Personalized Health Monitoring Assistance

A low cost solution to chronic diseases and cardiac healthcare

Abir Ahsan Akib, Mahmudul Hassan, Sadi Mohammad Siddiquee, Tanveerul Islam, Samiul Mushfik*

Department of Electrical and Electronic Engineering, Bangladesh University of Engineering and Technology

*Department of Computer Science and Engineering, Bangladesh University of Engineering and Technology

Mentor: Shuvangkar Chandra Das; Project Engineer; IICT, BUET

Abstract—In recent times, treatment of patients of chronic diseases has been a matter of great concern. In this project, we have tried to tackle the problems associated with chronic diseases, especially the ones that come with old age and sustain for a long period of time. The project subjects to the difficulty in keeping a patient admitted to a hospital for a long period of time and gives a 24 hour assistance to the patient at home. The project monitors the basic determinants of health of a patient including BPM, Blood Pressure, Temperature, Blood Glucose level, Breathing Rate and Cardiac Arrhythmia. The samples of photoplethysmogram (PPG) and electrocardiogram (ECG) signals along with temperature are processed to determine irregularities concerned to the health condition of the patient and store the data to a web server every minute. Close relatives and doctors have access to the server through an android application which sends an alarm to either the patient's close relatives or the doctor or both based on the severity of the irregularity. There is a switch which enables the patient to send an alarm to his relatives manually in case of any discomfort.

Keywords—PPG, ECG, BPM, Blood Pressure, Health Monitor.

I. DESCRIPTION OF PROJECT

The project deals with continuous monitoring system of a patient with long running diseases. Often it becomes impossible to keep them admitted to a hospital day after day. Again it becomes increasingly difficult for the family members of the patient or even an appointed nurse to keep an eye on him/her for 24 hours a day. In order to solve this problem, we have developed a personalized health monitoring system where the patient does not need constant monitoring from a person; rather it will be done automatically by our system [1] [2]. It will store the person's data on the server continuously which will only be accessible to the patient's relatives and doctor. Again the front-end android application will alarm and notify the authorized users; i.e. doctor and relative if the patient's health deteriorates at any time of the day or night. The patient can also notify them in case of discomfort by pushing a simple button.

The whole project is based on three parts-hardware interfacing, signal processing, and android application development.

A. Hardware

The system contains two biomedical sensors- an ECG sensor (AD8232 development board developed by Sparkfun) and a PPG pulse sensor (Developed by Sparkfun). Raw data is extracted from the sensors using a microcontroller. There is also a temperature sensor sensing the body temperature of the patient. Due to limited processing capacity of microcontroller, the sampled data is sent to a raspberry pi which works as the main processor. The raspberry pi, after processing will upload the data to a server. Another hardware component that will be used is a blood glucose sensor. Since measuring glucose requires blood and is an invasive procedure, the blood sugar data will be provided to the server twice a day manually.

B. Signal Processing

The ECG and PPG signal obtained from the sensors are generally noisy containing white noise, high frequency noises, 50Hz power system noise and baseline wander noise. The signals thus need to be filtered at the initial stage of processing. Then the signals will be processed. The ECG signal will be used to measure BPM and arrhythmia and the PPG signal will measure BPM and blood pressure. Since the PPG signal depends on the blood flow through a vain, the PPG signal can be used to determine the
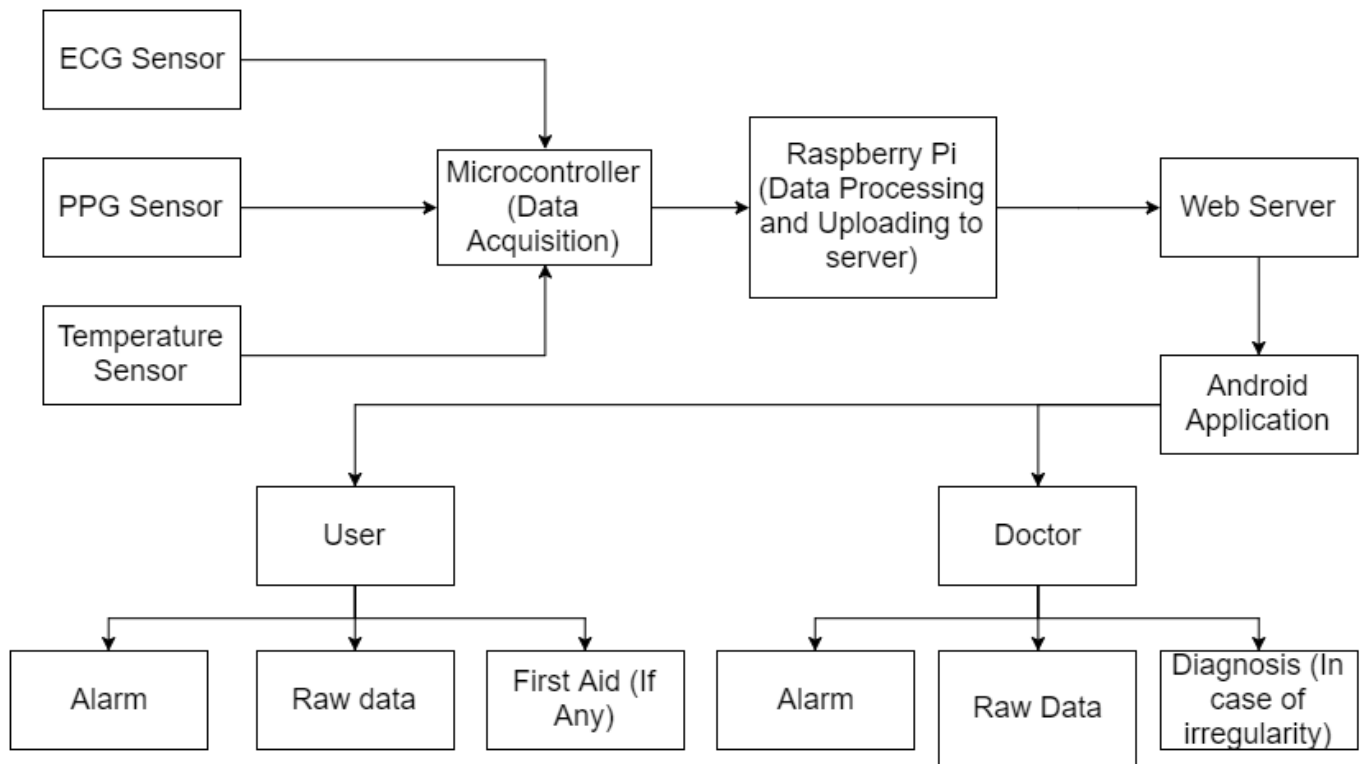
Figure 1: Functional Block Diagram of Personalized Health Monitoring Assistance

volume of blood flow through a vain and when processed using systolic and diastolic coefficient; obtained from regression and statistical analysis; can be used to accurately determine the blood pressure [3] [4] [5].

C. Android Application Development

This is the only section that will be accessible to the front end users; i.e. the authorized doctor and close relatives of the patient. The app will contain a login option where a user has to log in with appropriate password to view the reports of the patient to maintain patient data secrecy. The application will also contain a plotter that will plot the ECG and PPG signals so that the doctors can view the reports in traditional way alongside the verdict developed by processing the signal. There will also be a provision for the doctor to prescribe the patient sitting at his own place which will be uploaded to the server and accessible to the patient's authorized relatives.
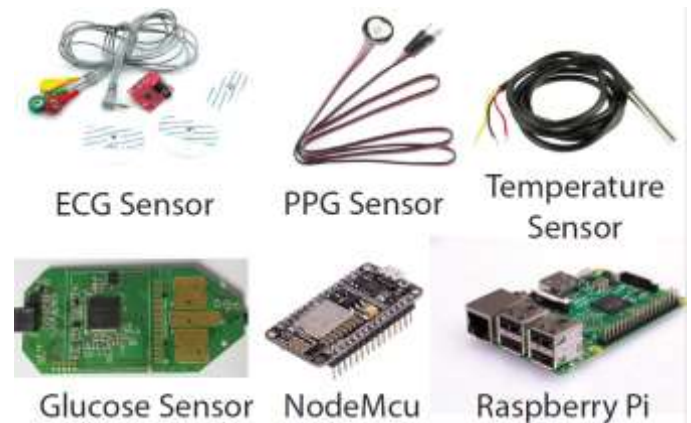

Figure 2: Hardware Components

II. COMPARATIVE STUDY BETWEEN THE EXISTING SYSTEM AND THE PROPOSED SOLUTION

In the existing system for health monitoring, the patient needs to get admitted to a hospital where he is taken care of by in charge doctors, nurses and sophisticated machines [6] to monitor patient's condition. The difference that our system has with
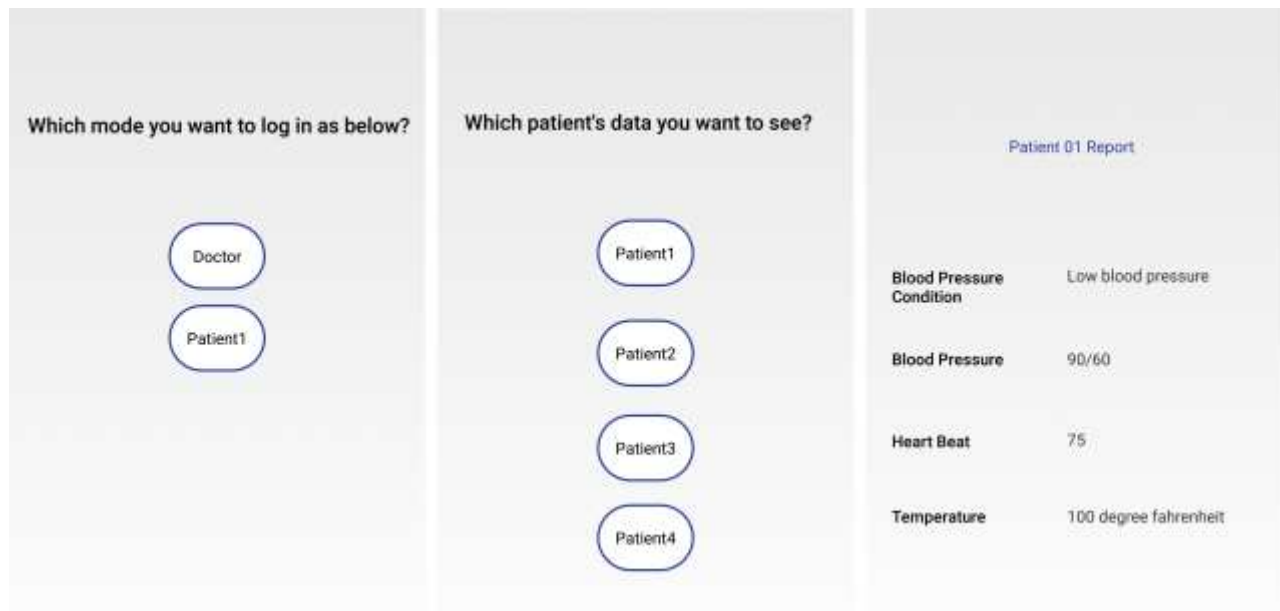
Figure 3: Primary Structure of the Developed App

the existing ones is the patient can get proper care sitting at home and any problem can be detected at the earliest stage to send him to hospital. Also there is a data logging provision. All the data get uploaded to server which can be used for future reference. Again the exact time of any irregular cardiac behavior can be known.

III. PRIMARY FEATURES

The primary monitoring features of the system includes provision for the followings:

- ✓ MEASUREMENT OF PULSE RATE [7] [8]
- ✓ MEASUREMENT OF BLOOD GLUCOSE
- ✓ MEASUREMENT OF BLOOD PRESSURE USING PPG AND ECG SIGNAL [9] [10]
- ✓ MEASUREMENT OF BODY TEMPERATURE
- ✓ DETECTION OF CARDIAC ARRHYTHMIA

With proper research opportunities, more features can be integrated in the same system.

IV. MAJOR DRAWBACKS

Because our system is at an initial stage of development, there are some unfortunate drawbacks that will take further research and development to overcome. First drawback is that the system is not portable in the initial stage of prototyping; which can be solved in future developments using low power processors. Another drawback is that though the device will be cheap as compared to the sophisticated devices of laboratory, this will still not be inexpensive enough to reach the hands of all classes of people. That being said, the cost can be drastically reduced in case of mass production.

The device and its operations are based on prototype sensors which are not specialized for medical purposes. Again the device has been made by engineering students based on the available online medical resources without the direct supervision of a physician. So any decision stated by the device will need a physician's agreement before acting upon it. So, the device can be used to understand the condition of health and the problems related to it, its actual application at this stage of development is to aid the physician and give the family members and doctor a proper alarm about deteriorating health so that a patient can be admitted into hospital as soon as his health deteriorates ensuring that nobody dies because of lack of medical aid in due time. With proper patronization, this system can be developed in association with physicians to increase the system's use and accessibility.

V. HUMANITARIAN IMPACT OF THE PROJECT

We believe that the project goes really well with the theme of the competition "Smart Technology for Humanities". Cardiac arrest or stroke in sleep eventually leading to death is a regular ongoing phenomenon. If the family members and doctors are given time and they are made aware of the situation, this toll of death can be significantly reduced. Again the low cost of the system will make it affordable to general mass of people and as a result it may be effectively used to serve a great number of people. The device provides smart monitoring of health with the sole aim of decreasing the death count due to not having proper treatment in time.

VI. CONCLUSION

Our project is a low cost, sustainable and easily accessible solution to the health monitoring issue. It has the capability of solving the severe problem of neglect towards people suffering from chronic diseases as health monitoring in conventional methods take high cost and time. Using our solution, people can finally relax about their old aged relatives' health issues as it gives them the ability to easily check their relatives' health and get notified in case of an emergency, aiding them to take necessary steps immediately and save the lives of their dearest ones. Our project is currently in prototype phase and has some limitations and drawbacks. But with proper investment and development opportunities, it can be fully developed into a portable full time health monitoring system which will ensure peoples' health while they are outside hospital observation. It will ensure that everybody receives immediate health care in case of any problem. This will change peoples' lives and lead them to futuristic health care system where everything will be automated and self-controlled. This can open the door towards fully automated 24/7 health service. Thus, our project has a huge potential to have a huge impact in developing a health ensured environment for everyone.

VII. REFERENCE

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