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Design and Implementation of a Self-Monitoring and Management System for Persons with Mental Health Disorders

Oghenevwede J. Emeni, Adeyinka Adedoyin, and Oyekunle, R.A.

Department of Information and Communication Science, Faculty of Communication and Information Sciences, University of Ilorin, Ilorin, Nigeria.
Email: genevwe@gmail.com, adedoyin.a@unilorin.edu.ng, oyekunle.ra@gmail.com

Abstract—The last decade has witnessed the digital revolution led by smartphones which has made progress in all aspects of life, not excluding healthcare. This revolution originated with the exponential upsurge of the smartphone, along with its equivalents in tablet technology and some wearables such as smart watches. Over 20 million Nigerians suffer from the mental disease (20% to 30% of the population), with a significant portion of them not receiving professional help. The traditional methods for tracking daily changes in a person's mental state over long periods of time have proven difficult. As solutions for tackling common mental disorders, mobile mental health support applications can be very simple but effective. Although many of the existing applications serve a useful purpose, the majority of them are over-engineered, rather than focusing on the core features that patients require to keep track of their health. This study aims to create a Mobile application that allows patients to track their mental health outside of regular clinical visits by inputting symptom data and receiving personalized feedback. The Mobile application was designed using Flutter as the front end, Node.JS as the server side, and NoSQL as the database. The developed system was found to meet predefined user requirements after it was evaluated by potential users.

Keywords/Index Terms—Mental health, Mobile health, Self-monitoring, Mobile application

1.   Introduction

In 2019, one in eight people, or 970 million people worldwide, suffered from a mental illness, the most common of which were anxiety and depressive disorders (W.H.O, 2022a). In 2020, the number of persons who experience anxiety and depressive disorders significantly increased owing to the COVID-19 pandemic. According to the WHO-AIMS report 2006, over 20 million Nigerians suffer from the mental disease (20% to 30% of the population), with a significant portion of them not receiving professional help. This high number is a result of economic hardship, unfavorable environmental externalities, and the nation's rising expense of an acceptable standard of living (EpiAFRIC, 2020).

Mental health according to W.H.O. (2022b) is a state of well-being in which a person realizes his or her own capabilities, can handle the normal stresses of life, can work in a productive manner, and is capable of contributing to his or her community. In the past, it was not unusual to see people wandering the streets of Nigerian cities while partially or completely naked. They were referred to as lunatics and they ate and lived in the streets. Nobody knew how they became that way, but it was generally agreed that they had a fatal illness, thus they were condemned to a life of wandering the streets until their death or disappearance. Unfortunately, this is the most common manifestation of

mental illness in Nigeria, and as a result, this is how most people there perceive it (EpiAFRIC, 2020).

However, mental disorders cover a wide range of issues with a variety of symptoms. They typically exhibit a mix of deviant thoughts, feelings, behavior, and interpersonal interactions. Depression, schizophrenia, anxiety disorders, compulsive behaviors, and eating disorders are some examples of mental diseases. A lot of people sometimes experience problems with their mental health. Nonetheless, a mental health issue becomes a mental disease when persistent symptoms put a person under so much stress and impair his or her capacity to accomplish daily tasks. Although it is impossible to predict with certainty if someone would experience a mental health issue, if some symptoms materialize quickly, they may provide hints (EpiAFRIC, 2020).

The smartphone-driven digital revolution over the past ten years has advanced all facets of life, including healthcare. The exponential growth of the smartphone marks the beginning of this revolution along with its equivalents in tablet technology and some wearables like smart watches (Yusuf et. al, 2021). The finest instruments for delivering mental health therapies are smartphones and other mobile devices because of their widespread use. The increase in mobile device users has created opportunities for the creation of mobile apps that deliver health interventions. Additionally, by including psychoeducation, self-monitoring therapy alternatives, and self-

management, mobile apps can help those struggling with mental health difficulties. These applications' anonymity, accessibility, and usability make them particularly alluring (Alqahtani et. al., 2021).

However, many of these applications are over-engineered, rather than focusing on the core features that patients require to keep track of their health (Powell et al., 2016). Consequently, users' emotional and psychological disorders can be improved by using carefully created and developed mental health apps (Cho et. al., 2022). In this paper, a self-symptom Mobile Application is developed, this system will allow people with mental health illnesses to create insights and analytics about their various symptoms and treatments.

As stated by Misra (2021) in his publication that researchers should always summarize the structure of the whole work, the remaining sections of this article are organized as follows: Section 2 presents a short overview of the literature. Section 3 discusses the system design, use case, and class diagram and in Section 4, the application development, the interface, and the evaluation results are presented. Finally, Section 5 concludes the paper with the conclusion and future works.

2. Related Works

In this section, some of the works previously done in the literature are

presented. Recently, a number of campaigns and initiatives have been started to try to enhance the identification and treatment of people who are depressed or anxious, and these initiatives include tactics to promote people's empowerment. As these facilities are frequently patients' first point of contact with the healthcare system, primary care practitioners are crucial in this situation for the identification and treatment of depression and anxiety (Firth et al., 2017; White et al., 2001). However, the treatment of various mental health illnesses is hampered by the resources available at primary care facilities and the constrained time allotted to each patient. As they have been shown to successfully reduce the symptoms of sadness and anxiety, mHealth and mobile applications (apps) may therefore prove to be a helpful resource for enhancing mental health outcomes in patients who visited primary care facilities (White et al., 2001). In addition, Digital health solutions also have the ability to scale up treatment for patients who have trouble accessing conventional mental health treatments (Torous et. al., 2018).

There are numerous mobile applications available to address depression and anxiety. The following examples are prevalent worldwide: MoodFit (Braun, 2022), a free application that helps users track their moods and gives them exercises to manage negative emotions. It is designed to help people encountering anxiety, depression, or high levels of stress. However, some reviews

showed that users found tracking their moods time-consuming and disliked the fact that they did not have access to professional help. Talkspace (Braun, 2022), is a proprietary software that connects people to an extensive network of mental health practitioners and is well-known across the board. However, it comes with some limitations such as being more expensive than most applications, not being appropriate for chronic mental health issues, having a limited range of therapeutic approaches, and having aggravating therapist evaluation surveys (Morin, 2022). Braun (2022) explained that Bearable aids in explaining symptoms and allows data to be shared with medical professionals. It also lets users track sleep, medications, exercise, social interactions, and food intake in the app. But it comes with a few limitations/disadvantages; generalization of symptoms, user experiences, frequent crashing, partial privileges being given to android users, and full access given to iOS users (Morin, 2022).

All of this research has indicated that mobile applications and online therapies have a great potential to manage depression and anxiety, thanks to their features. However, there is not a one-size-fits-all solution to good mental health. In this work, a mental health mobile application is designed that will provide precise data during therapy sessions and reminders about various activities. Unlike most existing platforms, the suggested system will not generalize symptoms; instead, it will allow users to log their specific symptoms, irritants, and relief.

3. Methodology

This section discusses the system design and modeling of the proposed Mobile application. In modeling the proposed system a use case diagram and a class diagram are presented.

3.1 System Design

The process of specifying a system's components, interfaces, and architecture in a way that satisfies or meets the necessary requirements is known as system design. With the goal of explaining the system's nature and what it does, which in general encapsulates the system's behavior, it specifies how the system functions and engages with outside users.
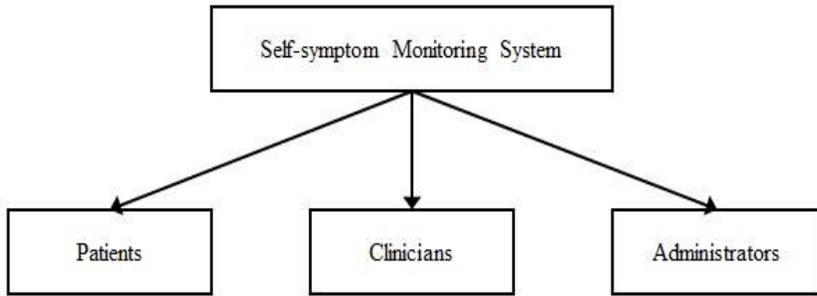
Figure 1: Diagrammatical representation of the different categories of the system users

The different categories of the system users as shown in Figure 1 includes;

• Patients: These are the target users. They make use of the system to track their health and generate analytics on their performances. They also have the privilege of being able to share the analytics generated with their clinicians to better improve sessions.

• Psychologists / Clinicians: This user group uses this system to jointly monitor their patients' health and get insights that will aid doctor-patient sessions. The analytics shared by their patients to them makes it easier for them to know the current state of progress of their patients.

• Administrators: Responsible for regulating the different activities that are being carried out on the platform. They are responsible for verifying the license and authenticity of the psychologist who signs up to the platform to offer their services. The administrator also manages disputes and all the users of the application.

3.2 Use Case Diagram
A Use Case Diagram is simply a representation of a user's interaction with the proposed system showing the relationship between the users of the system and the different use cases that involves the user. In this case, as shown in Figure 2 below, the users are the Patient and therapist.
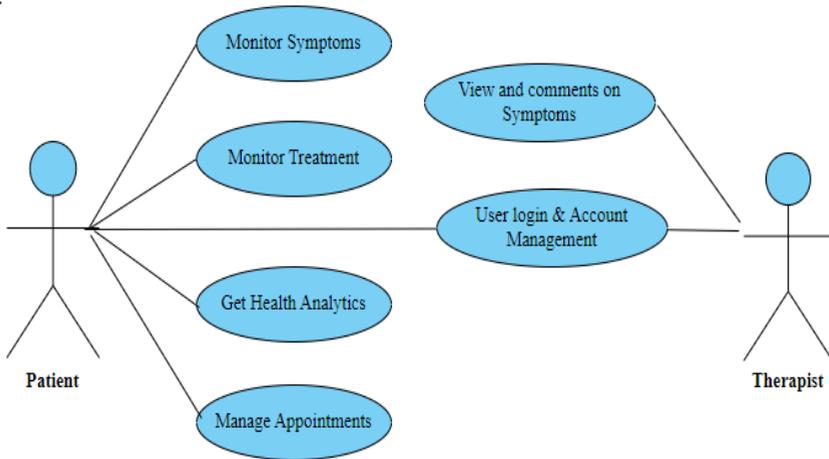
Figure 2: Use Case Diagram of the System

3.3 Class Diagram

In the Unified Modelling Language (UML), a class diagram is a diagram that displays the structure of a system through showing the system's attributes, classes, methods, and relationships among objects.
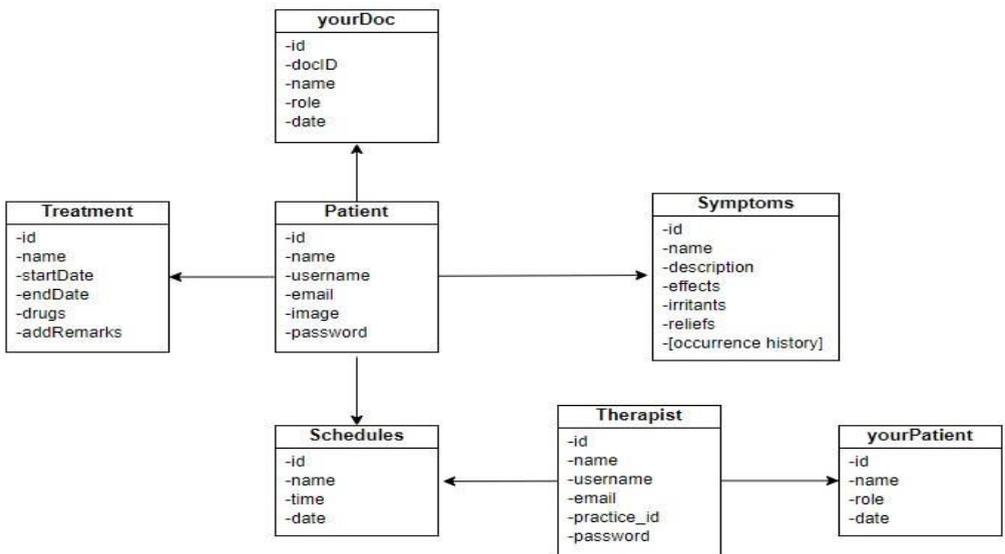

Figure 3: Class Diagram of the system

4. System Development and Evaluation

This section provides a brief description of the different technologies used in the development of the system. In addition, it provides a summary of the evaluation of the app to ensure the designed system meets the requirements of the proposed system.

4.1 System Development

The proposed system was designed using the following technologies: for the backend, a NoSQL database, and MongoDB was adopted. NoSQL database systems are non-relational and distributed databases that also use NoSQL mechanisms and language in working with data. NoSQL databases are found in companies like Google, Amazon, Facebook and Netflix, which are reliant on huge volumes of data not suitable for relational databases. MongoDB was chosen due to its scalability and ability to distribute load work across multiple servers.

The front end was designed using Flutter. Flutter is fast and easy to use. One of the major perks and reasons why it was selected is the fact that it allows developers to create platform-independent applications. It is a dart framework that has a myriad of widgets that are easy to understand and use. Using the bloc state management pattern the proposed system will communicate with the API to carry out different operations. According to Santos et. al. (2020), health information systems deal with human life, and errors in software development, management and operation can be disastrous.

4.1.1 Registration flow

This shows the different screens, from the Home page to the user account creation page and login page. As shown in Figure 4, the Landing page for the app, and then the registration page where users can provide username, password, and email address to create an account. Then next to it is the login page to log in after creating an account.
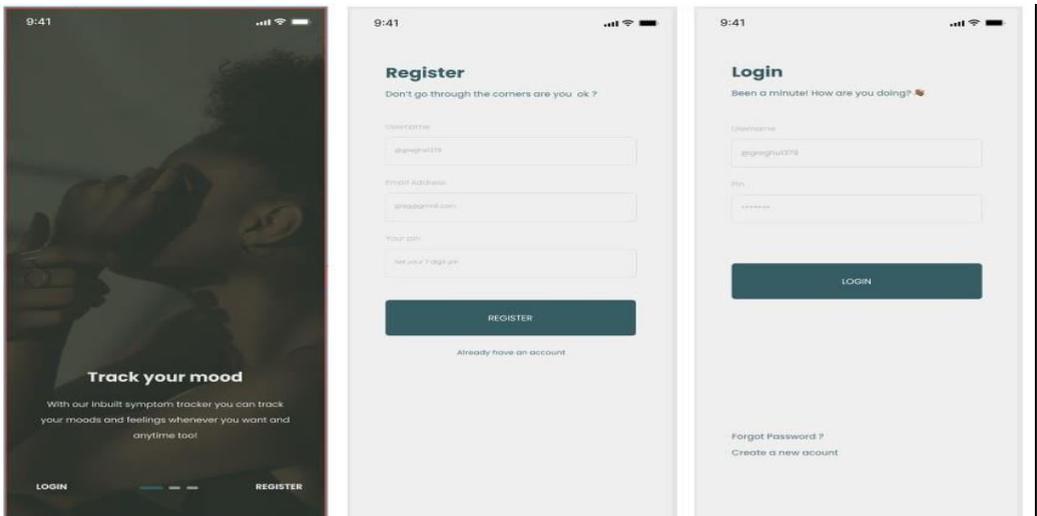

Figure 4: Registration flow

4.1.2 Patient Dashboard

The patient dashboard welcomes the user into the application. This is also the main screen that contains buttons that links a patient to all the major functionalities of the application. This page also includes Daily statistics. The daily statistics page contains data about the user's health for a particular day. It contains details about the symptoms observed and the different rating effects.
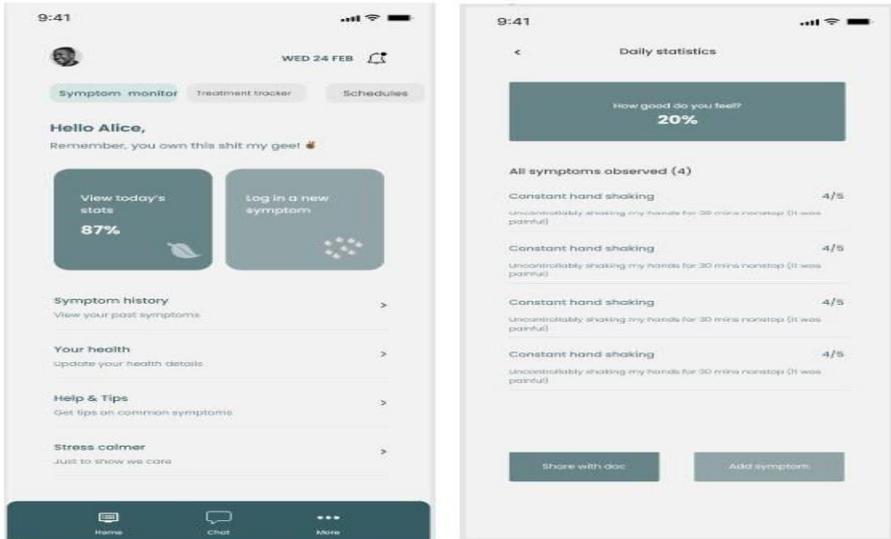

Figure 5: Patient Dashboard

4.1.3 Symptom Monitoring and Tracking

Users can use this tool to log symptoms, irritants, and reliefs, as well as view a history of occurrences.

This enables users to investigate the life cycle of their various symptoms as well as other factors related to these symptoms.
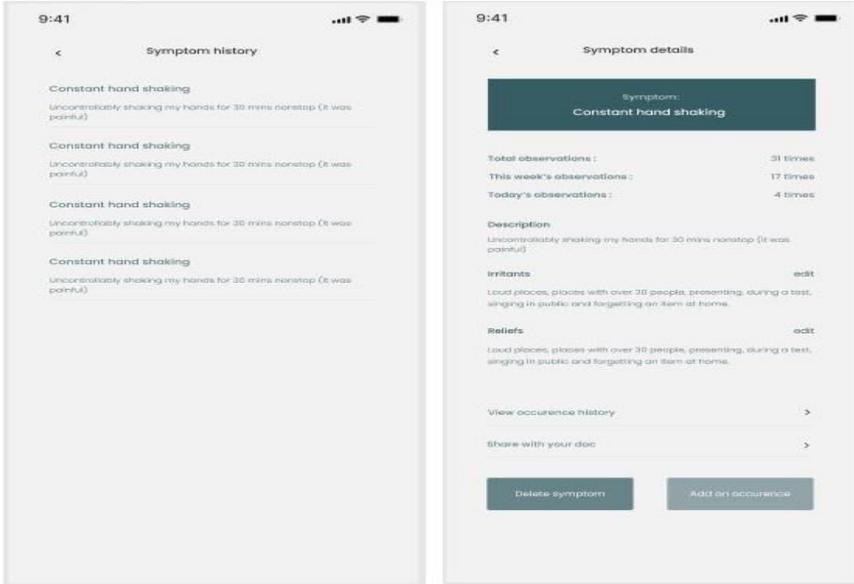

Figure 6: Symptom Monitoring and Tracking

4.2 Evaluation

System evaluation is a way of measuring the finished system alongside its original performance goals as well as performing continuous testing to ensure that the system continues to meet those goals (Conrad et al., 2016). This is a process of finding out if the system meets the requirements of the proposed system.

After the system's development, questionnaires were issued to evaluate the system's usability, security, and speed. There were a total of seven responses. Five of the comments came from people who have or have had a mental illness, and two came from psychologists in training. A summary of the findings is attached below:
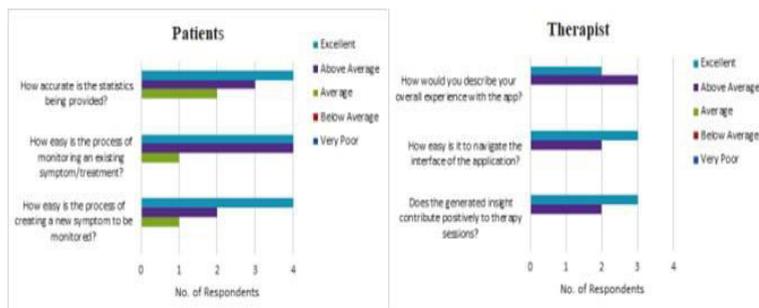

Figure 7: Result of the evaluation of the system by respondents

The summary of the evaluation shows that the majority of the users who made use of the system responded positively, it is fine to say the system met the predefined user requirement. And the noticed flaws received will also be put as a recommendation for future development.

5. Conclusion

In this paper, a self-symptom monitoring system was developed to assist people with mental illness in self-monitoring various mental health symptoms in real-time. The system was designed by means of an extreme programming model and developed using NoSQL, Flutter, and MongoDB for the database query. Potential users evaluated the developed system and it was found to meet the predefined user requirements. As future work, improvement can be made to the system by adding more features that will improve its use and meet user needs further. Some recommended features include a web platform for those who wish to access the system via their PC browsers and a mini community for people to communicate anonymously.

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