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Smart Dress(Shirt/Band)–Hospital Application (Cardiac Disorder Detection Remotely)

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ABSTRACT:

Embedded automation is playing a vital role in the modern world. In present day scenario most of the people around the age category of 45+ have more risk of having cardiovascular attacks. Sometimes they are left unnoticed as soon as they fall unconscious and hence reduce their chances of survival. Hence we have come up with an idea of a wearable watch which has an ECG sensor, pulse sensor, GPS and a GSM module. It has a manual override and also an automated system. The monitoring of biomedical signals in chronic patients, elderly person even in healthy patients without serious diseases is a Telemedicine application that has gained a great importance in recent years.

This project focuses on the design and implementation of an intelligent wearable device for ECG continuous acquisition and transmission with SMS based control and status updates. The designed device is an important component of a complete prototype for remote ECG continuous monitoring of patients with diverse cardiac diseases.

The ECG and pulse sensors are used to detect the ECG waves and the pulses that are obtained from the watch which is on the wrist of the person. The waves of the ECG are compared with the triangular waves & if any abnormalities are detected an alarm is triggered. If the alarm is turned off then the monitoring continues else it sends an SOS messages to all the preset numbers via the GSM module, sharing the location that is obtained from the GPS module and thus providing immediate response to the user.

INTRODUCTION

Electrocardiography is a medical diagnostic procedure used to record the electrical activity of the heart and display it as a waveform. An electrocardiogram (ECG) is obtained by measuring electrical potential between various points of the body using an instrumentation amplifier linked to the body via leads attached to electrodes (electrical contacts). Electrodes are placed on different sides of the heart to measure the activity of various parts of the heart muscle and the voltage between pairs of these electrodes is what is returned as ECG in the form of a graph.

A typical ECG tracing of a normal heartbeat (or cardiac cycle) consists of a P wave, a QRS complex and a T wave (Figure 1). The baseline voltage of the electrocardiogram is known as the isoelectric line. Typically the isoelectric line is measured as the portion of the tracing following the T wave and preceding the next P wave. The waveform and the relationship between the different sections composing it can be used to determine heart rate as well as distinguish various cardiac arrhythmias including tachycardia (abnormally high cardiac rhythm >100 bpm, bradycardia (an abnormally slow cardiac rhythm < 60 bpm).

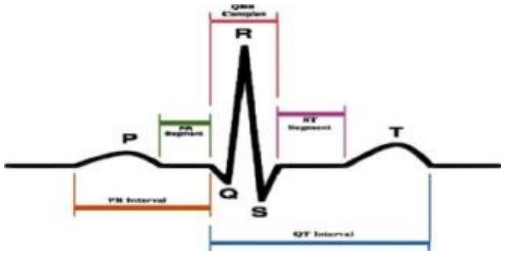

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Fig.1. Representative Schematic of Normal ECG waveform.

In [7] discussion about an eye blinking sensor is explained. Nowadays heart attack patients are increasing day by day."Though it is tough to save the heart attack patients, we can increase the statistics of saving the life of patients & the life of others whom they are responsible for. The main design of this project is to track the heart attack of patients who are suffering from any attacks during driving and send them a medical need & thereby to stop the vehicle to ensure that the persons along them are safe from accident. Here, an eye blinking sensor is used to sense the blinking of the eye. spO2 sensor checks the pulse rate of the patient. Both are connected to micro controller.If eye blinking gets stopped then the signal is sent to the controller to make an alarm through the buffer. If spO2 sensor senses a variation in pulse or low oxygen content in blood, it may results in heart failure and therefore the controller stops the motor of the vehicle. Then Tarang F4 transmitter is used to send the vehicle number & the mobile number of the patient to a nearest medical station within 25 km for medical aid. The pulse rate monitored via LCD .The Tarang F4 receiver receives the signal and passes through controller and the number gets displayed in the LCD screen and an alarm is produced through a buzzer as soon the signal is received.

METHODOLOGY

The block diagram of the wearable system to detect the cardiac attack and to indicate the system is shown in Fig.2. Microcontroller is the heart of the diagram of the system. It controls all the functions of the system. The sensors are used to detect the ECG waveform, pulse from the human body and send signals to the microcontroller. Microcontroller checks for abnormal waveforms and send the necessary communication thought the communication interface.

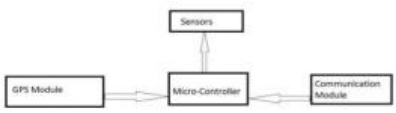

Fig.2. Block Diagram

The block diagram of actual component used is shown in fig 3.2. The UBlox is the Global positioning system to track the patient current location in the geographic area. The GSM module is used to the send the patient details such as patient location and condition to the hospital through short message service. Electrocardiogram Circuit extracts the Electrocardiogram signal from the patient body and sends the signal to the Arduino controller. EEPROM is used to store the data required to Global positioning system. The ESP module is used to detect the number of pulses per second from the human body. The Arduino microcontroller continuously receives the Electrocardiogram signal and number of pulses. It will compare the signal obtained with the normal value of pulses per second and Electrocardiogram signal periodically. If there is any deviation in the Electrocardiogram signal or pulses per second, it will identify the current location of the patient by Global positioning system. This location is send to the hospital through short message service by GSM module.

The waveform of Electro cardiac signal for normal, starting of heart attack and after heart attack is shown in fig.3

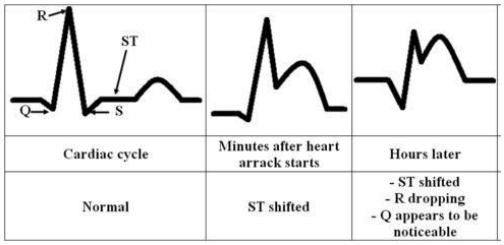

Fig.3. ECG CURVE

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PROGRAMMING STEPS:

1. Wake up the ECG module.
2. Get NEMA Strings continuously from GPS
3. Read Analog Pin for ECGSignal
4. Continuously matching with abnormal signals & transfer real time signal through internet connectivity module.
5. If abnormality is not detected, read the analog pin for next ECG signal.
6. If abnormality is detected, Make any GPIO pin high to call GSM cycle (to transfer captured $GPLL string)
7. Transfer of alert message to associated phone numbers with location.

RESULT

ECG SIGNAL MEASREMENT

The PCB Board for detecting the ECG signal is shown in Fig.4.

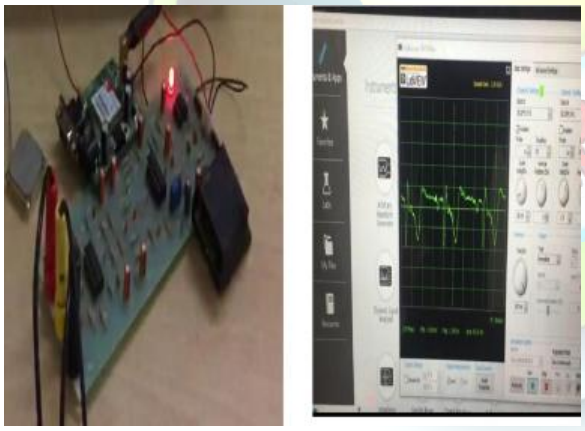

Fig.4 ECG measuring module

When the ECG module is connected to the human body, the normal ECG signal obtained is shown in fig .6.

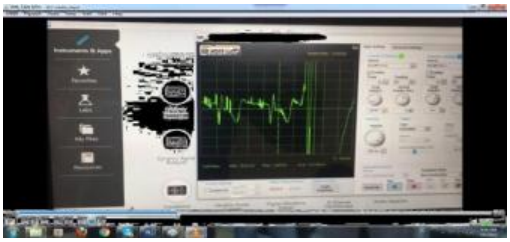

Fig.5 Detection of Abnormality in the Signals

An abnormal wave form is generated using Lab View signal generator and analyzer and is given to ECG module and it sensed by the microcontroller. The abnormal signal is shown inFig.6.

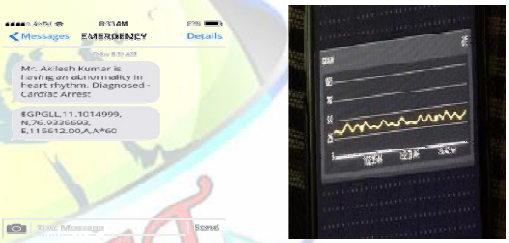

Fig.6 Pulse measurement in android app

The pulse is measurement using the device and the number of pulses is measured by the android app in the mobile device is shown in fig.8. After the detection of cardiac attack, the patient location is identified by global positioning system and send through short message service. The final implemented system in manual hand is shown in fig.7

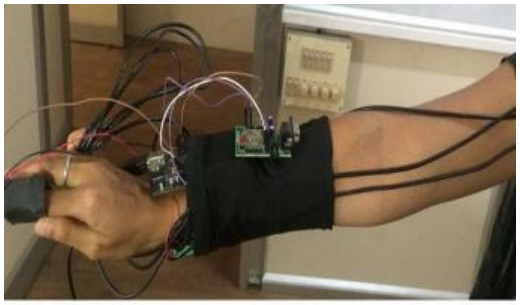

Fig.7. Implemented Project

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CONCLUSION

Heart attacks have been the number one rated killer disease in the world for the age categories 45+. They are mostly caused due to stress, unhealthy diet habits, heart valve blockages, etc. And most of the deaths are due to no proper response time i.e. the patient is left unnoticed that causes the death of the person.

This project helps to save the patient who had heart attack. The implemented project is a wired system which runs through the body. This project primarily pertained to the development of a wireless monitoring system for ECG. The construction of this device is tested on wireless transmission methods such as Radio frequency, Wi-Fi and Bluetooth module. There is timing constraints in getting the signals from the two electrodes of the ECG sensor module. Hence, the Wireless ECG Monitoring System is a stepping stone for the development of a Multi-parameter Wireless Bio monitor by looking forward to develop more such automations and robotic solutions for the effective utilization of human kind in future.

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