Sudan University of Since and Technology

College of Graduate Studies

Design of Medical Equipment Management Programs and Implementation

تصميم برامج للادارة وتنفيذ الاجهزة الطبيه

A thesis Submitted in Partial Fulfilment for the Requirement of the Degree of M.SC in Biomedical Engineering

By:

Naila Ahmed Ali Mahmoud

Supervised by:

Dr .Elias Sidieg Mohammed Hassan

Feb.2016

الاية

بسم الله الرحمن الرحيم

قال رب اشرح لي صدري*ويسر لي امري * واحلل عقدة من لساني * يفقهوا قولي *

سورة طه من الايه 25 الي 28

صديق الله العظيم

Dedication

To my Mother

To my Father,

Your kind support provided us to achieve our dreams

Brothers &sisters,

Friends &colleges,

With my love

Acknowledge

I would like to thanks all those whom assist me to complete this work.

Special thanks to Dr. Elyas   Siddig who supervised this project to his support and efforts. My special thanks also due to E. Mohamed Ibrahim Eltayeb Doj, and E. Osman Eltayeb Mohamed Ahmed for their generous help.

Deep thanks to any person, who stand beside me in my life.

Abstract

Proper management of health information is an important in providing safe and efficient patient care. Implementing of management information technology in health care participates in improving the quality of care, preventing of medical errors, reducing of health care cost. The slaw adoption of it in health care can be result of many factors like doubt of benefit vs. cost of it.

Personal interviews with medical engineer staff shown that from questionnaire was filled through personal interviews and data analysis which was done by a statistician using computer-based program Statistical Package for Social Sciences.

according to result of data analysis the equipment control management program, was designed and Implementation.

One of information technology systems is medical equipment control management which is a software program to medical equipment control and management. In this research responsible for exchanging medical equipment informatics data it is shall be controlled and managed.

The programming language Personal Home Page(PHP) with local sever Apache in addition to Cross-platform ,Apache ,MYSQL ,PHP, and Perl (X AMPP) program to facilitate and operating them together in computer which the system installed in it then link it with local net in the hospital by using its IP.

And then created database my Structured Query Language (MYSQL) contains information about the medical equipments which wants to be managed. And this database has Permittivity to add new medical equipments, edit their information and write a report about their condition.

After applying the system at Al Neelain medical research institute which provide its effectiveness to improve the performance of the desired health care.

المستخلص

إستخدام تكنولوجيا ادارة المعلومات فى صناعة الصحة دعمت المجال الصحي بالعديد من الفوائد أهمها التحسن النوعى بالعناية الطبية وتقليل الاخطاء الطبية ، علي الرغم من ان استخدام تكنولوجيا ادارة المعلومات جاء مؤخرا ويعزى هذا التاخيرالي عدة عوامل اهمها مدى الاستفادة من التقنيه مقارنه مع تكلفتها .

اوضحت المقابلات الشخصيه مع المهندسين الطبيين من خلال استبيان تم الاجابه عليه اثنا المقابله ثم تم تحليل بياناته بطريقه احصائيه وكانت النتيجه ان تصميم برنامج لادارة الاجهزه الطبيه يفيد العنايه الصحيه.

احدى التقنيات هو نظام ادارة تحكم المعدات الطبية هو برنامج يعنى بادارة المعدات الطبيه في مؤسسات الرعايه الصحيه ويرتكز هذا البحث على التحكم فى المعلومات التي تخص الاجهزه الطبيه .
وقد تم استخدام لغة برمجه (PHP) مع خادم شبكه محلي(Apache) بالاضافه الى برنامج (XAMPP) لتسهيل وتشغيلهم مع بعض فى جهاز حاسوب مثبت به النظام وربطه بشبكه محليه داخل المستشفى باستخدام عنوانه فى الشبكه .
وقد تم عمل قاعدة بيانات (MYSQL) تشتمل على معلومات الاجهزه الطبيه المراد ادارتها وتمتلك قاعدة البيانات هذه السماحيه باضافة الاجهزه الجديدة والتعديل فى بياناتها واستخراج تقارير عنها .
وبعد تطبيق البرنامج في مركز الابحاث التابع لجامعة النيلين ثبتت فعاليته في تجويد الاداء وتحسين الرعايه الصحيه المنشوده.

Table of content

Chapter one Introduction

Chapter Two Theoretical Fuandemtals &Background Studies

Chapter Three Methodology &Data analysis

Chapter Four Design ,Implementation &Discussion

Chapter Five Conclusion & Recommendations

List of Tables

List of figures

XI

Abbreviations

Abbreviation	Meaning
ACCE	American College of Clinical Engineering
APACHE	Name of server
CE	Certified European Mark
EU	European Union
FDA	Food and Drag Administrate
HTML	Hyper Text Markup Language
HTTP	Hypertext Transfer Protocol
LAMP	"Linux, Apache, MySQL, and PHP"
MECM	Medical Equipment Control Management
MYSQL	My Structured Query Language
PHP	Personal Home Page
XAMPP	,Apache ,MYSQL ,PHP, "Cross-platform and Perl"

Chapter one:
Introduction

1.1 General overview:

The number of critical medical devices used in a hospital may range   of 1000 devices for smaller community hospitals to well over 10,000 devices for large. The high number of critical medical devices requires   carefully designed equipment control management program to insure safe, effective, and economical use.

One of functions of clinical engineering is equipment control management; this work is more complex and costing without a computerized system , clinical engineers need new technologies to management this equipment to deliver good healthcare in healthcare Facilities.

Computer program in medicine is essential part in health field to play an important role in health care development .Now a day's many programs are developed to support healthcare technology management in medical fields one of this program is equipment control management program which produce a standard for hospital information systems.

One of the healthcare technology management professional's functions is Equipment control, in the research focus on   computerized equipment control management system.

Due to the continues development of technology and the vast amount of work in the field of the healthcare technology management .It's now indeed recommend to use computer software's and database. There are some software were designed by using database(MYSQL) and programming language such as APACHE, X AMPP ,PHP which was been used to manage medical equipment department.

1.2 Problem Statement:

 The main problem the developing countries not found medical equipment control management program using to regulates the work of the clinical engineer in hospital.

1.3 Objectives:

The objectives of this study included two types:

1

1.3.1General Objectives:

1. Development healthcare delivery.
2. Saving hospitals money by developing new method with cheapest component.

1.3.2 Specific objectives:

1. Design program system in a computer to manage and control medical equipment.
2. Save time by depending on software in medical equipment control rather than man work.
3. Support technology system in healthy filed.
4. Enable the medical equipment data to be transfer between healthcare units.

1.4 Methodology:

In the data collection stage data was gathered the search by internet and references possess. next in the survey a stage a group of professional clinical engineers will be asked to filled the questioner and the field of these surveys the medical equipment department staff either engineers, technical and medical administration after that the data analysis Statistical assessment will be obtained using the SPSS program; the studied variables will be described with bar charts and the odd ratio and p value will be obtained.

Then in the design stage the software shall be developed using PHP language program with database (MYSQL) and Apache server to develop the Software and to enable control and manage medical equipment.

Last a stage implementation equipment control management program in Research Centre.

1.5. Thesis lay out:

This thesis include of six chapter, chapter one contain the introduction of the topic, the theoretical bag round and fuandemtals covered in chapter two, the methodology explained in chapter three with the data analysis, in chapter four the design , implementation and the discussion appear, chapter five includes the conclusion and recommendations.

Chapter Two:

Theoretical Fuandemtals &Background Studie

2.1 Clinical engineering:

A clinical engineer is defined by the ACCE as "a professional who supports and advances patient care by applying engineering and managerial skills to healthcare technology." This definition was first adopted by the ACCE Board of Directors on May 13, 1991. Clinical engineering is also recognized by the Biomedical Engineering Society (BMES), the major professional organization for biomedical engineering, as being a branch within biomedical engineering.[1,2].

Clinical engineers are required to understand all modern medical technologies, as well as train, troubleshoot, and design, while managing entire clinical settings.

Is a specialty within biomedical engineering responsible primarily for applying and implementing medical technology to optimize healthcare delivery Roles of clinical engineers include training and supervising biomedical equipment technicians (BMETs), working with governmental regulators on hospital inspections/audits, and serving as technological consultants for other hospital staff. Clinical engineers also advise medical device producers regarding prospective design improvements based on clinical experiences, as well as monitor the progression of the state of the art in order to redirect hospital procurement patterns accordingly.

Clinical engineering department's at large hospitals will sometimes hire not just biomedical engineers, but also industrial/systems engineers to help address operations research, human factors, cost analyses, safety, etc. [3]

2.2 Healthcare Technology Management:

The management of healthcare technology is becoming more complex. It includes the business processes used in interaction and oversight of the medical equipment involved in the diagnosis, treatment, and monitoring of patients. The related policies and procedures govern activities such as the selection, planning, and acquisition of medical devices.

Through to the incoming inspection, acceptance, maintenance, and eventual retirement and disposal of medical equipment. Medical equipment management is a recognized profession within the medical logistics domain.

The healthcare technology management professional's purpose is to ensure that equipment and systems used in patient care are operational, safe, and properly configured to meet the mission of the healthcare; that the equipment is used in an effective way consistent with the highest standards of care by educating the healthcare provider, equipment user, and patient; that the equipment is designed to limit the potential for loss, harm, or damage to the patient, provider, visitor, and facilities through various means of analysis prior to and during acquisition, monitoring and foreseeing problems during the lifecycle of the equipment, and collaborating with the parties who manufacturer, design, regulate, or recommend safe medical devices and systems.[8]

Some but not all of the healthcare technology management professional's functions are:

Equipment Control Management
Equipment Asset Management
Equipment Inventories
Work Order Management
Data Quality Management
Equipment Maintenance Management
Personnel Management

2.3 Types of Medical Equipment:

There are several basic types:
Diagnostic equipment includes medical imaging machines, used to aid in diagnosis. Examples are ultrasound and MRI machines, PET and CT scanners, and x-ray machines.
Treatment equipment includes infusion pumps, medical lasers and LASIK surgical machines.
Life support equipment is used to *maintain* a patient's bodily function. This includes medical ventilators, anesthetic machines, heart-lung machines, ECMO, and dialysis machines.
Medical monitors allow medical staff to measure a patient's medical state. Monitors may measure patient vital signs and other parameters including ECG, EEG, and blood pressure.
Medical laboratory equipment automates or helps analyze blood, urine, genes, and dissolved gases in the blood.

Diagnostic Medical Equipment may also be used in the home for certain purposes, e.g. for the control of diabetes mellitus

Therapeutic: physical therapy machines like continuous passive range of motion (CPM) machines.

2.4.1 Regulations:

Regulation of medical devices is intended to protect consumer's health and safety by attempting to ensure that marketed products are effective and safe.

Standards establish basic requirements for safe development and implementation of medical devices, minimizing the risk caused to the patients when used. The new device must be proven not only safe but also effective in curing   specific disease Regulatory bodies. [4]

2.4.2 Classification of Equipment:

The regulatory authorities recognize different classes of medical devices based on their design complexity, their use characteristics, and their potential for harm if misused. Each country or region defines these categories in different ways. The authorities also recognize that some devices are provided in combination with drugs, and regulation of these combination products takes this factor into consideration. [4]

2.5.1European Union (EU) Classification:

The classification of medical devices in the European Union is outlined in Annex IX of the Council Directive 93/42/EEC. There are basically four classes, ranging from low risk to high risk.

    Class I (including Is & Im)
    Class IIa
    Class IIb
    Class III

The authorization of medical devices is guaranteed by a Declaration of Conformity. This declaration is issued by the manufacturer itself, but for products in Class Is, Im, IIa, IIb or III, it must be verified by a Certificate of Conformity issued by a Notified Body. A Notified Body is a public or private

organization that has been accredited to validate the compliance of the device to the European Directive It is designed to aid in the diagnosis, monitoring or treatment of medical conditions. [5]

The term medical devices, as defined in the Food and Drugs Act, covers a wide range of health or medical instruments used in the treatment, mitigation, diagnosis or prevention of a disease or abnormal physical condition. Health Canada reviews medical devices to assess their safety, effectiveness, and quality before authorizing their sale in Canada. [4]

  Medical devices that pertain to class I (on condition they do not require sterilization or do not measure a function) can be marketed purely by self-certification. [6]

The European classification depends on rules that involve the medical device's duration of body contact, invasive character, use of an energy source, effect on the central circulation or nervous system, diagnostic impact, or incorporation of a medicinal product. Certified medical devices should have the CE mark on the packaging, insert leaflets, etc. [7]

2.6 Medical equipment control management:

Every medical treatment facility should have policies and processes on equipment control. Equipment control involve the management of medical devices within a facility and may be supported by automated information systems (e.g., Enterprise Resource Planning (ERP) systems from Lawson Software are often found in U.S. hospitals, and the U.S. military health system uses an advanced automated system known as the Defences Medical Logistics Standard Support (DMLSS) suite of applications). Equipment control begins with the receipt of a newly acquired equipment item and continues through the item's entire life-cycle. Newly acquired devices should be inspected by in-house or contracted Biomedical Equipment Technicians (BMETs), who will receive an established equipment control number from the facilities Equipment/Property Manager. This control number is used to track and record maintenance actions in their database. This is similar to creating a new chart for a new patient that will be seen at the medical facility. Once an equipment control number is established, the device is safety inspected and readied for delivery to clinical and treatment areas in the facility. [8,9]

Facilities or healthcare delivery networks may rely on a combination of equipment service providers such as manufacturers, third party services, in-house technicians, and remote support. Equipment managers are responsible for continuous oversight and responsibility for ensuring safe and effective equipment performance through full service maintenance.

Medical equipment managers are also responsible for technology assessment, planning and management in all areas within a medical treatment facility (e.g. developing policies and procedures for the medical equipment management plan, identifying trends and the need for staff education, resolution of defective biomedical equipment issues). This industry is new, and there is not a clear line between IT and Bio med. [10]

2.7 Database:

It is an organized collection of data [11]. It is the collection of schemes, tables, queries, reports, views and other objects. The data is typically organized to model aspects of reality in a way that supports processes requiring information.

Database management system (DBMS) is a computer software application that interacts with the user, other applications, and the database itself to capture and analyze data. A general-purpose DBMS is designed to allow the definition, creation, querying, update, and administration of databases. Well-known DBMSs include:

My SQL.
Postgre SQL.
Microsoft SQL Server.
IBM DB2.

A database is not generally portable across different DBMSs, but different DBMS can interoperate by using standards such as SQL to allow a single application to work with more than one DBMS. Database management systems are often classified according to the database model that they support. Formally, a "database" refers to a set of related data and the way it is organized. Access to this data is usually provided by a "database management system" (DBMS) consisting of an integrated set of computer software that allows users to interact with one or more databases and provides access to all of the data contained in the database. The DBMS provides various functions that allow entry, storage

and retrieval of large quantities of information as well as provides ways to manage how that information is organized.

Because of the close relationship between them, the term "database" is often used casually to refer to both a database and the DBMS used to manipulate it

Outside the world of professional information technology, the term *database* is often used to refer to any collection of related data. This article is concerned only with databases where the size and usage requirements necessitate use of a database management system.[12]

Existing DBMSs provide various functions that allow management of a database and its data which can be classified into four main functional groups:
Data definition – Creation, modification and removal of definitions that define the organization of the data.
Update – Insertion, modification, and deletion of the actual data.[13]
Retrieval – Providing information in a form directly usable or for further processing by other applications. The retrieved data may be made available in a form basically the same as it is stored in the database or in a new form obtained by altering or combining existing data from the   database.[14]
Administration – Registering and monitoring users, enforcing data security, monitoring performance, maintaining data integrity, dealing with concurrency control, and recovering information that has been corrupted by some event such as an unexpected system failure.[15]

2.7.1 Application areas of DBMS:

 Databases are used to support internal operations of organizations and to underpin online interactions with customers and suppliers. databases are used to hold administrative information and more specialized data, such as engineering data or economic models. Examples of database applications include computerized library systems, flight reservation systems and computerized parts inventory systems.

2.7.2 MySQL:

is an open-source relational database management system (RDBMS) [16], and the most widely used open-source client–server model RDBMS.

MySQL is a popular choice of database for use in web applications, and is a central component of the widely used LAMP open source web application software stack .LAMP is an acronym for "Linux, Apache, MySQL, Perl/PHP/Python." Free-software-open source projects that require a full-featured database management system often use MySQL. Applications that use the MySQL database include: Word Press, phpBB, MyBB, Drupal and other software. MySQL is also used in many high-profile, large-scale websites, including Google, Face book, Twitter, Flicker, and YouTube.[17]

It is written in C and C++. Its SQL parser is written in yacc, but it uses a home-brewed lexical analyzer. MySQL works on many system platforms. [18]

The MySQL server software itself and the client libraries use dual-licensing distribution. It is offered fewer than two different editions: the open source MySQL Community Server and the proprietary Enterprise Server.

MySQL Enterprise Server is differentiated by a series of proprietary extensions which install as server plugins, but otherwise shares the version numbering system and is built from the same code base. [19]

`Ensuring high availability requires a certain amount of redundancy in the system. One of the projects aiming to provide high availability for MySQL is *MySQL Fabric*, an integrated system for managing a collection of MySQL servers, and a framework on top of which high availability and database sharing is built. MySQL Fabric is open-source and is intended to be extensible, easy to use, and to support procedure execution even in the presence of failure, providing an execution model usually called *resilient execution*. MySQL client libraries are extended so they are hiding the complexities of handling failover in the event of a server failure, as well as correctly dispatching transactions to the shards. As of September 2013, there is currently support for Fabric-aware versions of Connector/PHP, Connector/Python, as well as some rudimentary support for Hibernate and Doctrine. As of May 2014, MySQL Fabric is in the general availability stage of development. [20]

Many programming languages with language-specific Application programming interfaces include libraries for accessing MySQL databases.

These include MySQL Connector/Net for integration with Microsoft's Visual Studio.

2.8 PHP:

Is a server-side scripting language designed for web development but also used as a general-purpose programming language. It is free software released under the PHP License. It is a general-purpose scripting language that is especially suited to server-side web development, in which case PHP generally runs on a web server. [21]

Any PHP code in a requested file is executed by the PHP runtime, usually to create dynamic web page content or dynamic images used on websites or elsewhere. It can also be used for command-line scripting and client-side graphical user interface (GUI) applications. PHP can be deployed on most web servers, many operating systems and platforms, and can be used with many relational database management systems (RDBMS). Most web hosting providers support PHP for use by their clients. It is available free of charge, and the PHP Group provides the complete source code for users to build, customize and extend for their own use. For specific and more advanced usage scenarios, PHP offers a well defined and documented way for writing custom extensions in C or C++. [22]

Over time, PHP interpreters became available on most existing 32-bit and 64-bit operating systems, either by building them from the PHP source code, or by using pre-built binaries. For the PHP versions 5.3 and 5.4, the only available Microsoft Windows binary distributions were 32-bit x86 builds, requiring Windows 32-bit compatibility mode while using Internet Information Services on a 64-bit Windows platform. PHP version 5.5 made the 64-bit x86-64 builds available for Microsoft Windows. [23]

2.8.1Use of PHP:

Is a general-purpose scripting language that is especially suited to server-side web development, in which case PHP generally runs on a web server. Any PHP code in a requested file is executed by the PHP runtime, usually to create dynamic web page content or dynamic images used on websites or elsewhere.[24]

It can also be used for command-line scripting and client-side graphical user interface (GUI) applications. PHP can be deployed on most web servers, many operating systems and platforms, and can be used with many relational database management systems (RDBMS). Most web hosting providers support PHP for use by their clients. It is available free of charge, and the PHP Group provides the complete source code for users to build, customize and extend for their own use.[25]

2.8.2 XAMPP:

is a free and open source cross-platform web server solution stack package developed by Apache Friends,[26] consisting mainly of the Apache HTTP Server, MYSQL database, and interpreters for scripts written in the PHP and Perl programming languages.[27] [28]
XAMPP stands for Cross-Platform (X), Apache (A), MYSQLDB (M), PHP (P) and Perl (P). It is a simple, lightweight Apache distribution that makes it extremely easy for developers to create a local web server for testing purposes. Everything you need to set up a web server – server application (Apache), database (MYSQL), and scripting language (PHP) – is included in a simple extractable file. XAMPP is also cross-platform, which means it works equally well on Linux, Mac and Windows. Since most actual web server deployments use the same components as XAMPP, it makes transitioning from a local test server to a live server is extremely easy as well.

2.8.3 Usage of XAMPP:

Officially, XAMPP's designers intended it for use only as a development tool, to allow website designers and programmers to test their work on their own computers without any access to the Internet. To make this as easy as possible, many important security features are disabled by default.[29] XAMPP has the ability to serve web pages on the World Wide Web.[30] A special tool is provided to password-protect the most important parts of the package.[31]
XAMPP also provides support for creating and manipulating databases in MYSQL and SQLite among others. Once XAMPP is installed, it is possible to treat a local host like a remote host by connecting using an FTP client.

2.9 Privies Studies:

Here two studies are introduced .the first study addresses Medical Equipment Management (MEM) Cyber Security use of proper network architecture allows reducing the risk of a malware outbreak or system penetration and also can contain the impact should such event occur. The second study addresses the Development of Medical Equipment Management Systems the MEM-framework will then be used to compare equipment management systems in three developing countries.

2.9.1 Medical Equipment Management (MEM)-Cyber Security:

The main focus of this document is on network-connected medical devices. Many Implantable devices have some similar risk factors, but due to the way they are accessed and the risk to the patient, they add their own specific aspects to the problem. They are a unique type of equipment and require unique considerations, which are beyond the scope of this document. Most hospital IT personnel have not been responsible for Medical Devices. However, due to the shifting technology platforms, increasing interoperability, and the specific skill sets of IT personnel the scope of the IT department and their responsibilities is starting to change. Effective lifecycle management can also help to improve device reliability as well as security. These processes and policies can be.
 Implemented manually or via automated workflow management tools. This document provides guidance and suggestions on how Biomedical Engineers, IT professionals, manufacturers, and security experts can collaborate to minimize the risks associated with networked medical devices. May 27, 2011.

2.9.2 Conclusion:

The increasing integration of medical devices with hospital networks as well as use of off-the shelf technologies exposes devices and the PHI stored on them to cyber risks. This can lead to compromised devices, breach of PHI, or even open the door to a larger attack on the enterprise network, all of which putting patient data and lives at risk.[32]

2.9.3 Development of Medical Equipment Management Systems:

Medical Equipment Management (MEM) takes place within a context of human, material, structural, organisational and financial resources. Elements of this supporting context are frequently referred to as the Health Care Technical Services (HCTS); a concept discussed in the previous Paper. The effectiveness of a Medical Equipment Management System can be measured in terms of the operational performance of the stock of medical equipment which is being managed. This Paper first of all outlines and discusses the MEM-concept and its individual components. The MEM-framework will then be used to compare equipment management systems in three developing countries.

2.9.4 Selection:

The selection of equipment and suppliers is likely to be the most crucial stage in the indigenous management process. The output of the selection process is a detailed list of equipment names and models, stipulating the preferred supplier. This list constitutes the link between the selection and procurement stage.

2.9.5 Procurement:

Procurement can be regarded as the process by which an item of equipment, which has already been selected, is purchased by the user. Procurement is a predominantly administrative exercise, such as obtaining the best possible deal from the various sources of supply and organising the transfer of the equipment to the importing country and to its final destination.

2.9.6 Operation and Maintenance:

The technical managers are responsible for regular ordering of parts and other materials which are needed to carry out equipment maintenance.
In summary, some of the key issues for an effective equipment maintenance system are:
  1- Qualification of Technical Staff.
  2- Financial Provisions for Maintenance.
  3- Maintenance Facilities.

4- Maintenance Contracts.
5- Transport.
6- Technical Library.
7- Availability and Quality of Documentation
8- Equipment Inventory.

2.9.7 Cancellation and Disposal:

In order to avoid excessive downtime due to equipment absolution, it is imperative to replace medical equipment at predetermined intervals. The absence of a replacement policy invariably leads to unreliability and unpredictable performance of equipment. Periodic equipment acquisition should not only be concerned with adding new items to the current stock, but also apply to routine replacement of existing assets.

2.9.8 Comparison of MEM Systems in Three Countries:

In order to get an idea about how different countries have put in place systems for the management of medical equipment, the framework developed in this Paper will be used to assess three country situations. As mentioned before, these countries, being Yemen in the Middle East, Ghana in West Africa and Costa Rica in Central America, are extremely diverse in terms of the way in which their management systems have been developed.

2.9.9 Conclusions:

With regard to developing countries, various studies have suggested that certain management-process-related factors would be associated with the variation in equipment performance between countries. This Paper, therefore, set out to examine the relationship between country-specific medical equipment management systems and the operational performance of the equipment being managed. The country studies in this Paper have provided valuable insight into this relationship. More specifically, the following observations can be made:
(a) The internal development of specific choice criteria related to equipment and sup pliers of equipment, based on previous acquisition experiences, appears to be a crucial element of the equipment management process.

14

(b) Effective equipment management requires the development of specific managerial and organisational capacities and competences, in addition to purely engineering or technical skills.

(c) An effective equipment monitoring system improves the functionality of equipment management systems, as it plays a crucial role in the linkage and integration of individual aspects of management.

(d) The ability to manage foreign aid and associated aid relationships are of crucial importance for the internal development of a successful and sustainable equipment management system. [33]

Chapter Three:

Methodology and data analysis

3.1 Methodology:

The questionnaire was used to illustrate the lake present in those hospitals, economical use of equipment, effective, instruments or staff education & training.

1**.** First step was a study the current designs in the local hospitals through primary data collection by questionnaire illustrates the real problems and the lake present in those hospitals, economical use of equipment of equipment , effective , instruments or staff education & training.

2**.** Second step was data analysis that employs both descriptive and analytical statistics, which was done by a statistician using computer-based program Statistical Package for Social Sciences (SPSS). The aim of this step is to focus on the weakness in current medical equipment departments and treat it through the program design.

3**.** Finally and according to international standard of computerized equipment control management program, and Implementation was designed.

3.1.1 Survey Field:

The field of these surveys the medical equipment department staff either engineers, technical and medical administration. The criteria of this study included the economical use, medical devices evaluation, staff and training and patient Services. The field survey was used to identify problems and issues of medical equipment department, there were 17persons who participated in the interview.

3.1.2 Study sampling:

Forms were filled through personal interviews with the official responsible for MED at each hospital. The form contained 12 items and was administered to the health care establishments, 1 at each hospital.

3.1.3. Sampling techniques:

Non probability convenience sampling was used to recruit participants according to the following inclusion and exclusion criteria.

3.1.3 Data collection techniques and tools:

The interviews guided by questionnaires. it are composed of 12 questions to evaluate the quality of MED in the general hospitals, such questions prepared in accordance with the observation statistical standards for easy to understand and answer questions in a scientific and comprehensive (See Appendix A).

3.1.4 Ethical considerations:

1. A written informed consent from the university was obtained.
2. The study was approved by the university ethical review board (ERB).
3. A verbal informed consent was obtained from the participants.
4. The participant confidentiality will be conserved.

3.2.1 Data analysis:

Data analysis emblements both descriptive and analytical statistics, which was done by a statistician using computer-based program Statistical Package for Social Sciences (SPSS) version 22.

3.2.1.1 Type of hospital:

Through the study and analyses we found that 29.4% of sample study says Private hospital and 70.6% of the sample study says government hospital the table and figure (3.1) showing below:

Table (3.1): Type of hospital

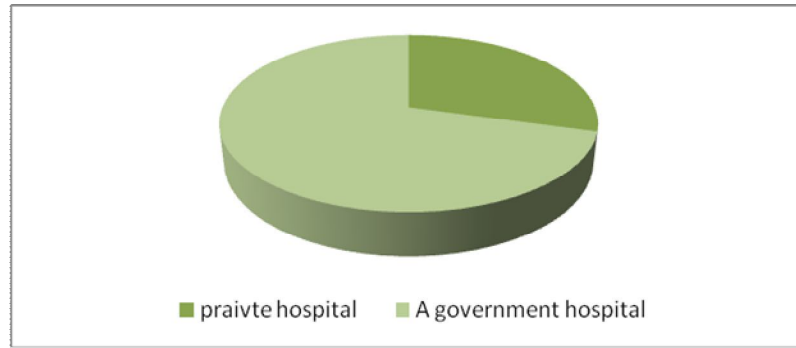| Choices	Frequency	Percent
private hospital	5	29.4
A government hospital	12	70.6
Total	17	100.0

Figure (3.1): Type of hospital

The majority of sample study was 70.6%, so we found the govermment hospital.

3.2.1.2 Department of medical devices in the hospital:

Through the study and analyses we found that 82. % of sample study says found medical devices department in the hospital and 18% of the sample study says No the table and figure (3.2) showing below:

Table (3.2): Department of medical devices in the hospital

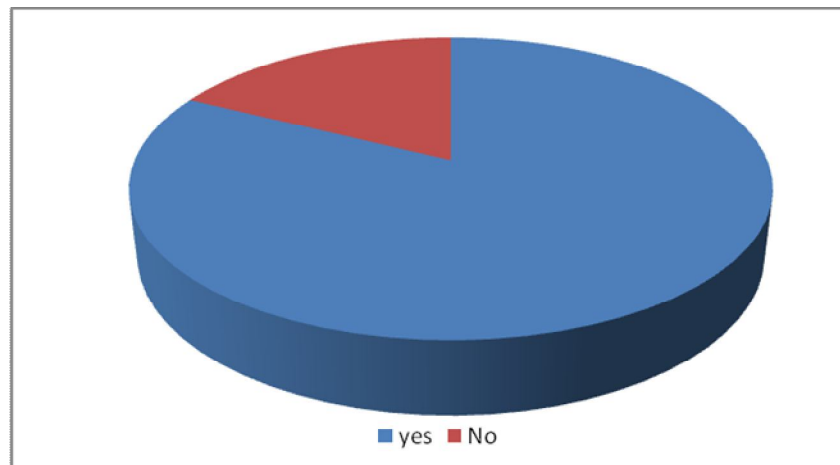| Choices	Frequency	Percent
yes	14	82.4
No	3	17.6
Total	17	100.0

Figure (3.2): Department of medical devices in the hospital

The majority of sample study was 82.4%, so we found the most hospital have medical devices department and that definitly leade to safe and effective use of medical devices.

3.2.1.3 Medical equipment department procedure:

Table (3.3) and figure (3.3) showing the percentage of Medical equipment department procedure, 11.8% of hospital answer by25%, and.17.6 %of hospitals about 50%of, also 29.4% answer by 75% or 100% and final 11.8% no answer.

Table (3.3): Medical equipment department procedure

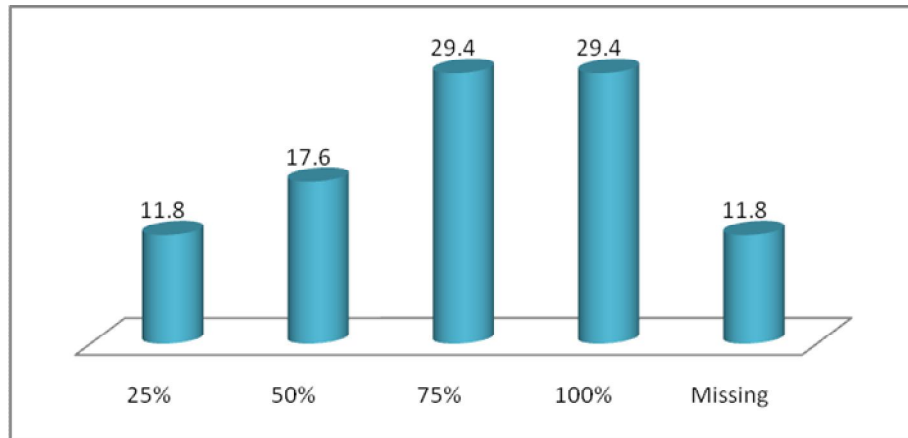| Choices	Frequency	Percent	Valid Percent
25%	2	11.8	13.3
50%	3	17.6	20.0
75%	5	29.4	33.3
100%	5	29.4	33.3
Total	15	88.2	100.0
Missing	2	11.8	
Total	17	100.0	

Figure (3.3): Medical equipment department procedure

Through this question there are hospitals no answer and that for two reasons:
 Some hospitals no found Medical equipment department and cannot provide the necessary services he other reason is the refusal of some hospitals has not medical engineering staff.

3.2.1.4 Number of medical engineers in the Department:

The study showing that, 60% of hospital with range from 1 to 3 medical engineers available not only for MED but for all other hospital departments,20% in range of 4-7 and that founded only in private hospitals, 20% for more than 7, and 12% for no Medical engineers founded in all hospital.

Table (3.4): Number of medical engineers in the Department

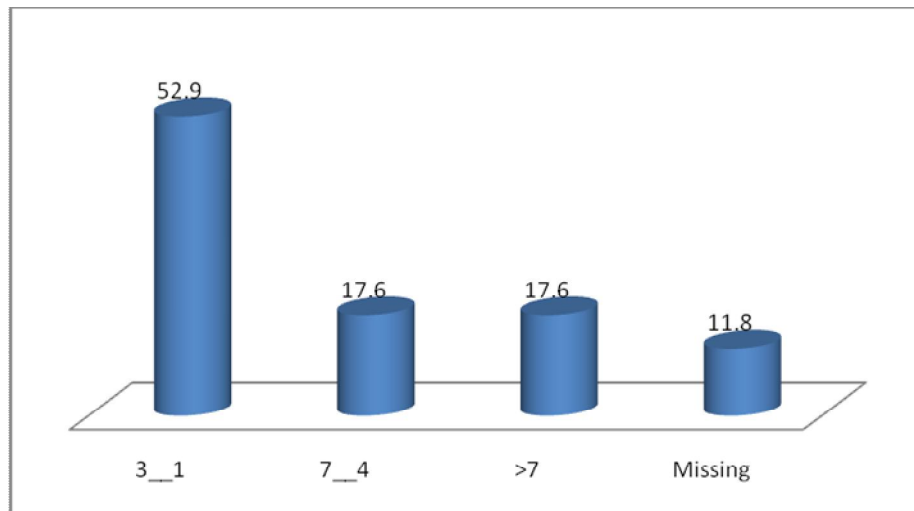| Choices	Frequency	Percent	Valid Percent
1-3	9	52.9	60.0
4-7	3	17.6	20.0
>7	3	17.6	20.0
Total	15	88.2	100.0
Missing	2	11.8	
Total	17	100.0	

Figure (3.4): Number of medical engineers in the Department

The important point in this section the decision of the ministry of health to employ of medical engineers in all the governmental hospitals and that to create of good services for all hospital, and this decision may lead to elevate the load on that MED.

3.2.1.5 Specialties of medical engineers:

 The evaluation of Specialties of medical engineers of MED represent in table (3.5) and figure (3.5), 71% answered there is no enough Specialties staff, and these one of most important point in MEC Program design these staff must be trained on speed in handling the different types of equipment monitions. Table and figure (3.5) showing that:

Table (3.5): Specialties of medical engineers

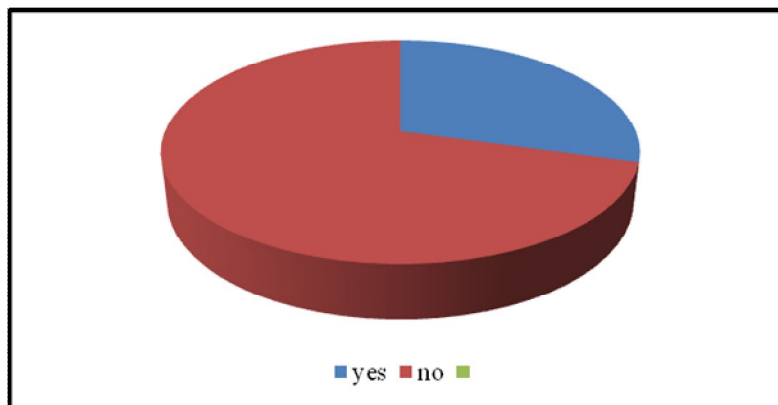| Choices	Frequency	Percent
yes	5	29.4
no	12	70.6
Total	17	100.0

Figure (3.5): Specialties of medical engineers

3.2.1.6 Availability of the medical devices in the hospital:

Throw the study and analysis we found that 65% saying yes for the availability in biomedical devices in the hospital and 35% says on the table and figure (3.6) showing that below:

Table (3.6): Availability of the medical devices in the hospital

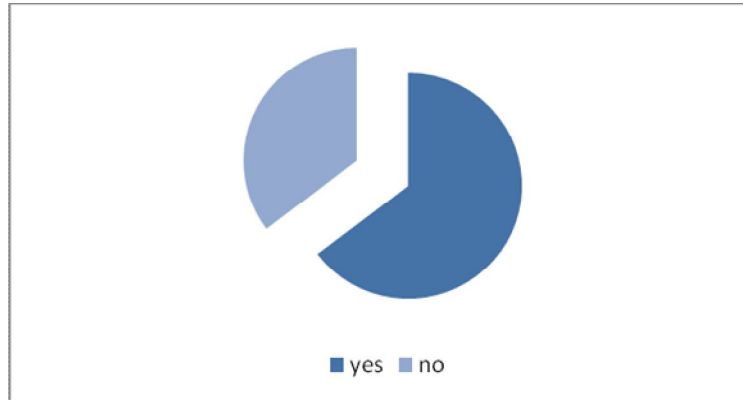| Choices	Frequency	Percent
yes	11	64.7
no	6	35.3
Total	17	100.0

Figure (3.6): Availability of the medical devices in the hospital

This Section to evaluate the hospital in terms of Availability of the medical devices that represent in figure (3.6), 65% answer with no permanent shortage, and all shortages resolved immediately by the biomedical engineering department, but also there is 35% answer they have problems and it is not resolve for a while, the next section represent the reasons.

3.2.1.7 Number of medical devices found in all departments of the hospital:

The study showing that, 29% of hospital with range from < 100 of medical devices found in all departments of the hospital ,24% in range of 100-300, 47% range form 301- 600 and that founded only in private hospitals.

Table (3.7): Number of medical devices found in all department of the hospital

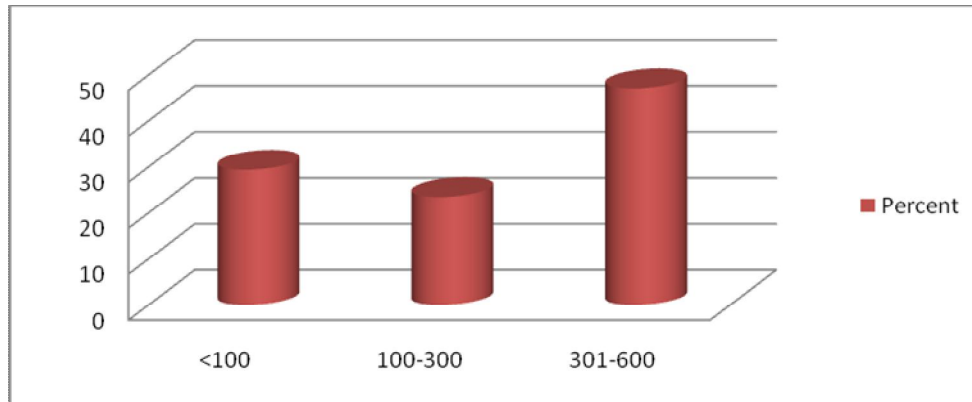| Choices	Frequency	Percent
<100	5	29.4
100-300	4	23.5
301-600	8	47.1
Total	17	100.0

Figure (3.7): Number of medical devices found in all department of the hospital

The result was 47% of medical devices found in all departments of the private hospital and these are very high percentage because the medical devices linked with coast.

3.2.1.8 Medical equipment department method:

The evaluation of t method of MED represent in table (3.8) and figure (3.8), 24% answered there is log book, 6%answered there is soft ware, 71% answered any way and these one of most important point in MECM program design. Table and figure (3.8) showing that:

Table (3.8): Medical equipment department method

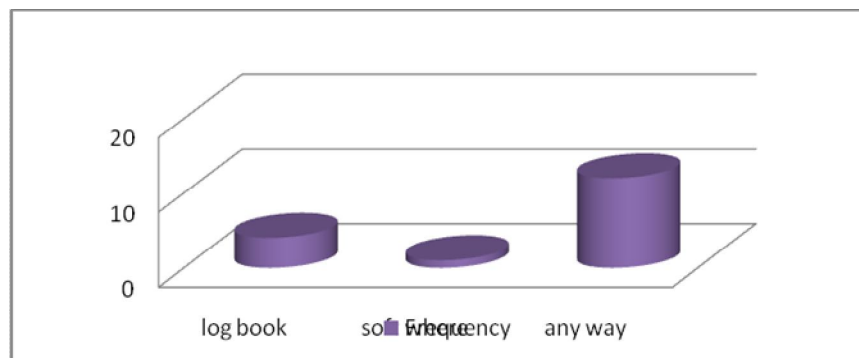| Choices	Frequency	Percent
log book	4	23.5
soft where	1	5.9
any way	12	70.6
Total	17	100.0

Figure (3.8): Medical equipment department method

3.2.1.9 Technique of Medical equipment department method:

The evaluation of Technique of method of MED represent in table (3.9) and figure (3.9),12 % answered there is use a computer, 65%answered there is use hand work and these one of most important point in MECM program design., 24% answered there is use an anther any way. Table and figure (3.9) showing that:

Table (9): Technique of Medical equipment department method

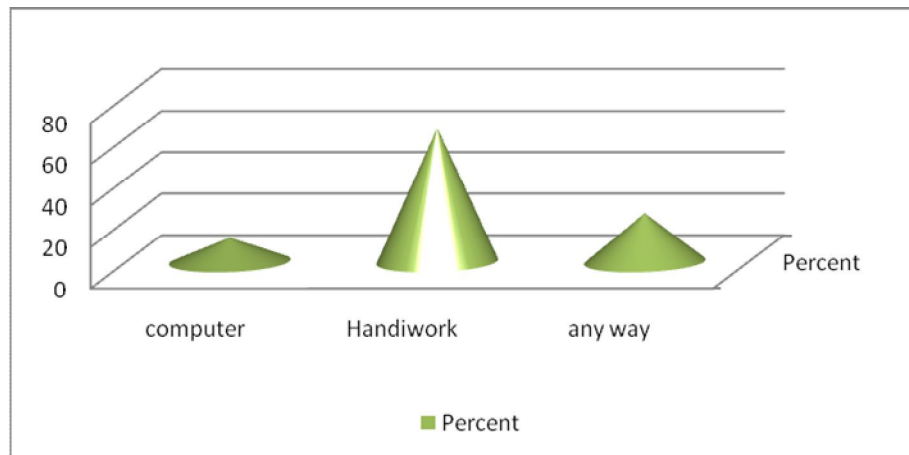| Choices	Frequency	Percent
computer	2	11.8
Handiwork	11	64.7
any way	4	23.5
Total	17	100.0

Figure (9): Technique of Medical equipment department method

3.2.1.10 the constraints of work efficiency:

Through the study and analyses we found that 12% of sample study says the constraints of work efficiency is Lack of medical engineering,18% of sample study says is lack of spear part and 70% of the sample study says is lack of tools the table and figure(3.10) showing below:

Table (3.10): The constraints of work efficiency

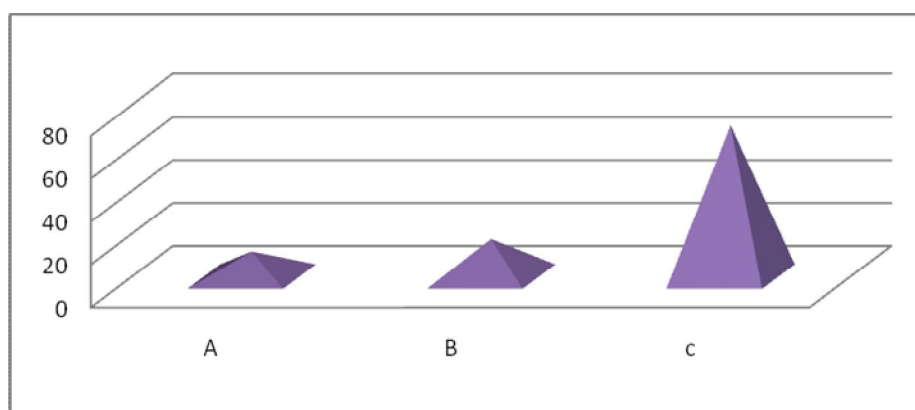| Choices	Frequency	Percent
A. Lack of medical engineering	2	11.8
B. lack of spear part	3	17.6
C. lack of tools	12	70.6
Total	17	100.0

Figure (3.10): The constraints of work efficiency

A- Lack of medical engineering. B- Lack of spear part C.-Lack of tools.

The majority of sample study was 70%, so we found the most hospital have few tools to efficiency in MED work and that definitly leade to high cost of tools.

3.2.1.11The ability to use computer program to improve and develop management:

The analysis found that to evaluate the MED ability to use computer program to improve and develop management the answer percentage 100% of hospitals both in governmental and private answer the department need to design MEC program to develop management. .Figure (3.11) and table (3.11) shows that.

Table (3.11): The ability to use computer program to improve and develop management

Choices	Frequency	Percent
eyes	17	100.0

3.2.1.12 Effectiveness use of the proposed new program:

These analysis is the most important question that "do you think the ME department can be more useful and more effective if use of the proposed new program ", the answer of these question shows in figure (3.11), 94% think so, and only 6% don't think that, these small percentage result from medical staff of hospital, answer question because have no ME department and Biomedical engineering staff that for some special cases. Table and figure showing that below:

Table (3.I2): Effectiveness use of the proposed new program

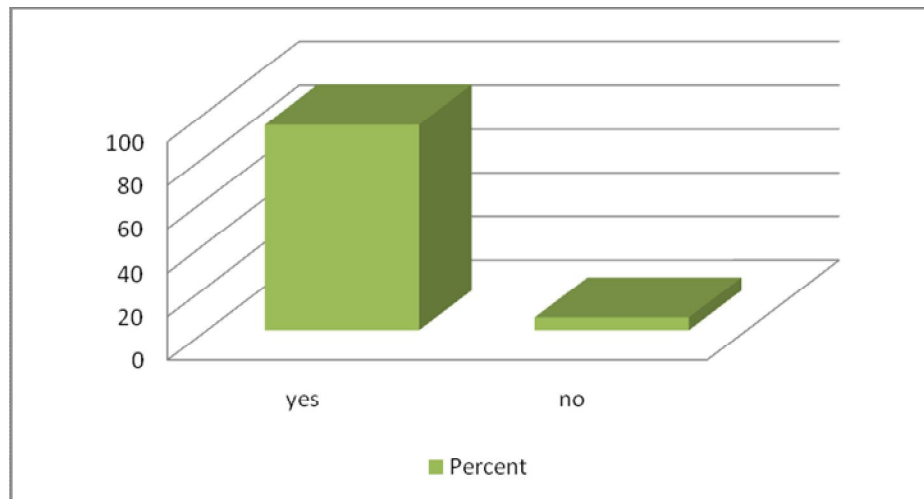| Choices	Frequency	Percent
Yes	16	94.1
No	1	5.9
Total	17	100.0

Figure (3.I1): Effectiveness use of the proposed new program

3.3 Co-relations:

In this study the evaluation of relation between two variables must be provided, the variable selected as below:

3.3.1 First relation between:

1. Department of medical devices in the hospital

2. Type of hospital.

Table (3.13): Correlation between Department of medical devices in the hospital and Type of hospital before treatment using Pearson Correlation

Type of hospital and Department of medical devices in the hospital Cross tabulation				
				Count
		Department of medical devices in the hospital		Total
		yes	No	
Type of hospital?	Private hospital	3	2	5
	A government hospital	11	1	12
Total		14	3	17

P value = 0.119 non sig.

By measuring the Pearson correlation we find that there is a relationship between two variables degree of freedom which is 0.119 higher than the 0.05 level measurement of any two-way relationship, so we reject the hypothesis of non-acceptance and accept the hypothesis which states that the existence of a specialized hospital is reduced the Department of medical devices in the hospital.

3.3.2 Second relation between:

1. Number of medical engineers in the Department.
2. Type of hospital.

Table (3.14) Correlation between Type of hospital and Number of medical engineers in the Department before treatment using Pearson Correlation

Type of hospital and Number of medical engineers in the Department Cross tabulation					
Count					
		Number of medical engineers in the Department			Total
		1-3	4-7	>7	
Type of hospital?	private hospital	4	0	0	4
	A government hospital	5	3	3	11
Total		9	3	3	15

P value =0.152 non sig.

By measuring the Pearson and Spearman correlation we find that there is a relationship between two variables degree of freedom which is 0.152 higher than the 0.05 level measurement of any two-way relationship, so we reject the hypothesis of non-acceptance and accept the hypothesis which states that the Represents Number of medical engineers in the Department is few in private hospital.

Chapter Four:

Design Program, Implementation &Discussion

4.1.1 Introduction:

The system is consist of two parts hardware and software the hardware consist
Of computer system. Software part employ PHP language which is the
communicating language employed to create the link between database and
apache. A computer is a general purpose device that can be programmed to
carry out a set of arithmetic or logical operations. Since a sequence of
operations can be readily changed, the computer can solve more than one kind
of problem.
The computer can be used has this technical specification:

1. Processor Pentium 4 or higher.
2. Ram 128 MB or higher.
3. Free memory space 2 MB.
4. Operating system windows XP or higher.

4.1.2 Designed Program:

Due to the continues development of technology and the vast amount of work
in the field of the healthcare technology management .It's now indeed we
recommend to use program software's and database. So there are some software
were designed by using database(MYSQL) and programming language such as
APACHE, X AMPP ,PHP which is been used to control and manage medical
equipment department.
So these programs used database management type MYSQL this database link
by PHP program interface software applications.PHP Program need to Apache
server Program to make computer run as a server. We used XAMPP Software
application to storage the Apache, PHP and MYSQL together at same package.

4.1.3 Data base planed:

It is data created to made relation between main tables:

Device

Type

Brand

Supplier

Department.

Maintenance.
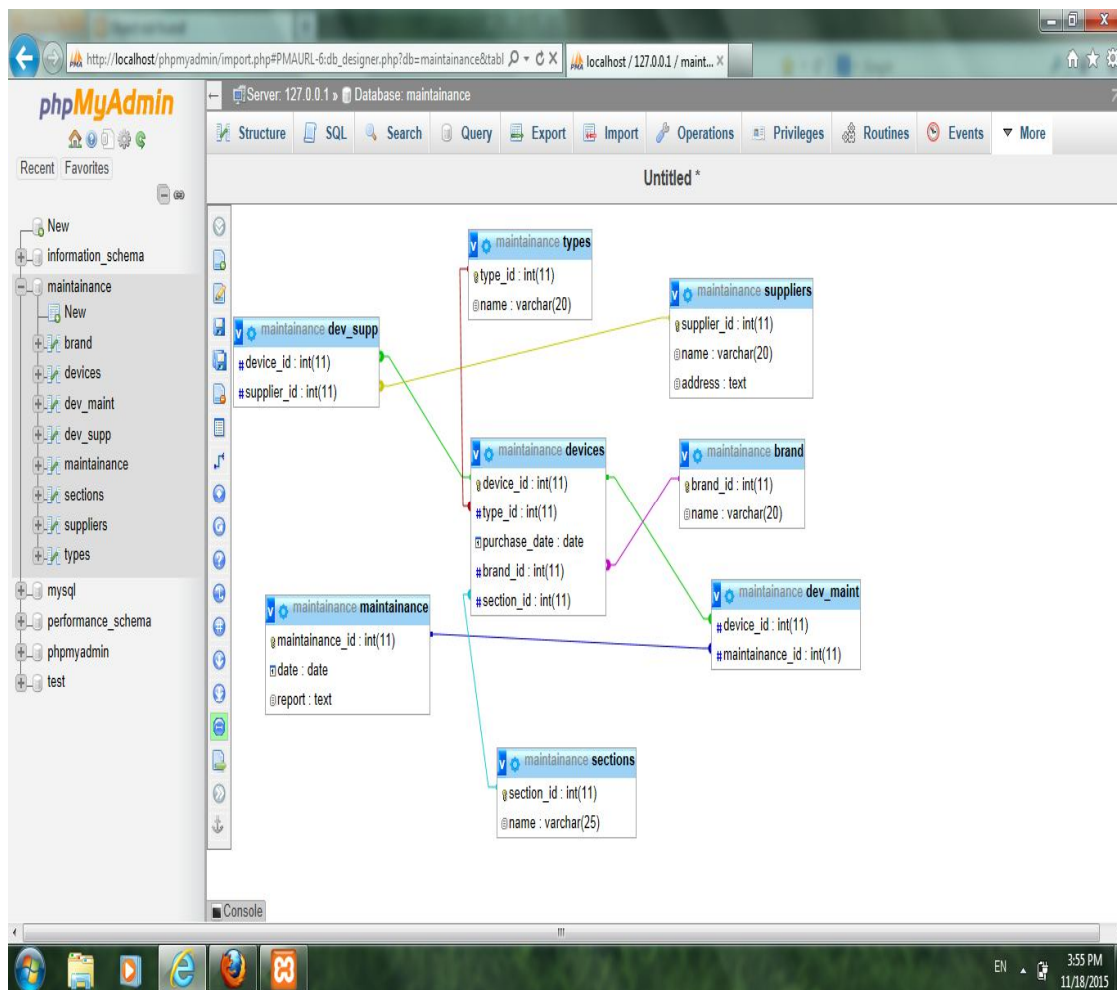
Reports.

Figure (4.1): showing below:

Figure (4.1): Relationships between tables in formation of database

4.1.4The sauced step in design of program:

The design of screen at first program appear   home screen it is include user entry screen include user name, password and name of program. Figure (4.2) showing below:
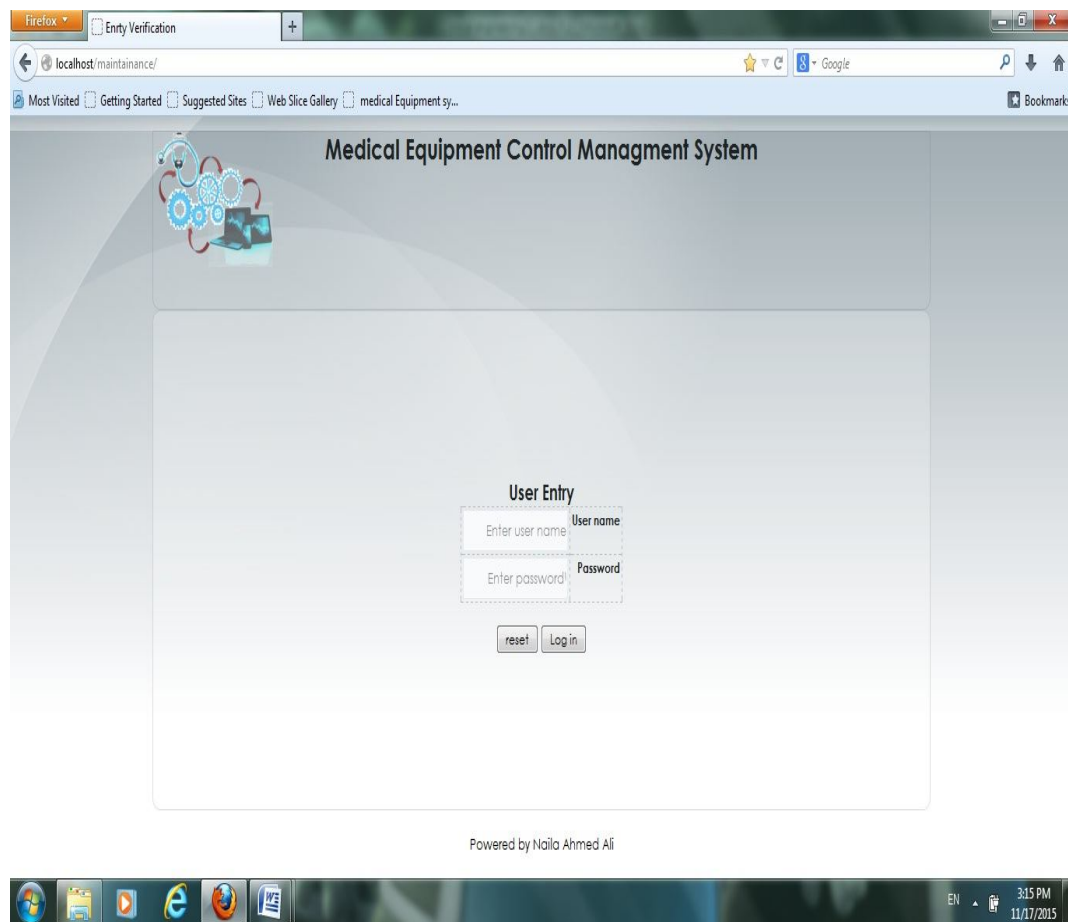

Figure (4.2): appear   home screen it is include user entry and user name

The main page screen show element of program as device, type, brand, supplier, department, maintenance, and reports. Figure (4.3) showing below:
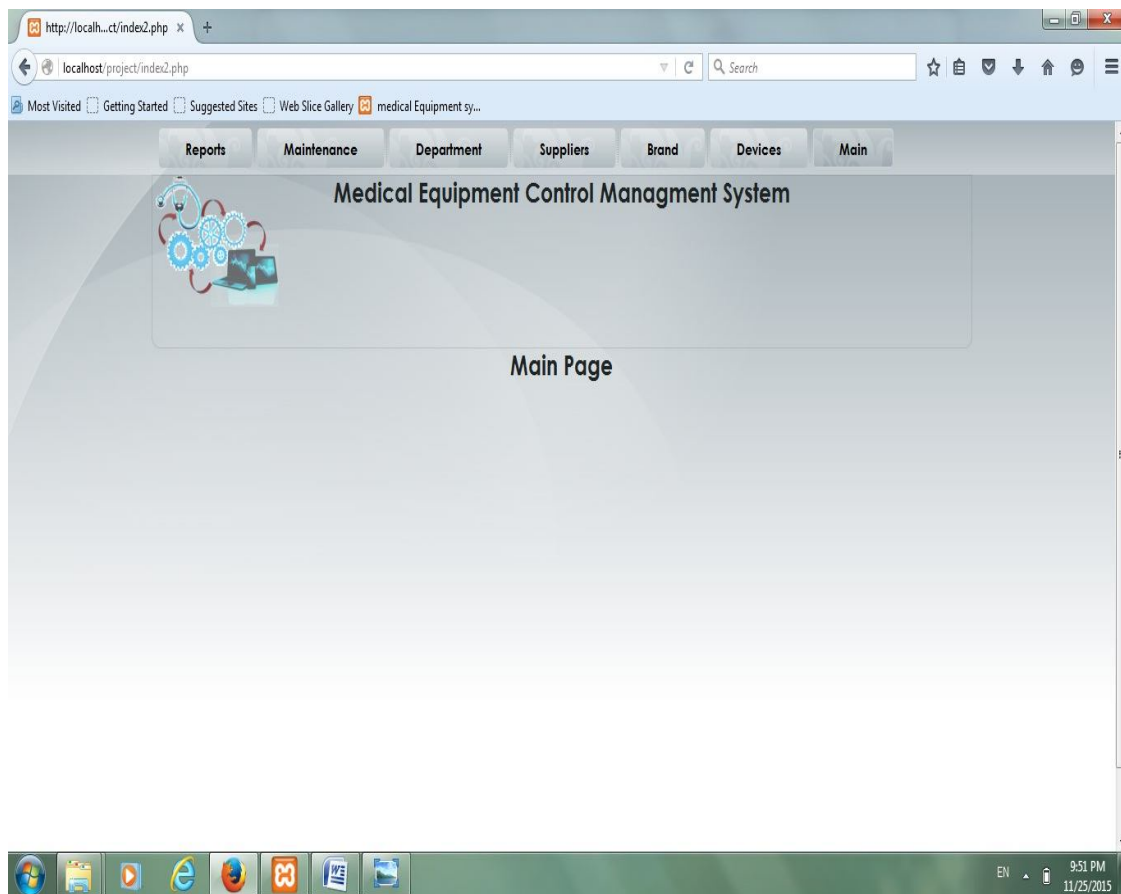

Figure (4.3): The main page screen show element of program

Add new device screen include information of device ID, type, supplier, brand, department and date of entry. Figure (4.4) showing below:

Figure (4.4): Add new device screen include information of device

Type of device screen show adds new Device type. Figure (4.5) showing below:
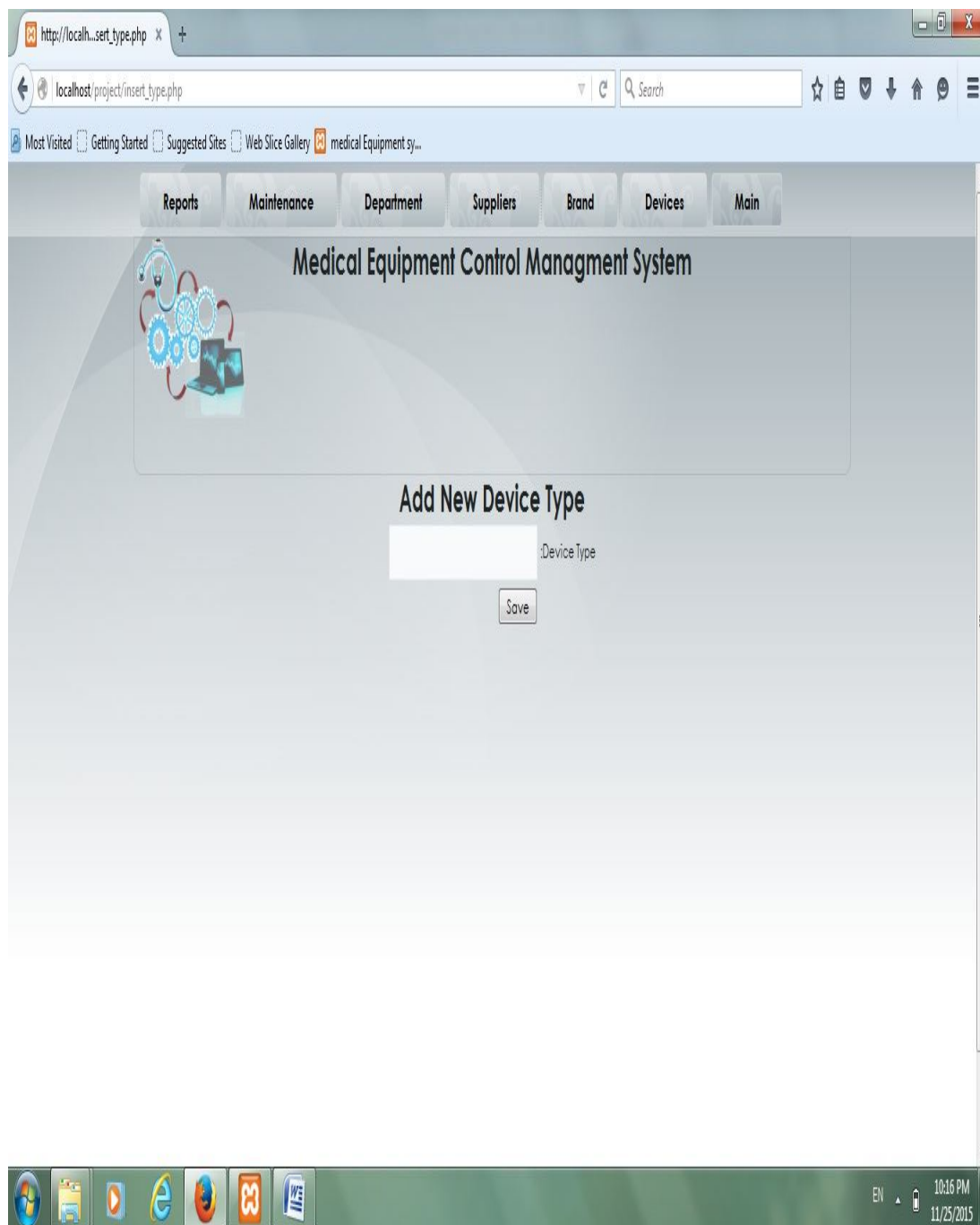
Figure (4.5): Device Type screen show adds new Device type

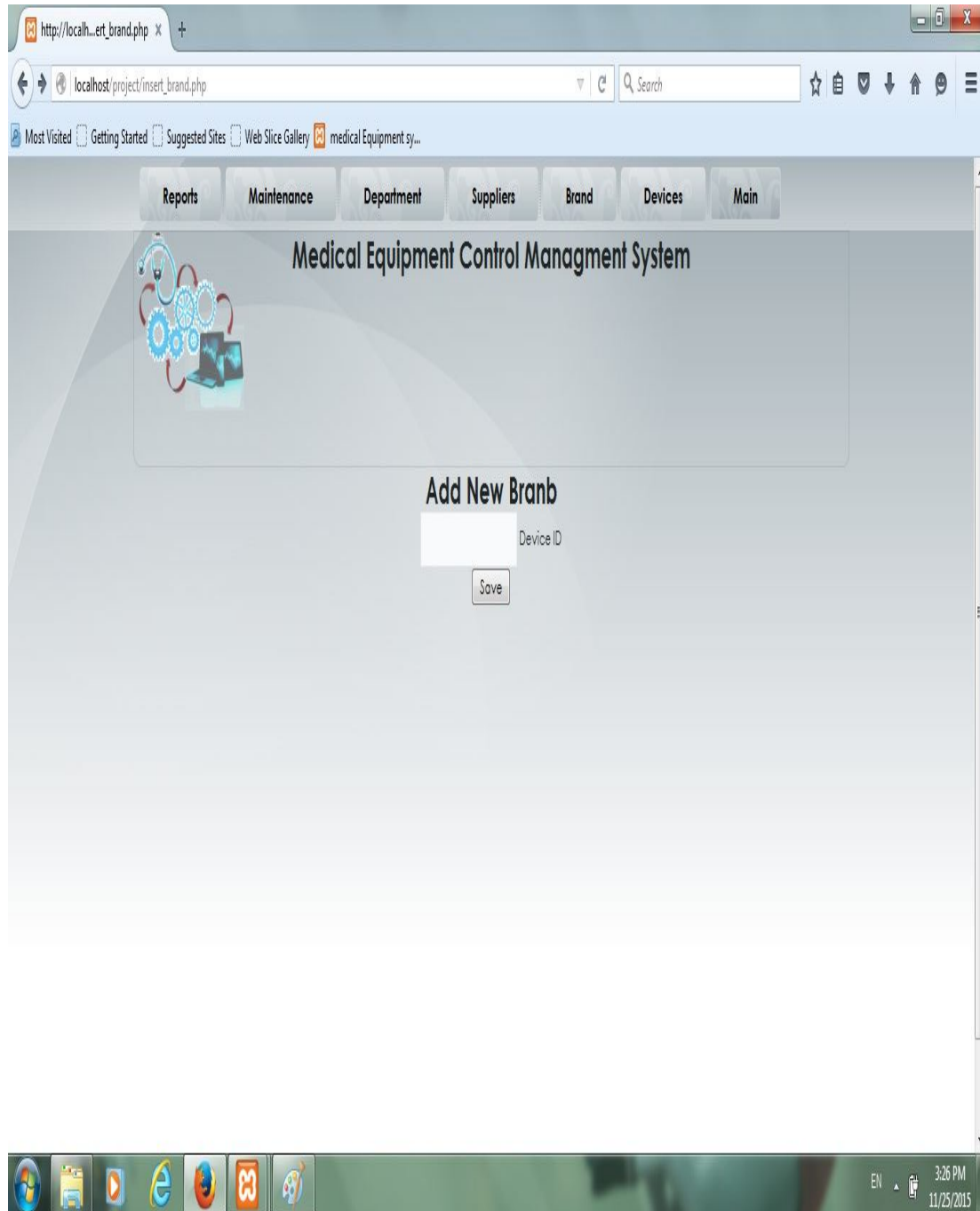Add new brand screen include adds new brand and save it. Figure (4.6) showing below:

Figure (4.6): Add new brand screen include adds new brand and save it

Add new supplier screen show supplier name and address. Figure (4.7) showing below:

Figure (4.7): Add new supplier screen show supplier name and address

Add new department screen show department name and save it.

Figure (4.8) showing below:
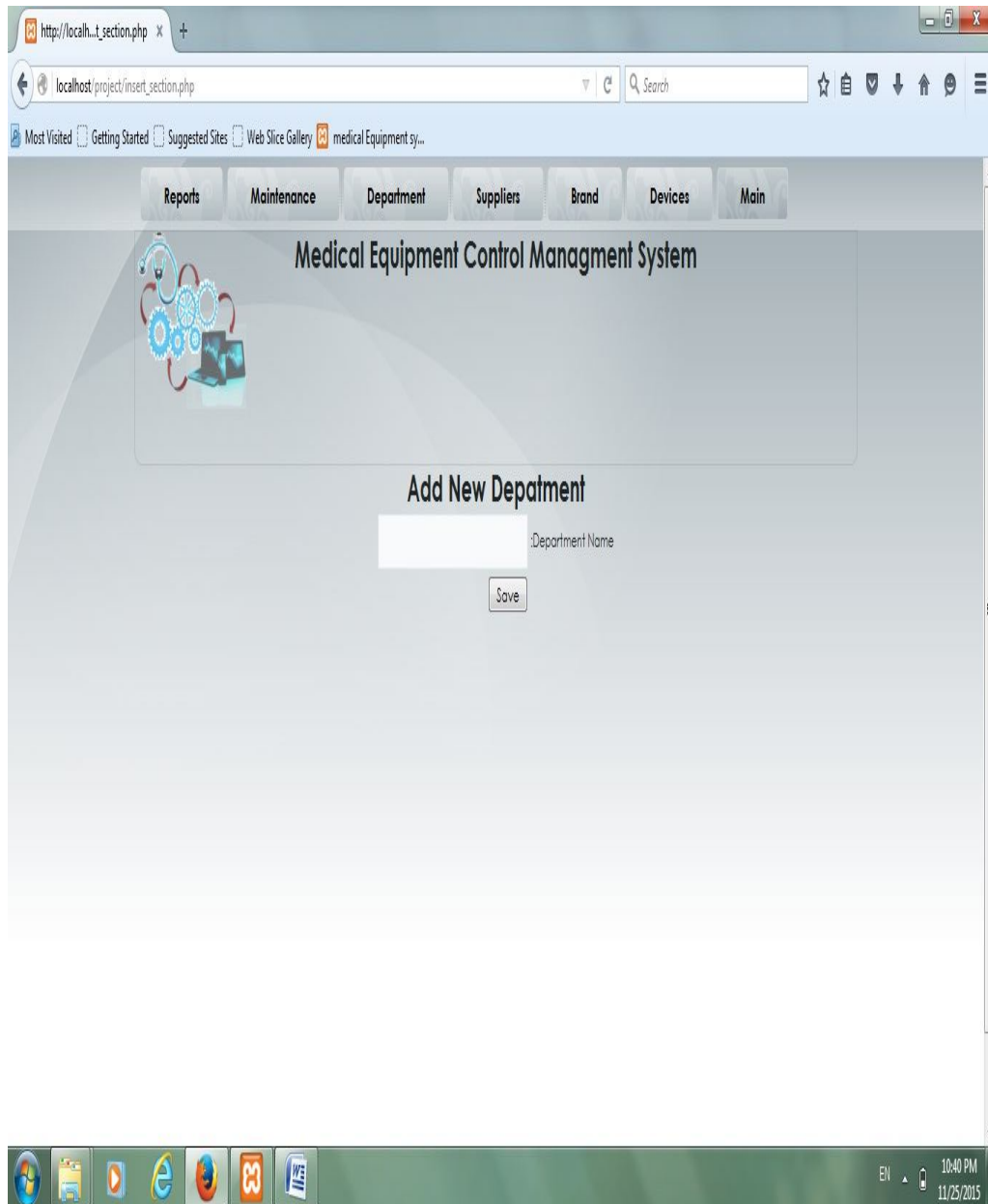
Figure (4.8): Add new department screen show department name and save it

Device maintenance screen include device ID, date maintenance and Report. Figure (4.9) showing below:
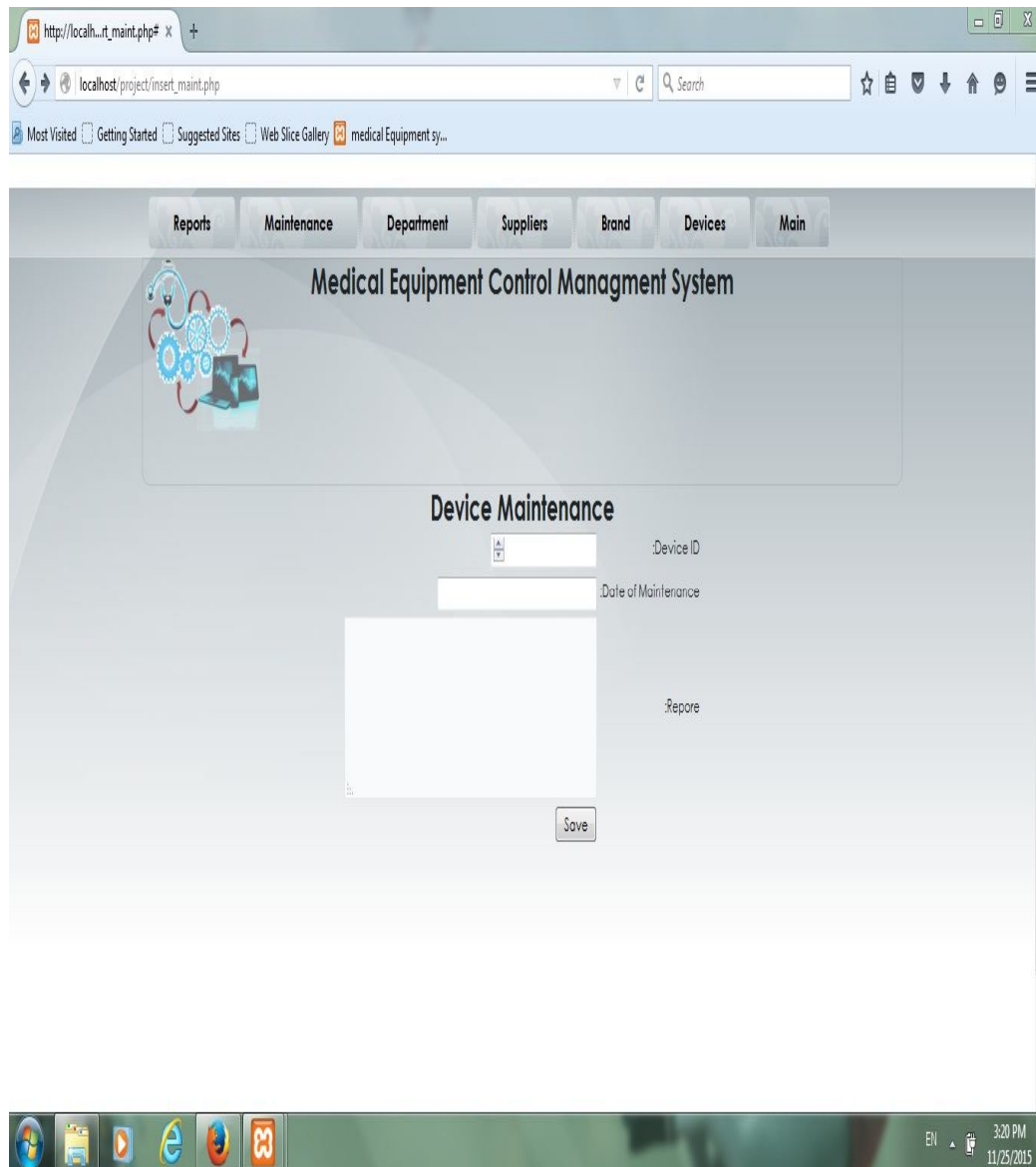
Figure (4.9): Device Maintenance screen include device ID and Report.

Report screen include at four reports "device, brand, supplier and department report". Figure (4.10) showing below:
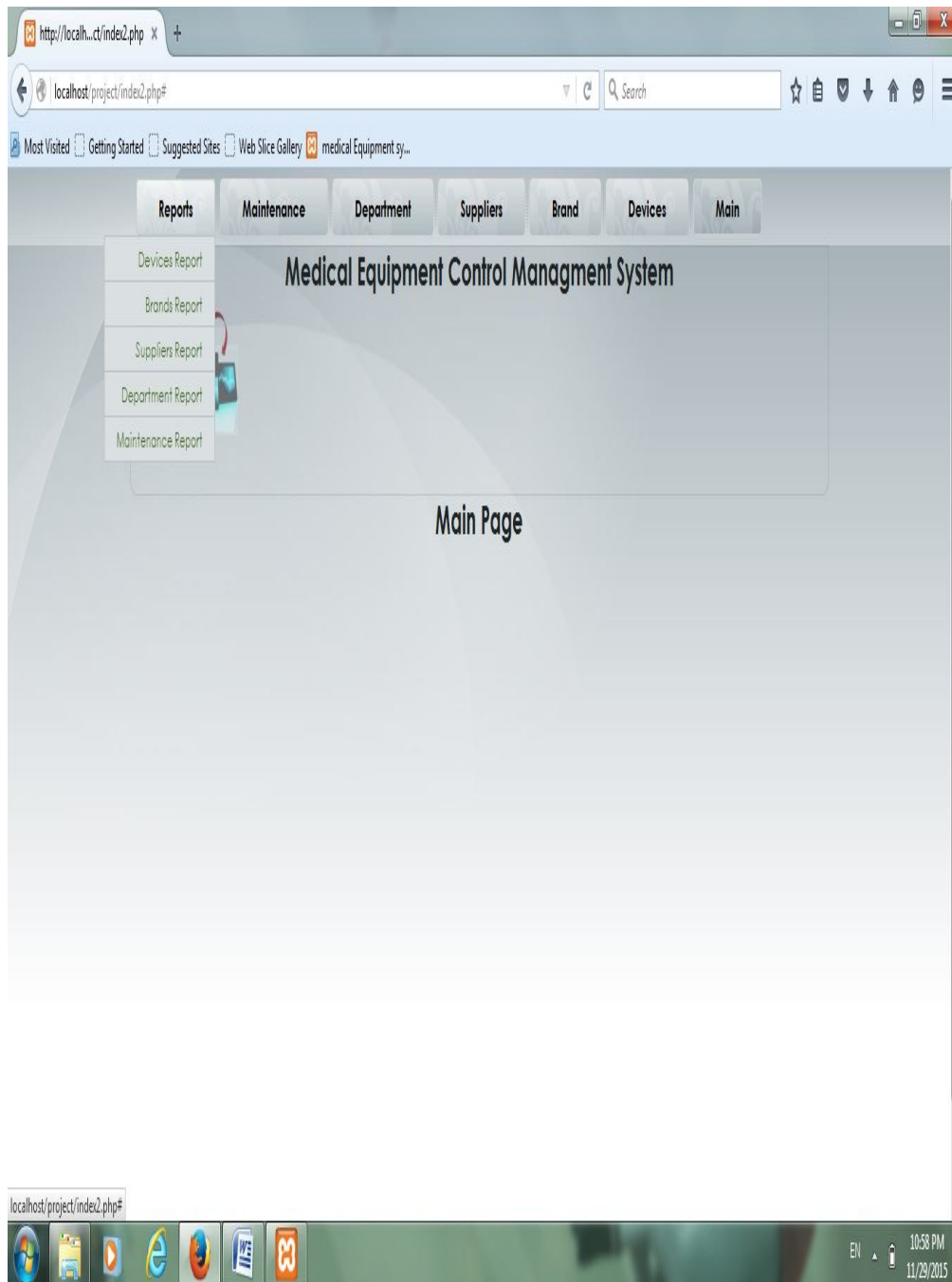
Figure (4.10): Report screen include at four reports

Device report screen include enter device ID and research. Figure (4.11) showing below:
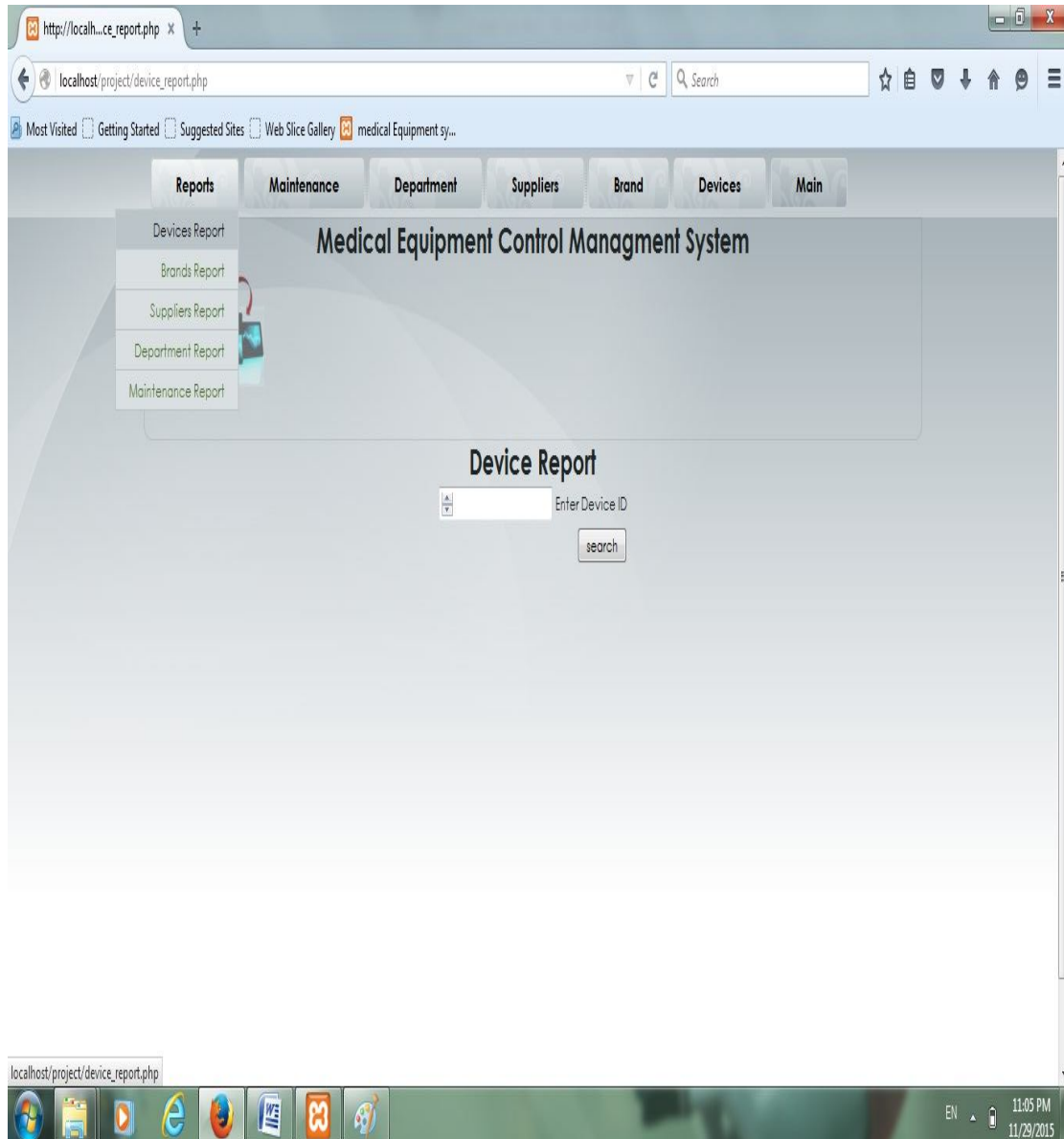
Figure (4.11): Device report screen include enter device ID and research

Brand report screen include enter brand and research. Figure (4.12) showing below:
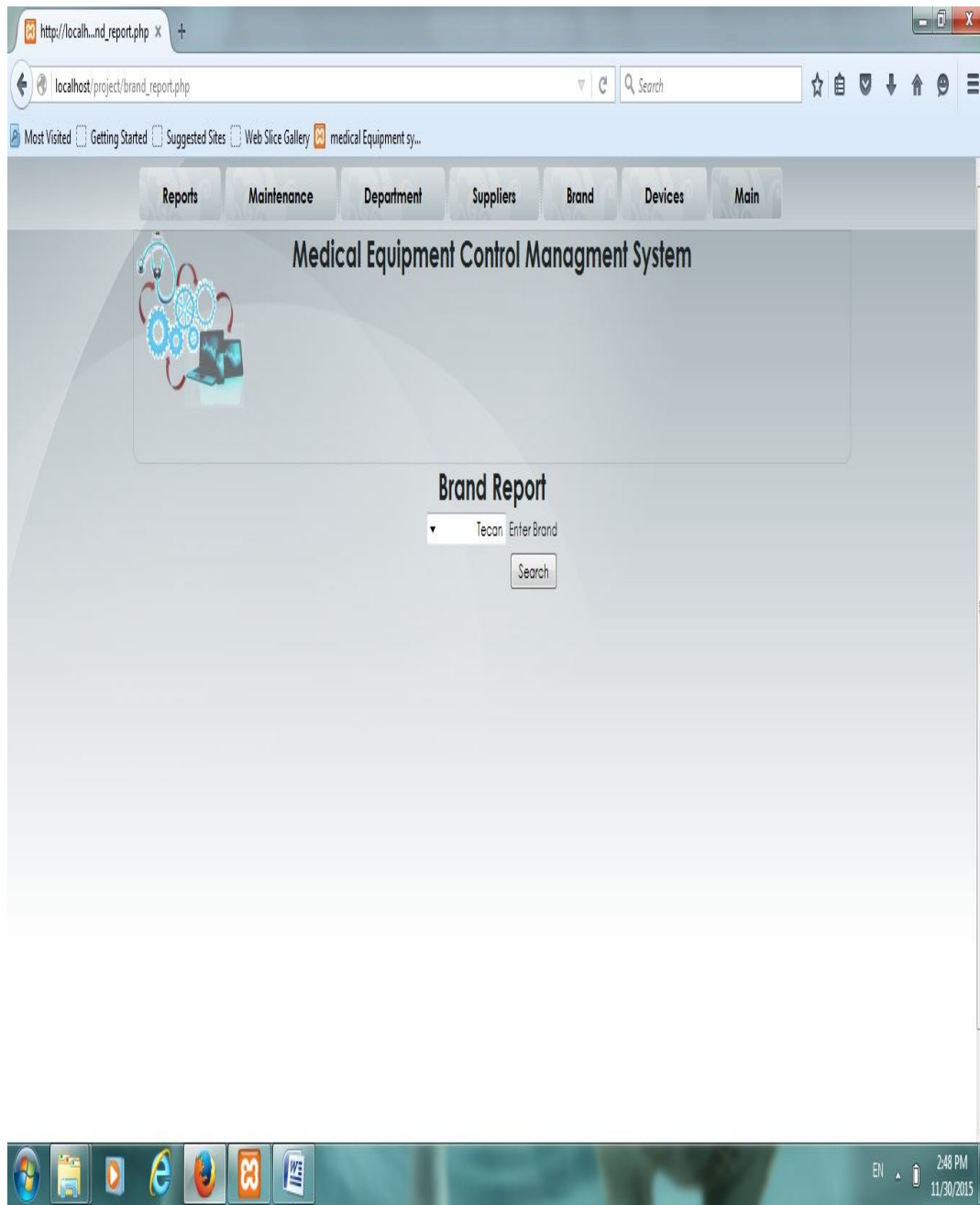
Figure (4.12): Brand report screen include enter brand and research

Supplier report screen include enter supplier and research. Figure (4.13) showing below:
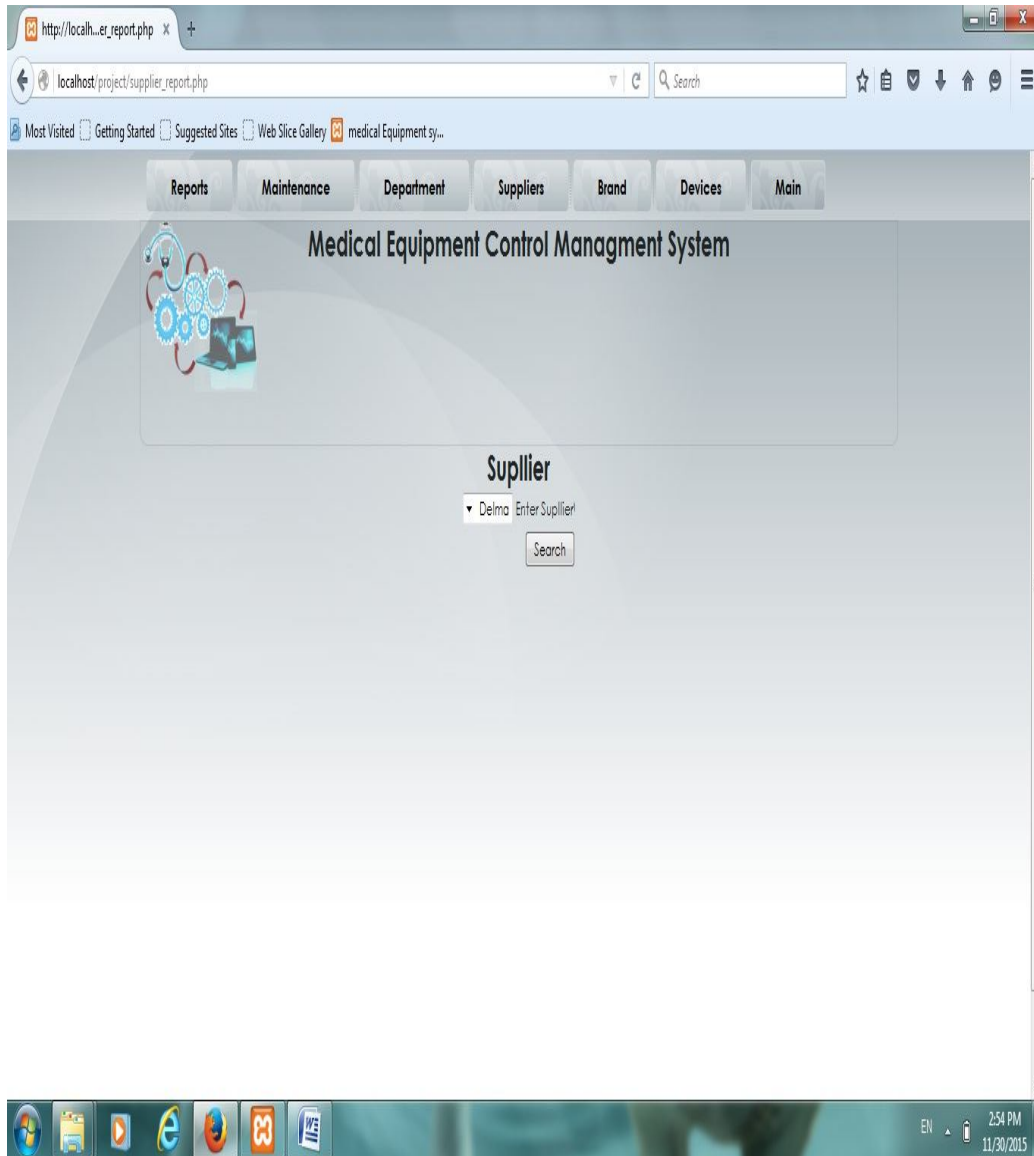
Figure (4.13): Supplier report screen include enter supplier and research

Department report screen include enter department and research. Figure (4.14) showing below:
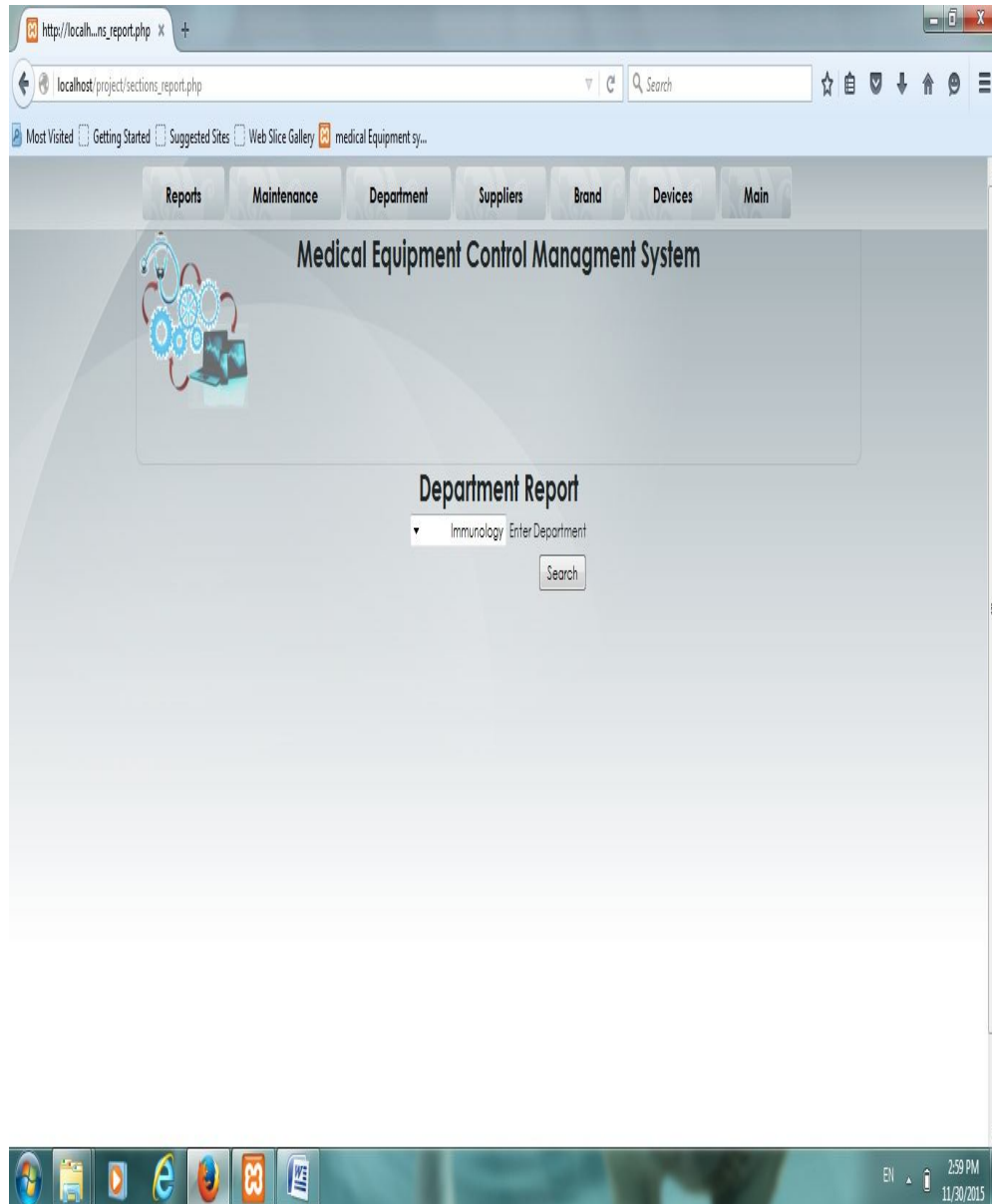
Figure (4.14): Department report screen include enter and research it

Device maintenance report screen include enter ID device and research. Figure (4.15) showing below:
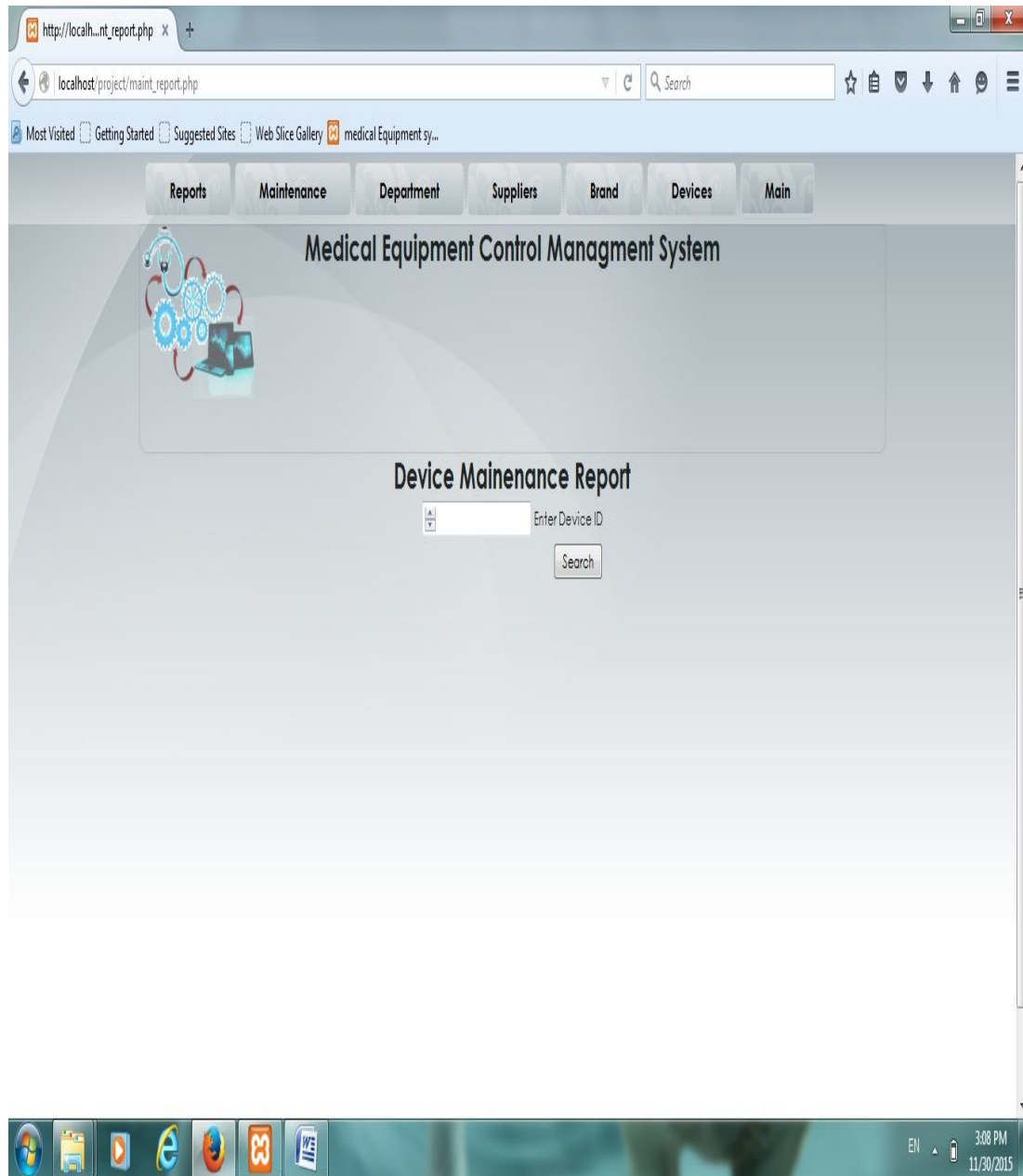
Figure (4.15): Device maintenance report screen include enter ID and research it

4.2 Implementation:

The program is to find method for controlling and managing equipment medical informatics data these data can be information or reports or any other data here our targeting is EID (equipment identification). The controlling method that used in these research is the MEC system with the computer and we have be able to get the most benefit from hospital and employ it in medical care industry, this employment of information technology in medical care provide accurate and timely service for the medical engineering which lead to improve the quality of medical care.

The implemented program (in Research Centre – Alneelain University) shown in below:
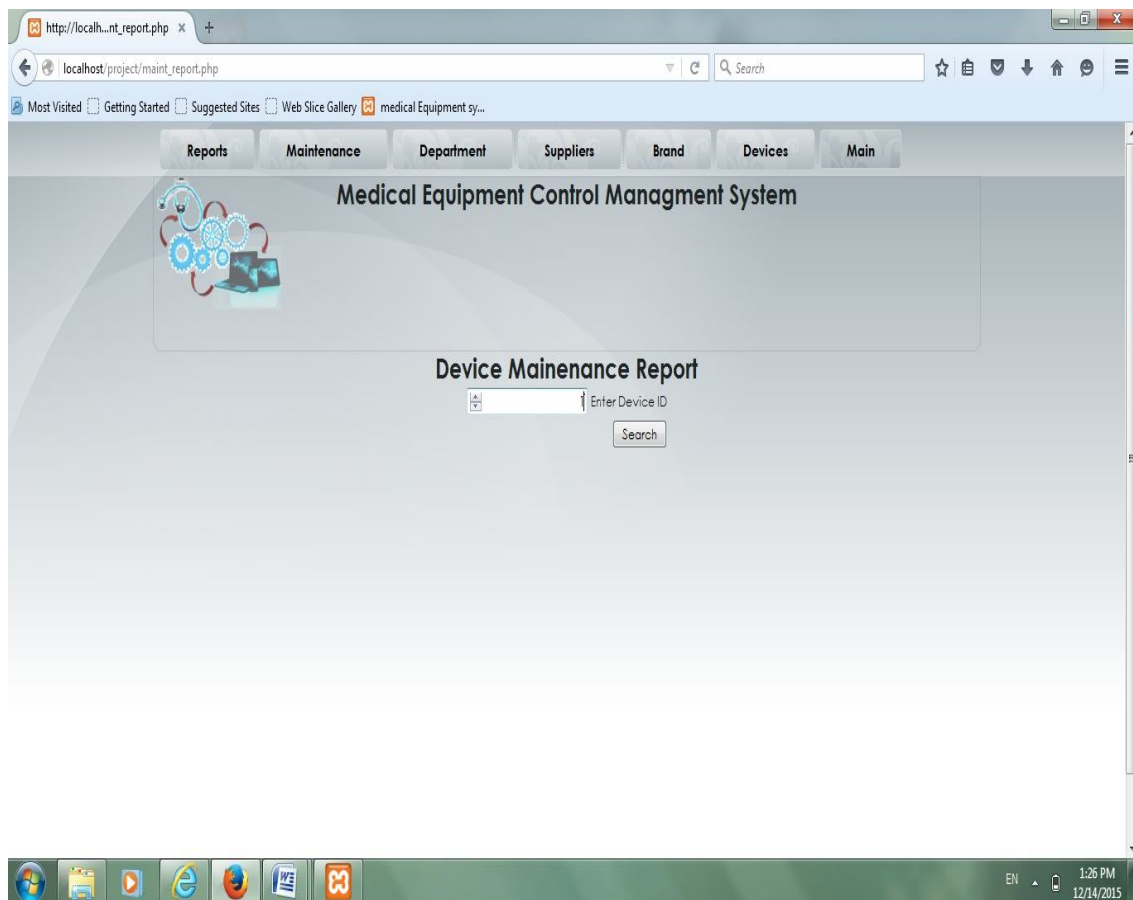
Figure (4.16): Device maintenance report screen include ID and search

45

After device identification (ID) the screen will illustrate the crevice report as shown figure (4.17) below:
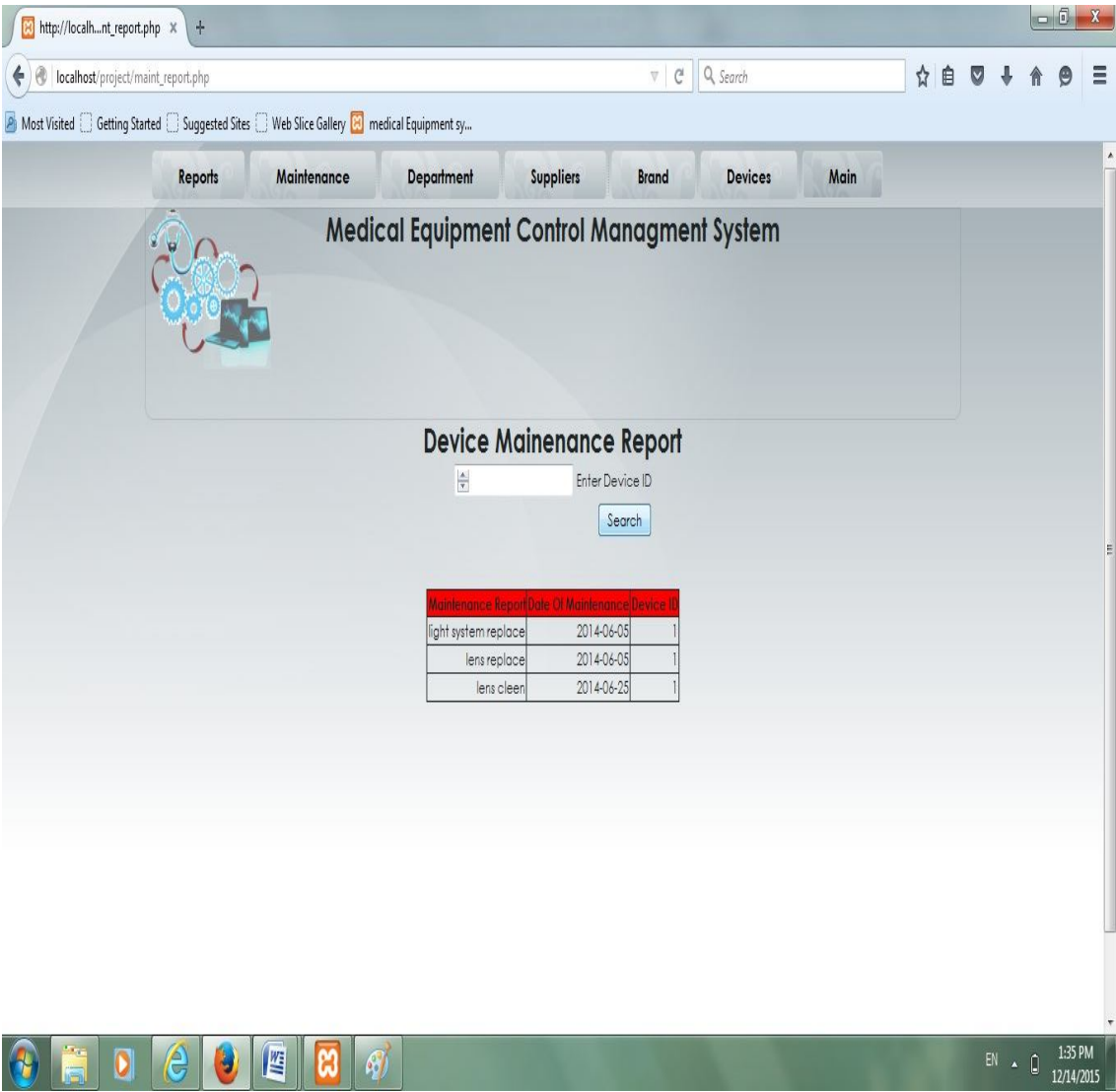
Figure (4.17): The screen will illustrate the service report

46

4.3 Discussion:

To design equipment control management program we must first study the situation of some medical equipment departments in our local hospitals and study the current design. The questionnaire was used to illustrate the lake present in those hospitals, economical use of equipment, effective, and staff education. Through analysis and study, we found that there are several problems in public hospitals can be summarized as follows: the ME department can be more useful and more effective if use of the proposed new program, most hospitals didn't have sufficient number of medical equipment, insufficiency of medical devices on MED on some hospitals, and Unavailability of trained medical engineer staff in public hospitals to provide the best services and medical care. HPH is large software as shown in it is construction and it has different version and which may make the user be confused.

Different version of PHP is one of it is problem for example if someone is create you database in PHP5 that you cannot link in PHP3 also PHP is coded value for example if one system uses code A while another system uses code then Someone must translate the code. The PHP specification may clearly note that a functions is optional, but some systems require the inclusion of the data in order to successfully exchange information. If you are unaware that a user's system requires an entry in a certain function, However, then data may be no read.

The web server solution stack package used in these research is the XAMPP design intended it for use only as a development tool, to allow website designers and programmers to test their work on their own computers without any access to the Internet. To make this as easy as possible, many important security features are disabled by default. XAMPP has the ability to serve web pages on the World Wide Web. A special tool is provided to password-protect the most important parts of the package. XAMPP also provides support for creating and manipulating databases in MYSQL among other. Have be able to get the most benefit from employ it in medical care industry.

Chapter Five:

Conclusion & Recommendations

5.1 Conclusion:

Financial issues always stopped the largest however this projects has a
Big value when done .our target is to reduce the cost of this projects specially
The need of these project in developed countries like Sudan is considerable urgent.

The software program successes in achieve the controlling and managing medical Equipment in hospital. this study illustrates how this designing and implementing system and how Hospitals will get the benefits from using this program.

The web server solution stack package used in these research is the XAMPP design intended it for use only as a development tool, to allow website designers and programmers to test their work on their own computers without any access to the Internet.

5.2 Recommendations:

After the complete of designing and implementing operation we successes in Controlling and managing equipment medical among computer systems and we recommended by the Following:

Give the hospital servers some care and tension to distribute the data to all device need for exchangeable data.

Creating central points (servers) in the ministry of health to monitor medical equipment controlling in hospitals to follow and ensure the timely and proper service.

Hospitals and health care units can send their data of medical equipment to the mentioned above server in the ministry of health to reduce the movements of their clinical engineering's outside the hospitals on the other hand ministry of health can Employ an employer to monitor the server and report the ministry of the receiving data of medical equipment from hospitals.

References

1. Landoll JR and Caceres CA, Automation of Data Acquisition in Patient Testing, Proceedings of the IEEE, Vol. 57, No. 11, November 2005.
2. According to The American College of Clinical Engineering, 10 June 2011.
3. Zambuto RP, Clinical Engineers in the 21st Century, IEEE Engineering in Medicine and Biology Magazine, May/June 2005, 37-41
4. http: //www.fad.gav.Summarised from the FDA's definition."Is The Product A Medical Device?", U.S. Department of Health and Human Services , U.S. Food and Drug Administration, Retrieved 15 June 2014.
5. WWW.thefreedictionary.com. Retrieved 14 November 2013.
6. http://eur."Directive 2007/47/ec of the European parliament and of the council". Eur-lex Europ, Retrieved 15 June 2014.
7. http://ec."Revision of the medical device directives". European Commission. Retrieved 15 June 2014.
8. Khandpur, R. S. "Biomedical Instrumentation: Technology and Applications". McGraw Hills, 5 September 2007.
9. Webb, Andrew G., "Introduction to Biomedical Imaging (IEEE Press Series on Biomedical Engineering)". 10 June 2014
10. WWW. "Database - Definition of database by Merriam-Webster" merriam-webster.com. 26 Feb 2015
11. Jeffrey Ullman , First course in database systems, Prentice–Hall Inc., Simon & Schuster, Page 1, ISBN 0-13-861337-0. 1997
12. http://www"Update - Definition of update by Merriam-Webster". merriam-webster.com. 2014-05-27.
13. http://www "Retrieval - Definition of retrieval by Merriam-Webster". merriam- webster.com.
14. http:// www "Administration - Definition of administration by Merriam-Webster". merriam-webster.co.2014-01-16.
15. http://"DB-Engines Ranking". Retrieved 12 Feb 2015.
16. Callaghan , Mark , MySQL at Facebook. YouTube (Google) 13 April 2010.
17. http:www"MySQL for OpenVMS". vmsmysql.org. 2011-03-30.
18. Harrison; Steven Feuerstein . MySQL Stored Procedure Programming.12-5-2013.
19. O'Reilly Media. p. 49. ISBN 978-0-596-10089-6.(2008).

20. Mats ,Kindahl . "MySQL Fabric: Musings on Release 1.4.3". mysqlmusings. blogspot.com. Retrieved. 2014-06-18.

21. Ide, Andy , "PHP just grows & grows". Retrieved . (2013-01-31).

22. Jackson, Joab ,"PHP gets a formal specification, at last", *IT world*,(2014-07-31).

23. http:// "PHP for Windows: Binaries and sources releases (5.5)". *php .net*. Retrieved 2013-10-29

24. http:// "PHP Manual Image Processing and GD;". php.net. Retrieved 2011-04-09.

25. http://PHP Manual: Preface, www.php.net .19 October 2015

26. http:// "Interview with Kai Seidler from the XAMPP project". MySQL AB. Retrieved 2015-06-07.

27. https ://www ."New XAMPP with MariaDB". apachefriends.org.   Retrieved 19 November 2015.

28. http ://"An easy to install Apache distribution containing MySQL, PHP, and Perl". SourceForge. Retrieved 2015-06-07.

29. .http :// "Embedding PHP in HTML". O'Reilly. Retrieved 2008-02-25.

30. .Jackson, Joab , "PHP gets a formal specification, at last". IT world. IDG. (2014-07-31)

31. Lerdorf, Rasmus , "PHP on Hormones" (MP3). The Conversations Network. Retrieved 2009-06-22.

32. PCD Technical Committee," Paper – Medical Equipment Management (MEM): Cyber Security", May 27- 2011.

33.   Dr Bastiaan L Remmelzwaal, "Paper-The Development of Medical Equipment Management Systems", January   1997

Appendices

Appendix (A)

Questionnaire:

جامعة السودان للعلوم و التكنولوجيا

كلية الدراسات العليا والبحث العلمي

قسم الهندسه الطبيه الحيويه

استبيان لدراسه

Medical Equipment control Implementation
الارشادات

نؤكد لك أن البيانات المستوفاة في هذه الاستمارة سرية ولا تستخدم إلا لأغراض البحث، كما نشير إلى أن صدق نتائج البحث تتوقف على صدق هذه البيانات وذلك نرجو تحري الدقة في الإدلاء بالإجابة

التاريخ :   الوظيفة : ....

نوع المستشفى : ....

1_ هل يوجد لديكم قسم خاص بصيانة الأجهزة الطبية في المستشفى ؟

أ_ نعم (   )   ب_ لا(   )

2_ أذا كانت الاجابه بنعم في السوال السابق هل يقوم بكل الوظائف الخاصة بالهندسة الطبية مثل الأدارة والشرا والتحكم والصيانة بنوعيها بنسبة:

أ_ 25%   ب_ 50%   ج_ 75%   د_ 100%

3_ كم عدد المهندسين الطبيين في القسم:

أ_ 1-3   ب_ 4-7   ج_ أكثر

4_ هل يوجد لديكم مهندسين طبيين ذات تخصصات مختلفة ؟

أ_ نعم (   )   ب_ لا(   )

5_ هل تحتوي المستشفى على كل الأجهزة الطبية التي يحتاجها المريض في مسيرته العلاجية علي حسب التخصص ؟

أ_ نعم (   )   ب_ لا(   )

6_ كم عدد الأجهزة الطبية التي توجد بكل أقسام المستشفى:

أ_اقل من 100(   )   ب- 100 -300 (   )   ج_ 400_600(   )   د_ 700-900 (   )
ه _ أكثر(   )

7_ هل لديكم طريقة تقوم بها الوحدة الهندسية الطبية لأدارة وتحكم وصيانة هذه الأجهزة مثل ؟

أ- log book   ب - Soft where   ج – باي طريقه اخرى ....

8 _ ما هي كيفية العمل بهذه الطريقة ؟

أ_ الحاسوب   ب_ العمل اليدوي   ج_ بأي طريقة أخرى ....

9_ أذا كان القسم يعاني من مشاكل في التحكم على الأجهزة الطبية وتنظيمها وأدارتها وصيانتها قد يكون بسبب؟

أ_ عدم توفر المهندس الطبي   ب _ عدم توفر الأدوات   ج – عدم توفر الاسبيرات

10_ أذا توفرت لكم طريقة برنامج يستخدم الحاسوب في التحكم على الأجهزة الطبية وتنظيمها وأدارتها هل تستخدمونها؟

أ_ نعم (   )   ب_ لا (   )

11_ في رأيك هل يمكن لقسم الهندسة الطبية أن يكون أكثر فعالية أذا تم أستخدام الطريقه في السوال السابق؟

أ_ نعم (   )   ب_ لا(   )

Appendix (B)

Program Code

```php
<?php
function conn($db_name)
{
$link=mysql_connect("localhost","root","") or die(mysql_error());
$db=mysql_select_db($db_name) or die(mysql_error());
return $link;
}
function table($query)
{
$a=mysql_query($query);
if(!$a)
echo "Not Implemented ".mysql_error();
if(mysql_num_rows($a)==0)
{
   echo " No Result";
   exit;
}
echo "<table border='1' style='border-collapse: collapse;'>";
for($j=0;$j<mysql_num_fields($a);$j++)
echo "<th bgcolor='red'>".mysql_field_name($a,
$j)."</th>";
while($row=(mysql_fetch_row($a)))
{
echo "<tr>";
for($i=0;$i<count($row);$i++)

echo "<td>".$row[$i]."</td>";

echo "</tr>";

}
```

```php
echo "</table>";

}

function options($result)

{
while ($row = mysql_fetch_row($result))
{
    echo "<option value='$row[0]'>" . $row[1] . "</option>";
}
}
function heading()
{
echo '
<!DOCTYPE html>
<html dir="rtl" lang="en-US"><head><!-- Created by Artisteer v4.1.0.59861 -->
  <meta charset="utf-8">
  <meta name="viewport" content="initial-scale = 1.0, maximum-scale = 1.0, user-scalable = no, width = device-width">
  <!--[if lt IE 9]><script src="https://html5shiv.googlecode.com/svn/trunk/html5.js"></script><![endif]-->
  <link rel="stylesheet" href="style.css" media="screen">
  <!--[if lte IE 7]><link rel="stylesheet" href="style.ie7.css" media="screen" /><![endif]-->
  <link rel="stylesheet" href="style.responsive.css" media="all">
  <script src="jquery.js"></script>
  <script src="script.js"></script>
  <script src="script.responsive.js"></script>
<style>.art-content .art-postcontent-0 .layout-item-0 { padding-right: 10px;padding-left: 10px; }
.art-content .art-postcontent-0 .layout-item-1 { padding-right: 10px;padding-left: 8px; }
.art-content .art-postcontent-0 .layout-item-2 { padding: 0px; }
.ie7 .art-post .art-layout-cell {border:none !important; padding:0 !important; }
```

```
.ie6 .art-post .art-layout-cell {border:none !important; padding:0 !important; }
</style></head>
<body>
<div id="art-main">
<nav class="art-nav">
  <div class="art-nav-inner">
  <ul                 class="art-hmenu"><li><a                href="index2.php"
class="active">Main</a></li><li><a
href="insert_device.php">Devices</a><ul><li><a href="insert_type.php">Device
type</a></li></ul></li><li><a      href="insert_brand.php">Brand</a></li><li><a
href="insert_supplier.php">Suppliers</a></li><li><a
href="insert_section.php">Department</a></li><li><a
href="insert_maint.php">Maintenance</a></li><li><a
href="#">Reports</a><ul><li><a             href="device_report.php">Devices
Report</a></li><li><a   href="brand_report.php">Brands   Report</a></li><li><a
href="supplier_report.php">Suppliers                   Report</a></li><li><a
href="sections_report.php">Department                   Report</a></li><li><a
href="maint_report.php">Maintenance Report</a></li></ul>
      </div>
  </nav>
<header class="art-header">
  <div class="art-shapes">
      </div>
<h1 align="center"
  <a href="#">Medical Equipment Control Managment System</a>
</h1>
</header>';
}
function footing()
{
echo '
</article></div>
              </div>
          </div>
```

```
        </div>
    </div>
<footer class="art-footer">
  <div class="art-footer-inner">
<div class="art-content-layout">
    <div class="art-content-layout-row">
    <div class="art-layout-cell layout-item-0" style="width: 100%">
       <span style="font-size: 13px;">
        Powered By Naila Ahmed Ali
       </span>
    </div>
    </div>
</div>
  </div>
</footer>
</div>
</body></html>';
}
?>
<?php
if(isset($_POST["submit"]))
{
$name=$_POST["user"];
$password=$_POST["pass"];
if($name=="admin"&&$password=="naila")
{
header("location:index2.php");
}
else
{
echo "<script>alert('user name or password is not correct');</script>";
}
}
?>
```

```html
<html dir="rtl" lang="en-US"><head>
 <meta charset="utf-8">
   <title>Enrty Verification</title>
   <meta name="viewport" content="initial-scale = 1.0, maximum-scale = 1.0,
user-scalable = no, width = device-width">
   <!--[if                    lt                    IE                    9]><script
src="https://html5shiv.googlecode.com/svn/trunk/html5.js"></script><![endif]-->
   <link rel="stylesheet" href="style.css" media="screen">
   <!--[if lte IE 7]><link rel="stylesheet" href="style.ie7.css" media="screen"
/><![endif]-->
   <link rel="stylesheet" href="style.responsive.css" media="all">
   <script src="jquery.js"></script>
   <script src="script.js"></script>
   <script src="script.responsive.js"></script>
<style>.art-content    .art-postcontent-0    .layout-item-0    {    padding-right:
10px;padding-left: 10px;  }
.art-content .art-postcontent-0 .layout-item-1 { padding-right: 10px;padding-left:
8px;  }
.art-content .art-postcontent-0 .layout-item-2 { padding: 0px;  }
.ie7 .art-post .art-layout-cell {border:none !important; padding:0 !important; }
.ie6 .art-post .art-layout-cell {border:none !important; padding:0 !important; }
</style></head>
<body>
<div id="art-main">
<nav class="art-nav">
   <div class="art-nav-inner">
     </div>
   </nav>
<header class="art-header">
   <div class="art-shapes">
       </div>
<h1 align="center"
   <a href="#">Medical Equipment Control Managment System</a>
</h1>
```

```html
</header>
<div class="art-sheet clearfix">
        <div class="art-layout-wrapper">
          <div class="art-content-layout">
            <div class="art-content-layout-row">
              <div class="art-layout-cell art-content"><article class="art-post art-article">
          <div class="art-postcontent art-postcontent-0 clearfix"><div class="art-content-layout">
  <div class="art-content-layout-row">
  <div class="art-layout-cell layout-item-0" style="width: 100%" >
    <p><span style="font-weight: bold;"><br></span></p>
  </div>
  </div>
</div>
<div class="art-content-layout">
  <div class="art-content-layout-row">
  <div class="art-layout-cell layout-item-0" style="width: 33%" >
    <br>
  </div><div class="art-layout-cell layout-item-1" style="width: 34%" >
         
  </div><div class="art-layout-cell layout-item-2" style="width: 33%" >
    <br>
  </div>
  </div>
</div>
<div class="art-content-layout">
  <div class="art-content-layout-row">
  <div class="art-layout-cell layout-item-0" style="width: 100%" >
    <p><br></p>
  </div>
  </div>
</div>
<div class="art-content-layout">
```

```html
    <div class="art-content-layout-row">
    <div class="art-layout-cell layout-item-0" style="width: 50%" >
        <h3><br></h3><div style="margin-left: 2em">
        </div>
    </div><div class="art-layout-cell layout-item-0" style="width: 50%" >
        <p><br></p>
    </div>
    </div>
</div>
</div>
 <body dir="rtl"><center>
<h1>User Entry </h1>
<form  method="post"><table border="0"><tr><td><h4>
User name </td><td><input type="text" name="user" value="" placeholder="Enter
user name" ></td><tr><td></h4><h4>
Password     </td><td><input     type="password"     name="pass"     value=""
placeholder="\Enter password">
</td></tr></table><br></h4>
<input type="submit" value="Log in" name="submit">
<input type="reset" value="reset">
</form></center>
</article></div>
            </div>
        </div>
        </div>
    </div>
<footer class="art-footer">
 <div class="art-footer-inner">
<div class="art-content-layout">
    <div class="art-content-layout-row">
    <div class="art-layout-cell layout-item-0" style="width: 100%">
        <span style="font-size: 13px;">
        Powered by Naila Ahmed Ali
        </span>
```

```
      </div>
      </div>
  </div>
    </div>
  </footer>
  </div>
  </body>
  </html>
  <?php
  include("funcs.php");
  heading();
  echo "<center><h1>Main Page</h1></center>";
  footing();
  ?>
  <?php
  include("funcs.php");
  heading();
  ?>
  <center><h1>Add New Device</h1></center>
  <form  method="post" action="inserts.php">
    <table align="center" dir="rtl">
      <tr valign="baseline">
        <td nowrap="nowrap" align="right">Device ID</td>
  <?php
  $link=conn("maintainance");
  $result=mysql_query("select count(*) from devices");
  /*if(@mysql_affected_rows($result)==0)
  $id=1;
  else
  {*/
  $row=mysql_fetch_row($result);
  $oldid=$row[0];
  $id=$oldid+1;
  ?>
```

```php
<td><input type="text" name="dev_id" value="<?php echo $id;?>" size="32"
/></td>
  </tr>
  <tr valign="baseline">
    <td nowrap="nowrap" align="right">Device Type</td>
    <td><select name="type_id">
<option selected>\Sellect</option>
      <?php
$link=conn("maintainance");
$result=mysql_query("select * from types");
options($result);
?>
    </select></td>
  </tr>
  <tr valign="baseline">
    <td nowrap="nowrap" align="right">Device Brand</td>
    <td><select name="brand_id">
      <?php
$link=conn("maintainance");
$result=mysql_query("select * from brand");
options($result);
?>
    </select></td>
  </tr>
  <tr> </tr>
  <tr valign="baseline">
    <td nowrap="nowrap" align="right">Supllier</td>
    <td><select name="supplier_id">
      <?php
$link=conn("maintainance");
$result=mysql_query("select * from suppliers");
options($result);
?>
    </select></td>
```

```
        </tr>
    <tr valign="baseline">
      <td nowrap="nowrap" align="right">Department</td>
      <td><select name="section_id">
        <?php
$link=conn("maintainance");
$result=mysql_query("select * from sections");
options($result);
?>
        </select></td>
    </tr>
    <tr valign="baseline">
      <td nowrap="nowrap" align="right">Date of Entry</td>
      <td><input type="date" name="in_date" value="" size="32" /></td>
    </tr>
    <tr valign="baseline">
      <td nowrap="nowrap" align="right"> </td>
      <td><input type="submit" value="Save" name="submit" /></td>
    </tr>
  </table>
</form>
<?php
footing();
?>
<?php
include("funcs.php");
heading();
if(isset($_POST["dev_type"]))
{
    $dtype=$_POST["dev_type"];
  $link=conn("maintainance");
  $sql="insert into types(name) values('".$dtype."');";
  $result=mysql_query($sql);
if($result)
```

```php
{
echo "<script>alert('Saved Successfully')</script>";
}
else
{
echo "Error ".mysql_error();
}
}
?>
<center><h1> Add New Device Type </h1></center>
<form  method="post">
  <table align="center" dir="rtl">
    <tr valign="baseline">
      <td nowrap="nowrap" align="right">Device Type:</td>
      <td><input type="text" name="dev_type" value="" size="32" /></td>
    </tr>
    <tr valign="baseline">
      <td nowrap="nowrap" align="right"> </td>
      <td><input type="submit" value="Save" /></td>
    </tr>
  </table>
</form>
<?php
footing();
?>
<?php
include("funcs.php");
heading();
if(isset($_GET["brand"]))
{
    $bname=$_GET["brand"];
  $link=conn("maintainance");
  $sql="insert into brand(name) values('".$bname."');";
  $result=mysql_query($sql);
```

```php
if($result)
{
echo "<script>alert('Saved Successfully')</script>";
}
else
{
echo "Error ".mysql_error();
}
}
?>
<center>
<h1> Add New Branb</h1>
<form>
Device ID <input type="text" name="brand"/>
<br />
<input type="submit" value="Save"/>
</form>
</center>
<?php
footing();
?>
<?php
include("funcs.php");
heading();
if(isset($_POST["sec_name"]))
{
    $secname=$_POST["sec_name"];
    $link=conn("maintainance");
    $sql="insert into sections(name) values('".$secname."');";
    $result=mysql_query($sql);
if($result)
{
echo "<script>alert('Saved Successfully')</script>";
}
```

```php
else
{
echo "Error ".mysql_error();
}
}
?>
<center><h1> Add New Depatment</h1></center>
<form  method="post">
  <table align="center" dir="rtl">

    <tr valign="baseline">
      <td nowrap="nowrap" align="right">Department Name:</td>
      <td><input type="text" name="sec_name" value="" size="32" /></td>
    </tr>
    <tr valign="baseline">
      <td nowrap="nowrap" align="right"> </td>
      <td><input type="submit" value="Save" /></td>
    </tr>
  </table>
</form>
<?php
footing();
?>
<?php
include("funcs.php");
heading();
if(isset($_POST["sup_name"]))
{
   $sname=$_POST["sup_name"];
   $sadd=$_POST["sup_add"];
   $link=conn("maintainance");
   $sql="insert into suppliers(name,address) values('".$sname."','".$sadd."');";
   $result=mysql_query($sql);
if($result)
```

```php
{
echo "<script>alert('Saved Successfully')</script>";
}
else
{
echo "Error ".mysql_error();
}
}
?>
<center><h1> Add New Supllier</h1></center>
<form  method="post">
  <table align="center" dir="rtl">
   <tr valign="baseline">
     <td nowrap="nowrap" align="right">Supplier Name:</td>
     <td><input type="text" name="sup_name" value="" size="32" /></td>
   </tr>
   <tr valign="baseline">
     <td nowrap="nowrap" align="right">Address:</td>
     <td><input type="text" name="sup_add" value="" size="32" /></td>
   </tr>
   <tr valign="baseline">
     <td nowrap="nowrap" align="right"> </td>
     <td><input type="submit" value="Save" /></td>
   </tr>
  </table>
  <input type="hidden" name="MM_insert" value="form1" />
</form>
<?php
footing();
?>
<?php
include("funcs.php");
heading();
?>
```

```php
<center><h1>Device Mainenance Report</h1>
<form method="post">
<table>
<tr>
<td>Enter Device ID</td>
<td><input type="number" name="dev_id"> </td>
</tr>
<tr>
<td><input type="submit" value="Search" name="submit"/></td>
</tr>
</table>
</form>
<br><br>
<?php
if(isset($_POST['submit']))
{
$id=$_POST['dev_id'];
$link=conn("maintainance");
$sql="SELECT devices.device_id as 'Device ID',maintainance.date as 'Date Of
Maintenance',maintainance.report as 'Maintenance Report' FROM
devices,maintainance,dev_maint WHERE devices.device_id='".$id."' &&
devices.device_id=dev_maint.device_id &&
maintainance.maintainance_id=dev_maint.maintainance_id;";
$result=mysql_query($sql);
table($sql);
}
echo "</center>";
footing();
?>
<?php
include("funcs.php");
heading();
?>
<center><h1>Brand Report</h1>
```

```php
<form method="post">
<table>
<tr>
<td>Enter Brand</td>
<td><select name="brand_name">
<?php
$link=conn("maintainance");
$res=mysql_query("select * from brand");
options($res);
?>
</select></td>
</tr>
<tr>
<td><input type="submit" value="Search" name="submit"/></td>
</tr>
</table>
</form>
<br><br>
<?php
if(isset($_POST['submit']))
{
$id=$_POST['brand_name'];
$link=conn("maintainance");
$sql="SELECT devices.device_id as 'Device ID',types.name as 'Device
type',suppliers.name as 'Supplier',devices.purchase_date as 'Date of Entry',
sections.name                  as                'Department'          FROM
devices,types,suppliers,brand,sections,dev_supp                      WHERE
brand.brand_id='".$id."'&&
devices.brand_id=brand.brand_id&&types.type_id=devices.type_id&&
brand.brand_id=devices.brand_id&&sections.section_id=devices.section_id&&de
vices.device_id=dev_supp.device_id&&suppliers.supplier_id=dev_supp.supplier_i
d ;";
$result=mysql_query($sql);
table($sql);
```

```php
}
echo "</center>";
footing();
?>
<?php
include("funcs.php");
heading();
?>
<center><h1>Device Report</h1>
<form method="post">
<table>
<tr>
<td>Enter Device ID</td>
<td><input type="number" name="dev_id"/></td>
</tr>
<tr>
<td><input type="submit" value="search" name="submit"/></td>
</tr>
</table>
</form>
<br><br>
<?php
if(isset($_POST['submit']))
{
$id=$_POST['dev_id'];
$link=conn("maintainance");
$sql="SELECT types.name as 'Device Type',brand.name as 'Brand',suppliers.name
as 'Supllier',devices.purchase_date as 'Date of Entry', sections.name as
'Department' FROM devices,types,suppliers,brand,sections,dev_supp WHERE
devices.device_id='".$id."' && types.type_id=devices.type_id &&
brand.brand_id=devices.brand_id && sections.section_id=devices.section_id &&
devices.device_id=dev_supp.device_id &&
suppliers.supplier_id=dev_supp.supplier_id;";
$result=mysql_query($sql);
```

```php
table($sql);
}
echo "</center>";
footing();
?>
<?php
include("funcs.php");
heading();
?>
<center><h1>Department Report</h1>
<form method="post">
<table>
<tr>
<td>Enter Department</td>
<td><select name="section_name">
<?php
$link=conn("maintainance");
$res=mysql_query("select * from sections");
options($res);
?>
</select></td>
</tr>
<tr>
<td><input type="submit" value="Search" name="submit"/></td>
</tr>
</table>
</form>
<br><br>
<?php
if(isset($_POST['submit']))
{
$id=$_POST['section_name'];
$link=conn("maintainance");
```

```php
$sql="SELECT devices.device_id as 'Device ID',types.name as 'Device
Type',brand.name as 'Brand',devices.purchase_date as 'Date of Entry',
suppliers.name as 'Supllier' FROM
devices,types,suppliers,brand,sections,dev_supp WHERE
sections.section_id='".$id."'&&
devices.brand_id=brand.brand_id&&types.type_id=devices.type_id&&
brand.brand_id=devices.brand_id&&sections.section_id=devices.section_id&&de
vices.device_id=dev_supp.device_id&&suppliers.supplier_id=dev_supp.supplier_i
d ;";
$result=mysql_query($sql);
table($sql);
}
echo '</center>';
footing();
?>
<?php
include("funcs.php");
heading();
?>
<center><h1>Device Mainenance Report</h1>
<form method="post">
<table>
<tr>
<td>Enter Device ID</td>
<td><input type="number" name="dev_id"> </td>
</tr>
<tr>
<td><input type="submit" value="Search" name="submit"/></td>
</tr>
</table>
</form>
<br><br>
<?php
if(isset($_POST['submit']))
```

```php
{
$id=$_POST['dev_id'];
$link=conn("maintainance");
$sql="SELECT devices.device_id as 'Device ID',maintainance.date as 'Date Of
Maintenance',maintainance.report as 'Maintenance Report' FROM
devices,maintainance,dev_maint WHERE devices.device_id='".$id."' &&
devices.device_id=dev_maint.device_id &&
maintainance.maintainance_id=dev_maint.maintainance_id;";
$result=mysql_query($sql);
table($sql);
}
echo "</center>";
footing();
?>
```

```php
<?php
include("funcs.php");
heading();
?>
<center><h1>Supllier</h1>
<form method="post">
<table>
<tr>
<td>ⁱEnter Supllier</td>
<td><select name="supplier_name">
<?php
$link=conn("maintainance");
$res=mysql_query("select * from suppliers");
options($res);
?>
</select></td>
</tr>
<tr>
<td><input type="submit" value="Search" name="submit"/></td>
<e/tr>
</table>
</form>
<br><br>
<?php
if(isset($_POST['submit']))
{
$id=$_POST['supplier_name'];
$link=conn("maintainance");
$sql="SELECT devices.device_id as 'Device ID',types.name as 'Device Type',brand.name as 'Brand',devices.purchase_date as 'Date of Entery', sections.name as 'Department' FROM devices,types,suppliers,brand,sections,dev_supp WHERE suppliers.supplier_id='".$id."'&&
```

```php
devices.brand_id=brand.brand_id&&types.type_id=devices.type_id&&
brand.brand_id=devices.brand_id&&sections.section_id=devices.section_id&&de
vices.device_id=dev_supp.device_id&&suppliers.supplier_id=dev_supp.supplier_i
d ;";
$result=mysql_query($sql);
table($sql);
}
echo "</center>";
footing();
?>
```