

PORTABLE ECG MONITORING WITH IOT

Submitted in partial fulfillment of the
requirements for the award of
Bachelor of Engineering degree in
Computer Science and Engineering with Internet of Things

By

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **S SAI SIVA SUBRAMANIYEM (40732007)** and **SIVA HARI PRASATH V (40732008)** who carried out Project entitled **"PORTABLE ECG MONITORING WITH IOT"** under my supervision from November 2023 to April 2024.


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DECLARATION

I, **S SAI SIVA SUBRAMANIYEM (40732007)** hereby declare that the Project Report entitled **PORTABLE ECG MONITORING WITH IOT** done by me under the guidance of **DR. A. VIJI AMUTHA MARY, B.E., M.TECH., Ph.D** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in **Computer Science and Engineering with Internet of Things**.

DATE: 12/4/24

PLACE: Chennai



SIGNATURE OF THE CANDIDATE

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ABSTRACT

Health monitoring is the major problem in today's world. Due to lack of proper health monitoring, patient suffer from serious health issues. There are lots of IoT devices now days to monitor the health of patient over internet. Health experts are also taking advantage of these smart devices to keep an eye on their patients. With tons of new healthcare technology start-ups, IoT is rapidly revolutionizing the healthcare industry. Hence the lack of assistance for elderly people in home has been reduced now a days due to the social change. Also, the regular health checkup has become difficult due to covid19 situations. This project is focused upon giving a health care assistance from home for the people who are not able to give a regular visit to doctors and for those people who were bed ridden Node MCU is a microcontroller unit that will get the dat from all the input sensor and will transfer all the data in the cloud platform. Pulse rate and body temperature readings are recorded over Ubidots so that patient health can be monitored from anywhere in the world over internet. A panic will also be attached so that patient can press it on emergency to send email/ SMS to their relatives.

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CHAPTER 1

INTRODUCTION

In case of emergency and dangerous situations we have to alert the doctor immediately. For this we are using a gsm based network for doctor to patient communication in the hospital and even to communicate and indicate the status of the patient through SMS. This way of communication is actually done with IOT network topology and with the GSM network. Each patient will be given this module and with the help of this module the patient health condition is monitored and if there is any change in the condition of the health then it immediately sends that changed data through IOT to the local system where the main module is connected to the computer to maintain the status of the patient.

The heart beat is monitored with the pulse rate of the body. The high intensity light sensor senses the expansion and contraction of the heart with the help of the nerves. That beam will transmit the. The controller is fixed for a no. of pulses initially.. This is convenient process to monitor the patients health conditions form any of the distance we present. Since we are using both the networks like IOT and GSM this makes the user to communicate for internal system and as well as to the longer distances.

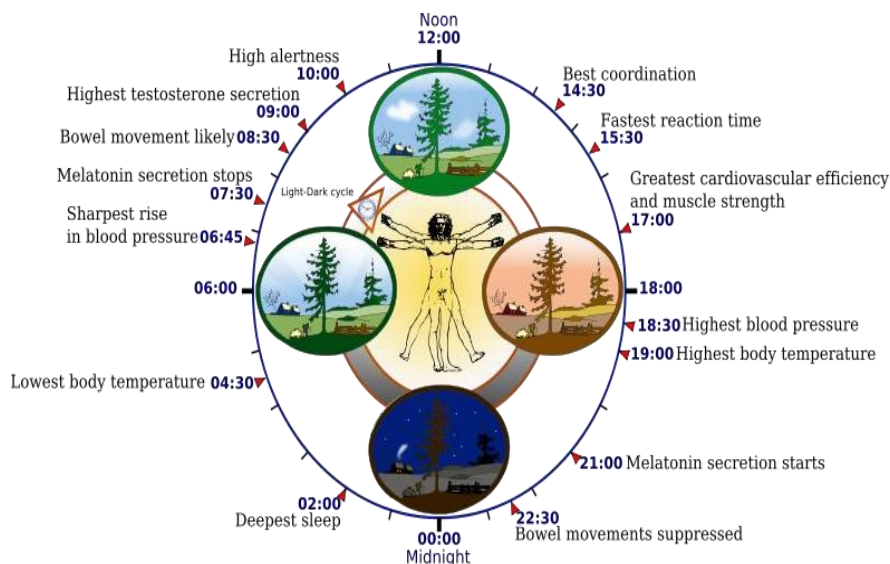


Fig: 1.0 Overview of biological clock in humans.

CHAPTER 2

LITERATURE SURVEY

IoT in healthcare is the key player in providing better medical facilities to the patients and facilitates the doctors and hospitals as well. The proposed system here consists of various medical devices such as sensors and web based or mobile based applications which communicate via network connected devices and helps to monitor and record patients' health data and medical information. The proposed outcome of the paper is to build a system to provide world-class medical aid to the patients even in the remotest areas with no hospitals in their areas by connecting over the internet and grasping information through about their health status via the wearable devices provided in the kit using a raspberry pi microcontroller which would be able to record the patient's heart rate, blood pressure. The system would be smart to intimate the patient's family members and their doctor about the patient's current health status and full medical information in case any medical emergency arises. The collected information can be used to analyze and predict chronic disorders or other diseases such as heart attacks in preliminary stage itself using the data mining techniques that will also provide the approach advantageous for decision making.

The Internet of things is the inter-connection of devices, apps, sensors and network connectivity that enhances these entities to gather and exchange data. The distinguishing characteristic of Internet of Things in the healthcare system is the constant monitoring a patient through checking various parameters and also infers a good result from the history of such constant monitoring. Many such devices equipped with medical sensors are present in the ICUs now-a-days. There could be instances where the doctor couldn't be alerted in time when there is an emergency, despite of 24 hours of monitoring. Also there might be hurdles in sharing the data and information with the specialist doctors and the concerned family members and relatives. The technology that enhances these features is already available but is not accessible and affordable by most of the people in developing countries such as India. Hence these solutions to these problems can be just a simple extension to the current devices which don't have these facilities. This paper demonstrates a Remote Health Monitoring System controlled by Raspberry pi. Raspberry Pi is a small payment card-sized single-board microcontroller made to enhance the basic computer science education in

colleges and developing nations. In this paper, a system is designed to continuously monitor the vital parameters such as heart rate, blood pressure and body temperature. The information is stored on a cloud server database and can be displayed through an online website or mobile application by authorized personnel only. The idea might not be very new, but we propose an absolute and cheap method for the system using Raspberry pi. The main objective of this system is to update the data online and send an alert to the doctors for any abnormality and also predict if the patient is having any disease. The former is accomplished by using MySQL db module to link Raspberry pi to the database whereas the latter is achieved by the combination of Raspberry Pi and GSM module and the web interface. This system has much future scope as the data collected by monitoring is so valuable and can be used for any kind of research by the medical community. The major aim of the paper can be summarized as following:

- To obtain the real-time medical information about a patient via IoT.
- Processing and classification of information gathered about the patient.
- To interpret and predict any disease or disorder in preliminary stage itself using the data mining techniques that will also provide the approach advantageous for decision making.
- To provide Internet of Things based healthcare solutions at anytime and anywhere.

Ahn et al implemented a system for measuring the physiological signals in sitting position such as ECG and BCG by using a smart chair that senses the non-constrained bio-signals and can be monitored using a monitoring system such as the one they had developed providing a classic example of the application of iot in healthcare.

Barger et al made a smart house facility using a sensor network to monitor and track the movements of the patient in home and a prototype of the same is also being tested. The primary objective of their work is to check if their system is capable to outsmart the behavioral patterns and have discussed about the same in their work.

Chiuchisan et al proposed a framework to prevent the threats to patient in smart ICUs. The proposed system intimates the patient's relatives and doctors about any inconsistency in their health status or their body movements and also about the atmosphere of the room so that the necessary precautionary measures can be taken. Dwivedi et al. developed a framework in order to secure the clinical information that

has to be transmitted over the internet for Electronic Patient Record (EPR) systems in which they propose a multi-layered healthcare information system framework which is a combination of Public Key Infrastructure, Smartcard and Biometrics technologies. Gupta et al proposed a model which measures and records ECG and other vital health parameters of the patient using Raspberry Pi and can be of a great use for the hospitals and patients as well as their family members.

Gupta et al present an approach using Intel Galeleo development board that collects the various data and uploads it to the database from where it can be used by the doctors and also reduce the pain born by the patients to visit hospital each and every time to check their health Parameters.

Lopes et al proposed a framework based on IoT for the disabled people so as to study and find the IoT technologies in healthcare segment that can benefit them and their community. They took two use cases to study the latest IoT technologies and its application that can be used mainly for the disabled people.

Sahoo et al studied the healthcare management system and about the large amount of patient data that is generated from various reports. They further analyzed the health parameters to predict the future health conditions of the patient or the said subject. They use a cloud based big data analytic platform to achieve the same using the means of probability.

Tyagi et al explored the role of IoT in healthcare and studied its technical aspects to make it reality and identify the opportunities for which they propose a cloud based conceptual framework in which the patients' medical data and information can be securely transferred, with the permission of patient and their family by building a network among patient, hospital, doctors, Labs etc. The primary reason behind this is to relieve patient from the expensive clinical aid, overcome the shortage of doctors and therefore providing enhanced care and service to patients.

Xu et al presented a data model to record and use the IoT data. They designed and developed a resource-based Ubiquitous Data accessing method to collect and publish IoT data globally so that it can be accessed anywhere, anytime. They also present an emergency medical service based on IoT and how to collect and use the IoT data

on different platforms.

According to World Health Organization (WHO), cardiovascular diseases cause nearly 31 percent of all global deaths every year (estimated 17.7 million deaths in 2015) and it keeps on increasing at an alarming rate. Similarly, numbers of diabetic people have been quadrupled to 422 million (2014) from 108 million (1980). Continuous surveillance of patients and early detection of chronic diseases is the need of the hour to avoid the risk of its fatal effects. In recent years, hospitals and rehabilitation centers face many challenges such as complex installation and wiring of the monitoring devices, effective patient monitoring, proper devices maintenance, etc in providing adequate health facilities to all [1]. Internet of Things (IoT) is an emerging technology which is used to interconnect humans and other objects anywhere and anytime through the internet domain. Experts forecast that 50 billion devices or things will be linked to the Internet by the year 2020.

IIoT in the medical field is used for remote monitoring of patients through Personal Health Devices and send timely notification messages to doctors and caretakers during an emergency situation. Personal Health Devices (PHD) is the devices which are used to collect the patients' health data. The collected personal health data include Temperature, pressure, breathing activity, Heartbeat, glucose, blood PH level, fall detection. This technology enables to deliver healthcare services over a long distance and also minimizes the cost of healthcare services through less hospital stays, less travel time and shared clinicians and professionals. Compared to other existing protocols, Message Queuing Telemetry Transport (MQTT) protocol plays a vital role in M2M communications.

MQTT is an application layer protocol which is used to transmit messages by connecting devices through constrained approach. It is lightweight protocol when compared to all other protocols. It is based on publish and subscribes messaging pattern through MQTT broker. The main advantage of MQTT is that it will buffer the unsent messages during broker disconnection and will send to the subscriber when it is connected again. Machine learning is an algorithmic application of computer science that enables the systems to learn, act and improve them automatically

without being programmed explicitly.

2.1 INFERENCES FROM LITREATURE SURVEY

Current home care and telemedicine systems have a separate device and diagnostic service system, which results in additional time and cost. Our proposed portable ECG device provides captured ECG data and suspected waveform to identify sporadic and chronic events of heart diseases. This device has been built and evaluated for high quality of signals, low computational complexity, and accurate detection

2.2 OPEN PROBLEMS IN EXISTING SYSTEM

Robust healthcare is a requirement for both developed countries, where the cost of healthcare is high and security and privacy are critical issues and developing countries like India, where there is a mass population to handle in hospitals and robust healthcare procedures are required. Doctors should visit the patient regularly and check the status. Situation may occur like nurse make mistake while noting the report. Doctors or Nurses will use the NFC card in card reader so that it sensors will send the details to microcontroller, from there through IOT we can view in PC. NFC tag can be employed for automation of identification of patient and doctors in hospital using smart phones and tablet computers that use the Android platform NFC can be used to explore new ways of real-time hospital workflows and data processing in the medical world.

It is often frustrating when the slow speed of network leads to limited connectivity and long processing hours while using wireless internet either at home network or coffee shop or airport or competing for bandwidth at a conference. As more and more users are tapped in with their devices, the clogged airwaves make it difficult to latch on a reliable signal. If Wi-Fi is implemented in many hospitals, interference from cell phones and computers can block signals from monitoring equipment.

CHAPTER 3

REQUIREMENT ANALYSIS

3.1 FEASIBILITY STUDIES/RISK ANALYSIS OF THE PROJECT

In small hospitals this method is possible, but when it comes to big hospitals it is not possible. We cannot maintain a database of a patient in hardcopy if any accidents like fire or file misplacement occurs. As more and more users are tapped in with their devices, the clogged airwaves make it difficult to latch on a reliable signal.

3.2 SOFTWARE REQUIREMENTS SPECIFICATION DOCUMENT

EMBEDDED C LANGUAGE

In every embedded system based projects, Embedded C programming plays a key role to make the microcontroller run & perform the preferred actions. At present, we normally utilize several electronic devices like mobile phones, washing machines, security systems, refrigerators, digital cameras, etc. The controlling of these embedded devices can be done with the help of an embedded C program. For example in a digital camera, if we press a camera button to capture a photo then the microcontroller will execute the required function to click the image as well as to store it. Embedded C programming builds with a set of functions where every function is a set of statements that are utilized to execute some particular tasks. Both the embedded C and C languages are the same and implemented through some fundamental elements like a variable, character set, keywords, data types, declaration of variables, expressions, statements. All these elements play a key role while writing an embedded C program.

The embedded system designers must know about the hardware architecture to write programs. These programs play a prominent role in monitoring and controlling external devices. They also directly operate and use the internal architecture of the microcontroller, such as interrupt handling, timers, serial communication, and other available features.

ARDUINO IDE

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

CHAPTER 4

DESCRIPTION OF PROPOSED SYSTEM

The main processes involved in this type of control system are to monitor the patient's health status. IOT is a wireless connection network that is used to connect different devices at a frequency of 2.4GHz. For medical applications also this IOT is widely used. The IOT can communicate with the devices of about 1km. The other network is GSM network. This can be operated from any distance to any point of control. The communication is done with the help of local network support. This can get communicated to any part of the world which the network of the local system is applicable. Here we are using for the hospital communication for monitoring the patient.

4.1 SELECTED METHODOLOGY OR PROCESS MODEL

Looking at the disadvantages of all the above methodologies used in previous systems, We have proposed a robust health monitoring system that is intelligent enough to monitor the patient automatically using IOT. It collects the status information through these systems which would include patient's temperature, body movement, heart rate, blood pressure and ECG and sends an emergency alert to patient's doctor as well as to the caretaker with his current status. We connected respiratory sensor, Temperature sensor, MEMS Sensor, and Heart beat Sensors to the Arduino to monitor our home through IOT Technology. This would help the doctor and caretaker to monitor his patient from anywhere in the world. The system uses smart sensors that generates raw data information collected from each sensor and send it to a cloud server where the data can be further analyzed and statistically maintained to be used. For each sensor value we would have set a predefined threshold value. When the system finds that the threshold value is exceeded then we would have set a predefined first aid action that has to be carried out during that time. These actions have to be remainder through any form of the output. Then it has to be the display that will alert whenever the system requires to send the emergency action to be taken whenever the values that go over the threshold value.

4.2 ARCHITECTURE / OVERALL DESIGN OF PROPOSED SYSTEM

The System starts when Node MCU is powered and all the sensors will be coming to the operation. All the input sensors connected in the operation will be active until the

device is active. Then the output side Node MCU is connected in the UART connection that will transmit and receive the data with the IOT. The node MCU will provide the wifi connection to the entire kit that will bring the entire kit into the internet. Any Physical device connected to the internet is said to be in IOT hence the entire kit will be in the IOT. The result of the project will ensure that all the sensor values will be measured constantly and the output reaction will be according to the predefined instructions. Then the values will be uploaded to the IOT platform. We will be able to view the Sensor values anywhere from the world as the device gives us the feature to view from IOT.

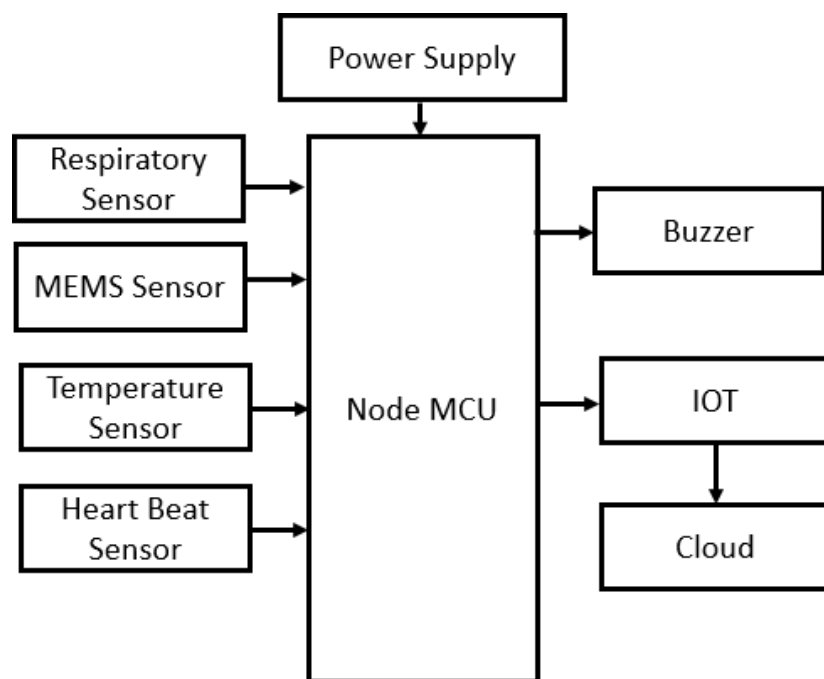


Fig: 4.0 block diagram of portable ECG

Micro-electromechanical systems (MEMS)

Micro-electromechanical systems (MEMS) is a technology that combines computers with tiny mechanical devices such as sensors, valves, gears, mirrors, and actuators embedded in semiconductor chips. MEMS or what he calls analogy computing will be "the foundational technology of the next decade." MEMS is also sometimes called smart matter.



Fig: 4.1 Micro-electromechanical systems (MEMS)

HEARTBEAT SENSOR

A person's heartbeat is the sound of the valves in his/her's heart contracting or expanding as they force blood from one region to another. The number of times the heart beats per minute (BPM), is the heart beat rate and the beat of the heart that can be felt in any artery that lies close to the skin is the pulse.

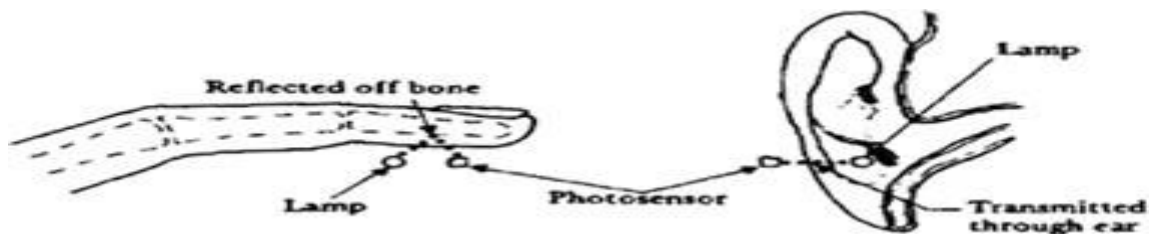


Fig: 4.2 Heart beat sensor

IOT

Internet of Things (IoT) has increasingly gained attention in industry to interact with different types of devices. IoT can have influence on industry and society by integrating physical devices into information networks [8]. IoT impacts can be on different perspectives, namely for private and business users. From the perspective of a private user, IoT has effect on both working and personal fields, such as smart homes and offices, e-health and assisted living. From the aspect of a business user the impacts

would be in fields such as automation and industrial manufacturing, logistics, business process management, intelligent transportation of people and goods.

IoT integrates physical things into information networks. IoT covers the overall infrastructure, including software, hardware and services, which is used to support these information networks. The integrated physical things can exchange data about the physical properties and information that they sense in their environment. To identify devices, we can use identification technologies like for example RFID, which allow each device be uniquely identified.

SOUND SENSOR

Sound detection sensor works similarly to our Ears, having diaphragm which converts vibration into signals. However, what's different as that a sound sensor consists of an in-built capacitive microphone, peak detector and an amplifier (LM386, LM393, etc.) that's highly sensitive to sound. With these components, it allows for the sensor to work:

Sound waves propagate through air molecules. Such sound waves cause the diaphragm in the microphone to vibrate, resulting in capacitance change. Capacitance change is then amplified and digitalized for processing of sound intensity.



Fig: 4.3 sound sensor

4.3 DESCRIPTION OF SOFTWARE FOR IMPLEMENTATION AND TESTING PLAN OF THE PROPOSED MODEL/SYSTEM

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normally utilize several electronic devices like mobile phones, washing machines, security systems, refrigerators, digital cameras, etc. The controlling of these embedded devices can be done with the help of an embedded C program. For example in a digital camera, if we press a camera button to capture a photo then the microcontroller will execute the required function to click the image as well as to store it. Embedded C programming builds with a set of functions where every function is a set of statements that are utilized to execute some particular tasks. Both the embedded C and C languages are the same and implemented through some fundamental elements like a variable, character set, keywords, data types, declaration of variables, expressions, statements. All these elements play a key role while writing an embedded C program.

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4.4 PROJECT MANAGEMENT PLAN

In case of emergency and dangerous situations we have to alert the doctor immediately. For this we are using a gsm based network for doctor to patient

communication in the hospital and even to communicate and indicate the status of the patient through SMS. This way of communication is actually done with IOT network topology and with the GSM network. Each patient will be given this module and with the help of this module the patient health condition is monitored and if there is any change in the condition of the health then it immediately sends that changed data through IOT to the local system where the main module is connected to the computer to maintain the status of the patient.

The heart beat is monitored with the pulse rate of the body. The high intensity light sensor senses the expansion and contraction of the heart with the help of the nerves. That beam will transmit the signal to the receiver and the minute change in the pulse is noticed as the heart beat. If there is any change in the pulses then it is noticed as the change in the heart and then the controller will get a disturbed pulse count which indicates the fault or malfunction of the heart.

The controller is fixed for a no. of pulses initially. If there is any change in the any of the pulse count then it considers as a malfunction of the heart and then it transmits the pulse count with the patients ID to the doctor in the hospital and at the same to it sends a sms to a fixed number in the microcontroller. This is convenient process to monitor the patients health conditions form any of the distance we present. Since we are using both the networks like IOT and GSM this makes the user to communicate for internal system and as well as to the longer distances.

4.5 TRANSITION/ SOFTWARE TO OPERATIONS PLAN

HARDWARE REQUIREMENTS

- Power Supply
- Node MCU
- MEMS Sensor
- Heart Beat Sensor
- Temperature sensor
- Respiratory sensor

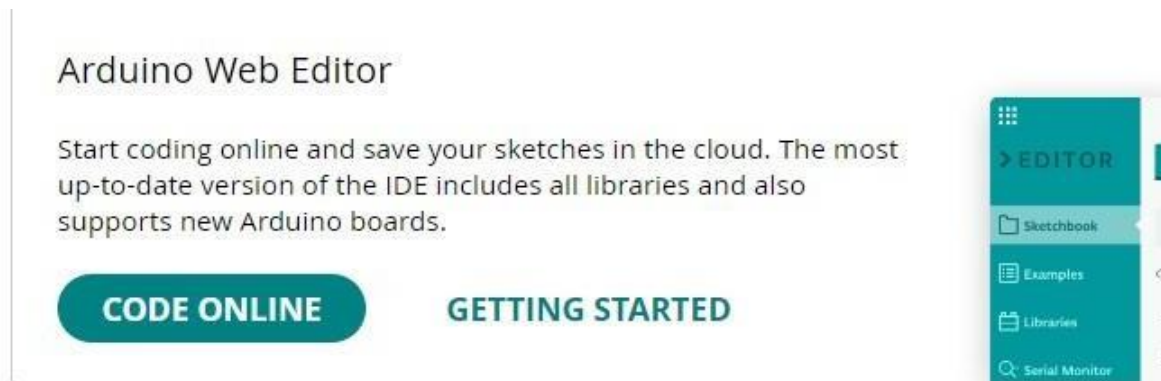
SOFTWARE REQUIREMENTS

- ARDUINO IDE
- Language: Embedded C

CHAPTER 5

RESULT & DISCUSSION

The monitoring system can monitor the patients all the time. The health parameters data are stored in cloud (Ubidots). Internet of things (IoT) is expected in various fields but more benefited in the field of healthcare. Health monitoring for ICU (Intensive Care Unit) patients need to monitor vital signs from time to time. By using the system, it reduces time and hence the patient monitoring system is designed. As a result, the doctor can examine his patient from anywhere and anytime. It can be allowed the doctors or nurses easily to use the computer for checking and to save in the database. Based on the work, doctors have been able to use mobile devices and can be implemented in a global network with the help of the Arduino.



Downloads



Fig:5.0 Installing Arduino IDE

CHAPTER 6

CONCLUSION

This proposed work focuses mainly on the point of medical safety for the patients who have blood pressure problem. The doctor anywhere can monitor the data of the patient even when he is not in the hospital, or the patient is not in the hospital. This will be a very useful device for the people who have high or low blood pressure.

The number of available devices that can record and analyze electric signals emitting from the cardiac conduction system is on the rise. A number of first-generation devices using a single lead to record cardiac rhythm have been manufactured, tested and are approved by regulatory agencies. These devices are best suited for a short-term rhythm analysis. Second generation devices that can record multiple leads are available as both wearable and nonwearable devices. Wearable devices are better suitable as ambulatory cardiac rhythm analysis devices and could be the future of Holter monitoring systems. Despite an explosion of such devices, published biomedical literature about their diagnostic accuracy, reproducibility, or utility is scant. The potential reasons for scant literature include early phase of development of such devices, regulatory environment not mandating robust studies prior to launch of such devices, devices being developed in engineering domain, and disconnect with biomedical research.

REFERENCES

- [1] B. Rebsamen, C. Guan, H. Zhang, C. Wang, C. Teo, M. H. Ang, Jr., and E. Burdet, “A brain controlled wheelchair to navigate in familiar environments,” *IEEE Trans. Neural Syst. Rehabil. Eng.*, vol. 18, no. 6, pp. 590–598, Dec. 2010.
- [2] J. d. R. Millan, R. Rupp, G. R. Muller-Putz, R. Murray-Smith, C. Giugliemma, M. Tangermann, C. Vidaurre, F. Cincotti, A. Kubler, R. Leeb, C. Neuper, K.-R. Muller, and D. Mattia, “Combining brain– computer interfaces and assistive technologies state-of-the-art and challenges,” *Frontiers Neurosci.*, vol. 4, pp. 1–15, 2010.
- [3] X. Perrin, “Semi-autonomous navigation of an assistive robot using lo throughput interfaces,” Ph.D. dissertation, ETHZ, Zurich, Switzerland, 2009.
- [4] Nijholt, D. Tan, G. Pfurtscheller, C. Brunner, J. del R. Millan, B. Allison, B. Graimann, F. Popescu, B. Blankertz, and K.-R. Muller, “Brain–computer interfacing for intelligent systems,” *IEEE Intell. Syst.*, vol. 23, no. 3, pp. 72–79, May/Jun. 2008.
- [5] J. R. Wolpaw, D. J. McFarland, G. W. Neat, and C. A. Forneris, “An EEG-based brain–computer interface for cursor control,” *Electroencephalogr. Clin. Neurophysiol.*, vol. 78, no. 3, pp. 252–259, Mar. 1991.
- [6] Y. Li, C. Wang, H. Zhang, and C. Guan, “An EEGbased BCI system for 2D cursor control,” in *Proc. IEEE Int. Joint Conf. Neural Network.*, 2008, pp. 2214–2219.
- [7] E. Donchin, K. M. Spencer, and R. Wijesinghe, “The mental prosthesis: assessing the speed of a P300-based brain– computer interface,” *IEEE Trans. Neural Syst. Rehabil. Eng.*, vol. 8, no. 2, pp. 174–179, Jun. 2000.
- [8] N. Birbaumer, N. Ghanayim, T. Hinterberger, I. Iversen, B. Kotchoubey, A. Kubler, J. Perelmouter, E. Taub, and H. Flor, “A spelling device for the paralyzed,” *Nature*, vol. 398, pp. 297– 298, Mar. 1999.
- [9] K.-R. Muller and B. Blankertz, “Toward noninvasive brain–computer interfaces,” *IEEE Signal Process. Mag.*, vol. 23, no. 5, pp. 125–128, Sep. 2006.
- [10] J. Williamson, R. Murray-Smith, B. Blankertz, M. Krauledat, and K.-R. Muller, “Designing for uncertain, asymmetric control: Interaction design for brain–computer interfaces,” *Int. J. Human-Comput. Stud.*, vol. 67, no. 10, pp. 827–841, Oct. 2009.
- [11] Y. Li, H. Li, and C. Guan, “A self-training semi supervised SVM algorithm and its application in an EEG-based brain computer interface speller system,” *Pattern Recognition. Lett.*, vol. 29, no. 9, pp. 1285–1294, 2008.
- [12] Y. Su, B. Wu, W. Chen, J. Zhang, J. Jiang, Y. Zhuang, and X. Zheng, “P300-based brain computer interface: Prototype of a Chinese speller,” *J. Compute. Inf. Syst.*, vol. 4, no. 4, pp. 1515–1522, 2008.

- [13] Hong, F. Guo, T. Liu, X. Gao, and S.Gao, “N200-speller using motion onset visual response,” *Clin. Neurophysiology*. vol. 120, no. 9, pp. 1658– 1666, Sep. 2009.
- [14] A. Karim, T. Hinterberger, and J. Richter, “Neural internet: Web surfing with brain potentials for the completely paralyzed,” *Neurorehabil. Neural Repair*, vol. 20, no. 4, pp. 508–515, 2006.
- [15] E. Mugler, M. Bensch, S. Halder, W. Rosenstiel, M. Bogdan, N. Birbaumer, and A. Kubler, “Control of an Internet browser using the P300 event-related potential,” *Int. J. Bioelectromagnetic*, vol. 10, no. 1, pp. 56–63, 2008.
- [16] M. Bensch, A. A. Karim, J. Mellinger, T. Hinterberger, M. Tangermann, M. Bogdan, W. Rosenstiel, and N. NessiBirbaumer, “An EEG controlled web browser for severely paralyzed patients,” *Comput. Intell. Neurosci.*, vol. 2007, pp. 1–5, 2007.
- [17] R. Krepki, B. Blankertz, G. Curio, and K.-R. M“uller, “The Berlin brain– computer interface (BBCI): Towards a new communication channel for online control in gaming applications,” *J. Multimedia ToolsAppl.*, vol. 33, no. 1, pp. 73–90, Apr. 2007.
- [18] EEG’s Signal Processing and Emotiv’s Neuro Headset by Andre Hoffmann
<http://data.text20.net/documentation/thesis.emotivsp.pdf>
- [19] Arduino – Arduino BoardUno
<http://arduino.cc/en/Main/ArduinoBoardUno>