



DESIGN AND IMPLEMENTATION OF AN INTEGRATED SYSTEM FOR MANAGING ELECTRONIC PATIENT RECORD (EPR)

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Abstract: - An Integrated System for Managing Electronic Patient Record (EPR) Presented to Imam Hussein Teaching Hospital in Annasiriyah to Improving Quality and Efficiency of Health Care. Hospital actually uses a manual system for the management and servicing of crucial information. The existing systems require many of paper forms, with data stores diffusion during the hospital management infrastructure. Many times information is imperfect, or does not follow management criterion. Forms are many times lost in passage through departments requiring an extensive auditing process to guarantee that no vital information is lost. Several of file of the same information exist in the hospital and might lead to conflict in data in different of data stores.

This paper proposes An Integrated System for Managing EPR, through provision of confidential records and to ensure, which include the revision date and name of the person and health care provided to him. These include information from several sources, which contain emergency, doctors, pharmacy, laboratory and others. This information, which is necessary for the care of patients, ready for use by those working in the field of health care in this hospital.

The basic idea of a Managing EPR is automation and document all patient information and purpose of the accuracy of the information, and speed transported between the department and another, and shorten the time as much as possible, and get the correct information without mistakes or misrepresentation, Archiving has become more quickly and accurately, and the like this archiving be able to strictly of statistic and investigation medically, so that the patient who enters the hospital even once shall be a healthy number stays with him as is the case in developed countries.

Keywords: Patient Record, Hospital management system, and Electronic health system.

1. Introduction

Hospitals presently use a manual system for the management and servicing of sensitive information. The presently system a lots of papers framework, with data stores expansion during the hospital management foundation [1]. Frequently information is imperfect or does not pursue management standards. Forms are in many cases lost in passage between departments need an extensive auditing process to guarantee that no vital

information is underdog. Numerous copies of the same information occur in the hospital and can made of lead to contradiction in data in different data stores [2].

The EPR is designed for any hospital to replace their existing manual paper based system. The new system is to control the information of patients. Room availability, staff and operating room schedules and patient invoices. These services are to be provided in an efficient, cost effective manner, with the goal of reducing the time and resources currently required for such tasks [3, 4].

An important aim of most developed health systems is the creation, expansion and linkage of EPR. The introduction of EPR technology offers numerous and significant benefits. Storing and transferring patient information electronically has the potential to significantly reduce clinical errors and improve patient safety as well as allowing clinicians to communicate more quickly and accurately and to identify relevant information more easily [5].

2. The Motivation and Aim of EPR

In the concept paper applications and solutions to be elaborate, the making available of the patient's own documents via internal EPR Access portal are by the patient basis. On the one hand it applies to applications describe and, secondly, the possible technical integration and implementation in a Show EPR infrastructure. In this context, should the technical and semantic Interoperability level are also considered as well [6]. There are mechanisms and rules defined which would be examined as certification criteria, such as an explicit Marking of documents that have been provided by the patient [7].

As described in the application scenarios arise data on health and disease at different places and in different ways. In the context of personal health records, many data may apply and indeed are relevant from the patient's point of view, but not in the context of his treatment. This view can of course change depending on the situation at any time [8]. The challenge is that treatment-related data in the present EPR. The patient should have the opportunity to structure within its personal health records accrued data to aggregate and create excerpts or summaries thereof. If necessary, the patient may include a family doctor, so this helps you decide [9]. At the end of the patient decides that this information will be published as a document in its EPR. Only relevant treatment, enriched with EPR metadata documents should be posted on the EPR. Aim of EPR, The following are the minimum benefits that should be realized with a successful implementation in accordance with the work order are:

- **Improved efficiency:** Physician practices should find themselves with more time to focus on patient care as they eliminate paperwork, speed up medical charting, receive lab test results electronically and prescribe electronically [10].
- **More time for more patients:** As physicians and support staff spend less time tracking paperwork, they should be able to see more patients. EPR should also allow physicians to complete and document patient encounters more quickly, further increasing their ability to see more patients [11].
- **Increased collections:** EPR provide physicians with the necessary documentation to support claims sent to insurance companies, Medicare and Medicaid. Integrated features for coding also help providers code visits appropriately and confidently. Of course, seeing more patients should naturally increase collections as well. This is one of the top benefits of electronic health records systems [12].
- **Improved quality of care:** Features such as integrated drug databases, symptom checks and drug interaction verification help physicians prescribe the correct medications and dosages. EPR can also provide prompts to physicians based on inputs of patient chief complaints and/or risky demographic factors. This is another one of the many advantages of electronic health records systems [13].

3. System Analyses of the EPR Study

The EPR is designed for any hospital to replace their having being manual paper based system. The new system is to supervision the information of patients. Room abundance, staff and operating room agenda. These services are to be supply in a functional, cost functional mode, with the purpose of reducing the time and resources presently required for such tasks.

3.1 Feasibility study

For feasibility analysis, some comprehending of the major requirements for the system is necessary. To study the feasibility, there are two types of (economic - technical) will be explained below:

a. Economic Feasibility

Since the EPR system will handle all the failures in the manual system, the new system will work to build a flexible and accurate database of high possibility. that could be expanded in the area of documentation in terms of the possibility of updating the new forms are working to arrange other aspects may not regulations manual processing, and covered fully and accurate. Therefore, the new system will affect the possibilities of including owned professional and technical to provide accurate reports and the vessels through which to make the right decision and the right by the hospital staff, which in turn reflected on the economic side of the hospital [14].

b. Technical Feasibility

Through the creation of this new system (EPR), which will be done using a database building (databases MySQL) when we use database MySQL, we find that it is characterized by the characteristics differ from the systems of other rules of the Banat where the advantage of the possibility of adjustment and development of the system to suit with future developments. EPR also will reduce the staff working on the collection of data and thus provides a greater effort and investment and staff costs in the implementation of business all this will affect positively on the technical side [15].

3.2 EPR Requirement

To be used efficiently, all computer software needs certain hardware components or the other software resources to be present on a computer. These pre-requisites are known as (computer) system requirements and are often used as a guideline as opposed to an absolute rule. Most software defines two sets of system requirements: minimum and recommended. With increasing demand for higher processing power and resources in newer versions of software, system requirements tend to increase over time. Industry analysts suggest that this trend plays a bigger part in driving upgrades to existing computer systems than technological advancements as shown Table (1).

a. Hardware Requirement

The most common set of requirements specified by any operating system or software application is the physical computer resources, also famous as hardware. A hardware requirements list is in many cases accompanied by a Hardware Compatibility List (HCL), particularly in case of operating systems. An HCL lists tested, suitability and sometimes-incompatible hardware devices for a special operating system or application. The following sub-sections discuss the several aspects of hardware requirements.

b. Software Requirement

Work environment and hardware needed in order for a computer program to function properly deal with defining software resource requirements and pre-requisites that require to be set up for use on a computer to supply optimal operating of an application. These necessity or pre-requisites are generally not contained in the software installation package and require to be installed while divided before the software is installed.

Table (1). EPR Requirement

Hardware Requirement	Software Requirement
Processor (Intel dual core)	Operation System (windows 7/xp/8)
RAM (512 MB)	Front end (html ,java script)
Hard Disk (80 GB)	Server side script (php5)
	Database (MySQL)

4. Design of EPR

To implementation (EPR) was to create a database on a server Appserver choose phpMyAdmin Database Manager Version 2.5.7.

4.1 Description of Application's Database

The aim of the online application, a database is created, which stores the necessary information. Therefore, the user has the ability to have a website with content that is updated dynamically every time that the components of the database are modified. In this way is easier to manage and view the contents of the application.

4.2 Create Database

The Database is created and is called "patient" and consists of "six" tables as follow: (login, inform_1, scal_1, lab_1, doctor_1, logout) and the tables are:

- Login table, This Table contains the names and password of only authorized people to enter the system.
- Inform_1 table, This Table contains all personal patient information such as (name, father name, mother name, age, gender... etc.).
- Scal_1 table, This Table contains the tour of the patient.
- Lab_1 table, This Table contains a results of laboratory inspection such as measuring sugar, weight... and all the measurements needed by the physician to diagnose the patient's condition.
- Doctor_1 table, This Table contains information on the supervisor doctor the patient's condition and diagnosis of the disease and give treatment.
- Checkout table, This Table contains determine the final status of the patient.

4.3 Statechart Diagrams

The study deals with procedures and according to this diagram [16] as shown in Figure (1), shows the diagram showing existing system's in hospitals, the general events from when a typical patient enters the hospital until when he/she leaves and depict activities as arrows linking the states. An arrow describe the transition from the one activity to the next.

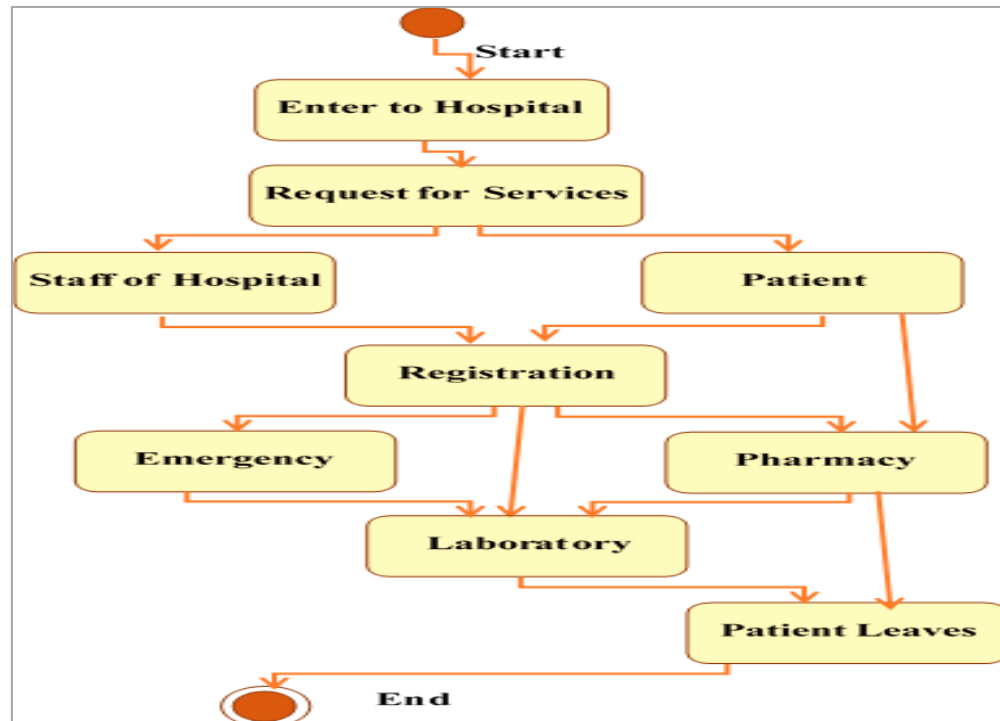


Figure (1). Existing System's In Hospital.

4.4 EPR Use Case Diagram

The use case of Figure (2), represent launching to system starting by select a visit use case, enter to hospital which is first operation .The second use case is create file. The third use case is modify file. The fourth use case view file, the five use case is doctor diagnosis of patient. The six use case prescription, in this use case we will get all the tests of the patient. The seven-use case refer patient and the eight-use case prescribe drugs.

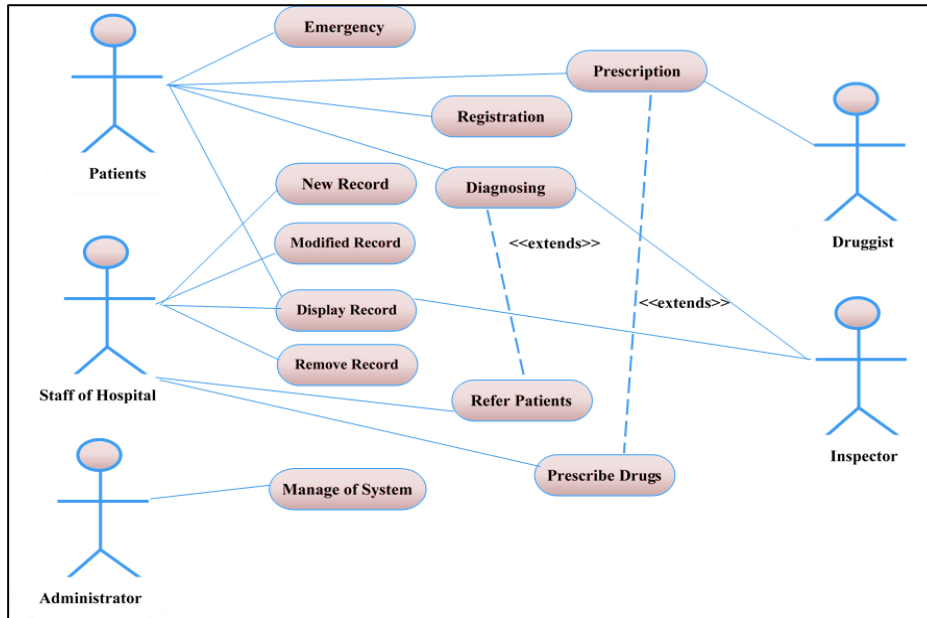


Figure (2). EPR Use Case Diagram.

4.5 EPR Entity Relationship Diagram (ERD)

A data model for describing the data or information aspects of a business domain or its process requirements. In an abstract way that lends itself to ultimately being implemented in a database such as a relational database. The main components of ERD models are entities (things) and the relationships that can exist among them as shown in Figure (3).

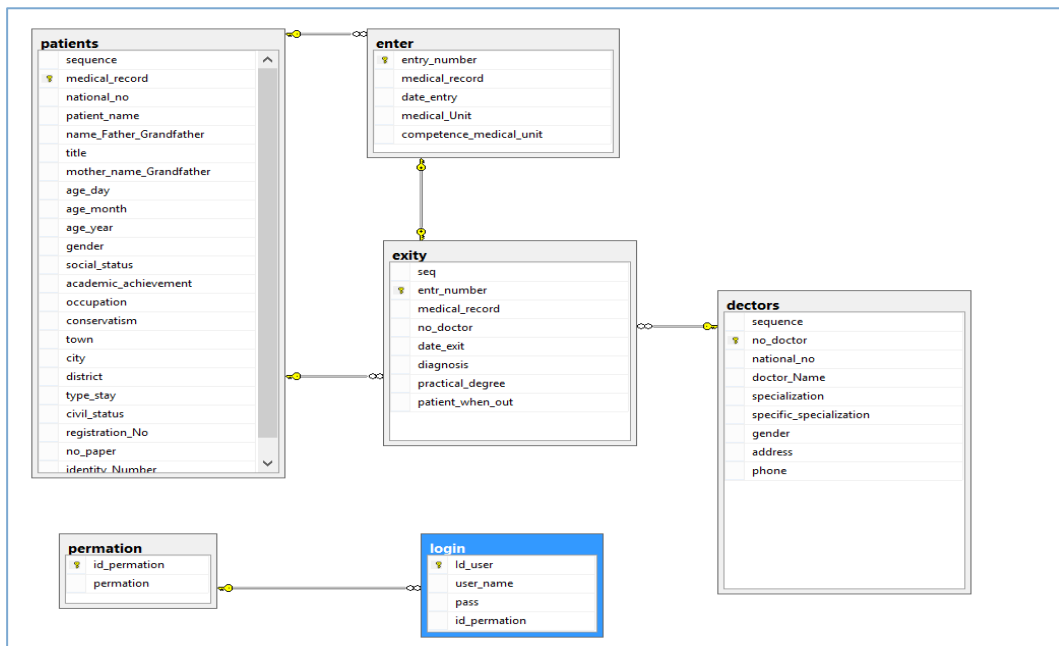


Figure (3). EPR Entity Relationship Diagram (ERD).

5. Implementation and used of EPR System

In this section we will explain all the interfaces that are designed to use the system and its implementation, which contains all the information related to the patient and our operations possible update or delete records or display patient information or search for patient or get the reports needed by the statistics employee. We designed the EPR system by create database and tables that is need to storage the information, and offered how the programs installation and work on it by explaining most of its major interfaces and necessary to work the system and how to deal with him in detail.

5.1 Login Pages to the EPR

To execute to the EPR are only authorized to enter any system administrator and also explaining in Figure (4.a). Through next Figure (4.b) can create a new account in system of the employee who enters the patient information, when click on create new account. The page in Figure (4.c) offers us the possibility to choose Arabic or English language, when choose the Arabic language, it will take us to all the pages in Arabic, when choose either the English language, it will open us all program pages in English and we will explain all program pages in English.



Figure (4). (a) Login Page, (b) Create new account page,
(c) Choose Language Page, and (d) Main Page.

Open the System login page and that contains the user name and password authorized person only a EPR administrator and then click on the enter button the EPR will match the action between the input information and the information stored in the database, if the wrong information will display an error message

will appear. "data entered wrong", if the user does not enter all the information, the EPR will display the " Please fill out all fields ".

After the user has the introduction of the parameters correctly, the EPR will display the "LOGIN", the EPR will move the user to language page to choose language that uses to fill patient information as Figure (4.c).When selecting the language will move on to the Main Page, which contains buttons (Add and Edit New Record for Doctor and Patients, Remaining Patients, Patients Exit, Inpatients, Periodic reports, Control Panel, Log Out) as Figure (4.d).

5.2 Patient Information Pages

Select a button added of appear page medical record number for the patient and the unique that not repeated in the case of entering the patient has already entered the personal information does not need to be entered again, as they exist and reserved and we can make sure that the patient has already entered or not by writing a record number of medical and press the Search button as Figure (5.a). The entering patient information will the user clicks on the save button to the patient in the database record is stored, and after saving process the user clicks on the next page button to move to the front of the daily examination. To get the information that you need to record exit data such as medical record number and entry number, as Figure (5.b).

Recording Patient Data Page

The Medical Record of Patient No. The Age

No. National of The Patient Day Month Year State Department of Civil Status

The Patient's Name Gender City Record Number

Name of Father and Grandfather Social Status Area Page Number

Family Name Degree Study Neighborhood Civil Status Civil Number

Name of Mother and Grandfather Profession Type of Stay

medical record	entry number	patient name	name Father Grandfather	mother name Grandfather	gender	nationality	area	profession	education	occupation
1	1	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
2	2	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
3	3	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
4	4	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
5	5	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed

(a)

Query of Patient

Find Remaining Patients

Medical Record of Patient No. Father and Grandfather Name

The Patient's Name Mother and Grandfather Name

medical record	entry number	patient name	name Father Grandfather	mother name Grandfather	date entry	medical Unit
4	4	ahmed	ahmed	ahmed	09/04/2016	66
5	5	ahmed	ahmed	ahmed	09/04/2016	44
5	7	ahmed	ahmed	ahmed	10/04/2016	

(b)

Display and Query the Remaining Patients

Medical Record of Patient No. The Patient's Name Father and Grandfather Name Mother and Grandfather Name

medical record	entry number	patient name	name Father Grandfather	mother name Grandfather	gender	nationality	area	profession	education	occupation
1	1	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
2	2	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
3	3	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
4	4	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
5	5	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed

(c)

Display and query for inpatient

Medical Record of Patient No. The Patient's Name Father and Grandfather Name Mother and Grandfather Name

medical record	entry number	patient name	name Father Grandfather	mother name Grandfather	gender	nationality	area	profession	education	occupation
1	1	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
2	2	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
3	3	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
4	4	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed
5	5	ahmed	ahmed	ahmed	male	egypt	egypt	university	graduate	unemployed

(d)

Figure (5). (a) Patient Information Page, (b) Tour Page, (c) Laboratory Page, and (d) Doctor Diagnosis Page.

To display this page we are clicking on button (Remaining Patients) from the (Home Page) and this page is intended to view all inpatients records currently This page contains also the fields to search or query for patients through the medical record number or through the patient's name only or through the patient's name with the name father and grandfather or through the patient's name with the father and the grandfather's name and the name of the mother and grandfather. Back button to return to the home page, as shown in Figure (5.c).

To Display this page we are clicking on button (Inpatient) of the (Home Page) and this page is intended to view all entrants patient records who have been entering data recording regardless of whether they had come out or not, and This page contains also the fields to search or query for patients through the medical record number or during the patient's name or only through the patient's name with the name of the Father and

grandfather or through the patient's name with the father and the grandfather's name and the name of the mother and grandfather . Back button to return to the home page, as shown in Figure (5.d).

At the same time the introduction of the patient's diagnosis will save the user clicks on the button to the patient in the database, record is stored after the conservation process the user clicks on the next page button to move to the front of the final state of the patient.

5.3 Remainder Pages of the EPR

To Display this page we are clicking on button (Periodic Reports) from the (Home Page) and this page is intended to display a page reports and contains buttons for several pages to multiple reports, such as doctors reports and diagnostic reports and reports of patients exit and reports inpatients, and reports the number of patients by the names of their doctors, and back button to return to the main page as shown in Figure (6.a).

EPR provides the ability to Display this page by clicking on the button (Doctors Reports) from (Reports Page) and this page is intended to view and print reports doctors, Back button to return to the reports page as shown in Figure. The Figure (6.b) shows that.

EPR supply the ability to Display this page we are clicking on button (Reports Diagnosis) from (Reports Page) and this page is dedicated to display and print pathological reports by the diagnosis of specific patients where the user types the desired diagnosis in the diagnostic field and press the search to display all patients with the disease or by the degree of the operation by the user selects the degree of process required from the list and click on the search to display all the patients who have this degree, such as small, medium or big or above the big, button view all to view all of the patients, the button back to return to the reports page, The Figure (6.c) shows that.

(a) Reports Page

(b) Doctors Reports

Doctor Name	Specialization	Specific Specialization	Gender	Address	Phone
ali mohamed kareem	asd		Male		
noor mohamed ali	qwe		Female		
jafer	asd		Male		

(c) Depending on the Diagnosis of Patients Reporting

date entry	doctor Name	diagnosis	practical degree	patient when out
09/04/2016	noor ali qasim	asd/qjh	Medium	Improvement
09/04/2016	noor ali qasim	qwert	Junior	out

(d) Outpatient Reports

Medical_Record 1	date entry	date exit	doctor Name	diagnosis	practical degree	patient when out
23	09/04/2016	09/04/2016	noor ali qasim	asd/qjh	Medium	Improvement
44	09/04/2016	09/04/2016	noor ali qasim	qwert	Junior	out

(e) Remaining Patients Reports

date entry	medical Visit
09/04/2016	54
09/04/2016	66

(f) Reports the Number of Patients by Doctors

Doctor Name	Patient Name	Name Father Grandfather	Mother Name Grandfather	Gender	
ali mohamed	1	falah	jaxim	huda	Male
	2	noor ali qasim	noor	ahmed	zainab
noor ali qasim	3	ahmed	ali	manar	Male
	4	ahmed	ali	manar	Male
Total					4

Figure (6). (a) Checkout Page, (b) Update Page, (c) Delete Page, (d) Display Page, (e) Print Page, and (f) Statistics Monthly page

To display Outpatient Reports for any patient, EPR system gives you this possibility and with ease at the moment that you enter the patient's name, the system will bring all patient information as Figure (6.d). We can display all of them that inpatients during this period, or by gender, where the user selects the sex desired from the list and click on the search to only see inpatients, according to the gender, such as male or female, view all button to display all the inpatients, Back button to return to the reports page as shown in Figure (6.e).

From this page such as Figure (6.f), view and print reports the number of patients according to the physician which each doctor and the number of patients treated, the back button to return to the reports page.

6. Configuring EPR System on the Local Network

Network software installation transpire together with the installation of the operating system software. During the same time, certain IP configuration parameters have to be stored in proper files so that they can be read at boot time. The parameters that are provide throughout network configuration follow:

1. First reset wireless router.
2. Change IP wireless router from 192.168.0.1 to 192.168.2.1
3. Go to wireless router and computer to put the following IP, as shown in Figure (7.a, b).

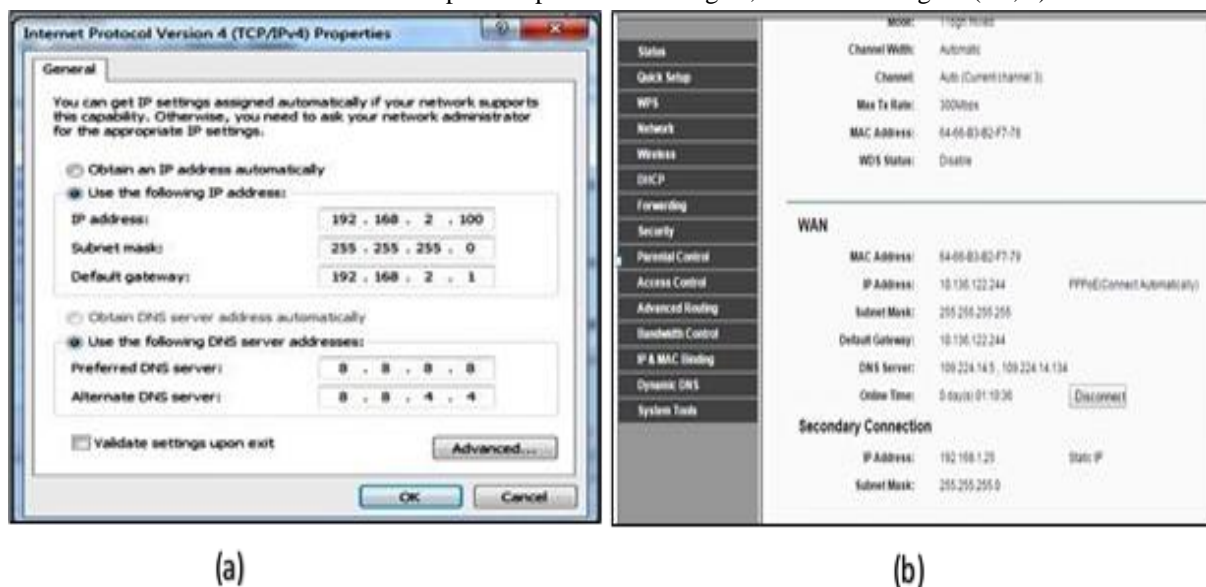


Figure (7). (a) Computer Setting, and (b) Router Setting

4. Computer setting that make IP any static to introduced IP it is will be a Virtual Server.
5. As for the other computers setting connected by router, by write the following address in internet explorer "192.168.2.100\EPR".
6. The previous steps have been the work of a connection between several computers by the router without Internet by installing IP for computer setting containing the database.
7. That no contact was the work of communication between the mobile and router the reason for the lack of a port or Port for it so we open in Port Router with writing your IP Computerized containing base.

7. Implementation of EPR as Application in Android and iOS systems

For easy use of the EPR system and work on it by staff at the hospital whether employee or Directors statistics employee or official laboratory or doctor We have developed a system and turn it as an application of modern Tablet or Smartphone operating under the Android Figure (8.a) and iOS environment as shown in Figure (8.b).



Figure 8. EPR (a) Android Application, and (b) iOS Application

8. Conclusions

When the arrival of any medical condition to the emergency lounge to Imam Hussein Teaching Hospital in Annasiriyah must open record of the patient as a first stage and foremost, and this process is done in the past by hand accompanied by a lot of mistakes and drawbacks. EPR converts manual labor to an electronic work and turn the record of a hand record to the electronic record to eliminate or minimize the negatives in the patient's paper record. Because it offers multiple possibilities of which clear line that does not accept the doubt to all patient information, ease of use of this information in all sections of the hospital, and quickly enormous costs using the internal network linking the hospital system. The sections with each other, the difficulty of loss or loss of any form or information on the fact that the patient's electronic system and provides the ability to print on paper record. In addition. The following deduction can be deduced from the development of the project.

- Provides a without the use of paper environment, which improves the traditional records storage methods, automation of the complete system improves the efficiency, and the system has sufficient scope for adjustment in future if it is necessary.
- Provides a friendly graphical user interface that proves to be improve when compared to the current system. All patients' records that filed and stored in an online database or Virtual Server that speeds up the workflow in the hospital.
- EPR system that assists doctor or other staff on hospital with process of deciding, it deliver proper access to the authorized users depending on their permissions, and modernization of information becomes so easier.

9. Future works

The modest possibilities available to us, we could not be apply to each EPR system capabilities expected so advised to avoids the manual work and the difficulty interest with it. It is a comfortably way to achieve the information respecting the different travel services that are introduce in our EPR System. Principally, Possible to modify and outfitted to another hospital-by-hospital or private clinic requirements, Add accounts possible if a private hospital, Possible run online on global networks, Use iCloud technology to save the system and data in a special server and deal with it online, and Can use distribute database.

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