A Smartphone Based Application for Medical Assistance of Elderly Patients

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***Abstract*: The importance of a routine health check-up for elderly patients, as well as the documentation of that check- up, cannot be overstated. Maintaining adequate documentation for a patient by himself or by his attendance, on the other hand, is extremely difficult. This paper primarily focuses on developing a framework that includes a smartphone application and introduces a real-time remote monitoring system for basic medical treatment of an elderly patient. It can keep track of a patient's emergency contacts. Using the SMS manager API, emergency contacts can receive messages with the patient's daily health alerts. Furthermore, the system will keep track of the patient's symptoms, and if anything goes wrong for a continuous period of time, the system will automatically send out reminders to schedule medical appointments. For medical appointments, a patient may be able to search for nearest doctors and schedule an appointment for him via the system. Here, Google map technology is used to search nearby doctors. A reminder is introduced in this system where all of the activities for a patient are notified on a regular basis.**

***Index Terms*: Regular Health Checkup, Firebase, SMS Manger API, Thresholds Value, Data Snapshots**

I. INTRODUCTION

Android phones are one of the most widely used accessories in the world. While it was once considered a luxury, it has now become a necessity for all generations. Android phones are now used by over 1.4 billion people worldwide. It's a multi-functional device that can be used for a variety of tasks and entertainment. An android phone can also be a great helper when it comes to health care.

Elderly people need care and comfort in order to live a safe, worry-free life.They become primarily reliant on others at this age. The years leading up to old age are the most important in a man's life. Each stage has its own set of issues and problems. As each stage progresses, both physical strength and mental health deteriorate. When people get older, they develop a variety of medical problems, including high blood pressure, diabetes, heart failure, arthritis, cancer, joint pains, tuberculosis, and kidney infections, to name a few. [1], [2]

An elderly citizen's health should be checked on a regular basis. It is very difficult to assess an elderly patient's condition without even visiting a doctor. Moreover, finding and schedul- ing an appointment with the desired doctor is quite difficult for elderly people. Furthermore, the current pandemic (COVID- 19) [3] situation is exacerbating the problem. The primary goal of this paper is to create an application that will aid in determining the health needs of elderly patients. When it's time to take patients to the doctor, the device will help the elderly people to take appointment with their required doctor. The rest of the paper is summarized as follows. A brief review of some existing research work is provided in Section

II. In Section III, methodologies are proposed. In Section IV, system implementation is shown. Finally, a conclusion with future work is provided in Section V.

II. RELATED WORK

Aging is a natural process and monitoring the health condi-tion of elderly people is very important. In this busy world it is not always possible that there will be someone all the time with the elderly people.

Nethshan Narasinghe et. al., developed a health monitoring system with both wearable and non-wearable devices that can measure the heart rate and track the real time location of a person and these data will be stored in a remote cloud. The doctors and the guardian of the elderly people can monitor the data [4].

Dr C. M. Velu et. al., proposed a health care system for the seniors with iphone and smart apple watch. The proposed health care app calculates the heart rate and when the heart rate is abnormal, it informs the emergency contacts via call or SMS or email or combination of all those. The app sends the report of heart rate to the concern doctor after a certain time. It also reminds to take medicine, to take a walk or to do some exercises [5].

Loneliness is a great concern for elderly people. Haobijam Basanta et. al., developed a system for constant monitoring of the elderly people through wearable devices, wireless sensors and actuators in real time so that in any kind of crisis the concerned caregiver or doctor can connect with the elderly people and give proper direction [6]. Gipsa Alex et.

al., developed a medicine box for the elderly people so that they can take the proper medicine on time and if the correct medicine is not taken by the patient emergency alarm will be activate [7].

Heartbeat, temperature and EEG can be monitored using Arduino UNO by the proposed system of C. Senthamilarasi et. al. By this system doctors can monitor the patient all the time and the data are stored in cloud [8]. If any anomaly occurs, the concerned doctor is informed instantly and the patient can get the proper medication as soon as possible [9].

S. Pinto et. al., developed a system prototype that can collect data like body temperature, pressure by using the sensor in wristband. These data can be monitored by concerned medical staff and concerned caretaker of an elderly person. If any vital sign is missing in the or any abnormal data is detected in the system then it will activate an emergency alarm [10]

In "Mobile Cloud Computing," Nirabi et al. [11] created a MESH model for Emergency Healthcare that involves an emergency procedure, a search for the nearest physician or emergency facility by chosen location, and an appointment in the patient's vicinity or at the medical center.

In [12], Jung et al. published in Mobile health (mHealth) that healthcare can be delivered online via a mobile phone and networking. Diabetes loss, weight management, cardio-cerebrovascular risk assessment, stress and depression assessment, exercise management, and settings are all included in the program. To provide services, information like EMR data is required. This paper focuses on six resources that help to synchronize EMR with data.

III. METHODOLOGIES

Our total implemented system is based on three subsystems.

1. Regular health Checkup and emergency contact 2. Data Analysis and doctor appointment 3. Reminder System

A. Regular health Checkup and emergency contact

Regular examinations may aid in the detection of possible health problems before they become a concern. When we see our doctor on a regular basis, they can diagnose health problems or diseases early. But it is not always possible for us to visit doctors regularly. Especially in this pandemic situation it almost becomes impossible to move with an aged patient or physically disabled patient. Early detection increases the chances of receiving the best care possible and preventing complications.

We have developed such a system where the elderly patient can check his health condition on a regular basis without moving from home. In our system, we assess a patient's health condition based on some fixed criterion. In most of the cases these criteria can decide efficiently if a patient leads a healthy life or not. These criteria are: blood pressure checkup (by using blood pressure monitor), temperature measurement (with the help of regular thermometer), sugar level (utilizing a blood sugar monitor), oxygen level check (by dint of oxymeter) etc. These criteria act as inputs in our system and these inputs can be given by a patient himself or may be a patient's assistant can complete the task. The input data is stored in our database and we have used firebase as our database system.

The input value given in our system can be compared with our existing threshold values for each criteria. To perform this comparison we have built a custom method whose algorithm is given below:

Algorithm

1: Read input data and threshold value 2: Compare input and threshold value

3: If (input>maximum threshold or input<minimum

threshold) Send message and store the data 5: Else: Store the data

6: Stop

In our system, input data and threshold values are written to a firebase database and will retrieve the data by attaching an asynchronous listener reference for further action. To read and write data from firebase we need to create an instance. FirebaseDatabase.getInstance ( ).getReference ( ) method is used to create an instance.

We use the addValueEventListener ( ) method to add a ValueEventListener to a DatabaseReference to read data at a route and listen for changes. The data at the designated position in the database at the time of the event is received by the listener in the form of a DataSnapshot. The Java object representation of the data is returned when getValue ( ) is called on a snapshot. If there is no data at the site, getValue ( ) returns null.

After reading data from the firebase, then our system compares the data with the given threshold value. If input data is above threshold value or below minimum threshold value then our system immediately sends a message to its enlisted emergency contact. For Example: About 90/60mmHg and 120/80mmHg is considered optimal blood pressure. Blood pressure of 140/90mmHg or higher is considered high. Low blood pressure is described as a reading of 90/60mmHg or less. By comparing these values, a patient's blood pressure can be detected as high or low blood pressure and our system will send SMS in both cases to its corresponding emergency contact.

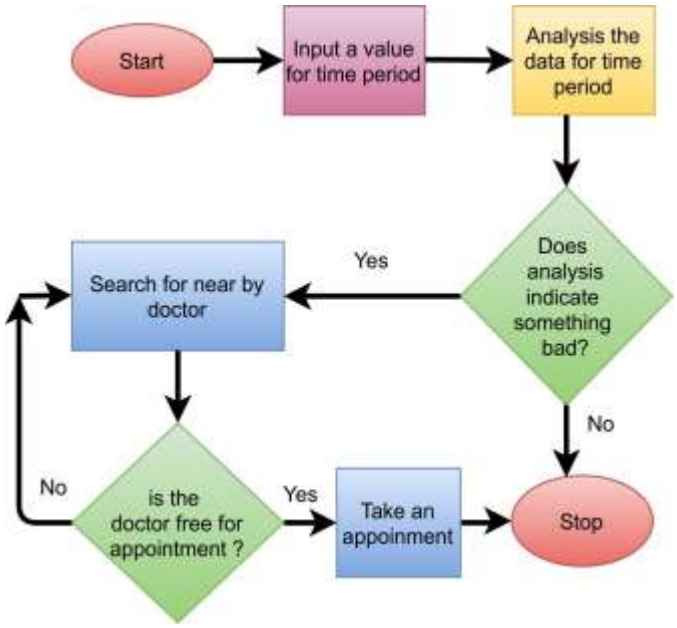

Fig. 1: Graphical View of regular health checkup.

For sending messages from our application, we use SMS Manager API. It will directly send a message to our enlisted contact bearing patients' health conditions. In order to accomplish the above task, we have used SMS Manager API in the following way. [13]

SmsManager smgr = SmsManager.getDefault() smgr.sendTextMessage(MobileNumber,null,Message,null,null)

To send SMS, the SMSManager API required the SEND SMS permission in our android manifest. The code snippet to set SEND SMS permissions in the manifest file is as follows.

<android:name="android.permission.SEND SMS"/>

Whether we require to send SMS or not our system will save all the data of a patient in the FireBase.

B. Data Analysis and doctor appointment

In our second system, we analyze our input data for a certain period of time. This time period can be decided based on the patient's condition. User will give this time period as input. If the user input for a patient is above or below threshold value it will mark as a point in our system. If this continues for a user mentioned time period, then our application will suggest the patient to visit a nearby doctor.

A patient can take an appointment to his nearest doctor or desired doctor by using our system. To find the nearest doctor we have used google map and GPS technology. A patient can confirm an appointment from the system if his desired doctor

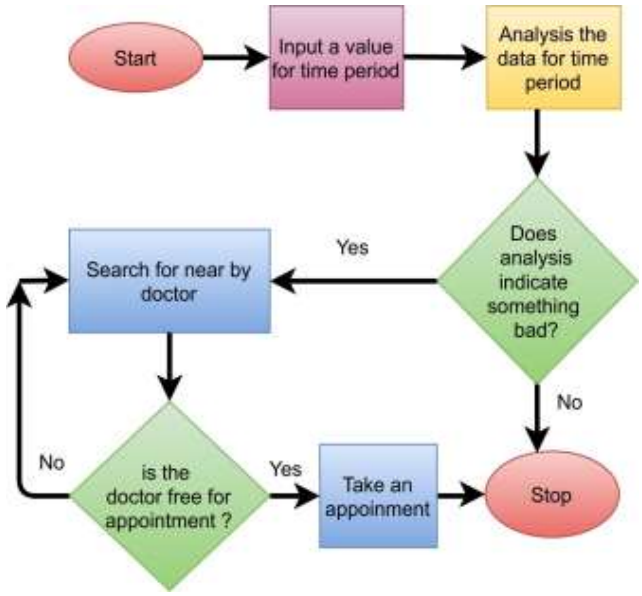

Fig. 2: Overall representation of data analysis and doctor appointment is free for that day otherwise it will search for other available doctors.

C. Reminder System

In our application, we have implemented a reminder system. This reminder system helps a patient to take medicine in time, to do some regular exercise, regular check up and inform him about his doctor appointment if any.

IV. IMPLEMENTATION

Our proposed framework has been turned into an Android app. When a user logs into our system, he will see an interface similar to the one shown in Fig.3. To access our main system, the user will need to enter their user id and password. If he isn't already a member, he will need to register with our system. After clicking on the sign up button, he will see a interface which is portrayed in Fig.3(c). To complete the sign-up process, he must now include the patient's appropriate details as well as his emergency contact information.

Fig. 3: Login and Registration Process

Now using id and password he will enter into our system and will see our main home page interface.

Fig. 4: Main Interface of the System

If any health related issues occur, then a notification will be seen in our system like Fig. 5(b).

B. Data Analysis and doctor appointment implementation

If any discrepancy report appears within the given time frame after analyzing the data, a notification is issued. It will alert the user to the fact that he will need to see a doctor. Our framework also allows users to schedule doctor appointments.

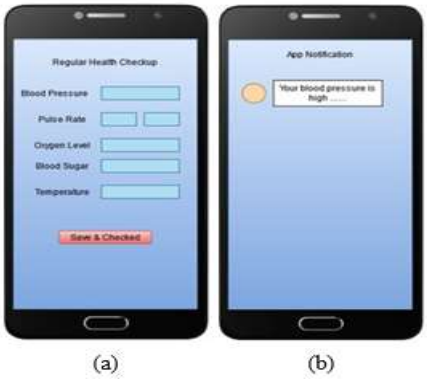

Fig. 5: Regular Health Checkup and Notification

A. Regular health Checkup and emergency contact implementation

An interface similar to Fig.5(a) will appear after clicking on the health checkup button. The patient or his assistant will need to input the necessary fields and click on the save and check button.

Fig. 6: Doctor Appointment

To take doctor appointment he will need to click the doctor appointment button which is shown in Fig 4. After clicking the button, the user will see the nearby doctors around him. He can also search the doctors by category through our system. After choosing the suitable doctor for him, he will see an interface like Fig .6(a). After pressing the make appointment button, the patient will be asked to include date and time [Like Fig.6(b)] in order to complete the doctor's appointment.

C. Reminder System implementation

In our system, we've included a reminder section where the user can enter his or her daily useful job, as shown in Figure 7. And our system will remind him of his task on a regular basis.

Fig. 7: Regular Health Checkup and Notification

V. PERFORMANCE EVALUATION OF OUR SYSTEM

We used Alpha and Beta testing to assess the performance of our application. The testers conducted alpha testing and discovered some faults and errors. We promptly fixed them, and after completing alpha testing, we moved on to beta testing. Because beta testing is done by users, they have suggested changes to the UI design. We've also updated our application to reflect the change. We've also given our application to real-time users, who have found it beneficial and provided us with positive feedback.

VI. CONCLUSIONS AND FUTURE WORK

In this research, we implemented a system that can do the regular health checkup and contact the concerned person in case of emergency. Moreover, the system can analyze the given data and suggest a nearby doctor. A reminder system is also included to remind the patient about their medicine, exercise in proper time. By combining google map, GPS technology and firebase database the system is developed which provides real time service. It will help the patient to get early treatment. Hospitals or such organizations will also be benefited by using the system to manage a large number of elderly patients with a minimum number of caregivers. In this system, we use a limited number of parameters such as blood pressure, blood sugar level and body temperature to analyze a patient's health condition. As a future work it is possible to use navigation using Bluetooth Beacons and WiFi, from home to the doctor's

chamber for the elderly patient's ease of use.

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