A Hospital assistance system for the Centre Hospitalo Universitaire de Kamenge

In Bujumbura- Burundi

Student number: 101327

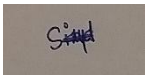
Group A

An Information Systems Project Proposal Submitted to the Faculty of Information and Technology in partial fulfilment of the requirements of the award of a Degree in a Business Information Technology

Date of Submission: January 2021

Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the research proposal contains no material previously published or written by another person except where due reference is made in the research proposal itself

Student Signature:  Date: January 2021

Supervisor Signature: _____ Date: _____

Abstract

Health is a very important sector of a country. In Burundi, the health sector has been paralyzed by so many factors over the years like civil wars, lack of enough resources, etc. The Centre Hospitalo Universitaire de Kamenge, one of the most known and ancient public hospitals in Burundi, also suffers from the lack of resources and therefore the services offered by CHUK are not fast and efficient. But in everything that might be affecting CHUK, the major issue that is going to be sorted out through this project concerns medical files which are still physical and usually lack all the necessary information that the ministry of health needs during the different controls done. The other problem that CHUK presents is the schedules of the specialist doctors that work which makes patients face problems of lacking doctors due to lack of necessary and enough information. Despite the fact that CHUK already has an Open Clinic as a Health Information System which is not used as its best. Open clinic is mainly used in registering patients at the Emergency Care Unit, it generates a unique ID to every patient which they will use to get the different hospital services. This is very unfortunate because Open Clinic is a broad system that covers the following departments: Administration, finances, clinical, laboratory, Xray, pharmacy, meals distribution and other data. The Information system that will be developed will therefore allow CHUK to have a system that does more than just registering patients at the ECU but also allows doctors, laboratory assistants and Pharmacists to update the electronic medical file that would be created at the ECU. The hospital direction will therefore be able to keep a record of their patients' medical files electronically so that in case of any health ministry control; every data needed is able to be traced back. Finally, the Information System from the project will allow the direction of CHUK to create a schedule for doctors and communicate it efficiently to the patients so that they can get the needed doctor at the exact needed time. This will improve very much on the quality and efficiency of the services provided by the CHUK.

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LIST OF ABBREVIATIONS

CHUK: Centre Hospitalo Universitaire de Kamenge

CSS: Cascading Style sheets

DBMS: Database Management System

ECU: Emergency Care Unit

ERD: Entity Relationship Diagram

HMIS: Health Management Information System

HMN: Health Metric Network

HTML: Hyper Text Markup Language

ICT: Information and Communication Technology

IDE: Integrated Development Environment

IT: Information Technology

PHP: Hypertext Pre-processor

UML: Unified Modelling Language

UNICEF: United Nations Children's Emergency

WHO: World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Background

Burundi is a small landlocked country in the African Great Lakes region in central Eastern Africa bordering Lake Tanganyika in the south west. The country shares borders with the Democratic Republic of the Congo, Rwanda, and Tanzania (Burundi, 2005).

Burundi is a country that is not so much developed and that has been shaken by so many civil wars since 1972 to 2015. This unstable political situation has therefore affected the country in so many different sectors, the health and Information and Technology sectors included.

Like many other African countries, Burundi suffers from what is called the "brain drain" which consists of the emigration of highly qualified and well-trained people from the country to more developed countries like Canada, United States, etc. (Muula, 2005)

According to a journal published by the Department of Community Health, university of Malawi College of Medicine, The reasons of the brain drain are many but they can be mainly put in 3 groups: **The push factors from the donor country** (factors like poor remuneration and poor prospects for further training), **The pull factors from the recipient country**(Better remuneration, prospects for further training) ,**Grab factors** (aggressive advertisements and recruiting agents networks of former migrants). (Muula, 2005)

Some facilities have been brought up in different hospitals of the country when it comes to how the health sector operates but it seems like the two reasons cited above really make the health sector not go so much far in Burundi. This is also the case of CHUK (Centre Hospital Universitaire de Kamenge) which means The Kamenge University Hospital Centre in English and is one of the most known hospitals in Burundi. The centre started working in 1984 and is known to be having in its staff the oldest and most experienced doctors of the country. (campana, 2017)

Despite the seniority of CHUK, Health services are still slow and not so much efficient due to lack of efficient and adequate software that would help the medical staff. In a country like

Burundi where even the IT sector is still quite behind, coming up with a software that helps the medical staff and the hospital management in general would be of a big interest.

1.2 Problem Statement

The current process used by CHUK in offering different services to the patients is fully physical. Patients are registered into books. Every patient has a paper file in which the doctor will fill in after consulting a patient. During my Community Based Attachment, I realized that when the ministry of health comes for a monthly control (Quality and Quantity controls), some data would be missing due to the fact that those books that are handled by so many people get old fast and lose some pages.

Another problem is the scarcity of doctors and the lack of communication to the patients. Specialist doctors usually work in 2 or more hospitals. If a patient goes to CHUK in the morning needing for example an ophthalmologist, they can be told to wait and they end up waiting for a whole day, sometimes in vain because that day the doctor was working in another private hospital or in his own consultation cabinet. The patient that cannot afford a consultation in a private hospital ends up not being treated that day. In some worse scenarios this can happen all over for a whole week, and you find the same patients going to queue and going back home without finding the doctor.

1.3 Aim

The aim is developing an information system for CHUK in order to solve the problem identified in section 1.2.

The system solves the problem by allowing the different steps made by patients from the time they seek assistance to when they get out of CHUK to be stored in a personal software file. The software file will be unique for every patient. This software file will be created by the patient by just creating an account and taking an appointment. After the consultation, the doctor will update it. The system will also have a section that shows which specialist doctors are available in CHUK and their schedules on a daily basis. This will therefore allow the patients to book appointments and simply to know when the specialist doctor needed is available. Also, The doctor can add after a consultation on the patient file some other details like billing (if the patient has paid and the amount he paid).

1.4 Specific Objectives

i. To review the current process of keeping medical files in CHUK

ii. To increase the amount of information that patients get when it comes to availability of specialist doctors

iii. To develop a web-based system that will allow a better management of medical files and inform the patients of the specialist doctors availability.

iv. To test the system

1.5 justification

This project is justified because the problem that it will be solving is a critical issue, the time a problem involves people lives, that means that it is of a big importance and needs to be handled urgently. The system will also help patients to avoid time and money losses, if they check on the website and find that there is no available doctor that day, instead of losing their time coming to CHUK, they can instead search for an alternative. Concerning the medical files, this will make the work of all the staff easier especially during the health care ministry controls. No data will be missing, and it will not take a whole day to put all the books of all CHUK service departments together. Work will be easier and faster at CHUK.

1.6 Scope and limitations

The project will mainly focus on creating and updating the medical files of the patients and showing the availability and the schedules of specialist doctors in CHUK. The patients being able to book an appointment and the billing functionality will be an optional functionality that will be added at the end of the project if only all the other functionalities have been successfully implemented. That will be the whole scope. The project will not cover any other functionalities apart from the ones specified above. For example, there will not be any update about CHUK that is not about doctors availability and schedules. The system will strictly be a web-based system for now. Later, it can be made into a mobile application.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter reviews the Burundian health sector, its budget, and the relationship that different Burundian hospitals have with Health Management Information Systems in general and CHUK in particular. It reviews what is documented about Open Clinic and reviews the different gaps in HMIS in different African countries.

2.2. The Burundian Health Sector

The Burundian health sector has been into a crisis due to the many civil wars that have shaken the country since 1993. According to the World Health Organization, the vaccination rate is low, the maternal and infant mortality are really high, and the lack of well-trained staff is very much present. Health policies in Burundi are partly the result of the government's own priorities: It only spends a small part of the budget on health. In 2005, it was barely 2.7%. Those health policies are also a result of the World Bank policies in Africa during the 1980s and 1990s, with the intention of overcoming the "financial handicap of the health sector" through the fees collected. The World Bank strategy got some additional strength due to the Bamako initiative that was initiated by WHO and The United Nations Children's Emergency Funds in African governments since 1987. (K, 2006). In 2020, The part of the overall government budget that is put into the health system is 223,8 billion Burundian Francs on an overall budget of 1.422,81 billion Fbu. (Nkuriyingoma, 2020)

2.3. The technology used in CHUK

After some research done in the hospital, I got to know that CHUK uses a technology called Open Clinic. Open Clinic GA is an open-source integrated hospital information management system covering management of administrative, financial, clinical, lab, x-ray, pharmacy, meals distribution and other data. It was developed in order to be used in limited sources hospitals and it is functional in several countries of Africa like Rwanda, Burundi, DRC and Somalia covering up to 5 to 7000 hospitals. (Medical Free/Libre and Open-Source Software, 2010). Despite the fact that Open Clinic is quite a broad Hospital Management Information System, CHUK has not been able to use its other functionalities apart from the registration bit. In CHUK, Open Clinic is mainly used in the Emergency Care Unit for the patient registration in

order for a patient to get a unique Identification Number that will help in identifying him in every hospital department. The patient details keyed in are: Names, Civil status, age, gender, and profession. In some cases, the doctor can key in the reasons for the consultation, but it is not that much common. In brief, Open Clinic is a registration system in CHUK.

2.4. The gaps in the Health Management Information Systems

In a study done in Somaliland, an independent state that seceded from Somalia in 1991, the whole health system is functioning poorly. HMIS have some gaps due to the convergence of some factors like:

1. Resource and Infrastructure limitations
2. Poor information and communications technology for help
3. Absence of enforced legal framework for information management
4. Limited use of common interoperability standards
5. Lack of an appropriately trained workforce
6. Fragmented HIS sub systems
7. Poor data quality
8. Limited use of available information
9. Weaknesses in data analysing capacity
10. Poor HIS management practises

Despite all these challenges cited, many countries in the Region have comprehensively reviewed and assessed their HIS with support of the WHO and the Health Metric Network. As an example, we can cite Sudan's HIS assessment that revealed the fact that there are seven surveillance systems designed vertically with their own specific approach to data collection, analysis, and information products. Therefore, Sudan realized the importance of an integration strategy as a key solution to better data production, use and dissemination. (Askar, 2016)

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The objective of this chapter is to specify and clarify the methodology that will be used in order to achieve the specific objectives and to solve the problem as stated in chapter one. The methodology that will be used in order to develop the CHUK assistance system will clearly be stated and the justification to why it has been chosen.

3.2 Description of the methodology

The system methodology that will be used in this project will be system protoping because it is a methodology that is suitable for systems or applications that are not really complex and does not involve too many analysts. It implies designing an early version of the system before attempting to build the final system then gradually developing it to meet the user's needs. (NGBAGARO, 2020) The reason why System prototyping is going to be the system methodology used is because the system is going to be a fruit of an intense work overtime. The improvements will be made according to how the users will react to the very first prototype that will be delivered.

The other reason why system prototyping has been chosen for the project is because of its advantages:

1. The users have more input and feedback
2. The system is much easier to change
3. It enables a quick identification of missing functionality
4. It enables a quick implementation of the system/ application

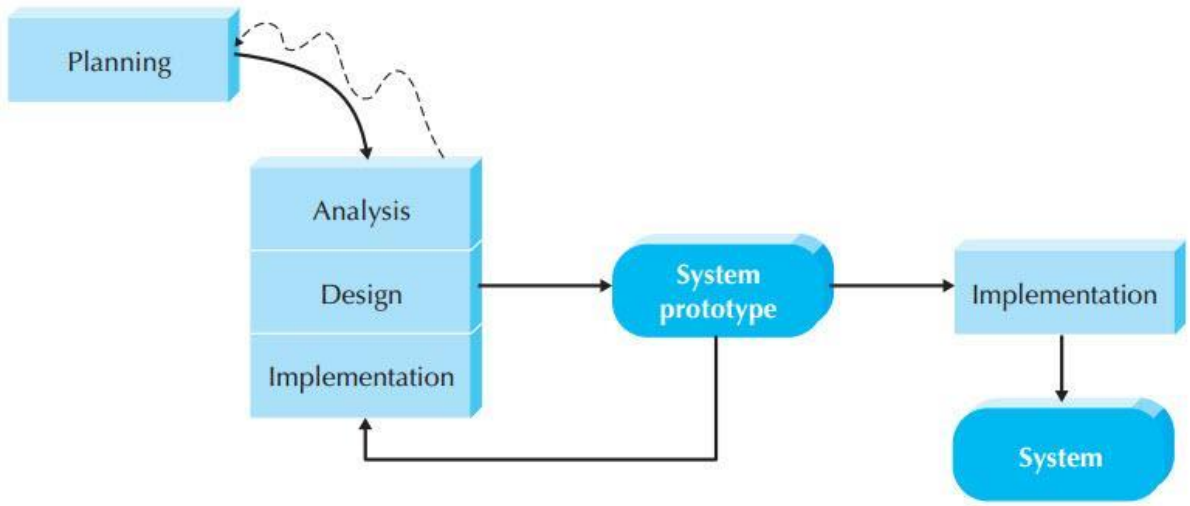


figure 3. 1: *System prototyping* (rasario, 2019)

The stages included in the prototyping methodology are:

1. Communication: Under this stage, a visit to CHUK and a talk with the personnel was made. It is very important to determine the relationship the CHUK personnel have with software use and know perfectly which type of system would suit them. This is the stage in which the end users (CHUK personnel) give their requirements which are very important to development of the end software product.

2. Construct first prototype: After analysing the end users requirements, a rapid and summarized prototype of the system was developed. The prototype had one module and it was taken back to CHUK so that some of the personnel could interact with it. The prototype was a very basic version of the system which had so less modules compared to the end software product.

3. End users Evaluation : This is the part in which their feedback was given. The feedback was quite positive even though some issues occurred considering the fact that a certain mini training was needed. As I specified it in chapter one, Burundi is a country where software utilization is quite behind and therefore some guidance was needed while introducing the prototype to the selected CHUK personnel

4. Prototype iteration: This is the stage in which the reviews given the second time by the selected CHUK personnel considering the prototype were taken into consideration and therefore helped in shaping the end software system. The prototype was modified in order to reach the end goal desired software.

3.3 Deliverables

The deliverables while going through the methodology stages were:

1. The software development took a more clear and precise approach.
2. The amount of time and work needed in order to complete the project development was approximately identified.
3. Necessary Feedback regarding the software development and the use of the end goal software was received.

3.4. System development tools and techniques

For the system development, the programming language that will be used is (Hypertext Pre-processor) because of some advantages that this programming language presents over other programming languages which are:

1. PHP is an Open source: It can be used by anyone and it is totally free. It is very easy to use and very easy to learn for beginners.

2. Cost efficient: As said above, PHP is free of cost and therefore very convenient to use.

3. Scalability: PHP has a quality to grow websites and attracts traffic. Its ability in supporting all major web browsers makes it even more scalable

4. Integration: PHP does not work on limited platforms or specific web sites.

5. Speed: PHP is the best when it comes to speed, it reduces it automatically which makes the outcome to come faster and best due to speed.

Also, PHP is embedded by Hyper Text Markup Language which is used to describe the structure of web pages using Markup. Finally, PHP will also allow us to Cascading Style sheets which is the language that describes the style of HTML

elements and JavaScript which is the programming language of HTML and the Web.

As an IDE, the system will be developed using Visual studio because it presents some advantages like accurate coding, quick debugging, rigorous testing, and customization options that are quite advanced.

As a DBMS, MySQL will be the one used for some reasons which are:

1. It allows multiple users to access to a variety of databases
2. It can handle a multitude of data in a fast and reliable manner all while allowing users to access several databases efficiently.
3. Tried and trusted, this open source has become an important and welcomed addition to many of today's business successes.
4. Finally, it is developed by Oracle and freely available for personal use via MYSQL community server.

On this, it can be added that MySQL is fast, reliable, and stable.

CHAPTER 4: SYSTEM ANALYSIS AND DESIGN

4.1. Introduction

The aim of this chapter is to provide a list of identified functional and non functional requirements and at the same time explain how they were gathered while the system analysis stage was taking place.

4.2. Requirement gathering

The process of gathering the requirements used was qualitative in the sense that the methods used were **interviews**. The interviewees were asked some questions on a one to one basis (some in person and others on the phone) concerning the current way of functioning of CHUK and what they would expect from a software system that would solve the problems that were highlighted. The group of interviewees was formed by interns , doctors and staff from the administration all working in CHUK.

4.3. System Requirements

The system requirements of the CHUK assistance system are as specified in the following points 4.3.1 and 4.3.2

4.3.1. Functional requirements

The functional requirements of the CHUK assistance system are:

FR1	The system should allow a new user to register (doctor and patient).
FR2	The system should allow the user (doctor, patient and hospital administrator) to login .
FR3	The system should be able to display an error message in case the login credentials are wrong.
FR4	The system should allow the doctors to view and edit the patient file.
FR5	The system should allow the patient to check on their medical file using their username.
FR6	The system should allow the CHUK administrator to add a weekly timetable showing which doctors will be available and at what time they will be working from CHUK.

FR7	The system should allow the CHUK administrator to view all medical files of the CHUK patients
FR8	The system should allow the CHUK administrator to have an overview on the hospital management (the total number of doctors, the total number of patients, reports made by the patients, billing)
FR9	The system should allow the patient to view the weekly timetable of doctors in CHUK

Table 4. 1: Functional requirements

4.3.2. Non-Functional requirements

The non-functional requirements of CHUK assistance system are:

NFR1	The system should ensure that access rights are restricted to the corresponding owners in the sense that a patient is allowed to view their own medical file and not be able to manipulate it in any way. The patient cannot update, delete, and save any results in the system.
NFR2	Considering the environment in which the system will be used, it is a requirement that the system be user friendly. The navigation between pages should be simple and easy.
NFR3	The system should be easy to use especially for the CHUK staff in order to have efficient and fast services.

Table 4. 2: Non-functional requirements

4.4. System Architecture

The system architecture comprises two main components: The web-based system and the database. The web-based system is the one that will be used by the actors (patient, doctor and administrators) and every actor will be able to only access and see the information that is for them. The web-based system shall be accessed using a computer while being by any of the actors.

4.5. System Analysis and design

Systems design is the process of defining elements of a system like modules, architecture, components, and their interfaces but also data for a system based on the specified requirements. It is the process of defining, defining, developing, and designing systems which satisfies the specific needs and requirements of a business or an organization. (Systems Design, 2020). Design will also help us to see how the different entities use the CHUK assistance system interactions.

4.5.1. Use case Diagram

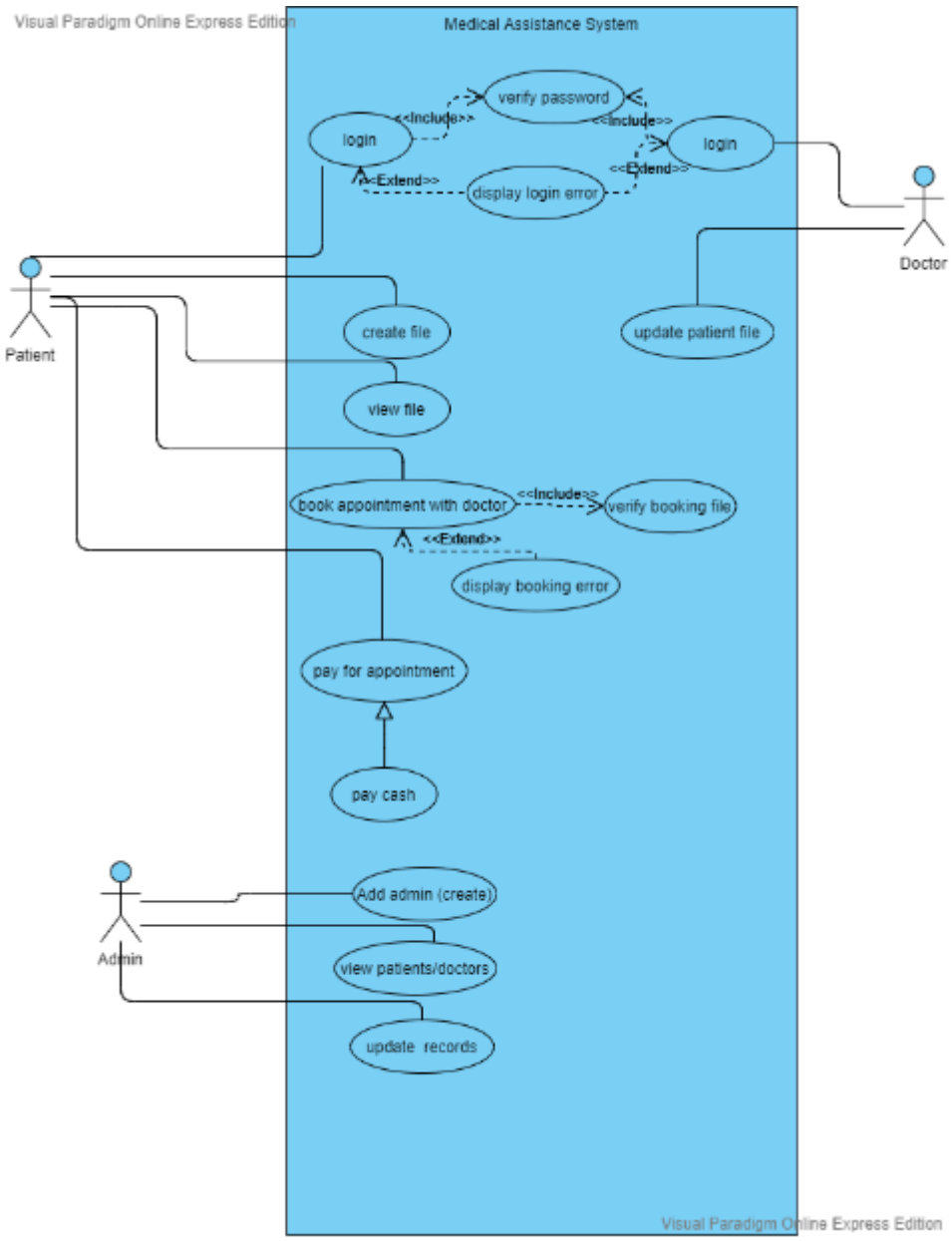


figure4. 1: Use case diagram

4.5.2 . Sequence diagram

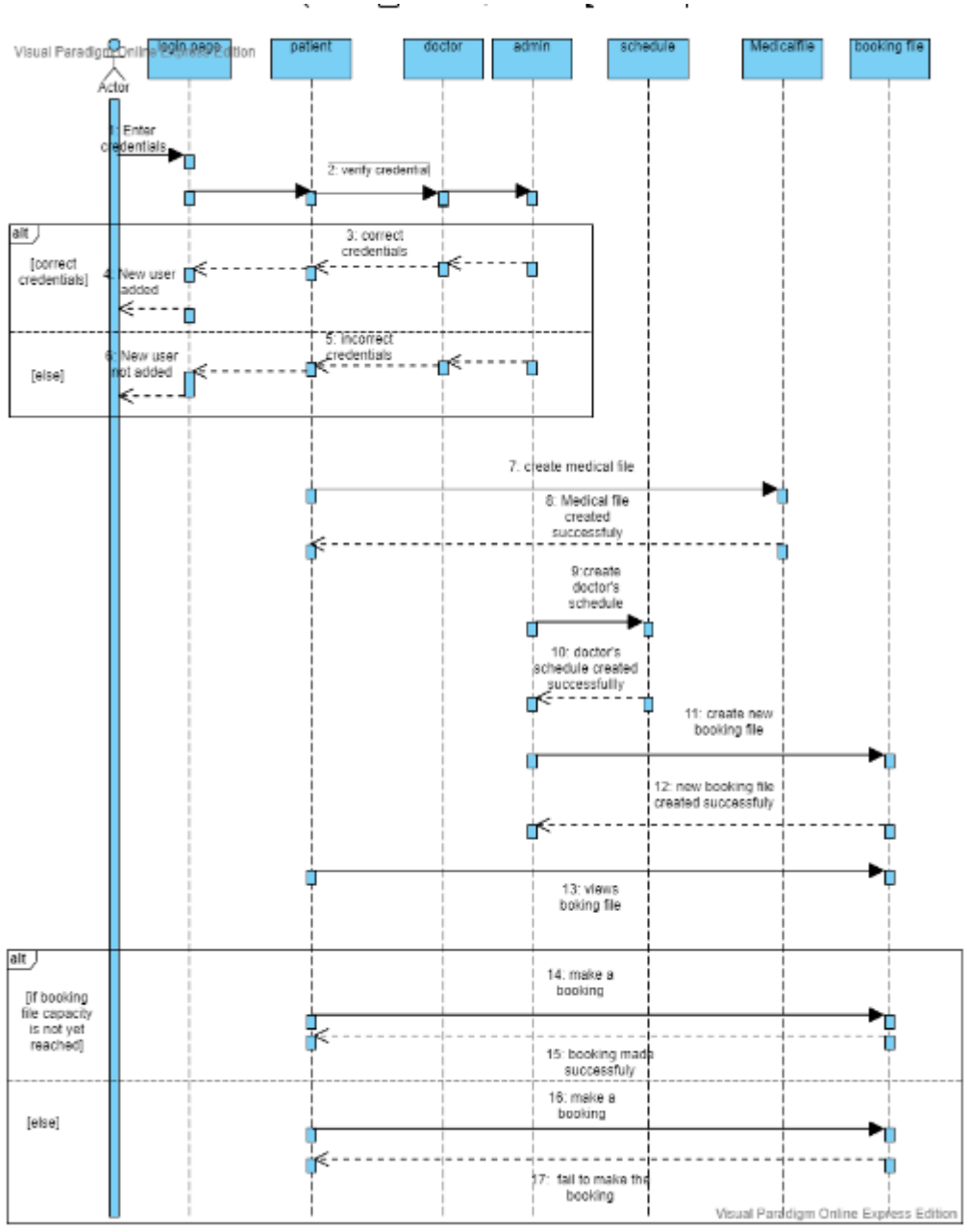


figure4. 2: Sequence diagram

4.5.3. Class diagram

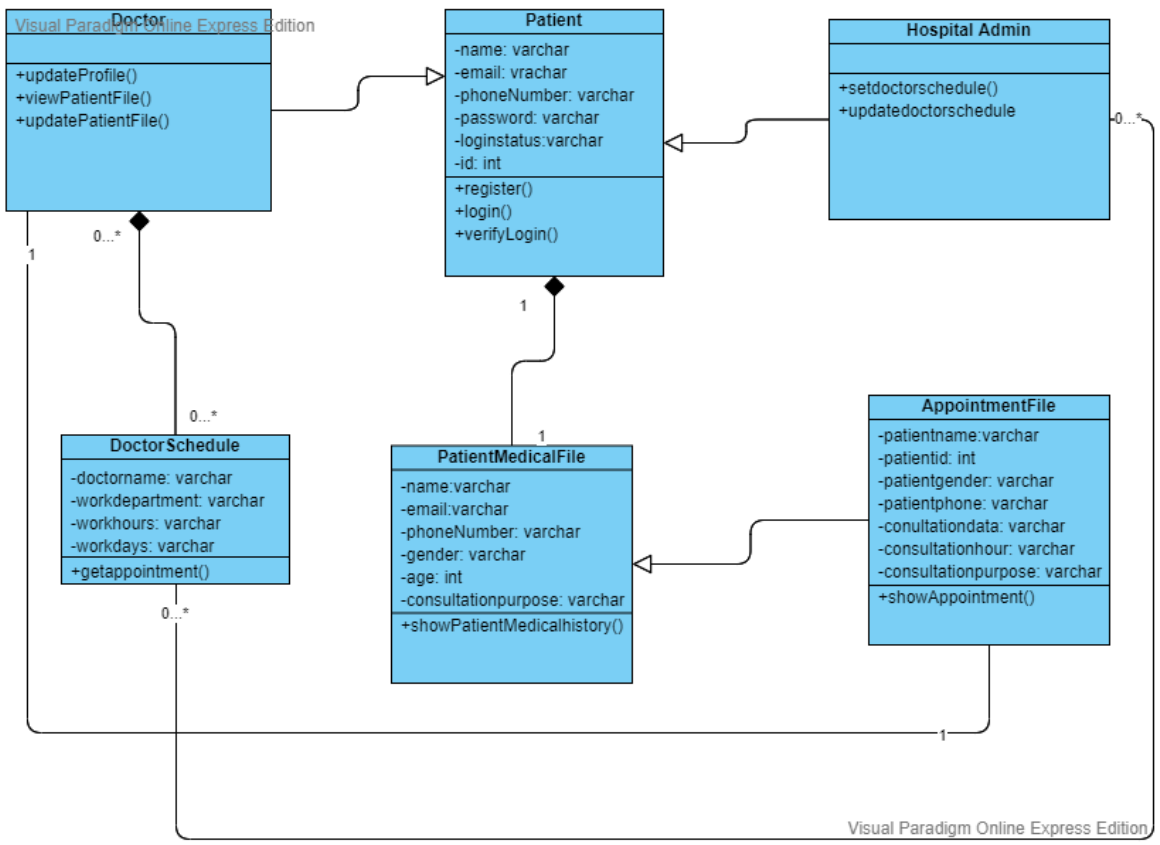


figure4. 3: Class diagram

4.5.4. Entity Relationship diagram

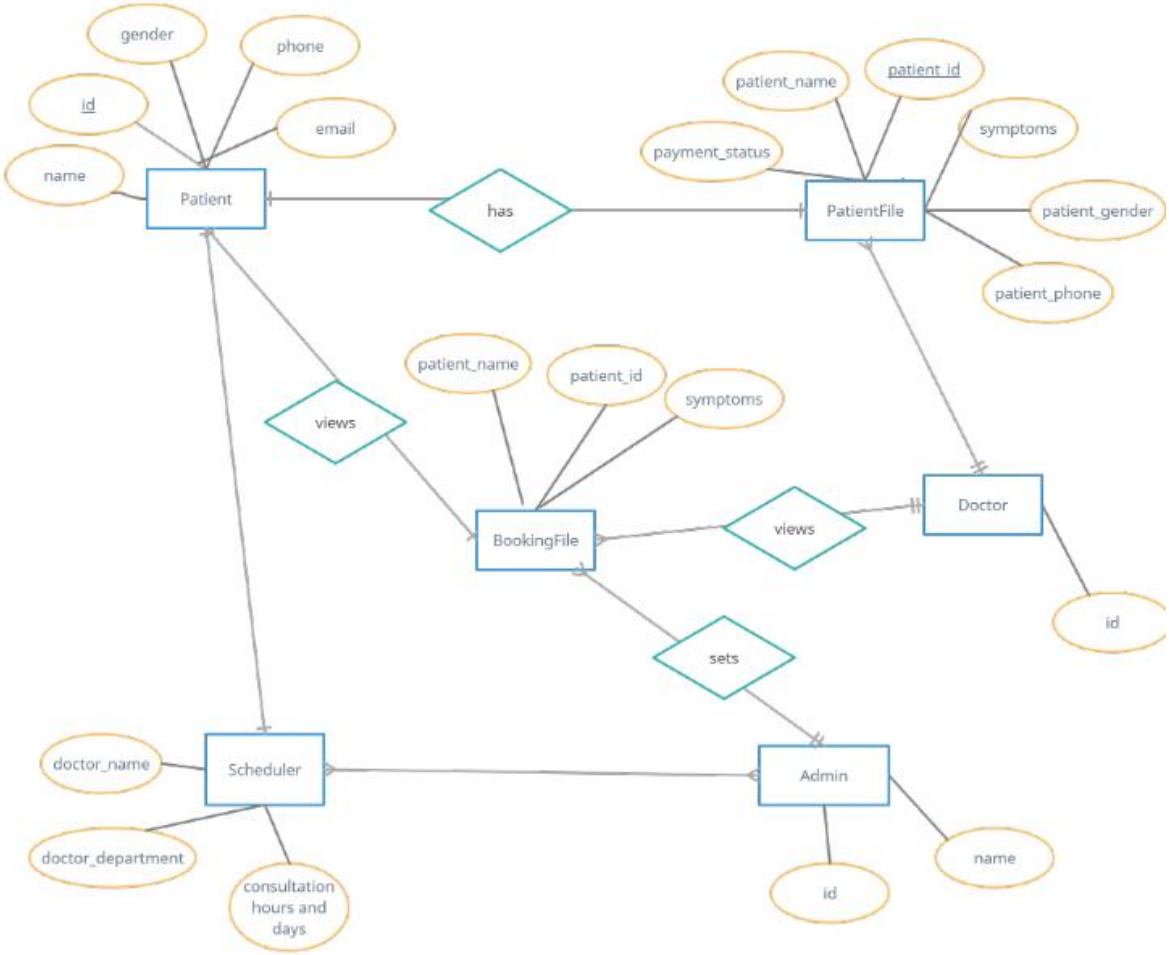


figure4. 4: Entity Relationship Diagram

4.5.5. Database Schema

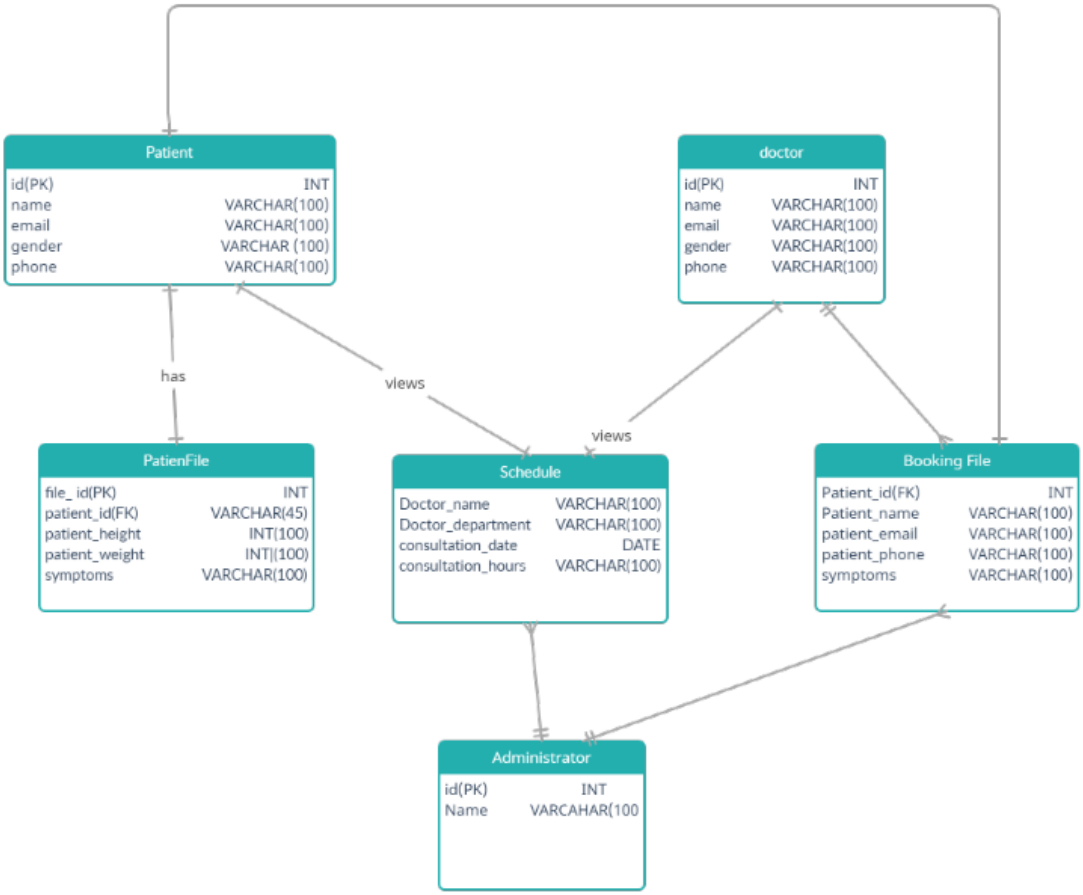


figure4. 5: Database Schema

CHAPTER FIVE : SYSTEM IMPLEMENTATION AND TESTING

5.1. System Implementation

Under this chapter, the process of how the system was implemented and tested is going to be described. The web-based system was developed starting from the front end (interface) and connecting it gradually to the back end (database). The modules were implemented following the logical flaw of the different activities that the system should perform. To explain this deeper, we can give as an example, A module was used at a time (for example patient) and the flaw of the different operations that the system should allow them to perform was implemented.

A patient signs up first (implementation of a sign-up page), he/she logs in (implementation of a login page), then they can book an appointment (implementation of a dashboard), etc.

For the web based to be installed on a computer, it needs a server. There are quite a number of servers that can be used while developing a web-based system using php but during the development of the CHUK assistance system; the server used was WAMP. Wamp can be downloaded easily online following this link https://www.wampserver.com/en/ . After downloading it follows the installation. Once Wamp is installed on the computer, it is good to make sure that all the services are running. if the wamp icon turns out to be green, it means that the services are all running, and the server is ready to be used. Otherwise (icon red or orange) it means that some or none of the services are running, therefore the error needs to be fixed before being able to use the server.

 : All services are running

figure 5. 1: Wamp green icon

 : None of the services running

figure 5. 2: Wamp red icon

 : Only 1 or 2 services running

figure 5. 3: Wamp orange icon

When the server is successfully set, the system can start to be implemented by coding. The code will be stored in the server's folder(Wamp64)/www/project folder. This way it can be accessed on any browser as long as the server is running.

The following screenshots show the different CHUK assistance system interfaces at different levels:

5.1.1. Home page

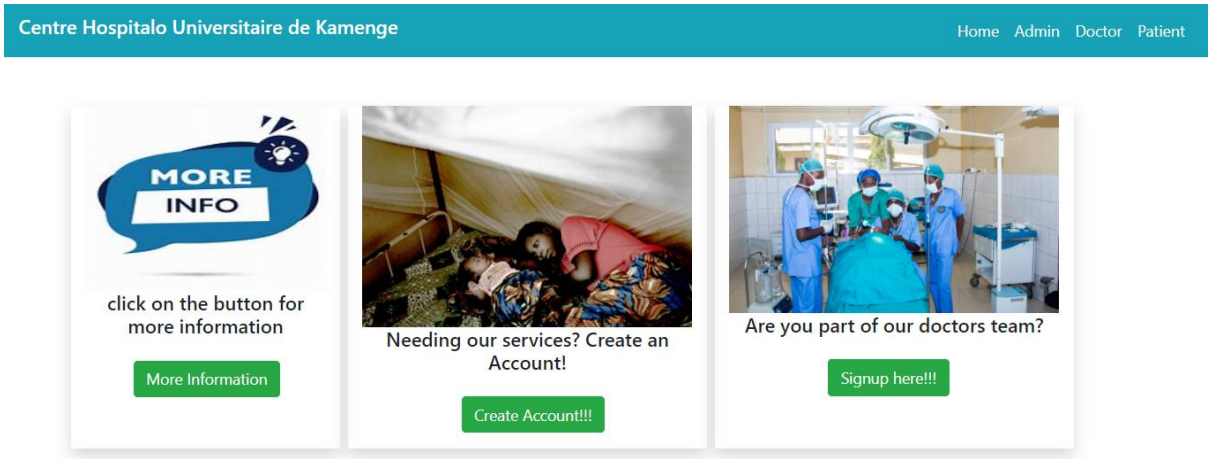


figure 5. 4: CHUK assistance system Home page

5.1.2. Registration page

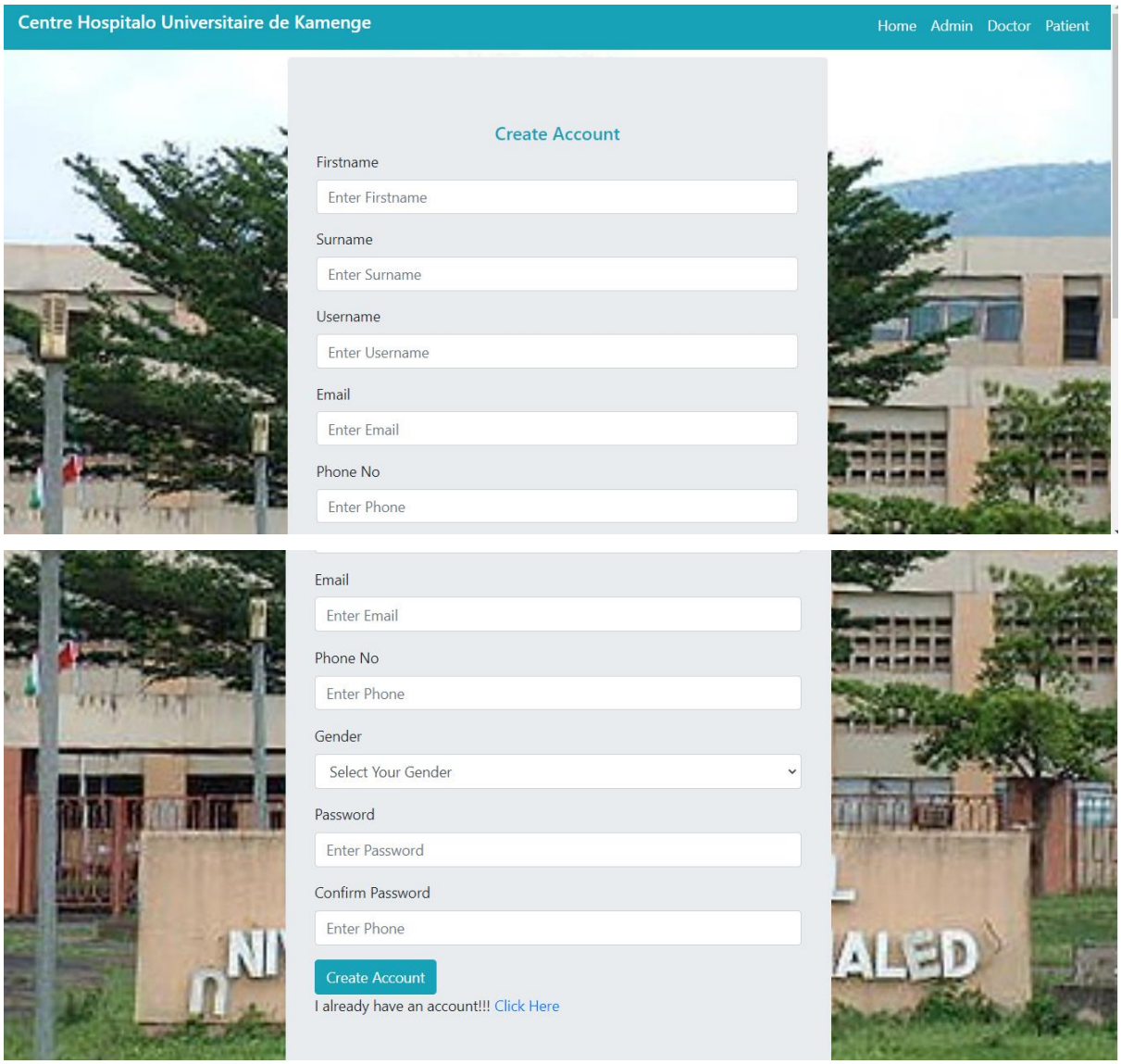


figure 5. 5: CHUK assistance system registration page

5.1.3. Login page

5.1.3.1. Patient Login Page

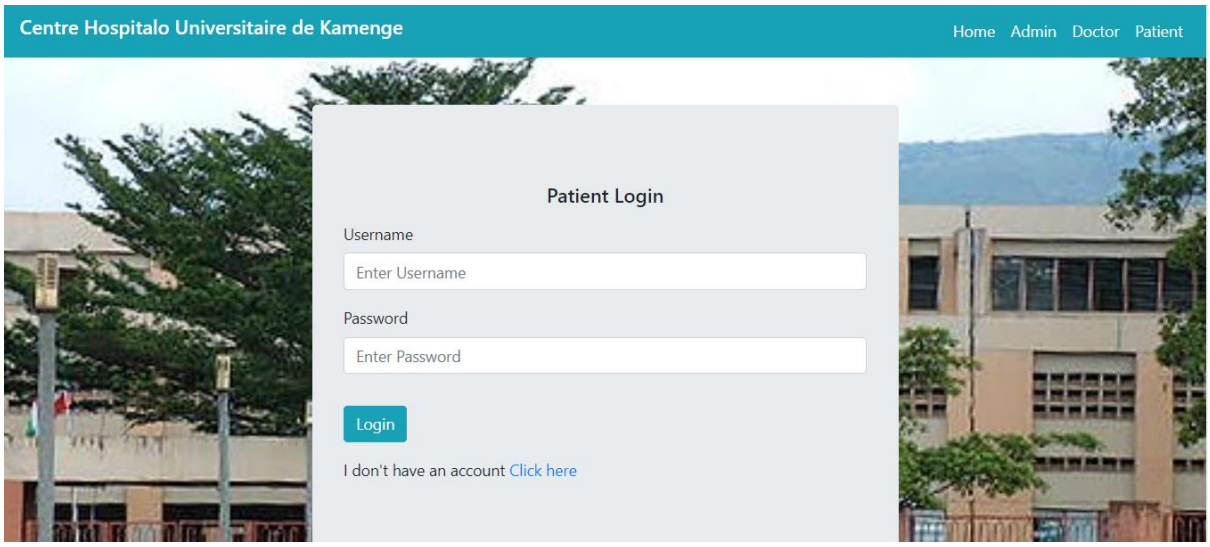


figure 5. 6:CHUK assistance system patient's login page

5.1.3.2. Doctor Login Page

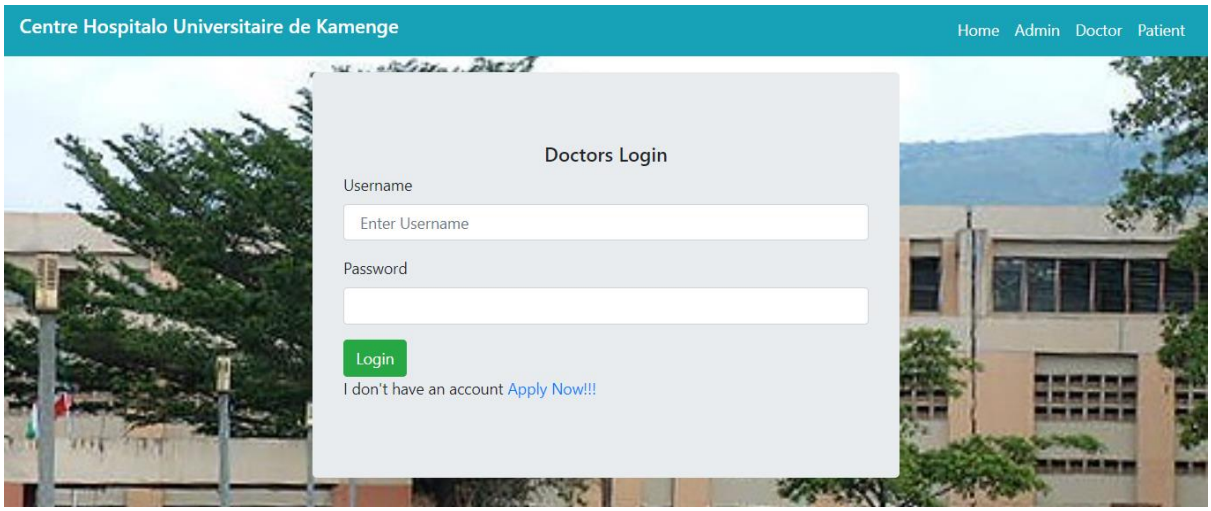


figure 5. 7: CHUK assistance system doctor's login page

5.1.3.3. Admin Login

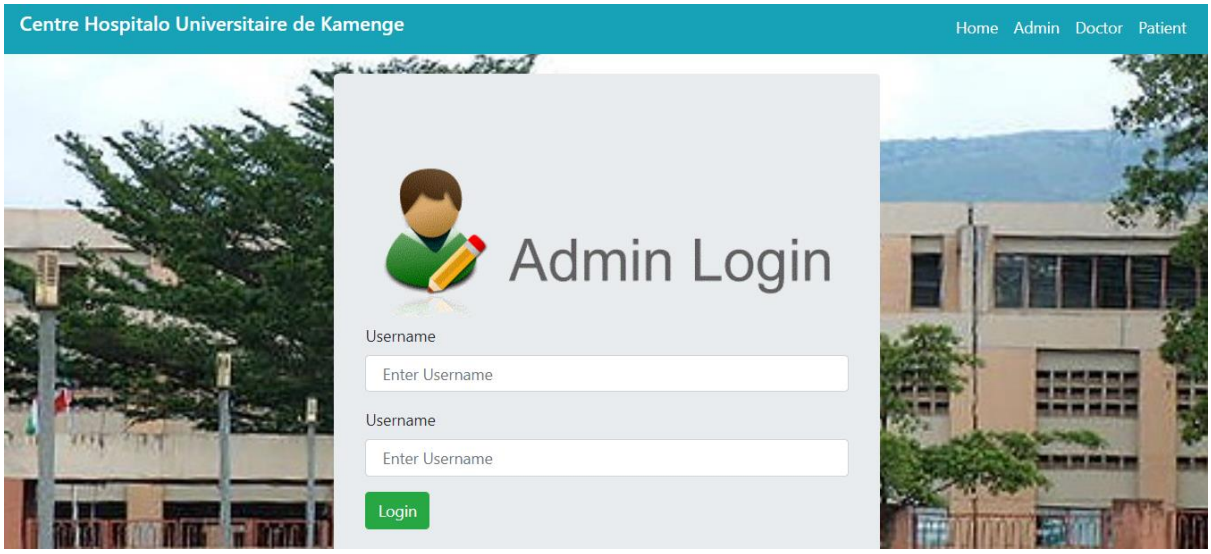


figure 5.7: CHUK assistance system Admin login's page

5.1.4 Patient Dashboard

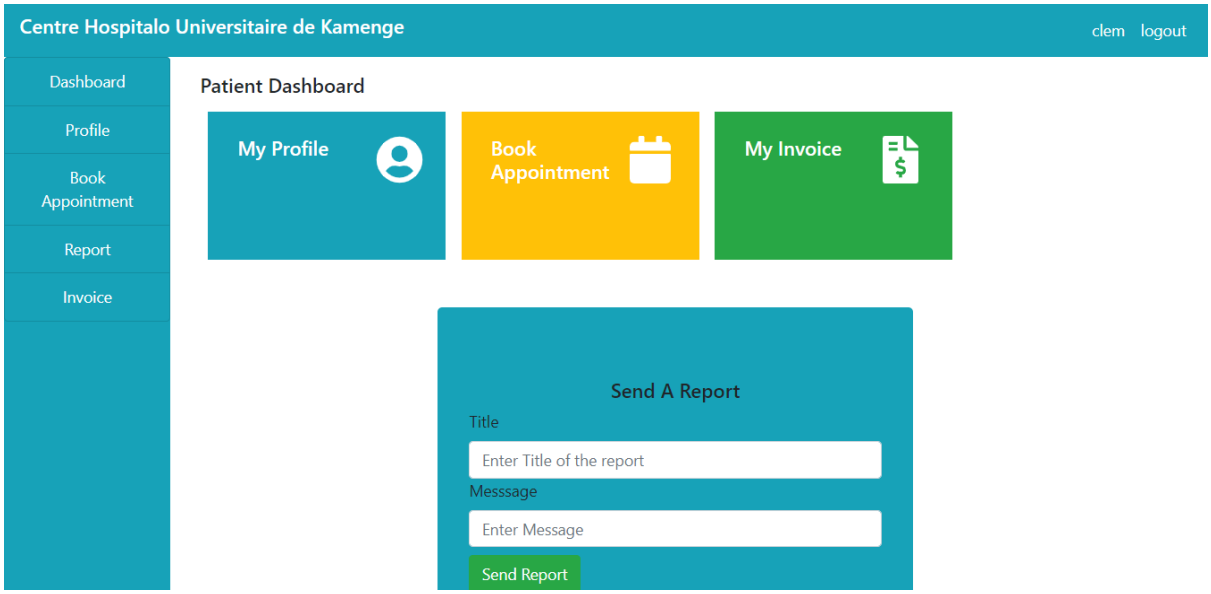


figure 5. 8: CHUK assistance system Patient Dashboard

5.1.5. Doctor Dashboard

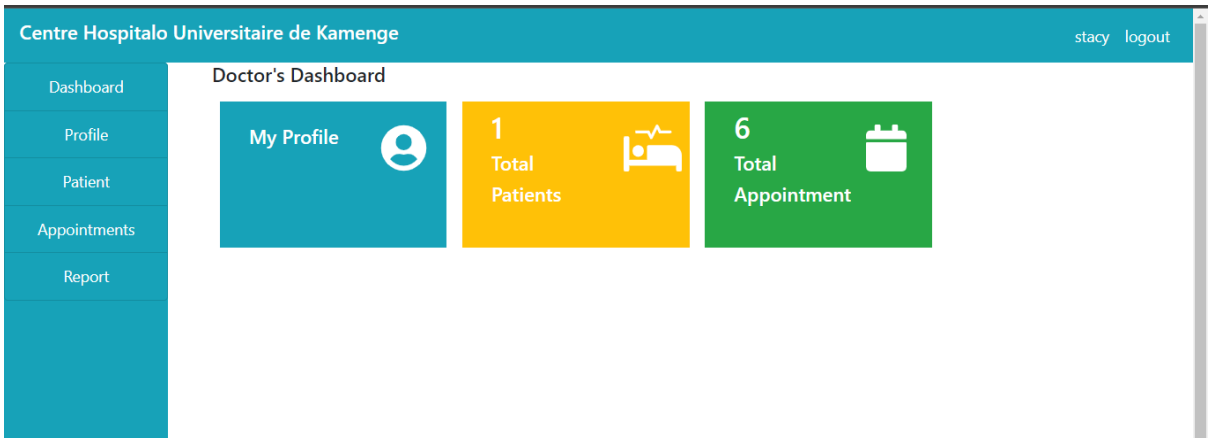


figure 5. 9:CHUK assistance doctor dashboard

5.1.6. Admin Dashboard

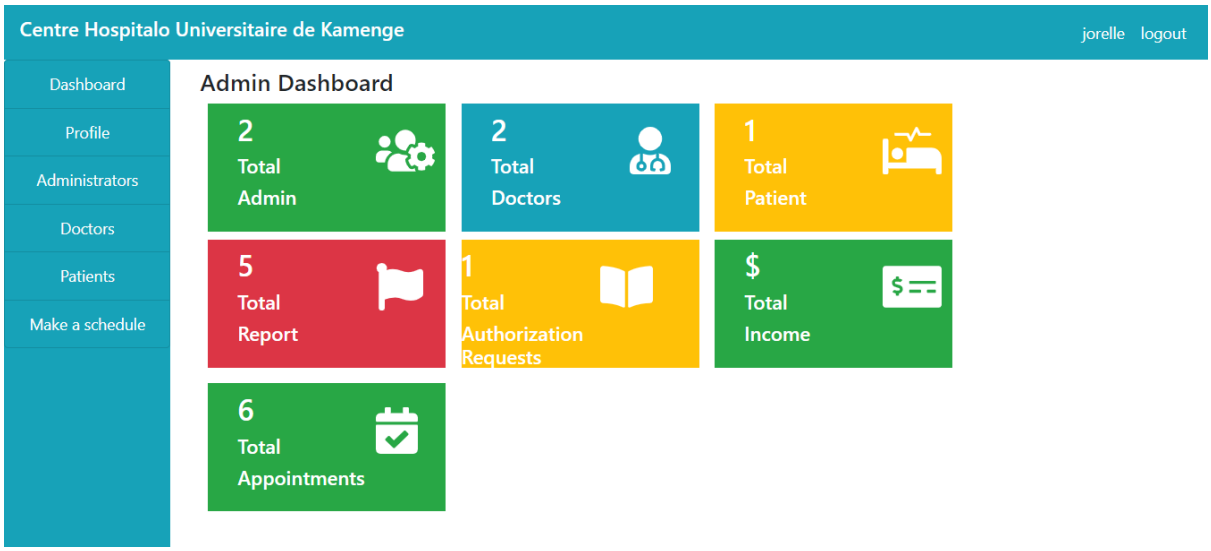


figure 5. 10: CHUK assistance admin dashboard

5.1.7 Patient can book appointment

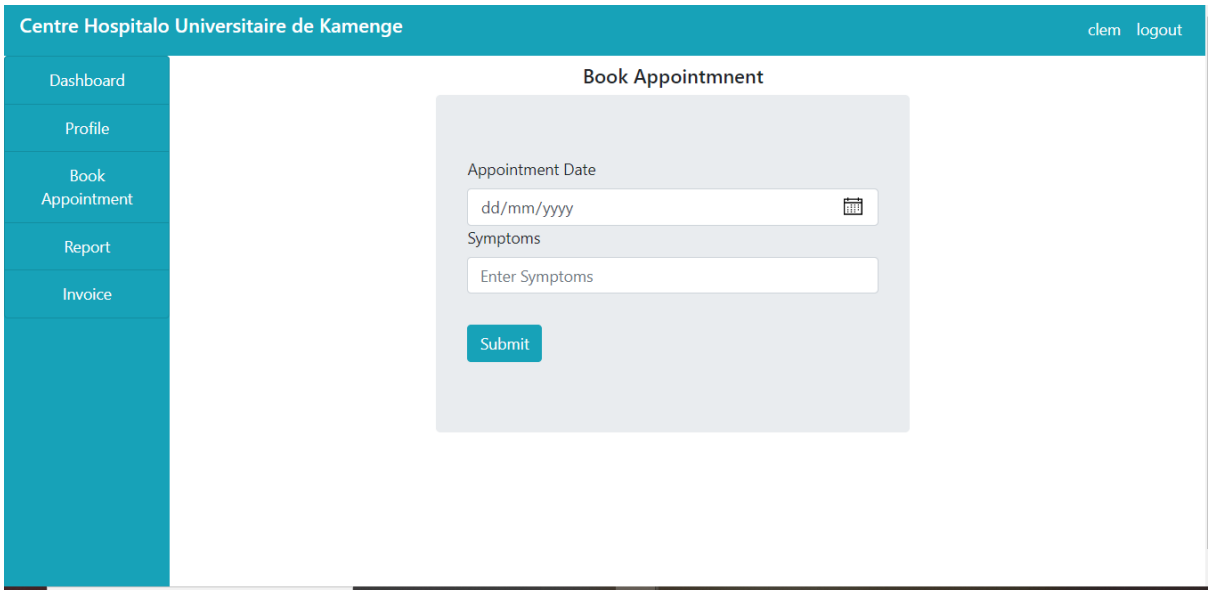


figure 5. 11: Booking appointment page

5.1.8. Doctors can view appointments

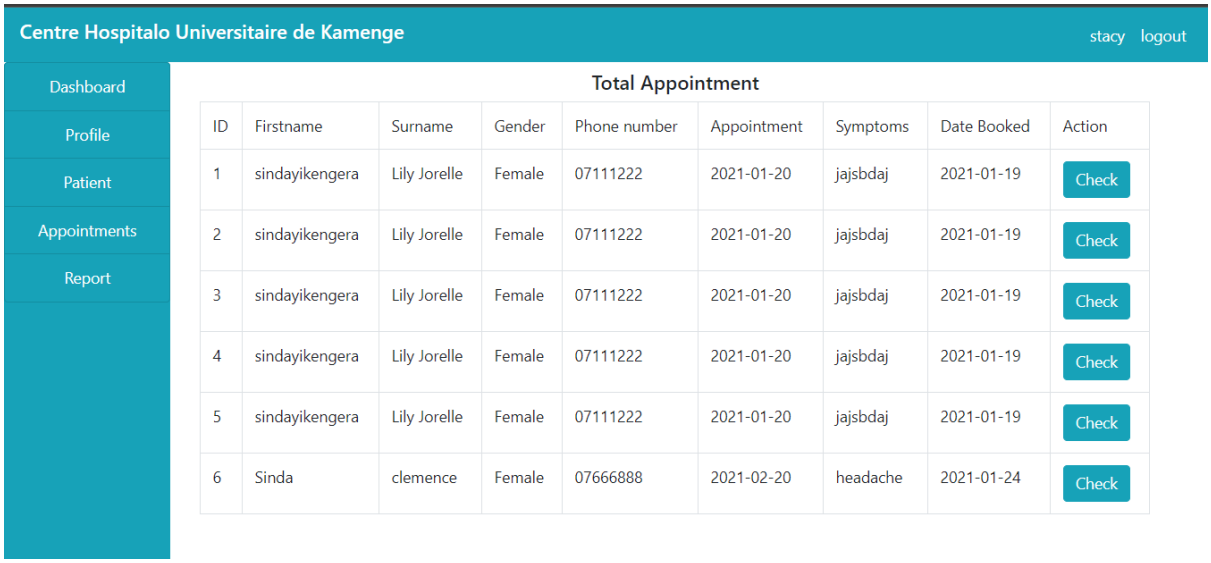


figure 5. 12: View the appointment page

Concerning the back end, the database in phpMyAdmin (part of Wamp server) which is quite simple when it comes to creating and using a database. For accessing phpMyAdmin, the username will be root and the password empty. After you click on go and you can be able to create a database and use it.

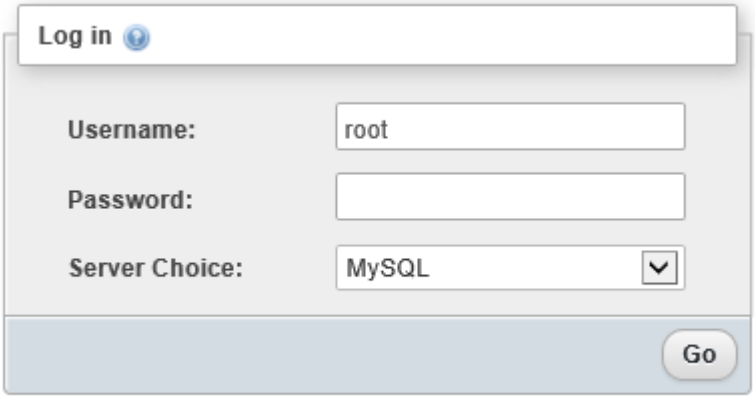


figure 5. 13: PhpMyAdmin login page

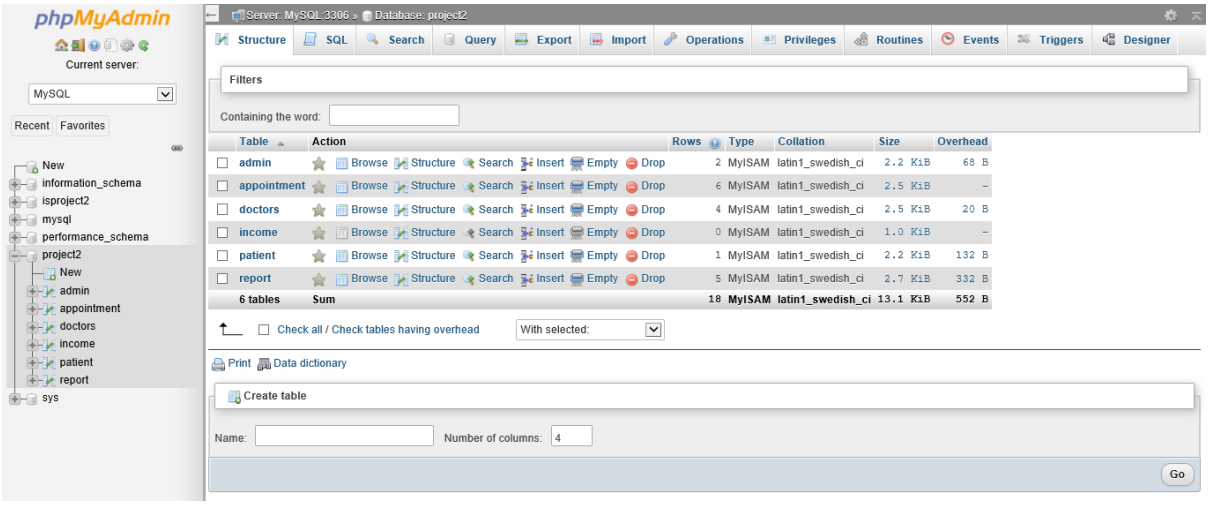


figure 5. 14: Database interface

5.2. System Testing

The system testing was done following these 3 types of testing:

5.2.1. Functionality testing

This is whereby it is checked if the functional requirements have been satisfied. At the end of the CHUK assistance system development, most not if all of the functional requirements as stated in point 4.3.1 had been satisfied.

5.2.2. Usability testing

The testing done under this point is the one that ensures if the system is easy to be used and if its interfaces are user friendly. CHUK assistance system has been developed for an environment that is assumed to be not so much familiar with the use of software systems. Therefore, it has been conceived in a manner that will help the user to understand the flow of information and be able to use the system without any difficulties. For example, at the end of every action, The CHUK assistance system has a way of noticing the user using pop ups, and indicating which action should be taken next.

5.2.3. Unit testing

This is whereby it was checked if the different components of the CHUK assistance system work as specified by the requirements in chapter four while they are not integrated all together. It was found that the components can work properly while not working all together.

CHAPTER SIX: CONCLUSIONS, RECOMMENDATION AND FUTURE WORKS

6.1. Conclusion

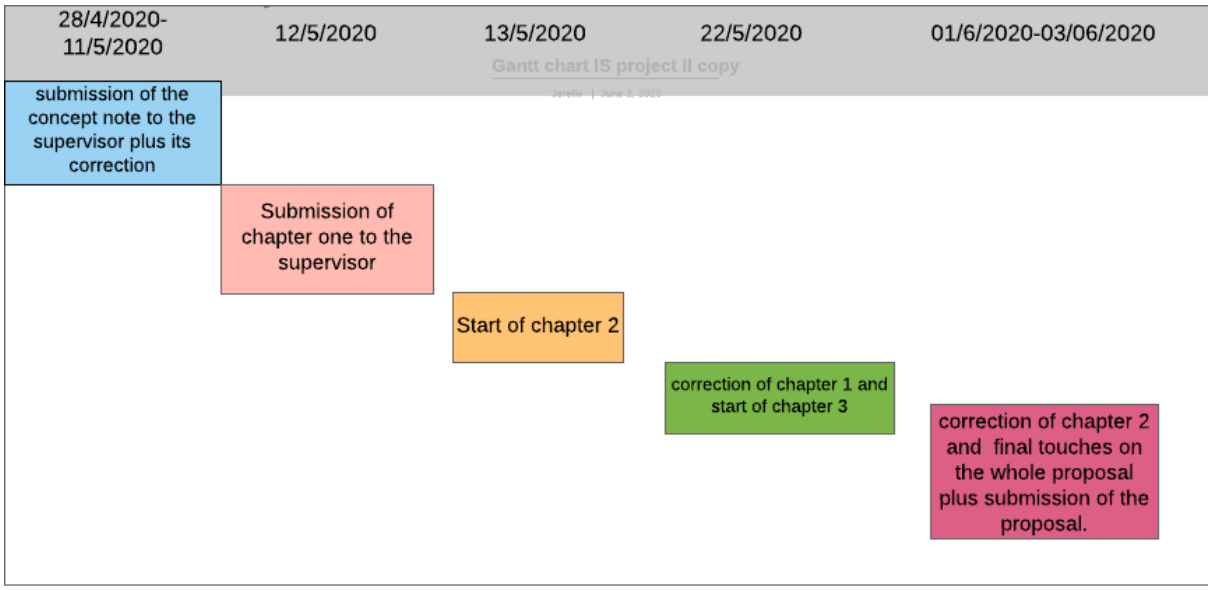
The Burundian health system as many other country's sectors have been facing some problems due to the lack of automation of different services. As stated in point 2.3, Centre Hospitalo Universitaire de Kamenge (CHUK), one of the most popular hospitals of Burundi has been having some management issues due to the lack of automation of its services. Therefore, this work proposes an assistance system to CHUK in order to manage better its services and allow the patients and the doctors to enter into contact easily. The CHUK assistance system will assist in avoiding critical losses like time, money and lives.

6.2. Recommendation and future work

For the CHUK assistance system to be accessed, it is required that the users have a computer and a stable internet connection.

Systems like CHUK assistance systems are more easy to use when they are mobile applications rather than web based systems, therefore as a future work, the CHUK assistance system will be made to be a mobile based application to facilitate its use.

Appendix A: Gantt Chart



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