

Wireless Sensor Based Health Monitoring System

K.V.E SAROJINI,
Dept. of ECE,

NS Raju Institute of Technology, Visakhapatnam

S. Kavya, Dept. of ECE, NSRIT

kavya.bujji22@gmail.com

K.Kalyani, Dept. of ECE, NSRIT

Kalyani1996sai@gmail.com

K. Harish Babu, Dept of ECE, NSRIT

hbabu994@gmail.com

M.Manoj, Dept. of ECE, NSRIT

manojmaradapudi999@gmail.com

Abstract: Heart rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. This paper describes a technique of measuring the heart rate through a fingertip and Arduino. It is based on the principal of photoplethysmogram (PPG) which is non-invasive method of measuring the variation in blood volume in tissue using a light source and detector. The fluctuation of blood can be detected through an optical sensing mechanism placed around the fingertip. The signal can be amplified and is sent to Arduino with the help of serial port communication. With the help of processing software heart rate monitoring and counting is performed.

Key Words: heart rate sensor, Heart rate measurement, photoplethysmogram (PPG), IR LED, .Arduino Software

I. INTRODUCTION

A heart rate monitor is a personal monitoring device that allows a subject to measure their heart rate in real 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. 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 heart rate monitor with a temperature sensor is definitely a useful instrument in knowing the pulse and the temperature of the subject or the patient.

II. BLOCK DIAGRAM OF THE PROPOSED SYSTEM

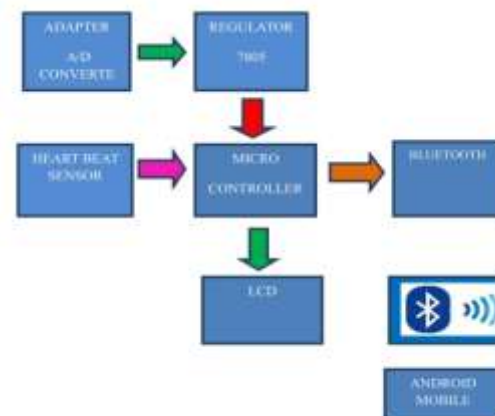


Fig 1: Block Diagram of health monitoring system

The above diagram illustrates the block diagram of the proposed system.

It mainly consists of:

- **Laptop:** This is used to receive the heart rate of a human being/animal.
- **Bluetooth module:** This is used to provide serial communication with the Arduino board. It receives commands from an android application and passes it to the Arduino board based on which the motors of the bot move accordingly.
- **Arduino:** This is a single board micro-controller, intended to make the application of interactive objects or environments more accessible.
- **Heart beat sensor:** It measures the change in volume of blood through any organ of the body

which causes a change in the light intensity through that organ (a vascular region). The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

- **Regulator:** The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. 7805 provides +5V regulated power supply.
- **LCD:** A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. LCDs are available to display arbitrary images or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock...
- **Power supply:** The power supplied to the robot is through a 12V and 7A battery which enhances the working of the bot efficiently.

III. DESIGN AND IMPLEMENTATION OF THE PROPOSED SYSTEM

1. DESIGN:

A. Arduino Board:

Arduino is a single board microcontroller, intended to make the application of interactive objects or environments more accessible. The hardware consists of an open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM.

An Arduino board consists of an Atmel 8-bit microcontroller with complementary components to facilitate programming and incorporation into other circuits. Most boards include a 5 volt linear regulator and a 16 MHz crystal oscillator or ceramic resonator in some variants.



Fig 2: Arduino Board.

B. HEART BEAT SENSOR:

The heartbeat sensor is based on the principle of photoplethysmogram. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

C. LCD:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

D. HC Serial Bluetooth:

HC serial Bluetooth products consist of Bluetooth serial interface module and Bluetooth adapter. Bluetooth serial module is used for converting serial port to Bluetooth. These modules have two modes: master and slaver device. The device named after even number is defined to be master or slaver when out of factory and can't be changed to the other mode. But for the device named after odd number, users can set the work mode (master or slaver) of the device by AT commands.

E. Softwares used:

a. Arduino software:

The Arduino Integrated Development Environment is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring projects. It includes a code editor with features such as syntax high-lighting, braces matching and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. Arduino programs are written in C or C++. Users only need define two functions to make a run able cyclic executive program:

Setup (): a function run once at the start of a program that can initialize settings.

Loop (): a function called repeatedly until the board powers off.

B. Bluetooth SPP Pro:

The software for the Bluetooth client communication tools i.e. Bluetooth slave mode, Bluetooth serial communication can be tested. This can connect a Bluetooth MCU and PC serial port. This supports android 4.0 version of the system.

If the connected Bluetooth device is not paired, the system will automatically prompt you for pairing. Bluetooth pairing is successful and can be connected again and again.

This can only connect Bluetooth serial module devices as they are generally used for MCU serial communication.

IV. IMPLEMENTATION

A finger of a human being is placed on the pulse sensor, so according to the blood pumping from the heart to other organs so, the sensor detects the flow of blood through photo diode. The signal is send to Arduino board then to the He serial communication port. The data is visualized in the mobile phone/laptop/lcd display. Where the output of the human heart beat is detected.

V. RESULTS



Fig.3 represents the heart beat system

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Byte stream mode CLEAR
*** Heart-Beat Happened *** BPM: 85
*** Heart-Beat Happened *** BPM: 80
*** Heart-Beat Happened *** BPM: 80
*** Heart-Beat Happened *** BPM: 75
*** Heart-Beat Happened *** BPM: 75
*** Heart-Beat Happened *** BPM: 70
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*** Heart-Beat Happened *** BPM: 74
*** Heart-Beat Happened *** BPM: 76
*** Heart-Beat Happened *** BPM: 74
*** Heart-Beat Happened *** BPM: 75
*** Heart-Beat Happened *** BPM: 77
*** Heart-Beat Happened *** BPM: 78
*** Heart-Beat Happened *** BPM: 77
*** Heart-Beat Happened *** BPM: 75
  
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VI. CONCLUSION

This paper focuses on the heart rate monitoring and alert which is able to monitor the heart beat rate condition of patient. The system determines the heart beat rate per minute and then sends short message service (SMS) alert to the mobile phone. It is portable and cost effective. It is a very efficient system and very easy to handle and thus provides great flexibility and serves as a great improvement over other conventional monitoring and alert systems.

The current version of the Processing application displays the near-real-time PPG waveform and heart rate but does not record anything. There is a lot of room for improvements.

Logging heart rate measurements and PPG samples along with the time-stamp information available from the PC Beeping sound alarm for heart rates below or above threshold Heart rate trend over time, etc.

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