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Heart Monitoring System Using ECG

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Abstract

Heart disease like arrhythmia need continual long-term monitoring. For example, in emergency at home, where the patient is unable help themselves or seek help, there is a need for long distance health monitoring for early and faster assessment for treatment. This project presents a remote monitoring system for monitoring the irregularity in heart rate, which enables real-time monitoring for the cardiovascular diseases (CVDs) patient. The sensor is non-invasive where pulse reading is taken from the finger.

The microcontroller is used to receive and process the signal. When irregularity in heart rate is detected, the microcontroller will send data to a smartphone using Bluetooth. A mobile application is developed to receive the data and to send out an alert in the form of a text message to another mobile phone. The alert is successfully sent to the specified recipient such as medical doctors or next of kin in the emergency which contain the details such as heart rate information and GPS coordinate. Evaluation on the functionality of the device shows that the developed device can reach accuracy of 97.50%, precision of 96.55%, sensitivity of 99.29% and specificity of 91.67%.

Keywords: *Heart Rate, IOT, GSM module, ESP32 Microcontroller, ECG Sensor AD8232.*

INTRODUCTION

Heart disease was becoming a big disease which health killer people from many years. World Health Organization (WHO) research also shows that the most people were dying due to heart disease. Therefore, this disease cannot be taken lightly. Hence, most health care equipment and monitoring system are designed to keep track the disease.

An ECG signal can trace various physiological and abnormal conditions of the heart. This heart monitoring system also helps to inform the person whether he/she has any heart diseases or not. This is done by checking the heart beat level. As we know that by analyzing or monitoring the ECG signal at initial stage these disease can be prevented. So we are working in this project.

Arrhythmia is one of the CVDs, a condition where the heart beats is irregular. Type arrhythmia rhythms are tachycardia, a condition where the rhythm of the heart is too fast and Bradycardia where heart rhythm is too slow. If tachycardia or bradycardia continuous for long period of time, it can cause the heart to pump less blood to the whole body, which can result in damaging vital organ like brain, heart, lung et cetera. An example of fatal form of arrhythmia is ventricular tachycardia , if it is not treated immediately, the victim might expose to injury and even death. Heart rate is the important parameter in classifying whether the heart beat is irregular or normal.

Heart rate is the number of heart contracting in a period of time, defined in beats per minute (bpm). The measurement of heart rate is important in the human cardiovascular system. The rate of heartbeat depends on several factors, which include age, body size, body movement, heart condition medication and even temperature.

Health care is a major area that requires constant vigilance. Continuous measurement of patient parameters such as heart rate and rhythm, respiratory rate, blood pressure, oxygen saturation and, and many other parameters has become a common feature used in major health care systems. When precise and speedy decision-making is essential, electronic monitors are widely used to collect and display body composition data. There are also cases where a patient is not ready to wait in line and be appointed for regular checkups and monitoring. Often a patient monitoring system detects and warns of serious or life-threatening events in

patients or critically ill patients. A patient monitoring program can be strictly defined as a continuous or continuous monitoring of a patient's body function, as well as the function of life support equipment, for the purpose of directing management decision. The project introduces wearable, portable, low power consumption, real-time bio-real-time signal monitoring system. This initiative provides an advanced step for the remote healthcare sector.

The number of people, who need health care is increasing every year and standard bio-signals monitoring systems require that patients be present within hospitals. This may result in poor patient care, especially for those with serious health problems. Therefore, internet technology and modern electronic devices can provide promising solutions in this field. Based on that, the project uses the mobile application as an IOT platform to remotely monitor live ECG signal, heart rate, Signals are measured and processed using a microcontroller-based device.

The main contribution of this paper is to send an electrocardiogram (ECG signal) to a specific smart phone for medical attention. This helps diagnose heart disease before it gets worse. Finally, the results obtained for this project are displayed on the smartphone.

METHODOLOGY

We interfaced ECG sensor with the ESP32 microcontroller board. So that we can monitor all the sensors reading in real-time. Next part is our GSM module which we are going to use for sending messages and for emergency calls. When sensor varies of give us values which determines the danger then we are going to send SMS and Emergency call through GSM module and emails and notification through ESP32. ESP32 supports both wifi and Bluetooth so that we can monitor it global as well as on local server. Our system probably a beacon of light for the doctors so that in very low cost they can monitor ECG very easily and comfortably.

ECG Sensor AD8232

The AD8232 Spark Fun Single Lead Heart Rate Monitor is a cost-effective board used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and output as an analog reading. ECGs can be extremely noisy, the AD8232 Single Lead Heart Rate Monitor acts as an op amp to help obtain a clear signal from the PR and QT Intervals easily.

ESP32 Microcontroller

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 microcontroller acts as the central processing unit of the system. It receives the voltage signals from the ECG sensor and processes the data to extract information about the heart rate and rhythm. The microcontroller can also be programmed to trigger an alarm (buzzer) in case of any abnormalities detected in the heart rate or rhythm. ESP32 Microcontroller is used to send email and notification.

GSM module

GSM module is a device that uses GSM mobile telephone technology to provide a wireless data link to a network. GSM modems are used in mobile telephones and other equipment that communicates with mobile telephone networks. They use SIMs to identify their device to the network. The GSM module is used to transmit the heart rate and rhythm information to a remote location, such as a doctor or a hospital. The data can be sent via SMS or GPRS to a designated phone number or server. This allows for remote monitoring and can be useful in case of emergencies. GSM Module is used for sending SMS and makes emergency call.

LCD Display

A display, such as an LCD screen, is used to show the heart rate and rhythm information in real-time. The data processed by the microcontroller is displayed on the screen for easy monitoring. LCD Display is used to display the heart beat level

Buzzer

The buzzer is used to give an audible alarm in case of any abnormalities detected in the heart rate or rhythm. The buzzer is triggered by the microcontroller when it detects any unusual activity in the heart rate or rhythm.

Buzzer is used to beeping in emergency case. It beeps when the heartbeat level increases.

Problem Formulation

Nowadays, many people died and suffered from serious diseases such people suddenly fainted during exercise, have a high blood pressure, heart problems, heart attack and other health problems involving our pulse rate. Therefore, there are several problems that have been identify which are:

1. People are unaware of their state of health and may be careless about their Health.

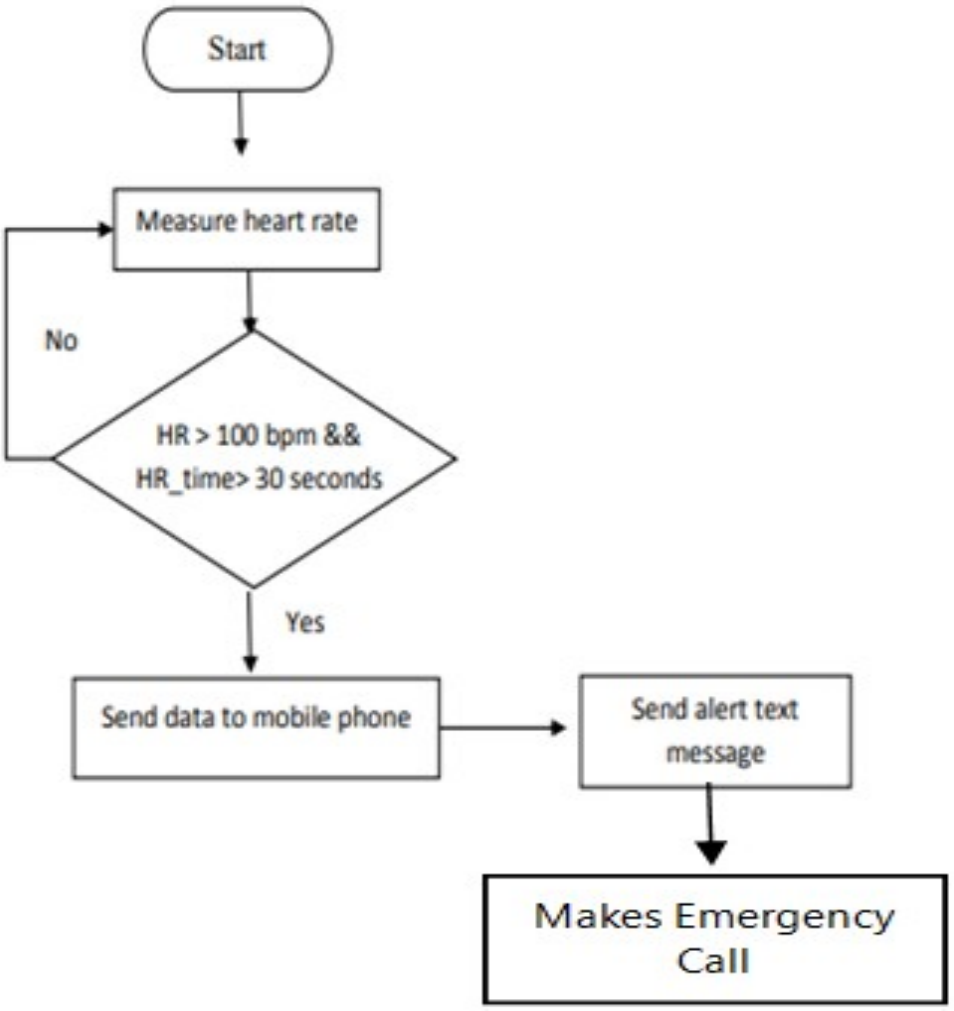
2. People who are busy and might be afraid to do health check-ups at the hospital.

3. Increasing number of people suffering from serious diseases such as heart problems, blood pressure, and other dangerous health problems regardless of age whether young or old.

4. When the patients heart rate is got abnormal then their relatives or guardians and also doctors can't know about it.

Hence, to solve this problem, this system can alert the user about their health. The user will know about their health status by monitoring. By doing so, it will alert the user when an output is display on screen and it shows whether their pulse rate measure in normal or abnormal. Then the user can take their action.

SYSTEM DESIGN



The working of Heart Monitoring System Using ECG

System works is as follows

The ECG sensors are attached to the patient's chest to measure the electrical activity of the heart. These sensors convert the electrical signals generated by the heart intoanalogsignals. The analog signals are then converted into digital signals by an analog-to-digital converter (ADC) for processing. The digital signals are then processed by a microcontroller, which performs various signal processing algorithms to extract relevant information such as heart rate, heart rhythm, and other parameters. The processed data is then transmitted to a remote monitoring station via a GSM module, which uses cellular communication to send the data over a network.

The remote monitoring station, which can be a healthcare provider's office or a healthcare provider's mobile device, receives the data and displays it for interpretation and analysis. In case of any critical condition, the remote monitoring station can alert the healthcare provider through an SMS message or a phone call.

In summary, an ECG heart monitoring system using a GSM model allows for continuous and remote monitoring of a patient's heart activity, providing a convenient and efficient way for healthcare providers to track and respond to changes in a patient's health.

ADVANTAGES

1. It is safe and advance.
2. Data can be uploaded or directly sent to the doctors by using IOT Technology.
3. By using more electrodes measurement can be more accurate.
4. Fitness and activity heart rate monitors.
5. Portable ECG Remote health monitors.

LIMITATION

Sometimes it takes longer time to detect heart rate.

FUTUREWORK

1. ECG and other health parameters can also be monitored.
2. Continuous monitoring and future diagnosis can be performed via the same system (TELEMEDICINE).
3. More than a single patient at different places can be monitored using single system.

CONCLUSION

This IOT Based Heart Monitoring System, this system will provide continuous health

monitoring services for patients in ICUS or who are bedridden at home, and it will be accessible from anywhere.

Two sensors have been employed to provide real-time monitoring of the patient's ECG signal and temperature: an ECG sensor and a digital thermometer.
It will benefit doctors in a number of ways and improve the efficiency of patient monitoring and treatment.

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