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“Coal Mine Safety Monitoring And Alerting system using smart helmet”

Submitted in the partial fulfilment of the requirement for the VIII Semester Project Work phase-2 - 18ECP83 for the award of degree of

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in

Electronics & Communication Engineering

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CERTIFICATE

Certified that the Project Work Phase-2 entitled "coal mine safety and alerting system using smart helmet" is a bonafide work carried out by RUFINA RF - 1GV20EC027, SINDHUJA VC - 1GV20EC033, SUNITHA P - 1GV20EC042 in the partial fulfillment for the award of degree of Bachelor of Engineering in Electronics & Communication Engineering of the Visvesvaraya Technological University, Belagavi during the year 2023-2024. It is certified that all corrections/suggestions indicated for the assessment have been incorporated in the report deposited in the departmental library. Project work phase-2 report has been approved as it satisfies the academic requirement in respect of the Project work phase-2 -18ECP83 prescribed for the Bachelor of Engineering Degree.

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ABSTRACT

A Mining is the extraction of minerals and other geological elements from the ground. There are several risks associated with the extraction of these minerals. The majority of accidents in coal mining occur as a result of dangerous gases emitted during mining, such as methane gas. A mine safety system involving a helmet is constructed, with an IOT platform serving as a data transmission channel. The system is used to monitor and regulate numerous factors in coal mines, such as gas leakage and temperature conditions. These sensors are all considered one unit and are mounted on the helmets of coal mine miners. The sensor values are continually transferred to the things speak for analysis. The gas is regularly monitored here, and if there are any doubts in the level of gas, a bell is utilized to inform the personnel. Temperatures are also continually monitored and shown on both the serial monitor and the things speak platform. The created helmet system is primarily used to improve the working environment in mines and to Guarantee worker safety.

CONTENTS

LIST OF FIGURE

CHAPTER 1

INTRODUCTION:

There are various kind of Hazards like earthquake, land slide, tsunami etc. but the most important and crucial disaster is a man-made disaster such as fire, loss of electricity, falling of bridge, building etc. coal has proven to be very dangerous and has caused many accidental deaths over the years. Keeping this in mind we have designed an intelligent system which can be used on helmets of these underground coal workers and can monitor/analyze a few major hazardous parameters found in these mines in real time. The coal mining industry, while pivotal for energy production, poses inherent risks and challenges to the safety of miners working in subterranean environments. Recognizing the critical need for a transformative approach to enhance safety measures in these hazardous conditions, the "Coal Mine Safety Helmet" project emerges as a pioneering endeavor at the intersection of technology and industrial safety. This innovative initiative integrates cutting- edge Internet of Things (IoT) technologies to create a sophisticated safety monitoring system specifically tailored for the unique demands of coal mining operations. Mining activities expose workers to diverse and dynamic risks, ranging from gas emissions and unstable environmental conditions to the ever-present threat of accidents. Conventional safety measures often fall short in providing real-time, comprehensive monitoring and response mechanisms, necessitating a paradigm shift towards advanced solutions.

The "Coal Mine Safety Helmet" project addresses thisgap by leveraging a multifaceted approach, encompassing hardware and software integration, to significantly improve safety standards in coal mines. The project comprises two integral models: the Helmet Model and the Band Model. The Helmet Model serves as a central hub equipped with an Arduino Uno microcontroller, an array of sensors such as UV and gas sensors for environmentalmonitoring, an IR sensor to ensure the continuous presence of safety helmets, and a GPS module for accurate location tracking. It also features a Node MCU for wireless connectivity, an emergency switch for immediate response, an LCD display for real-time data visualization, and Zigbee modules for seamless communication with the Band Model. Complementing the Helmet Model, the Band Model focuses on monitoring miners' physiological parameters. It incorporates an Arduino Uno, a heartbeat sensor for real-time heart rate monitoring, a temperature sensor for continuous tracking of body temperature, and a Zigbee module for wireless communication with the Helmet Model.

This project aims to achieve a holistic safety ecosystem by seamlessly integrating these two models, enabling real-time monitoring of environmental conditions, the continuous presence of safety equipment, and the tracking of vital signs. By doing so, the system empowers miners with enhanced situational awareness, facilitates prompt emergency responses, and contributes to the overall well-being of the workforce. In essence, the "Coal Mine Safety Helmet" project represents a technological milestone in the pursuit of a safer working environment for coal miners. By marrying IoT advancements with the specific safety needs of the mining industry, this initiative not only addresses current safety challenges but also establishes a foundation for future innovations.

As we delve into the intricacies of this project, we embark on a journey towards redefining safety standards in coal mining and ensuring the protection and prosperity of the individuals who play a pivotal role in powering our world. MINING is critical for global socio-economic growth as almost every industry value chain has a high demand for mineral resources. However, the global mining industry is facing economic concerns, such as high initial investment and fluctuating commodity prices, extreme conditions, such as deeper and steeper deposits, severe geotechnical and geological challenges, such as lower ore grade, and a range of social and environmental issues, such as safety and diverse community responses to mining activities. To address these problems, the mining industry has implemented numerous emerging technologies to improve mining efficiency and safety and reduce environmental hazards. Like many other industries, the mining industry is implementing digital transformation to achieve automation. To achieve efficient and safe mineral exploitation and extraction in underground mines, intelligent mining has become a trend in operations by increasing the autonomy of machines and by real-time monitoring of the environment, equipment, and crew.

The complicated and extreme working environment in underground mines is one of the main constraints to productivity and safety in themining industry. Underground mines have long and sometimes relatively narrow tunnels, unstablegeological structures, hazardous atmospheres, and equipment failures. Considering these environmental and operational challenges, monitoring of relevant environmental and structural parameters, positioning of personnel and equipment, and supervision of mine personnel can effectively enhance the productivity, efficiency, and safety of underground mining. Traditionally, wired sensors monitor working conditions at underground mines. However, a wired system can fail easily once the network has faults, significantly increasing the complexity of cable deployment and maintenance and reducing system scalability and capability. With the development of sensor and communication technologies, wireless sensor networks (WSNs) have gained popularity and have been widely used in the mining industry. Small, light, and energyefficient wireless sensor nodes can overcome the limitations of wired systems due to the advantages of convenient deployment, cost effectiveness, high reliability, scalability, capability, mobility, and flexibility.

REASON FOR SELECTING THIS PROJECT

1. **Safety Enhancement**: Coal mining is a high risk industry with potential hazards such as a gas leaks, cave-ins, and equipment malfunctions. Implementing a smart helmet system can significantly enhance safety by continuously monitoring environmental conditions and alerting miners to potential danger.
2. **Minimize Accidents**: This project aims to minimize accidents and injuries in coal mines by providing real-time data on gas levels, temperature, humidity, and air quality. This information allows miners to take proactive measures and evacuate if necessary, reducing the likelihood of accidents.

PROBLEM STATEMENT

In a coal mining industry, the lack of real time monitoring possess significant safety risk for workers.

OBJECTIVES

The objectives of this project are:

The goal is to create a robust safety infrastructure in coal mines technology.

1. The project facilitates timely responses to emergencies.
2. Develop a system that proactively identifies potential hazards, such as gas leaks or abnormal physiological parameters, enabling miners and mine operators to take preventive measures and mitigate risks before they escalate.

CHAPTER 2

LITERATURE REVIEW

A literature survey or a review in a project is a type of review articles. It is a scholarly paper, which includes the current knowledge findings, as well as theoretical and methodological contributions to a particular topic. Literatures reviews are secondary sources, and do not reportnew or original experimental work. It is a basis for research in nearly every academic field. Concentrate on the own field of expertise.

2.1 LITERATURE SURVEY

M. Ramya [1], K. Kousalya in 30th December 2017 proposed a title on "Investigation and design of helmet for coal miners in this document, a continuous monitoring system, which monitors the environmental parameters such as the presence of poisonous gases, temperature, oxygen level, ultraviolet rays? The different sensors such as methane sensor, carbon monoxide sensor, carbon dioxide sensor, temperature sensor, ultraviolet sensor, ultrasonic sensor are placed in the helmet.

The machine is a value powerful Zig Bee-based wireless mine supervising machine. Software adopted Zig Bee technology to build wireless sensor networks, determined out real-time surveillance with early-warning intelligence on temperature, leakage of gasoline in mining place, and alerting the manage station the use of wireless zig bee technology. The device is used to reduce capacity protection troubles in coal manufacturing. Zigbee is a WPAN era primarily based on the IEEE 802.15.4 popular. This technique allows the quick range of a person node to be accelerated and improved, covering a far larger region. This machine has transmitter phase .The aim of the project is to design a wireless helmet for coal miners using ZigBee wireless mine supervising machines. Nowadays coal miners are facial various problems. Workers safety in underground coal mines has always remained a challenging task. Several fatal and non-fatal accidents take place worldwide resulting in causalities and injuries of coal miners. Study aims to develop a wearable safety device comprising of gas sensor, temperature sensor, oxygen sensor, opguard, ultrasonic sensor, ultraviolet sensor. The values of different sensors are continuously transmitted by wireless transmitter to the remote monitoring unit which is placed outside the mine and received by the receiver module (PC).

Md Atiqur Rahman [2], Abid hasan toufik ahmed in june 2020 proposed a title on "IoT based smart helmet and accident identification system", A motorcycle frequently called motorbike or two-wheelers, which is the most used than another form of automobiles because of its low price. But another side, this is the most unsafe automobile. The accident can happen for driving fast or drunk driving. Safety and security in vehicle traveling are a pre-eminent concern for all. With the rapid urbanization and staggering growth of transport networks like two-wheeler vehicles, safety on the roads and security on the bike has emerged as an inescapable priority for us. It has expanded the rate of accidents, which leads to several damages with loss of lives. In many circumstances, we cannot able to detect the accident's location. A helmet is a form of protecting gear worn to keep safe the head from injuries.

More specifically, the helmet aids the skull in protecting the brain. A smart helmet can detect the accident's locations also save lives and makes two-wheeler driving safer from previously. This paper propounds a smart helmet system to avoid the accident. The system divides into three parts helmet circuit, automobile circuit, and mobile application. At first, the helmet circuit has IR and alcohol detection sensor. The automobile circuit has a 3-axis accelerometer, Bluetooth module, relay, and load sensor. The helmet circuit sends a signal to the automobile circuit to start if the helmet is wearied and no alcohol detects. Then the automobile circuit checks the status of the load to start. 3-axis accelerometer senses crash or hit.

V . Sai prasanna Kumar[3], M. shiva rama Krishnan, Dr. K. shambavi in May 5th 2021, proposed a title on " A smart helmet for coal miners" . In this document in earlier days, people used to work in the underground coal mines using helmets with very less protection and they used to contain a light to see the path. Due to the increase in accidents in coal mines, for example on April 5 2010 Upper Big Branch Mine disaster has occurred in the United States of America, the Safety and Health Administration (MSHA) released its statement concluding that violation of safety protocol led to a major accident. It also declared that due to harmful gases many people lost their lives. The problem would have been minimized if they had detected it at an earlier stage. Due to advancements in technologies living in the modern era, we can eradicate all such problems with ease. Considering this problem we implemented a smart helmet which can be very effective with minimal weight also with inflated security. C. J. Behr, A. Kumar and G. P. Hancke, A Smart Helmet for Air Quality and Hazardous Event Detection for the Industry‟, IEEE, PP. 2028-2031, 2016.In this paper there are air quality for A Smart Helmet for Coal Miners harmful gas detection, helmet removal sensor, collision sensor and zigbee for communication. They implemented helmet using temperature humidity sensor, light sensor, air quality sensor, WIFI module and GSM . In the earlier papers on the smart helmet for coal miners used zigbee technology based on IOT and WIFI module which is not very effective at medium to long ranges. This smart device consists of 4 sensors and an alert will be sent as soon as a threat is detected. All the input data will be fed into the Arduino. The Arduino then evaluates all the data given by input and compares with the setup range, if any input data exceeds then it turns on the buzzer, sends a message to an authorized person, and also displays status on the computer screen at the control room. This setup is appropriate for the control room as it will be very helpful to monitor all the workers who were working in the coal mines. DHT 01 sensor to is used to detect and determine temperature, humidity ranges in the mines. The obstacle sensor is used to detect unwanted obstacles throughout the path

DHT 01 sensor to is used to detect and determine temperature, humidity ranges in the mines. The obstacle sensor is used to detect unwanted obstacles throughout the path. The vibration sensor is used to detect the falling rocks, objects beforehand and that helps in awarding the worker to save his life. To detect harmful gases such as SO_2, CO_2, NO_2, NH_3 MQ2 sensor has been used. After analyzing the data it will be transferred through LoRa communication. LoRa communication is a wireless communication that transfers data in a very efficient way. The whole circuit uses less power consumption using temperature humidity sensor, light sensor, air quality sensor, WIFI module and GSM .

In the earlier papers on the smart helmet for coal miners used zigbee technology based on IOT and WIFI module which is not very effective at medium to long ranges. This smart device consists of 4 sensors and an alert will be sent as soon as a threat is detected. All the input data will be fed into the Arduino. The Arduino then evaluates all the data given by input and compares with the setup range, if any input data exceeds then it turns on the buzzer, sends a message to an authorized person, and also displays status on the computer screen at the control room. This setup is appropriate for the control room as it will be very helpful to monitor all the workers who were working in the coal mines. DHT 01 sensor to is used to detect and determine temperature, humidity ranges in the mines. The obstacle sensor is used to detect unwanted obstacles throughout the path

DR .T. Dinesh Kumar [4], Achala Vengal Reddy, Shiva Krishna in March 2022 proposed a title on “Design and implementation of Iot based smart helmet for road accident detection using Arduino” In this document, The project's goal is to ensure the safety and security of bikers on the road. A Smart Helmet is a unique concept that uses GSM and GPS technologies to make motorcycle riding safer than ever before. Another benefit of this study is that it can detect the presence of alcohol in drunk persons riding bicycles. We're working on an embedded kit or system that will be installed in Helmet. consist of sensors and electronic circuitry that continuously monitor and measure the alcohol level and accelerometer state. We take a reading of the alcohol level and display it on the LCD display. When the alcohol level exceeds a predetermined threshold, an alarm sounds and we are alerted to the inebriated person. Existing system Wearing a helmet puts a pressure on the helmet, and a data signal is sent to the transmitter, which causes the bike ignition control to switch on. However,

By putting any artificial substance inside the helmet, pressure can be created. Instead of wearing a helmet, the rider can provide the appropriate pressureby inserting any dummy material into the helmet. As a result, the primary goal of starting the bikewhile wearing a helmet might be easily overlooked. Our smart helmet's goal is to keep bike riderssafe while also providing information about the accident location to the ambulance and family members. The GSM module is used to accomplish this. However, simply relaying the accident's message is insufficient. We need to send the accident's location. As a result, we're utilizing the GPS module.

When an accident occurs, the MEMS sensor detects the event and sends a signal to the Arduino. The Arduino will then utilize the GPS to determine the location of the accident and give it to the user in the form of latitude and longitude. However, the average user will not comprehend how to get location from latitude and longitude. We're employing an alcohol sensor

Pooja gadu[5], karishma sheikh, in 7th June 2021 proposed a title on “IoT based coal mine safety monitoring and alerting system ” . In this document , Mines are the world’s most dangerous place to work because in the mines, explosion often happens and thousand people are dying. And a recent report states that in such mine accidents an average of around 12,000 people have died. Coal is a non-sustainable origin that cannot be widely replaced by humans, there are several mishaps of coalmines occurring in the mines, and the diggers are putting their lives at risk, by working in the coal mines, even once in a while they end up losing their lives in the coal mines that are an unfortunate part. Mainly such mishaps happen as a direct result of the old equipment and wired devices, resulting in the end, mishandling, spillage of the noxious gases in the coal mines, pose tremendous hazards to the excavators inside the coal mines. So we've designed the coalmine protection system to stay away from this problem. We tackled the issues in our research by testing each of the information collected by the sensors, we use and finishing the analysis using the Thinger system. Controlling can be done automatically or manually.

Jannatual ferdous riya [6], sabrin akter usha sujan howlader in 7th August 2023 proposed a title on " smart helmet ensuring safety of bike riders". In this paper, The number of bike accidents is rising daily. Numerous people have suffered serious injuries and lost their lives as a result of bike accidents. Bike riders can reduce their risk of collisions by wearing helmets. The advantages of smart helmets include a decrease in the number of bike accidents. The primary cause of fatality in the majority of accidents is a lack of quick first aid and emergency medical assistance. One of the primary causes of this might be the ambulance's late arrival, with no one at the scene of the accident to provide information to the ambulance. The objective of this paper is to develop a smart helmet powered by renewable energy that will ensure the safety of bikers. The helmet includes an Arduino as a microprocessor, Global System for Mobile communication (GSM) for phone calls, Global Positioning System (GPS) for tracking, and vibration sensors to detect accidents within a minute of detecting the accident, the system calls the registered number with a message and the precise position. Furthermore, if the user exceeds the average speed limit, the speed sensors will warn them. The rider can summon help in an emergency by activating the emergency switch. If the rider is not wearing a helmet, the bike will not start. Solar energy powers the prototype in its entirety. From the result analysis, it has been found that the developed helmet can provide safety to the bikers by conveying accurate and real-time information on accidents within minutes. is not wearing a helmet, the bike will not start. Solar energy powers the prototype in its entirety. From the result analysis, it has been found that the developed helmet can provide safety to the bikers by conveying accurate and real-time information on accidents within minutes.

CHAPTER 3

METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to the field of study it comprises the theoretical analysis of the body of methods and principles associated with the branch of knowledge. Typically, it encompasses concept such as paradigm, theoretical model, phase and quantitative or qualitative techniques.

3.1 INTRODUCTION:

Understand the specific safety challenges in coal mining operations and define the functional and technical requirements of the safety helmet system.

1. Conduct a thorough review of existing safety measures in coal mines. Engage with industry experts and miners to identify critical safety concerns.
2. Develop a comprehensive system architecture that integrates sensors, microcontrollers, and communication modules. Design communication protocols for Zigbee modules.
3. Assemble and configure the physical components of the Helmet and Band Models. Develop and assemble the Helmet Model with Arduino Uno, sensors, and communication modules. Build the Band Model, incorporating the Arduino Uno, heartbeat sensor, temperature sensor, and Zigbee module.
4. Develop the firmware for both the Helmet and Band Models. Write Arduino code for sensor integration, data processing, and communication protocols. Develop user interface code for the LCD display on the Helmet Model.
5. Ensure seamless communication between the Helmet and Band Models. Configure Zigbee modules for reliable wireless communication. Implement data transmission and reception protocols between the models.
6. Verify the functionality and reliability of the safety helmet system. Perform sensor testing for accuracy and reliability. Validate emergency response mechanisms.
7. Deploy the safety helmet system in real-world mining environments and plan for ongoing improvements.

3.2 BLOCK DIAGRAM:

Block diagram for helmet model and band model:

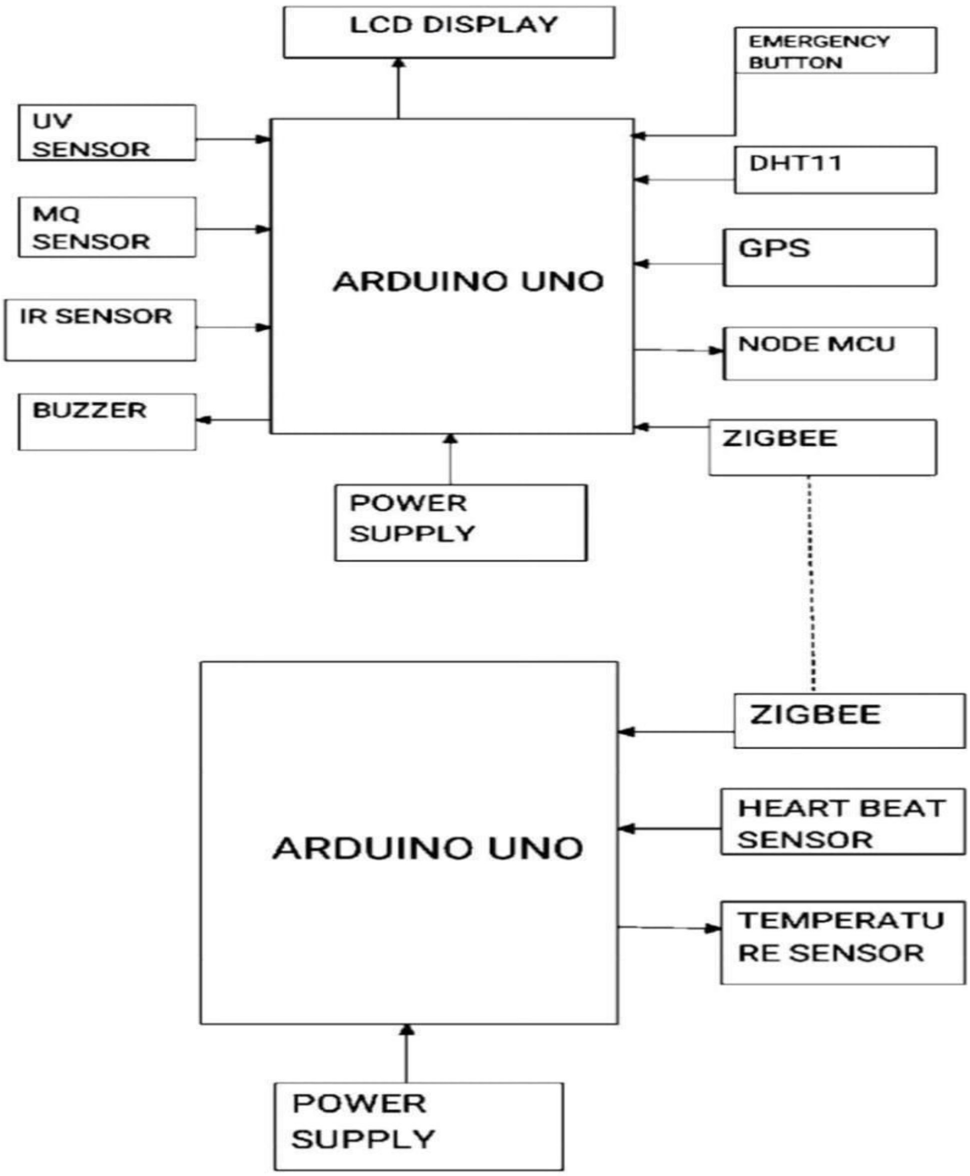


Fig no 3.2.1: BLOCK DIAGRAM FOR HELMET MODEL AND BAND MODEL

BLOCK DIAGRAM OF HELMET MODEL

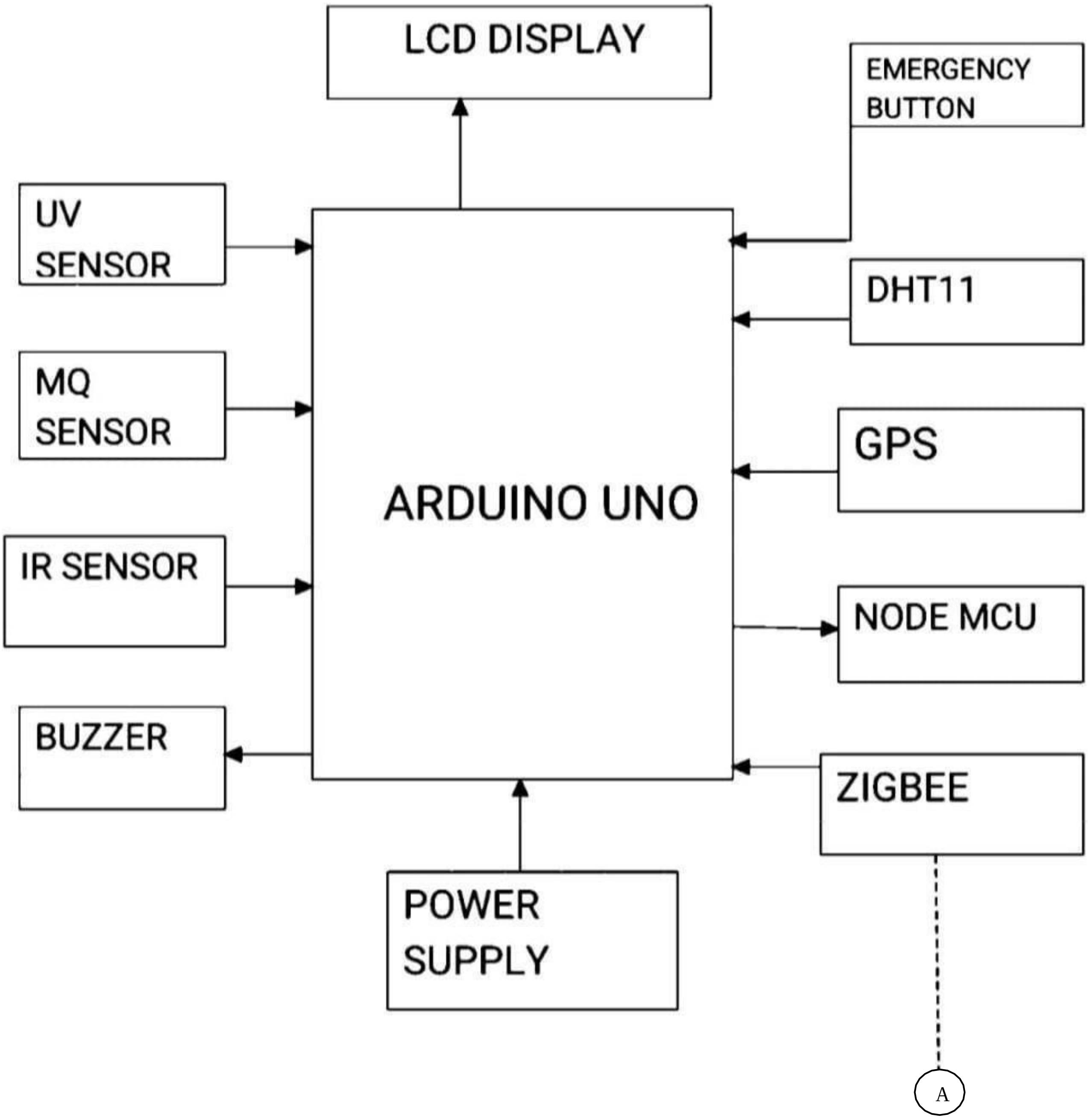


Fig no : 3.2.2 block diagram of helmet model

Band model:

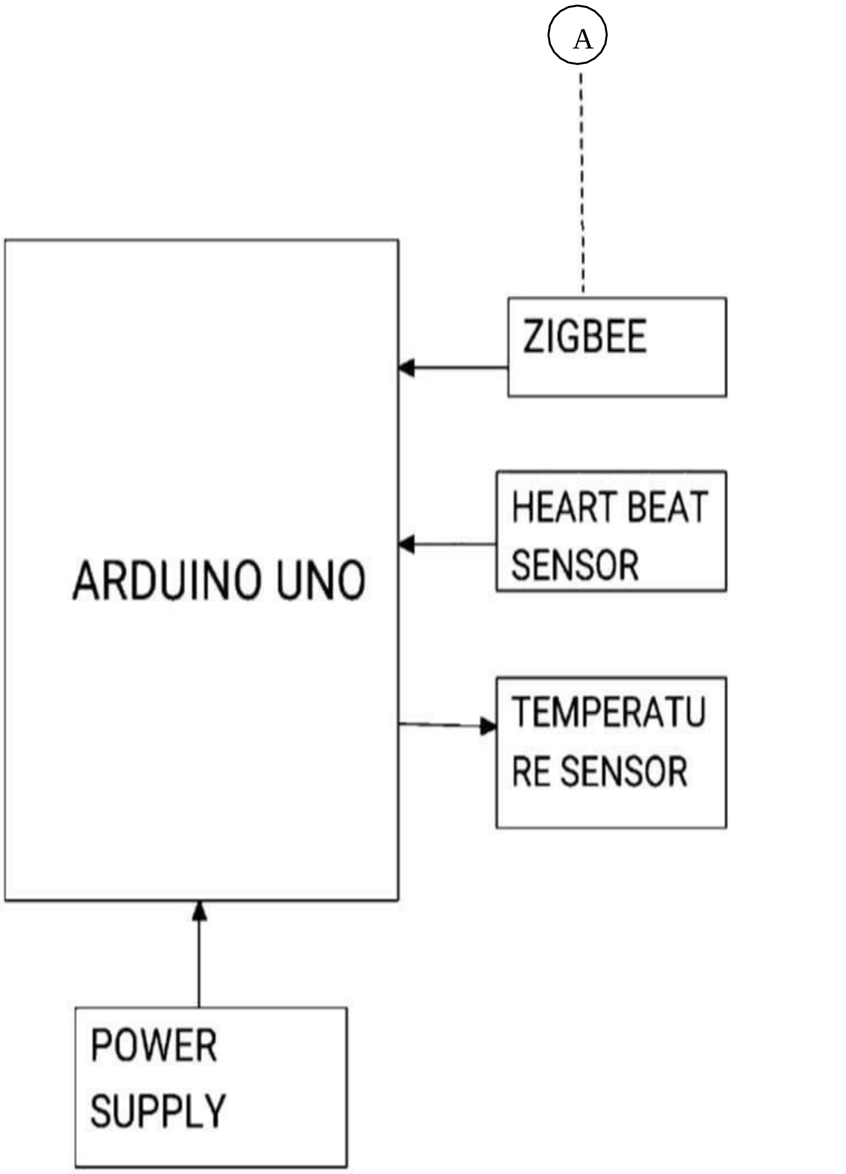


Fig no : 3.2.3 block diagram for band model

FOR HELMET MODEL

1. LCD Panel: This component is used to display important information such as sensor readings, alerts, and system status
2. UV Sensor: It measures the level of ultraviolet radiation to ensure the safety of workers by monitoring their exposure to harmful UV rays.
3. MQ Sensor: This gas sensor detects the presence of hazardous gases, such as methane or carbon monoxide, which are commonly found in coal mines.
4. IR Sensor: It is used for proximity detection and can help identify obstacles or potential dangers in the surroundings.
5. Buzzer: The buzzer is an audio output device that can be used to generate audible alerts or warnings in case of emergencies or abnormal conditions.
6. Arduino Uno: This microcontroller board serves as the brain of the system, processing sensor data, controlling outputs, and managing communication between different components.
7. Power Supply: It provides the necessary electrical power to operate the various components of the smart helmet.
8. Emergency Button: This button allows the wearer to trigger an emergency alarm or signal for immediate assistance in critical situations.
9. DHT11: This temperature and humidity sensor helps monitor the environmental conditions inside the mine, ensuring worker comfort and safety.
10. GPS: The Global Positioning System (GPS) module enables real-time tracking of the helmet's location, which can be crucial for rescue operations or monitoring worker movements.
11. NodeMCU: It is a Wi-Fi enabled microcontroller board that facilitates wireless communication and connectivity with other devices or systems.
12. Zigbee: This wireless communication module enables data transmission and reception between the smart helmet and a central monitoring system or other devices.
13. These components work together to enhance safety in coal mines by monitoring environmental conditions, detecting hazardous gases, providing real-time location tracking, and enabling communication in emergency situations.

For Band model:

1. Zigbee Module: Zigbee is a wireless communication protocol used for transmitting data between the smart helmet and the monitoring station. It enables reliable and low-power communication.
2. Heart Rate Sensor: This sensor measures the wearer's heart rate and provides real-time data for monitoring their health condition.
3. Temperature Sensor: The temperature sensor monitors the ambient temperature inside the coal mine and alerts the wearer and monitoring station if it exceeds safe levels.
4. Power Supply: The power supply module provides the necessary electrical power to operate the smart helmet and its components. It can be a rechargeable battery or any other suitable power source.
5. Monitoring Station: This is the central control unit where the data from the smart helmet is received and analyzed. It can display real-time information, generate alerts, and store data for further analysis.
6. The block diagram visually represents the interconnections and flow of data between these components, illustrating how they work together to enhance coal mine safety.

3.3 CIRCUIT DIAGRAM:

For Helmet model:

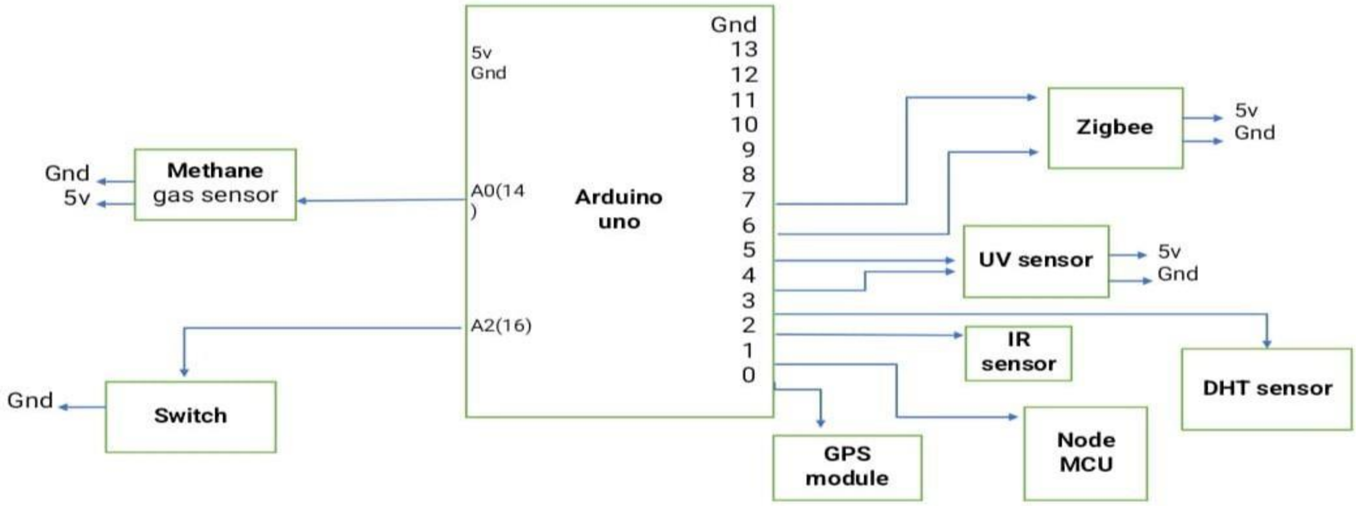


Figure 3.3.1: Circuit Diagram Of Helmet Model

Block diagram that shows how three sensors can be connected to an Arduino Uno.

A UV sensor

An IR sensor

A DHT sensor

The Arduino Uno is a microcontroller board that can be used to read data from sensors and control devices. The sensors in the diagram are all connected to the Arduino Uno using wires.The UV sensor is connected to analog pin A0 (14) on the Arduino Uno. The IR sensor is connected to analog pin A2 (16) on the Arduino Uno.The DHT sensor is not connected to a specific pin in the diagram. The 5v and GND pins on the Arduino Uno provide power to the sensors. The specific pins that the sensors are connected to will depend on the type of sensor and the code that is used to read the data from the sensor. UV sensors are used to measure the amount of ultraviolet (UV) radiation that is present. UV radiation is a type of electromagnetic radiation that can be harmful to human health.IR sensors are used to detect infrared radiation. Infrared radiation is a type of electromagnetic radiation that is invisible to the human eye. IR sensors are often used in motion detectors and security systems.DHT sensors are used to measure temperature and humidity. DHT sensors are commonly used in weather stations and home automation systems.

For Band model:

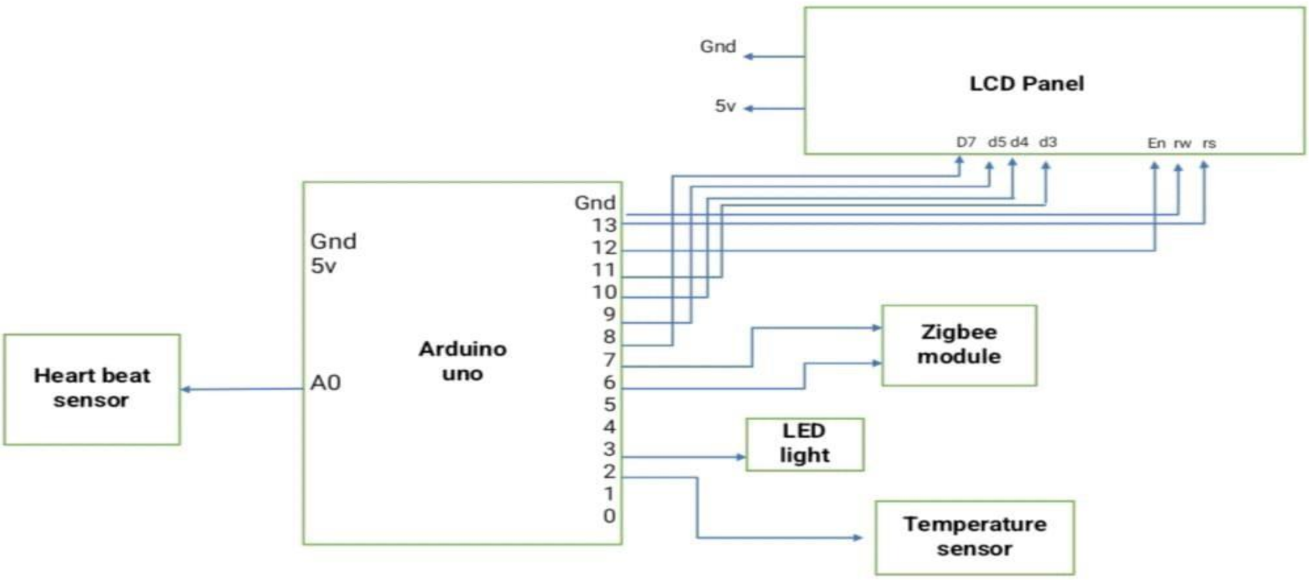


Fig3.3.2: Circuit Diagram Of Band Model

Block diagram of an LCD panel connected to an Arduino Uno board. Arduino Uno: A microcontroller board Wikipedia used for various purposes including controlling electronic devices.LCD Panel: A liquid crystal display panel. This panel displays information electronically.5v and GND: These are the power pins on the Arduino Uno board. They provide 5 volts of power and ground to the other components.D7 - D4: These are digital pins on the Arduino Uno board. They are used to send digital signals to the LCD panel.En, RW, RS: These are control pins for the LCD panel. En stands for Enable, RW stands for Read/Write, and RS stands for Register Select.The wires in the diagram connect the Arduino Uno to the LCD panel. The specific pins that are connected together will depend on the type of LCD panel and the code that is used to control it. Heart Beat Sensor: This sensor detects the heart rate by measuring the change in light caused by blood flow. It typically connects to an analog input on the Arduino. Temperature Sensor: Measures ambient temperature. Its data can be used by the Arduino to display on the LCD or make decisions. Zigbee Module: Enables wireless communication, allowing the band module to send data to a remote system or receive commands. LED Light: Acts as a visual indicator. It can be programmed to blink with each heartbeat or indicate other statuses. LCD Panel: Displays information such as heart rate and temperature readings in real-time. The circuit would be designed to have the sensors connected to the Arduino, which processes the readings. The processed data can then be displayed on the LCD panel and indicated through the LED light. The Zigbee module allows for wireless data transmission to another device or network.

CHAPTER 4

IMPLEMENTATION

Start : The system begins by collecting data from a helmet pressure sensor. exclamation This sensor is likely measuring pressure changes related to the miner's breathing, which could indicate signs of distress or exertion.

Data Collection: Following the initial pressure data collection, the system checks to see if all sensor data has been collected. If not, the system then retrieves data from two other sensors:

Zigbee: This is a wireless communication protocol often used in low-power networks for devices like sensors. expand more In this case, it likely refers to a body area network (BAN) sensor on the miner's body.

GPS: This sensor provides the miner's location underground. Once all sensor data is collected, the system proceeds to check for abnormal activity. This could include: Sudden changes in helmet pressure readings Unusual GPS movements that might suggest a fall or disorientation

Emergency Button: If no abnormal activity is detected, the system then checks to see if the emergency button has been pressed. If the emergency button is pressed, the system bypasses all other checks and sends a message with the miner's location.

Display and Alerts

- **Normal Activity:** If no abnormal activity is detected and the emergency button is not pressed, the system displays the collected data on an LCD screen. This might include helmet pressure readings, GPS location, and any other relevant sensor data.
- **Abnormal Activity Detected:** If the system detects abnormal activity, it will sound an alarm through a buzzer to alert the miner of a potential issue.
- **Emergency:** If the emergency button is pressed, or abnormal activity is detected, the system will also send a message with the miner's location to indicate that help is needed.

4.1 FLOW CHART:

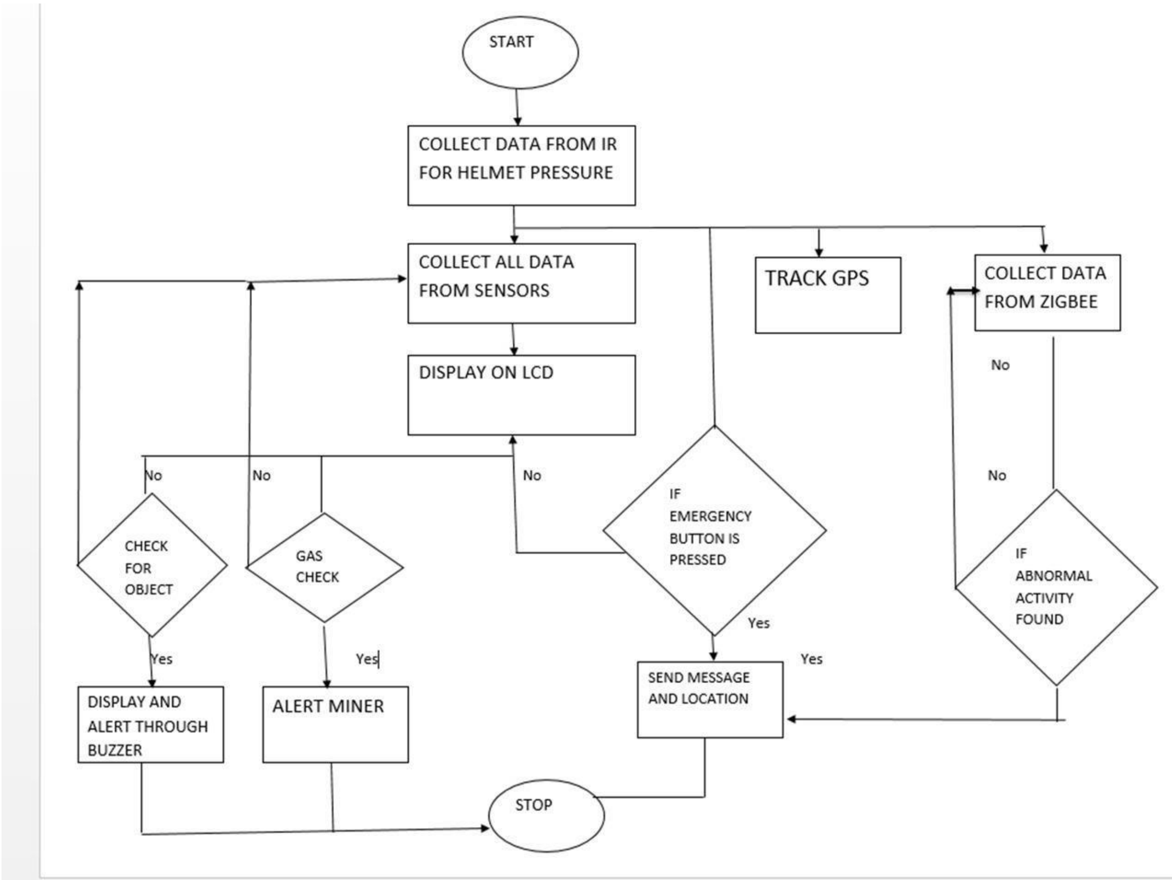


Figure 4.1:Flow Chart

4.2 : REQUIREMENTS

HELMET MODEL

1. Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2010. The microcontroller board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts, such as a rectangular 9-

volt battery. It has the same microcontroller as the Arduino Nano board, and the same headers

as the Leonardo board. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. The word "Uno" means "one" in Italian and was chosen to mark a major redesign of the Arduino hardware and software The Uno board was the successor of the Duemilanove release and was the 9th version in a series of USB-based Arduino boards. Version 1.0 of the Arduino IDE for the Arduino Uno board has now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use a FTDI USB-to-UART serial chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

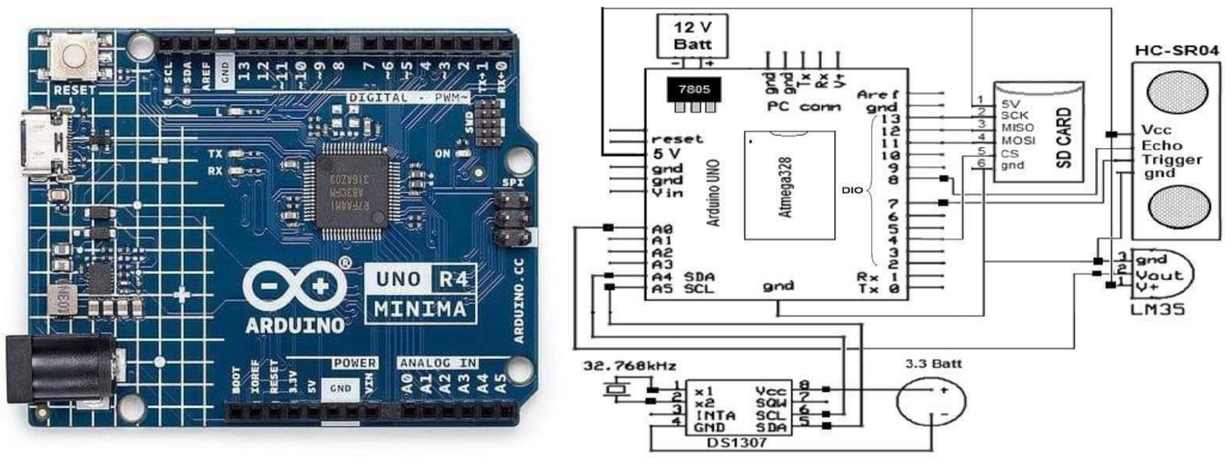


Fig no:4.2.1 ARDUINO UNO

2. UV SENSOR:-

An ultraviolet detector (also known as UV detector or UV-Vis detector)[1][2] is a type of non-destructive chromatography detector which measures the amount of ultraviolet or visible light absorbed by components of the mixture being eluted off the chromatography column. They are often used as detectors for high-performance liquid chromatography.[3] The vast majority of Liquid Chromatographic systems are equipped with ultraviolet (UV) absorption detectors, and the vast majority of them are variable wavelength detectors, which are in fact UV spectrophotometers on the flow. In this detector, it is decided in advance at which wavelength is needed for the detection, and its absorbance as function of time is collected in a graphic format called chromatogram. As can be seen in Figure 1, These detectors have a light source, a dispersion element that is a diffraction grating or prism, a flow cell, to where the sample arrives directly from the chromatographic column, an optical bench of lenses and mirrors, and a diode that receives the light coming from the optical system and translates it into a signal proportional to light intensity. When the user selects a wavelength for the detector, the optical system rotates the grating or prism in the space, so that the desired wavelength passes through optical system, then the flow cell and reaches the diode. The UV/VIS detector then produces a chromatogram as a two-dimensional (2D) output. This output plots time on the x-axis and response in absorbance units (AU) on the y-axis. The chromatogram is then analyzed by integrating the peaks curves to get their area, then getting their retention time (RT) from the peak maximum to identify them, and then perform quantitative analysis, by comparing their area to those of samples

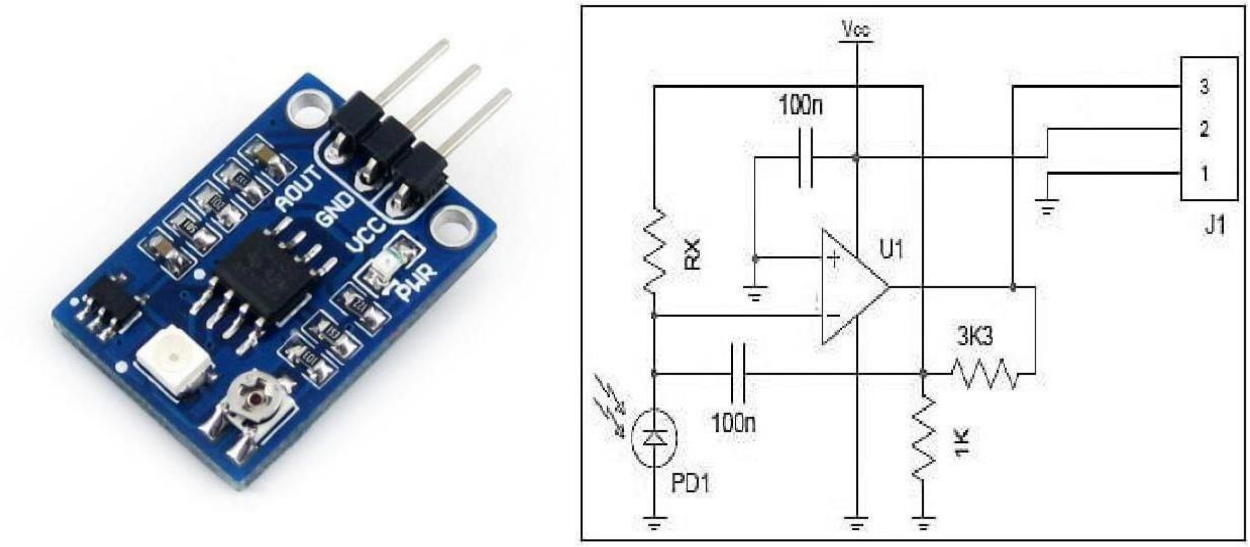


FIG NO:4.2.2 UV SENSOR

3. 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. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received. There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's of specific wavelength used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response**.** An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests. In a defined angle range, the sensor elements detect the heat radiation (infrared radiation) that changes over time and space due to the movement of people. Such infrared sensors only have to meet relatively low requirements and are low-cost mass-produced items. Infra Tec does not supply such products, Infra Tec develops, produces and sells pyro electric detectors.

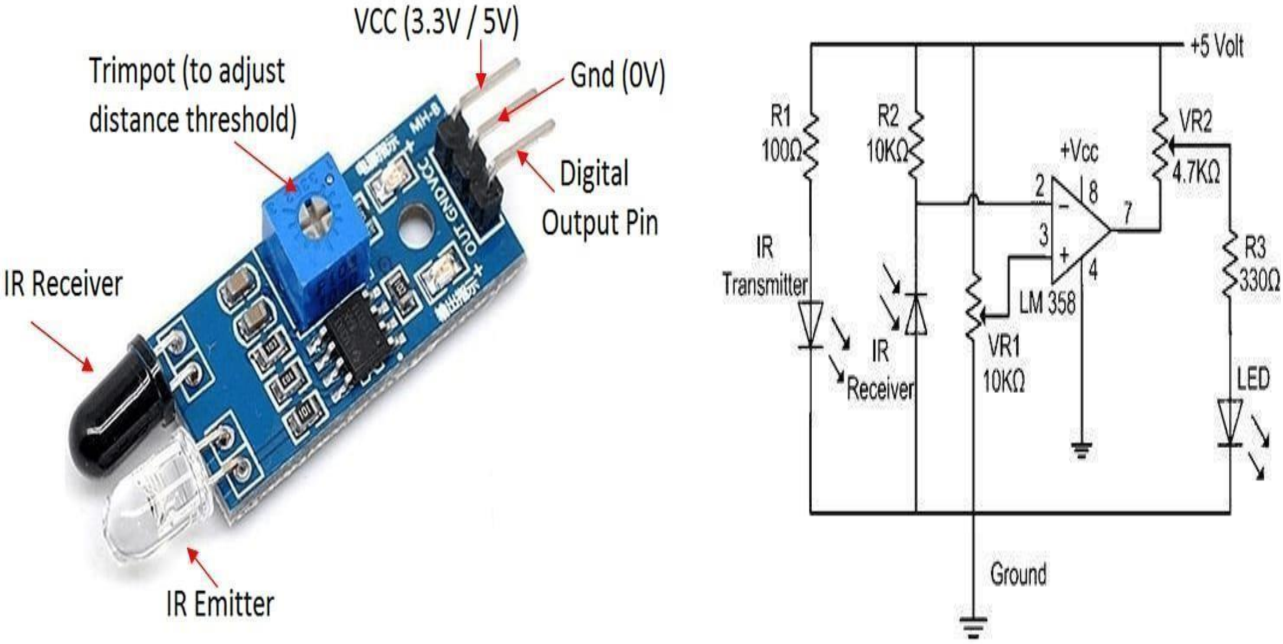


FIG NO:4.2.3 IR SENSOR

4. LCD DISPLAY:-

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. LCDs were a big leap in terms of the technology they replaced, which include light-emitting diode (LED) and gas-plasma displays. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. Where an LED emits light, the liquid crystals in an LCD produces an image using a back light. As LCDs have replaced older display technologies, LCDs have begun being replaced by new display technologies such as OLEDs .A display is made up of millions of pixels. The quality of a display commonly refers to the number of pixels; for example, a 4K display is made up of 3840 x2160 or 4096x2160 pixels. A pixel is made up of three sub pixels; a red, blue and green—commonly called RGB. When the sub pixels in a pixel change color combinations, a different color can be produced. With all the pixels on a display working together, the display can make millions of different colors.

When the pixels are rapidly switched on and off, a picture is created. The way a pixel is controlled is different in each type of display; CRT, LED, LCD and newer types of displays all control pixels differently. In short, LCDs are lit by a backlight, and pixels are switched on and off electronically while using liquid crystals to rotate polarized light. A polarizing glass filter is placed in front and behind all the pixels, the front filter is placed at 90 degrees. In between both filters are the liquid crystals, which can be electronically switched on and off. LCDs are made with either a passive matrix or an active matrix display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently, improving the screen refresh time.

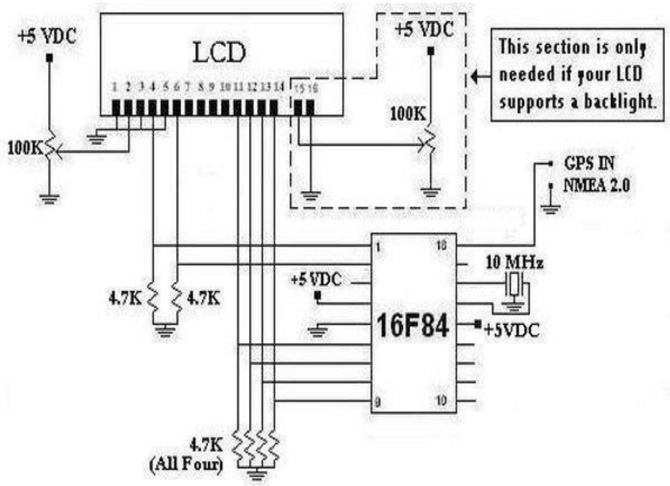


FIG NO:4.2.4 LCD DISPLAY

5. GAS SENSOR:

Gas sensors are generally understood as providing a measurement of the concentration of some analytic of interest, such as CO, CO2, NOx, SO2, without at this point dwelling on the plethora of underlying approaches such as optical absorption, electrical conductivity, electrochemical (EC), and catalytic bead (see Section 3). However, and as discussed in Section 2, many other gas sensors measure a physical property of the environment around them, such as simple temperature, pressure, flow, thermal conductivity, and specific heat, or more complex properties such as heating value, super compressibility, and octane number for gaseous fuels. The latter may require capital-intensive (engines) or destructive testing, for example, via combustion, or involve the measurement of a number of parameters to serve as inputs to a correlation with the complex property of interest.

When the sensor provides a multiplicity of outputs, as with optical or mass spectrometers (MSs), we refer to it as a gas analyzer. Gas chromatography (GC), differential thermal analysis (DTA), ion mobility, and nuclear magnetic resonance (NMR) are additional examples, some of which will be detailed in Section 4. Such analyzers, preferred by the author, should not be confused with sensor arrays, in which different sensing materials (typically polymers and metal oxides) are used on each element of the array, which then needs to conform to difficult-to-achieve stability requirements. The performance of all of the above-mentioned sensors and analyzers may be characterized by their signal-to-noise (S/N) ratio, minimum detectable limit (MDL), selectivity, and response time. Increasingly, power consumption, size, and weight are becoming more important as interest and demand increases for handheld, battery-powered sensors, with or without wireless capability. These specifications may be viewed as simple performance parameters, because they are relatively simple to quantify. Self-calibration, drift, S/N, and false alarm rate (FAR) (mainly for composition sensors or analyzers) require more sophisticated approaches, but are of increasing importance in all applications such as for medical, industrial, environmental, security, and first-responder use. Section 5 goes into the details of this subject.

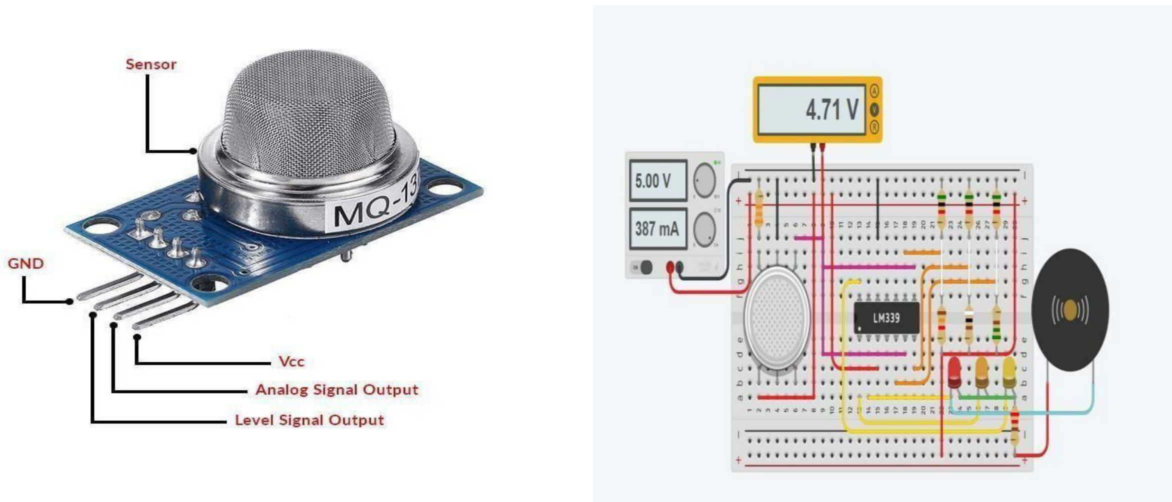


FIG NO:4.2.5 GAS SENSOR

6. DHT11 SENSOR:

Humidity is the measure of water vapour present in the air. The level of humidity in air affects various physical, chemical and biological processes. In industrial applications, humidity can affect the business cost of the products, health and safety of the employees. So, in semiconductor industries and control system industries measurement of humidity is very important. Humidity measurement determines the amount of moisture present in the gas that can be a mixture of water vapour, nitrogen, argon or pure gas etc… Humidity sensors are of two types based on their measurement units. They are a relative humidity sensor and Absolute humidity sensor. DHT11 is a digital temperature and humidity sensor.DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously**.** DHT11 humidity and temperature sensor is available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor. DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measure, process this changed resistance values and change them into digital form. For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature. To get larger resistance value even for the smallest change in temperature, this sensor is usually made up of semiconductor ceramics or polymers.

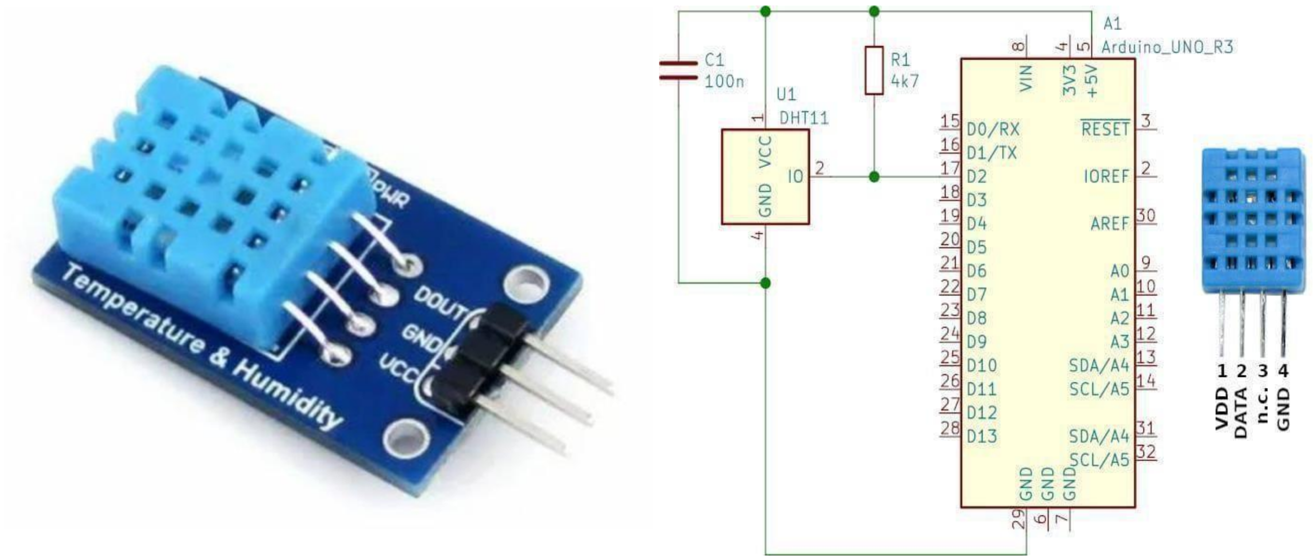
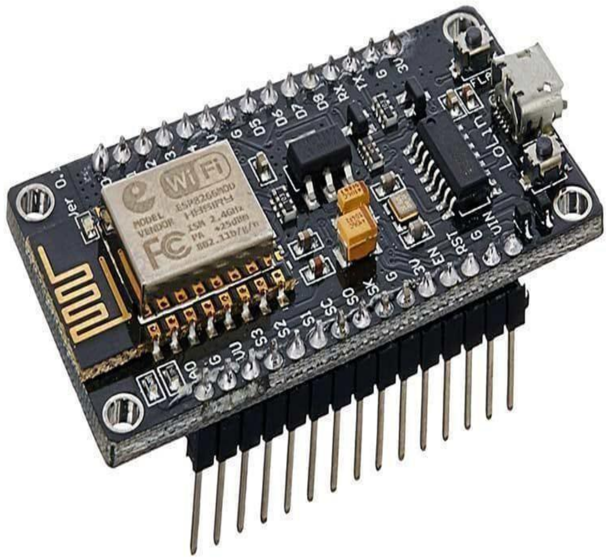


FIG NO:4.2.6 DHT 11 SENSOR

7. NODE MCU:

Node MCU is a low-cost open source IoT platform.[4][5] It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Express if Systems, and hardware which was based on the ESP-12 module.[6][7] Later, support for the ESP32 32-bit MCU was added. Node MCU is an open-source LUA based firmware developed for the ESP8266 Wi-Fi chip. By exploring functionality with the ESP8266 chip, NodeMCU firmware comes with the ESP8266 Development board/kit i.e. Node MCU Development board. Since Node MCU is an open-source platform, its hardware design is open for edit/modify/build. Node MCU Dev Kit/board consist of ESP8266 Wi-Fi enabled chip. The ESP8266 is a low-cost Wi-Fi chip developed by Express if Systems with TCP/IP protocol. For more information about ESP8266, you can refer to the ESP8266 Wi-Fi Module. There is Version2 (V2) available for Node MCU Dev Kit i.e. Node MCU Development Board v1.0 (Version2), which usually comes in black colored PCB. For more information about Node MCU Boards available in the market refer to Node MCU Development Boards Node MCU Dev Kit has Arduino like Analog (i.e. A0) and Digital (D0-D8) pins on its board. It supports serial communication protocols i.e. UART, SPI, I2C, etc. Using such serial protocols we can connect it with serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter + Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards, etc. Node MCU Development board is featured with wifi capability, analog pin, digital pins, and serial communication protocols. To get started with using Node MCU for IoT applications first we need to know about how to write/download Node MCU firmware in Node MCU Development Boards. And before that where this Node MCU firmware will get as per our requirement.



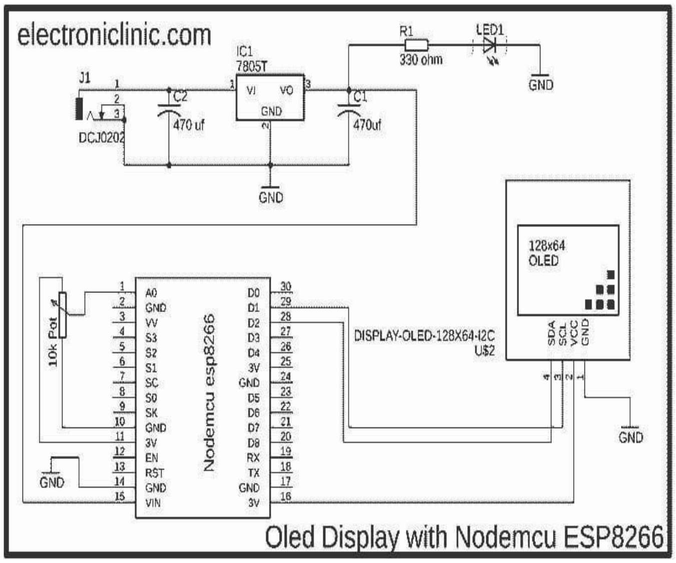


FIG NO:4.2.7 NODE MCU

8. GPS:

The Global Positioning System (GPS), originally Navstar GPS,[2] is a satellite-based radio navigation system owned by the United States government and operated by the United States Space Force.[3] It is one of the global navigation satellite systems (GNSS) that provide geo location and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.[4] It does not require the user to transmit any data, and operates independently of any telephonic or Internet reception, though these technologies can enhance the usefulness of the GPS positioning information. It provides critical positioning capabilities to military, civil, and commercial users around the world. Although the United States government created, controls and maintains the GPS system, it is freely accessible to anyone with a GPS receiver.[5] The Global Positioning System, originally Navstar GPS, is a satellite-based radio navigation system owned by the United States government and operated by the United States Space Force. The Global Positioning System (GPS) is a U.S.-owned utility that provides users with positioning, navigation, and timing (PNT) services. This system consists of three segments: the space segment, the control segment, and the user segment. GPS Was Developed By The U.S. Government. The Russians, or rather the USSR, launched the world's first man-made satellite (Sputnik) in 1957. …Four Is The Magic Number. …There Are Thousands Of Satellites In Orbit. …A Tragedy Inspired Public Use Of GPS.

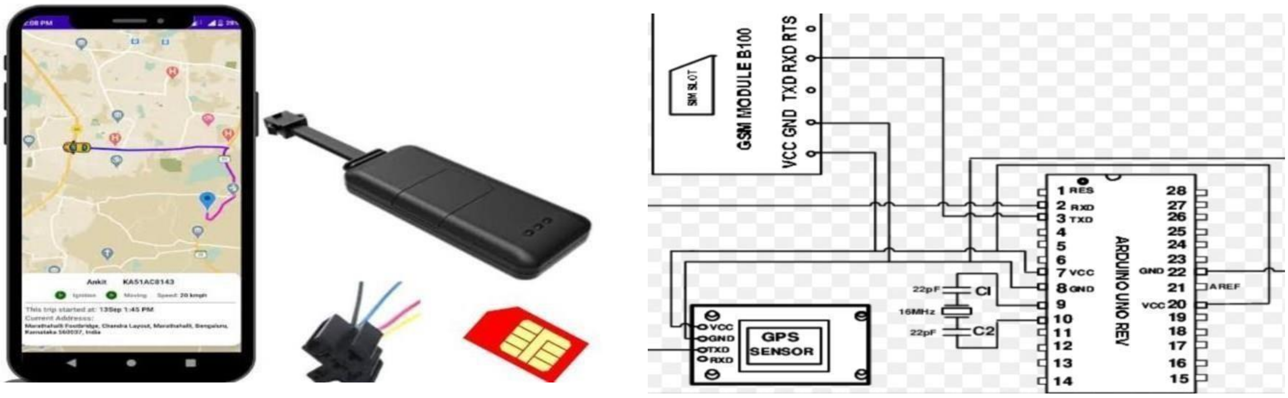


FIG NO:4.2.8 GPS

9. POWER SUPPLY:

A power supply is a device that converts one voltage to another more convenient voltage while delivering power. Power supplies are designed from the output back to the input. Since they are designed after the amplification stages, it is tempting to think of them as an afterthought; indeed, some commercial products reflect this attitude. It is most important to realize that an amplifier is merely a modulator and controls the flow of energy from the power supply to the load. If the power supply is poor and has insufficient energy to meet the amplifier’s peak demands, then the most beautifully designed amplifier will be junk. Valve amplifiers need a DC High Tension (HT) supply and one or more heater, or Low Tension (LT) supplies, which may be AC or DC. Often, the supplies for the pre-amplifier and power amplifier will be derived from the same power supply, which is frequently integral to the power amplifier, but this need not be so. The advent of Power Supply Unit Designer Version 2 freeware in 2003 has transformed the design of linear supplies, but an understanding of the underlying principles enables much faster convergence to an optimum design.

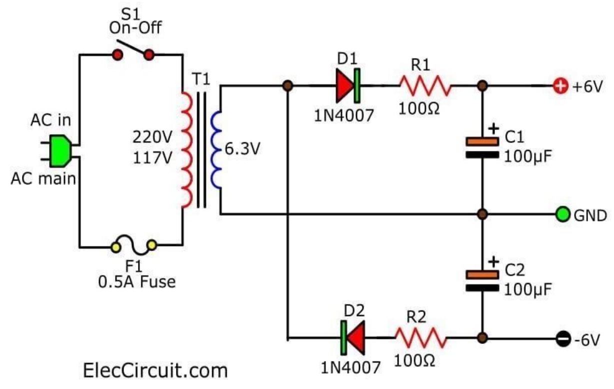


FIG NO:4.2.9 POWER SUPPLY

10. EMERGENCY BUTTON:

The Emergency Power Off (EPO) button, also called an EPO switch or EPO panel, is a safety measure for quickly disconnecting electrical power to a particular piece of equipment, or to an entire facility, in the event of an emergency. E-stop (emergency stop) is a simple, highly visible button designed to shut down operations on heavy and/or dangerous equipment. Used to save lives in industrial operations, E-stops shut down equipment immediately. Panic buttons help to keep employees safe and ensure help is available as quickly as possible in an emergency. Commonly used in both the hospitality and healthcare industries, they allow staff to call for help instantly if they feel threatened or if they suffer a medical emergency. Emergency stop buttons essentially break an electrical circuit to prevent power from passing through. This causes the machinery to stop functioning immediately. When the user presses the emergency button, it sends a call directly to 911 or to the user's predestinated emergency contacts rather than a monitoring center. Open the Settings app on your phone. Scroll down and tap Safety & Emergency. On earlier versions of Android, the Safety & Emergency menu can be found in the Advanced Settings menu. Tap Emergency SOS. Toggle the Use Emergency SOS slider. Push-pull: The button is pushed in to stop and released by pulling the button back. Twist release: The button is pushed in to stop and released by twisting the button. Key release: The button is pushed in to stop and only released with a key.

FIG NO : 4.2.10 EMERGENCY BUTTON

11. HEART BEAT SENSOR:

Heart beat sensors are designed to give digital output heart beat when a finger is placed on it. When the heart beat detector starts working, the light emitting detector (LED) blinks simultaneously for every heartbeat.An optical heart rate sensor measures pulse waves, which are changes in the volume of a blood vessel that occur when the heart pumps blood. Pulse waves are detected by measuring the change in volume using an optical sensor and green LED. Adopting an optical filter optimized for pulse wave detection in the sensor block minimizes the effects of ambient light such as red and infrared rays. This enables high quality pulse signals to be acquired, even outdoors. In addition, leveraging optical sensor technology cultivated over many years allowed ROHM to significantly increase the sensitivity of the sensor block. Support for low brightness low VF LEDs makes it possible to achieve a low power optical heart rate monitoring system without the need for external circuitry (i.e. boost circuit). This contributes to longer operating times in wearables with limited battery capacity. Answer From Edward R. Laskowski, M.D. A normal resting heart rate for adults ranges from 60 to 100 beats per minute. Generally, a lower heart rate at rest implies more efficient heart function and better cardiovascular fitness. Every time your heart beats, it squeezes and propels blood through the network of arteries in your body. Your pulse is the pressure in your arteries going up briefly as your heart pushes out more blood to keep circulation going. Between beats, your heart relaxes, which brings the pressure back down again.

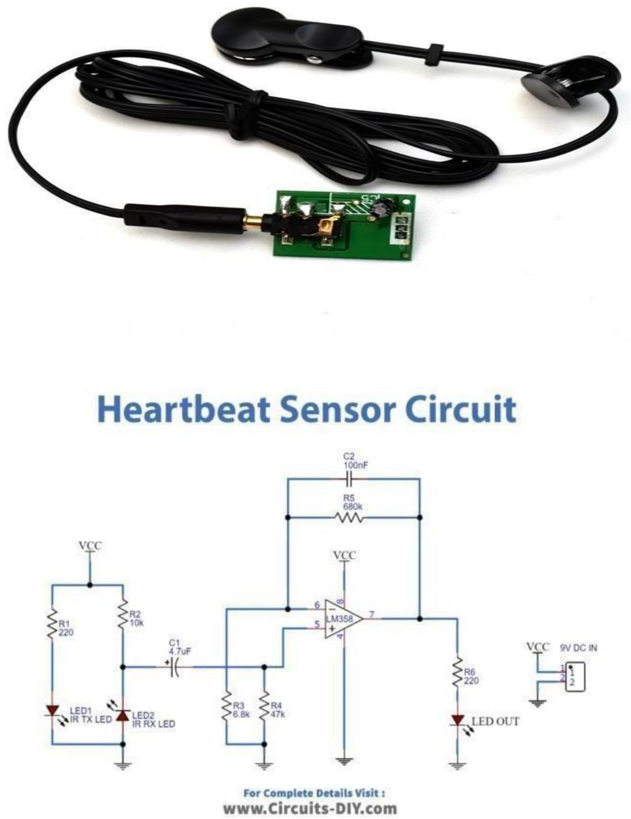


FIG NO : 4.2.11 HEART BEAT SENSOR

12. ZIGBEE:

Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network. The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or more general wireless networking such as Wi-Fi.

Applications include wireless light switches, home energy monitors, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate wireless data transfer. Its low power consumption limits transmission distances to 10–100 meters (30' to 300') line-of-sight, depending on power output and environmental characteristics.[1] Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate[10:28 Its low power consumption limits transmission distances to 10–100 meters (30' to 300') line-of-sight, depending on power output and environmental characteristics.[1] Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking. (Zigbee networks are secured by 128 bit symmetric encryption keys.) Zigbee has a defined rate of up to 250 kbit/s, best suited for intermittent data transmissions from a sensor or input device. Zigbee was conceived in 1998, standardized in 2003, and revised in 2006. The name refers to the waggle dance of honey bees after their return to the beehive.[2]

ZigBee is a Personal Area Network task group with low rate task group 4. It is a technology of home networking. ZigBee is a technological standard created for controlling and sensing the network. As we know that ZigBee is the Personal Area Network of task group 4 so it is based on IEEE 802.15.4 and is created by Zigbee Alliance. ZigBee is an open, global, packet-based protocol designed to provide an easy-to-use architecture for secure, reliable, low power wireless networks. Flow or process control equipment can be place anywhere and still communicate with the rest of the system. It can also be moved, since the network doesn't care about the physical location of a sensor, pump or valve.

FIG NO:4.2.12 ZIGBEE

CHAPTER 5

Source code:

```
#include <TinyGPS.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#include<SoftwareSerial.h>
SoftwareSerial Serial1(6,7);

TinyGPS gps;

void getgps(TinyGPS &gps);

char * dtostrf(
  double __val,
  signed char __width,
  unsigned char __prec,
  char *___s);

#define trigger 4
#define echo 5
int buzzer=15;
float  distance;
int dist;

int ir=2;
int sw=16;

#include<dht.h>
#define dht_dpin 3
dht DHT;
float latitude, longitude;
  float latitude_1, longitude_1;

void setup()
{
  Serial.begin(9600);
  Serial1.begin(9600);

  pinMode(ir,INPUT);
  pinMode(trigger,OUTPUT);
  pinMode(echo,INPUT);
  pinMode(buzzer,OUTPUT);
  pinMode(sw,INPUT_PULLUP);
//  lcd.clear();
//  lcd.setCursor(0,0);
```

```
//  lcd.print(" COAL MINE ");
//  lcd.setCursor(0,1);
// lcd.print(" SAFETY HELMET ");
  Serial.println("COAL MINE SAFETY HELMET");
  delay(1000);
//  lcd.clear();
//  lcd.print("GPS Signal");
//  lcd.setCursor(0, 1);
//  lcd.print("Searching... ");
}
void getgps(TinyGPS &gps)
{

  float latitude,  longitude;
  float latitude_1, longitude_1;

  //decode and display position data

  gps.f_get_position(&latitude, &longitude);

  //lcd.setCursor(0,0);
  Serial.print("Lat:");
  Serial.println(latitude,5);

  Serial.print("Long:");
  Serial.println(longitude,5);

//  lcd.clear();
//  lcd.print("Lat:");
//  lcd.print(latitude,5);
//  lcd.setCursor(0,1);
//  lcd.print("Long:");
//  lcd.print(longitude,5);

   latitude_1=latitude,5;
 longitude_1=longitude,5;

  String one = "LOCATION AT:https://www.google.com/maps/?q=";
  String two = "," ;
  String message = one +latitude_1 +two + longitude_1;

  // Convert String to char array
  int str_len = message.length() + 1;
  char textmessage[str_len];
  message.toCharArray(textmessage,str_len);
  Serial.println(textmessage);
  delay(1000);
  IR_CHECK();
```

```
//

//     String one = "$Landmine Detected  AT:http://www.google.com/search/?q=";


//  String two = "," ;
//  String message = one +latitude +two + longitude+'#';
//
//  // Convert String to char array
//  int str_len = message.length() + 1;
//  char textmessage[str_len];
//  message.toCharArray(textmessage,str_len);
//  Serial.println(textmessage);
//  delay(1000);
 }
   void loop()
{
  byte a;

  if ( Serial.available() > 0 ) // if there is data coming into the serial line

  {

    a = Serial.read(); // get the byte of data

    if(gps.encode(a)) // if there is valid GPS data...
    {

      getgps(gps); // grab the data and display it on the LCD
    }

  }

}
//void BAND_CHECK()
//{
//  if(Serial1.available()>0)
// {
//    char ch=Serial.read();
//    Serial.println(ch);
//    delay(500);
//    if(ch=='H')
//    {
//      Serial.println("$More Heartbeat Detected#");
//      lcd.clear();
//      lcd.setCursor(0,0);
//      lcd.print("MORE HEARTBEAT");
//      lcd.setCursor(0,1);
//      lcd.print("  DETECTED  ");
```

```
//      digitalWrite(buzzer,HIGH);
//      delay(1000);


//      digitalWrite(buzzer,LOW);
//      delay(500);
//
//    }
//    if(ch=='T')


//    {
//      Serial.println("$More Temperature Detected#");
//      lcd.clear();
//      lcd.setCursor(0,0);
//      lcd.print("  MORE BODY  ");
//      lcd.setCursor(0,1);
//      digitalWrite(buzzer,HIGH);
//      delay(1000);
//      digitalWrite(buzzer,LOW);
//      delay(500);
//    }
//  }
//}

void IR_CHECK()
{
  int irval=digitalRead(ir);
  if(irval==LOW)
  {
    Serial.println("HELMET IS WORN");

    delay(1000);
    DHT_CHECK();
    delay(1000);
    UV_CHECK();
    delay(1000);
    EMERGENCY();
    delay(1000);
    METHANE();
    delay(1000);

  }
  else
  {
    Serial.println("Please wear Helmet");
    Serial1.println('A');
    delay(1000);
  }
}
```

```
void DHT_CHECK()
{
  DHT.read11(dht_dpin);


 Serial.print("HUMIDITY");
  Serial.print(DHT.humidity);
  Serial.print("%");
  Serial.println(" ");
  Serial.print("Temperature");
  Serial.print(DHT.temperature);
  Serial.print("C");
  Serial.println(" ");



  delay(1500);
  if(DHT.temperature>34)
  {
    Serial.println("$More temperature in mining area#");
    Serial1.println('B');
    digitalWrite(buzzer,HIGH);
    delay(1000);
    digitalWrite(buzzer,LOW);
    delay(500);
  }

}
void UV_CHECK()
{

  digitalWrite(trigger,LOW);
delayMicroseconds(5);
digitalWrite(trigger,HIGH);
delayMicroseconds(10);
digitalWrite(trigger,HIGH);
distance=pulseIn(echo,HIGH);
dist=distance*0.034/2;
Serial.println(dist);
delay(1000);
  if(dist<30)
  {
    Serial.println("$Object Detected#");
    Serial1.println('C');
    digitalWrite(buzzer,HIGH);
    delay(1000);
    digitalWrite(buzzer,LOW);
    delay(500);
  }
}
```

```
void EMERGENCY()
{
  if(digitalRead(sw)==LOW)


  {

 String one ="Emergency location AT:";
    // String message = "
https://www.google.com/maps/place/Nitte+Meenakshi+Institute+of+Technology/@13.1294627,77.5873473,
20z/";

//     String two = "," ;
     String two ="http://maps.google.com/maps?&z=15&mrt=yp&t=k&q=";




String message= one + two +latitude+','+longitude;
     // Convert String to char array
     int str_len = message.length() + 1;


 char textmessage[str_len];
    message.toCharArray(textmessage,str_len);
    Serial.print('$');
   Serial.print(textmessage);
   Serial.println('#');
   Serial1.println('E');
   delay(1000);
}
}
void METHANE()
{
  int methaneval=analogRead(A0);
  if(methaneval>250)
  {
    Serial.println("$Harmful gases Detected");
    Serial1.println('D');
    digitalWrite(buzzer,HIGH);
    delay(1000);
    digitalWrite(buzzer,LOW);
    delay(500);
  }

}
```

5.1 HELMET MODEL & BAND MODEL

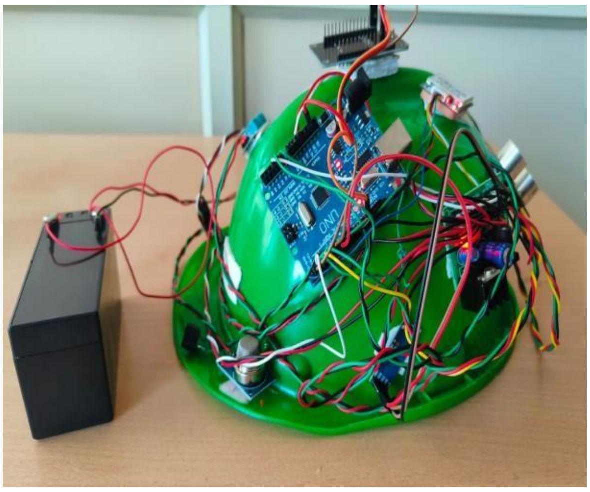


Fig 5.1.1:Helmet Model

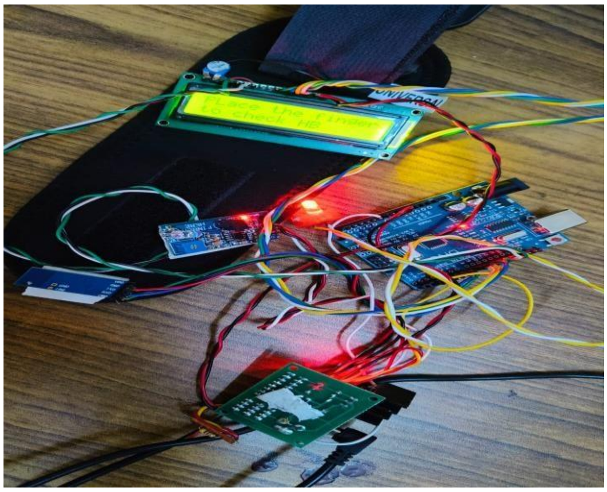


Fig5..1.2:Band Model

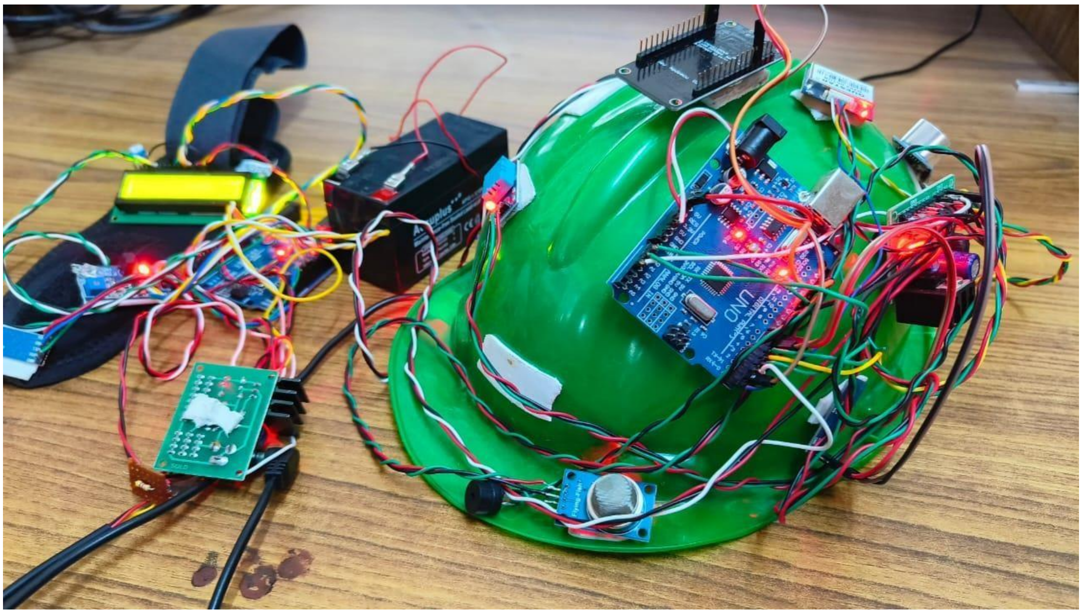


Fig 5.1.3:Helmet And Band Model

5.2 RESULT:

Fig:5.2.1 Result

CONCLUSION:

In conclusion, the "Coal Mine Safety Helmet" project represents a significant leap forward in addressing and mitigating the inherent safety challenges faced by miners in coal mining environments. The project's objectives of enhancing safety protocols, improving emergency response mechanisms, and promoting proactive safety measures have been met through the successful implementation of hardware and software requirements. Coal mine security framework is actualized utilizing Gas sensor, Temperature sensor and Humidity sensor, UV sensor and IR sensor to expand the wellbeing of the coal mineshaft representatives and to guard them. The use of IOT in this device allows for continuous monitoring of coalmine and alerting of workers.

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REFERENCE:

[1] Ninni Singh, Vinit Kumar Gunjan, Gopal Chaudhary, Rajesh Kaluri, Nancy Victor, Kuruva Lakshmanna. IoT enabled HELMET to safeguard the health of mine workers. Science Direct, Computer Communications Volume 193, 1 September 2022

[2] V. Jayasree,M. Nivetha Kumari, "IOT Based Smart Helmet for Construction Workers", IEEE 7th International Smart Structures and Systems ICSSS 2020

[3] Mangala Nandhini. V, Padma Priya G.V, Nandhini. S, Mr. K.Dinesh, "IoT based Smart Helmet for ensuring Safety in Industries",2018 International Journal of Engineering Research & Technology (IJERT), Department of Computer Science and Engineering Kongu Engineering College Perundurai, Erode

[4] Kodali, R.K., and Sahu S, "IoT based Safety System for Coal Mines", Institute of Electrical and Electronics Engineers, 2018

[5] Maviya Noorin, Suma KV, "IoT based wearable device using WSN technology for miners", 2018 3rd IEEE, Information & Communication Technology (RTEICT-2018), MAY 18th & 19th 2018

[6] Prof. Deepali Shinkar1, Saili S Garad2, Manali S Joshi3, Komal A Nimbhorkar4, Amir R Patel5 "IoT Based Smart Helmet for Coal Mining Tracking" Volume: 06 Issue: 12 (IRJET)

[7] C. j. Behr, A. Kumar and G. P. Hancke, "A Smart Helmet for Air Quality and Hazardous Event Detection for the Industry", IEEE, PP. 2028-2031, 2016