

DEVELOPMENT OF SMART HEALTHCARE MONITORING SYSTEM IN IOT ENVIRONMENT

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering Degree in
Electronics and Communication Engineering

by

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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 **MANIKANDAN K** (Reg. No. 38130128) and **JAGADEESHWARAN K A** (Reg. No. 38130086) who carried out the project entitled "**DEVELOPMENT OF SMART HEALTHCARE MONITORING SYSTEM IN IOT ENVIRONMENT**" under our supervision from December 2020 to March 2021.

Internal Guide
(Dr.P.Chitra)

Dr. T. RAVI, M.E., Ph.D.,
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Submitted for Viva voce Examination held on_____

Name:

Signature:

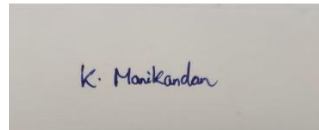
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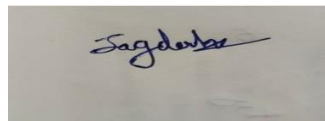
DECLARATION

We **MANIKANDAN K** (38130128) and **JAGADEESHWARAN K A** (38130086) hereby declare that the Project Report entitled “**DEVELOPMENT OF SMART HEALTHCARE MONITORING SYSTEM IN IOT ENVIRONMENT**” done by us under the guidance of **Dr.P.Chitra** at Sathyabama Institute of Science and Technology, **Chennai-600119** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

1.

A rectangular box containing a handwritten signature in blue ink that reads "K. Manikandan".

2.

A rectangular box containing a handwritten signature in blue ink that reads "Jagadeeshwaran".

DATE:

PLACE:

SIGNATURE OF THE CANDIDATES

ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of SATHYABAMA for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. N. M. Nandhita, Dean, School of Electrical and Electronics Engineering** and **Dr. T. RAVI, Head of the Department, Dept. of Electrical and Electronics Engineering** for providing us necessary support and details at the right time during the progressive reviews.

We would also like to express our sincere and deep sense of gratitude to our internal guide **Dr.P.Chitra** for her valuable guidance and suggestions during the progressive reviews for our project.

ABSTRACT

In today's world health problems became a significant issue, health related issues can't be controlled since they may ensue to the environmental changes, lifestyle changes or maybe heredity but it can improve the monitoring techniques so we might get immediate help and can be rescued in time. The proposed system aims to watch the patients remotely by using IoT. This device monitors a person's heartbeat, temperature, respiration and therefore the speed of the motion and sends it to the cloud over the net with the help of Node MCU that has in-built Wi-Fi, so the person will be monitored anytime and anywhere round the globe. Here the most sensors that are being employed are Heartbeat sensor to live the heartbeat of the patient, temperature sensor to observe the temperature and respiratory sensor to watch the breathing of the patient. The MEMS sensor is employed to detect the person's motion. These sensors are connected to the Arduino UNO as data input device and also the output is shipped to the cloud platform getting used. The cloud platform being employed during this project is Ubidots, it collects the information from the sensor and sends it to the cloud in order that the person are often monitored remotely and if the patient has an emergency situation the placement of the patient is additionally sent to the person monitoring the patient. The condition of the patients is conveyed via a portal to medical staff, where they will process and analyse this situation of the patients. The developed prototype is well matched for healthcare monitoring that's proved by the effectiveness of the system. the foremost goal of Li-Fi is to supply flexible data transmission in healthcare environments. it's proposed that a VLC system be used for indoor applications. We are specializing in cost reduction during this project, and so as to try and do so, we had to create proper system component selections, like modulation, coding, and filtering. With a low-cost solution, we wanted to realize acceptable bit error rate performance for indoor application. Using Li-fi communication as a wireless medium, the Microcontroller delivers data from the Sensor to a different microcontroller that's interfaced with a private Computer (PC). due to the rapid speed with which doctors and patients exchange data. This method of communication also reduces the danger of radiation threats and may be utilised practically anyplace, including places where transmission is prohibited.

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LIST OF ABBREVIATIONS

S.NO	ABBREVIATION	FULL FORM
1.	USB	UNIVERSAL SERIAL BUS
2.	GPS	GLOBAL POSITIONING SYSTEM
3.	RTD	RESISTIVE TEMPERATURE DETECTOR
4.	MEMS	MICRO-ELECTRO- MECHANICAL SYSTEMS
5.	GSM	GLOBAL SYSTEM FOR MOBILE COMMUNICATION

CHAPTER 1

INTRODUCTION

1.1. PROJECT OBJECTIVE

The PATIENT MONITORING SYSTEM FOR REMOTE DOCTORS USING GSM TECHNOLOGY is explained in this chapter. It provides an overview of the project design, as well as relevant literature and the surrounding environment. The thesis and appendices are organised chapter by chapter at the end of this chapter. First, we'll go through the major processing that the 8051 microcontroller does, and then we'll go over the processes that can be automated and are within the scope of the project. Then we talk about how to put it all together.

1.2. OVERVIEW

In the event of an emergency or a potentially dangerous scenario, we must promptly notify the doctor. We use a gsm-based network for doctor-to-patient contact at the hospital, as well as to communicate and show the patient's status via SMS. This method of communication uses the Zigbee network topology as well as the GSM network. This module will be supplied to each patient, and it will be used to monitor the patient's health. If there is a change in the patient's health, the updated data will be sent through Zigbee to the local system, where the main module will be connected to the computer to keep track of the patient's status.

The pulse rate of the body is used to monitor the heartbeat. The nerves allow the high-intensity light sensor detect the expansion and contraction of the heart. The signal will be transmitted to the receiver by that beam, and the heart beat will be detected by the minute shift in the pulse. If there is a change in the pulses, it is interpreted as a change in the heart, and the controller receives a disturbed pulse count, indicating a cardiac problem or malfunction. Initially, the controller is set for a specific number of pulses. If any of the pulse counts changes, it believes the heart to be malfunctioning

and sends the pulse count together with the patient's ID to a doctor in the hospital while also sending a text message to a fixed number in the microcontroller. This is a convenient way to keep track of a patient's health from any of the locations we have. Because we are employing both Zigbee and GSM networks, the user is able to communicate both within the system and over extended distances.

1.3. AIM OF THE PROJECT

The aim of this project is to observe the patient remotely using the fast growing technique IoT (Internet of Things). IoT in healthcare is that the key player in providing better medical facilities to the patients and facilitates the doctors and hospitals furthermore. the key functions of this sort of system are to stay track of the patient's health. this may be controlled from any point of control at any distance. Local network assistance is employed to facilitate communication. this may be conveyed to any region of the planet where the local system's network is in use. We're using this for hospital communication and patient monitoring. Various sensors like heartbeat sensor, MEMS sensor, Respiratory sensor and temperature sensors are getting used to watch the patient and these values are sent to the person monitoring the patient via cloud. The IoT platform used here is Ubidots.

CHAPTER 2

LITERATURE SURVEY

B. Rebsamen et al. (2010) While brain-computer interfaces (BCIs) can provide communication to people who are locked-in, they suffer from a very low information transfer rate. Further, using a BCI requires a concentration effort and using it continuously can be tiring. The brain controlled wheelchair (BCW) described in this paper aims at providing mobility to BCI users despite these limitations, in a safe and efficient way. Using a slow but reliable P300 based BCI, the user selects a destination amongst a list of predefined locations. While the wheelchair moves on virtual guiding paths ensuring smooth, safe, and predictable trajectories, the user can stop the wheelchair by using a faster BCI. Experiments with nondisabled subjects demonstrated the efficiency of this strategy. Brain control was not affected when the wheelchair was in motion, and the BCW enabled the users to move to various locations in less time and with significantly less control effort than other control strategies proposed in the literature.

J. D. R. Millan et al. (2010) Through several shown prototypes such as brain-controlled wheelchairs, keyboards, and computer games, fresh research has pushed the area of electroencephalogram (EEG)-based brain-computer interface (BCI) out of its infancy and into a phase of relative maturity in recent years. With the proof-of-concept phase completed, the time has come to focus on the development of realistic BCI technologies that can be implemented in real-world settings. We are particularly interested in the possibility of improving the lives of innumerable disabled people by combining BCI technology with existing assistive devices (AT). In order to develop more practical BCIs for usage outside of the lab, we identified four application areas where developments in BCI technology could considerably assist impaired individuals, namely "Communication and Control," "Motor Substitution," "Entertainment," and "Motor Recovery." We highlight the main research concerns in these four domains while reviewing the current state of the art and probable future advances. The most

progress is expected in the development of hybrid BCI architectures, user–machine adaptation algorithms, the exploitation of users' mental states for BCI reliability and confidence measures, the incorporation of principles in human–computer interaction (HCI) to improve BCI usability, and the development of novel BCI technology, such as better EEG devices.

X. Perrin (2009) This paper presents a semi-autonomous navigation strategy aimed at the control of assistive devices (e.g. an intelligent wheelchair) using low throughput interfaces. A mobile robot proposes the most probable action, as analyzed from the environment, to a human user who can either accept or reject the proposition. In case of rejection, the robot will propose another action, until both entities agree on what needs to be done. In a known environment, the system infers the intended goal destination based on the first executed actions. Furthermore, we endowed the system with learning capabilities, so as to learn the user habits depending on contextual information (e.g. time of the day or if a phone rings). This additional knowledge allows the robot to anticipate the user intention and propose appropriate actions, or goal destinations.

A. Nijholt et al. (2008) Advances in cognitive neuroscience and brain-imaging technologies give us the unprecedented ability to interface directly with brain activity. These technologies let us monitor physical processes in the brain that correspond with certain forms of thought. Researchers have begun using these technologies to build brain-computer interfaces (BCIs)—communication systems that don't depend on the brain's normal output pathways of peripheral nerves and muscles. Four short articles provide a quick overview of the past, present, and future of BCIs.

J. R. Wolpaw et al. (1991) This research started the creation of a unique communication and control modality for people with severe motor impairments. Normal volunteers were taught to navigate a cursor from the centre of a video screen to a target positioned at the highest or bottom edge using an 8–12 Hz mu rhythm recorded from the scalp over the fissure of Rolando of 1 hemisphere.

On-line frequency analysis was accustomed determine the amplitude of the Mu rhythm, which was then translated into cursor movement: bigger amplitudes moved the cursor up, while smaller amplitudes moved it down. Subjects learnt to switch mu rhythm amplitude rapidly and properly over several weeks, with the cursor often reaching the target in 3 seconds. Evaluation of the distribution of amplitudes in response to top and bottom targets yielded the parameters that translated mu rhythm amplitudes into cursor movements. This study's utilisation of those distributions was a standout feature and a vital contributor in its success. Improvements to the training techniques and therefore the distribution-based strategy for converting mu rhythm amplitudes into cursor movements should improve this 1-dimensional control even more. The achievement of two-dimensional control is being researched. For disabled people, the mu rhythm may well be an important new communication and control option.

C. Wang et al. (2008) An electroencephalogram (EEG)-based brain computer interface (BCI) for two-dimensional cursor control is proposed in this work. Mu/beta rhythm and P300 potential govern the cursor's horizontal and vertical movements, respectively. The key advantages of this system are: (i) the production of two nearly independent control signals at the same time; and (ii) the ability to move the cursor from one random position on the screen to another random position on the screen. Our experiment and data analysis have demonstrated these benefits.

R. Wijesinghe et al. (2000) Farwell and Donchin first described a brain-computer interface (BCI) in 1988, and this study was aimed to evaluate it. The approach takes advantage of the fact that the P300 component of the event-related potential is elicited by unusual events in the oddball paradigm (ERP). The BCI shows the user a 6 by 6 cell matrix with one letter of the alphabet in each cell. While the rows and columns of the matrix are magnified, the user concentrates his or her attention on the cell containing the letter to be transmitted. Each intensification is an oddball sequence event, and the row and column containing the attended cell are "unusual" items, eliciting a P300 solely for these occurrences. By calculating which row and column elicited the P300, the computer determines the transmitted character. The scientists report that an off-line version of the system can communicate at a rate of 7.8 characters per minute with an accuracy of 80 percent, based on a bootstrapping

approach. The system's real-time performance was also evaluated. According to the authors' findings, a P300-based BCI is viable and practicable. These conclusions, however, are based on experiments conducted on healthy people.

I. Iversen et al. (1999) It's difficult to develop user interfaces that can deal with unusual control features, and traditional interface design techniques aren't much assistance. This work looks at how interactions can be built to explicitly account for control input uncertainty and dynamics. The asymmetry of feedback and control channels, in particular, is highlighted as a fundamental design restriction, which is particularly apparent in current non-invasive brain-computer interfaces (BCIs). Brain-computer interfaces are devices that can decode cerebral activity in real time, allowing a computer programme to be controlled directly through thought. BCIs, on the other hand, have signal characteristics that are vastly different from those of most traditional interface devices. The bandwidth is extremely limited, and there are long and unpredictable delays. These interfaces can't just be treated like clumsy mice. They are an example of a burgeoning category of sensor-based interfaces with unusual control features in this regard. As an example, we show the text entry application "Hex-O-Spell," which is controlled by electroencephalography based on motor imagery (EEG). The system makes use of the large visual display bandwidth to compensate for the restricted control signals, with the timing of state changes encoding the majority of the data. We offer findings that demonstrate the interface's comparatively excellent performance, with entry rates reaching seven characters per minute.

C. Guan et al. (2008) We first introduce a self-training semi-supervised support vector machine (SVM) technique and its associated model selection method in this research, which are meant to train a classifier with limited training data. We then show that this algorithm is convergent. Two examples are given to demonstrate the applicability of our model selection process. Finally, we test our method using data from a P300-based brain computer interface (BCI) speller. This algorithm has been found to greatly minimise the amount of time required to train the P300-based BCI speller.

J. Mellinger et al. (2007) We've previously shown that an EEG-controlled web

browser based on self-regulation of slow cortical potentials (SCPs) allows severely paralysed patients to browse the internet without using their muscles. This system, however, had various flaws, including the fact that patients could only explore a limited number of web pages and had to select links from an alphabetical list, which caused issues if the link names were identical or if the user didn't recognise them (as in graphical links). Here, we describe Nessi, a novel EEG-controlled web browser that addresses these issues. The open source browser Mozilla was augmented by graphical in-place markers in Nessi, allowing the user to pick any link on a web page by corresponding distinct brain reactions to different frame colours placed around chosen things. Other interactive features, such as e-mail and virtual keyboards, are available to the user in addition to links, opening up a wide range of hypertext-based applications.

A. A. Karim et al. (2006) EEG-driven web browsers based on slow cortical potential (SCP) self-regulation have previously shown that patients with severe paralysis can surf the Internet independently of spontaneous muscle control. However, this system had some drawbacks. For example, patients can only view within a limited number of web pages, need to select a link from an alphabetical list, and have problems if the link names are the same or unknown to the user. (Example: Graphical left). Here we describe a new EEG-driven web browser called Nessi that overcomes these shortcomings. In Nessi, the open source Mozilla browser has been extended with in-place graphical markers, with different brain reactions corresponding to different border colors around selectable items, allowing users to use any on a web page. You can select the link. In addition to links, other interactive elements such as email and virtual keyboards are available to users, allowing them to take advantage of a variety of hypertext-based applications.

K.R. Muller et al. (2006) Designing person interfaces that may address unconventional manipulate houses is challenging, and traditional interface layout strategies are of little assist. This paper examines how interactions may be designed to explicitly recollect the uncertainty and dynamics of manipulate inputs. In particular, the asymmetry of remarks and manipulate channels is highlighted as a key layout constraint, that is specially apparent in present day non-invasive brain–pc interfaces

(BCIs). Brain–pc interfaces are structures able to interpreting neural pastime in actual time, thereby permitting a pc software to be without delay managed through thought. BCIs, however, have definitely specific sign houses than maximum traditional interplay devices. Bandwidth could be very confined and there are relatively lengthy and unpredictable delays. Such interfaces can not actually be dealt with as unwieldy mice. In this admire they're an instance of a developing subject of sensor-primarily based totally interfaces that have unorthodox manipulate houses. As a concrete instance, we gift the textual content access software “Hex-O-Spell”, managed through motor-imagery primarily based totally electroencephalography (EEG). The gadget makes use of the excessive visible show bandwidth to assist atone for the confined manipulate signals, in which the timing of the country modifications encodes maximum of the information. We gift consequences displaying the relatively excessive overall performance of this interface, with access costs exceeding seven characters consistent with minute.

CHAPTER 3

EXISTING METHODS

3.1 EXISTING SYSTEM

- Robust healthcare is a requirement for both industrialized countries, where healthcare costs are high and security and privacy are essential concerns, and developing countries, such as India.
- Hospitals must handle a large number of patients and robust healthcare procedures are required. Doctors should check on the patient on a frequent basis. It is possible that a nurse will make a mistake when recording the report.
- Doctors or nurses will insert the NFC card into a card reader, causing sensors to transfer data to a microcontroller, which can then be seen on a PC via ZIGBEE.
- Using Android-based smart phones and tablet PCs, NFC tags may be used to automate the identification of patients and clinicians in hospitals. In the medical world, NFC can be utilized to investigate new approaches of real-time healthcare workflows and data processing.

3.2 DISADVANTAGES

- In small hospitals this method can be followed, but in big hospitals this method can not be followed as the level of complexity is high.
- Maintenance of database of the patients as hardcopy of any accident or burn cases is not possible as some misplacement might occur.
- As more people use their devices to connect, the crowded airwaves make it difficult to find a stable signal.
- The most significant difficulty with IoT is privacy, as all linked devices transmit data in real time. If the end-to-end connection is not secure, personal data can be hacked. Criminals can profit from the personal information of others.

- Accuracy concerns may arise as a result of managing such large amounts of data in real time. Although the Internet of Things may lower the cost of diagnosis and treatment for patients, the cost of installing and maintaining all of the devices is rather expensive.
- **Security and privacy:** Because healthcare monitoring systems have the potential to be breached or hacked, security and privacy remain a major worry preventing users from embracing IoT technology for medical purposes. Theft of sensitive information regarding a patient's health and whereabouts, as well as tampering with sensor data, might have serious implications, negating the IoT's benefits.
- **Risk of failure:** Sensor and connected equipment performance can be impacted by failure or faults in the hardware, as well as power outages, putting healthcare operations at risk. Furthermore, skipping a planned software update could be much riskier than skipping a doctor's appointment.
- **Integration:** Because there is no consensus on IoT protocols and standards, gadgets from different manufacturers may not be compatible. The lack of consistency hinders IoT from being fully integrated, limiting its potential usefulness.
- **Cost:** While the Internet of Things (IoT) has the potential to lower healthcare costs in the long run, the cost of implementing it in hospitals and staff training is relatively expensive.

CHAPTER 4

PROPOSED METHOD

4.1 BLOCK DIAGRAM:

The block diagram of the proposed system is shown in the figure 3.1, here the connection of all the sensors that are given as the input devices and the LCD that is given as the output device. The system is run by NODE MCU using a platform Arduino and Ubidots as a cloud platform to share data over the cloud.

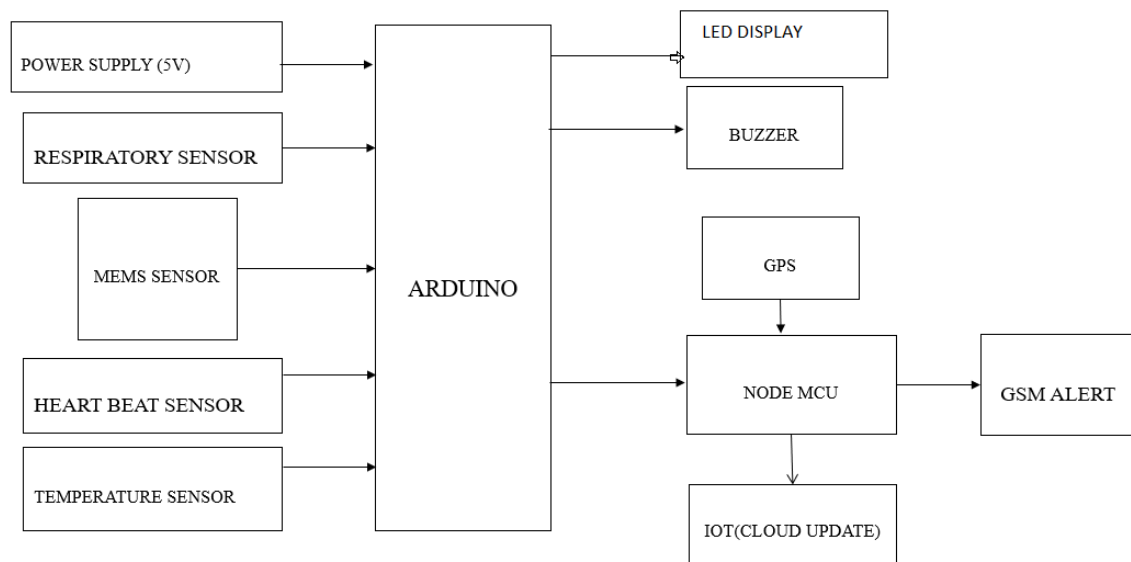


FIGURE 4.1
BLOCK DIAGRAM

4.2 PROPOSED SYSTEM:

- The proposed system is a robust device that monitors the health of the patient automatically using the upcoming technology IoT (Internet of Things).
- It collects status information from these systems, such as the patient's temperature, body movement, heart rate, blood pressure, and ECG, and sends an emergency alert to the patient's doctor as well as the caretaker with his current state.

- Using IOT technology, we connected a respiration sensor, a temperature sensor, a MEMS sensor, and a heartbeat sensor to the Node MCU to monitor our home.
- The doctor and the caretaker would be able to keep an eye on their patient from anywhere in the world.
- The system use smart sensors to capture raw data from each sensor and transfer it to a cloud server, where it may be further analyzed and statistically maintained before being used. The data that is being analyzed will be sent to a doctor or a caretaker to be monitored constantly anywhere around the world so that incase of any emergency immediate action can be taken.
- They're made for medical updates, with an interface and access to details and physical signal recording settings. Changes to the system's touch screen and drug sharing parameters can be made via a web interface by doctors. Records from the monitoring equipment are transferred to the system. The data is then encrypted using the control algorithm, Augmented Data Recognize, by the allocation system's distribution.
- The cloud framework is designed to ensure patient safety and security. As a result, the transferred data is saved in the patient file and separated from non-accessible government issues. Individual or short-term and long-term results are classify data on analytical hygiene gathered for all individuals in the cloud using two analytical methodologies.

4.3 HARDWARE REQUIREMENTS

- Power Supply
- ATmega328P Microcontroller
- Node MCU

- MEMS
- Temperature sensor
- Respiratory Sensor
- Heartbeat Sensor
- GPS Module
- GSM Module
- Arduino UNO

4.3.1 POWER SUPPLY

A power source (sometimes known as an electric supply unit or PSU) is equipment or system that provides electrical or other forms of energy to one or more output loads. The phrase is most generally used to describe electrical energy sources, with mechanical energy sources being used less frequently and others being used extremely infrequently. The power supply gives the required power for the system to run and provide the expected results.

4.3.2 AT MEGA 328P MICROCONTROLLER

With a wide number of pins and features, the ATmega328P is one of the high-performance AVR technology microcontrollers. It has an 8-bit CMOS processor and an RSIC CPU, which improves its performance and power economy. It also has auto naps and an internal temperature sensor. Internal protections and several programming techniques are included in this ATmega328P IC, allowing engineers to priorities this controller for various situations. The IC supports a variety of modern-era communication techniques for other modules and microcontrollers, which is why the ATmega328P microcontroller is becoming more popular by the day.



FIGURE 4.2

4.3.3 NODE MCU

NodeMCU is an open source IoT platform and it is also low cost platform, which initially include the firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, the hardware was based on the ESP-12 module. The support for the ESP32 32-bit MCU was added later. NodeMCU is majorly used to connect objects like sensors and lets the data to be transferred using the Wi-Fi protocols. For IoT platform it uses the Ubidots and Arduino IDE for the software part.



FIGURE 4.3

4.3.4 MEMS

MEMS or Micro-Electro-Mechanical Systems, is a technology that may be characterized as miniature mechanical and electrical parts (i.e., devices and structures) that are created using micro fabrication processes. MEMS device key

physical dimensions range from far below one micron on the lowest of the dimension spectrum to several millimeters on the high end. MEMS devices range in complexity from basic structures with no moving parts to very sophisticated electromechanical systems with several moving elements controlled by integrated microelectronics. The essential condition for MEMS is that at minimum some of the components have some type of mechanical functioning, regardless of whether or not they can move. In different regions of the globe, MEMS is referred to by different names.



FIGURE 4.4

4.3.5 TEMPERATURE SENSOR

A temperature sensor is an electrical device that gives temperature measurement in a readable form, such as a Thermocouple or RTD (Resistive Temperature Detector). The coolness or hotness of an entity is measured by the temperature sensor. The voltage read across the diode is what makes the sensor work. When the voltage is increased, the temperature rises, and the voltage between the emitter and base terminals of the transistor decreases. The sensor has saved that information. The gadget generates an analogue signal when the difference in voltage is amplified, and it is directly proportional to the temperature. Temperature sensors come in a variety of shapes and sizes.

There are different types of temperature sensors,

Types of temperature sensor :

- Thermocouple sensor
- Thermistor sensor
- Resistance temperature detector

- Thermometer
- IR temperature sensor
- Semiconductor based sensor

Temperature sensor applications:

- These are used in electric motors to measure the temperature of the motor windings, bearings, and brushes.
- These are used in electric cables to measure the temperature inside the cable.
- In a mechanical engine, the temperature of the engine oil and bearings is measured.
- They are also used in Rubber, plastic, and biomedical sectors are all examples.



FIGURE 4.5

4.3.6 RESPIRATORY SENSOR

The respiratory sensor measures the breathing rate of a person if the person is have proper breathing rate. It is used to measure the smallest rate of the breath of a patient. These sensors come with a ask and a tube to monitor the breathing rate of the patient, that are very handy and portable. The main feature of the sensor is the early detection of the person's inhalation phase which is connected to a set-up of NodeMCU will monitor the breath flow and immediately send the data over the internet using the cloud platform Ubidots, so that and immediate step of rescue can be done.

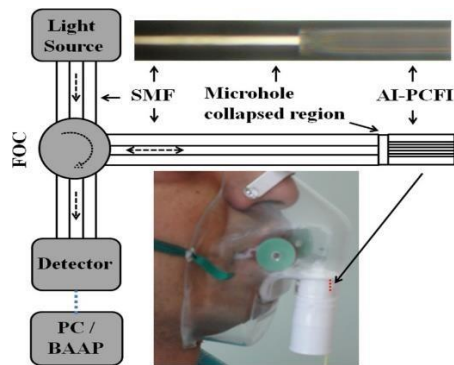


FIGURE 4.6

4.3.7 HEARTBEAT SENSOR

The sound of a person's heartbeat is the sound of the heart's valves contracting or expanding as they drive blood from one region to another. The heartbeat rate is the number of times the heartbeat per minute (BPM), and the pulse is the heartbeat that can be felt in any artery adjacent to the skin.

Manual Method: Checking one's pulses at two locations—the wrists (the radial pulse) as well as the neck—can be used to assess one's heartbeat (carotid pulse). The process is to lay a finger (index and right hand) on the wrist (or neck just below the throat) and count the number of pulses for 30 seconds, then multiply the result by two to get the cardiac rate. Nonetheless, pressure must be used carefully, and fingers should be shifted down and up until the pulse is sensed.

- **Using a sensor:** The optical power variation as light is reflected or absorbed in its whole route through the blood as the heartbeat changes are being used to measure heart rate.

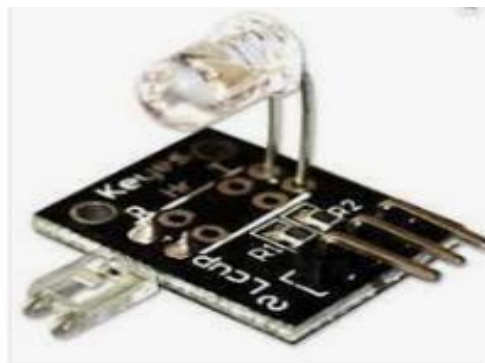


FIGURE 4.7

PRIMARY APPLICATIONS OF HEARTBEAT SENSOR

- Functions as a Digital Heart Rate Sensor
- Functions as a Heart Rate Monitoring System
- Functions as a Bio-Feedback Control System for Robotic Applications

Whenever the blood flows via the arteries, the finger becomes somewhat more opaque; as a result, less light reaches the detector from the LED. The detector signal varies with each heartbeat produced. An electrical pulse is generated from the varied detector signal. This electrical current is boosted and activated by an amplifier.

4.3.8 GPS MODULE

"Global Positioning System" is the abbreviation for "GPS". The Global Positioning System (GPS) is a satellite navigation system that determines an object's ground position. The United States military initially deployed GPS technology in the 1960s, and civilian adoption followed over the next few decades. Many commercial items, such as autos, cell phones, workout watches, and GPS Devices, now contain GPS receivers. The GPS has almost 24 satellites floating in space around 12,000 miles (19,300 km) above the surface. They orbit the earth every 12 hours at a speed of around 7,000 km (11,200kilometers per hour). The satellites are equally spaced, providing direct route access to four of them from everyone on the planet. Each GPS satellite sends out a message with the spacecraft's present state, orbit, and precise time. A GPS receiver uses triangulation to estimate its exact position by combining signals from several satellites. To calculate a receiver's position, three satellites are necessary, while a link to satellites is optimal because it gives more precision.

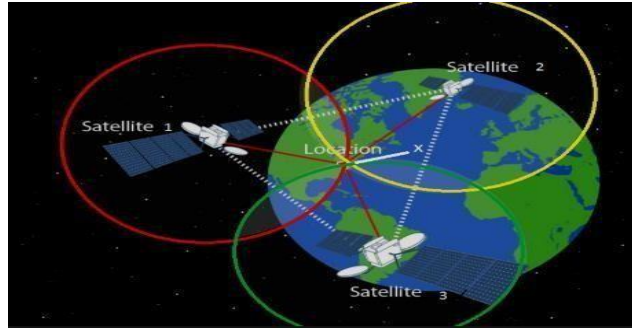


FIGURE 4.8

signals from several satellites. To calculate a receiver's position, three satellites are necessary, while a link to satellites is optimal because it gives more precision.

4.3.9 GSM MODULE

GSM is a digitized mobile network commonly utilized by phone users in Europe and other areas of the world. GSM is the most extensively exploited of the three wireless mobile telephony technologies: time division multiple access (TDMA), code-division multiple access (CDMA) (CDMA), and GSM.

GSM serializes and compresses data before transmitting it together with two additional streams of user information, each in its time slot, via a channel. It works in the 900 MHz or 1,800 MHz frequency bands.

GSM, along with other wireless mobile communications technology, is key to the development of wireless mobile telecommunications, which includes High-Speed Circuit-Switched Data (HSCSD), General Packet Radio Service (GPRS), Enhanced Data GSM Environment (EDGE), and Universal Mobile Telecommunications Provider (UMTS).

Global system for mobile (GSM) network

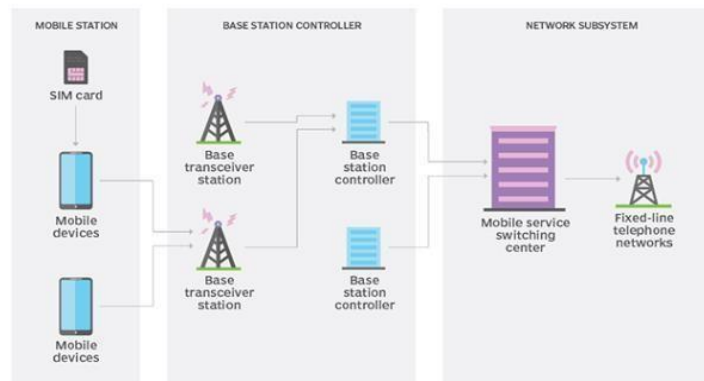


FIGURE 4.9

FUTURE OF GSM:

GSM, along with some other technologies, is part of a wireless mobile telecommunications development that also includes

- HSCSD is for High-Speed Circuit-Switched Data,
- GPRS stands for General Packet Radio System,
- EDGE stands for Enhanced Data GSM Environment, and
- UMTS stands for Universal Mobile Telecommunications Service (UMTS).

4.3.10 ARDUINO UNO

UNO (Arduino Uno) The Arduino Uno could also be a microcontroller board that uses the ATmega328 microcontroller (datasheet). There are 14 digital input/output pins (six of which could be used as PWM outputs), six analogue inputs, a 16 MHz oscillator, a USB connection, an influence jack, an ICSP header, and a switch on this board. It comes with everything you may have to induce started with the microcontroller; simply plug it into a computer with a USB cable or power it with an AC-to-DC adapter or battery. The gateway layer could also be a router-based network that sends traffic from the microcontroller to the acceptable Cloud. it's obvious that

when using the overall public cloud, this layer may have one or more hops, but within the proposed model, it's limited to 1 router. The Network layer is utilized to store sensor data using Ubidots and to allow users 'doctor or patient' to access the patient's state remotely or even to mentor it from any available device. The monitoring is administrated utilizing a smartphone that's connected to the Ubidots through a wireless connection.

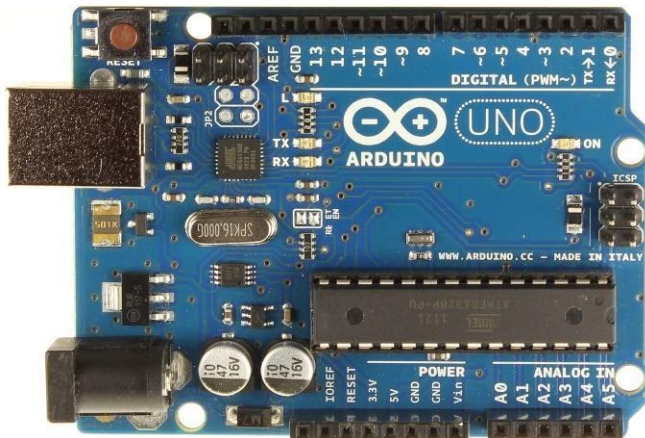


FIGURE 4.10

4.4 SOFTWARE REQUIREMENTS

- ARDUINO IDE
- Language : Embedded C
- Ubidots – IoT Platform

4.4.1 ARDUINO IDE

The Arduino Software (IDE) includes a text editor for writing code, a message area, a text console, a toolbar with buttons for basic functions, and a series of menus. It connects to the Arduino hardware, allowing it to upload and communicate with programs. This Arduino IDE is an open-source software that is used to develop the software part or the code for a particular device so that the code developed can be

uploaded in the particular board such as NodeMCU or sensors to perform the necessary task that is desired by the user. The Arduino IDE for this purpose consists of many libraries and is also available for different board like ESPs, Arduino UNO and there are a few inbuilt programs in the IDE like blink etc.

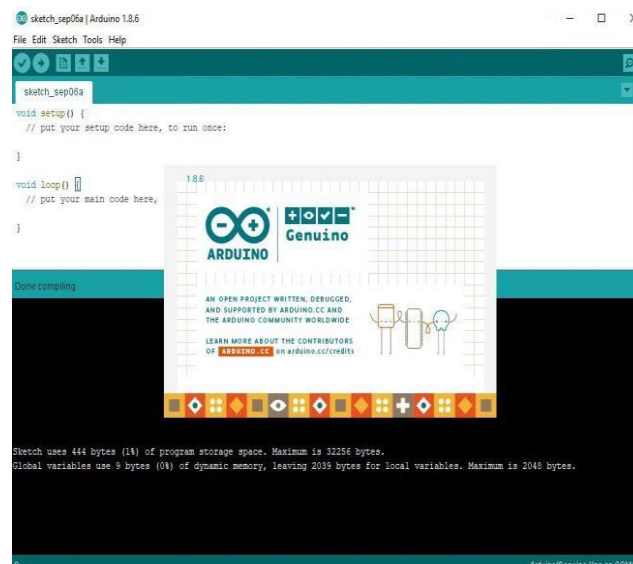


FIGURE 4.11

4.4.2 EMBEDDED C

Embedded C is the most popular and well known programming language amongst the programmers in the IT field. C language is almost used everywhere for developing a wide variety of electronic gadgets. Each of the processor that is being used in the system is associated with embedded software. The Internet of Things builds on an embedded system for which it is necessary to use the embedded C languages since most of the devices use embedded C as the software language to be uploaded in the device. Some embedded systems are very simple to use compared to others, the supplant human decision-making offers capabilities beyond what we can imagine and what humans could provide. For instance, the Aviation system in general and drones are capable of sensing data and are able to act upon the information provided by the sensors faster than the human could work, with a whole new set of operating features. Embedded C is being used in almost all the domains to support the embedded and

the IoT industry and is found everywhere around the globe for its simplicity and non-complex feature.

4.4.3 UBIDOTS – IoT PLATFORM

Ubidots is an Internet of Things (IoT) platform that enables innovators and businesses to prototype and expand IoT initiatives into production. Send data to the cloud using the Ubidots platform from any Internet-connected device. Then, using visual tools, you can define actions and alerts based on your real-time data and unleash the value of your data. Ubidots provides a REST API that lets you read and write data to the following resources: data sources, variables, values, events, and insights. The API accepts both HTTP and HTTPS requests and requires an API Key. The working of Ubidots is simple, once the code developed in the Arduino IDE is uploaded to the system, Ubidots IoT platform should be opened and the necessary details of the devices and the name of the system and the project and the output view that is desired by the user should be entered and then a link is given in the platform that has to be put in the code along with the Wi-Fi details of the user since the data will be sent through the Internet to the required person that needs the access to the data sent by the platform.



FIGURE 4.12

CHAPTER-5

RESULT AND DISCUSSION

5.1 DISCUSSION

The output of this system is given below with the pictures. The hardware setup of the system in the given **FIGURE 5.1** consists of an Arduino, ATmega328P Microcontroller, Node MCU, Temperature sensor, Respiratory sensor, ECG sensor, LED display and a power supply unit.

5.2 HARDWARE CONNECTION DISCUSSION

- The system uses a voltage regulator of 7-12V as the power supply to power the entire device.
- Sensors being used in this device are the heartbeat sensor, temperature sensor, respiratory sensor, MEMS sensor.
- The input sensors are connected to the Arduino and the output is given by the Node MCU where the data is sent to the cloud.
- The monitor cable is connected to the output pin of Arduino.
- The 16x2 LED Display is connected to the Arduino and shows the appropriate output for each sensor.

The hardware setup of the proposed system is shown below in **FIGURE 5.1**,

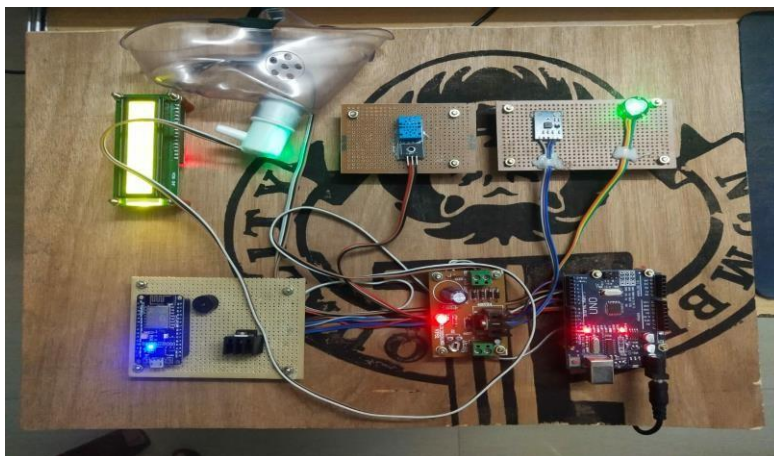


FIGURE 5.1 HARDWARE

PROCESS:

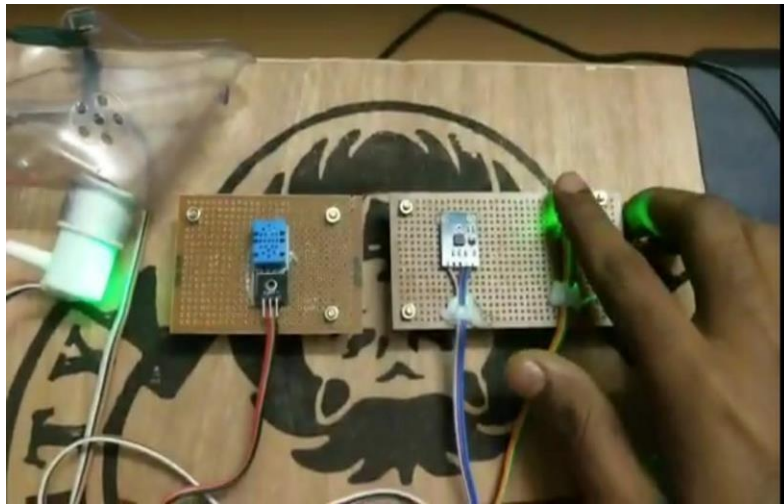


FIGURE 5.2 SENSORS

STEP 1: REGISTER

FIGURE 5.2 shows as there are necessary sensors, Patients will record the every HealthCare monitoring parameters using the following Heartbeat Sensor, Respiratory Sensor , Temperature sensor, MEMS sensor and ECG sensor.

These Recorded Values from the patients acts as the primary parameters of Smart healthcare system monitoring using Internet of Things.

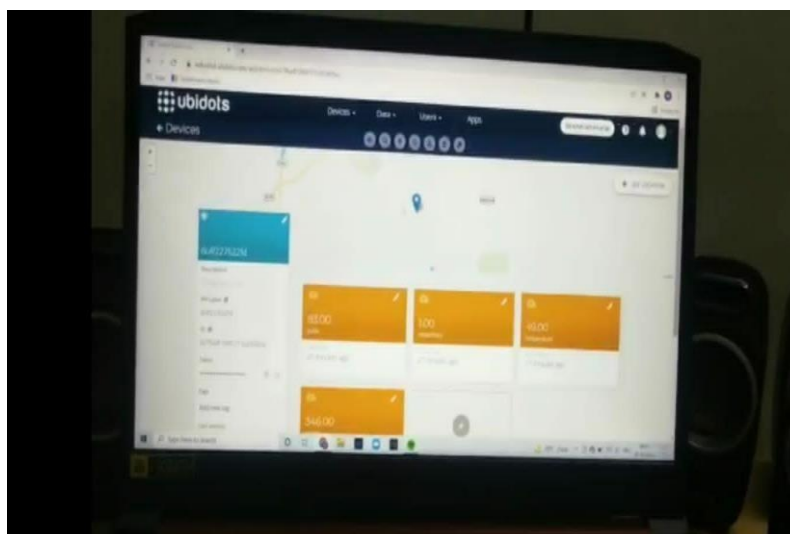


FIGURE 5.3 UBIDOTS CLOUD DATABASE

STEP 3 : RECORDED HEALTHCARE MONITORING PARAMETERS

FIGURE 5.3 shows Using Heartbeat Sensor, Patient's Main Pulse is been recorded, which is then stored in a private Database using Cloud.

The Pulse rate is then analyzed for the Steadiness of Patient and Is then monitored by respective doctor/guardian.



FIGURE 5.4 LED DISPLAY

LED DISPLAY:

Every values from Heartbeat Sensor is been displayed in the LED Display which then moved to cloud for Healthcare Monitoring as shown in **FIGURE 5.4**

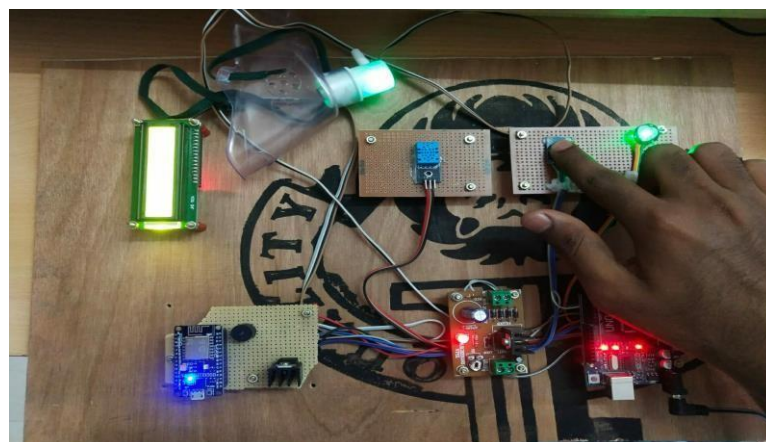


FIGURE 5.5 MEMS SENSOR

It is a chip-based technology where sensors are composed of a suspended mass between a pair of capacitive plates is shown above in **FIGURE 5.5**. Patient's Mobility and Human Mechanical moment is recorded from this sensor.

This Sensor in our project is mainly useful for bedridden/Coma Patients.

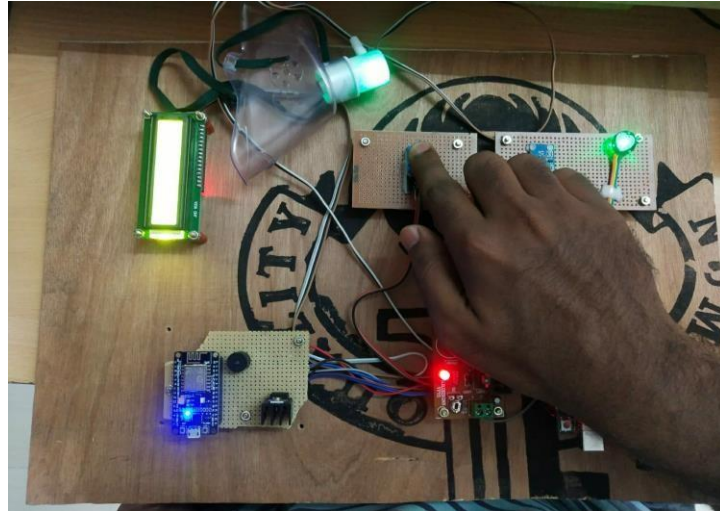


FIGURE 5.6 TEMPERATURE SENSOR

The temperature of the patient is recorded using the Temperature Sensor in our project is shown in **FIGURE 5.6**.

This Recorded parameter is used to check the regular condition of the patients, If The Value is exceeded the regular temperature (above 37 degree Celsius/100.4 Fahrenheit),The recorded Temperature in database will alert the respective patient's doctor/guardian.

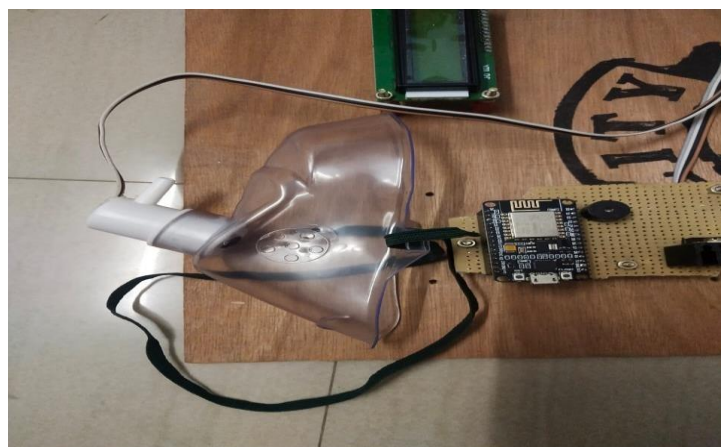


FIGURE 5.7 RESPIRATORY SENSOR

As shown in **FIGURE 5.7** Using the Respiratory Sensor, Patient has been equipped with The Respiratory Mask and the breathing of the patient is recorded in regular period of time.

This Sensor helps to check the unevenness of Respiration in patients.

STEP 4: RECORDED DATABASE USING CLOUD

Every Parameters Recorded Using The respective Sensors are Stored in a specific Database using Cloud.

- Analyzing the Pulse rate of Patient in the Cloud Database is shown in **FIGURE 5.8**.



FIGURE 5.8 OUTPUT OF PULSE SENSOR

- Analyzing the recorded Temperature of Patient in the Cloud Database is shown in **FIGURE 5.9**.

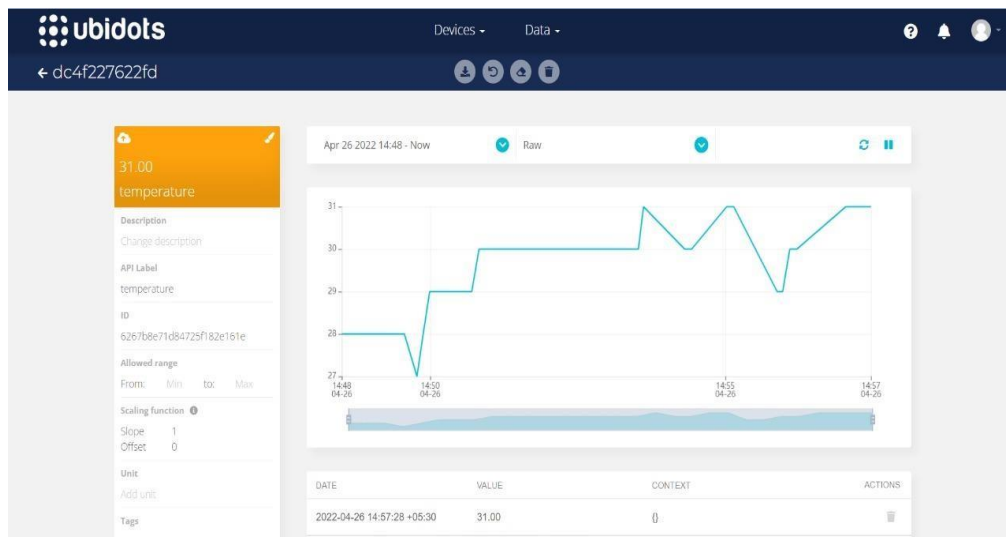


FIGURE 5.9 OUTPUT OF TEMPERATURE SENSOR

- Analyzing the recorded Respiratory Values using Respiratory Sensor in Cloud Database is shown below in **FIGURE 5.10**.

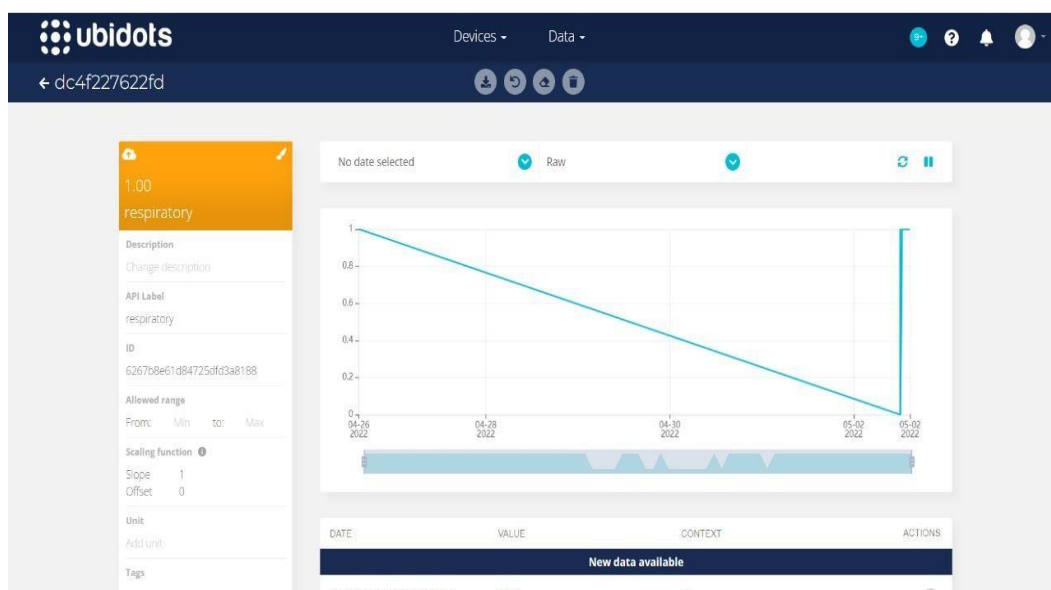


FIGURE 5.10 OUTPUT OF RESPIRATORY SENSOR

- Analyzing the Value Recorded using MEMS sensor in Cloud Database is shown below **FIGURE 5.11**.

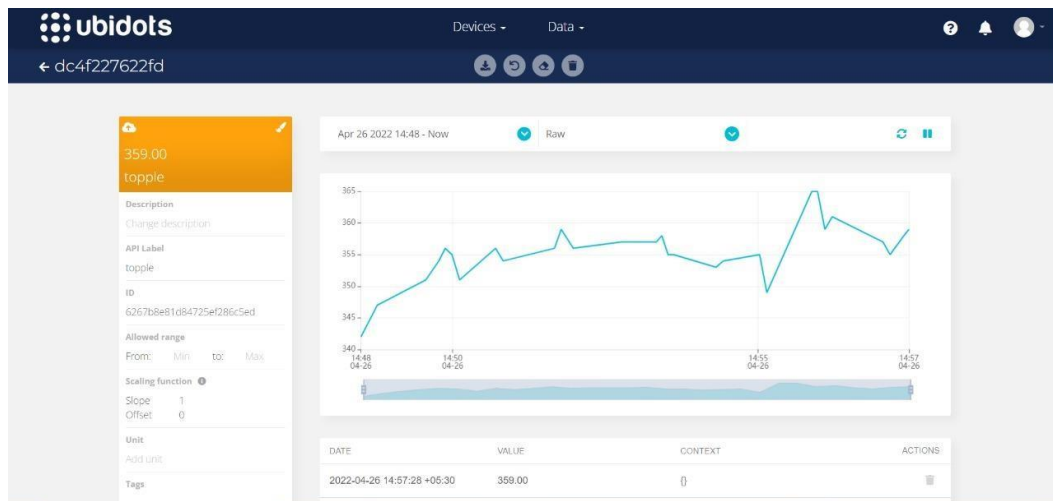


FIGURE 5.11 OUTPUT OF MEMS

As the above mentioned Recorded Parameters stored in Ubidots Cloud Database, Doctors/Guardians of the respective patients are given an unique Identification Password, in order to keep a check on the Patient's HealthCare Monitoring Parameters like Pressure , Temperature, Pulse rate, etc.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

The system introduced smart healthcare that monitors the patient's basic vital signs like rate and temperature, still as room condition measurements like room humidity, CO and CO2 gas. The success rate of observational and actual data is around 95% or higher all told cases of the developed healthcare system. Real medical staff can view and track data in real time, even when the patient is being tested outside the hospital. this method may also analyze raw medical data in an exceedingly short amount of your time, which is additionally beneficial for nurses and doctors in epidemic and crisis situations. The developed prototype is incredibly easy to style and use. The system is extremely useful within the case of communicable disease sort of a novel coronavirus (COVID19) treatment. The developed system will improve this healthcare system which will protect plenty of lives from death. You will learn a lot when you complete this project. Learn how IOT-based sensors actually work. This project is useful for both doctors and patients. Physicians can know the patient's health through IoT-based sensors and can also analyze health data stored in real-time databases. It saves time and the patient gets an instance of the appropriate treatment.

6.1 WHERE THIS PROJECT CAN BE USED

This project can be used in hospitals and diagnostic centers in patient management systems. It can also be used for remote health monitoring at home.

6.2 LIMITATIONS

The quality of the sensors we use is not very good, so we didn't get the efficient value of a real device. Also, the project board is a little big, so it can't be used as a mobile device. Cost is also a factor. If you use high quality sensors, the cost of your project will be a bit higher.

6.3 FUTURE PLAN

We want to make the project portable so that it can be carried anywhere. I want to develop an Android application for doctors and beautify my current website. Include machine learning in patient records for disease selection.

6.4 FUTURE WORK

In this article, we have presented and tested a prototype of an automated system that guarantees continuous monitoring of various health parameters and prediction of all types of illnesses or disorders and saves patients from frequent outpatient pain. The proposed system can be set up in a hospital and a large amount of data can be collected and stored in an online database. Even the results can be accessed via the mobile application. The system can be further improved by adding components of the artificial intelligence system that support doctors and patients. Data consisting of a history of many patient parameters and corresponding results can be examined by data mining to search for consistent patterns and systematic relationships of the disease. For example, if a patient's health parameters change according to the same pattern as the previous patient in the database, the results can also be estimated. If similar patterns are found repeatedly, it will be easier for doctors and medical researchers to find a solution to the problem.

Although the system looks somewhat bulky, it'll be a small device by proper manufacturing within the near future. The video feature is added for face to face consultation between the doctors and patients. Some more measures which are very significant to see a patient's condition just like the level of diabetes, respiration monitoring, etc. you'll be able to work thereon as a future job.

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