Heart Rate Monitoring using Arduino

[1]Manasa S, [2]RakshithaY and [3]Sanikakuttappa.K

[1,2,3] Department of Electronics and Communication Engineering, AMC Engineering College, Bangalore, India.
[1]rakshithay004@gmail.com, [2]sanikakuttappa@gmail.com, [3]manasa.srinivas@amceducation.in

©2023 The Authors. Published by AnaPub Publications.

Abstract - Pulse rate sensor is utilised in our project to measure heartbeat with the help of fingers. Patient heart beat needs to be continuously checked. This project uses sensors to measure heart rate. These sensors are connected to lcd to analyse the conditions of a patient. This module is an Arduino based which uses microcontroller and sensors to monitor patients heart rate. It supports very low data rates for sensor and medical healthcare applications.

Keywords - Pulse Rate Sensor, Heartbeat, LCD, Arduino.

I. INTRODUCTION

Patients with critical illness basically suffer from failure of organ systems in their body such as the heart, liver, kidney, brain, or lungs. So, we need better equipment and well-trained workforce for taking care of patients who require continuous attention when their health is critical. Home-bound patients suffer a lot because of their health parameter variations during emergencies. The situation becomes worse when they struggle with other chronic diseases related to heart, diabetes etc [1]. A reliable assistance technology is needed while monitoring home-bound patients. The situation turns to be worse when home-bound patients are bedridden. Many health issues along with their disabilities will make the situation more horrible [2].

That is why care providers should treat these patients with extra care. A boon to the home bound bedridden patients could be a device that can solve all these problems together [3]. The aim of this project is to construct a working model which continuously monitors the pulse rate of the patients. The main components of our project include arduino, heart rate sensor and lcd.

II. OBJECTIVE

The project aim is to detect the heart beat rate of the patient whether it is high, low or normal. The heart rate is then displayed on the lcd screen.

III. LITERATURESURVEY

Non-Contact Methods
The basic ideology of using non-contact methods is while using electrical apparatus we should consider the safety measures and also to monitor patient's health conditions. It is easy to monitor both the patients as well as the environment. Initially in ECG recordings non-conductivity of the electrodes was proposed which used the concept of fixed in the environment. The sensor was attached to the bed or any other object and the vibrations of the skin was monitored using seisomocardiography by using the technique called. "Ballistocardiography". Ultrasounds is used to monitor the actual heart movements with the help of sound waves produced by the heartbeat. The images of various heart parameters can be obtained using ultrasounds [4]. Few costly methods give the detailed images of human's entire body like "Magnetic Resonance Imaging (MRI)" and "Computer Tomography (CT)". The methods proposed initially was affordable by everyone, they were based on heavy and expensive. Light-weight and compact methods came as solutions later. The data required was offered by non-contact methods with the help of electromagnetic waves at certain frequencies which can penetrate through some of our body tissues. The basic principle of non-contact heart rate monitoring includes different laboratorial solution, Image based monitoring system, electrical impedances, ultrasounds. The actual reflections from the heart are not actually observed since they do not involve the physical contact with patient's body Fig 1. Only they recorded bodies surface movements. Contacted approaches only which requires a lot of control serve as substitute method to overcome sudden infant death syndrome (SIDS) and burn victims [5].

Non-contact methods are characterized into four types namely.
Systems based on laser
Systems based on radar
Systems based on images
Systems based on other monitoring
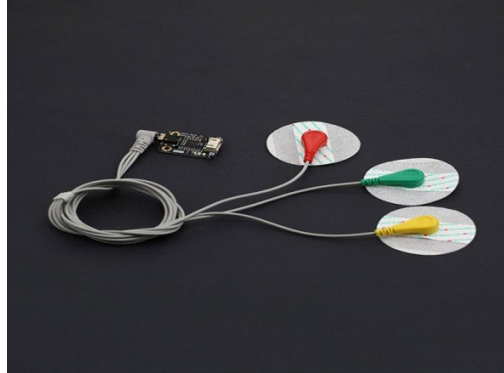
Fig1. Electrodes used for ECG signal measurement

EM Based-Medical Radar System
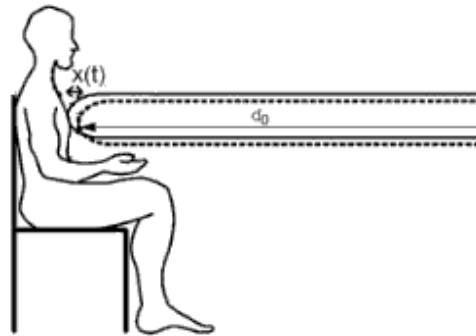
Fig 2. CW radar monitoring of the chest movement

To monitor the physiological movements of the human body electromagnetic waves which are of considerable frequency is used. Human heart rate can be detected from few meters distance with the use of medical radar technology [6]. Radio detection and Ranging is the abbreviation of RADAR. The range angle and the range velocity of the object with the help of radio waves is sensed by radar [7]. Radio waves frequencies ranges from 3KHz to 300GHz.Blood pressure monitoring and other changes in the heart rate can be done using radar so that different diseases can be recognized [8]. The heart beat from a particular distance can be measured by considering the frequency range of few MHz to 200GHz.Without connecting the patient and measurement equipment's wireless recordings of the patient's heartbeat can be made instantly. Radars actually depict the exact chest actions resulting due to the heartbeat unlike ECG which records only the electrical activity of the heart shows Fig 2.

Based On Imaging
Based on the skin deflections the image-based systems for heart rate monitoring can be visualized. The skin deflections will occur by two methods. In the first method skin will be illuminated by a 2mW HeNe laser beam in the veins and the scattered speckle pattern is observed accordingly from which a digitized code is to be implemented based on speckle image processing. This can be used to evaluate the skin displacement caused by the arterial deflections due to the systolic pressure inside the vascular branches [9]. In the second way of approach a mirror of small size is glued to the skin which has to be illuminated by the laser beam. Later by intersection of the reflected beam the position of the light spot takes place which is recorded and plotted the heart rate remote sensing can also be done. However proper quantitative analysis is not given by both the methods, soby the graph it is understood that they are completely in non-correlation with original reference signals which is the ECG signals shows Fig 3.
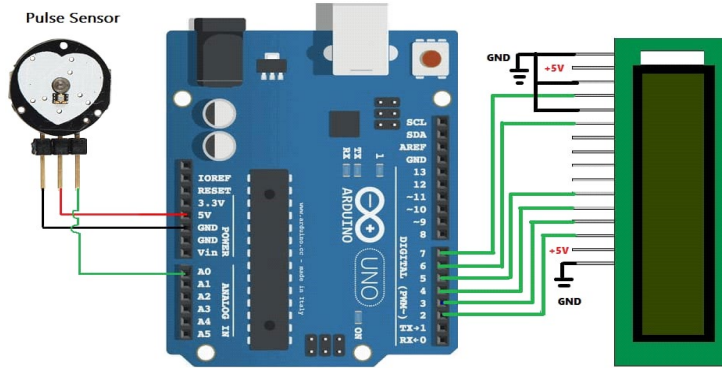
IV.CIRCUITDIAGRAM

Fig 3. Circuit Diagram

V.WORKING

This project is a functioning model which uses sensors to measure parameters like pulse rate. This model is an arduino based simple circuit microcontroller and biomedical sensors to monitor patients heart rate. To read the heartbeat of a person heart beat sensor or pulse sensor is used. In order to keep our body healthy, the basic things we generally monitor are the body temperature, heart rate and blood pressure. Heart Rate can be checked by checking the pulse at wrist or neck. Also, heart rate can be detected using sensor or.In this project by keeping finger on the sensor heartbeat is detected .

The volume of blood inside the fingertip increases when the heart expands and the volume of blood inside the fingertip decreases when heart contracts. The heart rate in beats per minute (bpm) is the heart rate and the count of number of pulses in one minute, itis directly proportional to the resultant blood volume inside the fingertip. So, our fingertip is placed on the LED of sensor. When the heart beats, this reflects more infrared waves to sensor because the volume of blood cells under the sensor increases the reflected beam decreases when there is no beat intensity [10]. Voltage pulse or current is produced by the sensor due to pulsating reflection. By suitable electronic circuits the sensor output is processed and displayed [11].

VI.BLOCKDIAGRAM

Block diagram of heart rate monitoring system using arduinois as shown below. The main component of this module is arduino board which is connected to pulse rate sensor and LCD display. Pulse rate sensor is connected to analog pin of Arduino Uno board so as to measure the human pulse rate. The pulse rate detected by the sensor is compared with the normal threshold value of human heart rate depending on which the condition of heart beat whether it's normal, high or low is displayed using lcd display shows Fig.4.
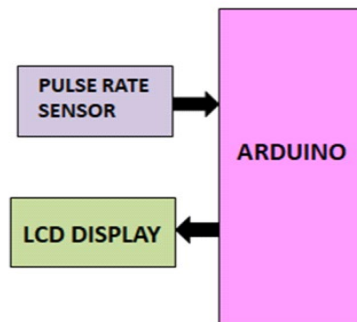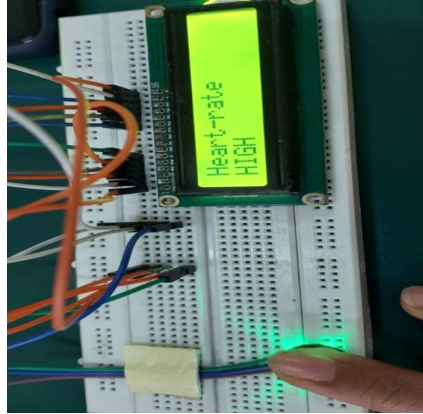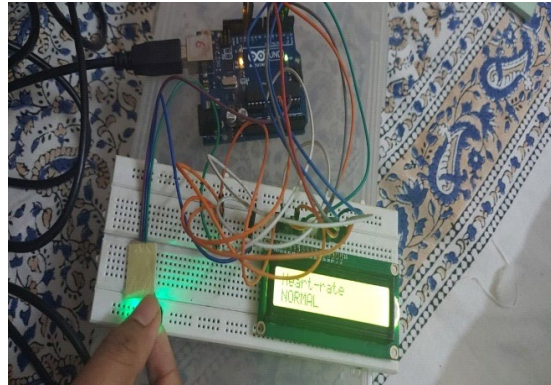

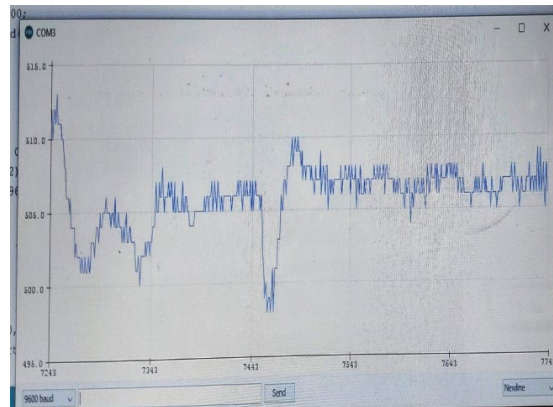**Fig 4.** Block diagram of heart rate monitoring system

VII.RESULT

Fig 5. Lcd Displaying Heart Rate High When Patient Keeps His Finger on the Sensor

Fig 6. Lcd Displaying Heart Rate Low When Patient Keeps His Finger on The Sensor

Fig 7. Heart Rate Representation in Serial Monitor

VIII.   CONCLUSION

This model helps to check the heart rate of the patients. Patients can use this model for checking whether their heart rate is normal high or low shows Fig.7. The patient needs to keep their finger tip on the heart rate sensor meanwhile the lcd will display whether the heart rate is normal, high or low. If it is normal, it's not an issue but if it is high or low than the patient has to consult a doctor shows Fig.5 and Fig.6. This model saves patients time as well as life.

References

[1]. Patil, Minal; Madankar, Abhishek; Khandait, P. D. (2019). [IEEE 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS) - Coimbatore, India (2019.3.15-2019.3.16)] 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS) - Heart Rate Monitoring System., (), 574–576. doi:10.1109/ICACCS.2019.8728501

[2]. Hari Kiran Pendurthi; Siva Sai Kanneganti; Jaswanth Godavarthi;S. Kavitha;Hemanth Sai Gokarakonda; (2021). Heart Pulse Monitoring and Notification System using Arduino. 2021 International Conference on Artificial Intelligence and Smart Systems(ICAIS),(),. doi:10.1109/icais50930.2021.9395825

[3]. Pawar, Prajakta A. (2014). [IEEE 2014 Conference on IT in Business, Industry and Government (CSIBIG) - Indore, India (2014.3.8-2014.3.9)] 2014 Conference on IT in Business, Industry and Government (CSIBIG) - Heart rate monitoring system using IR base sensor & Arduino Uno. , (), 1–3. doi:10.1109/csibig.2014.7057005

[4]. carlos faustina and K. Xie, "Study of a Low-cost Heart rate Remote monitoring system using the Arduino platform," Jun. 2021, doi: 10.36227/techrxiv.14633142.

[5]. M. Babu. Kolimpalle, "Heart Rate Monitoring using Arduino," International Journal for Research in Applied Science and Engineering Technology, vol. 9, no. VII, pp. 1422–1427, Jul. 2021, doi: 10.22214/ijraset.2021.36353.

[6]. P. A. Pawar, "Heart rate monitoring system using IR base sensor &amp; Arduino Uno," 2014 Conference on IT in Business, Industry and Government (CSIBIG), Mar. 2014, doi: 10.1109/csibig.2014.7057005.

[7]. D. Putra and I. Fahruzi, "Design and Implementation Internet of Medical Things for Heart Rate Monitoring System using Arduino and GSM Network," 2021 International Seminar on Application for Technology of Information and Communication (iSemantic), Sep. 2021, doi: 10.1109/isemantic52711.2021.9573244.

[8]. F. M. Yassin, N. A. Sani, and S. N. Chin, "Analysis of Heart Rate and Body Temperature from the Wireless Monitoring System Using Arduino," Journal of Physics: Conference Series, vol. 1358, no. 1, p. 012041, Nov. 2019, doi: 10.1088/1742-6596/1358/1/012041.

[9]. S. Mukherjee, A. Ghosh, and S. K. Sarkar, "Arduino based Wireless Heart-rate Monitoring system with Automatic SOS Message and/or Call facility using SIM900A GSM Module," 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN), Mar. 2019, doi: 10.1109/vitecon.2019.8899504.

[10]. Md. Asaduzzaman Miah, Mir Hussain Kabir, Md. Siddiqur Rahman Tanveer, and M. A. H. Akhand, "Continuous heart rate and body temperature monitoring system using Arduino UNO and Android device," 2015 2nd International Conference on Electrical Information and Communication Technologies (EICT), Dec. 2015, doi: 10.1109/eict.2015.7391943.