A WEARABLE MULTIPARAMETER MEDICAL MONITORING AND ALERT SYSTEM WITH FIRST AID

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Abstract- The main aim of the paper is biomedical monitoring of human being. Biomedical values are heart rate ,blood pressure ,body temperature and here we use a GPRS module and biomedical monitoring sensor and data from these sensor are updated to the web server and in addition to that we use an automated external defibrillator(AED) which automatically diagnosis the cardiac arrhythmia of ventricular fibrillation, and pulse less ventricular tachycardia and is able to deal them with an defibrillation, the requisition of electrical therapy which stops arrhythmia , allowing the heart to re-establish the normal rhythm when compare to regular defibrillator it require minimal training to use. Biomedical monitoring promises to give an overview of cardiovascular system non -invasively and this will be easy to use and operate without hospitalization.

Index terms: heart rate, monitoring sensor, GPRS, Automated External Defibrillator.

I. INTRODUCTION

Now a days many people were prone to the cardiovascular diseases. In developing nations (like India) ,rapidly changing socioeconomic condition of the population is resulting in changed habits and lifestyle. This makes people prone to CVDs. To overcome this problem, preventive cardiology appears to be the most promising approach.

Prolonged collection, monitoring and maintenance of health data of the target population is important for effective prevention of Cardiovascular diseases. With increased per capita income, many people are adopting to a new lifestyle, various food habits and addictions thus inviting a possible endemic of the so-called life-style diseases.

Very little attention has been paid to adult deaths caused by these effect in directly or indirectly . A major attention now needs to get focused on these so-called modern diseases those are fast emerging in our rural society. The particular health problem we have tried to focus in this work is the emerging global pandemic of coronary artery diseases. Fortunately, indications of CVDs can be obtained by several non-invasive low cost techniques, since the pumping of the heart causes several periodic predictable electromechanical changes in various observable parts of the human body which can be measured externally using appropriate sensors. Once these signals are acquired, update this signal to the web server using GPRS module. We also proposed to analyze the different signals gathered and we use an automated external defibrillator for reestablishing the normal heart rhythms. In this paper we use two sensor for monitoring the biomedical values like heart rate, blood pressure ,body temperature and automated defibrillator is used in case of any abnormal heart rate viewed in a sensor.

1.1 Heart rate sensor

The cardiovascular pulse wave is also measure through the heart rate sensor and that wave is established throughout the body. This wave is due a change in the arterial blood volume density with each pulse. This change can be detected by heart rate sensor or Photoplethysmograph which placed over peripheral parts of the human body like ear lobe or finger tip. The name of the device which detects the blood volume density is called a plethysmograph (or ‘Pleth’ for short) shown in figure.1. It is designed to give digital output of heat beat when it is placed on a finger.

Figure.1 PPG sensor

1.2 Blood pressure sensor

A blood pressure sensor is a device used to measure the force of the blood .for normal person , the force of blood flow is constant at rest and it lies in the ranges between 110/70 and 120/80. The systolic number is the larger number—it shows the force of blood when heart contrast. The diastolic number is the lowest number—it shows the force of blood when heart relaxes. If the blood force is more than 120/80, this value may represent hypertension. A blood pressure sensor is specially designed to register the force of the blood and help a doctor to determine the patient's health status. The patient can also check his/her own blood pressure with the use of this sensor. Blood pressure sensor come in both manual and automatic versions; they function similarly and here we use an automatic cuff shown in fig2. Automatic blood pressure sensor run on either electricity or battery power and have a digital screen that displays the blood pressure reading.

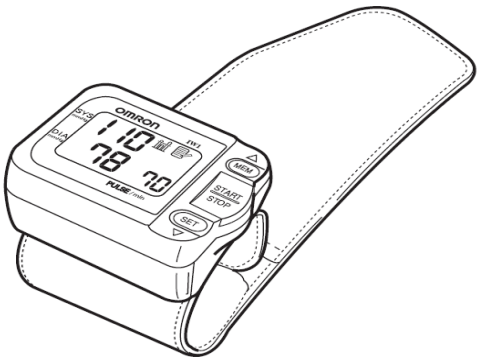


Figure.2 digital blood pressure sensor

1.3 Defibrillator

Defibrillation is an external treatment for cardiac arrhythmias, ventricular fibrillation, and non perfusing ventricular tachycardia. Defibrillation is a discharging a electric current to the abnormal heart with a device called defibrillator which cause depolarisation of the heart muscles and re-establishes normal conduction of the heart's electrical impulse . Different type of defibrillators used include external defibrillators, implanted defibrillator. And here we use an automated external defibrillators(AEDs) which is shown in fig.3, which can be easily used by nonprofessional rescuers.

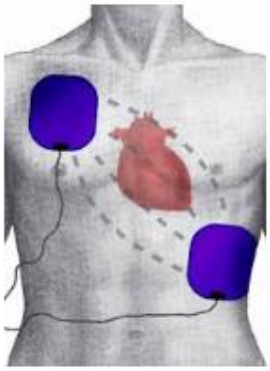


Figure.3 Automated External Defibrillator

II. Existing Methods

Few existing telemonitoring system along with the technology and sensors they used are given below

[1] Some proposed a patient monitoring system that could be used during transport. this system uses a personal digital assistant technology(PDA) and wireless local area network(WLAN).PDA technology is used to acquire the patient's vital sign wirelessly and continuously.

[2] Wearable advanced care and alert portable tele-medical monitor (AMON), which is used for patients with high cardiac risk. This wrist-worn system continuously collect and evaluate multiple vital signs. It was also used for intelligent multi-parameter medical emergency detection and cellular connection to a medical center.

[3] Portable medical device for tele diagnostics, long distance support and tele consultation of mobile healthcare providers. Patient's vital bio-signals and still images are transmitted from an emergency site to the consultation site using the GSM mobile telephony network.

[4] Telemedicine system for patient-monitoring that is based on Wireless Application Protocol (WAP). The device can monitor BP and ECG on WAP devices in store and forward mode. Authorized users can browse the patients' records and all other details on WAP devices.

[5]Cheap portable device for remote patient monitoring using public telephone line. The approach is focused on the use of telemonitoring, mainly for the sub-acute phases of illness, post hospitalization phase and for chronic diseases. It employs wearable ECG and BP monitor for continuous monitoring of the patients.

[6]Textile wearable interface based health monitoring system that has sensors, electrodes and connections implanted within the fabric. It can monitor ECG, respiration and activity. The proposed system is designed to monitor individuals affected by CVDs, in particular during rehabilitation phase.

[7] Biomedical Signal Acquisition system that can monitor, store and communicate electrical and mechanical functioning of heart, efficiency of lungs and condition of arteries concurrently in a non-invasive manner and extract different diagnostic information along with BP and HR.

III. Proposed Components

3.1Heart rate sensor we discussed earlier about this in introduction and some of the pictorial representation of heart rate sensor is given below in figure.4.

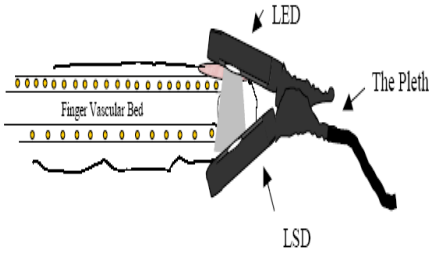


Figure.4 plethysmograph

- **3.2ARM microcontroller**ARM –Advanced RISC machine is a 32 bit RISC processor architecture developed by ARM holding. In this we use a device LPC2148 is ARM architecture based SOC product developed by NXP semiconductor. And it is preloaded with many in built features and peripherals. This make it more reliable and efficient.

LPC2148 has 32kB on chip SRAM and 512kB on chip FLASH memory. This chip has built in support up to 2kB end point USB RAM. This is more than enough for all the application and they have a tiny size and low power consumption and IC is shown in figure.5.

45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make it suitable for medical system.

Figure.5 IC of LPC2148

- **3.3 LCD display**A Liquid crystal display (figure.6) is a special thin flat panel that can let light ray to pass through it or block the light, electronically modulated optical device. And it is used in laptop, flat panel monitor, Digital watches by replacing the use of CRT.CRT consume higher power than LCD. It utilize lower power when equate to LED. It do not emit a light directly instead that use a blacklight to produce an image. The electric current pass through the liquid causes the crystal to align and block the light.

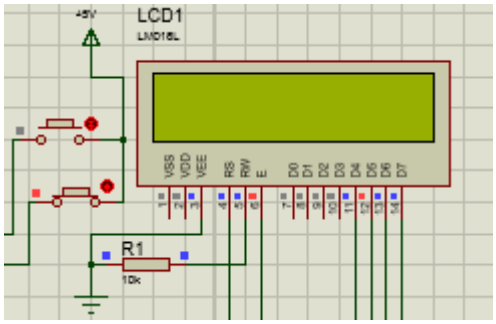


Figure.6 LCD display

3.4 GPRS module It is a wireless MODEM device that are designed for the purpose of interaction between GSM or GPRS network and computer.it require SIM card just like mobile phone for their recognisation. It send ,receive, delete the SMS messages in a SIM and here we use GSM SIM900A(figure.7).

Figure.7 GSM SIM900A

3.5 Relay

A relay is a simple electromechanical switch made upof an electromagnet and a set of contacts. Relays are found hidden in all sorts of devices.fig7 is shown below.

Figure.7 relay

IV. Working Principle

ARM Microcontroller is used .Microcontroller interface to heart rate sensor and blood pressure sensor and the sim900 module (i.e) GPRS module .blood pressure sensor contain the following sensor like that systolic and diastolic and heart rate.Systolic and diastolic nothing but a blood flow in the heart like blood enter to articular valve. diastolic means blood came out in ventricular valve of heart .now calculate the pressure of the blood enter and came out in heart. and then tell the status of the heart .This data are receive to the micro controller .and then data will be passed through particular server through the sim900 module .this description of the block diagram(fig8).If heart rate is low below the threshold value defibrillator on .here we are used defibrillator in project like led lights.

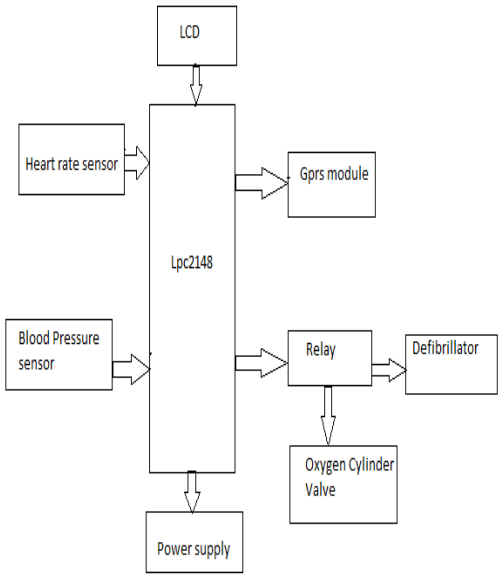


Figure.8 block diagram of monitoring biomedical values and Interfacing of defibrillator

V. Simulation Results

The keil micro vision software is used for compiling codes and proteus 8 professional software for running our simulation in software with fixed measured value. Hard ware is also used for monitoring a patient in regular basis. Our software simulation setup is shown in figure.9.

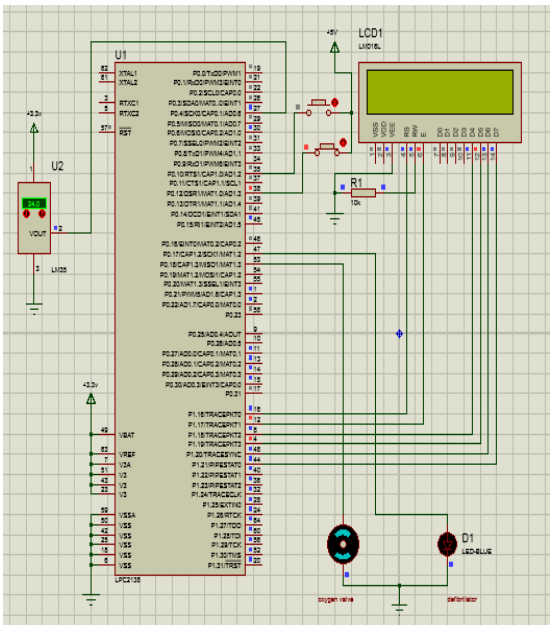
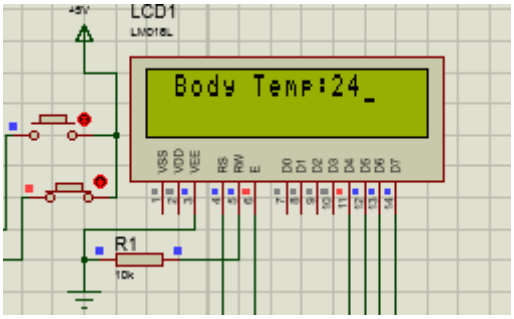
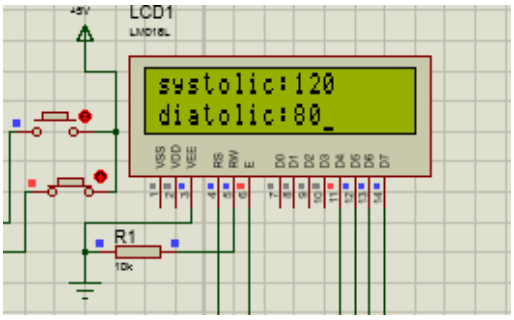


Figure.9 software simulation setup

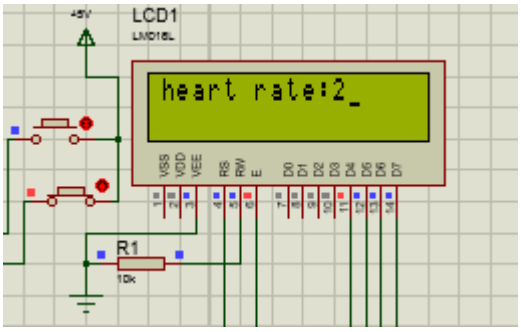
By varying the temperature in that temperature sensor and that will be viewed in the LCD display as shown in figure.10a) below, blood pressure sensor is used measure the systolic and diastolic pressure as shown in figure.10b) and heart rate sensor for measuring an heart rate and heart pulse as shown in Figure.10c)



(a)



(b)



(c)

Figure.10 LCD view of a) body temperature , b) systolic and diastolic pressure ,c) heart rate.

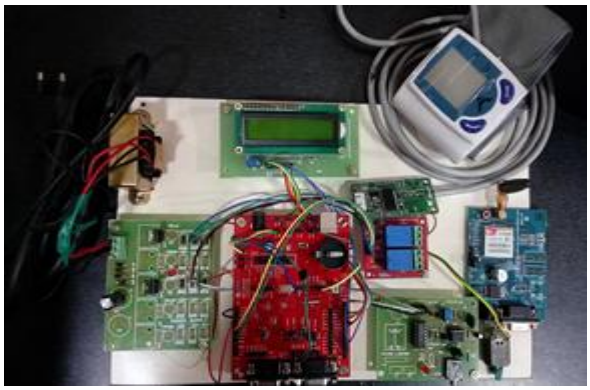


Figure.11 Interfacing of BP sensor and GPRS module

Above figure shows an interfacing of BP sensor and GPRS module (figure.11) and this is not the complete kit, we need to interface heart rate sensor and defibrillator.

VI. Conclusion

In this work, we proposed a transportable, inexpensive and non-invasive biomedical signal acquisition system with automated external defibrillator to re-establish the normal rhythm of the heart for an effected person. The system is capable of monitoring and communicating multiple biomedical signals-heart rate, blood pressure, body temperature and update the report to the doctor using GPRS module. These signals can be used to obtain an overview of an individual's health. And the system is easy to use, non-invasive sensors makes it user friendly.

Since high BP (hypertension) is the leading cause of ever increasing CVDs, we have shown how this device can be used to pre-screen hypertension by using the PPG signals of merely 10 second duration; the proposed device reliably extracts the HR form PPG signals. BP is measured through automatic digital BP monitor (OMRONHBP1300). And we can operate an device without any assistance of trained practitioner

As we said earlier, the device is non-invasive, transportable and user friendly, it can be easily used for continuous monitoring without hospitalization. Also, the data recorded from such prolonged monitoring can be used to detect arrhythmia , heart rate variability and by detecting this we can use an automated external defibrillator to overcome this problem.

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