Smart Mobile App for Remote Health Monitoring System using IOT

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Abstract : ***The Internet of Things has provided opportunities and applications for medical patients. The IoT app is the key technology to allow for medical performance. This paper highlights the practical use, low power consumption, real-time remote monitoring system based on the Internet of Things technology. This initiative provides an advanced step in the field of remote health monitoring. Population numbers, which require health care, are growing every year and standard signal monitoring systems require the presence of patients in person within hospitals. This can create an unhealthy environment for caring for patients with the disease, especially those with serious and unstable health conditions. Therefore, internet technology and modern electronic devices can provide promising solutions in this field. Based on that, the paper proposed a mobile system such as IoT platforms to remotely monitor ECG signal, heart rate, SPO2, blood pressure and body temperature in patients. Symptoms are measured and processed using a high-speed microcontroller. The main contribution of this paper is to send an electrocardiogram (ECG signal) to a mobile phone for medical examination. This helps to diagnose heart disease before a serious case occurs. Finally, the results obtained for this review page are displayed in the Smart mobile App.***

Keywords: IoT (Internet of Things), Blood pressure sensor, Temperature sensor, ECG sensor, pulse oximetry sensor, Blynk Mobile application.

I. INTRODUCTION

In this day and age, it is now difficult for anyone to know what life is like. Since health care is invisible and untreatable, people are at greater risk for health problems. Health care is the maintenance and monitoring of health through prevention, diagnosis and treatment. This was introduced by health and medical professionals such as doctors and nurses. However, in many parts of the world, such health care is still widely available despite advances in technology and health care. Another problem is the extra cost of post-operative care and post-hospital care. After the patient is discharged, home follow-up is equally important and necessary to ensure patient well-being. At home, continuous monitoring of health conditions provides caregivers with visibility on patients' recovery strategies.

Therefore, it should be carefully considered to get it completely. The process of documenting health conditions from time to time is prone to user error. For example, it is possible for a person to forget to take the reading at the right time, or it may also be incorrect. It is also important to treat the patient on time. However, it is possible to give the wrong pill or forget to put the medicine on top. These activities can be made easier by creating a system that informs them about their medications. The adoption of Internet of Things (IoT) in health care can greatly improve patient care and reduce user errors.

IoT is a system of connected devices that can exchange data. This allows them to make wise decisions about growth and development in the Internet of Things, better and better health care is now possible and easily accessible. The integration of IoT into health care can significantly reduce mortality, and ensure patient-centered care. With the integration of IoT in health care, it is possible to get a faster and more accurate diagnosis of diseases and to find the best solution for them.

The concept of the proposed paper is to define and implement a real-time health monitoring system using the Internet of Things (IoT) and a smart phone system. The system contains sensors that monitor various health factors such as blood pressure, electrocardiogram (ECG), heart rate, body temperature, and oxygen saturation (SpO2). The app displays information from the sensors from time to time in a simple way that is understandable to all.

Section 1 includes Introduction, section 2 includes literature survey of literature related to the paper, section 3 includes problem statement and objectives, section 4 includes methodology, section 5 includes hardware and software requirements and flowchart, section 6 includes result and discussion, section 7 includes future scope, section 8 includes conclusion and the section 9 includes references of the proposed paper.

II. LITERATURE SURVEY

In this paper [1], the author's proposed an effective approach, Smart phones are one of the most useful devices in the world. A smart phone usually contains many types of sensors and many sensors to be added in the future. Other sensors included in the smart-phone are wireless sensors, Bluetooth module, Accelerometer, Fingerprint sensor, Gyroscope, Magnetometer, Barometer, Proximity, GPS tracker, Camera, NFC - next to the field sensor most commonly used for health programs monitoring.

In this paper [2], the author's proposed a sensor-based health monitoring system collects information about the patient's health status through an electronic data signal and notifies the patient with a sound alarm. Different types of nerves, ECG, temperature and heart rate are widely used. Most health monitoring devices use body temperature sensors, heart rate sensor, temperature sensor.

In this paper [3], the author's proposed an practical research to create a less expensive PPG sensor and this is achieved by using a combination of LED-photodiode to emit light and receive reflected light. It penetrates into the tissues deep enough to detect a variety of blood volume. A light-based sensor can be used to detect this variety of heartbeats, this is done using a non-invasive Photoplethysmography (PPG) sensor. Diagnosis of atrial fibrillation is made by looking at the differences in the time of the heartbeat.

In this paper [4], the author's focus on the study of the various methods used to monitor patient health includes various important parameters. This will also give an idea to doctors and patients about the limits of medical care using the internet of things. Existing documents focused on this paper and published a variety of programs designed to monitor the health status of chronic patients or of people who are just on the verge of illness.

In this paper [5], the author's proposed an effective system that combines details such as temperature, circulatory difficulty and patient rate of stroke and restores the similarity of the specialists. The framework compiled exemplary data for ten patients to assess the condition of patients. This Health Monitoring System informs the patient of possible movements to get into them.

In this paper [6], the author's proposed an microcontroller research is a standard and widely used equipment for health monitoring systems around the world. MCUs are very useful for the rapid processing of raw sensor data. The proposed system is an Arduino-based parameter monitoring system controlled by a smart phone app.

In this paper [7], the author's proposed an remote heat formation and body temperature monitoring device. The result of this approach is a remote health measurement system with flexible structures that can be used in many areas of the application. The system has been tested and approved for bio signals such as heart rate and body temperature. Bio signals are measured in real time with high resolution but are very expensive for the measurement system.

In this paper [8], the author's proposed an effective literature survey on ECG feature extraction. This is a well organized health monitoring system. This system enables physicians to monitor patient health parameters such as fever, heart rate, ECG. Patient parameters were continuously measured using zigbee technology. Provides a solution to improve the performance and power management of the patient's health monitoring system.

In this paper [9], the author's proposed an IoT-based patient monitoring system. It is a cellular monitoring system that can continuously monitor a patient's heart rate using an ECG. In this proposed paper an ECG sensor that can be replaced with an electrode can be implanted in the patient's chest. Symptoms are produced when a muscle contraction is felt by the system and details are recorded. This new technology is able to provide a wide range of benefits to patients by quickly detecting unusual conditions.

In this paper [10], the author's proposed a health monitoring system using IoT and Raspberry Pi. IoT and Raspberry Pi health care monitoring system reviewed. Any unusual condition of the patient's health can be found and reported to the patient's relative. The proposed system works good and understandable with communication between patient and doctor.

III. PROBLEM STATEMENT

Monitoring an individual's health is considered important because of the increasing health problems in today's world. A growing stressful life takes a heavy toll on public health. As the queue grows in hospitals and the number of patients is increasing, doctor's fees have skyrocketed, especially for those patients who are unable to pay or who are not in large patients but who only know that after paying the doctor's fees.

Remote health monitoring can provide useful physical information at home. This precaution is helpful for elderly or chronically ill patients who may wish to avoid hospital stays. The system should collect the diagnosis of heart disease, blood pressure, temperature data and a few other parameters.

This program provides better health care for self-monitoring and consultation from a specialist. The customized app will be extremely useful for users of any age. Easy to present the app to the user will be the key to the success of this program.

The objectives of the proposed paper is :

- To remotely detect body temperature, blood pressure and pulse rate of an Individual using wearable sensor.
- To transmit these information to the concerned hospital and Doctor.
- To ensure data readability of the sensors where anybody can easily identify the status of the health without any prior technical knowledge.
- To provide a fast responding alert mechanism and timely medical help for critically ill patients.
- The proposed health monitoring system is compatible with the use of a variety of wearable sensors to extract medical data that helps determine multiple parameters

such as pulse rate, blood pressure, and body temperature, ECG at the same time.

IV. METHODOLOGY

The proposed system is to record various sensory information and present it to users in an easy-to-use interface. Recorded data that can be accessed through the app will show that the reading is within the normal range. It will also inform the user and their contacts regarding medication requirements such as dosage, meal time etc. In the next section, the building blocks will be specified.

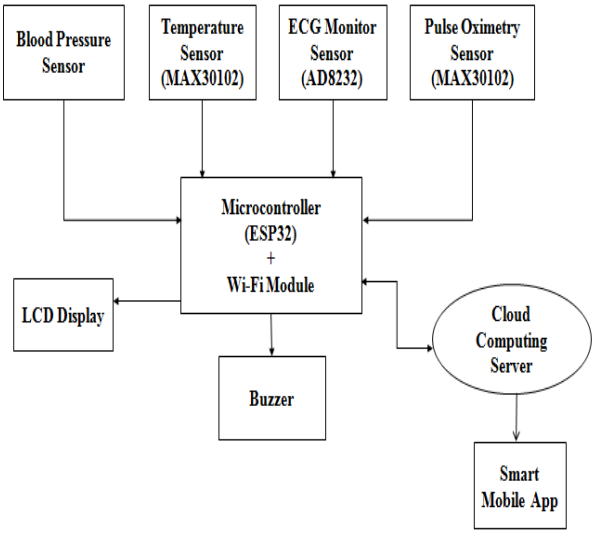

Figure 1. Block diagram of smart mobile App for remote health monitoring system

The proposed system consists of sensors that monitor various health parameters, namely heart rate, blood pressure, electrocardiogram (ECG), body temperature and oxygen saturation (SpO2).

V. HARDWARE AND SOFTWARE REQUIREMENTS

5.1 Hardware Requirements

The hardware and software requirements for implementation of the proposed system is blood pressure sensor, temperature sensor, ECG sensor, heart rate, and Blynk App.

A. Blood Pressure Sensor

BPS is a clinical sensor used to detect and measures the human blood pressure. It can measure systolic, diastolic and mean arterial pressure using an oscillometer process. Monitoring blood pressure is important because as it rises, it builds up in the bloodstream and thus weakens it. For these reasons, the risk of stroke, heart disease, and dementia is possible. Blood pressure refers to the force exerted by the blood flow to the atrial wall during congestion and diastole. A strong tendency to have high blood pressure (hypertension) is considered an early symptom that often helps medical professionals diagnose large patients.

Figure 2. Blood pressure sensor

B. Pulse Oximeter and Temperature Sensor (MAX30102)

The MAX30102 pulse oximeter is used in the proposed construction to measure temperature and oxygen saturation. The pulse oximeter is a non-invasive test that uses a probe that can be protected by a finger or an ear. It measures the level of oxygen in the blood. Typical oxygen saturation levels are between 95 and 100 percent. Low oxygen levels below 90 percent can cause cells to become depressed and damaged. The pulse oximeter is used to monitor the health conditions of a patient with problems affecting blood oxygen levels such as anemia, heart disease, heart failure etc. MAX30102 is a pulse oximetry solution and a heart rate sensor solution. It includes two LEDs (IR and Red), a picture detector (visible + IR), well-designed optics, and low-frequency signal operation to detect pulse oximetry and heart rate signals. It is completely configurable using software registers, and digital output data is stored in 32 deep FIFOs within the device.

Figure 3.Pulse Oximeter and Temperature Sensor

C. ECG Monitoring Sensor (AD8232)

The AD8232 ECG was approved to measure cardiac output at rest. The ECG (Electrocardiogram) provides details such as heart rate and rhythm. It can also provide information on increased heart rate due to high blood pressure (hypertension), symptoms of decreased oxygen supply to the heart, increased muscle mass in the heart, and may indicate signs of previous heart attack. The AD8232 ECG Module is integrated with the AD8232 IC from Analog Devices, which is a single-chip designed to extract, amplify, and filter powerful bio signals for potential bio-measurement applications (such as ECG and others). ECGs can be excessively sound so that the AD8232 Single Lead Heart Rate Monitor can act as an op-amp to help get clear signal from PR and QT intervals easily.

Figure 4. ECG Monitoring Sensor

D. Microcontroller (ESP32)

ESP32 is a highly flexible chip (SoC) system that can be used as a standard purpose microcontroller with a wide set of parameters including wireless capabilities. And it can be implemented as an excellent solution for a mass production bed. ESP32 can act as a completely independent program or as a slave device on the host MCU, reducing the communication stack over the main application processor. ESP32 can connect to another application to provide Wi-Fi and Bluetooth functionality with its I2C / UART port.

Figure 5. ESP32 Microcontroller

E. LCD Display

In this automated system for monitoring wireless health in patient hospitals, an LCD display is used to monitor a patient's body temperature. This LCD display connects to the microcontroller and is powered by 5V dc with a voltage regulator. This LCD display has 16 pins.

Figure 6. LCD DISPLAY

F. Buzzer

A buzzer or beeper is an audio signature tool, which can be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and user input verification such as mouse click or key.

Figure 7. Buzzer

5.2 Software Requirements

A. C Programming

C is the language of process planning. It is designed primarily as a programming language. Key features of the C-language include low memory access, a simple set of keywords, and a clean style, these features make the C-language ideal for programming as a functional program or compiler integration. C combines features of both high and low languages. It can be used to create low-level programming, such as pilots and characters and supports high-level language activities, such as writing software applications, etc. C is a systematic programming language that allows a complex system to be separated from simple systems called functions.

It also allows free flow of information across all these functions. C is highly portable and is used for writing programs that make up the bulk of the Windows, UNIX, and Linux operating systems. C is a language that sets common goals and can work well in business plans, games, graphics, and applications that need to be calculated, etc. Language C has a rich library that offers a wide range of built-in functions. It also provides powerful memory sharing. Using algorithms and data frames quickly, facilitates faster calculation of programs.

B. BLYNK App

Blynk is an app with iOS and Android platforms that will make this happen. Here by simply dropping widgets on the mobile screen we can create a visual interface for another project using the Blynk digital dashboard and it is very easy to use. This app will not make it true to a specific board but is an optional support tool. Whenever a processor board is used to connect to the Internet via Wi-Fi or Ethernet, Blynk will find it online and ready for "internet for your stuff".

5.3 Working of the System

The complete set of the proposed system is shown in Figure 8. Details of the blood pressure sensations, heart rate, body temperature, ECG is displayed on the local LCD display, and on android or iOS via the internet. The sensors are connected to the ESP32 microcontroller, which is also connected to the Wi-Fi Shield. The shield is mounted on a microcontroller board and provides internet connectivity throughout the system. The Microcontroller is connected to

the components of the hearing unit, the WIFI Module, and is powered by an external battery. The nerves are attached to the patient's body. The proposed system will serve as a real-time monitoring system.

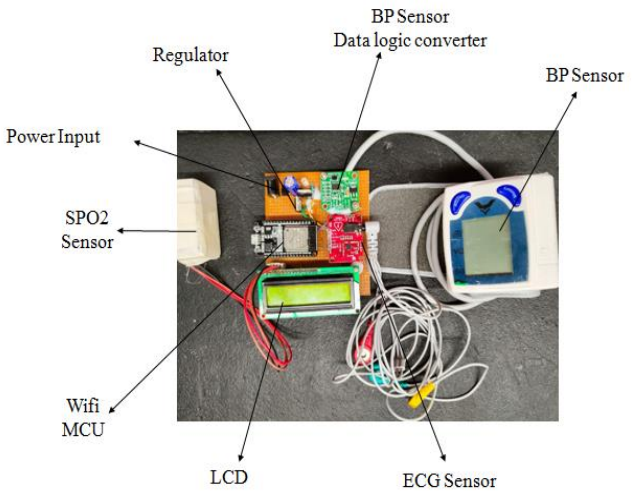

Figure 8. Experimental Setup of Proposed System

Depending on the time-varying adjustment between each reading done in the app, sensory reading is recorded by the system and displayed on the display. Used data is sent to android, iOS application using cloud computing where individual data is stored and monitored. In the event of an emergency, the application will send a notification to patients in that emergency.

The measured parameters i.e., blood pressure, pulse rate, body temperature, ECG of a person is displayed on the Blynk app. The sensors details are updated continuously on our mobile application. We can keep a constant watch at our body parameters by using the Blynk App. The medications can be suggested by the doctor even from a distance.

The mobile app will also provide a user interface that informs the user about medication that needs to be taken, at a set time. The recording details of the application send it to the LCD display as well as to the appropriate smart app.

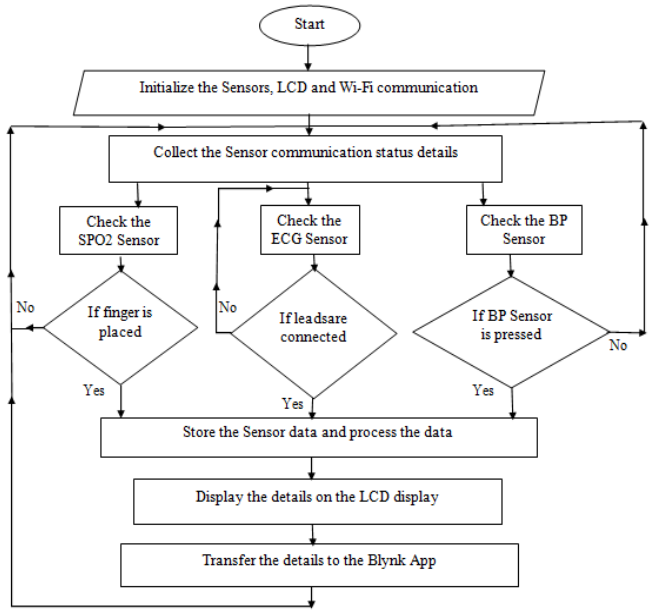

Figure 9. Flowchart of the Proposed System

Above figure 9 shows the flowchart of proposed system to understanding how a process is done.

VI. RESULTS AND DISCUSSION

In this proposed paper, the real-life health monitoring system is designed for a variety of health parameters such as blood pressure, heart rate, body temperature and ECG obtained through nerve endings. Details of the temperature and SPO2 sensor are shown on the LCD display as shown below Figure 10. Cardiovascular measurement details are shown on the LCD display as shown in Figure 11. The estimated physical parameters shown remotely in the Blynk app as shown in Figure 12. Also details ECG sensor is shown in the Blynk App shown in Figure 13.

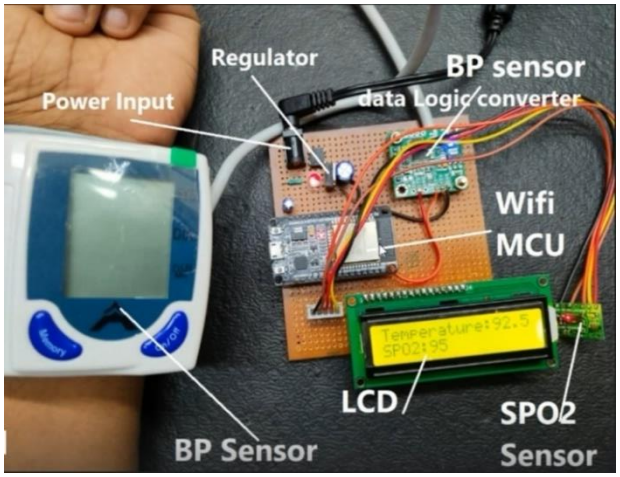

Figure 10. Temperature and SPO2 Sensor details are displayed on the LCD Display

Figure 11. Heart rate and blood pressure sensor details are displayed on LCD Display

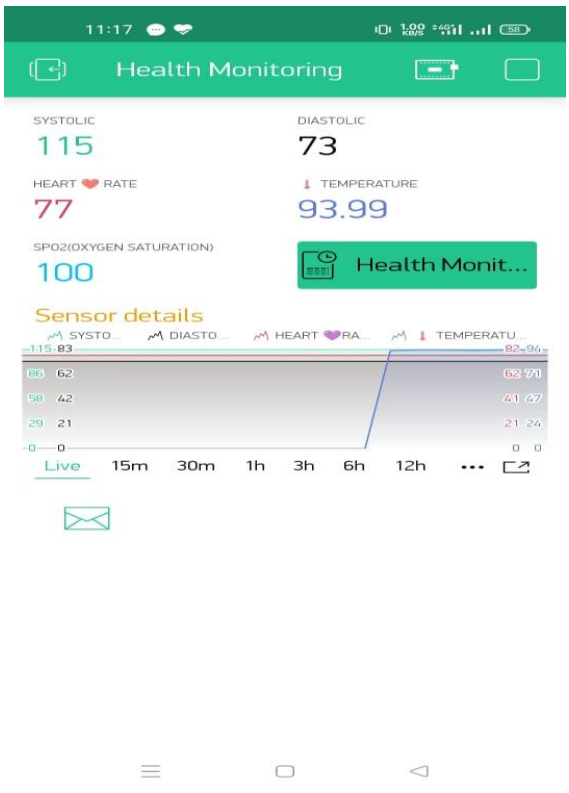

Figure 12. The estimated physical parameters shown remotely in the Blynk App

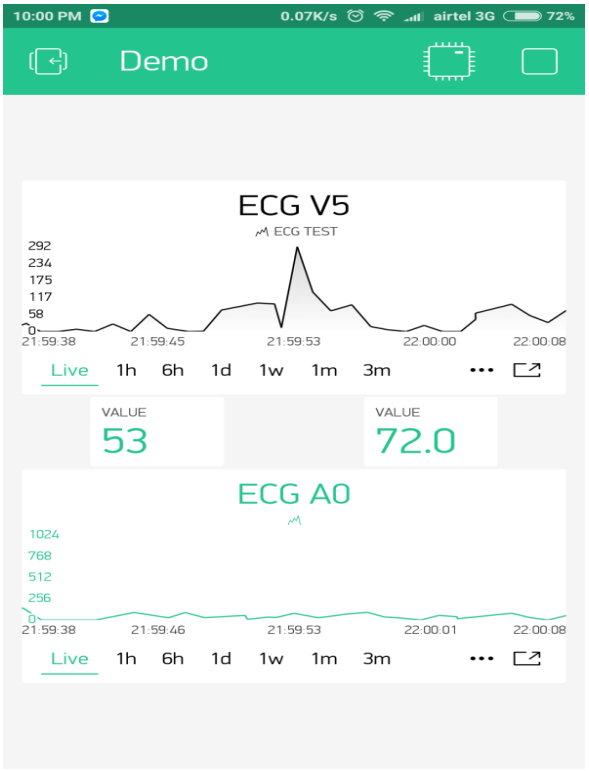

Figure 13. ECG Sensor details are displayed on Blynk App

VII. FUTURE SCOPE

The main advantage is a very simple user interface and fast conversion to CSV files to store real-time data. Real-time data can continue to be analyzed using the embedded C system to predict future human health conditions. It is clear that the implementation of such a program will help in early detection of rare cases of cardiovascular disease and prevention of its adverse effects.

VIII. CONCLUSION

Remote health monitoring system based on IoT, bearing low cost, portable, energy efficient has given satisfactory results. The system makes the use of sensors along with ESP32 microcontroller and Blynk App. The body parameters of a person sensed by the sensors are sent to the cloud with the help of Wi-Fi shield and the sensor details are displayed on the Blynk mobile application preinstalled on the android phone or ios. The proposed system is very useful and valuable to the society especially the senior citizens since they can have a regular check at their health sitting at their homes.

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