage disturbance in power transformer.

Transient Surge Voltage: high frequency surge and high voltage may arise in power system as a result of many causes, switching operation of different electrical equipment, arcing ground if neutral point id isolated, atmospheric lightening impulse [4].

Power Frequency Over Voltage: There could frequently be a potential of overvoltage because of abrupt disconnection of a huge load. Even though the amplitude of this voltage tends to be greater than its standard level, its frequency is the same as it was in a normal state. Over voltage within the system contributes amplification in stress on the transformer's insulator [4].

2) Phase-To-Phase Faults
Short circuits between the phases will give rise to substantial fault current only limited by the source impedance and the leakage impedance of the transformer.

3) Turn-To-Turn Faults
A direct metallic contact or flashover between conductors within the same physical winding is called a turn-to-turn fault. The current forces

caused by high fault current through a transformer during system faults, can crush or shave off the insulation and develop a turn-to- turn fault. This is particularly a risk for relatively small and aged transformer in powerful systems. A turn-to-turn fault can be caused by steep fronted surge voltage or corona discharges. A turn- to-turn fault short circuits a small part of the winding. Turn-to-turn faults between a few turns are difficult to detect by current measuring relays as the terminal current increases very little. The fault current at the terminals increases when the fault spreads and more turns are short circuited [4].

4) Backup Protection

Backup protection, typically overcurrent or impedance relay applied to one or both sides of the transformer, perform two functions. One function is to back up the primary protection, most likely a differential relay, and operate in event of its failure to trip. The second function is protection for thermal or mechanical damage to the transformer. Protection that can detect these external faults and operate in time to prevent transformer damage should be considered. The protection must be set to operate before the through fault withstand capability of the transformer is reached. Because of its large size or importance, only differential protection is applied to a transformer, clearing of external faults before transformer damage can occur by other protective devices must be ensured [4].

5) Primary-Secondary Phase Shift

For the transformer with standard delta-star connections, the current on the delta and wye side will have a 300-phase shift relative to each other. Current transformer used for traditional differential relays must be connected in star-delta (opposite of the transformer winding connections) to compensate for the transformer phase shift [3].

6) The Protection of Earthing Transformer

Earthing transformer is usually associated with three-phase supply systems. On a three- phase system, the neutral would be earthed either directly or through some limiting impedance resistance. The function of an earthing transformer is to provide a grounding point for the power system where machines have delta connection. An earthing transformer can be protected by IMDT overcurrent relays fed delta connected C. T.s. This relay is used as a back-up relay for external faults. Three-phase earthing transformers have six windings, earth of the same number of turns, mounted in pairs on limbs of the core and they are connected to the delta- connected windings of power transformers [3].

7) Transformer Overcurrent Protection

An overcurrent is any current that exceeds the ampere rating of conductors, equipment, or devices under conditions of use. The term "overcurrent" includes both overloads and short- circuits, for transformer protection. Overcurrent relays are used for the protection of transformer of rating 100 kVA and below 5MVA [2].

8) Restricted Earth Fault protection (REF)

Restricted earth fault protection is fast and can isolate winding faults extremely quickly, thereby limiting damage and consequent repair costs. If CTs are located on the transformer terminals only the winding is protected. However, quite often the secondary CT is placed in the distribution switchboard, thereby extending the protection zone to include the main cable [2].

9) Stabilizing Voltage of REF Relay

As discussed in the restricted earth faults in the previous paragraph, when one of the CT in a REF circuit is saturated, it will no longer work as CT and such a saturated CT can be replaced by its resistance.

Hence the healthy CT current will be flowing through resistance of the saturated CT circuit. Hence as the relay circuit is in parallel with this CT current, the voltage that appears across the saturated CT also appears arcos the relay circuit. To prevent the operation of the relay under this condition, the relay circuit burden is increased to a value so that the current in the relay circuit is kept below the set current of the relay [5].

10) Sensitivity and Magnetizing Current

The sensitivity of the REF protection depends on the magnetizing current of the connected CTs. The current that is available to the relay is the balance current after supplying the magnetizing current of all the CTs. i.e. the current that is available in the secondary circuit of the CT is not equal to the step-down current based on the transformation ratio of the CT but lesser than it be the magnetizing current required by the CT core. Hence if the fault current available in the primary of the CT is very low such that it is just sufficient for the CT magnetizing current, there will be no current available in the secondary circuit for relay to operate [4].

4) Stability and Magnetizing Current

In the case of sensitivity, the magnetizing current also effects the stability of the REF protection. The Ct sizing calculation is done for the through fault condition of the transformer. For example, the CT should be stable for a through fault condition [5].

6. TRANSFORMER DIFFERENTIAL PROTECTION

The among several issues that appear in the transformer, differential protection is a type unitary protection zone or a specific piece of equipment. The differential protection is based on the fact that the faults lie in the situation is high in the case of differences that faults in

between the inlet and outlet streams, it could be the difference in the current which sometimes important even without an internal error [5].

1)   Differential Relays.
2)   Digital Relays for Protection Transformer
3)   Percentage Differential Relays Protection
4)   Differential Protection Scheme in Power Transformer.
5)   Phase correction
6)   Differential Protection simulation.

7. DIFFERENTIAL PROTECTION SIMULATION OF AN ACTIVE GRID

A short circuit analysis should be performed in addition to the load flow analysis which tells the possible fault currents in the system. Results in figure (3) showing the over load condition to proposed grid. With this simulated no faults are existing no transformer yet. The load flow results (main bus) are obtained and present in the figure (3). In order to plan a full power transformer protection scheme for the given system, a load flow analysis is required. The analysis spots any problems with the system which must be corrected before any protection plan can commence. The load flow analysis shown in Figure (3) was completed using ETAP 12.5 and constructed using the given instructions with default equipment settings.

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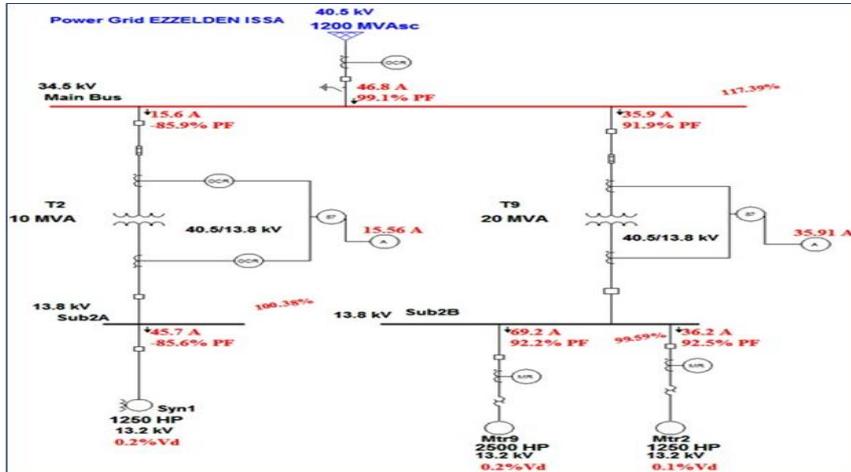
Figure (3) Overload on the buses

Results in figure (4) showing the normal circuit condition to proposed grid.
With this simulated no faults are existing no transformer yet.
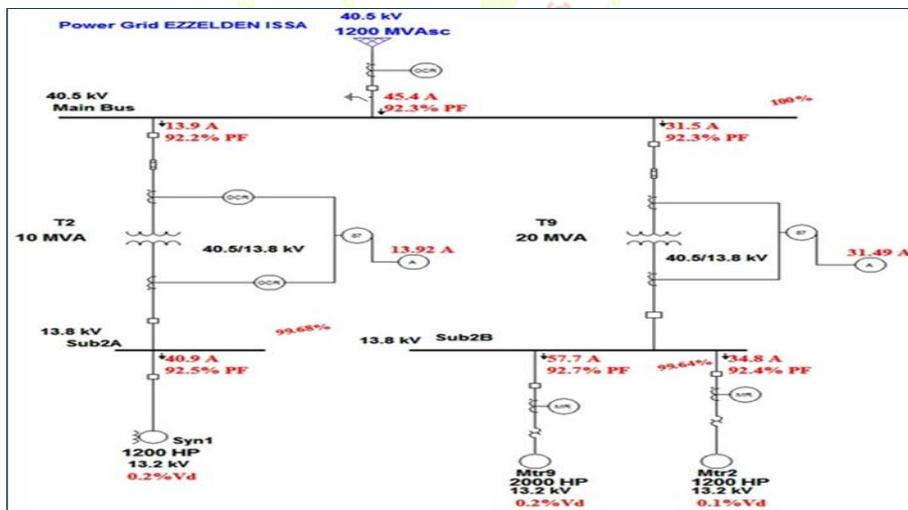
Figure (4) Design protection transformer 3 phases

Results in figure (5) showing the normal circuit condition to proposed grid.
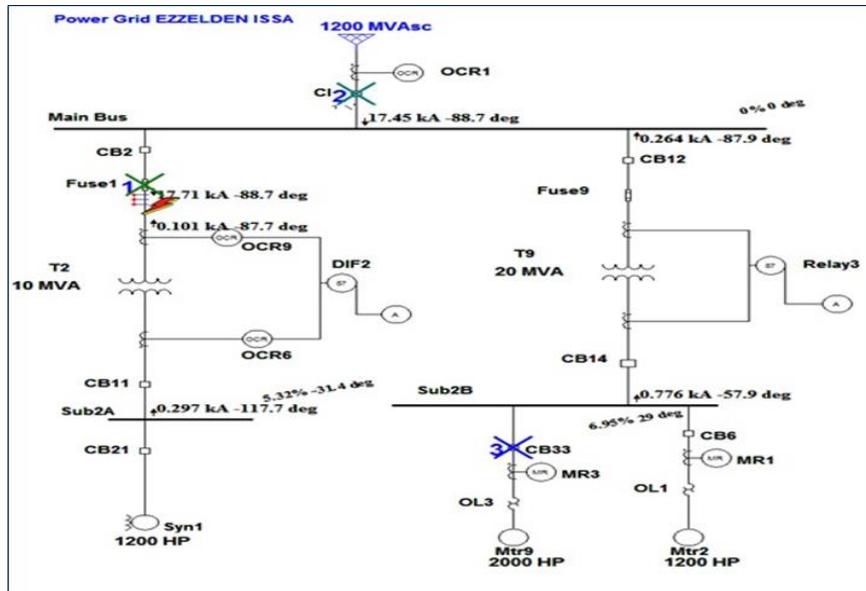
Figure (5) External fault on three phase transformers

This short circuit is called external faults. With this simulated the fault is existing in the line of the transformer. It can see from the simulation that fuse (1) is going to be trip separating that part for input supply as showing in the figure (5). Furthermore, circuit breaker CB1 will activate and separate the flow of electrical energy form power.

Star Sequence-of-Operation verifies, evaluates and confirms the operation and selectivity of the protective devices for different types of faults for any location directly from the one-line diagram and via normalized TCC curve views. Sequence-of-Operation provides a system-wide solution for an accurate and realistic operating time and state of protective devices, such as trip devices, relay, circuit breaker, fuse, contactor, etc. The operation time is calculated for each protective device based on its settings, time

current characteristic, and interlocks for a specified fault location and type. As shown in figure (6).

Figure (6) 3 phase symmetrical fault on connector between Fuse1 & CT 1

Results in the figure (7) is star plot options tool provides all the necessary options to customize the display of the Star TCC curve. This curve is shown the flow current in the circuit as demonstrated in the figure (7, 8).
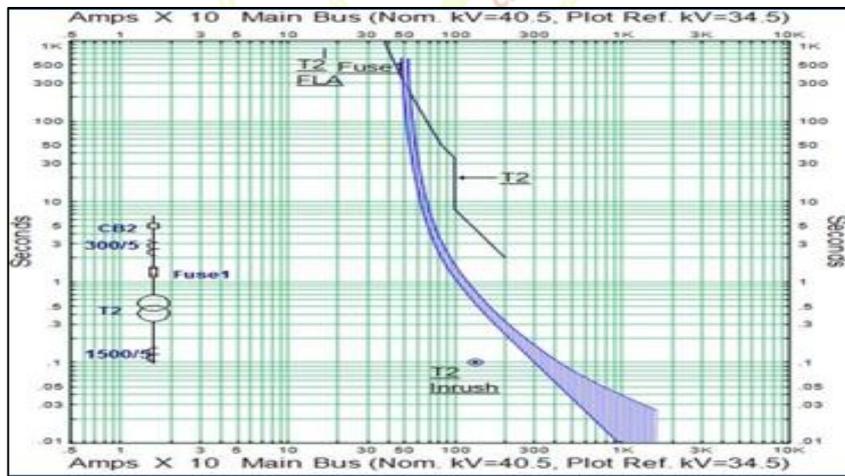


Figure (7) Star plot of current Flow
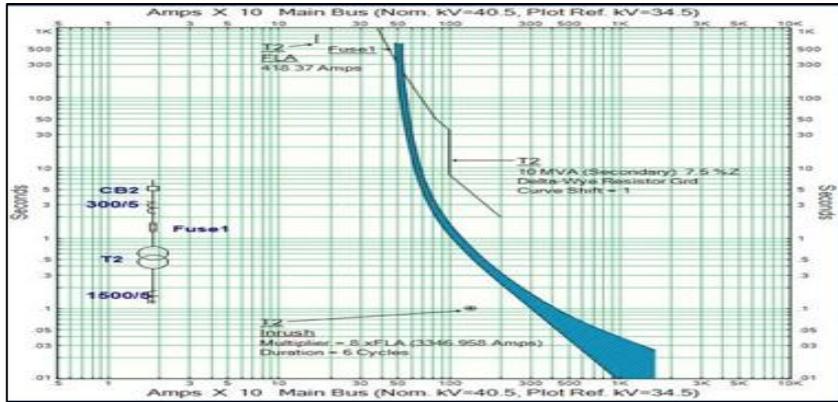
Figure (8) Star plot of current Flow

Results in figure (9) showing the normal short circuit condition to proposed grid. This short circuit is called external faults. With this simulated the fault is existing in the line of the transformer. It can see from the simulation that fuse (1) is going to be trip separating that part for input supply. Furthermore, circuit breaker CB1 will activate and separate the flow of electrical energy form power grid.
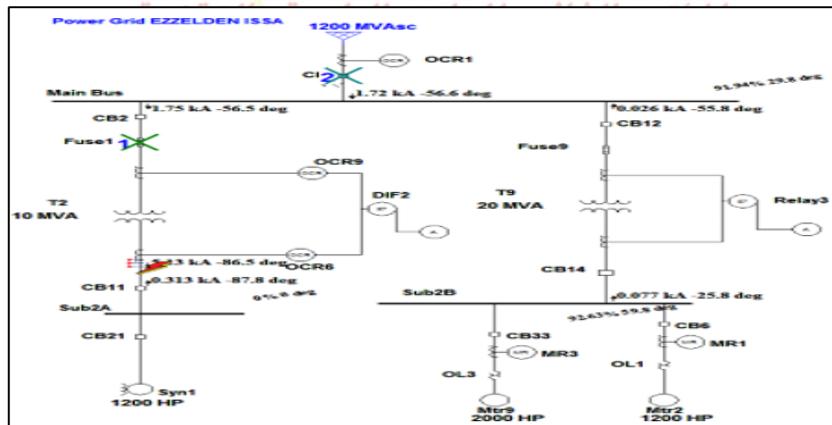

Figure (9) External fault on transformer T2

Results in the figure (10) showing the normal trip in the circuit power grid for external fault in the transformer (T2). The external fault is between CT and circuit breaker CB11. The fuse1, CB1, are protected the transformer. The time tripping to protection the transformer (T2) from external fault are shown as the sequence of operation events.

Figure (10) Time tripping internal faults in the transformer (T2)

Results in figure (11) showing the normal short circuit condition to proposed grid. This short circuit is called internal faults. With this simulated the fault is existing in the line of the transformer. It can see from the simulation that fuse (1) is going to be trip separating that part for input supply. Furthermore, circuit breaker CB1 will activate and separate the flow of electrical energy form power grid.
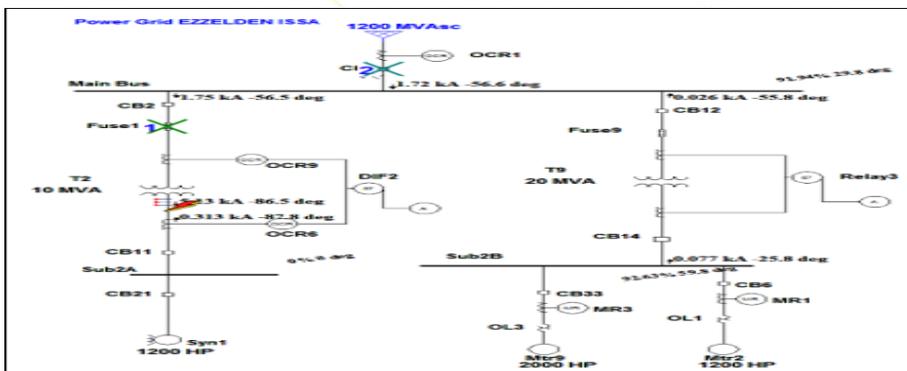

Figure (11) Internal fault on transformer T2

Results in figure (12) showing the short circuit condition to proposed grid. This short circuit is called external faults. With this simulated the fault is existing in the line of the transformer. It can see from the simulation that circuit breaker CB1 will activate and separate the flow of electrical energy form power grid.

Figure (12) another external fault on line phase

Results in the figure (13) showing the normal trip in the circuit power grid for external fault in the transformer (T9). The external fault is between circuit breaker CB14 and current transformer CT. Circuit breaker (1) is protected the transformer (T9). The time tripping to protection the transformer (T9) from external fault are shown as the sequence of operation events

Figure (13) Time Tripping When Occur External Faults

Results in figure (14) showing the normal short circuit condition to proposed grid. This short circuit is called internal faults. With this simulated the fault is existing in the line of the transformer. It can see from the simulation that circuit breaker CB1 will activate and separate the flow of electrical energy form power grid.
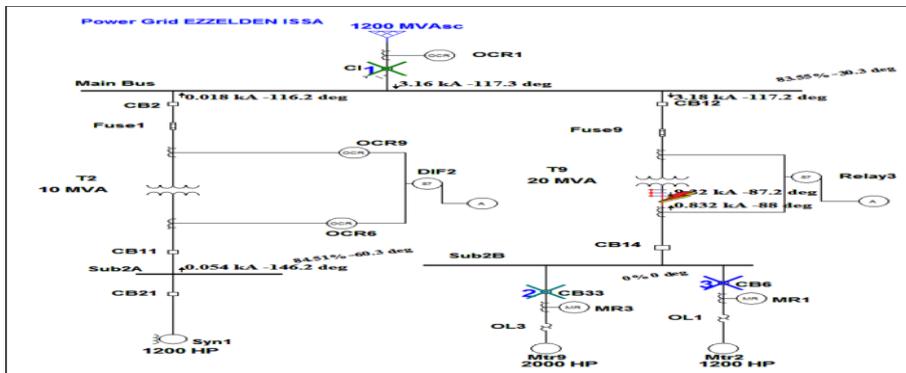

Figure (14) Internal fault in the line of transformer T9

The normal trip in the circuit power grid for internal fault in the transformer (T9). The internal fault is between delta three-phase and wye CT. The CB1, are protected the transformer. The time tripping to protection the transformer (T9) from internal fault are shown as the sequence of operation events as showing in the figure (15).

Figure (15) the sequence of operation events

Figure (16) Short- Circuit Report

Figure (17) Short circuit summary Report

Sequence-of-Operation Event Summary Report

Symmetrical 3-Phase Fault between CT1 and T2. Adjacent to Main Bus|

Time (ms)	ID		If (kA)	T1 (ms)	T2 (ms)	Condition
25.3	Fuse1		17.713	<10.0	<25.3	
28.2	OCR9		17.713	<28.2		Phase - OC1 - 51
15.3	OCR1		17.449	<15.3		Phase - OC1 - 51
236	CB1			83.3		Tripped by OCR1 Phase - OC1 - 51
4302	MR3		0.484	4302		Overload Phase - Thermal
4308	MR1		0.292	4308		Overload Phase - Thermal
4352	CB33			50.0		Tripped by MR3 Overload Phase - Thermal
4358	CB6			50.0		Tripped by MR1 Overload Phase - Thermal
9607	OL3		0.484	9607		
24340	OL1		0.292	24340		

Figure (18) Sequence-of –Operation Event Report

8. CONCLUSION

Effective way to fully protect power transformer engaged in active grid is presented in this study. The differential protection is selected due to its advantages which shown in the running simulation and the results given in chapter four. This technique is practical to be employment in most of the high-power rating transformer of 1000 (KVA) and above, the technique is robust and sensitive for full protection to the transformer, transformers in this level of rating are expensive and it should be fully protected at any cost due to the fact that transformers are not available just to replace in case of losing its service. Waiting time could reach few years in order to replace such a power transformer beside its cost. For future investigation digital control could be proposed with digital relays in order to speed the relays action compared with the full expected protection (which can be set from software setting).

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Abstract

With the invention of LED (Light Emitting Diodes) the idea of using light for communication has started again using the existing infra structure used in illumination. This technology is called Li-Fi (Light Fidelity). With the increasing popularity of solid state lighting devices, visible light communication (VLC) is globally recognized as an advanced and promising technology to realize short-range, high speed as well as large capacity wireless data transmission.

Li-Fi is a new paradigm for optical wireless technology to provide unprecedented connectivity within a localized data-centric environment. The increasing demand for higher bandwidths, faster and more secure data transmission as well as environmental and undoubtedly human friendly technology heralds the start of a major shift in wireless technology, a shift from RF to optical technologies.

This technology uses light to transmit data with a very high data rate through a LED bulb which converts the electrical signal to light, logic '1' indicates that the light bulb is on and logic '0' indicates that the light bulb is o but this happen very quickly that the human eye can't feel this change, in the other hand the PD (Photo- Detector) in the receiver take this light and convert it to a digital signal.

الخلاصة – مع اختراع LED (الثنائيات الضوئية) بدأت فكرة استخدام الضوء في تقنيات الاتصالات باستخدام التكنولوجيا الموجودة والمستخدمة في الإضاءة. هذه التقنية تسمى (Li-Fi (Light Fidelity. مع زيادة القبول والطلب علي أجهزة الإضاءة ، يتم التعرف وتطوير الاتصالات الضوئية المرئية (VLC) على مستوى العالم كتكنولوجيا متقدمة وواعدة لتحقيق سرعة نقل البيانات على المدى القصير والسرعات العالية فضلاً عن نقل البيانات اللاسلكية ذات السعات الكبيرة.

تعد Li-Fi نموذجًا جديدًا للتكنولوجيا اللاسلكية البصرية لتوفير اتصال غير مسبوق في بيئة مركزية تتمحور حول البيانات. إن الطلب المتزايد على عروض نطاق ترددي أكبر ونقل بيانات أسرع وأكثر أمانًا بالإضافة إلى التكنولوجيا الصديقة للبيئة التي لا شك في انها تبشر ببداية تحول كبير في التقنيات اللاسلكية، وهو تحول من الترددات اللاسلكية إلى الترددات البصرية. وتستخدم هذه التقنية الضوء لنقل البيانات بمعدل تدفق بيانات مرتفع جدًا من خلال مصباح LED الذي يحول الإشارة الكهربائية إلى الضوء ، ويشير المنطق '1' إلى أن لمبة الضوء تعمل والمنطق '0' يشير إلى أن لمبة الضوء لا تعمل Digital Optical Signal ولكن هذا يحدث بسرعة كبيرة بحيث لا يمكن للعين البشرية أن تشعر بهذا التغيير في جهاز الارسال ، في المقابل تأخذ (Photo-Detector) PD في جهاز الاستقبال هذا الضوء وتحوله من إشارة رقمية إلى اشارة تماثلية.

1. INTRODUCTION

Up to date radio frequency (RF) is used as media to transfer data. Increasing demand for capacity in the frequency band necessitated search for other media for data transmission.

VLC is an attempt to find another method to complement and expand data transmission media.

Visible Light Communication (VLC) is a wireless communication using visible light as a medium to transfer information. Light is an electromagnetic wave which frequency spectrum lies between 400 THz to 800 THz or wavelength between 375 nm to 780 nm. LED has longer lifetime, high tolerance to humidity, smaller size and lower power consumption. Hence it is more environmentally friendly and does not cause any harm to humans. LED is used for illumination and at the same time, it also can be used for communication.

The aim of this project is to study Li-Fi technology as means of data transmission. Make a prototype model to prove that data can be transferred over light.

This aim will be achieved through the following objectives:
- Knowledge of techniques those are compatible with this technology.
- Studying techniques that are based on li-fi technique.
- Designing and developing prototype using VLC Technology
- Testing the prototype

2. Visible Light Communications

Visible light communication (VLC) refers to the communication technology which utilizes the visible light source as a signal transmitter, the air as a transmission medium, and the appropriate photodiode as a signal receiving component. Visible light is the form in which electromagnetic radiation with wavelengths in a particular range is interpreted by the human brain. [1]. Visible light is thus by dentition comprised of visually-perceivable electromagnetic waves. The visible spectrum covers wave lengths from 380 nm to 750 nm. VLC use cases can be grouped into two categories, to which we refer as high data rate use cases and low data rate use cases. The high data rate use cases require specialized high-speed photodiode receivers, whereas low data rate use

cases can be realized using existing hardware available in mobile devices. Downlink communication from a light fixture or lamp used for general illumination to a mobile device, whether in a home, office, or even airplane cabin, is one of the earliest envisioned high data rate VLC use cases. Link data rates in the hundreds of megabits per second, rivalling those of Wi-Fi, have already been achieved with commercially available illumination-grade LEDs. Due to a high degree of spatial reuse, however, aggregate system throughput (sum rate) of VLC networks can be far greater than that of Wi-Fi networks in situations where, for example, walls are present to isolate VLC signals from each other. Other high data rate use cases include le transfer between mobile devices and streaming of content from a mobile device to a display. Low data rate use cases include positioning of mobile devices in indoor environments and device pairing [1].

The idea of using light in communication was implemented by Alexander Graham Bell in 1880 with his invention of the photo phone, a device that transmitted a voice signal on a beam of light. Bell focused sunlight with a mirror and then talked into a mechanism that vibrated the mirror.

The vibrating beam was picked up by the detector at the receiving end and decoded back into the voice signal, the same procedure as the phone did with electrical signals. But Bell could not generate a useful carrier frequency, nor was he able to transmit the light beam from point to point. Obstacles in nature such as fog and rain which could interfere with the photo phone made Bell stop any future research into his invention.

The problem of congestion of the radio spectrum utilized by Wi-Fi and cellular radio systems is also helping to create the market for VLC. One major advantage of VLC is that we can use the infrastructure around us without having to make any changes to it. LEDs ability to transfer information signals over light (light which is between 400 THz to 800 THz of frequency and whose wavelength is between 400 nm to 700 nm) makes it a very good communication medium.[2]

The US Federal Communications Commission has therefore warned of a potential spectrum crisis. Figure (1) shows that the visible light spectrum is 10,000 times larger than the entire radio frequency spectrum and this allows dealing with very high data rates.
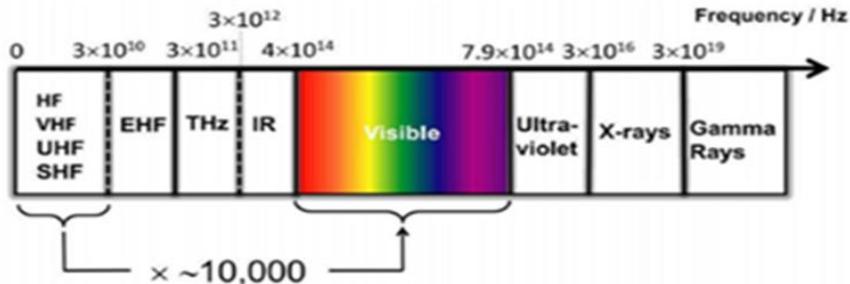
Fig.1. The electromagnetic spectrum

- **Advantages of VLC**

VLC has a lot of advantages as ease of deployment, can be used to power devices, license-free long-range operation (in contrast with radio communication), high bit rates and low bit error rates. Also it is a full duplex operation, has a protocol transparency, no Fresnel zone necessary, increased security when working with narrow beam and it has immunity to electromagnetic interference.

3. Light Emitting Diodes and Photodiodes

A light emitting diodes, a type of solid-state lighting (SSL), is a semiconductor diode that emits light when conducting current and it is often small in area (less than 1 mm2).

- **Advantages**

The different manufacturing process of OLEDs lends itself to several advantages over at panel displays made with LCD technology. The LCD is currently the display of choice in small devices and is also popular in large-screen TVs. Regular LEDs often form the digits on digital clocks and

other electronic devices. OLEDs offer many advantages over both LCDs and LEDs, including:

- Lower cost in the future
- Lightweight and flexible plastic substrates
- Wider viewing angles and improved brightness
- Better power efficiency and thickness

Response time: OLEDs also can have a faster response time than standard LCD screens.

3.2 Detector properties

Two main properties that must be achieved to have high performance from a PD are the Responsivity and rise time where Responsivity (R) is the ratio of the output current of the detector to the input power. it depends on operating wavelength, the curve of detector Responsivity as a function of wave length is referred to as the spectral response, as seen in Figure (2) And the second property is the Rise time (t_r) which is the time for the detector o/p current to change from 10 % to 90 % of its final value when the optical input power variation is a step see Figure(3).
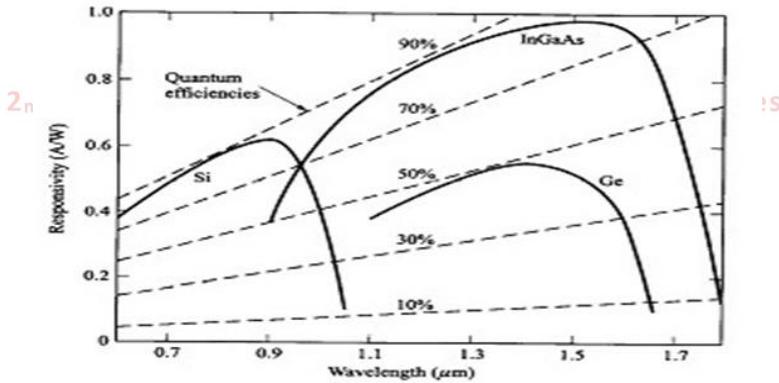
Fig.2. spectral response for different materials for pin photodiodes
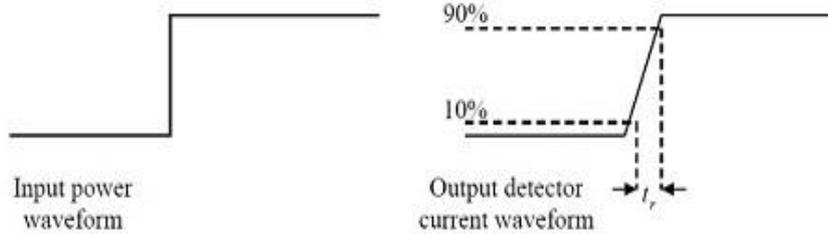
Fig.3. Photodetector rise time.

4. Experiments and Research

This section proposing a prototype of real-time audio using inexpensive commercially available LED lamps.

Experimental results show that real-time high quality audio with the maximum distance of 6m can be achieved through proper layout of LED sources and improvement of concentration effects.

The concept of a full duplex multi-access system for LED-based wireless communications is proposed by Nakagawa laboratories [6]. Simplex and duplex transceiver prototypes have been demonstrated in [7] which also prove the effectiveness of replacing existing illumination systems with LED lighting devices. With 300 THz of bandwidth available for VLC, multi-gigabit-per-second data rates could be provided over short distances, for example, using array of LEDs in a MIMO system [8][9]. Besides wireless connectivity in home environment, combining the function of illumination and transmission is also attractive in specific scenarios where healthy, secured and non-interfered communication is necessary, such as hospital; underground mine, under-water, airplane, etc. In this section, a VLC prototype with large increase in transmission distance and improvement in channel capacity was developed.

The optical link which performs as the substitute of connector wire

can be widely applied in video conference, real-time video frequency monitoring, smart traffic system and various practical scenarios where illumination and data transmission is in joint demand to serve modern daily life.

4.2 Audio streaming experiment

In this experiment, the audio transmitter and receiver prototype has been constructed to demonstrate the transmission of audio signal. Figure (4) illustrates the block diagram of the Audio transmitter and receiver.
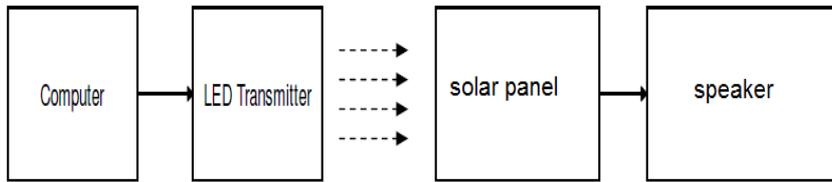
Fig .4. Block Diagram of VLC Audio Transmitter and Receiver

In demonstrating the transmission of audio signal through visible light, the intensity of the light emitted from white LED at transmitter must be modulated according to the audio signal. The audio signal can be obtained from the computer through a 3.5mm audio jack plug

4.3 Hardware Components and their functions

4.3.1 Two LED bulbs

The medium being used to transmit data in our design is light, with this light being provided via LEDs. The most important parameter associated with the LEDs is the brightness of the sender hardware component which is measured in units of Lumens. This experiment involved two types of led bulbs with different level of power, to prove the relation of the power level and the distance between the sender and the receiver devices. LED bulbs are shown below in Figure (5)

Fig.5. LED bulbs

4.3.2 Solar panel

The first element at the receiving side of an optical system is the solar panel that senses the optical power and converts it into a varying electric energy by changing the brightness of LED.

The primary function of the solar panel is power harvesting which is a kind of renewable energy however using the solar panel as receiver in the li-fi system considered as additional function and it doesn't interrupt the primary function and it can perform both tasks at same time. Solar panel is shown below in Figure (6)

Fig.6. Solar panel

4.3.3 Arduino

Arduino is a tool, a little computer that can help designer to interact with

the physical word.

They Arduino have been used to send a frequency using tone function, instead of the speaker for output; a LED has been used to achieve the sender side of Li-Fi system. Arduino is shown below in Figure (7)

Fig.7.Arduino

4.3.4 Speaker and Aux cable

The speaker receives the output from solar panel, aux cable used to transmit audio to the LED.

Speaker and Aux cable are shown below in Figure (8)

Fig.8.Speaker and Aux cable

4.3.5 Final prototype
1-Transmitter circuit

In this site the prototype has three scenarios; the first one is a high voltage carrier to demonstrate a long distance experiment; a 12 volte as power source and carrier for the signal produced form any standard 3.5 jack; taking in the consideration that the led can handle such high voltage, a simple circuit has been designed to perform the needed task, the circuit diagram is illustrated in Figure (9) below, a 10uF capacitor has been added to complete the circuit without any short-circuit.
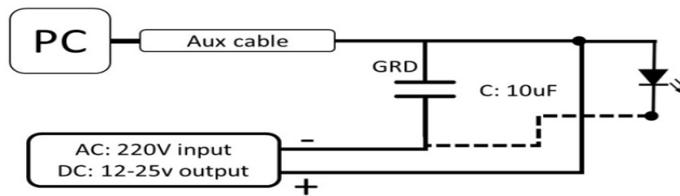
Fig.9. Transmitter Module with 12 volt power source

The second one almost similar to the first one, however, here the power source applied was 5 volt, and to vary in the experiment, Arduino has been used as power source, but the Arduino must be powered by the same device that produces the signal; the Figure (10) bellow addresses the circuit to use Arduino as carrier.
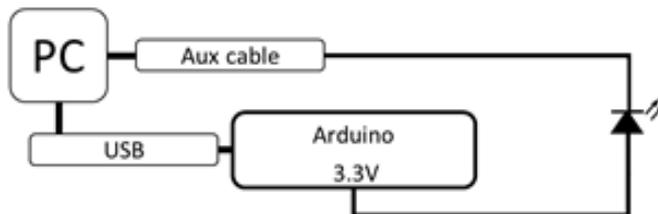
Fig.10. Transmitter Module with 5 volt power source

Over and above the last one was a little bit different that the previous scenarios; the Arduino has been used to produce the data as a frequency using Tone function, and the circuit is shown in Figure (10)

2- Receiver circuit

For the three transmitting scenarios, the same receiving circuit has been used; a simple circuit to meet the required performance, Figure (11) shows how this simple circuit is connected.
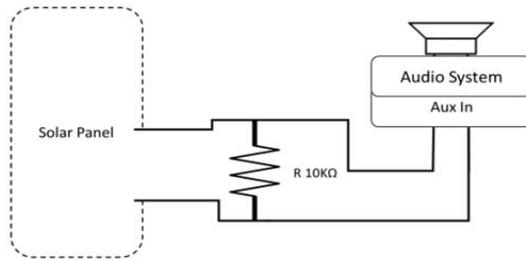
Fig. 11.Receiver Module

4.3.6 Results and Analysis

An audio recording was successfully projected to a solar panel using light intensity modulation as means for the projection. Projection was achieved by using a computer as means of audio player. The output signal via AUX cable was fed to LED bulb and was sensed by solar panel. Current produced by the solar panel was amplified and fed to the speaker to reproduce the audio recording with same quality of sound.

Two kinds of LED bulbs were used, 5 Volts 1 Watt, and 12 volt 5 watt. It was found that:

• As the power of LED bulb increases, the distance between transmitter and receiver increased to produce the same intensity of sound signal ,(About 3 meters for the 1watt and 6 meters for the 5 watt)

• The distance between the transmitter and receiver is an increase using a lens to focus the light on the solar panel.

• If the transmitter and receiver are not inline, a mirror can be used to direct the light to the solar panel to reproduce the sound projected.

5. Conclusion and Future Work

From the study it was possible to learn about LIFI technology and various techniques used to achieve the objectives. LIFI technology will revolutionize networking and data transmission.

Practically it was possible to prove the concept of LIFI by transmitting audio data over light using commercially produced LED lamp.

Next steps in the study is to develop video/audio transmission over light, Data transmission, improve the distance of transmission

6. Acknowledgements

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Measuring performance of scrum team

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ABSTRACT

Performance measurement is generally defined as regular measurement of outcomes and results, which generates reliable data on the effectiveness and efficiency of programs. Performance focuses on workforce productivity, efficiency, and progress.

Measuring the performance of Scrum teams is the largest challenge which utmost organizations face nowadays. Scrum Teams provide an agile plan with progress updated every day. An agile program's performance is measured by: first, responsiveness measures the ability of a team to deliver functionality soon after it's requested. Second, quality measures how disciplined a team is in preventing defects being introduced and how quickly they resolve any that occur. Third, productivity measures how much work a team accomplishes over time. Fourth, predictability measures how consistent a team is at producing work over time; an indication that teams are better at estimating their work and flowing increments of value. The authors suggested simple metrics to measure the performance considering time, cost and quality. These parameters were defined the goals as:

- **Goal 1**: Reduce the project implementation time
- **Goal 2**: Advance in quality

We have cleared five direct metrics being used in order to evaluate the performance. Also, for goal2 we have measured it using direct metrics defined as work completed and work planned for the current sprint. This paper continues by discussing the identified metrics and positive effects. Furthermore, the implementation concepts and main success factors are

stated.

Keywords – Scrum metrics, Software Engineers Performance Measure, Burndown.

الملخص

قياس الأداء يتم تعريفة بشكل عام على أنه عملية إدارية دورية هدفها قياس نقاط الضعف والقوة في الجهود التي يبذلها الفرد والسلوكيات التي يمارسها في موقف معين وفي تحقيق هدف معين خططت له المنظمة له مسبقاً.

قياس أداء فريق السكرم تحدي كبير يواجه الشركات الكبيرة هذه الايام. فريق العمل السكرم وهو مجموعة من الأفراد المتخصصين في تطوير النظم والبرامج. دور هذا الفريق دائما هو تفكيك المشروع المعقد الى أجزاء قابلة للتنفيذ والتسليم في مدد زومنية ودورات سباقية (جولات) *Sprints* متتالية وتحديد المدة والجهد اللازم لانهاء هذه الدورة السباقية *Sprints* مع ضمان جودتها وملاءمتها لتوقعات صاحب المشروع. في السكرم يتم تعريف الاداء علي أنه قياس منتظم للمخرجات والنتائج مما يولد بيانات موثوقة عن فاعلية وكفاءة البرامج. الأداء يركز على قوة الانتاجية والكفاءة والعمل المنجز.

يقاس الأداء في *Agile* بعدة طرق: اولا، عن طريق قياس الاستجابة و قدرة الفريق على توفير الوظائف بعد وقت قصير من طلبها. ثانياً، قياس جودة مدى انضباط الفريق في منع ظهور العيوب ومدى سرعة حل أي مشكلة تحدث. ثالثًا ، قياس الإنتاجية مدى العمل الذي يحققه الفريق مع مرور الوقت. رابعاً ، قياس القدرة على التنبؤ مدى تنسيق الفريق في إنتاج العمل مع مرور الوقت. في هده الورقة الباحثين اقترحوا مقاييس بسيطة لقياس الأداء حيث اخذوا بعين الاعتبار الوقت والتكلفة والجودة. هذه المعاملات حددت الهدف كما يلي:

- *تقليص وقت تنفيذ المشروع*

● *التركيز علي العمل المنجز والتخطيط الدورة الحالية Sprints*

في الهدف الاول نحن وضحنا خمس مقاييس مباشرة مستخدمة لقياس الأداء. آما في الهدف الثاني نحن استخدمنا كذلك مقاييس مباشرة للتركيز علي العمل المنجز والتخطيط الدورة الحالية.

INTRODUCTION

In the agile Scrum domain, as an alternative of providing complete, detailed descriptions of how everything is to be done on a project, much of it is left up to the Scrum software development team. This is as the team will know best how to solve the problem they are presented [1][2].

This is why in Scrum development, for instance, a sprint planning meeting is described in terms of the desired outcome (a commitment to a set of features to be developed in the next sprint) instead of a set of Entry criteria, Task definitions, Validation criteria, Exit criteria (ETVX) and so on, as would be provided in most methodologies (see Fig. 1) [3].
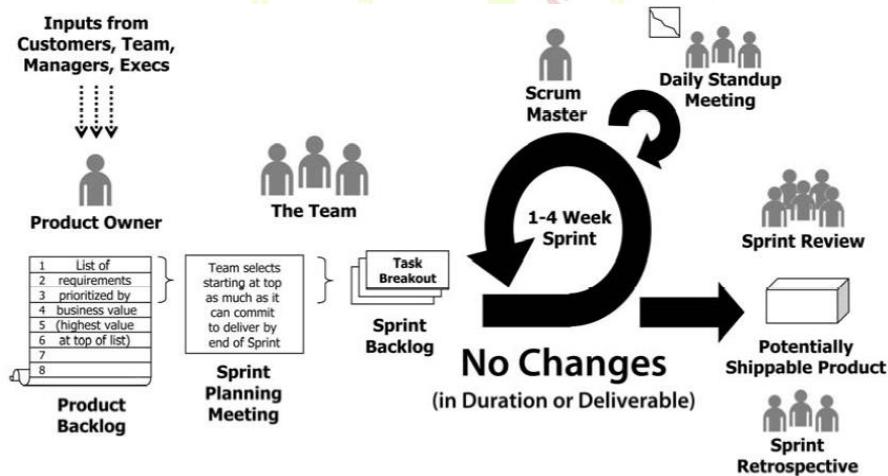
Fig. 1 – SCRUM Software Development Process Phase [3]

Scrum relies on a self-organizing, cross-functional team. The scrum team is self-organizing in that there is no overall team leader who decides which person will do which task or how a problem will be solved. Those are issues that are decided by the team as a whole. And in Scrum, a team is cross functional, meaning everyone is needed to take a feature from idea to implementation.

Within agile development, Scrum teams are supported by two specific roles. The first is a Scrum Master, who can be thought of as a coach for the team, helping team members use the Scrum process to perform at the highest level. The product owner (PO) is the other role, and in Scrum software development, represents the business, customers or users, and guides the team toward building the right product.

Scrum Process Framework can be noticed by means of a sequence of events and the corresponding artifacts. The Scrum events are time-boxed events. That means, in a project, every scrum event has a predefined maximum duration [4]. These events enable transparency on the project progress to all who are involved in the project (see fig 2)[5]. The vital events of scrum are:

- The Sprint
- Sprint Planning
- Daily Scrum Meetings
- The Sprint Review
- The Sprint Retrospective

Fig. 2 – Management activities [5].

Sprints

In Scrum, work is performed in iterations or cycles of up to calendar 4 weeks called sprints. The work completed in each sprint should create something of tangible value to the customer or user. Sprints are time boxed so they always have a fixed start and end date, and generally they should all be of the same duration.

Sprint Planning

A product backlog may represent many weeks or months of work, which is much more than can be completed in a single, short sprint. To determine the most important subset of product backlog items to build in the next sprint, the product owner, development team, and Scrum Master perform sprint planning. The Sprint Goal is an objective set for the Sprint that can be met through the implementation of Product Backlog. It provides guidance to the Development Team on why it is building the Increment.

Daily Scrum Meetings

The Daily Scrum Meeting is a 15 minutes meeting for the Team, conducted daily to quickly understand the work since the last Daily Scrum Meeting and create a plan for the next 24 hours. During the meeting, each Team member explains:

- What did he do yesterday that help the Team meet the Sprint Goal?
- What will he do today to help the Team meet the Sprint Goal?
- Does he see any impediments that prevent him or the Team from meeting the Sprint Goal?

Sprint Review

During the Sprint Review, a presentation of the increment that is getting released is reviewed. In this meeting, the Scrum Team and the stakeholders collaborate to understand what was done in the Sprint. Based on that, and any changes to the Product Backlog during the Sprint, the attendees arrive at the next steps required that could optimize value. Thus, the objective of Sprint Review is to obtain feedback and progress unitedly.

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للعلوم الطبية و النقنية
يوليو 2018 July

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International Science and Technology Journal
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Sprint Retrospective

The Sprint Retrospective is an opportunity for the Scrum Team to inspect itself and create a plan for improvements to be enacted during the next Sprint. The Sprint Retrospective occurs after the Sprint Review and prior to the next Sprint Planning. The purpose of the Sprint Retrospective is to:

- Inspect how the last Sprint went with regards to people, relationships, process, and tools.
- Identify and order the major items that went well and potential improvements.
- Create a plan for implementing improvements to the way the Scrum Team does its work.

Scrum Artifacts

Scrum's artifacts represent work or value to provide transparency and opportunities for inspection and adaptation. Artifacts defined by Scrum are specifically designed to maximize transparency of key information so that everybody has the same understanding of the artifact.

Product Backlog

The Product Backlog is an ordered list of everything that might be needed in the product and is the single source of requirements for any changes to be made to the product. The Product Owner is responsible for the Product Backlog, including its content, availability, and ordering.

Sprint Backlog

The Sprint Backlog is the set of Product Backlog items selected for the Sprint, plus a plan for delivering the product Increment and realizing the Sprint Goal. The Sprint Backlog is a forecast by the Development Team about what functionality will be in the next Increment and the work needed to deliver that functionality into a "Done" Increment.

Sprint Burn-Down Chart

At any point in time in a Sprint, the total work remaining in the Sprint Backlog can be summed. The Team tracks this total work remaining for

every Daily Scrum to project the likelihood of achieving the Sprint Goal. By tracking the remaining work throughout the Sprint, the Team can manage its progress. Sprint Burn-Down Chart is a practice for trending the work expended by the Scrum Team. This has been proven to be a useful technique in monitoring the Sprint progress towards the Sprint Goal.

Performance
Measuring progress against plan is essential in the software industry. Teams adjust their behavior to metrics used to measure their systems and evaluate their performance. This paper focused on essential performance scrum metrics such Sprint Burndown and Release BurnChart.

RELATED WORKS
Measurement of agile software development has been discovered by many authors ([6], [7], [8]). Ktata and Levesque defined a method to the design and implementation of a measurement program for Scrum teams by using the Goal Question Metric (GQM) method [9]. Hartmann and Dymond mentioned that agile metrics should not be simply adopted from plan driven approach but must be cleared in such a way that they do not harm the agility of the development process [10]. Marmamula Prashanth Kumar proposed the following simple method to measure the performance of Scrum teams :

Parameters
User stories planned versus user stories delivered, to measure planning effectiveness, efficiency

- User stories delivered versus user stories accepted, to measure quality of deliverables
- Defect-removal efficiency (DRE), to measure defects-removal rate

The advantages of this method are very simple to apply and easy to understand. Also, it can be applied at the release as well as sprint levels [11] [12]. Actually, this method only tells you how the team performed for a give sprint, how you consider expanding by comparing against previous sprints (time-series graph)?

We would also add that this is tool that the team can use during retrospective. Martin Alaimo recommend to measure progress based on a continually updated ETC (estimate-to-complete) for each story. He suggested using this approach at the end of every daily stand-up meeting or during the meeting itself, if timeboxing is something team have already mastered. His idea is basically this: when the team estimate the number of story points remaining to get a certain user story completed [13]. This method does not show how teams can credible decide when they are halfway done with a 9-tasks. Our idea is that teams who use this approach find it takes many days to finish off the last few remaining tasks of a story. In other words, we suspect it takes about the same amount of calendar time to go from 3 points to 0 that it took to go from 9 points to 3. To solve the problem, we suggested metrics plan for measuring the performance considering time, cost and quality. In the next part we explained these metrics.

METRIC DEFINITIONS
In order to measure the performance of the team, we defined a stakeholder, then for this stakeholder we defined different goals and metrics. This process implemented using GQM (Goal/Question/Metric) approach and it aims to measure the performance in a better and efficient way.

the performance was measured from the management point of view. In this view we measured the performance considering time, cost and quality. Considering these parameters, we defined the goals as:

- **Goal 1:** Reduce the project implementation time
- **Goal 2:** Advance in quality

In the next part we define metrics used to evaluate each goal.

IMPLEMENTATION TIME
First of all, we defined and name five direct metrics being used in order to evaluate the performance. These direct metrics are:

- WT_{ij}: The amount of time on day i which have been used

to work on task j

- **RT_{ij}:** The amount of remaining time on day i to work on task j

- **WD:** The total number of the working days defined for the project

- **PD:** The number of the passed working days from the beginning of the project.

- **RSR:** The ratios between the working spend and the working remained from d1 until d2

- **GP:** the gained performance (GP) for each task j on the day d

- **PAR:** planed achievement ratio

- **RT_{init}:** The initial estimating of the work remaining for task j

Now, using these direct metrics which we can capture them directly from the projects information[14]. We defined indirect metrics which directly show the performance of the project. At first, we defined the relation between the time spent on project and the reduced amount of work from day $d1$ to day $d2$ of the Sprint is computed using formula (1) where n is the number of tasks in the Sprint Backlog. We named it RSR and define as:

$$RSR = \frac{\sum_{i=d1}^{d2-1} \sum_{j=1}^{n} WT_{I,j}}{\sum_{j=1}^{n} RT_{d1,j} - \sum_{j=1}^{n} RT_{d2,j}} \qquad (1)$$

Where, n is the number of tasks in the sprint Backlog. The maximum amount of the RSR is 1 and any value less than 1 shows the remaining of the work in relation to the time being spent on the work.

Now we defined the Planned Achievement Ration (PAR). The PAR in the

gained performance with regard to planned performance defined before starting the project. In order to calculate the PAR, first we calculate the gained performance (GP) for each task j on the day d using the WT and the RT, as:

$$GP_{d,j} = \frac{\sum_{i=1}^{d-1} WT_{i,j}}{\sum_{i=1}^{d-1} WT_{i,j} + RT_{d,j}} \qquad (2)$$

where, d is the number of day and j is the number of task., Using the earning rule from formula (2), the *PAR* on day d is defined as:

$$PAR_d = \frac{\sum_{j=1}^{n} GP_{d,j}.RT_{init,j}}{\sum_{j=1}^{n} RT_{init,j}} \cdot \frac{WD}{PD} \qquad (3)$$

The value 1 calculated from this formula shows that the project is exactly on planned schedule and any value greater than 1 shows that the projects implementation speed was greater and better than planned performance and vice versa.

ADVANCE IN QUALITY

Quality is doing the right things right and is uniquely defined by each individual. On the other hand, Quality is meeting requirements or performing to specification [15]. A quality metric that provides benefit at both the project and process level is defect removal efficiency (DRE).

DRE is a measure of the filtering ability of quality assurance and control activities as they are applied throughout all process framework activities [16].

- To compute DRE:

▪ DRE = E / (E + D)   (4)

Where E= no. of error before release and D= defect found after release of software to end users.

- The ideal value for DRE is 1. That is, no defects are found in the software.

DRE encourages a software project team to institute techniques for finding as many errors as possible before delivery.

CONCLUSION

Providing performance evaluation for software engineers in a scrum agile development environment is complex. We recommended a simple method to measure the performance of Scrum teams. We measured the performance considering time, cost and quality. Considering these parameters, we classified the goals as reduce the project implementation time and advance in quality. We have cleared five direct metrics being used in to estimate the performance. For goal2 we have measured by using clear metrics defined as work accomplished and work planned for the recent sprint.

We think this method will help organizations to measure performance of scrum team in order to improve it. Also, this method may help in identifying weak areas.

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المؤتمر الثاني للعلوم الطبية والتقنية

2nd Conference on Medical & Technological Sciences

MATLAB Latency Effect on PC-Based Real-Time Control System Through Ethernet Using OPC Server

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الملخص:

في عمليات التحكم الصناعي ، فالتحكم في العمليات السريعة مثل التحكم في محرك حثي ثلاثي الأوجه من ضمن العمليات التحكم المستخدم في التحكم التناسبي الفرق التكاملي والتي تتم من OPC خلال شبكات الإيثرنت ومتضمنة أيضا التحكم عن بعد باستخدام خادم OPC.

في هذه الورقة تم تنفيذ نموذجان في الزمن الحقيقي كذلك تم التحقق منهما وهما PLC Based and PC based ، ففي النوع النموذج الأول كل عمليات التحكم تكون على عاتق المتحكم المنطقي المبرمج باستخدام دوال CONT_C والمتضمن لبرمجيات SIMATIC S7 فيما يكون دور جهاز الحاسوب مقتصر على عمليات إظهار ومراقبة ومتابعة البيانات فقط ، أما النموذج الثاني فإن جهاز الحاسوب هو المتحكم بينما يكون المتحكم المنطقي المبرمج كأنه دائرة توسيط لغرض إدخال البيانات وإخراجها ،في هذا النموذج يتطلب الدراسة وسيلة اتصال سريع بين الجهازين لتنفيذ النموذج عمليا ،فباستخدام MATLAB/Simulink Toolbox تم تنفيذ خادم OPC الموجود في MATLAB/Simulink ،حيث تمت الاختبارات باستخدام مستويات مختلفة من التأخير من خلال التجارب العملية تبين أن بعض التأخيرات لا تأثر بشكل كبير في أداء المنظومة واستقراها للعمليات التحكم الصناعية حيث أظهرت النتائج زمن استقرار صغير وادني قيمة تجاوز واصغر خطأ مستقر نسبياً.

Abstract
AC In industrial process control, rapid response control system such as induction motor speed control is one of the most basic aspects. the close loop PID control system (Proportional–Integral–Derivative) controller is

used to control the speed of the induction motor via PROFINET network including a remote control using OPC (OLE for Process Control) standard. In this paper two scenarios for implementation of real-time control system are investigated.. In the first one the control algorithm is directly implemented in PLC (programmable logic controller) using the available instructions like CONT_C instruction which is used on SIMATIC S7 automation systems. in this case the PC (personal computer) supports the visualization and data logging. In the second scenario the control algorithm design and execution is performed in PC using the MATLAB/Simulink Toolbox environments and investigating the effect of different levels of the latency for MATLAB/Simulink algorithms on performance of control system. The obtained experimental results demonstrate a possibility to establish the MATLAB/Simulink Based for remote control over the system while ensuring system's stability, efficiency and good performance of control systems caused by the network system latency and promising in terms of quick settling time, minimum peak overshoot and smallest steady state error.

Keywords
Ethernet; Latency: Close loop control; OPC server; PID controller; PLC.

1. Introduction
Recently, Networked Control Systems (NCS) are used in the Building plug-and-play control systems. This is based on digital systems for collecting data from sensors and controlling actuators. The elements of NCS are connected through industrial communication fieldbuses such as (can, PROFIBUS or PROFINET) or through wireless connections like (WiFi) [T. Murgaš et al, 2014].

However, there exist some obstacles to implement this kind of control system, such as network-induced delay or packet dropouts or latency, the latency is the total time it takes a data packet to travel from one node to another, both constant network-induced delay and latency have the same effect on the performance of the control system and both can lead to instability or degrade the control system of the industrial process. Moreover, these processes require real-time command execution and data acquisition, so appropriate real-time operating systems have to be used

without network delay , packet dropouts or latency. there are many examples of other systems that require real-time execution like military systems, banking systems, avionics or robotics, so providing real-time control for them is a strongly request task [R. Bachnak et al, 2006, B. Tabakova et al, 2008, M. Blaho et al, 2012]. The task is particularly challenging due to the need to reaccommodate the hardware and the software layer of the control system. The software has a very significant influence on the resources and that is why resource analysis and evaluation of real time systems at the aspect of software are needed [Y. Zhu et al, 2009].

In addition, implementation of modern control techniques (adaptive control, predictive control, etc.) includes increased computation demands, therefore the realization of the algorithms in PLCs is difficult or could be impossible. One of the possible solutions is to use PC with running control algorithm. In this case we need to provide feasible communication between both control systems. using communication standard called OPC which stands for Object Linking and Embedding (OLE) for Process Control for communication between PC and interface module (PLC). In this paper the performance of control system for PC based real time control system with MATLAB/Simulink is tested [Marián et al, 2012].

2. The latency problem

Latency is an interval time between receiving input data and responding to that data. low latency is critical in real-time systems. the Low-latency allows:

- Closed-loop control algorithms such as PIDs that respond in a fraction of a millisecond.
- Rapid response when scanning for safety limit violations or emergency shutdown conditions.
- Immediate network communication to other computers without buffering delays.

In real time control system the main function of a control device is only as good as the user program running and executing on it with high speed immediately (no Latency). So, the programming environment and language are crucial to optimal control system performance. one main difference between PLC- and PC-based solutions is how the user code is

executed to implement the system tasks. A PLC has a combination of scan-based and event-driven program execution, whilst PC software typically operates as event-driven. The scan-based execution of a PLC program might take long time due to the system needs to complete the higher priority actions in the cycle first. The difference in execution style requires a different programming structure.

Although, the initial cost of a PC might be higher, it provides a very powerful system of which the cost only increases incrementally when more performance is required. A typically start at a lower price point, but can quickly get more expensive than a PC when high performance is required as shown in figure 1[Whitepapers, 2012].

The control software can be efficient, stable, flexible, access operation of hardware equipment and fast enough to meet the requirement of to real time control system limitation and obviously improves the adaptability and interoperability of the whole system.
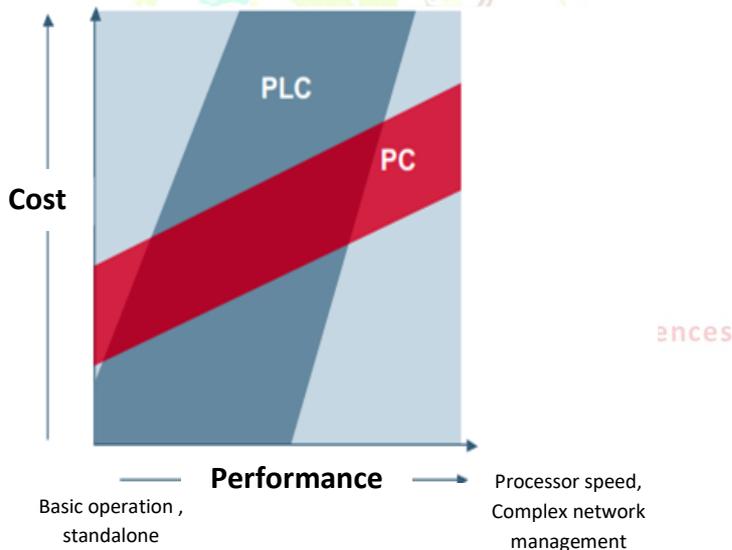
Figure 1. Performance against cost for PLC and PC control

3. OPC system
OPC established a set of interface standard that allows Windows operating

system programs to communicate with real hardware devices in industrial control which created with the cooperation of a number of leading worldwide automation hardware and software suppliers. As illustrated in figure 2 this standard interfaces developed to share data among control devices from different manufacturers for process of real time plant data. The source of this shared data can be a process control system data, a database or a supervisory control application data.

The OPC Foundation developed an non-proprietary technical specification in 1996 as the OPC-DA 1.0 (Data Access). That defines a set of standard interfaces based upon Microsoft's OLE/COM/DCOM platform [M. Felser et al, 2005]. This Foundation constituted of representatives from vendors of control systems, instrumentation systems, and process control systems to supervises the evolution, evaluation and maintenance of the OPC specifications.
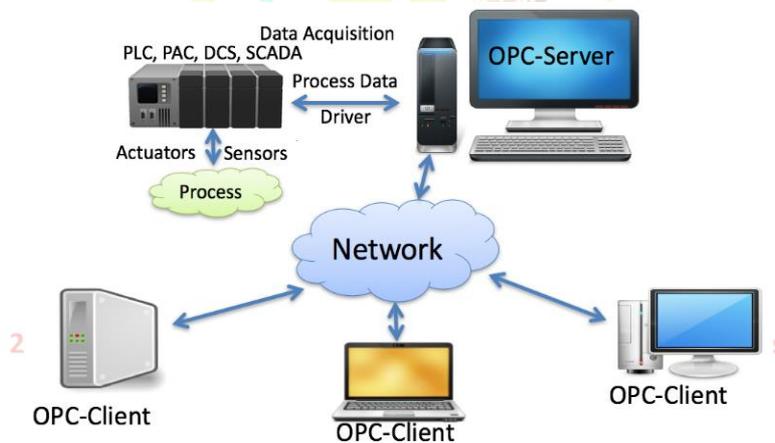
Figure 2. OPC server.

3.1. OPC Server

OPC server is the software application which operates as the protocol converter or as the application programming interface (API). OPC Server can be connected to a device such as PLC, distributed control system

(DCS), remote terminal unit (RTU) or the data source (database or user interface) and translates the data into a standard-based OPC format. OPC compliant applications such as a human machine interface (HMI), historian, spreadsheet, trending application, etc. can be connected to the OPC Server and then they can use it to read and write the device data. The OPC Server is based on a Server/Client architecture [Marián et al, 2012]. Accessing data from a networked server is the function of OPC-DA 1.0, within the application the OPC interfaces can be used in many places, they can get raw data (before signal processing) from the physical devices into a supervisory control and data acquisition system (SCADA) or DCS and vice versa. The structure and design make it possible to construct an OPC Server which allows a client application to access data from many OPC Servers provided by many different OPC vendors running on different nodes via a single object figure 3 shows the OPC sever structure
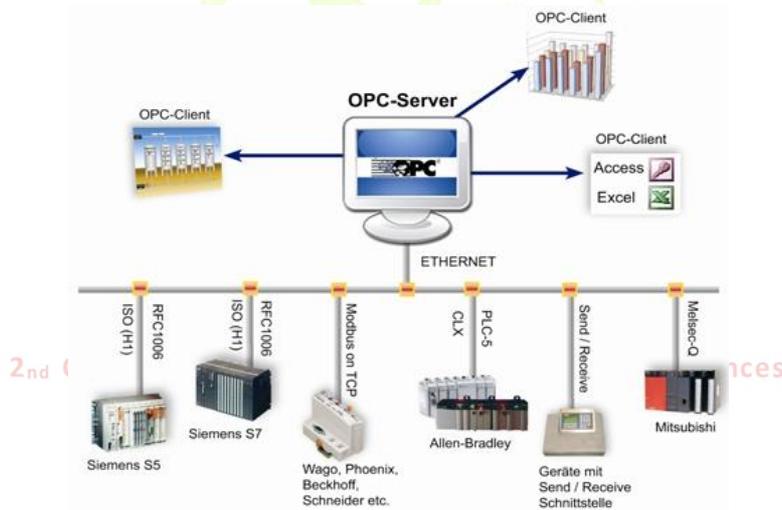
Figure 3. OPC server , OPC clients and different OPC vendors

The standard IEC 61784-2 made by the International Electric Committee classifies the industrial control systems into 3 classes according to the transmission time between two nodes [OPC Training Institute]. By using

this standard to judge whether the Latency delay meets the requirements of a control system.

1. The Class 1. The typical for the case of humans involved in the system observation and Most processes in process automation and building control laying within this class The delay is less than 100ms.
2. The Class 2. Powerful and expensive computer resources are needed to handle the TCP/IP protocol in RT. The delay is less than 10ms. This is the requirement for most tooling machine control systems like PLCs or PC-based control.
3. The Class 3. The delay is less than 1 ms with a jitter of not more than 1μs. It is imposed by the requirement of motion control systems

Recently, the OPC foundation has nearly 300 members over the world. It includes all the world's major manufacturers of automatic control system, instrumentation and process control system [OPC Training Institute]. By These specifications the devices from more than one manufacturer can be used and interchange devices throughout a plant without change the code that communicates with those devices. OPC specifications also help the users to make the control processes ,logging data and data acquisition in the real plant efficiently .

The OPC servers allow the users to utilize the communication settings, the parameters may be changed by clicking Device Properties then Timing Inter-request delay.

3.2. OPC Toolbox Matlab/ Simulink OPC Server

OPC Toolbox™ provides access to live and historical OPC data directly from MATLAB® and Simulink®. So it possible to read, write, and log OPC data from devices, such as DCS, SCADA, and PLC. OPC Toolbox provides work with data from live servers and data historians that conform to the OPC Data Access (DA) standard, the OPC Historical Data Access (HDA) standard, and the OPC Unified Architecture (UA) standard. The online supervisory control and perform hardware-in-the-loop controller testing can be implemented using OPC Toolbox [M. Felser et al, 2005].

Once the connection of an OPC DA server have been establishing a Data Access Group objects (DAgroup objects) can be created which represent collections of OPC Data Access Items. and then add Data Access Item objects (DAitem objects) to that group, for monitoring server item values

from the OPC server and writing values to the OPC server. this object allows the DAgroup object to perform such actions as determining how often the items in the group must be updated, executing a MATLAB function when the server provides notification of changes in item state, and other tasks related to the group Also, using OPC Toolbox DA functionality, log records (a list of items that have changed, and their new values) from an OPC Data Access Server to disk or to memory, for later processing can be implemented. The logging task is controlled by the DAgroup object. Log OPC Server Data describes how to log data using the OPC Toolbox logging mechanism, figure 5 pictured the integration Objects' OPC DA or HDA for MATLAB.
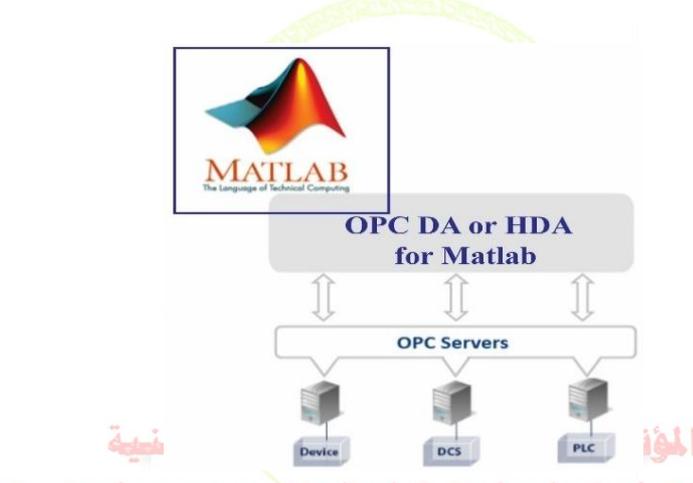
Figure 5. Integration Objects' OPC DA or HDA for Simulink.

4. The PID controller

PID controller is one of the most popular controller in industrial control loop controller, It also occupies an important position in industrial control area. PID controller has a typical structure as illustrated in figure 6, it programs easily, it has smaller computing workload, its parameters have clear physical significance, it adjusts parameters conveniently, it is easy to implement multi-loop control. At present, there are many PLC manufacturers offer PID control function product, For example, PID

closed-loop control module, PID control instruction and PID control system function blocks, etc. It makes industrial control become easy and convenient. This paper is based on S7 300 PLC Controller PLC PID control system function blocks introduce how to realize PID parameters auto-tuning method [www.mathworks.com]
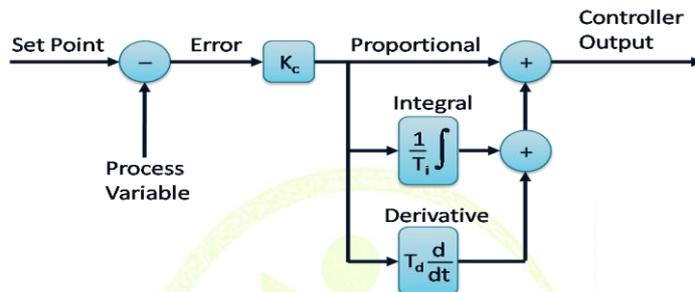
Figure 6. Basic PID loop controller structure.

By tuning the three parameters in the PID controller algorithm, the controller can provide control action designed for specific process requirements. The response of the controller can be described in terms of the responsiveness of the controller to an error, the degree to which the controller overshoots the set point, and the degree of system oscillation [Yan Li et al, 2011].

4.1 Mathematical Model and structure of PID controller

The OPC servers allow the users to utilize the communication settings, the parameters may be changed by clicking Device Properties then Timing The proportional, integral, and derivative terms are summed to calculate the output of the PID controller. Defining u(t) as the controller output, the final form of the PID algorithm is:

$$u(t) = K_p \, e(t) + K_i \int_0^t e(\tau)d\tau + K_d \, d/dt \, e(t) \qquad (1)$$

where,

K_p: Proportional gain, a tuning parameter

K_i: Integral gain, a tuning parameter

K_d: Derivative gain, a tuning parameter

e(t): Error at instantaneous time =set point - process variable

t: instantaneous time (the present)

τ: parameter of integration; the values from time 0 to the present.

In literature the PID controller has several ways to define a the controller. The PID controllers are classified as Academic , Parallel or Series form.

5. System Design , Process Implementation

5.1. System configuration

In this paper there are two scenarios of schemes for remote control system implemented in real time processes PLC and PC based control system. In PLC based control system with Proportional–Integral–Derivative (PID) controller pictured in figure 6, which is still widely used in Industrial control systems nowadays and this controller never changes its structure only controller parameters change and direct implementation of control algorithm in PLC using the available instructions (PLC device executed the controller) as shown in figure 7.

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Figure 7. Controller block for continuous control (CONT_C) in TIA
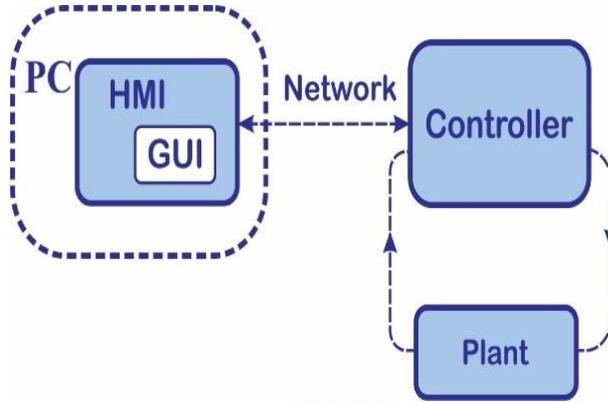
Figure 8. Network structure of the remote control system PLC based.

In this scenario the PC used as Human Machine Interface (HMI) devices for data acquisition and supervising the process data of the plant. whereas in PC Based the PC device represents the controller itself (PC device executed the controller) , HMI and the OPC client is connected through the OPC communication to the PLC via Ethernet network this scheme is illustrated in figure 9. In this scenario the structure of the controller is changeable from one structure to another and the PLC is act as the interface module.
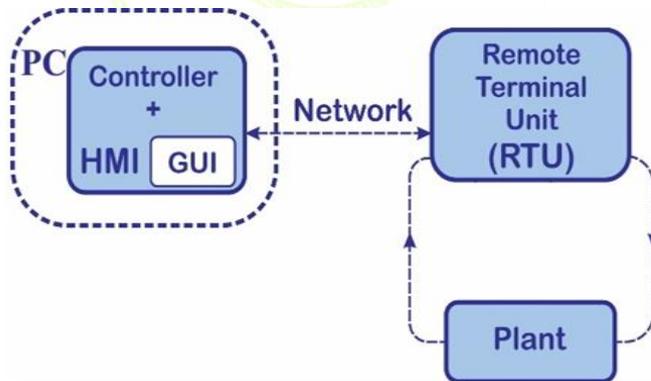
Figure 9. Network structure of the remote control system PC based. OPC.devices.

5.2 Implementation Process

The Ethernet control systems presented in this paper used to control the speed of three phase induction. In order to achieve the objectives, the establishment of the communication between PLC MATLAB which are the 2nd party software using OPC server. Thus, the implementation used MATLAB/Simulink to perform as controller programming environment in addition to HMI of SCADA system for example, start or stop operation of the prime mover, and varying the speed by changing the frequency of the high speed three phase induction motor using Micro master 420 inverter and connect or disconnect a several mechanical loading on the motor. However, this system can be also a SCADA and data logging since there is practical data collected and acquired from the actual input/output signals from the physical system , the close loop feedback is the actual speed that can be read from the Tach generator install at the same shaft of the induction motor figure 10 shows the whole system components and hardware configuration.

The frequency inverter (Micro master 420 type) is connected to the PLC through the analogue output channel of the remote control unit (RTU) the RTU has digital output modules for digital operation Like ON-OFF inverter ,change the direction of the motor, switch ON-OFF several loads , in addition to three analogue input channels to read the analogue values of the motor speed , current and voltage.

The control algorithm is realized on the inverter. A linear V/f characteristic is used to control the motor. In this case to keep the flux constant in the motor the stator voltage of the induction motor is adjustable directly proportionally to the stator frequency. In this case the stator voltage of the induction motor is controlled proportionally to the stator frequency. This technique has proven itself for a wide range of applications such as pumps, fans, belt motors and similar processes.

Computer Hosting OPC Server, Labview, Matlab and SIMATIC Manager Program

Micromaster 420 Variable Frequency Drive

Single Phase AC Power Supply

Laptop (Host)

IP 192.168.0.2

Motor voltage

up to 100 m length

ET200S RTU

IP 192.168.0.3

Tachogenerator

S7 300 PLC Controller

IP 192.168.0.1

3 Phase 2 Pole Induction Motor

3 Phase 4 Pole Induction Generator

Represents Mechanical load of the motor

Control Cable

Power Cable

Ethernet Cable

Measurement Cable

Figure 10. Overall system plan.

The PC is realized the HMI to display of critical motor values is enabled as well as the input of desired drive speed in the graphic interface The aim of communication with the OPC is to enable monitoring of a certain process from any of the computer (client) that are connected to the network. In reality, the controlled object is usually away from the place from where it is controlled in this study the distance not exceeds 100 meter it depends on the RTU specifications, the distance is enough in field of medium size industrial plants ,laboratory building in universities or technical institutes.

The real-time remote control system comprised a PLC is series. connected to RTU PROFINET IO device interface module IM 151-3 PN HF the induced delay of this module is about 6 microsecond (for 100 m length) in such control system this delay can be neglected. The physical structure of the proposed system is shown in figure 11.
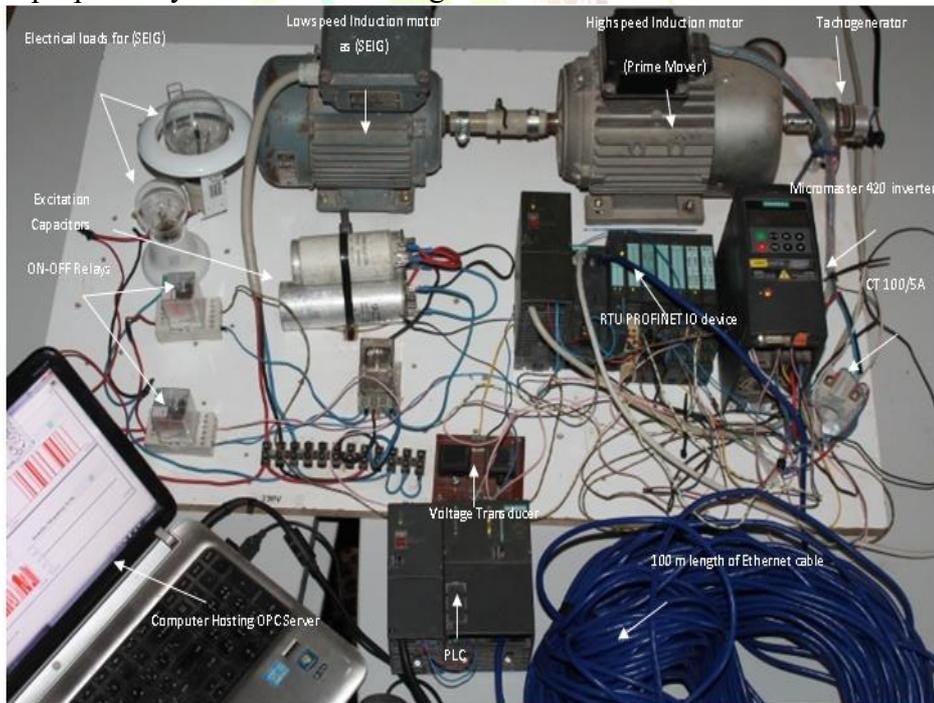
Figure 11. Components of the system in the laboratory.

6. Implementation of model in MATLAB/Simulink

Before running the Simulink model , There are 17 OPC tags was created and used in the implementation, and the details of the tags have been tabulated in Table 2.

Table 2. The details of OPC tags and its PLC Addresses.is indispensable).

OPC Tags	PLC Addresses	Data type	Description
Change direction	Q0.0	Bool	To Change the Direction of the motor
Load1	Q1.0	Bool	To Switch Load 50% Loading
Load2	Q0.3	Bool	To Switch Load 100% Loading
On/Off	Q0.0	Bool	To Switch On/Off Prime Mover
speed tacho	MD18	Dword	Measure the Actual Speed
PC Based	M0.3	Bool	To Switch PC mode
PID On_Off	M0.0	Bool	PID Controller On or Off
PID Reset	M0.1	Bool	PID Controller Reset
PLC Based	M0.2	Bool	To Switch PLC mode
AO to invertor	QW40	Word	the Actual Output analog signal to invertor
motor_current	IW202	Word	Measure the Actual motor current
PV (peed Ref.)	IW200	Word	Measure the Actual speed
Vinvertor	IW256	Word	Measure the Actual motor Voltage
Dervative_time_Td	MD30	Dword	To adjust the Dervative time of the PID
Integral_time_Ti	MD26	Dword	To adjust the Integral time of the PID
Propational_Gain	MD22	Word	To adjust the gain of the PID
Setpiont	DB2.DBD0	Float	To adjust the desired speed

The communication between MATLAB and PLC is realized by means of KEPServerEX OPC from Kepware. OPC toolbox available in MATLAB helps to fetch data from the KEPServerEX OPC. The basic objects of the OPC Toolbox are OPC data access client objects, Data access group

objects and Data access item objects. Figure 12 pictured the blocks of the Simulink model for the proposed closed loop PID control system.

The exchange of data between MATLAB and OPC Server can be performed either synchronously or asynchronously. In the synchronous mode, MATLAB will wait for the operation to complete before continuing with the next one. But asynchronous mode allows MATLAB to continue processing while the operation takes place in the background. The asynchronous mode is used to realize the data communication between MATLAB OPC toolbox and KEPServerEX OPC server in this paper.

An important graphs or trends can be drawn in real time and relevant data can be easily saved for another operation and analysis Figure 13 illustrated the trends of speed current and voltage of the motor .
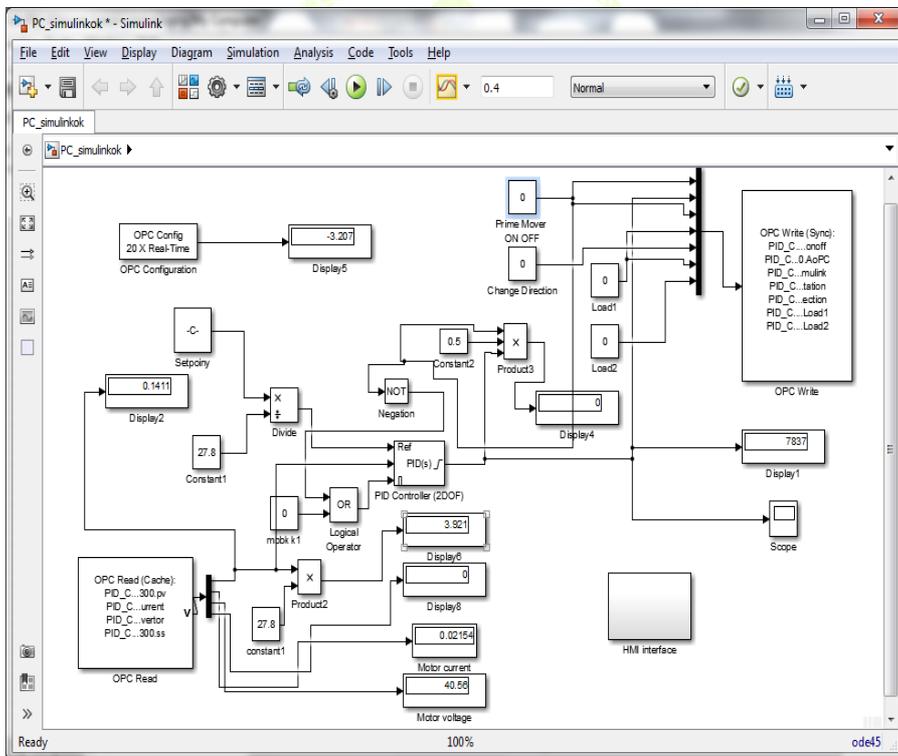
Figure 12. Simulink model for induction motor speed control using OPC server.
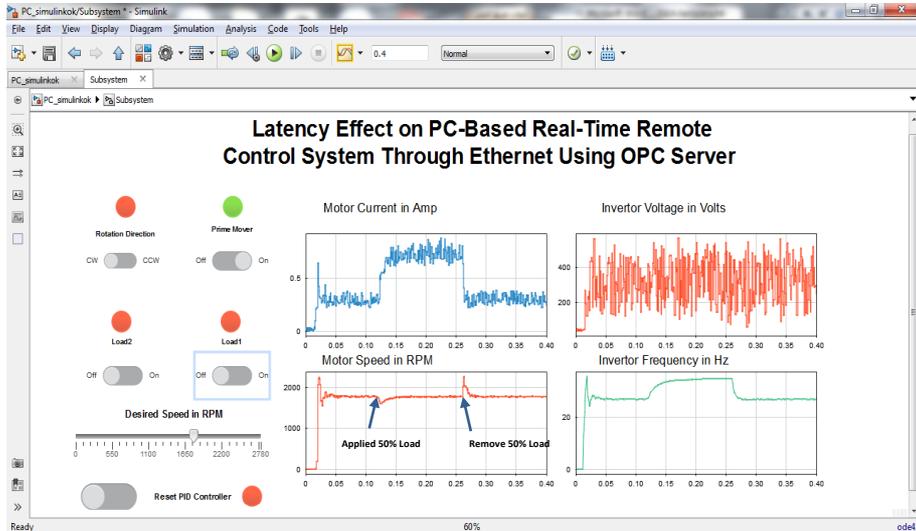
Figure 13. Dashboard of Simulink model.

7 Experimental tasks and results

In this section the experimental results will be shown, by select the desired speed of the motor in (rpm) and considering the system response for both PLC and PC based real time control system, after setting the OPC server/client parameters , the system's responses were held in to cases with the same PID controller parameters, by using the one of PLC self tuning instructions like TUN_EC instruction which is suitable for continuous PID controller, the optimal parameters found are Kp=0.333 Ti= 220 ms Td=10 ms and comparing the speed response of the system PLC based (as reference because there is on latency) with the speed response of the system PC based in several gain of latency by increase the inter-delay of the OPC clients for MATLAB/Simulink, From the obtained results it can be concluded that MATLAB/Simulink based has a very good control performance (tracking) is achieved without significant overshoot or undershoot and small settling time based as tabulated in Table 3.

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Table 3. The performance index of the control systems

Control system		Overshoot %	Settling time/s
Simulink Based	0ms of Latency	7.89	1.20
	10ms of Latency	36.83	1.12
	20ms of Latency	32.13	1.20
	30ms of Latency	32.90	1.45

The results obtained from experimental tasks demonstrate a possibility to establish the PC Based for real time remote control over the system while ensuring system's stability, and good performance of control systems caused by the system delay due to the acquisition rate or (scan rate) of the OPC server promising in terms of minimum peak overshoot, quick settling time and lower steady state error Figure 16 and Figure 17 illustrate the response with different Latency levels of Simulink based real time control system respectively. However, the difference in motor speed values in the same time on the server and client have significant values in some time moments. The high values of speed error are due to rapid increase a motor speed during the transient time.
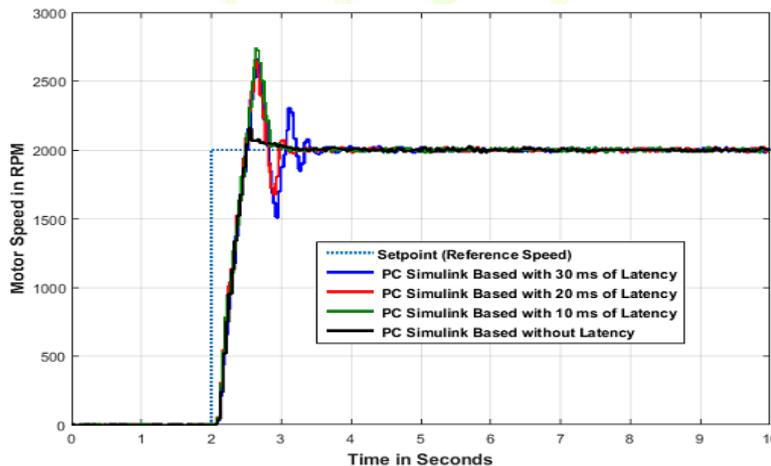
Figure 16 The step responses of control systems under different Latency levels.
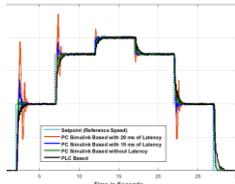
Figure 7 Multi step responses of control systems under different Latency levels.

8. CONCLUSIONS

This paper proposed and implemented a software and hardware solution for local and remote control of an induction motor, using PLC-based controller via PROFINET and OPC network. It was shown how it is possible to combine different networks in order to control the induction motor locally as well as remotely and still maintain system's efficiency and simplicity. That was achieved using OPC standard, because OPC represents open software interface standard that allows Windows programs to communicate with industrial hardware devices. System description, regulation laws and remote control via OPC have been considered and obtained experimental results have been discussed in detail. These results have demonstrated that very good control performance of the system can be achieved. Also, a signal delay through the system is negligible, so system's stability is guaranteed in both local and remote control.

After the entire system with all his functionalities and possibilities has been described, experimental results will be shown in this section. The physical structure of the proposed system is shown in Fig. 7. Like in any

other control system we set the desired motor speed on certain setpoints and considered system's response. All settings were made on the OPC client. Several motor speed responses were captured, with different regulator parameters. Optimal response was accomplished for following PID parameters: K=0.7, T53rdI=0.513 s, T=0 s. Fig. 8 shows the response of the motor speed with the PID parameters values set as proposed.

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Modern Trends for Improving Techniques of Teaching Writing to Libyan EFL Secondary School Students.

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ملخص الدراسة

تبحث هذه الدراسة في تأثير (Approach Tradi– techno) في تحسين مستوى طلبة الثانوية العامة في مهارات الكتابة. (Approach Tradi – techno) و هي طريقة جديدة لتدريس اللغة الإنجليزية عن طريق الربط بين الطرق التقليدية التي منها الطباشير والسبورة، والتكنولوجيا الحديثة و هي التعلم عن طريق الكمبيوتر و استخدام شبكة الاتصالات المحلية (NWBL). هذه الدراسة تهدف إلى توضيح مدى أهمية استخدام التكنولوجيا الحديثة على مستوى استيعاب طلبة الثانوية العامة لتعلم مهارة الكتابة. وقد قامت الباحثة بالنظر في الدراسات السابقة والتي قام بها العديد من الباحثين في هذا المجال و هو استخدام الكمبيوتر وشبكات الاتصالات المحلية في تدريس اللغة الإنجليزية. وقد أثبتت تلك الدراسات نجاح الطرق الحديثة في هذا المجال. ولإثبات تلك النتائج وضعت الباحثة افتراضات للوصول إلى مميزات Tradi–techno في تدريس اللغة الإنجليزية. استخدمت الباحثة (the questionnaire) لجمع البيانات. بعد تحليل البيانات أثبتت النتائج أن اغلب الطلبة موافقين علي سهولة ومتعة تعلم دروس الكتابة عن طريق استخدام الكمبيوتر والتقنية الحديثة. خرجت الدراسة بالتوصيات التالية: ضرورة تدريب طلبة الثانوية العامة علي تعلم اللغة طريق التكنولوجي لأثره الايجابي في تحفيز الطلبة. وكذلك لأهمية

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علاقة الكمبيوتر واللغة أوصت الباحثة المعلمين اللغة الاستفادة من التقنية الحديثة في تدريس مهارة الكتابة وكذلك المهارات الأخرى.

Technical Terminology

Tradi-techno approach: is a deigned approach by the researcher used in teaching writing skills, which is a companion of traditional methods and computers.

NWBL : Net Work Based Learning , learning through net woke technology

Writing skills: is a medium of human communication that represents language and emotion with signs and symbols. Wikipedia (2018).

Abstract

The study conducted to investigate the modern techniques that used in teaching witting skill to the Libyan secondary schools students who learn English as a foreign language.

In order to enhance the development of the processes of writing in an EFL English as a Foreign Language classroom teachers should try new technology. This paper used quasi-experimental study design, which is one of the most common form of quantitative research designs… the researcher used a questionnaire as an instrument to collect the data from a sample of students and EFL teachers, the aim of the questionnaire to show how integrated of writing programmes using computers work as effective and motivating method to teach and learn Writing skills.

The most important result of the study are that: Most students agreed that using computers in learning writing is an easy way of learning and the majority of the students indicated that, the tradi-technology method was enjoyable in learning

Writing skill. The study recommended that: . students should welcome studying and learning English language through NWBL. As well as the

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impact of technology in teaching EFL students in Libya recognize, because tradi-technology approach will benefit Libyan students' communication if integrated in teaching writing lessons.

Introduction

Writing is a production skill considered to be very important in teaching a foreign language. Widdowson defines writing as a communicative activity which is carried out in accordance with certain general principles that underline the use of language. In order to write, learners must "have knowledge of language" (Imssalem, 2000, 119). The aim in a writing task as pointed out by Broughton, et al (1980) is to enable students to produce fluent, accurate and appropriate written English (p.116). Nowadays there are verities ways of teaching writing, technology consider one of the one of the most important one. Using computer technologies in teaching a foreign language is important for both teachers and learners. Computers can offer a range of activities and carry out programmed functions of amazing speed. In this section, the manner in which computers are used in teaching reading and writing skills in EFL classes will be outlined.

The Statement of the Study

Working as an English teacher since fourteen years in Libyan schools and universities, the researcher observed that, the traditional ways of teaching writing were not workable and students have poor performance in writing skill. This encouraged the researcher to find out about the students' abilities in writing skill, so most of the students were unable to write correctly even simple sentences. There for, tried modern techniques of teaching writing such as computer, network, web-pages, etc.

Questions of the study

1. Can the use of tradi-technology influence the teachers' approaches in

delivering Writing lessons?

2. Can tradi-technology help students to develop their Writing skills?

3. Does tradi-technology help teachers to make EFL classes more interesting and interactive than the grammar translation approach (GTA)?

4. Can tradi-technology help teachers to increase students' motivation within the EFL classroom?

Hypotheses of the Study

1. The use of tradi-technology influence the teachers' approaches in teaching Writing lessons.
2. Tradi-Technology helps learners to develop their Writing skills.
3. Tradi- technology helps teachers to make EFL classes more interesting and interactive than traditional ways.
4.

The Aim of the Study

This study aims to show the importance of integrating technology(tradi-technology) in EFL classes as a motivational approach in order to enhance students' performance in teaching Writing skills in Libyan secondary schools.

The Teaching of Writing
Stages in Teaching Writing

There are a number of aspects which need to be considered when teaching writing:

- mechanical problems with scripts of English;
- problems of accuracy of English grammar and lexis;
- problems of relating the style of writing to the demands a particular situation; and
- problems of developing ease and comfort in expressing what needs to be said

Alkhuli, (1980) points out several stages of teaching writing. These include

the following: pre-writing, copying, dictation, controlled writing and free writing. It is imperative that teachers emphasize gradation of writing tasks. Teaching the writing skill should be graded like all educational processes. Thus teachers should start with the easiest part of the learning material and move on to more complicated parts.

The first stage in teaching writing is to teach hand writing, which may be called the pre-writing stage. Learners should be trained to write correctly the graphic symbol of the foreign language. The second stages, copying, consist of learners who are required to copy familiar passages. This serves several purposes: (1) copying is an exercise in hand writing; (2) it develops the learner's conciseness of spelling; (3) it helps in focusing learners' attention on capitalisation and punctuation; and (4) it reinforces previously learned words and patterns. The stage that follows copying is dictation. The dictation material is preferably previously read material. It is also advisable that the teacher assigns a passage to be read at home for dictation in the coming class period.

After the dictation stage, there is guided writing where students are usually provided with the needed content words, unlike free writing where students' provide the content word themselves. Controlled-writing may take any of the following two forms. With parallel sentences, a model sentences is given and a group of content words is supposed to be patterned on the model. With parallel paragraphs, some words are given to replace others in the model is to be written including: missing words, word ordering, and sentence completion. These are just a few examples of the type of exercises that may be included under controlled writing.

Types of Writing

There are varieties of types of written compositions that students at free-writing stage will write. Compositions may be classified into the following types: descriptive, narrative, expository, persuasive and précis (Alkhuli,

1980, p. 83-93). Descriptive writing, is based on an account of the described thing, may be a factual or imaginative. The tenses of verbs are usually present simple. Descriptive writing may be the easiest type with which to begin free writing.

Narrative writing is simply telling a story through a sequence of ideas. It is chronological and verbs are usually in past tenses. The story may be factual or imaginative. The aim of expository writing is to explain and clarify ideas directly through definition, analysis, comparison or interaction. The purpose of persuasive writing is to persuade emotionally or to convince rationally of a certain opinion. Précis is a kind of summary which requires controlled reading, disciplined thinking, and accurate writing.

According to AL khuli all the above types of writing may be practised at the stage of secondary education. Description and narration may be emphasized at the beginning, whereas exposition and persuasion may accompany all other types with proper attention to the difficulty level of the passage to be summarized.

Teaching Writing

Broughton, et al 1980, highlight a basic methodology for written work. Teachers can grade the task in the following ways:

- Limit the length of written material to be produced
- Increase the amount of class preparation for the task
- Provide guidance on the final form of the written work
- Encourage students to collaborate in the actual process of writing
- Allow cross-checking between the draft stage and the writing of the final product
- Limit the complexity of the writing task itself
- Demand that the task be completed either slowly or quickly

According to these researchers, the combination of these methods can be used to bring the task to the level of the class (Broughton, et al, 1980, p.

121).

With regard to teaching writing as a process, there are many steps to the writing process before learners complete the final version.

Hedge, (1996) suggested the following process: getting ideas together →planning and outlining→ making notes→ making a first draft →revising, redrafting →Editing → final version (, as cited in Mcdonough & Shaw, 2003).

Mcdonough & Shaw, 2003 provide a different set of steps: jot down ideas, change words, rephrase bits, move sections around, review parts of what they have written, cross things out, check though the final version, write tidy notes, write on odd pieces of paper as thoughts occur to them, write directly into a type writer or a word-processor (2003, p.103).

To conclude, teaching writing is not easy work for teachers. It needs of preparation before the writing class which depends on the techniques and procedures of teaching writing mentioned above. Teachers need to apply a variety of methods and materials in teaching writing.

Teaching Writing with Computers

Technologies in EFL classroom have been used in various ways. A word processor is considered one of the most important approaches of technology in teaching the writing skill. Computers are used in EFL classrooms, in two major areas: word processors in EFL writing; and online writing (net-working).

A word processor has many advantages which encourage teachers to integrate it in writing classes. It allows learners to cut and paste, delete and copy, check spelling and grammar, import images, change formatting, and print to publishable quality, all of which mean that texts are new generally longer, prettier, and more heavily revised (Hyland, 2003, p. 146).

Johnes & Fortescue, 1987, state "this ability to manipulate text freely is the principle on which all word-processing programs are based. By writing text into the memory of a computer, rather than onto paper, the writer is

freed from the linear constraints of pens and type writers, and can play around with his text until entirely satisfied" (Johnes & Fortescue, 1987, p. 49). This feature of word processoring enables learners to write more organized texts.

Word-processoring programs have various features that motivate learners to write. The most beneficial popular features of word processing are the spell checker and the various printer commands that are part of the software. Many word-processing programs can be used in conjunction with a spelling checker, which typically consists of a disk containing a list of up wards of 30,000 words. When a text is finished, the learners can run it through the spelling checker, which will draw his attention to any words not contained in the list. Most spelling checkers also allow the writer to add his own words to the list, which is useful for specialist vocabulary and proper names.

In addition to these features word-processing programs allow grammar checks, import images, and change formatting. All of these aspects of word-processing program help students to improve their writing.

Hyland (2003) point out that word processors have advantages as well as disadvantages include: greater motivation through writing time more revisions; greater development of content; removal of hand writing barriers; improvements in quality of the text; awareness of writing as a process; greater fluency and accuracy; longer compositions; as well as increased experimentation with language (2003). The disadvantages of word processing consist of : increased focus on surface features; increased anxiety; local revision rather than global; premature completion of work; decreased writer collaboration; increased plagiarism; quantity at the expense of quality; preoccupation with the physical appearance; and isolation of student writers.

In using word processors in the writing class, teachers should take into consideration issues of familiarities: are students familiar with the

keyboard of computers or not? Students should be given support and clear instruction on how to deal with their tasks. According to Hyland, instructions should therefore both support writing and be related to their goals. He put forward the following principles:

- Training in keyboard skills and word processing software
- The integration of computer writing activities into the writing course
- The provision of opportunities for collaboration and peer support (Hyland, 2003, p. 148).

A word processor can be used in guided writing as well in free-writing. After a student has had basic training in the use of word-processing programs, teachers can then ask their students to use it for guided writing. In a guided writing task, students are usually given a piece of writing which they alter in some way. It might be a passage or dialogue missing, or the words of one of the speakers. It could be a complete passage which needs changing: a text description of one person to be changed to adscription of another. At a more advanced level, the possibilities include a wordy and repetitive text which the student is asked to improve by pruning; an overly informal business letter which needs to be made more business-like; and a badly planned, but otherwise well-written text which needs some reorganisation (Hyland, 2003, p.51).

There are various differences between teaching guided writing and free writing via a word processor. In free-writing with a word processor the learner starts with an empty page, but in guided writing sentences or a text already exists in the program. Beginning with an empty page a teacher provided his students with instructions to start their writing with a word processor.

In this study the word-processor will play a very important role. Students will take /writing lessons through net-working using a word processoring program. At all times, the leaner can see an instantly updated, tidy picture of what he has written. The first and final drafts are no longer learner

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entities. When they finish their writing they can run the text through the spelling checker, and make a hard copy of their work on paper to hand in for correcting. But they also make a soft-copy on a floppy disk, by saving their texts as a data file. The teacher may mark the composition in the traditional way, by writing on the learner's printout, or may he use the word-processor to insert comments in the data file itself. Perhaps enclosing his remarks in square brackets, or by using a different text colour. There are certain programs which allow teachers to correct learner's writing on screen.

This last observation points to the real value of the word-processor. As Jones and Fortuscuse, (1987) have noted, it can help to change children's attitudes towards writing as an interesting activity, which is true of older language learners as well. Because the results are so satisfying to the eye, learners begin to enjoy writing, and that can be no bad thing.

Teaching Writing Online (Net-working)
Net-working can impact on language teaching and learning. In the previous section on word-processing programs, it was noted that, they are very important in teaching writing. They have a great many facilities but they do not allow more communication among students. This extension role is achieved through the advanced of net worked computers. There are two approaches to net worked writing: synchronous writing and asynchronous writing:

Synchronous writing
Synchronous writing occurs when students communicate in real time via discussion software on local area net works or Internet chat sites with all participants of their computers at the sometime. This communication can be accomplished by either using special software programs for local area net works, such as Daedalus, interchange, or common space or via the internet, using a variety of chat programs.

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Various activities can be done using the synchronous approach in EFL/ESL classroom. Computer-assisted discussion over local net works can be carried out with the entire class. It offers real-time conferencing between students or between students and the teacher. "This approach has its advantages which encourage greater peer participation and interaction between students than in non-net worked contexts" (Hyland, 2003, p. 152). Net works are used in writing discussions, online teacher feedback, and peer conferencing on texts.

In this research integrated word processors will be integrated with net working. The main approach will be the net working approach, because it has advantages for teaching writing that go well beyond those of word processing. For these reasons which show the impact of using CMC as an approach in teaching languages the NWBL approach integrated with traditional approaches has been chosen for teaching integrated writing/reading skills.

Asynchronous Writing

Asynchronous writing environments are where students communicate in a delayed fashion such as via email (Hyland, 2003), or throw other tools such as news groups and web-based conferencing systems. E-mail is the most important approach in asynchronous writing. It allows messages to go directly to students' individual mail boxes. Many students are familiar with e-mail, they can read, save, edit and reward to other users easily. E-mail is the major approach of asynchronous writing that used by EFL teachers in writing classes. "Many teachers in college and university writing classes have used e-mail discussion groups within their classes to give students opportunities for authentic writing assignments" (Warschauer& Healey, 1998).

Hyland maintains that" within a single class most information gap tasks can be accomplished by e mail encouraging written accuracy and clarity of expression" (2003, p. 156-157).

E mail as a tool allows learners to accomplish various facilities: learners can respond to parts of an e mail, delete un necessary parts, and then send it on to another student. Furthermore, it facilities question-answer sessions or serial stories to be developed.

In teaching writing skill inside EFL classes, through net-working, the internet can be an excellent tool. It can be as a source of language learning material and a published out let. According to Ho, (1997) of the American National Institute of Education, on-line teaching has the following advantages:

- accesses to a wide range of resources is great,
- the ease and speed of getting information to large numbers of students is increased,
- there is an attractive layout and graphics that charms learners,
- in links to other sites that help students access more information,
- The students get feedback without teachers having to mark their work.

In fact, writing has increased through the daily use of the internet. Because the internet can affect our writing skills positively, it has changed the nature of the traditional writing classroom. The Internet presents a change for students who need interesting materials for writing; thus, it can be a rich approach in teaching free-writing. For example the Internet can provide learners with different materials and topics. In essay writing, particularly comparison essays, for examples learners can find various websites which provide them with information which is needed to complete their assignments. The link between collaborative writing and electronic technology is an ideal means to help writers develop the much-needed skills for succeed in academic writing.

From the above literature review, we have seen that the modern trend in EFL teaching has various advantages and should be greatly encouraged. We have specifically seen that NWBL is the prime tool for teaching writing as a good method that takes care of the cooperative and commutative needs

of the learner. It also true that it is important not to ignore totally the traditional atmosphere that has for years guided EFL teachers around the world.

The Method of the Study

This study will be conducted using a quantitative design, namely the quasi-experiment. It sets to discover how significant and important CALL/ NWBL can be in teaching writing skill in Libyan secondary schools.

This study employs a quasi-experimental research design, one of the most common forms of the quantities research paradigm. The research seeks to obtain quantities data in the form of a questionnaire which attempts to obtain feedback from a sample of students who participate in the experimental group and EFL teachers of secondary schools.

Population and Setting

Libyan students studying English in secondary schools represent the population.

Sample of Study

The Al Quds secondary school was chosen as the school from which to draw the research sample. Two classes of second year have been selected. The second year students have selected, because those students have completed three years of Basic English in the preparatory stage and their first year of intermediate English in the secondary stage. This means they have both sufficient English language and computer skills.

Data Gathering Tools

The questionnaire was the data collected tool of this study. Two questionnaires were designed, one for students and another for teachers. The aim of the first questionnaire is to find out about the teachers' attitude toward using computers in teaching EFL classes. The second questionnaire designed to measure students attitude toward using computers in learning

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للعلوم الطبية و النقنية
يوليو July 2018

المجلة الذولية للعلوم والتقنية

International Science and Technology Journal

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writing in contrast with traditional methods.

Presentation and analysis of (Questionnaire data).
Research Question 1

Can the tradi-technology help the students to develop their Writing skills?
Can the use of tradi-technology influence teachers' way in delivering
Writing lessons?

Table 4 Questionnaire item 5 Writing Practice

Item	Frequency	Response	%
When compared with a regular classroom I find a computer-based classroom more practical for Writing skills.	26	Agree	83.9
	5	disagree	16.1
	31	total	100.0

Research Question 2
Can the tradi-technology help students to develop their Writing kills?

Table 5 Questionnaire item number 5

Item	Frequency	Response	%
I was able to express myself in reading and writing within a computer network setting than in traditional class.	24	Agree	80.0
	6	Disagree	20.0
	30	Total	100.0

Table 6 Questionnaire item number 11

Item	Frequency	Response	%
My computer skills have improved my ability to understand English text than before.	21	Agree	70.0
	9	disagree	30.0
	30	total	100.0

Research Question 3
Does the tradi-technology help teachers to make EFL classes more
interesting and interactive than traditional methods ?

Table 8 Questionnaire item number 8

Item	Frequency	Response	Valid %
In future I plan to use the computer network to teach Writing skills.	24	Agree	82.8
	11	disagree	17.2
	29		
	Missing system 2	Total 31	100.0

Table 9 Questionnaire item number 9

Item	Frequency	Response	%
I enjoy using computer to teach new English language skills.	29	Agree	93.5
	2	disagree	6.5
	31	total	100.0

Table 10 Questionnaire item number   11

Item	Frequency	Response	%
	27	Agree	87.7

Research Question 4

Can the tradi-technology help teachers to increase students' otivation within the EFL classroom?

Table 11 Questionnaire item number 1

Item	Frequency	Response	%
I enjoy using computers to learn English language skills.	29	Agree	96.7
	1	disagree	3.3
	30	total	100.0

Table 13 Questionnaire item number 13

Item	Frequency	Response	%
I would like to spend more time studying via the computer.	26	Agree	86.7
	4	disagree	13.3
	30	total	100.0

Table 14 Questionnaire item number 17

Item	Frequency	Response	%
I like using the new method, (tradi-technology) to study Writing skills.	24	Agree	80.0
	6	disagree	20.0
	30	total	100.0

Research Question 5

Has the tradi-technology method any specific advantages erformance in Writing skills?

Table 15 Questionnaire item number 2

Item	Frequency	Response	%
I prefer learning English from a teacher in a classroom than through computers.	16	Agree	53.3
	14	disagree	46.7
	30	total	100.0

Table 16 Questionnaire item number 3

Item	Frequency	Response	%
I participate more when I engage in computer network than when I discuss in class.	19	Agree	63.3
	11	disagree	36.7
	30	total	100.0

Table 18 Questionnaire item number 7

Item	Frequency	Response	%
I liked having the opportunity to write without paying special attention to spelling mistakes	26	Agree	86.7
	4	disagree	13.3
	30	total	100.0

Table 19 Questionnaire item number 15

Item	Frequency	Response	%
I prefer handwriting English than using the computers.	9	Agree	30.0
	21	disagree	70.0
	30	total	100.0

Table 20 Questionnaire item number 16

Item	Frequency	Response	%
I found it helpful having the printed copy of my own writing for grammar correction than a ready-prepared computer text.	23	Agree	76.7
	7	disagree	23.3
	30	total	100.0

Finding:

In this section, a few additional findings considered to be of interest with regard to the research questions will be presented. In addition to the analyses that are already presented, the data was also analyzed: (1) to see: the difficulties that might face teachers in using tradi-technology approach; (2) to find the effect of working in groups; and (3) to explore teaching and learning integration of computers.

In order to examine the possible difficulties teachers may face in using tradi-technology approach, statement number 2, 3, and 6 from teachers' questionnaire were used to investigation. The table bellow display the results.

Table 21 Questionnaire item number 2

Item	Frequency	Response	%
I find it easy to integrate computers in planning of my English course.	26	Agree	83.9
	5	Disagree	16.1
	31	Total	100.0

Table 22 Questionnaire item number 3

Item	Frequency	Response	%
I find difficulties scheduling hours for my course in the computer lab.	14	Agree	45.2
	17	disagree	54.8
	31	Total	100.0

Table 23 Questionnaire item number 6

Item	Frequency	Response	Valid percent
Technical difficulties interfere with my ability to teach using the computer.	19	Agree	63.3
	11	Disagree	36.7
	Missing system 1		
	Total	31	100.0

In order to examine the attitude towards stress statement number 14 from students' questionnaire used to collect the data. The table bellow display the results.

Table 24 Questionnaire item number 14

Item	Frequency	Response	%
I felt stressed while studying via the computer.	10	Agree	33.3
	20	disagree	66.7
	30	Total	100.0

In order to examine the attitude towards learning statement number 8 from students' questionnaire was used to investigation. The table bellow display the results.

Table 25 Questionnaire item number 8

Item	Frequency	Response	%
I did not learn very much from working on the computer.	11	Agree	36.7
	19	disagree	63.3
	30	total	100.0

The analysis and presentation of findings on data from the questionnaire. Namely, the report data that addressed the hypothesis and research questions of study.

To conclude it can be seen that, the tradi-technology approach in teaching Writing skills.

In sum,

1. The tradi-technology is an approach that is highly motivating for students in learning writing.
2. The tradi-technology is an approach that is highly motivating for teaching to employ in teaching writing skills.

The clear indication from the analysis is that the tradi-technology approach (NWBL) significantly increases students' performance in Writing skills as well as increasing teachers' motivation to teach and students' motivation to learn. It is with theses solid positive indications from the findings of the study that teaching tips or strategies are suggested for teaching Writing skills.

Discussion of the Research Findings

After testing the research hypotheses, the general findings after the statistical analysis showed that tradi-technology as an approach in teaching writing skills in Libyan secondary can be successfully utilized.

Spending more time studying via the computer.

Over Eighty-six percent of students positively agreed that they would like to spend more time studying via the computer.

Desire of using the new method (tradi-technology) to study Writing skills.

Most students (Eighty percent) expressed preference (agreed, strongly agreed) for Likeness of desire of using the (new method) (tradi-technology) to study Writing skills.

With regard to research question number 5, Has the tradi-technology method any specific advantages performance in Writing skills?

Appreciation learning English through the computer.

The students were positive regarding their networking time. Sixty-three percent disagreed with ("I prefer traditional Writing in class than on the computer").

Attitudes towards error correction.

Most students (eighty-six percent) expressed preference for using the computer correct their errors. They liked having the opportunity to write without paying special attention to spelling mistakes. Seventy-six percent indicated that it was very helpful to have the printout of their contribution and to have their errors highlighted. So that they would utilize the spell-checker on the computer.

Ease of (network) tradi-technology

Eighty-three % teachers indicated that they agreed with the ease of integration in using computers in planning their English course. On the other hand they think that they may find difficulties scheduling hours for their course in the computer lab due to the limited time to teach the English curriculum. Forty-five percent agreed for that and fifty-four percent disagreed). Indeed, some teachers' relative unfamiliarity with computers (in contrast to students of a computer generation) as well as technical difficulties interfered with their use of the network approach.

Psychologically, then, teachers reacted with more resistance than did their students when faced with the same technological constraints. Again, sixty-three percent agreed that technical difficulties interfered with their ability to teach using the computer, the response above implies that teachers need more overt technical assistance in handling computers in a pedagogical setting. They want to pay attention to their students, not to the machines their students use. When the researcher talked with teachers during the time of the experiment, several teachers noted that with this new method they needed to

develop new teaching techniques and that preparing a network session demanded as much or more time as preparing a traditional session.

Attitude towards stress

Over sixty-six percent agreed that computer was un stressful and facilitated self-expression. These students expressed similar opinions in informal, after class. The computer lab was described as less anxiety producing than the regular classroom.

Attitude towards learning and tradi-technology.

Sixty-three percent disagreed with ("I did not learn very much from working on the computer").

Attitudes towards group interaction (working in groups)

In the early (tradi-technology) sessions, the students expressed some frustration trying to keep up with the discussion. At the beginning, when all 35 students in class are Writing simultaneously on the network. Messages flash on the screen and scroll by with greet rapidity. To deal with this kind of frustration, the researcher divided the class into small groups. When students were asked if they preferred the small group format, eighty-three disagreed for preference whole class discussions, as opposed to smaller groups. Eighty-six percent agreed for. I like working with my classmates in groups than in alone. Sixty-four percent of teachers agreed at. ("I find it better to teach students in groups than whole class").

Conclusion

Finally, teaching English though technology help both teachers and students to improve their level in teaching and learning English in schools. This study supported using technology in teaching writing skills to improve students' performance in Writing skills. The tradi-technology approach is a good

motivational approach for EFL teachers. This goes to support finding that the tradi-technology approach increases the Libyan teachers' motivation in teaching English language.

Recommendations

1. The researcher recommends that students should welcome studying and learning English language through NWBL. By so doing, they would gain a deeper insight into the educational aims of learning the English language for better communication within the Libyan society as well as the entire human community.

2. In effect, students should be given an in-depth training programme on dealing with NWBL.

3. Libyan teachers should realize the positive effects on NWBL on themselves and their students. The researcher is of the opinion that they should organize, as well as attend, training courses on computer net working both at national as well as international level.

4. School authorities should consider teaching /learning through technology as a compulsory provision, particularly to EFL in general.

5. All teachers training colleges should be furnished with both computer assisted language learning labs and the Internet. This would greatly improve the teaching and learning of EFL.

6. The researcher recommends the introduction of text books that are adapted to the tradi-technology approach.

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2nd Conference on Medical & Technological Sciences

Motion Estimation of Glass Eels by Differential Methods

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ملخص:

ان تحليل الحركة للحيوانات الحية قد يساعد على فهم الخطر الذي يهددها، ولكنه في
بعض الأحيان يمثل تحديًا من الناحية الفنية. وهذا ينطبق بشكل خاص على علماء الأحياء
الذين يدرسون الأسماك المهاجرة في حوض آدور. هنا، نقوم باستخدام الرؤية بالكمبيوتر
من اجل التتبع التلقائي ومعرفة سلوك هجرة سمك الانقليس الزجاجي. لهذا الغرض، يتم
وضع علامة لونية على بعض من هذه الأسماك، ثم إدخالها في نجربه تحاكي ظروف
المد والجزر ومن ثم يتم تسجيلها في مقاطع فيديو. وللحصول على معلومات حول سلوكه
يتم تتبع حركته بواسطة تطبيق طرق التدفق البصري. والنتائج الأولية تظهر كيفية تقدير
سرعة وسلوك الحيوانات.

الكلمات الرئيسية: الانقليس الزجاجي، تحليل الحركة، الطرق التفاضلية، تتبع، سلوك
السباحة، الأسماك، هورن وشونوك، لوكاس وكناد p.

Abstract

Motion analysis of living animals might help to understand the dangers that threaten the species, but it is sometimes technically challenging. This is particularly true for biologists who study migrating fishes of the basin of Adour. Here, we investigate the use of computer vision for automatic tracking and acquisition of knowledge about the migratory behavior of glass eels. For that purpose, some glass eels are color-marked, then introduced into an experimental medium reproducing tidal conditions. Observations are collected in video sequences. To get information about fish behavior, one can track their motion by optical flow methods. Preliminary results show that one can estimate the velocity but also the swimming behavior, hence eventually leading to energetic information about the animals.

Keywords: glass eel, Motion analysis, Differential methods, Tracking, Swimming behavior, Fish, Horn and Schunck, Lucas and Kanade.

Introduction

In computer vision and image processing, motion estimation is of increasing interest because of the large number of applications: object tracking (military, video-surveillance, robotics), complex behavioral analysis (modeling of human body motions, meteorology), medical analysis (cardiac contraction follow-up, infarction detection) [1][2]. In biology, tracking the motion of animals sometimes poses technical problems, related to the characteristics of species and stages of development. For example, the European glass eel (Anguilla anguilla) has a complex life cycle, with reproduction in the sea of Sargasso, a larval phase that crosses the Atlantic Ocean and a juvenile stage, the glass eel, which goes up the estuaries to grow in the river [3]. To study the estuarine migration of glass eel, it is possible to reproduce the tidal currents in the laboratory and observe the swimming behavior of individuals [4]. The

major difficulties concern the animal itself, which is transparent, and moves mainly at night or at very low light intensity. To follow glass eels, each individual is tagged with VIE Tag (*Visible Implant Elastomer*) [5]. This marking consists in implanting under the skin a tip of colored elastomer, visible under UV. Tracking individuals is done on video recordings but it is a tedious job because currently not automated. The parameters that interest biologists are mainly the motion direction of glass eels (with or against the current) and their velocity. Any measure to assess energy expenditure is also sought, as glass eels do not eat during migration, and their energy status could play an important role in the migration potential. In this work, we have chosen differential methods for their many advantages. These methods are at first robust and precise, while being easy to implement. Because of its differential nature, the optical flow equation also allows a sus-pixellic estimation of the motion [6]. The advantages of these methods are: firstly, robustness and precision, the equation of the optical flow, because of its differential nature, allows a sub-pixellic estimation of the movement. The measurement of the motion requires only a local calculation of the spatio-temporal derivatives of the sequence as explained in a recent study [7]. The main disadvantage of differential methods is their foundation based on constant light intensity assumptions, and small displacements. During larger trips, however, it is possible to solve the problem by multi-resolution iterative approaches. In this case, we do not only process the image sequence at its acquisition resolution, but we build from each frame, a pyramid of images successively filtered and subsampled [8] [9]. The relevance of such an approach requires, however, that the images at the coarsest levels of the pyramid should not be too degraded by the lowering of the resolution. The purpose of this preliminary work is to use differential methods to estimate the motion of glass eel, determine the direction of their motion and assess their velocity. The article is structured as follows: section 2 presents the experimental

context of the study. Then we recall the two motion estimation algorithms, namely Lucas and Kanade algorithm and briefly H&S algo. Section 4 describes the proposed processing approach. Then we present the results. Finally, we end with a conclusion and perspective.

Experimental context

To make this study, an oval-shaped aquarium, 1.50 m in length and 50 cm wide, is separated by a rigid wall at its center. [4] (Fig.1).
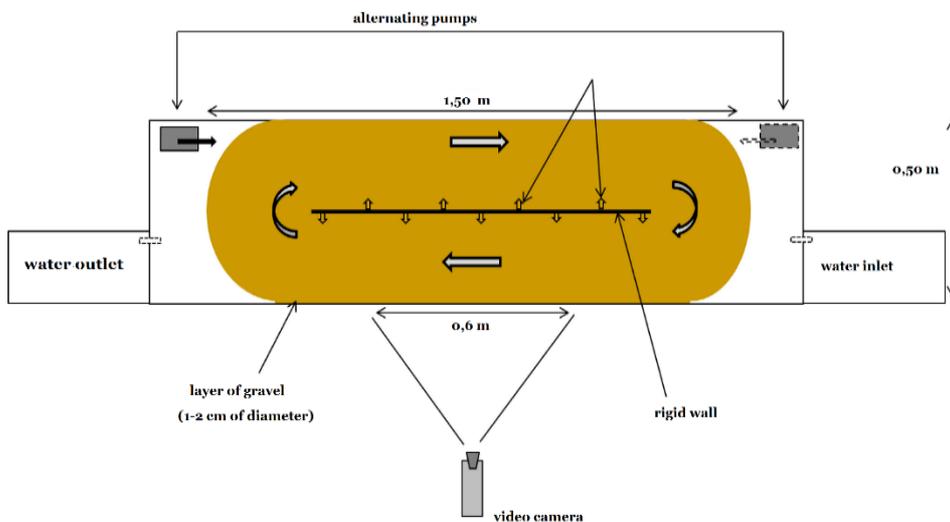

Figure 1 _ Diagram of the aquarium [10]

Two pumps, located at opposite ends of the aquarium, allow alternating water currents every 6.2 hours to replicate the rhythm of the tides. The temperature of the water is maintained at $11 \pm 0.5°$ C, and a layer of gravel covers the bottom of the aquarium. The velocity of the water flow is on average 11 cm/sec. Half of the glass eels are marked with color combinations (VIE marker system: Visible Elastomer Implant) visible

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يوليو 2018 July

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under UV regardless of the light conditions [11].

The average size of an glass eel is 7cm. The filmed area concerns the entire water column, over a width of 60 cm. Video recordings of 15 seconds are made every 40 minutes. The video frame rate is 15 frames/s. The database contains several hundred videos.

Motion estimation
Lucas and Kanade Algorithm

Their method is based on a local regularization of the velocity field [12] [13]. They assume that the optical flow equation remains constant in small regions Ω of the image. This is expressed by:

$$\big(u(x), v(x)\big) = argmin_{u,v} \sum_{P \in \Omega} W^2(P)\big[I_x(p)u + I_y(p)v + I_t(p)\big]^2$$
(1)

where W(p) is a window function (weighting) to give more influence to the center of the neighborhood rather than to its periphery. we note that $I_x = \frac{\partial I}{\partial x}$, $I_y = \frac{\partial I}{\partial y}$, $I_t = \frac{\partial I}{\partial t}$ are the gradient components according to (x, y, t) and $u = \frac{dx}{dt}$, $v = \frac{dy}{dt}$ are the velocity components according to (x, y). W is the diagonal matrix of W(p)

$$W = diag[w(p_1), \dots, w(p_n)]$$

Applying the least squares method, we find:

$$\begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} \sum W^2 I_X^2 & \sum W^2 I_x I_y \\ \sum W^2 I_x I_y & \sum W^2 I_y^2 \end{bmatrix}^{-1} \begin{bmatrix} -\sum W^2 I_x I_t \\ -\sum W^2 I_y I_t \end{bmatrix}$$
(2)

These local differential methods are interesting because each calculation on a small window is independent of the others. The results are also less sensitive to noise and allow the calculation of local motions, in particular using a pyramidal implementation.

Horn and Schunck Algorithm

The first optical flow calculation method, developed in 1981 by Horn and Schunck [5], combines the motion constraint equation with an overall regularization, using a smoothing term on the sum of the modulus squares of the velocity component gradients by minimizing the following equation:

$$\iint_D (\nabla I.V + I_t)^2 + \alpha^2(\|\nabla u\|^2 + \|\nabla v\|^2)dxdy \tag{3}$$

where the scalar α is a weighting coefficient that adjusts the influence of the smoothing (regularization) term. An iterative algorithm minimizes the integral defined on the domain D.

The iterative equations are:

$$u^{k+1} = \overline{u}^k - \frac{I_x[I_x\overline{u}^k + I_y\overline{v}^k + I_t]}{\alpha^2 + I_x^2 + I_y^2} \tag{4}$$

$$v^{k+1} = \overline{v}^k - \frac{I_x[I_x\overline{u}^k + I_y\overline{v}^k + I_t]}{\alpha^2 + I_x^2 + I_y^2} \qquad .$$

where k represents the iteration index, I_x, I_y, I_t are the components of the gradient according to x, y, t and $\overline{u}, \overline{v}$ are the average values calculated on a weighted neighbourhood. As differential methods rely on partial derivative calculations, the quality of the estimate is strongly dependent on the derivation formulae chosen. Since a derivative calculation is sensitive to noise, spatio-temporal low pass pre-filtering is often required.

Proposed processing method

As shown in (Fig.2)., our algorithm essentially consists of the following steps:
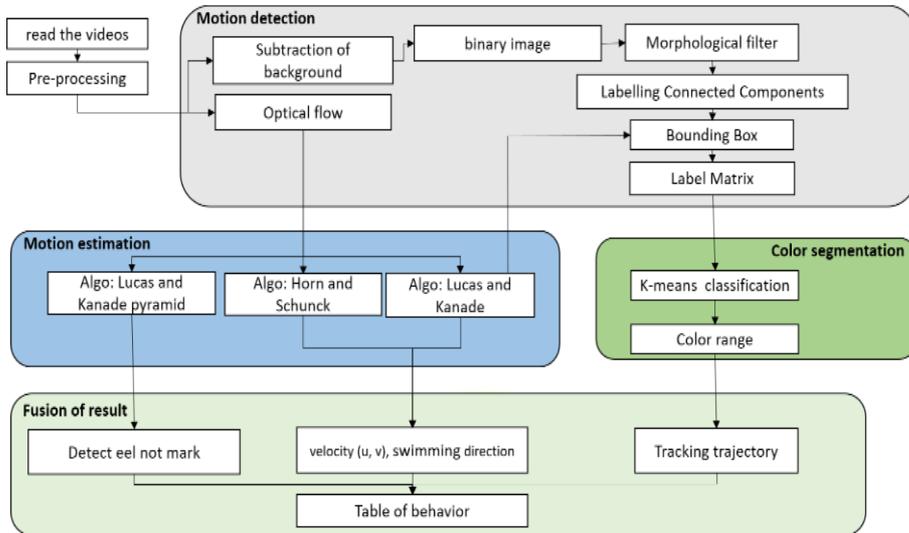
Figure 2 _ processing schema.

- **acquisition step:** The size in bytes of an image is 1280 X 960 X 3 (Fig.3). These RGB images are transformed into HSV images because of the independence between the colors in this color space.

Figure 3 _ A sequence of 6 consecutive images

- **pre-processing step:** during acquisition of the real scene by the sensor, noises appear and distort the visual rendering of the scene.

It is therefore necessary to pre-process the images in order to bring out the most relevant information. Conventional filtering techniques are applied to the raw data, in particular the low-pass filter, the averaging filter.

- **Motion detection**: In this stage our goal is to detect the moving objects in a video sequence [14]. Two methods are used: the optical flow method and the subtraction method. The optical flow is used in two steps: object detection and motion estimation. The motion estimation is applied by the two Lucas and Kanade algorithms and Horn and Schunck to determine the velocity vector fields, we also used the pyramidal implantation of Lucas and Kanade to detect some glass eels not marked in the aquarium (we are going to explain more detail in the results).

- **connected Components**: After the morphology operation we detected the groups of connected pixels (objects) and determined the parameters of each object such as: number of pixels, left edge, right edge, top edge, bottom edge. With these parameters, we define a bounding box for each object and then we build a label matrix of the sequence containing all these parameters.

- **K-means classification**: From this matrix, we used the K means method on the hue of each frame in the video sequence to determine the range of each color (the elastomer marking is done with four colors: blue, green, red and orange) [15]. At this stage of our study, we try to track the trajectory of each glass eel by Kalman filter and merge all the results in a behavior table that contains all the information about the glass eels.

- **fusion**: after extraction of the information by the motion detection, motion estimation and color segmentation, it can be merged to determine the swimming direction and the velocity of the fish and to follow the trajectory of the glass eels. At this stage of our study, we merged the results of the color segmentation step, it is to determine the colors of each marking and calculate the velocity by the motion estimation step.

- **archive**: finally, we store the results of this fusion in a table that contains all the information on the behavior of glass eels.

Results

First of all, in order to determine the basics of swimming behavior of glass eels (sense and velocity), we start by explaining the results obtained with the local method of Lucas & Kanade that meets the first need of biologists. Next, we present the results of the global method from Horn & Schunck, which shows in more details the motion of the glass eels. To apply these algorithms, we use two successive images. This is illustrated in Fig. 4. The original image (a) has four marked glass eels: the first two are at the bottom left in the image, one with a short orange marking (close) coded OOS, and the second with a double orange marking and long red (spaced) coded ORL; the third is in the middle of the image with a long green double marking (code GGL), and the fourth is on the right in the image with a double green and short blue marking (GBS code); image (b) corresponds to the next instant. The direction of the water current in this sequence goes from the right to the left of the image.
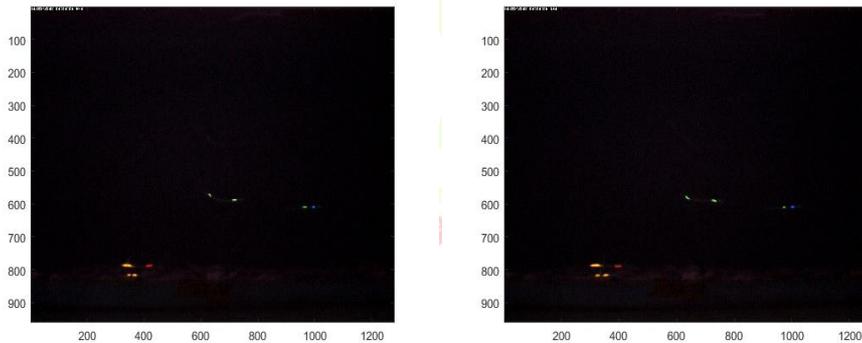

(a)   (b)

Figure 4_Two successive images: (a) at the instant t and (b) at the instant t+dt
With four marked eel (OOS, ORL, GGL and GBS).

Results with Lucas & Kanade

The differential method of Lucas & Kanade is interesting because each calculation on a small window is independent of the others. In the

algorithm we use small windows of size 40 X 40 pixels. In Fig. 5 (a), we notice in each window that the arrows have a general orientation corresponding to the direction of motion of the glass eels. To better visualize the velocity vector fields, we chose and enlarged three zones (b), (c), (d). Fig. 5 (b) shows the area (b). There are two different sizes of arrows, which reflect the presence of two individuals. These two glass eels move to the left of the image, the one characterized by the larger arrows swimming faster than the other. In the figure 5 (c) the size of the arrows is identical which means the presence of a single glass eel that moves to the lower right side of the image. Similarly, in the figure 5 (d), we see that the arrows are identical revealing a single glass eel moving to the right.   As a result, we can distinguish the mean velocity of different glass eels.
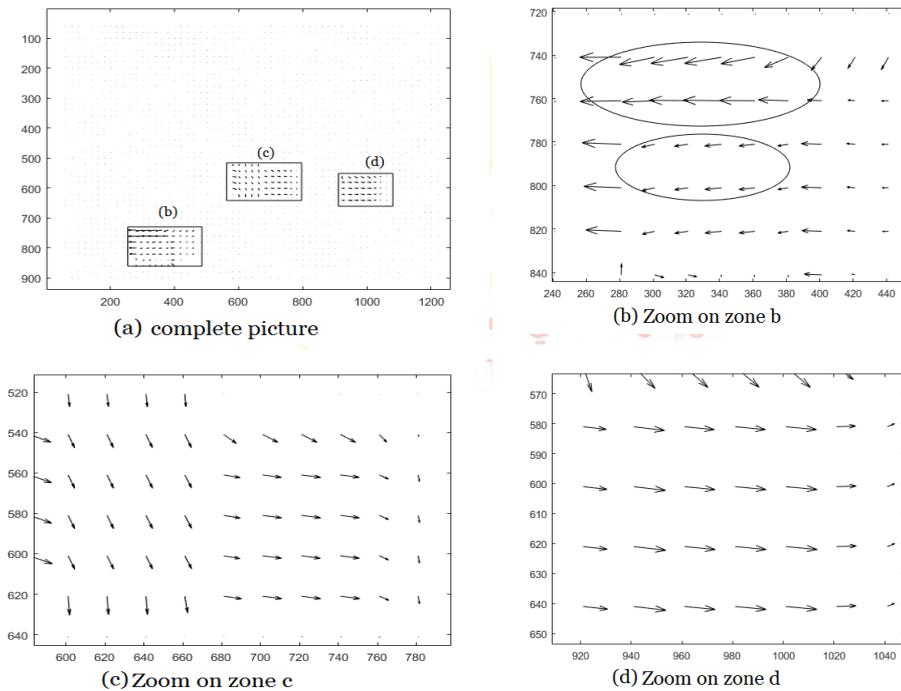

Figure 5_ Vector-velocity field by the Lucas & Kanade algorithm.

Calculating the velocity of glass eels

To calculate the velocity of glass eels, we chose a sequence of 6 images with a shift between each pair of successive images of 14 images, Fig. 6 (a). The principle of our algorithm is based on two phases. The first is to detect glass eels in the video sequence as described in the section 4 and to calculate the centers of gravity of *bounding boxes*, Fig. 6 (b). In the second phase, the Lucas & Kanade algorithm is used to estimate the velocity vector field in each center of gravity and calculate the velocity V of each glass eel thanks to the following equation: $\left\|\vec{V}\right\| = \sqrt{u^2 + v^2}$

The results obtained in Fig. 6 (c) make it possible to distinguish two different velocities: glass eels in the direction of the water current swim with a weak undulation and consequently they have a low velocity field. On the other hand, glass eels going against the direction of water flow swim with a strong undulation and the field of velocities is more important.


(a)

(b)

(c)

(d)
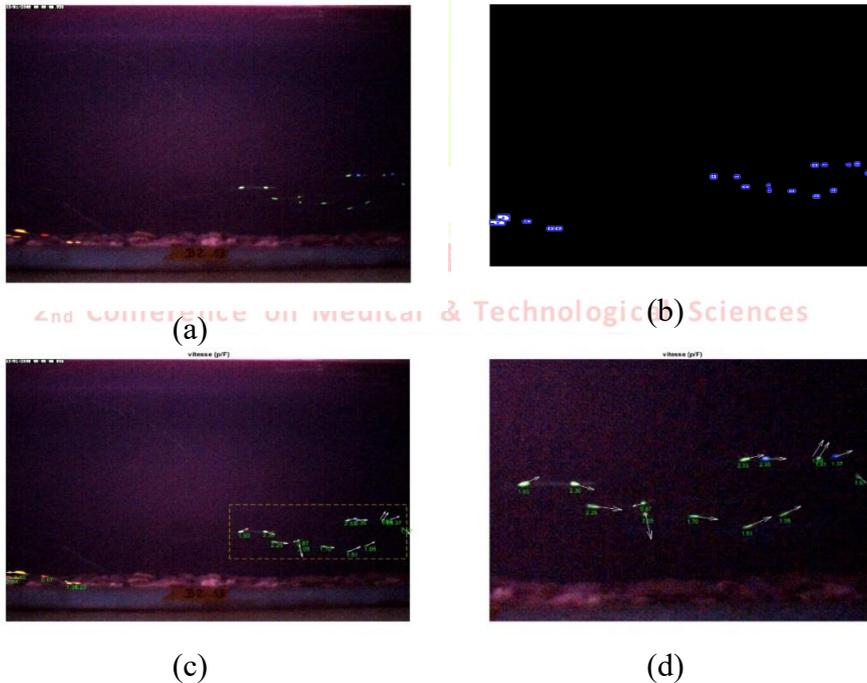
Figure 6-Calculate the speed of glass eels, (a) Sequence of 6 superimposed images,

(b) Bounding boxes and centers of gravity, (c) velocity $\|\vec{V}\|$ calculated in pixels/frame, (d) Zoom on the rectangle of the figure (c)

In order to observe the undulation of the glass eels swimming [15], for each mark detected we calculate the angle of undulation by the relation:

$$\theta = \arctan(\frac{v}{u})$$

knowing that each eel has two marks, on the results of Fig. 7, we note two undulations different from eel: if the swim is against the current, a significant shift occurs between the two angles of undulation [16] [17]. On the other hand, with the direction of water current, the two angles are very similar.

Figure 7-

The θ angles of the undulating of glass eels; two different swimming sense: WC (with current) and AC(against current)

Pyramidal implantation

A pyramidal implementation of the Lucas & Kanade algorithm has been implemented with iterative refinement at each level. The main steps of this pyramid algorithm are:

- A Gaussian pyramid is formed up to a three level (n=3), filtering the image with a Gaussian mask, then scaled by a factor of 0.5.
- The size of the integration window is maintained at Ω=20 X 20 and the number of iterations is i=10.
- The Lucas & Kanade algorithm is executed first at the highest level of the pyramid using an initial zero estimate of the vector field.
- The optical flow, calculated at the top level of the pyramid (L=n), is then scaled by a factor of 2 and propagated to the lower level (L=n-1), as the initial value for calculate the optical flow at the lower level. This process continues to the lowest level (L= 0).

Large motion can be correctly estimated with a small window of integration thanks to this approach; the problem of limitation of displacements with the classical method can thus be solved. Fig. 8 (a) shows the four glass eels already detected previously (b, c and d) and in addition, a new glass eel (zone e) which moves near the surface of the water. This unlabeled glass eel was not detected by the two main algorithms because its intensity is very low, which means a weak undulation too. Fig. 8 (b) shows its weak passage to the right side of the image in the direction of the current.


(a)   (b)
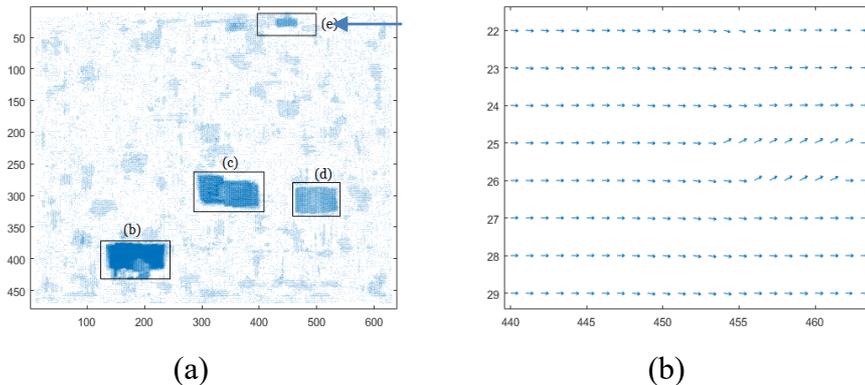
Figure 8- pyramidal of Lucas & Kanade, (a) direction of the water current goes from right to left: (b) Zoom on the chosen area(e)

Results with Horn & Schunck

In this algorithm, we optimized the results by playing on the number of iterations (i=11) and the smoothing parameter (α=1). We obtain in Fig. 9 (a) a vector-velocity field superimposed on the initial image. To better visualize the optical flow, each vector field has been zoomed in Fig. 9 (b, c, d).
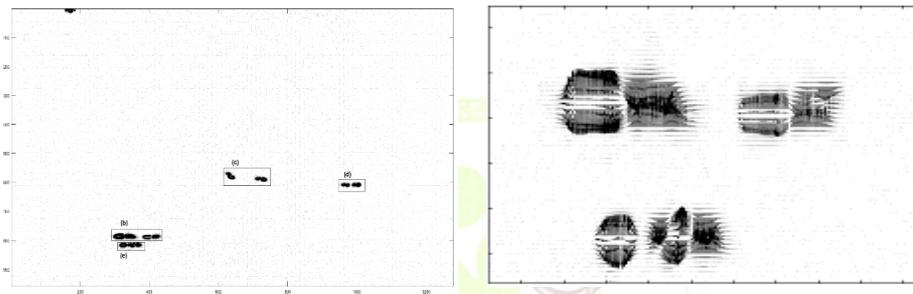
(a)global field superimposed on the initial image (1280X960)

(b) zoom on the area ORL field and OOS (WC)
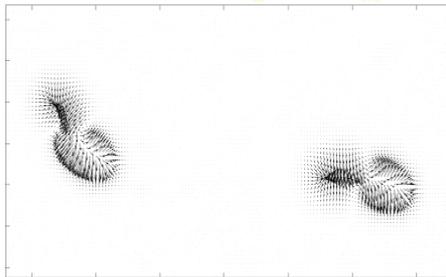
(c)Zoom on the area (c) GGL (AC) field
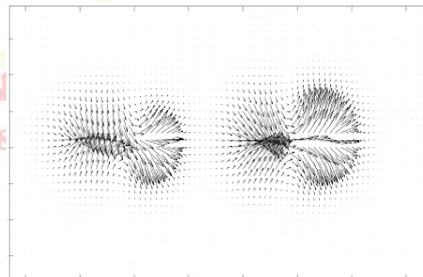
(d) Zoom on the area (d) BGS (AC) field

Figure 9_Velocity vector field with the Horn & Schunck algorithm

In zone (b): we see two glass eels, the first with double long marking

(ORL) and the second with two short marking (OOS): for each, we have a velocity vector field with two different orientations of arrow: the one is orientated inside to the origin which corresponds to the departure position of the glass eel (convergence) and the other is oriented of the origin to the outside which corresponds to the position of its displacement (divergence). We can also identify the direction of motion that will be from convergence to divergence. For example, here, the glass eel moves to the right of the image. The difference between the intensity of the convergent fields and the intensity of the divergence fields demonstrate the undulating motion of the glass eel [16] [17]. Moreover, the head of the glass eel has a greater field intensity than the tail.

Conclusion et perspective

The differential methods of Horn & Schunck and Lucas & Kanade are used in this article. The computation time of the optical flow of a pair of images obtained with Matlab is typically: 0.14s for the Horn & Schunck method, 0.51s for the Lucas & Kanade method. The flow obtained by the Lucas & Kanade local method makes it possible to determine the motion direction of the glass eels because the arrows of the vector-velocity field computed. The application of the Lucas & Kanade algorithm to the center of gravity of each glass eel also allows to obtain a superimposed sequence on which it is possible to calculate the velocity of displacement. The procedure of iterative refinement by a multi-resolution structure makes it possible to estimate the small incremental motions of glass eels, undetectable by the general differential methods. This result reflects a more accurate optical flow and suggests the possibility of detecting and tracking unmarked glass eels.

Horn & Schunk's global method specifies the undulatory motion of glass eels that could be used as a proxy for energy expenditure related to swimming. The glass eels adopt different swimming strategies (with or against the current), with more or less high velocity. In order to better

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understand these different migration tactics and their energy costs, biologists hope to couple these measures of velocity and range of motion with the weight loss of glass eels and their metabolism. Finally, the ultimate goal of this project is the automation of these measures in order to reduce the working time of the observer.   For that purpose, we have in perspective, thanks to the fusion of the results obtained by the main phases of processing of section 4, to build a tool allowing the automatic tracking of glass eels integrating sense of swimming, velocity and undulation energy.

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2nd Conference on Medical & Technological Sciences

Principal Component Analysis applied to digital image compression

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Abstract

The use of digital images grows increasingly fast, contributing to insufficient bandwidth of network and storage of memory device [1]. Therefore, the image compression becomes more and more significant to save more hardware space and transmission bandwidth. Principal Component Analysis (PCA) is a mathematical technique used to reduce the dimensionality of data [2]. It works on the principal of factoring matrices to extract the principal pattern of a linear system. this article, aims to evaluate the application of PCA (principal component analysis) on digital feature reduction [3], there is a new approach of image compression derived from data analysis and rarely used for such problems. Thus, principal component analysis involves finding the eigenvectors and eigen values of the covariance matrix and projecting the image onto the eigenvectors with the largest eigenvalues (Principal component analysis), those new dimensions to reform the image while still maintaining the principal properties of the original image. This technique achieved 30 % for the file size reduction for the best feature reduced quality and without much loss of information.

Keywords: Principal component analysis, Eigenvalues, Eigenvectors, Image compressing, Dimensionality reduction.

Introduction

The Principal Component Analysis (PCA) is used to extract the important information from a multivariate data and to express this information as a set of few new variables correspond to a linear combination of the originals

[4]. It's a statistical method which allows the identification of standards in data and their expression in such a way that their similarities and differences are emphasized. Once patterns are found, they can be compressed and their dimensions reduced without much loss of information.

In summary, the PCA is used to determine the axes according to which the data varies the most. It is a method of eliminating the correlation of data and finding a less redundant, more compact representation of the same information. It is one of the most successful techniques that have been used in image recognition and compression [5].

Proposed Technique

We apply the PCA technique for the grayscale image.

- **Grayscale Images**

An image is a matrix of simple elements called a pixel picture element; correspond to the color of that portion of the image. In grayscale image [6], we have a matrix of two dimension, it carries only intensity information within a given range between 0 and 1.

$$F(x,y) = \begin{pmatrix} f(1,1) & \cdots & f(1,m) \\ \vdots & \ddots & \vdots \\ f(n,1) & \cdots & f(n,m) \end{pmatrix} \qquad (1)$$

where x and y are the coordinates of the pixels in the image and $f(x,y)$ is the corresponding colour or grayscale level depending on its value type.

- **Principal Component Analyse (PCA)**

Suppose further, that the pixels of image are arranged as a set of m data vectors $X_1...X_m$ with each X_i represents a single grouped observation of the n variables. By definition [7], the principal component is the linear combination of Xi variables, that is:

$$Z_i = a_{i1}X_1 + a_{i2}X_2 + ... + a_{im}X_m$$

always calculated according to the eigenvectors and eigenvalues of the

data covariance matrix [8] [9].

- **Covariance Matrix**

As the pre-processing phase of PCA, we adjust the image around their mean and multiply the transpose of the matrix by itself to deduce the covariance matrix, which is symmetrical matrix and has the form:

$$C = \begin{bmatrix} \sigma_{11}^2 & \sigma_{12} & \cdots & \sigma_{1m} \\ \sigma_{21} & \sigma_{22}^2 & \cdots & \sigma_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{n1} & \sigma_{n2} & \cdots & \sigma_{nm}^2 \end{bmatrix} \qquad (2)$$

in which the elements positioned along the primary diagonal, are the variances of X_i and the element of the secondary diagonal represent the covariance between the variables $X_i\,Y_j$. We compute the eigenvalues which diagonalizes the covariance matrix C (variance). There are n eigenvalues represented by the symbol λ.

$$= \begin{bmatrix} \lambda_1 & 0 & \cdots & 0 \\ 0 & \lambda_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \lambda_n \end{bmatrix} \qquad (3)$$

Assuming that the eigenvalues are ordered as $\lambda_1 \geq \lambda_2 \geq \dots \lambda_n \geq 0$, then λ_1 corresponds to the first principal component**.** The eigenvalues are defined as the roots of:

$$|(C - \lambda I)| = 0$$

where I is the n × n identity matrix. This equation is called the characteristic equation (or characteristic polynomial) and has n roots.

The elements ($e_1,\ e_2,\ \dots,\ e_n$) are the directions of the new rotated axes are called the eigenvectors of the covariance matrix [10]. Let λ be an eigenvalue of C Then there exists a vector v such that:

$$Cv = \lambda v$$

The vector v= (e$_1$, e$_2$, …, e$_n$) is called an eigenvector of C associated with the eigenvalue λ and represents the principal features of the data. The eigenvector with the largest eigenvalue is the direction of greatest variation in the image data set.

- **PCA Algorithm**

Our algorithm for dimensionality reductions basically consists of the following steps [11]:

- Standardize the d dimensional dataset.
$$A = X - mean$$
- construct the covariance matrix.
$$C = A. A^T$$
- decompose the covariance matrix into its eigenvectors and eigenvalues.
$$[V, U] = eig(C)$$
- sort the eigenvalues by decreasing order to rank the eigenvectors.
$$[U, index] = sort(U)$$
- Select k eigenvectors that correspond to the k largest eigenvalues, where k is the dimensionality of the new feature subspace (k ≤ d).
$$Num\_retain=k$$
- construct a projection matrix W from the first k eigenvectors.
$$W=v(:,index(1:num\_retain));$$
- Transform the d dimensional input dataset adjusted A using the projection matrix W to obtain the new k dimensional feature subspace.
$$x\_reconstruction=W *A* W' +mean;$$

Results

To apply these algorithms, we used an image grayscale of Cyrene (an ancient Greek colony in Libya) of size (675 X 900) pixels, Fig. 1.a.
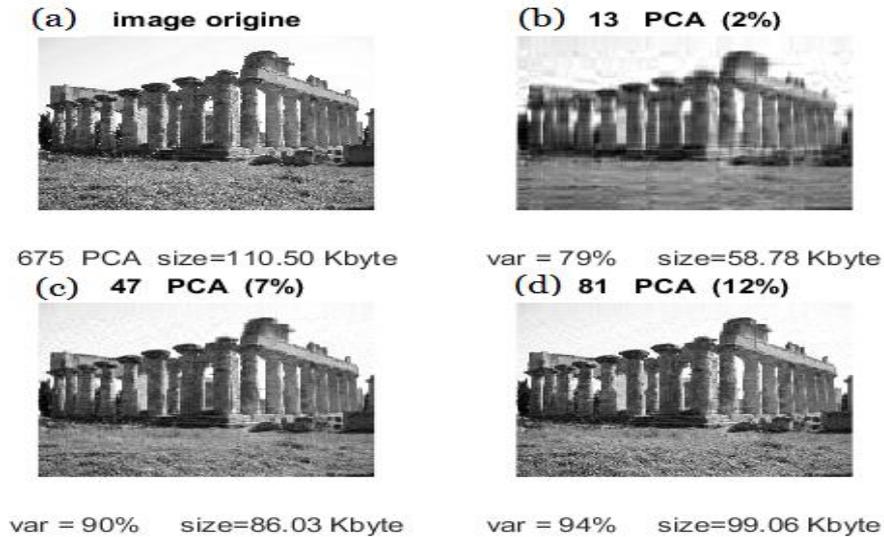
Fig. 1. (a) Original image (size = 110.50 KB); (b) feature-reduced image (size = 58.78KB, variance = 0.79); (c) feature-reduced image (size = 86.03KB, variance = 0.90; (d) feature-reduced image (size = 99.06KB, variance = 0.94).

Figures 1(b), 1(c) and 1(d) are the feature-reduced image after applying PCA. with the variance 0.79, 0.90 and 94 respectively. It can be observed that after PCA process the less significant features of the image data has been discarded but the image still maintains it's principal characteristics. Instead, the file size of Figure 1(b), 1(c) and 1(d) has reduced 53% and 77 % and 86% respectively, compared to the original image the dimension of the original image has been reduced without losing much information of the image.

Spectral decomposition is applied to the covariance matrix, generating the eigenvalues displayed below (figure 2) [12].

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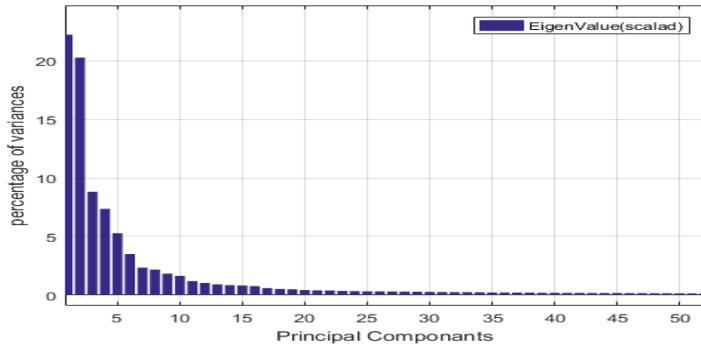
Fig.2 plot of the total variance explained by each component against its respective component.

Just as we expected, the eigenvalues are sorted from largest to smallest, as seen by the decaying trend of our curve. Ideally, we want this curve to be steeper, that is, we want as many of our eigenvalues as possible to be towards the left side of our graph so that when we use higher compression percentages we are not losing significant eigenvalues.

The explained variability of the principal components is then calculated from the eigenvalues, which is displayed in an incremental and cumulative manner (figure 3).
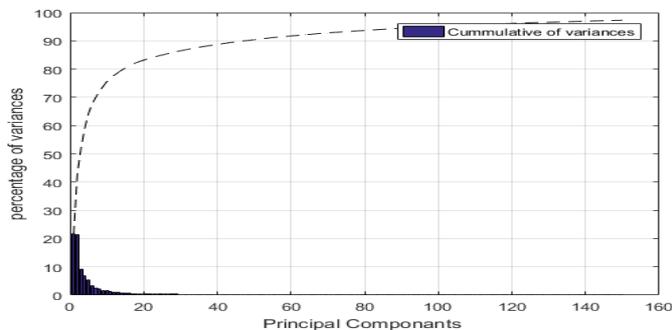

Fig.3 plot of the cumulative sum of variance explained by increasing numbers of principal components

Figure.3 shows that the first principal component alone accounts for 30 percent of the variance. Also, we can see that the first two principal components combined explaining almost 50 percent of the variance in the data. A slight elbow exists here after the seventeenth component, say the 120 components that are required here to explain 95% of the variability.

Compression rate:

This rate may be expressed in terms of the compression factor (ρ) in the approximation of **I** (original image) by **I'** (image obtained from the disposal of some of the components). The compression factor is defined by [13]:

$$\rho = \frac{I'}{I} = \frac{99.06}{110.50} = 0.89 \ \%$$

Error estimation:

To compare the various image compression, we use the Mean Square Error (MSE) and the compression rate. The MSE is the cumulative squared error between the compressed and the original image. The mathematical formulae for the MSE is:

$$MSE = \frac{1}{MN} \sum_{y=1}^{M} \sum_{x=1}^{N} [I(x,y) - I'(x,y)]^2$$

where I(x,y) is the original image, I'(x,y) is the compressed image and M,N are the dimensions of the images.
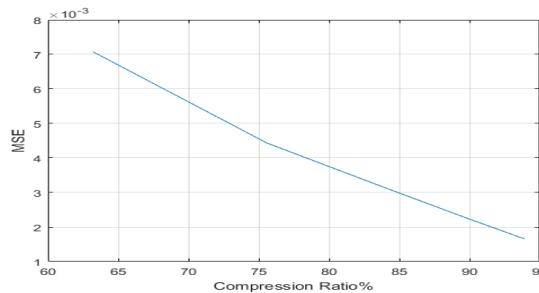
Fig.4 An illustration of the relationship between MSE and compression ratio.

This relation shows that by decreasing the value of compression Ratio, the MSE increases. where MSE shows the quality of the recovered image. Here with a compress ratio of 94% we have a value MSE of 0.0018, which mean a very weak loss.

These algorithms were tested on image of elvers as follows [14]:
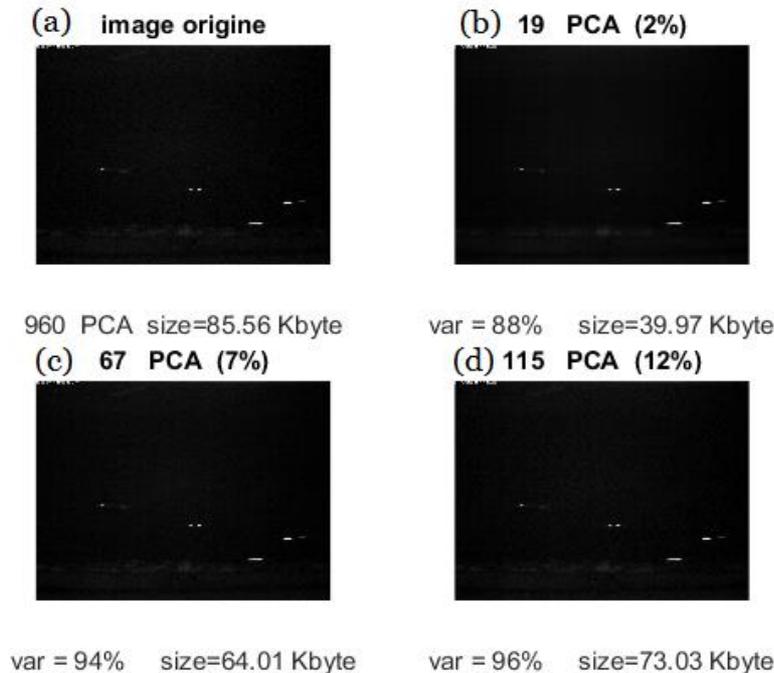

Fig. 5. (a) Original image (size = 85.56 KB); (b) feature-reduced image (size = 39.97KB, variance = 0.88); (c) feature-reduced image (size = 64.01KB, variance = 0.94; (d) feature-reduced image (size = 73.03KB, variance = 0.96), the size has reduced 46% and 74 % and 85% respectively.

Conclusion

The PCA algorithm has been used to reconstructs the original image. We can see that: if the number of principal components increases, the reconstruction becomes representative of the original image. This sequential improvement in quality is because as more principal components are used, the more the variance (information) is described. The first few principal components will have the most drastic change in quality while the last few components will not make much if any, difference to quality. Noise reduction is accomplished via reconstructing the image within the selected principal components with high variance and discarding the principal components with low variance (residual noise).

Image compression with principal component analysis is a useful and reduce the original image by 60% with little loss in image quality. Although there are more sophisticated algorithms for image compression, PCA can still provide good compression ratios for the cost of implementation.

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Tabu search for solving timetabling problem

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Abstract

Evolutionary algorithms (EA) are a set of algorithms such as Genetic Algorithm, Ant Colony, Simulating Annealing and Tabu Search that mimic real life events used to solve optimization problems. Evolutionary algorithms are considered to be a good general-purpose optimization tool due to their high flexibility accompanied by conceptual simplicity. Moreover, they have proven to be quite an effective tool for solving timetabling problems thus evolutionary algorithms framework has been chosen as a basis to build universal timetable problems solver. The problem of constructing a conflict-free examination timetable is a difficult task faced by colleges and universities across the world. The problem also varies with respect to the size, structure and constraints and with the importance of each constraint. For problem solution Timetabling will be this paper based on tabu search algorithm to speed up the optimization solution finding process from through the design of system to solve the problem of the schedule of exams in the Omar Mukhtar university.

الملخص

الـخوارزميات التطوّرية هي عبارة عن مجموعة الخوارزمياتِ مثل (Genetic Algorithm, Ant Colony, Simulating Annealing and Tabu Search) تحاكي أحداث الحياة الحقيقية المستخدمة لحل مشكلات التحسين. تعتبر الخوارزميات التطورية أداة جيدة لتحسين الأغراض

العامة بسبب مرونتها المرتفعة المصحوبة ببساطات مفاهيمية. وعلاوة على ذلك ، فقد أثبتت أنها أداة فعالة للغاية لحل مشاكل الجدول الزمني وبالتالي تم اختيار إطار الخوارزميات التطورية كأساس لبناء الحلول الزمنية للجدول العالمي. إن مشكلة إنشاء جدول زمني للامتحانات خالي من المتعارضات هي مهمة صعبة تواجهها الكليات والجامعات في جميع أنحاء العالم. وتختلف المشكلة أيضا فيما يتعلق بالحجم والهيكل والقيود وأهمية كل قيد.

لـحَلِّ المشكلةِ جدول المواعيد سَتكُونُ هذه الورقة مستندة على خوارزمية (**Tabu Search**) لتسريع عملية إيجاد حل الأمثل من خلال تصميم النظام لحل مشكلة جدول الامتحانات في جامعة عمر المختار.

Keywords: exam timetabling, optimization, tabu search.

1.Introduction:

Timetabling problems arise in a wide variety of domains including education (e.g., school and university timetabling), transport (e.g., train and bus driver timetabling), healthcare institutions (e.g., nurse and surgeon time schedule), etc. The problem of automated timetabling has attracted the attention of scientists from a number of differing disciplines, including operations research and artificial intelligence since the 1950s. Examination timetabling is a problem of allocating a timeslot for all exams in the problem instances within a limited number of permitted timeslots, in such a way that none of the specified hard constraints are violated. In addition to the hard constraints, there are often many soft constraints such as (exams in specific slot or early exams) which are desirable (but not essential) to satisfy. Most academic institutions face the problem of scheduling both courses and examinations in every semester. As the difficulty of the problem increases, due to a large number of students, courses, examinations, rooms and invigilator constraints, an automated

timetabling system that can produce feasible, and high quality timetables, is often required. Engineering and technology have been continuously providing examples of difficult optimization problems where we shall present the tabu search technique, which deals with exam timetable and gives a satisfactory result.

2.Description of the problem:

The main problem it exams timetable production process, because approaches production exams timetable manually consuming big time, besides there is constraints group and with the importance of each constraint. The constraints are divided into two types; hard constraints and soft constraints. The objectives are to satisfy all of the hard constraints as well as to satisfy as much as possible of the soft constraints. Such constraints and their importance are determined from before the educational institution.

3.Timetable problem:

Timetabling problems are a specific type of scheduling problem and are mainly concerned with the assignment of events to timeslots subject to constraints with the resultant solution constituting a timetable. According to A. Wren. (1996). [1], define timetabling in the following way, (Timetabling is the allocation, subject to constraints, of given resources to objects being placed in space time, in such a way as to satisfy as nearly as possible a set of desirable objectives).

Timetabling is a very large field covering many different types of problem, all with their own unique characteristics. Probably the most common type of timetable is a bus or train timetable. Without these, the whole transport network would be in chaos so it is easy to see the importance that timetables have in people's lives. In these cases, the timetable defines where and when buses, trains or other types of transport should be.

However, such a simple looking timetable can be very complicated to produce. The exam timetabling problem, as encountered by universities and other teaching institutions can be thought of as the problem of assigning a given set of exams to a number of time slots subject to a set of constraints. The number and variety of these constraints has increased markedly in recent years as a result of greater numbers of students. Include a set of exams to schedule, a given arrangement of time slots (either in a fixed or variable length timetable) and a set of student exam enrolments defining the clashes between exams.

The constraints on an exam timetabling problem can be divided into two categories, known as hard and soft constraints. Hard constraints are defined as those which must be satisfied in order for the solution to be considered feasible. Soft constraints are considered to be less essential and violation of these is acceptable, but still undesirable. The violation of these soft constraints is used in the evaluation of the quality of a given feasible solution. In some cases, it is required only that a solution is feasible, but more often a number of different solutions are evaluated with the aim of finding the best or most suitable.

4. The constraint

According to L. T.G. Merlot, N. Boland, B. D. Hughes, and P. J. Stuckey(2002).[2], when assigning an examination to a certain time slot, several constraints must be considered.

- **Time Clash Constraint:** A student group cannot have more than one examination at the same time.

- **Semester Clash Constraint:** Student groups from the same major but in different semesters cannot have examinations at the same time. This is needed to enable students who are re-taking a course from a previous semester due to poor performance to sit for the course examination.

- **Core Exam Constraint:** A student group cannot take more than one core examination per day.

- **Exam Restriction Constraint:** A student group cannot have more than a certain number of examinations per day.

- **Difficulty Constraint:** A student group cannot have two difficult examinations in two consecutive days (difficulty rating for a course is assigned by the course lecturer and students).

- **Capacity Constraint:** The total number of students sitting for an examination in a certain time slot cannot exceed a predefined limit. This constraint ensures that the total number of students sitting for an examination at a certain time slot do not exceed the total number of available seats in the university campus.

- **Pre-assignment Constraint:** An examination should be scheduled in a specific time slot.

- **Unavailability Constraint:** An examination should not be scheduled in a specific time slot.

4.1 Hard constraints

The hard constraints for TSOS system (the examination-timetabling problem) are:

1. There must be enough seating capacity.
2. No student should be required to sit two examinations at the same time.

4.2 Soft constraints

The soft constraints for TSOS system (the examination-timetabling problem) are:

- Courses have set in first period.

- Courses have set in second period.

- Courses have set in same period.

- Courses have not set in same period.
- Courses have set in limited period.

5. Tabu search

Word origin tabu: The word tabu (or taboo) comes from Tongan, a language of Polynesia, where was used by the aborigines of Tonga Island to indicate things that cannot be touched because they are sacred.

Tabu search, F. Glover (1990). [3] Is a well known meta-heuristic that guides a local heuristic search procedure to explore the solution space beyond local optimality. Its major components K. S. Al-Sultan (1990). [4] Are a set of moves for generating a set of trial solutions, a set of tabu restrictions (recorded in a tabu memory) for forbidding some moves, and a set of aspiration criteria for releasing some forbidden moves. For a given solution, a given tabu memory re-cording the given solution, and a given set of aspiration criteria, the tabu search regards the given solution as the current solution and the best solution visited. It then iteratively operates according to the following steps until the termination condition is satisfied. First, the tabu search performs a set of moves on the current solution to generate a set of trial solutions. Based on the tabu memory, the tabu search checks whether each newly generated trial solution is tabu. If the newly generated trial solution is identical to one of the solutions in the tabu memory, it is tabu; otherwise, it is an allowable solution. If the tabu solution satisfies the aspiration criteria, the tabu search then restores the tabu solution to an allowable solution. The tabu search selects the best among all allowable trial solutions as the next solution and then inserts the next solution into the tabu memory (if the tabu memory is full, the oldest solution in the tabu memory is removed). Finally, the next solution replaces the best solution visited if the next solution is better.

According to F. Glover M. Laguna (1990). [5], a description of the various steps of the tabu search method is as follows:

1. Choose a feasible solution to start the process. This solution is the present best solution.

2. Scan the entire neighborhood of the current solution in search of the best feasible solution.

3. Replace the best solution with the new one. Update the recency-based memory and go to step 2.

The flow diagram of the steps are depicted in Figure-1 governs a typical process of tabu search.

6. History of Tabu Search

The roots of tabu search go back to the 1970's, Glover (1986) [6] first presented it in its present form, the basic ideas have also been sketched by Hansen (1986) [7]. Many computational experiments have shown that tabu search has now become an established optimization technique which can compete with almost all known techniques and which by its flexibility can beat many classical procedures. In the following years, many other new approaches, mostly based on analogies with natural phenomena, were proposed (tabu search, Ant Systems, Threshold Methods). Now collectively known under the name of Meta-Heuristics (a term originally coined by Glover in 1986), these methods have become over the last fifteen years the leading edge of heuristic approaches for solving combinatorial optimization problems. Note (In fact, many elements of this first TS proposal, and some elements of later TS elaborations, were introduced in Glover, 1977, including short term memory to prevent the reversal of recent moves, and longer term frequency memory to reinforce attractive components.).
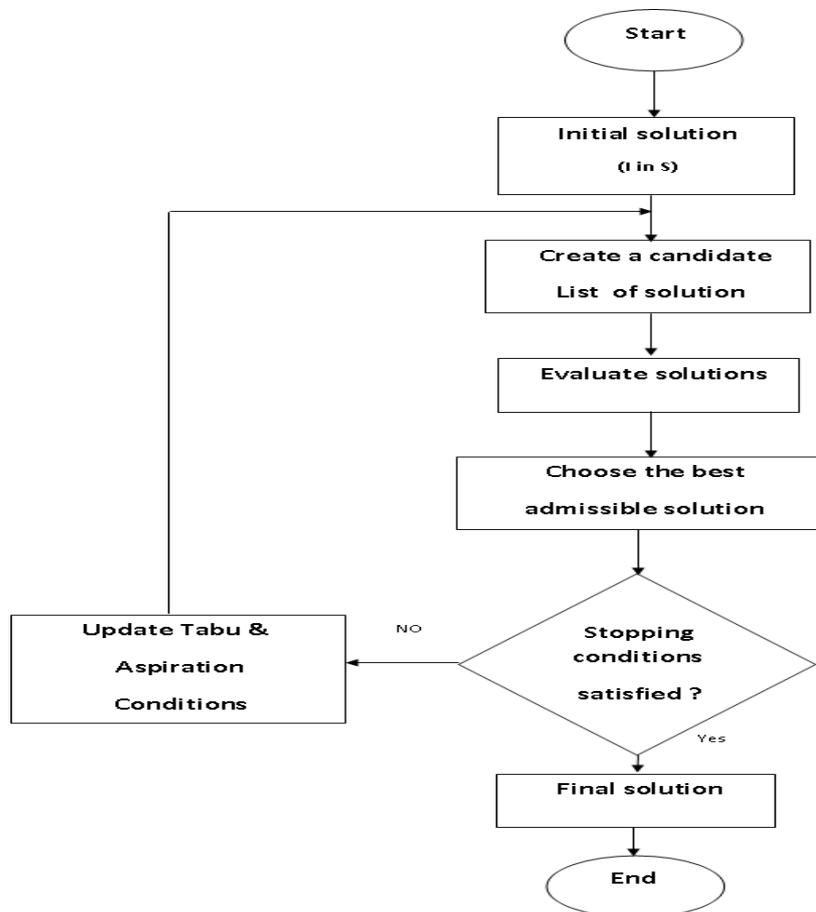
Figure-1: Flow chart of the basic tabu search

7. Elements of the tabu algorithm

According to Solomon (1987)[9],Liu and Shen (1999)[10]. presented brief discussion of the main element of TS algorithm.

7.1 Tabu list:

A list of the last few moves (or solutions). The memory of moves can be recency or frequency-based. Short-term recency-based memory forbids cycling around a local neighborhood in the solution space through setting

the last T moves as Tabu.

Recently made moves are stored in a mechanism that is referred to as the Tabu-Move list. The number of moves in the list is determining by the tabu list size, denoted by T. The list operates on a first-in-first-out principle. Other recency information that is stored in the Tabu list is the solution configurations. The larger the value of T, the longer the moves and solutions stay tabu.

The Tabu-Solution list is a set of solutions that have been created recently by exchanging segments between routes. Long-term frequency-based memory allows searches to be conducted in the most promising neighborhoods. The frequency-based memory provides additional information of how many times a tabu move has been attempted. To alleviate time and memory requirements, it is customary to record an attribute of a tabu solution, and not the solution itself.

7.2 Stopping criteria:

The search is terminated once a preset maximum number of iterations of the main TS algorithm have been reached. Alternative stopping criteria could be a predetermined number of attempts being made to set the same solution in the Tabu-Solution list as the new current solution. This indicates that the search has been caught in a local optimum, hence terminating the search.

8. Basic concept of tabu search

According to Fred Glover 1986[6], proposed a new approach, which he called Tabu Search. The basic principle of TS is to pursue LS whenever it encounters a local optimum by allowing non-improving moves cycling back to previously visited solutions has prevented by the use of memories, called tabu lists that record the recent history of the search, a key idea that can be link to Artificial Intelligence concepts.

8.1 Initial solution:

It is a randomly generated initial examination table so that the order of the courses and the timeslots in the form of two-dimensional matrix of the first row is a courses and the second row is the timeslot, so that the swapping process is on the second row while the first row has fixed as in table-1.

Table-1: Representation exam timetable

courses number	C1	C2	C3	C4	C5	-------------	Cn
Timeslot	p1	p6	P5	p3	p2	-------------	Pn

After generation, the initial table its verified hard constraint if its success then follows the mechanism of the algorithm in according the sequence otherwise it must regeneration of new and so on until we get on the table can be use verifies all hard constraints. Then evaluate the table and in accordance with the soft constraint and infer the value of the final bonuses which represents the table quality. Moreover, to generate other solutions, a randomly swapping process has used as in Figure-3. The cells used in the swapping is stored in the list to prevent the repetition process is called the tabu list.

P1	(P6)	P5	P3	P2	P4	(Pn)
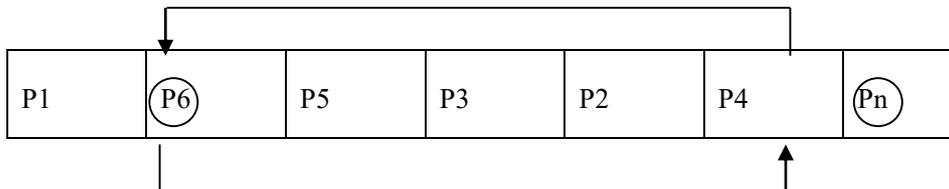
Figure-3: Swapping process.

8.2 Swap function:

swap1= **random(num_courses)**

Where: *swap1*= Generate random number within range of the number of the courses.

$$swap2= \text{random(num\_courses)}$$

Where:*swap2*= Generate random number within range of the number of the courses.

If *swap1 = swap2* then go to *swap2*.

let $X = 338$imeslot[swap1]

let timeslot[*swap1*] = timeslot[*swap2*]

let timeslot[*swap2*] = X

8.3 Tabu list:

This list mechanism depends on (first-in-first-out) in the form of Queue as figure-4, to prevents visiting solutions you visited soon. So that is controlled in the size of the list is considered as adapted memory (short or medium or long) from it we get results

First- in

First- out
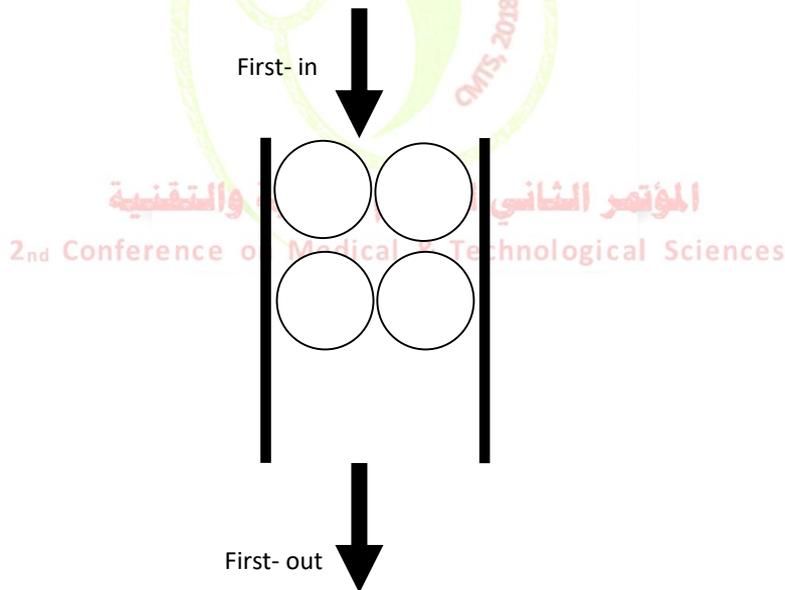
Figure-4: Tabu list.

which obtained by compared list with the stop criteria after obtain the appropriate value for satisfy the soft constraints.

8.4 Fitness function:

According to[11], represent the solution (table) quality where a large

number of bonus, mean high the value of the quality of the table.

$$fitnes = \sum_{i}^{N}(B * X)$$

Where:

- N ⟶ (numbers of constraints).
- B ⟶ (the value of the bonus soft constraint) each soft constraint has value specified by the system user represents the importance of constraint.
- X ⟶ (Number of cases of bonus of the soft constraint) are counted cases that have verifies the soft constraint.

8.5 Stop criteria:

Determine from the user where value set for times number of generation solutions then stop or from through value limited to the best fitness, or from through limited time, or stopped directly by user.

9 Tabu Search algorithm steps

The Tabu Search used in our system, as depicted in figure-5, consists of the following steps:

Step1: Generate initial exam tables randomly.

Step2: Verify hard constraint imposed on the table if not applicable then

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go to step [1].

step3: Check and calculate fitness initial exam table according to soft constraint.

step4: Generate two random numbers to use in the swapping process.

step5: If two numbers exist in the tabu list then go to step [4].

step6: Swap table cells data versus two random numbers.

Step7: Verify hard constraint imposed on the table if not applicable then go to step [6].

step8: Add the two numbers in tabu list.

step9: Verify and calculate the fitness for each table in according to soft constraint.

step10: Order the tables according to fitness for each table.

step11: If the stop criteria have not verified then go to step [5].

step12: Display the exam table that has top fitness.

Step13: End.

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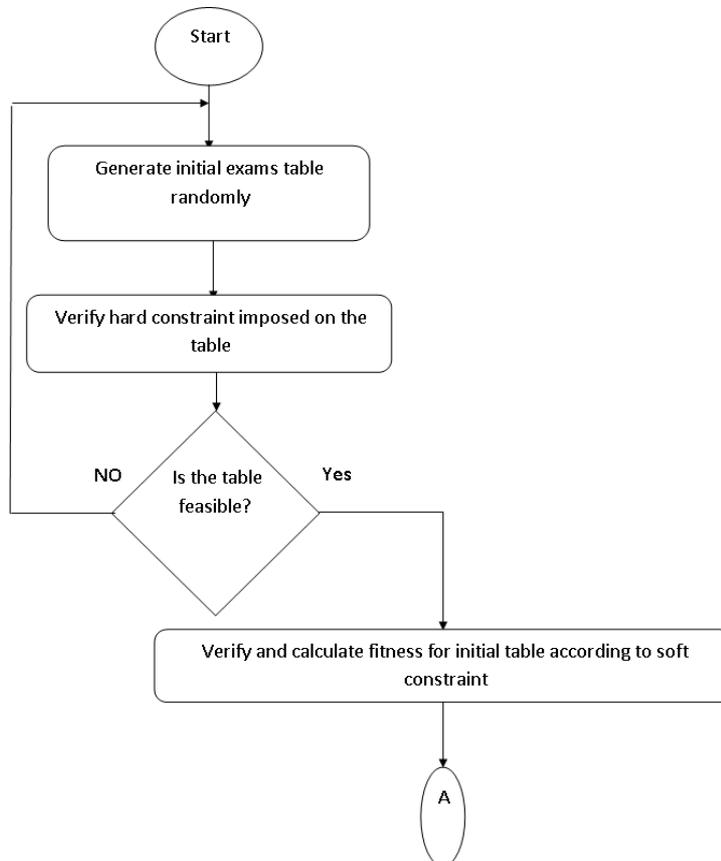
Figure-5: TSOS flow charts.-a
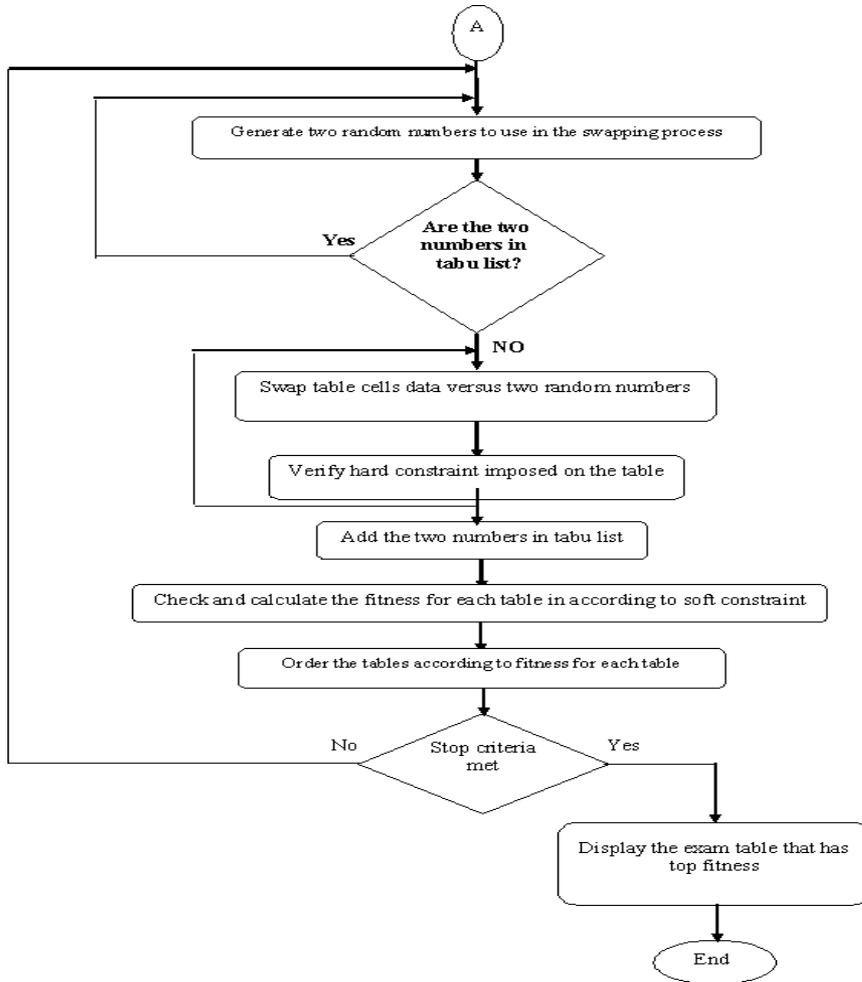
Figure-5: TSOS flow charts-b

10.Experiments and results

We will examine the different operators on real world data as case study. The case study is the timetable for the faculty of literatures and sciences in

the University of Omar Almukhtar (Branch Alguba).

The TSOS system has tested more than once in order to assess the impact of each operator and parameter on TS to obtain the best solution. Because the problem at hand is an optimization problem that could continue indefinitely so; the stopping criteria is based on the number of timetable generations or directly stopped by user.

All the experiments have performed on a Laptop computer with 1.86 GHz Intel processor, 1.49 GB of RAM, 80 GB hard disk, programming language Visual Basic Studio 2008 and Microsoft Windows 7 operating system.

10.1 Experiment 1

The experiment 1 of the TSOS system performance is the independent variable length of tabu list parameter with values of 1, 10,30,50,80 and 100. The other parameters had considered as the dependent variables. The dependent variables had fixed as follows:

Count of tables at 1000.

Count of courses at 40.

The results of this experiment had depicted in table.1 and the results had displayed graphically in figure-6.

Table-1: Results of experiment 1.

| Tabu list length	Time (min)	Best fitness value
1	0:24	15220
10	0:25	18520
30	0:28	17060
50	0:32	17290
80	0:36	18190
100	0:39	13420
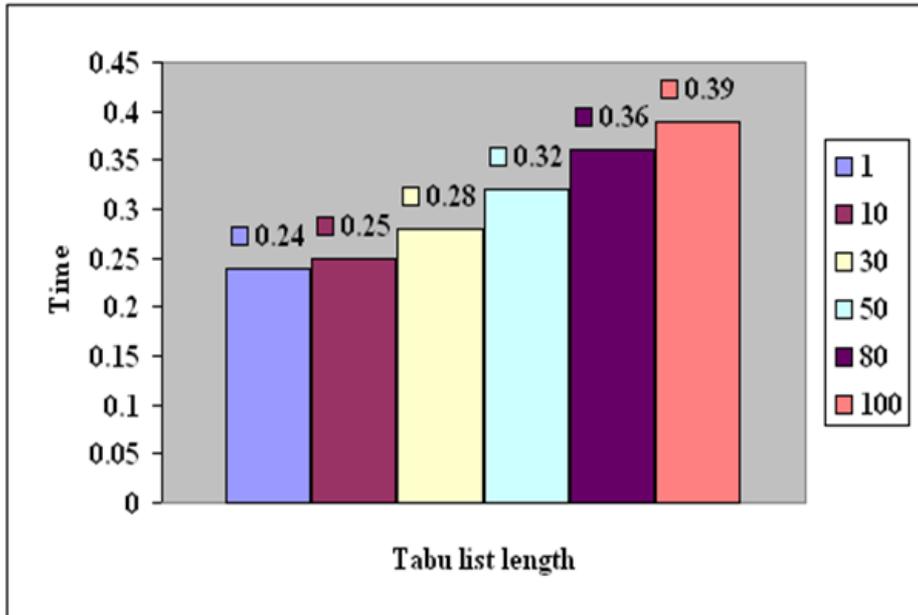
Figure-6: Results of experiment 1.

The above results show that whenever the tabu list length is increased, the time of run is increased. On the other hand, the system took more time. From this experiment, we can say that the best tabu list length is at (10) where the fitness value is (18520) and the time is (25 sec) which suitable than other.

10.2 Experiment 2
The experiment 2 of the TSOS system performance is the independent variable length of tabu list parameter with values of 1, 10,30,50,80 and 100. The other parameters had considered as the dependent variables. The dependent variables had fixed as follows: Count of tables at 500.
The results of this experiment had depicted in table-2 and the results had

displayed graphically in figure-7.

Table-2: Results of experiment 2.

| Tabu list length	Time (min)	Best fitness value
1	0:18	16220
10	0:19	16790
30	0:21	16520
50	0:23	17490
80	0:25	17290
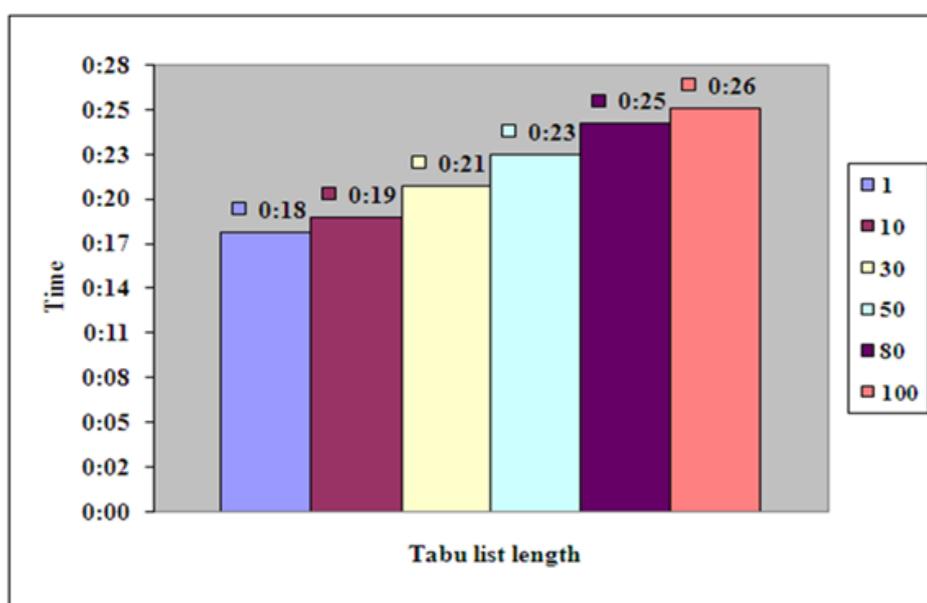
Figure-7: Results of experiment 2.

The above results show that whenever the tabu list length is increased, the time of run is increased. On the other hand, the system took more time. From this experiment, we can say that the best tabu list length is at (50) where the fitness value is (17490) and the time is (23 sec) which suitable than other.

10.3 Experiment 3

The experiment 3 of the TSOS system performance is the independent variable length of tabu list parameter with values of 1, 10,30,50,80 and 100. The other parameters had considered as the dependent variables. The dependent variables had fixed as follows: Count of tables at 400.

The results of this experiment had depicted in table-3 and the results had displayed graphically in figure-8.

Table-3: Results of experiment 3.

| Tabu list length	Time (min)	Best fitness value
1	0:16	13670
10	0:17	13650
30	0:19	16060
50	0:20	16460
80	0:22	15420
100	0:23	14390
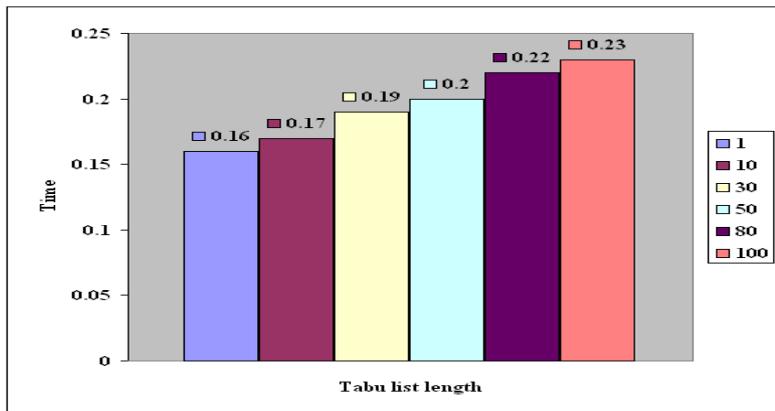
Figure-8: Results of experiment 3.

The above results show that whenever the tabu list length is increased, the time of run is increased. On the other hand, the system took more time. From this experiment, we can say that the best tabu list length is at (50) where the fitness value is (16460) and the time is (20 sec) which suitable

than other.

10.4 Experiment 4

The experiment 4 of the TSOS system performance is the independent variable length of tabu list parameter with values of 1, 10,30,50,80 and 100. The other parameters had considered as the dependent variables. The dependent variables had fixed as follows: Count of tables at 150.

The results of this experiment had depicted in table-4 and the results had displayed graphically in figure-9.

Table-4: Results of experiment 4.

| Tabu list length	Time (min)	Best fitness value
1	0:12	13150
10	0:12	13120
30	0:13	13420
50	0:13	13420
80	0:14	11350
100	0:14	10390
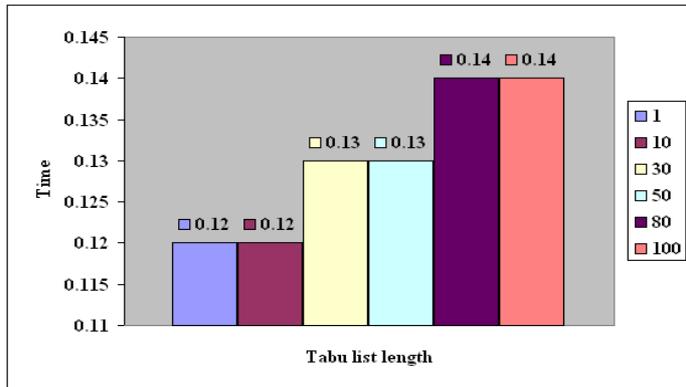
Figure-9: Results of experiment 4.

The above results show that whenever the tabu list length is increased, the time of run is increased. On the other hand, the system took more time.

From this experiment, we can say that the best tabu list length is at (30) and (50) where the fitness value is (13420) and the time is (13 sec) which suitable than other.

10.5 Experiment 5

The experiment 5 of the TSOS system performance is the independent variable length of tabu list parameter with values of 1, 10,30,50,80 and 100. The other parameters had considered as the dependent variables. The dependent variables had fixed as follows: Count of tables at 50.

The results of this experiment had depicted in table-5 and the results had displayed graphically in figure-10.

Table-5: Results of experiment 5.

| Tabu list length	Time (min)	Best fitness value
1	0:10	13150
10	0:10	12250
30	0:11	11350
50	0:11	13420
80	0:12	11460
100	0:12	9910
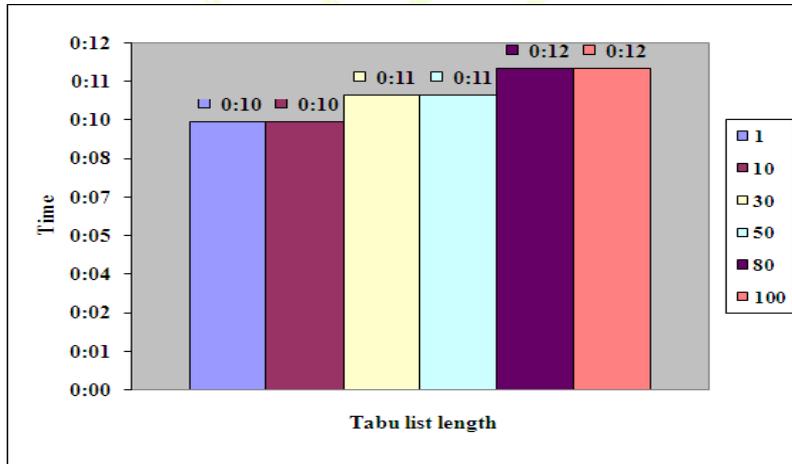
Figure-10: Results of experiment 5.

The above results show that whenever the tabu list length is increased, the time of run is increased. On the other hand, the system took more time.

From this experiment, we can say that the best tabu list length is at (50) where the fitness value is (13420) and the time is (11 sec) which suitable than other.

10.6 Experiment 6

When Length of tabu list at 1: The results of this experiment had depicted in table-6 and the results had displayed graphically in figure-4.9.

Table-6: Results of experiment 6.

| Count of exam time table	Average of best fitness value
1000	16180
500	16794
250	14834
150	13824
100	10681
50	11124
10	8874
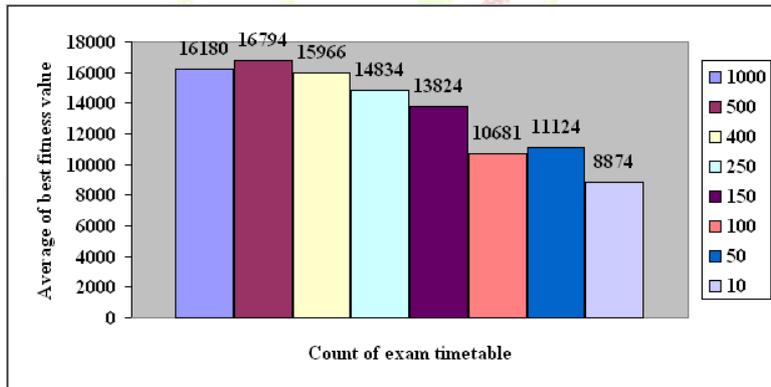
Figure-11: Results of experiment 6.

Through the foregoing results presented above, we conclude that when of the length of tabu list 1, as well as the number of generated tables 500, we

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have acquired the highest value to Average of best fitness value from between all value.

10.7 Experiment 7

When Length of tabu list at 10: The results of this experiment had depicted in table-7 and the results had displayed graphically in figure-12.

Table-7: Results of experiment 7.

| Count of exam time table	Average of best fitness value
1000	17149
500	17911
400	16966
250	14544
150	14329
100	13490
50	11924
10	8874
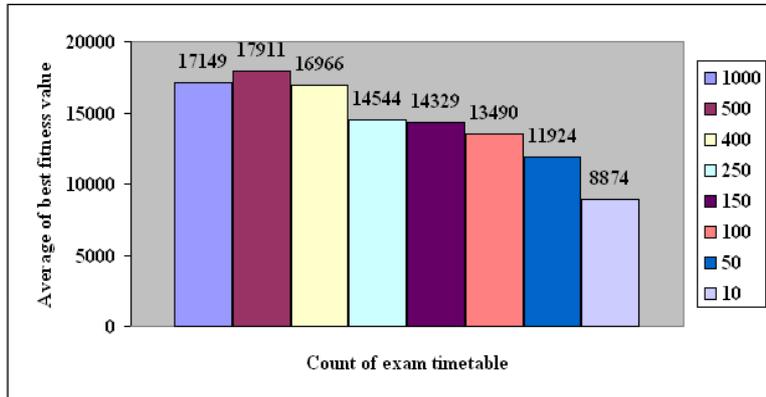
Figure-12: Results of experiment 7.

Through the foregoing results presented above, we conclude that the length of the length of tabu list 10, as well as the number of generated tables 500, we have acquired the highest value to Average of best fitness value from between all value.

11. Conclusion

Tabu Search approach can be useful in solving examination-timetabling problems. in the next steps we demonstrate the obtained conclusion:

From through previous experiments we conclude that whenever we increase the number of generated tables, and diminish the length of tabu list we approaching an optimal solution.

When was the length of tabu list at 10 and the number of generated tables at 500 we reached to high best fitness from through all foregoing experiments.

Upon increase the length of tabu list which consume more time because the search process of swapping between timeslots require for verification of forbidding iteration in the tabu list.

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Using Chaos to Improve Communications Security

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Abstract

Communications systems security is becoming very important, since the whole world rely on reliable and efficient information being delivered by trusted users, companies, military and government agencies and received by trusting entities. The problem is; information while in the media between the sender and the receiving end is being compromised and many hacking techniques are used to steal and or disturb information and prevent it from reaching its destination complete, safe and secure. This problem has been researched and it was found that most work toward solving it have been done using conventional methods, which are not reliable and inefficient, so non-conventional method must be implemented, where specific chaotic signals are used to carry information on the transmitting side and chaotic circuits are used to extract information on the receiving end. This technique has been proven to be more efficient and reliable in assuring that information reaches its destination, complete, safe and secure, and that was verified and proven by utilizing NI's Multisim tools.

Keywords: Communications Security; Chaos; Chua Circuit; Masking; Synchronized Chaotic Systems

الملخص

أصبح أمن أنظمة الاتصالات في غاية الأهمية ، لأن العالم كله يعتمد على المعلومات الموثوقة والفعالة التي يتم تقديمها من قبل المستخدمين الموثوقين ، والشركات ، والمؤسسات العسكرية والحكومية ، وتتلقاها كيانات تثق في مصداقيتها وتعتمد عليها. المشكلة هي أنه يتم التعرض للمعلومات في وسائل الإتصالات بين المرسل والمتلقي ، ويتم استخدام العديد من تقنيات القرصنة لسرقة المعلومات أو التلاعب بها ومنعها من الوصول إلى وجهتها كاملة وآمنة ومأمونة. وقد تم البحث كثيرا في هذه المشكلة ووُجد أن معظم العمل على حلها قد تم باستخدام طرق تقليدية لا يمكن الاعتماد عليها لأنها غير فعالة ضد القرصنة التي تستخدم أحدث طرق النكنولوجيا ، لذلك يجب استخدام تقنيات غير تقليدية ، مثل تحميل المعلومات على إشارات فوضوية تستخدم لنقل المعلومات في جانب المرسل وتستخدم دوائر جانبية فوضوية لاستخراج المعلومات على الطرف المتلقي. وقد ثبت أن هذه التقنية أكثر كفاءة وموثوقية من أجل ضمان وصول المعلومات إلى وجهتها ، كاملة وآمنة ، وتم التحقق من ذلك باستخدام أدوات الملتيسيم.

الكلمات الدليلية : أمن الاتصالات ، الفوضى (كايوس) ، دائرة شوا ، الإخفاء ، نظم الفوضى المتزامنة

I. Introduction

Communications systems security is one of the important factors when it comes to government, public, private and military work reliability, efficiency and safety. The problem is that security has been the main target

of various attackers; from individual hackers to competing businesses to government and international intelligence agencies. Information, while in the media between the sender side and the receiving end is being compromised and many advanced hacking techniques are used to steal and or disturb information and prevent it from reaching its destination complete, safe and secure.

Most of the work toward solving this problem has been done using conventional methods, which is unreliable and inefficient, that is why it is important to use non-conventional methods, specifically using chaotic signals to hide information on the transmitting side and using chaotic circuits to extract information on the receiving end. In specific, this is done by utilizing the concept of masking and utilizing synchronized chaotic systems to improve communications systems security.

This paper is structured as follows. In Section II the communications security problem is studied and that includes the scope of security threats, sources of security threats, types of threats, and how it was dealt with. Chaos and how it is implemented in communications control is discussed in Section III. The design and results of a specific synchronized chaotic system is detailed in Section IV. At the end, some concluding remarks and recommendations are listed in Section V.

II. Security Threats and Challenges

Conventional communications security features are not sufficient by themselves to provide a secure system. Security has to be considered throughout the entire development life cycle of networks and its components as part of quality assurance and system reliability [1] and using nonconventional methods can overcome and strengthen any weak points in the security cycle. Although this work emphasizes the importance of media security threats, it also recognizes the existence of some other important security threats like insider security threats and disaster and accident threats.

A. Sources of Security Threats

Sources of security threats can be classified as: Employees/insiders,

natural disasters and malicious hackers [1]. About 65% of security threats are intentional and accidental errors, omissions, and malicious acts by employees cause the majority of the damages and losses experienced in the communications industry. About 20% of security threats are natural disasters and accidents resulting from man-made causes which can affect the availability of reliable, safe and secure communications service. Disasters such as earthquakes, floods, fire, etc., impact the timeliness and quality of services and only about 15% of threats are due to hackers [1].

B. Types of Security

Most of the threats come from the Trojan family such as Zeus and Spy Eye. Other examples of threats are: Backdoor, Botnet, Phishing, Kelogger, Adware, Dialer and Cookies.

C. Communications Security Challenges

The protection of telecommunications systems is very important and challenging for a number of reasons. First, government, military and industry have become dependent upon telecommunications. Second, many distributed systems rely on the underlying fixed or mobile phone network in ways that are often not obvious. Third, the history of security failures in communications is very well known. One of the main problems in communication security is the ability of intruders to interrupt information while it is in the medium between the transmitting end and the receiving end. Intruders rely on the fact that information is carried over some specific signals that could be predicted and estimated which means carried signals could be reproduced and used to extract the sent information and/or disturb it and change its contents according to intruders evil desires. One solution to this problem is to carry the signal over unpredictable chaotic signal. Fig. 1 shows an example of a signal and its conventional carrier that could be predicted or estimated, while Fig. 2 shows an example of a signal and its unconventional chaotic carrier which could not be predicted or estimated, which means securing the information on its way from the sender to the receiver and assuring that it reaches its destination complete and secure.
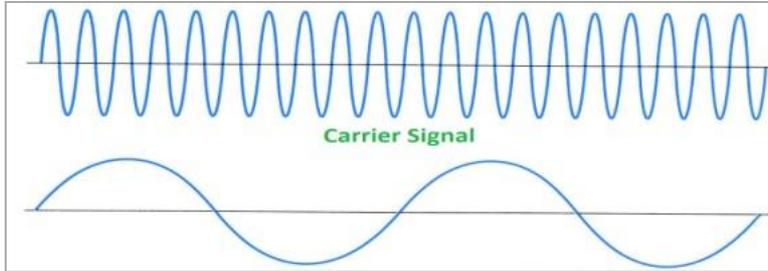
Fig. 1. A signal and its conventional carrying signal
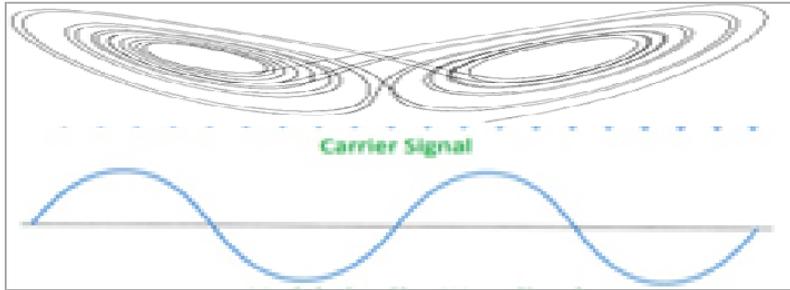
Fig. 2. Using a chaotic carrier

III. Using Chaos in Communications Control

A. Chaos

Chaos is a word derived from the ancient Greek, which means unpredictable behavior and opposite of the cosmos or order, however it is known to be "a periodic long-term behavior in a deterministic system that exhibits sensitive dependence on initial conditions" [6]. A nice property of chaos can be seen by plotting the variable z versus x of Lorenz system, which can be summarized in (1) and its graph is shown in Fig. 3. The figure shape is called "strange attractor", and it demonstrates how a simple looking deterministic system could have extremely erratic dynamics [2] and that could be simulated using Chua's circuit.

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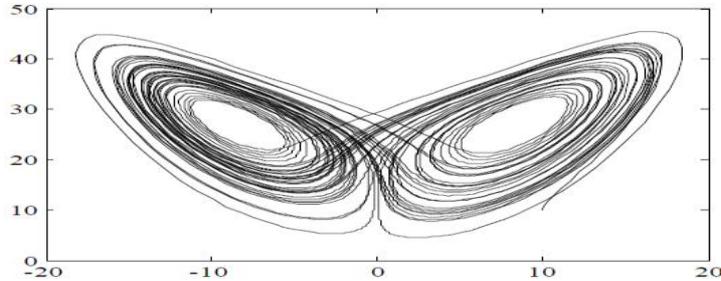
Fig. 3. A strange attractor of the Lorenz system [2]

B. Chua's Circuit

Chua's circuit (Fig. 4 (a)) is a simple oscillator circuit that exhibits classic chaos behavior, it was introduced by Leon Chua in 1983. It has only one nonlinear element; a 3-segment piecewise-linear resistor (Fig. 4 (b)) [2].
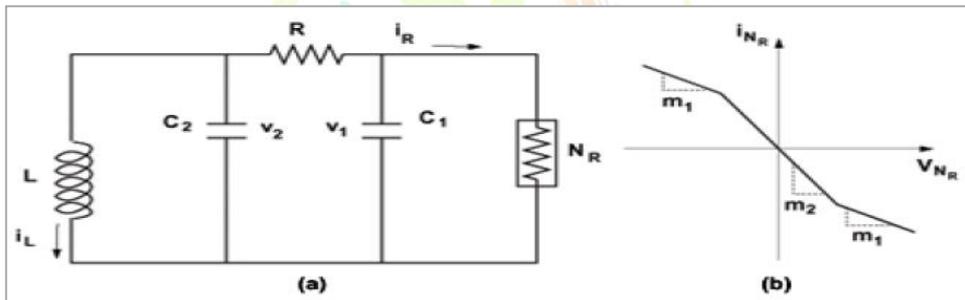

Fig. 4. (a) Chua's circuit and (b) Characteristic curve of Chua's diode [2]

Chua's circuit in the normalized form can be written as in [2]:

$$\dot{x} = \alpha\,(y - x - f(x))$$
$$\dot{y} = x - y + z \tag{1}$$
$$\dot{z} = -\beta\,y - \gamma\,z$$

where $f(x)$ is the following piece-wise linear function:

$$f(x) = G_b x + 0.5(G_a - G_b)(|x+1| - |x-1|) \tag{2}$$

α, β and γ are the parameters of the system that governs the chaotic property, $\alpha = 10$, $\beta = -14.87$, $\gamma = 0$, while $G_a = -1.27$ and $G_b = 0.68$ [2].

Implementing Chua circuit is not easy, because it is difficult to find an inductor with a specific value and it is very hard to find Chua's diode in the market, so the Kennedy modified circuit is used instead [5] (Fig. 5).
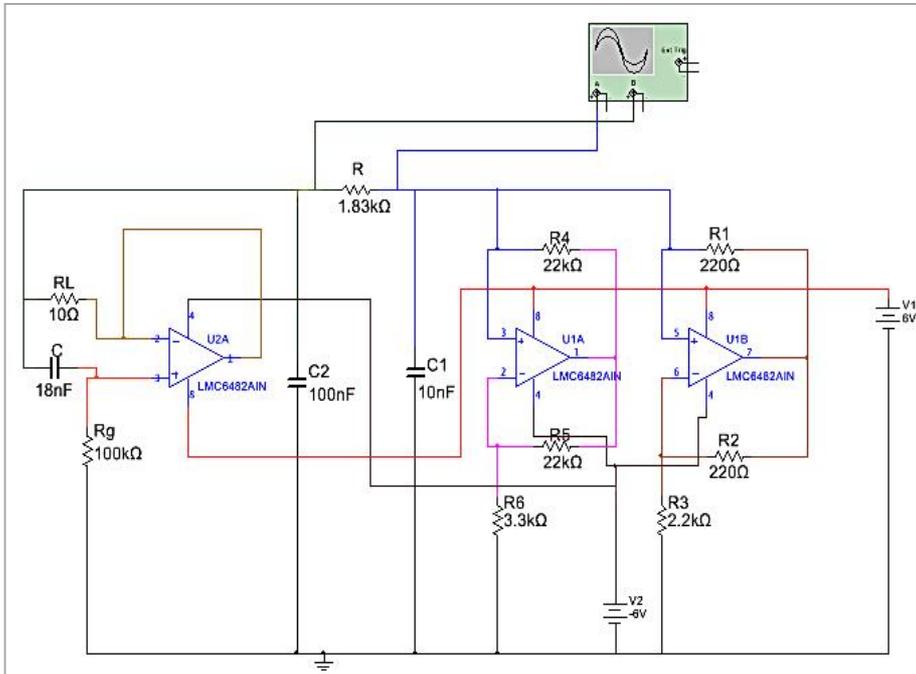

Fig. 5. Kennedy Modified Chua's circuit

C. Chaotic Masking

This is one of the earlier methods to use chaotic signals for transmitting a message signal as described in [2] and is illustrated in Fig. 6. In this scheme, the message signal is added, i.e. masked, to the output of a chaotic oscillator at the transmitter side prior to transmission. Upon receiving the signal at the receiver, a chaotic synchronization is performed and the estimate of the chaotic component is subtracted from the received signal, Thus recovering the original message signal m(t).

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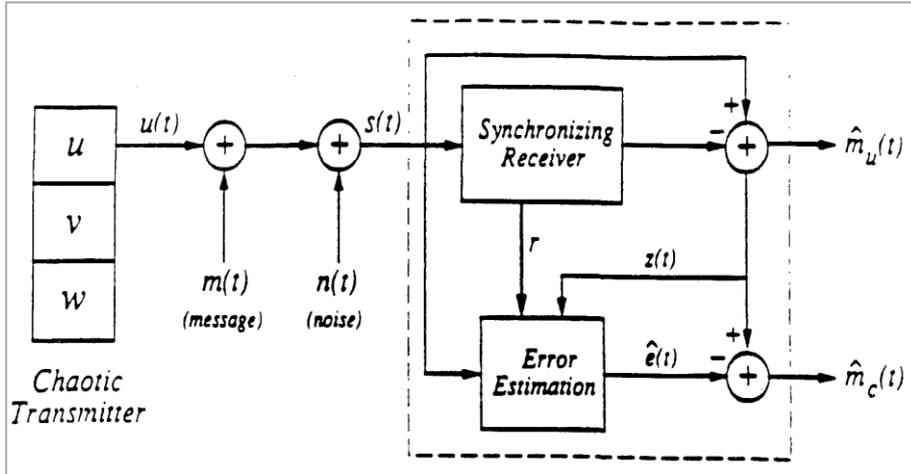
Fig. 6. Chaotic communication scheme based on chaotic masking [2]

In the simulations below, extracting the transmitted signal is done with no estimation and the state space representation is as in [2]:

$$\dot{x}(t) = F(x(t)) \quad, \quad \dot{y}(t) = H(x(t)) \qquad (3)$$

The output signal is $y(t)$ which is the function of the transmitter state $x(t)$. It is added to $m(t)$ to form the transmitted signal $s(t)$ which is given by:

$$s(t) = u(t) + m(t) + n(t) \qquad (4)$$

The receiver dynamics, which is being driven by $s(t)$, is given by the following state space representation [2]:

$$\dot{\tilde{x}}(t) = F(\hat{x}(t), s(t)) \qquad (5)$$

$$\dot{\tilde{y}}(t) = H(\hat{x}(t)) \qquad (6)$$

$$\tilde{m}(t) = s(t) - y^{\wedge}(t) \qquad (7)$$

The main task is how to mask the transmitted signal and use chaotic signal as noise so the transmitted signals would not be apparent until the receiver supplies the exact chaotic synchronized signal to uncover the transmitted signal [2].

IV. System Design and Results Analysis

When this work started on improving telecommunication security, it was thought that conventional methods, especially concerning modulation and

demodulation and using the usual carrier signals would do the job, so, a mod/demodulation circuit has been used as shown on Fig. 7, which is explained in [6], then comes the idea of using non-conventional methods, like chaos, so the chaotic circuit shown in Fig. 3, which is a modification of Chua chaotic circuit shown on Fig. 4, was used instead, because of the unavailability of the coil and Chua's diode, to supply a chaotic signal shown in Fig. 6 which is used to carry the transmitted signal, but it was discovered that two problems arise, one is the need for synchronization between the transmission side and the receiving end, and the other is the need to modify the circuit parameters every time the input signal is changed: sine, sawtooth, square, etc. The mod/demodulation circuit is shown in Fig. 7, and the input signal (transmitted), the carrying signal and the received signal are shown in Fig. 8.
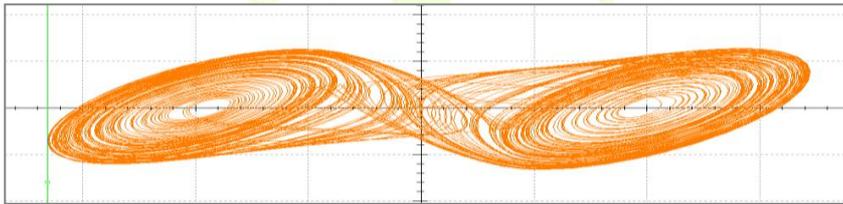

Fig. 6. Chua's chaotic signal used to carry the transmitted signal
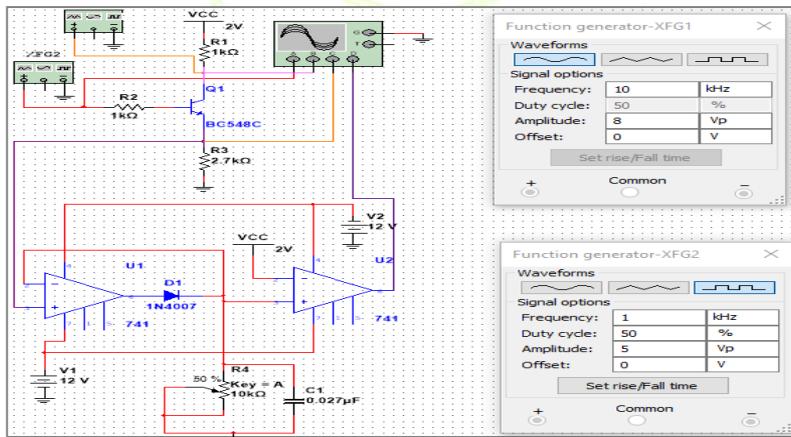
Fig. 7. Modulation/demodulation circuit [4]

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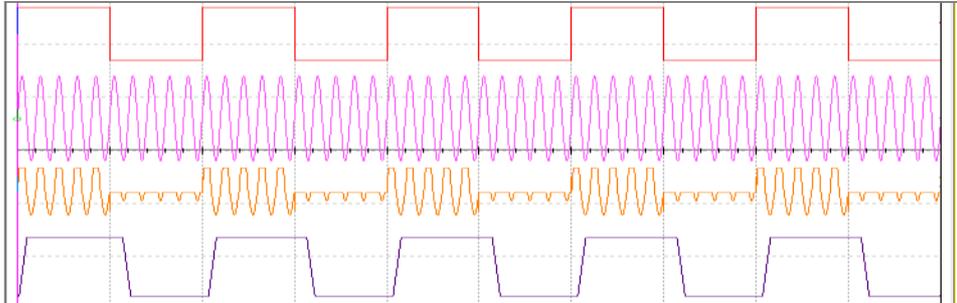
Fig. 8. The transmitted (top) signal and the received signal (bottom)

The above conventional method does not guarantee the arrival of the transmitted signal complete, safe and secure to its destination, because intruders can interrupt the signal in its way in the medium and extract the transmitted signal simply by using the right carrier signal.

To solve the security (intrusion) problem above, a chaotic signal from Chua circuit was used to carry the transmitted signal and injected it in the mod/demod configuration, on the other side a chaotic circuit is to be used to extract the transmitted signal and deliver it complete and safe (Fig. 9), thinking that is all what is needed to do the job, but that was not sufficient, since that worked for specific signals at specific frequencies, due to not only the chaotic carrier's signal deterministic random behavior but also due to the need for synchronization, because the two chaotic circuits, on the transmitting end and the receiving end cannot be the same at the same time, due to noise and the system dynamics which may affect sensitive parameters that largely affect the chaotic phenomena, mainly "very tiny changes in initial conditions may lead to huge change in the chaotic outcome", that would be a big factor in a mismatch between the transmitted information and the signal received at the destination, which means there is a need for synchronization which was utilized as needed. (notice that the received signal shown in Fig. 10 is not exactly the same as the one transmitted, though it is very close), but it was found that by
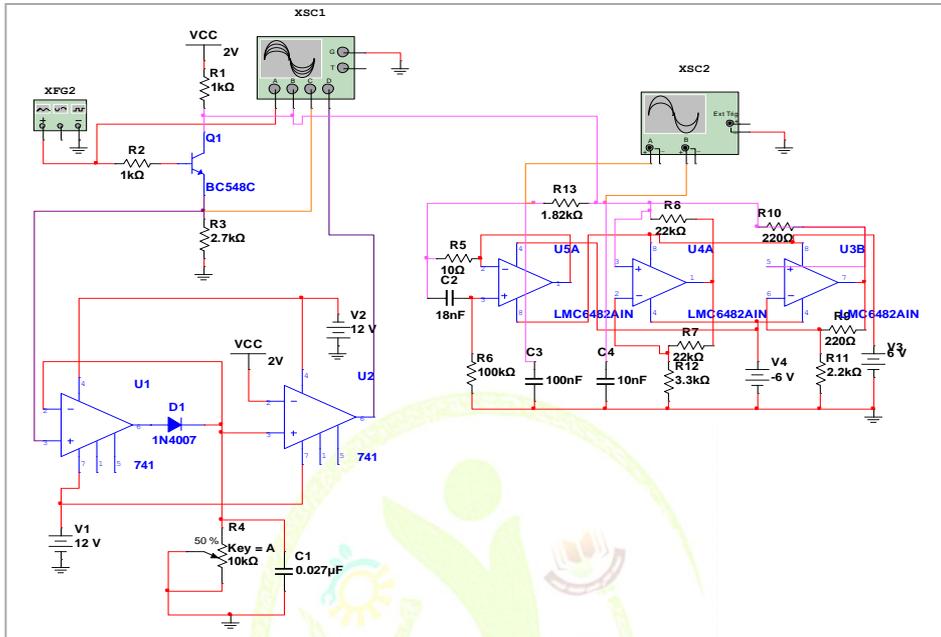
Fig. 9. Using chaotic signal to carry information
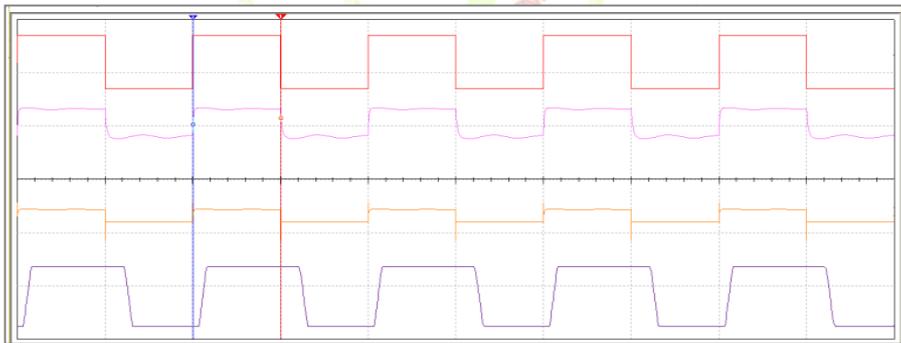
Fig. 10. Transmitted signal (on top) and received signal (on bottom)

changing the resistance from 346 Ω to 1.82 K Ω, the received signal got very close to the transmitted one, and as the exact information sent was received on the receiving end, it was decided to change the input signal to a triangle signal instead of the square (this is not done by the researchers

in papers reviewed), it was surprising to find that the received signal looks far different from the sent information (Fig. 11), so rethinking the way of combining mod/demodulation configuration and the chaotic signal was a must. (Notice that the received signal is not the same as the transmitted one).
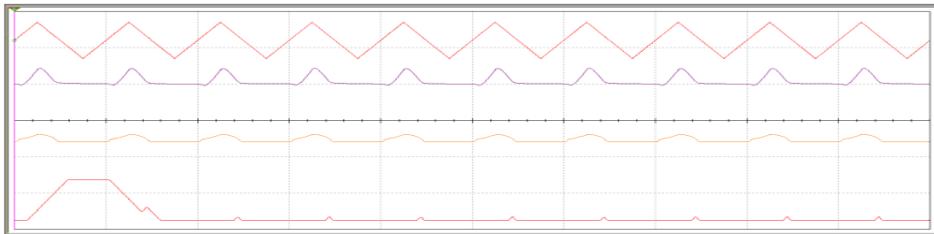

Fig. 11. Transmitted signal (on top) and received signal (on bottom)

As the values of the parameters (primarily R) were changed, the received signal appeared close to the transmitted signal (Fig. 12)(An OpAmp inverting circuit must be used to get the transmitted signal and the received one in phase), but there was a problem which was the need to change parameters as the input signals change in shape, amplitude and frequency, which lead to the use of a different approach that has been learned in researching the problem, and that is chaotic masking, and to make it work the two chaotic signals at the transmission and at the receiver had to be synchronized.
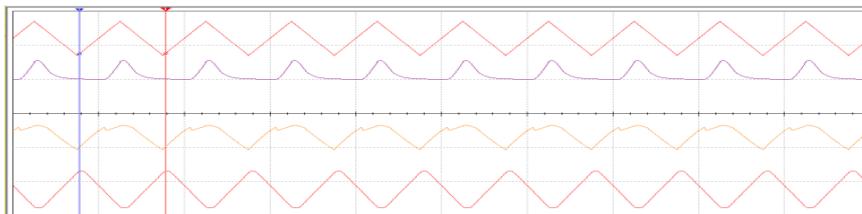

Fig. 12. Some improvement in the received signal as R changed

The two circuits are shown in Fig. 13 and the output (without synchronization) is shown in Fig. 14. Notice that the outputs are not the

same.
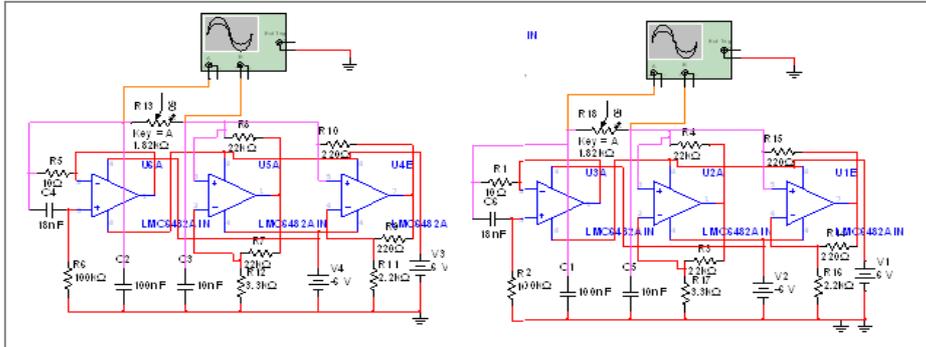
Fig. 13. Unsynchronized chaotic circuits (exactly the same)

but their outputs in Fig. 14 are not the same.
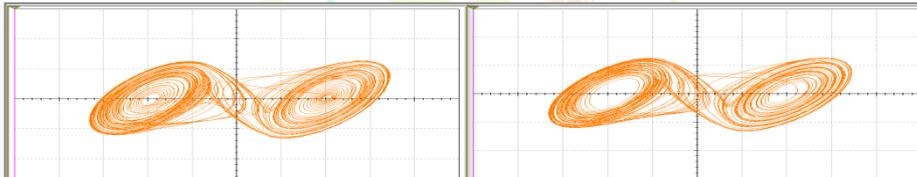
Fig. 14. The outputs of the two chaotic circuits above (not the same)

When synchronization is used, by changing R's simultaneously, that yield the two outputs in Fig. 15 (they are exactly the same). Changing the value of the connecting resistance between the two circuits simulates the environment (parameters like temperature, noise, electric and magnetic fields, etc.) that might affect the transmitted signal and cause it to reach its destination different than the original.
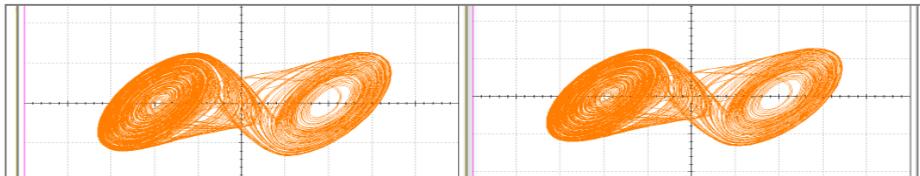

Fig. 15. The outputs of the synchronized circuits (exactly the same)

When all needed circuits and components were connected, the chaotic

circuits, the synchronization connections, the masking on the transmitting side and the extracting on the receiving end, that proved to be working for all kinds of signals, square, sine and triangle, with various amplitudes and frequencies, but with some distortion as shown in Fig. 16).

As R1 and R14 were doubled and capacitor values (C1, C2, C3, C4, C5, and C6) were changed from small values (in micros) to larger values (in millis) there was almost perfect match between the transmitted signal and the received signal (Fig. 17) (notice that some OpAmp inverter circuit at the very end of the system is added to get the two signals in phase).
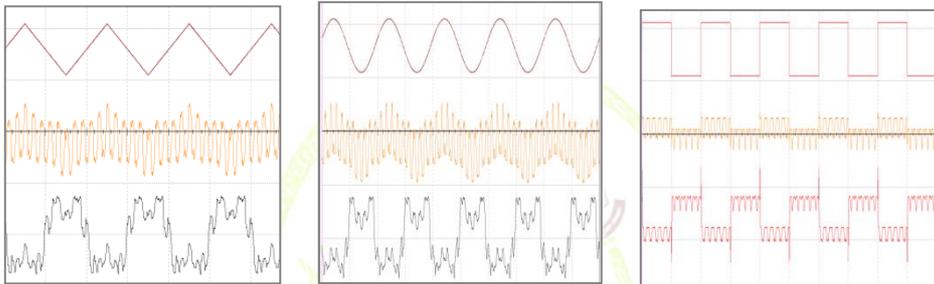
Fig. 16. Outputs of different signals, showing improved received signal
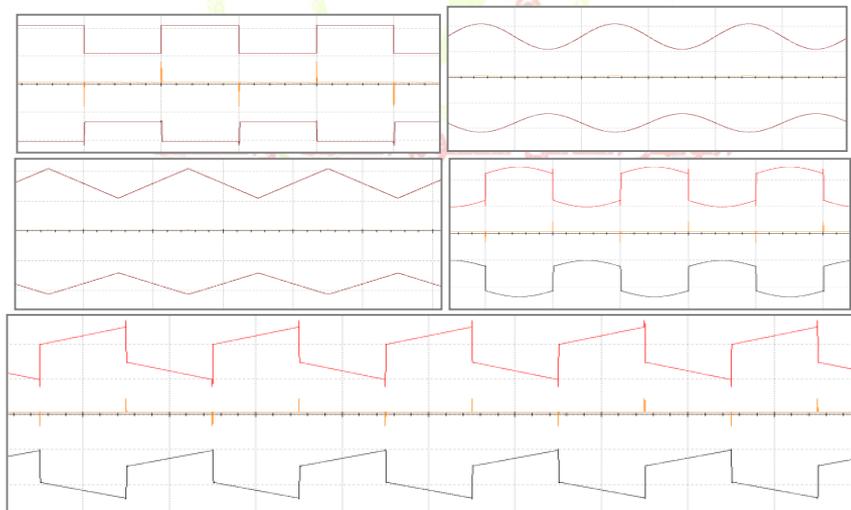
Fig. 4.17. Perfect match between input and output signal (OpAmp inverter circuit must be added)

V. Conclusions

Studying the communication problem and reviewing many research papers showed that conventional security techniques are not sufficient to guarantee that information reaches its destination complete, safe and secure. Many hackers are using nonconventional techniques to compromise information while it is in its way from the sender to the receiver, by stealing and or disturbing it. So there is a need for non-conventional methods to solve this problem and using chaotic signals to carry the information at the sender side, and chaotic circuits to extract the information, complete, safe and secure at the receiving end. During the simulation work and results analysis it was clear that synchronization is an important factor when implementing chaos in security issues. In addition to that noise and system dynamics may affect sensitive parameters that largely affect chaos, so system parameters must be changed accordingly, that is changing the values of resistance connecting the send/receive which simulate the environment (media parameters like temperature, noise, electric fields and magnetic fields, etc.). Finally, since hackers are using the latest hacking techniques, it is recommended that more than one chaotic masking circuit must be used in order to make it more difficult for intruders to guess the chaotic technique used to mask the transmitted signal.

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Evaluation of Information Retrieval System at Electronic Libraries Case Study (Summon)

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الملخـــص

نظراً للدور المهم الذي تقوم به استراتيجية تكنولوجيا المعلومات في إنشاء خدمة جديدة للبحث في مكتبات البحث الموحدة، باسم خدمة الاستكشاف على نطاق الإنترنت اي ((Search Engines)) حيث تلعب محركات البحث دورًا حيويًا في مساعدة المستخدمين للبحث والمعرفة والحصول على معلومات موثوق بها وذات مصداقية من المكتبة. ايضاً محركات البحث تمنح الطلاب والباحثين الفرصة للبحث في محتوى المكتبة مثل المجلات العلمية والكتب والموارد الإلكترونية مثل المقالات الصادرة من الصحف، الكتب الإلكترونية، ومقاطع الفيديو، وقائع المؤتمرات العلمية وقواعد البيانات الأكاديمية. النقطة الأكثر أهمية هي أن محرك البحث مرتبط بمعظم المعلومات المتوفرة في المكتبة بالجامعة وايضاً إمكانية الوصول إلى المعلومات عبر الإنترنت بسهولة أكبر.

Abstract

Given the important role of the IT strategy to create a new service for researching in libraries of the federated search is known as "Search Engines" web2.0-scale discovery service. Moreover, the research engine plays a vital role in helping users to research, find out, and get reliable and credible information from the library. Also, the Search engine gives

students the opportunities to find out about journals, books, electronic-resources, newspaper articles, e- books, videos, conference proceedings, and academic databases. The most important point is that search engine is connected with most information which is available in the library at the University and accessibility of online information more easily.

Keywords: web**,** web2.0, e-library, Search engine, electronic-resources

1. Introduction

The most of the Web 2.0 or library technologies is the use of the Open URL which has been created a vital link from library-licensed resources to the library users. Further, the Open URL services can play an important role in facilitating the connection between open web sites such as Google Scholar, and the library licensed resources. Furthermore, the electronic libraries primary challenge in expanding their repositories can be considered as a huge existing backlog of poor items that may possibly need to be digitised and exchanged with more accurate catalogue information. Changing traditional catalogue data with modern search engine provides a significant challenge, competitive advantage, and development for the specific needs of users.

Summon can be described as a research engine which has been used at University of Huddersfield recently and it is a system that aims to help students to be more convinced with using the library facilities. The Summon can be based on using a new technology which is called "architecture" and the latter delivers research experiences that have been found on the Open Websites. Moreover, the research engine Summon is worked by a single index that may enable students to research in a quick way to get the results that they might need. Also, the different approaches quantitative and qualitative approaches will be used to evaluate the system in comparison with other research engines like Google. The use of the two approaches in the research helps to get statistical and comments from participants and this is quite likely that increase the validity and reliability

of the research trough triangulation.

2. Aims of the Research

The incredible development of Web resources and services has become a motivation for many studies and for Universities to invest on developing new search engines or adding new features and abilities to their search engines. Researchers have focused on Web page structure to increase the quality of search. So, Search engine "Summon" for case studies is a good way to identify these types of resources which has been used at University of Huddersfield in the UK and it is a system that aims to help the users to be satisfied with the electronic library tool.

The aims of this study are (1) to look at the IT strategy which is replaced scholar databases "Metalib Library" to search engine "Summon", (2) to compare search engine "Summon" with others such as Metalib library and Google scholar, and(3) evaluate information system in search engine "Summon".

This online library provides students with the following types which basically mean more or less the same:

- Effectiveness of the search.
- Size of resources and the speed of search.
- Usability issues like content, page layout.
- Metasearching – This is the searching of many databases and the results compiled into a single list. Also, Federated searching.

3. The Search Engine (Summon):

The web scale discovery "Summon" can include both next- generation OPAC and federated search at the same time. In addition, the Summon can also involve materials such as articles, books that are quite likely to enable students to get satisfied results which can be regarded as different from other research engine like Metalib (Wisniewski, 2010). Figure (1) shows the comprehensive nature of the Summon™ service.

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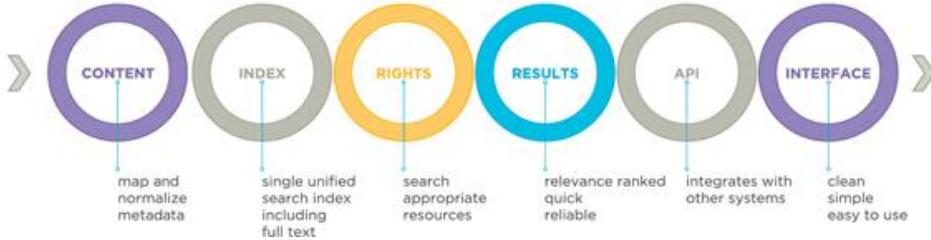
Content types include: library catalogue records, e-journal articles, databases, newspaper articles, e-books, dissertations, institutional repositories, conference proceedings, grey literature, cited references, reports, digital library, more (Serials Solutions, 2009).

According to Wisniewski the search engine Summon can work in the same way as Google because it can reduce the need for libraries to make these content choices and it may help students to expose to them. Furthermore, web scale discovery systems can be possible solutions since there may not be infrastructure considerations that can exist with next- generation OPACs (Wisniewski, 2010). The flow-chart (2) and (3) illustrate the multi-research works:
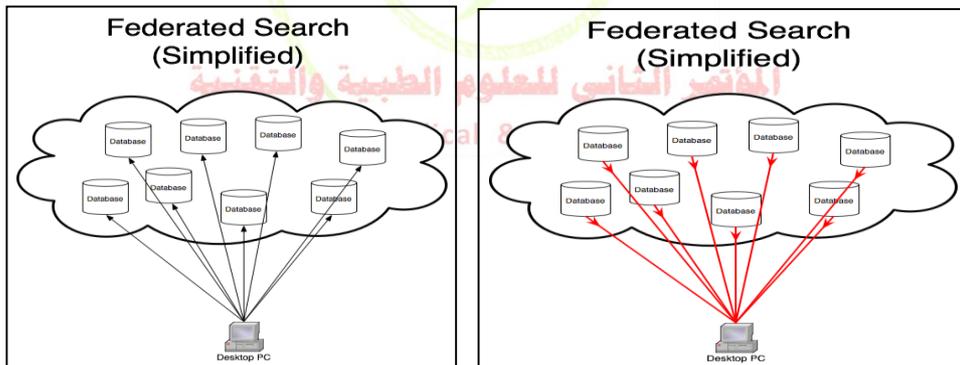
Figures (2) and (3) research goes out, processes and translates, then returns to you at varying speeds.

Resource: < http://kb.library.ucalgary.ca/?View=entry&EntryID=93>

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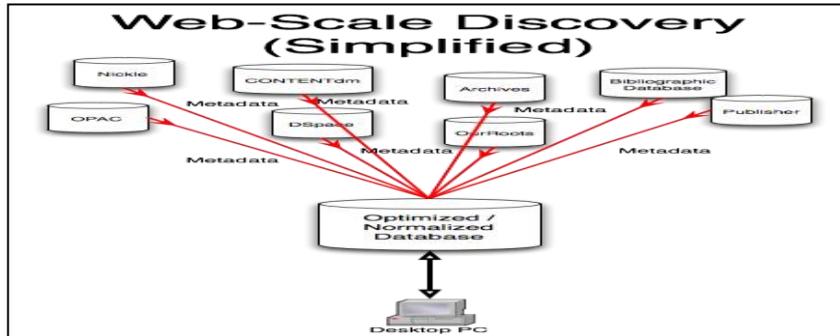
Figure (4) shows web-scale discovery.

3.1 The Scope of Summon

The main scope of Summon can include most of the materials that are available in library catalogue records. The Summon needs content via agreements with content owners, journal, newspaper publishers, e-book publishers, and third-party aggregators. Nowadays Summon contains 534 million items (6,000+ publishers' content; 50,000+ journal and periodical titles + 3 newspapers and journal articles as can be shown in the chart (figure5).Resource:

<http://www.dartmouth.edu/~library/admin/docs/Summon_Report.pdf>.

Figure.(5).Scope and Content

3.1.1) *The Index:* Summon relies on database of metadata and the majority of its database design may include Lucerne/SOLR and an open source enterprise search server. Also, the Summon has the goal to have one record per item and these records are formulated into a single entry within Summon in order to reduce duplication.

3.1.2) *The Web Interface and API:* An API allows users to craft interfaces and to embed Summon into other services such as Blackboard.

http://www.dartmouth.edu/~library/admin/docs/Summon_Report.pdf>n

3.1.3) *Updates of Existing Material:* Many concerns such as adding journals, delays; and advising customers have been taken into consideration and this may possibly due to the lack of current materials which are regarding the occurrence of journal issues. Now users are quite likely that they are familiar with getting new content easily as can be seen in figure (6) (Stone, 2010).

Figure (6) Updates of Existing Material,
Recourse: < http://library.hud.ac.uk/blogs/er/?tag=summon>

4. Literature Review

Recent researchers use many tools to get the information resources that they might need. These resources are more likely to be found at a physical library, on the Websites, and in proliferation of formats and interfaces. According to Nicholas *et al.* (2009), both undergraduate and postgraduate students are quite likely to use library electronic resources. In spite the fact that librarians spend too much time to help students in researching and to allow them to use the available facilities, the library might fail in meeting the students' needs.

Nygren *et al.* (2007) indicate that some students prefer to use simple search interfaces, e.g, Google; Google Scholar as they are easy and manageable in their use. In contrast, a large number of students claim that the Metalib interface is complex and difficult in its use. RIN states that: "*The availability of little articles, non standard and inconsistent search rules are the main problems for both students and libraries*" (RIN, 2009, p. 24). It is an important area to consider because libraries often fail to facilitate their resources in order to be manageable for all students and this may have an impact on the benefits which are given by the library.

The expectations of the students at University of Huddersfield are discussed in order to investigate the current electronic resources and to suggest solutions which may provide easy searching and access for the students. Consequently, the University of Huddersfield creates the first UK commercial adopter of the research engine "Summon" in 2009 which provides information about the library catalogue and electronic resources (Stone, 2010). Summon can be described as a good resource for searching about various kinds of topics. Thomson Reuters states that: *"The Summon™ service is a pioneer in providing single search box access to the breadth of library collections – from books and videos to e-resources at the article level"* (Serials Solutions, 2009). A user refines the results by choosing such as date, subject, academic journals and other options, and then, a student views the results and click to follow the link to the full text. In comparison with federated search tools, the web-scale discovery tool

Summon permits users to search across a single index in more effective and a fast way.

Further, Summon searches across more than a half billion items and it involves holdings from a library's online catalogue, metadata from more than six thousand publishers, database producers, and content providers. Unlike federated search or Google Scholar, Summon allows for refinement both before and after researching results have been returned < http://works.bepress.com/doug_way/12**>.**
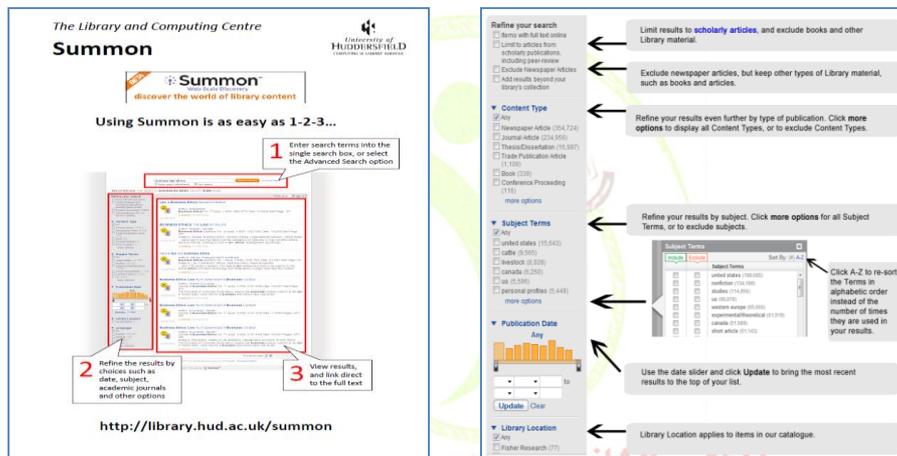
Figures (7, 8) Refining Search Results with the Options on the Left of the Results Screen (Serials Solutions, 2009).

Medeiros predicts that Summon is rather likely to be successful solution in library supplied sources rather than federated search tools. Moreover, Summon harvests most of the content in advance from library catalogues which makes the process faster and helps in reaching to required results (Spencer, 2009).

Possible Solutions have been taken into account with content producers, including the American Institute of Physics, the American Psychological Association, Cambridge University Press, Oxford University Press, and

Springer (Medeiros, 2009).

5. The Evaluation of Information Retrieval System (Summon):

5.1 Evaluation Method:

Effectiveness of Information Retrieval System (IRS) has now a wide-ranging concern in the context of their activity to recover related documents (Saracevic, 1970). Currently, the effectiveness of IRS has become an emerging concern for researchers in the area of management information systems (Sanders, 1984 & Srinivasan, 1985), while the initial concern was more focused on accuracy (identification of program 'bugs') and machine competency (Hirschheim & Smithson, 1988).

The significance of assessment in IRS has discussed in the literature through fact that it usually requires a minimum chapter in information retrieval textbooks (e.g. Belkin &Vickery, 1985, Chap.9; Lancaster, 1979). The limited information of effective evaluation mechanisms have resulted captured both manufacturers and consumers in their preference in the context of development and utilize (Regazzi, 1988), such that:

"As of now, it is probably true to say that all information retrieval systems represent   an act of faith on the part of someone or some organization"   (Cleverdon, 1970, p. 64).

5.2 Mixed Methods Research

Mixed method research approach allows multi types of data accumulation and analysis. The methods could be a combination of both qualitative and quantitative methods, a range of different quantitative methods or a combination of different qualitative approaches and techniques.

Mixed methods research is formally defined here a "*the class of research where there searcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study*" (Onwuegbuzie and Johnson, 2004, p. 17)

5.2.1 Phases of Mixed Methods:

In the mixed method approach, there are eight stages which are shown in figure 9.
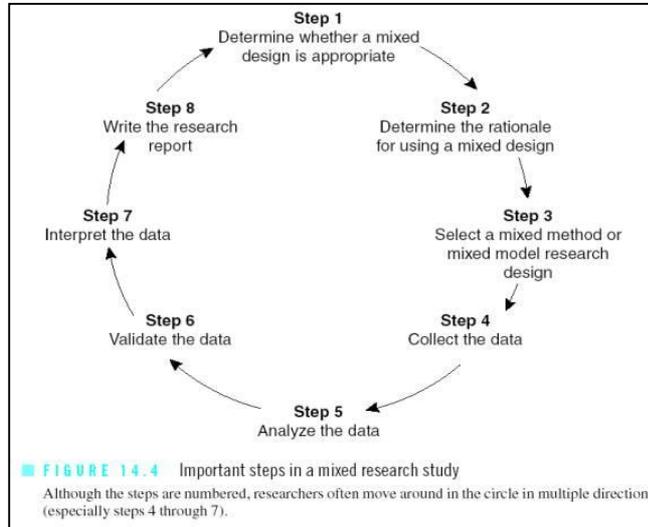
Figure (9): The eight Phases of Mixed Methods.
Resource: < http://www.southalabama.edu/coe/bset/johnson/studyq/sq14.htm>.

5.3 Data Collection Methods:

5.3.1 Qualitative Method: Qualitative approaches to research are the way of studying where reality is based upon perceptions that are different from one person to another and can change over time (Urquhart, 2001). In this approach, different perceptions are put together to make wholes and meaning is produced (Rich and Ginsburg, 1999) to achieve novelty.

5.3.1.1 Interviews:

There are many types or interviews that have been described and discussed. Interviews allow a researcher verbally inviting question for selected participant or respondent to respond verbally (Thomas, 2003).

5.3.2 Quantitative Method: Quantitative Moreover, quantitative research uses structured data in the appearance of number or can be changed into number by using statistical and mathematical analysis according to research design to explore the result (Thomas, 2003).

Comparison: 5.3.2.1

The act of comparing things contains classifying how the chosen things are *similar* to and *different* from each other.

Features List

Features List	Metalib	Summon	Google Scholar
Basic Search	✓	✓	✓
Follow Citations	✓	✓	✓
Save Documents	✓	✓	✓
Save Query	✓	✓	✓
Boolean Search	✓	✓	✓
Bibliography	✓	✓	
Full Text	✓	✓	✓
Free Text	✓	✓	✓
Metasearching	✓	✓	✓
Federated searching	✓	✓	✓
A single search box	✗	✓	✓
Find print/physical material in the Library collection	✗	✓	✗
Browser classified searcher	✗	✗	✗
Tagging	✗	✗	✗
cited by	✗	✗	✓
The resources, Controlled Vocabulary	✗	✗	✗
Browser Tag Cloud	✗	✗	✗
Geo Tagging	✗	✗	✗
Comments	✗	✗	✓

5.4 User Interface:

Some of "Summon" user interface (UI) has several major components

Tables (Abe Crystal, 2010)

Advanced Search	Strengths	Weaknesses
	Users can manage search factor beyond the index type and subject sort out, recommending. Users can discover Advanced Search competent and efficient for recognized item recovery. Users can search papers or manuscripts from a particular date.	Rigid to determine this mechanism- uncertain what "sophisticated" means. Form design is not easy to scan and parse. Summon changes the enquiry sequence after the Advanced Search form is filled out, which can be puzzling for trainee users

Content Type	Strengths	Weaknesses
	users can discover the filters interesting and attractive (e.g., "Hey, it's like eBay!") Next to original---time filtering offer a sense of closeness and control (dynamic manipulation). By Content Type users can also filter their outcomes.	No noticeable command or arrangement to the list of items, making it difficult to recognize. Parallel session content types can be puzzling ("journal" vs. "journal article"). Can be puzzling to see a diverse set of selections for each query, particularly when expecting a specific choice such as "book" to be there.

Refine your Search	Strengths	Weaknesses
	Being able to limit to peer---reviewed journals maps to many students' assignments, specifically for preliminary classes.	Lengthy checkbox labels are difficult to scan and read, and the first word in each label is unclear ("items"/ "limit"/ "exclude"/ "add").
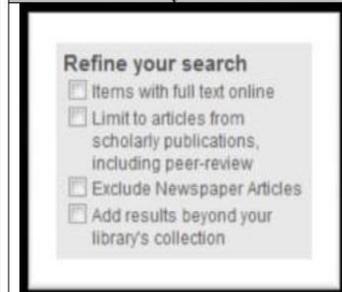
Subject Terms	Strengths	Weaknesses
Subject Terms ☑ Any ☐ law (214) ☐ international law (157) ☐ politics (144) ☐ human rights (139) ☐ history (136) ☐ united states (121) more options	Summon can return results from several diverse subjects /disciplines, which subject terms can help to disambiguate. Users can manage search factors beyond the content type, recommending control of subject or topic could have significance. Further opportunities for Subject Terms generate a pop-up box of relevant terms.	Somewhat irresistible number of terms presented in a very long list. Large variety of terms from different subjects and disciplines, without composition or grouping to assist understanding.

Publication Date	Strengths	Weaknesses
Publication Date Any [slider widget] to Update Clear	Slider widget is appealing and easy to recognize. Use the slider(s) to modify the Publication Date range of results.	Dropdown menus for choosing a particular date are opaque and difficult to construe at first.

6. Research Design:

Well structured questionnaire designed is an important step in the research procedure as it allows the respondents to help accurate answer. This help to accumulation of information and data accuracy and later data analysis with the optimum level of reliable and generalised results.

With the aim of obtaining user response in the context of assessment; a questionnaire was developed and administered anonymously to evaluate the number of students who prefer and consider easier with a new search engine (Summon) and to assess the satisfaction of students who use the search engine (Summon).

7. Data Analysis:

7.1 Quantitative Study: Questionnaire

Collected quantitative data were analyzed with the statistical packages (Microsoft Excel) and optimum level of qualitative interpretation using a

range of qualitative modes through interpretive approach. Graphical presentations were performed through different graphical pattern

The questionnaire was modified according to feedback and was sent to 100 postgraduate students participants through email in the University of Huddersfield Library online Website.

Using the Huddersfield library Web site by Mode of Study and Age:

As could be expected, analysis of using the electronic library tool by age of students discloses strong links with the mode of study, as younger students (especially students aged 21–35) were full-time students. As the graphs in figure 10 illustrates, full-time students used the Huddersfield Libraries Web site more than 4 hours a week and had a strong tendency to using technology compared with other students, such as part-time students. Especially, there were important differences for:

- Less than 1 hour a week.   (12% compare with73 %);
- (1---3) hours a week.   (19 % compare with 18%);
- (4---10) hours a week.   (69 % compare with 9%);

However, there was quite a similar number for using the Huddersfield library website between(1—3) hours a week (19% compared with 18%); notably, younger students were more likely to use the Huddersfield Libraries Web site especially the research tool "Summon" for different reasons compared with students aged 35+.
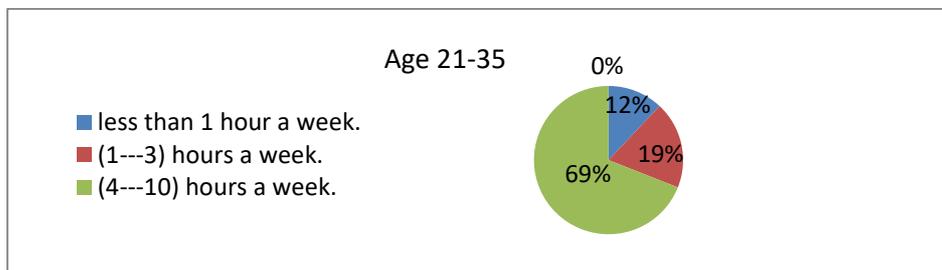

Figure (10): using the Hudders field library Web site by full-time students.
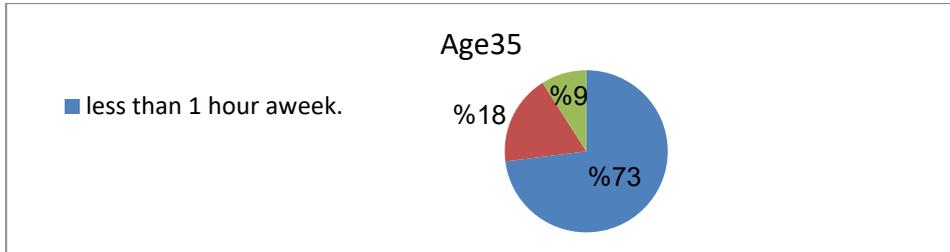
Figure (11): using the Huddersfield library Web site by part-time students.

In order to discover how students feel about using Summon Search they were asked to state which of these statements most closely related to them: How useful have you found Summon in your research?
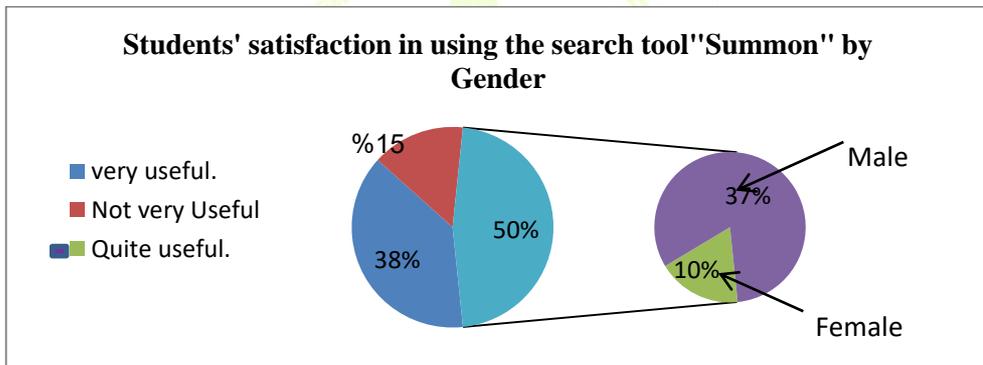
Figure (12): Students' satisfaction towards "Summon" by Gender.

Age was a significant element, with older students less satisfaction than younger learners, 10% of students aged 35+ felt satisfaction compared with 41% 21–35-years-old as shown below. Students studying Computer Science, Business and English were the most confident in using the electronic tool "Summon", whereas students studying Engineering, Chemistry and Art Design and Architecture were the least satisfaction in using the search tool "Summon". Full-time students stated more satisfaction in using the search engine "Summon" than part-time students.

Students' satisfaction in usage the search engine "Summon" by Age

- Very useful.
- Not very useful.

%12 %19 %69 %31 21-35 Age %38 35+ Age
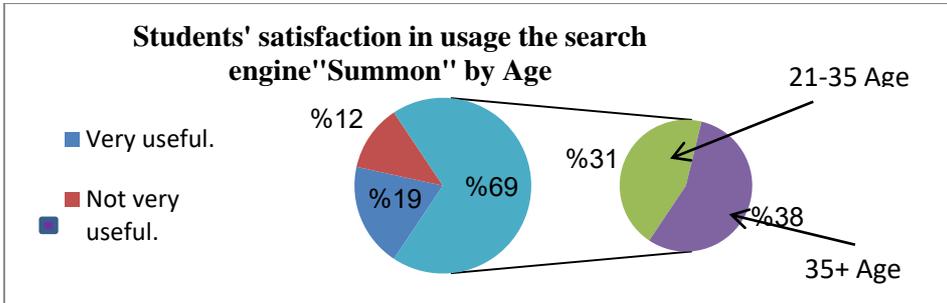
Figure (13): Students' satisfaction towards "Summon" by Age

Learners were asked questions regarding the electronic tool (Summon) use in their study. As would be expected, students describing themselves as satisfaction and it was very easy to use Summon search than students who considered they were not satisfaction with using "Summon". The significant factor with students using (Summon) was so easy use to access e-resources concerning their subjects as in Figure (14), the percentage was 65% and 19% compared with other students who stated that the search tool "Summon" was not easy to use and they need instruction before they could use the search engine efficiently, as illustrated in the graph below.

How easy to use is Summon

Summon is difficult to use. 0%
Not very easy. 16%
Quite easy. 19%
Very easy. 65%
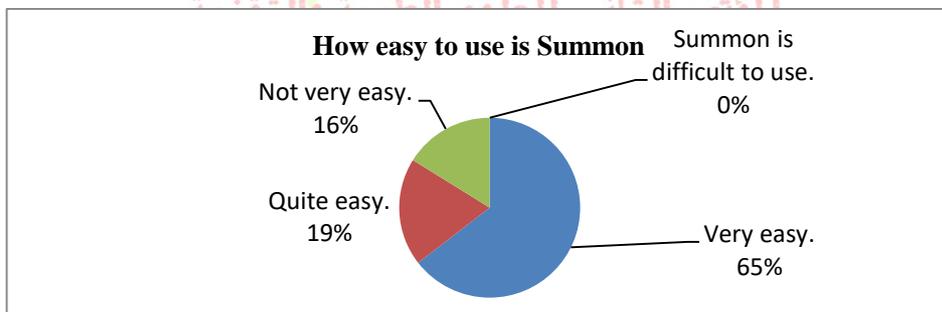
Figure (14): The search tool" Summon" is easy to use.

In general how relevant are the documents you find during a Summon search?

Most of them are relevant.
Some of them are relevant.
Only a few of them are relevant.
None of them are relevant.

%0   %0
%28
%72
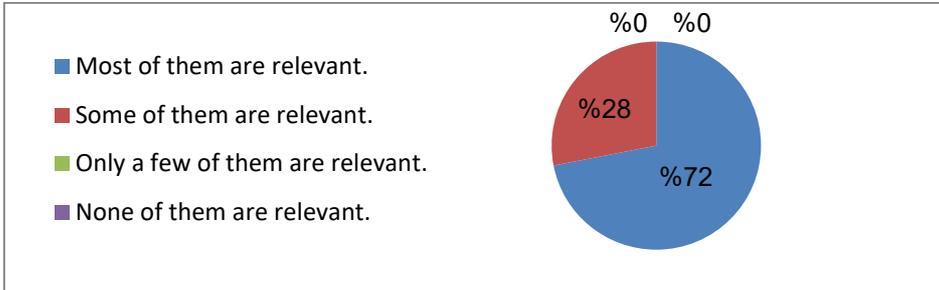
Figure (15): Students' satisfaction towards "Summon"

As illustrated in figure 16, most students both females and males have been using "Summon". They were able to find relevant information on their research topic. The percentage was (72) compared with other students who stated that they find it is necessary to look at irrelevant materials on their research topic.

Features that you would like to see are essential to be added:

A) Search using tags.

B) Search by a tag or Keyword"cloud".

c)Boolean search facilities.

%0   %31   %34   %35
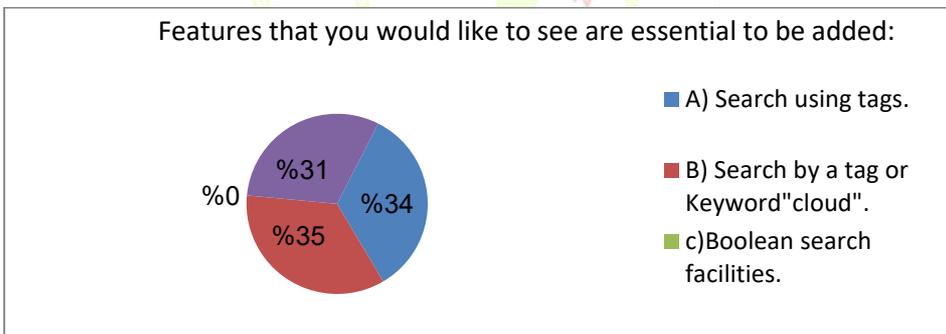
Figure (16): Features to your research would be useful additions to "Summon

The figure shows the results for the useful of features additions to summon search. The most important feature on the search page according to students' Search by Tag and in second place is Search by Tag clouds. The lowest score being with feature (C) (see Figure16).

8. Conclusion

The overall intention of responses to the survey regarding the use of the Summon was not positive or negative, it was middling. Answer to open-ended questions indicated that there is chance to apply these techniques to increase more students' involvement, attentive, and motivation. The lack of adequate capability was reported to be a problem by some participants. However, respondents expressed the hope that additional activity related to Summon would be available on their library in the near future.

The electronic searching tool is one of a growing number of devices which offer students shared workspace, thus encouraging interactive and collaborative learning. The incredible development of Web resources and services have become a motivation for many studies and for Universities to invest on developing new search engines or adding new features and abilities to their search engines. Researchers have focused on Web page structure to increase the quality of search.

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Managing the Risks of Software Projects

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ABSTRACT

A software project is likely to face various kinds of risks throughout its development process. Identifying and managing these risks is very critical for the project to be successful. In software project risk management, there are various tools and techniques that are employed to mitigate and reduce risks. A successful manager is one who makes use of these tools and techniques to safeguard the project into a successful finish. This paper presents, in an easy to understand terms, a comprehensive summary of the risk concept, types, their effect on project success, and the processes to identify and mange them as suggested by well known risk management models. It gives the readers an overview of the software risk management activities that are executed in the course of managing the risks that software projects are likely to face. The contribution of this paper is to help those interested in the area of software risk management to gain an overall understanding of the area. It should be of immense help to the software engineering community, because of its simple and illustrative way of presenting the activities of managing software project risks.

الخلاصة

من المحتمل أن يواجه المشروع البرمجي العديد من أنواع المخاطر خلال كامل مراحل تنفيذه. إدارة هذه المخاطر في غاية الحساسية لنجاح المشروع. في إدارة مخاطر المشاريع البرمجية هناك عديد الأدوات والتقنيات يمكن توظيفها للتخفيف والتقليل من هذه المخاطر. مدير المشروع الناجح هو الذي يستغل هذه الأدوات والتقنيات ويستخدمها في ضمان سلامة ونجاح المشروع. هذه الورقة تعرض، في كلمات بسيطة وسهلة للفهم، ملخص شامل لمفهوم

الخطر وأنواع المخاطر وتأثيرها على نجاح المشروع وعمليات تحديد وإدارة هذه المخاطر كما تم اقتراحه في نماذج شهيرة لإدارة المخاطر. فهي تزود القارئ بنظرة عامة لأنشطة إدارة المخاطر البرمجية والتي يتم تنفيذها في إطار إدارة المخاطر البرمجية المحتمل مواجهتها في المشاريع البرمجية. المساهمة التي تقدمها هذه الورقة هي مساعدة المهتمين بمجال إدارة المخاطر البرمجية في الحصول على فهم شامل لهذا المجال. هذه الورقة يفترض أن تكون ذات فائدة كبيرة لمجتمع هندسة البرمجيات لأنها تعرض أنشطة إدارة المخاطر البرمجية بشكل توضيحي مبسط.

1. INTRODUCTION

Software projects are like any other projects in other engineering fields. They must be managed to ensure that they will meet their expectations. The goal of any project is to deliver, in time and within the budget constraints, a product that meets its customer's needs and expectations. The essential factors of project success are the quality, the time and the budget. The lack of risk management results in schedule slippage, budget overrun, unsatisfactory quality of the product, failure to accomplish company business goals of the project, and disappointment of the employees. Present software projects are often facing expanding and changing client demands and are put under cost and schedule pressures. Systems are growing in size and become increasingly complex. [1].

Consequently, despite of the progress in technology, the software engineering project management still faces similar problems as was in earlier years. The requirements are not defined precisely which results in the expansion of the system scope or in rejection of the final system. Technical difficulties are continuing to effect software projects. The resulting software is constantly error-prone, the cooperation among the project members is often poor and the expectations of the clients are not satisfied. Altogether, it calls for some significant improvements to the software engineering process to ensure project success. One of such innovative approaches is managing the risks that the software project is likely to face, and hence minimizing project failure.

This paper presents, in an easy to understand terms, a brief and comprehensive summary of the software risk management process. It gives the readers an overview of the software risk management activities that are executed in the course of managing the risks that software projects are likely to face.

This paper is organized as follows. In Sec.2 we define risk and explain what type of risks software projects are likely to face. In Sec.3 we present the software project failure rates in one of the leading software producing countries around the world, which demonstrates the importance of risk management. In Sec.4 we talk about the risk management concept and its effectiveness in the software development life cycle. In Sec.5 we present the risk management process characteristics and describe two commonly used approaches for risk management. The detailed activities of the risk management process are described in Sec.6. Finally, concluding remarks are given in Sec.7.

2. RISK AND RISK TYPES

In the Oxford English dictionary risk is defined as "a possibility of suffering harm, loss or injury." It is also defined as "a measure of the probability and severity of adverse effects." In the Software Development Life Cycle (SDLC), risk can be defined as "a measure of the probability and severity of adverse effects inherent in the development of software that does not meet its intended functions and performance requirements." [2]

Risk is a future event that we prefer not to have happen. So, it is something that we can anticipate but cannot be sure of its occurrence. However, a risk has three characteristics that we strive to predict [3]:

- The probability or likelihood that loss or damage will occur.
- The expected time of occurrence.
- The magnitude of the negative impact that can result from its occurrence.

The seriousness of a risk can be determined by multiplying the probability of the event actually occurring by the potential negative impact to the cost, schedule, or performance of the project[9]:

Risk Severity = Probability of Occurrence × Potential Negative Impact

Thus, risks where probability of occurrence is high and potential impact is very low, or vice versa, are not considered as serious as risks where both probability of occurrence and potential impact are medium to high.

Project managers recognize and accept the fact that risk is inherent in any project. They also recognize that there are two ways of dealing with risk. One, risk management, is proactive and carefully analyzes future project events and past projects to identify potential risks. Once risks are identified, they are dealt with by taking measures to reduce their probability of occurrence or to reduce their impact. The alternative to risk management is crisis management. It is a reactive and resource-intensive process, with available options constrained or restricted by events [1].

Software project risks can be categorized as follows [1]:

Project risks – these are risks that affect the project schedule or resources.

Product risks – these are risks that affect the quality or performance of the software being developed.

Business risks – these are risks that affect the organization developing the software.

Among the types of risks that a software project might encounter are [2]:

- Technology risks – these are risks that derive from the software or hardware technologies that are used to develop the system.
- People risks – these are risks that are associated with the people in the development team.
- Organizational risks – these are risks that derive from the organizational environment where the software is being developed.
- Tools risks – these are risks that derive from CASE tools and other support software used to develop the system.
- Requirements risks – these are risks that derive from changes to the customer requirements and the process of managing the requirements change.
- Estimation risks- these are risks that derive from the management estimates of the system characteristics and the resources required to build the system.
-

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للعلوم الطبية و النقنية
July 2018 يوليو

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International Science and Technology Journal

3. SOFTWARE PROJECT FAILURES

The failure rate of software projects is high, as shown by numerous surveys conducted in the IT industry. The overall statistics on software project failures of US software projects as reported by Standish Group over the years 1994-2009 is presented in Figure 1 below.

The Chaos Report (Standish Group) on IT Project survey

IT Project	Year 2009	Year 2006	Year 2004	Year 2002	Year 2000	Year 1998	Year 1996	Year 1994
Successful	32%	35%	29%	34%	28%	26%	27%	16%
Challenged	44%	19%	53%	15%	23%	28%	40%	31%
Failed	24%	46%	18%	51%	49%	46%	33%	53%

➢**Successful**: delivered on time, on budget, with required features and functions
➢**Challenged**: late, over budgeted, and/or with less than the required features and functions
➢**Failed**: cancelled prior to completion or delivered and never used.

Source: http://www.pmhut.com/the-chaos-report-2009-on-it-project-failure

Figure 1. Failure rates of US Software Projects 1994-2009 [4]

Although the situation may seem to have improved over the years, the success rate of software projects is still far from being satisfactory. The success rate of software projects over the nine year period between the years 2000 and 2009 has, obviously, hardly improved. Risk management aims at increasing the chance of success of software projects by early identification of project risks and effectively mitigating their negative impact on project success.

4. RISK MANAGEMENT

Risk management is regarded as the distinguishing aspect of successful projects. It has lately received wide attention in the software engineering field and has become an area of much research by concerned parties. Risk management is about understanding the internal and external project

influences that can cause project failure. It is about changing our attitude towards risks [5]. A project without risk management faces serious problems, (the deadline is not met, the budget is overrun, the quality is poor). The need for risk management is illustrated in Gilb's risk principle, "If you don't actively attack the risks, they will actively attack you" [6]. A project with risk management aims at early identification and recognition of risks and then actively changes the course of actions to mitigate and reduce these risks. The lack of managing risks exposes a project to a great risk of failure.

Much work on risk management has been already done. However, Implementing risk management involves inserting the risk management principles and practices into the software development life cycle process. Risk management begins with the exploration of the concepts leading up to acceptance of a software development project and continues throughout the life cycle until the product is delivered.

Effective risk management requires establishing and following a rigorous process. It involves the entire project team, as well as requiring help from outside experts in critical risk areas. Because risks will be found in all areas of the project and will often be interrelated, risk management should include hardware, software, integration issues, and the human element [7].

An important demonstration of where risk management is most effective during the life cycle of the software development process is shown in Figure 2 [8]. It's reflected through the demonstration of the relationship between risk and the dollar value of the project over the life cycle. The project investment gradually increases through the end of the requirements phase. The concept and system exploration along with requirements are the first three life cycle phases and are the phases where project planning has the greatest impact on risk mitigation. The inherent project risk is highest in these three phases and drops through project execution. Design, implementation and installation phases have the highest project execution risk reduction potential. The final three phases, operations and

support maintenance, and retirement, have the lowest software development risk and the highest dollar investment. These three phases derive the highest risk impact from the product market. The part of the figure labeled "Area of Highest Risk Mitigation Impact" covers requirements, design, implementation and part of installation. This is the area of the project where the project manager has the most impact on risk mitigation. As long as risks are determined and mitigated, the amount of risk will smoothly decrease and the project investment will continue on its predicted path. If risks are not identified and mitigated, the project cost will rapidly increase.
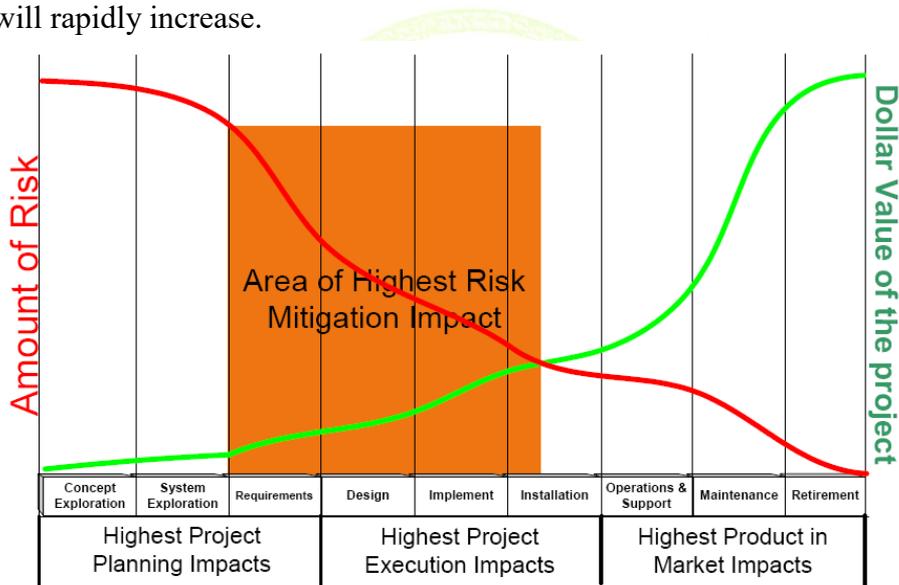

Figure 2. Project Risks during the Life Cycle

5. RISK MANAGEMENT PROCESS CHARACTERISTICS

There are certain characteristics that the risk management process should account for to be successful. These characteristic are common to various risk management paradigms. These are:

- Planned and structured risk management process.
- Integration of the risk process with the acquisition process.
- Developers, users, and all other stakeholders work together closely to implement the risk process.
- Continual monitoring and reassessment of the risk management process.
- The cost, schedule, and performance elements of the project have defined set of success criteria.
- Metrics are defined and used to monitor effectiveness of risk management strategies.
- Formal documentation of all facets of the risk management program.
- Communication and feedback are an integral part of all risk management activities.

Commonly used approaches are Barry Boehm's Risk Management paradigm, and the Software Engineering Institute's (SEI) Risk Management paradigm. These are briefly described next.

5.1 BARRY BOEHM'S RISK MANAGEMENT MODEL

Barry Boehm is a pioneer in software risk management, developing his risk management methodology in conjunction with his risk driven spiral development model. Boehm offers a six step risk management process (Figure 3), composed of two main steps, each divided into three sub-steps [9][10]:

- risk assessment, consisting of
  - identification of those risks likely to cause problems.
  - analysis to determine the loss probability and loss magnitude for each risk and to develop a compound risk.
  - prioritization to rank the identified risk items according to their compound risks.
- risk control, consisting of
  - management planning to bring the risk items under control.
  - resolution to eliminate or resolve the risk items.

o monitoring to track the project's risk reduction progress and to apply corrective action where necessary.

Boehm proposes sample tools for use at each of his steps. For more details on Boehm's model see [9].
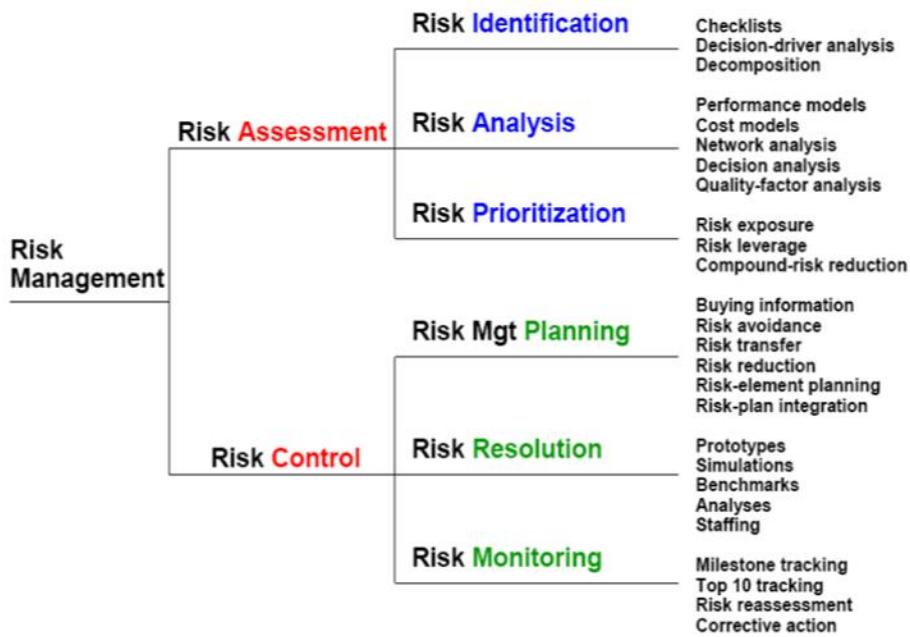

Figure 3. Barry Boehm's Risk Management Model

5.2 SOFTWARE ENGINEERING INSTITUTE's RISK MANAGEMENT MODEL

The Software Engineering Institute's Risk Management Model is composed of five steps as shown in Figure 4, with the risk identification step being the first step [11].
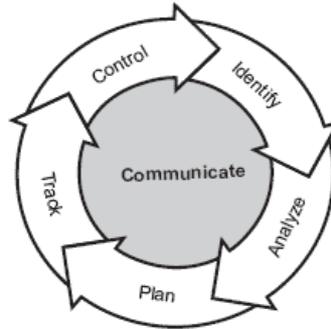
Figure 4. *Software Engineering Institute's Risk Management Paradigm*

The activities are executed within a framework for risk communication and risk documentation.

The SEI emphasizes that effective implementation of the risk management requires recognition of the process specifics and compliance to some good principles and practices. It has defined seven key principles for risk management [11].

The SEI also emphasizes the need for comprehensive software tool support within the entire risk management process.

6. RISK MANAGEMENT PROCESS ACTIVITIES

The process is iterative and should have all the components shown in Figure 5. There is a feedback loop from the monitoring activity that allows planning and the other activities to be redone or controlled by actual results, providing continual updates to the risk management strategy.
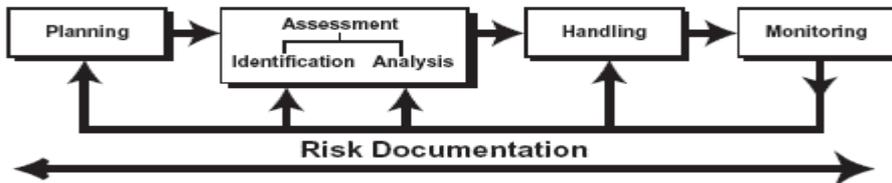

Figure 5: *Risk Management Process Components*

The interactions of the overall risk management process components are demonstrated in figure 6 below. The process starts with planning a strategy for identifying risks and evaluating and prioritizing them. A risk management plan is then created to contain risks. Contingency actions that are taken if triggers indicate a risk is turning into a problem are also provided for in the risk management plan. The tracking step involves monitoring the status of containment actions as well as the status of known risks. It reveals important information for updating the risk management plan. That is, closing the no longer threatening risks and providing for the new identified ones.
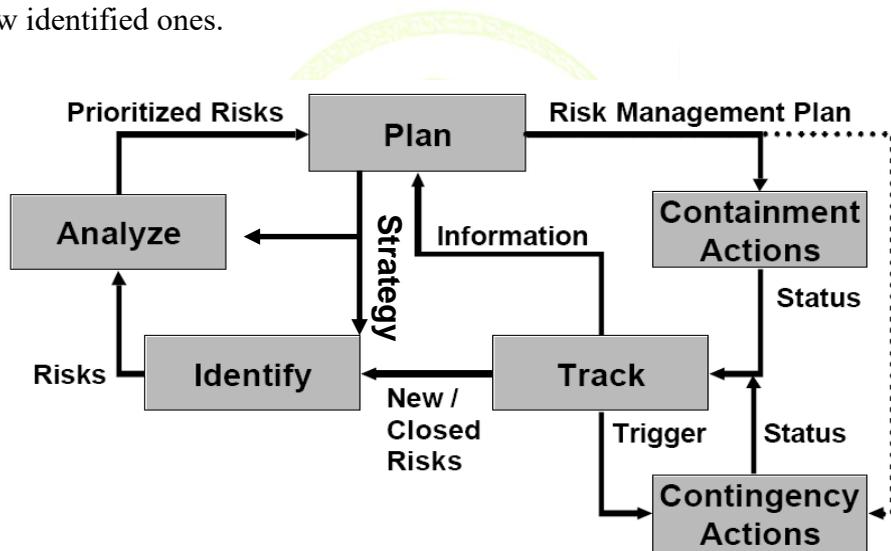

Figure 6: *Risk Management Process Components Interactions*

The following sections provide more information on the above risk management process activities.

6.1 PLANNING

A viable risk management plan can mean the difference between success and failure. Risk planning includes developing and documenting a

structured, proactive, and comprehensive strategy to deal with risk. Key to this activity is establishing methods and procedures to do the following[12]:

1. Identify and analyze risks.
2. Develop risk-handling plans.
3. Monitor or track risk areas.
4. Assign resources to deal with risks.
5. Risk reporting and communicating.

A generic sample risk management plan can be found in Appendix B of the "Risk Management Guide for DoD Acquisition" [12].

6.2 ASSESSMENT

Risk assessment involves two primary activities: risk identification and risk analysis. Risk identification is actually begun early in the planning phase and continues throughout the life of the project. The following methods are often used to identify possible risks [13]:

- Brainstorming.
- Evaluations or inputs from project stakeholders.
- Periodic reviews of project data.
- Questionnaires based on taxonomy, the classification of product areas and disciplines.
- Interviews based on taxonomy.
- Analysis of the Work Breakdown Structure.
- Analysis of historical data.

When identifying a risk it is essential to do so in a clear and concise statement. It should include the following two components [1]:

1. **Condition:** A sentence or phrase briefly describing the situation or circumstance that may have caused concern, anxiety, or uncertainty.

2. **Consequence:** A sentence describing the key negative outcomes that may result from the condition.

An example of a risk statement is shown in Table 1.

Table 1: *Risk Statement Example [14]*

CONDITION	Customer submits requirement changes even though we are in the design phase and the requirements have been base lined.
CONSEQUENCE	Changes could extend system design cycle and reduce available coding time.

The second step of assessment is risk analysis. This is the process of examining each risk to refine the risk description, isolate the cause, quantify the probability of occurrence, and determine the nature and impact of possible effects. The result of this process is a list of risks rated and prioritized according to their probability of occurrence, severity of impact, and relationship to other risk areas [2].

Once risks have been defined, and probability of occurrence and consequences assigned, the risk can be rated as to its severity. This facilitates prioritizing risks and deciding what level of resources to devote to each risk. An assessment model using risk probability and consequence levels in a matrix to determine a level of risk severity is described in [5].

6.3 HANDLING

Risk handling is the process that identifies, evaluates, selects, and implements options for mitigating risks. Two approaches are used in risk handling. The first is to take some containment actions which employ options that reduce the risk itself. This usually involves a change in current conditions to lessen the probability of occurrence. The second approach, contingency action, is often employed where risk probability is high, is to use options that reduce the negative impact to the project if the risk condition should occur. Improving jet engine maintenance and inspection

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procedures to reduce the risk of in-flight engine failure is an example of the first approach. Providing a parachute for the pilot, to reduce loss if the risk condition should occur, is an example of the second approach [6].

Basically, there are four options available for risk handling options:

Risk avoidance: changing the strategy to avoid a particular risk from affecting the project. Risk avoidance may result in not doing the project at all.

Risk transfer: look for someone else to take the risk.

Risk mitigation: take some immediate, proactive actions to reduce the risk probability or the impact of the risk.

Risk acceptance: decide to live with the risk but plan for contingency action to take if the risk becomes a reality.

6.4 MONITORING

Risk monitoring is the process of continually tracking risks and the effectiveness of risk handling options to ensure risk conditions do not get out of control. This is done by knowing the baseline risk management plans, understanding the risks and risk handling options, establishing meaningful metrics, and evaluating project performance against the established metrics, plans, and expected results throughout the process. Continual monitoring enables new risks to be identified if they become apparent over time and risks that are no longer a threat to be closed. It also causes contingency plans to be implemented when triggers indicate the onset of a problem. Further monitoring reveals the interrelationships between various risks [3].

The monitoring process provides feedback into all other activities to improve the ongoing, iterative risk management process for the current and future projects.

6.5 DOCUMENTATION

Documentation of risk is very essential for the current, as well as future, projects. It consists of recording, maintaining, and reporting risk management plans, assessments, and handling information. It also includes recording the results of the risk management activities which provides a knowledge base for better risk management in later stages of the project and in other projects [3]. The documentation should include the following information[x]:

- Risk management plans.
- Project metrics used for risk management.
- Identified risks and their descriptions.
- The probability, severity of impact, and prioritization of all known risks.
- Description of risk handling options selected for implementation.
- Project performance assessment results, including deviations from the baseline plans.
- Records of all changes to the above documentation, including newly identified risks, plan changes, etc.

7. CONCLUSION

In effective risk management, risks are identified, analyzed, and prioritized. Plans are then made to mitigate and reduce the impacts of those identified risks. Intensive, continuous, and different means of communication should take place between the project stakeholders during the monitoring process of the risk mitigation actions. The monitoring process reveals the current status of the risks that are identified for actions and the effect of the actions taken to mitigate them. It also uncovers new information that can be used to update or modify the risk management

plans. This information is very vital for effective and better use of the project's resources.

Risk management is a continual set of activities that is an absolute necessity for the success of any software project. Regardless of the complexity and the technological challenges involved, a systematic approach towards risk management can improve the chances of success of any Software Project.

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