Kannada Sangha Pune's
Kaveri College of Arts, Science and Commerce, Pune

Electronics Project

(As a part of Electronics Practical)

Project report on

Title

Beats Per Minute (BPM) Sensor

Submitted by

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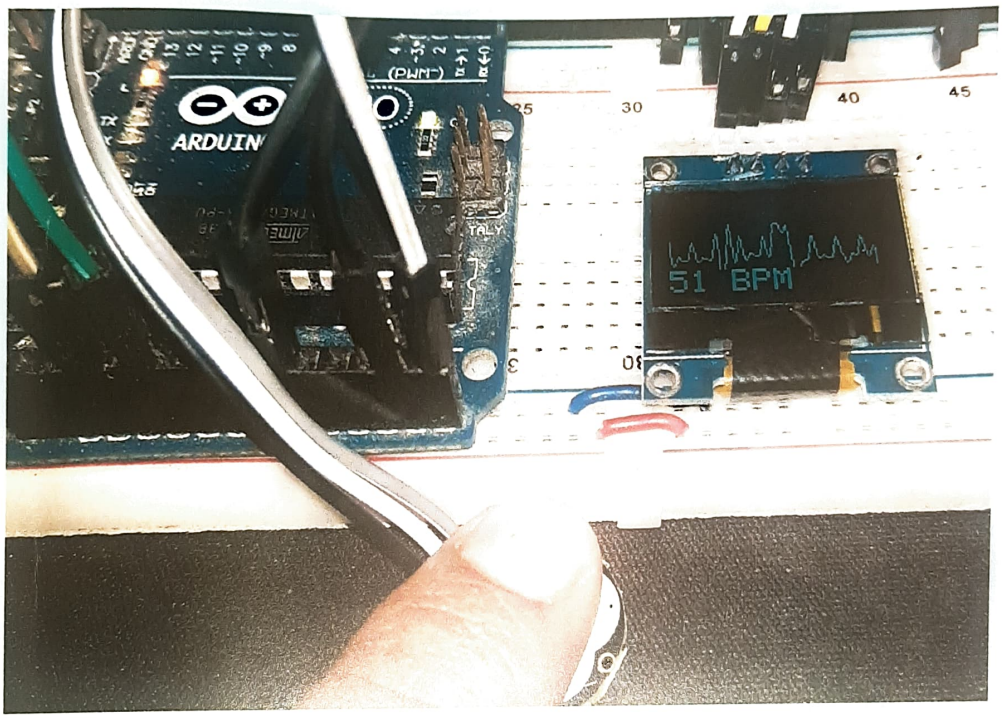
2019-2020

6/11/20

BEATS PER MINUTE
(BPM)
SENSOR



BY :- ADITI KATHALAY & ISHA HOSUR

INTRODUCTION:

The heart rate is one of the vital signs, or the important indicators of health in human body. It measures the number of times per minute that the heart contracts or beats.

The speed of heart beat varies as a result of physical activity, threats to safety and emotional responses.

FACTS:

- The heart rate measures the number of times the heart beats per minute.
- At the age of 10 years, the heart rate of a person should be between sixty and hundred beats per minute while they are resting.
- The heart will speed up during exercise. There is a recommended maximum heart rate that varies depending upon age of individual.
- It is not only the speed of the heart rate that is important. The rhythm of the heartbeat is also crucial, and an irregular heart beat can be sign of serious health condition.
- One in every four deaths in United States occurs as a result of heart disease. Monitoring your heart rate can help prevent heart complications.

"In this project, a pulse sensor is used. This sensor can sense a person's beats per minute and display it on LED display module. It also consists of an Arduino Uno in which the program is to be inserted. We can also keep a record of these readings using an application on your cell phone"

FOREWORD:

NORMAL RESTING HEART RATE:

It is important to identify whether your heart rate sits within the normal range. If disease or injury weakens the heart, the organs will not receive enough blood to function normally. The United States National Institutes of Health (NIH) have published a list of normal resting heart rates. The heart rate gets progressively slower as a person moves through childhood toward adolescence. The normal resting heart rate for adults over the age of 10 years, including older adults, is between 60 and 100 beats per minute (bpm).Highly trained athletes may have a resting heart rate below 60 bpm, sometimes reaching 40 bpm.
The following is a table of normal resting heart rates at different ages according to the NIH:

Age	Normal heart rate (bpm)
Up to 1 month	70 to 190
From 1 to 11 months	80 to 160
From 1 to 2 years	80 to 130
From 3 to 4 years	80 to 120
From 5 to 6 years	75 to 115
From 7 to 9 years	70 to 110
Over 10 years	60 to 100

The resting heart rate can vary within this normal range. It will increase in response to a variety of changes, including exercise, body temperature, emotional triggers, and body position, such as for a short while after standing up quickly.

PRINCIPLE:

The heartbeat sensor is based on the principle of photo plethysmography. 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.

There are two types of photo plethysmography:

Transmission: Light emitted from the light emitting device is transmitted through any vascular region of the body like and earlobe and received by the detector.

Reflection: Light emitted from the light emitting device is reflected by the regions

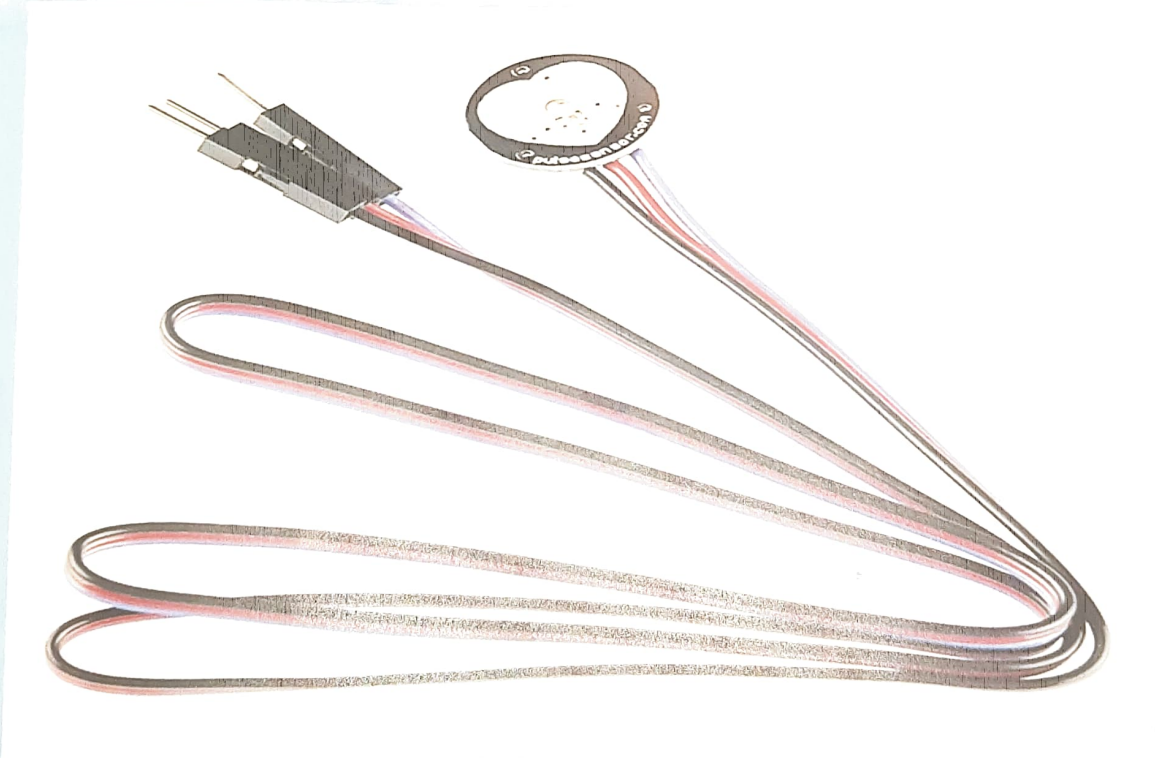
CIRCUIT:

The components of this project are:

1. Pulse sensor
2. Arduino Uno
3. OLED display
4. Jumper wires
5. Bread board

• PULSE SENSOR:

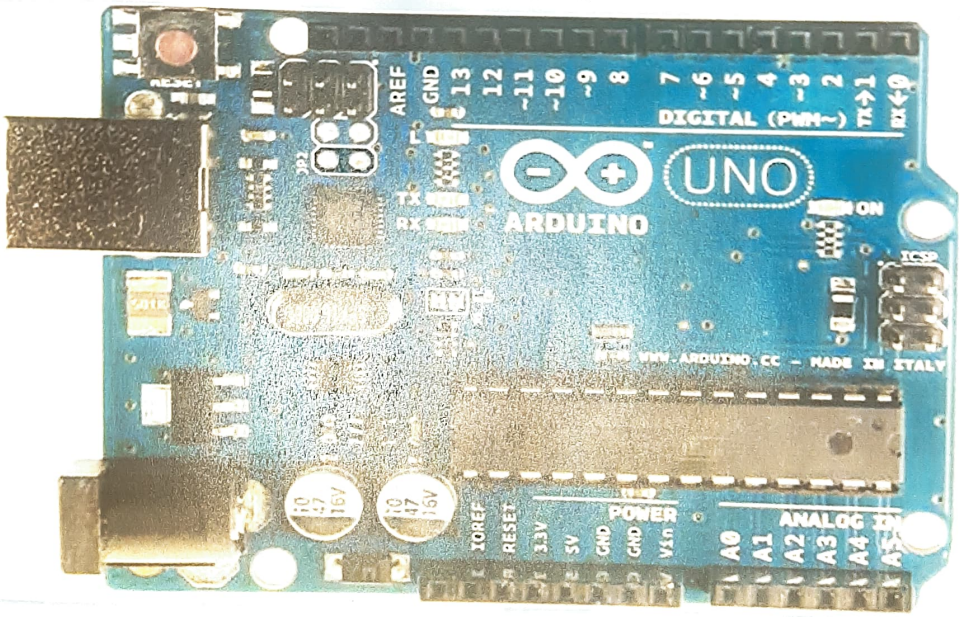
Pulse sensor consists of three pins viz. VCC which operates between +5V or +3.3V and current consumption is 4mA. The second pin is the Signal pin through which the output signal is given. The third pin is ground which is 0V. It has inbuilt amplification and noise cancellation system. With diameter 0.625" and thickness 0.125", this play & plug sensor detects biometric pulse rate.



- **ARDUINO UNO:**

The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

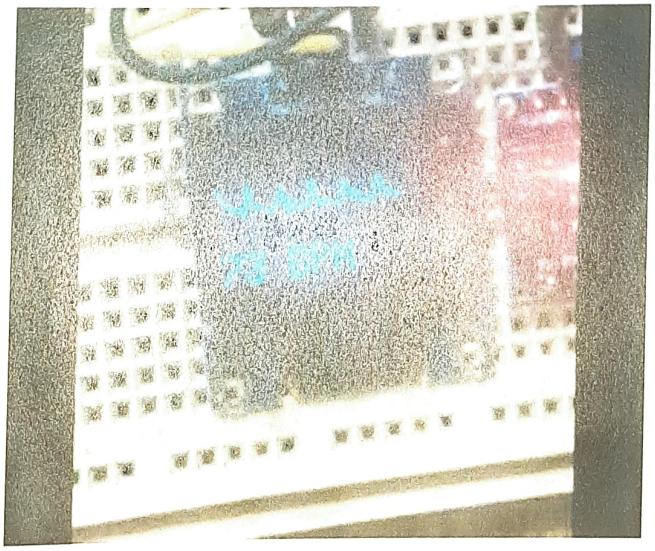
The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.



- **OLED DISPLAY:**

(**O**rganic **LED**) A display technology that offers rich colours, high contrast, deep blacks, wide viewing angle, low power and fast response time for action scenes. Instead of silicon or gallium, which LEDs are made of, OLEDs use "organic" carbon emitting layers. OLED screens are found in TVs, smartphones, tablets, watches and VR/AR headsets. Increasingly, laptop displays and monitors are OLED, but screen burn-in is a problem when the same toolbars and logos remain on screen for weeks on end. For more OLED technology details, see OLED layers.
See LED and PHOLED.

Transparent OLEDs (TOLEDs) function in heads-up displays and even as window shades. Flexible OLEDs (FOLEDs) can be folded, and OLEDs are also used for general-purpose ceiling and light fixtures. OLED's thinness, transparency and flexibility make it a versatile display technology for the 21st century.
See TOLED, FOLED, WOLED and OLED lighting.



- **JUMPER WIRES:**

A **jump wire** (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.[1]

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

- **BREAD BOARD:**

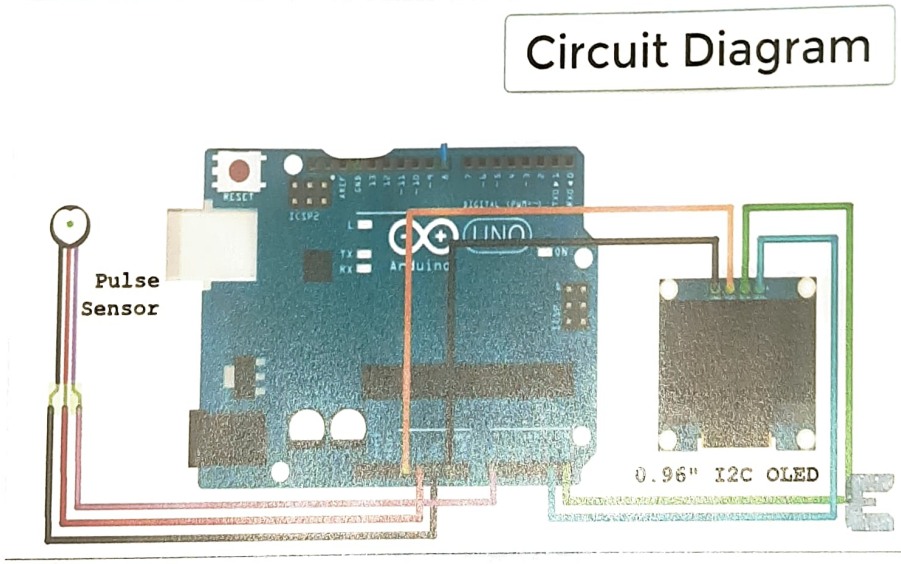
A **breadboard** is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used for slicing bread. In the 1970s the **solderless breadboard** (a.k.a. **plug board**, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these.

Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Older breadboard types did not have this property. A stripboard (Vero board) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs).

CIRCUIT:

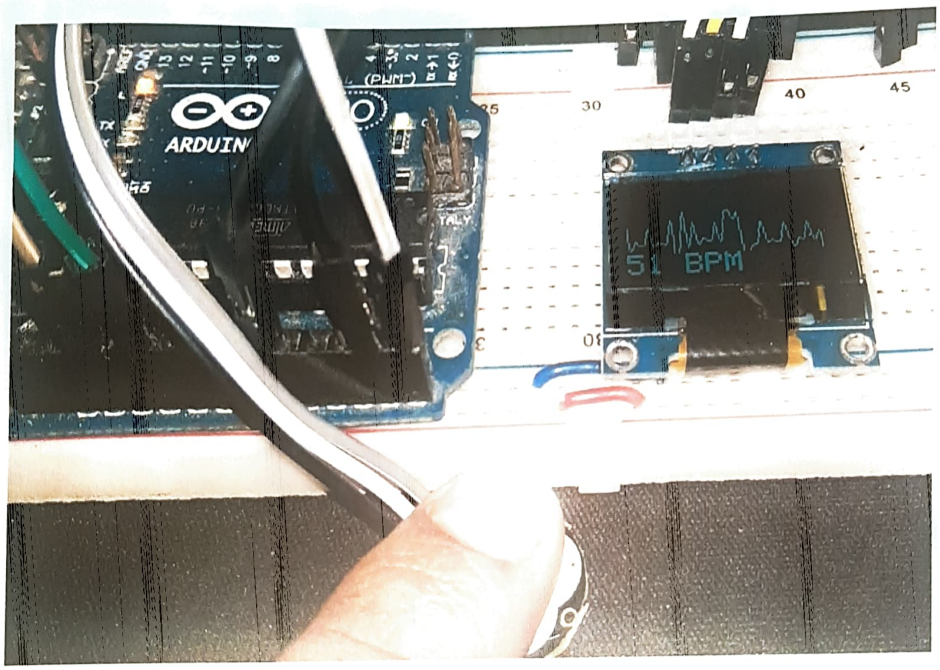
In pulse sensor firstly, the Arduino Uno is programmed and the pulse sensor is connected to the Arduino Uno. The OLED display is also connected to the Arduino Uno with the help of jumper wires. After the program is uploaded, the Arduino Uno is then connected to the power source. Then the current flows through the whole circuit. A potentiometer can also be added to lower down the sensitivity of the pulse sensor. This potentiometer can be connected to the bread board.

The schematic diagram below shows the exact circuit connections of the circuit:



WORKING:

When the Arduino Uno is connected to battery or any power source the light of pulse sensor glows and the pulse sensor starts sensing. If a person's finger is places (except thumb) on the sensor, the sensor senses his/her pulse rate. With the help of the program uploaded on the Arduino Uno, the reading of pulse rate is displayed on the OLED display along with the ECG. Hence the heart rate that is beats per minute (BPM) of a person is calculated and is also displayed.



APPLICATIONS:

A pulse sensor measurer or a circuit has a lot of application viz.

- It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live **heart-rate** data into their projects.
- This sensor is used for Sleep Tracking
- This sensor is used for Anxiety monitoring
- This sensor is used in remote patient monitoring or alarm system
- This sensor is used in Health bands.

THANK YOU