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Omnipresent ECG-Oversee Android Watch

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ABSTRACT
" Omnipresent ECG -oversee android watch" is designed to implement the increasing awareness of alteration in the rhythm of heart beat and coronary heart diseases due to stress and other risk factors. Death caused by heart diseases are high it can be reduced when a person's heart beat rate is monitored continuously for this purpose "Omnipresent ECG -oversee android watch" is used. It can be used by higher officials/patients to keep track of their heart beat rate by self-opinion or for remote diagnosis of chronic heart disease patients before sudden flicker. This watch works by ceaseless monitoring over a person's heart beat rate if any deflection is found it generates an alert. It is mainly used by people who are living alone or by those who suffer from any heart disease. It scales the ECG using three lead electrocardiography and impart three signals to smart watch for processing and for generating alert
Keywords - ECG, EKG, Electrocardiography, Smart watch.

I. INTRODUCTION

In the future there will be a increase in the usage of smart watch and their applications. Therefore these smart watches can be used for continuous medical analysis of patients who are suffering from various chronic heart diseases by scanning the persons ECG. Electrocardiography is an explication of the electrical activity of heart over a period of time and it is sensed by placing electrodes outer to the skin and recorded for future use by an external device. The aim of "Omnipresent ECG -oversee android watch" is to design and implement an ECG device and an application for an android watch which is used for monitoring and diagnosing heart condition of the people.


Fig 1: Andriod Watch

This device can be used by people who are living alone or those who are suffering from cardiac diseases and by people who are at high post. The aim of the paper is to develop a battery powered system capable of measuring three analogue channels of ECG on subject and transmitting them to the smart watch via Bluetooth which process the signals and generate the correct alert.

II. LITERATURE VIEW

2.1. THE ANALYSIS OF HEART

Myocardium is a cardiac muscle present in the heart wall. It also has striation similar to skeletal muscle. Heart is divided into four compartments left atria, left ventricle, right atria and right ventricle. The phases of the heart is such that the front phase consists of right ventricle while the rear phase consists of left atrium. Heart consists of two units one is the atria and the other is the ventricle. The left ventricle pumps blood to the entire body and the pressure here is higher than for pulmonary circulation, it emerges because of the right ventricle overflow therefore the right ventricular free wall and septum is much thinner than the right ventricular wall. The cardiac muscle fibres are categorized into four groups: Two group winds around outside of both the ventricles and the third group winds around both the ventricle

below those two fibres and the fourth fibre winds around only the left ventricle. The four group of fibres are oriented spirally whereas the cardiac muscle cells are oriented more tangentially than radially and the muscle fibre has resistivity in the lower direction and has significance in electrocardiography and magnetocardiography.

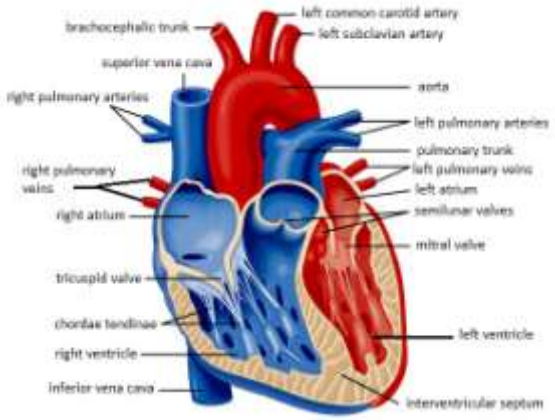

Fig 2: heart Structure

There are two ventricles and four valves in heart.The ventricles are left ventricle and right ventricle and also we have left atrium and right atrium.In between left atrium and left ventricle is present the mitral valve.Tricupsid valve is present in between the right atrium and right ventricle.Pulmonary valve lies between the pulmonary artery and the right ventricle.Aortic valve is present between aorta and the left ventricle.Systemic circulation of blood takes place as a result the deoxygenated blood goes to the right atrium and then through triucupsid valve it is pumped to right ventricle.When it is filled then again pumped through pulmonary valve to the lungs.From lungs the oxygenated blood is collected by left atrium and passes through mitral valve to the left ventricle.Through aorta finally the oxygenated blood is passed to the rest of the body.

2.2 ELECTROCARDIOGRAPHY

Electrocardiography is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the patient's body. The functioning of heart creates an electrical field which is conducted to the body surface with the help of body tissue and recorded by an external device. The graph that is recorded is known as ECG (Electrocardiogram).

2.3 FUNCTION OF ECG

The Electrocardiogram is a diagnostic tool that is routinely used to access the electrical and muscular functions of the heart.It can only identify in certain areas whether the heart muscle has been damaged or not in case of myocardial infection.Due to Insufficient blood supply which result in muscle fibre damage and Whenever there is a change in the ionic environment(the flaw is detected)causes there is a change in the electrical activity.

2.4 ECG GRAPH PAPER

ECG is a voltage versus time graph where voltage is plotted along y-axis and time along x-axis.The graph paper is usually splitted in the form of squares each of 1mm length.The standard representation is each mV on y-axis as 1 cm and in x-axis each second as 25mm that is at the speed of 25mm/s but we can also use a faster speed. Let us consider that one small block can be translated to 40 ms at paper speed of about 25 mm/s so that one block is made of five small blocks which can be translated into 200 ms and so there are five large blocks per second. A 1 mV standard signal should displace the stylus vertically 1 cm that is 2 large squares

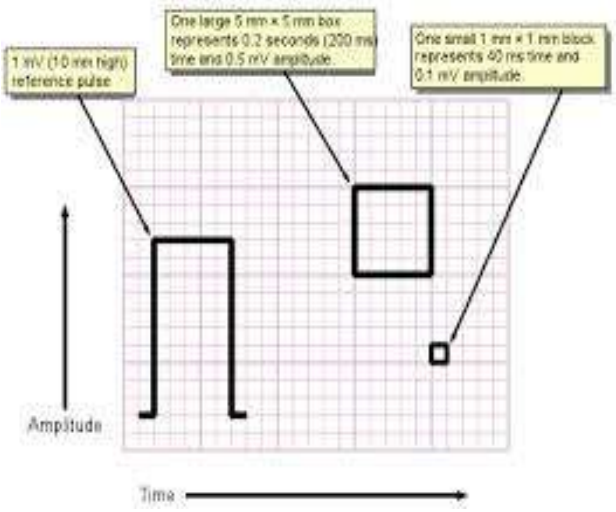

Fig 3: ECG graph paper

2.5 ECG INTERPRETATION

Heart is a muscle that works continuously like a pump .Each heart beat is represented by a electrical signal and this activity is recorded as a voltage versus time graph called ECG. Each heart beat is composed of four actions, they are atrial contraction, atrial relaxation, ventricular contraction and ventricular relaxation.ECG deals with the electrical properties which are depolarization and repolarization. Sinoatrial node is located in right atrium where each signal of heart beat begins. Right atrium is filled with deoxygenated blood which causes the electrical signal to spread acroos the right and left atria. As a result it causes the atria to contact or squeeze and then blood is pumped to left and right ventricles through the open valve.

P wave is the first short upward movement which indicates that atria are contracting and pumping blood into the ventricles.This time interval is represented in the graph as the line segment between P and Q wave.

The signal is released and it travels to the bundle of His, located at the inferior end of the interatrial septum, to the ventricles of the **heart.**The signal fibers from the bundle of His divides into left and right bundle branches. These bundle of branches pass through the heart septum. On the EKG, This is represented by Q wave. The signal leaves the left and right bundle branches through the purkinje fibers (arrives from the sinoatrial node) connect directly to the cell in the wall of heart's ventricles.

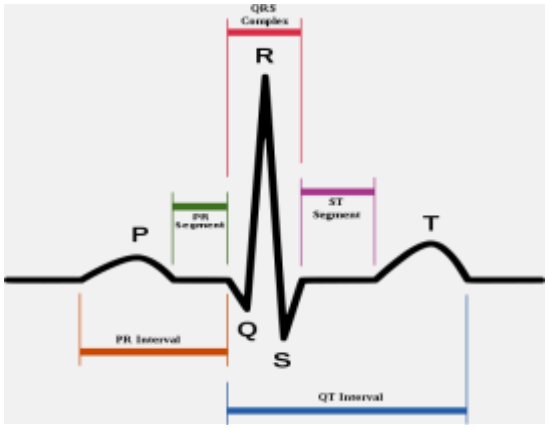

Fig 4: Typical Heart Signal Waveform

As the signal spreads across the cells of the ventricle wall both ventricle contracts (left ventricle of heart contracts an instant before the right ventricle). On the EKG the R wave marks the contraction of heart's left ventricle and the S wave marks the contraction of heart's right ventricle. By the contraction mechanism, The heart's right ventricle pushes blood through the pulmonary valve to lungs and the heart's left ventricle pushes blood through the aortic valve to the rest of body. As the signal passes the walls of heart's ventricle relax and await for the next signal. On the EKG, the T wave specify where the heart's ventricle is relaxing. This process continues time and again.

III. ESSENTIALS OF SYSTEM

3.1. HARDWARE ESSENTIALS

3.1.1. ECG ELECTRODE

Electric activation in the heart muscle cell, takes place by the inflow of sodium ions across the cell membrane.Three ECG sensor electrodes are used to measure the ECG signal. A bio potential electrode is a transducer that consist of electrolyte solution(that has contact with tissue)on one of its side and consist of conductive metal connected to lead wire(connected to the instrument).The transducer senses ion distribution on the surface of tissue, and converts the ion current to electron current. At the interface between the electrolyte and the electrode there will be a chemical reaction.

3.1.2. PIC 18 MICROCONTROLLER

The microprocessor acquires analogue signals(ranging from 0 to 3.3V). It sends them to a Bluetooth module by standard serial protocol. It requires Built in USART must be usable in a 3.3V system, Must be able to read four or more analogue channels at0-3.3V and programmable in circuit.

3.1.3. BLUETOOTH MODULE

It is used for communication between electronic devices without cable at low cost and in robust way. It consists of a RF transceiver, baseband, and protocol stack offering services which are used to share data between devices. Bluetooth is a short-range communications system .

3.2. SOFTWARE ESSENTIALS

For the developing environment we will be using Eclipse IDE halios (3.6).we will be using Android2.3 (Gingerbread) as platform which was developed by Open Handset Alliance led by Google.

3.2.1. FIRMWARE DESIGN

It consists of the ECG electrodes, amplifier, microcontroller and the Bluetooth module. The electrical signal is captured by the ECG electrode and they send the signal to the operational amplifier. The amplifier generates output in analog form which has to be converted into digital form. The output from operational amplifier will be processed by the microcontroller and perform the following task

Microcontroller samples analog values from ECG and convert them to digital. Serial port configuration takes placeData send via serial UART to Bluetooth Module. initialization of the serial port and baud rate fixing for communication is done by the microcontroller once the system is turned on.

3.2.2. ANDROID SYSTEM APP

This ECG App frameworks is based on the Android OS (Operating System). This will act as GUI of system which is a smart watch and user can easily interact with the system to make it user friendly. This consists of application developed on android operating system from Google. With the Smart watch applications data from the ECG sensing hardware can be seen. The main functions of android app system are as follows

3.2.2.1. COMMENCEMENT OF COMMUNICATION WITH THE ECG SYSTEM

The mode of operation of the firmware is controlled by this module.System for mutual recognition between the devices and network pairing is identified in this module by handshaking between the transmitter and receiver.*C*ommunication with the ECG device is set up in this module using the Android Bluetooth API. It also handles the job of sending acknowledgement to the hardware and receiving the ECG packet.

3.2.2.2. INPUT AND OUTPUT OF THE ECG SYSTEM

Smart watch reads the output received from Bluetooth module and displays it on screen .Decoding of the ECG packets is done and
Plotted using java layout.

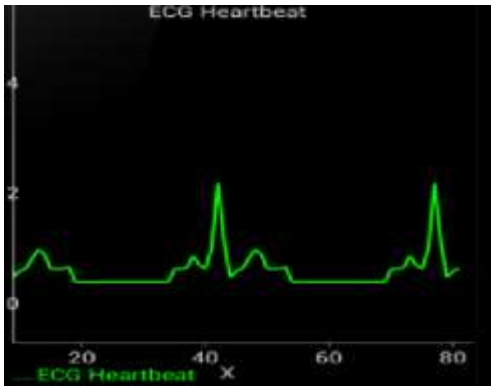

Fig 5: Android watch output pulse

3.2.2.3. STUDY THE ECG WAVE

The spikes in each cycle of ECG wave is counted inorder to analyze the ECG wave.The threshold value is compared with the highest spike value which was calculated.If spike value is not between the threshold value then an alert is generated by the system.

3.2.2.4. GENERATE CAUTION

Caution or *A*lert can be of two types they can be either call alert or message alert.Certain emergency phone number's are stored in the watch to which the alert has to be sent.

3.2.2.5. DISPATCH DATA TO SERVER

The ECG wave generated can be sent to doctor on his system periodically for manual analysis. This ECG wave will be sent over internet for storage purpose on doctor's request or even patient can send it for future reference.

IV. PSEUDOCODE

Pseudo code for failure detection of ECG wave is:

```
While(ecg_con)
For each cycle
    Count peck
If((for_one cycle peck<3 or peck>8)
        Failure>failure+1
If(failure>=3)
      Quit and
Generate_graph()
Generate_alert()
  End for
End while
Function generate_graph()
If(graph-request_permit)
      Update and transfer last 25 cycles to
server
Message(doctor's number)
   End if
End Functiongenerate_graph()
Function generate_alert()
If(alert_permit)
Establish a call to the primary number
Call_end
Message(primary number)
If(derivative_alert_permit)
        Message(derivative number)
End if
End if
End Functiongenerate_alert()
```

IV.INFERENCE

In this paper, we have put forth the device which will monitor the ECG of a person and it operates on an android OS platform. This device was motivated to monitor and diagnose a person's heart beat with the help of an ECG sensor and generate an alert message in case of any deviation in the heart beat. It will also diagnose the ECG wave and sends a proper alert message to the doctor system in case of emergency or if required. This system can be enhanced by adding more physiological sensors for sensing the accurate ECG.

V. CITATION

We would like to t hank all those who have helped us in our project either directly or indirectly. We would also like to show our gratitude to our friends without whom this project would not have seen the daylight.

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