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A project presentation on

"ADVANCED HEART RATE DETECTION USING EMBEDDED SYSTEM"

Presented by

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INTRODUCTION

- A heart rate is the number of times a person's heart beats per minute.
- A normal pulse rate depends on an individual's health, age, medication use, and also emotions may have a major impact on it.
- 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.
- It is economical and user friendly that uses optical technology to detect the flow of blood through the index finger.
- It allows the user to monitor their health constantly without going to the clinic for a check up, especially for elders.

- The pulse can be detected easily by sensing the density of the blood flow through the skin part as the arteries will be connected very close to the skin. So, that the fluctuation in that blood flow can be sensed easily by a sensor that indicates the pulse rate.
- The fluctuation in that blood flow can be sensed easily by a sensor that indicates the pulse rate.
- Awareness and much knowledge regarding the heart rate can help the person in monitoring the health condition, maintaining the body fitness level.
- It also helps to detect and monitor the developing health problem at the initial stage if that person is undergoing some of the symptoms related to that particular disease.

LITERATURE SURVEY

1. The authors named N.M.Z Hashim, N.A. Ali, A. Salleh, A.S. Jaafar, N.A.Z. Abdin proposed a paper called “Development of optimal photosensor based heart pulse detector”.

- The output of this work provided better service for the people, to maintain their health condition.
- The future work of this research was to enhance communication methods by adding wireless connection, to meet the needs of people, and it is required to be environmental friendly for all the OS of androids [1].

2. The authors named Kala Venugopal, Amit Kumar proposed a paper titled “Centralize heart beat monitoring and automatic message alert system using WBAN”.

- In this paper, the multiple heart beat and temperature data are measured and stored.
- This system was applicable only for hospitals or any other clinics. The future work is to expand this system to remote patient’s connected to a centralized monitoring system using wireless network [2].

3. A GSM modem integrated bio-sensor detecting heart beat rate system was proposed to detect
heart attacks.

- In this work, the heart rate was detected using LDR, LED band and the finger was made to place in it.
- This helps the doctor to diagnosed the patient and provide easier precaution for them.
- The future scope was to implement better packaging of the circuitry by using low cost and sensitive sensor to attain better accuracy [3].

PROBLEM DEFINITION

- Heart failures such as heart arrhythmias needs continuous monitoring for a longtime.
- However, these group of patients are discharged too early from the hospitals, as another patient is in a need of that bed to be hospitalized immediately.

SOLUTION

- To overcome all these problems a low cost heart beat monitoring system is proposed which is portable and can be used by each individual at home.

- Using this device the patients can measure their heart rate regularly at home by themselves and can contact the doctor only when there is any problem.
- The system will provide more accurate results in measuring the heart rate and helps each and every individual to constantly check and monitor the heart condition to lead a better life.

OBJECTIVES OF THE PROPOSED WORK

The objectives of the proposed work are defined as follows

1. To analyse the existing systems of the Heart Pulse Detection system.
2. To Implement the IR Sensor for the Detection of the Heart Rate monitoring system.
3. To implement the real time module of the proposed method from the above heart rate monitoring system using Arduino board.
4. To Test and Validate the proposed method with current existing system.

BLOCK DIAGRAM

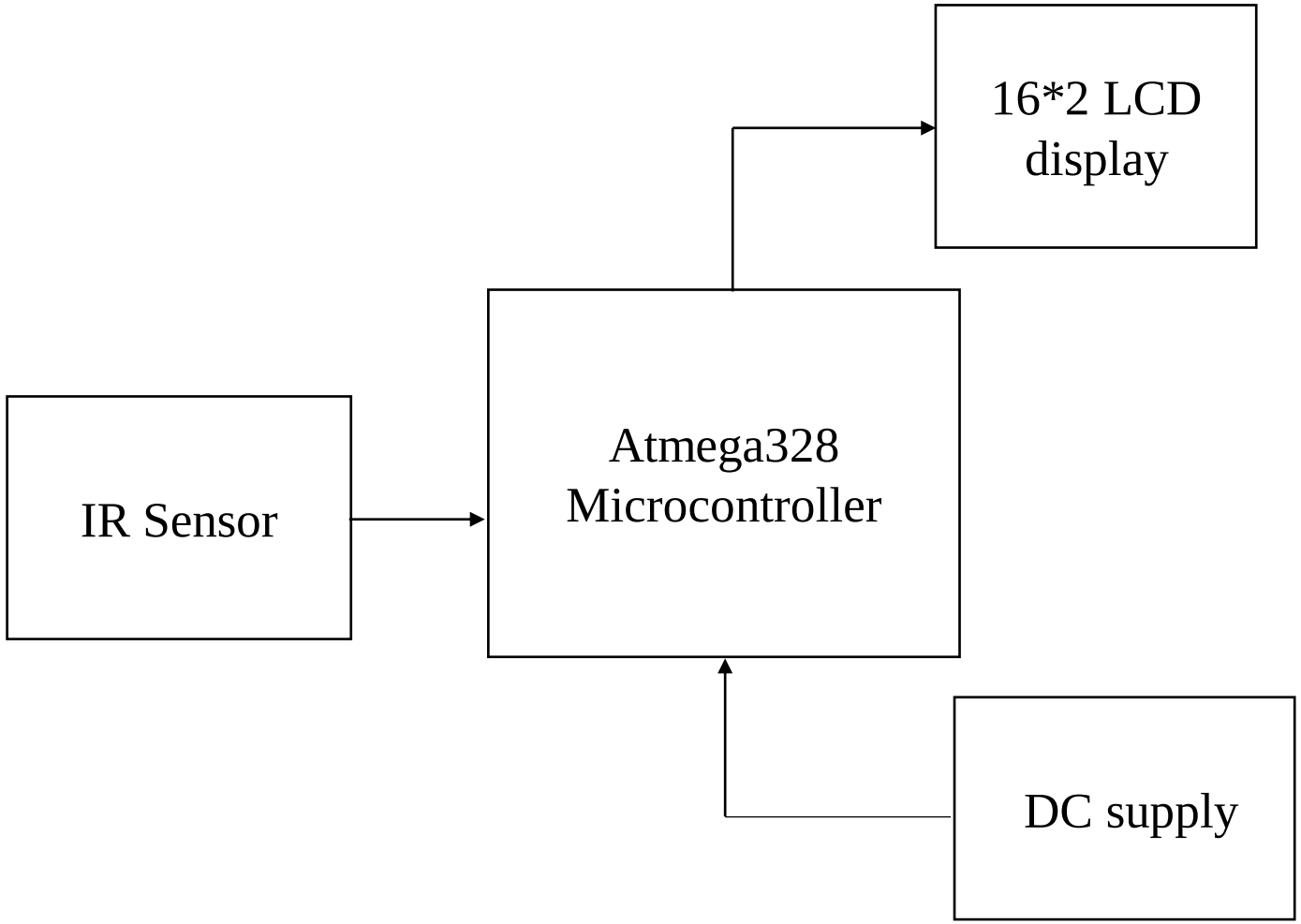


Figure1: Block diagram of the proposed work

- The block diagram consists of IR sensor used to sense the heart beat by detecting the changes in the blood flow through the finger with the help of artery that are closely connected to the skin.
- Every time the heart beats, it is sensed by the IR sensor and the LED turns on.
- The pulses sensed by the sensor are in analog form, these pulses are send to the microcontroller which converts the pulses to the digital form.
- The digital count of the heart rate is displayed on the LCD.

IR SENSOR

- This sensor unit consists of infrared light emitting diode and a photo diode placed side by side and fingertip is placed over the sensor assembly.
- The higher LED transmits an IR light to the fingertip in part of which is reflected from the blood inside the finger arteries.

- The photodiode senses the position of the light is reflected.
- The intensity of the reflected light depends upon the blood volume inside the fingertip.
- So, everytime the heart beats, the movement of reflected IR light changes which can be detected by the photodiode.
- The IR sensors detects the change in the density of the blood due to the heartbeat and the photodiode sends signal to the LPF which are cascaded.
- This signal is amplified and the pulses are given to an LED.
- As the heart beats, LED glows and the beats are recorded by the microcontroller and are displayed.

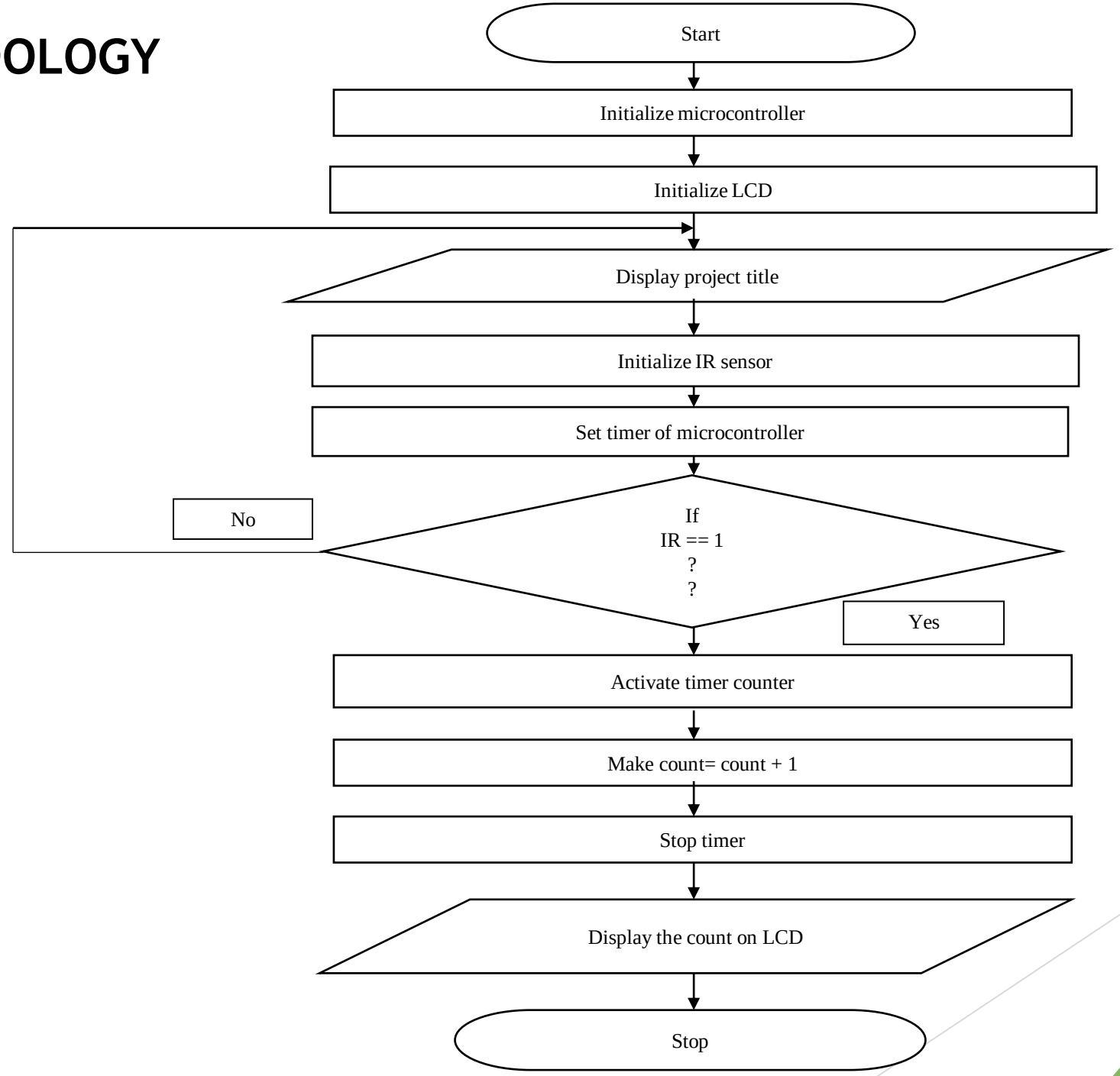
ARDUINO

- It is an open source microcontroller development board.
- We use Arduino to read sensors and control signals like motor and light.
- This allows the user to upload programmes to this board which can then interact with things in the real world.
- A TMEGA 328 is the Arduino which is used in our experiment.
- It runs at 8MHz.It has 9 digital input pins and 4 analog output pins.

LCD DISPLAY

- The digitized output obtained from the microcontroller is displayed on the LCD screen.

METHODOLOGY



This work includes the following steps:

- Step 1: Initialization of both microcontroller and the LCD is done, then the project title is made to be displayed on the LCD monitor.
- Step 2: IR sensor is initialized to detect the pulses by observing the fluctuations of the blood flow by undergoing the density of the blood. The output signal is obtained in the form of an analog signal or a voltage signal.
- Step 3: As soon as the IR sensor senses the pulse, LED turns on indicating that the heart pulse is detected. This output is fed as an input to the microcontroller.
- Step 4: Microcontroller is processed to perform the required operation with the help of an Arduino IDE software program. The timer gets activated and starts the count and measures the respective pulse rate.
- Step 5: finally, after counting the pulse rate the timer stops and the measured data are displayed on the LCD monitor.

RESULTS

1. Test to check the working condition of the proposed model.

- Initially the model is tested without placing the finger or any obstacle towards the sensor to check the perfectness of it.
- When the finger is not placed towards the senor, LED remains off, indicating that the sensor has not detected the pulse. So, the GUI graph remains empty and only the title will be displayed on the LCD monitor as shown in the figure below.
- This indicates that the proposed model is ready to undergo the test to calculate the heart pulse.

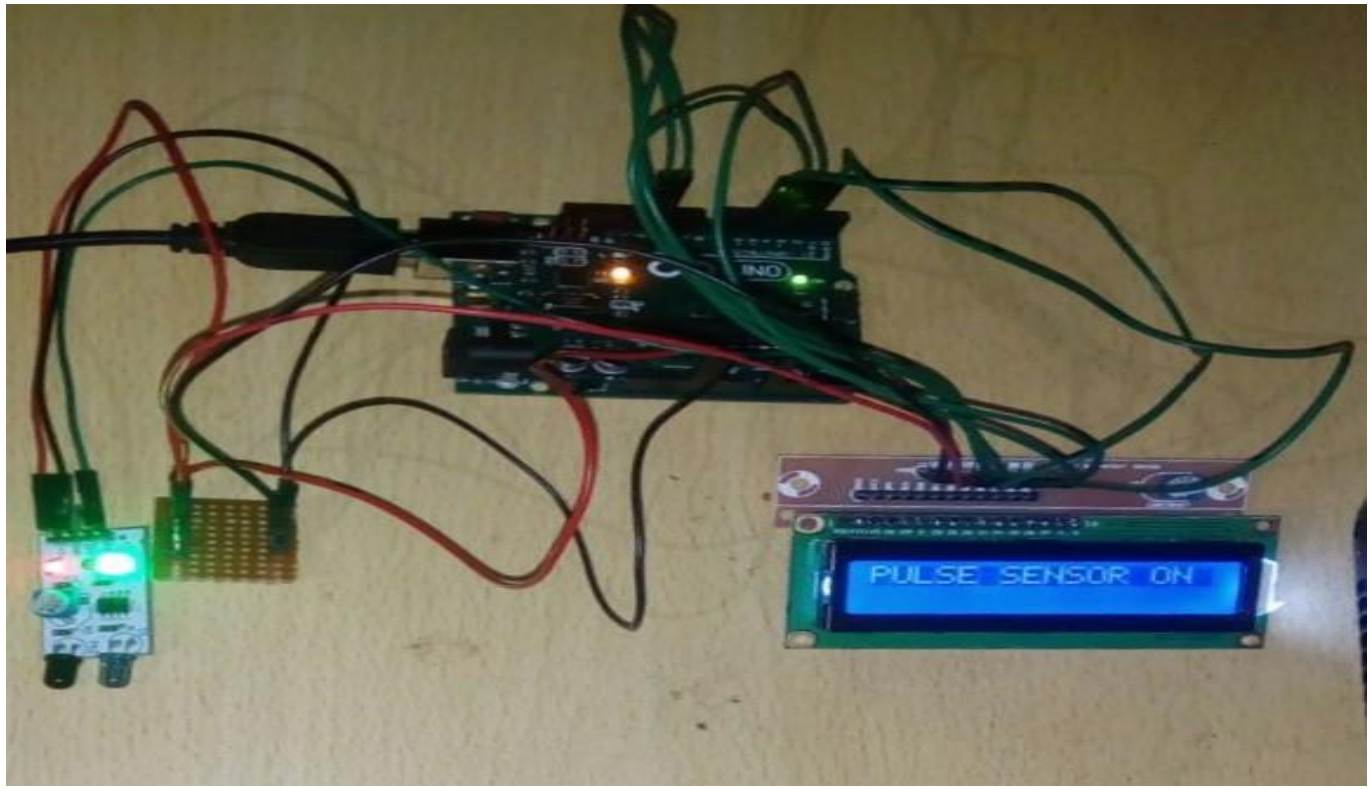


Figure 3: Tested view of the module

2. Test to detect the heart pulse

- Initially, the testing is performed by placing the finger towards the IR sensor. The finger has to be placed very close to the sensor to get more accuracy.
- IR sensor detects the pulse by observing the fluctuations caused in the blood flow. As soon as the pulse is detected the LED turns on. This detected pulse rate is viewed on the GUI and also displayed on the LCD monitor as shown in the figure below.

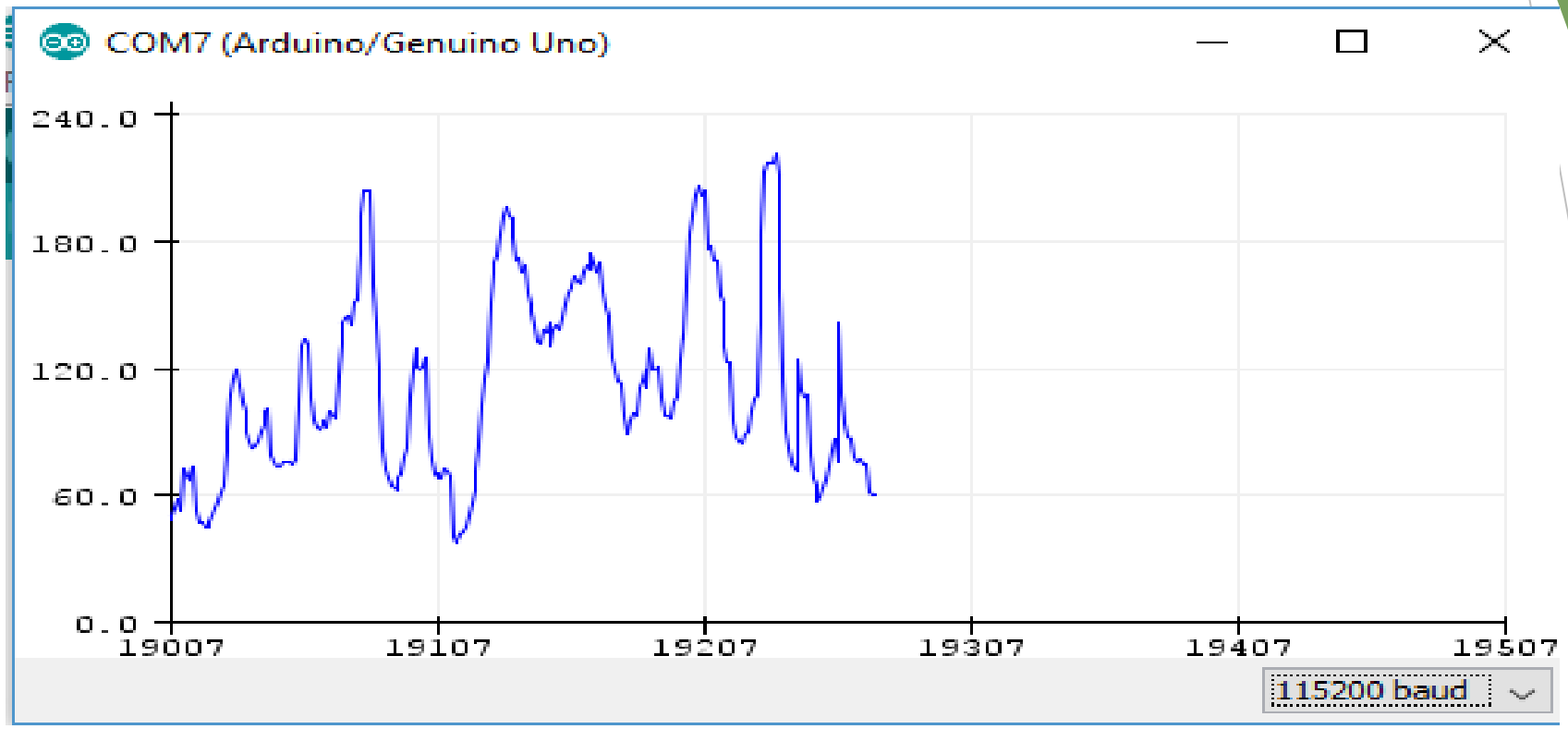


Figure 4: Tested GUI view of a detected heart pulses by the IR sensor

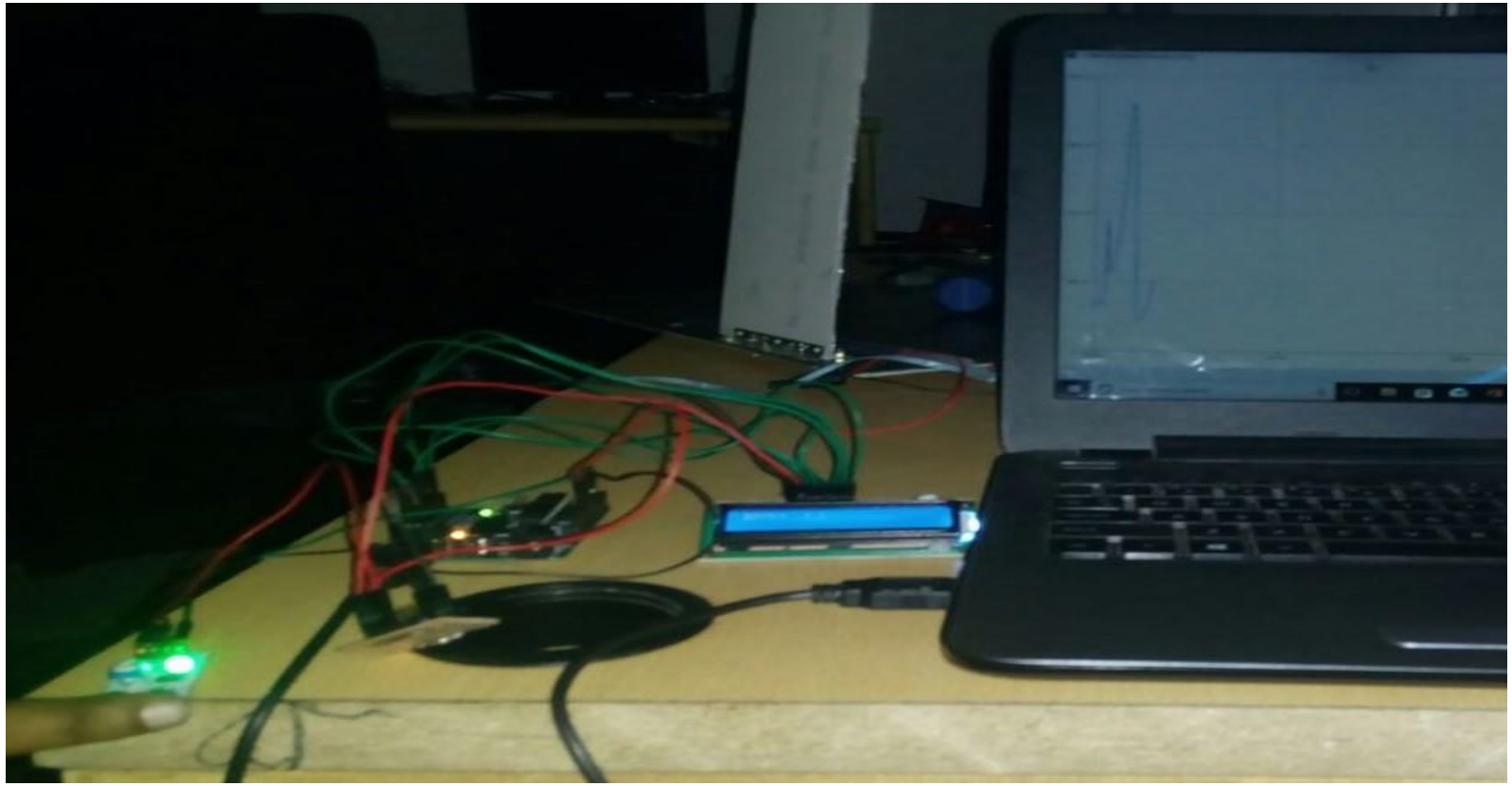


Figure 5: Tested view of module when the pulses are detected.

3. Final output of the proposed model.

- The detected pulses obtained by the sensor are voltage signals. Later on, this pulses are sent to the LED. The LED turns on and the signal is sent to the microcontroller.
- The microcontroller is processed by the Arduino IDE software which considers only the high frequency components of the detected pulses per minute as per the program is generated.
- This pulses are digitized and fed to the LCD monitor.
- LCD monitor displays the final count of a heart rate per minute in digitized form as shown in the figure below.

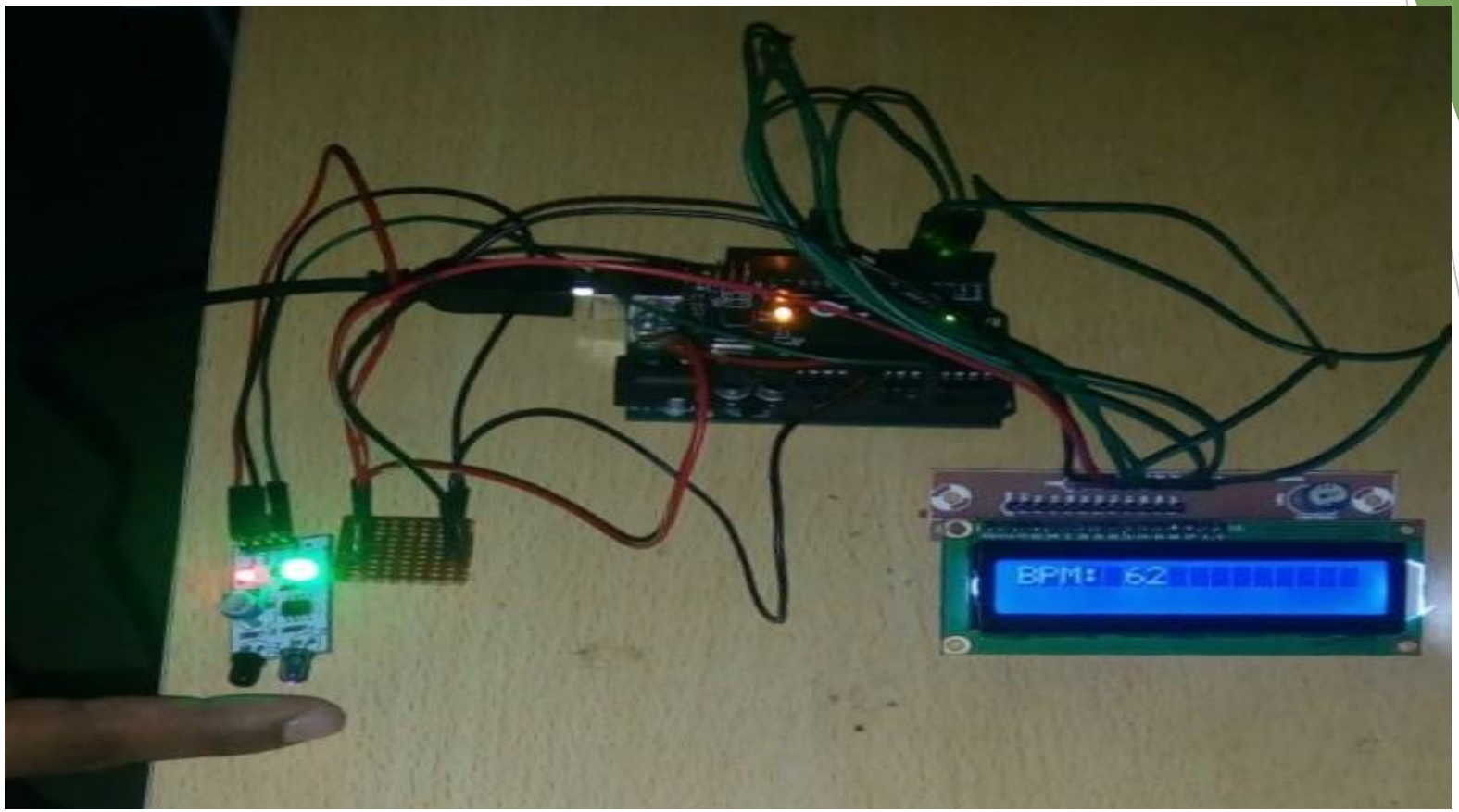


Figure 6: Final output of the proposed module.

4.Recognised heart conditions based on the detected heart rate

As it is verified by doctor a normal heart rate of a person varies with respect to different age groups. Some of the data of different heart conditions regarding the heart rate of a patient are recognised and shown below.

Table 3: different conditions of detected pulse rate.

SL NO	CONDITIONS	HEART RATE
1	NO PULSE RATE	Below 40 bpm
2	NORMAL CONDITION	60 to 100 bpm
3	ABNORMAL CONDITION	40 to 60 bpm
4	HIGH PULSE RATE	Above 100 bpm

4.1 No pulse rate

If the detected pulse rate of a patient is below 40 bpm then it is considered as no pulse rate and is displayed on the LCD monitor as shown in figure 7

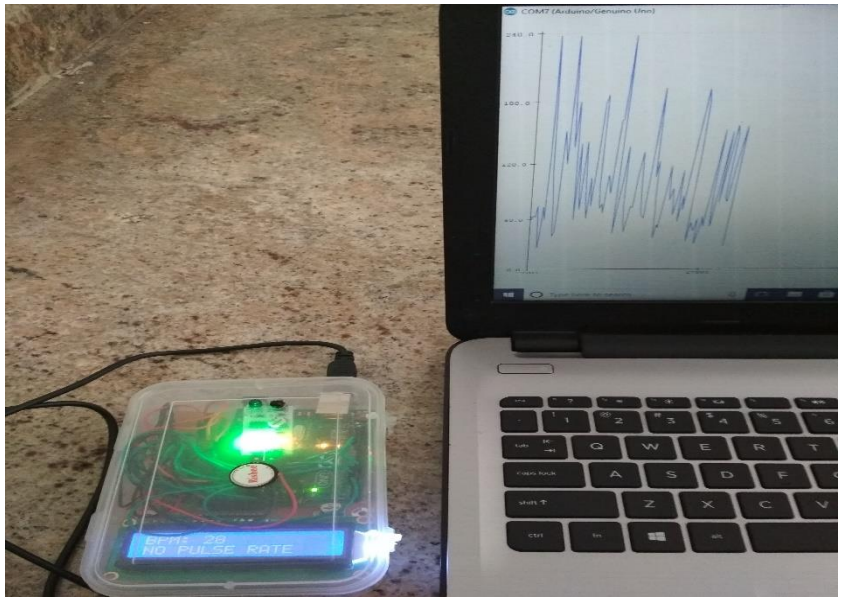


Figure 7: no pulse rate.

4.2 Normal condition

If the detected pulse rate is between 60 to 100 bpm then it is considered as normal pulse rte and displayed on the LCD monitor as shown in figure 8.

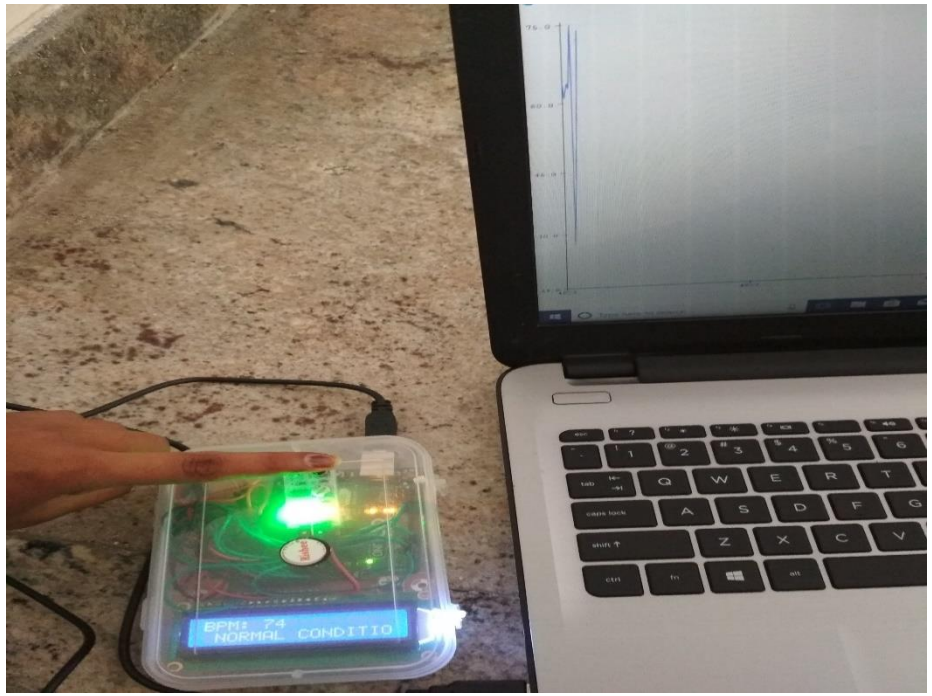


Figure 8: Normal condition

4.3 Abnormal condition

If the detected pulse rate is between 40 to 60 bpm then it is considered as abnormal condition and displayed on the LCD monitor as shown in figure 9.

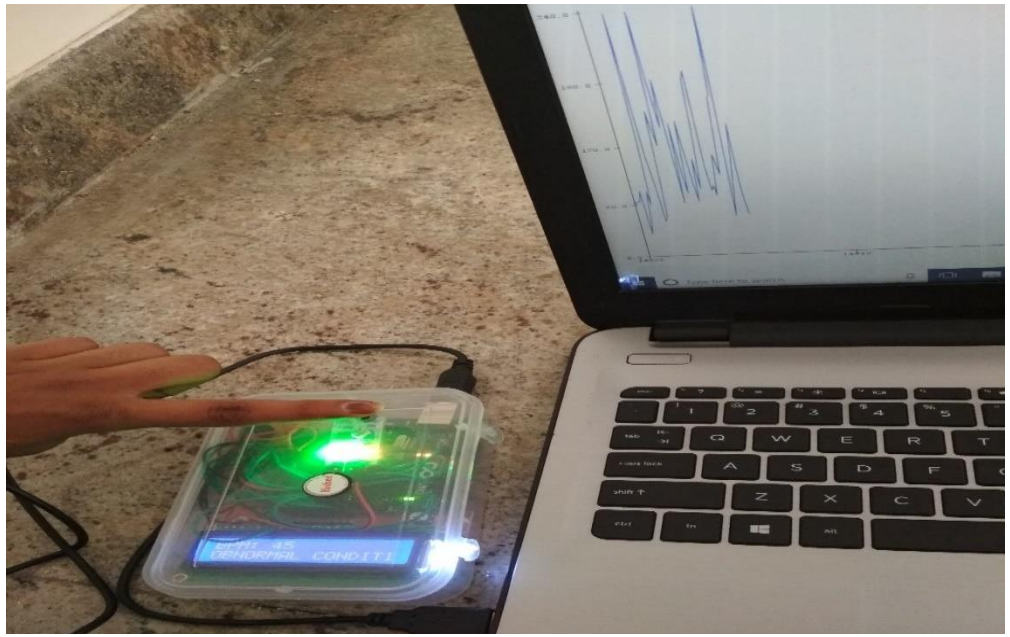


Figure 9: Abnormal condition

4.4 High pulse rate

If the detected pulse rate is above 100 bpm then it is considered as high pulse rate and it is displayed on the LCD monitor as shown in figure 10.

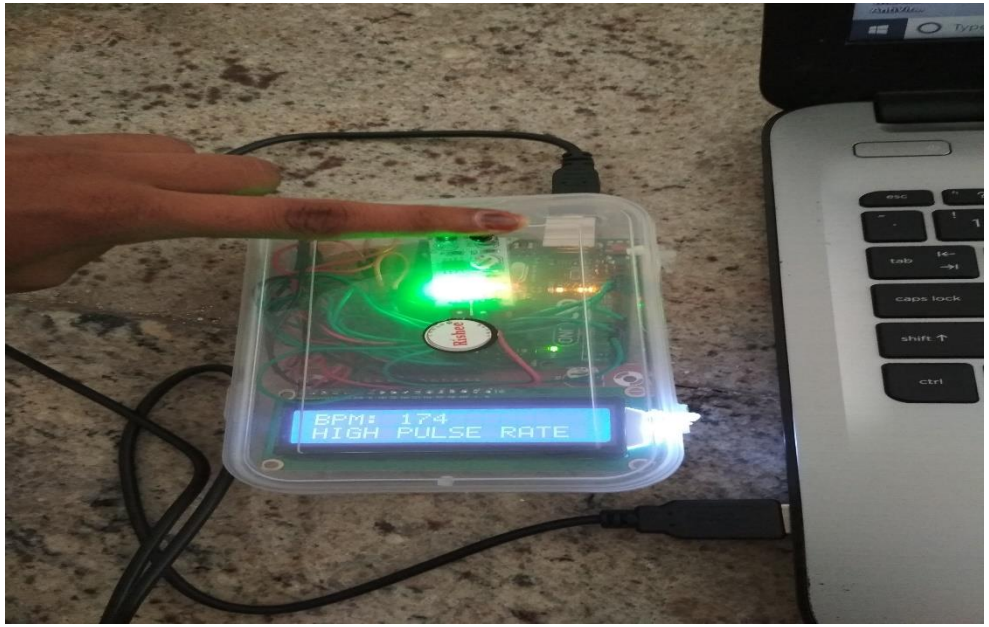


Figure 10: High pulse rate

APPLICATIONS

1. Industries: hospitalizing automations.
2. Health: useful for common man.
3. Medical application: A heart rate monitor can be a useful tool for anyone interested in exercise because it allows a person to manage the intensity of a workout.This is because personal fitness goals require exercise to be maintained at some target heart rate.

ADVANTAGES

- Low cost and low power consumption,
- Portable and accurate.
- Time consuming and user-friendly.
- Applicable to all age groups of humans.
- Environmental-friendly and less design complexity.

The project implemented a low cost, low power heart rate monitoring using microcontroller. Lists of accomplishments include: Adequately amplifying biological signal ADC conversion of analog signal Semi functional heart rate meter Functional notification and LCD heart rate display Use of low power components for battery operation.

DISADVANTAGES

- Due to the use of electronic components it lags behind in getting 100% accurate results.
- The component provided in market especially the component of infrared sensor are provided without datasheet or name to search about it. This is one of the drawback because the electrical characteristics of the components are unknown.

CONCLUSION AND FUTURE WORK

- The proposed working model functioned smoothly and the overall observation were made and the objectives were achieved successfully.
- The proposed work provides better service for the people to lead a healthy life by monitoring their heart condition from time to time on their own without the need of consulting the medical experts to check their heart rate.
- The device is made simple to use, portable, safety and applicable to all levels of users and very useful for a common man, especially for elders.
- In the future, this work is looking forward to include some more methods to make it more advanced.
- This proposed working model is more accurate due to the use of IR sensor as it provides more stable output, low cost and simple in design when compared to commercial devices that are currently available in the market.

REFERENCES

1. N.M.Z Hashim, N.A. Ali, A. Salleh, A.S. Jaafar, N.A.Z. Abdin, “Development of optimal photosensor based heart pulse detector”, faculty of electronics and computer engineering, University Technical Malaysia Melaka, Hang Tuah Jaya, 76100, Page no. 1-7. Durian Tunggal Melaka, Malaysia 2013.
2. Kala Venugopal, Amit Kumar, “Centralized heart rate monitoring and automated message alert system using WBAN”, International journal of scientific and research publications, page no. 1-4, 2013.
3. Anand Giri, Aparna Dubey, “Performance improvement of health monitoring system using wireless technologies”, International Journal for research in applied science and engineering technology (IJRASET), page no. 88-92, 2014.
4. T.S. Arulananth, B. Shilpa, “Fingertip Based Heart Beat Monitoring System Using Embedded System”, IEEE conference, 2017.
5. Bandana Mallick, Ajith Kumar Patro, “Heart Rate Monitoring System using Fingertip through Arduino and Processing software”, International Journal of Science, Engineering and Technology Research (IJSERT), page no. 84-89, 2016.
6. Liena Elrayah Abdelkhair Khairelseed, “Microcontroller Based Heart Rate Monitor using Fingertip Sensor”, university of Khartoum, 2011.
7. Gulati M, Shaw I.J, Black HR, Merz CN, “Heart Rate Response to Exercise Stress Testing in Asymptomatic Women”, June 2010.
8. M.M.A. Hashem, Rushdie Shams, Md. Abdul Kadar, “Design and development of a heart rate monitoring device using fingertip”, International Conference on Computer and Communication Engineering (ICCCE2101) Kuala Lampur, Malaysia, 2010.