



**HEARTBEAT MONITORING SYSTEM**

##### A MINOR PROJECT - III REPORT

###### ***Submitted by***

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**BONAFIDE CERTIFICATE**

Certifiedthatthis **18ECP105L - Minor Project III** report “HEATBEAT MONITORING SYSTEM” is the bonafide workof “**GOWSIK (927621BEC053),DINESH(927621BEC050),AJAYRAGHAV(927621BEC009),KIRTHIKK KUMAR(927621BEC305)”**who carried out the project work under my supervision in the academic year **2023 -2024 - ODD SEMESTER**.

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**PROJECT COORDINATOR**

**INSTITUTION VISION AND MISSION**

**Vision**

To emerge as a leader among the top institutions in the field of technical education.

**Mission**

**M1:** Produce smart technocrats with empirical knowledge who can surmount the global challenges.

**M2:** Create a diverse, fully -engaged, learner -centric campus environment to provide quality education to the students.

**M3:** Maintain mutually beneficial partnerships with our alumni, industry and professional associations.

**DEPARTMENT VISION, MISSION, PEO, PO AND PSO**

**Vision**

To empower the Electronics and Communication Engineering students with emerging technologies, professionalism, innovative research and social responsibility.

**Mission**

**M1:** Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.

**M2:** Inculcate the students in problem solving and lifelong learning ability.

**M3:** Provide entrepreneurial skills and leadership qualities.

**M4:** Render the technical knowledge and skills of faculty members.

**Program Educational Objectives**

**PEO1:** **Core Competence:** Graduates will have a successful career in academia or industry associated with Electronics and Communication Engineering.

**PEO2:** **Professionalism:** Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

**PEO3:** **Lifelong Learning:** Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadership quality.

**Program Outcomes**

**PO 1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO 2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO 3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO 4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO 5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO 6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO 7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO 8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO 9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO 11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO 12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Program Specific Outcomes**

**PSO1:** Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

**PSO2:** Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

|  |  |
| --- | --- |
| **Abstract** | **Matching with POs, PSOs** |
| **Heart beat sensor module, Arduino nano, LED Display** | **PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2** |

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**ABSTRACT**

This project presents an early sample for the monitoring of Heartbeat rate for the patients. The Heartbeat sensor, detects the pulse of the person and converts it into the form of electrical signals and pulse. The pulse rate of the person will be displayed on OLED [Organic light emitting diode] display. In order to measure our body temperature, we use thermometers, in the same way the Heartrate of the person can be measured in two ways: one way is to check manually at wrists or neck and the other way is to use a Heartbeat sensor. The Arduino nano present in the project acts as a microcontroller. Although number of methods had been implemented in this domain, in this text which we had provided is a robust method of measuring Heartrate. Heartrate is most important in health parameter that is directly related to human cardiovascular system. Heartbeat use to monitor the health condition of our heart. The pulsating reflection is converted to a suitable current or voltage pulse by the sensor. The sensor output is processed by suitable electronic circuits to obtain a visible indication (digital display). It is also use by individuals like athletes who are interesting in monitoring their heart beat during a run-in order to acquire maximum efficiency.

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**LIST OF ABBREVIATIONS**

|  |  |  |
| --- | --- | --- |
| **ACRONYM** |  | **ABBREVIATION** |
| IRD | - | Infrared device |
| LCD | - | Liquid Crystal Display |

CHAPTER 1  
INTRODUCTION

* 1. BACKGROUND

A heart rate monitor is a personal monitoring device that allows a subject to measure their heart rate in real. 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. 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 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. 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. In this heart rate is increased when the human doing an exercise it is increased and the rest of the time it is going to a normal condition.

* 1. **OBJECTIVES**

Perform comprehensive literature search on tachycardia detection system by using pulse sensor. Suggest and choose potential solutions to the problem. Build and test tachycardia detection system using pulse sensor of technology to be safe and secure -to- use for healthy patients. This notification through RF. Channel would to take an appropriate action at an instance of time, thereby alerting the appropriate persons. 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).

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.

**CHAPTER 2**

**LITERATURE SURVEY**

Microcontroller is programmed with an algorithm to run the proposed heart rate counting system. The results obtained using this process when compared to those obtained from the manual test involving counting of heart rate was found satisfactory. He proposed system is applicable for family, hospital, community medical treatment, sports healthcare and other medical purposes. Also, fit for the adults and the pediatrics. Heart beat Sensing and Heart Attack Detection Using internet of things. The sensor is interfaced to a microcontroller that allows checking heart rate readings ad transmitting them over internet. The user may Set the level of heart beat limit. After setting these limits, the system starts monitoring and as soon as patient heart beat goes above a certain limit, the system sends an alert to the controller which then transmits this over the internet and alerts the doctors as well as concerned users. Also, the system alerts for lower heartbeats. The sensor is interfaced to a microcontroller that allows checking heart rate readings ad transmitting them over internet. The user may Set the level of heart beat limit. After setting these limits, the system starts monitoring and as soon as patient heart beat goes above a certain limit, the system sends an alert to the controller which then transmits this over the internet and alerts the doctors as well as concerned users. Also, the system alerts for lower heartbeats.

**CHAPTER 3**

**EXISTING SYSTEM**

 The Arduino requests 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 button. Based on the information from the sensor, Arduino calculates the heart rate and displays the heartbeat in bpm. Heartbeat Sensor is used as blood pressure and body [temperature](http://microcontrollerslab.com/temperature-sensor-using-pic16f877a-microcontroller/) are very important parameters to know for the human body. We go to doctors who use different kinds of apparatuses to determine the heart rate of a human. In this tutorial, we are going to make our own heartbeat sensor that will tell us the heart rate. We will make an [Arduino](http://microcontrollerslab.com/getting-started-with-arduino-uno-r3/) based heartbeat sensor that will tell us the number of pulses in a minute when we place a finger on it. 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. It uses RF. To help both the patient and the concerned doctor to take an appropriate action. It is beneficial in terms of cost. It saves time and is very helpful to patients who lives alone. It offers a freedom of movement to patients. It has a low power consumption though the stability of its wireless data communication is still to be enhanced. To some degree, the wireless data communication via RF has anti-jamming ability. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator.

**CHAPTER 4**

**PROPOSED SYSTEM**

The proposed system is to send the heart rate information to the doctor through SMS, if there are any abnormalities in heart rate of the patient, they will get patient’s information from their mobile, and then simply, they provide treatment within short time. The heartbeat rate of a patient is 12 measured from the index finger or the wrist or neck using IRD (infrared device) sensors and the rate is then averaged and displayed on a text board LCD. The device sounds an alarm when the heartbeat and body temperature exceed the safe threshold value. The programmer stipulates this threshold value at the time of programming of the microcontroller. The threshold value given for the device is between 20 to 120 pulses per minute for heart beat indication and 18 degrees Celsius to 38 degrees Celsius for temperature.

**HEART BEAT SENSOR MODULE**

**POWER SUPPLY**

**LCD DISPLAY**

**ARDUINO NANO**

Figure 4.1: Block Diagram

The proposed system analysis the pulse rate in the way of fingertip using Arduino controller, and it’s based on photo plethysmography principle. This method to analysis the blood pressure difference and identified the variations of the value of blood pressure and send to the controller. This type of changes is identified with help of the heart beat sensor is placed in the finger to measure the value, and the signal is sent to the controller via serial communication system it is help to monitoring the heart beat range. The photo diode is analysis the light signal and reflected back to the device, so the difference between the light signals the value is send to the controller. It is continuously processed in every circulation of blood in the fingertip region, and sends the variation of changes in the light signal to the controller via serial communication.

**CHAPTER 5**

**HARDWARE**

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. Although the hardware and software designs are freely available under copyleft licenses, the developers have requested the name Arduino to be exclusive to the official product and not be used for derived works without permission. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (Atmega8, Atmega168, Atmega328, Atmega1280, or Atmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Y. The default bootloader of the Arduino Uno is the Opti boot bootloader. Boards are loaded with program code via a serial connection to another computer. Other variants, such as the Arduino Mini and the unofficial Board, use a detachable USB to-serial adapter board or cable, Bluetooth or other methods.

**CHAPTER 6**

**METHODOLOGY**

**6.1 COMPONENTS REQUIRED**

**6.1.1 POWER SUPPLY**

The device uses two 9V disposable Lithium battery for making it portable. For safety and short circuit protection, a voltage regulator used. The heart rate data is detected by using Grove-Heart Rate sensor that is clipped on the fingertip. 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. The Control Circuit consists of an Op-Amp IC and few other components that help in connecting the signal to a Microcontroller



Figure 6.1.1: Power Supply

**6.1.2 ARDUINO NANO**

Arduino Nano is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino NANO. It is a small size board and also flexible with a wide variety of applications. And other development boards are AVR Development Board, PIC Development Board, Raspberry Pi, Intel Edison, MSP430 Launchpad, and ESP32 board. It includes everything required to hold up the microcontroller; simply attach it to a PC with the help of a USB cable and give the supply to get started with a AC-to-DC adapter or battery. You can tinker with your nano without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. 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 NANO. 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 NANO.

Figure 4.1: Power Supply

Figure 6.1.2 :Arduino NANO

**6.1.3 LCD Display**

LCD is used mainly for displaying the needed information about the project. Information like temperature and flame level can be displayed through LCD Emergency fire alert also will be displayed through LCD will be connected with the digital pins (RC0, RC1, RC2, RC3) of the controller as 4-bit mode or 8-bit mode In addition we also need to connect RS, EN, RW pins of the LCD with controller It is supplied with 5 volt dc and ground This word comes from the liquid crystal and represents its screen size. In the Liquid crystal display and there are 2 rows and 16 columns. These devices are thinner as well and power consumption is extremely less. An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A LCD display is a very basic module and is very commonly used in various devices and circuits. A LCD means it can display characters per line and there are 2 such lines. In this LCD each character is displayed in a pixel matrix. The intelligent alphanumeric dot matrix displays is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data. Command register stores various commands given to the display. Data register stores data to be displayed.



Figure 6.1.3:LCD Display

**6.1.4 Pulse sensor**

A plug-and-play sensor that is used to detect the heart rate data is known as a pulse sensor. This sensor is used by athletes, students, mobile & game developers, etc. This sensor clips on an earlobe or a fingertip by connecting right to an Arduino board through jumper An optical heart rate sensor measures pulse waves, which are changes in the volume of a blood vessel that occur when the heart pumps blood. Pulse waves are detected by measuring the change in volume using an optical sensor and green LED. A pulse sensor, or any optical heart rate sensor, works by shining a green light (~550 nm) on your finger and measuring the amount of reflected light with a photo sensor. Oxygen-rich hemoglobin in arterial blood has the property of absorbing green light. Pulse testing a constant current source is very similar to the above mentioned power supply testing with a. few differences. We put the electronic load in constant voltage mode and pulse the voltage set points of. The load between the two different voltage levels.

Figure 6.1.4: Pulse sensor

**CHAPTER 7**

**SOFTWARE**

The software implemented on the Microcontroller Arduino UNO, is written in assembly C language. Figure 3 depicts a flow chart to pulse measurement. The flow starts from getting inputs from the sensor module. The microcontroller checks whether all three inputs are given properly. If someone of the inputs is not detected well, the system send a warning; if all inputs are detected, the software send the signal thought the application to process cardiac parameters. Take a pulse sensor and connect its VCC pin with the 5 volt pin of the Arduino. Join the GND pin of the pulse sensor with the GND pin of the Arduino. Attach the OUT/signal pin of the heart beat sensor to the Analog-0 pin of the Arduino. The working of the Heartbeat Sensor is Photo plethysmo graph. According to this principle, the change in the volume of blood in an organ is measured by the changes in the intensity of the light passing through that organ.

**CHAPTER 8**

**WORKIGN PRINCIPLE**

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 r. 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.

The principle behind the working of the Heartbeat Sensor is Photo plethysmo graph .According to this principle, the change in the volume of blood in an organ is measured by the changes in the intensity of the light passing through that organ. Reflective Sensor, on the other hand, has the light source and the detector adjacent to each other and the finger of the person must be placed in front of the sensor.

Smartwatches and fitness bands measure heart rate by scanning blood flow near your wrist, by illuminating it with LEDs. The colour green is chosen, because it is absorbed well by our red blood, so optical sensors can gauge the flow of blood and heart beats accurately.

**Applications of Heart Rate Monitor using Arduino**

A simple project involving Arduino UNO, 16×2 LCD and Heartbeat Sensor Module is designed here which can calculate the heart rate of a person.

This project can be used as an inexpensive alternative to Smart Watches and other expensive Heart Rate Monitors

**CHAPTER 9**

**PROGRAM CODE**

#include <SPI.h>

#include <Wire.h>

#include <Adafruit\_GFX.h>

#include <Adafruit\_SSD1306.h>

Adafruit\_SSD1306 srituhobby = Adafruit\_SSD1306(128, 64, &Wire);

#define sensor A0

#define Highpulse 540

int Sx = 0;

int Sy = 60;

int x = 0;

int Svalue;

int value;

long Stime = 0;

long Ltime = 0;

int count = 0;

int Bpm = 0;

void setup() {

  Serial.begin(9600);

  srituhobby.begin(SSD1306\_SWITCHCAPVCC, 0x3C);// Address 0x3C for 128x32

  delay(1000);

  srituhobby.clearDisplay();

}

void loop() {

  Svalue = analogRead(sensor);

  Serial.println(Svalue);

  value = map(Svalue, 0, 1024, 0, 45);

  int y = 60 – value;

  if (x > 128) {

    x = 0;

    Sx = 0;

    srituhobby.clearDisplay();

  }

  srituhobby.drawLine(Sx, Sy, x, y, WHITE);

  Sx = x;

  Sy = y;

  x ++;

  BPM();

  srituhobby.setCursor(0, 0);

  srituhobby.setTextSize(2);

  srituhobby.setTextColor(SSD1306\_WHITE);

  srituhobby.print(“BPM :”);

  srituhobby.display();

}

void BPM() {

  if (Svalue > Highpulse) {

    Stime = millis() – Ltime;

    count++;

    if (Stime / 1000 >= 60) {

      Ltime = millis();

      Serial.println(count);

      srituhobby.setCursor(60, 0);

      srituhobby.setTextSize(2);

      srituhobby.setTextColor(SSD1306\_WHITE);

      srituhobby.print(count);

      srituhobby.print(“HB”);

      srituhobby.display();

      count = 0;

    }

  }

}

**RESULT**

The heart rate monitoring system was successfully made and worked fine. The Heartbeat Monitoring System is the part of Patient Monitoring System, can be extended to measure other parameters of patient like ECG & temperature etc. Heart Beat is measured by passing a high intensity red light through a finger which is collected by LDR, amplified and displayed over an LCD display via microcontroller. Heartbeat sensors will create a digital pulse corresponding to each thump. After counting of pulse for one minute, the value of the heartbeat will be displayed on LCD and if the value is beyond the normal range. The proposed system is directly connected with the hospital database which helps to communicate the patients while necessary but these facilities are not available in the previous works. A patient is in normal condition if the measurement shows 120-80 mm Hg; consequently, no emergency notification is sent to the hospital. A physical problem confronts the patient when the bp fluctuates and as a result the system automatically notifies the hospital. Sometimes heartbeat sensor systems may face a single point failure problem because of the central control-based system but to get rid of this problem there are some reliable solutions with standard and calibrated medical devices. Multiple biosensors can ensure signal quality as well.

**CONCLUSION**

The main objective of this paper is to present the idea that can help many dying patients who can be saved by regular monitoring of the heart rate. Emergency service can be helpful to get an ambulance to the doorstep which in turn will be beneficial for those who stay alone in a house. The patient just has to use it in their hand to get the optimal result. This system can be used in home, or during travelling, or in hospitals also. For testing this system we have measures heart rate and pressure of different person. By keeping value outside normal range, I checked it will message to care person that message contains latitude and longitude. By inserting these latitude and longitude in Google Earth we got name of location of patient. A medical device is intended for use in the diagnosis of disease, or in the cure, treatment, or prevention of diseases.

**FUTURE SCOPE**

1. EEG, ECG and other health parameters can also be monitored.
2. Continuous monitoring and future diagnosis can be performed via the same system (TELEMEDICINE).
3. More than a single patient at different places can be monitored using single system.

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