# HARDWARE IMPEMENTATION TO MEASURE HEART-BEAT USING FINGERTIP

Submitted in partial fulfillment of the Degree of
Bachelor of Technology

**DEPARTMENT OF COMPUTER SCIENCE**
**JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT**

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# CERTIFICATE

This is to certify that the work titled "**HARDWARE IMPEMENTATION TO MEASURE HAERTBEAT USING FINGERTIP"** submitted by **"Priyanka"** in partial fulfillment for the award of degree of B.Tech of Jaypee University of Information Technology, Waknaghat has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

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| Name of Supervisor | …………………….. |
| Designation | …………………….. |
| Signature of Supervisor | …………………….. |
| Date | …………………….. |

# ACKNOWLEDGEMENT

First of all I would like to acknowledge the almighty god for bestowing his good wishes and giving me the strength at every moment of despair to complete this project.

It's incumbent on my part to thank my project guide **"Brig. S.P Ghrera"** Dept. of Computer Science and Information Technology, Jaypee University of Information Technology, Waknaghat, Solan (H.P.) who has been a great support and guided us throughout the completion of my roject.

Last but not the least I express my warm thanks to my respected parents and all my friends for their support and their constructive suggestions, which enabled me to bring improvements in my project.

Signature of the student ……………………..

Name of Student ……………………..

Date ……………………..

# SUMMARY


Heart rate measurement is one of the most vital parameters of the human cardiovascular system. The heart rate of a healthy adult at rest is around 72 beats per minute (bpm).Heart rate measurement is an important diagnostic tool because it reflects our state of mind and physical condition. So, we are trying to make a project which will be an indication of how healthy our body is, by measuring and monitoring the heart beat.

The project presented here uses a fingertip sensor that monitors the heartbeat and displays its value on the LCD connected to the microcontroller. The microcontroller is interfaced with the SIM module for the sole purpose of sending the heartbeat value to the mobile phone when a message is sent by it to the microcontroller. In this way the doctor can simply monitor the condition of his/her patient without actually being in the vicinity of the patient.

The measurement of heart rate is used by medical professionals to assist in the diagnosis and tracking of medical conditions. It is also used by individuals, such as athletes, who are interested in monitoring their heart rate to gain maximum efficiency from their training. It can be used as a revolutionary concept in E-health.


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| Date | Date |

# CHAPER 1:
# INTRODUCTION

### 1.1.What is heart Rate?

**Heart rate** is the speed of the heartbeat, specifically the number of heartbeats per unit of time. The heart rate is typically expressed as beats per minute (bpm). The heart rate can vary according to the body's physical needs, including the need to absorb oxygen and excrete carbon dioxide. Activities that can provoke change include physical exercise, sleepy, anxiety , stress, illness, ingesting, and drugs. The normal adult human heart rate ranges from 60–100. The heart beats at different rates depending on whether your body is at rest or at work. When resting, the heart rate beats an average of 72 times per minute for high school students and an average of 85 BPM for middle school students. During strenuous physical activity, your heart rate or pulse increases, sometimes to twice or more its resting rate. Your stroke volume, the amount of blood pumped for each heartbeat, also increases. This is because the muscles that are working demand more blood to supply them with oxygen and other nutrients.

Normal adult human heart rate range:60-100 bpm. Heart rate below 60 bpm is known as Bradcyardia. Heart rate above 100 bpm is known as Tachcyardia When the heart is not beating in a regular pattern, this is referred to as an arrhythmia. These abnormalities of heart rate sometimes, but not always, indicate disease.

## 1.2 What is a patient heartbeat and Tempature using R.f?

A patient heartbeat and temperature monitor using RF. is a radio frequency based pulse wave and body temperature monitoring system, which allows the control of a sick person’s condition in real time. The system monitors the heart beat and temperature of a patient simultaneously and if the patients heartbeat rate or body temperature is abnormal, the system alerts sends an alert to the doctor or patient’s family members to quickly examine or diagnose the patient’s condition and take early precaution to save the patient’s life. The alerts sound can be triggered at any time as long as there is a deviation in the health condition of the patient from the normal, such that the status of the patient can be known on time. The system consists of a sensor, which monitors the patient and sends a signal to a microcontroller which processes it to determine the tempature and heartbeat rate of the patient before sending an alert to a receiver using radio frequency. The receiver has to be in the possession of the patient's doctor or family members. This project can also be used by athletes who engage in physical exercise and by medical professionals. Individuals, such as athletes, cyclists or those who are interested in monitoring their heartbeat rate and body temperature to gain maximum efficiency from their training can also use this project. It can be used during physical exercise and healthcare.

## 1.3 Problem Defintion

The human health is one of the most important concerns in the world today. Anything/everything becomes meaningless when one becomes sick and dies due to improper Medicare. For health reasons, people, governments and several voluntary bodies spend a lot of money to ensure a better health condition for themselves and the entire populace. Scientists and Engineers are always at work to device a means of supporting/sustaining a sound health condition for all through the invention of numerous technologies both Electrical/Mechanical gadgets that are in use for health care delivery today. The heart is a very delicate organ in the human body (once it stops beating, nothing else matters). Thus, If early actions are taken (and on time) the heart condition can be managed effectively and many patients can be cured and saved.The problem of patient slumping and dying is associated with cardiovascular arrests and can be checkmated this sensitive and highly effective device (the patient heartbeat and temperature monitor). This device has an outstanding advantage that it is easy to handle and access. Heartbeat rate and body temperature monitors are part of the most vital tools needed in first aid kit for saving lives. Unlike the x-ray, the heartbeat and temperature monitor does not impose any hazard to the human health. There devices in the market which can provide raw measurement data of the patients to the doctors, but the patients may not be able to interpret the medical measurement into a meaningful diagnosis due to their limited medical background. On the other hand, if raw medical data is delivered to the doctor, time is wasted and may pose a problem, but in emergencies waste of time can never be tolerated. It is tough to share data over large area within a short period. Most of the products available in the market have this drawback of limitation in flexibility and portability. If the heat that is produced from metabolism cannot be checkmated on time, it will cause a turbulent body temperature, which could be worse than 40°C and lead to headache, vertigo, low blood pressure, high energy consumption, unconsciousness and crocking up of body temperature regulation function. On the other hand, when the produced heat is less than the dissapting heat,the body tempature cannot hold on and it will result to a disease in metabolism.

## 1.4AIMS AND OBJECTIVES

The major aim and objective of this design [of a patient heartbeat and temperature monitor using RF.] is to help the doctors and family members to keep track of the heartbeat condition of their loved ones [as well as their body temperature] in the case of an abnormality in the health condition (for those with heartbeat defects and those that run excessive high temperature beyond normal). If any varied change takes place, it is notified. This notification through RF. Channel would to take an appropriate action at an instance of time, thereby alerting the appropriate persons..

## 1.5 Methods for measure Heart Rate

Heart rate is measured by counting the number of times your heart beats in one minute. One way to determine your heart rate is to manually take your pulse.

The two most common locations used to take a pulse are at the radial artery in the wrist and the carotid artery in the neck. It is best to practice locating and counting your pulse when you are at rest and again during physical activity.

1.2.1 Measuring the radial pulse. Place the tips of the index and second fingers of one hand on the inside wrist of the other hand. Position the fingers just below the base of the thumb to take the radial pulse at the wrist

1.2.2 Measuring the carotid pulse. Place the tips of the index and second fingers of one hand on the side of the neck just behind the windpipe.

1.2.**3 Measuring your resting heart rate**. Your pulse fluctuates during the day due to activity, stress, caffeine, medications, and other factors that might influence your heart rate. A resting pulse is the lowest your heart rate would go during the day. You can get your best reading when you first wake up in the morning, before any activity. Relax your body, and follow the steps below for measuring your pulse.

## The following are steps to take when measuring your pulse:

- Step One: Apply light to moderate pressure with the fingers until the blood pulsing beneath the fingers is felt. If no pulse is felt, move the fingers around slightly, up or down, until a pulse is felt. Do not apply excessive pressure. This may compress the artery and distort the measurement. Once the pulse is felt, move to step two.

- Step Two: Using a watch or clock with a second hand, count the number of beats felt in 30 seconds, then multiply that number by two to compute a heart rate ,expressed in BPM.

## 1.6 Techniques for measure Heart Rate

It is not known whether it is better to measure heart rate with an electrocardiogram or rather to take the pulse rate. The electrocardiogram would appear to be more accurate, but the number of cardiac cycles used for heart rate calculation is usually quite small. Recently, electronic pulse meters were made available for measuring heart rate automatically from the finger, wrist, or chest.[22] These devices allow measurements to be taken continuously, and can be used during exercise when manual measurement would be difficult or impossible.

***Pulse palpation***

Traditionally, heart rate has been measured by pulse palpation. The pulse rate is measured by counting the beats in a set period of time (from 15 to 60 seconds) and multiplying that number to get the number of bpm. This is still the method currently used by doctors and other healthcare professionals in daily routine. The pulse rate can be measured at any point on the body where an artery is close to the surface. Most common places are radial, carotid, brachial, and femoral arteries. If stroke volume is subject to high variability such as in cases of atrial fibrillation, some heart beats can be missed at pulse palpation, and heart rate should be measured directly from heart auscultation.

***Electrocardiography***

There are, however, techniques that allow heart rate to be measured more precisely and for longer periods of time. Electrocardiographic recording is the most precise method of heart rate measurement and is routinely carried out in many clinical settings, especially in critical care medicine. Whether electrocardiographic measurement may also be advantageous in epidemiological studies or in clinical routine is not known, however. The use of electrocardiography obviously implies greater financial costs, and it is not known whether increased measurement precision actually translates into more meaningful data.

***Electronidevices***

Electronic pulse meters consist of two parts, a transmitter placed over the artery and a receiver attached to a belt worn around the chest or a wrist watch receiver for display. A photo diode or a photo transistor can be used to detect pulse rate. The skin may be illuminated with visible (red) or infrared light emitting diodes using transmitted or reflected light for detection. Infrared sensors can easily be clipped to finger ends or ear lobes to detect the heart beat using plethysmographic technology. Because of frequent noise sources that may produce disturbance signals, valid pulse measurement requires extensive preprocessing of the raw signal. New systems combine analog and digital signal processing to suppress disturbance signals. A digital system is usually accurate to within 3-4 bpm. Simple heart rate monitors may only display the heart rate on the screen. More professional monitors are available that can be set to record time, calculate average and maximum heart rate for a given period, and sound an alarm when a person reaches or exceeds a predetermined target heart-rate zone. These devices are used mostly by athletes and sportspeople wishing to monitor their workouts in order to achieve their desired training benefit. More complex ambulatory devices can also record other biological signals such as breathing movements, nasal and oral flow, and blood oxygen saturation, which can be useful for monitoring sleep apnea episodes

This project describes the design of a very low-cost device which measures the heart rate of the subject by clipping sensors on one of the fingers and then displaying the result on a text based LCD. The device has the advantage that it is microcontroller based and thus can be programmed to display various quantities, such as the average, maximum and minimum rates over a period of time and so on. Another advantage of such a design is that it can be expanded and can easily be connected to a recording device or a PC to collect and analyse the data for over a period of time.This project demonstrates a technique to measure the heart rate by sensing the change in blood volume in a finger artery while the heart is pumping the blood. It consists of an infrared LED that transmits an IR signal through the fingertip of the subject, a part of which is reflected by the blood cells. The reflected signal is detected by a photo diode sensor. Heart rate is simply and traditionally measured by placing the thumb over the subject's arterial pulsation, and feeling, timing and counting the pulses usually in a 30 second period. Heart rate (bpm) of the subject is then found by multiplying the obtained number by 2. This method although simple, is not accurate and can give errors when the rate is high. More sophisticated methods to measure the heart rate utilize electronic techniques. Electro-cardiogram (ECG) is [3,4] one of frequently used and accurate methods for measuring the heart rate. ECG is an expensive device and its use for the measurement of the heart rate only is not economical. Low-cost devices in the form of wrist watches [5,6] are also available for the instantaneous measurement of the heart rate. Such devices can give accurate measurements but their cost is usually in excess of several hundred dollars, making them uneconomical. Most hospitals and clinics in the UK use integrated devices designed to measure heart rate.

Current medical techniques for monitoring the heart rate and other vital signs use electrodes attached to the body, which are impractical for patients who want to move around. These techniques pose a problem especially in the rural areas where we do not have the required infrastructure and commuting to the nearest hospital or primary health centre is a daunting task.Keeping in mind the problems faced by people, we have designed a system which is portable, can be effectively and efficiently used without the need of a doctor in close proximity. It also saves the valuable time of both the patient and the doctor.Here the data is simply sent to the mobile phone of the intended recipient and analysis of the body atvital signs can be done on its basis.

The project has been divided into various chapters giving a detailed description of the project components and also for a better understanding of the project working. This has been supplemented by the images and the interfacing programs between the various components.

Towards the end we have drawn a conclusion to the project giving its future scope. Additional information related to the project has been given in the appendices. We have also mentioned the references from where we got help for successful completion of the project

# CHAPER 2:

# HARDWARE REQUIREMENTS

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## Hardware Requirement Specification*:*

The required hardware combination for this project will be as following:-

1. Micro controller-ATMEGA8
2. A/D Converter
3. LCD Display
4. Buzzer
5. Reset switch
6. LDR
7. LED
8. IC-LM358
9. Potentiometer-50K
10. Transistors-BC547
11. Capacitors-15pF,33pF,104pF,10uF,1000uF
12. Resistors-1K,8.2K,10K,330K
13. Voltage regulator-7805
14. 5v DC supply.

# CHAPTER-3

# LITERATURE REVIEW

## 3.1 MEDICAL MONITORING DEVICE

Medical monitor devices are of integrated technology and are found in the area of electronics, computers, material and information Engineering. It plays an important role in the medical/patient simulation system. With the help of the medical monitoring systems, a doctor can get an up to date information of a patient. In any modern society, the physical condition and safety of patients has attracted more and more attention. Patients, who are merely over conscious of their health are easily susceptible to the unexpected situations, such as contraction of diseases/infections as well as some kind of sickness because they take their health issues for granted. Thus, for a good guarantee of the patient's daily life, a monitor designed for this purpose is needed. This monitoring device requires wearable bracelet bangle connected to the device from where the body temperature and heart condition is monitored.

This study aims at the designing of a patient monitoring device with good stability, wearable, low power consumption, low cost and high anti- jamming ability, which enables the doctors to acquaint themselves with the real-time condition of their patients.

## 3.2 HISTORY OF PATIENT MONITORING SYSTEM

The invention of a patients monitoring system has been very important even to the fitness industry and as well as an aid to living a healthy lifestyle. Today, many treadmills and elliptical machines often have these monitors built in them to check the rate of the heartbeat at any given time. These monitoring devices are also very important to cyclists and athletes because it prevent them from over training or under training. The very first monitoring device with heartbeat rate (without a body temperature detector) was invented in 1975 by writer, lecturer and inventor Gregory Lekhtman. Lekhtman continues to design fitness electronic devices for his international award winning company, Biosig Instruments Incoporated. He has also collaborated with fitness equipment manufacturers such as Sony, Polar and Nordic Track. By 1977, improvements were made on the original heart rate monitor, and the Polar Electro Company produced the first wireless heart rate monitor. It was specifically used in training the Finnish National Cross Country Ski team. By the late 1970s and early 1980s, heart rate monitors were available in stores abroad for consumers.

## 3.3 FUNCTIONS OF PATIENT HEALTHCARE MONITORS

Patient heart rate monitors can perform many functions beyond tracking of heart rate in real time. One of the features is that when one enters an information and programming of choice within the machine, the monitor can average the person's heartbeat rate and estimate how many calories the person burns per hour. The information obtained can be downloaded into a computer for tracking purposes.

On cardiovascular machines like the treadmill or elliptical trainer, once an information is entered like age and program, the machine can adjust the body resistance until it reaches the desired zone for the heartbeat rate. One of the existing patients monitoring system demonstrated below in this literature review is a technique that measures the heartbeat rate by sensing the change in blood volume in a finger artery (or mostly wrist artery) while the heart is pumping blood. The system consists of an infrared LED that transmits an IR. signal through the fingertip or wrist of the subject, a part of which is reflected by the blood cells. The reflected signal is detected by a photo diode sensor. The changing blood volume with heartbeat results in a train of pulses at the output of the photo diode, the magnitude of which is too small to be detected directly by a microcontroller. A two-stage high gain, active low pass filter is designed for the system using two operational amplifiers (Op-Amps) to filter and amplify the signal to appropriate voltage level so that the pulses can be counted by the microcontroller, (ATMEGA-8)

Finally, the detected heart rate was displayed on a three (3)-digit seven-segment display. The schematic circuit diagram of the system is shown in figure signal in appropriate voltage level so that the pulses can be counted by the microcontroller,(ATMEGA-8).

Finally, the detected heart rate was displayed on a three (3)-digit seven-segment display. The schematic circuit diagram of the system is shown in below.

Based on the information gathered on this literature review, the heartbeat rate detected by the machine can be defined as the number of heartbeats per unit of time and is usually expressed in beats per minute (bpm). In adults, a normal heart beats for about 60 to 100 times per minute (occurring during resting condition).

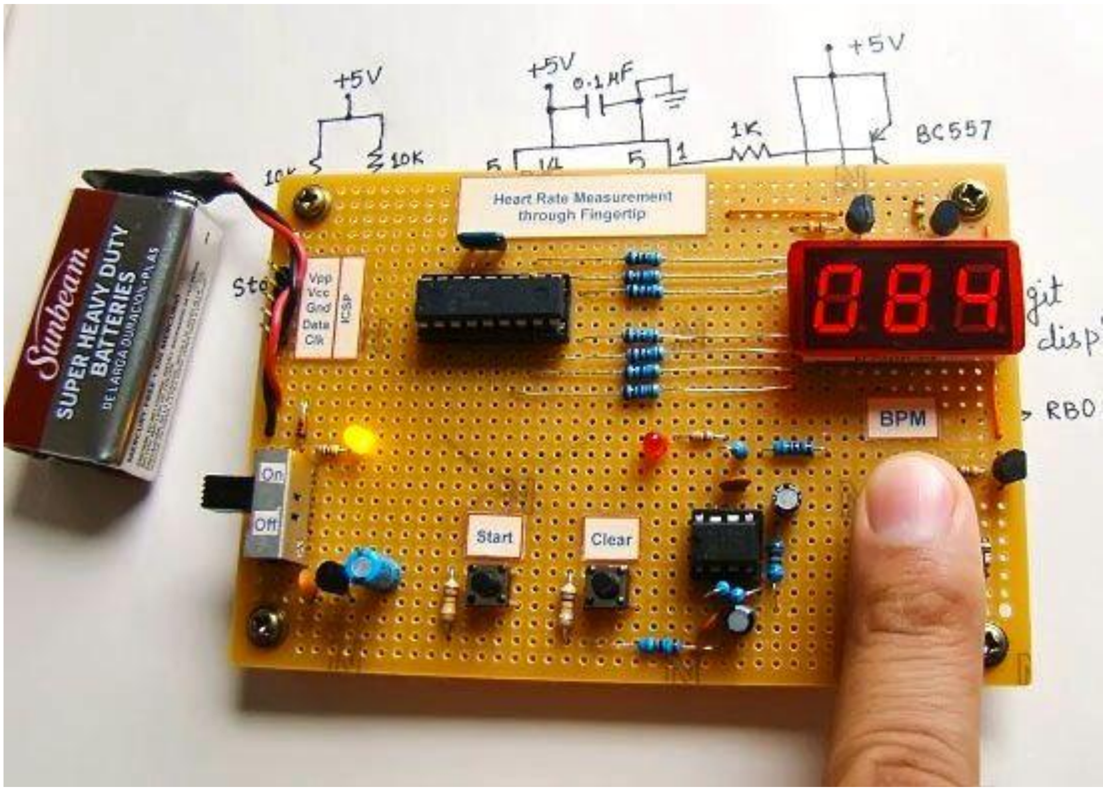


Fig:3.1

The heartbeat rate during rest condition plays a role in determining the health solution of a patient. The monitoring device can measure the heartbeat rate from any spot on the body from where pulses can felt with the thumb or finger. The most common places are the wrist and neck. You can count the number of pulses within a certain interval (say 15 sec), and easily determine the heartbeat rate in bpm (beats per minute). In the above project design approach, the monitoring system uses an optical sensor to measure the alteration in blood volume at the fingertip with each heart beat. The sensor unit consists of an infrared light-emitting-diode (IR. LED) and a photodiode, placed side by side as shown below.

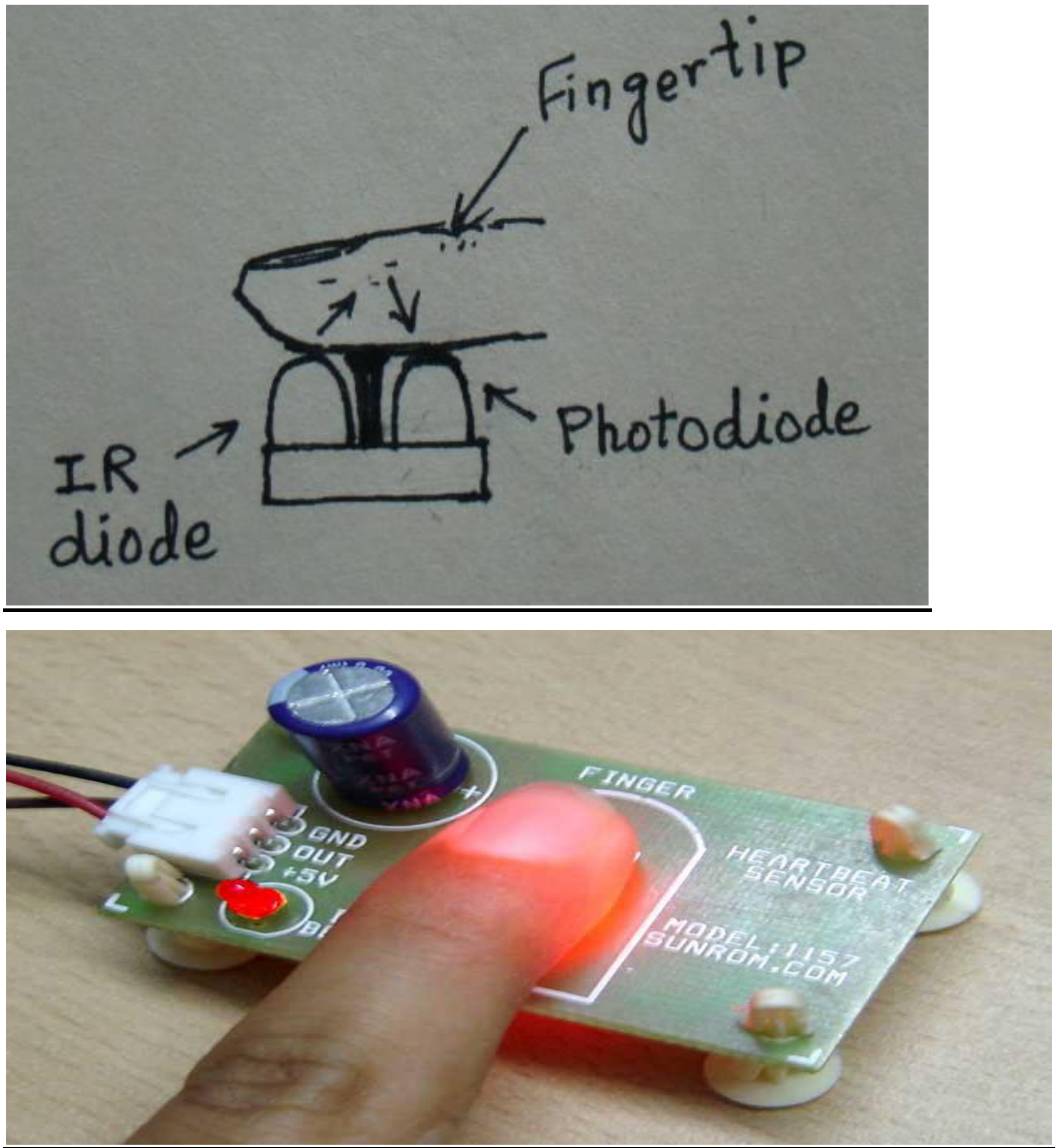


**Fig:3.2 FINGERTIP PLACEMENT OVER THE SENSOR UNIT**

The IR. Diode transmits an infrared light into the fingertip (placed over the sensor unit), and the photodiode senses the portion of the light that is reflected back. The intensity of reflected light depends upon the blood volume inside the fingertip blood vessel. Thus, each heartbeat slightly alters the amount of reflected infrared light that can be detected by the photodiode. With a proper signal conditioning, this little change in the amplitude of the reflected light can be converted into a pulse. The pulses can later be counted by a microcontroller to determine the heartbeat rate. A circuit diagram of the signal conditioning of the system is as shown below:

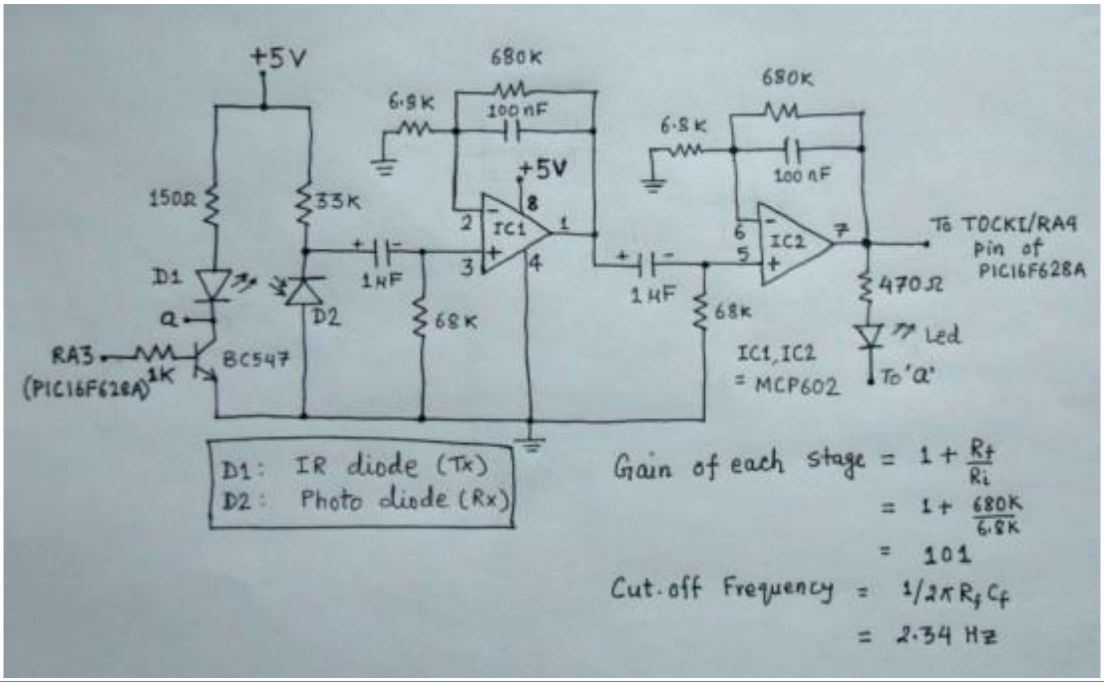


**Fig: 3.3 IR. SENSOR AND SIGNAL CONDITIONING CIRCUIT**

In the above system design, a signal conditioning circuit consists of two identical active low pass filters with a cut-off frequency of about 2.5 Hz. This means the maximum measurable heart rate is about 150 bpm.

The value of IC 1 and IC 2 in the above diagram is MCP602.

Inverting bias resistor- 680k (Rf.)

Non- inverting resistor – 68k (RI)

The Inverting Amplifier: the **Open Loop Gain**, (Avo) of the operational amplifier can be very high, as much as 1,000,000 (120dB) or more. However, this very high gain is of no real use to us as it makes the amplifier both unstable and hard to control as the smallest of input signals, just a few micro volts, (μV) would be enough to cause the output voltage to saturate and swing towards one or the other of the voltage supply rails loosing complete control. As the open loop DC gain of an operational amplifier is extremely high, we can therefore afford to lose some of this gain by connecting a suitable resistor across the amplifier from the output terminal back to the inverting input terminal to both reduce and control the overall gain of the amplifier. This then produces and effect known commonly as **Negative Feedback**, and thus produces a very stable Operational Amplifier based system. **Negative Feedback** is the process of "feeding back" a fraction of the output signal back to the input, but to make the feedback negative, we must feed it back to the negative or "inverting input" terminal of the op-amp using an external **Feedback Resistor** called Rf. This feedback connection between the output and the inverting input terminal forces the differential input voltage towards zero. This effect produces a closed loop circuit to the amplifier resulting in the gain of the amplifier now being called its **Closed-loop Gain**. A closed-loop amplifier uses negative feedback to accurately control the overall gain but at a cost in the reduction of the amplifiers bandwidth. This negative feedback results in the inverting input terminal having a different signal on it than the actual input voltage as it will be the sum of the input voltage plus the negative feedback voltage giving it the label or term of a *Summing Point*. We must therefore separate the real input signal from the inverting input by using an **Input Resistor**, R-in. As we are not using the positive (non-inverting) input, this is connected to a common ground or zero voltage terminal as shown below, but the effect of this closed loop feedback circuit results in the voltage potential at the inverting input being equal to that at the non-inverting input producing a *Virtual Earth* summing point because it will be at the same potential as the grounded reference input. In other words, the op-amp becomes a "differential amplifier”

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**INVERTING AMPILIFIER CONFIGURATION**

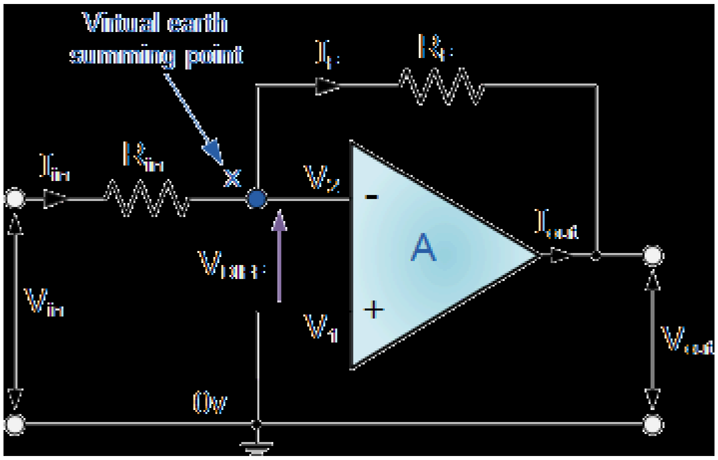



Fig:3.4

In this **Inverting Amplifier** circuit, the operational amplifier is connected with feedback to produce a closed loop operation. For op-amps there are two very important rules to remember about inverting amplifiers, these are: "no current flows into the input terminal" and that "V1 equals V2", (in real op-amps, these rules are broken). This is because the junction of the input and feedback signal (X) is at the same potential as the positive (+) input, which is at zero volts, or ground then, the junction is a **"Virtual Earth"**. Because of this virtual earth node, the input resistance of the amplifier is equal to the value of the input resistor, R-in and the closed loop gain of the inverting amplifier can be set by the ratio of the two external resistors.

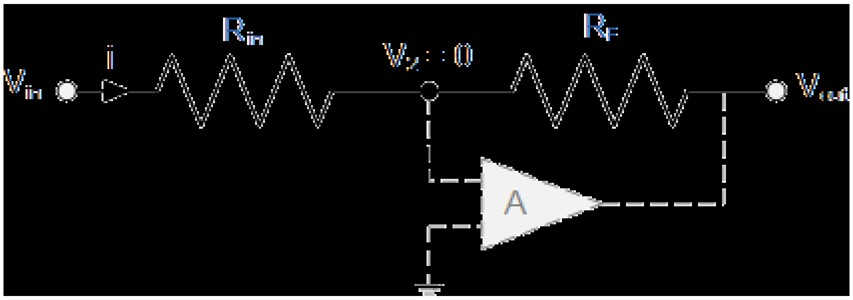
We said above that there are two very important rules to remember about **Inverting Amplifiers** or any operational amplifier for that matter and these are.

1. No Current Flows into the Input Terminals

2. The Differential Input Voltage is Zero as V1 = V2 = 0 (Virtual Earth)

Then by using these two rules, we can derive the equation for calculating the closed-loop gain of an inverting amplifier, using first principles.

Current (I) flows through the resistor network as shown




i=Vin-Vout/Rin+Rf

therfore i=Vin-V2/Rf=V2-Vout/Rf

i=Vin/Rf-V2/Rin=V2/Rf-Vout/Rf

so Vin/Rf=V2[1/Rin+1/Rf]- Vout/Rin

and as i=Vin-0/Rin=0-Vout/Rf     Rf/Rin=0-Vout/Vin-0

the closed loop gain is given as, Vout/Vin=-Rf/Rin.

Then, the **Closed-Loop Voltage Gain** of an Inverting Amplifier is given as.

GAIN(Av)= Vout/Vin=-Rf/Rin

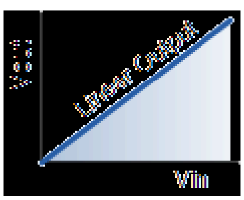



**Fig:3.5 LINEAR OUTPUT**

In the above system design, a signal conditioning circuit consists of two identical active low pass filters with a cut-off frequency of about 2.5 Hz. This means that the maximum measurable heart rate is about 150 bpm. The operational amplifier IC used in this circuit is MCP602, a dual op-amp chip from Microchip. It operates at a single power supply and provides rail-to-rail output swing. The filtering is necessary to block any high frequency noise present in the signal. The gain of each filter stage is set to 101, giving the total amplification of about 10000. A 1uF capacitor at the input of each stage is required to block any unwanted DC component in the signal. The equations for calculating gain and cut-off frequency of the active low pass filter are shown in the circuit diagram. The two-stage amplifier/filter provides sufficient gain to boost the weak signal coming from the photo sensor unit and converts it into a pulse. An LED connected at the output blinks every time a heartbeat is detected. The output from the signal conditioner goes to the T0CKI input of PIC16F628A. The display unit of the system comprises of a 3-digit, common anode, seven segment module that is driven using multiplexing technique. The segments a-g are driven through PORT-B pins RB0-RB6, respectively. The unit's, ten's and hundred's digits are multiplexed with RA2, RA1, and RA0 port pins. A tact switch input is connected to RB7 pin. This is to start the heart rate measurement. Once the start button is pressed, the microcontroller activates the IR. transmission in the sensor unit for 15 sec. During this interval, the number of pulses arriving at the T0CKI input is counted. The actual heart rate would be 4 times the count value, and the resolution of measurement would be four. The IR. transmission is controlled through RA3 pin of PIC16F628A microcontroller. The microcontroller runs at 4.0 MHz using an external crystal. A regulated +5V power supply is derived from an external 9V battery using an LM7805 regulator IC.

### 3.4 PRESENT DESIGN

There are some systems present in the market but all are having some defect. What makes this project different form the past existing products is its wireless communication and method of monitoring of patients. This project can monitor the patient and utilize a radio frequency (RF.) module for a free transmission of data or signal collected by the sensor placed on the patient's body. The radio frequency module makes this project unique and extraordinary. It alerts the doctors or patient family members when the patient's body temperature or heartbeat rate is irregular. The system is very simple and can be used by medical professionals and non-professionals. It is the sensor used that checks the condition of the patient. As soon as the system detects an erroneous signal on the patient's skin, the RF. module will pick up the signals and send it wirelessly to a receiver meant for the project. No wires, no taking of pulse nor involving a multiplication equation, (i.e. the system has two units, the bigger unit "monitor" and the smaller unit "receiver". The bigger unit is placed by the side of the patient. This one is connected with a simple probe to a bracelet on the wrist of the patient but the smaller unit, which is the receiver, has no wire connection of any sort with the monitor). The design concept of using RF. helps to minimize size and functionality in the computerized element of the project. In addition, small size increases the battery's life span and limits the display. The overall design challenge was to minimize the size and weight of the project to be comfortable for the users and easy to understand. For the users comfort reasons, the size and weight will be less obtrusive to everyday, all day usage. The small weight requires careful material selection and product design packaging.

# CHAPTER4:

## Hardware DESCRIPTION

## 4.1 BLOCK DIAGRAM

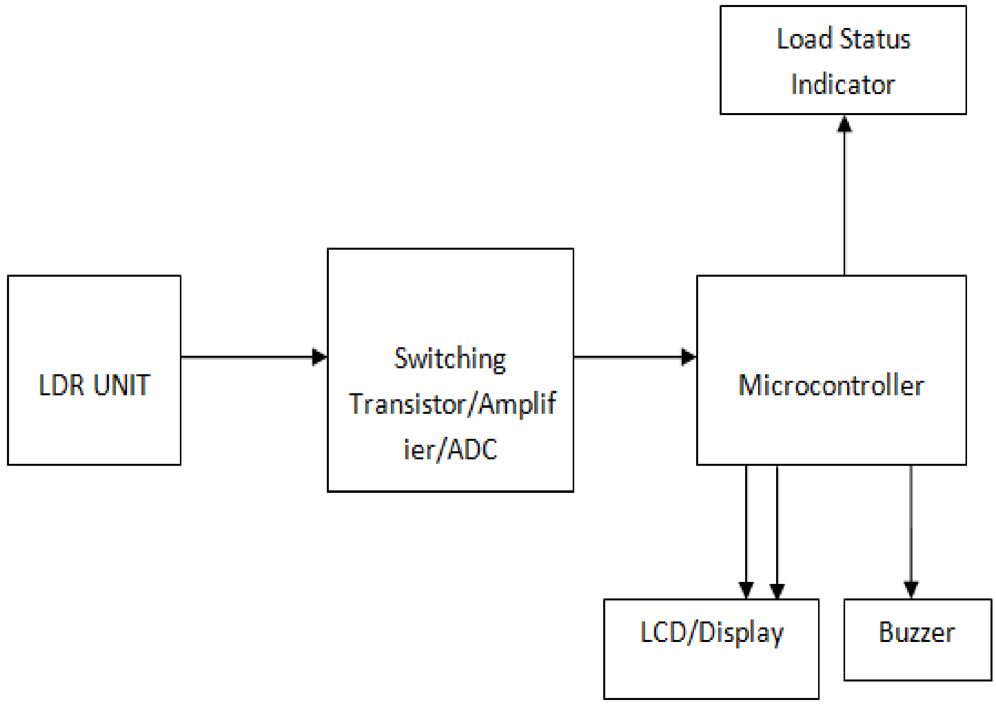



Fig:4.1

## 4.2 COMPOMENT DESCRIPTION

There are a number of components in this module and they are as follows:

1. Micro controller-ATMEGA8

2. A/D Converter

3. LCD Display

4. Buzzer

5. Reset switch

6. LDR

7. LED

8. IC-LM358

9. Potentiometer-50K

10. Transistors-BC547

11. Capacitors-15pF,33pF,104pF,10uF,1000uF

12. Resistors-1K,8.2K,10K,330K

13. Voltage regulator

**Now let us discuss about each of the component:**

## Micro controller-ATMEGA8:


Fig:4.2

The ATMEGA8 is a low-power, low cost, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the indus-try-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory pro-grammer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel ATMEGA8 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The ATMEGA provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

## Features

• High-performance, Low-power Atmel 8-bit Microcontroller

• Advanced RISC Architecture

– 130 Powerful Instructions – Most Single-clock Cycle Execution

– 32 × 8 General Purpose Working Registers

– Fully Static Operation

– On-chip 2-cycle Multiplier

• High Endurance Non-volatile Memory segments

– 8Kbytes of In-System Self-programmable Flash program memory

– 512Bytes EEPROM

– 1Kbyte Internal SRAM

• Peripheral Features

– Two 8-bit Timer/Counters with Separate Prescaler, one Compare Mode

– One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode

– Real Time Counter with Separate Oscillator

– 6-channel ADC in PDIP package

Six Channels 10-bit Accuracy

– Byte-oriented Two-wire Serial Interface

– Programmable Serial USART

– Master/Slave SPI Serial Interface

– Programmable Watchdog Timer with Separate On-chip Oscillator

– On-chip Analog Comparator

• Special Microcontroller Features

– Power-on Reset and Programmable Brown-out Detection

– Internal Calibrated RC Oscillator

– External and Internal Interrupt Sources

• I/O and Packages

– 23 Programmable I/O Lines

– 28-lead PDIP, 32-lead TQFP, and 32-pad QFN/MLF

• Operating Voltages

– 2.7V - 5.5V (ATmega8L)

– 4.5V - 5.5V (ATmega8)

• Speed Grades

– 0 - 8MHz (ATmega8L)

– 0 - 16MHz (ATmega8)

• Power Consumption at 4Mhz, 3V, 25□ C

– Active: 3.6mA

– Idle Mode: 1.0m

# Pin Configuration

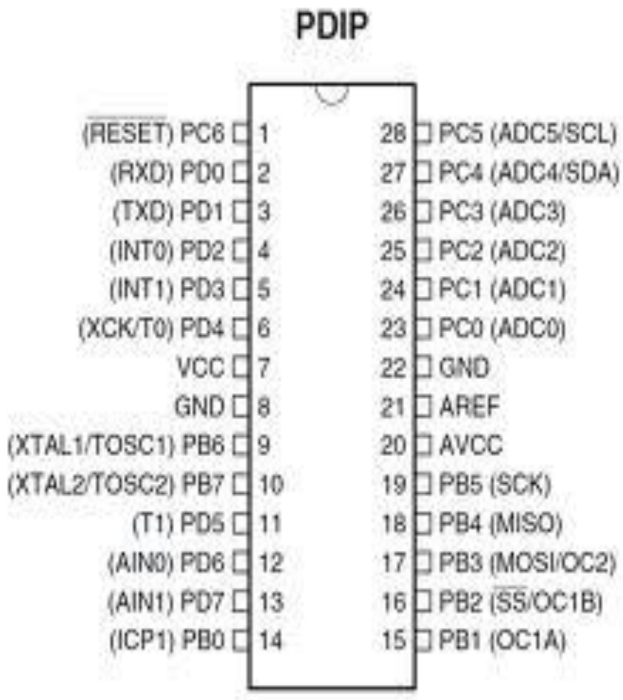



**Fig:4.3**

**Pin Description:**

**VCC** Digital Supply Voltage

**GND** Ground

**Port B (PB7..PB0)XTAL1/XTAL2/TOSC1/TOSC2 :**Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). ThePort B output buffers have symmetrical drive characteristics with both high sink and sourcecapability. As inputs, Port B pins that are externally pulled low will source current if the pull-upresistors are activated. The Port B pins are tri-stated when a reset condition becomes active,even if the clock is not running.Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit.Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier.If the Internal Calibrated RC Oscillator is used as chip clock source, PB7..6 is used as TOSC2..1input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set.

**Port C (PC5..PC0)**: Port C is an 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and sourcecapability. As inputs, Port C pins that are externally pulled low will source current if the pull-upresistors are activated. The Port C pins are tri-stated when a reset condition becomes active,even if the clock is not running.

**PC6/RESET** : If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C

**Port D (PD7..PD0)** : Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and sourcecapability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active,even if the clock is not running.

**RESET** : Reset input. A low level on this pin for longer than the minimum pulse length will generatead reset, even if the clock is not running.

**AVcc**: It is the supply voltage pin for the A/D Converter, Port C (3..0), and ADC (7..6). It should beexternally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that Port C (5..4) use digital supply voltage, VCC

**AREF** : It is the analog reference pin for the A/D Converter.

**ADC7..6 (TQFP and QFN/MLF Package Only)** : In the TQFP and QFN/MLF package, ADC7..6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

## A/D CONVERTER-ADC0804:

The ATMEGA-8 family are 8-Bits,successive approximation
A/D converters which use a modified potentiometric ladder and are designed to operate with the 8080A control bus via three-state outputs. These convertersappear to the processor as memory locations or I/O ports, and hence no interfacing logic is required. The differential analog voltage input has good commonmode - rejection and permits offsetting the analog zero-inputvoltage value. In addition, the voltage reference input can be adjusted to allow encoding any smaller analog voltage span to the full 8 Bits of resolution.

## Pin Diagram:

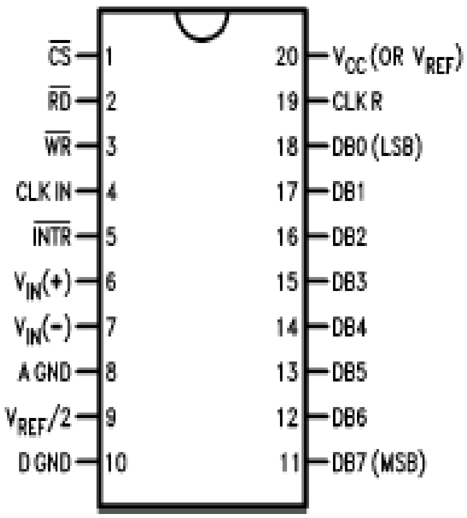



**Fig: 4.4**

1. CS - Chip Select (Active Low)
2. RD - Read (Active Low)
3. WR - Write (Active Low)
4. CLK IN - Clock IN
5. INTR - Interrupt (Active Low) 6. Vin+ - Analog Voltage Input
7. Vin- - Analog Voltage Input
8. AGND - Analog Ground
9. Vref/2 - Voltage Reference / 2
10. DGND - Digital Ground

11. DB7 - Data Bit 7 (MSB)
12. DB6 - Data Bit 6
13. DB5 - Data Bit 5
14. DB4 - Data Bit 4
15. DB3 - Data Bit 3
16. DB2 - Data Bit 2
17. DB1 - Data Bit 1
18. DB0 - Data Bit 0 (LSB)
19. CLKR - Clock Reset
20. Vcc - Positive Supply or Vref

## Absolute Maximum Ratings Thermal Information

Supply Voltage: 6.5V

Voltage at Any Input: -0.3V to (V+ +0.3V)

## Operating Conditions

Temperature Range: 0 C to 70 C

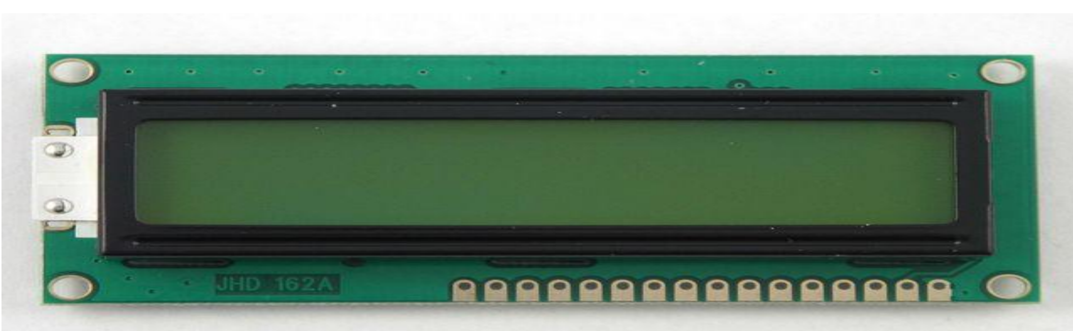
Thermal Resistance (Typical, Note 1) JA (oC/W)

PDIP Package : 80

Maximum Junction Temperature Plastic Package :150oC

## LCD DISPLAY:

Fig:4.5



A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. They are used in a wide range of applications including: computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. LCDs have displaced cathode ray tube(CRT) displays in most applications. They are usually more compact, lightweight, portable, less expensive, more reliable, and easier on the eyes. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they cannot suffer image burn-in.

LCDs are more energy efficient and offer safer disposal than CRTs. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically-modulated optical device made up of any number of pixels filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in colour or monochrome. The earliest discovery leading to the development of LCD technology. Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes, and two polarizing filters, the axes of transmission of which are (in most of the cases) perpendicular to each other. With no actual liquid crystal between the polarizing filters, light passing through the first filter would be blocked by the second (crossed) polarizer. In most of the cases the liquid crystal has double refraction The surface of the electrodes that are in contact with the liquid crystal material are treated so as to align the liquid crystal molecules in a particular direction. This treatment typically consists of a thin polymer layer that is unidirectionally rubbed using, for example, a cloth. The direction of the liquid crystal alignment is then defined by the direction of rubbing. Electrons are made up of transparent conductor called Indium Tin Oxide(ITO).

## BUZZER:

Fig:4.6

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, oelectronic. Typical uses of buzzers and beepers include alarms, timers and confirmation of user input such as a mouse click or keystroke. A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep. Electronic buzzers find many applications in modern days.

## RESET SWITCH:

It is used to reset the lcd display screen such that the new readings can be taken.

## LDR(LIGHT DEPENDENT RESISTOR):

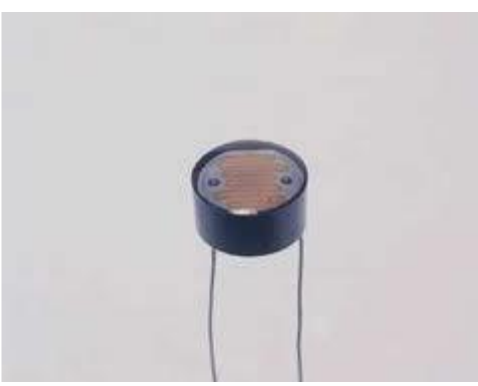


Fig:4.7

A photoresistor or light dependent resistor or cadmium sulfide (CdS) cell is a resistor whose resistance decreases with increasing incident light intensity. It can also be referred to as a photoconductor.A photoresistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance. A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, e.g. silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire bandgap. Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (i.e., longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction

## LED(LIGHT EMITTING DIODE):

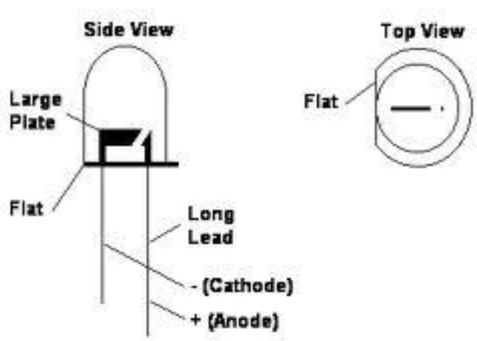



**Fig:4.8**

A light-emitting diode (LED) is a semiconductor light source. It used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962,[2] early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness.When a light-emitting diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. An LED is usually small in area (less than1 mm2), and integrated optical components are used to shape its radiation pattern and assist in reflection.[3] LEDs present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching, and greater durability and reliability. LEDs powerful enough for room lighting are relatively expensive and require more precise current and heat management than compact fluorescent lamp sources of comparable output. Light-emitting diodes are used in applications as diverse as replacements for aviation lighting, automotive lighting (particularly indicators) and in traffic signals. The compact size of LEDs has allowed new text and video displays and sensors to be developed, while their high switching rates are useful in advanced communications technology. Infrared LEDs are also used in the remote control units of many commercial products including televisions, DVD players, and other domestic appliances.

## **POTENTIOMETER**:


Fig:4.9

A potentiometer (colloquially known as a "pot") is a three-terminal resistor with a sliding contact that forms an adjustable voltage divider.[1] If only two terminals are used (one side and the wiper), it acts as a variable resistor or rheostat. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick.

Potentiometers are rarely used to directly control significant power (more than a watt). Instead they are used to adjust the level of analog signals (e.g. volume controls on audio equipment), and as control inputs for electronic circuits. For example, a light dimmer uses a potentiometer to control the switching of a TRIAC and so indirectly control the brightness of lamps.

Construction of a wire-wound circular potentiometer. The resistive element (1) of the shown device is trapezoidal, giving a non-linear relationship between resistance and turn angle. The wiper (3) rotates with the axis (4), providing the changeable resistance between the wiper contact (6) and the fixed contacts (5) and (9). The vertical position of the axis is fixed in the body (2) with the ring (7) (below) and the bolt (8) (above). A potentiometer is constructed with a resistive element formed into an arc of a circle, and a sliding contact (wiper) travelling over that arc. The resistive element, with a terminal at one or both ends, is flat or angled, and is commonly made of graphite, although other materials may be used. The wiper is connected through another sliding contact to another terminal. On panel pots, wiper is usually the center terminal of three. For single-turn pots, this wiper typically travels just under one revolution around the contact. "Multiturn" potentiometers also exist, where the resistor element may be helical and the wiper may move 10, 20, or more complete revolutions, though multiturn pots are usually constructed of a conventional resistive element wiped via a worm gear. Besides graphite, materials used to make the resistive element include resistance wire, carbon particles in plastic, and a ceramic/etal mixture called cermet.

**TRANSFORMER:** Transformer making the ac voltage 220 volt to step down to 9-0-9 volt ac.

**FULL WAVE RECTIFIER**:It is rectifying the voltage to get larger average dc voltage.

**7805 VOLTAGE REGULATOR:** It’s regulate the voltage to 5V,which is the operating volatage for our microcontroller.


FIG:4.10

## TEMPATURE SENSOR-LM35A

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearlyproportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ± 1/4°C at room temperature and ± 3/4°C over a full -55 to +150°C temperature range.

Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in a 8-lead surface mount small outline package and a plastic TO-220 package.

## CAPACITOR:

FIG:4.11

Capacitors are two-terminal electrical component separated by a dielectric (insulator) and used for storing electric charges. It consists of metal foils separated by a layer of insulating film. When there is a potential difference (voltage) across the insulated films, a static electric field develops across the dielectric, causing positive charge to attract on one plate and negative charge on the other plate. Energy is stored in the electrostatic field. An ideal capacitor is characterized by a single constant value. Capacitance is measured in farads. Capacitors are widely used for blocking direct current while allowing alternating current to pass. In this project, it is used as a filter network, smoothening the output of the power supply and preventing radio frequency interface.

## RESISTORS:

A resistor is a linear,passive,two terminal compoment that implement electrical resitance as a circuit element. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. Thus, the ratio of the voltage applied across a resistor's terminals to the intensity of current through the resistor is called resistance. This relation is represented by Ohm's law: $I= V/R$. Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in most electronic equipments. Practical resistors can be made of various compounds and films, as well as resistance wire (wires made of a high-resistivity alloy, such as nickel-chrome). Resistors are also implemented within integrated circuits, particularly analog devices, and can be integrated into hybrid and printed circuits. The electrical functionality of a resistor is specified by its resistance: common commercial resistors

. are manufactured over a range of more than nine orders of magnitude When specifying that resistance in an electronic design, the required precision of the resistance may require attention to the manufacturing tolerance of the chosen resistor, according to its specific application (Wikipedia, 2011). The temperature coefficient of the resistance may also be of concern in some precision applications. Practical resistors are also specified as having a maximum power rating which must exceed the anticipated power dissipation of that resistor in a particular circuit: this is mainly of concern in power electronic applications Resistors with higher power ratings are physically larger and may require heat sinks. In a high-voltage circuit, attention must sometimes be paid to the rated maximum working voltage of the resistor.

## POWER SUPPLY:

5volts dc supply is taken from the 230volts a.c. mains by using a step down transformer in which a voltage regulator 7805 is used.

## 4.3 HEARTBEAT SENSOR:


Fig:4.12

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison witheach heart beat. This digital output can be connected to microcontroller dire ctly tomeasure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

### Features

1.Microcontroller based SMD design

2.Heat beat indication by LED

3. Compact Size

4. Working Voltage +5V DC

## Applications

•Digital Heart Rate monitor

•Patient Monitoring System

•Bio-Feedback control of robotics and applications

## 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 heart beat
- The output is active high for each beat and can be given direc tly for interfacing applicatons.


Fig:4.13

## The Working

- The sensor consists of a super bright red LED and light detector. The LED needs to besuper bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signalis amplified and triggered through an amplifier which outputs +5V logic level signal.The output signal is also indicated by a LED which blinks on each heart beat.Following figure shows signal of heart beat and sensor signal output graph.Fig.2 shows actual heart beat received by detector (Yellow) and the trigger pointof sensor (Red) after which the sensor outputs digital signal (Blue) at 5V level.

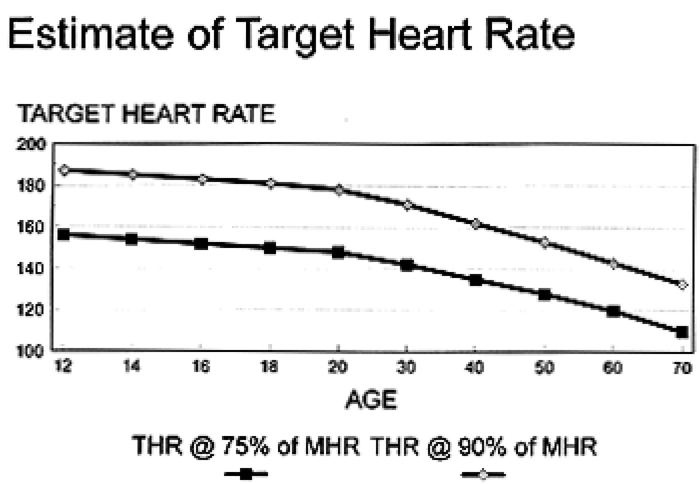



Fig:4.14

This figure shows target pulse rates for people aged between 20 and 70. The targetrange is the pulse rate needed in order to provide suitable exercise for the heart. For a 25-year old, this range is about 140-170 beats per minute while for a 60-year old it istypically between 115 and 140 beats per minute.

## CHAPTER-5

## SYSTEM IMPLEMENTATION

### 5.1 HARDWARE IMPLEMENTATION

The final hardware design of this project was implemented on a strip Vero-board. The Vero-board was inspected of wrong linkages in its line, which may be a mistake from the manufactures. The holes of the board were checked to be through for passing the terminals of the components for soldering. An abrasive paper was used on the soldering section of the board for an easy binding of the terminals on the board.

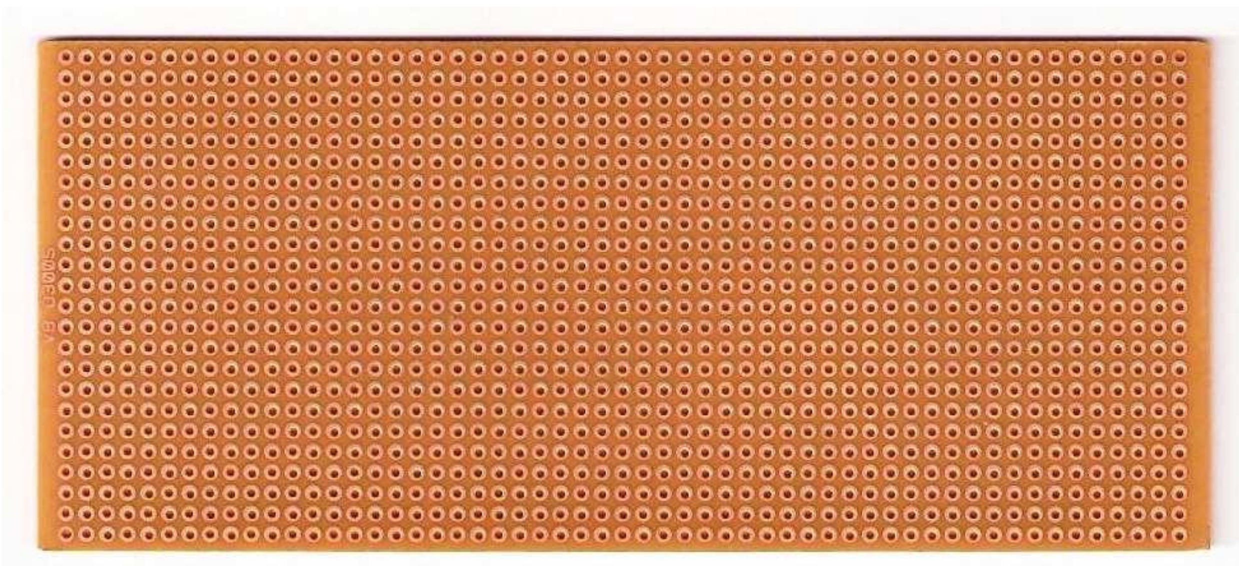


Fig:5.1

**THE VERO_BOARD USED IN THE PROJECT**

**The Vero-board used in the project** Components are usually placed on the plain side of the board, with their leads protruding Components are usually placed on the plain side of the board, with their leads protruding through the holes. The leads are then soldered to the copper tracks on the other side of the board to make the desired connections, and any excess wire is cut off, the continuous tracks is neatly cut as desired to avoid continuity between conductors using a hand cutter made for the purpose or a knife.

The tracks may be linked up on either side of the board using wire. With practice, very neat and reliable assemblies can be created, though such a method is labor-intensive and therefore unsuitable for production.

Vero-board is also called strip board. It is a widely used type of electronic board used mostly for the production of prototypes. It is characterized by features such as: 0.1 inch (2.54 mm) regular (rectangular) grid of holes, with wide parallel strips of copper cladding running in one direction all the way across one side of the board. In using the board, breaks are made in the tracks, usually around holes, to divide the strips into multiple electrical nodes.

## FIXING OF THE COMPONENTS

The sensor was first connected to the input pin of the ADC before the microcontroller unit, then the wireless detection module. During design simulation on the computer, the wireless detection module was removed because the computer software cannot simulate the module. Therefore, a buzzer was connected to the microcontroller to test run the system and latter replaced to the RF. wireless module so that it can send an alert to another location where the receiver is.

A 9 volts battery was used to energize the system and the microcontroller chip was programmed using assembly language programming. The code are written in an editor called MIDE and burned in the chip using a programming machine.

## DESIGN PROCESS

A microcontroller based project design is characterized by the following; Definition of task, Requirements, Factor that influence the choice. In defining a task, every design comes from an

idea or a problem that requires a solution. Questions can arise on what exactly is required to be achieved and the feasibility of the implementation. If these questions are analyzed critically with tangible solutions to the problem, a development of this idea into reality is the next step.
Requirements for design process have to be considered once an idea has been established. The need to determine whether or not the idea requires a PC or not, depending on the complexity of the circuit, or whether the circuit to be designed needs to make a complex decision or deal with complex data. The microcontroller is the best option for highly sensitive circuits. Thus, to test/know the ability of the microcontroller, a written program designed for the purpose is used

## 5.2 CIRCUIT DIAGRAM

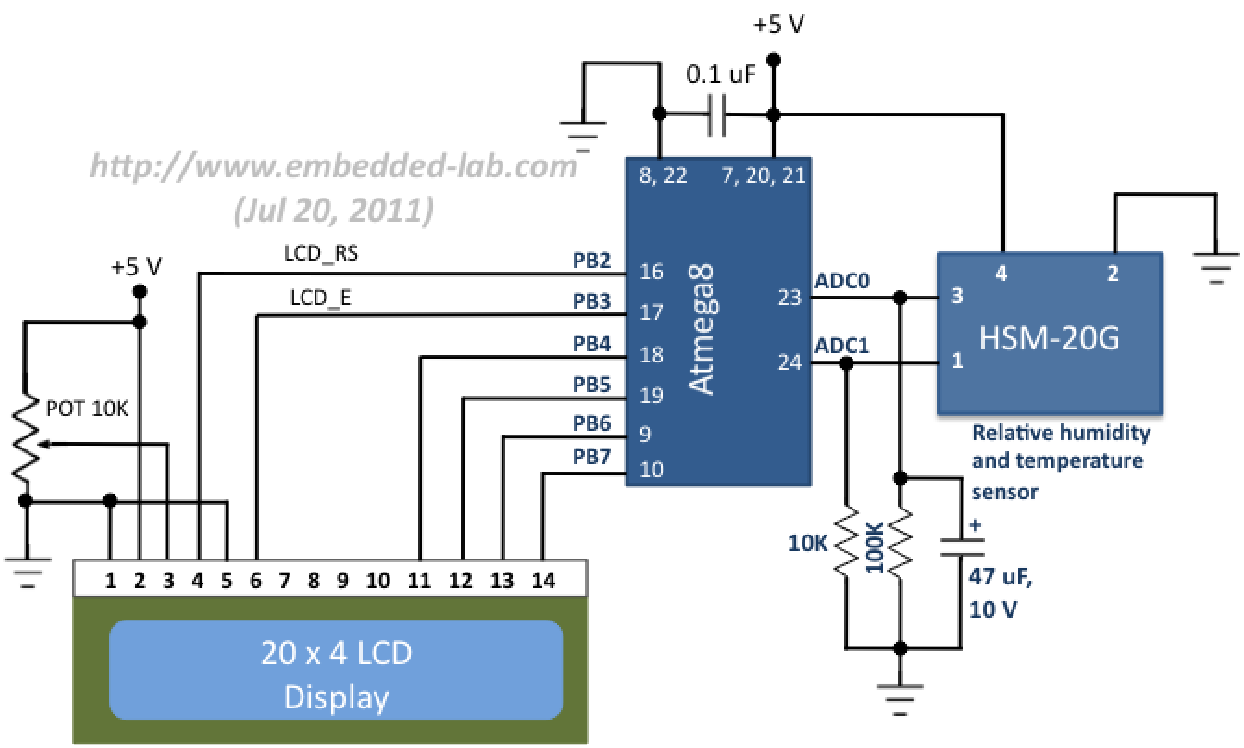



Fig:5.2

## SYSTEM TEST

After the design and implementation phase, the system has to be tested for durability, efficiency, and effectiveness and to ascertain if there is need to modify the design. The system was first assembled using a breadboard. The system was first powered (switched) ON and the patient sensor was placed on a hot iron. As the temperature of the iron increased above 37 o C, an alarm was sounded at the RF. communication module unit, indicating that the system is in good working condition.

Therefore, if a patient's body temperature increases, the sensor can detect it and trigger an alarm at the sensor receiver end.

During the breadboard practical experimentation, all components were properly inserted into the breadboard from where some tests were carried out at various stages. To ensure proper functioning of components, a test was carried out using a digital multi-meter (DMM). Resistors were tested to ensure that they were within the tolerance value. Faulty resistors were discarded .The LM7905 voltage regulator was also tested, the resulting.output was 5.02v, which is just a deviation of 0.20v from the expected value of 5.00v.The RF. modules and microcontrollers, were tested to ensure that they were all working properly.

# CHAPTER -6

## 6.1 APPLICATIONS

The instrument consists of the circuits which measure both the heart rate and temperature has various applications.

1.Heart rate monitor can be used in hospitals for the diagnostic purposes.

2.Since the instrument is not expensive,it can even be used at home.

3.The instrument also has the flexibility which helps us to affix it to vehicles ,etc..

4.The other part of the instrument,which measures the temperature can also be used in hospitals for diagnostic purpose.

5.The instrument can also be integrated with higher level equipment and used in various applications.

6. The instrument can also be used in vehicles.

## 6.2 CONCLUSION

Hence an attempt is made to design a device which not only acts as an alarm system but also Can measure the parameters of the body and the attempt made is successful.

- The device is economic, portable, durable, and cost effective. The HRM device is efficient and easy to use.
- Tests have shown excellent agreement with actual heartbeat rates.

This device could be used in clinical and non-clinical environments. It can also be easily used by individual users, e.g. athletes during sporting activities.

## 6.3 FUTURE SCOPE

The human body scanning system could be made more sophisticated by incorporating blood pressure and EEG sensors. The analog channel inputs AN4 and AN7 can be used and the Port B can be programmed as an input port along with an additional ADC chip in the external circuit.

Hospitable –wide wireless capability would allows doctor to occur the patients' database using their word held computers.

The entire medical data acquisition could be made wireless and wearable. Such a package would contain the circuiting for inputs from ECG sensors, EEG sensors, pressure measurement and pulse rate transducers. This wearable module can transmit the data continuously over a fiber optic link or through an internet digital radio. The received data can be stored in separate memory and be processed by a microcontroller. This enhancement will enable monitoring of patients to be more flexible and strain-free.

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