CERTIFICATE

A SEMINAR REPORT ON

"Heart Beat Monitoring System Project"

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SAVITRIBAI PHULE PUNE UNIVERSITY

As Per

COMPUTER ENGINEERING DEGREE

Submited By

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DEPARTMENT OF COMPUTER ENGINEERING

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0.0.1 This is to certify that the Mrs. RUCHETA PANICKER from TE-B division ,roll no. 13 submitted her seminar report on " Heart Beat Monitoring System Project" under my guidance Prof. Radha S. Shirbhate and supervision. The work has been done to my satisfaction during the academic year 2021-2022 under Savitribai Phule Pune University.

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Shirbhate	Shirbhate	Bhandari
Seminar Guide	**Seminar Co-ordinator**	**H.O.D**
Date : Place :BSIOTR,Pune		

ACKNOWLEDGEMENT

This is a great pleasure & immense satisfaction to express my deepest sense of gratitude & thanks to everyone who has directly or indirectly helped me in completing my Seminar work successfully.

I express my gratitude towards seminar guide **Prof. Radha Shirbhate** , seminar coordinator and **Prof. G. M. Bhandari**, Head, Department of Computer Engineering, Jspm's, Bhivarabai Sawant Institute of Technology and Research, Wagholi, Pune, who guided & encouraged me in completing the Seminar work in scheduled time.

I would like to thanks our Principal **Dr. T. K. Nagraj**, for his extended support. No words are sufficient to express my gratitude to my family for their unwavering encouragement. I also thank all friends for being a constant source of my support.

Rucheta Panicker

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1 CONTENTS

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ABSTRACT

The Heart Rate Monitoring system is developed using IOT technology with an objective of detecting the heart beat of the patient in order to monitor the risk of heart attack and also the regular checkup. Body health monitoring is very important to us to make sure our health is in excellent condition. One of the vital parameter for this device under consideration is the heart rate (HR). In this project we describe the design of low cost heart rate monitoring device from fingertips based on the Bluetooth technology.

The entire system is comprised of several parts such as Heart Rate module, Android application and Bluetooth module. The Heart Rate (HR) module picks up heart rate signal by a non-invasive technique (Photoplethysmography) from the subject (patients) and sends it (signal) wirelessly to computer or android application using Bluetooth module. This system can be embraced and combined as a part of telemedicine constituent.

3 INTRODUCTION

Cardiovascular disease is one of the main causes of death in the many countries and in 1999, it accounted for over 15 million deaths worldwide. In addition, several million people are disabled by cardiovascular disease (WHO, 1999). The delay between the first symptom of any cardiac ailment and the call for medical assistance has a large variation among different patients and can have fatal consequences. One critical inference drawn from epidemiological data is that deployment of resources for early detection and treatment of heart disease has a higher potential of reducing fatality associated with cardiac disease than improved care after hospitalization. Hence new strategies are needed in order to reduce time before treatment. Monitoring of patients is one possible solution. Also, the trend towards an independent lifestyle has also increased the demand for personalized non-hospital based care.
This project “Heart beat monitoring by GSM technology" can be used in hospitals and also for patients who can be under continues monitoring while traveling from place to place. Since the system is continuously monitoring the patient and in case of any abnormal in the heart beat rate of the patient the system will immediately message to the concerned doctors and relatives about the condition of the patient and abnormal details.
To perform these operations the system uses heart beat sensor, GSM modem, and to control all these devices the heart of the system micro controller (P89V51RD2) is used.

4 Proposed Work

Some severe diseases and disorders e.g. heart failure needs close and continual monitoring procedure after diagnosis, in order to prevent mortality or further damage as secondary to the mentioned diseases or disorders. Monitoring these types of patients, usually, occur at hospitals or healthcare centers. Heart arrhythmias for instance, in many cases, need continual long-term monitoring. However, the patients are often too early released, owing to need of hospital bed for another patient on the waiting list, who needs to be hospitalized immediately.

5 Scope of the Work

Long waiting time for hospitalization or ambulatory patient monitoring/treatment, are other well-known issues for both the healthcare institutions and the patients.
This project provides healthcare authorities to maximize the quality and breadth of healthcare services by controlling costs. As the population increases and demand for services increases, the ability to maintain the quality and availability of care, while effectively managing financial and human resources, is achieved by this project. The use of modern communication technology in this context is the sole decisive factor that makes such communication system successful.

6 Design Methodology

In transmitter circuit the Heat Beat is measured by LED and LDR, then it is applied to the microcontroller. The Microcontroller maintains the records of the measured readings. It compares the measured heart beat with the normal readings and checks it is within the normal range or not. If it is normal, then it sends the message as normal otherwise it sends abnormal to the specified mobile number. The time specified for sending message is given by the user.

7 MOTIVATION

Some severe diseases and disorders e.g. heart failure needs close and continual monitoring procedure after diagnosis, in order to prevent mortality or further damage as secondary to the mentioned diseases or disorders. Monitoring these types of patients, usually, occur at hospitals or healthcare centers. Heart arrhythmias for instance, in many cases, need continual long-term monitoring. However, the patients are often too early released, owing to need of hospital bed for another patient on the waiting list, who needs to be hospitalized immediately.

The principle motivation for this project is to develop a method of monitoring heart activity for patients with heart disease, pacemakers, and other special heart conditions so the patient can lead a relatively active life without being confined to a specific region. The current 12-lead ECG systems in use are uncomfortable, non-portable, invasive and unsuitable for long-term use. By being able to monitor sickly patients remotely, peace of mind can be offered to extended family knowing that emergency services can be dispatched in the event of cardiac arrest, or irregular heart patterns.

8 LITERATURE SURVEY

1. **IoT based System for Heart Rate Monitoring**
   International Journal of Engineering Research & Technology (IJERT) , 2020

The Heart Rate Monitoring system is developed using IOT technology with an objective of detecting the heart beat of the patient in order to monitor the risk of heart attack and also the regular checkup. Body health monitoring is very important to us to make sure our health is in excellent condition. One of the vital parameter for this device under consideration is the heart rate (HR). In this project we describe the design of low cost heart rate monitoring device from fingertips based on the Bluetooth technology. The entire system is comprised of several parts such as Heart Rate module, Android application and Bluetooth module.

1. **Heart Rate Monitoring System , Mr. Ved Prakash , JETIR May 2018**

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Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy. In order to measure the body temperature, we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure. Heart Rate can be monitored in two ways: one way is to manually check the pulse either at wrists or neck and the other way is to use a Heartbeat Sensor. Pulse oximetry is used in this project to detect the heartbeat using fingers. When the heart expands (diastole) the volume of blood inside the fingertip increases and when the heart contracts (systole)the volume of blood inside the fingertipdecreases.

8.1 E-health monitoring system , International Conference on Applied Internet and Information Technologies, 2016

.Monitoring of patients' vital parameters very often is limited to hospitals or other health care centres, which makes the process time consuming and expensive. Rapid advancement in information and communication technologies offers great opportunities for development of remote monitoring systems, which on one hand, will reduce costs and travel time, and on the other will increase health service efficiency and user satisfaction.

The goal of this paper is to propose an ehealth system that allows doctors to closely monitor patients' vital parameters, no matter where they are located. Integration of web, mobile and smart TV technology, will provide greater accessibility of patients' data, and will improve patient – doctor communications

9 OBJECTIVE AND SCOPE

- The goal of this project is to design low-cost device which measures the heart rate of the subject by clipping sensors on wrist and then displaying the result Miniaturized heart rates monitor system based on arduino. The project explains how a single chip microcontroller can be used to analyze heart beat rate signals in realtime. The Hardware and software design are oriented towards a single-chip microcontroller-based system, hence minimizing the size.

- The scopes in this project include the hardware and software parts. For the hardware part, ECG circuits have been designed in order to interpret data from ECG simulator, which act as a patient. Then, a temperature sensor was developed to measure the temperature of human being. Both systems are controlled by Arduino Nano board & need some programming works. For the software part As and Arduino IDE software have been used.

10 METHODOLOGY

11 In transmitter circuit the Heat Beat is measured by LED and LDR, then it is applied to the microcontroller. The Microcontroller maintains the records of the measured readings. It compares the measured heart beat with the normal readings and checks it is within the normal range or not. If it is normal, then it sends the message as normal otherwise it sends abnormal to the specified mobile number. The time specified for sending message is given by the user.

12 RECOMMENDER SYSTEM FOR HEART

13 MONITORING SYSTEM

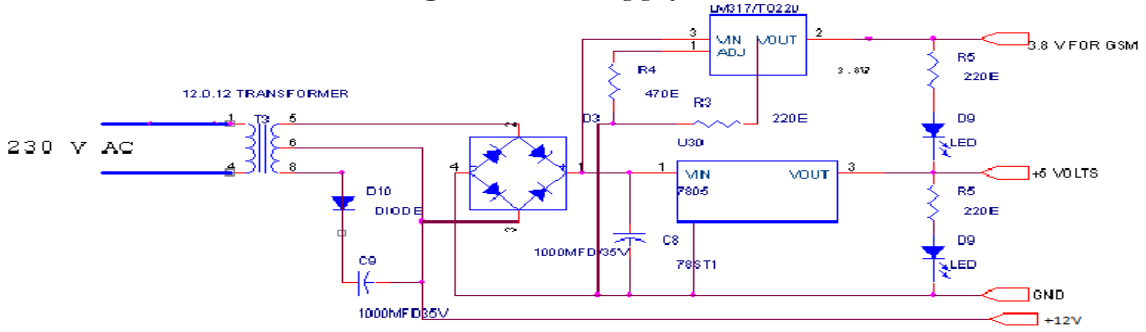
14 POWER SUPPLY

below.The +5 Volt and 3.8V power supply is based on the commercial **7805** & **Lm317** voltage regulator IC. This IC contains all the circuitry needed to accept any input voltage from 8 to 18 volts and produce a steady +5 volt & 3.8volt output, accurate to within 5% (0.25 volt). It also contains current-limiting circuitry and thermal overload protection, so that the IC won't be damaged in case of excessive load current; it will reduce its output voltage instead.

The **1000μf** capacitor serves as a "reservoir" which maintains a reasonable input voltage to the 7805 throughout the entire cycle of the ac line voltage. The bridge rectifier (**WM04**) keep recharging the reservoir capacitor on alternate half-cycles of the line voltage, and the capacitor is quite capable of sustaining any reasonable load in between charging pulses.

The **LED** and its series resistor(**220ohm**) serve as a pilot light to indicate when the power supply is on and also helps to the reservoir capacitor is completely discharged after power is turned off. Then I know it's safe to remove or install components for the next experiment.

Fig 1: Power supply Circuit



Diagram

6.2 MICROCONTROLLER P89V51RD2

1.General description

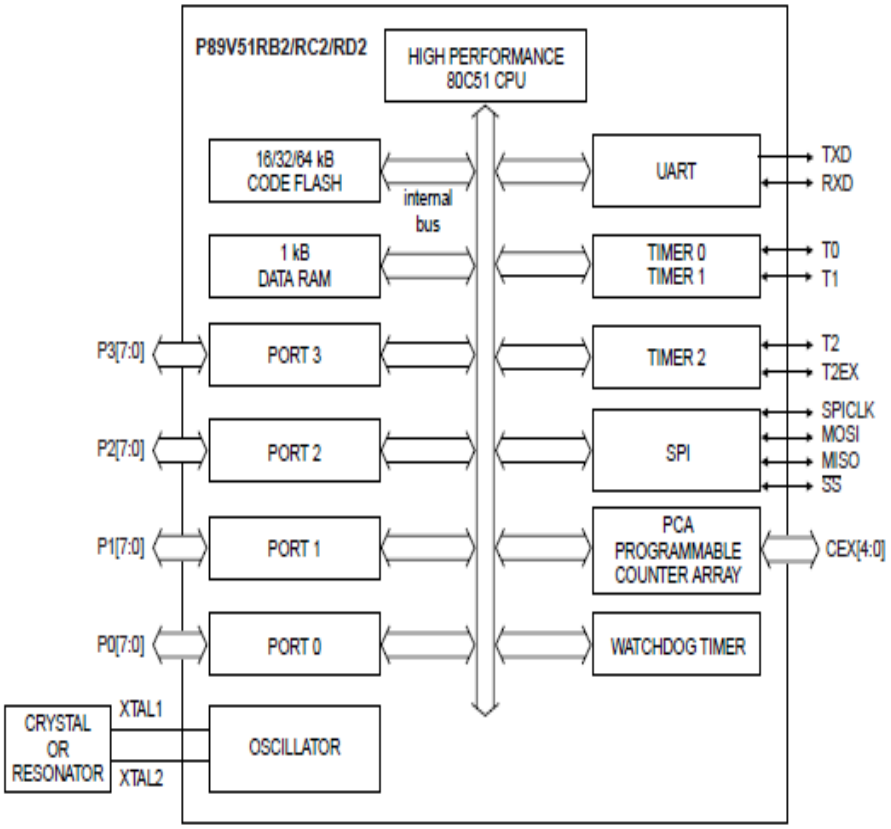
The P89V51RB2/RC2/RD2 are 80C51 microcontrollers with 16/32/64 kB flash and 1024 B of data RAM. A key feature of the P89V51RB2/RC2/RD2 is its X2 mode option. The design engineer can choose to run the application with the conventional 80C51 clock rate (12 clocks per machine cycle) or select the X2 mode (six clocks per machine cycle) to achieve twice the throughput at the same clock frequency. Another way to benefit from this feature is to keep the same performance by reducing the clock frequency by half, thus dramatically reducing the EMI The flash program memory supports both parallel programming and in serial ISP. Parallel programming mode offers gang-programming at high speed, reducing programming costs and time to market. ISP allows a device to be reprogrammed in the end product under software control. The capability to field/update the application firmware makes a wide range of applications possible. The P89V51RB2/RC2/RD2 is also capable of IAP, allowing the flash program memory to be reconfigured even while the application is running.

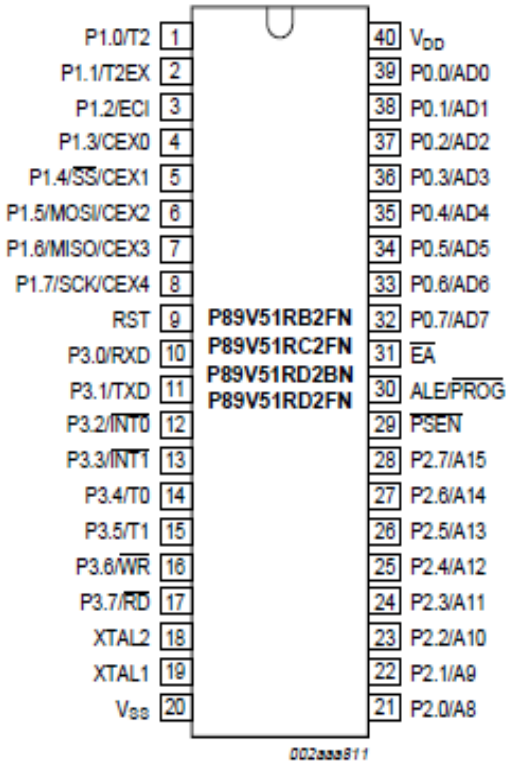
14.1 Features

- 80C51 CPU
- 5 V operating voltage from 0 MHz to 40 MHz
- 16/32/64 kB of on-chip flash user code memory with ISP and IAP
- Supports 12-clock (default) or 6-clock mode selection via software or ISP

- SPI and enhanced UART
- PCA with PWM and capture/compare functions
- Four 8-bit I/O ports with three high-current port 1 pins (16 mA each)
- Three 16-bit timers/counters
- Programmable watchdog timer
- Eight interrupt sources with four priority levels
- Second DPTR register
- Low EMI mode (ALE inhibit)
- Power-down mode with external interrupt wake-up
- Idle mode

3.Block diagram of P89V51RD2





6.3 HEART BEAT SENSOR

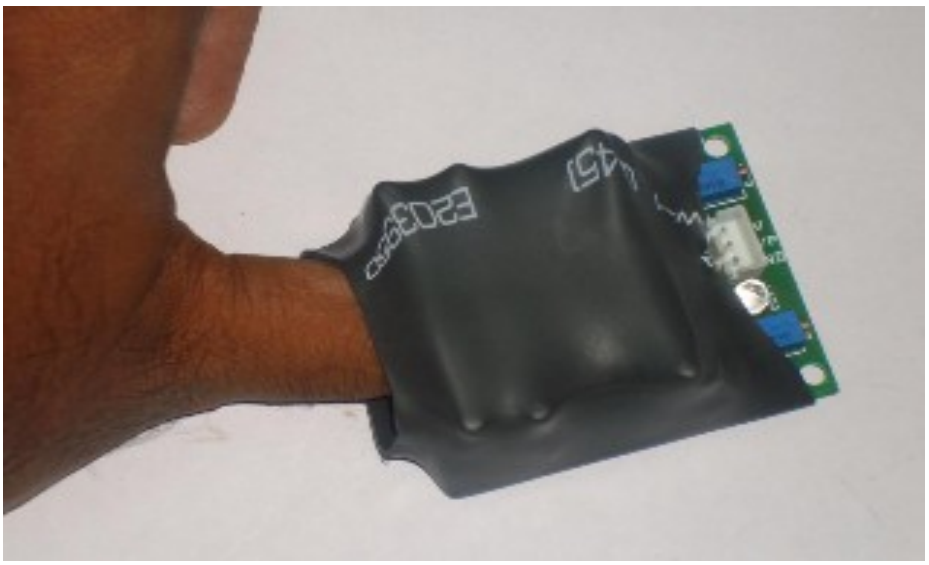


Fig 5:Heart beat sensor

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of

blood through Finger. As the heart forces blood through the blood vessels in the Finger, the amount of blood in the Finger changes with time. The sensor shines a light lobe (small High Bright LED) through the ear and measures the light that is transmitted to LDR. The signal is amplified, inverted and filtered, in the Circuit .By graphing this signal, the heart rate can be determined, and some details of the pumping action of the heart can be seen on the graph.

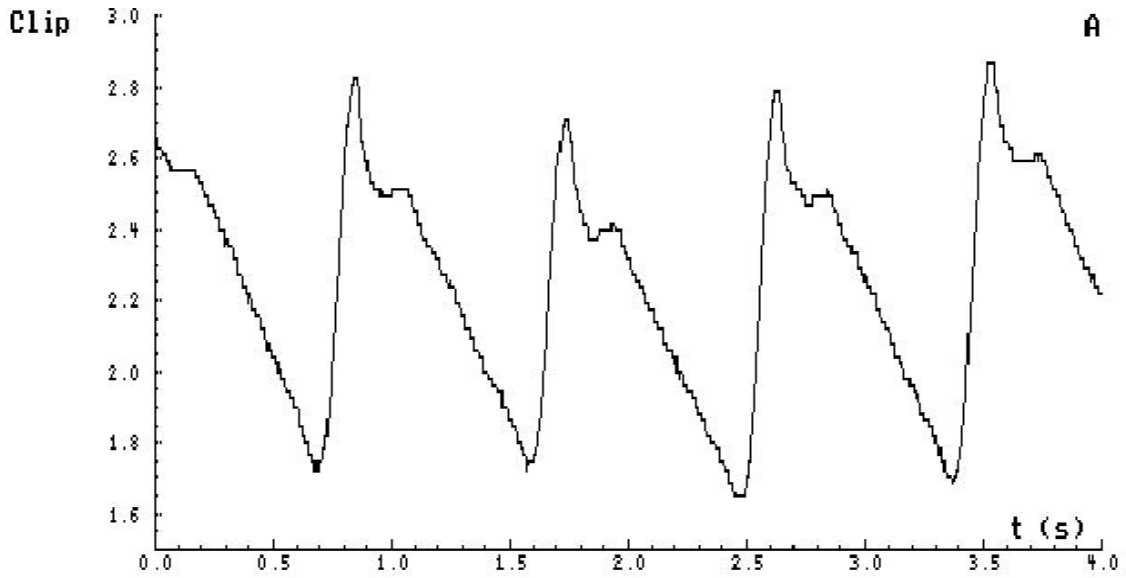


Fig 6: A sample measurement taken with the heartbeat sensor.

Figure 3.3.1 shows that the blood flowing through the Finger rises at the start of the heartbeat. This is caused by the contraction of the ventricles forcing blood into the arteries. Soon after the first peak a second, smaller peak is

observed. This is caused by the shutting of the heart valve, at the end of the active phase, which raises the pressure in the arteries and the earlobe.

FEATURES

- Heat beat indication by LED
- Instant output digital signal for directly connecting to microcontroller
- Compact Size
- Working Voltage +5V DC

APPLICATIONS

- Digital Heart Rate monitor
- Patient Monitoring System
- Bio-Feedback control of robotics and applications

SPECIFICATIONS:

Parameter	Value
Operating Voltage	+5V DC regulated
Operating Current	100 mA
Output Data Level	5V TTL level
Heart Beat detection	Indicated by LED and Output High Pulse
Light source	660nm Super Red LED

PIN DETAILS:

Board has 3-pin connector for using the sensor. Details are marked on PCB as below.

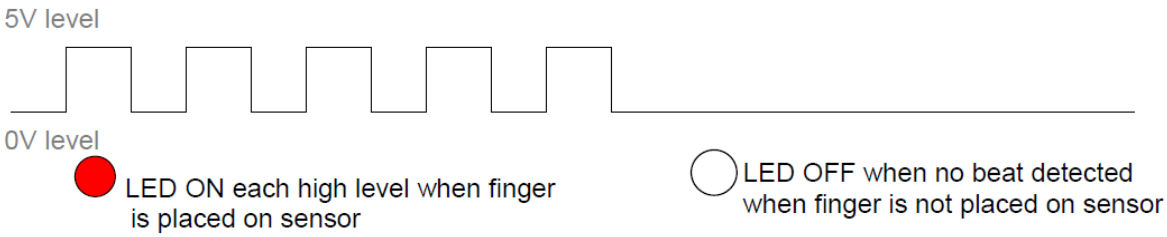
Pin	Name	Details
1	+5V	Power supply Positive input
2	OUT	Active High output
3	GND	Power supply Ground

USING THE SENSOR

- Connect regulated DC power supply of 5 Volts. Black wire is Ground, Next middle wire is Brown which is output and Red wire is positive supply. These wires are also marked on PCB.
- To test sensor you only need power the sensor by connect two wires +5V and GND. You can leave the output wire as it is. When Beat LED is off the output is at 0V.
- Put finger on the marked position, and you can view the beat LED blinking on each heartbeat.
- The output is active high for each beat and can be given directly to microcontroller for

  interfacing applications.

HEART BEAT OUTPUT SIGNAL



6.4 LIQUID CRYSTAL DISPLAY

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Liquid crystal displays (LCDs) offer several advantages over traditional cathode-ray tube displays that make them ideal for several applications. Of course, LCDs are flat and they use only a fraction of the power required by cathode-ray tubes. They are easier to read and more pleasant to work with for long periods of time than most ordinary video monitors. There are several tradeoffs as well, such as limited view angle, brightness, and contrast, not to mention high manufacturing cost.16x2 LCD is used in this project to display data to user. There are two rows and 16 columns. It is possible to display 16 characters on each of the 2 rows. It has two registers, command register and data register.

Fig 7: 8051 and LCD interface.

14.1.1 PIN OUT

The module that we are using is a 16 character x 2 line display that we stock over here. It uses an ST7065C controller, which is HD44780 compatible. The figure below shows the LCD module and pin out.

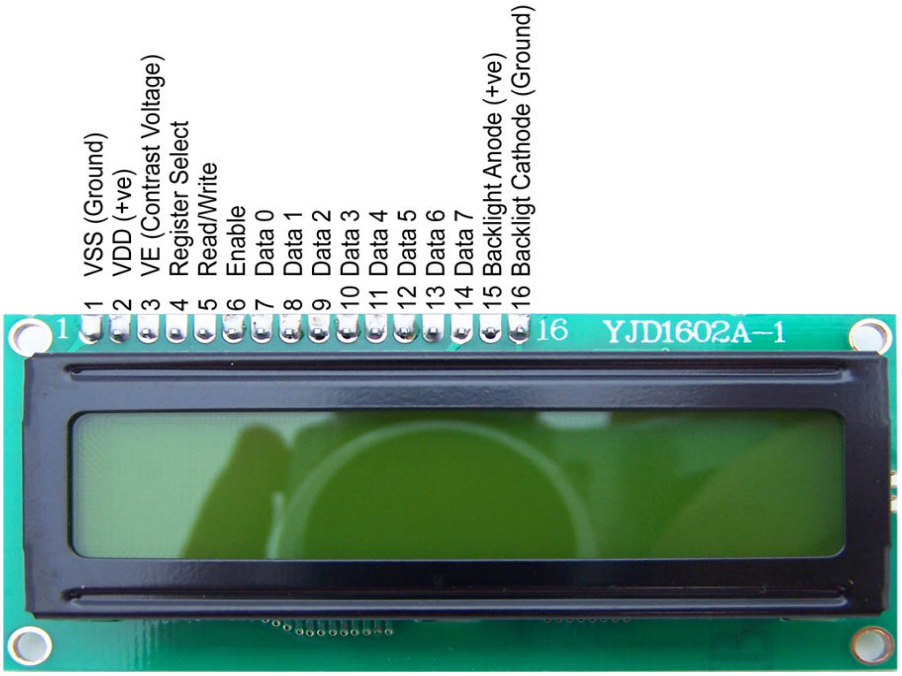

Fig 8: LCD pin out

The last 2 pins (15 & 16) are optional and are only used if the display has a backlight.

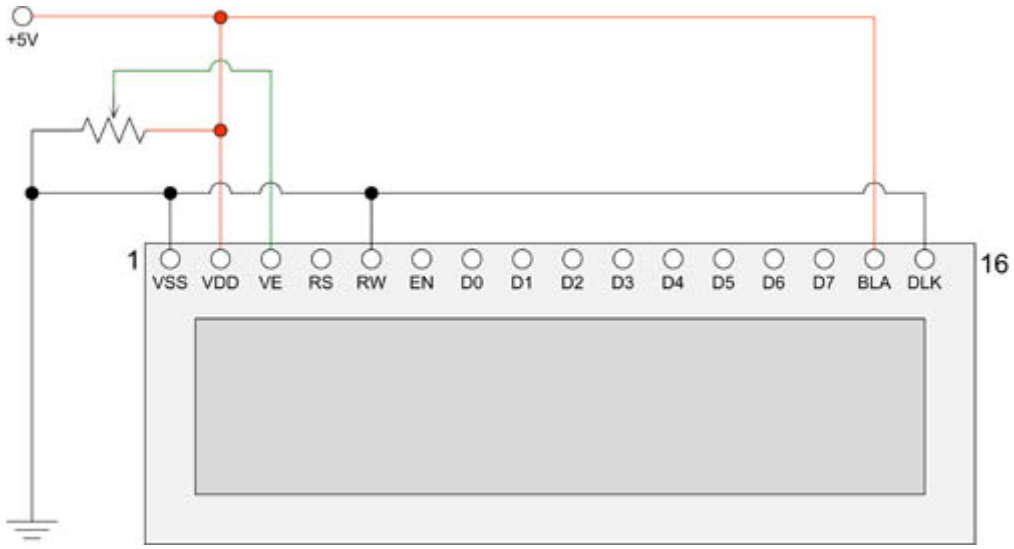

Figure 1: LCD pin out The last 2 pins (15 & 16) are optional and are only used if the display has a backlight.The circuit diagram below shows the LCD module with the basic "plumbing" wired up. You will notice that pin 5 (RW) is tied to ground. This pin is use to control whether you are reading or writing to the display. Since reading from the display is very rare, most people just tie this pin to ground.

Fig9: LCD pin3 connection

6.5. GSM

GSM (Global System for Mobile Communications originally from **Group Special Mobile**) is the most popular standard for mobile telephony systems in the world. The GSM Association, its promoting industry trade organization of mobile phone carriers and manufacturers, estimates that 80% of the global mobile market uses the standard.

The ubiquity of implementation of the GSM standard has been an advantage to both consumers, who may benefit from the ability to roam and switch carriers without replacing phones, and also to network operators, who can choose equipment from many GSM equipment vendors.

Newer versions of the standard were backward-compatible with the original GSM system. For example, Release '97 of the standard added packet data capabilities by means of General Packet Radio Service (GPRS). Release '99 introduced higher speed data transmission using Enhanced Data Rates for GSM Evolution (EDGE).

15 The GSM Network – Circuit Switching Domain:

The GSM network was designed keeping in mind the voice activities of the user and its main purpose was to provide voice connectivity like Public Switched Telephone Networks but with mobility. The data communication was of secondary importance to this network but to support this also, designers have considered the circuit switching itself the mechanism for transmitting data packets.

15.1 GSM Architecture:

Fig 10: GSM Architecture

The Mobile Station (MS) directly interacts with one of the Base Transceiver Stations, which in turn interacts with a Base Station Controllers (BSC). BTS and BSC combined together forms the BSS. More than one BTSs are connected with one BSC. The BSC further interacts with Mobile Station Controller (MSC) which is a the heart of the GSM network. MSC further gives connectivity to the PSTN and other PLMNs. MSC is also responsible to interact with HLR and VLR, which form the Permanent and Temporary data bases for all the subscribers' static and dynamic information.

15.1.1 GSM Speech and Channel coding :

First of ALL speech is converted to 8 Ksps by going through a LPF and a A/D converter. Then each symbol is encoded as 13 bits giving 104 Kbps output. Now this is applied to a RPE/LTP encoder, which converts this to 13Kbps. Speech is divided into 20 millisecond samples, each of which is encoded as 260 bits, giving a total bit rate of 13 kbps.The words, "Mobile Station" (MS) or "Mobile Equipment" (ME) are used for mobile terminals supporting GSM services. A call from a GSM mobile station to the PSTN is called a "mobile originated call" (MOC) or "outgoing call", and a call from a fixed network to a GSM mobile station is called a "mobile terminated call" (MTC) or "incoming call". In this document, the word "product" refers to any product supporting the AT commands interface.

LED Status Indicator: The LED will indicate different status of the modem:

- OFF Modem Switched off
- ON Modem is connecting to the network
- Flashing Slowly Modem is in idle mode
- Flashing rapidly Modem is in transmission/communication (GSM only)

Now every embedded system is used to communicate with other system using GSM and GPRS technology, In this project MODEM is used to access the message sent by the user to display in doctors mobile.

SOFTWARE DESCRIPTION

1. SOFTWARE USED

1.1 KEIL SOFTWARE

The KEIL 8051 Development Tools are designed to solve the complex problems facing embedded software developers.In this project we select the KEIL software of version8.08 .Because it provides Device Database and the μVision IDE sets all compiler, assembler, linker, and memory options for you. Numerous example programs are included in this software, and also the KEIL μVision Debugger accurately simulates on-chip peripherals (I^2C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of your 8051 device.

Simulation helps you understand hardware configurations and avoids time wasted on setup problems. When testing the software application with target hardware, use the MON51, MON390, MONADI, or FlashMON51 Target Monitors, the ISD51 In-System Debugger, or the ULINK USB-JTAG Adapter to download and test program code on your target system.

16 EMBEDDED C

The C programming language is perhaps the most popular programming language for programming embedded systems. Most C programmers are spoiled because they program in environments where not only there is a standard library implementation, but there are frequently a number of other libraries available for use. The cold fact is, that in embedded systems, there rarely are many of the libraries that programmers have grown used to, but occasionally an embedded system might not have a complete standard library, if there is a standard library at all. Few embedded systems have capability for dynamic linking, so if standard library functions are to be available at all, they often need to be directly linked into the executable. Oftentimes, because of space concerns, it is not possible to link in an entire library file, and programmers are often forced to "brew their own" standard c library implementations if they want to use them at all. While some libraries are bulky and not well suited for use on microcontrollers, many development systems still include the standard libraries which are the most common for C programmers.

C remains a very popular language for micro-controller developers due to the code efficiency and reduced overhead and development time. C offers low-level control and is considered more readable than assembly. Many free C compilers are available for a wide variety of development platforms. The compilers are part of an IDEs with ICD support, breakpoints, single-stepping and an assembly window. The performance of C compilers has improved considerably in recent years, and they are claimed to be more or less as good as assembly, depending on who you ask. Most tools now offer options for customizing the compiler optimization. Additionally, using C increases portability, since C code can be compiled for different types of processors.

16.1 CHARACTERS DISPLAYED IN LCD SCREEN

Graphics Type 'SHAPE' is not supported yet. Please insert it as image.
1. INITIAL DISPLAY

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2. WHEN SIM CARD INSERTED

3. WHEN FINGURE PLACED AND PUSH BUTTON PRESSED
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Graphics Type 'SHAPE' is not supported yet. Please insert it as image.4. WHEN MSG SENT SUCCESFULLY

5. IF MSG NOT SENT

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17 OBSERVATION

It is neccesarry to monitor the heart beat rate of patients those already receiving some forms of surgical treatment,so our device will be nearly helpful for them.
Our device will be able to

- **Provides early detection of heart attacks**
- **Eliminates delays in receiving medical treatment**
- **Improves healthcare services to at risk population**
- **Saves lives and improves quality of living**

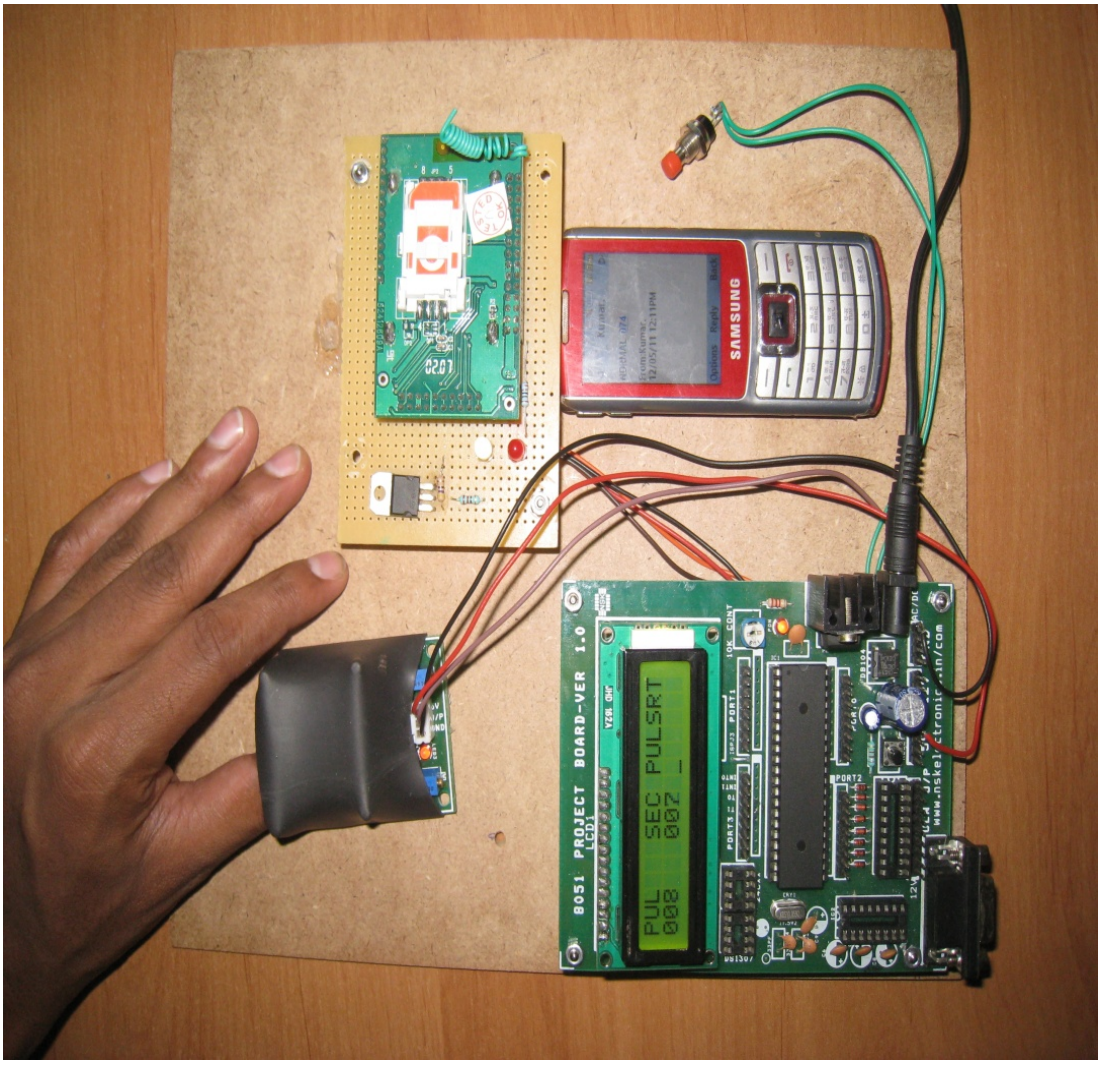

Figure 2: Heart Beat Monitoring By GSM Technology

FIG: Microcontroller With LCD Unit and mobile

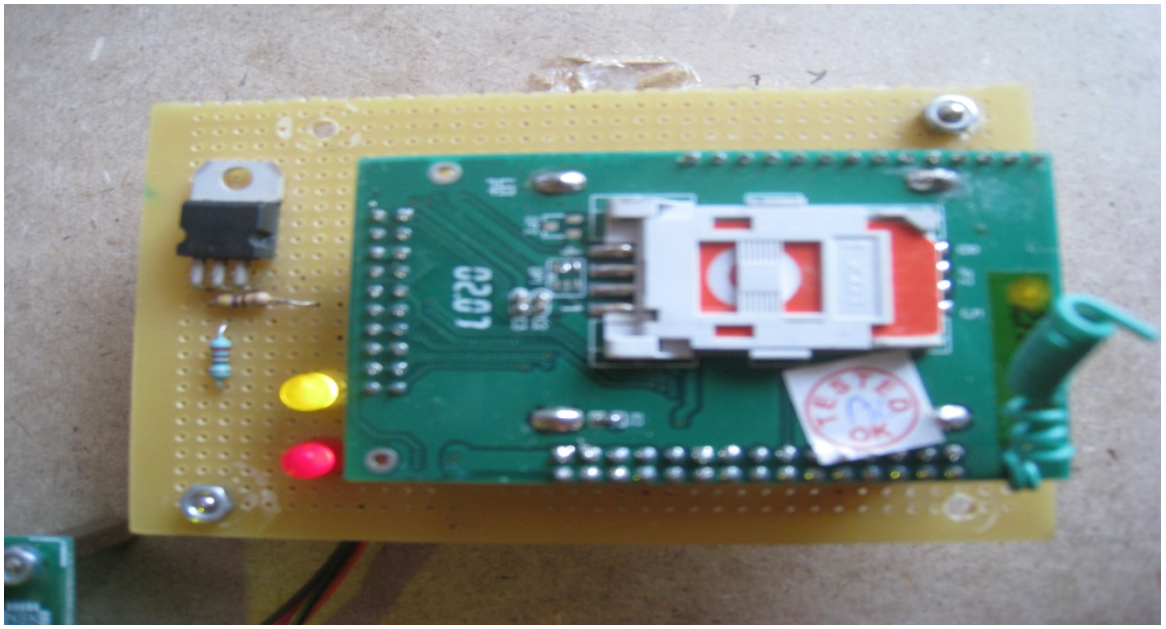

FIG: GSM Modem with sim card inserted

CONCLUSION AND FUTURE ENHANCEMENTS

18 CONCLUSION

Cardiovascular disease is one of the major causes of untimely deaths in world, heart beat readings are by far the only viable diagnostic tool that could promote early detection of cardiac events. Wireless and mobile technologies are key components that would help enable patients suffering from chronic heart diseases to live in their own homes and lead their normal life,while at the same time being monitored for any cardiac events. This will not only serve to reduce the burden on the resources of the healthcare center but would also improve the quality of healthcare sector. In this project,the heart beat rate of the patient is sensed.When the implant detects a heart beat rate, it will alert the microcontroller which in turn will automatically send the message and provide the patient's condition so that the patient will be given medical attention within the first few critical hours, thus greatly improving his or her chances of survival.

19 FUTURE ENHANCEMENTS

- **This algorithm deals only with single patient. This algorithm can be extended to multiple doctors and multiple patients.**
- **In future we can also design PC software to analyze this received signal and generate the report and this can be sent back to the doctor.**
- **With the connection established between two ends we can also send patient's body temperature, blood pressure to doctor's side.**
- **In addition to ECG rate, we can also send EEG (electroencephalogram) and EMG (electromyogram) signals for analyzing.**
- **Using GSM technology we can display the ECG signal on doctor's mobile phone.**

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- **Electronics For You - Magazine**
- **www.Wikipidea.com**
- **www.google.com**