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DEVELOPMENT OF E-GOVERNMENT APPLICATION TO MANAGE
PATIENTS' INFORMATION:
A CASE STUDY OF HEALTH SECTOR IN MOSUL - IRAQ

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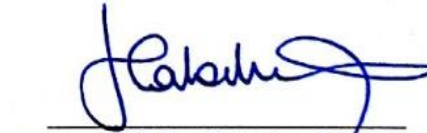
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ABSTRACT

DEVELOPMENT OF E-GOVERNMENT APPLICATION TO MANAGE
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The introduction of information and communication technologies in all government aspects is the goal of many of the countries that look for progress and advancement. Such goal has been associated with the use of information technology in government agencies, a case that leads to the emergence of a new concept called e-government. This concept would redevelop the government apparatus, and thus, the adoption of a new operation method of service within the institutions of the state is to guarantee the individuals with speed, efficiency, increased transparency and efficiency in the management of state services. The most important services that concern us most here are the services that are found in the health sector.

In this regards, the adoption of e-governance in Iraq is a process of change that will help to expand the areas of citizens and businessmen to participate in a new economy based on knowledge. In order to get the full potential of e-government, a new electronic system that offers the e-government services must be developed. One of the most important e-government applications that elevate the work of the health sector in Republic of Iraq for the better is the Patients Management Information System, which is expected to be useful in many areas; to increase effectiveness, efficiency, speed, accuracy, experience, communication, etc., The application is expected to reduce the number of operational factors, including the cost, time, medical errors, diagnosis and therapy, and to save space and the ability to transfer patient data.

Key Words: e-government, health e-government system, PMIS.

ÖZ

HASTA BİLGİSİ YÖNETİMİNE YÖNELİK E-DEVLET UYGULAMASI GELİŞTİRME: MUSUL - IRAK SAĞLIK SEKTÖRÜ İÇİN BİR ÖRNEK ÇALIŞMA

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İlerleme ve gelişme beklentisinde olan birçok ülkenin hedefi devletle ilgili tüm işlemlerde bilgi ve iletişim teknolojilerinden faydalanmaktır. Böyle bir hedefe tüm devlet kurumlarında, e-devlet olarak adlandırılan yeni kavramın ortaya çıkmasına yol açacak bir olgu şeklindeki, bilgi teknolojilerinin kullanılmasıyla ulaşılabilir. Bu kavram, devlet kurumlarındaki teçhizatın yenilenmesini sağlar, bunun sonucunda da devlet kurumlarındaki hizmet sunumu için bireylerin, devlet hizmetlerinin yönetiminde hız, artan şeffaflık ve etkinliğe kavuşmalarını garanti altına alan yeni yöntemlerin benimsenir. Bizleri burada en çok ilgilendiren en önemli hizmetler, sağlık sektöründeki hizmetlerdir.

Bu bakımdan, Irak'ta e-yönetimin benimsenmesi, bilgiye dayanan yeni ekonomide yer alabilmek için vatandaş ve işadamlarının alanlarının genişletilmesine yardımcı olacak bir değişim işlemi şeklinde değerlendirilebilir. E-devletin tüm potansiyelinin kullanılabilmesi amacıyla e-devlet hizmetlerini sunan yeni bir elektronik sistemin oluşturulması gerekmektedir. Irak Cumhuriyeti sağlık sektöründeki çalışmaları, daha iyisini yapabilmek için cesaretlendirecek en önemli e-devlet uygulaması, hız, doğruluk, deneyim, iletişim, etkinlik, verimlilik ve benzeri özellikleri arttırmak amacıyla diğer birçok alanda da kullanışlı olacağı beklenen Hasta Yönetim Bilgi Sistemi (HYBS)'dir. Maliyet, zaman, tıbbi hatalar, teşhis ve tedavi gibi birçok işlevsel etkenin sayısının bu uygulama sayesinde azalması, yerden tasarruf sağlanması ve hasta verilerinin taşınabilmesi beklenilmektedir.

Anahtar Kelimeler: e-devlet, sağlık e-devlet sistemi, HYBS.

TABLE OF CONTENTS

CHAPTERS:

CHAPTER I

INTRODUCTION

CHAPTER II

THE E-GOVERNMENT PHENOMENON

CHAPTER III

LITERATURE REVIEW

CHAPTER IV

BUILDING PATIENT MANAGEMENT INFORMATION SYSTEM

CHAPTER V

CONCLUSIONS AND FUTURE WORK

LIST OF FIGURES

LIST OF ABBREVIATIONS

E-government: Electronic Government

PMIS: Patients Managing Information System

ICT: Information and Communication Technology

IT: Information Technology

SMS: Short Message Service

G2C: Government to Citizen

G2B: Government to Business

G2G: Government to Government

G2E: Government to Employee

G2N: Government to Non-profit

FEA: Federal Enterprise Architecture

EA: Enterprise Architecture

IA: Interoperability Architecture

XML: Extensible Markup Language

OMB: Office of Management and Budget

BLL: Business Logic Layer

DAL: Data Access Layer

VS2010: Visual Studio 2010

ASP: Active Server Pages

C#: C Sharp pronounced as (See Sharp)

IIS: Internet Information Service

GUI: Graphical User Interface

PDF: Portable Document Format

HTML: Hyper Text Markup Language

XLSX: XLSX is a file extension for an open XML spreadsheet file format

XLS: XLS is a file extension for an open XML spreadsheet file format

CVS: Concurrent Versions System

CHAPTER I

INTRODUCTION

In the late nineties, new applications have emerged operating via the Internet and using different communication and information technologies. They aim at the provision of digital government services and firing the e-government applications. These applications provide the possibilities to increase the convenience of the audience by assembling these services in order to be accessible 24 hours a day, 7 days a week, besides the benefits of enhanced accuracy and diminishing the budget of the government. These services do not need to communicate directly with any government employee. As we witness a radical transformation in a large part of our world due to the modern technology, e.g. computers, smartphones, tablets, Internet, etc. growing around us, the pattern of our daily lives and contacts have been greatly influenced. One of the important aspects that must make use of the information and communication technology with regard to the delivery of services in Iraq is the health sector.

The Republic of Iraq has made health care one of its priorities since the twenties of the last century. Thus, the purpose behind the foundation of the Iraqi Royal Medical College was to train doctors locally. By the seventies, the health care system in Iraq was one of the most advanced systems in the whole region. After the invasion of Iraq in 2003, health care has deteriorated significantly; in that, the primary health care services, prevention, control of diseases and infrastructure for health research have been destroyed. There are still several factors that hinder the attempts to revive the health care system in Iraq, including the fragile national security and the lack of public utilities such as water and electricity. The effect is still continuous with a lot of damage to this system since the early years of the invasion till now.

The current system in Iraqi hospitals is one of the primal systems compared with the systems at the time of the technology revolution. As a part of our duty in the reconstruction of infrastructure of Iraqi health sector is to improve the reality of the delivery of medical government services to the citizens. To that end, it has been proposed here the implementation of a Patient Information Management System (PMIS) that automates the services inside and outside the Iraqi hospitals.

Upon entering the patient to the hospital the hospital administration has to deal with the information written on papers and with lists that are especially prepared for this purpose. These papers are usually accumulated in the archives of Iraqi hospitals, and copies of such papers or reports are to be kept for other medical and laboratory tests for the patient. This information related to the patient's paper and the patients' archive in the hospital are often subject to the loss and damage caused by many factors. As such, the doctors cannot know the medical history of the patient because of the lack of pathological information related to the patient; a case that adversely affects the patient himself. In many cases, Iraqi patients are exposed to great danger in hospitals due to the lack of knowledge of medical history of the patient. Thus, the urgent need for the introducing of information and communication technologies into the delivery of government services in Iraqi hospitals has emerged so as to reduce the burden on the shoulders of the Iraqi citizen and to follow-up a medical history for each patient through a special system of storing information with various kinds of the patient's electronic form which is compatible with the recent technological development.

The reasons mentioned above show the urgent need to develop an application that supports the delivery of government services for the health sector, viz. the electronic form that can be one of the e-government services for the Republic of Iraq. This is the essence of the idea behind the development of PMIS that serves both the citizens and the government.

Information management refers to the collection, storage and retrieval of information and knowledge; it is related to communication and the optimal use of data, Information management systems of an organization recommended that you spend

some time with your manager to discuss the systems, policies and procedures and guidelines relevant to our workplace.

This will include:

- Patient Records: documentation in patient records is an essential part of the health professional activities. At a high level, documenting the patient's records is very important to meet the legislative requirements and professional health sector, and improve communication between health professionals. Guided and documentation of patient records in accordance with the standards and principles of good practice for the medical profession.

- Patient management systems: the patient is used to support all functions related to the management of patients and clients. Can these systems include the ability to record all patient information electronically and access to patient records, and make a referral laboratory tests requested electronic access to the results of laboratory tests, and manage the number of issues of doctors and their accounts.

- Patient collection of statistical data: Usually, most of the health services and organizations have systems in place to gather information about the services they offer. Can include this information on the types of patients; how many times you see them, how much time you see them, and where you see them. Data collection may be either paper or electronic.

- Intranet: Intranet is a private computer network that uses Internet technologies to exchange information securely or regulatory systems with its employees. Intranets are often "one-stop" for information specific to organization, including for example forms and templates, manuals, documents, policies and procedures.

- Communications: include of using wired and wireless communication and technologies such as, telephone, computer, servers, Internet and Intranet. Computer can be important instrument for all employees in the field of health.

The expected benefits of the implementation of this e-government application PMIS in the field of health in Iraq, especially government hospitals, are highly considerable. The various aspects of care provided for the patient, the medical history and other relevant health information are to be stored in a digital format instead of the traditional paper files. Electronic medical records are more suitable; in that, they reduce operational costs, save the space form using electronic records, improve the management, increase the accuracy, collect the patient's disease history and does other benefits that will be discussed in the conclusions part.

CHAPTER II

THE E-GOVERNMENT PHENOMENON

In the previous years, the Internet was very simple and serves specific works like providing or viewing information so as to be available for everyone; Because of the fast changes and developments in communication and information technologies that occur nowadays, the Internet has been made available in everywhere and for all. Therefore, the Internet became an important tool to provide different services.

Today, the Internet has become an essential and important element in life. It enters every aspect of life due to its multiple functions that facilitate many necessary daily activities. The community has become more interested in the Internet and its services that are provided electronically. Electronic government (e-government) is one of its important online applications which is used by a lot of government institutions to increase the use of computers, and hence, to communicate and interact easily with ministries, companies and citizens.

The main objective of the e-government which is an electronic task is to improve access to information, and to increase the possibility to develop and improve electronic services (e-services). Many companies are using various Information and Communication Technology (ICT), and adopting electronic services in their work in order to ease communication and access to the required information. The key of Iraq's future is to create e-government services, so as to meet the needs of citizens and to increase their participation in government operations.

2.1 Definition of E-Government

The e-government appeared in the end of 1990's. Since then, it has been named with many labels like Electronic Government, Digital Government, and Electronic Governance. In this chapter, many well-known definitions of e-government are going to be discussed.

From the World Bank (2011) perspective, the e-government is define as result of the integration of traditional government services with information and communication technologies; It aims at strengthening the relations among the government institutions and all of (citizens, businesses and other governments). Information and communication technology can achieve several goals, including: providing a new way to deliver government services to citizens, easing the access to information and sharing it with citizens, creating new opportunities for both business and industry sectors and increasing the efficiency of government services. It can offer various benefits: making the relationship transparent between the government and citizens, providing the comfortable services for the citizens, the eliminating corruption and fraud, increasing the income and decreasing the production costs in the business sector [1].

From the United State government perspective (2002), the e-government is defined as the government's use of web applications and information communication technologies, and the selection of appropriate methods to benefit from these technologies in the following manners:

a. Provide new methods to access information and government services, and share them with all of the citizens, businesses, and other government organizations; or
b. Improve service quality, increase efficiency, and improve the efficiency of traditional government services [2].

According to Turban and a group of scholars (2002), e-government is defined as easing the access to information and government services as much as possible, and thus, to provide comfortable services to citizens, through the use of information technology and electronic commerce (e-commerce), as well as, to share this information and services with citizens, owners of companies and employees [3].

From the technical perspective, Schware and Deane, Sprecher and Al-Mashari have define e-government as the extent of using information and communication technologies in government institutions and other service organizations and the provision of e-services in these institutions and organization make them places capable of providing Electronic services [4, 5, 6].

From the citizen perspective, Burn and Robins, and Banerjee and Chau have defined e-government as a method to provide information and various electronic services to the citizens. Therefore, it is considered a tool for the development of the relationship between the government and citizens [7, 8].

Another definition of e-government comes from the communication perspective that combines technical and citizen perspectives, In this regard, e-government is defined as a method that makes electronic transactions between the government, businesses and citizens, and this is done through the implementation of information and communication technology [9, 10, 11, and 12].

Another important definition of e-government that reflects the government perspective is given by Wimmer who states that e-government represents the electronic version of the regular government with all its administrative borders and this forms the term "electronic communities" [13].

As a concluding remark, there are several proposals to define e-government. However, there is no one specific definition covering all points of view. Some of the above definitions appear similar to each other, although there is a slight difference in their content.

2.2 Types and Characteristics of E-Government

As the studies differ in their definitions of the concept of e-government due to their different objectives, the implementation of the applications of the e-government becomes more complex and difficult than necessitating the need for proper planning and deliberate before starting the implementation. We find that e-government forms multiple types for different target groups of stakeholders. These types of e-government are the most important factors that depend on them in the management of governments affairs through different applications; it can confine most of the e-government applications types in the following five forms:

- government to citizens (G2C) services: The governmental institutions in this mode targeting citizens and residents, through the presentation of what they interested into governmental information and various services, that offered through a single web site or through the government gate (Portal), this gives citizens the opportunity to participate in some of government decisions and policies [14]. Citizens have many relations with the government, to facilitate these relationships; the government providing public services needed by the citizens on the Internet. The level of complexity of this types of transactions deference between citizens themselves, There are some of citizens want to access to a certain information and the identity of the citizen may be unnecessary, in some cases, the interactions be more complex so that require knowledge of the identity of citizens to obtain government information, in this case the government has worked to provide privacy for citizens [15].

- Government to business (G2B) services: In business sector the e-government plays a significant role in facilitating the interactions of all types of businesses with government. This allows the business to participate in government information and electronic interactions, such as paying taxes, obtaining permits, registration of new businesses or renewal of business licenses. This type of e-government includes e-procurement operations, they facilitate the business interactions with various sectors (citizens, companies with each other and governments), these e-procurement operations includes exchange of goods and services or bidding, this leaves the character of transparency on business processes and eliminate cases of extortion or corruption in the provision of tender offers and big business deals [16]. In contrast, business management processes electronic form by the government reduces costs; such electronic business operations do not need intermediaries or agents for the completion of business processes [17].

- Government to Government (G2G) services: This type of e-government backbone of e-government; information and communications technology provides platform to integrating all the services of ministries and government institutions, therefore, e-government provides e-services characterized by speed, efficiency and effectiveness and transparency [18]. This type is the most complex types of e-government, where aims to integrate and standardize

services, procedures and transactions of the government, which include more than a government institution in various specialties and software. In other words, G2G provides government departments or agencies collaboration and networking through the Internet a huge database for the government and thus have an impact on the efficiency and effectiveness, and this also provides the internal exchange of information.

- Government to employees (G2E) services: This pattern of e-government services in the perspective of some researchers is the internal part of (G2G) and there are other studies considered this type as a separate sector of e-government services [19]. G2E is making the initiatives to facilitate service management and internal communications with the staff of any government and in other words, this type refers to the relationship between the government and its employees only. The purpose of this relationship is to serve the staff and provide some services and important information on the Internet to employees as salaries, get information on vacations, see balance vacations and the upcoming training sessions [20].

- The government to non-profit (G2N) services: In this type, e-government provides information and communication to non-profit organizations (charitable), Political parties, social organizations and legislative organizations of information, etc. [21].

2.3 Stages of E-government

The e-government as a result appears to enter the information and communication technologies into the traditional work of government; we should note here that e-government is more complicated than it is just transforming traditional government services on electronic services available to citizens. E-government has a number of strategies in the implementation. E-government is carried out in the strategy through a number of stages (phases); these stages are different in design and content from one researcher (scholar) to another. These stages are used to implement and measure the extent of the implementation of e-government.

These stages (phases) are uncorrelated, in another sense, it is not necessary to the completion of a certain stage to start another stage shall be the ultimate goal of the stages is to achieve the targeted objectives of e-government.

The following literature shows a number of studies, researches and reports prepared by researchers, scholars and even organizations, with the aim of organizing stages for the implementation of e-government; More specifically, differences between studies of Gartner Group (2000), the United Nations Division for Public Economics and Public Administration (2001), Deloitte and Touch (2001), IBM Business Consulting Services (2003) and the World Bank (2002) are to be reviewed here briefly:

2.3.1 Gartner study (Four stages of e-government)

According to the Gartner study, e-government implementation is divided into four stages (phases) through the development of an integrated plan for measuring progress and development in e-government initiatives and the development of a map to achieve the required levels. The stages of Gartner Group are [22]:

- Presence: This stage is the first stage of the development of e-government, where is characterized by simplicity and low cost but offers few choices for citizens and the best example is a Web site works to provide a simple information, such as hours of work, where this information is negative and have no possibility to interact and sometimes described as (brochure ware).
- Interaction: This stage is the second stage of the development of e-government, it includes a simple interactions on the Web site, such as the interactions that occur between the government and the citizen (G2C), the interactions in the business sector (G2B) and the interactions that occur between the governments (G2G), but the efforts in this stage is limited in their ability to do government services, where these interactions provide simple information to get the required e-government services.
- The transaction: In this stage, the development of e-government become more complicated than just provide simple information, where the interactions based on self-service, such as paying taxes, license renewal and procurement contracts.

In this stage clients and citizens can do their requests electronically at any time anywhere, whether day or night, the level of progress in these interactions is highest and largest than the interactions in the second stage (interaction).

- The transformation: this stage is the final stage of the implementation of e-government, after the completion of this stage; e-government will be as close as possible to the traditional government of all administrative and legal boundaries. In general, this model one of models that is interested in citizen-centric, by using information and communication technology, and on the basis of regulatory and administrative boundaries.

2.3.2 UN \ ASPA study (Five stages of e-government)

The study provided by the United Nations Division for Public Economics and Public Administration (2001) classifies stages of the development of e-government into five stages and focuses on the provision of services through the electronic government site on the Internet. These stages are [23]:

- Emerging: this stage is the first stages of measuring the development of e-government, where the government is established a government websites that separated from each other, each of these websites specialized to provide a particular service to the citizen, these websites is to providing limited, simple and fixed information with a few options for citizens.

- Enhanced: At this stage, there is an improvement in the government websites in terms of providing information where the information becomes more active and dynamic, this information is updated regularly.

- Interactive: At this stage, the interaction has become more developed than it was in the previous stage where the users are able to interact through the internet, download various forms, search in databases and easily access to information.

- Transactional: The developed operation from previous stages will be more sophisticated, at this stage users (citizens) will be able to pay for actual electronic services that provided by the government. So citizens can handle transactional operations through governmental websites.

- Seamless: This stage is more advanced stages in the model of providing e-government services, at this stage services and functions are all integrated across the administrative boundaries, where citizens can access any kind of services from the government website at any time, thus all government services available on the internet.

2.3.3 Deloitte and Touch study (Six stages of e-government)

Deloitte and Touch (2001) provide a model for measuring the progress of e-government that consists of six stages. The model is built on the basis of achieving the goals of e-government. This model serves primarily citizens as customers and creates a long-term relationship with the citizen [24]. Following the full description of each stage in the Deloitte and Touch model:

- Information publishing / dissemination: in this stage, the government allows citizens access to information. In other words, government setup, some website's offers information that can be accessible by the citizens, where they can access to the information through the Internet and from anywhere at any time. The stage communication descript as one way communication.
- Official two way transaction: which began in the first stage as unilaterally transact, in this stage will use Information and Communications Technologies (ICT) to improve transactions between government agencies and citizens, so in this stage start the concept of interaction with electronic services for e-government.
- Multipurpose portal: In the third phase of this model, the government establishes a unified portal to encompass the electronic services provided by various government departments (departments, ministries, bodies and all governmental organizations).
- Portal personalization: the government enables all kinds of beneficiaries (users and citizens) from the portal to make modifications and improvements in the quality and methods of delivery of electronic services that provided through this portal.

- Clustering of common services: this stage of the Deloitte and Touch model aims to reduce the middlemen and improve cooperation in the provision of electronic services (operations) in order to provide transparent and seamless services to citizens.

- Full integration and enterprise transaction: Seamless revelation in governments that provide advanced services and unified, that personalized to each customer (citizens) conferring to their own requirements and inclinations. In other words, government to change its structure and offer more developed services, integrated and personalized to the citizens.

Like other models, it is totally based on citizen centric. However, regardless of ignoring the potential benefits of the political changes in the government, it also offers little responsiveness to what extent the security issues relating to the use of information and communication technologies.

2.3.4 IBM study (Four stages of e-government)

IBM Business Consulting Services in 2003 has published a study that put four stages to measure the progress of e-government. This model aims to build a flexible e-government; governmental organizations achieve what citizens expect from e-government services. In other words, the government implements the demands of citizens from electronic services. On demand environment requires building the e-government upon open infrastructure (scalable), the use of the latest information and communication technologies and the appropriate applications and to promote e-government. It can measure the progress of the (implementation) of e-government in four phases (waves), these phases starting from (Automate) the simplest forms of e-government and end with (On demand), these stages flexible (dynamic) characterized by the fast response and respond to requests of citizens [25].

- Automate: this phase focuses clearly on the service provided to citizens through Web pages clear and defined represent the beginnings of e-government services.

- Enhance: at this stage, the government made improvements and the development of the services provided in the previous stage, but not in order to reach the next stage.

- Integrate: this stage is necessary in order to reach the final stage of the model, in this model begins transformation and integration of simple processes to integrated operations.
- On demand: it is the final stage of e-government. At this stage, e-government turns from the simple model to an on demand model which involves three paths: business transformation model, and transformation of infrastructure and cultural transformation.

2.3.5 World Bank study (Three stages of e-government)

The U.S. Center for Democracy and Technology (2002) divides the stages of the implementation of e-government into three stages, and each stage separate from the other stages [26], these stages are:

- Publish: the first stage concerned with the dissemination of government information on Web sites translates this information to serve a wider slice of the audience. In addition, these sites represent the beginnings of e-government and the edges.
- Interact: the second stage represents the added portability citizen interaction of electronic government and this process must be a two-way communication. Interaction extends from simple issues and functions in government institutions such as contact information and e-mail to government offices and institutions and even ability of citizens to vote for new laws and legislation.
- Transact: allowing citizens to obtain government services or doing business over the Internet using e-government services provided by the government. E-government website on the Internet offering direct links to government services, which are available at any time and at any place. These websites can enhance productivity in both the public and private sectors through the processes that need to assist of the government or the approval in a simpler, faster and cheaper than it makes.

2.4 Architectures of E-government

At the beginning of the emergence of e-government, the architecture was just a simple tool that deals with the technical side of e-government. Regarding the great

development of information and communication technologies at the present time, the architecture deals with several aspects of e-government. These aspects are the business of e-government, the citizen side, information technology, and the link of each one of these aspects with all dimensions of governance.

The factors success of electronic governments varies according to the viewpoints adopted. It also from one country to another in accordance with the nature of these factors, such as; The country's economic potential, the evolution of the infrastructure, the ability of connecting citizens, security and the political situation of the country, etc. From the viewpoint of information and communication technologies, the architecture of e-government is the most important factor in the success of e-government. In addition to these factors, software engineers consider architecture design of any system is a success factor of the system [27].

The term architecture (interoperability framework) is used alternatively. A framework is, in fact, a collection of applications, software and tools. It provides a suitable set of common tools that support applications of e-government interoperability; architectures are considered a step further ahead by means of organizing these applications and not only listing them. Interoperability means the ability of information systems and technology for making communication among operations within the e-government through the exchange of data and enabling the exchange of information and knowledge [28].

There is a wide range of e-government architectures as a result of a large number of studies and research (Interoperability Frameworks, Enterprise Architecture, XML (Extensible Markup Language) Architecture and Web Services Architectures) or architectural designs for the e-governments in a number of countries (The European one-stop government, Service Development Framework (UK), The US Federal Enterprise Architecture (FEA), etc.) [1].In the coming subsections, we will review these studies focusing specially on the most important architectures of e-governments.

2.4.1 Enterprise Architecture (EA)

Enterprise Architecture (EA) is described as the way that supports the strategies and operations of organizations through the preparation of organizational structures, information and technology. In the field of government institutions there is a harmonized group of spheres of activities involving one or more of the public organizations and possibly third-party entities, private organizations or civil society. There is increased awareness of the importance of EA projects and architecture of enterprise software in most of the leading countries in the field of established e-government. At present, there are mature models of enterprise architecture with specific relationships representing well-known stages of maturity of e-government. This refers to the increasing popularity of the practice of architectural enterprise by governments in both developed and developing countries through various global surveys on architectural enterprise [29].

Enterprise architecture in e-government, according to Beryl and Felix (2004) and Guijarro (2007), is necessary to the developing of information systems and developing new systems that enhance the principles of their goals. This is accomplished in terms of logical business (for example, business functions and the flow of information) and technical terms (for example, software, hardware, and communications), including a plan to transfer the sequence of basic environment to the target environment of e-government. Enterprise architecture is a tool to manage the agency's commitment to e-government depending on the familiarity of the executives with the concept [30, 31].

3.4.2 Interoperability Architecture (IA)

Considerations should be given to e-government as a set of interrelated classes and not just a simple layer placed on top of the pyramid in the design structure. In the digital age, public institutions change their strategies, operations and information technology used in its infrastructure to achieve the maximum benefit from advances in information and communication technology.

Sometimes this transformation goes on electronic government with success, but this is not enough. Government institutions, departments, senior public institutions and

organizations in collaboration, should create a series of joint activity and use networks in their work to create a system of integrated public service, and this needs to reshape the public sector, and thus, shows the need to develop models for new architecture [32].

To achieve this goal, the use of Interoperability Architecture (IA) in the design of e-government is the best solution which should be adopted, as it ensures the connecting of the various systems, processes and organizations in order to be able to work together using a single and common infrastructure. Thus, a number of definitions of Interoperability have to be considered here. Interoperability is a multi-faceted notion, referring to the ability that allows separate systems to communicate and share information mutually [33]. Also there is another definition from IEEE. IEEE defines Interoperability as the ability of two or more systems or components to exchange information and data and use such information and data that are exchanged within a single infrastructure [34].

2.4.3 Web service architecture

Over the past years, public administrations spent extensively in the development and use of information systems in institutions. However, the whole issue has been done without a unified strategy. As a result, the ministries and institutions, for example, use different information systems. Today, the new idea is to connect some of the existing systems together to provide a homogeneous and unified system for users. This new idea looks at the development of the Internet and new technologies such as Internet services as a means to achieve the desired level of integration between those systems.

At present, it is generally agreed that integrate existing software applications is a must although it represents a daunting task. It is scheduled greater variations of hardware, middleware, language, interfaces, data storage and the absence of acceptable standards of this complexity, creating a heterogeneous environment. Moreover, the applications in many cases are not designed to deal with other applications [35].

Most governments recognize that the use of information and communication tools represents a powerful way to increase cooperation and coordination between various public institutions. The objectives are to provide better services and more efficient for citizens. Ambitions of governments to facilitate and encourage the development of heterogeneous network platforms and services for citizens with only one single authentication, and access to many public services such as taxation, social services, health care, etc..

2.5 Benefits of E-government

There are many benefits and advantages for government services. If e-government is built correctly and successfully, it can progress and achieve many of the benefits of the government. In the (G2G) sector, services provided by the government between the government organizations are faster, easier, less time and faster response. According to the Office of Management and Budget (OMB), there is a process of exchange of the necessary and important information between the government agencies and government organizations through the Internet so that there is accuracy and speed of transfer the information and to be more interactive [36].

E-government offers many benefits to governments and the government organizations; it works to provide more accuracy and more efficient, lowest cost and is working to provide time for the employee who is consumption by doing repetitive routine works [37]. In addition, e-government enhances the efficiency and effectiveness of government performance [38].

In (G2B), business has a chance also to take advantage of electronic services offered by e-government, as it works to save money, time and effort on all sides worked with e-government and provide expenses significant financial, and thus, the private sector and the public sector utilized services provided online by e-government such as improving the management and facilitate transactions and reduce the cost [39]. There are other studies showing that the private sector can get more business opportunities with the government due to the increased awareness from the e-government [40]. Also, the provision of an electronic procurement service, improve the quality of

service to the government and the business sector, offers comfort and facilitate procurement [41].

In the sector (G2C), e-government plays an important role in the digital life of citizens and on this basis it can enhance the interaction between the citizens and the government and make the life easier. Individual citizens are free and able to track information that suits them unlike the traditional way [42, 43].

There are many benefits of e-government and the beneficiaries of these benefits are citizens, business and the government itself. It seems that the citizens are the biggest beneficiary group to get these benefits, as citizens, representing the largest sector in the system of government compared to the business and the government [44].

The following are some of the benefits of e-government to citizens, business, the government and others:

- Confirm and show transparency in the work of the government [45].
- Create additional channels of communication between citizens and businesses on the one hand and the government on the other hand [45].
- The working on providing information to the citizens.
- E-Government systems respond anytime and anywhere and immediately, 24-hrs/day, 7 days/week [45].
- Reduce the cost of government by improving their performance and make it more efficiency [46].
- The system of government is supported from computer databases in real time; therefore this system can provide effective access to many of the database records and other documents [46].
- Save money and time and effort on all parties worked with e-government, and provides significant financial expenses were behave while working e-government [47].
- Motivate citizens to use e-government, thus creating an information society capable of dealing with the technical data and keep up the information age [48].

2.6 Challenges of E-government

E-government is a great opportunity to provide services and information to the citizens, but one must also consider some of the difficult issues it faces. Challenges usually face the human being when he or she performs any natural effort. These efforts performed by human beings are to ensure overcoming the obstacles posed by that distance default, which is determined by which the amount of success and failure in performance, and we will discuss here the challenges facing e-government [49].

2.6.1 The technical impacts

These challenges enter into the context of necessary information configuration task of infrastructure. These obstacles or difficulties emerge in countries that do not have the industries' electronic technology. These are the challenges that are in need of huge financial investments to find technical information for building Information Technology (IT) infrastructure. The lack of the necessary expertise in techniques also opposes reliance on information technologies with the conservation of information security. In the presence of the digital dilemma as a result of educational and economic regulatory obstacles that make the entering into the digital world a difficult process, and hence, result in poor infrastructure in areas of communications [49].

Interoperability shows that the system must be interoperable. When you put a new service in e-government, it should be compatible with existing legacy services. Therefore, it is important to use "open standards" architecture, to avoid heavy maintenance on existing applications [50].

2.6.2 The administrative impacts

Examples of these challenges with regard to administrative impacts might be the existence of variation among organizations in taking the causes of activation of information systems management, poor integration planning and analysis, the disability to predict the future, the absence of harmonization between the needs of the diverse and conflicting , the lack of balance between the plan of the organization

and the overall strategic view of the multiplicity of organizations and government institutions.

The absence of management change so that the transition to a model of e-government will lead to the change of the relationship in governmental organizations which would require redesigning of the administrative process that deals with the administrative apparatus, the difficulty of the transition to regulation-mail, hardening of the organizational culture, resistance to change by employees, and the failure of technology (strategy) intervention [51].

2.6.3 The security impacts

These challenges are associated with two dimensions: spatial dimension and temporal dimension. These difficulties indicate in several aspects, including accelerated technical development, growing threats to deal with these technologies. These threats (threats of breakthroughs, financial threats like fraud, threats of organized crimes, and the threat of hostile sites, piracy and espionage threats and destruction) [51].

The computer security is one of the most important challenges for the implementation of e-government where you must maintain the citizens' rights to privacy and confidentiality in the provision of personal information as part of the access and use of electronic services. On this basis, websites should get the great interest in terms of privacy and confidentiality [50].

2.6.4 The political impacts

There are many topics and political issues that should be taken into consideration, where the government could provide many and varied electronic services , but must be more integrated, useful and accurate, and thus increasing the scope of e-government services to the largest number of sectors of society. From the point of user perspective, must be a unifying process is simple (easy to use) with compensation, agreements and power, where the responsibility must be placed in a clear format and recognized in order to provide protection to the user [52].

2.6.5 The cultural impacts

In this aspect, the challenges in e-government are more difficult because they rely heavily on the psychological factor of the user and the e-government should support the principle of (easy to use) in order to achieve success. E-government services should be available for many of the people even illiterates, who can take advantage of e-government services [52].

2.6.6 The legal impacts

In this aspect, there are many problems related to the security breach, violation of network threats such as viruses and hacker attacks and denial of identity that are unauthorized and computer forgery, as well as, there is an imbalance and a lack of laws that related in the field of information technology [52].

CHAPTER III

LITERATURE REVIEW

In this chapter, we will review some of the successful electronic health systems that have proven to be successful around the world. We chose the following countries for the purpose of the present study: Australia, United Kingdom, Turkey and Iraq.

3.1 Australia Health System

Australia's health system is one of the best systems in the world. However, the preservation of the results provided by this system or do not improve these results. It is facing increasing pressures on the health care system and so requires a fundamental change in the health care. This change includes processing of how to get and share information across the health systems and this will affect the way of interaction between the staff and consumers with the health system.

The system of Australia is characterized as being able to provide health care services remotely. This benefit reaches rural communities that can get access to the health care services easily. The system works to support officials in health care with the ability to get access to the sources of their data, and to reduce the time for consumers to reserve appointments manually and request for treatment electronically. The exchange of information across the health sectors, and the elimination of duplicate tests personal are necessary to avoid medical errors, especially in chronic cases, and to get rid of travel to the remote and rural areas [53].

3.2 United Kingdom (UK) Health System

In the United Kingdom (UK), the Department of Health uses the national health system (NHS). The objective of this project is to manage medicine systems in the hospitals in terms of the nature of medicines, to avoid an error occurs in dose medications, keep the patient safety from the occurrence of any error in the use of medications, not to give any dose non available in the list of medications, design a template to summarize the clinical context of each patient, and to work a detailed description of the medication management systems using a scheme to process and compare the results.

The preparation and the development of guidelines are to inform employees the medicines that should not be deleted and validation of the guidelines during an interview with the staff of pharmacists and nursing staff [54].

3.3 Turkey Health System

In Turkey, the first initiative of the national system of health information is to launch the useful and effective program for health and make electronic health records that have begun in 2003. The objective of this system is to collect and save the data for all the departments of the Ministry of Health, including all hospitals, health care institutions, laboratories and family medicine [55]. There are several goals for this system, the adoption of national standards for the data elements, the development and introduction of the new and existing content of health information in Turkey on the basis of these criteria and store all the information and data in a special dictionary for data. To strengthen the Ministry of Health with a network of the Internet to help administrators, staff and citizens of access to systems and services; to meet the needs of digital security for all health care information, anti-virus, impartiality and confidentiality at work [56]. Such a system works to improve the health status and reducing inequalities between regions and rural areas in health status, increase population coverage, increase access to quality health services, distribution of health services in an equitable manner for all, and the introduction of health technology, assessment and improve the skills of the doctors and management skills [57].

3.4 Iraq Health System

Iraqi Ministry of Health has adopted a health system depends primary health care, as an essential foundation includes the provision of health services in accordance with the standards of quality as the level of services first report to the citizen while ensuring the integration of these services with the second level (public hospitals), and the third specialist centers through the application of the system of family medicine at the centers health and the introduction of health visitor.

This system focuses on the introduction of a package of basic health services in health centers that provide services surveillance and screening for women. This includes the health system in Iraq all the institutions of preventive and curative. This system is based on the registration of visitors to hospitals and care centers and clinics using paper records and compiles these records by names (alphabet) and give the patient a paper (card) shows the record number and limitation. It is the responsibility of the patient to keep these papers, including the results of clinical and laboratory tests in paper. In order to review the health status of the patient by the physician are obliged to keep these papers from damage or loss, and often the patient to visit a doctor or health center without these papers that contain the health history of the patient, which exposes the patient to serious health risks due to loss of paper health history.

It is well known that Iraq faced serious health risks, because of the war, the siege, the decline of human capacity and financial and technical for the health sector, and because of environmental degradation, and the destruction of infrastructure, coupled with declining economic potential of citizens, resulting in high mortality rates, and the deterioration of health services, and the growing psychological burden the material on the citizens. Although disbursement of huge amounts of money for the advancement of the health sector in Iraq but it has not been any the introduction of an electronic system to manage patient information electronically, Iraqi hospitals are is almost without any that electronic systems or even the simplest communication technologies for example, communication networks (wired or wireless).

3.5 Evaluation of the Systems

We have noticed above, the importance of the impact of information and communication technologies and e-government applications in the health sector in Turkey, Australia and United Kingdom. As presented about the Australian health system at the beginning of this chapter.

It is considered one of the best health systems in the world is characterized by the provision of health system remotely, share health information of the patient, facilitate decision-making on a satisfactory health condition, a request for the electronic treatment, reduce of the medical dangers, ending medical duplicates and tests and a lot of advantages which inspired us to develop the health system in Iraq.

This shows the urgent need for the entering of this technology into the health sector in Iraq after a long realm of neglect, vandalism and devastation. With the advent of new technology in the prospects, it will be quite necessary to change the primitive health system to the contemporary system.

To that end a range of patient health information in digital form is required referred to by the term Patient Managing Information System. The health system will be a new electronic system to keep medical records of e-health where it becomes an important part of health care systems in order to improve the health status of the Iraqi patient. To achieve this goal we decided to prepare a case study, and selected the health sector in the province of Mosul as a case of study and development of the system to suit the hospitals in this province in line with the administrative and medical staff of the Iraqi hospitals as well as for the patients. A meeting was held with a special committee of the General Directorate for Health in Mosul in order to know the criteria required in the design of an electronic system to manage medical and administrative information for hospitals. After a number of meetings reflected the curtain from the main objective of the system is to store any information related to the patient's health in electronic health record, which is expected to be of great benefits in many health areas, increasing in effectiveness, efficiency, speed, accuracy, experience, communication, etc. The application is expected to reduce the number of operational factors, including the cost, time, medical errors, diagnosis and therapy, save space and the ability to transfer patient data.

CHAPTER IV

BUILDING PATIENT MANAGEMENT INFORMATION SYSTEM

This work aims to develop an e-government application of Patient Management Information System (PMIS) to manage patients' information inside the hospital and among other hospitals. Our application is targeting multi types of workers in the hospitals of the Iraqi Ministry of Health in the province of Mosul. This application gathers the patients' information (personal and pathological) in the system database and generates a private health number for each patient. Through this unified number (doctors, laboratorians and others) who work in the hospital can follow-up the information about the patient from the inside hospital or from the outside of the hospital even from other hospitals through two types of applications. The first, a window's application is to serve the workers inside the hospital; the second, a web application is to serve the doctors in other hospitals and the patients from outside the hospital. In this chapter, we will clarify our application architecture, the tools that are used in developing our application, the database structure of the application and finally we will explain all parts of the application of each type of application user.

4.1 PMIS Application Architecture (Methodology)

We use 3-tier architecture in our application of architecture design. This architecture mainly consists of three logical tiers (layers): Presentation Layer, Business Logic Layer (BLL) and Database Access Layer (DAL). We prefer to use three-tier architecture because it is providing multiple benefits. Scalability is where each layer can be changed in size horizontally and without affecting the rest of the classes. Performance is the presentation layer responsible for sending data of the correct format. It reduces the load on networks as well as reduces the work in layer responsible for data storage and processing.

Availability of any change happening on any layer does not affect the other layers as well as he does not affect the work of the application. The 3-tier application architecture is shown in Figure 4.1.

- Presentation Layer: refers to the Graphical User Interface (GUI) of the application, it is working with the output of Business Logic Layer, this tier responsible to interpret all information to readable and useable by the end user.

- Business Logic Layer (BLL): it is responsible for all process in the application, this layer also represent the connectivity between the presentation layer and data access layers, any data request from the presentation layer toward data access layers must pass and processed by business logic layer.

- Database Access Layer (DAL): Provides access to the database by executing a set of command from Business Logic Layer.
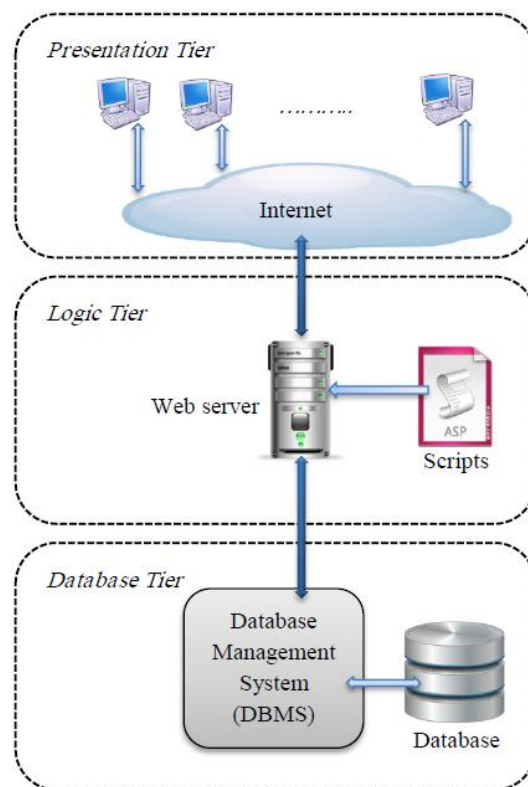
Figure 4.1: the 3-tier Application.

4.2 Development Tools for PMIS

We use several tools to accomplish the application. These tools vary with regard to development environment, programing language, developing assistance tools, GUI providers and operating system. The most common tools that are used in application development are:

1. Visual Studio 2010 (VS2010) is an Integrated Development Environment (IDE).

2. ASP NET Framework 4.0 (Active Server Pages) as a server side web application framework.

3. C# "see sharp" object-oriented and type safe programming language.

4. DevExpress: Feature-Complete UI Controls, IDE Tools, and Business Application Frameworks for Visual Studio

5. Internet Information Service (IIS) is web applications server software.

6. SQL Server 2008 Enterprise Edition, software product for the managing database system.

7. Windows Server 2008 is a brand name for the server operating system.
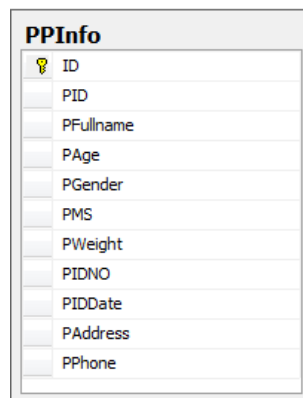
4.3 PMIS Database Structure

The database is the most important element of e-government applications. It is responsible for storage of all types of data of users. In our e-government application PMIS there are data for doctors, laboratorians, nurses, employees as well as administrators. Our application has been developed to contain two databases to separate between the patient personal information and hospital information (such as doctors' information, information satisfactory to the patient, etc.). The first database is named PPINFO; the second database is named PMISDB.

It is worth to mention here that all the relationships between the databases and between the data tables within a single database has been handled programmatically through the development environment (Visual Studio 2010) during the application development phases.

4.3.1 PPINFO Database

Currently, the Iraqi Interior Ministry does not possess a unified database including all personal information of the Iraqi citizens that can utilize our application. For that reason we develop a PPINFO Database dedicated for personal information of the patients that can be used until the Iraqi Ministry of Interior introduces a unified database for Iraqi citizens. This database is consisting only one table PPInfo to hold personal information of the patients as shown in Figure 4.2.

Figure 4.2: PPINFO Database's Table PPInfo.

4.3.2 PMISDB Database

The PMISDB Database consists of three tables to hold everything related to the patient pathogenesis information, the system user's information, and information of the laboratories and the results of laboratory analyzes. The tables of the PMISDB Database are shown in Figure 4.3.
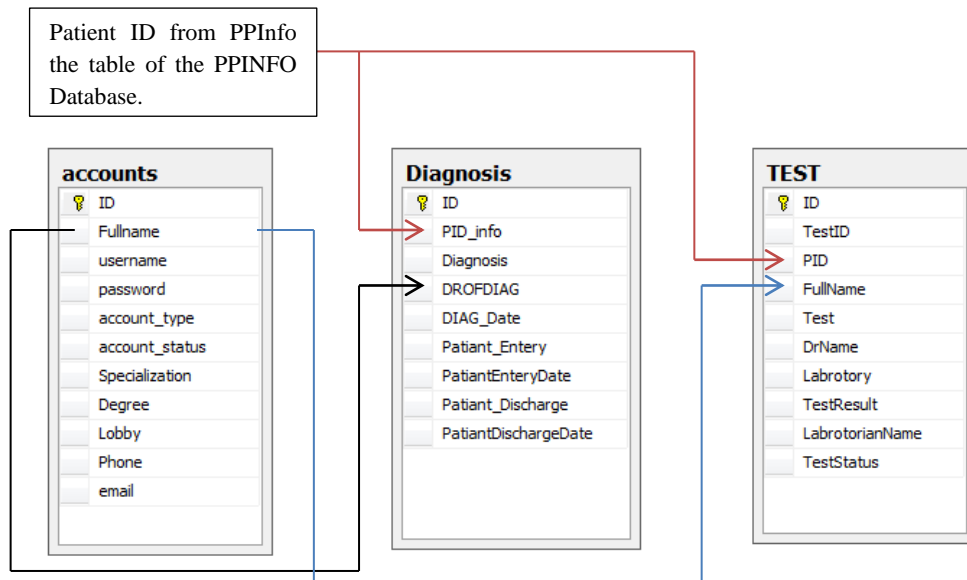
Figure 4.3: PMISDB Database tables.

- The **accounts** table: this table holds information related to the accounts information of the users, full name of the user, user name, password, account type (doctor, data entry, laboratorian and administrators). Depending on account type, the success login is redirected to the special window, as will be explained later in this chapter.

- The **Diagnosis** table: this table holds the diagnosis of the patients that can be entered by a doctor to follow up the health history of the patients, this table hold patient ID number that stored in the PPINFO Database, diagnosis, the doctor of the diagnosis, diagnosis date, and patient entry date to the hospital and the discharge date from the hospital.

- **TEST** table: this table was created to hold all laboratories test information. Each test having an ID number also caring patient ID number, patient's full name, the type of test, the doctor name who recommended the test and the laboratorian who are process the test.

4.4 Technical Overview of PMIS

In this part, we will describe our application design and the flow charts of using the application. As mentioned previously our application is mainly divided into two parts. The first part works inside the hospital by using the hospitals' Internet or Intranet network; mainly the application is the Microsoft Windows® application.

The second part of the application is the web application. It works wider through the internet to serve citizens, doctors and other hospitals from outside the hospital.

4.4.1 PMIS windows application

This part of the application is designed to run under environment of the windows and uses network facility to run smoothly and faster. This application serves mainly the staffs in the Iraqi hospitals through four windows: Accounts managing windows, Patient information entry windows, Health tracking windows and Laboratories managing windows. The controlling of these windows will be through Login window. The application design flow chart is shown in Figure 4.4 below.
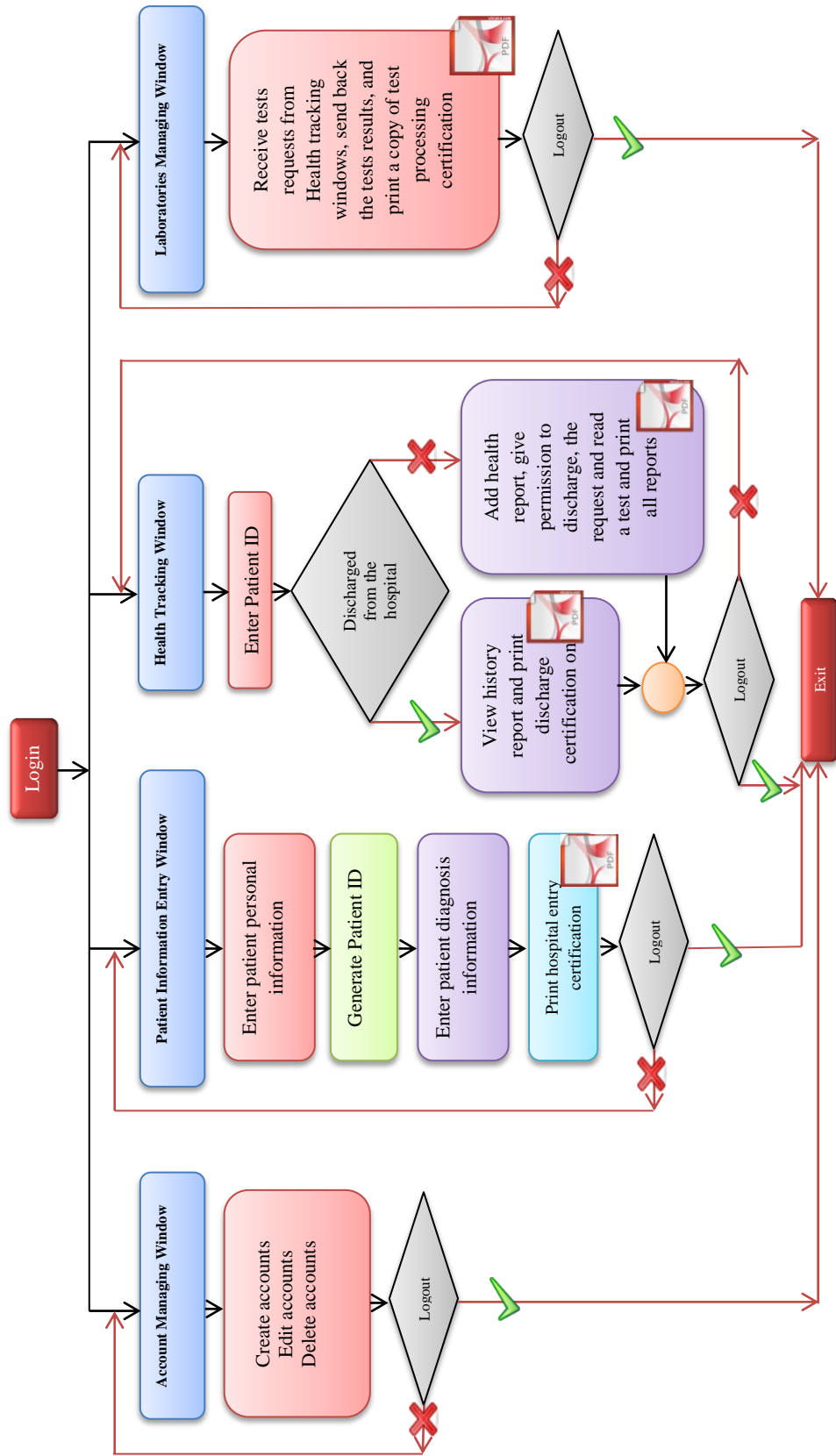
Figure 4.4: PMIS Windows Application Design.

4.4.1.1 Login window for PMIS

The first window in the application represents as a controlling gate for each successful login to the system. This window will redirect the user to the concerned window depending on the account type and account status. For successful login, the account type in our system must be one of four types: Accounts Manager, Patient Information Entry, Doctor, and Laboratorian; and account status must be enabled not disabled. These accounts can be managed from a different window called accounts managing windows. Figure 4.5 shows the use case diagram for login window for PMIS Application and Figure 4.6 shows the login window implementation.
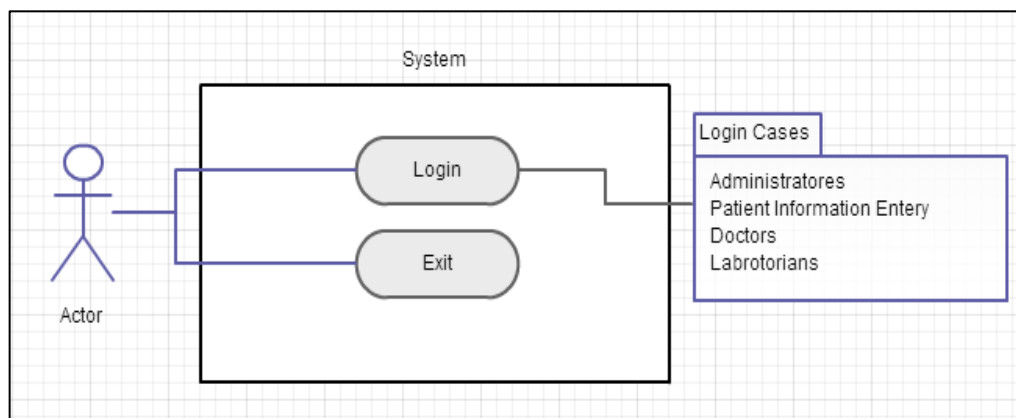
Figure 4.5: Use Case Diagram for Login Windows.
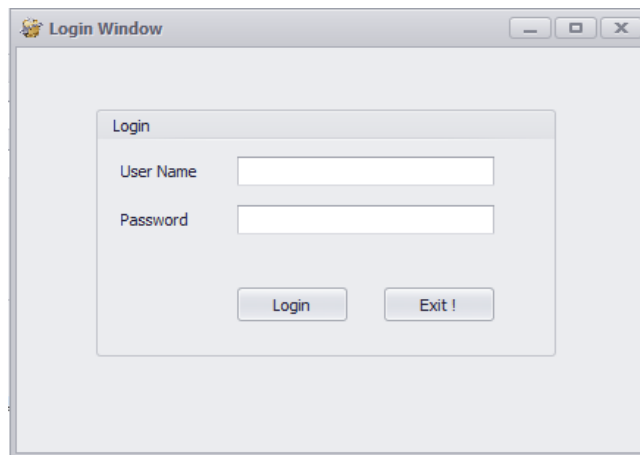
Figure 4.6: Login Window for PMIS Application

4.4.1.2 Accounts managing window

Account managing window is mainly implementing to manage the users accounts to support three main facilities: create accounts, edit accounts and remove accounts from the system. Also this window ensures the distribution of competences among the hospital's staff. Figure 4.7 shows the use case diagram for PMIS administrators and Figure 4.8 shows the implementation of account managing window.

Figure 4.7: Use Case Diagram for PMIS Administrators.

Figure 4.8: Account Managing Window.

The window consists of two parts; the first part is the data entry area is representing by ten textboxes with four buttons to create, delete or update accounts information. The second part is the information view area is representing by DataGrid view control with five buttons to easily navigate through accounts information and bind them with the content of textboxes. Each window in our application consists on a logout button to handle the logout operation for the user to exit from the current window and redirect the user to the main login window again.

4.4.1.3 Patient information entry window

This window is one of important windows in the system because it is dealing with two databases and generating a unique patient identification number (patient ID). This window is quite easy to use; essentially the system separates the personal information the pathogenesis information of the patient and generating the patient ID after entering the personal information to the system. Figure 4.9 shows the use case diagram for patient information entry.
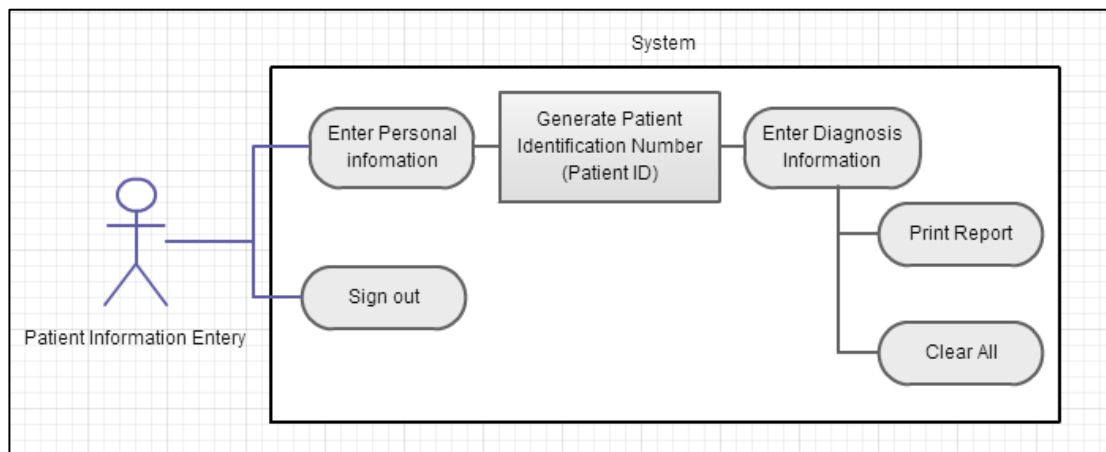
Figure 4.9: Use Case Diagram for Patient Information Enter in PMIS.

At first the window forces the user to enter the personal information of the patient form the group panel that shown in Figure 4.10.

Figure 4.10: Patient Information Entry Window for Personal Information Panel.

After sending the personal information to the database, behind the scenes, the patient ID number is generated to be a nine digits number the current date and time is used in the generation method to prevent the generation of similar patient IDs, the ID appeared in the second group panel on the same window to enter the Pathological information of the patient, as shown in Figure 4.11.

Figure 4.11: Patient Information Entry Window for Pathological Information Panel.

Now, after the user sends the both of personal and diagnosis information to the system the window will appear two buttons, first 'Print Report' button for printing the entry certification to the hospital, the second 'Clear All!' button to start over the operation for a new patient, the window shown in Figure 4.12.
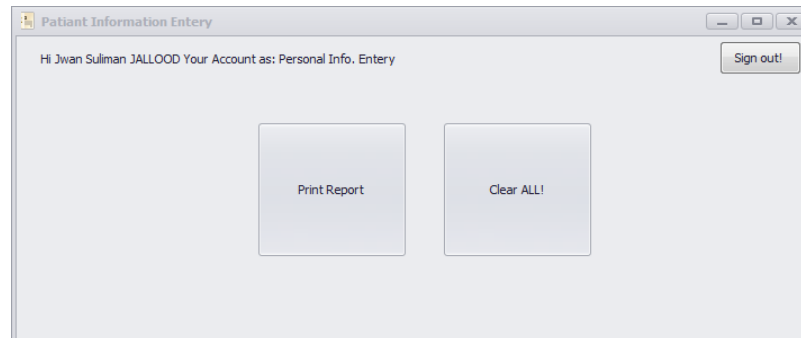
Figure 4.12: Patient Information Entry Window Final Buttons.

The entry certification to the hospital will be handled by DevExpress printing control that enables user from doing multiple important operations such as exporting the report to multiple file formats, e.g. PDF, Image, Text, HTML, XLSX, XLS, and CVS etc. send the certification by e-mail in several formats, search, navigation and print.

Our certification, shown in Figure 4.13, is carrying personal and diagnosis information and the recommendation of the doctor to the patient to stay in a certain lobby in the hospital. One of the most important information in the report is the patient unique number (ID) is converted to a barcode to be easily read in other hospital departments and facilities.

Hospital Entry Certification

Patiant Personal Information

Patiant ID	566488222
Full Name	Hassan Khalid SAEED
Patiant Age	30
Patiant Gender	Male
Maritial State	Maried
Patiant Weight	90
Patiant ID Number	123456
Patiant ID release Date	14/06/2005
Patiants' Address	Iraq - Mosul - Hadba Q.
Phone	07701610440

Patiant Diagnosis Information

Entery Date	25/10/2013
Discharge Date	Null
Diagnosis	Severe Cold
Recomendation	Ear, Nose and Throat Lobby
Doctor Full Name	Jwan Suliman JALLOOD

Signture

Friday, October 25, 2013   Page 1 of 1

Figure 4.13: Hospital Entry Certification.

4.4.1.4 Health tracking window

This window specially implemented to serve the doctors and patients, in the design of this window; we consider making the functions of the hospital electronic automation based on the patient ID number. Figure 4.14 shows the use case diagram for doctors in health tracking window of PMIS.
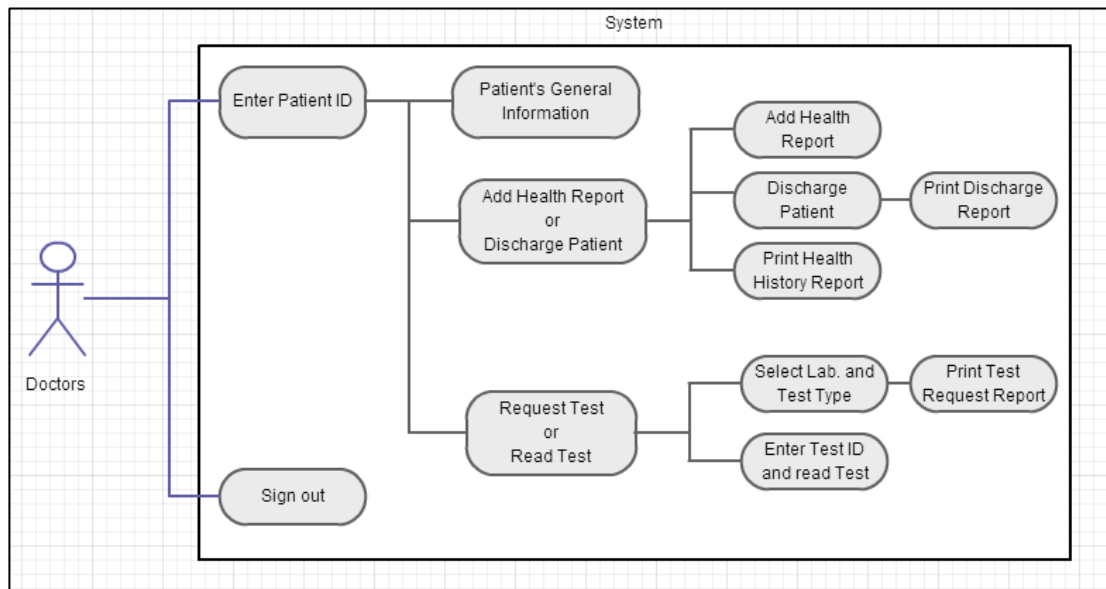
Figure 4.14: Use Case Diagram for Doctors Login in PMIS.

Therefore, this window enables the doctors from tracking the patient health history by using the patient ID number. The window implementation is shown in Figure 4.15 requires the patient ID number to retrieve all information about the patient.
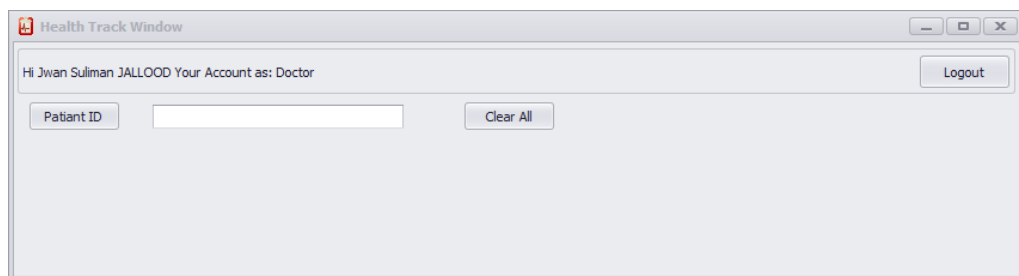
Figure 4.15: Health Tracking Window Request the Patient ID Number.

After entering the patient ID number, the window will retrieve last diagnosis and personal information (from two databases) of the patient that has been added earlier to the system by a doctor. Figure 4.16 shows the first tab 'Patient's General Information' in the health tracking window.

Figure 4.16: Health Tracking Window First Tab.

The second tab of this window 'Add Health Report And Discharge The Patient', is responsible to add a health report to the patient's health history if he or she does not discharge the hospital, there is also a table that refreshed automatically to view the complete health history of the patient with capability to print, send and export the report, all previous functions shown in Figure 4.17 below.

Figure 4.17: Health Tracking Window Second Tab.

The last tab of this window specializes in the request a laboratory testing from a particular laboratory or the receipt of laboratory test results were processed by the competent laboratory. This operation accomplished by generating an electronic request to a certain laboratory, this request having two identification number the first is patient ID number and the second is Test ID number. The third tab is shown Figure 4.18.

Figure 4.18: Health Tracking Window Third Tab.

After the test request sending, a report will be ready to print or export to any file format, the report sample is shown in Figure 4.19 includes two barcodes to be easily read in a laboratories side, the first barcode for patient ID number and the second barcode for test ID number.

Test Request Form

Request Detials

Patian ID: 566488222   **Test ID:**   640501871

Patian Full Name: Hassan Khalid SAEED

Test Type   :   Test3

Labrotory   :   Lab1

Dr. Name   :   Jwan Suliman JALLOOD

Signature   :

Test Processing Confirmation

Labrotorian Name:

Signature   :

Date   :

Monday, October 28, 2013   28 October, 2013 06:49:01 PM

Figure 4.19: Test Request Form Sample.

4.4.1.5 Laboratories managing window

Another window in our system is laboratories managing a window that is responsible from receiving laboratory tests that requested by doctors in hospital lobbies and send the results electronically and confirm processing laboratory testing on the laboratory examination form that is provided from the therapist in the hospital lobby. Figure 4.20 shows the use case diagram for the laboratorian login to the PMIS.
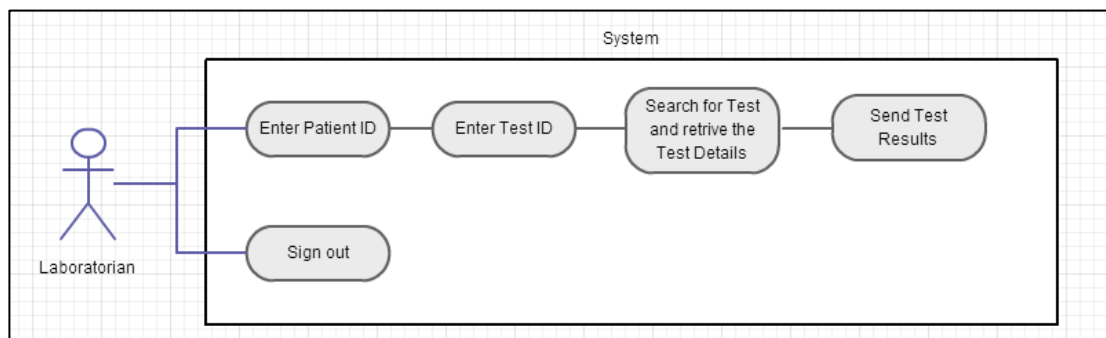

Figure 4.20: Use Case Diagram for Laboratorian Login Case in PMIS.

This operation accomplished by entering both the patient and the test IDs into the system to retrieve the test detail to be a process and send the results from the same window as shown in Figure 4.21, After founding the test detail, the second part of the window will be enabled to send the result of the test.

Figure 4.21: Laboratories Managing Window.

4.4.2 PMIS web application

The second part of the system is represented by a web application; this application provides the portal gate of the e-government application out of the hospitals to serve doctors and other hospitals by provide them with the right health history of the patient. Our web application is implemented by using Microsoft Visual Studio® ASP.NET, Web Tools and Csharp (C#) as behind code. The web application mainly depends on the login window to identify the users because our system policy is enabling the doctors to retrieve personal and pathological information of the patients from the system. Figure 4.22 shows the main page of the web application.
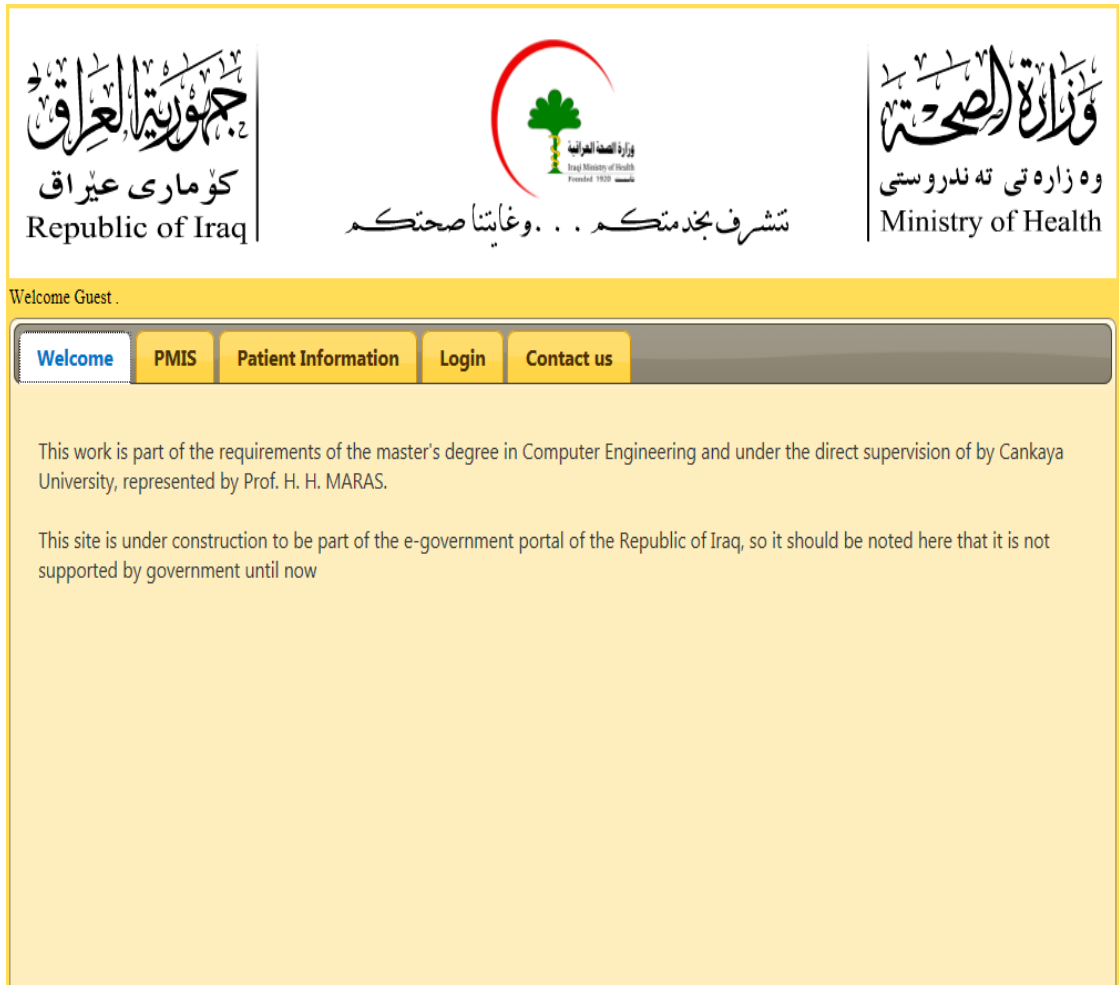
Figure 4.22: Main Page of PMIS Web Application.

4.4.2.1 Login tab of web application

The login tab design is to control access to the system. One of the important issues in our system is to make sure the privacy of the patient information. Therefore, we recommend that only the doctors can access to the patient information. The accounts can be created for the doctors by means of the first part of the e-government application windows that managed by hospitals. In this way, this account created and configured by the official governmental entity. The login window will check the account type then it will guarantee access to the system if the account type is doctor, Figure 4.23 shows the login tab in the web application. After success login, the login tab will be disabled and patient information will be enabled, to make the doctors enable to enter the patient ID to retrieve all patient information.

Figure 4.23: the Login Tab of the Web Application.

4.4.2.2 Patient information tab of web application

The patient information tab is implemented to view the patient personal, diagnosis and tests information after entering the patient ID by the doctors. The patient information tab by default is disabled, after success login of the doctors; the patient information tab will be enabled to receive the patient ID to view his information. Figure 4.24 shows the patient information tab after success login to the system, and after entering the patient ID the web application will retrieve all patient information.

Figure 4.24: Patient Information Tab after Success Login.

CHAPTER V

CONCLUSIONS AND FUTURE WORK

5.1 Conclusions

The system is implemented to conform to the work contexts of the Iraqi government health sector. The system implemented to be one of the Iraqi e-government applications (one of the components of the Iraqi e-government portal) targeting both citizens and the government itself, as noted in the second chapter, the relations of e-government has several forms, according to the design and services provided by the PMIS system, it serves the citizens administers their information sick and personal inside and outside hospitals Iraqi and provides electronic services for the government itself, represented by government staff (e.g. administrators, doctors, laboratories, etc.) in these hospitals.

The implementation and adoption of the system by government agencies, so far, have not entered the stage of reality by the Iraqi authorities as they need official approvals by the Minister of Health and Minister of Science and Technology. It is a routine operation in the conditions of the deteriorating of the security situation. The system is implemented to achieve the goals for both the e-government application and electronic health care assistance. The PMIS application is expected to achieve a large number of desired goals because it is designed to meet the needs of stakeholders. The important part of the success of the health e-government application is being designed to satisfy the private interests in the health sector of the government. Only in this way we can apply the PMIS that will be sustainable for Iraqi hospitals, health workers (i.e. doctors, laboratorians, administrators, nurses and patients). The system has significantly reduced the amount of time that must be spent searching for specific records data.

Our design is easy to use the application interface. This interface is clear and precise, easy to use, easy to transfer among the pages of the system. The system language is English. The system uses the barcode, and this means that there are a very small number of inputs that must be done by typing. All of these factors reduce the barriers that prevent the use of the system.

The overall expected benefits from using Patient Managing Information System in the health sector of Iraqi government are:

- Reducing operational costs such as paper copies and additional work costs.
- Electronic medical records customizable and scalable that can grow with the doctor practice.
- The ability to transfer patient data quickly from one department to another within the hospital or outside the hospital is an enormous asset.
- To save space to take advantage of the nature of digital records environment.
- Improving the management of results and patient care with a reduction in errors in the practice of the medical profession.
- Increase the accuracy of the analysis and follow-up of the condition of the patient through the participation the pathogenesis of patient information by a group of doctors and at the same time.
- Collection of the patient's disease history and permanently stored in the hospital's servers to know the medical history of the patient and reduce the burden on the patient himself to save this information, which are often prone to loss.
- Improve the diagnosis and therapy.
- Much less errors found in Profile health records.
- Faster decision-making and responses from medical professionals of the hospital staff.

We recommend to get a support from the government, because it is one of the most important success factors for e-government health applications, the high levels of support from the government sector, and this support is necessary because of the lack of material resources of the government institution that helps to ensure that the implementation and continuation of such applications.

5.2 Future Work

The current system is designed to help the cadres of the Iraqi hospitals to serve the patients. The outlook for the application is that there are a number of additions that could be added to improve the application and electronic government services provided to citizens and the government at the same time. Among other suggestions to work on the application in the future are:

- Deploying the system after the official approval from Iraqi health authority represented in General Directorate of Health in Mosul.
- Initiating a pilot study for a specific area, a region that the system is targeting for our study will be Mosul Province.
- Constructing a questionnaire in the study area among beneficiaries of the system, e.g. doctors, patients and hospital workers, etc., and collecting the feedbacks to demonstrate the effectiveness of the system
- Connecting a unified database system for the citizens of Iraq, this is supposed to be implemented by the Iraqi Ministry of Interior.
- Adding a module for health and treatment centers for early breast cancer and advisory clinics in order to facilitate the work of medical staff in these centers and therefore easy follow-up of each patient electronically.
- Adding a new module in order to follow-up children's vaccinations by automatically sending a text message to parents' phones reminding the necessity of vaccination for a child in the specified date.
- Designing another module for the private pharmacies inside Iraqi hospitals in order to prepare medicine recipes electronically.

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