

PREGNANT WOMEN HEALTH MONITORING SYSTEM

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

by

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INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with Grade “A” by NAAC
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APRIL – 2023



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BONAFIDE CERTIFICATE

This is to certify that this Final Year Project Report is the bonafide work of AMMIREDDY SUPRAJA (39130019) and ARAVAPALLI DIVYA VASAVI (39130032) who have done the project work as an individual who carried out the project entitled "PREGNANT WOMEN HEALTH MONITORING SYSTEM" under my supervision from November 2022 to April 2023.

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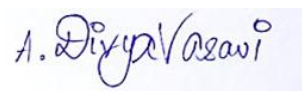
DECLARATION

We, **AMMIREDDY SUPRAJA** (39130019) and **ARAVAPALLI DIVYA VASAVI** (39130032) hereby declare that the Project Report entitled “**PREGNANT WOMEN HEALTH MONITORING SYSTEM**” done by us under the guidance of **Dr. K. V. KARTHIKEYAN M.E., Ph.D.**, Professor, Department of Electronics and Communication Engineering, at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

DATE: 19/04/2023

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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 my thanks to **Dr. N. M. NANDHITHA, M.E., Ph.D., Professor & Dean, School of Electrical and Electronics** and **Dr. T. RAVI, M.E., Ph.D., Professor & Head, Department of Electronics and Communication Engineering** for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Dr. K. V. KARTHIKEYAN, M.E., Ph.D., Professor, Department of Electronics and Communication Engineering**, for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Electronics and Communication Engineering who were helpful in many ways for the completion of the project.

ABSTRACT

Regular health checkup is essential for pregnant women. But remote people don't have enough facilities to go to the hospitals. So here we are developing a portable device for overall checkup for pregnant women like ECG signal and sending this ECG signal analysis to android mobile. And along with ECG signal here we are checking mother pulse rate using pulse sensor and oxygen level using pulse oximeter and blood pressure using bp sensor. A smart health monitoring system is being developed using Internet of Things (IoT) technology which is capable of monitoring blood pressure, heart rate, oxygen level, and ECG signal of a person. This system is helpful for rural areas or villages where nearby clinics can be in touch with city hospitals about their pregnant women health conditions. This healthcare monitoring system has been created that can provide real time online information about a patient's conditions.

The system is made up of sensors, a data acquisition unit, a microcontroller (ESP32) and software. The patient's temperature, heart beat rate, ECG, blood pressure and SPO2 are regularly monitored, displayed, and stored by the system and the same has been sent to the doctor's mobile containing the application. Thus, IOT based real time health monitoring system systematically monitors the condition of patient's health and saves their life on time. This health monitoring system based on IoT helps doctors to collect real-time data effortlessly. The availability of high-speed internet allows the system to monitor the parameters at regular intervals. Furthermore, the cloud platform allows data storage so that previous measurements could be retrieved soon. This system would help in identifying and early treatment in case any emergency occurs. Additionally, a message is sent and call to the doctor's mobile if any of the parameter crosses the threshold value.

TABLE OF CONTENTS

Chapter No.	TITLE	Page No.
	ABSTRACT	v
	LIST OF FIGURES	viii
1	INTRODUCTION	1
	1.1 Objective	3
	1.2 Risks Associated with health parameters	4
	1.3 Problem Statement	5
2	LITERATURE SURVEY	6
	2.1 Literature Survey	6
	2.2 Existing Methodology	14
3	REQUIREMENT ANALYSIS	16
	3.1 Risk analysis of the project	16
	3.2 Hardware and Software Requirements	16
	3.2.1 Hardware requirements	16
	3.2.2 Software requirements	29
4	DESCRIPTION OF PROPOSED SYSTEM	31
	4.1 Selected Methodology or Process Model	31
	4.2 Architecture or Overall Design of Proposed System	32
	4.3 Description of Software for Implementation and Testing Plan for Proposed System	33
	4.4 Project Management Plan	36
	4.5 Financial Report on Estimated Cost	37
5.	IMPLEMENTATION DETAILS	38
	5.1 Development and Deployment setup	38
	5.2 Algorithms	40

6	RESULT AND DISCUSSION	41
6.1	Result on LCD	41
6.2	Result on Cloud	41
6.2.1	Admin section	42
6.2.2	Doctors section	42
6.3	Result on mobile	44
6.4	Advantages of proposed model	44
7	SUMMARY AND CONCLUSION	45
7.1	Conclusion	45
7.2	Future Work	45
	REFERENCES	47
	APPENDIX	49
	A. SCREENSHOTS	49
	B. RESEARCH PAPER	50

LIST OF THE FIGURES

Figure No.	FIGURE NAME	Page No.
2.1	Block diagram of existing model	15
3.1	Temperature sensor	17
3.2	ECG sensors	18
3.3	Pin diagram of ECG sensor	20
3.4	Heart Rate sensor PCB	20
3.5	Blood Pressure Sensor	21
3.6	MEMS sensor	23
3.7	Arduino uno board	24
3.8	Wi-Fi module	27
3.9	SIM900A GSM MODULE	28
3.10	LCD display	29
4.1	Model of the project	31
4.2	System Architecture	32
4.3	Arduino UNO board connection with Arduino IDE along with Wi-Fi module	34
4.4	Selecting the board on Arduino IDE	34
4.5	Selecting the port on Arduino IDE	35

4.6	Login page on cloud platform	36
4.7	IOT cloud platform	36
5.1	Proteus simulation of heart rate sensor and GSM module with Arduino UNO	38
5.2	Experimental setup with all connections	39
5.3	Algorithm for pregnant women health monitoring system	40
6.1	Output on hardware setup using LCD display	41
6.2	Admin section page	42
6.3	Output data on cloud platform	42
6.4	Search results	43
6.5	Output in the form of graph	43
6.6	Alert message on mobile	44

CHAPTER 1

INTRODUCTION

Internet of things (IoT) has become an interesting topic in the field of technological research. It is basically interconnecting of devices with each other over the internet. Beside its general use in terms of autonomous cars and smart homes, but some of the best applications of IoT technology in fields of health care monitoring is worth mentioning. The main purpose of this project is to provide comfort services for pregnant women. It can be used to promote basic nursing care by improving the quality of care and pregnant women safety from her own home environment. Rural area of a country lacks behind the proper patient monitoring system. So, remote monitoring and prescribing by sharing medical information in an authenticated manner is very effective for betterment of medical facilities in rural area.

In the health management arena, a remarkable revolution is the implementation of IoT- based e-Health schemes, which allow the monitoring and acquisition of pregnant women data remotely, in real time, and enable enhanced medical services, treatments and interventions. This, typically, requires a complex system to guarantee the specific quality of service (QoS) requirements for pregnant women.

Pregnant women and hospitals always need better management. The database of all patients should be handy enough. In addition, there should be data prevention. Also, the patient data should be kept private in case. Healthcare is the most important concern of many countries in the world. Improving the lives of patients especially in the weaker parts of the society that include the elderly, physically and mentally disabled as well as the chronically ill patients is the major factor to be improved. In existing system, the data is recorded in the form of paperwork or on general storage server. But generally, that data is accessible to all the staff and doctors. Hence, we are proposing a new way where patient and doctors able to communicate through mobile application and web application. In hospitals, there are provisions for continuous monitoring of patients. Their heartbeats are continuously monitored. There is no provision to check the parameters when they return to home. Hence, there is a chance that the disease may return.

Patient's data (oxygen level, heart rate, blood pressure and pulse rate position) will be frequently measured and sent to server. Period of sending (say every 3 min) can be set. Monitoring person learns patient specific threshold. Say the regular body heartbeat of a patient is 60-100 beats per second whereas one person feels feverish if his heart beat is more than 120 bps. By employing an averaging technique over a relatively long time, Observer can learn these thresholds for patients. Using Android Application in doctor's smart phone, doctor can view his patient's health status. When any of the parameter goes beyond the threshold value, he will get an alert notification. Using Android Application in patient's or his caretaker's smart phone the patient can view his health status. Early detection and diagnosis of potentially fatal physiological conditions such as heart attack require continuous monitoring of patient's health following transfer from hospital to home. Studies have shown that 30% of patients with a discharge diagnosis of heart failure are readmitted at least once within 90 days with readmission rates ranging from 25 to 54% within 3 – 6 months.

In response to these types of needs, health-monitoring systems are being proposed as a low-cost solution. Such a system consists of physiological data that stores, process and communicate through a local manner such as smart phones, personal computers. Such systems should satisfy strict safety, security, reliability, and long-term real-time operation requirements. In the proposed system, we present a health monitoring system that uses the sensors for collecting data from patients, intelligently predicts patient's health status and provides feedback to doctors through their mobile devices having android application. The pregnant will participate in the health care process by their mobile devices and thus can access their health information from anywhere any time. Today Internet has become one of the important parts of our daily life. It has changed how people live, work, play and learn. Internet serves for many purpose educations, finance, Business, Industries, Entertainment, Social Networking, Shopping, E-Commerce etc.

The next new mega trend of internet is Internet of Things (IOT) visualizing a world where several objects can sense, communicate, and share information over a Private Internet Protocol (IP) or Public Networks. The interconnected objects collect the data at regular intervals, analyze and used to initiate required action, providing an intelligent network for analyzing, planning and decision-making. This is

the world of the Internet of Things (IOT). The IOT is generally considered as connecting objects to the Internet and using that connection for control of those objects or remote monitoring. But this definition was referred only to part of IOT evolution considering the machine-to-machine market today. But actual definition of IOT is creating a brilliant, invisible network which can be sensed, controlled and programmed. The products developed based on IOT include embedded technology which allows them to exchange information, with each other or the Internet and it is assessed that about 8 to 50 billion devices will be connected by 2020. Since these devices come online, they provide better life style, create safer and more engaged communities and revolutionized healthcare. The entire concept of IOT stands on sensors, gateway and wireless network that enable users to communicate and access the application/information.

1.1 OBJECTIVE

The objective of this project is to propose an IoT- based health care system implementation scheme using Electro Cardio Gram (ECG) signals, oximeter, pulse sensor, and blood pressure sensor. The aim to improve the quality of service and wellbeing for the pregnant women who are not able to come to primary health centers by checking pregnant women remotely from their place through nurses or and sending data to the cloud so that doctor is able to monitor pregnant women ECG signals and oxygen level and blood pressure to check cardio problems, and to enhance health or medical services. The proposed e-health system collects ECG data from AD8232 ECG sensor and body oxygen level from pulse oximeter and measuring pulse from pulse sensor and blood pressure from BP sensor and this data is processed through ESP8266 which connected to Wi Fi and the data is transferred to the cloud for storage. The details of the pregnant women can be obtained from all the places which is connected to the cloud.

It is Basically interconnecting of devices with each other over the internet. Beside its general use in terms of autonomous cars and smart homes, but some of the best applications of IoT technology in fields of health care monitoring is worth mentioning. The main purpose of this project is to provide comfort services for pregnant women. It can be used to promote basic nursing care by improving the quality of care and pregnant women safety from her own home environment. Rural

area of a country lacks behind the proper patient monitoring system. So, remote monitoring and prescribing by sharing medical information in an authenticated manner is very effective for betterment of medical facilities in rural area.

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1.2 RISKS ASSOCIATED WITH DIFFERENT HEALTH PARAMETERS

Body Temperature is one of the most important health indicators. A person's typical body temperature varies from 36.1°C to 37.2°. A temperature over 100.4°F (38°) can be the indication of several human diseases and illnesses such as ear, skin, lungs, throat, bladder, or kidney infection, rheumatoid arthritis, hormone abnormalities such as hyperthyroidism and a variety of other underlying ailments. An extremely low body temperature can also be potentially deadly because it causes shock in the heart, neurological system, and other organs, putting the individual at danger of heart attack, respiratory failure, and death. Too much humidity causes the body temperature to rise and even aggravates the growth and spread of viruses, bacteria, and fungus thus causing allergic reactions. High blood pressure and heart disease can be caused by chronic high amounts of stress. Stress can raise the chances of having a preterm or low-birthweight baby during pregnancy, and premature newborns are more vulnerable to health issues. Heart rate and blood oxygen saturation (SpO₂) are yet another two important factors of the human body. A high heart rate causes the heart to pump less efficiently causing a reduction in the blood flow to the heart and the rest of the body and since the heart is beating faster the heart muscles need more oxygen and an inability to supply more oxygen causes lightheadedness and shortness of breath and in extreme cases causes heart attack. A low heart rate causes the brain and the organs to be deprived of oxygen thus leading to fatigue, dizziness, memory difficulties, etc. In our proposed model we will be monitoring these vital parameters, along with other factors, so that such health concerns can be addressed as early as possible.

1.3 PROBLEM STATEMENT

Pregnant Women need to get their health checkup done regularly. When comes to the availability of the doctors and hospitals, many remote areas are not having proper hospitals and required equipment. Even the hospitals are organizing health camps regularly, it is difficult to carry necessary equipment which are large. In this project, we are developing a wearable or easy to carry device for health monitoring.

CHAPTER 2

LITERATURE SURVEY

For getting overview about the previous work related to this project we have reviewed many papers and summary of that paper are as follows

2.1 LITERATURE SURVEY

Alvee Rahman, Sazzed Hpssain, Tahsinur Rahman et.al [1]

This paper proposes an intelligent patient monitoring system that automatically screens the patient's health condition through various sensors. The data is then processed using a Raspberry Pi and useful information is saved to the IoT cloud. Primarily the system would be extracting the bio signal, ECG using an ECG sensor. Through continuous monitoring and graphical representation of the patient's information, doctors/nurses/relatives can remotely check the patient's condition. Furthermore, if the condition becomes critical, a notification is sent to the doctor/nurse/relative to inform them and either party will have the opportunity to start a video call.

The system proposed in this paper is an effective patient monitoring system that takes ECG signal and temperature as the input, saves the data to the cloud and takes actions based on the values. The primary goal for proposing a system as such was to provide an inexpensive alternative to existing health monitoring systems. So even though introduction of a GSM module would have made the system better, the less costly option of using a web-based SMS service was used. The SMS service had a pay-per-use system and no initial costs unlike the GSM module, where the module had to be purchased. The system works perfectly with the above-mentioned setup. It is taking continuous data from ECG sensor and digital temperature sensor and stores the values in the cloud and MySQL database along with the timestamp and heart rate that is derived from the ECG signal. the graphs generated in cloud from the readings taken from the sensors. It also analyses the values of the temperature and heart rate to set the value of the notification parameter to either 0 or 1. As per the notification value of the latest entry, the website sends SMS to the designated person in case of emergencies.

Devendra R Sanghavi, S. V. Athawale et.al [2]

From this paper it is seen that, the ECG monitoring system that is based on IoT is low cost and efficient for remote patient. The architecture of the ECG monitoring system was presented at first. The components of the system are Raspberry Pi, Arduino and ECG AD8232 Wired Sensor were introduced and compared. With the help of an ECG AD8232 monitoring sensor node with three electrodes, real-time ECG signals can be collected with satisfactory accuracy. The gathered data were transmitted to the Bluemix IoT cloud using Wi-Fi from Raspberry Pi. The IoT cloud is responsible for visualizing the ECG data to users and storing these valuable Data for further analysis, which is implemented on the basis of the HTTP server, MQTT server, and storage server. Eliminating the need for mobile applications, the web-based GUI provides a versatile means independent of any mobile OS platform for users to access the ECG data. This system is low-cost compared to other existing systems in literature and can also provide Real Time Notification when the ECG signals of patient are abnormal.

Charushila Patil, Anita Chaware et.al [3]

This paper is focused on a Heart rate monitoring system with the help of IoT. The heart rate monitoring model with a pulse rate sensor and the piezoelectric sensor is used here. This model will be useful for tracking patients in real-time and can also be used in hospitals and residential areas. A pulse sensor is used to collect heartbeat from the patient's body and the resonance frequency is calculated using a piezoelectric sensor. To take readings, these sensors are mounted on the human body. The Node MCU module is used to capture and process the raw data and send it to the cloud for storage and analysis purpose. Arduino IDE is used to write program to do pulse rate monitoring. With the help of blood flow in vein heartbeat are detected. After completion of the coding and execution portion in Arduino, the precise time is shown and a nearby value is noted and then sent to the cloud. Using internet or without network, the data can be measured. The values of heart rate and resonance frequency calculated using code can be seen through the Arduino software's output window. In this real-time system, The NodeMCU Wi-Fi module plays a significant role.

When the API key of the channel is attached, the Wi-Fi is connected to external devices such as phones, laptops, etc. for the heart rate data reference value, as noted by the Arduino software code. After getting connected all the components we will get output at Arduino software. For research and storage purposes, the data from the NodeMCU is sent to the cloud. Hence the Application Program Interface key serves as a hardware-cloud interface platform. Within fraction of a second, the pulse rate sensor detects the individual's heartbeat. By using only human finger, the heart rate can be found and recorded. The piezoelectric sensor senses a human's resonance frequency.

Mohamed T A.Mahgoub, Otham O. Khalifa, Khairul Azami Sidek, Sheroz Khan et.al [4]

This paper presents a remote Pulse Oximetry System for health monitoring purposes. The framework lays on the idea that the vital health signs, can be collected from the patient and passed to a processor, where these signs will be processed, compared, and monitored in order to alert important personnel in the case of an emergency. The blood oxygen saturation is the biometric sign which is monitored by this device. The technique used in this work is called "Photoplethysmography" which is based on the change in the intensity of light transmitted through the tissue due to arterial blood pulse. This technique converts the intensity of light into a voltage signal which is used to calculate the oxygen saturation of the patient.

This is because oxygenated blood has such characteristics in absorbing the Red and Infrared wavelengths which differs from the deoxygenated blood. Comparison of the two absorptions produces an estimation of the oxygen saturation in the patient's blood. The pulse oximeter is able to measure the SO₂ saturation based on the fact that the blood changes color as the hemoglobin absorbs two spectrums of light depending on its saturation with oxygen. The two wavelengths used are red light with a wavelength of 660nm and infrared light with a wavelength of 940nm. The oxy hemoglobin absorbs more infrared light than it does with the red light. However, when the oxygen saturation decreases, the absorption of the red light increases as a result to that the color of the blood becomes darker.

Elisa Spano, Stefan Di Rascoli, Giuseppe Iannaccone et.al [5]

We have proposed a wireless wearable ECG monitoring system embedded in an IoT platform that integrates heterogeneous nodes and applications, has a long battery life, and provides a high-quality ECG signal.

The system allows monitoring multiple patients on a relatively large indoor area (home, building, nursing home, etc.). ECG sensor, based on a high-performance ADC and a microprocessor-radio combo chip, provides much better performance, in terms of power consumption and noise. An actual deployment of the system was used to evaluate key aspects of the system architecture, in particular the possibility to monitor the ECG signal of multiple patients in a large area and for a long time and the possibility to access ECG data through the web interface.

The test deployment consisted of six ECG sensor nodes, a ZigBee gateway and an IoT server [26], [27]. The IoT server was installed on a Linux machine. The ZigBee gateway has been configured to connect to the server, through an ADSL router. Various tests have been performed in order to evaluate: A. quality of the ECG signal; B. maximum range; C. maximum data rate in terms of maximum number of ECG belts that can be connected to a single gateway at the same time; D. power consumption

Norleзах Hashim, Nurbahirah Norddin, Fakrulradzi Idris, Siti Nur Ilmani Mohd Yusoff, Madiha Zahari et.al [6]

In this work, IoT Blood Pressure Monitoring System (IBPMS) is designed to monitor patient's blood pressure remotely. This project use Raspberry Pi as a gateway to view the value of blood pressure online. Result showed that the design is capable to transfer data from blood pressure detector through the network using USB TTL serial cable which is directly attached to the Raspberry Pi. User can also view the blood pressure reading continuously from Telegram application and email service. Furthermore, the system can measure the value of blood pressure accurately when user is in sitting position. The user is having a normal blood pressure reading at the time the data was taken. Sitting position shows the blood pressure in normal condition, while in the standing position the blood pressure shows in high blood pressure level and at the lying position is at the low blood pressure. The best accuracy of the readings is obtained.

Mohammad Monirujjaman Khan, Turki M. Alanazi, Amani Abdulrahman Albraikan, Faris A. Almalki et.al [7]

This paper presents the design and implementation of a health monitoring system using the Internet of Things (IoT). In present days, with the expansion of innovations, specialists are always looking for innovative electronic devices for easier identification of irregularities within the body. IoT-enabled technologies enable the possibility of developing novel and non-invasive clinical support systems. This paper presents a health care monitoring system. In particular, COVID-19 patients, high blood pressure patients, diabetic patients, etc., in a rural area in a developing country, such as Bangladesh, do not have instant access to health or emergency clinics for testing. Buying individual instruments or continuous visitation to hospitals is also expensive for the regular population.

The system we developed will measure a patient's body temperature, heartbeat, and oxygen saturation (SpO₂) levels in the blood and send the data to a mobile application using Bluetooth. The mobile application was created via the Massachusetts Institute of Technology (MIT) inventor app and will receive the data from the device over Bluetooth. The physical, logical, and application layers are the three layers that make up the system. The logical layer processes the data collected by the sensors in the physical layer. Media access management and intersensory communications are handled by the logical layer. Depending on the logical layer's processed data, the application layer makes decisions. The main objective is to increase affordability for regular people. Besides sustainability in the context of finance, patients will have easy access to personal healthcare. This paper presents an IoT-based system that will simplify the utilization of an otherwise complicated medical device at a minimum cost while sitting at home.

M. Mamun-Ibn-Abdullah, M. Humayun Kabir et.al [8]

In this paper the main concept of IoT is defined as the integration with electronic devices that connect with doctors or health monitoring persons. The proposed system consists of Raspberry-pi, ECG Simulator, NodeMCU. Also displays the extracted data or extracted parameters on the cloud through Raspberry-pi and Wi-Fi access point for immediate access to the experts or doctors. First electrodes capture the QRS parameters and send to controller.

The controller which used here is Raspberry-pi, that process ECG signal and sends to Thing Speak. Raspberry-pi is used to send data to cloud (Thing Speak) wirelessly, Thing Speak cloud is the open Internet of Things (IoT) with MATLAB analytics used to visualize data to doctor or experts, then doctor or expert analyst make the decision.

Moreover, in case of emergency, nurse or patient's relative check out patient's condition by using LIVE monitoring option and distinguished normal and abnormal ECG using different machine learning algorithms. After wards, we did the research on predicting few diseases depending on the availability of the data for a particular disease. The model that we trained to predict the outcome for different diseases and classify between normal and abnormal ECG can also be used to predict outcome for other diseases that we did not work for. In addition, our target was to figure out which algorithm gives the best result in predicting the diseases we worked with. We analyzed the results that we predicted by using our model and calculated the accuracy level of different algorithms.

Abdullah Mukhtar, Muneeb Abdul Rauf et.al [9]

This paper is significant in various ways because in today's world, everyday many lives are affected because the patients are not timely and properly operated. Also, for real time parameter values are not efficiently measured in clinic as well as in hospitals. Sometimes it becomes difficult for hospitals to frequently check patient's conditions. Also, continuous monitoring of ICU patients is very difficult. To deal with these types of situations, our system is beneficial. Our system is designed to be used in hospitals and homes also for measuring and monitoring various parameters like temperature, ECG, heart rate, blood pressure. The results can be recorded using Arduino. Also, the doctors can see those results on android app. The system will also generate an alert notification which will be sent to doctor. Our system is useful for monitoring health system of every person through easily attach the device and record it. In which we can analysis patient's condition through their past data, we will recommend medicines if any emergency occurred through symbolic A.I.

Navyashree K, Soundarya S, Suhani H S, Gulafshan Firdos, Dr. Ravi Kumar V
et.al [10]

The proposed system focuses on collection of patient's various vital health parameters and generates alert message to care takers and doctors so that immediate action can be taken in case of critical conditions. The stored in cloud can be accessed by the authorized medical professionals via internet from anywhere anytime. cloud has high processing power, large amount of storage which can be scaled according to application needs.

Smart devices and wireless sensor networks are used for real time analysis of various health parameters of patients, the design and implementation of an e-health monitoring network system is done. The main aim is to develop a set of modules which can facilitate the diagnosis for the doctors through telemonitoring of patients. To monitor the health parameters of the patient remotely, the set of various sensors are used. These sensors are used to sense the data and then that data will be sent to the server using Wi-Fi module. The patients are monitored by the doctor in real time on the basis of the data received through the server. For any future obstacles and for easy access and processing for planning and prediction, this architecture is used to store the medical history of the patient on cloud and hence for monitoring single patient particularly at home as well as in hospitals and public healthcare units.

Anand D. Acharya, Shital N. Patil et.al [11]

This paper presented a design and implementation of an IoT-based smart doctor kit for a critical medical condition that can provide a versatile connection to IOT data that can help emergency health services such as Intensive Care Units (ICU). Now in recent days, the healthcare control system is necessary to regularly monitor the patient's physiological parameters. Heart Beat, body temp, ECG and Respiration are the physiological parameters of the body. The process of measuring these body parameters is called Health monitoring. Different sensors are used to monitor this data and this data is continuously monitored and send towards the internet server or on a mobile app. main advantage of health monitoring is that it reduces human error.

The proposed model allows users to achieve better health-related risks and minimizes healthcare costs by collecting, recording, testing and distributing large data in real-time and perfectly. The idea behind this paper is to reduce the patient's worry about visiting a doctor every time. The time not only of patients but also of doctors is saved with the aid of this project proposal, so doctors can also help patients as much as possible in critical condition.

B. P. Raj; G. S. Harshitha; B. Archana; S. Eluri et.al [12]

This paper proposed a system in which ECG is used to quickly find an actual human heartbeat pattern, and that may be a cause of ill human health. This also uses the Arduino platform consisting of both hardware and software modules. With the flourishing patterns of health care and the stipulation of advanced measures to monitor day-to-day health conditions, such inventions prove worthwhile. This project also utilizes a heartbeat sensor to detect the human's heartbeat to be measured and provides the result promptly, suggesting its variation from the actual average human being's heartbeat. It indicates the severity of the heartbeat deflection on display. The advancement in this system is that it is accessible from remote areas and one that can be put in to use with no complications.

Dhanurdhar Murali; Deepthi R Rao; Swathi R Rao; M Ananda et.al [13]

In this project, we offer a modern day, embedded systems & IoT based solution for continuous and non-invasive measuring of the cardiac values using an upcoming technology known as pulse-oximetry. This technology uses a medical sensor creating a photoplethsmogram from which we can detect the oxygen saturation level and variations in blood volume in the tissues. This analog waveform is further processed using hardware filters to obtain heart rate and SpO₂ values. These values are digitized using the A2D converters in the ATmega32 based SoC and are constantly stored and uploaded to the cloud. In case the cardiac values are found to deviate away from the set thresholds, an automated emergency alert system is triggered which uses GSM for automated SOS calls, GPS to track the patient's location and GPRS to make the system truly mobile and wireless. Also, a patient can self-trigger the same alert system by using google voice assistant on their smart-phone.

K. Praghash; S. Mahfooz Ali Baig; V. Sree Lakshmi Dhatri; Muzammil Parvez M; Durga Prasad Tripathi et.al [14]

In this paper they proposed a device that integrates the latest up-to-date and cutting-the-edge trending IoT technologies. Consecutive and selective sampling of the patient and home environment Health tracking is feasible by using ECG and blood pressure monitors. Important shifts in the patient's pulse and ECG can be observed using multiple sensors. This project is used to measure the heart rhythm using Arduino and O2. It's just about maintaining track of many kinds of biological metrics, including heart rate, oxygen level, and temperature, which can be constantly monitored electronically and available, with no doctor present face- to-to-face touch, where the doctor can view the patient's data and relevant details whenever. Outline the effects of periodic visualization Patient Observations and symptoms are monitored using ThingSpeak.

2.1 EXISTING METHODOLOGY

The system consists of mainly four sensors: Electrocardiogram (ECG) module, blood pressure sensor, pulse sensor and an oximeter module. The sensors will be integrated into one system using Arduino. The data collected from the sensors will be sent to a Wi-Fi module called Node MCU ESP8266, through which the data will be uploaded on cloud, which will allow the healthcare provider to view it. In this paper we have measured the four vital parameters for 10 different patients and presented it.

2.1.1 *Portable patient monitoring Architecture*

The functioning block diagram of the mobile patient monitoring system is shown in Fig 2.1. It first collects the data from the various sensors i.e pressure sensor, pulse oximeter, temperature sensor and ECG module. The data is collected using Arduino. The collected data is sent through the Node MCU to cloud. After the required processing is done on this cloud stored data, the data will be able to view it from the hospital before the patient arrives.

The system consists of mainly four sensors: Electrocardiogram (ECG) module, blood pressure sensor, temperature sensor and a pulse oximeter module. The sensors will be integrated into one system using Arduino. The data collected

from the sensors will be sent to a WIFI module called Node MCU ESP8266, through which the data will be uploaded on cloud, which will allow the healthcare provider to view about pregnant women health data

Block diagram

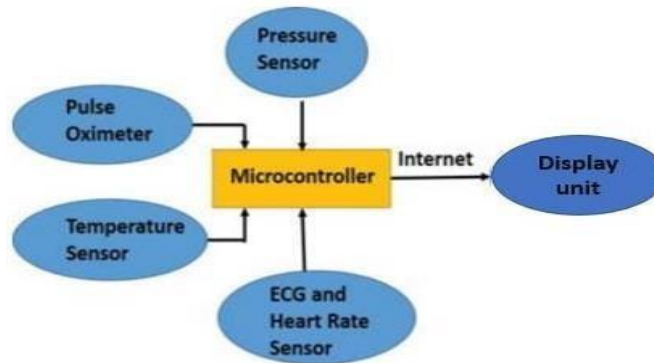


Fig: 2.1: Block diagram of existing model

2.1.2 Algorithm for Node MCU Esp8266

Node MCU is an open source IoT device enabled through Wi-Fi. It is connected to Arduino through which it will receive the sensor data. It will send all the sensor data over Wi-Fi to Thing speak which is an online IoT analytics platform. Thing speak is equipped with Mat lab, which will allow us to perform data processing on the received data.

- Connect Node MCU Esp8266 to Arduino.
- Receive all the data on Arduino.
- Design a high pass filter to remove baseline drift from the ECG signal.
- Design suitable filters for removing power line interference and adaptive white Gaussian noise.
- Plot all the data into four different graphs.

All the four parameters were picked up from 11 participants. The ECG captured the baseline drift and the other noise such as additive white Gaussian noise, power line interference and so on present mainly in the ECG signal would be removed during the transmission of the data to Thing speak.

CHAPTER 3

REQUIREMENTS ANALYSIS

3.1 RISK ANALYSIS OF THE PROJECT

The health parameters of a pregnant woman that we have monitored can vary due to many reasons including her lifestyle, mental health, age, and weight so we cannot come to a proper conclusion only from the data that we have received without knowing these factors. We need to have proper knowledge of any small details that can affect any of these parameters. If we want to take a large amount of data or want to monitor someone for a long period of time, it might not always be possible to keep track of every significant change happening in her life. As a result, the device may not always provide us with an accurate or correct analysis.

If the provided emergency contact number is out of reach for any reason, our system will not be able to alert the emergency contact person, so it is critical that the number we provide is always operational.

The ESP8266 needs to establish a secure and stable connection, so that the MCU and cloud server maintain proper communication. If that network connectivity is lost, the device will not be able to send the data to the server.

If any of the sensors get damaged during taking readings from the mother, the only option is to replace it with a new or better one. As a result, the system has to be rectified once more with a new sensor.

It may be difficult to take readings in rural areas with poor internet connectivity, and because our system is built on the Internet of Things, we may not be able to effectively access the health problems of pregnant women in those locations.

3.2 HARDWARE AND SOFTWARE REQUIREMENTS

Here in this project, we have used both hardware and software, all the details have been explained clearly below,

3.2.1 Hardware Requirements

1. Temperature sensor
2. ECG module
3. Pulse Oximeter
4. Blood Pressure sensor

5. MEMS sensor
6. Arduino UNO board
7. NodeMCU
8. GSM module
9. LCD display

Temperature sensor:

A one-wire digital temperature sensor, the DS18B20 measures temperature. The Fig 3.1, shows the temperature sensor. This indicates that communication with the Arduino only needs one data line (together with GND). It has two power options: it can be fueled by an external powersource or it can use "parasitic mode," which draws power directly from the data line. The 64-bit serial code on each DS18B20 temperature sensor is distinct. This makes it possible to connect several sensors to a single data link. Thus, you may use a single Arduino digital pin to obtain the temperature from various sensors.

Each DS18B20 temperature sensor has a unique 64-bit serial code. This allows you to wire multiple sensors to the same data wire. So, you can get temperature from multiple sensors using just one Arduino digital pin. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control system.

Flexible User-Definable Nonvolatile (NV) Alarm Settings with Alarm Search Command Identifies Devices with Temperatures Outside Programmed Limits.

- Simplifies Distributed Temperature-Sensing Applications with Multidrop Capability.
- Each Device Has a Unique 64-Bit Serial Code Stored in On-Board ROM



Fig: 3.1: Temperature sensor

ECG module:

The AD8232 is a tiny chip that analyses the electrical activity of the heart. The Fig 3.2, shows the ECG sensor. This electrical activity can be monitored using an ECG, or electrocardiogram. Many heart conditions can be identified with electrocardiography. The recorded ECG curve aids in locating heart problems. These aids medical professionals in diagnosing heart patients. Heart rate (HR), heart rate variability (HRV), and other characteristics are measured by an ECG sensor. To capture the electrical signals from the person's chest, electrodes are affixed with AD8232. To record the ECG, atleast three electrodes are needed. Heartbeat analogue signals are produced by the AD8232. To display an ECG pattern, a microcontroller or Arduino Uno board can be utilized.



Fig: 3.2 ECG sensor

The AD8232 is an integrated signal conditioning block for ECG and other biopotential measurement applications. It is designed to extract, amplify, and filter small biopotential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. This design allows for an ultralow power analog-to-digital converter (ADC) or an embedded microcontroller to acquire the output signal easily. The AD8232 can implement a two-pole high-pass filter for eliminating motion artifacts and the electrode half-cell potential. This filter is tightly coupled with the instrumentation architecture of the amplifier to allow both large gain and high-pass filtering in a single stage, thereby saving space and cost. An uncommitted operational amplifier enables the AD8232 to create a three-pole low-pass filter to remove additional noise. The user can select the frequency cutoff of all filters to suit different types of applications. To improve common-mode rejection of the line frequencies in the system and other undesired interferences, the AD8232 includes an amplifier for driven lead applications, such as right leg drive (RLD). The

AD8232 includes a fast restore function that reduces the duration of otherwise long settling tails of the high-pass filters. After an abrupt signal change that rails the amplifier (such as a leads off condition), the AD8232 automatically adjusts to a higher filter cutoff. This feature allows the AD8232 to recover quickly, and therefore, to take valid measurements soon after connecting the electrodes to the subject. The AD8232 is available in a 4 mm × 4 mm, 20-lead LFCSP and a LFCSP_SS package. Performance for the A grade models is specified from 0°C to 70°C and the models are operational from -40°C to +85°C. Performance for the W grade models are specified over the automotive temperature range of -40°C to +105°C.

The features of this sensor mainly include the following.

- Operation of single supply ranges from 2V to 3.5V
- The front end is integrated fully with only lead ECG
- The virtual ground can be generated through integrated reference
- RFI filter is used internally
- The current supply is low like 170 μ A
- The output is rail to rail
- Shutdown pin
- CMRR is 80 dB
- Incorporated RLD amplifier (right leg drive)
- Electrode configurations are 2 or 3
- The operational amplifier is uncommitted
- It accepts half-cell potential up to ± 300 mV
- Three-pole adaptable LPF with adaptable gain
- The signal gain is high using DC blocking capacity
- Filter settling can be improved by quick restore
- Two-pole adaptable HPF
- 4 mm × 4 mm and 20-lead LFCSP package

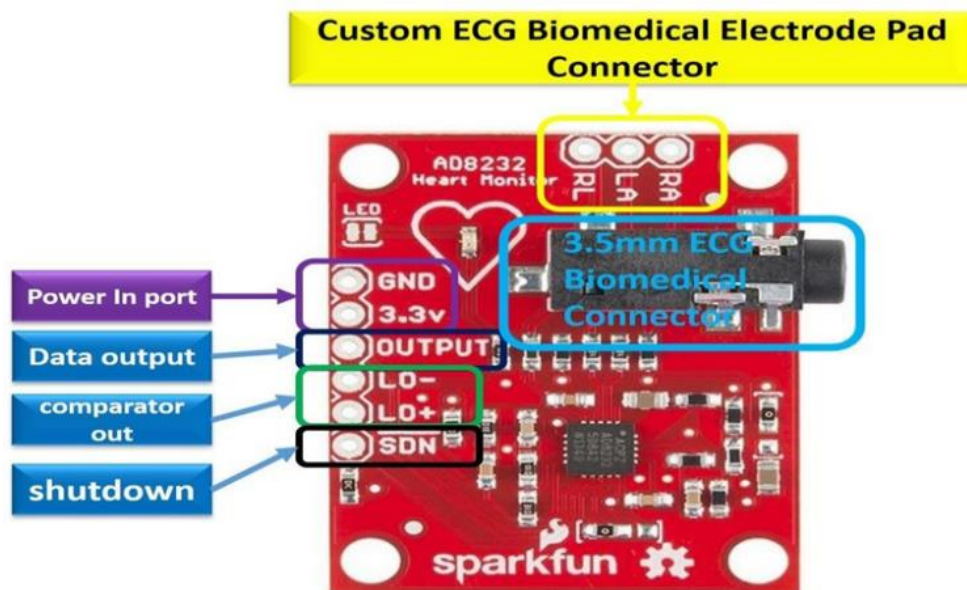


Fig: 3.3: Pin Explanation for ECG sensor

Heart Beat Sensor PCB board:

Heart Beat sensor works on a very basic principle of optoelectronics. All it takes to measure your heart rate is a pair of LED and LDR and a microcontroller. IR led emits infrared radiation and surface reflects the infrared light. Depending on reflectivity of the surface amount of light reflected varies this reflected light is made incident on reverse biased IR sensor which results in reverse leakage current. Amount of electron-hole pairs generated depends on intensity of incident IR radiation. More intense radiation results in more reverse leakage current. This current can be passed through a resistor to get proportional voltage. Thus, as intensity of incident rays varies, voltage across resistor will vary accordingly.

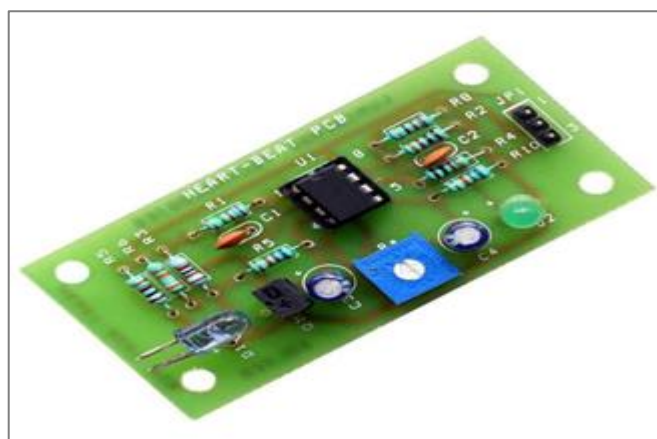


Fig: 3.4: Heart Beat sensor PCB board.

The operation of the board is very simple. After powering the board from a 3-5.5V supply, the Enable (EN) pin must be pulled high to activate the IR sensor. Next, place the tip of your forefinger gently over the sensor on its face. Your finger should be still and should not press too loud hard on the sensor. Within a couple seconds the circuit stabilizes and you will see the LED flashing synchronously with your heart beat. You can feed the output signal (Vout) to either a digital I/O or an ADC input pin of the microcontroller for measurement of the heart beat rate in BPM.

Blood Pressure sensor:

An absolute pressure sensor is the BMP280. Its tiny size and low power consumption enable the incorporation in battery operated products like watches and mobile phones. Blood Pressure sensor is shown in Fig 3.5. Based on Bosch's tried-and-true piezo-resistive pressure sensor technology, the BMP280 has a high degree of precision and linearity, long-term stability, and strong EMC robustness. Highest flexibility is guaranteed by a variety of device operation options. The device is tuned for filter performance, resolution, and power consumption. The BMP280 is an absolute barometric pressure sensor, which is especially feasible for mobile applications. Its small dimensions and its low power consumption allow for the implementation in battery-powered devices such as mobile phones, GPS modules or watches. The BMP280 is based on Bosch's proven piezo-resistive pressure sensor technology featuring high accuracy and linearity as well as long-term stability and high EMC robustness. Numerous device operation options guarantee for highest flexibility. The device is optimized in terms of power consumption, resolution and filter performance.



Fig: 3.5: Blood Pressure sensor

- The BMP280 module comes with the BMP280 sensor, a temperature sensor, a barometric pressure sensor that is the next generation upgrade to the BMP085/BMP180/BMP183 sensor.
- This sensor is great for all kinds of weather sensing and can even be used in both I2C and SPI applications.
- This precision sensor is the best low cost, precision sensing solution for measuring barometric pressure with ± 1 hPa absolute accuracy and temperature with $\pm 1.0^{\circ}\text{C}$ accuracy. Because pressure changes with altitude and pressure measurements are so good, it can also be used as an altimeter with ± 1 meter accuracy.
- Pin pitch: 2.54mm
- Module size: 11.5mm*15mm

This module consists of both IC and SPI. Due to this feature, you can interface or connect this sensor with Arduino and any other microcontroller using either I2C or SPI interface. It is used in weather sensing applications. This low-cost sensor provides precise values of barometric pressure and temperature with ± 1 hPa and $\pm 1.0^{\circ}\text{C}$ accuracy. As it can measure pressure which changes with altitude, therefore, it can also measure altitude. You can use the BMP280 module as an altimeter also which gives readings with an accuracy of ± 1 meter.

This six-pin module supports both the interfaces SPI and I2C. It uses barometric pressure sensors of the BMP280. These sensors are pre-calibrated, unlike other sensors. They therefore start measuring temperature, pressure and humidity immediately after power-up. No additional components are required for calibration or operation.

MEMS sensor:

The primary purpose of a MEMS sensor, often known as an accelerometer sensor, is to track how the body moves. The Fig 3.6 shows the MEMS sensor. When the accelerometer sensor is inserted into the mother's abdominal wall, the three axes X, Y, and Z display the tilt of the fetus. The fetus's kicking activity is measured using a MEMS sensor. MEMS technology does have some advantages of its own. MEMS sensors provide convenient features available with every other sensor line without any space constraints. In addition, MEMS makes use of very compact micro machine

components so tiny that each MEMS sensor can easily fit into the palm of your hand. Plus, MEMS sensors have an IP67 seal. This is because the sensors need to be able to withstand some intense temperatures ranging from 40° to +85°C. Most industries in which MEMS sensors are used operate in extreme temperatures. And, this seal enables the sensors to be submerged into shallow water for temporary periods, allowing them to monitor the offshore and subsea pitch and roll applications. Other electrolytic sensors might have higher accuracy but are often more sensitive to temperature.

Another advantage of these MEMS sensors is their shock and vibrations resistance. MEMS sensors may not be the most persevering in shock absorbing environments but MEMS inclinometers have a vibration resistance of 10grms @ 10-1000Hz and accelerometers bear a shock resistance of 100G.

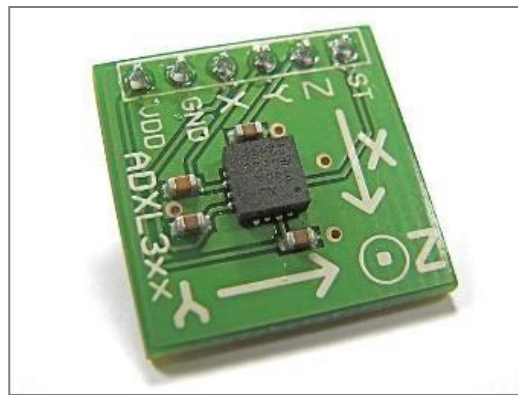


Fig: 3.6: MEMS sensor

Arduino UNO board:

The entire system can be managed by the microcontroller named Arduino UNO. The Arduino UNO board, which features an ATmega328 microprocessor, is inexpensive, open source, and simple to use. The Fig 3.7 shows the Arduino UNO. It features 6 analogue inputs, a USB connector, and 14/16 digital input/output pins, six of which are PWM outputs.

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board. The USB port in The Arduino board is used to connect the board to the computer using the

USB cable. The cable acts as a serial port and as the power supply to interface the board. Such dual functioning makes it unique to recommend and easy to use for beginners.

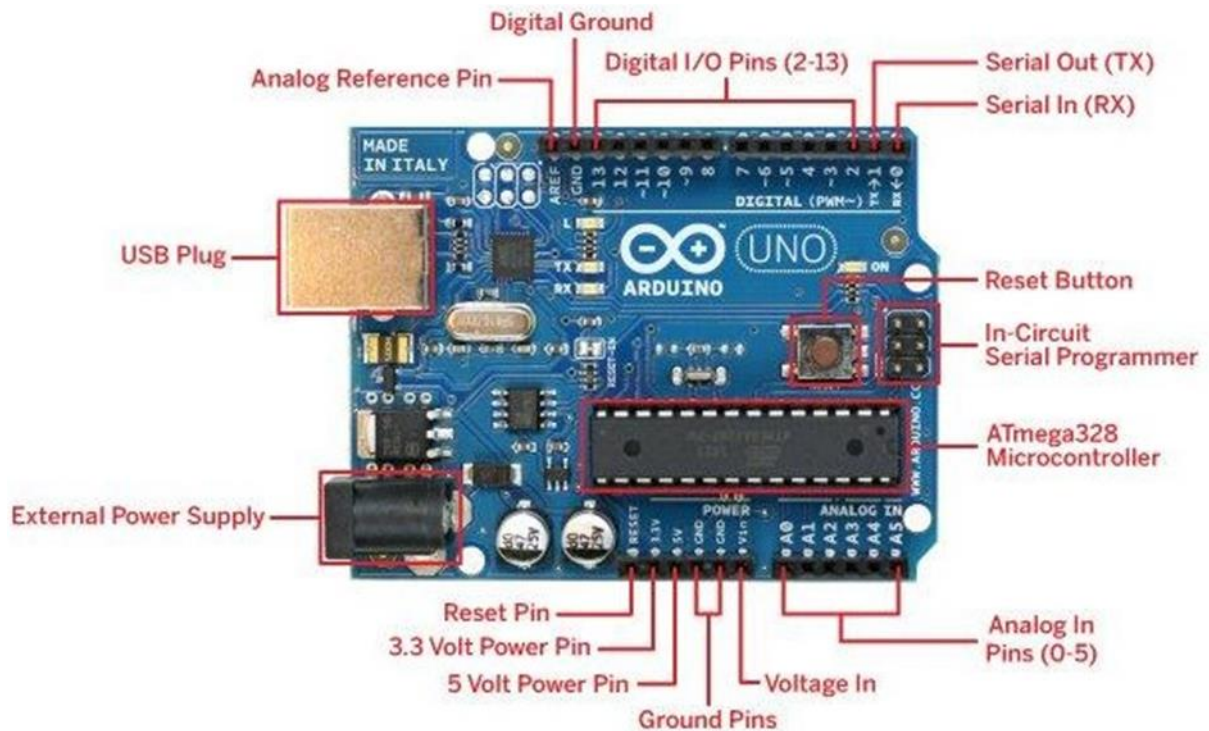


Fig: 3.7: Arduino UNO board.

The Arduino Uno board is the most popular board and mostly referred for the beginners as they are super easy to begin with, it does not require any specific Arduino uno software instead of that all you need is to select the Arduino uno in the device option before uploading your program. There are plenty of Arduino uno boards look different from the one as shown. But they all have plenty of the same components given below.

Voltage Regulator: The Arduino Uno can be powered by USB cable or directly supplying 9-12v from the barrel jack. The circuitry operates at 5v dc which in case input more than that is regulated with the help of 7805 voltage regulator. The 7805 voltage regulator ic is used regulate the voltage supplied to the Arduino board and manage it through processor and other elements.

Crystal Oscillator: There are certain case when the processor has to deal with time-signal issues, in order to balance it the crystal oscillator is used.

Reset Button: There is a reset button given which is used to restart the program running in the Arduino uno. There are two ways to restart the whole program.

- You can use the default reset button.
- You can connect your own reset button at the pin labeled as Reset.

Arduino Uno Board General Voltage Pins: There are following output voltage pins.

- 3v output pin
- 5v output pin
- GND (ground)

Most of the Arduino components operate at 5v or 3.3v and so can be powered with these pins. There are several ground ports which can be used to give ground to your circuit and components. There is a Vin pin which can be used to power the Arduino uno from an external source. The voltage must be 5v DC in case the Arduino board is powered using external source.

Analog I/O Pins: The Arduino uno board has 6 analog input and output pins from A0 to A5. The pins are best used in case of the analog sensors. The analog pins can read the analog signals from them like temperature, proximity, humidity etc and converts them into digital values that can be read and processed by the microcontroller.

Microcontroller In Arduino Uno Board: Different Arduino boards have different microcontrollers. It can be said that is the main component in the overall Arduino board. The main IC is a bit different in different Arduino uno boards. The microcontrollers used basically are of ATMEL Company and it is necessary for you to know what IC you are using in order to load your program in it. You can easily read the information on the top of the IC and select the corresponding from the option given in the Arduino software. For more information about the ic you can refer to the corresponding datasheet.

SPI Ports: The SPI (Serial Peripheral Interface) is considered for an expansion of the output. In most of the cases the ICSP Pin as a small programming header in Arduino Uno consist of RESET, SCK, MOSI, MISO, VCC and GND.

Power Indicator LED: When you power up the Arduino uno board, there must be an LED light up which will indicate the board is powered up correctly. In case you don't see the glowing light, there must be something wrong with the connection you've made.

TX And RX Pins: In the Arduino Uno board there are two LEDs labeled as TX (transmitter) and RX (Receiver), Same are labeled on the pin 0 and 1 respectively. These pins are used for serial communication and the corresponding LED glowing indicated if the data is being sent by TX and if the data is being received by RX. The TX LED flashes at the different frequency which depends on the baud rate being used by the Arduino board to transmit.

Digital I/O Pins: Arduino uno board does have 14 digital i/o pins (input/output pins) out of which contains 6 PWM output (Pulse width modulation). The digital pins can be configured to read logic values such as 0 and 1 or can give logic (0 and 1) output for different modules such as LEDs, Relays, etc. there is a symbol “~” corresponding to the PWM pins. Additionally, AREF which is used to set an external reference voltage as the upper limit to the analog input pins. The external reference voltage is usually in between 0 to 5 volts.

NodeMCU:

The ESP8266 Wi-Fi module is a self- contained Security Operation Centre that integrates TCP/IP protocol to provide direct micro controller access to the Wi-Fi network. It has low cost and is specifically made for use with mobile devices and other Internet of Thing applications. The Fig 3.8, shows the NodeMCU board. A wireless Wi-Fi network, internet intranet, extranet communication, and other networking features can all be connected to the physical device. NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

The NodeMCU ESP8266 development board comes with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

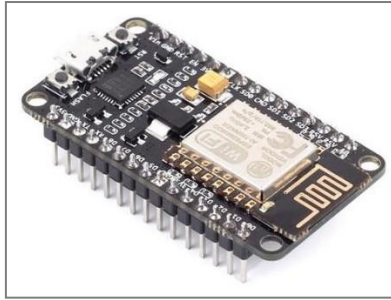


Fig: 3.8: Wi-Fi Module.

NodeMCU ESP8266 Specifications & Features.

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT project.

GSM module:

SIM900A is a dual-band GSM/GPRS device. It is compatible with 900 or 1800 MHz frequencies. The frequency bands can also be changed using AT commands. The AT command can be used to adjust the baud rate between 1200-115200. The SIM900A is shown in Fig 3.9. The GSM/GPRS Modem's built-in TCP/IP stack enables us to use GPRS to connect to the internet. The wireless SIM900A module is compact and dependable. With a high-performance single-chip processor built around the ARM926EJ-S core, we were able to create a complete GSM/GPS module in SMT format, taking the advantage of its small size and inexpensive price.

With a tiny configuration of 24mm x 24mm x 3mm, SIM900A can meet almost all the space requirements in your applications, such as M2M, smart phone, PDA and other mobile devices. The physical interface to the mobile application is a 68-pin SMT pad, which provides all hardware interfaces between the module and customer's board. The SIM900A is designed with power saving technique so that the current consumption is as low as 1.5mA in SLEEP mode.



Fig: 3.9: SIM900A GSM MODULE

LCD display:

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. The LCD display is shown in Fig 3.10. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other. A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to a controller is an LCD display. Some of the most common LCDs connected to the controllers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line, 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively. Many microcontroller devices use 'smart LCD' displays to output visual information. LCD displays designed around LCD NT-

C1611 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 5X7dots plus cursor of the display. They have a standard ASCII set of characters and mathematical symbols. For an 8-bit data bus, the display requires a +5V supply plus 10 I/O lines (RS RW D7 D6 D5 D4 D3 D2 D1 D0). For a 4-bit data bus it only requires the supply lines plus 6 extra lines (RS RW D7 D6 D5 D4). When the LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller.

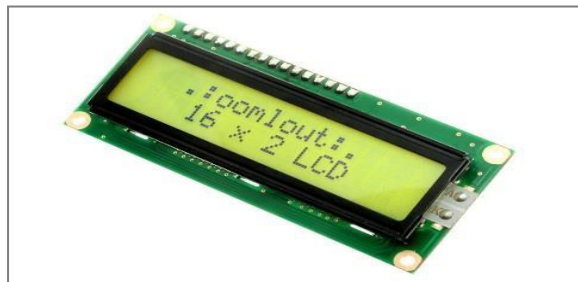


Fig: 3.10: LCD display

3.2.2 Software Requirements:

1. Arduino IDE
2. IOT cloud platform.

Arduino IDE:

The Arduino Integrated Development Environment or Arduino Software (IDE) contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension (.ino). The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. The development of electronics is now easier thanks to Arduino software (IDE), and Arduino boards (hardware). This set help to build digital and interactive devices with the help of other components.

The Arduino software (IDE) is an open-source software, which is used to program the Arduino boards, and is an integrated development environment,

developed by arduino.cc. Allow to write and upload code to Arduino boards. And it consists of many libraries and a set of examples of mini projects. Arduino software (IDE) is compatible with different operating systems (Windows, Linux, Mac OS X), and supports the programming languages (C/C++). The Arduino software is easy to use for beginners, or advanced users. It uses to get started with electronics programming and robotics, and build interactive prototypes. So, Arduino software is a tool to develop new things. and create new electronic projects, by Anyone (children, hobbyists, engineers, programmers, ... etc.).

IOT Cloud platform:

Here in this project, we are using WIFI-IOT logs web server or storing the data, it is a very safe and secured platform the person who has username and password can be able to see the data in the cloud.

It is a very secure and flexible platform, the data in the cloud will automatically be updated along with the patient's name, mobile number and his email.id and then data. We will be able to date and timing of at what time the data have been updated on platform, when we want to search for any particular pregnant women.

CHAPTER 4

DESCRIPTION OF PROPOSED MODEL

4.1 SELECTED METHODOLOGY OR PROCESS MODEL

In this proposed methodology, we are measuring pregnant women heart rate and oxygen level using heart rate pcb board, ECG signal using ECG sensor (AD8232), Blood pressure using bp sensor, Temperature using Temperature sensor and baby movement using accelerometer sensor.

The proposed model as shown in the Fig 4.1, the device which we will make consists of oximeter, bp sensor, pulse rate sensor, ECG sensor, temperaturesensor as an input from the patients. All these will convert into analog to digital signals and connected to the central processing unit (microcontroller) here we are using Arduino UNO. For cloud purpose, we are using NodeMCU board. The data from all the input sensors is collected and will send to the Arduino UNO board. From the Arduino Board, the processed data is sent to the cloud using NodeMCU for storage purpose. Pregnant women and doctor can monitor the data in our mobile through a message and cloud service. If any abnormal or any emergency occurs immediate alert will be sent to the doctor through GSM.

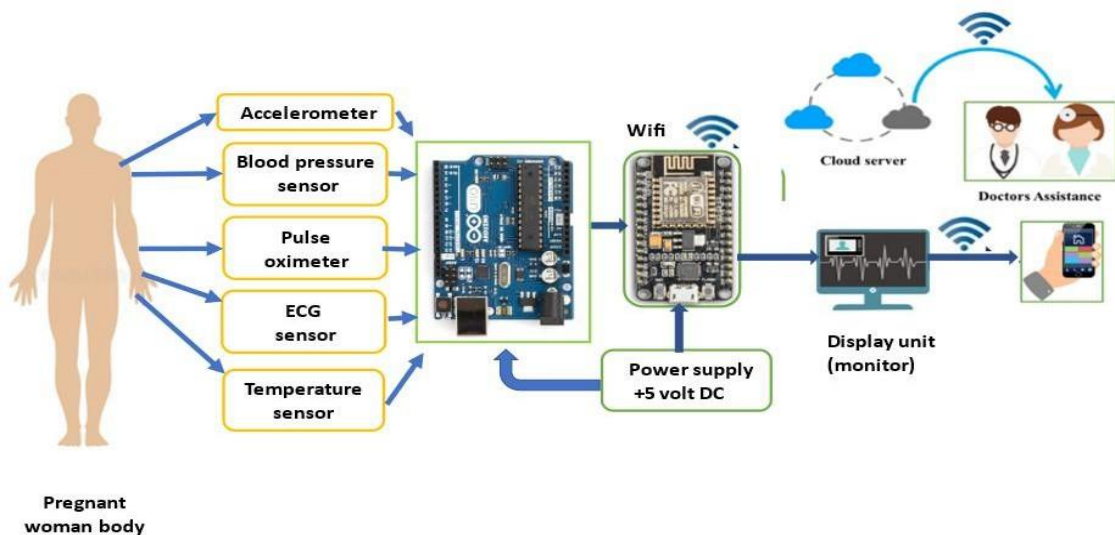


Fig: 4.1: Model of the project

4.2 ARCHITECTURE OR OVERALL DESIGN OF PROPOSED MODEL

The architecture of the proposed system is shown in Fig 4.2. The sensors Temperature, ECG, Pulse oximeter, Blood Pressure, and Accelerometer to the Arduino Board. These sensors collect the data from the pregnant woman and send the data to the microcontroller say Arduino board. The Arduino board processes the input data and displays it on the 16x2 LCD display. The processed data is also sent to the Wi-Fi module say NodeMCU board. With the help of this Wi-Fi module, the processed data is given to the IOT cloud platform. This IOT cloud platform shows the patient details including their mobile number, mail id, and name.

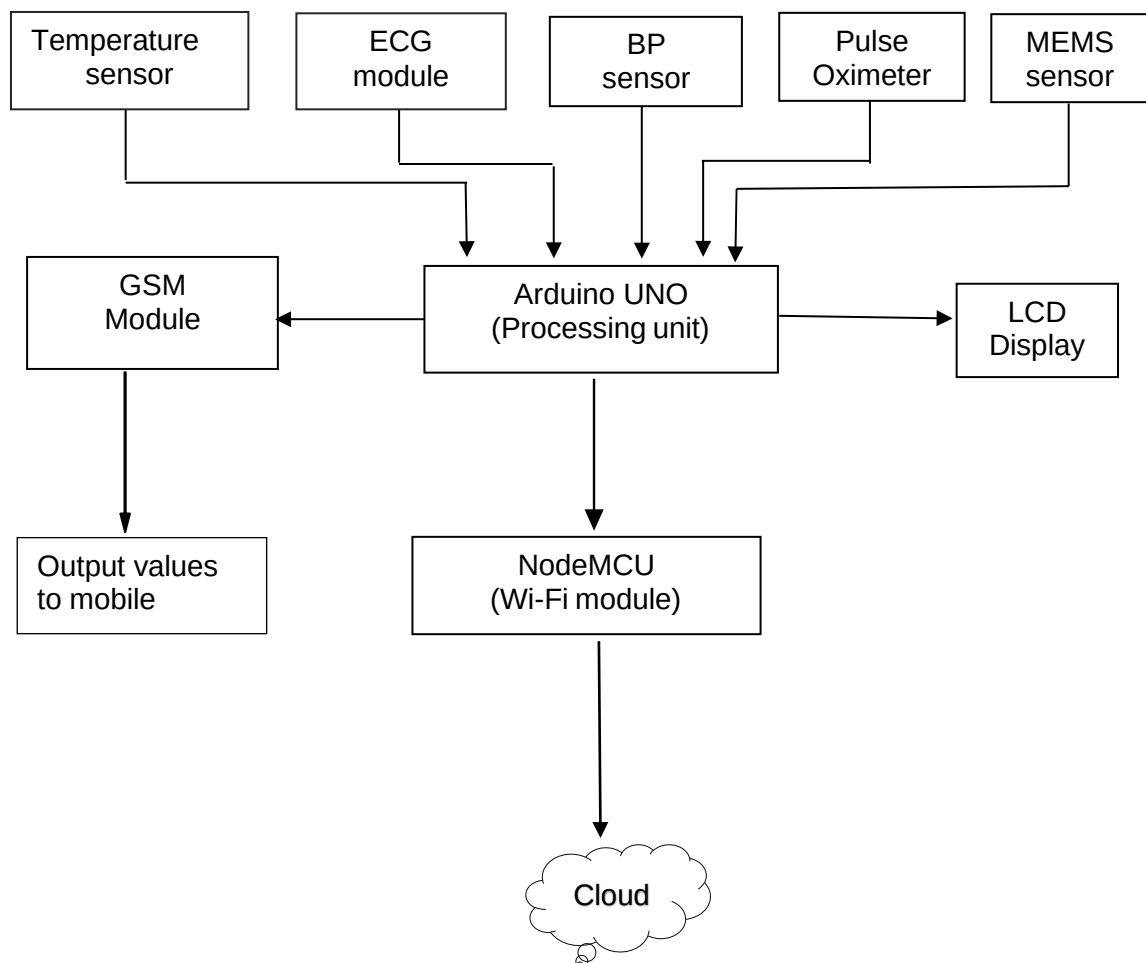


Fig: 4.2: System Architecture

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

Arduino IDE:

The Arduino Integrated Development Environment or Arduino Software (IDE) contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension (.ino). The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. The development of electronics is now easier thanks to Arduino software (IDE), and Arduino boards (hardware). This set helps to build digital and interactive devices with the help of other components.

The Arduino software (IDE) is an open-source software, which is used to program the Arduino boards, and is an integrated development environment, developed by arduino.cc. Allow to write and upload code to Arduino boards. And it consists of many libraries and a set of examples of mini projects. Arduino software (IDE) is compatible with different operating systems (Windows, Linux, Mac OS X), and supports the programming languages (C/C++) The Arduino software is easy to use for beginners, or advanced users. It uses to get started with electronics programming and robotics, and build interactive prototypes. So, Arduino software is a tool to develop new things. and create new electronic projects, by Anyone (children, hobbyists, engineers, programmers, ... etc.).

- Connect your Arduino board into your computer by using the USB type a to b cable.

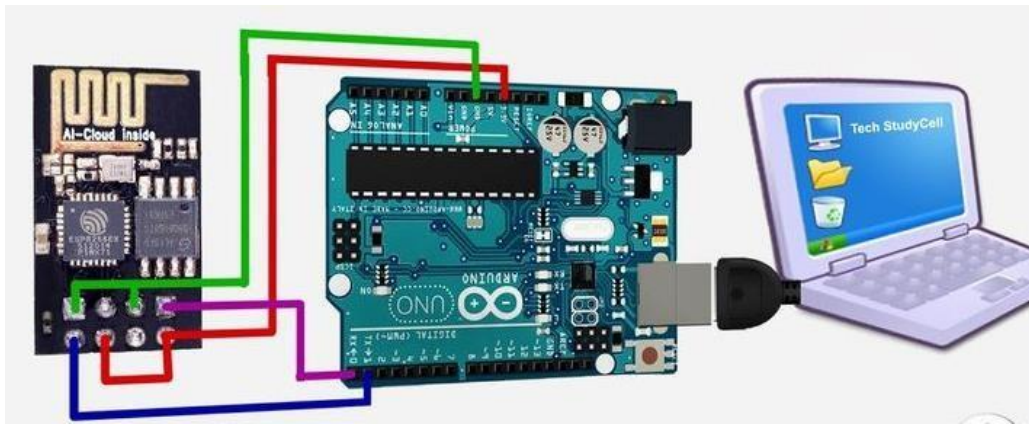


Fig: 4.3: Arduino UNO board connection with Arduino ide along with Wi-Fi module

- Open the Arduino IDE and go to Tools > Board > then select the Arduino Uno board

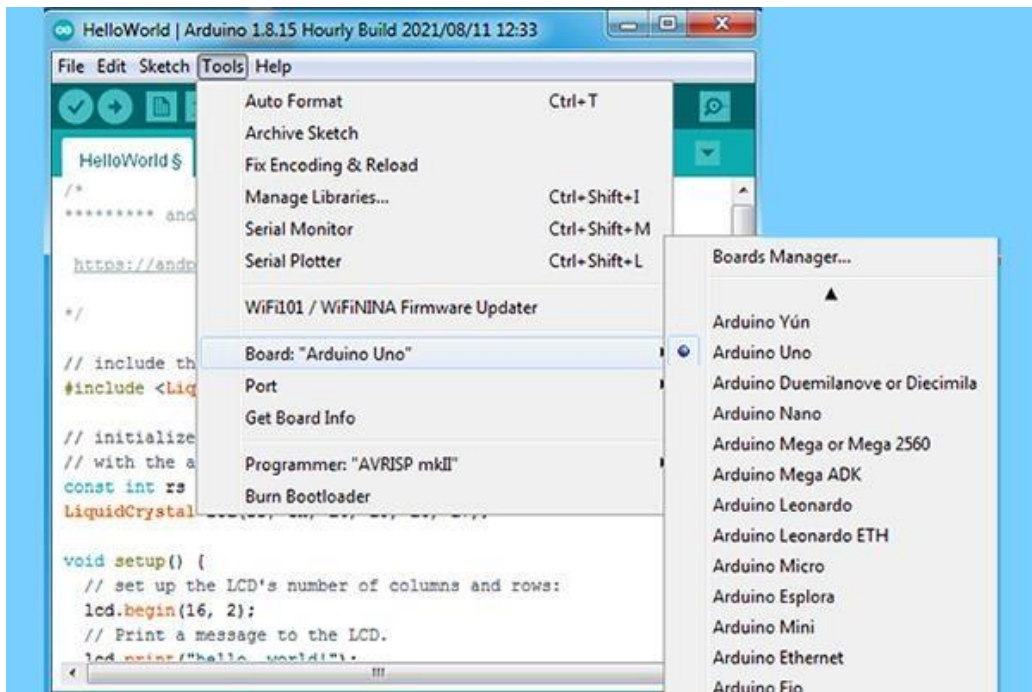


Fig: 4.4: Selecting the board on Arduino IDE

- Now Open the Arduino IDE and go to Tools > port > then select the port.

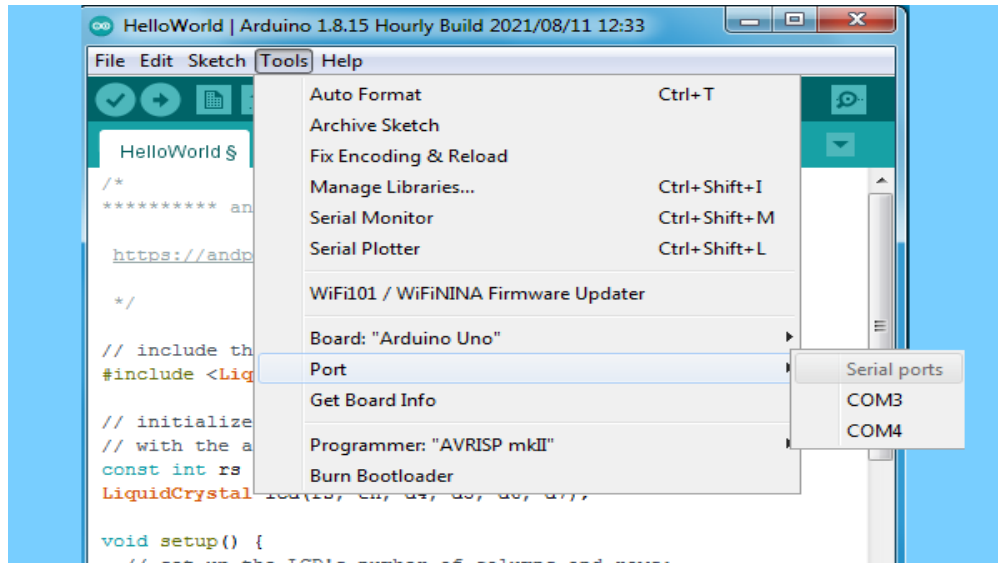


Fig: 4.5: Selecting the port on Arduino IDE

Now, write program on Arduino IDE

Testing:

- After the Arduino IDE finishes the programming, you can now test the project. Place the sensor in water this should activate the buzzer, LED should turn ON and gate should be opened automatically.
- Now remove the sensor from water LED and buzzer should get turned off and also the dam gate should be closed automatically.
- If nothing is working redo the above steps and make sure the steps are followed correctly

IOT cloud platform:

Here in this project, we are using WIFI-IOT logs web server or storing the data, it is a very safe and secured platform the person who has username and password can able to see the data in the cloud. The Fig 4.6, shows the login page of the cloud platform.

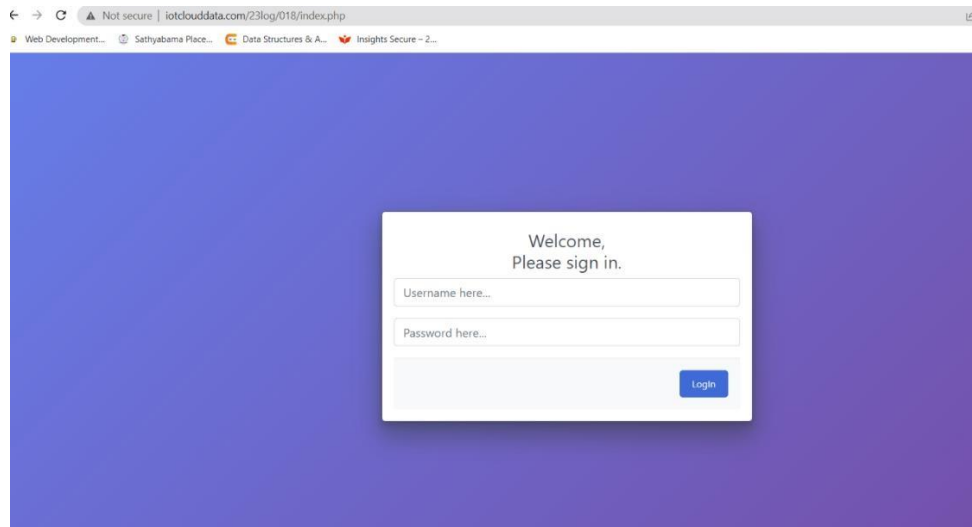


Fig: 4.6: Login page in cloud platform

Next after login to the page the data which we have measured from the sensor has been stored when the NodeMCU board connected to the internet. along with the data plus login time and date has showed along with name, email.id.

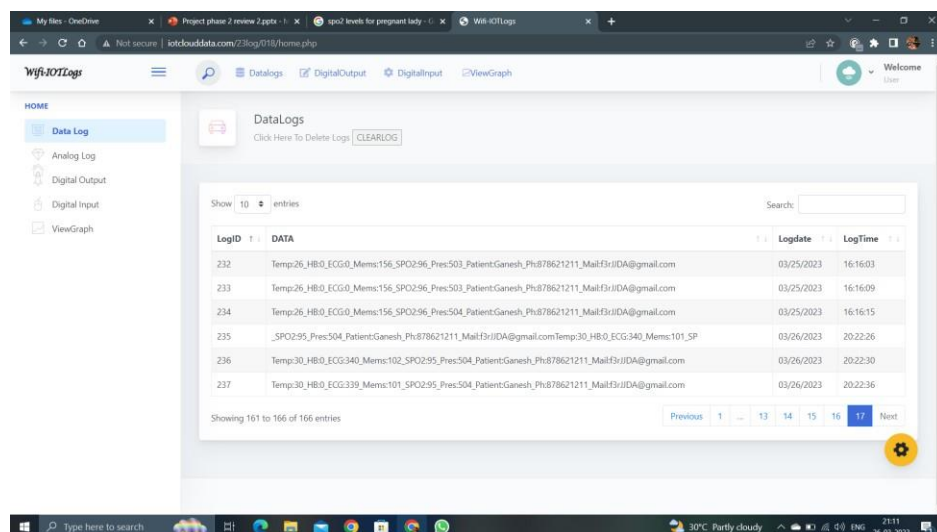


Fig: 4.7: IOT cloud platform

4.4 PROJECT MANAGEMENT PLAN

The first thing we looked at was the selection of microcontroller which is required for our project. We came through two or three options while looking for it. Based on our requirements and the price, we have selected Arduino UNO board for our project.

As we were going to measure different health parameters, we started

searching for the sensors which can give the required readings. We have chosen temperature sensor, ECG sensor, MEMS sensor, Pulse rate sensor and Blood Pressure sensor.

In our project, we decided to store all the collected data from the patient to be stored in a cloud. So, we chose a NodeMCU board. A GSM module was also required in order to send messages to a mobile number.

We tested every sensor individually and then interfaced them and then checked again. This is how we planned and completed the project.

4.5 FINANCIAL REPORT ON ESTIMATED COSTING

Component name	Price
Temperature sensor	100
ECG sensor	650
Blood Pressure sensor	500
Heart Beat Sensor PCB board	800
MEMS sensor	200
Arduino UNO board	600
NodeMCU	450
GSM module	1000
16x2 LCD Display	150
Adapter/ power supply	200
Jumper wires	200
Total	4850

CHAPTER 5

IMPLEMENTATION DETAILS

5.1 DEVELOPMENT AND DEPLOYMENT SETUP

This section describes step-by-step the system analysis. The system was designed and simulated in proteus and a working prototype was developed using the different hardware components with data being sent to the cloud platform.

Fig 5.1 shows the simulation setup for the system on proteus design suit. Given the fact that the specific selected OEM component libraries were not available for simulation on proteus. Alternatives were selected to show the flow working of the system.

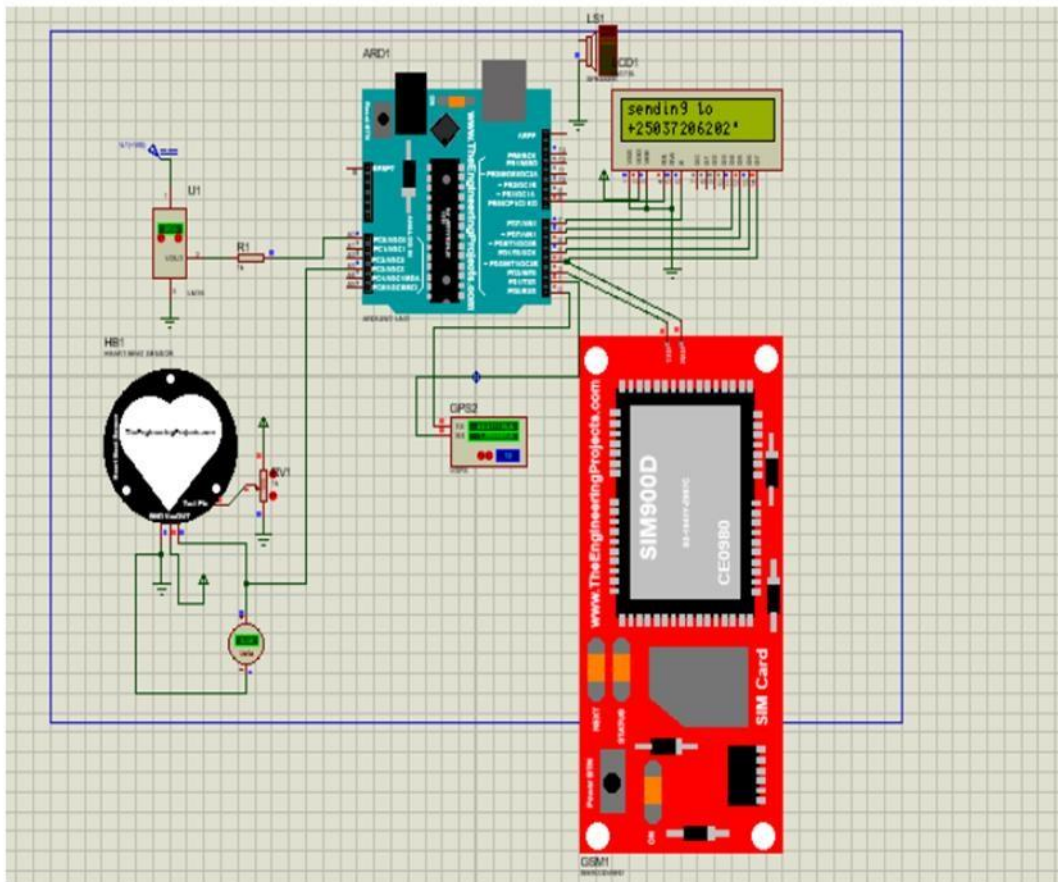


Fig: 5.1: Proteus simulation heart rate sensor and GSM module with Arduino

Basically, this system is segregated into 3 major parts. First input section consists of sensors for measuring different health parameters like ECG signal using AD8232 sensor and heart rate and oxygen level is measured using pulse oximeter (MAX30100) and blood pressure using bp sensor and temperature sensor using bp

sensor and temperature sensor using DS18B20 temperature sensor and movement of the baby is measured using MEMS sensor. All these inputs are sends to microcontroller (ARDUINO UNO) board whereall inputs are connected to the where who data is converted to digital and processingis done .and for providing cloud service to this system we are connecting WI-FI module named as ESP8266 into it. Third section is an output section here we have showed our output in 3 formats: -

1. LCD display
2. Message on mobile through GSM module
3. Cloud platform for doctor assistance

As shown in Fig. 5.2, once the input sensors are activated the Arduino uno will receive the data from the sensors and these Arduino uno microcontroller processesthe data from the input sensors and completes the execution process. After processing the data, the values of the output are displayed on LCD display board. The Arduino board connected with WIFI module (ESP8266) provide the internet services to the system. The cloud platform will receive the processed data if the system is provided with an internet connection. The analysis of the data takes place.If the data is not up to the limit, with the help of GSM module we will send an alert message to their mobile and if the values are within the limit, then safe message willbe sent.

Experimental Setup

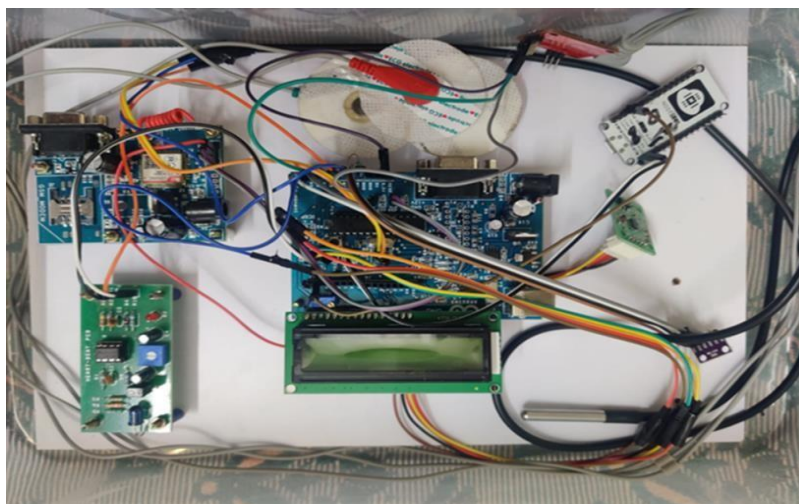


Fig: 5.2: Experimental setup with all connections

5.2 ALGORITHMS

As shown in Fig. 5.3, once the input sensors are activated the Arduino uno will receive the data from the sensors and these Arduino uno microcontroller processes the data from the input sensors and completes the execution process. After processing the data, the values of the output are displayed on LCD display board. The Arduino board connected with WIFI module (ESP8266) provide the internet services to the system. The cloud platform will receive the processed data if the system is provided with an internet connection. The analysis of the data takes place. If the data is not up to the limit, with the help of GSM module we will send an alert message to their mobile and if the values are within the limit, then safe message will be sent.

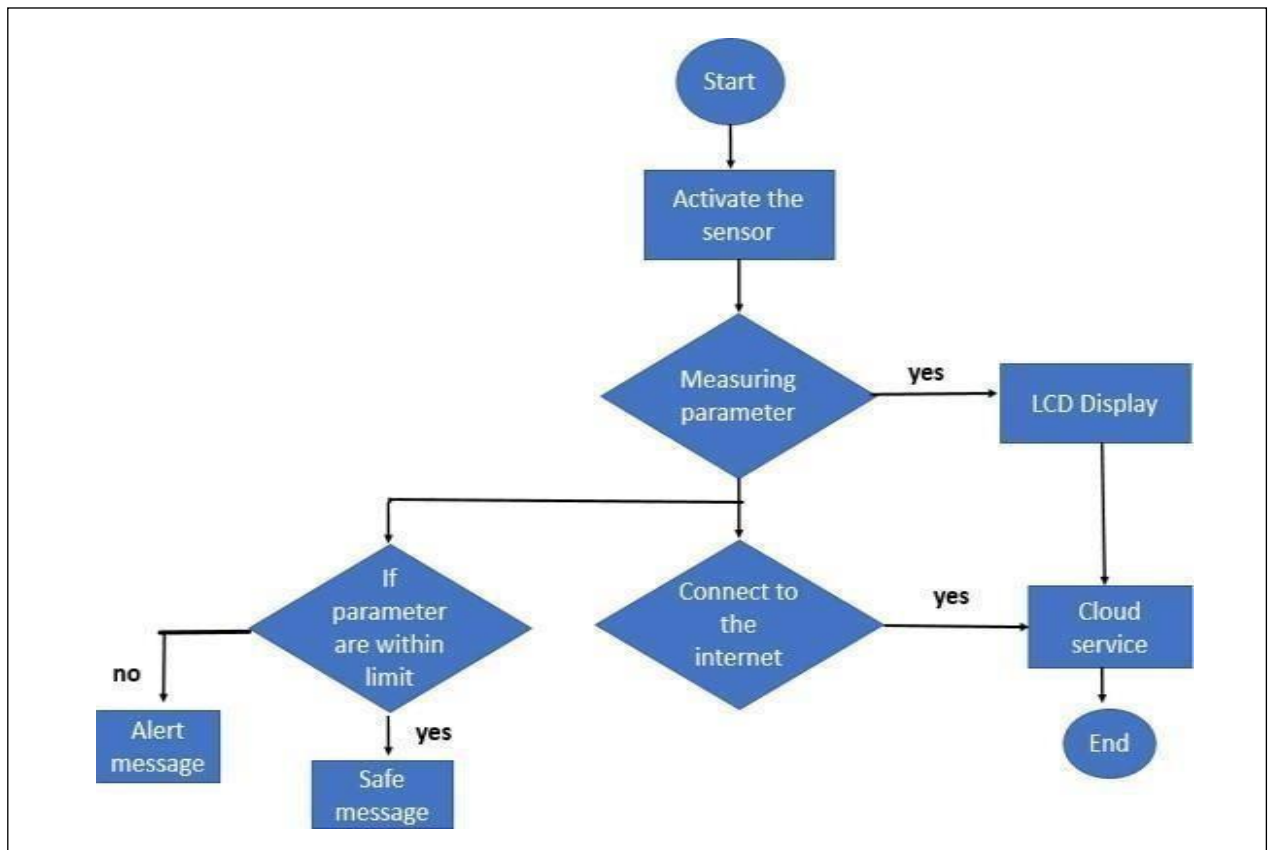


Fig: 5.3: Algorithm for Pregnant Women Health Monitoring System

CHAPTER 6

RESULTS AND DISCUSSION

Patient monitoring system consist of 3 modules namely

6.1 RESULT ON LCD

After making all the connections and uploading the code to the microcontroller we will able to visible the output on hardware directly using lcd display which is shown in Fig 6.1.

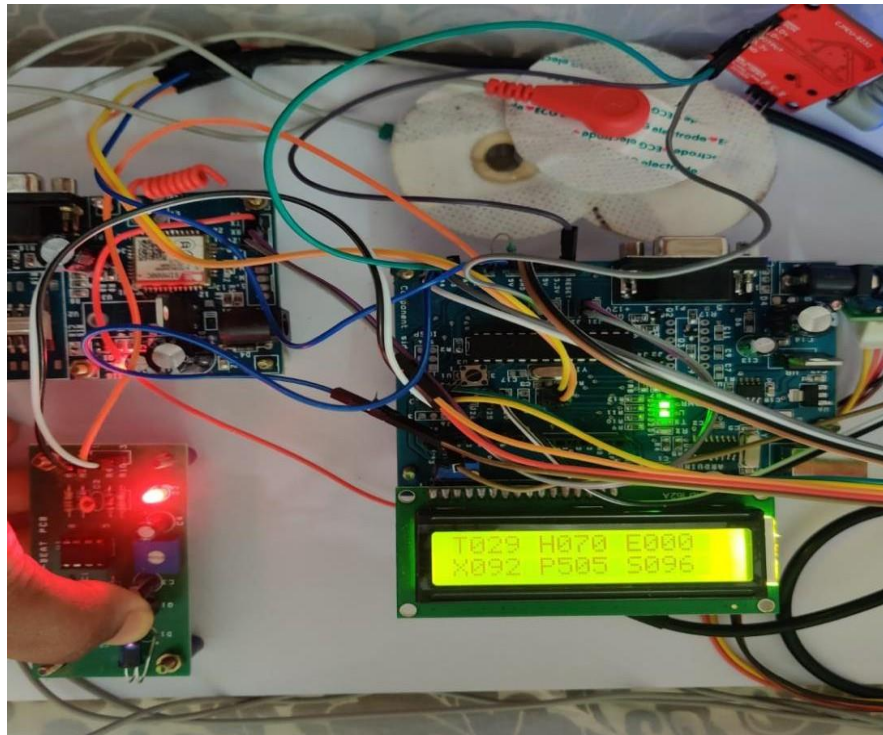


Fig: 6.1: output on hardware setup using LCD display

6.2 RESULT ON CLOUD PLATFORM

After these we uploaded this code to Arduino board the data will be updating the values of health parameters which we measure through the input sensors in the cloud webserver and these cloud,

Before displaying the result, we will have security system so that only persons who knows login credentials can be see the data.

6.2.1 Admin's section:

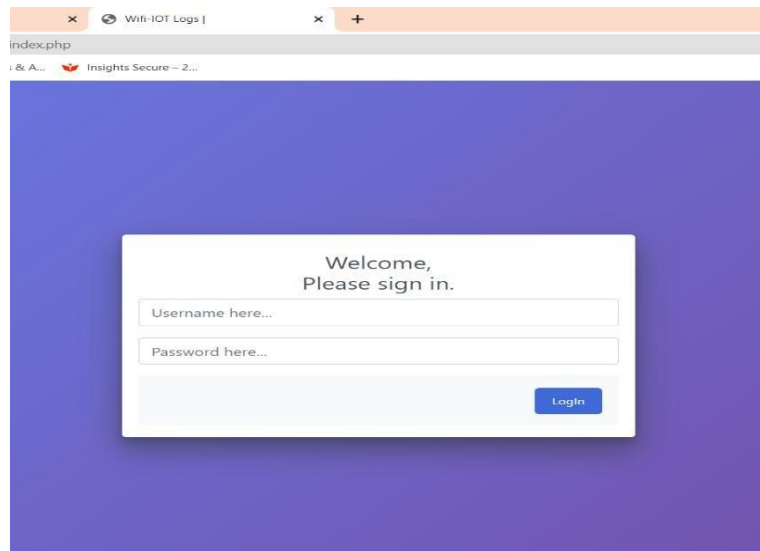


Fig: 6.2: Admin section page

6.2.2 The doctor's section:

In the **doctor's section**, he/she has the whole history of the patient as well as if any problem occurs, the doctor is always there for help and one can also stay connected with doctor via SMS and the doctor can also check the patient's health graph status as to how there is an increase in the health. After checking the patient's health graph if any improvement is needed the doctor prescribes the required medicines.

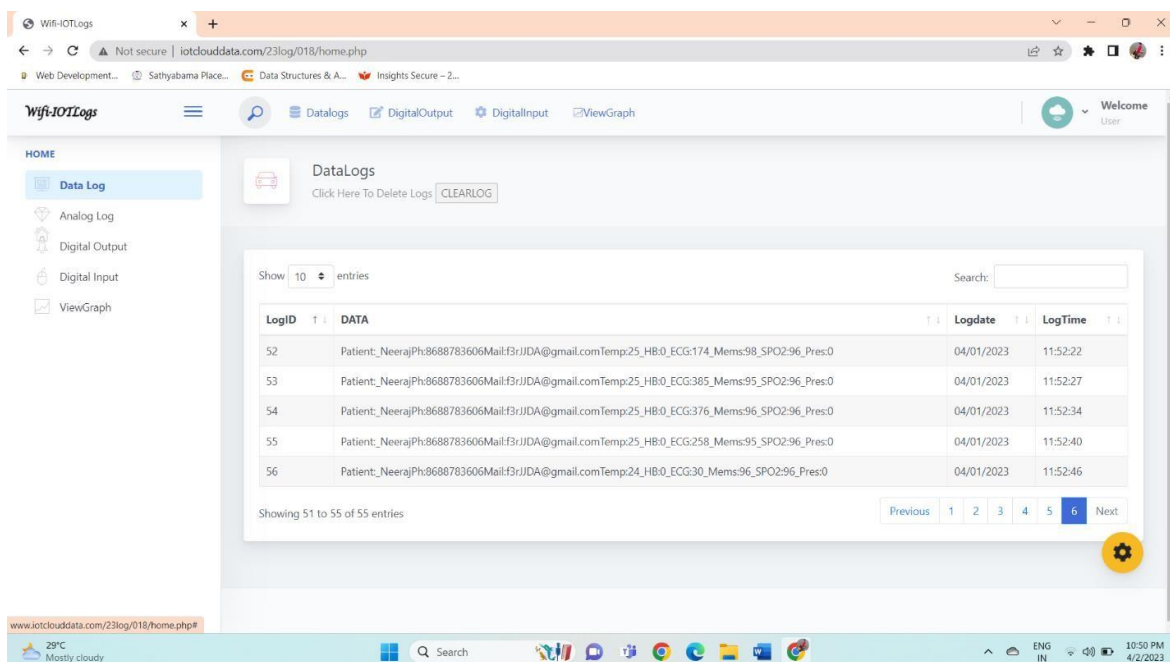


Fig: 6.3: Output data on cloud service

And when we want get the information about particular patient, we can search data of that particular patient only.

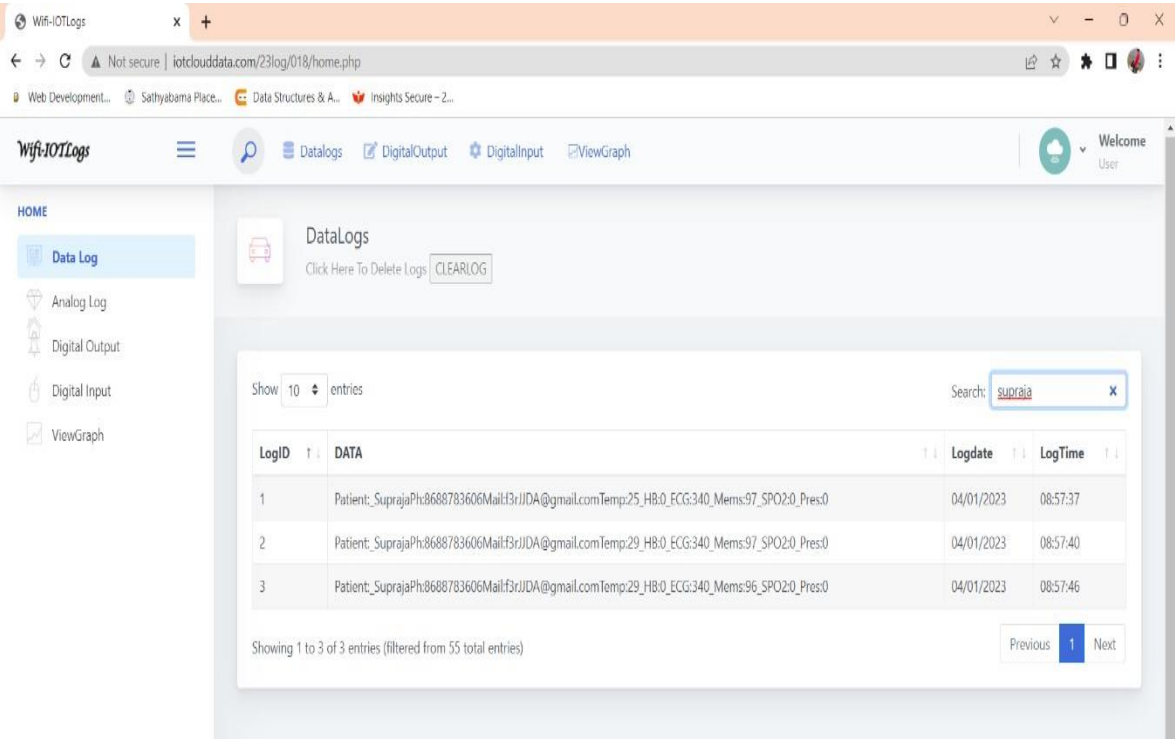


Fig: 6.4: Search results

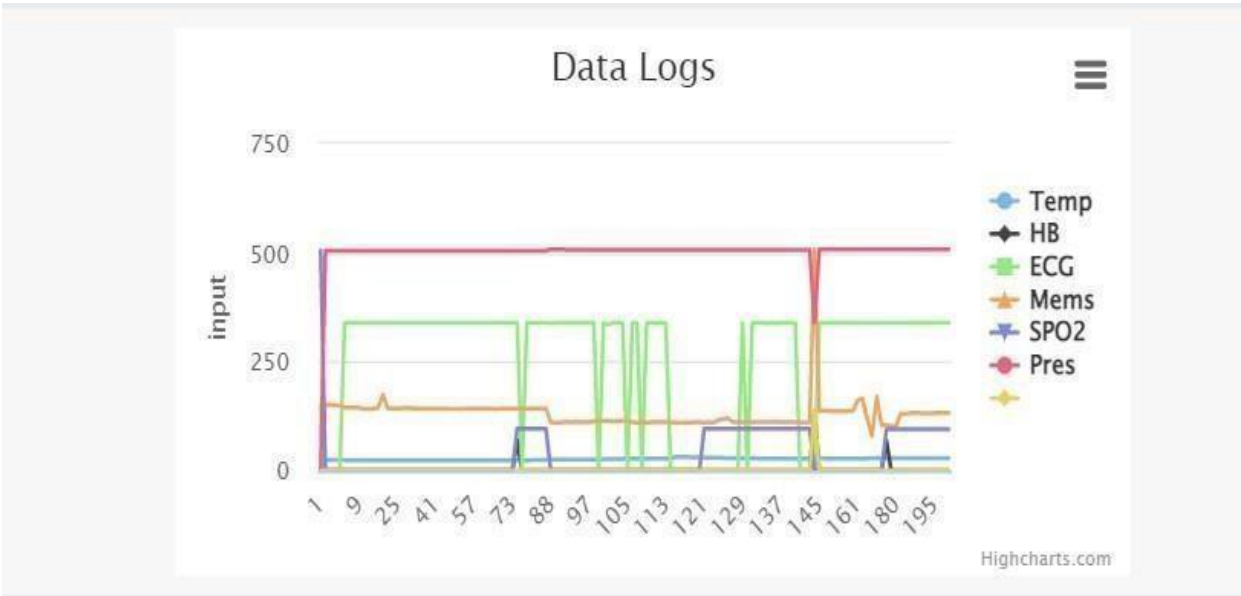


Fig: 6.5: Output in the form of graph

The data can also be showed in the format of graph for analyzing the parent women health progress.

6.3 RESULT ON MOBILE

If any abnormal thing occurs an alert message also sends to the registered phone number. In this section, if any problem he/she can convey a message to the doctor saying any health-related issues (if there is headache, stomach pain, fever, etc.) via SMS and then the doctor will revert with the appropriate medicines.

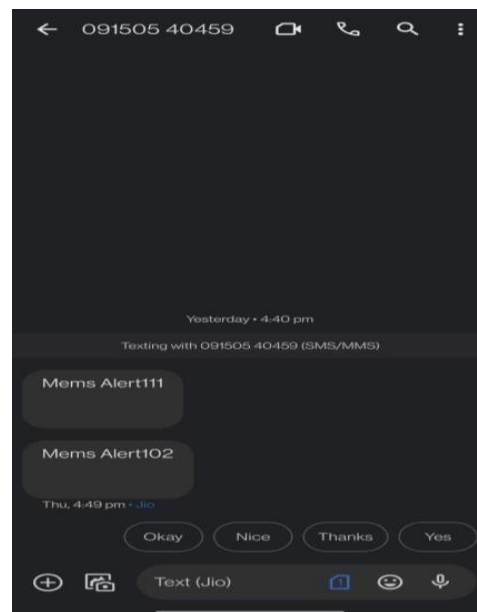


Fig: 6.6: Alert message on mobile

6.4 ADVANTAGES OF PROPOSED MODEL

1. In exiting model, we are checking temperature, pulse, pressure and ECG but inour proposed we are measuring the oxygen level along with them.
2. In exiting model, the monitoring system (cloud) only consists of storing and monitoring facility there is no emergency alert response in it. But in the proposed model we have hospital service, emergency response system and outsourcing system.
3. Proposed system is more reliable than existing because here the cloud connected with the android application and e-health service management system.

CHAPTER 7

SUMMARY AND CONCLUSION

7.1 CONCLUSION

From the study it is evident that it is important to monitor the health status of pregnant women. Different solutions have also been developed to make this a reality. However, existing solutions are not portable to the African setting and thus the need for customized solutions. The emerging technology of IoT is an area that can be exploited to make this a reality. The simulation and the prototype results show the effectiveness of such a system in monitoring pregnant women. If implemented this will lead to reduction of deaths and complication during pregnancies. In implementing the system there is a need for an architecture for integration with existing solutions. The study therefore recommends an IoT integration architecture. The architecture is made of five layers; the data collection layer, transportation layer, Data integration layer, application layer and a business layer. This will go a long way towards the integration of IoT into the existing pregnancy monitoring systems. Future works will involve the deployment of the system in different rural health facilities for further testing and validation. Additional health conditions will also be explored for a more effective solution. The proposed architecture will be used to ensure seamless integration. This proposed system, it is concluded that Wireless sensor technology is emerging as a significant element of healthcare services. In this proposed system a mobile physiological monitoring system is presented, which can continuously monitor the patient's heartbeat, blood pressure and other critical parameters in the hospital. The system is able to carry out a long-term monitoring on patient's condition and is equipped with an emergency rescue mechanism using SMS.

7.2 FUTURE WORK

Our project still has a lot of space for improvement and possibilities in the future like any other project

- The whole system can be implemented by using machine learning for advanced system management.
- In this project, we used Arduino UNO as a source for collecting data from the

sensors but this can be replaced by Raspberry Pi. The additional benefit that we will get from using Raspberry Pi is that it can take data simultaneously from a large number of people.

- We can improve the accuracy of the data by using more high-end sensors, i.e., a better version of the sensors compared to that we have used in this system for each measurement parameter.
- To solve the problem of internet connection in rural areas, we can use portable Wi-Fi modules and wireless routers, which will be able to provide Internet connectivity up to a certain range of regions. We will then use as many such Wi-Fi devices to extend the connectivity to an expanded range of areas. Besides this, use of Wi-Fi repeaters will be beneficial in case of poor network regions. The Wi-Fi repeater operates by connecting to the portable Wi-Fi network and rebroadcasting the signal to a larger area.
- The prototype can be converted into any type of wearable device that is easy to carry and can monitor the mother for a longer period of time.

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APPENDIX

A. SCREENSHOTS:

The screenshot displays the 'Wifi-IOTLogs' web application. The interface includes a sidebar with navigation options: HOME, Data Log, Analog Log, Digital Output, Digital Input, and ViewGraph. The main content area is titled 'DataLogs' and features a 'CLEARLOG' button. Below this, there is a table of log entries. The table has columns for LogID, DATA, Logdate, and LogTime. The data shows five entries with LogIDs 52 through 56, each containing patient information and sensor data (Temp, HB0, ECG, Mems, SPO2). The Logdate for all entries is 04/01/2023, and the LogTime ranges from 11:52:22 to 11:52:46. A pagination bar at the bottom indicates 'Showing 51 to 55 of 55 entries' and includes 'Previous' and 'Next' buttons.

LogID	DATA	Logdate	LogTime
52	Patient:_NeerajPh:8688783606Mail:f3rjJDA@gmail.comTemp:25_HB0_ECG:174_Mems:98_SPO2:96_Pres0	04/01/2023	11:52:22
53	Patient:_NeerajPh:8688783606Mail:f3rjJDA@gmail.comTemp:25_HB0_ECG:385_Mems:95_SPO2:96_Pres0	04/01/2023	11:52:27
54	Patient:_NeerajPh:8688783606Mail:f3rjJDA@gmail.comTemp:25_HB0_ECG:376_Mems:96_SPO2:96_Pres0	04/01/2023	11:52:34
55	Patient:_NeerajPh:8688783606Mail:f3rjJDA@gmail.comTemp:25_HB0_ECG:258_Mems:95_SPO2:96_Pres0	04/01/2023	11:52:40
56	Patient:_NeerajPh:8688783606Mail:f3rjJDA@gmail.comTemp:24_HB0_ECG:30_Mems:96_SPO2:96_Pres0	04/01/2023	11:52:46

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