

AN INTERACTIVE MESSAGING SYSTEM FOR PATIENTS' COLLABORATION
WITH HEALTH WORKERS

CASE STUDY: MULAGO HOSPITAL.

BY

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DECLARATION

I BIRARIO BRIAN MOGERE and IAN OMONDI MIGITHA do hereby declare to the best of our knowledge that this graduation project is our original work and that it has never been submitted to any university or any other institution.

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APPROVAL

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DEDICATION

I BIRARIO BRIAN MOGERE, dedicate this research project to my dad, **MR. Moses B. Okerosi**, my mum **MRS. Norah N. Birario** whom through their unending love supported me financially and morally throughout my study in the university. My brothers; **Dickens, Sam**, and **Jackton**, my sisters **Evelyn** and **Dorothy**. You're all a great inspiration to me.

I IAN OMONDI MIGITHA, dedicate this research project to my mum, **Eunice Migitha**, my sisters **Deborah** and **Doreen** whom through their unending love supported me financially and morally throughout my study in the university. You're all a great inspiration to me.

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ABBREVIATIONS

SMS – Short Message Service

GSM - Global System for Mobile Communications

MAP - Mobile Application Part

IS - Information System

DDA- Data Definition Language

MB – Mega byte

GB – Giga byte

GHz – Giga Hertz

RAM – Random Access Memory

CPU – Central Processing unit.

PDAs- Personal digital Assistants.

WAP-Wireless Application Protocol

URL- uniform resource locator.

Abstract

Health issues in developing countries are becoming more serious day by day, as different diseases attack and infect people making the public health sector overwhelmed. This has made it difficult for health workers to accurately study the trend of different diseases in many cases, thus failing to analyze the way patients behave after being diagnosed. At the same time there is an increased use of mobile information technology gadgets, which can be used as a way to minimize on the gap between health centers and patients. Monitoring and evaluation also becomes a problem as most of the health centers in Uganda lack personnel that can analyze the collected data to effectively give reports that reflect what is on the ground. In this system we propose the use of mobile messaging technologies to enhance health monitoring and patient data analysis.

The use of SMS software to inform health workers in the field about symptoms can potentially improve patient follow-up care and cut fuel costs and travel times.

This system captures and stores patient's information about their symptoms. Upon implementation, a patient sends this information via a given number and waits for a reply from the doctor who interfaces with the system in order to view the patient's records and give necessary recommendations

We find that this mobile information technology will facilitate the health workers with information which they can use to effectively monitor and evaluate health performance of different patients in a short time.

CHAPTER ONE

INTRODUCTION

1.0 Background

Mulago Hospital is a National Referral and Teaching Hospital with a bed capacity of 1500 beds. It provides specialist services in Surgery, Internal Medicine, Pediatrics, Obstetrics and Gynecology, Oncology, Radiology with computerized Tomography (CT scan), Intensive Care , Renal Dialysis, Dentistry and Oral Surgery, Orthopedics including limb fitting, Ear, Nose and Throat (ENT), Dermatology, Genital/Urinary (urology) medicine, Neurosurgery, Cardiology and Cardiothoracic surgery and Accident and Emergency among others. Founded in 1913, Mulago Hospital suffered a phase of decline posed by the Socio-Economic effects that resulted from the national political upheavals of the 1970s and 1980s. Since mid 1980s, Mulago has undergone a series of rehabilitation works, development of the Human Resource, procurement of equipment in the numerous service centers including the remodeling of Theatre Suite, installation of ICT, furniture and other medical systems aimed at improving service delivery. A Tele-Medicine Centre at Lower Mulago was recently installed through Pan- African collaboration between the Indian Government and Government of Uganda. This facility has enhanced consultation support between Mulago Hospital specialists and their counterparts in India's high level health care Institutions. This eases the quality of patient care and enhances training of Health workers. Mulago Hospital offers state-of-art Private Patients as well as General low-cost and free Services including emergency, outpatient and inpatient services.

In today's competitive business climate, customers are demanding and expecting faster delivery of services. This demand dictates that organizations must put in place programs and resources that increase speed and efficiency of executing their programs and services to help them to react faster to changing conditions. Mulago hospital is not an exception; it has a responsibility to offer speedy services to its patients.

The initiative to introduce the use interactive messaging system was based on the fact that most patients wish to access health services such as doctoral appointments and consultations, but are faced by challenges like; the time needed to make for appointments and consultations and having to travel for long distances to reach the facility.

With regard to the widespread usage of mobile telephony today, the researchers chose to use the technology since they anticipate it will reach a large population.

An interactive messaging system for patients' collaboration with health workers is a system that uses mobile phone technology that enables communication between patients and health workers. This system services both new and continuing patients. Continuing patients communicate with the health workers on their progress, while new patients send their preliminary symptoms to the health workers via SMS. All this information is stored in a database residing at the health facility, which serves as a reference point for the health workers as they respond to the messages received. Therefore by the use of mobile phones, patients will be able to effectively collaborate with the health workers without necessarily having to visit the health facility.

1.1 Problem Statement

Due to the fact that there are limited health facilities in Uganda, the few that are available like Mulago hospital are faced with congestion; therefore patients do not receive the required services effectively.

Therefore this system would effectively reduce the amount of time spent by the patients to access services offered by the hospital especially when seeking doctoral appointments.

1.2 Objectives of the Project

1.2.1 Main objective

To develop an interactive messaging system that will enable remote collaboration of patients' with health workers.

1.2.2 Specific objectives

1. To investigate the existing system(s) with the aim of identifying requirements for the new system.

2. To design a system that will reduce the time and costs spent by patients to access useful services from the hospital and also enable remote access to medical services.
3. To implement and test the interactive messaging system for patients' collaboration with health workers.
4. To evaluate an interactive messaging system for patients' collaboration with health workers.

1.3 Research questions

1. Will an investigation of the current system facilitate identification of requirements for the new system?
2. Will an interactive messaging system for patients' collaboration with health workers reduce the time and costs spent by patients to access useful services from the hospital and also enable remote access to medical services?
3. Will the system enable collaboration of patients' with health workers when implemented and tested?
4. How can we evaluate the system?

1.4 Significance of the Study

1. Due to the ease and wide use of short messaging services, the proposed system was highly anticipated to be of very great help to Mulago hospital which serves patients from various parts of the country. As a result of establishment of the system, collaboration of patients with health workers would be made easy and faster regardless of the physical distance from the hospital.
2. This is regarded as cost effective and time saving, bearing in mind that one did not have to travel to the hospital and at the same time the system was anticipated to reduce the congestion at the hospital.
3. The system would be used as a reference point for the school of computer studies.

1.5 Scope of the Study

This scope of the study was divided into three aspects namely; time scope, geographical scope and content scope.

1.5.1 Time Scope

The project was to be done within a period of three months as required by the School of Computer Studies. During this period the proposal would be submitted and the system would be ready. The final report would also be ready.

1.5.2 Geographical Scope

The study would be bound to Mulago general hospital and implemented at the ICT department.

1.5.3 Content Scope

The research would be restricted to the creation of an interactive messaging system which would ensure fast and efficient collaboration between patients and health workers.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter is aimed at reviewing the related literature on the question under study. The problem under study is to develop an interactive messaging system that will enable collaboration of patients with health workers.

2.1 System

It's a group of interrelated components working together towards a common goal by accepting inputs and producing outputs in an organized information process.

2.1.1 System characteristics

1. The system will have a structure, defined by components and their composition.
2. The system will have a behavior, which will involve inputs, processing and outputs of information or data.
3. The system will have interconnectivity; the various parts of a system will have functional as well as structural relationships between each other.

2.2 Short Message Service

Short Messaging Service (SMS) was first developed in 1991 for GSM digital mobile phones, almost by accident (*Baron, Patterson, and Harris, 2006*).

SMS was the triumph of the consumer - every generation needs a technology that it can adopt as its own to communicate with - and the text generation took up SMS.

The fact that the entry barriers to learning the service were so high were an advantage because it meant that parents and teachers and other adult authority figures were unlikely, unable and unwilling to use the service.

SMS is one of the few services in consumer history that has grown very fast without corresponding decreases in pricing.

Although SMS suffers a limitation from the 160 character text-only format, innovations such as the ability to send bar codes improve opportunities for coupons, point-of-sale redemption, and ticket purchases (Trappey III & Woodside, 2005) have opened opportunities for marketing via mobile phone.

2.2.1 Support in other architectures

According to (Rohiza Ahmad, Aliza Sarlan, Khairul Aiman Ab Maulod, Eliza Mazmee Mazlan, and Rozana Kasbon⁴

) of the Department of Computer and Information Sciences, University Teknologi PETRONAS, Bandar Seri Iskandar, 31750 Tronoh, Perak, MALAYSIA), in their system- SMS-based final exam retrieval system on mobile phones;

Application development for mobile phones is not uncommon. For example, users nowadays can easily read news using their mobile phones, conduct banking activities using mobile phones, and even perform daily work process such as patient care using the device. In several e-business applications using mobile technology such as PDAs and mobile phones are discussed. These mobile applications are used for various business activities such as hotel check-ins, insurance quotations request and registering, food ordering, vending machines operations and emergency service and risks assessment.

In healthcare environment several mobile applications have already been developed and used. For example a mobile phone application known as Patient-Centered Assessment and Counseling Mobile Energy Balance (PmEB) is used to allow its users to do self-monitoring of their caloric balance in real time. Basically the user of the application would enter their caloric consumption and physical activity for the day and the application then calculates their caloric balance. Also there's a mobile application that can give verbal motivation and encouragement to obese teenagers to be involved in physical activities. As for the university domain, several projects have been reported to be developed for mobile devices, in particular PDAs, such as student information systems which were developed by Ismail from the University of Kuala Lumpur [9] and, Khamis and Ang from the University of Malaya [10]. Both systems were developed using the Wireless Application Protocol (WAP) platform. Among the functions provided by both systems are course registration and announcement.

Other than WAP based systems, mobile applications have also been developed for the SMS platform. Back in 2002, an SMS based application for public transport service system was developed in Singapore [12]. The system sends messages to alert users of incoming buses based on signal relayed at certain location. Another example of SMS-based application would be the SMS search system developed by Chen, Linn and Subramaniam [13]. The system developed is capable of returning a short answer which abides to SMS capability (140 bytes) to even arbitrary topics. Based on the above works, it can be seen that mobile phones can be implemented to support various areas of daily transactions. However, since the capability of the device is lower than conventional desktop (small screen display, dependent on battery life, a bit costly etc.), the nature and outcome of the transaction need to be fine tuned to the device.

2.3 Perceived Usefulness

Essentially, Technology Acceptance Model is considered as a powerful model in predicting IS usage acceptance (*McKechnie et al. 2006*). According to the model, two distinct beliefs, which are perceptions of usefulness and ease of use of the technological system, are key determinants of technology acceptance behavior (*McKechnie et al. 2006*).

In this study, perception of usefulness is termed as perceived usefulness (*Ramayah et al. 2006*). The variable of perceived usefulness was used in measuring user productivity.

It measured the user belief that using a computer in the workplace would increase productivity, improve job performance, and enhance job effectiveness. As such, perceived usefulness can be defined as the degree to which a person believes that using a particular system would enhance his or her job performance (*Davis et al. 1989*). Prior studies have suggested that there is a positive relationship between perceived usefulness and usage intention. In Malaysia, there are several studies that have investigated the relationship between perceived usefulness and usage intentions (*Amin et al. 2007; Ramayah et al. 2006; Ndubisi et al. 2001*).

In other countries, there are several studies that have investigated the relationship between perceived usefulness and usage intentions (*Cheong et al. 2005; Pikkarainen et al. 2004; Wang et al. 2003*).

Explained in more detail; *in Korea, Cheong and Park (2005)* argued that perceived usefulness has a positive impact on intention to use Mobile-Internet. This indicates that the perceived usefulness of Mobile-Internet plays a critical role in developing the positive attitude toward Mobile-Internet as well as intention to use.

Wang et al. (2003) found that perceived usefulness has a significant positive effect on behavioral intention for IS. Based on these findings, the following hypothesis is proposed:

H₁: Perceived usefulness is significantly related to usage intentions

2.4 Perceived Ease of Use

The second construct of the model is perceived ease of use (*McKeehnie et al. 2006*). Perceived ease of use refers to how clear and understandable interaction with the system is, ease of getting the system to do what is required, mental effort required to interact with the system, and ease of use of the system (*Ndubisi et al. 2003*). Previous studies have documented the importance of perceived ease of use in explaining Information System usage intentions (*Amin et al. 2007; McKeehnie et al. 2006; Ramayah et al. 2006; Guriting et al. 2006*). Further, *Amin et al. (2007)* found that there is a significant relationship between perceived ease of use and mobile banking usage intentions by Malaysians.

On the Internet banking acceptance study, *Guriting and Ndubisi (2006)* and *Ramayah, Jantan, Noor and Ling (2003)* found that perceived ease of use has proven to have significant impact on intention to use Internet banking in the Malaysian banking environment. The significant impact between perceived ease of use and usage intentions is also found in *Kleijnen et al. (2004)* and *Wang et al. (2003)* in Netherlands and Taiwan respectively. These results corroborate with the findings by *Ramayah et al. (2003)*, *Ramayah, Dahlan, Mohamad and Ling (2002)*, *Adams, Nelson and Todd (1992)*, and *Davis et al. (1989)*, to name a few.

Based on these studies, the researchers believe that perceived ease of use is also important in explaining the interactive messaging system usage intentions among patients. In line with this, we propose the following hypotheses:

H₂: Perceived ease of use is significantly related to usage intentions

H₃: Perceived ease of use is significantly related to perceived usefulness

2.5 Perceived Enjoyment

By definition, Davis, Bagozzi and Warshaw (1992) defined “perceived enjoyment” as an activity, where using a computer is perceived to be enjoyable. A number of studies on “perceived enjoyment” (Nysveen et al. 2005; Pikkarainen et al. 2004; Teo et al. 1999; Igbaria et al. 1995; Davis et al. 1992) highlighted the importance of “perceived enjoyment”. Nysveen et al. (2005) and Teo et al. (1999) found that perceived enjoyment significantly affects intentions to use an electronic system. As an example, Nysveen et al. (2005) found that perceived enjoyment correlates positively with intention to use mobile chat, which is a stronger determinant for female users in comparison to the male users.

Teo et al. (1999) noted that perceived enjoyment correlates positively with the frequency of internet usage, and believed that the internet usage offered fun, pleasant and excitement to the users. On the contrary, Pikkarainen et al. (2004) found that perceived enjoyment is merely a statistically significant variable. The argument is that perceived enjoyment does not statistically and significantly affect the use of Internet banking.

Moreover, Igbaria et al. (1995) also found that perceived enjoyment does not significantly affect the acceptance of data processing systems. On this basis, we propose the following hypotheses:

H₄: Perceived enjoyment is significantly related to usage intentions

H₅: Perceived enjoyment is significantly related to perceived ease of use

2.6 Perceived System Quality

A reliable system quality is important within the context of an interactive messaging system. The failure to provide a good system quality such as frequent delay in response, frequent disconnection, lack of access and poor security will contribute to users becoming reluctant to use the particular system (*Delone & Mclean, 1992; Seddon, 1997; Lee, 1999; Lin et al. 2000*). *Lin and Lu (2000)* employed information quality, response time and system accessibility as IS

qualities. They argued that these 3 variables are useful predictors of the perceived ease of use and perceived usefulness.

2.7 Social Norm

In this study, the construct ‘social norm’ is also added in explaining patients’ intention to use the interactive messaging system. Social norm or normative pressure (*Nysveen et al. 2005*) refers to the person’s perception that most people who are important to her or him should or should not perform the behavior in question (*Fishbein et al. 1975*). According to *Nysveen et al. (2005)*, social norm or normative pressure is revealed to influence behavioral intention in numerous studies based on the theory of reasoned action.

Previous studies have documented the importance of the relationship between social norm and usage intentions (*Amin et al. 2007; Nysveen et al. 2005; Kleijnen et al. 2004*). Explained in more detail, *Amin et al. (2007)* found social norm to be an important construct that explains the mobile banking usage among bank customers in East Malaysia. On the mobile chatting context, *Nysveen et al. (2005)* found that social norm is an important construct that contributes to the success of the system. Furthermore, the result demonstrated that users used the IS because the usage reflected their personal value and the influence of others on them.

2.8 Related study

1.)
(*Agent based system for confirming user appointment through callback URL push*).

The research is done by *Jung-Jin Yang (2005)*. The research focuses on building an agent-based system for confirming user appointment through Callback URL. It involves the use of SMS on the mobile phone in order to reduce the failing appointment and the loss from such failures. The research also introduces method to avoid the system from degradation from the excessive accesses per try. The methods are methods in processing large-scale transactions, preventing obstacles, along with the comparison of the two methods.

The similarity of this research to the proposed system is that it deals with the SMS notification for the purposes of reminding an appointment. Therefore, this research can be used as reference in setting up the proposed system.

2.)

According to Wand et al [2006], many health care services are now delivered in outpatient settings where patients receive care then return home. During such, care patients assume significant responsibility for monitoring their own health status, managing recovery and communicating with clinicians from home. Further they say that patients regularly coordinate with multiple providers and interact with the health information system. Instant messaging has proved itself as an effective tool for not only streamlining corporate communication needs but also as a popular social tool; [Karen, et al. 2006]. Families use it to communicate daily activities and it also gives people an interactive platform. SMS has been used for years in Europe and Asia and USA and is beginning to be used in other developing countries [Robert, 2005]. While it is relatively difficult to enter text in a mobile phone than it is on a computer, mobile text messages are being used in learning process. Sharing information and technical [Sheila. et al. 2008] exchange can reduce on the amount of time it takes to launch a solution and reduce the associated costs. Organizations continue to use trial and error when it comes to utilizing mobile technologies in their work. Mobile technology initiatives in this field are still emerging, [Sheila et al. 2008]. Mobile solutions, as with any other ICT project, need to be appropriate to their environment to have impact, and be responsive to local needs and conditions. Many positioning systems use the most common GPS. For example, wireless handset is a sort of cellular phone commonly used to provide communication system with more features, such as voice-activated dialing, a WAP browser, and two-way text messaging [Kim et al. 2006]. Many purpose built and off-the-shelf systems don't work in all scenarios providing quick positioning in emergency situations, [Ali et al. 2009].

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter explains the methodology or step-by-step approaches that were used in developing the project and at the same time satisfying user requirements.

3.1 Area of study.

The investigation was carried out at Mulago national and referral hospital located in Kampala Uganda.

3.2 Population of study.

A sample should be able to give a whole representation of a population in every aspect. Therefore this research targeted some members of the ICT department, the doctors in the hospital, and a few patients.

3.3 Research instrument.

The researchers used two instruments for their research:

- Primary research instruments.
- Secondary research instruments.

3.3.1 Primary research instruments.

The researchers used these instruments to gather information that aided in the development of the proposed system. These instruments are:

1. **Administering written questionnaires:** The researchers gave written questionnaires to the respondents in order to collect the research data. The researchers chose this data collection technique because;
 - 1) It is less expensive since it does not necessarily require hiring of research assistants.
 - 2) It permits anonymity and may result in more honest responses.
 - 3) Eliminates bias due to phrasing questions differently with different respondents.

2. Interviews. The researchers also interviewed respondents (the doctors in the hospital, and a few patients in person in order to collect the research data. This helped the researchers to understand what users expected of the system. The researchers chose this data collection technique because;

- 1) This technique would give first-hand information, because it was done face to face with the correspondents.
- 2) It has a higher response rate than written questionnaires.
- 3) Is suitable for use with both literates and illiterates.
- 4) Permits clarification of questions.

3.3.2 Secondary research instruments.

Secondary data was gathered from readings and reviewing previous projects done by other researchers. Readings were also done on any related and trusted material from the internet and books. The researchers also reviewed the existing or previous projects in order to get better view of the requirements for the project that was being developed. It was important in gaining extra information for developing the project.

CHAPTER FOUR

PRESENTATION OF DESIGN ANALYSIS AND INTERPRETATION OF DATA

4.1 Analysis of data collection

The data was collected through the use of interviews and questionnaires. The targeted population was 50, though the researchers managed to research on 40 respondents.

The researchers used SPSS (Statistical package for social sciences) to analyze these data. The mode of tabulation was the Bar chart.

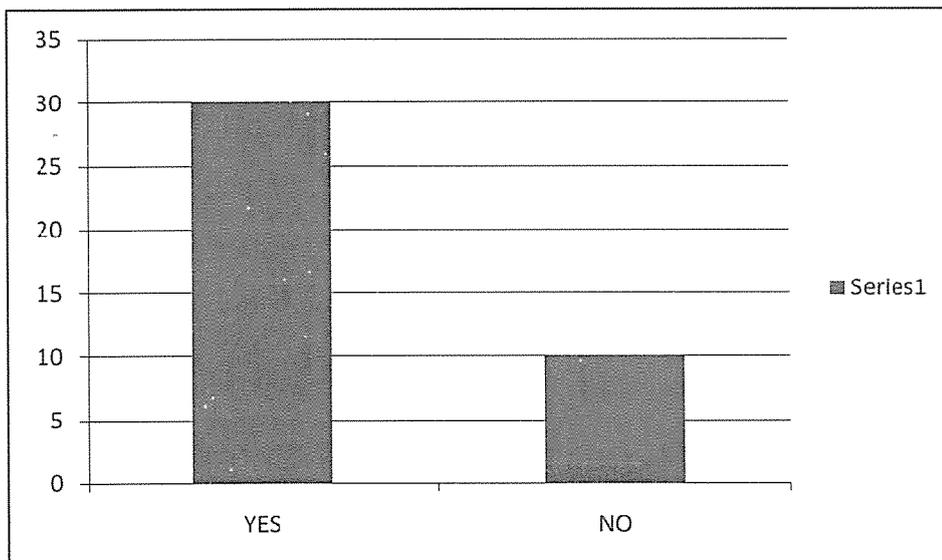
Below is the analysis of the data collected during the field study.

4.1.1 The no of respondents who were comfortable with using only a computer.

The table below shows the no of respondents who were comfortable with using only a computer.

	No of respondents
YES	30
NO	10

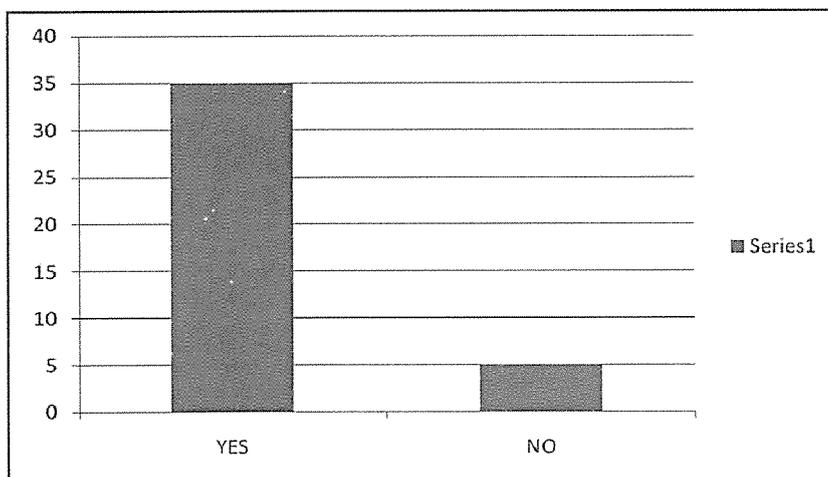
Bar-chart



4.1.2 The no of respondents who had full knowledge of how to use a mobile phone.

	No of respondents
YES	35
NO	5

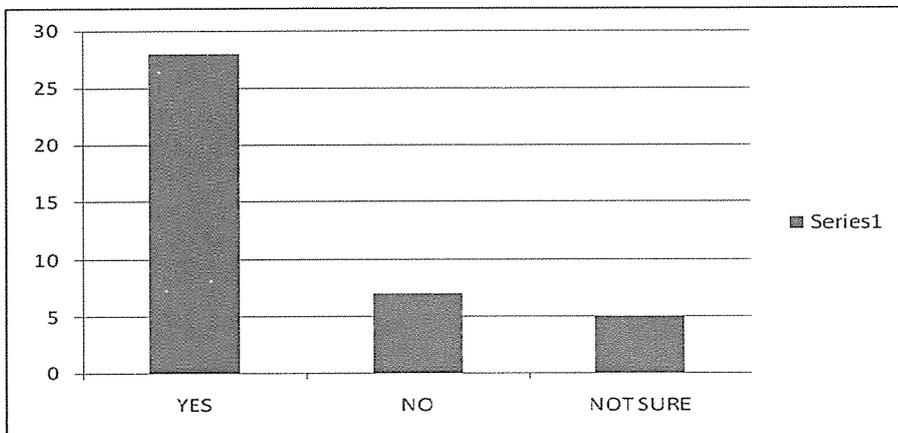
Bar-chart



4.1.3 The no of respondents who thought the system would help improve on the services offered by the hospital to their customers.

	No of respondents
YES	28
NO	7
NOT SURE	5

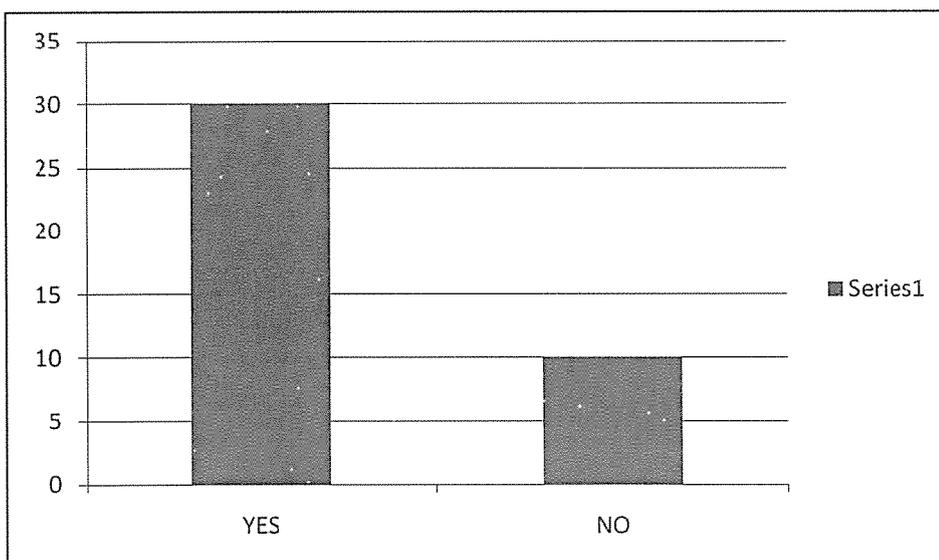
Bar chart



4.1.4 The no of respondents who found it challenging to access hospital services in most public hospitals E.g. Mulago hospital.

	No of respondents
YES	30
NO	10

Bar chart



4.1.5 The respondents who recommended that appointments with health workers to be made available via mobile phone messaging service.

This was an open ended question; therefore the researchers did not tabulate the results though the respondents' views were summarized in the general perception tabulation.

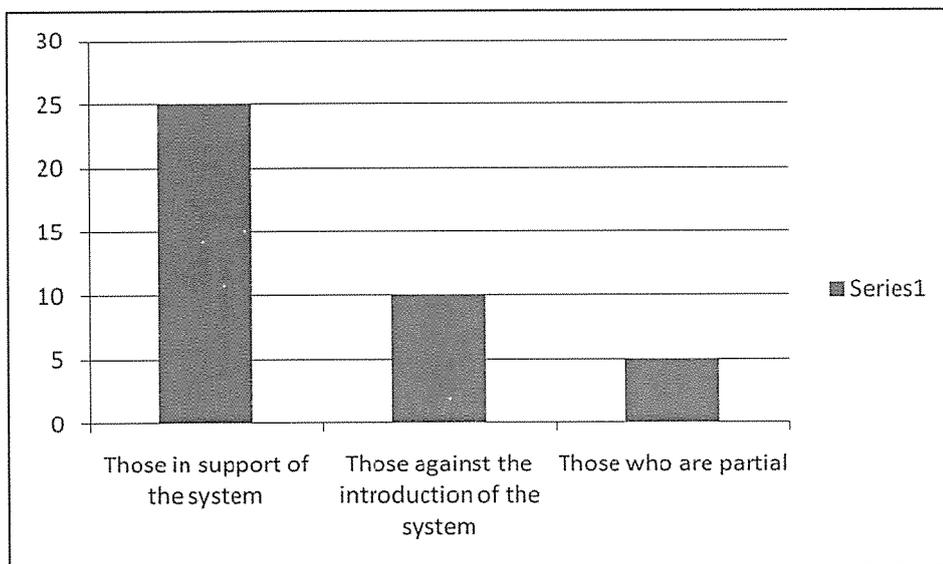
4.1.6 The no of respondents who seconded an interactive messaging system to be introduced to provide easy interaction with health workers.

This was an open ended question as well; therefore the researchers did not tabulate the results though the respondents' views were summarized in the general perception tabulation below.

4.1.7 The general perception of the respondents on the introduction of an interactive messaging system for patient's collaboration with health workers.

	No of respondents
Those in support of the system	25
Those against the introduction of the system	10
Those who were partial	5

Bar chart



4.1.8 The interpretation of the data collected on the introduction of an interactive messaging system for patients' collaboration with health workers.

From the analysis of the data collected from the respondents, the researchers deduced that the general perception of the targeted users is that the system will address major health concerns in

terms of quick delivery of services and would aid in increasing efficiency of the hospital if implemented.

4.2 Analysis of the system

The researchers studied the problem, deficiency or new requirements and specifications for the developed project in more detail. This included the usage of SPSS (Statistical package for the social sciences). Besides, the previous or existing system was studied to gain understanding which stood a good stead for providing improvement according to the situation then or incase a problem arose from the use of the developed project.

Moreover, hardware and software requirements were identified at this stage and the details are listed as follows.

4.2.1 Requirements analysis

The requirements were analyzed in the following categories:

4.2.2 Functional requirements

These are statements of the services that the system would provide, how the system would react to particular inputs and how the system would behave in particular situations.

These would appear when all the system components worked together to achieve a common goal. These include:

- ✓ Sending information via SMS to the health facility server.
- ✓ Retrieval of the information sent by the patients from the database by the concerned persons.
- ✓ Sending of reply to the sender via SMS.

4.2.3 Non functional requirements

Constraints on the services or functions of the system that relate to the behavior of the system in its operational environment. The expected non-functional requirements of the interactive messaging system were:

- ✓ Reliability.
- ✓ Efficiency
- ✓ Security.
- ✓ Economical use of computer resources.

4.2.4 Hardware requirements

The hardware requirements are as follows:

- ✓ Computer (Pentium III of 896 MHz and above)
- ✓ 4 GB of disk space (minimum)
- ✓ 256 MB of RAM (minimum)
- ✓ Mobile phone.
- ✓ Modem (GSM).

- ✓ VGA with 1024 x 768 minimum resolution)

4.2.5 Software Requirements

Besides determining the hardware requirements, the software requirements were also considered.

The software requirements were as follows:

- ✓ Galileo Eclipse.

- ✓ Java Development Kit 7.0.

- ✓ WampServer5.

4.3 System design

System design represents the logical and physical design of the system. It provides information flowchart-illustrations, how data was inputted, processed and outputted. It also shows the display of screenshots of all the interfaces of the design layout and explanation of their contents and functionality.

4.3.1. Physical design

Is the process of producing a description of the system implementation on a secondary storage. The main aim of physical design was to describe how we intended to physically implement the logical design. There was feedback between physical and logical design, since decisions are taken during physical design for improving performance that may affect the structure of the logical data model.

4.3.2 Logical design

This the process of constructing a model of the information used in an enterprise based on a specific data model (e.g. relational). Conceptual data model was refined and mapped on to a logical data model. The logical data model was based on the target data model for the system. The logical model also served an important role during the operational maintenance stage to application lifecycle.

4.3.1 UML Sequence Diagram

A sequence diagram is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart.

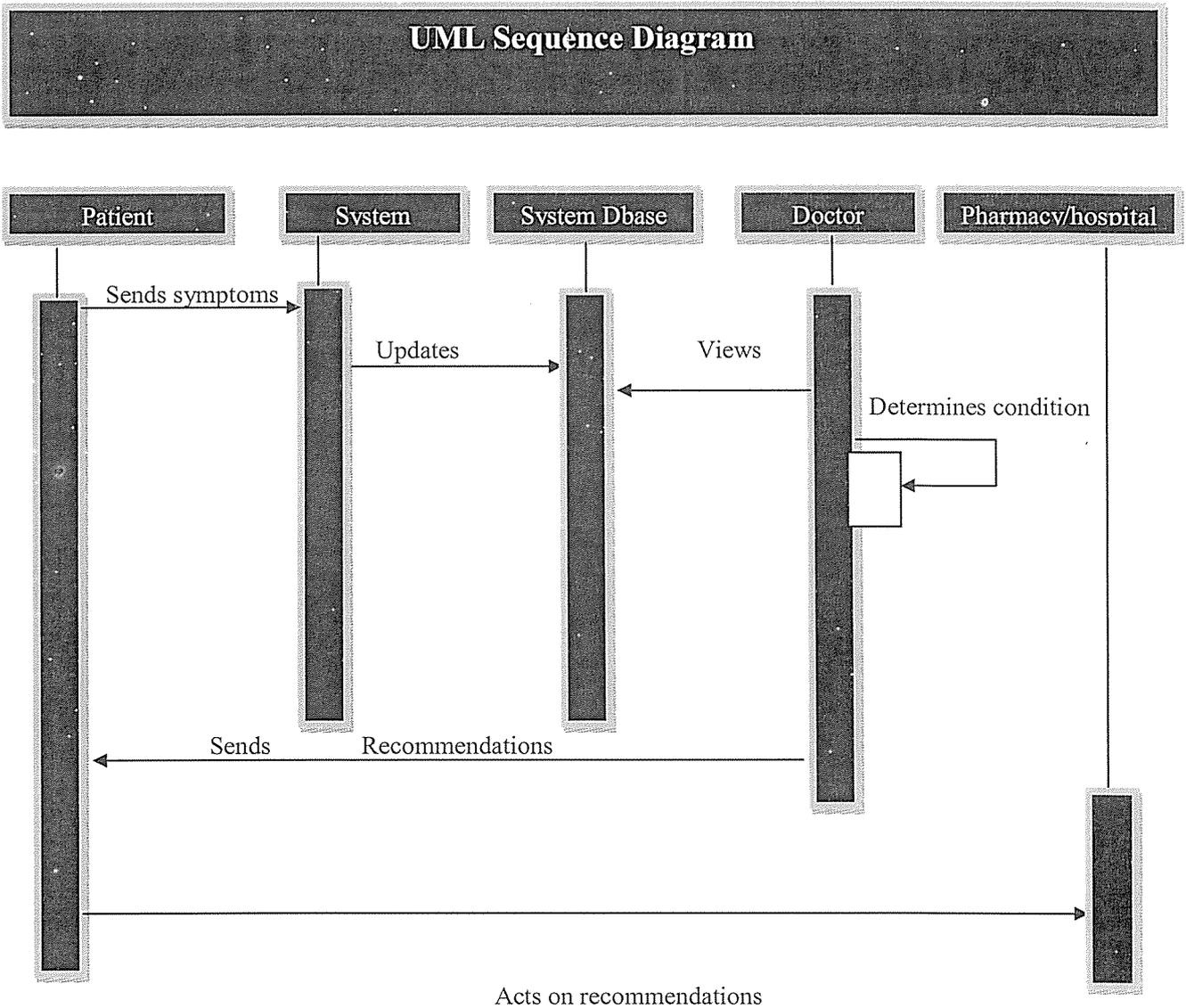
The sequence diagrams showed the various steps taken by both the patient and the doctor and the system database.

It shows the patient's first action i.e. sending symptoms to the System then, the System then updates the database and subsequently sends a notification to the patient that the request has been received and is being processed. When the Doctor refreshes his Database he will be able to see the new cases and act upon them.

The Doctor then determines the condition of the new cases and sends his recommendations to the System which in turn updates the records within the Database and sends out a text detailing the condition and recommendation to the respective patient.

The patient then acts on the information received e.g. either goes for an appointment at the hospital or goes to the pharmacist to get the prescribed drugs or in other cases, visit a pre-natal clinic for further examinations.

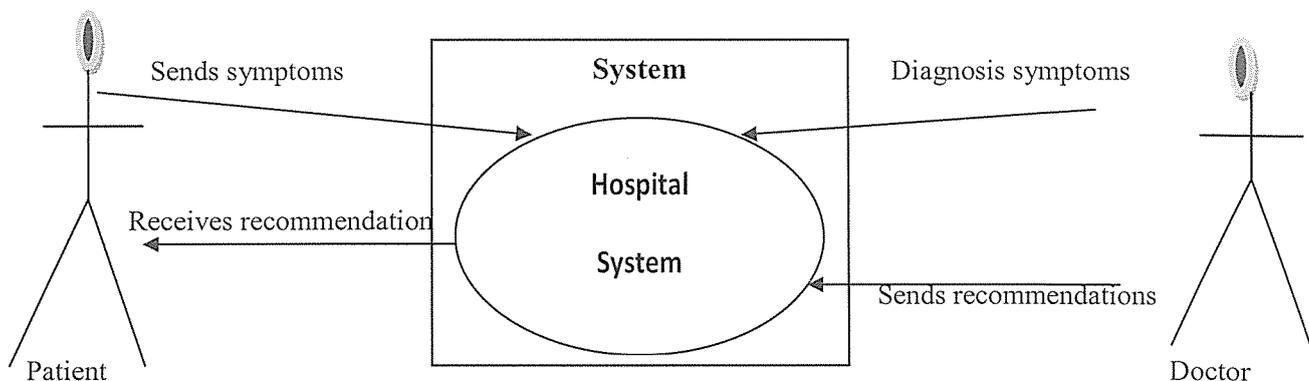
Fig: 4.0 UML Sequence Diagram



4.2.2 UML Use case diagram

A use case diagram is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The Use case diagram is the simplest to do and explain. It simply takes the actor and

relates their activities directly to the system e.g. the patient sends symptoms to the hospital system and the doctor diagnoses the symptoms and sends back the diagnosis to the hospital system which in turn sends back feedback to the awaiting patient.



4.2.3 UML Activity diagrams

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

The UML Activity diagram represents all the actions that take place within the system from the time the patient sends a request to the system to the system updating or posting the request on the database, to when the doctor gets to update his database and sees the new cases.

When the Doctor sees the new cases he has to diagnose them and post his recommendations in the database. The system then sends the patient a text showing his condition and recommendations. The patient will choose how he/she acts on the information received.

Below is a UML Activity diagram:

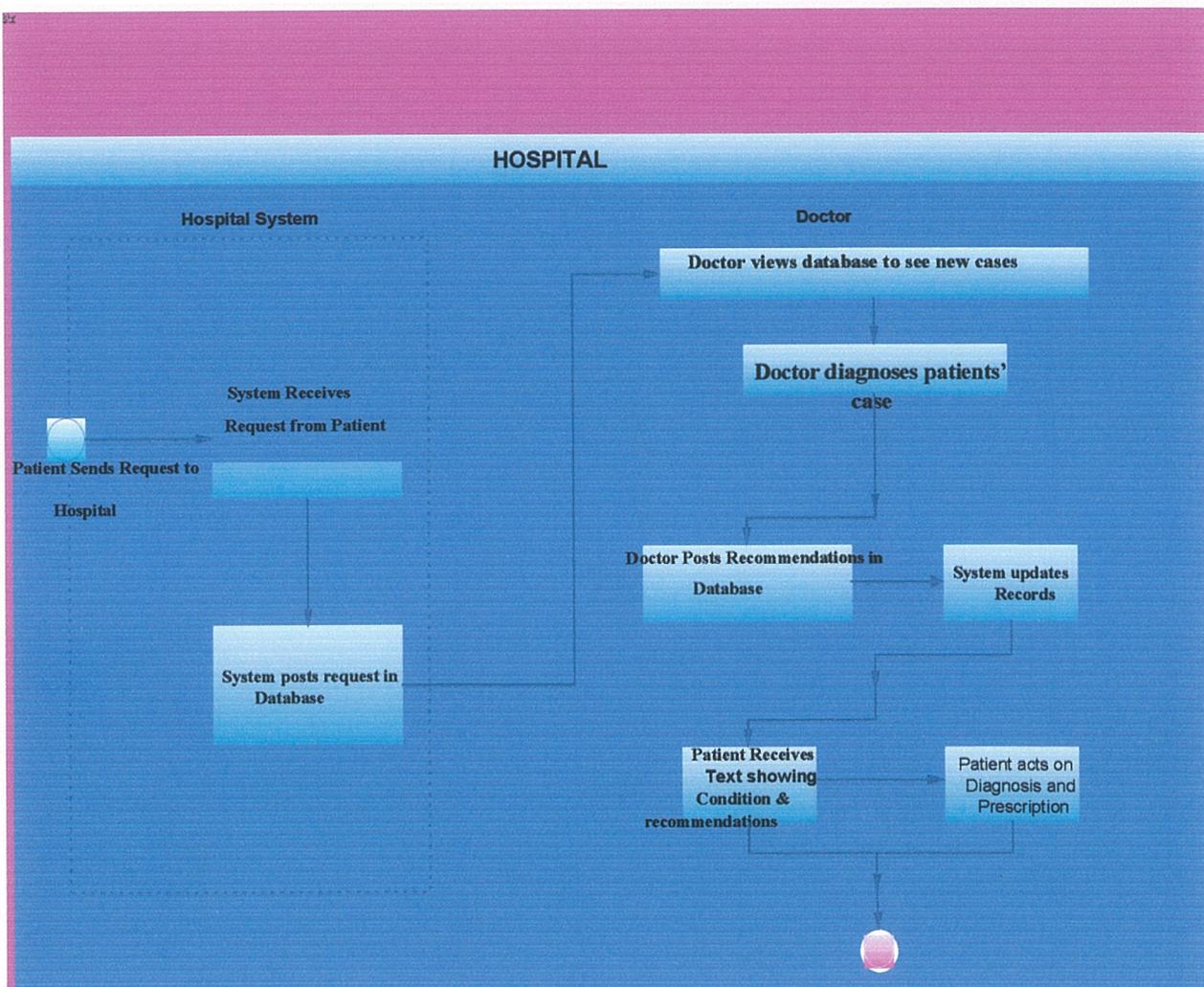


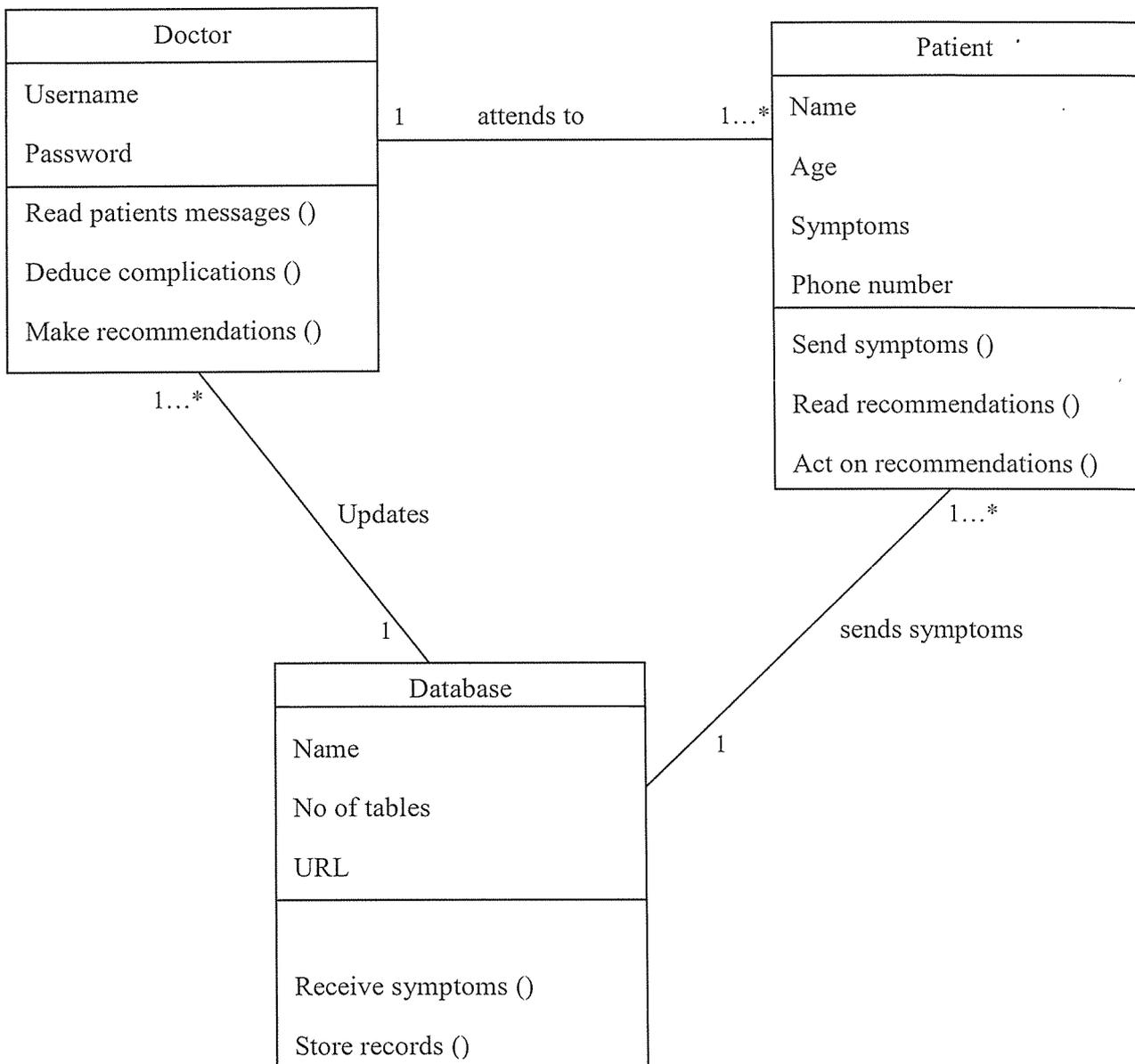
Fig: 4.2 UML Activity diagrams

4.2.4 UML Class Diagram

The class diagrams describe the structure of a system by showing the classes of the system, their attributes, the relationships among the classes and also the operations performed on those classes. In the diagram below, the Patient class interacts with the Doctor and System classes. The Patient class sends request to the System which then sends a notification to the Doctor who acknowledges receipt of the request and sends the diagnosis to the System Database.

The System then sends the condition and recommendations to the Patient.

Fig: 4.3 UML Class Diagram



4.3. The User Interface Design

The screenshots used in the design lay-out show the interfaces developed for handling information.

Below are samples of screenshots:

Figure 4.4 The doctor's Login screen

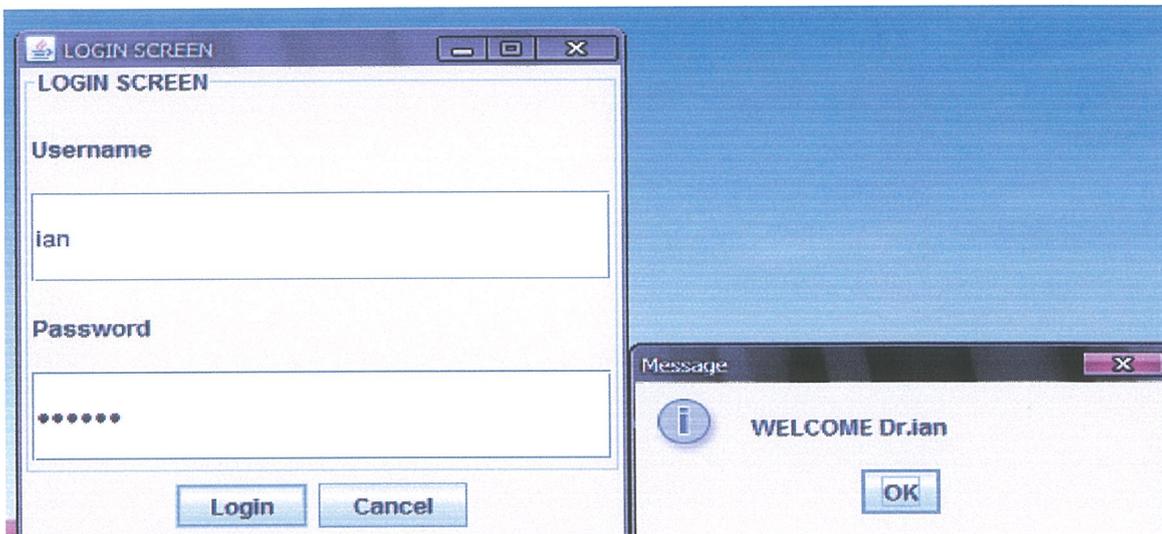


Fig: 4.5 Doctor's form

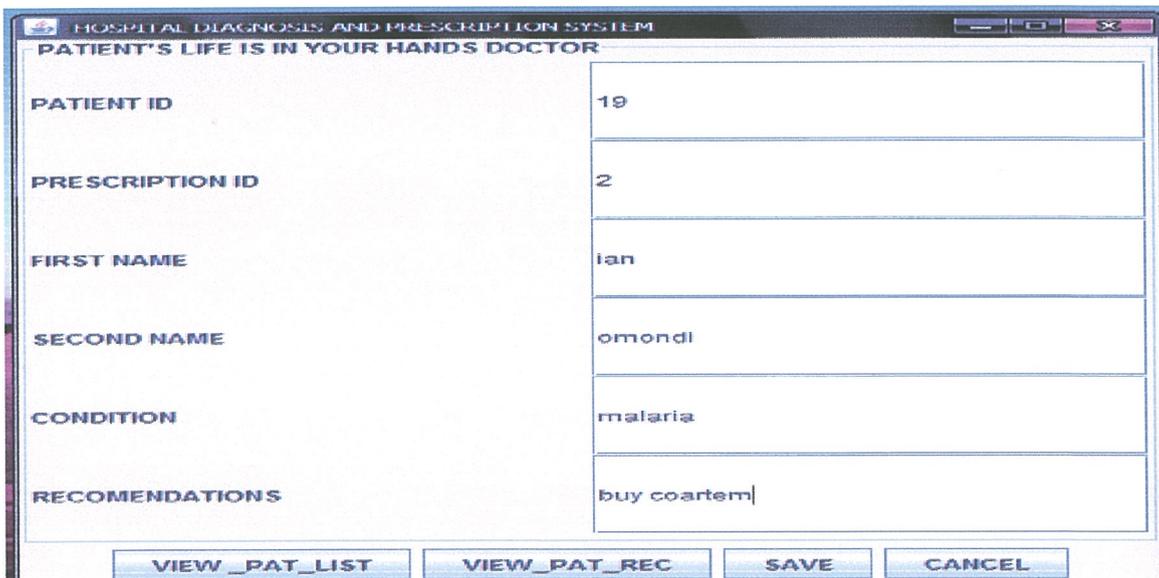


Fig: 4.6 Emulator test screens

The phone interface

The messaging interface

The reply interface



Fig: 4.6 patients' database

The image shows two screenshots of a database application. The top screenshot displays a table titled 'PATIENTS LIST' with the following data:

PatID	name1	name2	age	PhoneNumber	date-time
19	ian	omondi	66	0789698158	2011-06-22 ...
20	brian	birario	55	0781314076	2011-06-22 ...
21	simo	mwangi	44	0788050712	2011-06-22 ...
22	shadrach	lesos	66	0788050712	2011-06-22 ...
23	erick	lagat	67	0788050712	2011-06-22 ...

The bottom screenshot displays a table titled '19_ian_omondi_RECORDS' with the following data:

id	symptom1	symptom2	symptom3	otherinfo	complica...	recomen...	date_time
1	vomiting	fever	headache	asthmatic			2011-06...
2	vomiting	headache	fatigue	feeling ...			2011-06...

4.4 Database Design and Entity Design Summary

This is the process of creating a design for the database that will support the hospital's operations and objectives.

The database for this system is called Hospital 2 and it has got two tables:

Patlist table:

This is the table storing the patients information

Patlist (PatID,age,name1,name2,phoneNumber, date -time)

Login table:

This tables stores the Doctor's login information

Login (userName, passwd)

CHAPTER FIVE

IMPLEMENTATION AND EVALUATION

5.0 Implementation

This chapter deals with literally handing over the process of the system to the users.

We used JAVA programming language for implementation of the codes with our text editor being GALILEO ECLIPSE.

We designed our database application using MYSQL. Some features of MYSQL which were relevant to our system include:

- ❖ MYSQL uses multi-layered server design with independent modules.
- ❖ MYSQL provides transactional and non transactional storage engines.
- ❖ MYSQL is designed to make it relatively easy to add other storage engines. This is useful if you want to provide an SQL interface for an in-house database.
- ❖ MYSQL uses a very fast thread-based memory allocation system.

5.1 System testing

The testing and implementation was done in the university labs to ensure effectiveness of the developed system and to also ensure that the system was ready for use.

5.2 System Evaluation

Evaluation of the system was carried out to establish consistency. Errors found during testing and implementation were rectified and the system was recommended for use under systems monitoring to clients for a short period of time to enable the designers fix any problem that would arise thereafter.

5.3 User training

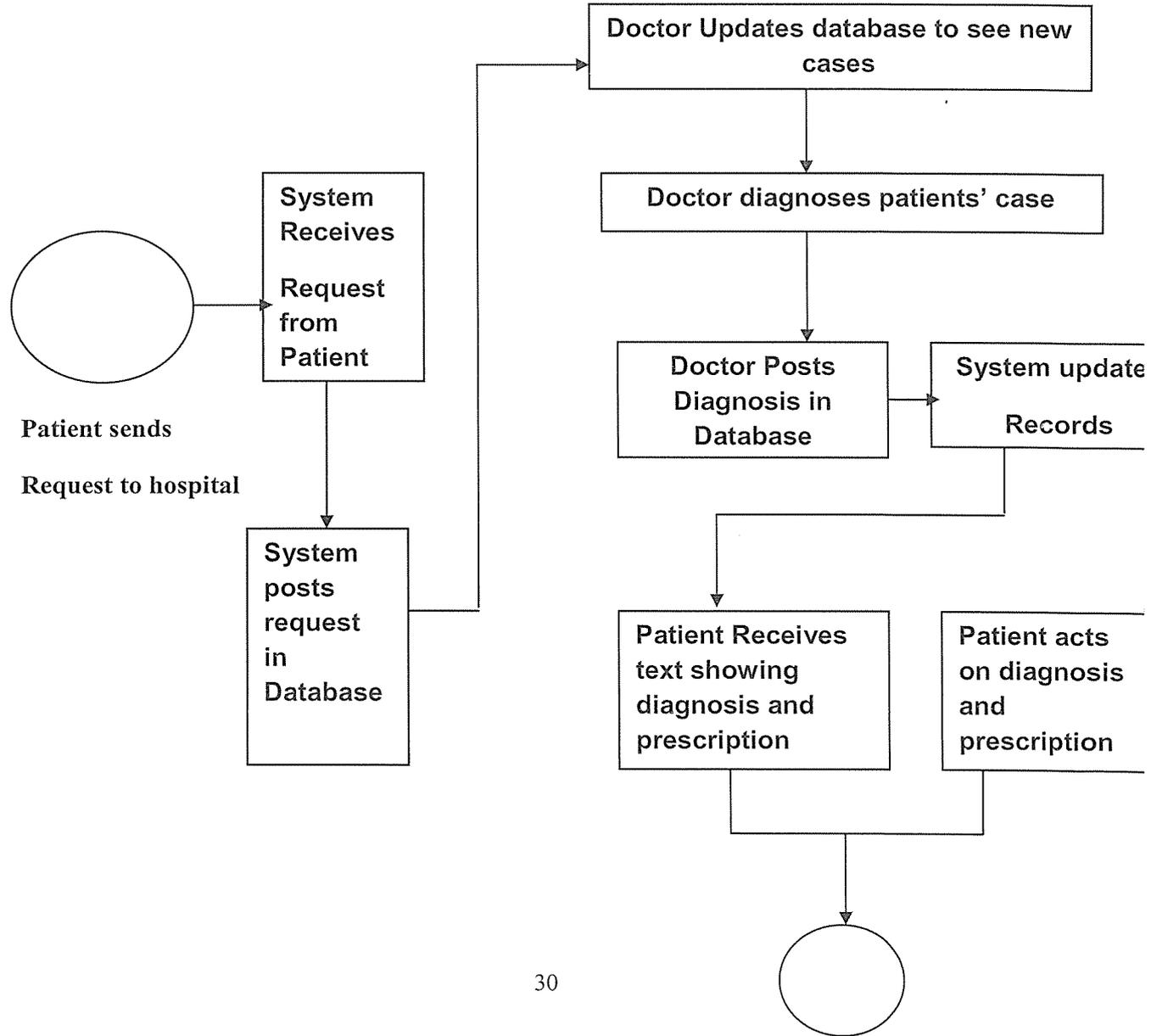
Training would be given to the health workers at the hospital on how to log on to the system, how to view the patient's medical records and how send the recommendations back to the patients.

On the other hand, the sender (patient) was expected to have a basic knowledge on sending and receiving SMS and would only be trained on the format of sending the SMS. A mechanism was also included in the system to counter this problem such that if a patient sends an SMS using a wrong format, the system would automatically issue an error message decoding the right format to be used.

5.4 System security

For purposes of confidentiality of patients' records, the authorized health workers were to log on to the system using a given username and specific password. On the other hand, the backend database was assigned a unique password which would be used to access the database by the database administrator.

5.5 Program flowchart.



CHAPTER SIX

FINDINGS, CONCLUSIONS AND RECCOMENDATIONS

6.0 Findings

This chapter summarizes the findings of the project on existing issues, the extent to which the project will be useful to the hospital and possible future upgrade of the system.

6.1 Problems encountered.

Some of the problems we encountered include:

- ❖ Time limit: problems arose during the creation of the new system which extended the intended duration of the project. Allocating extra time to each phase of the system ensured that the project was finished on time.
Securing a proper time frame to interview the users was so challenging because most of them were busy with their daily endeavors.
- ❖ We lacked proper equipments for use.
- ❖ Financial constraints: It was somehow challenging financially to carry-out our research and to also purchase some equipments because they were expensive

6.2 Recommendations

- ❖ The users should be offered training on the use of the database and its operations to ensure sufficient delivery of services to the users.
- ❖ This system can be modified and expanded to incorporate other features such as a mechanism for interaction between health workers themselves and various hospital departments according to changing user requirements.
- ❖ Since cost of running the system is an issue, especially on the part of the hospital, which has to foot the expenses of replying to messages, a consensus should be reached on who should incur the expenses. For example a proposal could be made to the mobile operators to shift the costs to the clients (patients) for that particular

communication channel or since matters of health is a national concern, the government could subsidize the costs so that the service could be toll free.

6.3 Conclusion

We anticipated that this system would assist greatly in hospital systems. This is because it can be used as a way to minimize on the gap between health centers and patients. And it saves patients time otherwise spent going to the hospital. We also found out that this mobile information technology would facilitate the health workers with information which they could use to effectively monitor and evaluate health performance of different patients within a short time.

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APPENDICES

APPENDIX A: BUDGET

ITEMS	COST IN Ugx.Shs.
Software	100,000
Hardware	1,000,000
Printing and binding	75,000
Flash disk	25,000
Miscellaneous	200,000
TOTAL	1,400,000

APPENDIX B: GANTT CHART

SCHEDULE	DURATION (WEEKS)												
	1	2	3	4	5	6	7	8	9	10	11	12	
System modeling and engineering													
Feasibility study													
System Analysis and Design													
Coding													
Testing, Documentation and Implementation													

APPENDIX C: INTERVIEW GUIDE

This interview guide was prepared by the researchers to help in collection of data that was relevant for the design of the interactive messaging system for patient's collaboration with health workers.

- 1) Do you find it challenging to monitor outgoing patients bearing in mind that you have so many patients to attend to?
- 2) Do you consider congestion a problem in the hospital in terms of patient's appointments and consultations?
- 3) Are you comfortable in using a computer?
- 4) Do have full knowledge of how to use a mobile phone?
- 5) Do you find it challenging to access hospital services in most public hospitals E.g. Mulago hospital?
- 6) Do you recommend appointments with health workers to be available via mobile phone messaging service?
- 7) Do you second an interactive messaging system to be introduced to provide easy interaction with health workers?
- 8) Do you think this system will help improve on the services offered by the hospital to their customers?

APPENDIX D: QUESTIONNAIRE

The table below depicts the sample of the number of users who willingly backed up the idea of introducing this system.

No:	Question	Analysis	Remarks
1.	Are you comfortable in using a computer?	Yes: No:	
2.	Do have full knowledge of how to use a mobile phone?	Yes: Partial: No:	
3.	Do you find it challenging to access hospital services in most public hospitals E.g. Mulago hospital?	Yes: No:	
4.	Do you recommend appointments with health workers to be available via mobile phone messaging service?	Yes: No:	
5.	Do you second an interactive messaging system to be introduced to provide easy interaction with health workers?		
6.	Do you think this system will help improve on the services offered by the hospital to their customers?		

APPENDIX E: CODE EXTRACTS.

The following section provides the important code extracts used in the implementation stage of the system. It gives both the JAVA programming language codes and also the data definition language for the database implementation.

Data Definition Language (DDL) code extracts for the database

/* Data Definition Language (DDL) code extracts for table Patlist*/

```
-----
-- Table structure for table `patlist`
--
CREATE TABLE `patrec` (
  `PatID` int(15) NOT NULL auto_increment,
  `name1` varchar(20) default NULL,
  `name2` varchar(20) default NULL,
  `age` int(5) default NULL,
  `PhoneNumber` int(15) default NULL,
  `Date-time`
  PRIMARY KEY (`PatID`),
) ENGINE=InnoDB DEFAULT CHARSET=latin1 AUTO_INCREMENT=2 ;

--
-- Dumping data for table `patlist`
--

INSERT INTO `patrec` (`PresID`, `age`, `name`, `symptom1`, `symptom2`,
`symptom3`, `otherinfo`, `PhoneNumber`, `Complication`, `Recomendations`,
`Doctor`) VALUES
```

/* Data Definition Language (DDL) code extracts for table Login*/

```
-----
-- Table structure for table `login`
--
CREATE TABLE `login` (
  `UserName` varchar(15) NOT NULL,
  `Passwd` varchar(10) NOT NULL,
  PRIMARY KEY (`UserName`)
) ENGINE=InnoDB DEFAULT CHARSET=latin1;

-- Dumping data for table `login`

INSERT INTO `login` (`UserName`, `Passwd`) VALUES
```

JAVA code extracts

Code for data base connection

```
package hospital;
import java.sql.*;
public class DBConn

{
    String compl;
    String ugonjwa;
    private Connection conn;
    private Statement state;
    private ResultSet result;
public DBConn()
{
    this.connect();
}
//method to connect to database
public void connect()
{
    String Driver = "com.mysql.jdbc.Driver";
    String Database_url = "jdbc:mysql://localhost:3306/";
    String UserName = "root";
    String Passwd = "";

    try
    {
        //loading database drivers
        Class.forName(Driver);
        conn = DriverManager.getConnection(Database_url, UserName, Passwd);
        System.out.println("Drivers Loaded");

        state = conn.createStatement();
        System.out.println("Connection ok");

        //create statement
        state = conn.createStatement();
    }

    catch(Exception exc)
    {
        exc.printStackTrace();
    }
}

//method to close database connection
public void close()
{
    try
    {
        if(state != null)
            state.close();

        if(!conn.isClosed())
```

```

        conn.close();
    }
    catch(SQLException exc)
    {
        exc.printStackTrace();
    }
}

//method to retrieve contacts
public String RequestDiagnosis(String name1,String name2,String age, String symptom1, String symptom2, String
symptom3, String otherinfo,String sender)
{
    String message = "There was a problem. Try again later";

    String query = "INSERT INTO hospital.patlist(name1,name2,age,PhoneNumber) VALUES
("+name1+"','"+name2+"','"+age+"','"+sender+"")";
    PreparedStatement statement;
    try
    {
        statement = conn.prepareStatement("select name1, name2, PhoneNumber from hospital.`patlist` ")
        ResultSet result = statement.executeQuery();
        while (result.next())
        {
            String nameVal1 = result.getString("name1");
            String nameVal2 = result.getString("name2");
            String phoneVal = result.getString("PhoneNumber");

            if (name1.matches(nameVal1) && name2.matches(nameVal2)&& sender.matches(phoneVal))
            {
                message = "You already exist in the system. please use your ID in the form
id#symptom1#symptom2#symptom3#otherinfo or call customer care on 0788995500";
                statement.close();
                conn.close();
            }
        }
        state.execute(query)
        int count;
        String query1 = "SELECT * FROM hospital.patlist where name1='"+name1+"'";
        String output = "";
        try
        {
            result = state.executeQuery(query1);

            while(result.next())
            {
                output = result.getString("PatID");
            }
        }
        catch(SQLException exc)
        {
            exc.printStackTrace();
        }
        String name=output+"_"+name1+"_"+name2;
        state.executeUpdate ("DROP TABLE IF EXISTS patients."+name);
    }
}

```

```

state.executeUpdate (
    "CREATE TABLE patients."+name+" ("
    + "id INT UNSIGNED NOT NULL AUTO_INCREMENT,"
    + "PRIMARY KEY (id),"
    + "symptom1 CHAR(40),"
    + "symptom2 CHAR(40),"
    + " symptom3 CHAR(40), otherinfo CHAR(40), complication CHAR(40), recomendations
CHAR(40),"
    + "date_time TIMESTAMP ON UPDATE CURRENT_TIMESTAMP Default
CURRENT_TIMESTAMP)");
count = state.executeUpdate (
    "INSERT INTO patients."+name+" (symptom1, symptom2,symptom3,otherinfo) VALUES
("+symptom1+"',' "+symptom2+"',' "+symptom3+"',' "+otherinfo+"')");
state.close ();
System.out.println (count + " rows were inserted");
message = "REQUEST RECEIVED AND IS BEING processed.Be patient for a response. your ID is:
"+output+". Next time contact us in the format:id#symptom1#symptom2#symptom3#otherinfo.";
    }
    catch(SQLException exc)
    exc.printStackTrace();
}
return message;
}
public String getPatPhoneNo(String id)
{
String query = "SELECT * FROM hospital.patlist where PatID = '"+id+"'";
String output = "";
try
{
result = state.executeQuery(query);
while(result.next())
{
output = result.getString("PhoneNumber");
}
}
catch(SQLException exc)
{
exc.printStackTrace();
}
System.out.println(output);
return output;
}
public void insertEntry(String patID,String PresID,String name1,String name2,String condition, String
recomendations)
{
String name=patID+"_"+name1+"_"+name2;
String query="UPDATE patients."+name+" SET complication = '"+condition+"',
recomendations='"+recomendations+"' where id = '"+PresID+"'";
System.out.println(query);
try
{
state.execute(query);
System.out.println("Entry inserted");
}
catch (SQLException e)

```

```

    {
        System.out.print("the error is here");
        e.printStackTrace();
    }
    System.out.println("completed");
}
public String updateEntry(String ID,String symptom1,String symptom2,String symptom3, String otherinfo)
{
    String query = "SELECT * FROM hospital.patlist where PatID='"+ID+"'";
    String output1 = "";
    String output2 = "";
    String message = "There was a problem. Try again later";
    try
    {
        result = state.executeQuery(query);
        while(result.next())
        {
            output1 = result.getString("name1");
            output2 = result.getString("name2");
        }
    }
    catch(SQLException exc)
    {
        exc.printStackTrace();
    }
    String name=ID+"_"+output1+"_"+output2;
    String query1= "INSERT INTO patients."+name+" (symptom1, symptom2,symptom3,otherinfo)
VALUES ('"+symptom1+"','"+symptom2+"','"+symptom3+"','"+otherinfo+"')";
    System.out.println(query1);
    try
    {
        state.execute(query1);
        message = "REQUEST RECEIVED AND IS BEING DIAGNOSED BY Dr. PAUL. Have a nice day";
    }
    catch (SQLException e)
    {
        System.out.print("the error is here");
        e.printStackTrace();
    }
    return message;
}
}
}

```

Code for database tables

```

package hospital;

import javax.swing.*;

import javax.swing.table.*;

import java.awt.*;

import java.util.Vector;

import java.sql.*;

```

```

@SuppressWarnings("serial")
public class DBTable extends JFrame
{

public static void patlist( ) throws Exception
{
DBTable frame = new DBTable();
frame.setSize(500,500);
frame.setLocation(200,100);
frame.setTitle("PATIENTS LIST");
JPanel jPanel = new JPanel( new BorderLayout() );
//Connection establishment to the database
String Driver = "com.mysql.jdbc.Driver";
String username = "root";
String password = "";
String Database = "jdbc:mysql://localhost:3306/hospital";
Connection Conn;
Class.forName(Driver);
Conn = DriverManager.getConnection( Database, username, password );
System.out.println("*** Connect to the database ***");
//Access Rows and Columns from database
Vector<String> Columns = new Vector<String>();
Vector<Vector<Object>> Rows = new Vector<Vector<Object>>();
String Query = "Select * from patlist";
Statement smnt = Conn.createStatement();
ResultSet results = smnt.executeQuery( Query );
ResultSetMetaData metaDt = results.getMetaData();
int cols = metaDt.getColumnCount();
Columns.clear(); // clear unwanted value if exist any in Columns variable.

```

```

//Get Columns From database
for (int i = 1; i <= cols; i++)
{
Columns.addElement(metaDt.getColumnName(i));
}

Rows.clear(); // clear unwanted value if exist any in Rows variable.

//Get RowsNames From database
while( results.next())
{
Vector<Object> row = new Vector<Object>(cols);
for (int i = 1; i <= cols; i++)
{
row.addElement(results.getObject(i));
}

Rows.addElement(row);
}

results.close(); //close Resultset.
smnt.close(); //close Statement.

//Define TableModel
TableModel tmodel = new DefaultTableModel(Rows, Columns){ };

// JTable Creation
JTable Table = new JTable(tmodel);
JScrollPane scroll = new JScrollPane(Table);
jPanel.add(scroll);
frame.add(jPanel, BorderLayout.CENTER);
frame.setVisible(true);

Conn.close(); //Close Connection to the database
}

public static void patrec(String id, String name1, String name2 ) throws Exception

```

```

{
DBTable frame = new DBTable();
frame.setSize(500,500);
frame.setLocation(200,100);
frame.setTitle(id+"_"+name1+"_"+name2+"_RECORDS");

JPanel jPanel = new JPanel( new BorderLayout() );
//Connection establishment to the database
String Driver = "com.mysql.jdbc.Driver";
String username = "root";
String password = "";
String Database = "jdbc:mysql://localhost:3306/patients";
Connection Conn;
Class.forName(Driver);
Conn = DriverManager.getConnection( Database, username, password );
System.out.println("*** Connect to the database ***");
//Access Rows and Columns from database
Vector<String> Columns = new Vector<String>();
Vector<Vector<Object>> Rows = new Vector<Vector<Object>>();
String Query = "Select * from "+id+"_"+name1+"_"+name2;
Statement smnt = Conn.createStatement();
ResultSet results = smnt.executeQuery( Query );
ResultSetMetaData metaDt = results.getMetaData();
int cols = metaDt.getColumnCount();
Columns.clear(); // clear unwanted value if exist any in Columns variable.
//Get Columns From database
for (int i = 1; i <= cols; i++)
{
Columns.addElement(metaDt.getColumnName(i));
}
}

```

```

}
Rows.clear(); // clear unwanted value if exist any in Rows variable.
//Get RowsNames From database
while( results.next())
{
Vector<Object> row = new Vector<Object>(cols);
for (int i = 1; i <= cols; i++)
{
row.addElement(results.getObject(i));
}
Rows.addElement(row);
}
results.close(); //close Resultset.
smnt.close(); //close Statement.
//Define TableModel
TableModel tmodel = new DefaultTableModel(Rows, Columns){ };
// JTable Creation
JTable Table = new JTable(tmodel);
JScrollPane scroll = new JScrollPane(Table);
jPanel.add(scroll);
frame.add(jPanel, BorderLayout.CENTER);
frame.setVisible(true);
Conn.close(); //Close Connection to the database
}
}

```

Code for doctor's form

```

package hospital;

import java.awt.BorderLayout;

```

```

import java.awt.GridLayout;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import javax.swing.BorderFactory;
import javax.swing.JButton;
import javax.swing.JFrame;
import javax.swing.JLabel;
import javax.swing.JOptionPane;
import javax.swing.JPanel;
import javax.swing.JTextField;

@SuppressWarnings("serial")
public class DoctorsForm extends JFrame implements ActionListener
{
    private JLabel label1,label2,label3,label4,label5,label6;
    DBConn dbman= new DBConn();
    private JTextField textField1,textField2,textField3,textField4,textField5,textField6;
    private JButton button1;
    private JButton button2;
    private JButton button3;
    private JButton button4;
    private JPanel panel1;
    private JPanel panel2;
    public DoctorsForm()
    {
        super(" HOSPITAL DIAGNOSIS AND PRESCRIPTION SYSTEM");
        label1 = new JLabel("PATIENT ID");
        label2 = new JLabel("PRESCRIPTION ID");
        label3 = new JLabel("FIRST NAME");
        label4 = new JLabel("SECOND NAME");

```

```

label5 = new JLabel("CONDITION");
label6 = new JLabel("RECOMENDATIONS");

textField1 = new JTextField(6);
textField2 = new JTextField(6);
textField3 = new JTextField(6);
textField4 = new JTextField(6);
textField5 = new JTextField(6);
textField6 = new JTextField(6);

button1 = new JButton("SAVE");
button1.addActionListener(this);
button2 = new JButton("CANCEL");
button2.addActionListener(this);
button3 = new JButton("VIEW _PAT_LIST");
button3.addActionListener(this);
button4 = new JButton("VIEW _PAT_REC");
button4.addActionListener(this);

panel1 = new JPanel();
panel1.setLayout(new GridLayout(0, 2));
panel1.setBorder(BorderFactory.createTitledBorder("PATIENT'S LIFE IS IN YOUR HANDS
DOCTOR"));

panel1.add(label1);
panel1.add(textField1);
panel1.add(label2);
panel1.add(textField2);
panel1.add(label3);
panel1.add(textField3);
panel1.add(label4);
panel1.add(textField4);
panel1.add(label5);

```

```

panel1.add(textField5);
panel1.add(label6);
panel1.add(textField6);
panel2 = new JPanel();
panel2.add(button3);
panel2.add(button4);
panel2.add(button1);
panel2.add(button2);

getContentPane().setLayout(new BorderLayout());
getContentPane().add("Center", panel1);
getContentPane().add("South", panel2);
}

public static void main(String args[])
{
    JFrame frame1 = new DoctorsForm();
    frame1.setSize(500, 500);
    frame1.setVisible(true);
    frame1.setResizable(false);
}

public void actionPerformed(ActionEvent event)
{
    if (event.getSource() == button1)
    {
        String PatId=textField1.getText();
        String PresId=textField2.getText();
        String FirstName=textField3.getText();
        String SecondName=textField4.getText();
        String condition=textField5.getText();
    }
}

```

```

String recomendations=textField6.getText();
dbman.insertEntry(PatId,PresId,FirstName,SecondName, condition,recomendations);
String theNumber="";
String theMsg="";
System.out.println(PresId+condition+recomendations)
theMsg = condition+"\t"+recomendations;
theNumber = dbman.getPatPhoneNo(PresId);
Reply msg = new Reply(theNumber, theMsg);
try
    {
        msg.doIt();
    }
    catch(Exception e)
    {
        e.printStackTrace();
    }
    System.out.println(theMsg);
}
if (event.getSource() == button3)
{
    try {
        DBTable.patlist();
    } catch (Exception e) {
        // TODO Auto-generated catch block
        e.printStackTrace();
    }
}
if (event.getSource() == button4)
{

```

```

try {
    String PatId=textField1.getText();
    String FirstName=textField3.getText();
    String SecondName=textField4.getText();
        DBTable.patrec(PatId,FirstName,SecondName);
    } catch (Exception e) {
        JOptionPane.showMessageDialog(null, "Please fill in the patient id,
first name and second name to view the patients database");
    }
}
if (event.getSource() == button2)
{
    System.exit(1);
}
}
}

```

Code for doctor's login form

```

package hospital;
import java.awt.BorderLayout;
import java.awt.GridLayout;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import javax.swing.BorderFactory;
import javax.swing.JButton;
import javax.swing.JFrame;
import javax.swing.JLabel;
import javax.swing.JPanel;
import javax.swing.JPasswordField;
import javax.swing.JTextField;
import java.sql.*;

```

```
import javax.swing.JOptionPane;

@SuppressWarnings("serial")

public class Login extends JFrame implements ActionListener
{
    private Connection conn;

    private JLabel label1;
    private JLabel label2;
    private JTextField textField1;
    private JPasswordField textField2;
    private JButton button1;
    private JButton button2;

    private JPanel panel1;
    private JPanel panel2;

    public Login()
    {
        super("LOGIN SCREEN");
        label1 = new JLabel("Username");
        label2 = new JLabel("Password");
        textField1 = new JTextField(6);
        textField2 = new JPasswordField(6);
        button1 = new JButton("Login");
        button1.addActionListener(this);
        button2 = new JButton("Cancel");
        button2.addActionListener(this);
        panel1 = new JPanel();
        panel1.setLayout(new GridLayout(0, 1));
        panel1.setBorder(BorderFactory.createTitledBorder("LOGIN SCREEN"));
        panel1.add(label1);
```

```

panel1.add(textField1);
panel1.add(label2);
panel1.add(textField2);
//instantiating jpanel p3
panel2 = new JPanel();
panel2.add(button1);
panel2.add(button2);
getContentPane().setLayout(new BorderLayout());
getContentPane().add("Center", panel1);
getContentPane().add("South", panel2);
}

@SuppressWarnings("deprecation")
public void databaseConnection()
{
String Driver = "com.mysql.jdbc.Driver";
String Database_url = "jdbc:mysql://localhost:3306/";
String UserName = "root";
String Passwd = "";
if (textField1.getText().equals("")||textField2.getText().equals("") )
{
JOptionPane.showMessageDialog(null, "Please fill in all the fields", "Login Screen", 1);
}
PreparedStatement statement;
try
}
Class.forName(Driver);
conn = DriverManager.getConnection(Database_url, UserName, Passwd);
statement = conn.prepareStatement("select userName, passwd from hospital.`login` ")

```

```

ResultSet result = statement.executeQuery();

while (result.next())
{
    // String string1 = result.getString(1);
    // String string2 = result.getString(2);
    //String string3 = result.getString(3);
    // String str = (String) comboBox1.getSelectedItemAt();
    String paswd = result.getString("passwd");
    String name = result.getString("username");
    if (textField2.getText().matches(paswd) && textField1.getText().matches(name))
    {
        //if (str.matches("Admin"))
            JOptionPane.showMessageDialog(null, "WELCOME Dr."+name);
            DoctorsForm frm= new DoctorsForm();
            frm.setSize(500, 500);
            frm.setVisible(true);
        }
        else
        {
            JOptionPane.showMessageDialog(null, "Enter A Valid Username and Password To Login");
        }
    }
    statement.close();
    conn.close();
}

catch(SQLException sqe)
{
    sqe.printStackTrace();
}

```

```

catch(ClassNotFoundException cnf)
{
    cnf.printStackTrace();
}
}
public void actionPerformed(ActionEvent event)
{
    if (event.getSource() == button1)
    {
        databaseConnection();
    }
    if (event.getSource() == button2)
    {
        System.exit(1);
    }
}
public static void main(String args[])
{
    Login frame1 = new Login();
    frame1.setSize(300, 300);
    frame1.setVisible(true);
    frame1.setResizable(false);
    // frame1.databaseConnection();
}
}

```

Code for inbound SMS.

```

package hospital;
import java.io.IOException;
import org.aiti.sms.IAITIInboundMessageNotification;
import org.smslib.GatewayException;

```

```

import org.smslib.InboundMessage;
import org.smslib.OutboundMessage;
import org.smslib.Service;
import org.smslib.TimeoutException;
import org.smslib.Message.MessageTypes;
public class InboundSMS implements IAITIInboundMessageNotification
{
    DBConn manager = new DBConn();

    String output = " ";

    public void process(Service srv, String gatewayid, MessageTypes messageType,
        InboundMessage msg)
    {
        String text=msg.getText();
        String sender=msg.getOriginator();
        String replymsg=GetSymptoms(text,sender);
        OutboundMessage reply=new OutboundMessage(sender,replymsg)
        try
        {
            srv.sendMessage(reply);
        }
        catch (TimeoutException e)
        {
            e.printStackTrace();
        }
        catch (GatewayException e)
        {
            e.printStackTrace();
        }
    }
}

```

```

    }
    catch (IOException e)
    {
        e.printStackTrace();
    }
    catch (InterruptedException e)
    {
        e.printStackTrace();
    }
}

public String GetSymptoms(String text, String sender)
{
    String parts[]=text.split("#");
    System.out.println(parts.length);
    if(parts.length==7)
    {
        String name1=parts[0];
        String name2=parts[1];
        String age=parts[2];
        String symptoms1=parts[3];
        String symptoms2=parts[4];
        String symptoms3=parts[5];
        String otherinfo=parts[6];

        String response = manager.RequestDiagnosis(name1,name2,age, symptoms1,
symptoms2,symptoms3,otherinfo,sender );

        System.out.println(response);
        return response;
    }
    else if(parts.length==5)
    {

```

```

        String id=parts[0];
        String symptoms1=parts[1];
        String symptoms2=parts[2];
        String symptoms3=parts[3];
        String otherinfo=parts[4];

        String response = manager.updateEntry(id, symptoms1,
symptoms2,symptoms3,otherinfo);

        System.out.println(response);

        return response;
    }
    else
    {
        return output="invalid protocol. please call customer care on 0788995500";
    }
}
}

```

Code for class main

```

package hospital;

import org.aiti.sms.AITISMSServer;
import org.aiti.sms.SMSHandlerThread;

public class Main
{
    /**
     * @param args
     */
    public static void main(String[] args)
    {
        // TODO Auto-generated method stub. set flag of the emulator true or false
        AITISMSServer app = new AITISMSServer(true);
    }
}

```

```

        SMSHandlerThread.setAITIInboundMessageNotification(new InboundSMS());
        app.setComPort((short)3, 460800);
        try
        {
                app.doIt();
        }
        catch (Exception e)
        {
                // TODO Auto-generated catch block
                e.printStackTrace();
        }
    }
}

```

Code for class Reply

```

package hospital;

import org.smslib.IOutboundMessageNotification;
import org.smslib.Library;
import org.smslib.OutboundMessage;
import org.smslib.Service;
import org.smslib.modem.SerialModemGateway;

public class Reply {
    private String phoneNo;
    private String message;
    public Reply(String no, String m)
    {
        phoneNo = no;
        message = m;
    }
    public void doIt() throws Exception

```

```

{
    Service srv;
    OutboundMessage msg;
    OutboundNotification outboundNotification = new OutboundNotification();
    System.out.println("Example: Send message from a serial gsm modem.");
    System.out.println(Library.getLibraryDescription());
    System.out.println("Version: " + Library.getLibraryVersion());
    srv = new Service();
    SerialModemGateway gateway = new SerialModemGateway("modem.com3", "COM3", 460800,
"Huawei", "");
    gateway.setInbound(true);
    gateway.setOutbound(true);
//    gateway.setSimPin("0000");
    srv.setOutboundNotification(outboundNotification);
    srv.addGateway(gateway);
    srv.startService();
    System.out.println();
    System.out.println("Modem Information:");
    System.out.println(" Manufacturer: " + gateway.getManufacturer());
    System.out.println(" Model: " + gateway.getModel());
    System.out.println(" Serial No: " + gateway.getSerialNo());
    System.out.println(" SIM IMSI: " + gateway.getImsi());
    System.out.println(" Signal Level: " + gateway.getSignalLevel() + "%");
    System.out.println(" Battery Level: " + gateway.getBatteryLevel() + "%");
    System.out.println("Dr. PAUL NYAGOA..... RESTORES HEALTH... YOU WILL BE
REACH...");
    // Send a message synchronously.
        msg = new OutboundMessage(phoneNo, message);
        srv.sendMessage(msg);
    srv.stopService();
}

```

```
}
```

```
public class OutboundNotification implements IOutboundMessageNotification
```

```
{
```

```
    public void process(String gatewayId, OutboundMessage msg)
```

```
    {
```

```
        System.out.println("Outbound handler called from Gateway: " + gatewayId);
```

```
        System.out.println(msg);
```

```
    }
```

```
}
```

```
}
```