KEC-354

MINOR PROJECT REPORT

On

HEART BEAT SENSOR DEVICE

Submitted for partial fulfillment of award of the degree of

Bachelor of Technology

In

Electronics and Communication Engineering

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CERTIFICATE

Certified that Mohit Singh, Mohit Tiwari have carried out the Minor project work presented in this report entitled **" HEART BEAT SENSOR DEVICE"** for the award of **Bachelor of Technology** in **Electronics and Communication Engineering** during the Academic session 2022-23 from **Dr. A.P.J. Abdul Kalam Technical University (Formerly U.P.T.U), Lucknow**. The project embodies result of the work and studies carried out by Student himself and the contents of the report do not form the basis for the award of any other degree to the candidate or to anybody else.

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LIST OF SYMBOLS, ABBREVIATIONS

IC	Integrated Circuit
IR	Infrared
LED	Light Emitting Diode
Via	By Way of
V	Volts
uF	Micro farad
E	Ohms
K	Kilo
PCB	Printed Circuit Board
mm	Millimeters
R&D	Research And Development
AC	Alternate Current
DC	Direct Current
mV	Millivolts
mA	Milli Ampere
A	Ampere

ABSTRACT

A Heartbeat Sensor is a monitoring device that measures the heart rate the speed of the heartbeat. A person's heartbeat is the sound of the valves in his heart expanding or contracting as they force blood from one region to another. There are two ways to monitor the heart rate: one way is to manually check the pulse either at the wrists or neck and the other way is to use a Heartbeat Sensor.

In this tutorial, we will show you how to design a circuit that can sense the heartbeat by using an LM358 IC along with an infrared transmitter and receiver. The IR transmitter in this circuit is an IR LED and the detector will be a photodiode.

CHAPTER-1

INTRODUCTION

1.1 OVERVIEW

Heart beat monitoring Heart beat signal is nonlinear in nature with chaotic characteristics. To analyze how the nonlinear signal recurrence plot is done, but it has certain difficulties such as non-suitability for longer data stream or selection of threshold such as recursive points are not lost. Extraction of two-dimensional features adds a good amount of accuracy in detecting the heart disease. Using heart beat sensor, we can study the heart's function in a simple and efficient manner. This sensor senses the blood flow through the ear lobe. The earlobe projects a noise free and better measurement of blood flow in comparison to any device that is wearable at the wrist. As the heart pumps blood in the entire body, earlobes responds to this change in blood flow that can be measured as the change in blood flow with respect to time. The sensor flashes a light source in form of an incandescent lamp on the ear and monitors the light modulation. The clip if used for fingertip in between on body surface (skin contact) within the thumb and index finger. The measured signal is amplified and inverted. Filtering is done to reduce noise signal. This signal helps in measuring the heart rate, where the heart pump rate can be obtained. Heart rate, though averaged as 72 per minute, mostly varies from person to person to some extent. The ideal value of an adult heart rate is different than that of an athlete who possesses less heart beat rate. For children, the heart rate is even more that could go up to 90 per second (though may vary from case to case). A person doing heavy physical activity must have a different heart rate than a person performing normal activity or in rest. The sensor employed here is exposed to all such conditions and well aware of the different rates occur for such factors.

1.3 ADVANTAGES & LIMITATIONS

1.3.1 ADVANTAGES

- Tracking heart rate during exercise.
- Monitoring stress and activity levels during the day.
- Tracking sleep quality at night.
- Monitoring your vital signs at home, especially if you have certain health conditions or concerns
- Connectivity via Bluetooth Smart with various other devices and soft-ware, like mobile apps and other training devices

1.3.2 LIMITATIONS

- Not necessarily accurate in sports where you move your hands vigorously or flex the muscles and tendons near your wrist.
- Limited ability to accurately measure heart rate through dark or tattoed skin.
- More likely to be worn incorrectly, either not tight enough or too tight.
- Have to remember to carry the strap with you and wear it in addition to the wrist unit.

1.4 APPLICATIONS

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

CHAPTER-2

CIRCUIT DIAGRAM AND WORKING

2.1 Circuit Diagram

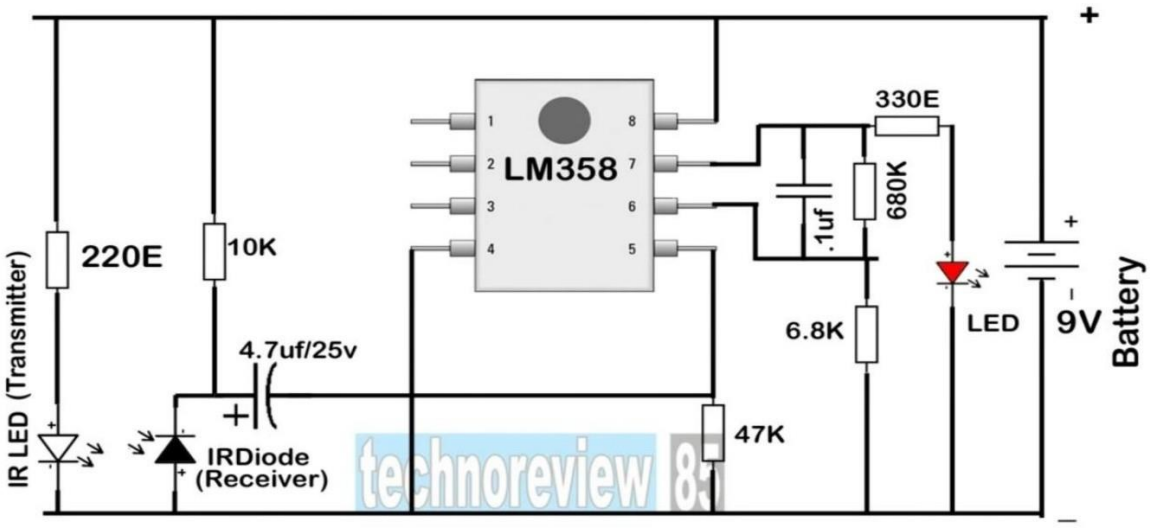


Fig 2.1 Circuit Diagram

These devices use electrical detection to track your heart rate. They detect electrical activity through a band that wraps around your chest. For most of these devices to work as designed, the band must be wet, or you need to use a conductive gel where the sensors touch your skin.

2.2.1 Process of work

The heartbeat sensor circuit diagram comprises a light detector and a bright red LED. The LED needs to be of super-bright intensity because maximum light passes and spreads if a finger placed on the LED is detected by the detector. When the heart pumps blood through the blood vessels, the finger becomes slightly more opaque; due to this, less amount of light reaches from the LED to the detector. With every heart pulse generated, the detector signal gets varied. The varied detector signal is converted into an electrical pulse. This electrical

signal gets amplified and triggered through an amplifier which gives an output of +5V logic level signal. The output signal is also directed by a LED display that blinks on each heartbeat rate

2.2.2 Working Model

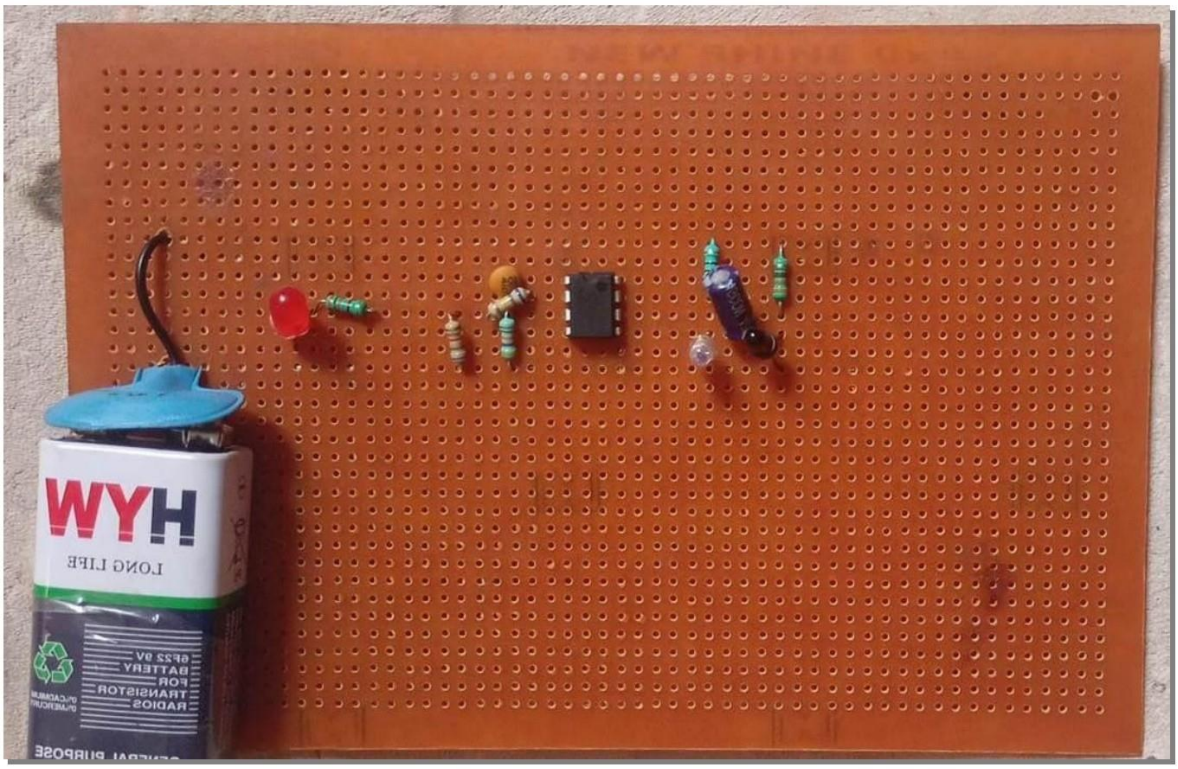


Fig 2.2 Working Model

CHAPTER-3

DESIGN SPECIFICATIONS AND COMPONENT DESCRIPTION

3.1 Lists of Components

The list of components used to make a Heartbeat sensor device are as followed:

S. No	Components	Specifications
1.	LED	5mm
2.	IR Transmitter LED	5mm
3.	IR Receiver Photodiode	5mm
4.	Resistors	220E,330E,6.8K,680K,47K,10K
5.	Capacitors	0.1uf (104),4.7uf (25V)
6.	Zero PCB	6*4
7.	Battery	9V
8.	Connector	_____
9.	IC	LM358

Table 3.1 Components used

3.1.1 ZERO PCB BOARD

General Purpose PCB or Zero PCB or Dotted PCB also known as Perfboard are perfect for quick prototyping and can be used by students for school and college projects. These PCB's are also used by Hobbyist and in Industries for R&D and Testing of small circuits.

Printed circuit Board commonly abbreviated as PCB is the base (literally) of electronics. The PCB provides support as well as electrically connects various Electronic Components in the circuit.

For testing or for mounting your components you can either design or manufacture a custom PCB or else you can mount it on a zero PCB and accordingly make the connections. General Purpose PCB are perfect if you have not finalized the design or you are making the circuit just once like for a school or college project.

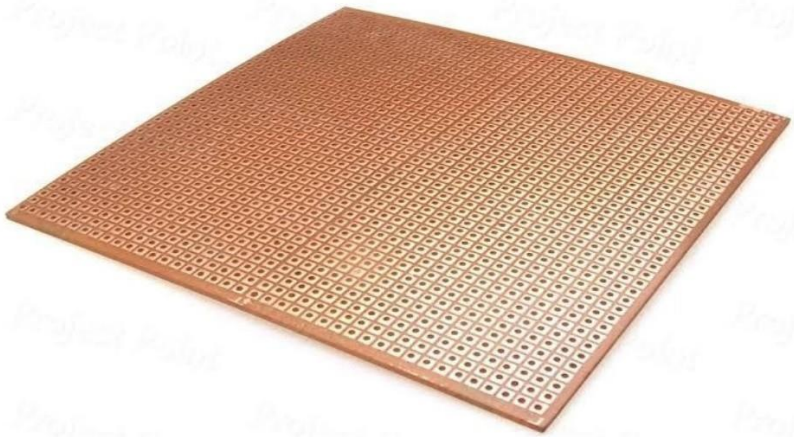


Fig 3.1 Zero PCB Board

3.1.2 IR TRANSMITTER LED

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degrees Kelvin) gives off infrared radiation.

There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected

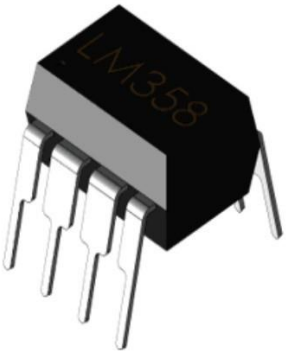
by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems (such as in robots).

Fig 3.2 IR Transmitter LED

3.1.3 IC LM358

LM358 IC is a dual operational amplifier integrated circuit with two Op-Amp powered by a common power supply. It consists of two independent compensated operational amplifiers with low power and high gain frequency.

LM358 is specially designed to operate from a single supply over a wide range of voltage. It is more flexible for low voltage AC and moderate voltage DC applications. LM358 is available in a cheap-sized package so it is widely used in real-life applications including transducer amplifier, DC gain block, active filter, and conventional op-amp circuit design. LM358 IC can handle 3V- 32V DC supply and source up to 20 mA per channel.



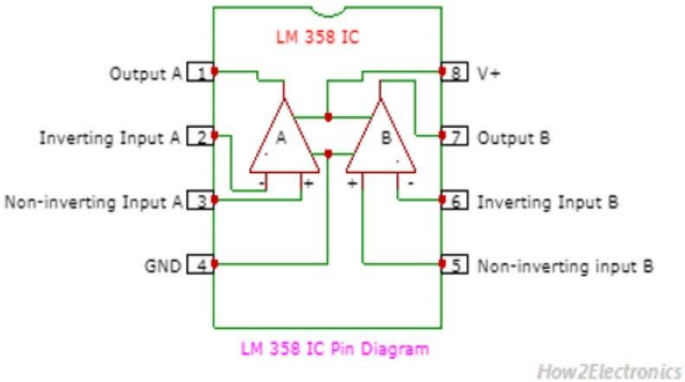


Fig.3.3 IC LM358

3.1.4 RESISTORS

The resistor is a passive electrical component that creates resistance in the flow of electric current. In almost all electrical networks and electronic circuits they can be found. The resistance is measured in ohms (Ω). An ohm is the resistance that occurs when a current of one ampere (A) passes through a resistor with a one volt (V) drop across its terminals. The current is proportional to the voltage across the terminal ends.

Fig.3.4 Resistors

3.1.5 CAPACITORS

In this introduction to capacitors tutorial, we will see that capacitors are passive electronic components consisting of two or more pieces of conducting material separated by an insulating material. The capacitor is a component which has the ability or "capacity" to store energy in the form of an electrical charge producing a potential difference (Static Voltage) across its plates, much like a small rechargeable battery.

Fig. 3.5-Capacitors

3.1.6 LED

A light-emitting diode (LED) is a semiconductor device that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Fig 3.6 LED

3.1.7 Battery

A battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells; however, the usage has evolved to include devices composed of a single cell.

Fig. 3.7 9V Battery and connector

3.1.8 IR RECEIVER PHOTODIODE

An IR photodiode is an electrical component that converts light into electricity. This type of component is specifically designed to respond to light in the infrared range. Communications, sensors, and security are three applications that often use them. All photodiodes use the photoelectric effect to generate electrical current from light. When photons of light hit the surface of a diode, electrons are "knocked" out of place. A charge occurs when the electron is moved. Continuous exposure of a photodiode to light will create a constant flow of electricity. The amount of current corresponds to the amount of light hitting the surface of the diode.

Fig.3.8 IR Photodiode

CHAPTER-4

RESULT AND DISCUSSION

Our mini project, pulse detector has been successfully developed. However, there are a few limitations of this project that we think it can still be improved in the future. First of all, we have discovered that the reading voltage from the IR sensor very small. Therefore we designed a circuit which has2 Operational Amplifiers to magnifying reading. Besides that, when we test using oscilloscope, we found that there are a lot of noise in the screen of the oscilloscope. In order to get rid of the noise, we add in RC filter to reduce the noise of the oscilloscope reading. The main reason we use the oscilloscope in our mini project is to test and study the signal from output and to confirm our circuit diagram is functioning correctly.

First of all, the special thank goes to our helpful lecturer, En. Nasir, and our Vocational Training Officer (PLV) EnIsmail they gave us this opportunity by giving us this mini project. They gave us fully support by helping us in the progression and smoothness of the mini project. The co-operation is much indeed appreciated. Secondly, a million thanks to our group members: TongJanice, Thomas Tan Wan Kiat and Fatin Nabila. Each of them contributed their hard time and energy during this few weeks when completing this mini project. All hard work would be nothing without the enthusiasm, imagination and co-operation from all of them. Last but not least, we would like to thank all my course-mates and friends for kindly helping us when we seek for help or facing problem when doing this mini project

CONCLUSION

In conclusion, our mini project is about designing and developing a low cost pulse detector to detect pulse rate in an easier and simpler way. Overall, this project has achieved our objectives and it has been beginning by constructing circuit until it testing step by step to achieve the functionality we need for this project. We noticed that is a good way of learning to have this mini project because we able to learn more about programming and the other application which we are able and unable to learn in class. Our mini project, pulse detector has been successfully developed and tested

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