ANDROID BASED ELECTROCARDIOGRAM MONITORING SYSTEM

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ABSTRACT

The problem we are facing today is the unexpected death of our loved ones because of the sudden heart attack. Because of the changing life style the heart attack rate is increasing day by day. The current heart attack death rate is about 25 percent of the total deaths in India. The main cause of heart attack death is the lack of medical care at the right time. To avoid this there is a need of regular checkup of health. In some cases it might be required to monitor ECG frequently. But it is not possible due to the high cost of healthcare equipment as well as time consuming process. This is the limitations of existing system. So, there is a need of low cost, portable, low power and time saving ECG monitoring device. With the use of this portable device the patient can monitor there ECG anytime, anywhere and send the report of ECG to the doctor and can effectively communicate with the doctor. In case of any abnormality doctor may call the patient. This paper presents the development of a Low cost, low power, portable and time saving ECG monitoring device.

Keyword: - ECG *Monitoring System, Ethernet shield, Arduino board, Android Smart Phone* **.**

1. INTRODUCTION

According to World Health Organization (WHO) Cardiovascular Disease (CVD) is a one of the leading cause of the death worldwide. The high cost of care, lower quality of life and premature death causes a big burden on society .The monitoring of patients physiological information are very important for the further treatment. Many patients can benefit from continuous monitoring as a part of diagnostic procedure. The remote monitoring also enables the patients to live his normal live and to decreasing the cost of healthcare. Electrocardiography (ECG) is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the skin. These electrodes detect the tiny electrical changes on the skin that arise from the heart muscle's electro physiologic pattern of depolarizing and repolarizing during each heartbeat. It is a very commonly performed cardiology test. Hence our aim is to design and implement an ECG measurement device and an App system based on the Android OS platform which can monitor and diagnose patients' heart conditions in real time. This system can useful especially by patient like senior citizens or having physical disabilities or who are alone. Therefore, this system can be utilized for remote medical systems to assist the elderly patients, for self-testing diagnostics, or for physicians to diagnose diseases of the circulatory system. Android is a platform of choice because of its availability on most mobile phones apart from strong existing and future growth prospect. The android platform based smart phone will be used for diagnosis and will also be transmit captured images to a care givers , health care centers or medical professionals for specialist advice.

2. SYSTEM MODEL

2.1 Block Diagram

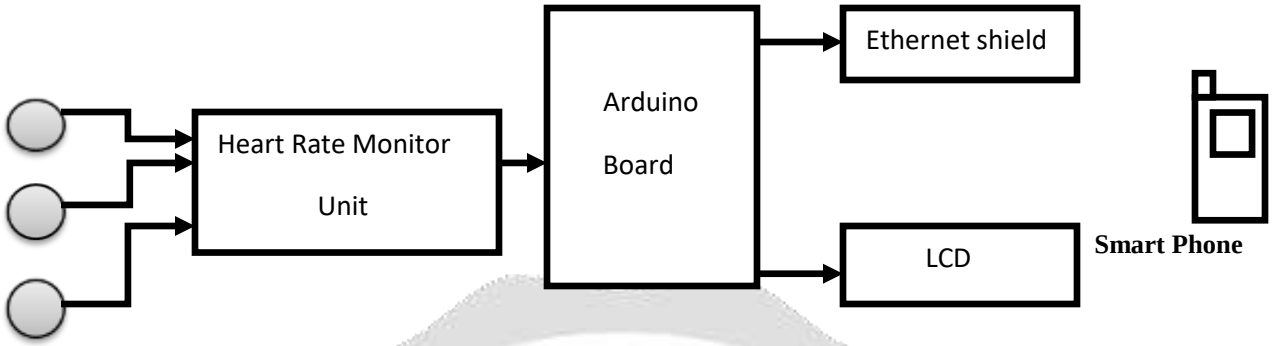

Fig-1 System Block Diagram

An ECG is a way to measure and diagnose abnormal rhythms of the heart, and helps to diagnose properly. An ECG is used to measure the regularity and rate of heartbeats also in the position and size of the chambers, the existence of any damage to the heart, and the impact of devices or drugs used to regulate the heart. ECG device is real time continuously attended ambulatory cardiac monitoring system. The system as in figure 1.1 consists of three modules; the patients ECG acquisition device, cloud server, and the control unit in the mobile phone. Here we uses the three electrodes out of three out of three the one electrode is connect on the right arm of the patient's body another is connect on the left arm and the last one is connect on the left leg of the patient's body. These electrodes convert the ionic potential of the patient into the electrical potential. This signal is in the digital form the arduino processing on this signal and converts it in analog form which is coming from the heart rate monitor unit. His ECG will be recorded continuously on real time basis. The Ethernet shield is communicate with the cloud server through that then the data is sent to the mobile device of the patient, where it is processed, filtered, and plotted in the form of actual ECG waveform. This ECG signal is then sent to the server and sends this information to the concerned doctor along with the patient's basic information, so that the doctor can see the ECG of patient directly on his mobile phone. Thus, this system has immediate, 24 hour access to a doctor to review transmitted data and make clinical decisions regarding the patient. The physician can assist the patient in case of an emergency.

2.2 ECG Waveform

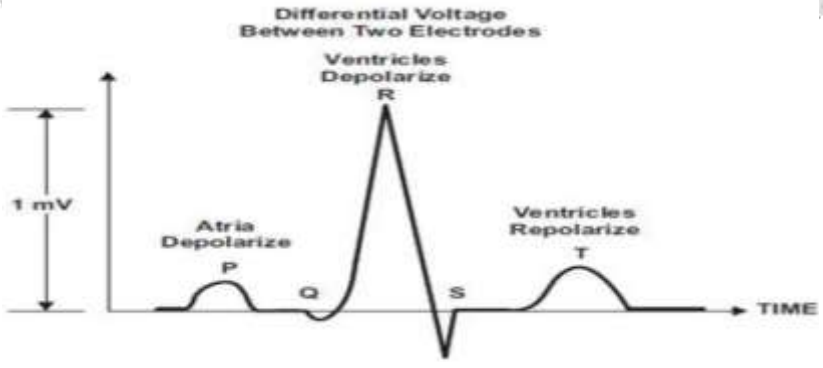

Fig-2 ECG Waveform

ECG is a graph showing electrical activity of the heart. It is a trace of voltage generated by the cardiac muscle during a heartbeat as shown in fig.1.The heart generates an electrochemical impulse that spreads out in the heart in such a fashion as to cause the cells to contract and relax in a timely order and thus gives the heart pumping characteristics. This electrochemical action can be measured at the surface of the body. An actual voltage potential of approximately 1 mv develops between various body points. ECG signal from electrodes is very low amplitude signal nearly 0.8 to 1.2 mv which is amplified and filtered by signal conditioning circuit.

3. HARDWARE REQUREMENT

Any system is consists of hardware part as well as some of software part. This system requires hardware namely electrodes, heart rate monitor circuit, ardiuno board, Ethernet shield and the display unit means LCD. The function and the operation of each unit is as follows

3.1 Electrodes

ECG is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the skin. An electrode is a conductive pad in contact with the body that makes an electrical circuit with the electrocardiograph. These electrodes detect the tiny electrical changes on the skin that arise from the heart muscles. In this project three electrodes are used each electrode is made up of an electrically conductive gel. These skin gel which is made up of sliver chloride (AgCl) which is used to apply the interface between the skin and the electrodes to reduce the impedance of the skin and fast pickup of the electrical surface activities.

3.2 Heart Rate Monitor

In this project we used the AD8232 is a 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. The AD8232 is an integrated signal conditioning block for ECG and other biopotential measurement applications. It is designed to extract, amplify, and filter small biopotential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. The AD8232 Heart Rate Monitor breaks out nine connections from the IC that you can solder pins, wires, or other connectors to. SDN, LO+(Leads off detect+), LO-(Leads off detect-), OUTPUT, 3.3V, GND provide essential pins for operating this monitor with an Arduino or other development board. Also provided on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to attach and use your own custom sensors. Additionally, there is an LED indicator light that will pulsate to the rhythm of a heart beat.

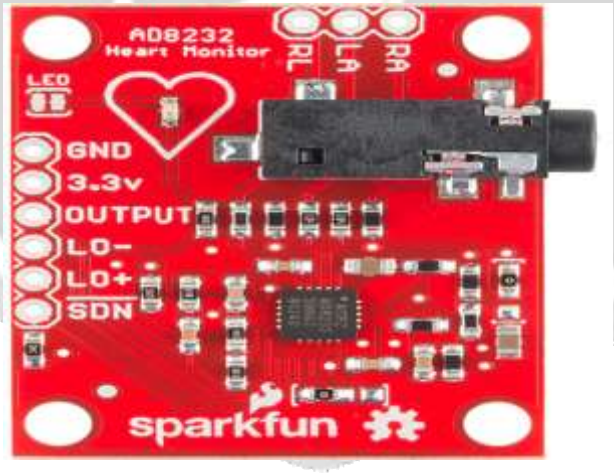

Fig. -2 Heart Rate Monitor

3.3 Arduino Board

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Fig -3 Arduino Board

3.4 Ethernet Shield

The Arduino Ethernet Shield allows an Arduino board to connect to the internet. It is based on the Wiznet W5100 ethernet chip (datasheet). The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous socket connections. Use the Ethernet library to write sketches which connect to the internet using the shield. The ethernet shield connects to an Arduino board using long wire-wrap headers which extend through the shield. This keeps the pin layout intact and allows another shield to be stacked on top.

Fig-4 Ethernet Shield

4. ANDROID APPLICATION

Android is an open source and Linux-based Operating System for mobile devices such as smartphones and tablet computers. The main objective of this paper is that by using android platform we can produce the prototype for portable ECG. In this project “Thing Speak” application will be used to display the ECG data signal sent from the ECG circuit. According to its developers, "Thing Speak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thing Speak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates". Thing Speak was originally launched by ioBridge in 2010 as a service in support of IOT applications.

Fig-5 Screen of ECG Signal

4. CONCLUSION

An effective heart attack detection system is proposed in this work. It helps to reduce deaths caused by heart attacks since the main cause of heart attack deaths are due to delay in proper treatment. This can be avoided since the system will acts as a virtual doctor for the patients with the used of this the patients can avoid the regular visit to the clinic for checkup so it saves the time of the patients. In this work, an android application was proposed which can continuously receive ECG signals from acquisition device wirelessly; it computes heart rate and plot the real time ECG signal on mobile phone for displaying. Also, it can be used to send information to concerned physician via server for medical diagnosis. Experiments show that the proposed system is unobtrusive and can be comfortably use by the user during daily activities.

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BIOGRAPHIES

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