

IOT BASED COAL MINE SAFETY AND HEALTH MONITORING SYSTEM

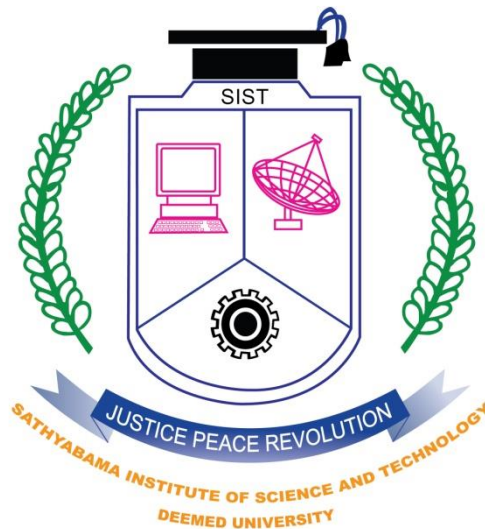
Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

by

V. PARKAVI (Register No. 39140035)

V. PAVITHRA (Register No. 39140038)



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

SATHYABAMA

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

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

APRIL 2023



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with "A" grade by NAAC
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai – 600 119
www.sathyabama.ac.in

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of V. PARKAVI (Reg. No. 39140035) and V. PAVITHRA (Reg. No. 39140038) who carried out the project entitled "IOT BASED SAFETY AND HEALTH MONITORING SYSTEM" under our supervision from November 2022 to April 2023.

[Signature]
20/4/23

Dr. V. MEENAKSHI
Internal Guide

[Signature]
20/4/23

Dr. V. SIVACHIDAMBARANATHAN
Head of the Department

Submitted for Viva voce Examination held on 26/4/23

Name: On S. Raghav

Signature: *[Signature]*

Internal Examiner

[Signature]
Dr. V. Balamurugan

[Signature]

External Examiner

DECLARATION

We V. PARKAVI (Reg. No. 39140035) and V. PAVITHRA (Reg. No. 39140038) hereby declare that the Project Report entitled "IOT BASED COAL MINE SAFETY AND HEALTH MONITORING SYSTEM" done by us under the guidance of Dr. V. MEENAKSHI is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering.

1. V. Pavithra

2. V. Parkavi

DATE: 26/04/23

PLACE: Chennai

SIGNATURE OF THE CANDIDATES

ACKNOWLEDGEMENT

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

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

We would like to express our sincere and deep sense of gratitude to our Project Guide **Dr. V. Meenakshi** for her 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 Electrical and Electronics Engineering who were helpful in many ways for the completion of the project.

ABSTRACT

This project deals there are many sectors that depend on coal, and it is often referred to as the "Black Diamond" by many. In order to meet India's ever-increasing electricity needs, coal mining has become a national priority. However, this work is hazardous and could be fatal for those who perform it. The environment poses several challenges to coal miners, including high temperatures that cause excessive sweating and can have negative health effects as well as the emission of hazardous gases, to name a few. These elements make the workplace a dangerous place for employees to be, endangering their very lives. In this project, a data transmission platform called Think speak IoT is used as a medium to transmit the data. The IoT technology is used to monitor the different parameters of coal mine workers, such as heart rate, sweat rate, and spo2 level. IR Sensor, EDA Sensor, Gas Sensor all these sensors are all deemed one unit and are installed in coal mines. All sensor values are constantly transmitted to the think speak IoT platform for analysis. The developed system is primarily used to rescue employees' health conditions and to guarantee workers' safety. So that appropriate actions can be taken whenever a potentially dangerous situation appears.

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO
	ABSTRACT	v
	LIST OF FIGURES	ix
	LIST OF TABLES	Xi
	LIST OF SYMBOLS AND ABBREVIATIONS	Xii
1	INTRODUCTION	
	1.1 INTRODUCTION	1
	1.2 MOTIVATION FOR THE PROBLEM	4
2	LITERATURE SURVEY	
	2.1 MAJOR FINDINGS FROM LITERATURE SURVEY	5
	2.2 PROBLEM IDENTIFICATION	15
	2.3 SCOPE OF THE PROJECT	15
	2.4 OBJECTIVE	16
	2.5 METHODOLOGY	16
	2.6 APPLICATIONS	16
3	PROJECT DESCRIPTION	
	3.1 EXISTING BLOCK DIAGRAM AND EXPLANATION	17
	3.2 DISADVANTAGE OF EXISTING SYSTEM	18
	3.3 PROPOSED BLOCK DIAGRAM AND EXPLANATION	18

	3.4	ADVANTAGES OF PROPOSED SYSTEM	20
	3.5	FLOW CHART	20
4		SYSTEM DESIGN	
	4.1	SYSTEM HARDWARE DESIGN	21
	4.1.1	Node MCU	21
	4.1.2	Gas Sensor	22
	4.1.3	Carbon Monoxide	23
	4.1.4	IR Sensor	24
	4.1.5	EDA Sensor	24
	4.1.6	L293d Motor Driver	25
	4.2	IEEE STANDARDS	26
	4.3	CONSTRAINS	27
	4.4	TRADE-OFF	28
5		SIMULATION AND RESULT	
	5.1	CODE	29
	5.2	HARDWARE AND RESULT	31
6		CONCLUSION	
	6.1	FUTURE SCOPE	33
		REFERENCE	34

LIST OF FIGURES

FIGURE No.	TITLE	PAGE No.
1.1	Wireless sensor network	3
2.1	Existing Block Diagram	17
2.2	Proposed Block Diagram	19
2.3	NODEMCU	22
3.1	Gas sensor	23
3.2	IR sensor	24
3.3	EDA sensor	25
3.4	L293D motor driver	26
3.5	Program output	30
4.1	Simulation	30
5.1	Hardware	31
5.2	Result	31

LIST OF SYMBOLS AND ABBREVIATIONS

Node MCU	Node Microcontroller Unit
IOT	Internet Of Things
WSN	Wireless Sensor Network
LCD	Liquid Crystal Display
Wi-Fi	Wireless Fidelity
IR	Infrared Sensor
EDA	Electro Dermal Activity Sensor
HBR	Heart Beat Rate
ADC	Analog to Digital Converter
SPO2	Saturation of Peripheral Oxygen
L293D	Output Clamp Diodes for Inductive Transient Suppression

CHAPTER 1

INTRODUCTION

1.1 GENERAL

The use of human labor in underground mining is an extremely dangerous scenario, with the risks increasing as the distance from the ground rises. The various methods used by miners to extract different minerals create unsafe mining operations. The hazard becomes more visible as the mine lengthens. Safety measures are poorly implemented, especially in the coal mine industries. Because of its numerous commercial uses, coal is a valuable resource for all countries. Coal is widely used in the production of thermal power, cement, and steel, as well as as a fuel in numerous uses. Coal mines have a variety of hazardous conditions, including high temperatures and humidity, as well as the release of harmful gases, all of which create an unsafe atmosphere for specialists operating there. Many coal mine workers are leaving or are no longer interested in working in such sectors. This makes it difficult for workers in the coal mining industry to obtain work. Underground coal mine explosions continue to occur despite advances in technology that allow mining monitoring methods to become more sophisticated. The harsh environments and unsafe working conditions are the primary causes of accidents and disasters in coal mines. This increases the importance of using mine checking systems in coal mines. In the proposed model, less power is consumed and efficient sensors are used to detect a worker's pulse, sweat level, and hazardous gases released into the environment. Observation systems constructed of wires have aided mine safety for many years. Wireless networks are greatly preferred in the present scenario due to the complexity and feasibility of wired networks. The main goal of this proposal is to monitor mineworker health parameters. Zig bee technology, which establishes wireless communication and updates the data from the sensor to the webpage, is used by the IoT to send the data from the mine worker section to the webpage.

Safety measures in port operations are primarily concerned with the protection of working machinery, with sensors and switches used to ensure worker safety. Port worker observation and control are not possible with current technologies due to their high mobility

and risk. Coal has always been India's main source of energy, contributing considerably to the country's rapid industrial growth. It accounts for roughly 70% of total electricity production. As a result, coal's significance in the energy industry is unquestionable. However, the manufacturing process generates other byproducts, which pose a possible danger to the ecosystem and the people involved. Instead, the current effort is a genuine attempt at analysing the gravity and developing a real-time detection tracking system based on ZigBee technology.

Wireless sensor networks (WSNs) are gaining a lot of interest around the globe right now. A WSN is a type of ad hoc, multi-hop, self-organizing network that comprises of a large number of nodes distributed over a large region to monitor the phenomena of interest. It has potential uses in medicine, the environment, science, and the defence. Wireless sensor networks are made up primarily of sensor nodes or motes that detect a phenomenon and base nodes that manage the network and gather data from distant nodes. Many variables impact sensor network design, including scalability, operation system, failure tolerance, sensor network topology, hardware limitations, transmission media, and power usage. Many variables impact sensor network design, including scalability, operation system, failure tolerance, sensor network topology, hardware limitations, transmission media, and power usage. Wired network monitoring systems have assisted the mine safety significantly, but it is not idea for all types of mining environment. Area monitoring is a common application of WSNs. In area monitoring, the WSN is deployed over a region where some phenomenon is to be monitored. A military example is the use of sensors to detect enemy intrusion; a civilian example is the geo-fencing of gas or oil pipelines. There are several types of sensor networks for medical applications: implanted, wearable, and environment-embedded. Implantable medical devices are those that are inserted inside the human body. Wearable devices are used on the body surface of a human or just at close proximity of the user. Environment-embedded systems employ sensors contained in the environment. There are many applications in monitoring environmental parameters,[12] examples of which are given below. They share the extra challenges of harsh environments and reduced power supply.

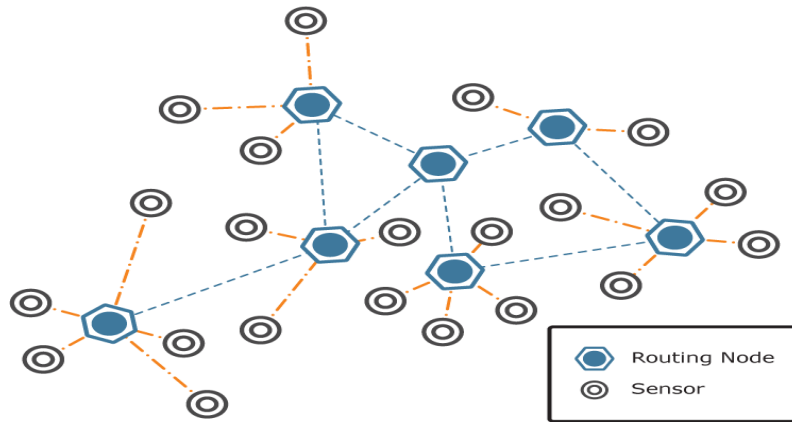


Fig 1.1 Wireless Sensor Network

These small-sized sensors are less costly than conventional sensors and demand fewer computing and processor resources. These sensor nodes can sense, measure, and gather information from their surroundings, and then relay that information to the control centre based on some local statistical decision process. It offers three significant benefits over wired monitoring network solutions. They are as follows:

1. There are no wires to place and simple installation in blind regions, lowering the expense of the surveillance system. To remove blind spots, the number of connections can be raised. It also provides basic dialogue and objective allocation
2. The dense nodes guarantee high-accuracy data capture and optimal data transfer, as well as the subsequent implementation of a real-time surveillance system for the underground environment.
3. Because sensor nodes have limited processing power and storage space, they are well suited for distant surveillance systems.

Because of the benefits listed above, wireless sensor networks are perfect for monitoring the secure output of coal mines

1.2 MOTIVATION FOR THE SELECTION OF PROBLEM

In underground mine, ventilation systems are critical to supply adequate oxygen, keeping up non-dangerous and non-lethal environments and an effective working mine. And also people get over sweating. It may results unknown disease. To monitor the health condition of mine and primitive procedures of monitoring a mine's air can be followed back to the utilization of can aries and different creatures to ready diggers when the climate gets to be lethal. Incorporating health monitoring systems empowers a mine to insightfully roll out improvements in view of the far reaching information given by the monitoring systems. Sudden changes in the system are identified by the monitoring system, permitting quick move to be made. New and creating correspondence and following systems can be used to monitor mines more proficiently and transfer the information to the surface. The occurrence of disasters in coal mines is mainly due to the harsh environment and variability of working conditions. So, it makes the implementation of mine monitoring systems essential for the safety purpose. Wired network systems used to be a trend for traditional coal mines, which have really played a significant role in safely production in coal mines. So, it is essential to have a wireless sensor network mine monitoring system, which can be disposed in such mines in order to have a safe production within.

CHAPTER 2

LITERATURE SURVEY

2.1 MAJOR FINDINGS FROM LITERATURE SURVEY

These are Literature survey on various systems using various technologies for environmental protection.

Priyanka et al., (2021) suggested a LoRaWAN-based system for monitoring manhole covers in smart city settings. For radio communication, they used the LoRa physical layer, and for cloud access, they used the LoRaWAN protocol. LoRa is a Low Power Wide Area Network (LPWAN)-based Internet of Things protocol (IoT). It has numerous uses in the smart city environment and is rapidly being implemented. Pycom's LoPy4 Pysense nodes, inertial sensors, nano-gateway, TTN network, and application server were used. The accelerometer devices detect cover damage and theft by performing angle algorithms on a regular basis. When the manhole cover moves, the accelerometer sensor delivers a signal to the LoRa router, which wirelessly relays RF signals over long distances in the unlicensed frequency range. This signal is picked up by a neighbouring LoRa nano-gateway that is linked to the TTN server. The data is transferred to the cloud and saved, and it alerts the maintenance staff for fix reasons. However, using LoRaWAN does not ensure network operators' confidence. This project's future work could include developing a Blockchain-based solution for LoRaWAN network nodes that takes advantage of the benefits of both technologies. Blockchain technology offers an open, decentralised, trustworthy, and tamper-proof system that includes an irrefutable method for verifying that transaction data exists.

Dania et al., (2021) suggested a LoRa network design tracking system based on a smart gateway and the simple LoRa Protocol. In this paper, they create a Smart Gateway using a network architecture for the SLP protocol, which involves writing programming code and building information systems to handle data from the client and assess the QoS parameters in the communication system (packet loss and throughput). For scripting, they use the Arduino IED in the Windows 8 running system. The gateway can insert data into the

database. The gateway can receive data from the database and display it on the web server. They used fake sensors as the end devices, which were linked to an Arduino UNO with a LoRa shield to send the false sensor data. The Smart Gateway, which uses a Raspberry Pi 3b+ as a gateway and computer, receives the data transferred. This paper shows the real-time smart gateway network architecture, and it can be stated that the system designed can service one to five clients. The system can instantly register and seek info. The technology is inaccessible from outside the neighbourhood gateway. According to QoS testing, the average speed is 489 bit/s, and the average packet loss is 0.01%.

Agus Ramelan et al., (2021) suggested a real-time preliminary prototype of a LoRa-based wireless sensing network for tracking forest fires. Forest fires that occur anywhere pose extremely hazardous risks, including the formation of fog, air pollution that causes respiratory illnesses, and the loss of surviving animal populations, which causes economic losses in the area. However, as technology improves, forest fires can be predicted and avoided by watching them afar. This article describes a real-time forest fire tracking system that uses Long Range (LoRa) technology to watch conditions in a specific forest. This device made use of an Arduino that was outfitted with a LoRa adapter and a temperature sensor. Humidity and air quality sensors are included. This article describes a strategy for using radio signals in IoT (Internet of Things) applications. This instrument can be improved by including a generator and a solar panel (PV) on top to replenish the supply to the battery, allowing the sensor nodes to switch on and off as needed. The LoRa gateway is used in the Gateway section to link LoRa data to the server via a Wi-Fi network. HTTP can use the protocol for transmitting data to the server to ease the sending process.

Simitha et al., (2019) suggested an IoT and WSN-based Air Quality Tracking and Energy Saving System for a Smart City Initiative. Nowadays, air pollution is caused by urbanisation, the use of fertilisers and pesticides, metropolitan growth, and other factors. India also has seven of the world's ten most dirty towns. A dependable air quality monitoring system, followed by the necessary actions, helps to minimise these negative impacts to a large degree. The suggested system, which is built on IoT and WSN, applies an effective street light energy saving system while also providing real-time air quality data. This document discusses real-time water quality tracking, air quality monitoring, and an energy-

saving street light system. Phase 1 involves real-time water quality tracking, while Phase 2 includes air quality monitoring. The technology employs LoRa to establish a local network for data sharing between sensors and the gateway. It also includes sensor integration with the microcontroller, a wireless LoRa module for sending and getting sensor values, and the Thing Speak IoT application for scrutinising and visualising uploaded air quality sensor values.

Joshitha et al., (2021) proposed LoRaWAN based Cattle Monitoring Smart System. Cattle monitoring system is proposed in this paper. Usually cattle move around the wide spread farms and hence differentiating each cattle may be difficult due to their indistinguishable appearance. Identification of individual cattle is mandatory for various reasons like to manage breeding process, to monitor draining status, to restrict dispersion of ailments. This paper presents the real time application of a novel cattle Monitoring using LoRa WAN. Cattle monitoring is one of the major applications of LoRa device as it supports not only to identify the strayed animal, but also monitors animal's vital condition. Here they used LoRaWAN is the principal element in this system which supports to communicate the information in a long-range area. For location identification they used GPS module. In order to have better protection to the cattle, environmental condition is monitored temperature and humidity sensors are used which is an optional element. The entire transmitter system is powered using 9V . In order to find the latitude and longitude coordinates for cattle tracking purpose, GPS module is adopted in the proposed system. Wherever the cattle move, the GPS module will capture the corresponding coordinates and this data will be communicated with receiver end with the support of LoRaWAN gateway system. The body temperature and environmental condition of cattle can be monitored using DHT 11 sensor battery as it supports to be mobile. On the other hand in the receiver side, the collected data will be shared to IoT dashboard using Raspberry Pi module. Hence the farm owner can monitor the cattle even from remote place.

Simitha et al., (2019) proposed IoT and WSN Based Water Quality Monitoring System. Nowadays water is getting polluted due to industrialization, use of fertilizers and pesticides, urban development etc,. A SmartCity is an area populated with electronic sensors which provides data that helps to control assets and resources effectively. It is the

result of faster development of the new age information technology. This paper presents a reliable water quality monitoring system. In the proposed system they implemented IoT and WSN gives real-time data of water quality so that the authority can manage and conserve the valuable water resources more effectively. With IoT & WSN, smart monitoring and management is attainable. It helps create more efficient city services and to keep citizens informed. The system includes integrating sensors to the microcontroller, wireless LoRa module for transmitting and receiving sensor values, and Thingspeak IoT platform for examining and visualizing water quality sensor values which have been uploaded. In the proposed system they have splitted into two phases. In Phase 1 and 2, water sensing node integrates sensors in realtime water quality monitoring and it includes temperature sensor, pH sensor, turbidity sensor, and dissolved oxygen content monitoring. These sensor values from node 1 are transmitted to the gateway via LoRa module RA-02 which is an LPWAN wireless communication technology. The gateway here is ESP32 Wi-Fi module. The gateway then transmits the sensor data packets to the ThingSpeak cloud server over internet protocol and we can monitor the sensor values in ThingSpeak API, in internet enabled devices. Future scope the system can be extended to IoT and WSN based SmartCity project which includes air quality monitoring and street light energy saving system.

Nilanjana et al., (2021) presented a LoRa-based Wireless Sensor Network-based IoT-based Health and Agricultural Tracking System. This project's foundation is built on IOT approach. Continuous and long-term health tracking systems are now required in healthcare settings to guarantee increased efficiency and dependability of medical diagnostics, particularly in remote and mountainous regions where routine health check-ups and medical facilities are insufficient. Smart agriculture and health care systems must be designed in order to maximise agricultural processes and automate medical centres, respectively. This paper describes the real-time implementation of health and farm monitoring system architecture. Two Final Nodes are suggested here. One for receiving data from the soil such as soil temperature, moisture, atmospheric temperature, and humidity. The Gateway acts as a gateway between the Nodes and the Network Server, connecting to it via high speed networks such as Wi-Fi, Ethernet, or cellular. The Network Server collects info from End Nodes via the Gateway. It verifies their security, decrypts their contents, and saves them in

a database for further examination. The gathered data is evaluated and visually visualised before being provided to the customer via a real-time dashboard. A person can learn about the state of his products as well as his own health by using saved data. Every person's info in cloud storage will be verified by an auto-generated id. A doctor and an agricultural specialist can diagnose the individual based on this information.

Farid et al., (2021) presented a Live Greenhouse Climate Monitoring Based on LoRaWAN Protocol Using Grafana. IoT in agriculture is quickly expanding, due to rising market demand for high-quality food ingredients. To obtain high-quality food components, vegetation must be well-cared for; this is where IoT comes into play. This article will show a real-time IoT-based greenhouse surveillance system that will be built using the LoRa communication protocol. There are four sensing parameters: temperature, humidity, light strength, and soil wetness. This sensor data will be sent to the LoRa gateway via LoRa RFM95 and then saved in Antares as an IoT platform. The spreading factor number and location of the LoRa device affect the transmission efficiency of LoRa. The average RSSI value measured in indoor circumstances is -113 dBm, and the SNR is 0.96 dB. Meanwhile, the average RSSI value measured in outdoor circumstances is -89.8 dBm, and the SNR is 4.84 dB. This has an effect on the quantity of data successfully sent; in interior circumstances with an SF12 value, the data successfully sent is 292 out of 480 data packets that should have been sent, whereas in outdoor conditions with an SF12 value, the data successfully sent is 451 out of 480.

Hilmiey et al., (2020) suggested a single-channel LoRaWAN gateway for remote indoor monitoring. This article discusses A single-channel LoRaWAN gateway was installed with a frequency range of 923 to 925 MHz, while the sensing devices used 923.2 MHz. To satisfy the requirements of sensing device communication in the network, the uplink bandwidth was eight times greater than the downlink connection. The single-channel network offers a small-scale service that operates at minimal power and over a long distance. As a result, the LoRaWAN gateway was elevated above the sensor device. In this instance, the gateway was on the 7th floor, while the two groups of sensor nodes were on the 5th and 20th floors, respectively, with an estimated height of about 2.5 metres for each level. The temperature and humidity monitors in the sensing devices were linked to the

gateway from three separate floors in a high-rise structure. The LoRaWAN network was monitored using the TTN interface, which was linked to the network host. In general, owing to the greatest distance, the sensor node on the 20th level experienced significant packet loss of more than 78%. Furthermore, despite the noise level linearity, its RSSI varied the most. While the sensor node on the fifth level is only two floors away, it shows intermediate packet loss.

Shiyang et al., (2019) suggested by A LoRaWAN Wireless Underground Sensor Network Simulator for Farm Uses was They concentrated on Wireless Underground Sensing Networks in this study (WUSNs). It is a new field of IoT utilisation. However, due to their limited transmission range in an underground setting, existing wireless sensor networks produce findings that are neither practical nor scalable for a real-world application. This study concentrates on LoRa/LoRaWAN technology as a possible WUSN option in agriculture applications. LWS is a discrete event emulator for WUSN built on LoRaWAN. LWS adhered to and integrated the LoRaWAN standard, and it is intended to investigate the viability and scalability of LoRaWAN deployment as a WUSN. Using LWS, real-world elements of implementing a WUSN (such as soil attenuation and path loss) can be considered prior to system implementation. Their simulation findings indicate that LoRaWAN can accomplish multi-kilometer network coverage with a burial depth of less than 70 centimetres in the topsoil area. Furthermore, WVC can have a significant impact on signal loss, which affects the network's total DER. Furthermore, the network's ACK rate can create network congestion due to area duty cycle limitations. LWS is a flexible instrument for pre-deployment LoRaWAN WUSN analysis. However, because LoRaWAN employs LoRa as its physical layer, the path loss model may require precise tuning to the LoRa CSS modulation algorithm in order to produce a more exact outcome. By improving our existing model with site data, we can acquire a more precise path loss model.

Ahmad et al., (2020) suggested the implementation of a MQTT and LoRaWAN system for real-time environmental monitoring applications. Based on LoRaWAN technology, this study article expanded on real-time environment monitoring. The goal of this article is twofold: first, to explain the integration of temperature and humidity sensors on the Arduino UNO, which then transmits data via the LoRaWAN module. Second, to describe

the web development to ingest the data from the cloud server, and then visualize the sensors reading for ease of data analyzation. Temperature and humidity in classrooms of different elevation were monitored and transmitted to a network server using MQTT. It can be built upon JavaScript language and the runtime is built on Node.JS. Node RED also provides the MQTT interface, hence the integration of the sensor end nodes to the TTN server become versatile. Thus, the graphical strategic dashboard has been created for each of the sensor end nodes instance. The MQTT settings one of the sensors end node using the Node RED. It defined the TTN server connected and the subscribed topic of the MQTT broker for the respective sensors end node. The temperature and humidity readings were plotted using line chart of the Node FRED. At last this works also has proved that LoRaWAN has been feasible to be implemented as an IoT system applications

Kam et al., (2019) created a supervision and energy management device In the context of smart building domains, this paper provides an innovative design for a remote management system based on Internet of Things (IoT) and cloud technologies. This piece is set up to watch a telecom tower becoming "smart" using Low-Power Wide-Area. It describes different data gathering techniques that are built on the LoRaWAN protocol and are used to gather data from delocalized IoT devices. We used the "Atoll" software to establish the coverage of our private LoRaWAN network based on tower details, gateway position, and transmission restrictions after installing the LoRa Gateway atop the telco tower (Forsk company). Telecom firms frequently use this software application as a planning aid for wireless network architecture. The device is situated in a very deep indoor area, like a cellar, which is the first thing to take into account. The device's deep interior location in a windowless chamber on the ground floor is the second thing to take into account. The device's outdoor use is the fourth thing to take into account. Finally, since LoRa is a bidirectional technology, it is possible to build a smart telco tower or other smart building in Metz with a private LoRaWAN Network.

Utkarsh et al., (2020) presented a performance study of different LoRa WAN frequencies for optimum data transfer of water quality parameter measurement. They suggest in this paper that the efficacy of the LoRa frequency spectrum of 433 MHz, 865 MHz, and 915 MHz was assessed using the MATLAB/Simulink environment for the

transmission of water quality data as an example application. A comparison of these frequencies based on power usage and data-packet loss for various transmitting lengths was given. This comparison may be helpful in selecting a LoRa module for a specific purpose. It was discovered that the distance between the transmitter and recipient causes a rise in packet data loss. However, the receiver's sensitivity can be improved by using greater SF values to achieve broader coverage while reducing data bit-rate. The appropriate SF number is determined by the distance between the LoRa transmitter and recipient and is a compromise between data-packet loss and battery usage. This choice will differ depending on the sort of application, and the graphs provided in this paper can be used as guidelines. This study can be expanded by comparing the efficacy of LoRa modules with various antenna kinds.

Jasrina Jaffar et al., (2020) designed A LoRaWAN-based Mobility Tracking System was recommended by The foundation provided by the LoRaWAN protocol in this article can be used to develop radio frequency data transmission. Instead of the Dragino LoRa /GPS Shield and LoRa Shield, the basic and prototype code can also be used with other modules, such as the Cytron LoRa RFM module and the GPS Adafruit Ultimate module. In an attempt to ensure the successful progression of this task, investigations and observations have been made. The impact of the surroundings on a radio frequency covered region was investigated using a systematic research. To obtain better performance in the future, it is recommended that a high gain antenna be used instead of the built-in module. This choice Ja To enable a larger coverage region, for example, an increase from 3dbi to 57dbi can be introduced. It is also proposed that a smaller module and battery cell be used to create a smaller but more compact prototype. It has also been discovered that the use of the Dragino YUN Shield in this prototype is not user-friendly due to an issue where the YUN Shield programme and Datalog are deleted every time the LoRa Gateway reboots. As a result, another option for data recording is to use the SD Card Adapter. Despite the fact that the initiative lacked materials, skills, and time, the effort produced a good outcome for future growth. This project's future work will be carried out using comparable LoRaWAN research for other performance purposes.

Mimansa Raut et al., (2017) proposed An automatic dam tracking and alert system based on a raspberry pi was presented by This project's goal is to use the Raspberry Pi and cutting-edge IOT idea to watch the water level in a dam. The Internet of Things (IOT) is a technology that connects real-time objects to the internet. This device can be used as a warning system as well as to identify explosives and feel earthquake vibrations. In order to accomplish the same task mechanically and send the state to a raspberry pi, an ultrasonic sensor is installed in the barrier. The Raspberry Pi device validates the data and posts the results online. Through this project, every change in the water level is transmitted via the internet to the control centre, where it is immediately communicated to neighbouring residents, potentially saving many lives and averting unpleasant situations. They are utilising a Raspberry Pi 2B variant for this endeavour. Compared to the Raspberry Pi's earlier iteration, it has more computing capacity. It has an ARMv7 quad-core BroadcomBCM2836 CPU with four USB connections. It is possible to link via HDMI for visual connections. The links can be made using any of the 40 GPIO ports. The data is stored on a micro SD device with 1 GB of Memory. The Raspberry Pi is linked to a WiFi module to transmit the information over IOT. The raspberry pi is linked to an LCD, which shows the message. Sirens are used as a warning mechanism. The engine is operated by a motor controller IC. The dam's barrier is operated by a motor. They are utilising the metal detector VK557 and the piezo-ultrasonic sensor HC-SR04 ICWith the aid of a Raspberry Pi 2B module demonstrating the IOT idea, all the captured data will be made accessible online. The end output of the run programme is shown on an LCD monitor. In this study, an ultrasonic instrument is used to measure the dam's water level. The state of the water level will be shown on the Screen if the water level is between 2 and 400 metres. If not, the notification "Out of range" will appear. Additionally, if it detects seismic vibrations and the existence of adjacent explosive (metal), it will warn the user in advance.

V. Chandrasekhar et al., (2018) presented a real-time flood tracking and alert management system built on the internet of things. The system is extremely beneficial in terms of safeguarding humans and animals' lives. The suggested model is widely used for tracking water levels and flow variations in rivers, and it can also be used to measure water levels at dams and reservoirs. The measured values are changed on the web server on a regular basis, which is very useful for sending flood warnings to consistent authority and

people for quicker action. The initiative consists primarily of wireless sensor units known as motes, which are put along river beds to measure water quality. Each Node is linked to a Cellular modem. The processed data is sent via GPRS from the relevant node to the alarm management system. An application programme interface (API) for Google Spreadsheets was developed, and this API is used as a data recorder. The Google Spreadsheet is linked to free monitoring software known as the warning management system. The warning management System can be used to watch, document, and communicate with people prior to disasters. The monitoring station's data gathering device will benefit from precise and accurate detection of water level. Flood warning information can be posted on LED display screens for road users and put in strategic areas for safety reasons. Such data should be collected in real time and wirelessly relayed from the measured spot. Solar cells are one potential source of electricity for the sensors and centralised control centre. If the Flood Observatory System is fueled by solar cells, it will be simple to deploy and operate. Solar energy will also provide a less expensive source of electricity for the complete system.

Wan Adlin Harris et al., (2011) and colleagues recommend a text flood alert system. This study's findings For the protection of drivers, flood alert information can be displayed on LED displays in key locations. Such information ought to be wirelessly transmitted from the measured location and gathered in real time. One possible source of energy for the sensors and centralised control system is solar cells. The Flood Observatory System will be straightforward to install and run if it is powered by solar cells. For the entire system, solar energy will also offer a less costly supply of electricity. shows a GSM-based liquid sensor-based remote water level alert device. The system uses the Global System of Mobile Connections (GSM) and Short Message Service (SMS) to send data from sensors to users' mobile phones as it is intended to autonomously monitor water levels. The Easygate GSM Module, three (3) liquid sensors, a generator, and a Micro Controller Unit (MCU) PIC18F452 make up the system's components. Software for the device consists of (ATTENTION) AT commands in C assembler code. This programme is expected to benefit the neighbourhood and act as a safeguard against a water catastrophe in any area that is vulnerable to them.

Hung Ngoc Do et al., (2015) suggested a mobile network-based early flood detection device. An early flood notification system has been researched and created in this article.

The system comprises of a solar-powered early flood alert station, a tracking centre, and a notification system. The flood alert system has a water level sensor as well as a precipitation sensor. The data collected by sensors will be saved on a memory card and relayed to a monitoring centre via the GPRS protocol. The surveillance center's duties are to receive, analyse, and transmit data from stations to a notification system where warnings can be produced for the affected residential areas. Flood alert levels can be readily configured by using the circuit board's buttons or an SMS communication from the user's mobile phone. A webpage was also developed to show the river's water level, rainfall, and forecast information for the next few hours. Because of the compact size of the control board and the use of solar energy, this system has a high mobility feature and can be readily implemented. The water alert system is split into three categories based on sensor data. The system will perform an upgrade for each alert level.

2.2 PROBLEM IDENTIFICATION

- Surveillance cameras were always used for tracking.
- It requires humans to monitor and spot potentially dangerous circumstances.
- The current method produces instabilities.
- They could not control the death of mine workers.

2.3 SCOPE OF THE PROJECT

The safety of coal mine workers is an essential thing in coal mine output. Gas disasters are the most hazardous to coal mine safety. It is critical to monitor the gas concentration in mines during the mine construction process. For the time being, gas concentration monitoring systems use sensors and due to over sweating the mine affected by unnamed disease. So, for sensing sweat value of a mine we are using EDA sensor to track Sweat rate and we are also measuring HBR and SPO2 level.. After detecting the amount of these gases, sweat rate and HBR rate the ESP8266 controller will initiate the appropriate management procedure.

2.4 OBJECTIVES

- The identification of various toxic substances in the industrial area.
- Establishing communication between devices and Wi-Fi.
- Creation of a wireless sensor network.
- Creation of a mechanism for real-time observation.
- Save the health condition of mine workers.

2.5 METHODOLOGY

Our undertaking is divided into two parts. The first one involves keeping track of the health of mine employees, and the second one involves detecting poisonous gas in coal mines. We are utilising a gas monitor, MEMS sensor, and pulse sensor. The NODE MCU will enable and notify the person through the buzzer and information shown in LCD if any gas sensor value exceeds the cutoff range at the spot. Members of the Monitoring area can view and be aware of the state of the Mine workers as well as refresh the information that has been gathered using the Zig bee module and IOT.

2.6 APPLICATION

- It is used to prolong the life of coal miners and it is constantly observable.
- If any urgent scenario arose, a note was immediately sent via mail or message.
- Establishing communication between sensors and Wi-Fi.
- Detecting various toxic chemicals in the industrial area.

CHAPTER 3

PROJECT DESCRIPTION

3.1 BLOCK DIAGRAM AND EXPLANATION

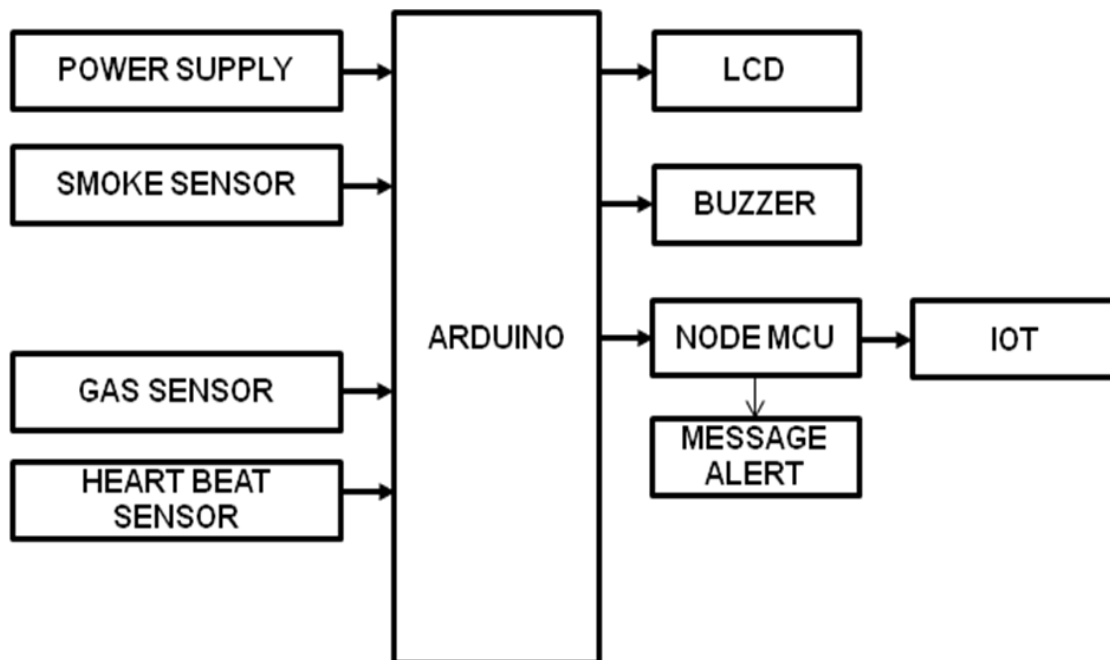


Fig 3.1 Existing system block diagram

Several parts make up this tracking system, including boards (NodeMCU, ADC, and SPI), a Wi-Fi transmitter, various sensors, and other minor electrical parts. Each of these parts is thoroughly discussed in this chapter, along with how it functions. The suggested system fixes the gas sensor modules, temperature sensor, smoke sensor, and switches for the coal mine safety systems. They connect the device to every monitor. To begin, they registered for a Thing Talk account. They primarily have tracking and controlling tools in this system. All of the info from various devices is monitored by the monitoring system. The atmosphere of the coal pit is gas-sensing. The buzzer will sound loudly to alert the mine employees if the gas level rises above the usual level. Continuous uploads of these sensing

data are made to the cloud for study and future use. Inside the coalmine, the temperature and smoke level readings are also measured and sent to the data management unit via NodeMCU. Fig. 3.1 depicts the suggested system block layout.

3.2 DISADVANTAGES OF EXISTING SYSTEM

- Using extra instruments, it would be feasible to keep an eye on any potential safety hazards, including gases, dust, vibrations, fire, etc.
- Wi-Fi can also be used to monitor mining activities for things like erosion and water leaks, among other things.
- When wired contact is difficult, this method can be used to transmit other crucial info, making it possible.
- Since the technology allows for simple entry, the control can be managed from the surface itself.

3.3 PROPOSED BLOCK DIAGRAM AND EXPLANATION

In our Proposed system, we We intend to monitor the health of mines using the suggested system. EDA sensors are used to measure the mine's sweat level, while an IR sensor is used to compute the mine's spo2 and heart rate, and the sensor measures values provided to the Node MCU. When the EDA device values, HBR, and Spo2 levels exceed the threshold range, the NODEMUC will notify the user via buzzer and using the ZigBee module, transmitting information to the monitoring area. The website posts the obtained data according to IOT (Think speak). Health parameters such as heart rate, spO2 level, and sweat levels of coal mine workers are seen in our suggested system. Each sensor constantly monitors its own parameters, which are transmitted to the webpage. The detectors are set up with a predetermined range of values; buzzer activates when the sensor outputs surpass or fall below that range. The amount of times one's heart beats in sixty seconds is referred to as a pulse. And it varies from individual to person. In a relaxed state, a Low heart beat is often associated with improved cardiovascular health and more effective cardiac function. Adults should keep their heart rates between 60 and 100 beats per minute.

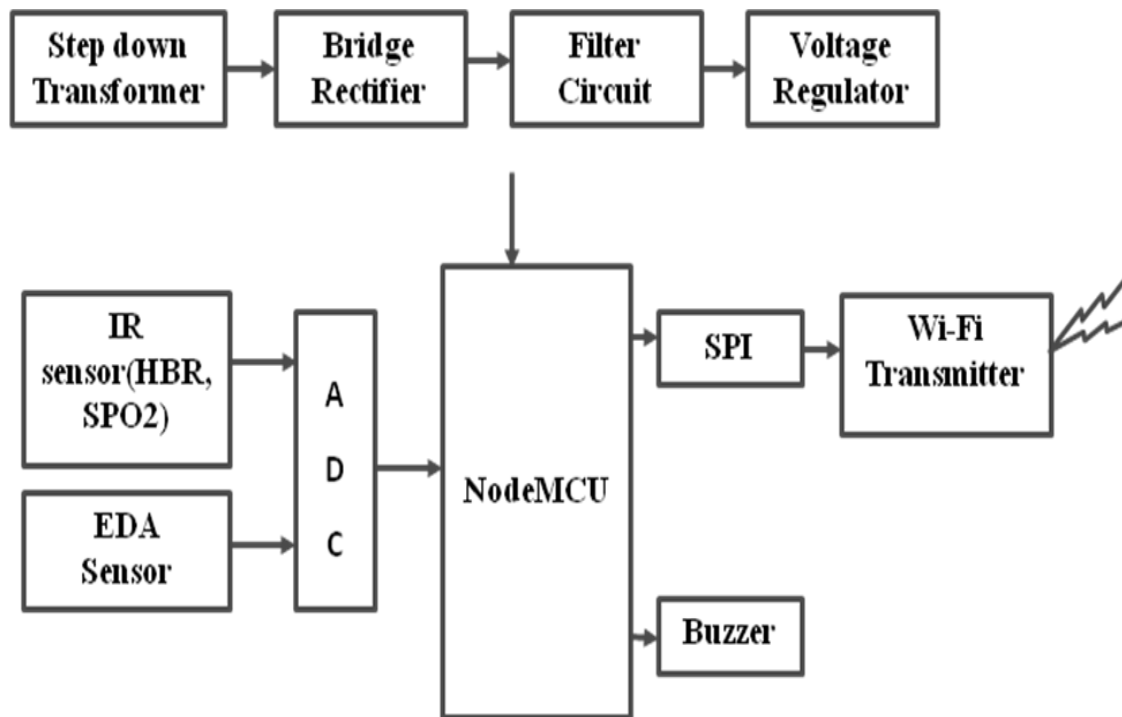


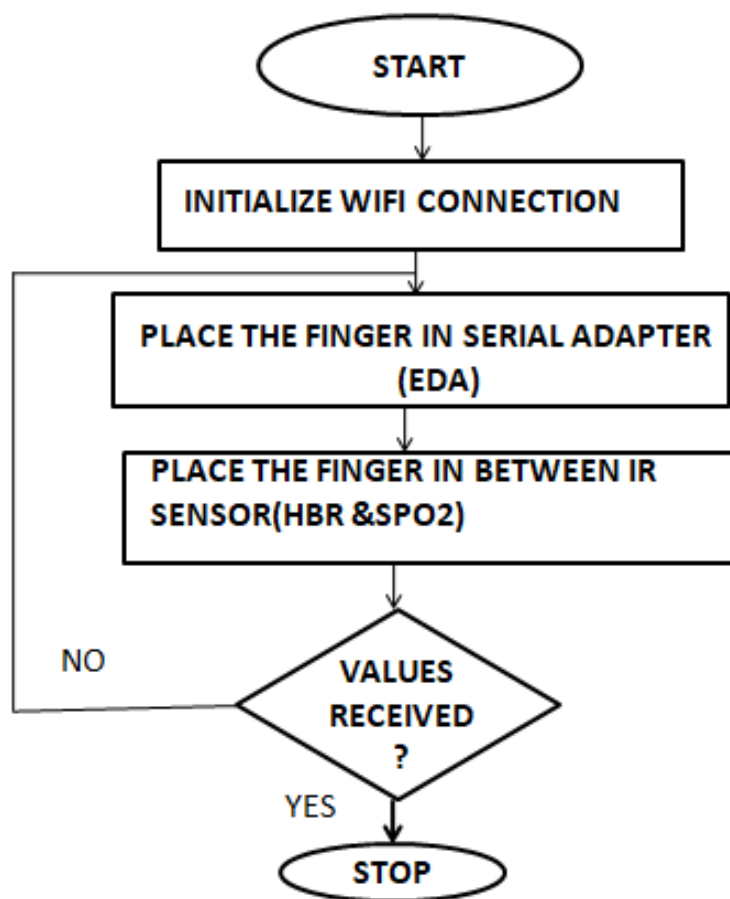
Fig 3.2 Proposed system block diagram

when the heartbeat range surpasses 100 beats per minute or goes below 60 beats per minute, it is deemed abnormal. Sweat rates differ from person to person based on health and level of physical activity. Sweating rates differ with age as well. The proposed system identifies mineworkers' sweat rate in real time. The info from the EDA and IR sensors is updated on the webpage. The buzzer activates when the sweat, HBR, and spo2 levels surpass or exceed the threshold range of values. In mines, gases do not scatter continuously. As a consequence, they keep looping within the mine environment. A gas sensor was also used to detect the gas level. A special webpage also receives updates with the data where only authorised individuals can view it. Power supply, NodeMcu, EDA Sensor, IR Sensor, Zig bee networking protocol, IoT module, Buzzer, and L293d motor driver are all included in the suggested system. We have made a real time monitoring system for coal mine workers. It will be useful to measure the sweat rate and rescue the workers with unnamed disease.

3.4 ADVANTAGE OF PROPOSED SYSTEM

- We can easily measure sweating rate status of mine workers.
- We could save their health.
- Communication establishment between sensors and Zigbee.
- Provides stable result.

3.5 FLOW CHART



CHAPTER 4

SYSTEM DESIGN

The system architecture is covered in this chapter. This part primarily covers the hardware and software requirements. The suitable working environment is set up, along with all of the components needed to develop the system. The system was tested in the specific setting after it was developed. This chapter describes the development of a hardware system step by step, followed by software development and execution.

4.1 SYSTEM HARDWARE DESIGN

This monitoring system includes boards (NodeMCu board and Zigbee USB interfacing board), various sensors, and other small electrical components. This chapter provides a thorough review of each of these parts, as well as their operating principles.

4.1.1 NODEMCU

NodeMCU is an open source Internet of Things framework. It contains firmware that runs on Espressif Systems' ESP8266 Wi-Fi SoC and hardware that is based on the ESP-12 module. By default, the term "NodeMCU" applies to the firmware rather than the dev kits. The Lua programming language is used in the firmware. It is developed on the Espressif Non-OS SDK for ESP8266 and is based on the eLua project. It makes extensive use of open source applications such as Lua-cjson and spiffs. LUA-based interactive firmware for the Expressif ESP8622 Wi-Fi SoC, as well as an open source hardware board that, unlike the \$3 ESP8266 Wi-Fi modules, contains a CP2102 TTL to USB chip for programming and debugging, is breadboard-friendly, and can be powered directly through its micro USB port.

* The ESP8266 chip needs a power supply voltage of 3.3V. It should not be powered by 5 volts, as other Arduino devices are.

* The NodeMCU ESP-12E dev board can be powered by 5V via the micro USB connector or the Vin port on the board.

* The ESP8266 I/O pins can only interact or input/output at 3.3V. In other words, the ports are NOT 5V tolerant inputs.

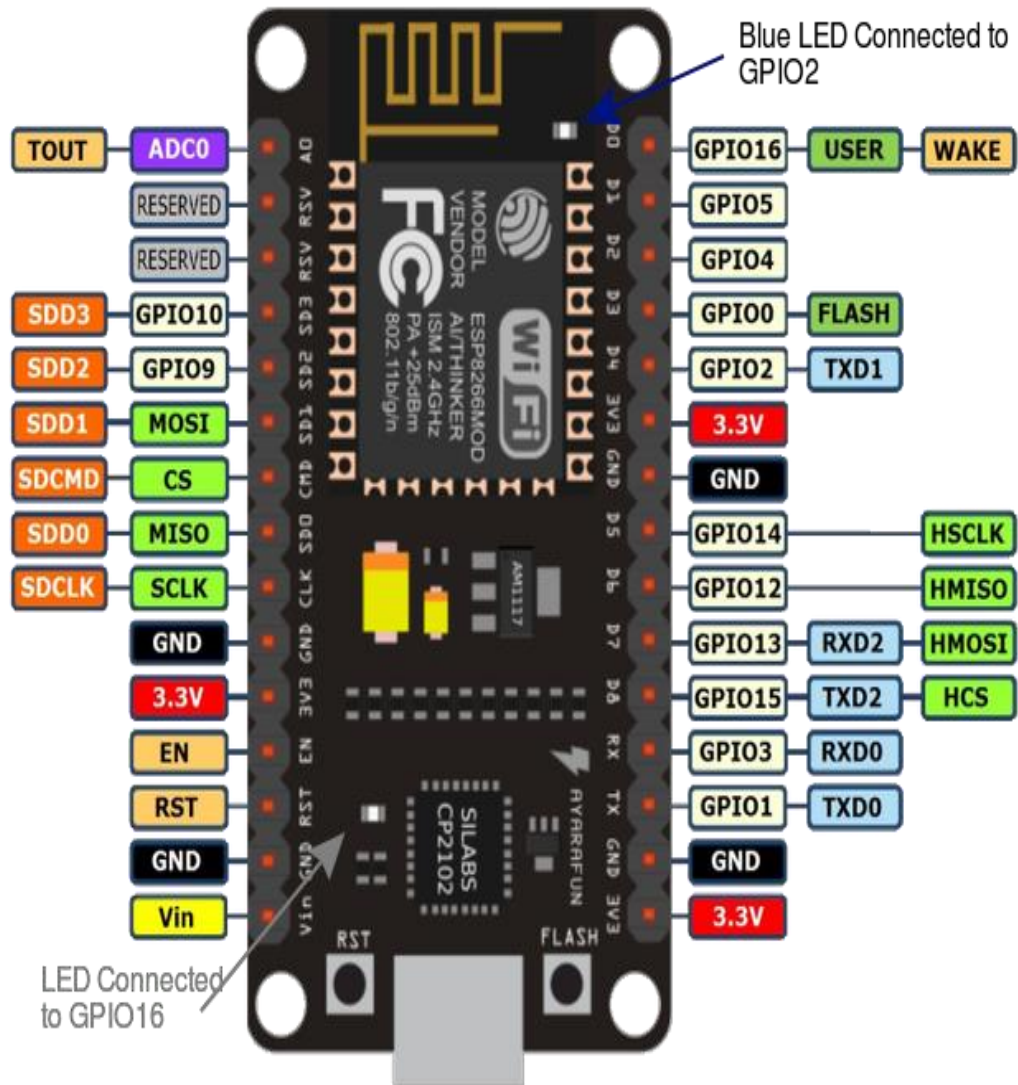


Fig 4.1 Node MCU

4.1.2 GAS SENSOR (MQ-4)

The gas sensor monitor is made of a ceramic tube and Tin Dioxide. The MQ2 has an electrochemical sensor, which changes its resistance for different concentrations of varied gasses. The sensor has different sensitivity for different types of gasses - Power Supply

4.5V to 5V DC. High sensitivity to Propane, Smoke, LPG and Butane. The gas sensor is used to measure the gas level of a person.



Fig 4.2 MQ-4 Sensor

4.1.3 CARBON MONOXIDE (CO)

Carbon monoxide gas has no color, odor, flavor, or irritant properties. It is only marginally higher than the surrounding atmosphere. It is combustible but not conducive to burning. It dissolves in water. In air, it burns to CO₂ with a faint blue flame.

Sources of CO :

The production of the CO in a mine may be due to any one or more of the following cases:

Oxidation of coal and other carbonaceous matter: Under typical mining conditions, the percentage found is negligible and harmless in the return of a coal mine.

Explosives: Although explosives contain the amount of oxygen needed for a complete chemical reaction, the chemical reaction that occurs when the explosive is blasted is rarely perfect, resulting in the formation of CO.

Spontaneous Combustion: This is the primary cause of dangerous percentages of CO in a coal mine. Active fire in an underground mine produces hazardous amounts of CO.

Explosion of Methane or Coal Dust: Gases produced by the explosion of methane coal dust usually contain a high percentage of CO.

Underground Equipment: Common sources of CO generation include faulty air compressors and the exhaust gas of internal combustion engines such as diesel locomotives. In reality, if proper lubricants are not used, every machine produces CO.

Impacts of CO :

CO is a highly toxic gas with a nearly 300-fold affinity for hemoglobin in the blood. If CO is present in even trace amounts in the inhaled air, blood struggles to acquire adequate amounts of oxygen to sustain life. CO penetrates the circulatory system, reducing oxygen delivery to the organs and tissues. Individuals suffering from coronary artery disease are particularly sensitive. The onset of abnormal states is associated with vision impairment, work limitations, limited learning ability, and the completion of difficult tasks. When the target combustible gas is present, the conductivity of the sensor increases as the gas quantity increases. The MQ-4 sensor has six pins, four of which are used to collect signals and the other two to provide heating current.

4.1.4 IR Sensor

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

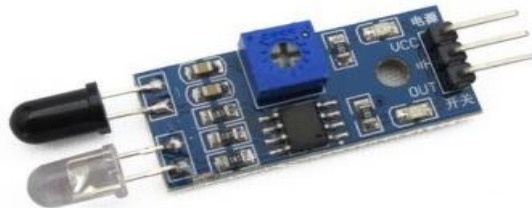


Fig 4.3 IR Sensor

4.1.5 EDA SENSOR

EDA expands Electro Dermal Activity Sensor. It is used to measure the changes in conductivity produced in the skin due to increases in the activity of sweat glands. The preferred sites for EDA measures are located in the palms of the hands and the soles of the

feet. The eccrine glands secrete sweat due to external stimuli and endogenous processes (memory, attention, vigilance, motor commitment, etc.), filling the skin pores and increasing the conductivity. The amount of sweat glands varies across the human body, being highest in hand and foot regions (200–600 sweat glands per cm²).



Fig 4.4 Electro dermal activity sensor (EDA)

4.1.6 L293D MOTOR DRIVER

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

DC motors in any direction at the same time. And is the capable of bidirectional drive currents of upto 600mA. It canbe used to control small dc motors such as toy motors.



Fig 4.5 L293D Motor driver

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

4.2 IEEE STANDARDS

- IEEE P2413 - Standard for an Architectural Framework for the Internet of Things (IoT). This standard provides a framework for designing and developing IoT systems, including those related to women's safety. It covers topics such as system architecture, interoperability, and security.
- IEEE P2418.1 - Standard for the Architectural Framework for the Internet of Things: Application Layer. This standard provides guidance on the design of

IoT applications, including those related to women's safety. It covers topics such as application architecture, data management, and system integration.

- IEEE 802.15.4 - Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs). This standard specifies the wireless communication protocols used in many IoT devices, including those related to women's safety. It covers topics such as network topology, data transfer rates, and power consumption.
- IEEE 802.11- Wireless Networking
- IEEE 802.16 Wireless Networking(WiMAX)

4.3 CONSTRAINS

1. **Power consumption** - The largest constrains in design is power consumption. Sensors needs to monitor system states and updates the network, with the added Wrinkle that devices may be distributed over a wide area with limited access to a continuous power supply.
2. **Small size** - In most cases, transducers have to be small in size, in order that they do not interfere with the operation of the device to which they are attached. For instance, a sensor that measures the flow of water must be small enough not to affect the flow of water itself. Another reason they need to be small is that they are often used in large numbers. Water supply meters, for instance, deployed across a colony or a city, can be in the thousands, if not millions. For cost and aesthetic reasons, the sensors in such meters would need to be small.

- 3. Device management** - It is rarely feasible to upgrade each device manually. Upgrades and patch-fixes have to be automated. This can only happen if they are sent wirelessly. Wireless transmission of software, called Software over the Air (SOTA) is a challenge, given the constraints on power and range.
- 4. Economic viability** - IoT sensors are extremely price sensitive. One, they are often deployed on a massive scale - in their hundreds and thousands – because of which slight increases in price could add millions of dollars to project cost. The economics of IoT projects demands that IoT devices be cheap. For this reason, manufacturers are reluctant to use power-saving batteries or sophisticated modems, which may save power but add to device cost.
- 5. Networking** - Connections need to be established before transmission, which due to the often trivial length of the latter, means considerable energy expenditures spent on setup versus the actual content of the data. Standard TCP congestion control and buffering are also similarly inefficient; though in fairness, these are not issues exclusive to TCP, and solutions geared towards the specific needs of IoT have been developed.

4.4 TRADE - OFF

IoT solutions drive rich analytics capabilities across vast areas of crucial enterprise functions, such as operations, customer care, finance, sales, and marketing. At the same time, they can be used as efficient exit points for edge gateways. Careful consideration must be given to architecting highly efficient IoT implementations where data and analytics are pushed to the cloud by devices, and where machine learning algorithms are pulled down to the device gateways from the cloud. Individual devices will be constrained by the throughput supported over a given network. The frequency with which data is exchanged must be balanced with the transport layer and the ability of the device to optionally store, aggregate, and then send data to the cloud. Send data from devices to the cloud at timed intervals that align to the time required by backend applications to process and take action on the data. For example, if you need to see data at a one-second increment, your device must send data at a more frequent time interval than one second.

CHAPTER 5

SIMULATION AND RESULT

We have used Arduino Software (IDE). Arduino IDE contains a text editor for writing code, a message area, a tool with buttons for common functions and a series. It connects to the Arduino and Genuine hardware to upload programs and communicate with them. Coded part is done in this software. We have to upload the code here and run. If there is no error in output the program will successfully give the positive result.

5.1 CODE:-

```
pinMode (7, OUTPUT);

void loop()

int Co= analogRead (A3); int HBR analogRead (A4);

int EDA= analogRead (A5); lcd.setCursor(0, 0);

lcd.print ("CO:"); lcd.print (Co);

lcd.setCursor (8, 0);

lcd.print ("HBR: "); lcd.print (HBR);

lcd.setCursor(0, 1); lcd.print ("EDA:"); lcd.print(EDA);

if (EDA>600)

Serial.println("High EDA detected"); digitalWrite(7,1);

else

delay(1500); lcd.clear();
```

```

File Edit Sketch Tools Help
V2_Analysis
pinMode(7,OUTPUT);
}

void loop()
{
    int Co = analogRead(A3);
    int HBR = analogRead(A4);
    int EDA = analogRead(A5);
    lcd.setCursor(0, 0);
    lcd.print("CO:"); lcd.print(Co);
    lcd.setCursor(8, 0);
    lcd.print("HBR:"); lcd.print(HBR);
    lcd.setCursor(0, 1);
    lcd.print("EDA:"); lcd.print(EDA);

    if (EDA > 600)
    {
        Serial.println("High EDA detected"); digitalWrite(7,1);
    }
    else
    {
        digitalWrite(7,0);
    }
    delay(1500);
    lcd.clear();
}

Time compiling

Sketch uses 3322 bytes (10%) of program storage space. Maximum is 32256 bytes.
Global variables use 248 bytes (13%) of dynamic memory, leaving 1750 bytes for local variables. Maximum is 2048 bytes.
Arduino Uno on COM10
AM 10:51
30-01-2023

```

Fig 5.1 Program output

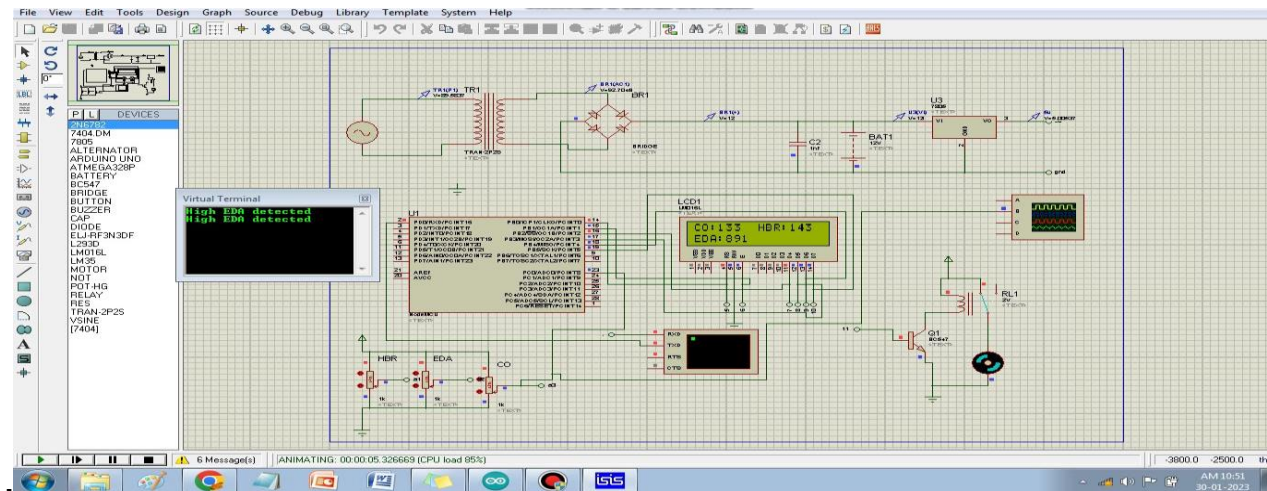


Fig 5.2 Simulation

5.2 HARDWARE & RESULTS:-

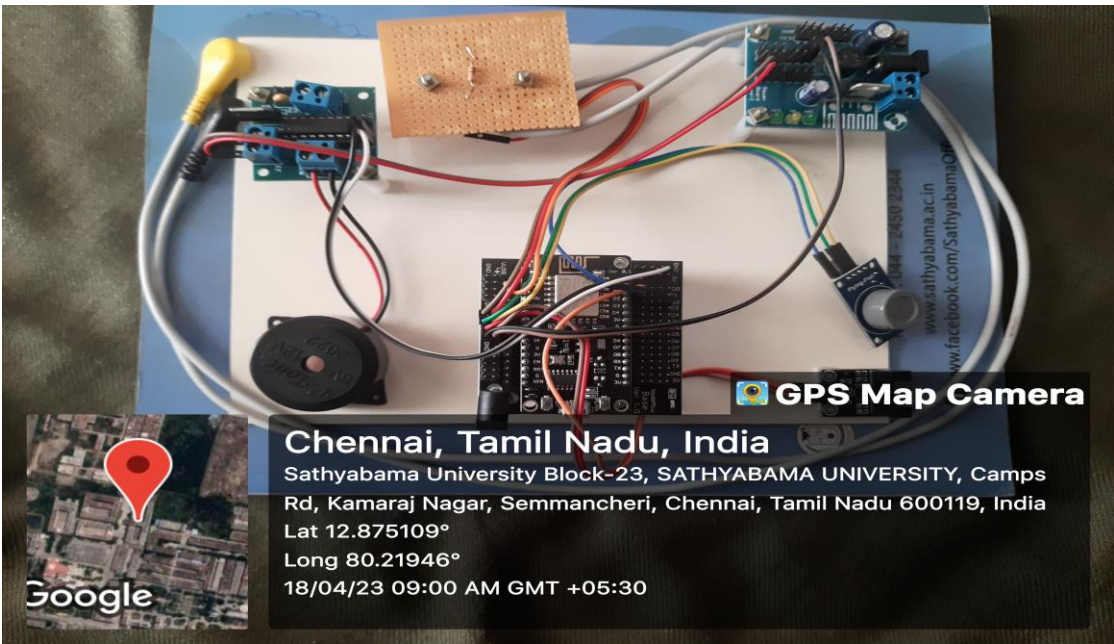
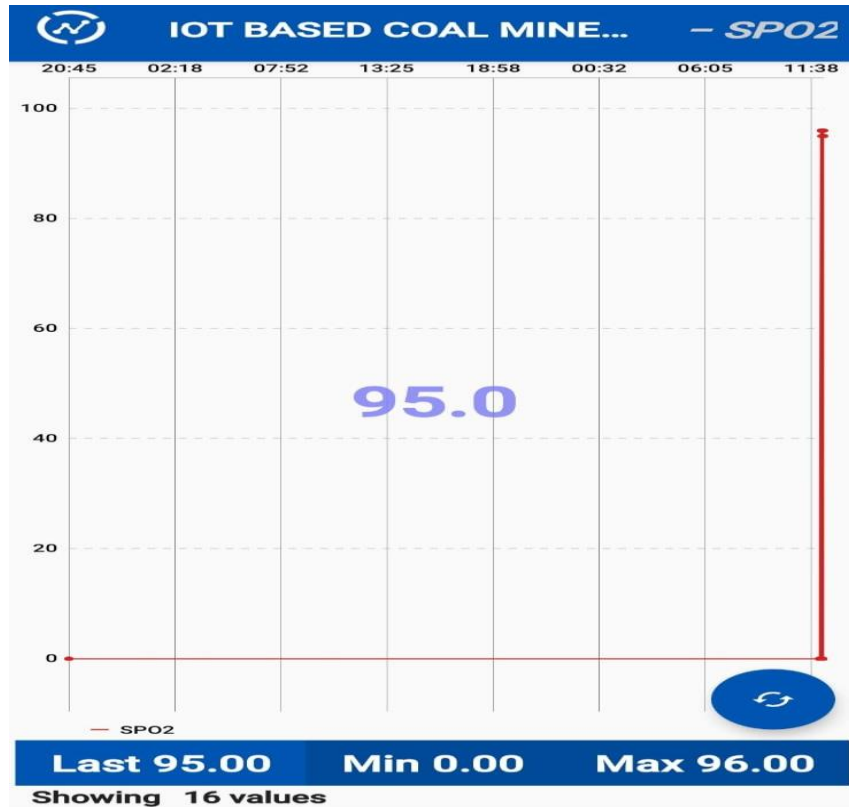


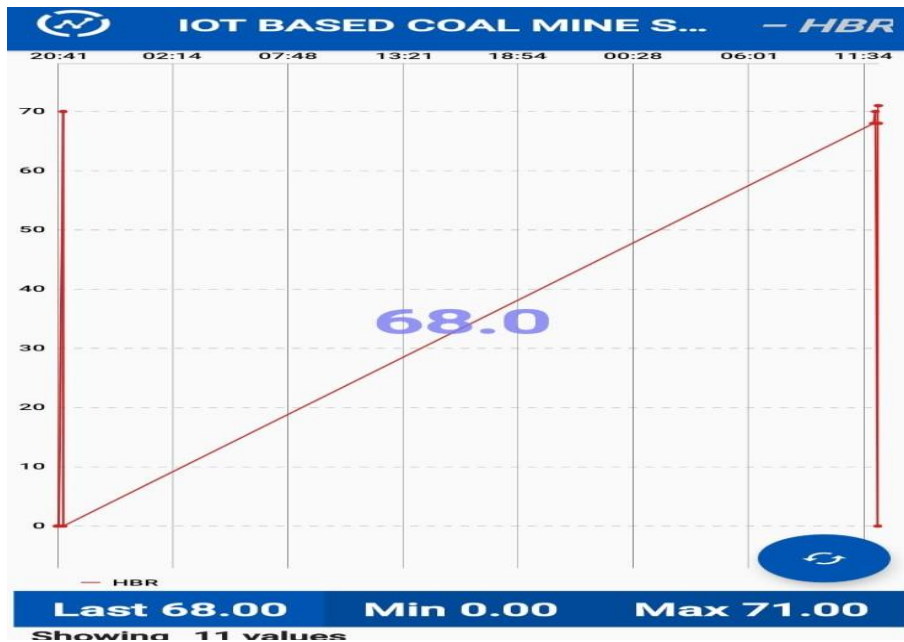
Fig 5.3 Hardware of proposed system



5.4 Screenshot of EDA value measurement & graph



5.5 Screenshot of SPO2 value measurement & graph



5.6 Screenshot of HBR value measurement & graph

CHAPTER 6

CONCLUSION

This chapter describes all prior work connected to mine's health safety. Based on the research, the following work is an improvement on the real-time tracking system using wireless data transmission technology. There are many sectors that depend on coal, and it is often referred to as the "Black Diamond" by many. In order to meet India's ever-increasing electricity needs, coal mining has become a national priority. However, this work is hazardous and could be fatal for those who perform it. The environment poses several challenges to coal miners, including high temperatures that cause excessive sweating and can have negative health effects as well as the emission of hazardous gases, to name a few. These elements make the workplace a dangerous place for employees to be, endangering their very lives. In this research, a data transmission platform called Think speak IoT is used as a medium to pass the data. There are various sensors like EDA IR and Gas is used to sense the different parameters of human health parameters they are heart beat rate, sweat rate, and spo2 level. These sensors are all deemed one unit and are installed in coal mines. All sensed values are constantly transmitted to the think speak IoT platform for analysis. If the values are going beyond the buzzer sound will happen with the help of L293D motor driver. The developed system is primarily used to rescue workers health conditions and to guarantee workers' safety. So that appropriate actions can be done whenever a potentially dangerous situation appears.

6.1 FUTURE SCOPE

The system is cost-effective and efficient with which the medical data of the mine worker is obtained and used for further artificial intelligence-based medical prognosis. Hence the proposed system reduces the death rate and disease alerts for the workers in the mining industry.

REFERENCES

1. Chaudhari, Priyanka, Aman Kumar Tiwari, Shardul Pattewar, and S. N. Shelke. "Smart infrastructure monitoring using LoRaWAN technology." In *2021 International Conference on System, Computation, Automation and Networking (ICSCAN)*, pp. 1-6. IEEE, 2021.
2. Liya, M. L., and M. Aswathy. "LoRa technology for Internet of Things (IoT): a brief survey." In *2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC)*, pp. 8-13. IEEE, 2020.
3. Eridani, Dania, Eko Didik Widiyanto, and Richard Dwi Olympus Augustinus. "Monitoring system in LoRa network architecture using smart gateway in simple LoRa protocol." In *2019 international seminar on research of information technology and intelligent systems (ISRITI)*, pp. 200-204. IEEE, 2019.
4. Ramelan, Agus, Muhammad Hamka Ibrahim, A. Chico Hermanu Brillianto, Feri Adriyanto, Muhammad Rizqi Subeno, and Ayu Latifah. "A Preliminary Prototype of LoRa-Based Wireless Sensor Network for Forest Fire Monitoring." In *2021 International Conference on ICT for Smart Society (ICISS)*, pp. 1-5. IEEE, 2021.
5. Kosnin, Nur Sakinah, Shihabeldin Fadli Yousif Hasan, Mohamed Hadi Habaebi, and Mod Rafiqul Islam. "Sungai Pusu River Emergency Vital Signs Monitoring Using LoRaWAN." In *2021 8th International Conference on Computer and Communication Engineering (ICCCE)*, pp. 49-52. IEEE, 2021.
6. Simitha, K. M., and MS Subodh Raj. "IoT and WSN based air quality monitoring and energy saving system in SmartCity project." In *2019 2nd International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICT)*, vol. 1, pp. 1431-1437. IEEE, 2019.

7. Joshitha, C., P. Kanakaraja, Mallela Divya Bhavani, Yerramsetti Naga Venkata Raman, and Tadepalli Sravani. "Lorawan based cattle monitoring smart system." In *2021 7th International Conference on Electrical Energy Systems (ICEES)*, pp. 548-552. IEEE, 2021.
8. Bandyopadhyay, Nilanjana, Prashant Gaurav, Moumita Kundu, Bidisha Misra, and Bijita Hoare. "IoT-based health and farm monitoring system via LoRa-based wireless sensor network." In *2020 4th International Conference on Electronics, Materials Engineering & Nano-Technology (IEMENTech)*, pp. 1-7. IEEE, 2020.
9. Al Fajar, M. Chw, and Octarina Nur Samijayani. "Realtime greenhouse environment monitoring based on LoRaWANProtocol using grafana." In *2021 International Symposium on Electronics and Smart Devices (ISESD)*, pp. 1-5. IEEE, 2021.
10. Rawat, Arvind Singh, Jagadheswaran Rajendran, Harikrishnan Ramiah, and Arti Rana. "LORA (Long Range) and LORAWAN technology for IoT applications in Covid-19 pandemic." In *2020 International Conference on Advances in Computing, Communication & Materials (ICACCM)*, pp. 419-422. IEEE, 2020.
11. Hanaffi, Hilmiey, Roslina Mohamad, Saiful Izwan Suliman, Murizah Kassim, Nuzli Mohamad Anas, and Ahmad Zaki Abu Bakar. "Single-Channel LoRaWAN Gateway for Remote Indoor Monitoring System: An Experimental." In *2020 8th International Electrical Engineering Congress (iEECON)*, pp. 1-4. IEEE, 2020.
12. Kevin, I., Kai Wang, Shiyang Wu, Ameer Ivoghlian, Zoran Salcic, Andrew Austin, and Xiaokang Zhou. "LWS: A LoRaWAN wireless underground sensor network simulator for agriculture applications." In *2019 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computing, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovation (SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI)*, pp. 475-482. IEEE, 2019.

13. Rahman, Habib Ur, Mudassar Ahmad, Haseeb Ahmad, and Muhammad Asif Habib. "LoRaWAN: state of the art, challenges, protocols and research issues." In *2020 IEEE 23rd International Multitopic Conference (INMIC)*, pp. 1-6. IEEE, 2020.
14. Rosli, Ahmad Nazhan, Roslina Mohamad, Yuslinda Wati Mohamad Yusof, Shahrani Shahbudin, and Farah Yasmin Abdul Rahman. "Implementation of mqtt and lorawan system for real-time environmental monitoring application." In *2020 IEEE 10th Symposium on Computer Applications & Industrial Electronics (ISCAIE)*, pp. 287-291. IEEE, 2020.
15. Hernandez, Leonel, Luz Marquez, Stefany Correa, and Tarcila Simanca. "Design and Prototyping of a Scalable IoT Solution Based on LoRaWAN to Improve the Service of School Routes in the South West Location of Barranquilla." In *2020 6th International Conference on Science in Information Technology (ICSITech)*, pp. 17-22. IEEE, 2020.
16. Hernandez, Leonel, Luz Marquez, Stefany Correa, and Tarcila Simanca. "Design and Prototyping of a Scalable IoT Solution Based on LoRaWAN to Improve the Service of School Routes in the South West Location of Barranquilla." In *2020 6th International Conference on Science in Information Technology (ICSITech)*, pp. 17-22. IEEE, 2020.
17. Kam, Olle Michel, S. Noel, Pierre Kasser, Camel Tanougast, Harry Ramenah, and Kondo H. Adjallah. "Supervision and energy management system for smart telecom tower based on the LoRaWAN protocol." In *2019 6th International Conference on Control, Decision and Information Technologies (CoDIT)*, pp. 539-544. IEEE, 2019.
18. Alset, Utkarsh, Atul Kulkarni, and Hrishikesh Mehta. "Performance Analysis of Various LoRaWAN Frequencies For Optimal Data Transmission Of Water Quality Parameter Measurement." In *2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT)*, pp. 1-6. IEEE, 2020.

19. Jaffar, Jasrina, Ahmad Faez Abdul Malik, Megat Farez Azril Zuhairi, Aznida Abu Bakar Sajak, and Mohd Taha Ismail. "Development of the lorawan-based movement tracking system." In *2020 14th International Conference on Ubiquitous Information Management and Communication (IMCOM)*, pp. 1-6. IEEE, 2020.
20. Jaffar, Jasrina, Ahmad Faez Abdul Malik, Megat Farez Azril Zuhairi, Aznida Abu Bakar Sajak, and Mohd Taha Ismail. "Development of the lorawan-based movement tracking system." In *2020 14th International Conference on Ubiquitous Information Management and Communication (IMCOM)*, pp. 1-6. IEEE, 2020.
21. Mahbub, Mobasshir, Md Abdur Rouf, and Mir Md Saym. "Industrial Plant Environment Surveillance and Safety Assurance System Based on IoT." In *2020 2nd International Conference on Sustainable Technologies for Industry 4.0 (STI)*, pp. 1-4. IEEE, 2020.
22. Souifi, Jihen, Yassine Bouslimani, Mohsen Ghribi, Azeddine Kaddouri, Tobie Boutot, and Hsan Hadj Abdallah. "Smart home architecture based on LoRa wireless connectivity and LoRaWAN® networking protocol." In *2020 1st International Conference on Communications, Control Systems and Signal Processing (CCSSP)*, pp. 95-99. IEEE, 2020.