SMART HEALTH MONITORING SYSTEM FOR COMA PATIENTS USING IoT

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report "SMART HEALTH MONITORING SYSTEM FOR COMA PATIENTS USING IoT" is the bonafide work of "SOUNDAR K (19BEC4199), TARUNKUMAR P (19BEC4220), YASWANTH M G (19BEC4238)" who carried out the project work under my supervision in the academic year 2022-2023.

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

INSTITUTION VISION AND MISSION

Vision

To emerge as a leader among the top institutions in the field of technical education.

Mission

M1: Produce smart technocrats with empirical knowledge who can surmount the global challenges.

M2: Create a diverse, fully -engaged, learner -centric campus environment to provide quality education to the students.

M3: Maintain mutually beneficial partnerships with our alumni, industry and professional associations

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Mission

M1: Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.

M2: Inculcate the students in problem solving and lifelong learning ability.

M3: Provide entrepreneurial skills and leadership qualities.

M4: Render the technical knowledge and skills of faculty members.

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PEO1: **Core Competence:** Graduates will have a successful career in academia or industry associated with Electronics and Communication Engineering

PEO2: **Professionalism:** Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

PEO3: **Lifelong Learning:** Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadership quality

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PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

PSO2: Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

Abstract	Matching with POs, PSOs
Variable Sensors, Network Connectivity, Internet of Things, GSM Module, Coma Patients.	PO1, PO2, PO3, PO4,PO5, PO6,PO8,PO9,PO10,PO11, PO12, PSO1, PSO2

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ABSTRACT

A coma is a state of unconsciousness in which a patient cannot speak or move. These patients require immediate attention and constant monitoring. We present a system that records and monitors patient data continuously without human intervention. If any abrupt changes in the range of typical body parameters such as a rise or fall in body temperature or a reduction or increase in heart rate occur, it will automatically send notification.By logging in to the system IoT cayenne app, a doctor and the caretaker can monitor a patient's condition.Our project's objective is to create and develop a reliable, a system for patient monitoring that can transmit real-time patient data. The parameters of patient are measured continuously through heartbeat, temperature, eye blink, urine level, conductivity, accelerometer sensor and transmitted using IoT and alerted through call and SMS using GSM. We are using vibrator motor, when the patient is in coma it will be used to have a normal blood circulation and it may avoid chronic diseases.

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LIST OF ABBREVIATIONS

ACRONYM		ABBREVIATION
GSM	-	Global System Monitoring
PSI	-	Phase Synchrony Index
EEG	-	Electro Encephalo Graphy
IOT	-	Internet of Things
ROC	-	Receiver Operating Characteristic curve
CRS	-	Cytokine Release Syndrome
USB	-	Universal Serial Bus
GPL	-	General Public Licence
IDE	-	Integrated Development Environment
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
STN	-	Super Twisted Nematic
TFT	-	Thin Film Transistor
IR	-	Infrared
WIFI	-	Wireless Fidelity

CHAPTER 1
INTRODUCTION

The Revolution and rapid improvement of the internet, technology such as the Internet of Things has emerged and is snowballing. Internet of Things with cloud computing and edge computing realizes a new and more efficient way of data sharing and transmitting. The Internet of things will remodel the healthcare sector and improves the health and wellbeing of humanity. The traditional healthcare system requires patients to visit the clinic or hospital for medical checkups which is time-consuming and inefficient. The Internet of Things is capable of realizing a real-time health monitoring system that involves sensors to measure heart rate and body temperature of patients and visualize the data in real-time. By such, people can have better control of their health condition. Instead of relying on infrequent visits to clinics or hospitals for various tests, people can access their health data through the internet and start to track their health conditions. The Internet of Things that realizes the connection between devices allows activities such as sending an alert during an emergency to be possible by making use of open source services. A coma is a state of unconsciousness in which a patient cannot speak or move. These patients require immediate attention and constant monitoring. We present a system that records and monitors patient data continuously without human intervention. If any abrupt changes in the range of typical body parameters such as a rise or fall in body temperature or a reduction or increase in heart rate occur, it will automatically send notification.By logging in to the system IoT cayenne app, a doctor and the caretaker can monitor a patient's condition.

1.1 PROBLEM STATEMENT

In the traditional healthcare system, people are required to visit clinics or medical centres regularly for medical checkups, which is less effective and time-consuming. The high medical cost and long waiting will discourage people from performing medical checkups 2 regularly. A health monitoring system that collects and monitors the health status of the user in real-time will benefits the people by saving their money and time of visiting clinics and medical centres unless there is a need for it. Besides, the security of the health system is vital to safeguard the privacy of the user. People may avoid healthcare in sensitive areas due to health information privacy concerns. Smart wearable gadgets such as Apple Watch and Samsung Galaxy Watch are storing the collected health data in the cloud. Cloud storage allows users to enjoy high-quality services without any burden of storage maintenance. However, cloud users are more vulnerable to issues such as theft, confidentiality, and information leaked to the third party compared to local storage users. Storing confidential health information in the health system itself will help reduce the chance of information leakage, as the health information will only be accessible by authorized users which improves the security and privacy of the system. The location tracking function plays a vital role in the health monitoring system as it allows people to track the whereabouts of the user. Besides, the coordinate of the user should be recorded as it allows people to trace the whereabouts of the user. The function will come in handy when there is a need to track down a person. The whereabouts of the patients are useful to trace the source of the disease. Besides, the information will aid in the prevention and evacuation works that will prevent or reduce the spreading of the disease.

1.2 OBJECTIVE

This project is developed for comma patients to provide Dynamic service and Non Dependency Verification has been implemented using IOT. In last decades health issues are raising day to day life at very high speed every day. One of the major health issue is a coma. Coma is a deep state of persistent sleep in which a person cannot be awakened; he fails to respond normally to painful stimuli, light, or sound; lacks a normal wake-sleep cycle; and does not initiate voluntary actions. Comas can be caused by various things such as- a severe injury to the head that hurts the brain, infections in the brain, brain damage due to lack of oxygen for too long, taking too much medicine (overdose) or other drugs, may be due to chemical imbalances in the body from other illnesses. Someone who is in a coma is unconscious and has minimal brain activity. They're alive but can't be woken up and show no signs of awareness. The person's eyes will be closed and they'll appear to be unresponsive to their environment. They won't normally respond to sound or pain, or be able to communicate or move voluntarily, and basic reflexes, such as coughing and swallowing, will be greatly reduced. Our project delivers a health status assisting system that identifies human body parameters such as heart beat, body temperature, body movement, urine level sensor and eye blink sensor information on the update the LCD display and IoT server through cayenne. In emergency situations, this system automatically creates the intimated in IOT , so that doctors can monitor if any strange data detected. Various sensors such as heart beat, conductivity sensor for urine leakage, eye blink sensor, temperature, acceleration and Urine level sensor are used to collect body health parameter information for the proper treatment.

1.3 SCOPE AND LIMITATIONS

This project uses IoT to provide dynamic service to comma patients and implements non-dependency verification. Over the past few decades, health problems have become more prevalent in daily life at an alarming rate. A coma is a major health problem. He exhibits abnormal responses to pain, light, and sound; lacks a normal cycle of wake-sleep. A number of things can put a person in a coma, including a severe head injury that damages the brain, brain damage from not getting enough oxygen, infections in the brain, taking too much medication (an overdose) or other drugs, and chemical imbalances from other illnesses. They are still alive, but they are unconscious and unable to be awakened. They won't normally respond to pain or sound, communicate, or move voluntarily, and their ability to cough and swallow will be severely diminished. Our project delivers a health status assisting system that updates the LCD display and IoT server using cayenne to identify human body parameters like heart rate, temperature, body movement, urine level sensor, urine leakage, eye blink sensor and vibrator motor. This system creates information in IoT automatically in emergency situations so that medical professionals can keep an eye out for any unusual data. For the purpose of providing the appropriate treatment, a variety of sensors, including heart rate, conductivity sensors for urine leakage, eye blink sensors, temperature sensors, acceleration sensors, and urine level sensors, are utilized. Our project's objective is to create and develop a reliable, a system for patient monitoring that can transmit real-time patient data. The parameters of patient are measured continuously through heartbeat, temperature, eye blink, urine level, conductivity, accelerometer sensor and transmitted using IoT and alerted through call and SMS using GSM.

CHAPTER 2

LITERATURE SURVEY

2.1 Riasat Khan et al proposed "Using Phase Synchrony Index for Improved Assessment of Consciousness in Ischemic Stroke Patients" IEEE Access – 2019

Accurate behavioral assessments of consciousness are crucial in guiding management as they provide diagnostic and prognostic information, but they are challenging since different clinical scales lead to varying results for the same patient. This paper aimed to investigate the phase synchrony index in differ entiating the states of consciousness (wakefulness, somnolence, stupor, light coma, middle coma, and deep coma) in ischemic stroke. We evaluated whether the quantitative electroencephalography (EEG) measure, phase synchrony index of the left and right hemispheres, can facilitate the assessment of consciousness in stroke patients. This paper included 82 patients with ischemic stroke admitted for inpatient rehabilitation. The phase synchrony index of the left and right hemispheres was computed in the alpha band (8–12 Hz) and beta band (13–30 Hz), respectively. The associations between the phase synchrony index of the left and right hemispheres in two frequency bands with the clinical states, including the level of consciousness and the National Institutes of Health Stroke Scale score were analyzed. For further assessments of phase synchrony of the left and right hemispheres (PSI-LR), four local phase synchrony indexes in the beta band were also evaluated. The experiments result showed that PSI-LRs in the beta band correlated significantly with the level of consciousness of ischemic stroke patient and the National Institutes of Health Stroke Scale score, and they can identify the impaired consciousness in ischemic stroke patients with an accuracy of 84.15%.

Compared with local phase synchrony, the phase synchrony index of channel FP1 and channel FP2 exhibited a more significant correlation with the level of consciousness than the other three local phase synchrony measures. These results suggest that the novel quantitative EEG measure, PSI-LR provides a new objective way to assess the level of consciousness in ischemic stroke patients. A number of limitations are worth mentioning, including the unbalanced nature of our data. The number of patients without impaired consciousness is much larger than the number of stroke patients with dis orders of consciousness. Therefore, the different levels of consciousness were not completely balanced. In addition, not all of the specific lesion sites of the subjects in this study were recorded, as some patients were transferred from other hospitals. As a result, when we analysed the lesion site, the number of subjects was smaller than the number of total subjects. Future studies will measure QEEGs in a larger cohort of stroke patients with impaired conscious ness. At the same time, longitudinal investigations of the relationship between PSI-LR and the changes in level of consciousness will be further studied.Based on the quantitative EEG feature PSI-LR, we were able to identify the impaired consciousness in ischaemic stroke patients with an accuracy of 84.15 percent. This is remarkable and will likely allow the future construction of an objective assessment tool to quantify consciousness without requiring expert interpretation. Our findings suggest that the QEEG measure PLI-LR, obtained as part of routine clinical care, complements the clinical assessment of unconscious patients after ischaemic stroke.

2.2 GeethaRamaniet al proposed"IOT base health monitoring system"IEEE, CONFERENCE - 2020

IoT places a vital role in coma patient health monitoring. Continuous fitness monitoring can store up to 60% of human lives through timely detection. The device is specially designed for actual time monitoring of the health parameters of the coma sufferers. It has more suitable by means of the use of GSM and IoT to recognize the status or condition of the patient. This proposed method consists of numerous smart sensors like Temperature, Heartbeat, Eye blink and SPO2 (Peripheral Capillary Oxygen Saturation) sensors for fetching the patient's body temperature, coronary heart rate, eye movement and oxygen saturation percentage of the patient. This system use ARDUINO-UNO board as a microcontroller and Cloud computing concept. Here the accelerometer sensor used to display the body movement of the coma sufferers. The patient's vital parameters are transmitted to smart telephones and laptops of the legal individual by the use of a cloud server. These records may be saved and analyzed for further evaluation and selection making.

Coma is the state of unresponsiveness wherein patient lies along with his eyes are closed and they cannot be aroused to external and internal responses but they had been alive in nature. Coma can be caused by diffusion of issues like Traumatic, head injury, stroke, brain tumor, capsules or alcohol intoxication. It additionally arise even a underlying infection which include diabetes or an infection. So we reveal the coma patients frequently. In this system numerous sensors are used to monitor the numerous health parameters to realize the recovery rate and abnormalities in the health condition. Moreover the system makes use of WiFi (Wireless Fidelity) technology for the IoT in which "ThingSpeak" application is used here to displaying the coma affected person's health condition in online through mobile phone. So consequently, there is no need for a number of medical personnel for accompanying with patients to be physically present to check the health condition of the coma affected person. This application sends health condition of sufferers with appropriate time and date for end result evaluation. The proposed method was designed by using an IoT technique that is known as ThingSpeak. This system uses additionally two sensors which are Eye blink sensor and, SPO2 sensor to monitor the eye blink and oxygen saturation percentage of the coma patients. All sensors of the proposed frame work and these sensors output values are used to checked health condition of the coma patients. These sensors are connected to the microcontroller to monitoring the health parameters of the coma patients. If there is find any abnormalities in one of the health parameters of the coma patients, the microcontroller immediately triggers an alert message through the GSM device and Wi-Fi module.

The proposed frame work used Nemours health sensors such as temperature sensor, eye blink sensor, heart beat sensor, body movement sensor and SPO2 sensor. These sensors have been used for IoT to be transmitting the medical data by using the ESP8266 Wi-Fi module and the patient's data can be saved, analyzed, displayed in forms of graphs and it can be viewed by using mobile application. The entire proposed work is autonomous hence there are requirement of medical staff ratio can be decreased and if we used this monitoring system at the home, there is a need of physical accompanying for monitoring the patients will be reduced too. The cost of the clinical staff is also reduced exponentially.

2.3 Manzar E Hassin et al proposed “NeuroSpy: A low-cost portable IoT enabled EEG and ECG data processor”IEEE, CONFERENCE - 2021

Different commercial portable electroencephalography (EEG) monitoring devices are available in the market, but these devices are expensive. Product service availability from these devices is based on the monthly/yearly subscription basis, which is not budget-friendly to people from developing countries. In this paper, a portable, cost-effective system ‘NeuroSpy’ using off-the-shelf jellybean components has been designed, which is functionality-wise similar to commercially available devices from different vendors. The developed system has production and implementation costs significantly lower by a factor of ~2.22 90 than the traditional commercial devices. This system can extract different biomedical signals such as electroencephalogram and electrocardiogram and monitor the human body temperature in real-time. We can use this multifunctional battery-powered portable biomedical signal recorder to monitor sleep conditions, analyze symptoms of various diseases such as encephalitis, epilepsy, coma, and so on. Another use of this kind of device is to interface (BCI) with computers through brain waves of the human body, which may help disabled people. This system is Internet of Things (IoT) enabled; thus, we can store captured data into a central database for further analysis. The main purpose of this paper is to design a multifunctional portable biomedical device, which can monitor the user’s brain activity, heart rate, and ambient body temperature simultaneously in real-time. As the prototype is equipped with IoT, the users can easily connect themselves to the cloud to store clinical data for further analysis.

This project uses commonly available basic through-hole components instead of highly complicated chips to reduce complexity and production costs. This prototype is based on open-source multiplatform (Linux, Windows) hardware. Though it is a battery-powered standalone device, it can interface to any Windows/Linux operating system running PC through a USB port and communicates through IEEE 802.3 (Ethernet) protocol between devices via web browsers.

The human brain is the most complex architecture of our body. To monitor the electrical activity of the brain, we need an instrument to be placed along the scalp of our head. To accomplish the goal, an EEG data processor becomes the prime component. Commercial consumer-grade EEG data processors are highly expensive due to its complex architecture and time constraint subscription policies. The primary objective of this paper is to build such a medical data analyzer that features similar to the commercial EEG devices at a minimal cost. We have performed several tests of our designed system NeuroSpy, e.g., EEG eye blinking and deep thinking tests, comparison of EEG data between our system and a commercial device Emotiv Insight and real time electrocardiogram waveform acquisition. The designed data processor system shows almost similar results to other commercially available systems from different vendors. Our system is cost-effective than the other commercial EEG data processors, with a reduction in the implementation cost of ~2.22 90 times. So, this prototype can serve different purposes in developing countries with endless possibilities.

2.4 NandakumarSel et al proposed "Towards Remote Continuous Monitoring of Cytokine Release Syndrome"IEEE,CONFERENCE - 2022

Cytokine release syndrome (CRS) is a noninfec tious systemic inflammatory response syndrome condition and a principle severe adverse event common in oncology patients treated with immUNOtherapies. Accurate monitoring and timely prediction of CRS severity remain a challenge. This study presents an XGBoost-based machine learning algorithm for forecasting CRS severity (no CRS, mild– and severe–CRS classes) in the 24 hours following the time of prediction utilizing the common vital signs and Glasgow coma scale (GCS) questionnaire inputs. The CRS algorithm was developed and evaluated on a cohort of patients (n=1,139) surgically treated for neoplasm with no ICD9 codes for infection or sepsis during a collective 9,892 patient-days of monitoring in ICU settings. Different models were trained with unique feature sets to mimic practical monitoring environments where different types of data availability will exist. The CRS models that incorporated all time series features up to the prediction time showcased a micro-average area under curve (AUC) statistic for the receiver operating characteristic curve (ROC) of 0.94 for the 3 classes of CRS grades. Models developed on a second cohort requiring data within the 24 hours preceding prediction time showcased a relatively lower 0.88 micro-average AUROC as these models did not benefit from implicit information in the data availability. Systematic removal of blood pressure and/or GCS inputs revealed significant decreases ($p<0.05$) in model performances that confirm the importance of such features for CRS prediction. Accurate CRS prediction and timely intervention can reverse

CRS adverse events and maximize the benefit of immunotherapies in oncology patients.

There were six models developed and tested as a part of this work, two sets of three models each. The first set of three models were the models that did not require vitals or GCS data within the 24 hours leading up to the time of prediction. The second set of three models did require vitals and/or GCS data within the 24 hours leading up to the time of prediction. Each of the sets had one model that incorporated features from all nine data types discussed above (vitals and GCS), a second model that incorporated only the vital sign data types discussed above, and a final model that incorporated only heart rate, respiration rate, SpO2 and body temperature features. These models became increasingly more suited for remote and continuous patient monitoring. The data types are accurately measurable with common wearable devices.

There is clear evidence that the no, mild, and severe CRS classes are well separated regardless of the data used when using the patient day cohort that does not require vitals or GCS data within the 24hrs before the time of prediction. The models separating severe CRS from non-severe CRS (no CRS and mild CRS) had a minimum AUROC of 0.87 and separating no CRS from CRS (mild or severe) had a minimum AUROC of 0.95. The low standard deviations in performance across the five folds for all models shows the consistency with which these classes are separable.To address the issue of missing data being predictive, we consider the models that predicted CRS grades on days for which there was vitals and/or GCS data in the preceding 24 hours. These models are intended to be more practical as they attempt to not exploit the different monitoring levels.

LITERATURE SURVEY SUMMARY:

S.NO	TITLE	AUTHOR	YEAR	METHODOLOGY
1	**Using Phase Synchrony Index for Improved Assessment of Consciousness in Ischemic Stroke Patients**	Manzar E Hassin; Riasat Khan	2019	Consciousness, EEG, phase synchrony, ischemic stroke.
2	**IOT base health monitoring system**	V Tamilselvi; S Sribalaji; P Vigneshwaran; P Vinu; J. GeethaRamani	2020	Internet of Things, Variable Sensors Health Monitoring System, Wi-Fi module, GSM Module, COMA patients.
3	**NeuroSpy: A low-cost portable IoT enabled EEG and ECG data processor**	Manzar E Hassin; Riasat Khan	2021	Brain-computer interface, electro-encephalogram, internet of things, inter-integrated circuit.
4	**Towards Remote Continuous Monitoring of Cytokine Release Syndrome**	Michael J. Pettinati; Arad Lajevardi-Khosh;	2022	Area Under Curve, Receiver Operating Characteristic Curve, Cytokine release syndrome
5	**Coma Patient Health Monitoring System Using IOT**	Monisha S G;Nithishna B	2020	Internet of things, Network connectivity, Non Dependency, Web based, sensors, Microprocessor.

Table.2.1: Literature Survey Summary

CHAPTER 3
EXISTING SYSTEM

The Existing framework gives the solution for just three wellbeing parameters of the trance like state patients. This existing work utilizes the results of heart beat sensor, Temperature sensor and body development sensor for detecting the health parameters such as heartbeat rate, internal heat level, patients body temperature and movements of the trance like state patients. In the event there is discover any variations from the results of health parameters of the patient suddenly the microcontroller sends an alarm message through the GSM device. It sends that information to the mobile number of the patient's in charge person and guardian.Furthermore in this framework LCD (Liquid Crystal Display) used to show the readings which are taken from the sensors. It has the accompanying drawbacks, for example, utilizing constrained detecting parameters, one of the chance that any irregular condition the message alert send through GSM module to the cell phone as SMS and also it showed in LCD board. These drawbacks could be overwhelmed by the proposed framework.

3.1 INTRODUCTION

Coma is the state of unresponsiveness wherein patient lies along with his eyes are closed and they cannot be aroused to external and internal responses but they had been alive in nature. Coma can be caused by diffusion of issues like Traumatic, head injury, stroke, brain tumor, capsules or alcohol intoxication. It additionally arise even a underlying infection which include diabetes or an infection. So we reveal the coma patients frequently. In this system numerous sensors are used to monitor the numerous health parameters to realize the recovery rate and abnormalities in the health condition. Moreover the system makes use of WiFi (Wireless

Fidelity) technology for the IoT in which "ThingSpeak" application is used here to displaying the coma affected person's health condition in online through mobile phone. So consequently, there is no need for a number of medical personnel for accompanying with patients to be physically present to check the health condition of the coma affected person. This application sends health condition of sufferers with appropriate time and date for end result evaluation.

3.2 BLOCK DIAGRAM OF EXISTING SYSTEM

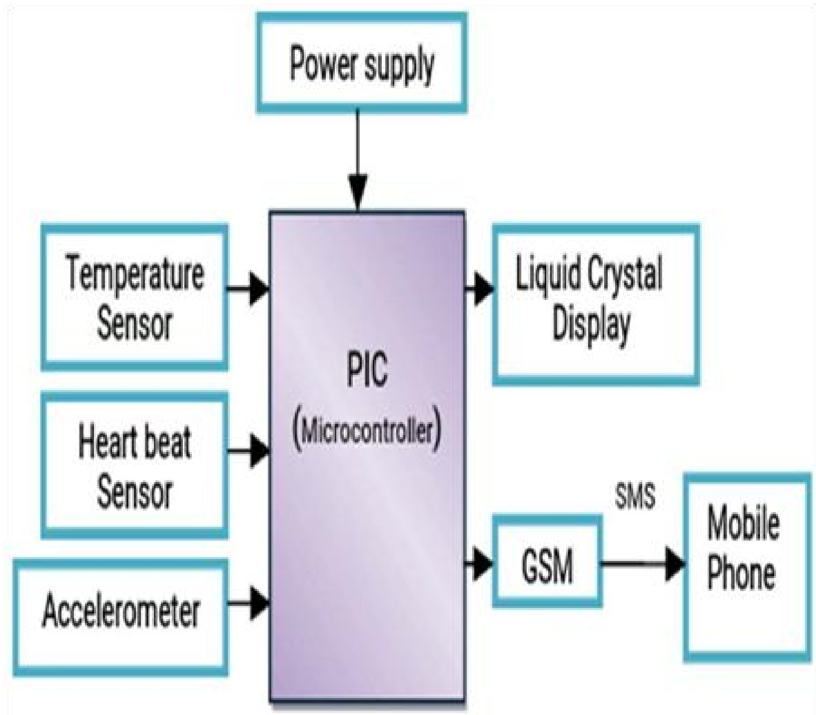

Fig.3.1: Block Diagram of Existing System

The proposed method was designed by using an IoT technique that is known as ThingSpeak. This system uses additionally two sensors which are Eye blink sensor and, SPO2 sensor to monitor the eye blink and oxygen saturation percentage of the coma patients. All sensors of the proposed frame work and these sensors output values are used to checked health condition of the coma patients. These sensors are connected to the microcontroller to monitoring the health parameters of the coma patients. If there is find any abnormalities in one of the health parameters of the coma patients, the microcontroller immediately triggers an alert message through the GSM device and Wi-Fi module. The proposed frame work used Nemours health sensors such as temperature sensor, eye blink sensor, heart beat sensor, body movement sensor and SPO2 sensor. These sensors have been used for IoT to be transmitting the medical data by using the ESP8266 Wi-Fi module and the patient's data can be saved, analyzed, displayed in forms of graphs and it can be viewed by using mobile application.

Temperature Sensor accurately measures temperature and provides an over temperature alarm/interrupt/shutdown output. It converts temperature measurements to digital for the usage of a high decision, sigma-delta, analog-to-digital converter (ADC). It has high accuracy and low-voltage operation aids designers in meeting errors and electricity budgets. An ADC might not be required to feel the data which produces correct human frame temperature readings with an accuracy of 0.1C.

Heartbeat sensor is utilized to gauge the computerized yield of a heart beat for every moment. It comprises of two LEDs discharges red light and other one radiates IR light where as to quantify the beat rate and IR light is required as the heart contract and afterward unwinds and the assurance of heartbeat rate by expanding or diminishing of oxygenated blood.

Accelerometer is utilized as body movement sensor which is used to predict the motion tracking of the patients. It is the strategy for recording developments of individuals and objects. This sensor is a gadget which is delicate to the infrared radiation so then distinguishes the patient development whether to be moved as in right, left or straight position and these sensors are exceptionally created for information observing for the biophysical and the biochemical component.

3.3 EXISTING RESULT

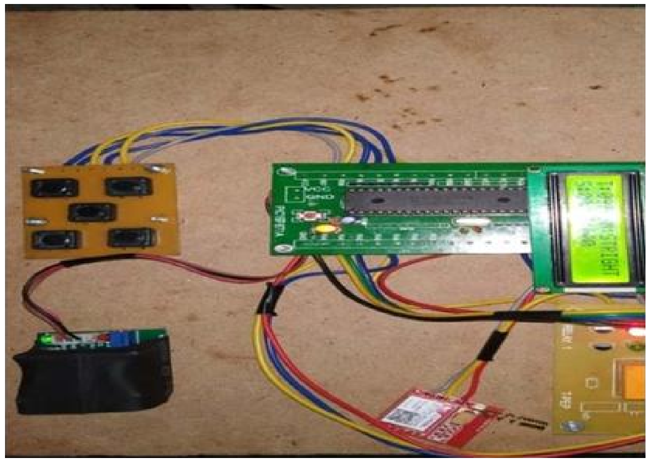

Fig.3.2: Existing Output

This system introduces an IoT based health care monitoring system for the coma patients along with GSM. The proposed methodology work analyzes the variable health parameters values which are taken from sensors. This system gives better and effective healthcare services to patients and the information is collected through internet and communication devices in turn connected to cloud services. By using this method where the doctor can check his patient anywhere, anytime. Emergency alert message will be to predefined Smartphone number if once the obtained current value is exceed or deceed the threshold value. This system is helpful for patients who need healthcare services at 24/7.

CHAPTER 4

PROPOSED SYSTEM

We use a variety of sensors, including one that measure heart rate, temperature, urine level, conductivity, accelerometer, and eye blink. A coma patient's temperature is measured using the temperature sensor. The heartbeat is observed using the heartbeat sensor. The urine level in a urine bag can be measured with a urine level sensor. In the event that the level is high, we ought to supplant it. The patient's movements are measured by an accelerometer, and the urine leakage is detected by a conductivity sensor. A coma patient's eye blink is measured with an eye blink sensor. The GSM is used to notify the doctor and family if a sensor is abnormal. The IoT module will be used to monitor patient health information. In the event of an emergency, an LCD display will be used to display the necessary information and the status can also be viewed through cayenne application.

There are various modules in the block diagram including the sensor section, Zigbee Transceiver, controller section, LCD display, power supply, and so on. Energy source block is utilized to power the controller, Arduino UNO. The 230 volt AC supply is changed into a 5 volt DC supply that is compatible with controllers.

4.1 BLOCK DIAGRAM

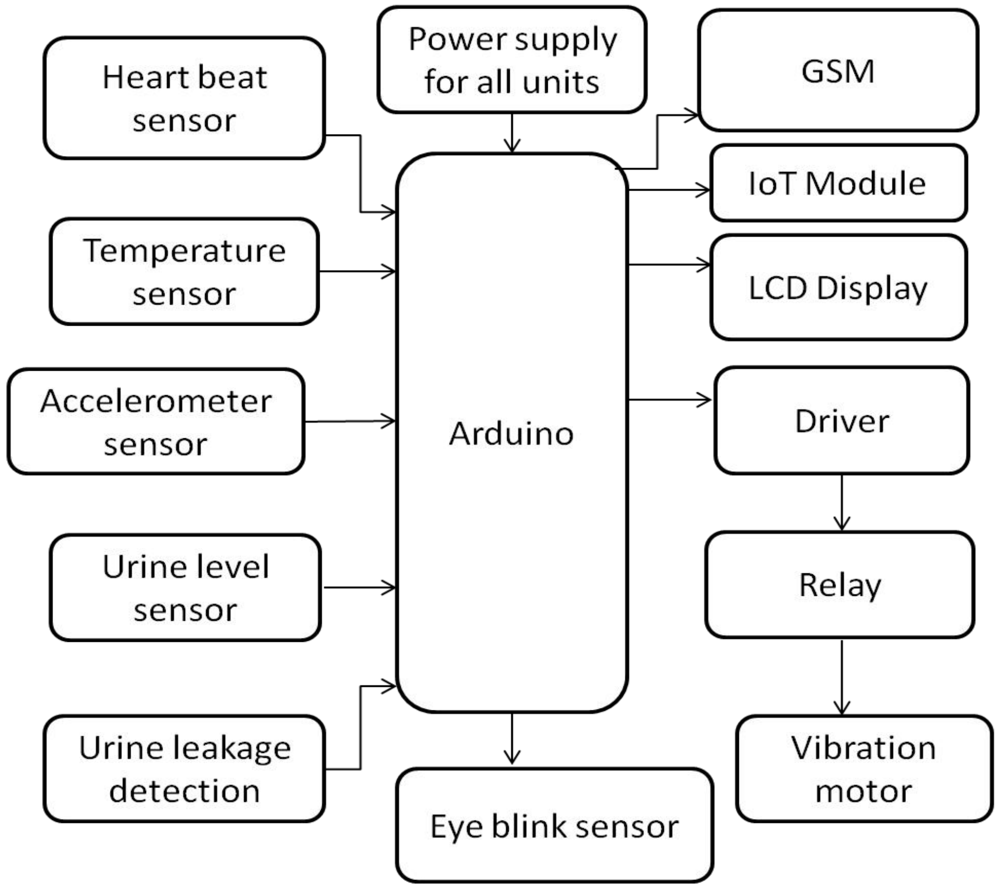

Fig.4.1:Block Diagram

4.2 HARDWARE REQUIREMENTS

- Power Supply& Transformer
- Arduino/Genuino UNO
- Heat beat sensor
- Temperature sensor
- Accelerometer sensor
- Urine level sensor

- Eye blink sensor
- LCD display
- IoT Module – ESP8266-12E (NODE MCU)
- Vibration motor
- Relay
- GSM (900L)

4.3 POWER SUPPLY

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

4.3.1 LINEAR POWER SUPPLY

An AC powered linear power supply usually uses a transformer to convert the voltage from the wall outlet (mains) to a different, usually a lower voltage. If it is used to produce DC, a rectifier is used. A capacitor is used to smooth the pulsating current from the rectifier. Some small periodic deviations from smooth direct current will remain, which is known as ripple. These pulsations occur at a frequency related to the AC power frequency (for example, a multiple of 50 or 60 Hz).

The voltage produced by an unregulated power supply will vary depending on the load and on variations in the AC supply voltage. For critical electronics applications a linear regulator will be used to stabilize and adjust the voltage. This regulator will also greatly reduce the ripple and noise in the output direct current. Linear regulators often provide current limiting, protecting the power supply and attached circuit from over current.

Adjustable linear power supplies are common laboratory and service shop test equipment, allowing the output voltage to be set over a wide range. For example, a bench power supply used by circuit designers may be adjustable up to 30 volts and up to 5 amperes output. Some can be driven by an external signal, for example, for applications requiring a pulsed output.

4.4 TRANSFORMER

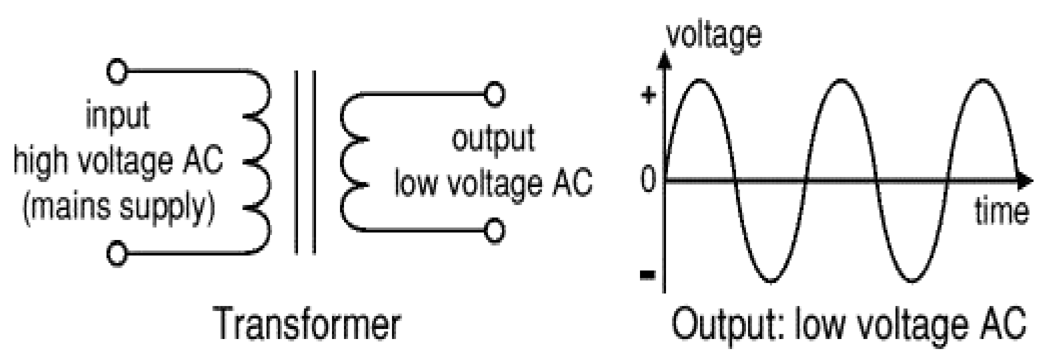

Fig.4.2: Transformer

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage**.** The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core. Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up.The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

Turns ratio=Vp/Vs=Nn/Ns and Power out=Power in

Vs*Is=Vp * Ip

Vp = primary (input) voltage	Vs = secondary (output) voltage
Np = number of turns on primary coil	Ns = number of turns on secondary coil
Ip = primary (input) current	Is = secondary (output) current

The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor.

4.5 ARDUINO UNO

Arduino/Genuino UNO is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"UNO" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The UNO board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The UNO board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

Arduino is an open source, computer hardware and software company, project, and user community that designs and produce microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

The Arduino UNO is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The UNO differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the UNO board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode Revision 3 of the board has the following new features: 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board.

In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes. Stronger RESET circuit.Atmega 16U2 replace the 8U2. "UNO" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The UNO and version 1.0 will be the reference versions of Arduino, moving forward. The UNO is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

4.5.1 HARDWARE DESCRIPTION

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. The source code for the IDE is released under the GNU General Public License, version 2. Nevertheless, an official Bill of Materials of Arduino boards has never been released by Arduino staff.

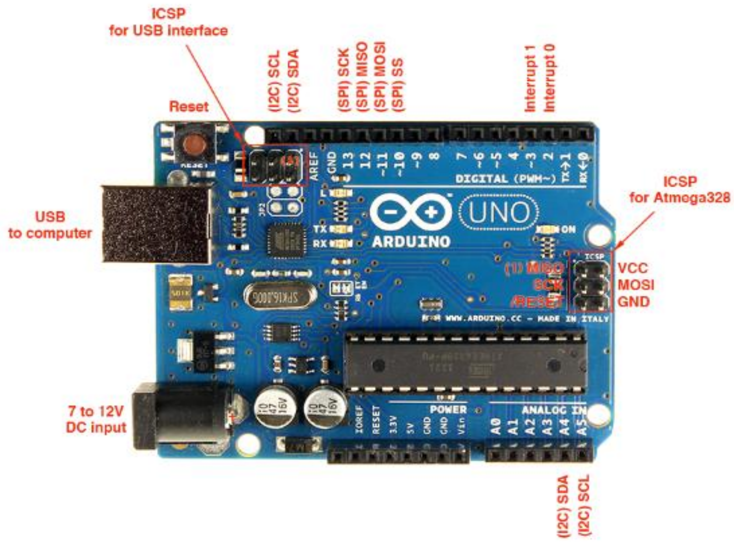

Fig.4.3: Arduino

4.5.2 SPECIFICATION

- Microcontroller ATmega328.
- Operating Voltage 5V Input Voltage (recommended) 7-12V.
- Input Voltage (limits) 6-20V.
- Digital I/O Pins 14 (of which 6 provide PWM output).
- Analog Input Pins 6.
- DC Current per I/O Pin 40 mA.
- DC Current for 3.3V Pin 50 mA.
- Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader SRAM 2 KB (ATmega328) EEPROM 1 KB (ATmega328) Clock Speed 16 MHz.

4.5.3 INPUT AND OUTPUT CONFIGURATION

Each of the 14 digital pins on the Arduino UNO can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms.In addition, some pins have specialized functions:

Serial: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

External Interrupts: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it’s off.

The UNO has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function. Additionally, some pins have specialized functionality:

TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

There are a couple of other pins on the board:

AREF. Reference voltage for the analog inputs. Used with analogReference().

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

4.5.4 DIGITAL PINS

In addition to the specific functions listed below, the digital pins on an Arduino board can be used for general purpose input and output via the pinMode(), digitalRead(), and digitalWrite() commands. Each pin has an internal pull-up resistor which can be turned on and off using digitalWrite() (w/ a value of HIGH or LOW, respectively) when the pin is configured as an input. The maximum current per pin is 40 mA.

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. On the ArduinoDiecimila, these pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip. On the Arduino BT, they are connected to the corresponding pins of the WT11 Bluetooth module. On the Arduino Mini and LilyPad Arduino, they are intended for use with an external TTL serial module (e.g. the Mini-USB Adapter).

External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function. On boards with an ATmega8, PWM output is available only on pins 9, 10, and 11.

BT Reset: 7. (Arduino BT-only) Connected to the reset line of the bluetooth module.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

LED: 13. On the Diecimila and LilyPad, there is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

4.5.5 ANALOG PIN

In addition to the specific functions listed below, the analog input pins support 10-bit analog-to-digital conversion (ADC) using the analogRead() function. Most of the analog inputs can also be used as digital pins: analog input 0 as digital pin 14 through analog input 5 as digital pin 19. Analog inputs 6 and 7 (present on the Mini and BT) cannot be used as digital pins. While the main function of the analog pins for most arduino users is to read analog sensors, the functionality of general purpose input/output pins.

I^2C: 4 (SDA) and 5 (SCL). Support I^2C (TWI) communication using the Wire library (documentation on the Wiring website).

4.5.6 POWER PIN

VIN (sometimes labelled "9V"). The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin. Note that different boards accept different input voltages ranges, please see the documentation for your board. Also note that the LilyPad has no VIN pin and accepts only a regulated input.

5V. The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

3V3. (Diecimila-only) A 3.3 volt supply generated by the on-board FTDI chip.

GND. Ground pins.

Other Pins

AREF. Reference voltage for the analog inputs. Used with analogReference().

Reset. (Diecimila-only) Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

4.6 HEART BEAT SENSOR:

Here we are using IR sensor for detecting the HEART BEAT. IR has less noise and ambient light than at normal optical wavelengths. The light is produced only when current passes through in the forward direction and block current in the reverse direction. Plethysmograph is an infrared photoelectric sensor used to record changes in pulsatile blood flow from the finger. The Plethysmograph operates by recording changes in blood volume as the arterial pulse expands and contracts the microvasculature.

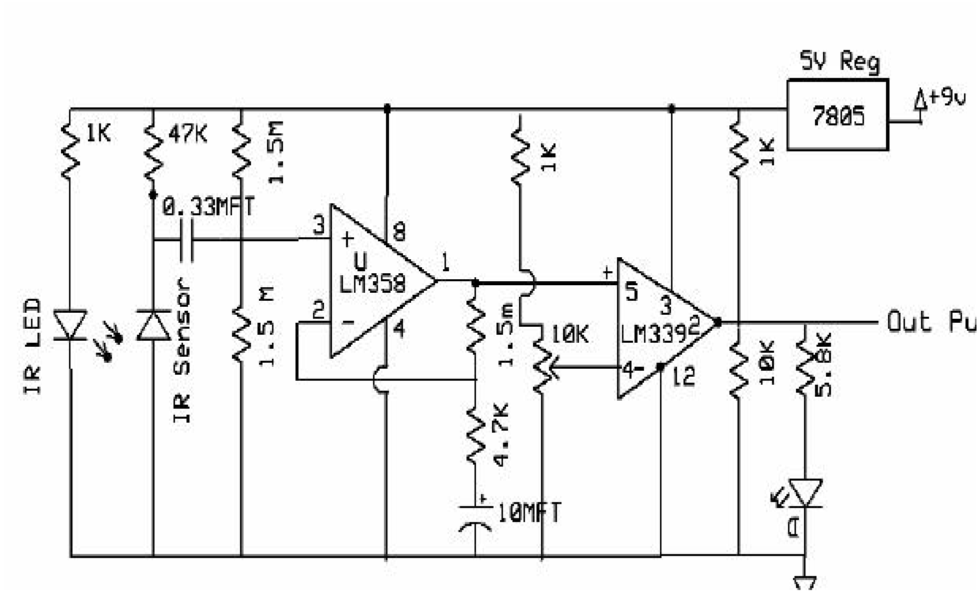

Fig.4.4: Heart Beat Sensor Circuit Diagram

This is a non-invasive measurement for changes in finger blood flow during wakefulness and sleep. Pulse wave amplitude (PWA) is the most frequently used parameter obtained by finger plethysmography. PWA is directly and positively correlated to finger blood flow. The hypothesis of this study was that finger plethysmography detects pharmacologically induced changes in finger blood flow, in particular changes induced by stimulation and blockade of vascular a-receptors. Due to the anatomic structure of the finger we expected that alterations of vascular tone following sympathetic activation or inhibition might be reflected by changes of PWA. A change in finger blood flow, reflected by PWA is derived from the finger plethysmography. PWA derived from finger plethysmography allows continuous, noninvasive measurement of changes in finger blood flow during wakefulness and sleep. Finally, to demonstrate the ability of finger plethysmography to continuously monitor vascular tone, PWA responses to obstructive breathing and concomitant arousal events in patients with obstructive sleep apnea were recorded and analysed.

Fig.4.5: Heart Beat Sensor

4.7 TEMPERATURE SENSOR (LM35):

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C). The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.

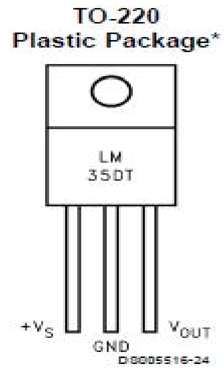

Fig.4.6: LM35 PIN Diagram

It has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/ºCThe LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4 ºC at room temperature and +/- 0.8 ºC over a range of 0 ºC to +100 ºC.Another important characteristic of the LM35DZ is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The sensor self-heating causes less than 0.1 ºC temperature rise in still air.

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

4.8 ACCELEROMETER SENSOR

An accelerometer is a device that measures proper acceleration; proper acceleration is not the same as coordinate acceleration (rate of change of velocity). For example, an accelerometer at rest on the surface of the Earth will measure an acceleration due to Earth's gravity, straight upwards (by definition) of $g \approx 9.81\ m/s^2$. By contrast, accelerometer in free fall (falling toward the center of the Earth at a rate of about $9.81\ m/s^2$) will measure zero.

Accelerometer have multiple applications in industry and science. Highly sensitive accelerometer are components of inertial navigation systems for aircraft and missiles. Accelerometer are used to detect and monitor vibration in rotating machinery. Accelerometer are used in tablet computers and digital cameras so that images on screens are always displayed upright. Accelerometer are used in drones for flight stabilisation. Coordinated accelerometer can be used to measure differences in proper acceleration, particularly gravity, over their separation in space; i.e., gradient of the gravitational field. This gravity gradiometry is useful because absolute gravity is a weak effect and depends on local density of the Earth which is quite variable.

Single- and multi-axis models of accelerometer are available to detect magnitude and direction of the proper acceleration, as a vector quantity, and can be used to sense orientation (because direction of weight changes), coordinate acceleration, vibration, shock, and falling in a resistive medium (a case where the proper acceleration changes, since it starts at zero, then increases). Micromachined accelerometer are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input.

An accelerometer measures proper acceleration, which is the acceleration it experiences relative to free fall and is the acceleration felt by people and objects. Put another way, at any point in spacetime the equivalence principle guarantees the existence of a local inertial frame, and an accelerometer measures the acceleration relative to that frame. Such accelerations are popularly denoted g-force; i.e., in comparison to standard gravity.

Accelerometer are devices that measure acceleration, which is the rate of change of the velocity of an object. They measure in meters per second squared (m/s^2) or in G-forces (g). A single G-force for us here on planet Earth is equivalent to 9.8 m/s^2, but this does vary slightly with elevation (and will be a different value on different planets due to variations in gravitational pull). Accelerometer are useful for sensing vibrations in systems or for orientation applications.

4.9 CONDUCTIVITY SENSOR

A conductivity sensor or urine leakage sensor is one kind of switching device which is used to detect the water. It works like a switch and the working principle of this sensor is, whenever there is water, the switch will be normally closed. Basically, this board includes nickel coated lines and it works on the resistance principle. This sensor module permits to gauge moisture through analog output pins & it gives a digital output while moisture threshold surpasses.

This module is similar to the LM393 IC because it includes the electronic module as well as a PCB. Here PCB is used to collect the water drops. When the water falls on the board, then it creates a parallel resistance path to calculate through the operational amplifier.

This sensor is a resistive dipole, and based on the moisture only it shows the resistance. For example, it shows more resistance when it is dry and shows less resistance when it is wet.

4.9.1 PIN CONFIGURATION

The pin configuration of this sensor is shown below. This sensor includes four pins which include the following.

- Pin1 (VCC): It is a 5V DC pin
- Pin2 (GND): it is a GND (ground) pin
- Pin3 (DO): It is a low/ high output pin
- Pin4 (AO): It is an analog output pin

Fig.4.7: Conductivity Sensor

This sensor module uses good quality of double-sided material. Anti-conductivity & oxidation with long time use. The area of this sensor includes 5cm x 4cm and can be built with a nickel plate on the side. The sensitivity can be adjusted by a potentiometer. The required voltage is 5V. The size of the small PCB is 3.2cm x 1.4cm. For easy installation, it uses bolt holes. It uses an LM393 comparator with wide voltage. The output of the comparator is a clean waveform and driving capacity is above 15mA.

4.10 EYE BLINK SENSOR

The eye blink sensor is an infrared sensor. It contains two parts. A transmitter and a receiver. The transmitter continuously emits infrared waves onto the eye. While the receiver continuously looks for variations in the reflected waves which indicates that the eye has blinked.. If the eye is closed that means it will give high output. If the eye is open then it will give a low output. This sensor can be used in a very different variety of robotics and mechatronics projects as it provides excellent results and is very economical.

The eye blinking system can be used for different purposes. First, let's look at the blink sensing system. The eye blink sensor constantly sends infrared waves which are reflected and detected by the receiver. As soon as the eye blinks, the output of the sensor goes high. This output is sent to the Arduino board. The Arduino sends the signal to the cayenne to make the alert . In this way, a blink is detected. Another purpose for which this system can be used is called the driver drowsiness system. This system can be used to check if the driver might sleep during driving. This can be done with some minor changes in the Arduino code.

Instead of detecting blinks, the Arduino should give the command to buzz when the eyes of the driver are closed for more than 2-3 seconds depending upon your preference. This system can be used with all modes of transports be it trains, ships, planes, cars, etc. This can be very useful to avoid accidents.Another purpose of this system, it can be used in hospitals to check when patients gain consciousness. A patient when unconscious, has the eyes closed. So whenever they open their eyes, the buzzing sound can inform the nurse that the patient is awake.

This can also be done with the help of some minor weaks in the Arduino code. The output of the sensor has to be constantly high in this case as the patient is unconscious. When the output goes low i.e. when the eyes of the patient open, that is when the Arduino should command the buzzer to ring.This works best for patients who are in a coma. The nurses can be easily informed with the help of this system.

4.11 VIBRATION MOTOR

Fig.4.8: Vibrator Motor

The need for smaller, thinner designs led to the adaptation of brush motor technology into the coin-type vibration motor. Figure 4 is an internal construction diagram of the brush coin-type motor. Similar to the bar-type vibration motor, coin-type vibration motor is comprised of a weight, a ring magnet, rotor with commutation points attached in the front and coils assembled on the back, and power supplied brushes attached to the ring magnet.

The commutation points, which are the yellow part on the bottom pic, are in contact with the end of the brushes. It will energize the electrical coils in the rotor. Energizing the coils produce a magnetic field and it is strong enough to interact with the ring magnet integrated into the stator, causing rotation. A force is generated due to the magnetic field. This force causes the weight to displace. The repeated displacement of the weight produces a varying force which is felt as vibration. The commutation points are used in changing the polarity pairs, so that as the rotator moves, the coils are constantly reversing the polarity.

4.12 ESP 8266- 12E NODE MCU (IOT MODULE)

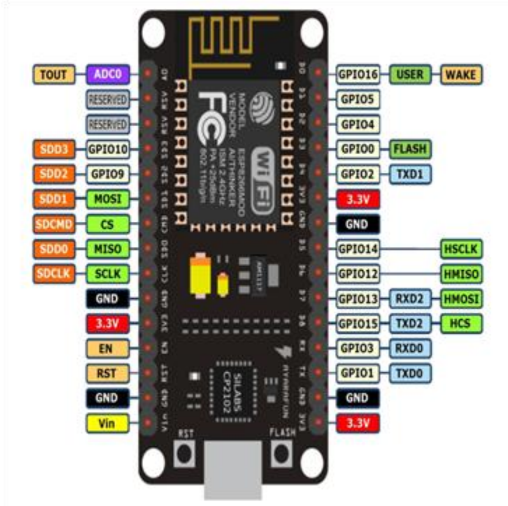

Fig.4.9: IoT Module

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.

The Internet of things (IoT) is the network of everyday objects — physical things embedded with electronics, software, sensors, and connectivity enabling data exchange. Basically, a little networked computer is attached to a thing, allowing information exchange to and from that thing. Be it lightbulbs, toasters, refrigerators, flower pots, watches, fans, planes, trains, automobiles, or anything else around you, a little networked computer can be combined with it to accept input (especially object control) or to gather and generate informational output (typically object status or other sensory data). This means computers will be permeating everything around us — ubiquitous embedded computing devices, uniquely identifiable, interconnected across the Internet. Because of low-cost, networkable microcontroller modules, the Internet of things is really starting to take off.

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266. The ESP8266 is a Wi-Fi SoC integrated with a TensilicaXtensa LX106 core, widely used in IoT applications. NodeMCU started on 13 Oct 2014, when Hong committed the first file of nodemcu-firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9. Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform, and committed to NodeMCU project, then NodeMCU was able to support the MQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to NodeMCU project, enabling NodeMCU to easily drive LCD, Screen, OLED, even VGA displays.

4.13 LCD DISPLAY

Liquid crystal cell displays (LCDs) are used in similar applications where LEDs are used. These applications are display of display of numeric and alphanumeric characters in dot matrix and segmental displays.

LCDs are of two types:

I. Dynamic scattering type.

II. Field effect type.

When sufficient voltage is applied to the electrodes the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarizer, which would result in activating/highlighting the desired characters. The power supply should be of +5v, with maximum allowable transients of 10mv. To achieve a better/suitable contrast for the display the voltage (VL) at pin 3 should be adjusted properly. A module should not be removed from a live circuit.

The ground terminal of the power supply must be isolated properly so that voltage is induced in it. The module should be isolated properly so that stray voltages are not induced, which could cause a flicking display. LCD is lightweight with only a few, millimeters thickness since the LCD consumes less power, they are compatible with low power electronic circuits, and can be powered for long durations. LCD does not generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. LCDs have long life and a wide operating temperature range. Before LCD is used for displaying proper initialization should be done.

LCDs with a small number of segments, such as those used in digital watches and pocket calculators, have individual electrical contacts for each segment. An external dedicated circuit supplies an electric charge to control each segment. This display structure is unwieldy for more than a few display elements. Small monochrome displays such as those found in personal organizers, or older laptop screens have a passive-matrix structure employing super-twisted nematic (STN) or double-layer STN (DSTN) technology—the latter of which addresses a color-shifting problem with the former—and color-STN (CSTN)— wherein color is added by using an internal filter.

The pixels are addressed one at a time by row and column addresses. This type of display is called passive-matrix addressed because the pixel must retain its state between refreshes without the benefit of a steady electrical charge. As the number of pixels (and, correspondingly, columns and rows) increases, this type of display becomes less feasible.

Very slow response times and poor contrast are typical of passive matrix addressed LCD. High-resolution color displays such as modern LCD computer monitors and televisions use an active matrix structure. A matrix of thin-film transistors (TFT) is added to the polarizing and color filters. Each pixel has its own dedicated transistor, allowing each column line to access one pixel.

The row line is then deactivated and the next row line is activated. All of the row lines are activated in sequence during a refresh operation. Active-matrix addressed displays look "brighter" and "sharper" than passive-matrix addressed displays of the same size, and generally have quicker response times, producing much better images. A general purpose alphanumeric LCD, with two lines of 16 characters. So the type of LCD used in this project is16 characters * 2 lines with 5*7 dots with cursor, built in controller, +5v power supply, 1/16 duty cycle.

Fig.4.10: LCD Display

PIN DESCRIPTION FOR LCD:

PIN NO	SYMBOL	FUNCTION
1	Vss	Ground terminal of Module
2	Vdd	Supply terminal of Module, + 5v
3	Vo	Power supply for liquid crystal drive
4	RS	Register select RS=0…Instruction register RS=1…Data register
5	R/W	Read/Write R/W=1…Read R/W=0…Write
6	EN	Enable
7-14	DB0-DB7	Bi-directional Data Bus. Data Transfer is performed once ,thru DB0-DB7,incase of interface data length is 8-bits;and twice, thru DB4-DB7 in the case of interface data length is 4-bits.Upper four bits first then lower four bits.
15	LAMP-(L-)	LED or EL lamp power supply terminals
16	LAMP+(L+) (E2)	Enable

Table.4.1: PIN DESCRIPTION FOR LCD

4.14 RELAY

A relay is an **electrically operated switch**. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have **double throw** (**changeover**) switch contacts as shown in the diagram. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. The coil will be obvious and it may be connected either way round. Relay coils produce brief high voltage 'spikes' when they are switched off and this can destroy transistors and ICs in the circuit. To prevent damage you must connect a protection diode across the relay coil.

The relay's switch connections are usually labeled COM, NC and NO:

- **COM** = Common, always connect to this, it is the moving part of the switch.
- **NC** = Normally Closed, COM is connected to this when the relay coil is **off**.
- **NO** = Normally Open, COM is connected to this when the relay coil is **on**.
- Connect to COM and NO if you want the switched circuit to be **on when the relay coil is on**.

Connect to COM and NC if you want the switched circuit to be **on when the relay coil is off**.

4.15 GSM

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.This is a GSM/GPRS-compatible Quad-band cell phone, which can be used not only to access the Internet, but also for oral communication (provided that it is connected to a microphone and a small loud speaker) and for SMS. Externally, it looks like a big package (0.94 inches x 0.94 inches x 0.12 inches) with L-shaped contacts on four sides so that they can be soldered both on the side and at the bottom. Internally, the module is managed by an AMR926EJ-S processor, which controls phone communication, data communication (through an integrated TCP/IP stack), and (through an UART and a TTL serial interface) the communication with the circuit interfaced with the cell phone itself.

The processor is also in charge of a SIM card (3 or 1.8 V) which needs to be attached to the outer wall of the module.In addition, the GSM900 device integrates an analog interface, A/D converter, RTC, SPI bus, I^2C, and a PWM module. The radio section is GSM phase 2/2+ compatible and is either class 4 (2 W) at 850/ 900 MHz or class 1 (1 W) at 1800/1900 MHz.

The TTL serial interface is in charge not only of communicating all the data relative to the SMS already received and those that come in during TCP/IP sessions in GPRS (the data-rate is determined by GPRS class 10: max. 85,6 kbps), but also of receiving the circuit commands (in our case, coming from the PIC governing the remote control) that can be either AT standard or AT-enhanced SIMCom type. The module is supplied with continuous energy (between 3.4 and 4.5 V) and absorbs a maximum of 0.8A during transmission.

CHAPTER 5

SOFTWARE DESCRIPTION

5.1 Arduino IDE

The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows. **Simple, clear programming environment** - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.**Open source and extensible software** - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.**Open source and extensible hardware** - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

5.1.1 VARIABLES

A variable is a place for storing a piece of data. It has a name, a type, and a value. For example, the line from the Blink sketch above declares a variable with the name ledPin, the type int, and an initial value of 13. It's being used to indicate which Arduino pin the LED is connected to. Every time the name ledPin appears in the code, its value will be retrieved. In this case, the person writing the program could have chosen not to bother creating the ledPin variable and instead have simply written 13 everywhere they needed to specify a pin number. The advantage of using a variable is that it's easier to move the LED to a different pin: you only need to edit the one line that assigns the initial value to the variable.

5.1.2 FUNCTIONS

A function is a named piece of code that can be used from elsewhere in a sketch. For example, here's the definition of the setup() function from the Blink example:

```
  void setup()
{
      pinMode(ledPin, OUTPUT);
}
```

The first line provides information about the function, like its name, "setup". The text before and after the name specify its return type and parameters: these will be explained later. The code between the { and } is called the body of the function: what the function does.

pinMode(), digitalWrite(), and delay()

The pinMode() function configures a pin as either an input or an output. To use it, you pass it the number of the pin to configure and the constant INPUT or OUTPUT. When configured as an input, a pin can detect the state of a sensor like a pushbutton; As an output, it can drive an actuator like an LED.

The digitalWrite() functions outputs a value on a pin.

For example, the line:

digitalWrite(ledPin, HIGH);

The delay() causes the Arduino to wait for the specified number of milliseconds before continuing on to the next line. There are 1000 milliseconds in a second, so the line:

delay(1000);

setup() and loop()

There are two special functions that are a part of every Arduino sketch: setup() and loop(). The setup() is called once, when the sketch starts. It's a good place to do setup tasks like setting pin modes or initializing libraries. The loop() function is called over and over and is heart of most sketches. You need to include both functions in your sketch, even if you don't need them for anything.

Everything between the /* and */ is ignored by the Arduino when it runs the sketch (the * at the start of each line is only there to make the comment look pretty, and isn't required). It's there for people reading the code: to explain what the program does, how it works, or why it's written the way it is. It's a good practice to comment your sketches, and to keep the comments up-to-date when you modify the code. This helps other people to learn from or modify your code.

5.2 CAYENNE

Cayenne is the world's first drag and drop IoT project builder that empowers developers, designers and engineers to quickly prototype and share their connected device projects. Cayenne was designed to help users create Internet of Things prototypes and then bring them to production. Cayenne was designed to work from iOS and Android smartphones and popular browsers. There are several major components in the platform: Cayenne Mobile Apps – Remotely monitor and control your IoT projects from the Android or iOS Apps. Cayenne Online Dashboard – Use customizable widgets to visualize data, set up rules, schedule events and more.

Step 1: Create Cayenne Account

Visit website: https://cayenne.mydevices.com/cayenne/login,

On the Sign Up page, enter your Name, Email and create a Password.

Once you create an account, you then add your device so it can be seen in the online dashboard. Through the dashboard, everything on your Board is accessible. You can remotely monitor and control your IOT devices, for example, you can turn off /on a LED, Monitor temperature.

Cayenne can support multiple devices as well. Beyond adding as many Raspberry Pi/Arduino as you want, you can select from a range of sensors, extensions and actuators that will be wired to your Board. in this example, we'll use Arduino UNO Board

Step 2: Hardware Setup

Please visit: https://cayenne.mydevices.com/cayenne/login enter your user name and password to login.

1: select Arduino to start our IOT project.

2: Connect Ethernet Shield W5100 to Arduino UNO.

Step 3: Add Cayenne Library to Your Arduino IDE

The Cayenne Library is a collection of code, known as sketch files, that makes it easy for you to connect and send data to and from sensors, actuators and devices connected to Arduino boards. Cayenne sketch files can be combined with other sketch files for your IoT projects.

The Cayenne Library is available directly from the Arduino IDE Libraries list. To install the library, select **Sketch > Include library > Manage Libraries**. The Library Manager dialog will appear. From here, search for the Cayenne library and install it.

The Cayenne library has now been expanded in the libraries folder in your Arduino sketches directory. You can verify this by going to the **Sketch > Include Library menu** where you should now see the Cayenne library at the bottom of the drop-down menu under Contributed Libraries. The Cayenne library is now ready to be used in your project.

Step 4: Configure Arduino IDE

In order to successfully program your Arduino board, you will need to verify that the appropriate Board and Port are selected in the Arduino IDE. First, verify that the correct Board is selected in the Tools > Board menu. Be sure to select the board type that you will be programming.

Then, verify that you have the correct Port selected for communicating with your Arduino. Pick the correct port based upon how you are connecting your Arduino to your PC/Mac.

Step 5: Connect Arduino to Caynne IoT Servo

After setting up your PC/Mac computer with the Arduino IDE and the Cayenne Library, you are ready to install Cayenne onto your device. Back to Cayenne Dashboard, select your Arduino board, a list of connections appears below the board name. Select the Arduino UNO, and select Ethernet shield W5100.

Click on the Sketch button next to "Ethernet Shield W5100", you will get a pop-up window which has Arduino Sketch code.

Copy & paste the sketch code into Arduino IDE and select **Sketch > Upload** to compile and upload the sketch into Arduino UNO board.As soon as your Arduino device comes online and connects to Cayenne, you will see your Arduino Board in the online dashboard.

CHAPTER 6

RESULTS AND DISCUSSION

This project's main goal is to create an internet-based system for monitoring health that employs identity-based improved data transmission to deliver a message and make an alarm call to an Internet host using a publicly accessible infrastructure technique. The values of the sensors variable health parameters are examined in the proposed methodology work. Patients benefits are improved and more efficient healthcare services provided by this system and information is gathered via communication and internet-connected devices integrated with cloud services. Using this technique, the doctor may review on the person at any time and from anywhere. An emergency alert message and a call alert will be sent to the designated mobile number, if the acquired present value exceeds or deviates from the predefined threshold. Patients who require 24-hour healthcare can benefit from this system. It aids in the accurate diagnosis of Coma patients with numerous chronic conditions who require ongoing monitoring. As a result, routine health examinations are also simplified. Because the patient's history is saved on the server, it helps with follow-ups. Because it utilizes information technology for the evaluation, human errors are eliminated, resulting in improved performance. The fig.5.1 represents the complete outlook of the projects, where the sensors were connected with each other through arduino and transfer the data from esp8266 to cayenne application. With this sketch, data on any digital or analogue pins used by Cayenne Dashboard widgets will be automatically sent to the Cayenne server. Running the main communication loop, this sketch establishes a connection with the Cayenne server via an Arduino Serial USB connection.

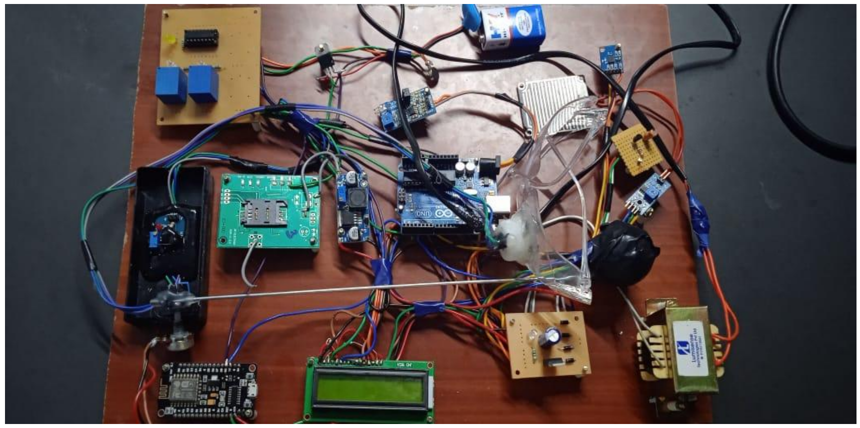

Fig.5.1: Coma Complete Design

You must run this sketch in the Cayenne Library. The Arduino IDE Library Manager is where you may install it. Virtual Writes should be used to send data to any Virtual Pins that the widgets utilize. Since of this, you can't print messages using a serial device because you need to utilize a serial USB connection. You may connect another device to read messages through the Software Serial pins and utilize Software Serial if you need to print. Running the connection script on the computer the Arduino is connected to is required for this to function. In the main library folder, the scripts are housed in a folder called scripts. In this way, the Cayenne server receives traffic originally headed for the Arduino.

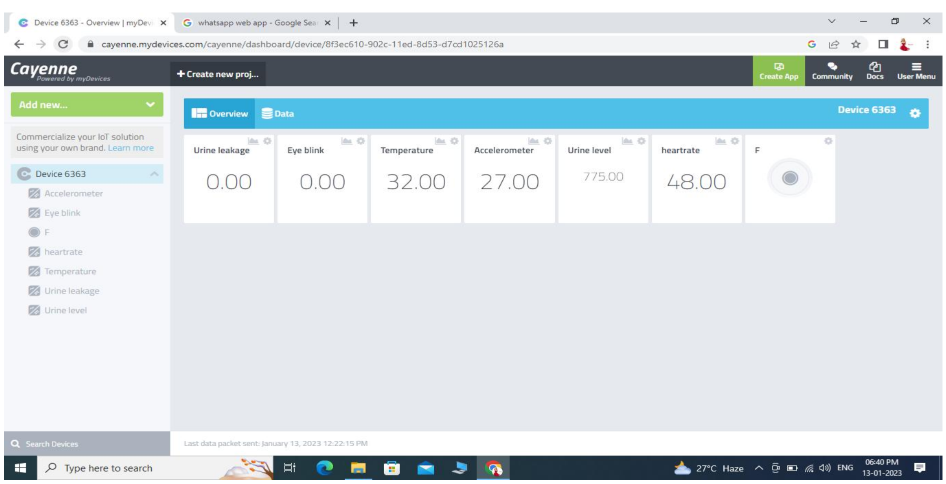

Fig.5.2: IoT Page

The fig.5.2 is been the website where the doctor and caretaker can used to track the condition of the patients in coma and the caretaker can switch on and off the vibrator motor through the application. The urine leakage or conductivity can be displayed as 0 and 1. When there is no leakage of urine it will displayed as 0 and if there is a leakage of urine 1 will be displayed in the cayenne application. Through the value displayed the caretaker can identify. The eye blink of the patient can be notified by the caretaker if the patient opens his eye the sensor gets starts to work and 1 will be displayed or else 0 will be displayed.The accelerometer can be displayed based on the capacitance inside the sensor varies, whenever an acceleration is applied. The acceleration of the item is then determined using this change in capacitance and it can be monitored through cayenne. The graphical representation can also be viewed.

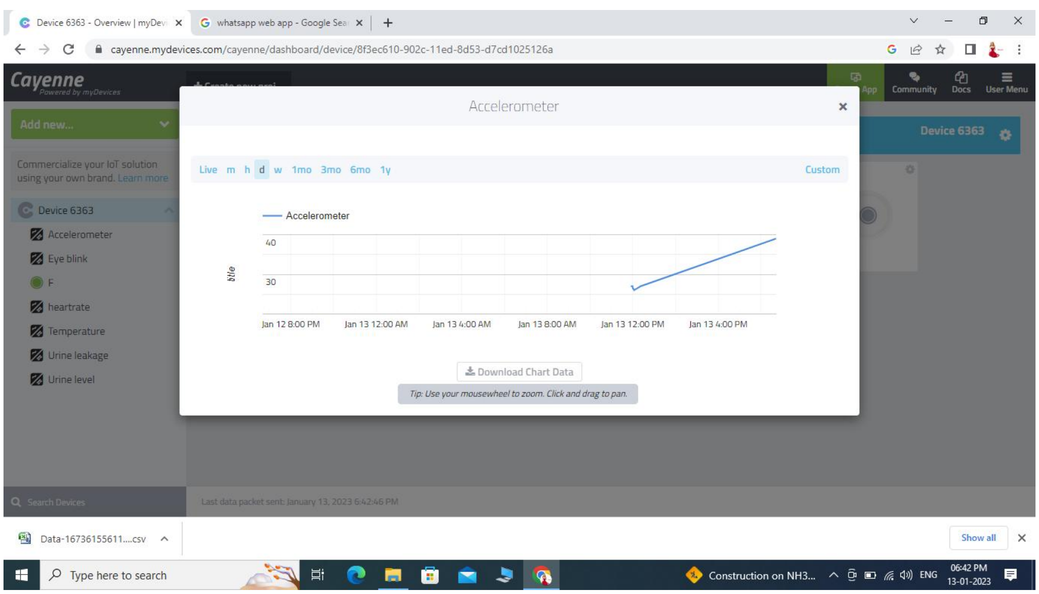

Fig.5.3: Accelerometer Graph

The results of the IoT accelerometer data are shown in Fig.5.3. Effective transmission of the discovered data to the application. The graphs indicate the relationship between the found data and time. Through the help of graph, the changes in the patients body can be viewed with an addition of date and time.

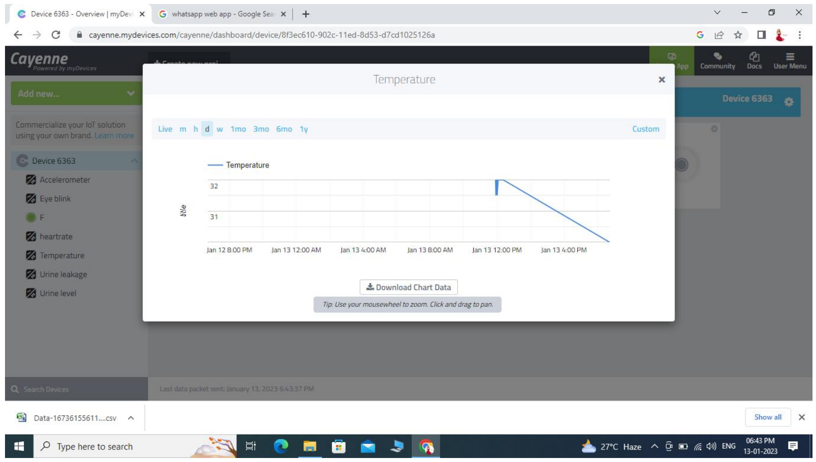

Fig.5.4:Temperature Graph

In Fig5.4, the findings of the IoT data for temperature are displayed. The detected data was effectively transmitted to the Cayenne application. The figures illustrate how the discovered data is shown in relation to time.Every time an abnormality is discovered, such as when the temperature changes is greater or lower than the set point, it activates the alert notification, which then calls the patient's family and sends the necessary signals to the doctor.

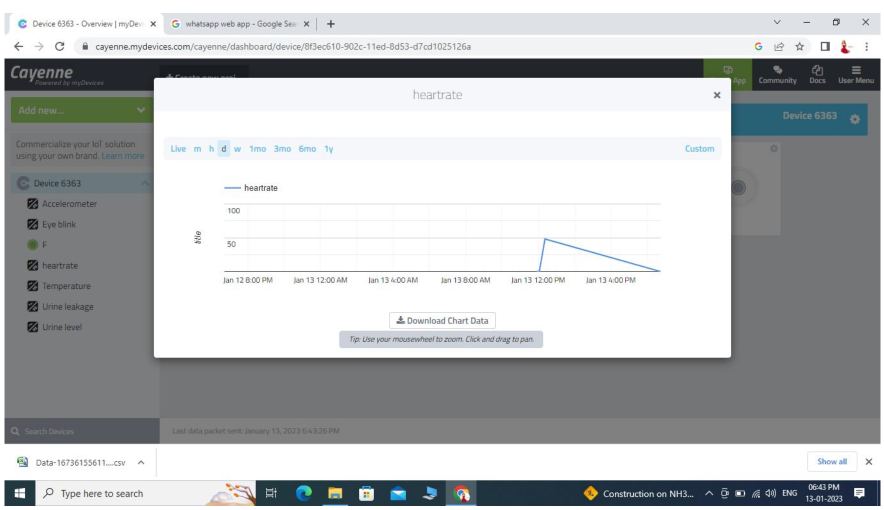

Fig.5.5:Heart Beat Graph

The heart rate signal, which was obtained from the sensor and displayed using the ardunio serial monitor, is shown as having been processed in Fig.5.5. In which also shows the BPM learned during trials, the raw signal's variation is clearly shown. It is asserted that the BPM value created is somewhat dependable, nonetheless, because the average value was established.If any variation occurs in the patient condition, it can be monitored and can be rectified as soon as possible.If the BPM is reduced below the specified level or it goes beyond the certain level it will send SMS to the doctor about the condition and as well as call alert to the caretaker.

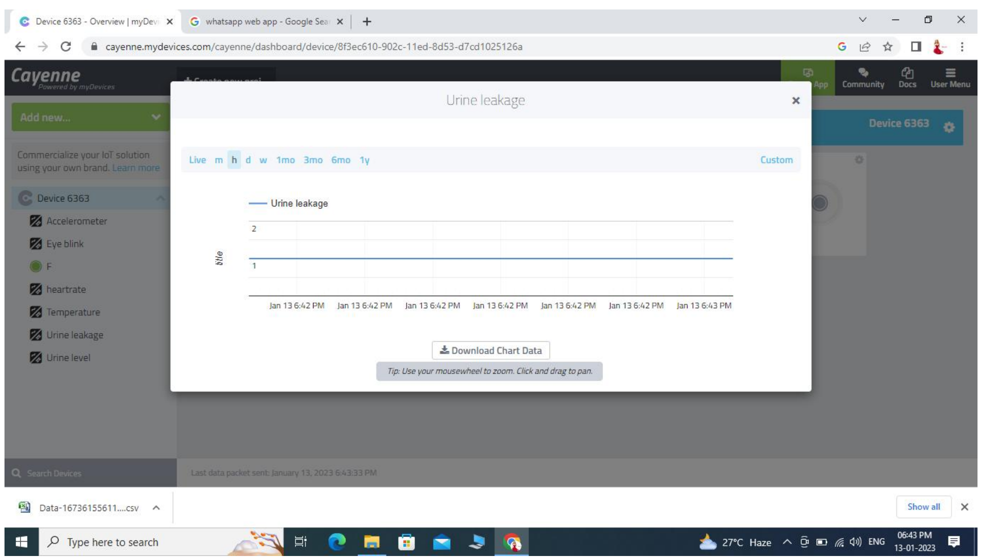

Fig.5.6: Urine Leakage Graph

In Fig.5.6, the findings of the IoT data for urine leakage are displayed. The detected data was effectively transmitted to the Cayenne application. The figures illustrate how the discovered data is shown in relation to time. Here the graphs shows that when there is a leakage then the line corresponding to time will be moves to 2, until there is no leakage there will be a straight line at 1. By viewing the graphs or value in the cayenne the caretaker can identifies that there is a leakage and it can be rectified before causing any infection.

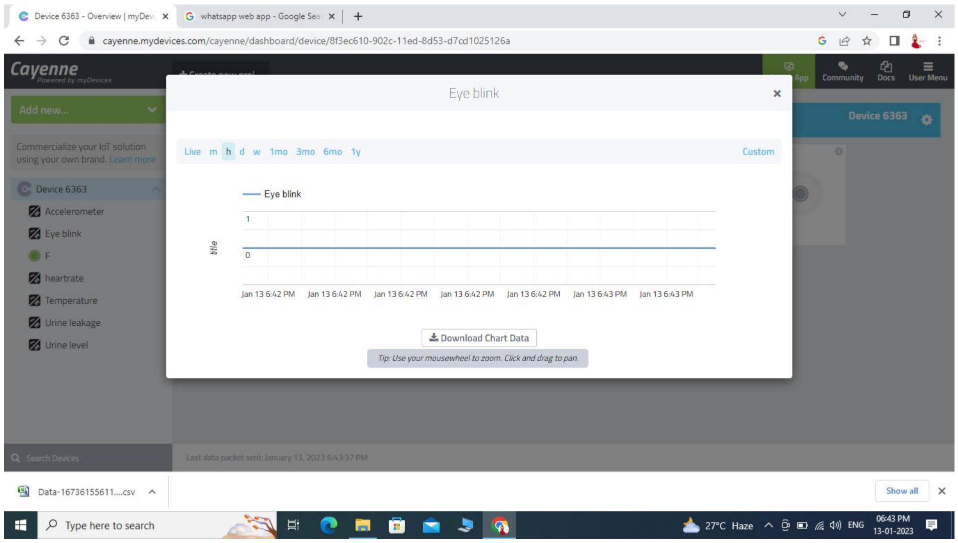

Fig.5.7: Eye Blink Graph

The eye blink signal, which was obtained from the sensor and displayed using the arduino serial monitor, is shown as having been processed in Fig.5.7. The graph indicates that the patient who is in coma doesn’t blinks his eye with an exact date and time. If the patient blinks his eyes then the straight line in 0 will be changes to 1. Even the data can be downloaded if it’s necessary.

CHAPTER 7

CONCLUSION AND FUTUTE WORK

Smart medical beds are integrated solutions for patient care, assistance and monitoring, based on a comprehensive, multidisciplinary design approach. Research in this field is critical in a context of global ageing, and powered by a surge in opportunities for accessibility solutions. Thishave a unique opportunity in enabling more efficient efforts for caregivers, and more responsive environments for patients.An effective healthcare system for monitoring the vital parameters of a patient in comatose stage is built using various sensors which coordinate with processor. This processor in turn processes this data and transfers this to the Wi-Fi module. Wi-Fi module then transmits the data via the cloud to the web-page. It also makes sure to store the previously read data in a proper form as a database for a future access. An alert sms system is also setup to counter emergency situations by sending an alert.

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