HEARTBEAT SENSOR USING ARDUINO

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Abstract

The main objective of the project is 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. Our idea is to design a Heart Rate Monitor System using Arduino and Heartbeat Sensor. You can find the Principle of Heartbeat Sensor; working of the Heartbeat Sensor and Arduino based Heart Rate Monitoring System using a practical heartbeat Sensor.

Monitoring heart rate is very important for athletes, patients as it determines the condition of the heart (just heart rate). There are many ways to measure heart rate and the most precise one is using an Electrocardiography.

But the more easy way to monitor the heart rate is to use a Heartbeat Sensor. It comes in different shapes and sizes and allows an instant way to measure the heartbeat...

Key words: Arduino UNO x 1, 2. 16 x 2 LCD Display x 1, 10KΩ Potentiometer, 330Ω Resistor, Push button, heartbeat sensor module with probe (finger based), Bread board, Connecting Wires

1. INTRODUCTION

Monitoring heart rate is very important for athletes, patients as it determines the condition of the heart (just heart rate). A heart rate monitor is a personal monitoring device that allows a subject to measure their heart rate in real. There are many ways to measure heart rate and the most precise one is using an Electrocardiography. But the easier way to monitor the heart rate is to use a Heartbeat Sensor. It comes in different shapes and sizes and allows an instant way to measure the heartbeat. Heartbeat Sensors are available in Wrist Watches (Smart Watches), Smart Phones, chest straps. The heartbeat is measured in beats per minute or bpm, which indicates the number of times the heart is contracting or expanding in a minute. Time or record their heart rate for later study. Early models consisted of a monitoring box with a set of electrode leads that attached to the chest. The heart rate of a healthy adult at rest is around 72 beats per minute (bpm) & Babies at around 120 bpm, while older children have heart rates at

around 90 bpm. The heart rate rises gradually during exercises and returns slowly to the rest value after exercise [2]. The rate when the pulse returns to normal is an indication of the fitness of the person. Lower than normal heart rates are usually an indication of a condition known as bradycardia, while higher is known as tachycardia. Heart rate is simply 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. In this project, we have designed a Heart Rate Monitor System using Arduino and Heartbeat Sensor. You can find the Principle of Heartbeat Sensor; working of the Heartbeat Sensor and Arduino based Heart Rate Monitoring System using a practical heartbeat Sensor. Heart rate can vary according to the demand of muscles to absorb oxygen and excrete carbon dioxide changes, such as during exercise or sleep . It also varies significantly between individuals based on fitness, age and genetics. That means heart must beat faster to deliver more oxygen-rich blood. During exercise routines, the heart rate gives a strong indication of how effective that routine is improving health. Normal heart rate of a resting person is about 70 bpm for adult males and 75 bpm for adult females. A heart rate monitor is simply a device that takes a sample of heartbeats and computes the beats per minute so that the information can easily track heart condition .Medical professionals use heart rate for tracking of patient's physical conditions. Individuals, such as athletes, who are interested in monitoring their heart rate to gain maximum efficiency from their training, also use it. Body temperature means measurement of the body's ability to generate and get rid of heat. It is one of chief indicators of normal functioning and health. The nature of the human body is to keep its temperature within a narrow, safe range in spite of large variations in temperatures outside the body.

2. WORKING PRINCIPLE

The principle behind the working of the Heartbeat Sensor is Photoplethysmography. According to this principle, the changes in the volume of blood in an organ are measured

By the changes in the intensity of the light passing through that organ. Usually, the source of light in a heartbeat sensor would be an IR LED and the detector would be any Photo Detector like a Photo Diode, an LDR or a Photo Transistor.
With these two i.e. a light source and a detector, them in two us can arrange ways: A Transmissive Sensor and a Reflective Sensor. In a Transmissive Sensor, the light source and the detector are place facing each other and the finger of the person must be placed in between the transmitter and receiver. Reflective Sensor, on the other hand, has, has source and the detector adjacent to each other and the finger of the person must be placed in front of the sensor.

3. WORKING OF HEARTBEAT SENSOR

A simple Heartbeat Sensor consists of a sensor and a control circuit. The sensor part of the Heartbeat Sensor consists of an IR LED and a Photo Diode placed in a clip. The Control Circuit consists of an Op-Amp IC and few other components that help in connecting the signal to a Microcontroller. The above circuit shows the finger type heartbeat sensor, which works by detecting the pulses. Every heartbeat will alter the amount of blood in the finger and the light from the IR LED passing through the finger and thus detected by the Photo Diode will also vary. The output of the photo diode is given to the non – inverting input of the first op – amp through a capacitor, which blocks the DC Components of the signal. The first op – amp cats as a non – inverting amplifier with an amplification factor of 1001.The output of the first op – amp is given as one of the inputs to the second op – amp, which acts as a comparator. The output of the second op – amp triggers a transistor, from which, the signal is given to a Microcontroller like Arduino. The Op – amp used in this circuit is LM358. It has two op – amps on the same chip. Also, the transistor used is a BC547. An LED, which is connected to transistor, will blink when the pulse is detected.

4. CIRCUIT DESIGN OF HEARTBEAT SENSOR WITH ARDUINO

The circuit design of Arduino based Heart rate monitor system using Heart beat Sensor is very simple. First, in order to display the heartbeat readings in bpm, we have to connect a 16×2 LCD Display to the Arduino UNO. The 4 data pins of the LCD Module (D4, D5, D6 and D7) are connected to Pins 1, 1, 1 and 1 of the Arduino UNO. Also, a 10KΩ Potentiometer is connected to Pin 3 of LCD (contrast adjust pin). The RS and E (Pins 3 and 5) of the LCD are connected to Pins 1 and 1 of the Arduino UNO. Next, connect the output of the Heartbeat Sensor Module to the Analog Input Pin (Pin 1) of Arduino.
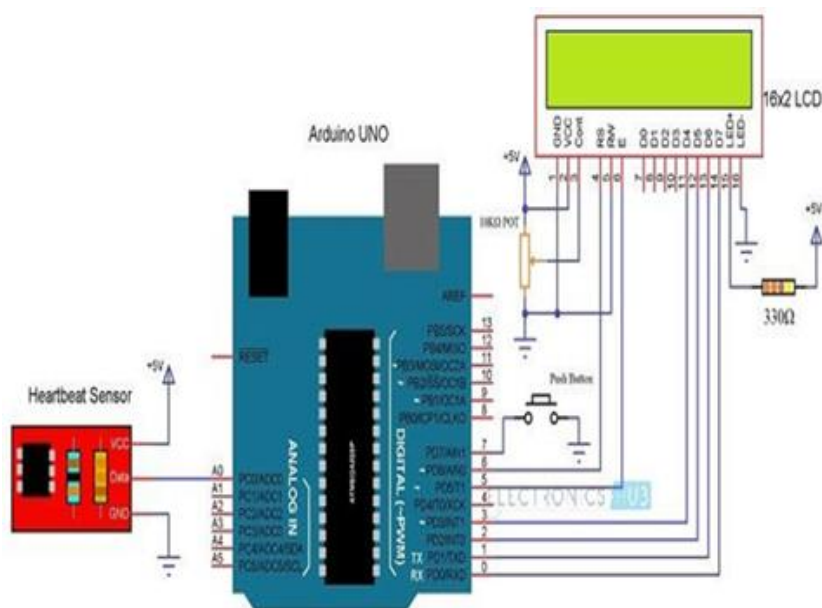
Fig.1 Circuit Diagram

5. WORKING OF CIRCUIT

Upload the code to Arduino UNO and Power on the system. The Arduino asks us to place our finger in the sensor and press the switch. Place any finger (except the Thumb) in the sensor clip and push the switch (button). Based on the data from the sensor, Arduino calculates the heart rate and displays the heartbeat in bpm. While the sensor is collecting the data, sit down and relax and do not shake the wire as it might result in faulty values. After the result is displayed on the LCD, if you want to perform another test, just push the rest button on the Arduino and start the procedure once again.

6. FUTURE SCOPE

Further improvements can be applied to this project to enhance its performance: - Design robust system to improve measuring efficiency even in the presence of noise. In addition to propose a new method for efficient transmission of data between the MCU and the Android application. - To ensure the accuracy of heart rate monitor device, more testing can be performed to larger number of people with different ages and weights. - Replace the LM35 with specific temperature sensor of body measurement in order to make it more accurate and more functional to use. - More vital signs parameters should be added to increase the value of the project to the patients. These can include: Blood Pressure, Respiratory Rate and other parameters. - Implement pulse and other parameters measurements using the mobile phone camera along with other built-in sensors in order to obtain these parameters on demand if the patient started experiencing some symptoms or abnormalities. - The MCU should send a control signal along with the measured data when detect heart attack and the buzzer is turned ON. The control signal should enable

GPS, instruct the application to send an SMS containing the measured data and the patient's location to the medical emergency and emergency contacts of the patient in order to get an ambulance and notify his relatives. - The device should be miniaturized into a PCB making its weight lighter in order to make the device commercial for public use. - Portable battery unit for the device to provide required power by the sensors and MCU.

7. RESULT

Heartbeat And Body Temperature Monitoring using Arduino will detect the heart beat using the Pulse Sensor and body temperature using LM-35 sensor. Sensor and will show the readings in BPM (Beat Per Minute) on the LCD connected to it. The body Temperature will be displayed on serial monitor along with BPM readings.
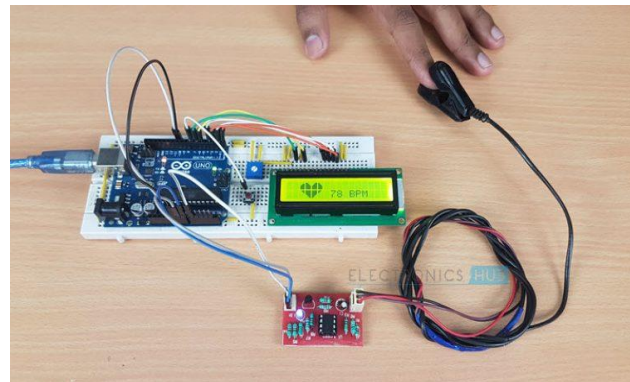
Fig.2 Result

8. CONCLUSION

A pulse sensor which considered as an infrared sensor that has a response to variations in light intensity instead was used. The key objective of developing this project with the help of Android Open Source platform is to immediately alert Medical Emergency and the patient's emergency contacts about the health condition of patient. We are developing prototype of this application using the continuous monitoring of parameters to detect and predict the heart attack and generate an alarm. The buzzer will turn ON when body temperature and heart rate exceed or goes below specified threshold level. This objective is met with measuring the heart rate and body temperature. It is helpful where continuous monitoring is required under critical condition.

In addition, it is very usable device due to its portability which means the patients can carry it with him therefore no need to stay at hospitals because the Heart Rate Monitor is applicable almost everywhere. Along with the Heart Rate Monitor, we developed an Android Application that allows both doctors and patients to interact with each other; records the data received from the heart monitor via Bluetooth as well as enable access to these records by the doctor.

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