

IOT BASED HEART ATTACK DETECTION AND HEART RATE MONITORING SYSTEM

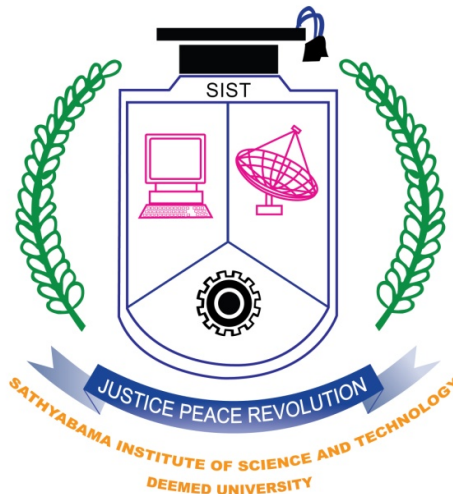
Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

by

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of JOTHIKA P (Reg. No. 39140020) and PRADEENA G (Reg. No. 39140041) who carried out the project entitled "IOT BASED HEART ATTACK DETECTION AND HEART RATE MONITORING SYSTEM" under our supervision from November 2022 to April 2023.

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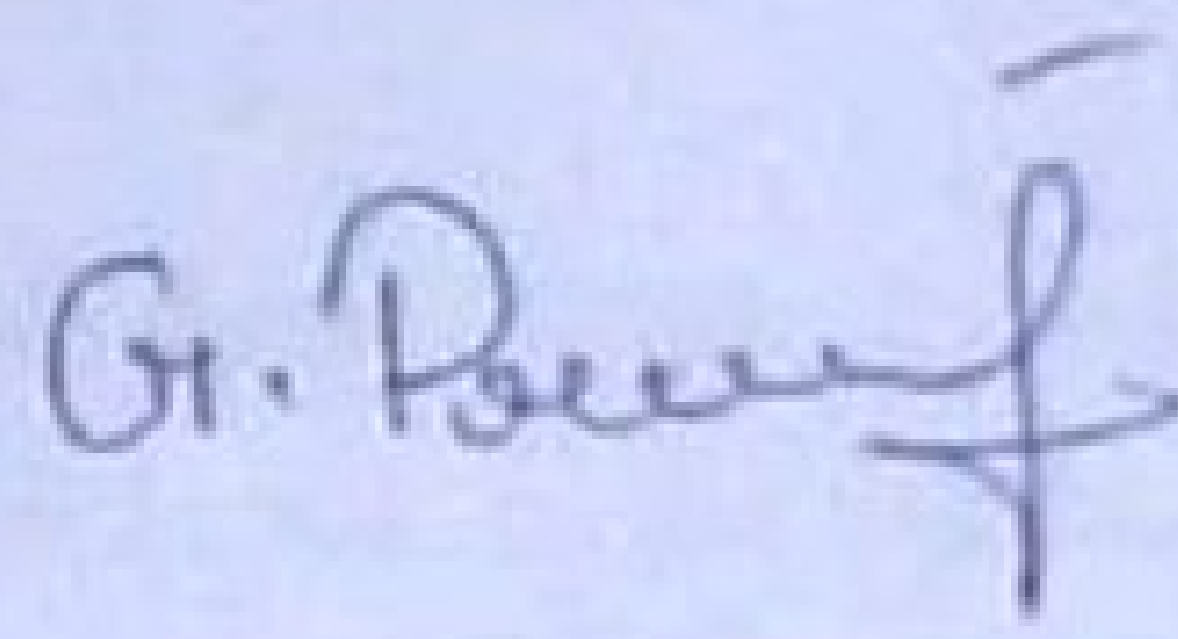
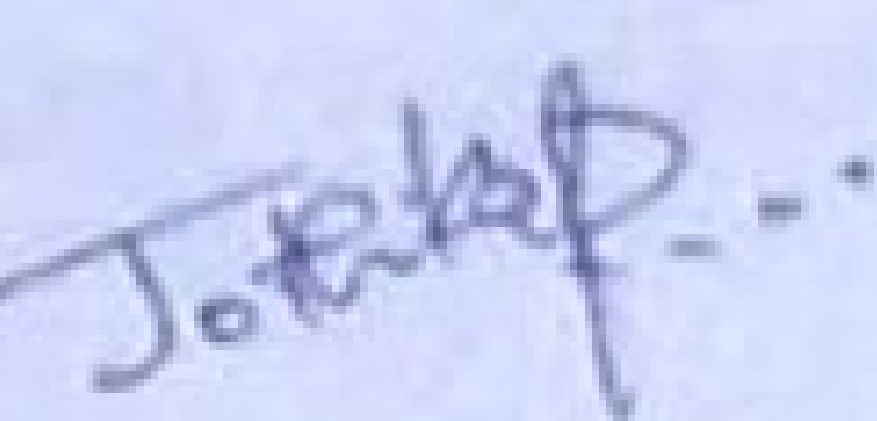
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DECLARATION

We JOTHIKA P (Reg No. 39140020) and PRADEENA G (Reg. No. 39140041) hereby declare that the Project Report entitled "IOT BASED HEART ATTACK DETECTION AND HEART RATE MONITORING SYSTEM" done by us under the guidance of Dr. S. D. SUNDARSINGH JEBASEELAN is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering

1. 
2. 

DATE: 26/04/2023
PLACE: Chennai

SIGNATURE OF THE CANDIDATES

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ABSTRACT

Nowadays people have heart illnesses ,increased risk of heart attacks are more prevalent today. This project which helps to detect heart rate of person using GSR sensor even if person is at home. this project helps to measure body temperature ,heart beat of person. The GSR sensor which is interfaced with microcontroller that can verify heart rate values and transmit them over the internet using WIFI module . the user has the option to establish a heartbeat restriction that is both high and low. Following the establishment of these restrictions, the system begins monitoring. When the patients heart rate exceeds a certain threshold, the system sends a notification to the controller, which then broadcasts this over the internet and notifies the doctors and respective relatives . this project also warns when a heartbeat is too low.

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LIST OF SYMBOLS AND ABBREVIATIONS

BPM	-	Beats Per Minute
ECG	-	Electrocardiography
PVC	-	Premature Ventricular Contractions
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
PPG	-	Photo-Plethysmography
BCG	-	Ballistocardiography
MCU	-	Multipoint Control Unit
PTT	-	Pulse Transit Time
UART	-	Universal Asynchronous Receiver Transmitter
CABG	-	Coronary Artery Bypass Grafting
WBAN	-	Wireless Body Area Network
PIEM	-	Portable Intelligent ECG Monitor
MQTT	-	Message Queuing Telemetry
SHS	-	Smart Hospital System
WSN	-	Wireless Sensor Network
SMS	-	Short Message Service
PHDs	-	Personal Healthcare Devices

CHAPTER 1

INTRODUCTION

1.1 GENERAL

The heart rate monitoring and heart attack detection system that will be built using the onboard Wi-Fi module is described in this project. The ability to transmit patient information to a doctor or other healthcare practitioner continuously as well as in an emergency is what makes remote monitoring such a successful technique of providing urgent care. Remote patient monitoring will transform healthcare in general. In addition to work, home, and leisure pursuits. We can regularly check patients thanks to these modern technology, replacing the requirement for repeated trips to the neighborhood doctor. According to a recent survey, chronic disorders are the main reason for deaths in India. People with chronic illnesses have their vital signs continually checked. signals of life. include determining the temperature, heart rate, Internet of Things (IoT) It's often said to be a collection of real things. Everyone knows that the internet is a network of Instead of only being a network of computers, the internet has evolved into a network of all kinds of objects, including cars, smart phones, household appliances, toys, cameras, medical equipment, industrial systems, animals, people, and even buildings. These items are all interconnected and in communication with one another To achieve location, tracking, safety, and control, as well as individual real-time online monitoring, etc., information sharing and clever reorganizations based on defined protocols are used. The Internet of Things (IoT) in general offers a picture of objects like alarm clocks, wearable watches, and home appliances becoming intelligent and alive through communication, sensing, and computation by embedding small devices.

This project proposes a heart rate monitoring detection system using IoT. Nowadays treatment of most of the heart-related diseases requires continuous as well as long term monitoring. IoT is very useful in this aspect as it replaces the conventional monitoring systems with a more efficient scheme, by providing critical

information regarding the condition of the patient accessible by the doctor. In addition, the nurses or the duty doctor available at the hospital can monitor the heart rate of the patient in the serial monitor through the real-time monitoring system.

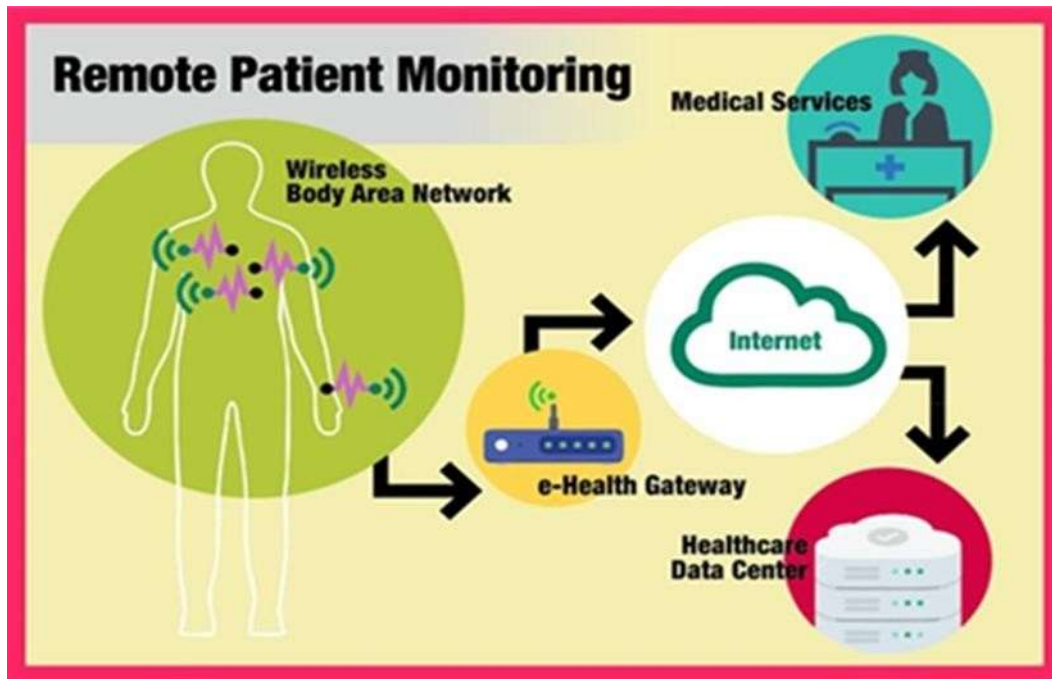


Fig 1.1 IOT monitoring for patients in hospitals

1.2 MOTIVATION FOR THE SELECTION OF PROBLEM

Organizations should prioritize occupational H&S because of the increasing number of accidents and injuries at workplaces, such as dangerous equipment, electricity, toxic substances, fire or any other kinds of working hazards. The importance of H&S at the workplace is deduced from the importance of human resources because human loss is priceless and unbearable for families and organizations. H&S management in the workplace is important to protect workers' lives because their productivity and loyalty increase when they are healthy and

happy. Therefore, decision makers in all industries should focus on the H&S conditions in the workplace by minimizing accidents that continuously occur on a daily basis to promote the wellness of employees and employers. Accidents that resulted from lack of safety conditions force employees to be absent from work and lead to huge losses.

H&S products should be prioritised when managing workplace accidents because they save the lives of workers who are exposed to such accidents and hazards at work. First aid boxes should be prioritised because it directly helps save peoples' lives. Any item that is missing from the first aid box to aid an injured person may lead to fatal loss. Fire extinguisher is another imperative safety product because its absence could cause huge damage to people, buildings and the organisation's wellbeing. Another product is ear plug dispenser, which has a special importance in protecting employees who are exposed to long periods of high-level noise that could cause hearing loss.

Traditionally, monitoring the H&S data is manually accomplished every week, month or year, in which the status of the equipment, such as leak or damage, might change. In this way, the building service manager cannot update the information to maintain equipment compliance. The manual checking of H&S products requires high wages for several employees to continuously check these products. All the aforementioned reasons are the motivations of this study.

1.3 OVERVIEW

The IoT based Heart Attack Detection and Heart Rate Monitoring System is a project that aims to provide a real-time monitoring solution to track and detect heart-related anomalies. The system consists of multiple sensors that are placed on the body of the patient, which continuously monitors the heart rate, blood pressure, and other vital parameters. The collected data is then transmitted to the cloud-based platform for further analysis and monitoring .

The system is designed to detect any abnormal changes in the heart rate and other vital parameters and provide immediate alerts to the healthcare professionals or the concerned family members. This early detection can help to prevent heart attacks

and other cardiac-related diseases. The project uses IoT technology to connect various devices and sensors, which work together to provide real-time data. The system is based on wireless communication protocols such as Bluetooth and Wi-Fi, which enables seamless data transmission between the sensors and the cloud-based platform. The heart attack detection and heart rate monitoring system can be useful for patients suffering from cardiovascular diseases or people who are at high risk of heart attacks. The system can also be used by healthcare professionals to monitor the health of patients in hospitals or remote locations.

Overall, the IoT based Heart Attack Detection and Heart Rate Monitoring System can play a crucial role in preventing heart-related diseases and improving the quality of life for patients suffering from cardiovascular diseases.

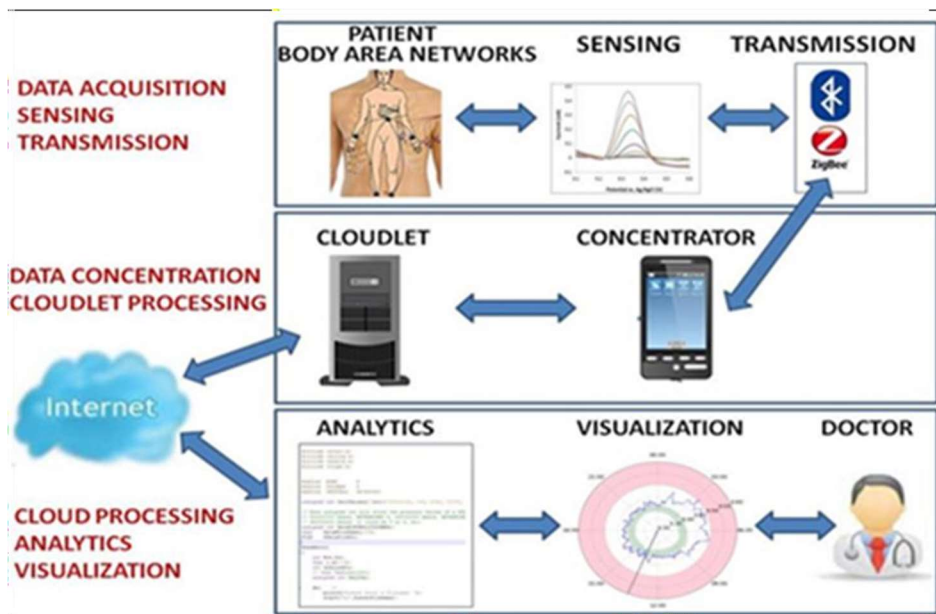


Fig 1.2 IOT for Doctors

CHAPTER 2

LITERATURE SURVEY

2.1 MAJOR FINDINGS FROM LITERATURE SURVEY

D.Selvathi et al., (2017) proposed Embedded based automatic heart attack detector and imitator, When a finger is placed on a heartbeat sensor, a digital output of the heartbeat is intended to be produced. The LED flashes in time with each heartbeat as soon as the heartbeat detector begins to function. a heartbeat When the sensor blinks, one LED represents one pulse. The microcontroller can be attached to this digital output. the rate of Beats Per Minute (BPM) is directly measured. It is effective. based on the idea that blood flow via a lens causes light to change finger each pulse with. It keeps a constant watch on the heartbeats of the uninterrupted individual. The supplied digital square wave form is converted by the microcontroller into the number of pulses. The controller part of the heart attack detector and intimator system uses a PIC16F877 controller to operate the heart attack detection algorithm programme. It determines whether the heartbeat is normal or pathological using this algorithm. The controller activates the GSM module whenever an aberrant heartbeat (defined as a BPM of less than 60 or more than 90) is found. SIM300 GSM GPRS Modem is a highly flexible plug and play modem based on tri band SIM300 GSM module. Industrial quality PCB with adequate grounding for better performance and noise immunity. SIM 300 is a tri-band GSM / GPRS engine works on frequencies GSM 900MHz, dcs 1800 MHz and pcs 1900 MHz. Heart beat sensor has a direct contact with the huma finger to detect the heart beat of the human. The output of the sensor is given to the microcontroller section which runs a heart attack algorithm which is already programmed into it. If abnormal heartbeat is detected, then it activates the GS module. GSM module will intimate to the helpline, thereb the life of the person can be saved.

Andriy Temko et al., (2017) proposed Accurate heart rate monitoring during physical exercise using PPG. An innovative technique (WFPV) that makes use of a

Wiener filter to attenuate motion artefacts and a phase vocoder to improve the Tracking the subject's physiology using an HR estimate and user-adaptive post-processing. Additionally, an offline variant of the Viterbi decoded HR estimation. The algorithms provide average absolute errors of 1.97 and 1.37 on the entire dataset of 23 PPG recordings. HR monitoring can help athletes adjust their training load and more effectively match their programmer. In place of conventional Electrocardiography (ECG)-based HR measurement, PPG signals have gained popularity. biopotential produced by electrical signals is measured. govern the heart's chambers' expansion and contraction. However, the existence of ground and reference sensors is necessary for ECG. it needs to be secured to the chest. PPG-based HR monitoring at the extremities, such as the wrists, fingertips, or earlobes, is seen to be a far more practical alternative. The PPG signals come from PPG sensor which are embedded in these wearable devices. A PPG sensor emits light to the skin and measures the changes of intensity of the light which is reflected or transmitted through the skin. The periodicity of these measurements in most cases corresponds to the cardiac rhythm, and thus, HR can be estimated from the PPG signal.

Priyanka Sasidharan et al., (2018) proposed Wearable Cardio respiratory Monitoring device Heart attack prediction. A wearable cardio respiratory monitoring system that could concurrently monitor and show 4 parameters on a phone screen or a computer monitor in real time. PC monitor a heart rate evaluation prototype system, respiration rate and oxygen saturation in nearby capillaries and designed temperature. the equipment will be reasonably priced. And wearable and little in size on a daily basis. photoplethysmography is the measurement of heart rate (PPG). there is a change in blood volume with regard to each heartbeat as blood flows through an organ or a blood artery. a light is shone through the exposed skin and the blood volume changes its intensity will alter accordingly. the arduino microcontroller has an AT mega 328p microprocessor which has 14 digital pins and it is connected to programming and shows prototype while measuring data. When detected heart rates are plotted as a graph we get a spectrum with numerous peaks. From this, a Pulse Transit Time (PTT) can be calculated which can be converted as respiration rate through signal processing both ECGR wave and PPG peak can be

recorded as aa time or amplitude series. Now the PTT series can be derived from them. To make the extracted series smooth a linear interpolation method is used. Now an FIR filter is applied to these obtained interpolated signals. Respiration rate is normally calculated in one minute data segments. the Spo2 Sensor.Fingertip sensor that can be used for this purpose. Using transmissive arrangement of a sensor and detector SpO2 can be measured from the change in light intensity. According to the change in intensity of red color the color detected in the detector also changes and from this spO2 value can be derived. Normal SpO2 values ranges from 95% to 100% for a healthy individual. Pulse oximetry works on the basis of Beer Lamberts law . technique can even be helpful in asthma patients or other respiratory disorders. The earlier proposed system used MATLAB programming for the determination of respiration rate and this system is entirely dependent on the android system using mobile phone. This makes the system more handy and comfortable to be a wearable device.

MD Rysul kibria Badhon et al., (2019) proposed A Microcontroller based missing heart beat detection and real time heartbeat monitoring system. This paper describes a technique to develop a mobile device where heart rate is measured through a pulse sensor, Arduino Uno board and microcontroller ATmega 328p which is based on the PPG process. The system can monitor heart rate, detect missing heart beats due to premature ventricular contractions (PVCs) and initially display the information on a Liquid Crystal Display (LCD). Then the heart rate and missing beat information is transmitted serially to ESP 8266 Wi Fi module that uploads the information to a website through Message Queuing Telemetry Transport (MQTT) protocol. With timely missing beat detection a person can be notified prior to a potential heart attack or other heart vulnerabilities. The same data is again processed by Arduino UNO and The receiver needs to login to the website from computer/cell phone and see the values uploaded from the sensor end continuously. The same heart rate with missing pulse information calculated above by microcontroller will be shown on the website. Power is supplied to the device via an USB cable. So there are many the options available to power proposed device. To reduce the environmental noise affecting the received signal, the PPG signal can

be compared with the output of a triple axis accelerometer during motion. the pulse sensor can be further improved by introducing better noise immunity. This device can be further improved to measure blood pressure and respiratory rate. To Authentication system can be implemented using facial recognition or fingerprint verification.

Minal Patil et al., (2019) proposed Heart rate monitoring system . the heart rate is measured and then it is displayed on the display device like mobile phone or laptops. It is required to place our finger on the top of the sensor to measure heart beat .the main idea behind the working of this pulse sensor is that will sense the heartbeat by measuring the amount of change in light from the expansion of capillary blood vessels .these variations are then amplified and converted into the form of pulses. the importance of the heart beat sensor is that it transforms the heart beat into pulses that can be measured using the timer and counter of wemos controller. while performing ECG test in hospitals ,electrodes must be connected to the body patient so that anyone can see the ECG graph on CRO. It is required to connect ECG sensor to the system such that whenever the patient wants to see the ECG pulses of his own heart then he can simply connect the external model of ECG sensor to the device and can see the waves of his own pulses on the laptop. Electrocardiogram represents the graph of voltages produced by heart . In ECG There are 5 features which corresponds to different stages that makes up a heartbeat. These stages are denoted by letters P, Q, R, S and T. When the R peaks is detected and if we measure the time between them the heart rate can be calculated and then displayed In many system the design of system consist of pulse oximotor sensor but in proposed system uses PPG sensor in the place of pulse oximotor because the cost of oximotor sensor is high than the PPG sensor and the result of both the sensor nearby same. So that, the cost of PPG circuit will be low. Some system consist of zigbee module which can work only for specific range of area and the proposed system based on IOT so it can cover entire area of the world. Some system works on the basis of app design, app handling is not possible by everyone because app handling required particular instruction to be followed which not understandable by everyone but our system simply based on SMS facility which can be understand by anyone. So, basically in proposed system the target is to

design such a system which will continuously monitor the heart beat of patient. The system will be connected to then wi-fi module which will send the information continuously on the cloud server. So when a person require to see his pulse rate history then it can be retrieved from the cloud server. When the heartbeat of a person goes too low or too high than the predetermined value then this system triggers an alarm and in addition it sends this information via GSM technology to the relatives of the person and to the doctor. And it also keep the record of the database file on cloud server when there is a need these files can retrieved to view from cloud server. The proposed system is designed to minimized hardware, hence the cost of system is very low. So this system is affordable and easy to implement. In this way, the proposed aim is achieved to detect the heart attack in the easiest way. The threshold value is set with Microcontroller as the input crosses the threshold value it will send notification to the registered user.

T.Elakkiya et al., (2017) proposed Wearable safety wristband device for elderly health monitoring with fall detect and heart attack alarm. This feature is to care of elder people or any physically challenged persons in this busy world. Another way of this technique adapted is smart phone so elders can easily notify their situation. This technique is about having multiple method in a single device to monitor location, heart rate or attack, alarm, device missing alert, take medicine at correct time with suitable tablets, traffic signal reading. The idea is to embed an inexpensive NFC tag into the medicine bottle lid or a medical tablet pack cover. An NFC tag is simply a permanent memory card with wireless access. The measure of memory storage is normally less than a kilobyte and hence they are inexpensive. This can be done using an NFC smart phone or an NFC reader-writer device. On the Elder-GUARD device, the person must press the medicine record button and bring the medicine tag very close to it (less than 10cm). Elder-GUARD has the ability read and write these tags and hence it will read the content of the tag and stores it in its own permanent memory. The device will resume its normal activity after this process. If the patient cannot remember which medicine to take and at what quantity, simply bring the medicine tag near the device and it will blink GREEN light if that medicine should be taken or the light which emits red colour is not allocated

for that time. In this device use high end processor and controller for ARM cortex M0+ series. High speed interface used for UART, I2C, SPI protocols. here use smart e- paper to display the best than mature display method. Finally project has multiple things in a single device and provides better help for elders, children and physically challenged people. The short range of the NFC standard allows for an intrinsically secure access but it also represents a strict limitation. Possible future work is a review process to include new low-power wireless technologies as the Bluetooth Smart ready (Bluetooth Low Energy).

Po-Wei Huang et al., (2020) proposed A Heart rate monitoring framework for real world drivers using remote photoplethysmography. the importance of traffic safety cannot be overemphasized; based on a study prepared on behalf of the Task Force from the European Society of Cardiology, it is estimated that 8 percent of disease- related vehicle accidents are associated with cardiovascular issues . To assess the medical status or the state of fatigue of a driver, the heart rate (HR) is considered a representative measure and is a frequently used indicator. Researchers have long estimated HR using contact sensors for electrocardiograms (ECGs) and photoplethysmography (PPG). However, physical contact with such sensors may cause discomfort and distraction in drivers. To reduce the risk of such distraction, HR measurement based on remote photoplethysmography (rPPG) is a good alternative. a new method based on heart rate (HR) extraction and analysis in rPPG which significantly improves the accuracy of heart rate monitoring under driving scenarios. The proposed algorithm, based on statistical signal processing and Monte Carlo simulation, provides an explainable model in terms of probability and facilitates an improved balance between robustness and sensitivity. Moreover, a large database for driving scenarios was built as a part of this study, including different types of vehicles and challenging routes. To the best of our knowledge, this is the first study to analyze the influence of different vehicles. The HR MAE of the Passengers, Compact Cars, and Buses datasets are reduced to 3.43 bpm, 7.85 bpm, and 5.02 bpm, respectively. Interdataset and intradataset analyses reveal that the proposed algorithm outperforms benchmark techniques and results in improvement in driving scenarios.

Lena Gohlke et al., (2020) proposed An IoT based low-cost heart rate measurement system employing PPG sensors .First-level medical examinations the utilize a variety of parameters, including body temperature, blood pressure, heart rate, and respiratory rate, to examine the general state of health of the patient. To make the remote assessment of these parameters widely accessible in rural areas, it is necessary to measure these four parameters with low-cost, easy-to-use, and low-maintenance devices that provide an IoT functionality for an online assessment by a remote physician. In this paper, the main focus on the development of a heart rate sensor as a first building block towards a complete toolkit for medical diagnosis in rural areas in emerging countries. The resting heart rate is typically between 40 bpm and 109 bpm establishing the minimum dynamic range of the heart rate sensor. One possible way to measure heart rate and blood pressure is by photoplethysmography (PPG). PPG is a cuff-less and non-invasive method to measure changes in blood volume . an LED or an array of LEDs is used to emit light that is partly absorbed and partly reflected by the tissue. A photodiode (PD) detects the reflected part of the light, which is a function of the blood volume in the tissue. Since each heartbeat alters the actual blood volume in the tissue, the time trace of the absorbed light signal can be used to monitor the heart rate. Unfortunately, the LED signal is also reflected by bones, which, together with motion artifacts, ambient light fluctuations, and tissue deformation, lead to an increased noise floor and signal artifacts in the measured PPG signal that complicate the extraction of the heart rate from the raw PPG data. To measure blood pressure from PPG data, two spatially displaced sensors are required. Then, the linear relationship between blood pressure and the speed of blood traveling through arteries can be used to extract the blood pressure from the PPG data of the two sensors. Therefore, a in the proposed system, simultaneously acquire the PPG signals from two PPG sensors, one placed at the wrist and another one at the fingertip of the patient. a sensing platform that is capable of measuring the heart rate, blood pressure, and blood oxygenation. The total cost of a prototype system including the PPG sensors, the Raspberry Pi, and the 3D printed parts is less than 30 USD. All required signal processing is performed on the Raspberry Pi, and the processed data are made remotely accessible via a

website. The functionality of the device in measuring the heart rate using a custom developed algorithm has been successfully demonstrated on data recorded from 45 patients with a very good agreement between our low-cost system and a medical device

Dhruv R.seshadri et al., (2020) proposed Accuracy of the apple watch 4 to Measure Hear Rate in Patients With Atrial Fibrillation. Atrial fibrillation and atrial flutter(AF, collectively) are the most common types of cardiac arrhythmia and affect over five million people in the United States. The technological maturation and validity of wearable devices has recently been questioned by the medical community due to the lack of clinical data assessing their accuracy and efficacy in the identification and monitoring of human diseases assessed the accuracy of wrist-worn monitors to measure heart rate in healthy subjects. however, there is limited research in such devices to accurately monitor heart rate in individuals with cardiac arrhythmias such as AF assessed the accuracy of the AW4 HR monitor function in patients with AF to determine whether or not the AW4 should be used in the clinic. The difference in heart rate among patients with AF and sinus or other rhythms presented . Since the patient had to manually press the button on the side of the crown to obtain areading/tracing, there needed to be some awareness on their part that they might be in AF, unless they were in persistent/continuous AF. If the patient had no symptoms then there would not have been an incentive to obtain a reading from the AW4. The AW4 would be better served if it could automatically detect a change in the patient's rhythm and automatically obtain a reading. However, this is not the case with the current model of the AW4. In addition to the noted drawback of the device, the study noted several limitations which could have affected the accuracy of the results or long-term use-case of this technology for use in the clinic such as: 1) fluid overload and edema following surgery and 2) interference with other medical equipment on or near the patient.

Christoph Hoog Antink et al., (2020) proposed Ballistocardiography Can Estimate Beat-to-Beat Heart Rate Accurately at Night in Patients After Vascular Intervention. NIGHT-TIME physiological monitoring with unobtrusive bed-integrated ballistocardiography (BCG) sensors has gained interest in the wellness domain as it

the use of BCG monitoring enables an easy-to-use approach for self-monitoring of sleep quality and quantity. So far, the use of BCG monitoring in clinical applications has been limited. A potential clinical application for this technology is unobtrusive monitoring of patients who are staying in beds in the general hospital ward. Currently, monitoring of such patients is relatively sparse or unsystematic, and is mainly performed visually or with intermittent measurements. Continuous real-time monitoring of hospital patients would be beneficial for monitoring of recovery and early detection of the deterioration of a patient's condition e.g. due to postoperative complications. In addition, heart rate variability (HRV) is a potential, clinically underexploited measure of the state of the autonomic nervous system that could provide information on the recovery of a patient noninvasively. It has been shown in several studies that recovery of HRV parameters after surgery is altered in patients developing postoperative complications. Monitoring techniques based on cardiac-associated vibrations have been proven adequately accurate for heart rate (HR) and heart rate variability (HRV) measurements in healthy subjects with bed-integrated ballistocardiography (BCG) as well as wearable seismocardiography sensors. When heart rate variability is to be estimated, the situation becomes even more challenging than BBI estimation alone. As consecutive segments of BBIs are necessary for HRV calculations, missing beats can have detrimental effects. Nevertheless, estimation of the time-domain HRV parameters SDNN and RMSSD was shown to be possible in principle. In terms of absolute values, the error was actually found to be smaller for the patient data. However, since both SDNN and RMSSD were significantly smaller in the patients, the resulting relative error was higher. Also, while the estimation of SDNN was more accurate in the ultra short window of 45 seconds, some authors suggest that shorter window sizes lead to different results compared to SDNN estimation in 5-minute windows, whereas RMSSD is largely unaffected, even if the window is reduced to only 30 seconds. However, other authors have concluded that both RMSSD and SDNN can be calculated reliably from multiple windows of only 10 seconds. In our study we found that both parameters were systematically underestimated compared to the ECG reference with the same window size. One potential reason might lie in the

developed iterative estimation approach itself: In contrast to the original CLIE algorithm, the estimation is augmented by an adaptive prior based on the median BBI interval. While this improved results in terms of BBI estimation and coverage in general, it might steer the estimation closer to the median, i.e. reduce variability. In the future, this should be analyzed in detail, preferably with synthetic data where HRV parameters can be controlled systematically. Algorithms that allow estimation of surrogates that correlate well with established time- and frequency- domain HRV parameters.

Alessio Burrello et al., (2021) proposed Energy-Efficient PPG-Based Heart Rate Monitoring on Wearable Devices. MODERN wrist-worn devices include increasingly heterogeneous sensor sets, monitoring movements and vital parameters such as electrodermal activity and heart rate (HR). HR monitoring, in particular, is important for clinical purposes and precise activity tracking. Early wrist-worn HR tracking devices were connected to a separate chest band, equipped with a simple 1-3 leads Electrocardiogram (ECG) sensor. While accurate, this solution was expensive and created discomfort for users in daily life usage. Therefore, in recent years, ECG chest bands have been progressively replaced by cost-effective and more comfortable photoplethysmography (PPG) sensors, which enable the measurement of HR and blood oxygenation (SpO₂) directly from wrist-worn devices. Examples of commercial devices that include this type of sensor are the Apple Watch and some Fitbit models. PPG sensors consist of one or more Light-Emitting Diodes (LEDs) that periodically emit light onto the skin and a photodetector (i.e., a photodiode) that measures the variations of light intensity caused by blood flow. More specifically, the larger the blood volume variation, the greater the attenuation of the light emitted by the LED, resulting in a lower current output on the photodiode. Therefore, in an ideal PPG signal, peaks can be associated with the HR. A major source of inaccuracy in PPG sensors is constituted by motion artifacts (MA), i.e., signal artifacts caused by movements of the user arm and hand, which in turn produce variability in the sensor pressure on the skin or ambient light leaking into the gap between the photodiode and the wrist. Several studies compared ECG chest straps with PPG-based HR tracking systems showing that the former typically obtain

better accuracy, especially in the presence of MAs. As a result, the ECG-base solutions are still considered the reference benchmark for wear able HR tracking .to overcome this gap have recently focused on sensor fusion approaches that integrate PPG with inertial generates a richset of Pareto-optimal TCNs in the accuracy versus memory (or n. of operations) design plane, among which designers can then select a particular model based on the constraints of their hardware target. Executing PPG-based HR tracking on wearable devices is increasingly important in both clinical contexts and daily lives.However, most research on this task focuses only on maxi- mizing performance, through hand-tuned and often complex algorithms. To the best of our knowledge, there are no algorithms deployed on wearable-class devices that reach good performance on a large dataset. In this work, we have tackled this limitation introducing Q-PPG, a new set of quantized deep learning models that span 3 ordersof magnitude in memory occupation, with MAEs ranging from a state-of-the-art 4.36 BPM to ≈ 20 BPM, on the largest publicly available dataset for this task. All models are derived from a single seed network through the application of a cascade of automatic tools, which progressively either i) improve the performance of tracking or

ii) shrink the model complexity and memory footprint. We have deployed some of our models on a wearable MCU-based device, demonstrating that they achieve real-time HR tracking with low error, while only contributing to 14.1% of the total energy consumption of the system, when considering also sensing and communication.

Manar M. Edris et al., (2021) proposed a IoT-Based Monitoring System for Detection of Epileptic Seizure by Heart Rate Variation . Nervous system disorders affect people of all ages, races,social classes and geographical locations, causing death and disruption of life. One example of such disorder is epilepsy. Epilepsy is a brain disease that causes seizures. A seizure is abnormal or excessive activity in the brain that can cause electrical signals to be sent to various muscles through the peripheral nervous system .Electroencephalography (EEG) was the first device used to monitor brain signals and seizures. However, EEG is not practical to use daily cause it requires to attach electrodes to the head scalp and it takes time to get

results. Alternatively, recent studies showed how the abnormal neuronal activities have effect on the autonomic nervous system (ANS) and how seizures alter the heart rate pattern. Many of the devices used to detect epileptic seizures were sophisticated and different provided information that was difficult to understand for most people. Though there were a lot of studies demonstrated the changes in HRV before epileptic seizures occur and the possibility to view an ECG is more easily than an EEG, HRV based seizure prediction was limited to a few research. In this study, we aim to make an IoT device to predict seizures by HRV, that can convey necessary information about the patient's condition to doctors or family members, and it will reduce the risk of having a sudden seizure. The sensor reads heart beats, after that it will convert data to signals. The collected values and signals will be send to the microcontroller for further processing then it will be transmitted by the Wi-Fi module which it is use for sending data via internet to the ThingSpeak platform for the analysis and visualization of the heart rates in the simplest forms. The IoT-based seizure monitoring system records the patient's heart rate and these data will be recorded in ThingSpeak so that the patient's health status can be monitored from anywhere in the world via the internet. The implemented system consisted of three main unites; the pulse sensor is the input unite, the LCD display and the screen used to accesses the ThingSpeak channel is the output unite and finally processing unite which it consists of the NodeMCU model. Sensors and laboratory. After making a device to monitor heart rate using IoT based ThingSpeak application and then testing heart rate, it can be concluded: This device can measure the pulse changes of the epilepsy patient instantly with high accuracy and can slide the patient's condition by sending the measured values to the online platform. This device uses the LCD to make it easy to for the patient's to monitor heartbeat instantly and clearly. A well-working heart rate monitor can be proven by tests and results that appear in the ThingSpeak app. Based on the test, a heart rate monitor will give results within 15 seconds of the test.

Charushila Patil et al., (2021) proposed Heart (Pulse Rate) Monitoring using Pulse Rate Sensor, Piezo Electric Sensor and NodeMCU. The major difference between the above mentioned medical diagnostic system and techniques are that the

first one takes the data from the manually stored systems and the second one remotely. Remote health monitoring system catches the data using Wireless Body Area Network (WBAN), an emerging area in Wireless communication. There are a variety of health or bio-sensors that operate within the body or attached on or kept near to the human body, which in turn gather the required information from the human body. The collected data is transmitted to the appropriate destination via the communication network for processing. There upon, the decisions are made based on the analysis result. Conventionally, ECG system is used in which up to 12 electrodes (sensors) are attached on chest and limbs of patient for recording the signals that make heartbeat, the electrodes are having sticky patches with wires that connect to a monitor. A computer records the information and displays it as waves on a monitor or on paper. A human's natural heartbeat rate is 72 per minute. The resonance frequency is also the measurement factor of the human body that can be useful to detect most of the diseases. In measuring the heart rate, the resonance frequency of body also plays important role. Fusion of sensors will be made to make system more compact and handy. In future the system will be upgraded for the more vital parameters like blood pressure, temperature, brain waves for real time monitoring.

G. Muhammad et al., (2017) discussed and suggested the use of IoT-cloud technologies to monitor patients' speech pathologies. Their project involved creating an Internet of Things (IoT) monitoring system that detects voice signals and transmits them to a smartphone serving as the hosting device that then transports them to a cloud appropriately. After cloud verification, the medical professional obtained the processed data for analysis and decision-making. The local binary pattern on a representation of the Mel-spectrum was used by the authors to construct their framework's vocal pathology monitoring system. To identify pathology, an extreme learning machine was employed as a classifier. The suggested monitoring system was easy to use and had a high level of detection precision.

T. A. Rahman et al., (2016) provided a modified design for a healthcare monitoring system that can remotely and in real time monitor patients' vital indicators

such their heart rate, blood pressure, body temperature, and blood sugar level. The proposed "mobile health monitoring system" contained several wearable sensors that could link to the cloud and automatically summon assistance when required.. To make the system's implementation easier, they built it in two basic steps. The sensors initially sent the data they had gathered to an Android application that had been created to serve provides a channel of communication between LTE mobile networks and the sensors. The patient's acquired data were sent to the LTE network in the second stage using a new dynamic scheduling mechanism that was based on how sensitive the patient's condition was. This technique provided the data based on on the priority of the application's class and served the sensors in accordance with the demands made by the applications, such as amount, postponement, and container damage rate.

M. S. Hossain et al.., (2016) presented a real-time controlling and monitoring system to access and examine patient healthcare data in order to provide high-quality patient care and avoidable patient deaths by implementing IoT technologies for enhancing the healthcare industry (Health-I-IoT). The proposed Health-I-IoT system was built on a number of practical strategies, including interconnected technologies, sensors, devices, apps, and health professionals who can access, store, and analyse patient data anywhere in real time to continuously monitor and track the patients. By simulation and experimental evaluation, the viability of this strategy was confirmed. Mobile devices and sensors captured health-I- IoT information (such as ECG signals) and securely communicated it to the cloud so that healthcare professionals could access and monitor it safely. In order to prevent identity theft and clinical blunders, the authors used a variety of analytical techniques, prior to transferring the data to the cloud, e.g. signal augmentation and healthcare data watermarking.

Neha A. sarnarik et al.., (2018) developed a system in which the location of a heart attack was logged and the heartbeat was monitored. Pulses can be read via to the utilized connection to a microcontroller and sent over the Internet. The user can choose the maximum and minimum heartbeat rates. Afterwards, monitoring starts to see if the heartbeats are going over or below the thresholds.

The patient is connected to the transmitting circuit, and the authorized staff is connected to the other circuit. A database recordings of healthy participants' 24-hour ECGs and people who had just had myocardial infarction is then evaluated using the novel approach. The study reveals that the model parameters of sick patients and those in the reference group differ statistically significantly of healthy individuals. LCD panel displays current pulse rate as determined by the heartbeat sensor. This proposed system has no limitations and can be applied everywhere. You are not required to use the device at home.

J. Haritha et al., (2018) In this system The Arduino Uno controls the system, and the GSM module manages communication. The patient's heart rate is constantly monitored by the pulse oximeter. In a pulse oximeter, the photodetectors are placed next to one another. When a finger is employed in the reflecting technique, the light is reflected back to the sensor. The amount of blood in the finger grows with each heartbeat, increasing the amount of light reflected back to the sensor. The heart rate is therefore represented by the peak in the waveform of the signal that was received. The microcontroller-provided threshold value is continuously compared to the detected heart rate. When the continuously monitored heart rate falls or rises outside of the predetermined range, the microcontroller automatically sends a message to the patient's physician or family members using the standard GSM module connected to the controller unit. Also, the doctors can access the patient's most recent medical history from the database to ensure that the patient receives the required treatments.

Tamas Horvath et al., (2022) Explain an effort to circumvent this issue in the proposed system by utilizing a novel HRV time series evaluation method in this study. they develop a master curve (or "M- curve") for characterizing the HRV(HR) function based on a modified Poincare plot of the data acquired by a wearable heart-rate and activity sensor. This curve displays impressive invariance to the majority of other overt elements (time, physical activity, etc.), leading researchers believe that it can be used to measure an individual specifically. Usually, two exponentials can be used to fit the M-curve if the HR interval is large enough.; additionally, they provide a stochastic

model based on biomimetic principles for a more comprehensive mathematical explanation.

Uchechukwu et al., (2015) In this system, the functionality of the device was enhanced and carefully considered in order to reflect desired features like price, complexity of the design, the lack of portability, weight, size, and software development. For extremely accurate detection and monitoring changes in heart rate, this design makes use of a tiny pulse sensor (IC sensor). The system uses the microcontroller to calculate the heart rate in beats per minute (BPM), displays the measured heart rate on a 16X2 character LCD, and sends an SMS with the current BPM value if the heart rate changes above a set threshold. In addition, the patient module's associated buzzer alarm sounds as a warning. The LCD display Minimaturised sensor were chosen with mobility and compact size in mind in order to do away with the need for a PC display and make the device easy to carry around for continuous monitoring. Because of this, real- time remote monitoring is flexible regardless of location or distance.

2.2 INFERENCE OF THE PROJECT

The IOT based Heart Attack Detection and Heart Rate Monitoring System is an innovative solution that utilizes IoT technology to provide real-time monitoring of heart rate and other vital parameters. The project aims to improve the early detection of heart-related anomalies and prevent heart attacks and other cardiac diseases

The system consists of multiple sensors that are placed on the body of the patient, which continuously monitors the heart rate, blood pressure, and other vital parameters. The collected data is transmitted to a cloud-based platform for further analysis and monitoring. The system can detect any abnormal changes in the heart rate and provide immediate alerts to healthcare professionals or concerned family members.

The heart attack detection and heart rate monitoring system can be useful for patients suffering from cardiovascular diseases or people who are at high risk of heart attacks. The system can also be used by healthcare professionals to monitor

the health of patients in hospitals or remote locations.

Overall, the project can help to improve the quality of life for patients suffering from cardiovascular diseases by providing early detection and prompt medical attention. The system can also help healthcare professionals to make informed decisions and provide timely interventions to prevent heart attacks and other cardiac diseases.

2.3 PROBLEM IDENTIFICATION

Accuracy: The accuracy of the heart attack detection system is critical, and any false positives or negatives could result in incorrect diagnoses and potentially harmful consequences. Therefore, it is essential to ensure that the sensors used in the system are precise and reliable.

Data processing: The collected data should be processed in real-time to detect potential heart attacks promptly. It requires the use of complex algorithms that can analyze the data and identify any patterns or abnormalities.

User interface: The system should have a user-friendly interface that can display the data in a meaningful way. It should be easy to use and understand by healthcare professionals and patients alike.

Power consumption: The system should consume low power to increase the battery life of the device. If the system consumes high power, then it may not be feasible to use it for an extended period without charging.

Cost: The cost of the system should be reasonable so that it can be affordable for the general public.

2.4 AIM OF THE PROJECT

The aim of the project for an IoT-based heart attack detection and heart rate monitoring system is to develop a reliable and effective solution for continuous monitoring of heart rate and early detection of potential heart attacks. The project aims to provide a system that is user-friendly, accurate, and accessible to individuals at risk of heart disease or those who have already experienced a heart attack.

The project aims to use IoT technology to provide real-time monitoring of heart rate through sensors, which can be transmitted to the cloud for analysis and

early detection of potential heart attacks. The system should also be able to provide historical data and notifications of significant changes in heart rate to help individuals manage their heart health and make lifestyle changes to reduce the risk of heart disease.

The project also aims to address challenges related to the implementation and deployment of the system, such as ensuring the accuracy of the sensor data, addressing privacy concerns, and making the system accessible and affordable for individuals from all backgrounds.

Overall, the aim of the project is to develop a comprehensive and effective solution for heart rate monitoring and early detection of potential heart attacks, with the goal of improving the overall health and well-being of individuals at risk of heart disease.

2.5 SCOPE OF THE PROJECT

The scope of the project for an IoT-based heart attack detection and heart rate monitoring system includes the design, development, testing, and deployment of a system that can continuously monitor heart rate, detect potential heart attacks, and provide historical data and notifications of significant changes in heart rate.

- **Sensor development:** Development and testing of sensors that can accurately measure heart rate and transmit data to the cloud.
- **Cloud infrastructure development:** Development of the cloud infrastructure for receiving, storing, and analyzing heart rate data.
- **Data analysis and alert system development:** Development of algorithms for analyzing heart rate data and detecting potential heart attacks. This includes the development of an alert system that can notify the user or emergency contacts in case of a potential heart attack.
- **User interface development:** Development of a user interface that is easy to use and provides access to heart rate data and notifications.

- Testing and validation: Testing and validation of the system to ensure its accuracy, reliability, and effectiveness.
- Deployment and maintenance: Deployment of the system to individuals who need continuous heart rate monitoring and maintenance of the system to ensure its ongoing performance.
- The scope of the project may also include addressing challenges related to data privacy and security, ensuring the affordability and accessibility of the system, and addressing any regulatory requirements related to the use of health data.
- Overall, the scope of the project is to design, develop, and deploy a comprehensive heart rate monitoring system that can improve the health outcomes of individuals at risk of heart disease.

2.6 OBJECTIVE

- To provide system where heart attack can be detected early heart beats of the patient are monitored .
- To the existence and influence, health related parameters and issues are of utmost importance to man. Various systems have been developed that are able to capture and monitor changes in health parameters.
- A real time remote monitoring and controlling of heart functionality and epilepsy is presented in this system.
- A low cost, efficient and flexible heart rate detection and alert system using wireless module has been implemented in this system.
- If system detects any abrupt changes in patient heartbeat, body functionality the system automatically alerts the doctor and respective relatives about the patient's status through IOT and also stores the patient details in the cloud for future use.

2.7 APPLICATION

Early Detection of Heart Attack: An IoT-based heart attack detection system can continuously monitor a person's heart rate, blood pressure, and other vital signs to identify any irregularities that may indicate a potential heart attack. The system can then send an alert to the patient or healthcare professional, allowing for timely medical intervention.

Remote Patient Monitoring: An IoT-based heart rate monitoring system can be used to remotely monitor a patient's heart rate, providing physicians with real-time data about their patient's heart health. This can be particularly useful for patients with chronic heart conditions, as it can help detect any changes in their condition early on.

Personalized Treatment Plans: By tracking a patient's heart rate and other vital signs over time, an IoT-based system can help healthcare professionals develop personalized treatment plans that are tailored to the patient's individual needs.

Reduced Healthcare Costs: By detecting potential heart attacks early and allowing for timely medical intervention, an IoT-based heart attack detection system can help reduce healthcare costs by preventing costly hospitalizations and other medical procedure.

CHAPTER 3

PROJECT DESCRIPTION

3.1 EXISTING SYSTEM BLOCK DIAGRAM AND EXPLANATION

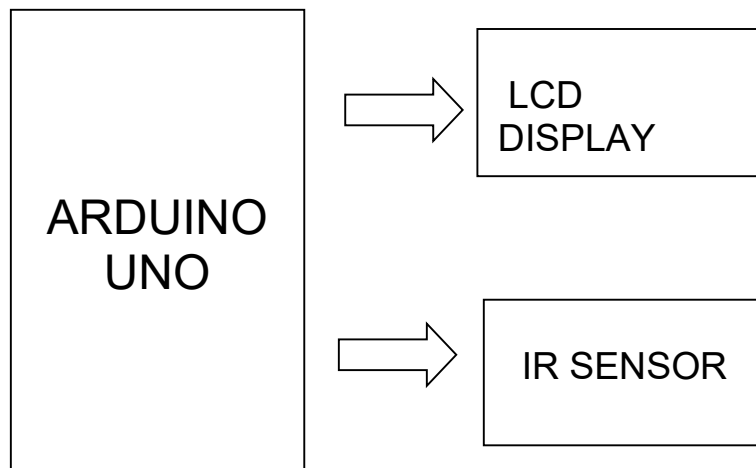


Fig 3.1 Block Diagram Of Existing System

The model comprises cardiac regional cellular-electrophysiology types connected by a path model along a conduction network. The regional electrophysiology and paths are modeled with hybrid automata that capture non-linear dynamics, such as action potential and conduction velocity restitution and overdrive suppression. The hierarchy of pacemaker functions is incorporated to generate sinus rhythms, while abnormal automaticity can be introduced to form a variety of arrhythmias such as escape ectopic rhythms. Model parameters are calibrated using experimental data and prior model simulations.

3.2 DISADVANTAGE OF EXISTING SYSTEM

- Existing system monitored only the heart rate and temperature
- In this system there is no before epilepsy detection.

- The arduino has lesser memory and processor capability as compared to node mcu.
- No electric pulse generation

3.3 PROPOSED BLOCK DIAGRAM AND EXPLANATION

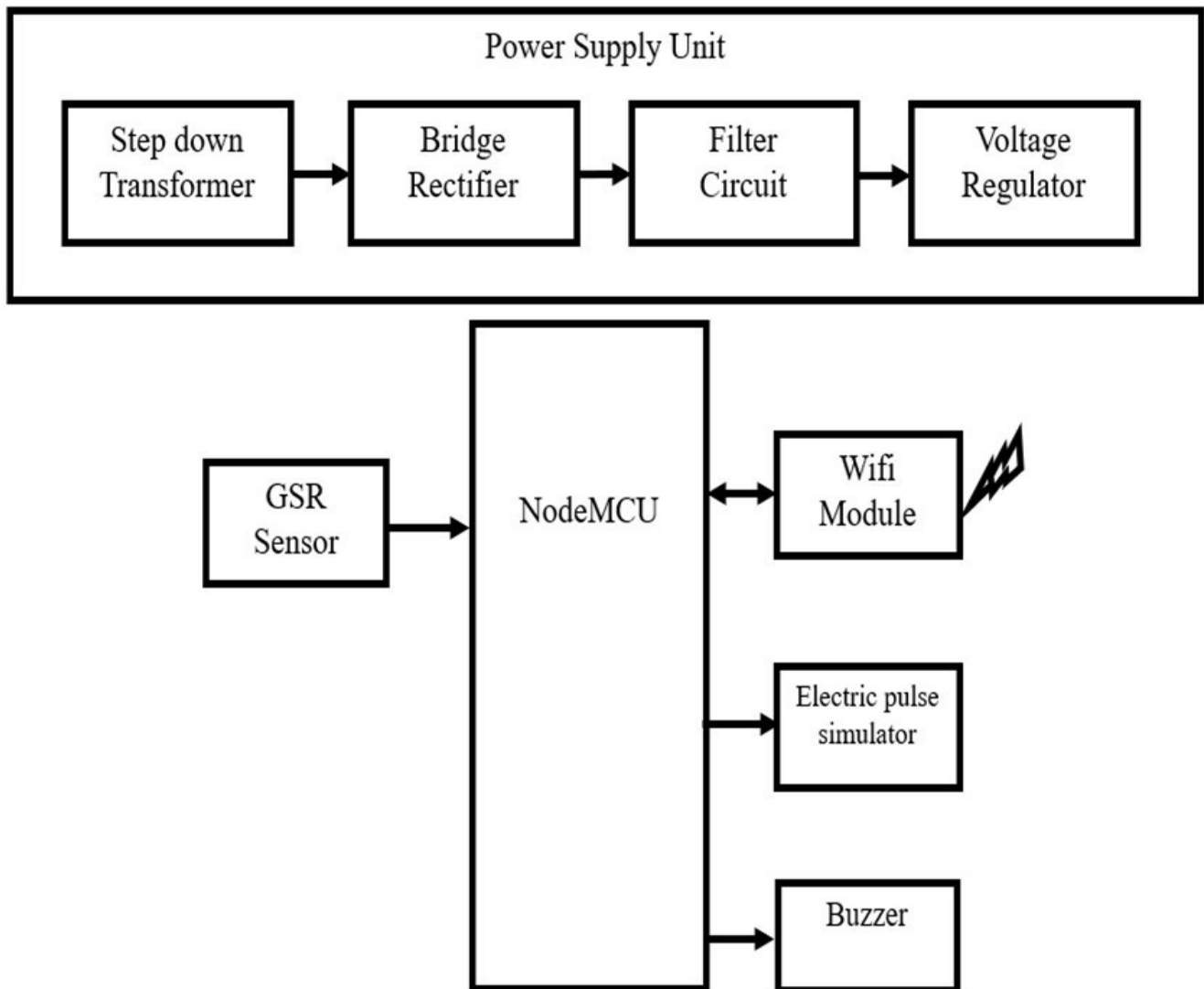


Fig 3.2 Block Diagram Of Proposed System

In order to estimate a person's heart rate even when they are at home, the suggested system approach uses sensors that enable heartbeat sensing. The sensor is then connected to a microcontroller, which can examine heart rate readings and transmit them online. Users can decide whether to set a high or low heartbeat restriction. The system starts monitoring after these limits are put in place. The technology tells the controller when the patient's heart rate exceeds a preset limit. The controller then disseminates this information online and alerts the medical professionals and worried users. So those who are concerned can keep an eye on heart rate and receive an alarm when a patient is having a heart attack from anywhere. Additionally, with the aid of an electric pulse simulator, we'll create an electric pulse that will go throughout the entire body.

3.4 ADVANTAGE OF PROPOSED SYSTEM

- Every time a user signs in for monitoring, the system also shows the patient's real-time heart rate.
- As a result, those who are concerned can keep an eye on the patient's heart rate and instantly alert them to a heart attack from anywhere, saving the patient's life.
- It's also reduce the patient work load by checking his details staying at home rather going to hospital.
- If system detects any abrupt changes in patient heartbeat, body functionality the system automatically alert the doctor and respective relatives about the patient's status.
- While patient gets epilepsy and heart attack we are going to generate electric pulses through whole body with the help of electric pulse simulator.

3.5 FLOW CHART

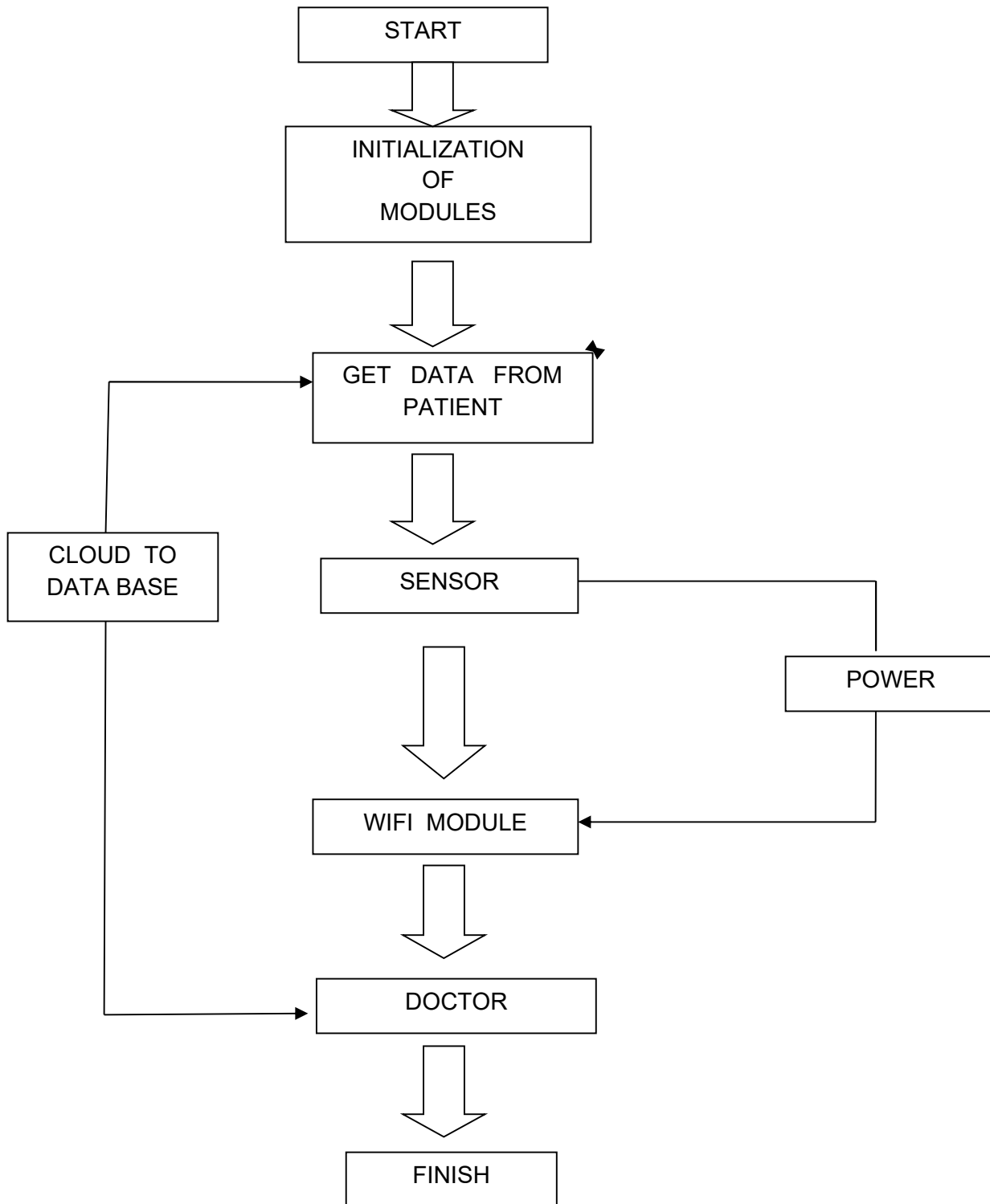


Fig 3.3. Flow Chart Of Proposed system

3.6 METHODOLOGY

Identify the requirements: Define the scope and objectives of the project. This involves identifying the target audience, the primary features, and functionalities that the system should have. For example, the system should be able to detect heart attacks, monitor heart rate, and notify medical personnel in real-time.

Research: Conduct thorough research on the existing technologies, sensors, and communication protocols that can be used in the system. Identify the most suitable hardware and software components that can be used to achieve the objectives of the project.

Prototype development: Develop a prototype of the system based on the design. This involves integrating the hardware and software components, and testing the system in a controlled environment.

Field testing: Test the system in real-world scenarios to ensure its effectiveness in detecting heart attacks and monitoring heart rate. This will involve working with medical professionals and patients to collect data and refine the system.

Deployment: Once the system has been successfully tested and refined, deploy it in a real-world environment. This may involve partnering with medical facilities or hospitals to make the system available to patient.

CHAPTER 4

SYSTEM DESIGN

Modules are part of a program that contains hardware and software components, or one or more routines. The project “IOT based heart attack detection and heart rate monitoring system” consists of two main modules.

4.1 Hardware

4.2 Software

4.1 Hardware description

4.1.1 Node MCU

The NodeMCU (*Node Microcontroller Unit*) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Expressive Systems, contains the crucial elements of a computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK.

- The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.
- GPIO Pins NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital-enabled GPIO can be configured to internal pull-up or pull-down, or set to high impedance.
- The ESP826 I/O pins can only interact or input/output at 3.3V. In other words, the ports are NOT 5V tolerant inputs.



Fig 4.1 Node MCU

4.1.2 ELECTRIC PULSE SIMULATOR

When the heart pumps blood, a blood vessels volume changes, creating a pulse wave. a pulse sensor is the detector that tracks this change in volume. Electric pulse simulator allows muscles that have been paralyzed or partially paralyzed by stroke to move again. When using Electric Simulator as a treatment after a stroke, an electrical current is applied to the skin over a nerve, or over the bulk of a muscle, which causes the muscle to contract. If the peripheral nerves are damaged, it may not work.

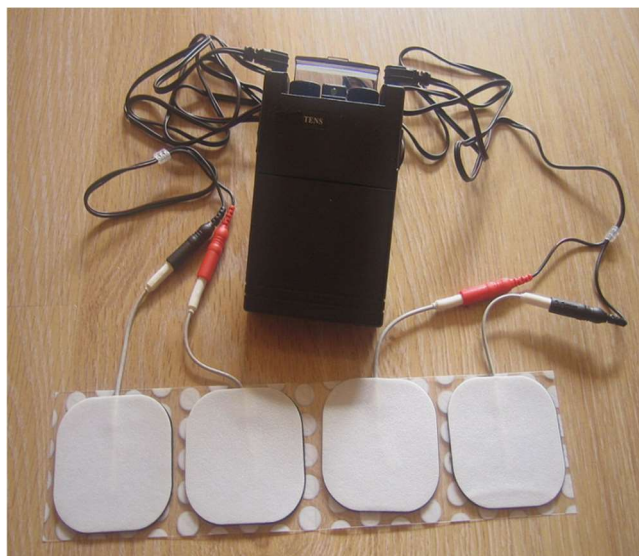


Fig 4.2 Electric pulse simulator

The type of electric pulse simulator that focuses on pain relief send signals on a different wavelength so they reach the nerves,rather than the muscle.electrical stimulation can block pain receptors from being send from nerves to the brain.

4.1.3 L293D MOTOR DRIVER

The L293D IC receives signals from the microprocessor and transmits the relative signal to the motors. It has two voltage pins, one of which is used to draw current for the working of the L293D and the other is used to apply voltage to the motors. The operating voltage of L293D is 4.5 V to 36 V, and the maximum output current is 1A. L293D has up to 4 bidirectional DC motors and 4 channels of PMM speed regulation (about 0.5% resolution), up to 2 stepper motors forward and reverse control, single/double step control, staggered or micro-step and rotation angle control. Each bridge of the L293D chip provides 0.6A (peak 1.2A) current and has thermal shutdown protection. The pull-down resistor ensures that the motor remains stopped when power is applied. Two large terminal external power connection terminals ensure the separation of logic and motor drive power. Large terminal terminals make wiring easier.

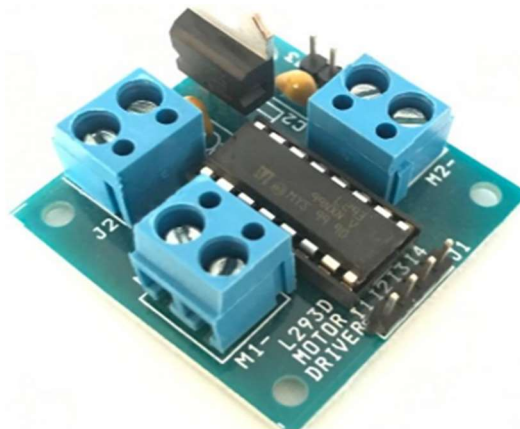


Fig 4.3 L293D Motor Drive

The L293D switches it output signal according to the input received from the microprocessor. If the microprocessor sends a 1(digital high) to the Input Pin of L293D, then the L293D transmits a 1(digital high) to the motor from its Output Pin. An important thing to note is that the L293D simply transmits the signal it receives. It does not change the signal in any case.

4.2 SOFTWARE DESCRIPTION

Send sensor data privately to the cloud Our houses, smartphones, cars, factories, urban infrastructure, and more are all equipped with sensors. All types of information are measured and captured by sensors. They transmit this information in some manner, such as a signal or a number. Data is gathered by sensors and objects, which typically operate locally. arduino IDE enables data to be sent to the cloud and stored on private or public channels via sensors, devices, and websites. By default, arduino IDE keeps data in private channels, but you can share your data with others via public channels. Once your data is in the arduino IDE you may use it to create new data, analyse and visualise existing data, or communicate with other devices, web services, and social media.

Analyze and visualize the data Your data is easily accessible if you save it in the cloud. You can examine and display your data with the help of online analytic tools. Find correlations, trends, and patterns in the data. New data can be calculated. Visualize with gauges, charts, and graphs. Your data is easily accessible if you save it in the cloud. You can examine and display your data with the help of online analytic tools. Find correlations, trends, and patterns in the data. New data can be calculated. Plot, diagram, and assess your ideas.

4.3 IEEE STANDARDS

- IEEE 802.11 standard defines the physical and data link layer protocols used for wireless local area networks (WLANs)
- IEEE 802.15.1 (Bluetooth): A standard for short-range wireless communication that is commonly used for connecting mobile devices to accessories such as headphones and speakers.
- IEEE 802.15.4 (Zigbee): A standard for low-rate wireless personal area networks (WPANs) used in IoT applications.
- IEEE 802.16 (WiMAX): A standard for long-range wireless broadband communication that can cover larger areas than Wi-Fi.

- IEEE 802.11 b/g/n standards the ESP8266 Wi-Fi chip used in the NodeMCU supports which means that it can communicate with devices that also supports those standards.

4.4 CONSTRAINTS

Technical constraints - The development of such a system requires expertise in hardware and software engineering, data analysis, and medical expertise. There may be technical limitations in terms of the availability of suitable sensors, communication protocols, and decision making algorithms.

Data privacy and security - The system will be collecting sensitive medical data, which must be protected against unauthorized access or breaches. It is essential to implement robust data privacy and security measures to ensure the confidentiality, integrity, and availability of the data.

User acceptance - The system must be user-friendly and acceptable to patients and medical professionals. The design and user interface must be intuitive and easy to use, and the system should not create any additional burden or stress for patients or medical personnel.

Reliability and accuracy - The system must be reliable and accurate in detecting heart attacks and monitoring heart rate. Any false alarms or errors can result in unnecessary interventions or delayed treatments, which can have serious consequences for patients.

Regulatory compliance - The system must comply with regulatory requirements such as HIPAA, which govern the collection, storage, and transmission of medical data. Failure to comply with these regulations can result in legal and financial penalties.

Cost - Developing an IoT-based heart attack detection and heart rate monitoring system can be expensive, particularly in terms of hardware and software development, data storage, and maintenance costs. It is essential to consider the cost-effectiveness of the system and ensure that it provides value for money.

4.5 TRADE-OFF

Cost: One of the biggest tradeoffs is cost. Developing and implementing an IoT-based heart attack detection and heart rate monitoring system can be expensive, especially if you want to use high-quality sensors and data analysis algorithms.

Data Privacy: Collecting and transmitting personal health data over the internet can be a privacy concern. Proper security measures must be taken to ensure that the data is encrypted and secured during transmission and storage.

Accuracy: The accuracy of the system is critical. If the system provides false readings, it could lead to incorrect diagnoses and treatments, which could be dangerous for patients. Therefore, the system must be calibrated regularly and undergo rigorous testing to ensure its accuracy.

Battery Life: IoT devices need to be powered continuously. Depending on how long the device needs to run, the battery life of the device may be a concern. The longer the battery life, the more expensive the device can become, and a shorter battery life may require more frequent charging.

Usability: The ease of use of the system is also important, especially for elderly people or people with limited technical skills. The system should be easy to set up, and the interface should be intuitive and user-friendly.

Overall, an IoT-based heart attack detection and heart rate monitoring system can provide many benefits, but it requires careful consideration of these tradeoffs to ensure that the system is effective, safe, and accessible.

CHAPTER 5

SIMULATION AND RESULTS

And for simulation we have used Arduino Software(IDE). Arduino IDE contains a text editor for writing code,message area,a tool with buttons for common functions and a series.it connects to the arduino and genuin hardware to upload programs and communicate with them. coded part is done in this software. We have to upload the code here and run .if there is no error in output the program will successfully given the positive result.

5.1 CODE

```
#include<liquidcrystal.h>
Liquidcrystal lcd(8,9,10,11,12,13);
Void setup()
{
  Lcd.begin(16,2);
  Lcd.setcursor(0,0);
  Lcd.print("heart attack");
  Lcd.setcursor(0,1);
  Lcd.print("detection");
  Delay(2500);
  Lcd.clear();
  Seral.begin(9600);
  Pinmode(7,output);
}
Void loop()
{
  Int = GSR analogread(A3);
  GSR=GSR/10;
  Lcd.setcursor(0,0);
```

```

Lcd.print("gsr");
Lcd.print(GSR);
If(GSR>60)
{
Digitalwrite(7,1);
}
Else
{
Digitalwrite(7,0);
}
Delay(1500);
Lcd.clear();
}

```

sketch_apr11b | Arduino IDE 2.0.4
File Edit Sketch Tools Help

Arduino Uno

```

1  #include<liquidcrystal.h>
2
3  Liquidcrystal lcd(8,9,10,11,12,13);
4
5  Void setup()
6  {
7
8
9  Lcd.begin(16,2);
10
11 Lcd.setCursor(0,0);
12
13 Lcd.print("heart attack");
14
15 Lcd.setCursor(0,1);
16
17 Lcd.print("detection");
18
19 Delay(2500);
20
21 Lcd.clear();
22
23 Serial.begin(9600);
24
25 Pinmode(7,output);
26
27 }

```

Output

Fig 5.1 program output

5.2 SIMULATION OF PROPOSED SYSTEM AND EXPLANATION

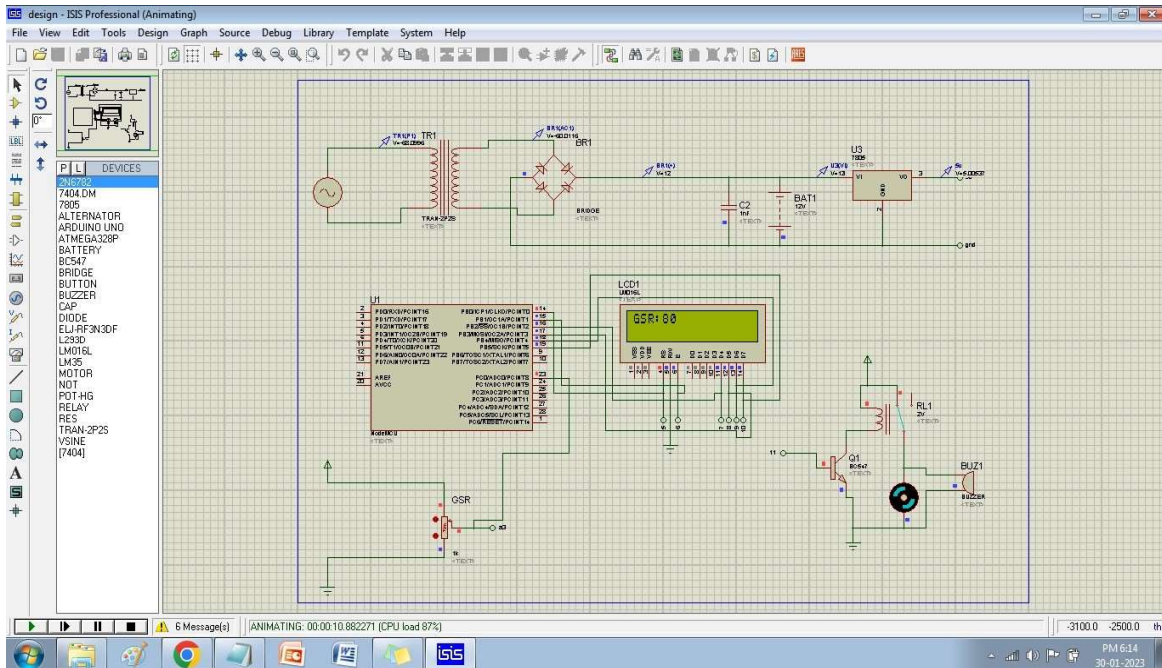


Fig 5.2 simulation of proposed system

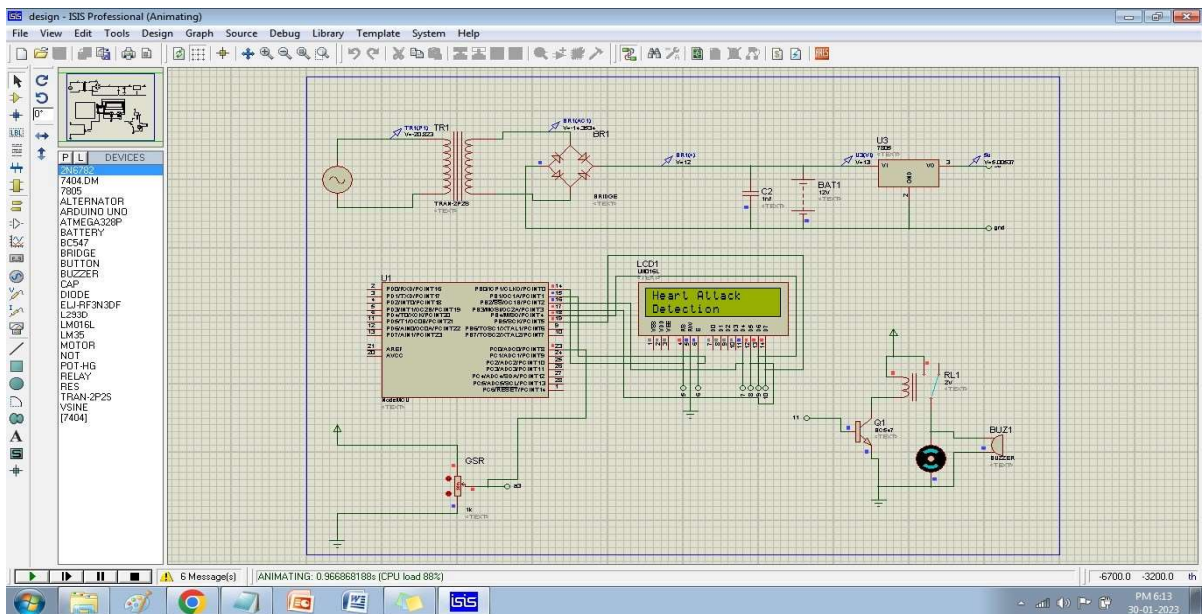


Fig 5.3 simulation for Heart Attack Detection

- The low pulse rate is displayed when the heart rate BPM (beats per minute) is >40 and <60 . the low pulse rate may lead to medical complications this indicates that the patient needs the doctors help.
- The normal pulse rate ranges is between >60 and <100 which indicates that the patient has the normal range pulse rate without no complication.
- The high pulse rate is between >100 and <150 which indicates the patient has high pulse range that could result in the heart related disease.

5.3 HARDWARE AND RESULTS

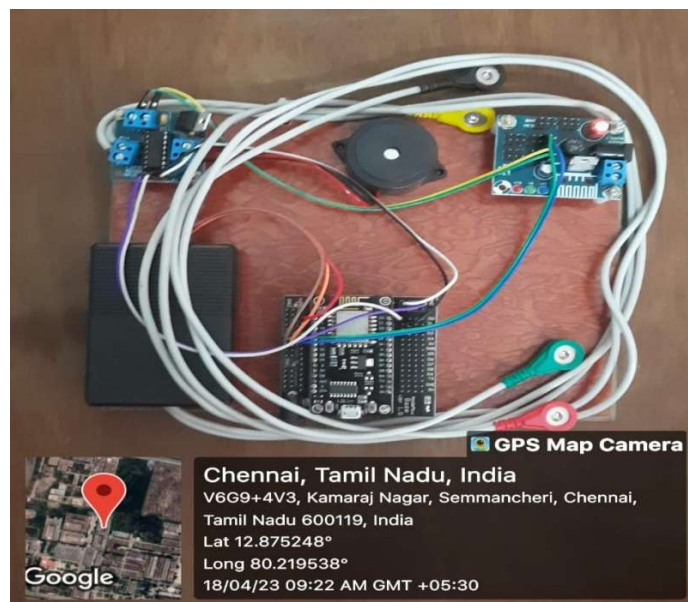


Fig 5.4 Hardware of Proposed System

The GSR sensor which is interfaced with NodeMCU microcontroller senses the heartbeat of person and transmits them over internet using WIFI module .system allows setting limits of beat.after setting these limits person can start monitoring the heart beat and whenever the persons heart beat goes above certain set point they can get an alert on high heartbeat and also about the chances of heart aattack .also the system alerts for low heart beat. If system detects any abrupt changes in patient

heartbeat,body functionality the system automatically alerts the doctor and respective relative about the patients status through IOT and also stores the patient details in the cloud for future use.



Fig 5.5 Result of Proposed System



Fig 5.6 Result of Heart Attack Detection

Whenever the heart beat goes above 60-100 ,it detects heart attack and it gives alert to the doctor and the respective relatives about the patient status.

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 SUMMARY

The project aims to develop an IoT-based system for heart rate monitoring and detection of heart attacks. The system will consist of a wearable device equipped with sensors to monitor the user's heart rate, and a mobile app to display the real-time heart rate data and alert the user in case of any abnormalities.

The wearable device will collect the heart rate data and send it to the mobile app using Bluetooth or Wi-Fi connectivity. The app will analyze the data using machine learning algorithms to detect any irregularities in the user's heart rate, and alert the user and emergency contacts in case of a potential heart attack.

The system will also have a feature to record and store the user's heart rate data over time, allowing them and their doctors to track changes and patterns in their heart rate.

The project aims to provide an affordable and accessible solution for heart rate monitoring and heart attack detection, particularly for individuals at high risk of heart disease.

6.2 CONCLUSION

In this investigation, we made an effort to put up a comprehensive report on identifying heart attacks by keeping an eye on a person's heartbeat. The microcontroller and heartbeat sensor interface senses a person's heartbeat and sends it over the internet via a Wi-Fi module. System enables setting of heartbeat restrictions. following setting this restriction an individual can begin keeping track of their heart rate, and once it rises above a predetermined threshold, they will receive a warning about their elevated heartbeat and the potential for a heart attack, system notify the doctor and patient's appropriate relatives about the patient's state using IOT if it notices any abrupt changes in the patient's heartbeat or body functions. It also retains the patient's information in the cloud for later use

6.3 FUTURE EXTENSION

Enhanced decision-making algorithms: Develop more advanced algorithms that can detect heart attacks with greater accuracy and speed. This can be achieved by incorporating machine learning techniques and using larger datasets.

Wearable technology: Develop wearable devices that can continuously monitor heart rate and other vital parameters. These devices can be integrated with the IoT-based heart attack detection system to provide real-time monitoring and alerts.

Predictive analytics: Develop predictive analytics models that can identify individuals at high risk of heart attacks based on their medical history, lifestyle, and other factors. This can be used to provide personalized recommendations for preventive measures and interventions.

Integration with Electronic Health Records (EHRs): Integrate the IoT-based heart attack detection system with EHRs to provide medical professionals with a more comprehensive view of a patient's health status. This can facilitate early detection of heart attacks and provide timely interventions.

Telemedicine: Develop telemedicine capabilities that allow medical professionals to remotely monitor patients using the IoT-based heart attack detection system. This can improve access to healthcare services and reduce the need for in-person consultations.

Integration with other medical devices: Integrate the IoT-based heart attack detection system with other medical devices such as blood pressure monitors and glucose monitors. This can provide a more holistic view of a patient's health status and facilitate early interventions.

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