Development of Smart Health Application for Patient Record Management, Prescription, and Appointment

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Abstract: A system based on an Android application has gained great popularity for making people's lives easier. Since mobile platforms have become more user-friendly, computationally powerful, and affordable, innovations in mobile software applications can be beneficial to public health. We have developed and evaluated application that facilitates the connection between doctors and patients. A user-friendly interface has been developed to make this system efficient and user-friendly, providing the doctor with previous detailed patient information that is stored permanently in the database, making it easy for the doctor to review previous prescriptions of the specific patient when they encounter any problems. After successful registration and login, the patient can book an appointment and view prescribed medicines by the doctor and past lab records. The purpose of this application is to record patient information in a digital format for future reference.

Keywords: Smart health, mobile healthcare, web application, Android application.

I.   INTRODUCTION

Many aspects of human life, including healthcare, have been transformed by the rapid progress of mobile technology. It is estimated that over 85% of the world's population is now covered by a commercial wireless signal, with over 5 billion mobile phone subscriptions [1].

As Smartphone usage is increasing day by day, healthcare professionals and patients alike need to adapt quickly to the ever-changing mobile technology landscape in order to meet their needs. A specific objective of our paper is to develop an application that facilitates patient-doctor communication for appointment scheduling, prescription management, and lab records. Whenever and wherever the patient chooses, they have access to their medical records.

II.   LITERATURE SURVEY

Meenakshi Gautham, M.Sriram Iyengar, and Craig W Johnson [2] developed a clinical guidance system for the management of fevers, diarrhea, and respiratory problems for rural health providers which were mobile based. Its control design was field tested with 16 rural health providers and 128 patients at various rural/tribal sites in Southern India [2]. Protocol compliance groups for control, as well as experimental groups, acceptability, and patient feedback, were evaluated and the results indicated that mobile phone-based, media-rich procedural guidance applications have great potential to achieve the consistently high standardized quality of care by rural health providers.

M.V Ramana [3] proposed different subsystems for the "Mobile based Primary Health Care Management System" that is being developed by CDAC, Electronics City, Bangalore for better management of primary health care in rural and urban slums of India. The system will capture complete information related to an individual patient treated by a primary health care centre. The proposed sub-systems are- a central information repository with a database for patient information, a web server, an SMS interface for sending and receiving SMS to 2G mobile systems, WAP Gateway for linkage with a GPRS/3G mobile, a localisation module for providing an interface for translation.

Ravi Aavula, M. Kruthini, N. Ravi Teja, K. Shashank [4] proposed a smart health android application that enables users to get an instant report on their health issues through intelligent health care. Users can express their symptoms and issues

which are then processed by the application for various health issues that could be associated with the symptoms. If the application is not able to provide a solution, then it requests its users to undergo tests like blood tests, CITI scan accordingly.

Malik Bader Alazzam, Fawaz Alassery, and Ahmed Almulihi [5] describe the development of a mobile application that allows patient-doctor interaction and helps patients receive prompt medical guidance from the doctor or specialist through the application.

The development of this application was done using the Design Thinking Process to obtain the MVP3 (minimum viable product) as well as the Running Lean Process to perform iterations and develop a design that adds value to the user. The software development was done using the agile-scrum framework.

III. SYSTEM SOFTWARE, DATABASE, AND AUTHENTICATION

A. System software

The application software development was performed using Flutter which is an open-source framework by Google for building beautiful, natively compiled, multi-platform applications from a single codebase [6]. A powerful mobile framework and a powerful language combine to make Flutter an extremely powerful language and framework. It works on both iOS and Android [6]. For developing an Android Application, we have used VS Code software [7]. A Dart programming language [8] is used to code an Android application.

B. Database

In order to make our application work, we'll always need a database. Here we have used Cloud Firestore Database. Cloud Firestore is a flexible, scalable database for mobile, web, and server development from Firebase and Google Cloud [9]. Firestore is a flexible, scalable NoSQL cloud database to store and sync data [9]. As a first step, we have enabled the Firestore Database in our Firebase console. As a second step, we wrote the code for the backend that handles reads and writes from a database. As a last step, adding and retrieving data from the database are accomplished with our UI.

C. Authentication

It is provided through Firebase in this application to ensure that only authenticated users can access it. We have used simple email-password authentication here.
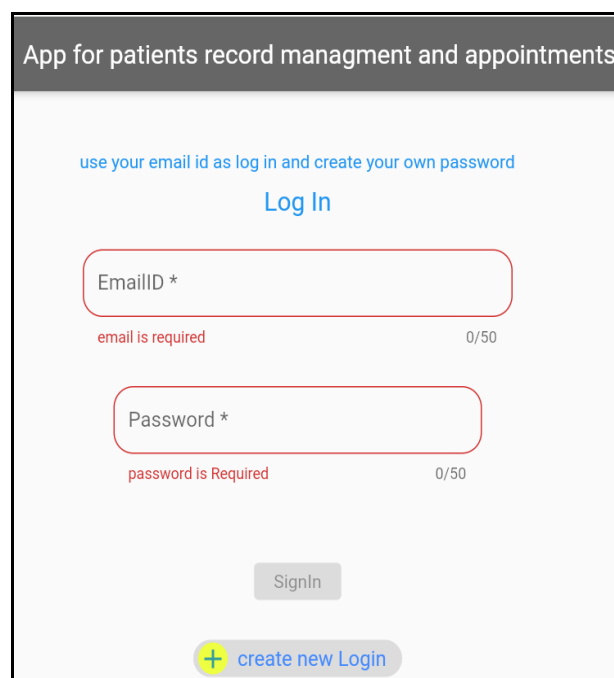

Fig. 1 Log in UI

We created a simple UI for Login registration. Firebase credentials are passed through our backend code. Then we called functions from our UI and response validation is done based on credentials are true or not. Registration and login options are available on the application's home page which is shown in Figure 1. Here new users need to provide a few details, such as their name and phone number by clicking on 'create new login'.

IV. SYSTEM ARCHITECTURE

Various users (patients, doctors, and admin) use the application, which gives the system the capability of being viewed from three perspectives: Admin, Doctor, and Patient.

A. Administrator Panel

Administrators are responsible for providing both doctors and users with the necessary information. Details about doctors and patients can be viewed/edited by the administrator. The block diagram of the Admin panel is shown in Figure 2.
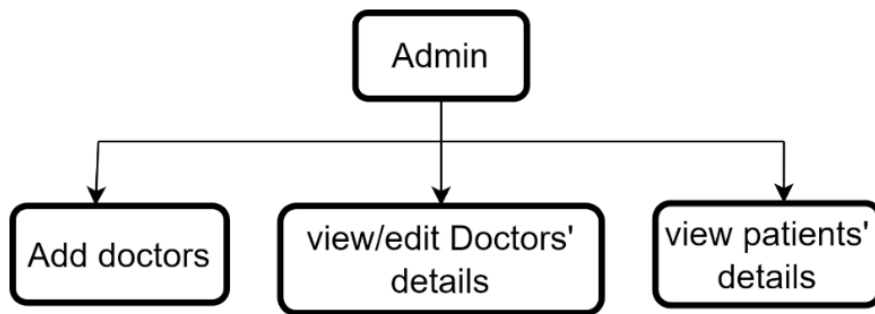

Fig. 2 Administrator access

B. Doctor's Panel

The flow chart of the Doctor's panel is shown in Figure 3. As soon as the doctor has completed registration, he or she will be asked to log in with his or her user id and password, and if the information provided is accurate, the doctor will have access to the system.
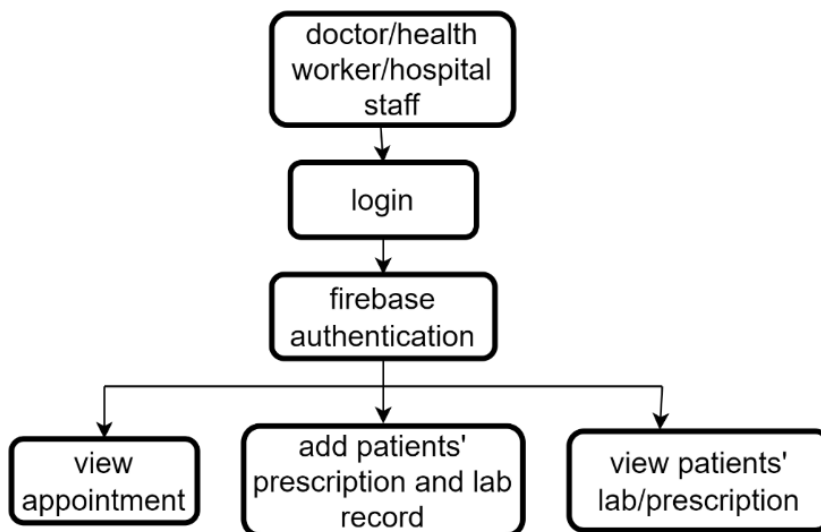

Fig. 3 Flow chart of Doctor's Panel

The doctor's panel contains two modules as shown in Figure 4. When a doctor clicks a view appointment link, the query goes to the front end part. After that front end fetches the booked appointment details from the database. As shown in Figure 5, the results are returned to the front end and displayed on the doctor's panel. With the view appointment module, It is possible for the doctor to view a list of patients who have booked his/her appointments.
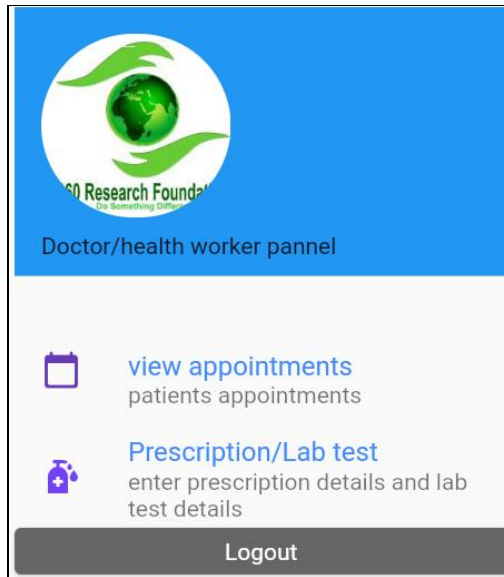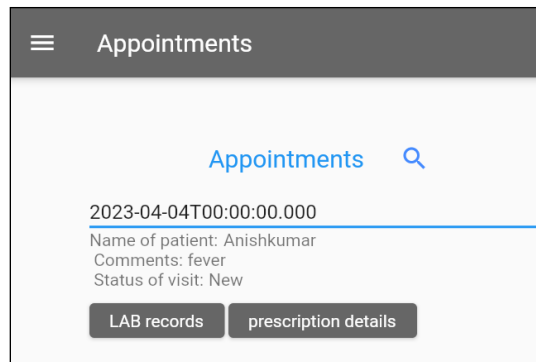
Fig. 4 Doctor/health worker's panel

Fig. 5 View the appointment module

The prescription/lab records module in the doctor's panel will allow doctors to add prescription and recommended lab report details. Later this prescription and lab results entry are seen by the doctor on the next visit.

C.   Patient's Panel
The flow chart of the Patient's panel is shown in Figure 6
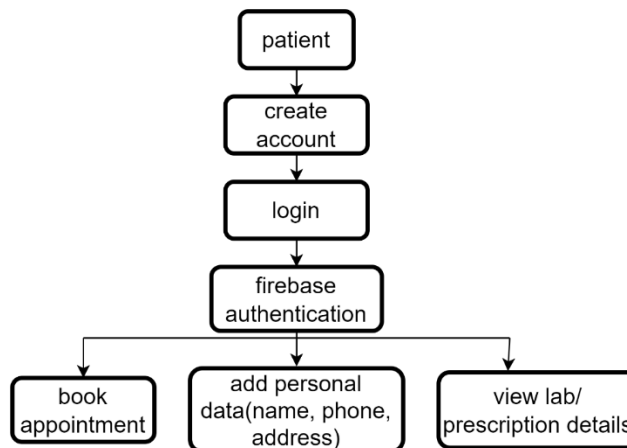

Fig. 6 Flowchart of patient's panel

It is necessary for new users to register by providing the following information: Name, Phone Number, and valid E-mail Address. After login, the user will be directed to a screen that shows appointment booking and the user's previous records of prescriptions and lab tests. The patient's panel contains three modules as shown in Figure 7.
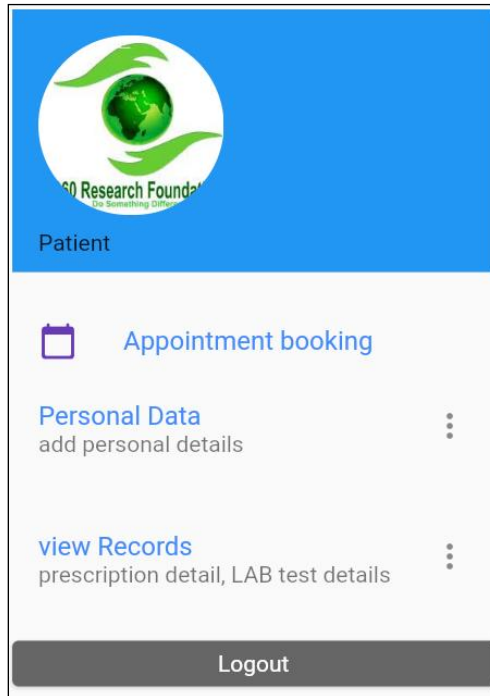

Fig. 7 View of patient's panel

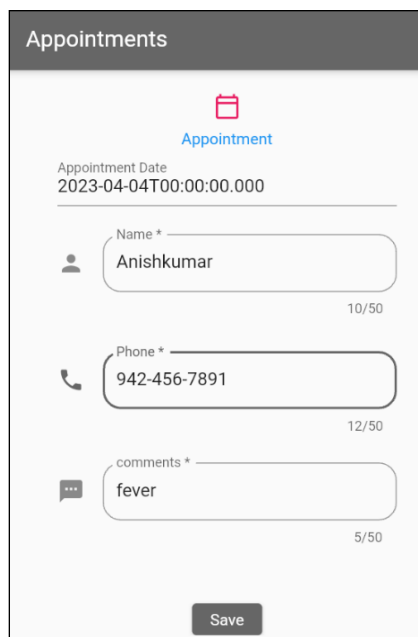The patient can book the appointment by clicking on the Appointment module as shown in Figure 8.

Fig. 8 View of the patient's appointment booking module

The user's previous records of prescriptions and lab tests are also viewed from the Record module on the patient's panel. These data are stored by doctors/ health workers or hospital staff and later they can be viewed by patients.

V.   CONCLUSION

Using mobile technology, the purpose of this work is to provide patient and doctor communication for better healthcare. The major significance of this work is to provide easy access to electronic health records to be viewed and entered at anytime and anywhere. With a mobile app, it is more convenient to maintain records, reduces errors, and allows healthcare providers to provide better patient care. In the future this work can be extended to support video consultancy, incorporating more privacy and this work will be updated to support graphical files.

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