



An Android-Based Chronic Disease Management System (ABCDMS)

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ABSTRACT: Chronic diseases, such as heart disease, diabetes and stroke are expensive to manage and preventable, yet they affect half of all adults. These diseases cause a huge burden on society by reason of their prohibitive cost of care, high use of health care resources, elevated rates of hospitalizations, lower quality of life and consequently, premature deaths globally. Telemedicine has been proven to have tremendous capabilities in alleviating this condition. This research employed the Wagner's chronic care model to propose a personalized, mobile and multi-disease management system. The primary aim of this work was to design, develop and pilot-test an android-based telemedicine system that helps patients to self-manage their chronic health conditions with mobility considerations. Free-of-charge tools like Java and MySQL database were utilized for implementation with user friendly interfaces. The videoconference services are provided by preloaded android applications such as WhatsApp, Imo, and Google Hangouts. Implementation of the designed system based on the chronic care model (CCM) shows that the system can serve as a tool to manage patients of chronic illnesses in a convenient and fast manner both for the physician and the patient.

KEYWORDS: android-based, chronic disease, telemedicine, video conferencing.

I. INTRODUCTION

Chronic diseases are diseases that persist over a long period of time [1]. Chronic Disease Management (CDM) is continuous care and support to assist individuals impacted by a chronic health condition with the medical care, knowledge, skills and resources they need to better manage on a day to day basis [2]. Chronic Disease Management is defined as an integrated care approach to managing chronic illness which includes screenings, check-ups, monitoring and coordinating treatment, and patient education to improve patients' quality of life while reducing patients' health care costs by preventing or minimizing the effects of a disease [3].

This research focuses on the design and implementation of an Android-Based Chronic Disease Management System (ABCDMS) which is a mobile system that automates chronic disease management. It is a self-management approach to chronic diseases which has a great potential to reduce the variability of diagnoses as well as improving clinical management and delivery of health care services worldwide by enhancing access, quality, efficiency, and cost-effectiveness.

Chronic diseases, by their very nature, necessitate frequent monitoring and management of patient's condition [4]. It is a conscious struggle on the patient's part to take appropriate measures in preventing further deterioration of his/her condition to realize the benefits in the long term [5]. In [6], a mobile phone based telemedicine system for the management of blood pressure (BP) among hypertensive patients was developed. Therefore ABCDMS leverages on the proliferation of mobile phones to simplify health management such that the patient is better positioned to oversee his/her condition throughout the day, week, and year without distance constituting a barrier.

Mobile communication has broadly been applied to diverse domains of healthcare system. This is attributed by the rapid advances in mobile technologies, the continuous increasing coverage of mobile networks and the ever-rising opportunity for integrating mobile concept with existing electronic health care services [7]. Mobile technologies are featured as pervasiveness, portability, immediacy, and convenience which make them an ideal choice of new healthcare

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approach [8]. Mobile phones are suitable as they are cheaper than personal computers (PCs) and they require minimal technical know-how [9].

Wagner's chronic care model (CCM) on which this research is premised, consists of four key constituents [10]: (1) self-management support, (2) delivery system design, (3) decision support, and (4) clinical information systems, to maximize the impact of community and health systems on chronic care as shown in Figure 1. In addition, the CCM also addresses an important concept of patient-provider interaction in chronic care that emphasizes the relationship between informed/active patients and prepared/proactive practice team [11].



Figure 1: The chronic care model (CCM) ([10];[11])

II. METHODOLOGY

A. The System Model

Android Based Chronic Diseases Management System Model is an extension of the Wagner's Chronic Care Model (CCM). It reflects remote diagnosis and community health facilities.

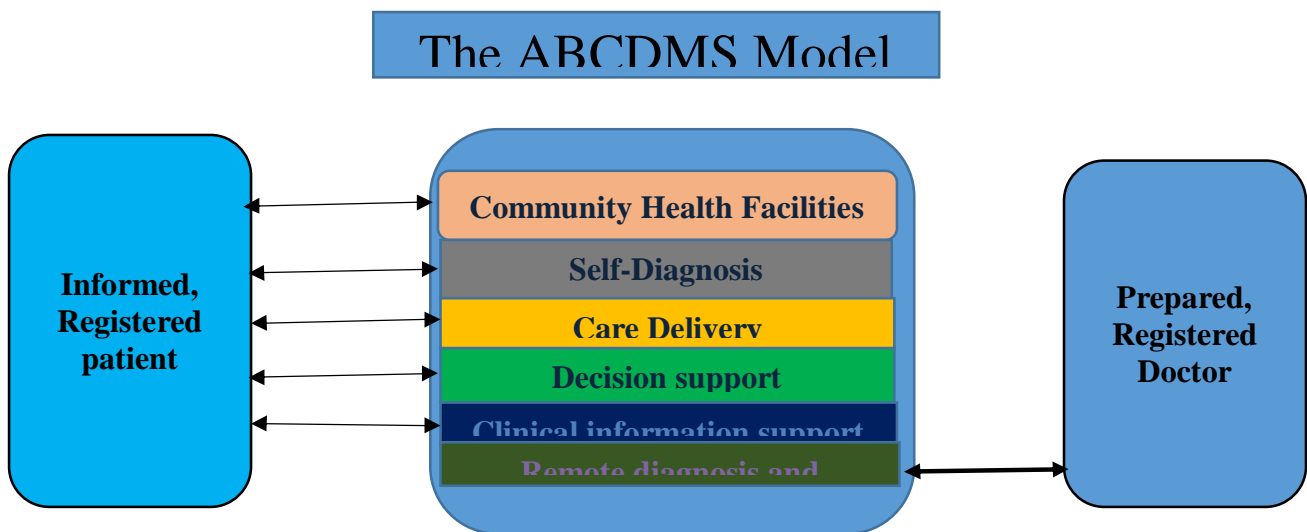


Figure 2: The Modified Chronic Care Model

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B. Requirement analysis of ABCDMS

The main requirements and functionalities of the system are listed below.

- A patient assistance will be able to connect to the system via his/her Android phone.
- 2 way video conferencing will be established by the patient as well as the doctor or specialist.
- The patient will be able to transfer images from his/her phone to the doctor for examination
- A doctor will be able to connect and communicate with the patient via his/her android phone.
- ABCDMS will provide medical assistants (diagnosis, treatments, social behavioral changes and links to specialist) to patients.

95% of the management process is self-performed by the patient while the remaining 5% are performed via the links to specialists provided by ABCDMS which could be achieved by placing a call; sending sms, video conference and/or real-time chatting us WhatsApp available on Android phone.

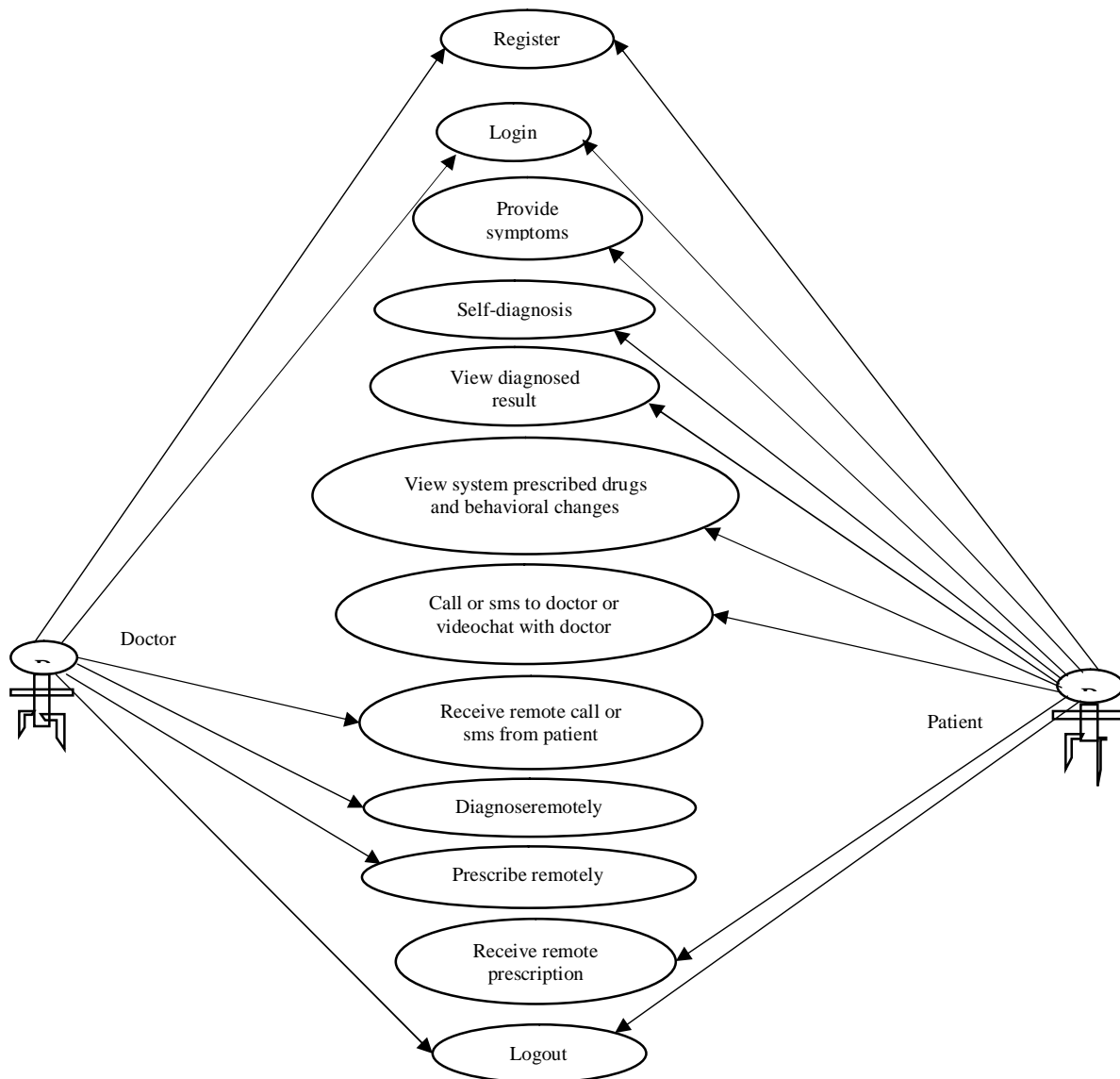


Figure 3: System use case

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C. System Analysis Modeling with Unified Modeling Language (UML)

A model of the designed system was built using Unified Modeling Language (UML). In this paper, UML Use case diagram, sequence diagram and data flow diagram were used to model the system as shown in Figures 3-5 respectively.

The ABCDMS UML Sequence diagram models the flow of logic within the system in a visual manner, enabling both the documentation and validation of the system logic, and is used for both analysis and design purposes. The UML sequence diagram for ABCDMS is shown below in Figure 4.

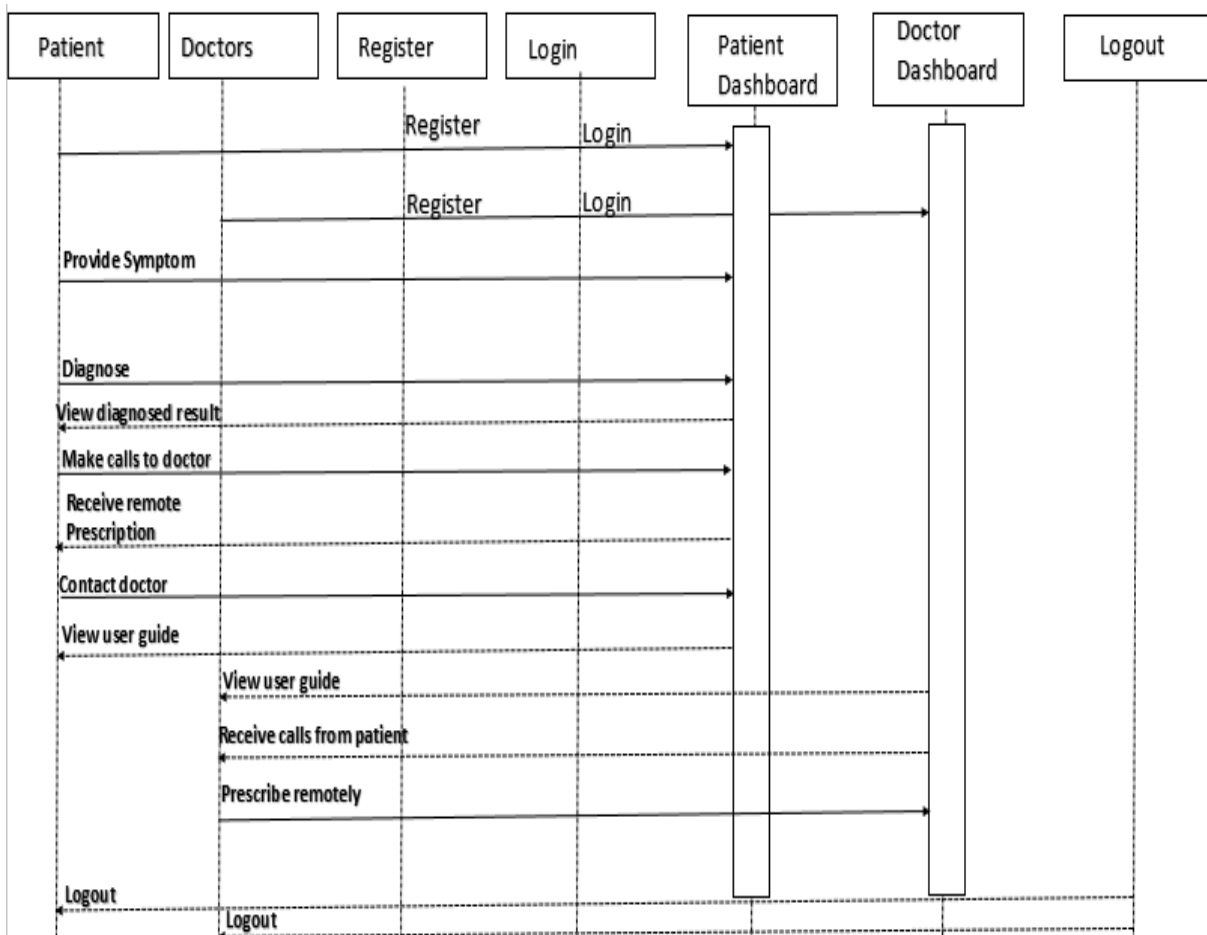


Figure 4: system sequence diagram

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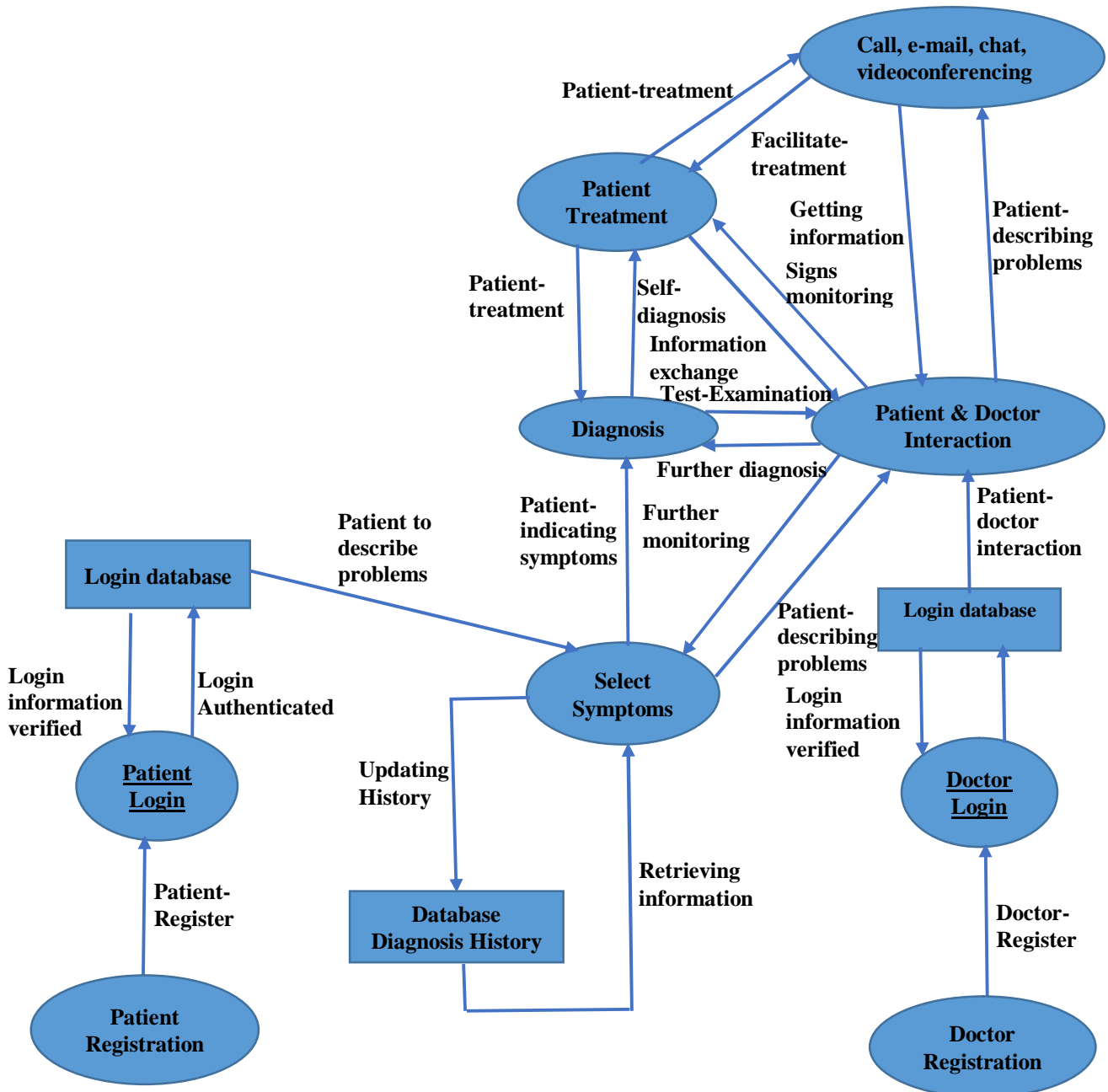


Figure 5: ABCDMS Data Flow Diagram



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III. SYSTEM IMPLEMENTATION

The first port of call of the system is the home page which provides users (patients and doctors) with menu to navigate through the system as shown in Figure 6.

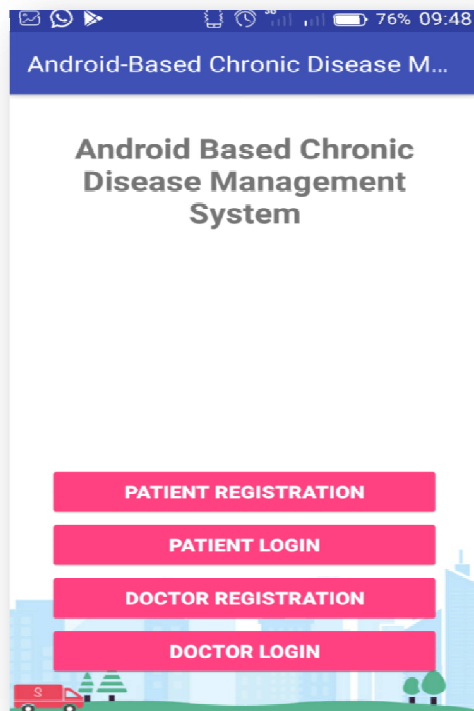


Figure 6: Home page

Figures 7 and 8 represent the patient and physician's registration interface respectively. They both serve as registration forms to upload users' picture and supply personal information for registration purpose. As an authentication measure, Figures 9a and 10 prompt users for the username and the password in an attempt to enforce security measures.

The patient's dashboard is shown in Figure 10 which is an interface that welcomes patient to the system and provide them with menu to view his/her diagnostic history, self-diagnose, edit profile and logout of the system while the screen shot represented by Figure 11 keeps and displays history of recent and past diagnosis.

The system database has been preloaded with about fifty nine (59) symptoms of the six chronic diseases that can be managed by the system for the patient to select from to be able to diagnose their present condition. The interface is as shown in Figure 12.



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Patient Registration
Register as a patient

Username
Sa'ad

Password
.....

First Name
Bisiryu

Last Name
Taiwo

Phone number
08038645039

Email
bisiriyutaiwo@ospolyiree.com

Age
45

Figure 7: Patient's registration interface

Doctor's Registration
Register as a Doctor

Add Photo

Email

Password

First Name

Last Name

Phone Number

Neurologist

REGISTER

Figure 8: Doctor's registration interface

Patient Login
Enter username and password to login

Username

Password

LOGIN

Figure 9a: Patient's login interface

Doctor Login
Enter username and password to login

Username

Password

LOGIN

Figure 9b: Doctor's login interface

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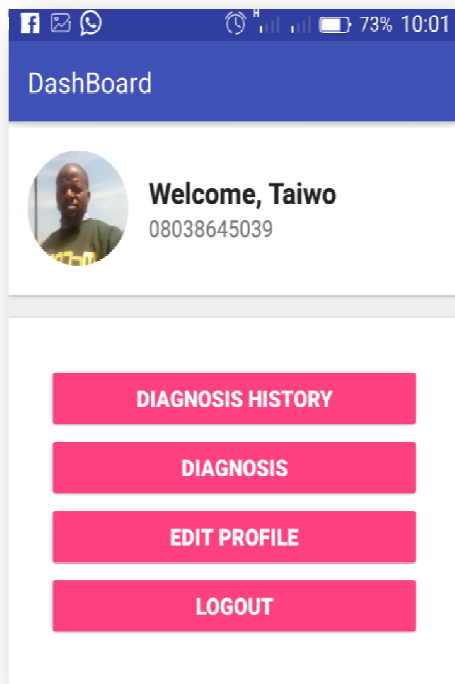


Figure 10: Patient's dashboard

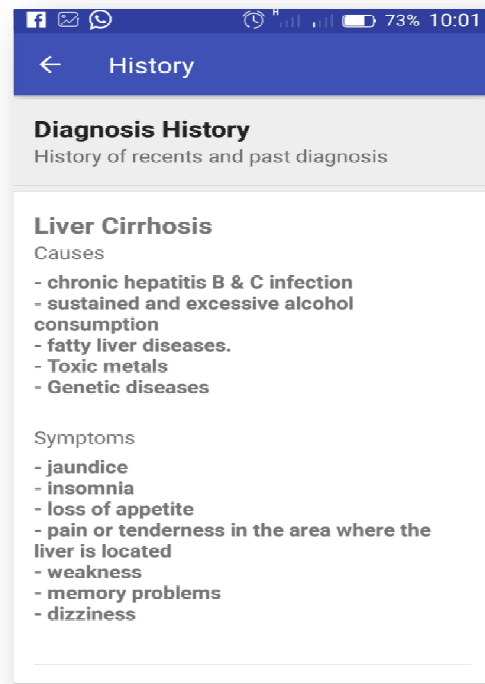


Figure 11: Patient Diagnosis History Interface

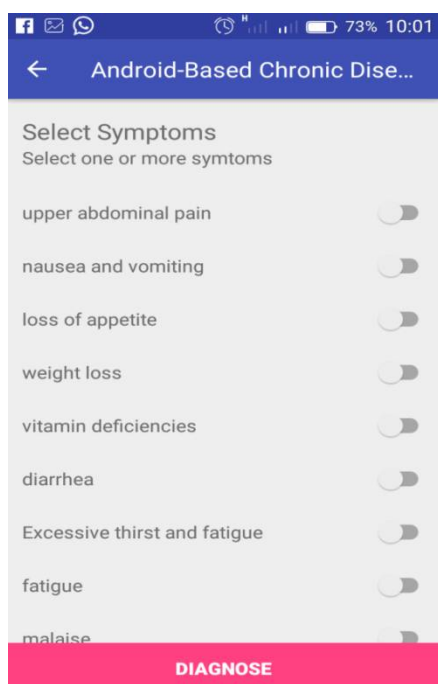


Figure 12: Symptoms Selection Interface

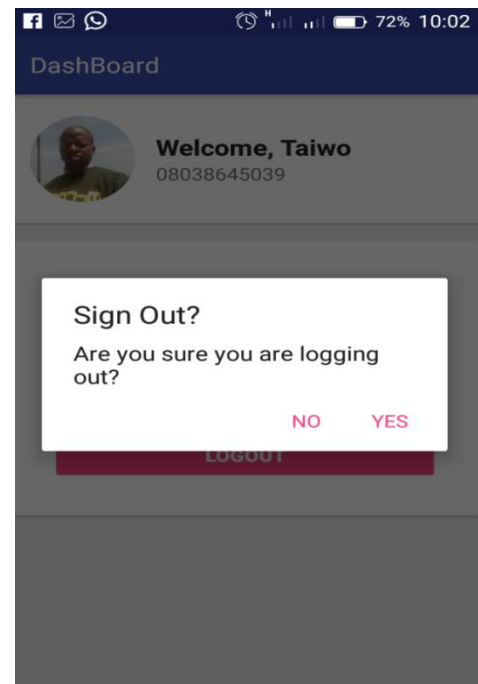


Figure 13: Logout Dashboard



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IV. CONCLUSION AND FUTURE WORK

This work was conducted in order to design and implement an Android Based Chronic Disease Management System that is suitable and adoptable for management of six chronic diseases which are Liver Cirrhosis, Obstructive Pulmonary diseases, Bronchitis, Kidney diseases, Cancer, and Hypertension, therefore, it is recommended for further study to be able manage other chronic diseases that are not covered in this work.

Also, the application is android-based; it is open to further research to be used on a mobile phone that is not android-based for the benefit of all mobile phone users.

In addition, the system is recommended for further study to include language translator to other common world's native languages in order to benefits more patients across the globe.

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