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A mobile-based system for mental health patients in Kenyan Universities.

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Declaration

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

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Abstract

Mental health is a very crucial part of a person's health, as it accounts to a person's peace of mind. Mental includes a person's emotions, psychological and social wellbeing. Mental health is what majorly determines how a person performs in every part of his life be it at work, at home or with his friends because logically a person can not be at his optimum productivity when he is sad / frustrated or mentally disturbed. It is very unfortunate that this crucial part of a persons health is looked down upon and not given the importance that it deserves making it very difficult for patients to get the help that they need when they need it. Some of the major difficulties that mental health patients face include discrimination and stigmatization from the society whereby these people are regarded as weak. Stigmatization and Discrimination is the main reason as to why Mental health patients refuse to see a specialists under the excuse of putting up a strong façade in the society. Other challenges that mental health patients face include lack of adequate time in the context that university students are usually busy with classes. The few mental health patients who eventually make it to see the specialist, there is no well-defined way for the psychiatrist to follow up on how the patient is doing until the next session.

As clearly explained above, mental health patients face several challenges on their journey to get treatment. To solve these problems, a mobile mental health information system is proposed. The system is able to facilitate the treatment sessions between the doctor and the patient at the comfort of their home. It facilitates the exchange of prescription and the tracking of the patient's progress. The system also comprises of a way to get the patient to reach out for immediate help in case they feel overwhelmed and want to harm themselves. The system is developed using Java and PHP as the programming language and MySQL as the database management system, it also uses firebase to send out push notifications. Laravel framework is used to develop the backend and Android studio was tool used to develop the frontend of the application. In conclusion this system is a valuable application in combating mental health illnesses effectively.

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Abbreviations

IDE – integrated development environment

GUI – Graphical User Interface

API – Application Programming interface.

Chapter 1: Introduction

1.1 Background

Mental health is a very crucial part of a person's health, as it accounts to a person's peace of mind. Mental includes a person's emotions, psychological and social wellbeing. Unfortunately, About 14% of the global burden of disease has been attributed to neuropsychiatric disorders, mostly due to the chronically disabling nature of depression and other common mental disorders (Prof Martin, Prof Vikram, Shakhar, & Prof mario, 2007).

People with mental illness face stigma and discrimination in a variety of settings, which can have an economic impact. (Jessica, Paul, & GrahamThornicroft, 2010). This is not only on the society but also in the country at large. People who talk about their mental illness or discomfort are usually regarded as weak and not strong willed in our community and this is not only wrong but also demoralising. Due to this stigma several mental health patients fail to make an appointment to see a specialist to get help. Mental health patient who do not seek help early enough end up being less productive at work, that is if they are productive at all thus affecting the economy at large.

It is clear by now that mental health is a crucial part of a person's health and must be treated and taken care of as much as physical health. According to the world health organization report in 2001 they discovered that, If projections are correct, within the next 20 years, depression will have the dubious distinction of becoming the second cause of the global disease burden (WHO, 2001). Here we are 19 years later, and it is evident that so many people are facing issues pertaining mental health. Apart from stigmatization and discrimination, some of the other reasons as to why people facing mental health issue do not seek help include: Inadequate time, Failure to follow up on the appointment due to their busy schedule, Inadequate funds. Among other reasons.

To address some of these problems that have been identified above, an information system was developed. The developed system is mobile based thus making it portable and a user can access the doctor from any point that he would like. The system also helps the user to follow up on the prescription that has been given to him. The system also has a fail-safe plan for the user in a situation where they feel suicidal, they may receive help at the press of a button.

1.2 Problem Statement

The traditional ways of treating mental health patients such that the patient has to set up an appointment with the doctor and go the psychiatrists office for the when the time reaches, undertake the session and await for diagnosis and prescription. This has proven to be inefficient due to the stigmatization and discrimination of mental health patients in the society which makes it hard for them to get the medical treatment that they need in our modern, digitalized, and portable world.

The “treatment gap” is also another problem that the proposed system is trying to address as the world health organization has best put it “Mental health is as important as physical health to the overall well-being of individuals, societies and countries. Yet only a small minority of the 450 million people suffering from a mental or behavioural disorder are receiving treatment” (WHO, 2001)

1.3 Aim

The aim of this proposal is to develop a system that digitalizes the mental health medical procedure, to reduce or completely clear the obstacles that a mental health patient faces when trying to get help or when they are undergoing treatment.

1.4 Specific Objectives

- i. To Analyse the mental health treatment protocols and procedures.
- ii. To Examine current systems used in mental healthcare.
- iii. To collect data on how patients are treated, and the standard procedures involved the healing process for the patient.
- iv. To develop a Mobile based application for the patients and doctor’s that will allow them to administer the treatment and follow up on the progress of their patients until the treatment is over.
- v. To test the system.

1.5 Justification

This is a very vital project in these modern day and time, not only because of the pandemic that we are currently facing but also in our day to day lives. The proposed project will be help improve the mental health systems that are present already and help put a system in place for the countries that do not have a well-defined mental health system.

As stated above, mental health is a vital part of a person's health, it largely contributes on the functionality and productivity of a person and just as the world health organization stated in their report, "for all individuals, mental, physical and social health are vital strands of life that are closely interwoven and deeply interdependent. As understanding of this relationship grows, it becomes ever more apparent that mental health is crucial to the overall wellbeing of individuals, societies and countries" (WHO, 2001)

1.6 Scope and Limitations

1.6.1 Scope

Just like any project this too has a specific scope that it will focus on and a couple of things that it will cover these will be:

1. The proposed project will enable a patient to undergo mental treatment in terms of sessions remotely
2. The proposed system will also allow the patient and the doctor to exchange prescriptions and track progress on how the patient is reacting with the treatment.
3. The proposed system will also allow the patient to seek medical attention in case he/she feels suicidal.
4. The proposed system will also allow the user to access blogs and articles that will help them cope with their current situation.

1.6.2 Limitations

Some of the minor limitations that the proposed project will have are:

1. The proposed system is targeting the people that are mobile phone literate.
2. The system will also require the user to have an internet connection.

Chapter 2: Literature Review

2.1 Introduction

This chapter reviews the existing literature on the current state of mental health illnesses treatment in Kenya and the world in general and some of the sectors that would require improvement. This chapter will also focus on reviewing current technological trends and applications that are used to manage or help in the treatment of mental health illnesses. After a careful review of these sectors a conceptual framework on how the proposed system will help reduce if not solving these drawbacks completely, will be explained.

Schizophrenia, depression, epilepsy, dementia, alcohol dependence and other mental, neurological and substance-use (MNS) disorders constitute 13% of the global burden of disease, surpassing both cardiovascular disease and cancer. (Collins, Patel, & et al, 2011)

Depression is the third leading contributor to the global disease burden, and alcohol and illicit drug use account for more than 5%. Every seven seconds, someone develops dementia, costing the world up to US\$609 billion in 2009. (Collins, Patel, & et al, 2011)

There are various ways on treating mental health illnesses that vary with the type of illness the patient is facing, however, “For many people with mental illness, the concept of recovery is about staying in control of their life rather than the elusive state of return to premorbid level of functioning” (Jacob, 2015).

2.2 Current system of mental health illnesses treatment.

The main way of treating Mental health illness is a process that involves setting an appointment with the specialist that will diagnose the type of illness that the patient is facing by asking questions and taking notes. After carefully make a diagnosis the doctor will prescribe the necessary drugs to be purchased and schedule a next appointment with the patient if needed and these will continue until the patient is feeling better.

As the Professor of Psychiatry, Christian Medical College stated in his article, on the traditional way of treating patients, “Doctors listened to patients’ concerns, examined them, ordered laboratory investigations, diagnosed disease, prescribed medication and prognosticated about course and outcome. While they did explain the issues to their

patients, medical perspectives and opinions guided their decisions. Patients were expected to follow their advice. (Jacob, 2015).

This paternalistic approach of treating patients with mental health illnesses is both outdated and inefficient since “medical profession often dismissed patient perspectives and did not take kindly to objections or different points of view”. (Jacob, 2015).

2.3 Demerits/drawbacks in the current system.

The current system of treating mental health that has been described in the sub-section above has several drawbacks such as: stigmatization, discrimination and It is highly time consuming. These drawbacks and limitations are what will be reviewed in this subsection.

2.3.1 Stigmatization

“Mental illness stigma continues to be a major barrier for individuals with mental illness” (Ciftci & Jones, 2012). It is very unfortunate that patients with mental health illnesses do not try to reach out for help at the early stages of the illness but rather withdraw from the society until much damage has been inflicted on both their work and society. Stigmatization that the patient feels is usually the main problem at this stage because people in the society might call them “crazy” or weak.

2.3.2 Suicidal Attempts

Another demerit of the current system is that, in case of emergencies such as when a patient experiences an overwhelming stream of suicidal thoughts, It is upon the patient to reach out to people who may or may not take him/her seriously, hence increasing the chances of a patient committing suicide. Just as Collins and his colleagues’ in their periodical journal “By 2020, an estimated 1.5 million people will die each year by suicide, and between 15 and 30 million will make the attempt” (Collins, Patel, & et al, 2011) .

2.3.3 Time Consumption

The current system is also faced by the challenge of being time consuming. In the time and age everyone is in a rush and the process of mental health illness treatment is long, tiring and not at all flexible as a matter of fact, the patient has to see the specialist for as long as the specialist finds it necessary so it is hard to even adjust or put it in someone’s schedule.

2.4 Technological solutions to help in treatment of mental health illnesses.

Now that the gaps and demerits in the current system have been addressed above in this subsection a review of the technological solutions that have already been implemented will be brought to light.

One of the methods that technology has implemented is the use of tele counselling. “Distance counselling (telecounseling) is a method of service delivery with potential to supplement traditional mental health counselling” (Riemer-Reiss & Marti, 2000).

This technique is one that allows a patient to receive counselling over a phone call or an online meeting this meeting has a lot of advantages that were explained in the journal of mental health counselling such as “Advantages of distance mental health counselling include increased resources, cost-effectiveness, convenience, and efficiency.” (Riemer-Reiss & Marti, 2000)

The technique stated above has a lot of advantages as stated above but it also has a number of demerits and gaps such as “The challenges of using this mode of communication in mental health settings involve potential technological difficulties, discomfort with technology, relationship development, access to technology, and ethical issues” (Riemer-Reiss & Marti, 2000)

Another technological solution that has implemented to help in the treatment of mental health illnesses are mobile applications such as calm and better help that allow a user to monitor their mood and identify triggers that make them have suicidal thoughts. By identifying the triggers that make them have suicidal thoughts the patient can manage their moods. “Calm was branded as Apple’s “App of the Year” in 2017. The app is designed to reduce anxiety, improve sleep, and help you to feel happier.” (Nichols, 2018)

As for better help, this is an application that facilitates online therapy sessions between the patient and the specialists. This technological solution is effective and saves a lot of time for both the doctor and the specialist. The patient usually logs into the application schedule and appointment and they have a video conference on skype or

on another chatting application. After the session, the specialist sends the prescription to the patient and that how the system works.

2.5 Existing gaps in mobile applications.

The previous sub-section was mainly focused majorly on the current existing technologies that are present in the market. In this subsection the focus will be majorly on the gaps that exist in the previously discussed technological solutions.

To begin with the teleconferencing technique, as stated before this method is effective and saves on time however, it has some disadvantages as stated Marti and his colleague “The challenges of using this mode of communication in mental health settings involve potential technological difficulties, discomfort with technology, relationship development, access to technology, and ethical issues”

Some of the disadvantages of applications such as calm and better help is that there is discontinuity in the treatment and no follow up or a way of tracking the patients progress to see how the treatment is affecting them. There is also no way of sending out an emergency distress message in case the person gets suicidal thoughts while undertaking their treatment.

2.6 Conceptual Framework.

After analysing the traditional procedure of treating mental health patients and the challenges that the traditional method was facing, the sub-section tried to analyse how technological solutions have tried to solve / curb these challenges and finally the gaps that still persist in these solutions. In this sub-section the focus will be on how the proposed system will try to curb / address the gaps that exist and how it will improve the current system of mental health treatment.

To begin with the proposed system will facilitates the appointment of the patient and the specialist and allow them to send each other both notes and prescription on the system while the session is ongoing and after the session is over.

After the session is complete the proposed system will have very helpful materials in form articles that will encourage the patient and teach them how to deal with anxiety and all the symptoms of mental illness and the triggers they face.

The proposed system will also allow the specialist to follow up on their patient's progress. It will also have a panic button that will help a patient get immediate medical attention in the scenario that the patient feels like they want to commit suicide.

A simple visual way to describe this system is by a diagram as below:

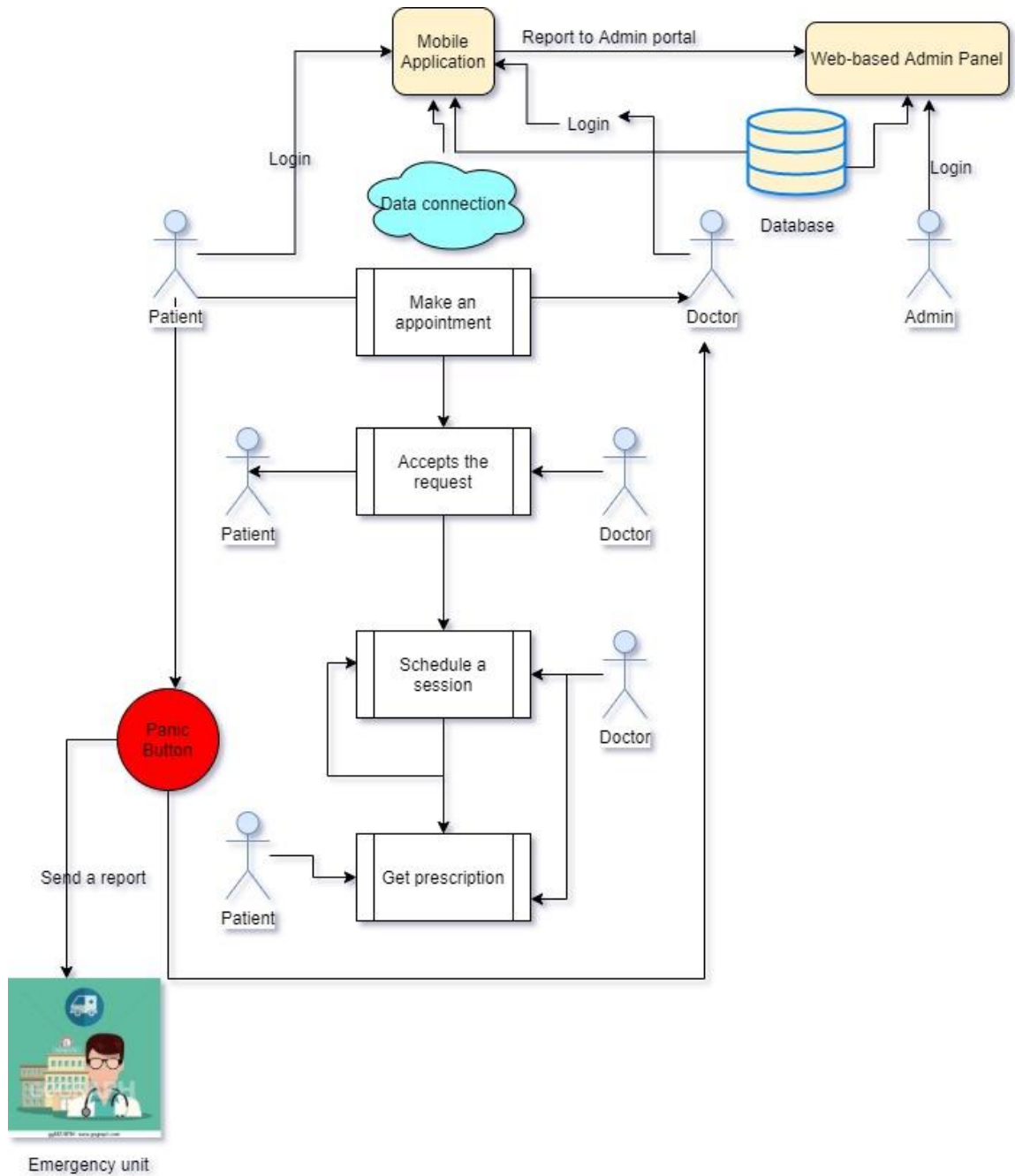


Figure 1.1 System Design Diagram

Chapter 3: System Development Methodology

3.1 Introduction

This chapter gives a summary of the methodology that has been used to develop the system. To begin with the methodology and the stages that are a guide to the development of the system are clearly explained.

After the methodology has been explained the chapter focuses on the functional and non-functional requirements, tools and techniques that are used to develop the system and finally conclude on the milestones and deliverables of the system.

3.2 System Development Methodology

As explained by Abdellatif Benzine a system development methodology is “a standard process followed by an organization to conduct all the steps necessary to analyze, design, implement, and maintain information systems” (Benzine, 2002)

The system used the object-oriented analysis and design methodology and the prototyping framework in the analysis, design, implementation and testing of the system. This methodology has been justified and explained in detail in the subsequent sub-sections.

3.3 Object Oriented System Development Life Cycle.

The object-oriented approach /methodology is majorly focused on the capturing the structure and behaviour of the system into small modules that combines both data and processes. This approach gives room for module testing as the system is being developed hence Improving on the quality of the product and the level to which the customer is involved.

The Rapid Application development (RAD) framework goes hand in hand with the object-oriented approach such that prototyping is a sub-process in the object-oriented analysis and design methodology. The Prototyping framework/ methodology is a framework used in system development where “the developer presents the user with a series

of rough approximations (or prototypes) of the computer system” (Burns & Dennis, 1985).

Developing with the object-oriented analysis and design methodology involves going through five stages that will be explained in detail below:

3.3.1 Object-oriented Analysis

In this phase of system development, the developers analyzed the system requirements and developed a use case model to describe the interaction between the user and the system.

3.3.2 Object-oriented Design

The objective of this phase was to design and refine the classes, attributes, methods, and structures that are identified during the analysis phase, user interface, and data access. This phase also identified and defined the additional classes or objects that support implementation of the requirement.

3.3.3 Prototyping

After identifying the system requirement and making the design for the system then the first prototype was made to better understand how the user requirements will be made and implemented.

3.3.4 Implementation

After developing the prototype, we move into implementation of the requirement in terms of coding. Under implementation we can use either component-based development or Rapid Application Development.

The developed system will use the Rapid Application development approach.

3.3.5 Incremental Testing

After development of a module the module undergoes testing and at different stages of development the prototypes are tested this is what is meant by incremental testing in this section.

3.4 Justification of Methodology

The prototyping methodology is by far the simplest approach to use in terms of system testing and client involvement as Jane E Tozer said in her periodical journal “It is common these days to build prototype systems before delivering an expensive system. However, there can be much conflict between developer and user about timescales, adjustments and a deliverable end result. One UK software house shows how conflicts can be avoided through clearly defined project roles and adoption of a workable methodology.” (Tozer, 2003).

Prototyping, through its process of gradual refinement, helps match the performance of the evolving system to user expectations, thus increasing satisfaction (Burns & Dennis, 1985).

“The prototyping methodology is based on one simple proposition: users can point to features they don't like about an existing system (or indicate when a feature is missing) more easily than they can describe what they think they would like in an imaginary system". Rather than force the user to attempt to understand the many minute details of a paper system design specification (often several hundred pages), the developer presents the user with a series of rough approximations (or prototypes) of the computer system. (Burns & Dennis, 1985)

3.5 Methods of data collection

Some of the methods that were used to collect data to be analysed to better understand the project are:

3.5.1 Research

Due to the current constraint of covid-19, research is one of the major ways in which data has been gathered and collected. Research material that has been used in the system include journal articles, books, academic papers, and Organizational reports on mental health that have been referenced in the reference section.

3.5.2 Observation

Another method that has been used to gather information on the system is by observing the people in my environment how they react to the current stressful situations and how they are handling the pandemic.

3.5.3 Questionnaires

Finally to gather more data on the mental health topic a questionnaire has been sent out to the sample population which comprises of random university students in Strathmore university to better understand the needs of the patients that the application will serve.

3.6 Data Analysis methods

After the collection of data in the previous subsection the data will go further to be analysed using the following methods.

3.6.1 Content Analysis

This is one of the most common methods to analyse qualitative data. It is to simply analyse the data/responses based on what an interviewee or responses from a questionnaire. This method of data analysis is appropriate to use to analyse the questionnaires that will be sent out.

3.6.2 *Statistical Analysis*

Statistical Analysis is the best way to the close ended questions such as do you feel mental health patients are discriminated? Such quantitative questions can be analysed by evaluating the mean, median based on the responses from the questionnaire.

3.7 Ethical Considerations

While conducting this research some ethical measures have been put to place to ensure that every person who participated has agreed on this and is okay to be part of it.

Some of the measures include:

3.7.1 *Voluntary participation*

All the people involved in this research have voluntarily agreed to take part in it for the wellbeing of other people.

3.7.2 *No harm done*

No one was harmed physically or mentally during this research and as it was a safe and easy questionnaire to fill in.

3.7.3 *Confidentiality*

All the information that has been provided will be in the research will be kept confidential and will only be accessed by the research coordinator.

3.8 Proposed Functional Requirements

As defined by Kevin MacG and Adams a functional requirement is “a statement that defines what a product or process must accomplish to produce required behaviour and/or results. Functional requirements can also be described as A requirement that specifies a function that a system or system component must be able to perform.” (Adams, 2015)

Some of the functional requirements that the proposed system will have are:

3.8.1 *Authentication*

The first functional requirement of the system is to register and authenticate users to protect and secure the data that the users will be providing.

3.8.2 *Facilitate the appointment*

After authenticating the user on registration and logging in, the next functional requirement is to facilitate the treatment that is to allow the patients to request for appointments and the doctors to accept or reject the appointment.

3.8.3 Facilitate the exchange of prescriptions and progress tracking

After facilitating the treatment, the next functional requirement is to enable the exchange the of any prescription and track the progress by prompting the patient to fill in how they feel regularly.

3.8.4 Emergency Functions

The proposed system should also be able to allow the user to make an emergency attempt to reach out in case they are not in control of their mental state.

3.8.5 Administrative functions

After the conducting the treatment and tracking functionalities the proposed system should be able allow and administrator to view and manage users on the web-admin portal.

3.8.6 Reporting functions

The final function is that the proposed system should generate helpful report such as what helps patient get well faster.

3.9 Proposed Non-functional Requirements

A system cannot perform well just being functional but rather some non-functional requirements are necessary to improve the functionality of the system. Some of the non-functional requirements include:

3.9.1 Performance

The first functional requirement is to ensure that the proposed system works with a certain speed and ensure that the down time is reduced, and the uptime of the proposed system is maximized.

3.9.2 Accuracy

The proposed system should also be able to present, and report correct data that the user has enrolled with, in the system without corrupting or changing it in any way.

3.9.3 Usability

The propose system should also be user friendly in the sense that, it is easy for a user to manoeuvre around and find what they are looking for.

3.9.4 Security

Finally, it is highly crucial that the proposed system protects and secures the data that will be going through the system due to patient doctor privilege.

3.10 Tools and Techniques

Some of the tools and techniques that will be used in this chapter are:

3.10.1 Android Studio

This is the main Integrated development environment (IDE) that will be used in the development of the proposed system for the mobile application using java for android programming language.

3.10.2 Firebase

Fire base will majorly be used to facilitated push notifications from the app to the user to alert them to keep track of their progress and to encourage them to learn better ways to help themselves recover faster.

3.10.3 Bootstrap

Bootstrap will majorly be used for the graphic user interface (GUI) to make the administration panel more appealing and easier to navigate.

3.10.4 Laravel Framework

Laravel is a PHP framework that will harbour the backend of the mobile application. It will be the sever that will communicate with the backend of the application.

3.10.5 MySQL

MySQL is the relational database that will be used to create database and manage the data that will be following into and out of the application.

3.10.6 PhpMyAdmin

This is the software that will be used to manage the MYSQL database the will be used for the project on the web.

3.10.7 Post Man.

Postman is tool that will be used the Application program Interfaces (API) that will be used to retrieve data from the database to the android application by using Laravel as the server.

3.11 List of diagrams that will be drawn in chapter 4

The proposed system will use the OOAD method where the following diagrams will be drawn:

- i. Use case diagram.
- ii. Class diagrams

- iii. Sequence diagrams
- iv. Database schema
- v. Graphical User Interface (GUI) wire Frames.

Chapter 4: System Analysis and Design.

4.1 Introduction

The aim of this chapter is to highlight the methods and techniques that we used to gather the system requirements. The major focus of this chapter will be on the system and what the system will be capable of achieving at the end of the day. After Identifying the system requirements, the system architecture will be presented as an illustration of how the different modules interact to accomplish these requirements.

4.2 Requirements Gathering

Two main methods were used to get the perspective of the end users of the system and what functionality would best suit their needs as stated in chapter 3. The results of the questionnaire and the interviews underwent both qualitative and quantitative analysis and from this analysis the functional and non-functional requirements were derived.

Questionnaires were drafted using google forms and distributed using several platforms such as social media and email. The questionnaire included both open-ended and closed questions that allowed the data to undergo both qualitative and quantitative analysis. Using questionnaires data was able to be collected from different people that were not reachable through physical contact.

The second method that was used were Interviews, this technique was conducted on participants that gave their consent and were informed about the purpose of the interview. Being face to face with the interviewee made them more comfortable speaking out their views and what changes they would like to be implemented in the mental health care system.

4.3 System Requirements

4.3.1 Functional Requirements

The mental health application system has three main modules which are:

4.3.1.1 Admin

The admin is the administrator of the system and he/she is mainly an administrator and a regulator of the entire system he/she is responsible of making suspending rogue doctors as well as settling payments.

The table below summarizes the functional requirements of the admin.

ID	Description
FRQ1	The system should allow the admin to sign in
FRQ2	The system should allow the admin to view all the system users
FRQ3	The system should allow the admin to approve and suspend users.
FRQ4	The system should allow the admin to view payments for the appointments made
FRQ5	The system should allow the admin to generate reports
FRQ6	The system should allow the admin to view and export appointments by date
FRQ7	The system should allow the admin to create a blog
FRQ8	The system should allow the admin to logout

Table 1.1 Admin Functional Requirements

4.3.1.2 Doctor

ID	Description
FRQ9	The system should allow the doctor to register
FRQ10	The system should allow the doctor to set a pin for their account.
FRQ11	The system should allow the doctor to upload their required documents for verification
FRQ12	The system should allow the doctor to accept appointments from patients
FRQ13	The system should allow the doctor to start and terminate appointments
FRQ14	The system should allow the doctor to make a prescription
FRQ15	The system should allow the doctor to view appointments that he facilitated
FRQ16	The system should allow the doctor to receive panic alerts from patients.
FRQ17	The system should allow the doctor to logout of the system

Table 2.1 Doctor Functional Requirements

4.3.1.3 Patient

ID	Description
FRQ18	The system should allow a user to register and login as a patient.
FRQ19	The system should allow the patient to view and read blogs
FRQ20	The system should allow the patient to request for an appointment
FRQ21	The system should allow the patient to view the details of all their previous appointments
FRQ22	The system should allow the patient to view any prescription that they have been given to them.
FRQ23	The system should allow the patient to send out a panic alert to the doctor and admin when in distress
FRQ24	The system should allow the patient to make payment before the start of an appointment.

Table 3 Patient Functional Requirement

4.3.2 Non-functional Requirements

ID	Category	Description
NFRQ1	Usability	The system should be easy to use and navigate for the end users
NFRQ2	Reliability	The system should provide security for the users and their data that is stored in it.
NFRQ3	Recovery	The system should not allow for the permanent deletion of data but rather go for a soft delete where data can be recovered if/when needed
NFRQ4	performance	The system should be able to cater for the request of its end users at an optimal speed.
NFRQ5	Supportability	The system should be able to run on multiple devices without crashing to allow all end users to access the system

Table 4 system Non-functional Requirements

4.4 System Architecture

The system architecture is a diagram that describes the relationship between the main entities of a system. The main components of the developed system and their relationships are shown below:

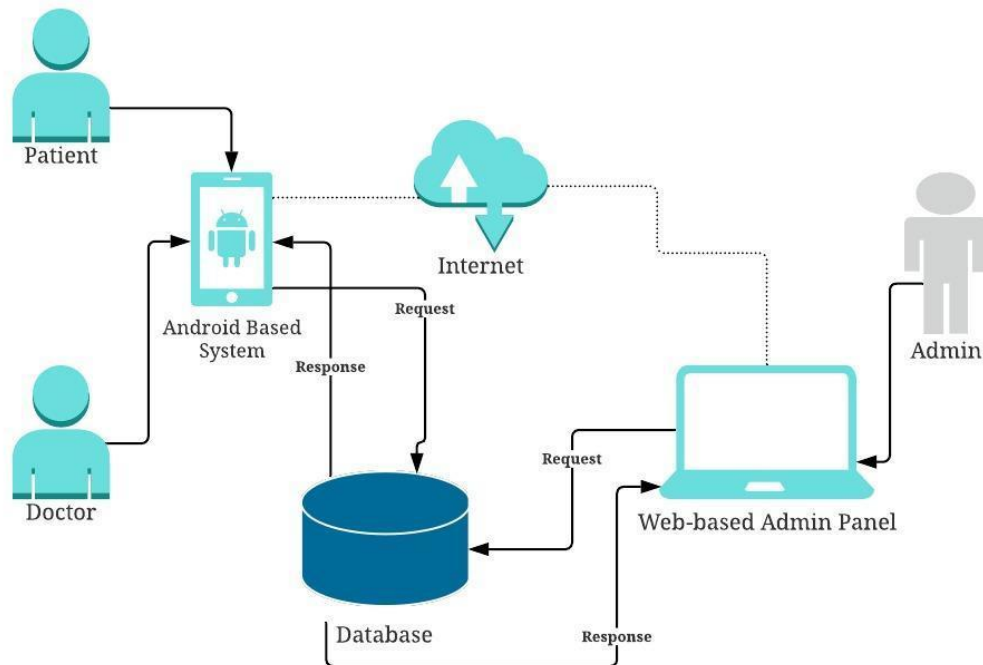


Figure 2 System Architecture

The developed system contains three major entities the Patient, the Doctor, and the admin. The patient and the doctor will conduct the requesting the appointments on the android side of the application because it is convenient and very portable. As for the admin his major base of operation is the web based application where he will monitor the operations and transactions of both the patient and the Doctor.

4.5 System Designs

4.5.1 Use-case Diagram

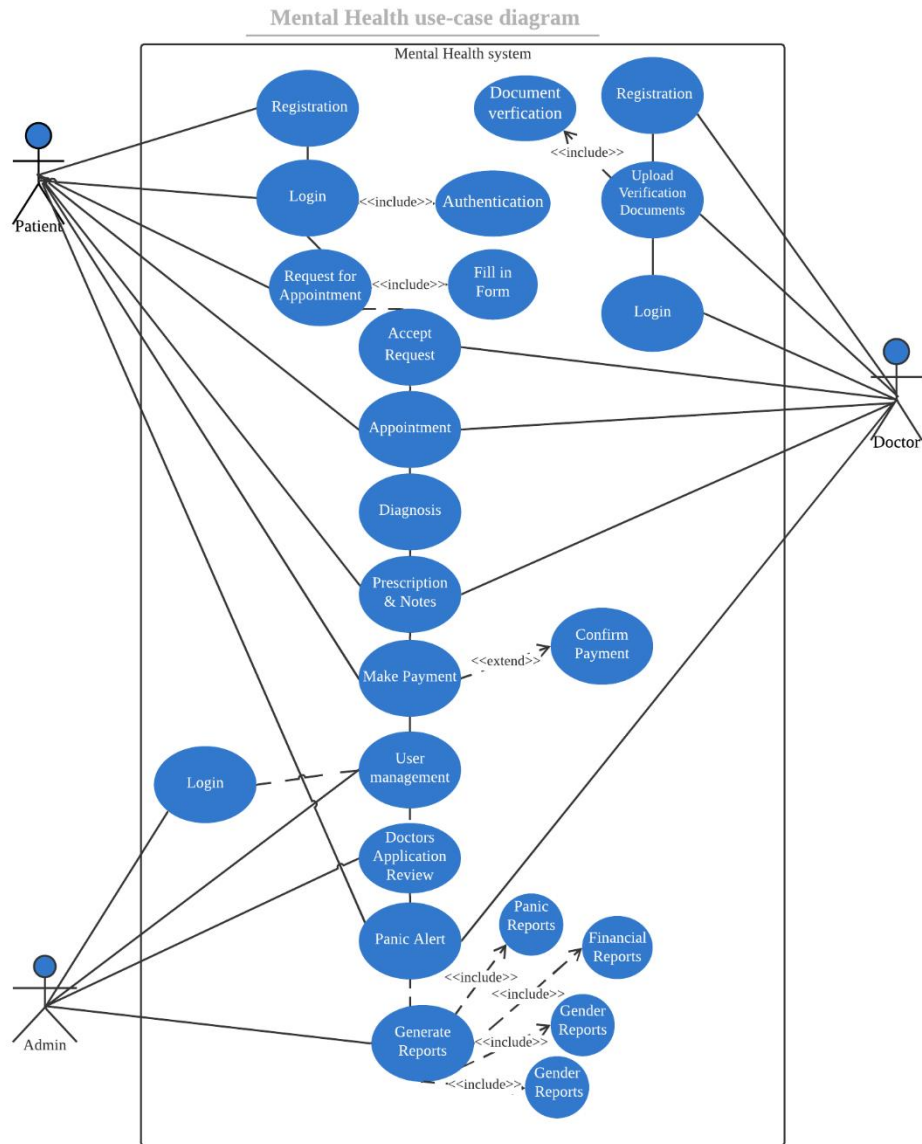


Figure 3 System Use-case Diagram

4.5.2 Class Diagram

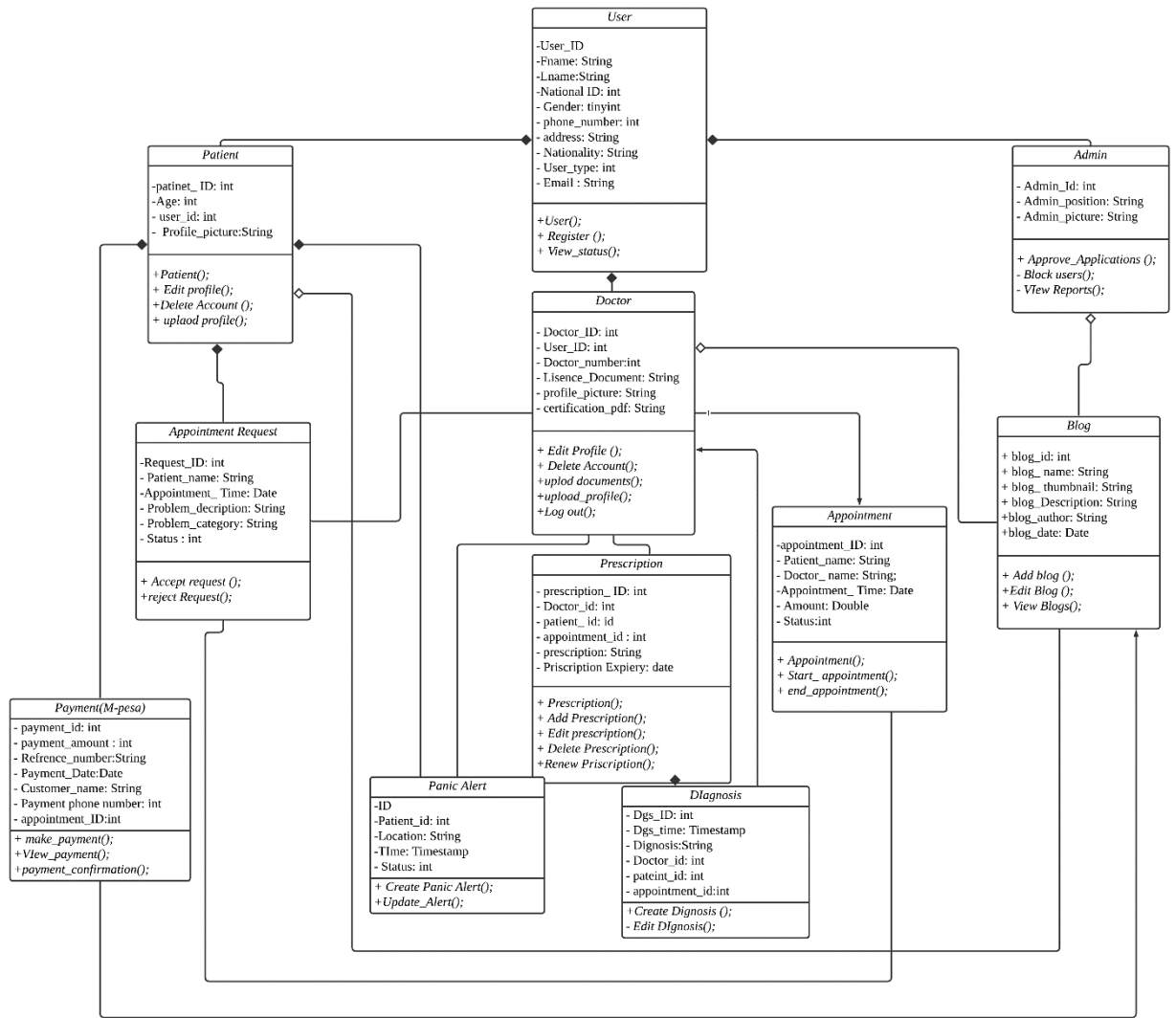


Figure 4 System class Diagram

4.5.3 Sequence Diagram

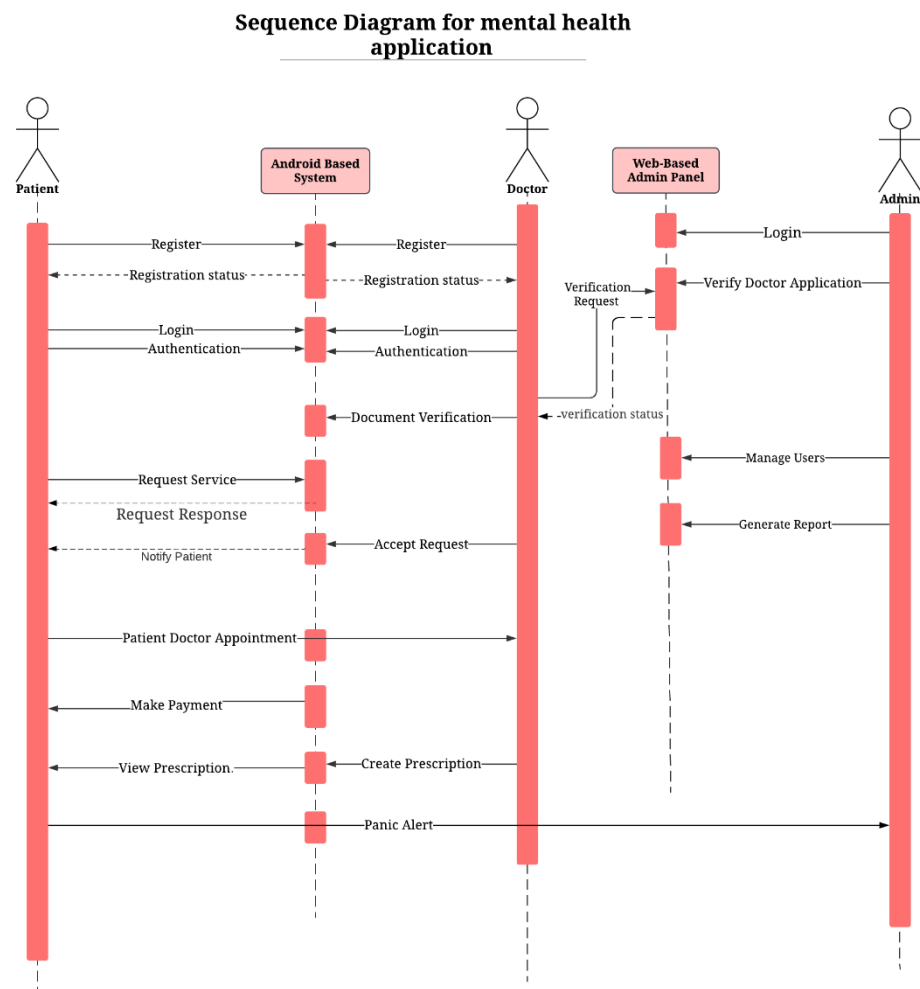


Figure 5: Mental Health Sequence Diagram

4.5.4 Entity Relationship Diagram (ERD)

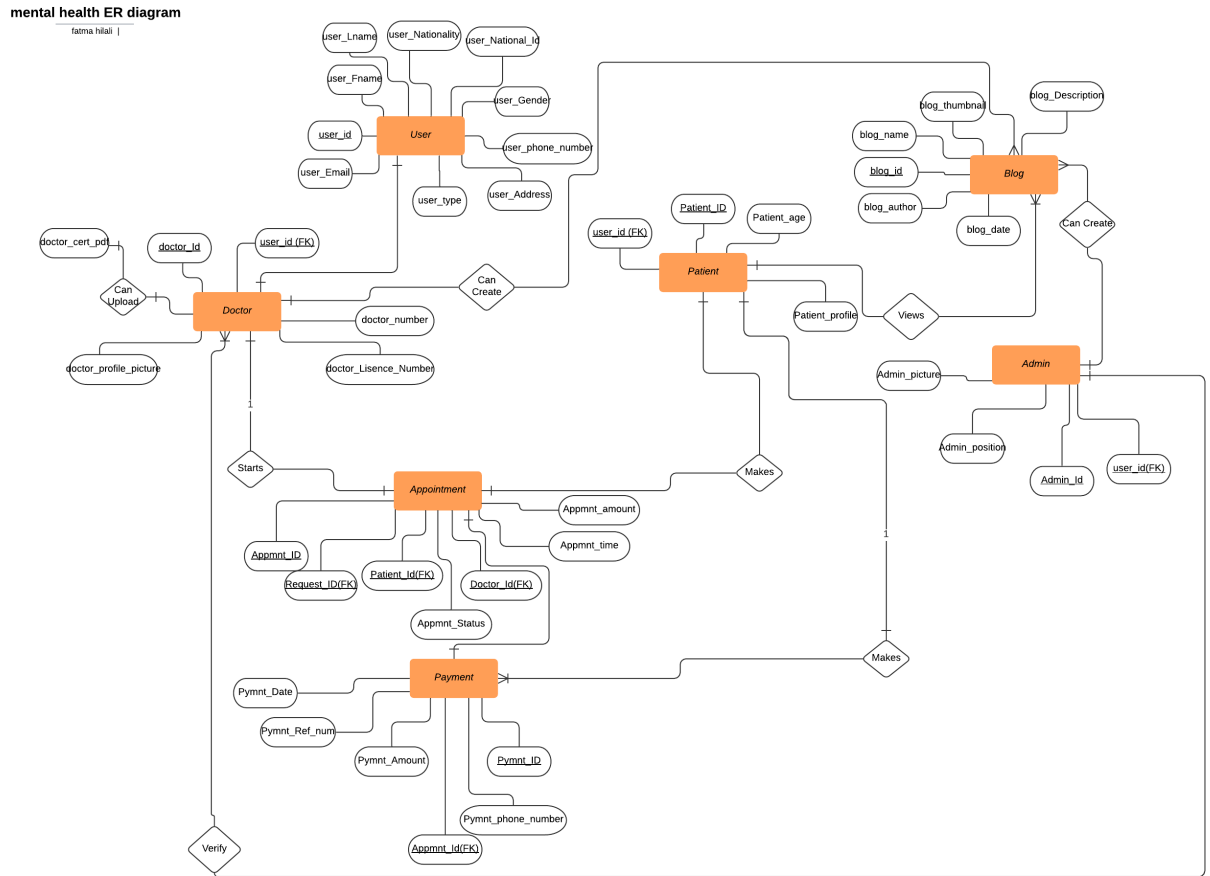


Figure 6 Mental health ERD (Entity Relationship Diagram)

4.5.5 Database Schema

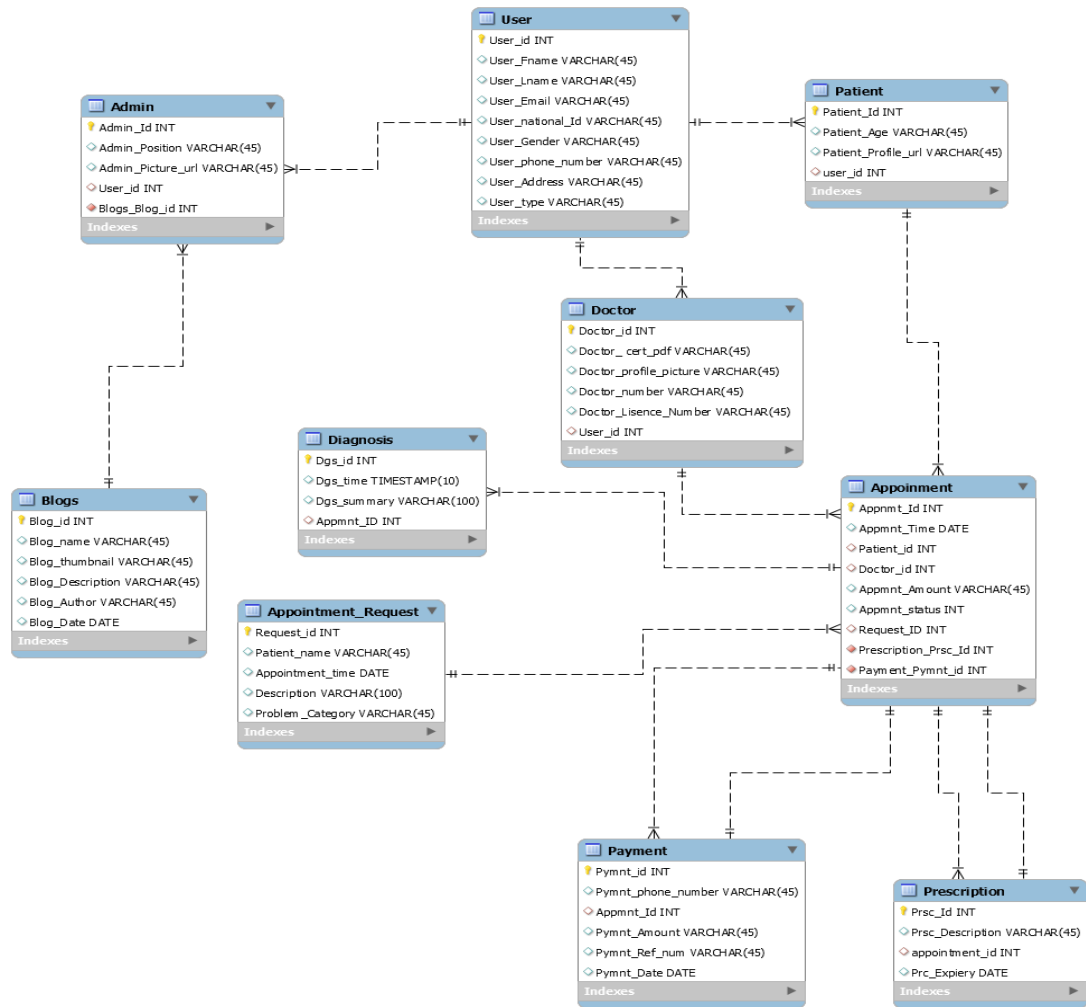


Figure 7: Mental heal system database schema

4.5.6 UI mock-ups

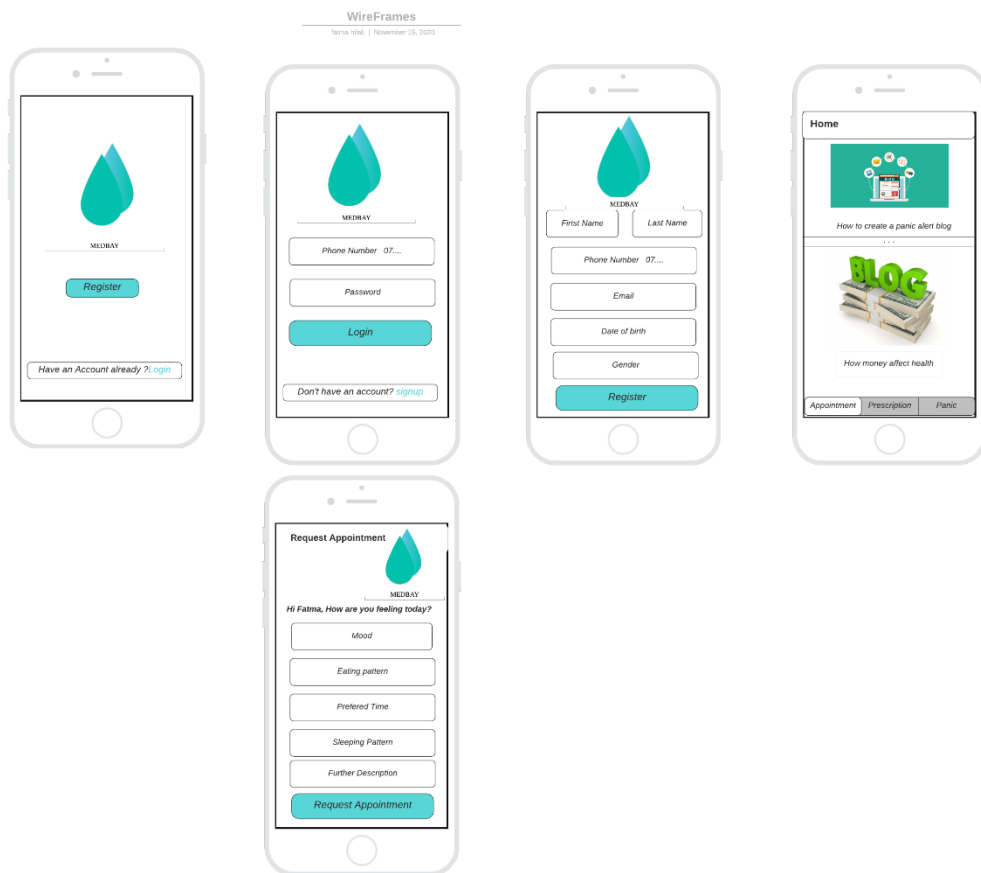


Figure 8: mental health system User interface Mock-ups

Chapter 5: System Implementation and Testing

5.1 Introduction

This chapter will focus on two major areas which are System implementation which is how the system was developed. System implementation includes two major parts which are the back-end logic/ algorithm that will be used to execute requests and interact with the database and the front-end development which majorly includes the user interface and how the system appears.

The second major part of this chapter is system testing where further details will be explained on how the system was tested, the environment it was tested in and the methods that that were used to test the system. System testing is conducted to ascertain that the system can correctly execute the functional and non-functional requirement that were discussed earlier in chapter 4 to allow the user to use the system easily without crashing down.

5.2 System Implementation

5.2.1 System Front-end implementation

The developed system front-end was developed using android studio in the java language. The user interfaces for both the Doctor and the patient were designed using xml format the UI designs for the doctor and the patient are as shown below:

5.2.2 Doctor User Interface

21:04

MEDBAY
The care you Deserve

Full Name

Email

Phone Number

Location

Weight in Kgs

Height (cm)

Choose Gender

Select your blood group

I am a: Patient Doctor

REGISTER

Already Registered? Login

By Registering you agree to our Terms and Conditions

21:04

MEDBAY
The care you Deserve

Phone Number

PIN

LOGIN

Not Registered? Register now

Forgot Password?

21:05

Appointment Requests

4

Patient_name: /

Preferred Time: :3:00

Description: :Not motivated

ACCEPT REJECT

you got a response and its not null

21:05

My Appointments

#: 12/12/2020 14:50

Meeting Code: :medbay3946872

Symptoms: :medbay3946872

Description: :This one is dying next week just refund

ADD PRESCRIPTION START MEETING

#: 12/12/2020 14:50

Meeting Code: :null

Symptoms: :null

Description: :This one is dying next week just refund

ADD PRESCRIPTION START MEETING

#: 12/12/2020 14:50

Meeting Code: :medbay3204046

Symptoms: :medbay3204046

Description: :To be Updated After meeting

ADD PRESCRIPTION START MEETING

#: 12/12/2020 14:50

Meeting Code: :medbay3916654

Symptoms: :medbay3916654

DoctorHomeActivity

Hello doctor Fatma, Kindly upload your documents for verification to receive Appointment requests

DASHBOARD

My Appointments Prescription

Payments Blogs

Upload Documents Appointment Requests

LOGOUT

Figure 9: Doctor user Interface Design

5.2.3 Patient User Interfaces

Some of the patient's user interfaces include:

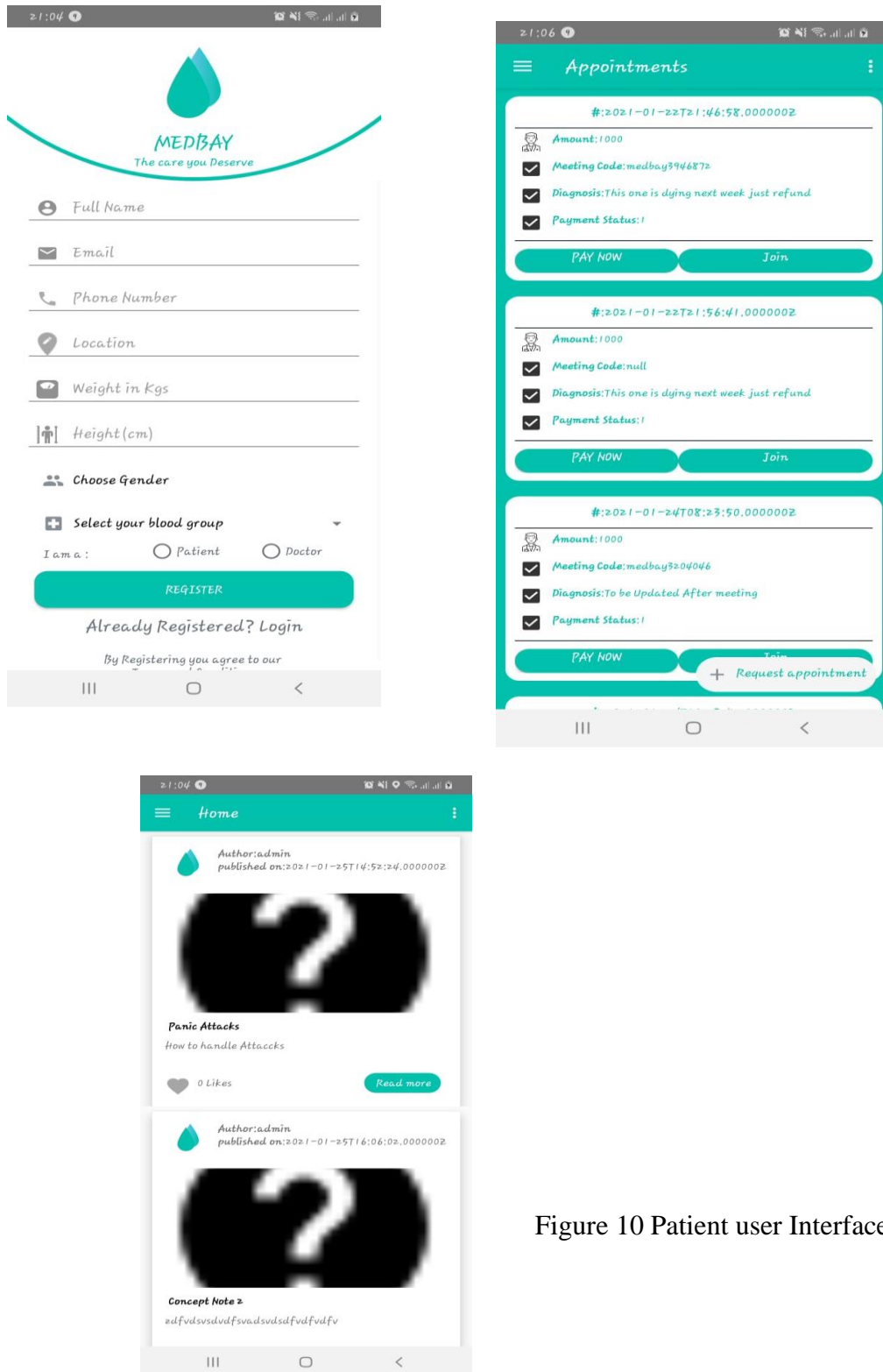


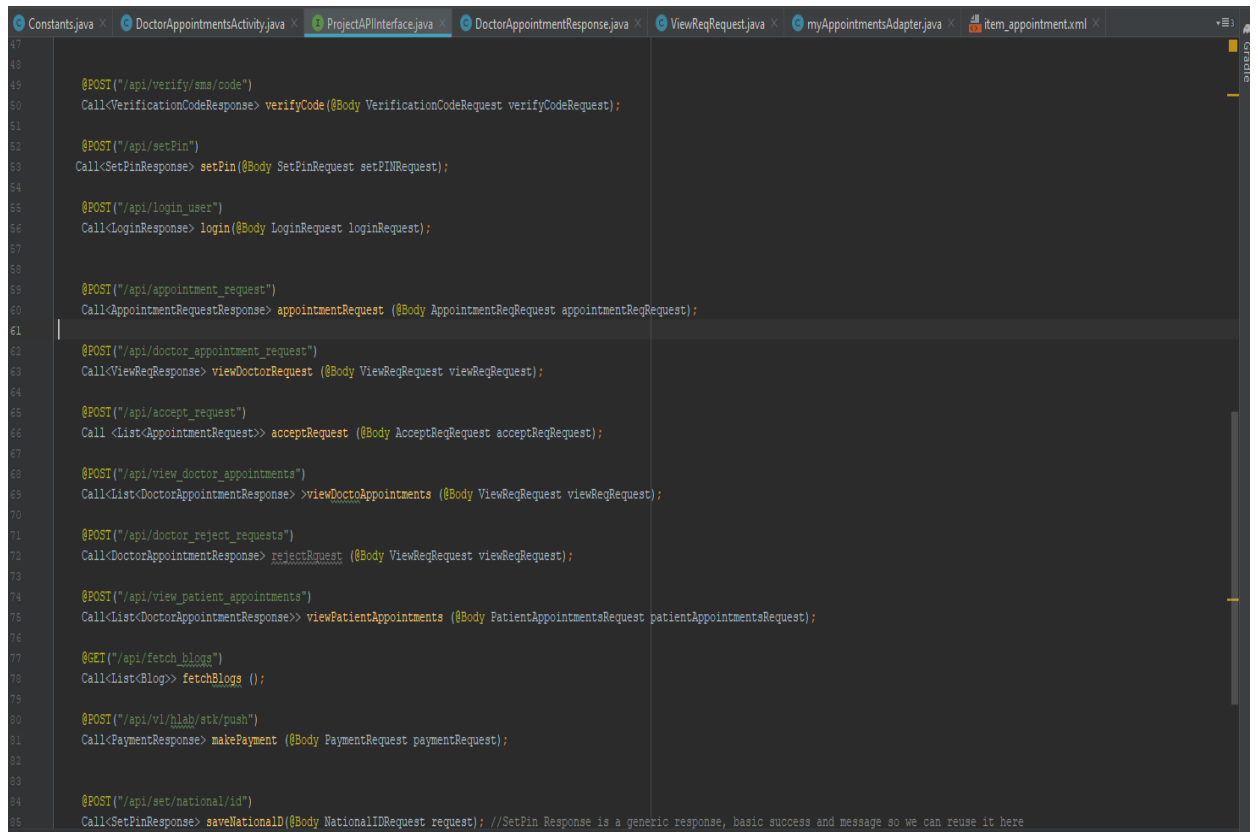
Figure 10 Patient user Interface Design

5.2.4 System Back-end Implementation

The Backend of the developed system was done using the web PHP framework Laravel, that was used to create an admin panel and to develop RESTful Application programming Interfaces that would allow the admin and the android users that is the Doctor and the patient to communicate efficiently.

The android side of the application's main method that was used is using the routes in Laravel to direct requests that are coming from the android application to the web application server and to send back a response accordingly. Below is snapshot of the backend routes that were used in communication between the back end and the front-end:

a) Request routes coming from the android side



```
49 @POST("/api/verify/sms/code")
50 Call<VerificationCodeResponse> verifyCode(@Body VerificationCodeRequest verifyCodeRequest);
51
52 @POST("/api/setPin")
53 Call<SetPinResponse> setPin(@Body SetPinRequest setPINRequest);
54
55 @POST("/api/login_user")
56 Call<LoginResponse> login(@Body LoginRequest loginRequest);
57
58
59 @POST("/api/appointment_request")
60 Call<AppointmentRequestResponse> appointmentRequest (@Body AppointmentReqRequest appointmentReqRequest);
61
62 @POST("/api/doctor_appointment_request")
63 Call<ViewReqResponse> viewDoctorRequest (@Body ViewReqRequest viewReqRequest);
64
65 @POST("/api/accept_request")
66 Call <List<AppointmentRequest>> acceptRequest (@Body AcceptReqRequest acceptReqRequest);
67
68 @POST("/api/view_doctor_appointments")
69 Call<List<DoctorAppointmentResponse> >viewDoctoAppointments (@Body ViewReqRequest viewReqRequest);
70
71 @POST("/api/doctor_reject_requests")
72 Call<DoctorAppointmentResponse> rejectRequest (@Body ViewReqRequest viewReqRequest);
73
74 @POST("/api/view_patient_appointments")
75 Call<List<DoctorAppointmentResponse>> viewPatientAppointments (@Body PatientAppointmentsRequest patientAppointmentsRequest);
76
77 @GET("/api/fetch_blogs")
78 Call<List<Blog>> fetchBlogs ();
79
80 @POST("/api/vi/hi/ab/stk/push")
81 Call<PaymentResponse> makePayment (@Body PaymentRequest paymentRequest);
82
83
84 @POST("/api/set/national/id")
85 Call<SetPinResponse> saveNationalID(@Body NationalIDRequest request); //SetPin Response is a generic response, basic success and message so we can reuse it here
```

b) Response routes from the back-end web-based server

```
Route::post( uri: 'register', action: 'App\Http\Controllers\AuthController@register');
Route::post( uri: 'login', action: 'App\Http\Controllers\AuthController@login');
Route::get( uri: 'logout', action: 'App\Http\Controllers\AuthController@logout');
Route::get( uri: 'user', action: 'App\Http\Controllers\AuthController@getAuthUser');
Route::post( uri: 'send/sms/', action: 'App\Http\Controllers\AuthController@sendVerifyText');
Route::post( uri: 'verify/sms/code', action: 'App\Http\Controllers\AuthController@verifyCode');
Route::post( uri: 'setPin', action: 'App\Http\Controllers\AuthController@setPin');
Route::post( uri: 'login_user', action: 'App\Http\Controllers\AuthController@authenticate');
Route::post( uri: 'appointment_request', action: 'App\Http\Controllers\AuthController@appointmentRequest');
Route::post( uri: 'doctor_appointment_request', action: 'App\Http\Controllers\AuthController@viewDoctorAppointmentReq');
Route::post( uri: 'view_doctor_appointments', action: 'App\Http\Controllers\AuthController@viewDoctorAppointments');
Route::post( uri: 'view_patient_appointments', action: 'App\Http\Controllers\AuthController@viewPatientAppointments');
Route::get( uri: 'fetch_blog', action: 'App\Http\Controllers\AuthController@fetchblogs');

Route::post( uri: 'accept_request', action: 'App\Http\Controllers\AuthController@acceptRequest');

//Media Routes
Route::post( uri: 'set/national/id', action: 'App\Http\Controllers\DoctorMediaController@storeID');
Route::post( uri: 'media_upload/pdf/', action: 'App\Http\Controllers\DoctorMediaController@storePdf');
Route::post( uri: 'media_upload/image/', action: 'App\Http\Controllers\DoctorMediaController@storeAvatar');
Route::post( uri: 'media_download', action: 'App\Http\Controllers\MediaController@download');
```

Figure 11: Laravel API Example

5.2.5 User Manual

To set up the system for end user to access the services of the developed system the following steps should be followed.

- I. Download XAMPP or WAMP SERVER from the internet, for this example, we will use XAMPP. Go to <https://www.apachefriends.org/index.html> and select the installer for your specific Operating system.

After downloading the installer select install and continue with the default setting to install XAMPP as shown below:

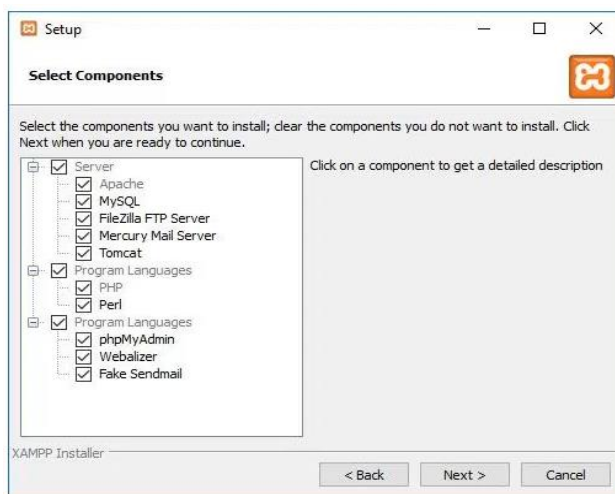


Figure 12: XAMPP Installation manual

II. Clone the web admin project from GITHUB

After installing XAMPP the next step is to follow the link below to the GitHub repository to download the web admin panel. <https://github.com/hilal567/project> .

After downloading the zipped file from GitHub extract file in the htdocs/ www folder of the XAMPP or WAMP server that you downloaded.

III. Open the project in an editor of your choice and run the following commands:

- i. **composer update**
- ii. **npm install.**
- iii. **npm run dev.**
- iv. **php artisan migrate: fresh.**
- v. **php artisan dB: seed.**
- vi. **php artisan key: generate.**

Lastly run **php artisan serve** to serve the project and you can access the system with the URL provided in the terminal

IV. Install the android application from GitHub

After the successful installation of the web admin panel the next step is to download the android side of the project from the repository below:

https://github.com/hilal567/medbay_android_project

V. Serve the project on the IP address of the machine

After downloading the project navigate to the Java/utility/constant.php as shown below and replace the base URL with the line of code below:

<http://127.0.0.1:8000>

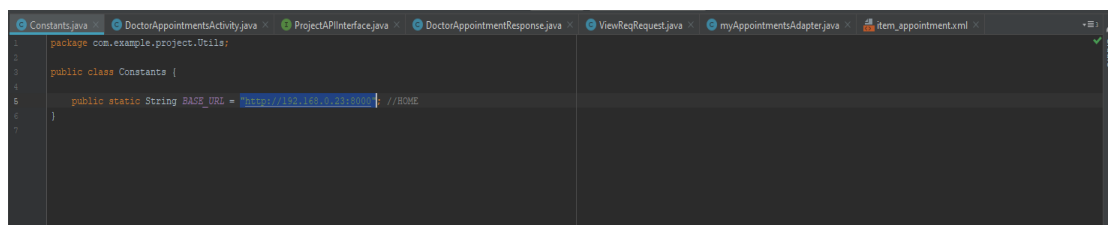


Figure 13: Android Base URL class

VI. After changing the base URL run the android project and start registering as patient of a doctor.

5.3 System testing

System testing involves a series of test that are conducted on the developed system in order to establish whether or not the system fulfil the functional and non-functional requirements that it is suppose to fulfil as described in chapter four.

5.3.1 Test Cases

a) Admin Test cases

Test ID	Requirement ID	Inspection Check	Pre-Condition	Test Data	Priority Level
T1	FRQ1	Does the system allow the admin to sign into the system?	The admin should be able to fill in the login form and submit it	Email: admin@gmail.com Password: Password	High
T2	FRQ2	Does the system allow the admin to view all the users in the system?	The admin should be login into the system		medium
T3	FRQ3	Does the system allow the admin to approve and suspend doctors?	The admin should be login into the system	Doctor_id = 001	High
T4	FRQ4	Does the system allow the admin to view the payments made for the appointment	There should be payments that have been made earlier in the database.		medium
T5	FRQ5				
T6	FRQ6	Does the system allow the admin to view appointments	There should be appointments that have been accepted by the doctor.		medium
T7	FRQ7	Does the system allow the admin to upload a blog?	The admin should submit a filled in form with the details of the blog	Title : Panic Attacks Introduction: take a deep breath in and out. Body: think positive thoughts Conclusion: you are going to get through this.	High
T8	FRQ8	Does the system allow the admin to logout?	The admin should press the logout button that would send a logout request.	Press the logout button	Low

Table 5 : Admin Test Cases

b) Doctor Test cases

Test ID	Requirement ID	Inspection Check	Pre-Condition	Test Data	Priority Level
T9	FRQ9	Does the system allow the user to register as a Doctor?	The user must submit a form with all the fields that are required?	Name: Fatma Hilal Phone number: 0795291708 Email: fatma@gmail.com Height: 130cm Weight: 54 Blood group: A Gender: female User type: 1	High
T10	FRQ10	Does the system allow the user to set PIN	The user must have input a valid phone number to receive the verification code.	PIN: 1234	Very High
T11	FRQ11	Does the system allow the user to upload documents for verification by the admin?	The Doctor should upload his practitioner certificate in pdf format, his profile picture and his national ID number	Practitioner cert: cert.pdf Profile: picture.png	High
T12	FRQ12	Does they system allow doctor to accept appointment from patient	The doctor must have been verified by the admin	Request Id: 1	medium
T13	FRQ13	Does the system allow the doctor to start and terminate appointments	The doctor must have the meeting code	Meeting code: medbay247680	medium
T14	FRQ14	Does the system allow the doctor to make a prescription for the appointment they carry out?	The doctor must have a specific request to make a prescription for.	Request ID: 1	low
T15	FRQ15	Does the system allow the doctor to receive panic alerts when patients are in distress?	The doctor must be logged on to the system for him to see the report.	null	medium
T16	FRQ16	Does the system allow the doctor to logout of the system	The doctor must be logged on to the system	Doctor Id: 1	low

Table 6: Doctor Test Cases

c) Patient Test Cases

Test ID	Requirement ID	Inspection Check	Pre-Condition	Test Data	Priority Level
T17	FRQ17	Does the system allow a user to register and login as a patient?	The user must have filled in all the fields in the form and submitted the form.	Name: Fatma Hilal Phone number: 0795291708 Email: fatma@gmail.com Height: 130cm Weight: 54 Blood group: A Gender: female User type: 0	High
T18	FRQ18	Does the system allow the patient to add and view blogs?	The patient must be logged into the system for them to view the blogs	null	medium
T19	FRQ19	Does the system allow the patient to request an appointment?	The patient must have filled in and submitted the request appointment field.	Category: Stress Urgency : critical Condition: migraines Description: chest pain Hours of sleep: 5 hours Physical condition: healthy	high
T20	FRQ20	Does the system allow the patient to view a summary of previous appointments?	The patient must be logged into the system	Appointment id: 1	medium
T21	FRQ21	Does the system allow the patient to view prescriptions that have been given by the doctor?	The patient must be logged in and they must have an appointment that has a prescription	Request id: 1	high
T22	FRQ22	Does the system allow the user to send out a panic alert in case of an emergency?	The user must be logged and has enabled the location of the phone	Patient id: 1	medium
T23	FRQ23	Does the system allow the user to make payment for an appointment?	The user must be using the a telecommunication line that has MPESA enabled on it.	Phone number: 0795291708 Request id : 1	Very high

Table 7: Patient Test Cases

Chapter 6: Discussion Conclusion and recommendation

6.1 Introduction

The purpose of this chapter is to summarise the discussion on the objectives that were defined in chapter one and to review the challenges that were faced in the development of the system and the extent to which the system solves the issues that were previously addressed. The chapter will also conclude by discussing the recommendations and future works that can improve the current solution.

6.2 Discussion

As discussed in chapter two the current procedure, of treating mental health patients begins with the patient going to the psychiatrist's office and requesting an appointment and then the patient goes to meet the psychiatrist at the designated time that the appointment was scheduled for, the demerits of this system have been discussed in detail in chapter 2 of this documentation, they include loss of time, stigmatization, and inadequate motivation to finish the treatment to mention a few.

This system has been developed as a solution to the problems that were encountered in the current system. The developed system allows the user to request and conduct consultation with the doctor at the comfort of their home. This does not only help to reduce the amount of time that the patient spends in setting up the meeting but also in curbing the stigma that they might face. The presence of blogs that constantly motivates the patients in the system motivates the patient not to give up and it also boost the morale for them to finish their treatment. The developed system has also incorporated mobile payments to make it more convenient for the patient and to reduce the amount of time. These are among the benefits and ways in which the developed system has that are used to combat the limitation and shortcoming of the current system.

The current system has an additional admin module that monitors the transaction of the doctor and vets the doctors to ensure the privacy and to make sure that only qualified and certified doctors can use the system.

6.3 Conclusion

In conclusion the process of treating mental health patients is a very delicate and it does not help if the process is tedious and put the patient at the risk of facing stigmatization and losing the morale to finish their treatment.

The developed system gives chance for the patient to be treated at the convenience of their home and without putting them at the risk of facing stigmatization. The developed system also stays in touch with the patient by uploading motivational blogs that help with boosting morale of the patient throughout their treatment.

However, to use this system a patient must be technology literate and have basic knowledge as to how to use an application. The system also uses English as the language of communication therefore the patients who would like to use this system must be English literate.

6.4 Recommendation & future works.

There are many suggestion and ways in which the mental health care system can be improved. The developed system is one among the many ways in which a system might help in improving the mental health treatment but just like any other solution this solution also has some limitations such as the system can only be accessed when user has stable internet connection and the only method of patient is using M-PESA therefore, limiting usage to users who have the Safaricom line. These are some of the limitations that the system has and might be taken up by the next researcher or developer to improve it in the future.

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Appendix A: Timeline of Activities

