A PROJECT REPORT ON

"WEATHER AND POLLUTION MONITORING SYSTEM FOR MINING"

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UNDERTAKING

I declare that the work presented in this project titled **"WEATHER AND POLLUTION MONITORING SYSTEM FOR MINING"**, submitted to the All India council of robotics and Automation, for the award of the Internship in **INTERNET OF THINGS (IOT)**, is my original work. I have not plagiarized or submitted the same work for the award of any other Internship. In case this undertaking is found incorrect, I accept that my Project may be unconditionally withdrawn.

OCTOBER, 2021

B.E ELECTRONICS AND COMMUNICATION

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CERTIFICATE

Certified that the work contained in the project titled **"WEATHER AND POLLUTION MONITORING SYSTEM FOR MINING"**, by SUDHARANI AND SHESHADRI A has been carried out under my supervision and that this work has not been submittedelsewhere for a Internship..

All India Council of Robotics and Automation
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Chapter 1

INTRODUCTION

1.1 Introduction

Weather condition plays an important role in our daily life as weather and climate are the most ubiquitous factors for home and environment planning. Moreover, the tremendous development of internet nowadays made possible to monitor weather conditions and collect the respective data in-situ. All the objects, sensors and devices can be linked through Internet to share and analyse the data collected at various locations. The Internet of Things (IOT) can be much more extensive in predicting and knowing the weather conditions in particular place by connecting this weather station to the Internet.

Fig 1.1 Contemporary of underground mining

The climate in general in capricious that is hard to predict nowadays. With advanced technology to help humanity and bring convenience to the society, it is now the time for the weather broadcasting to be implemented into mobile phone instead of keep checking through only television or radio. However, with the mobile weather checking system we have in this era still often we see people rushing for

schedule under the rain without umbrella; laundries are still showering by rain; home panted plants are wilted due to the hot and dry weather.

Therefore, the objective of this project is to create an online weather system which enables user to check real time weather parameters of a place anytime and anywhere with just a few button click. On top of that, people will receive real time notification or reminder. Weather prediction will be done which allows user to get themselves prepared for their plans in the current weather.

Google cloud platform is chosen because it is easy to set up, easy to run, and with security built in features. It will be used to do data analysis and building a mobile weather checking applications. Google cloud is suitable to be used in this project that needs several functions provided in this platform in order to obtain desired result.

1.2 Abstract

The level of pollution is increasing rapidly due to factors like industries, urbanization, increasing in population, vehicle use which can affect human health. IOT Based Weather and Pollution Monitoring System is used to monitor the Air Quality by using sufficient sensors. It will trigger an buzzer and as well as display same on the LCD display when the air quality goes down beyond a certain level, means when there are sufficient amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3 and NOx. It will show the air quality in PPM on the LCD so that Weather and pollution can be monitored very easily.

Chapter 2

LITERATURE SURVEY

2.1 Problem Statement

To provide efficient decision support by using RaspberryPi to ensure proper Weather and Pollution Monitoring System for mines.

2.2 Objectives

The main aim of the project is to completely work on to provide an alert system for rescuing the employees in mining environments. The use of IOT is centralized for the communication and to know the status of the employee and underground areas.

The weather and pollution monitoring system has a 9 applications they are as follows room temperature and humidity to monitoring the room , soil moisture is to know the soil level, rain level is to know the rain falling on the open cast mining, wind speed to know the wind speed, co if co level is increased it causes the human health, LCD to continuously displaying the reading of mining and the employee heart and pulse rate , sound sensor to intimate if any variation occurred in the undergrounds, Wi-Fi module, heart and pulse rate

2.3 Hardware and Software Requirements

2.3.1 Hardware

Raspberry pi

Temperature and humidity sensor

Soil moisture sensor

Rain level sensor

Wind sensor

CO sensor

LCD

Sound sensor

Wi-Fi module

Heart & pulse rate sensor

2.3.2 Software

Spider

Chapter 3

METHODLOGY

3.1 Block Diagram Of Weather And Pollution Monitoring SysteM

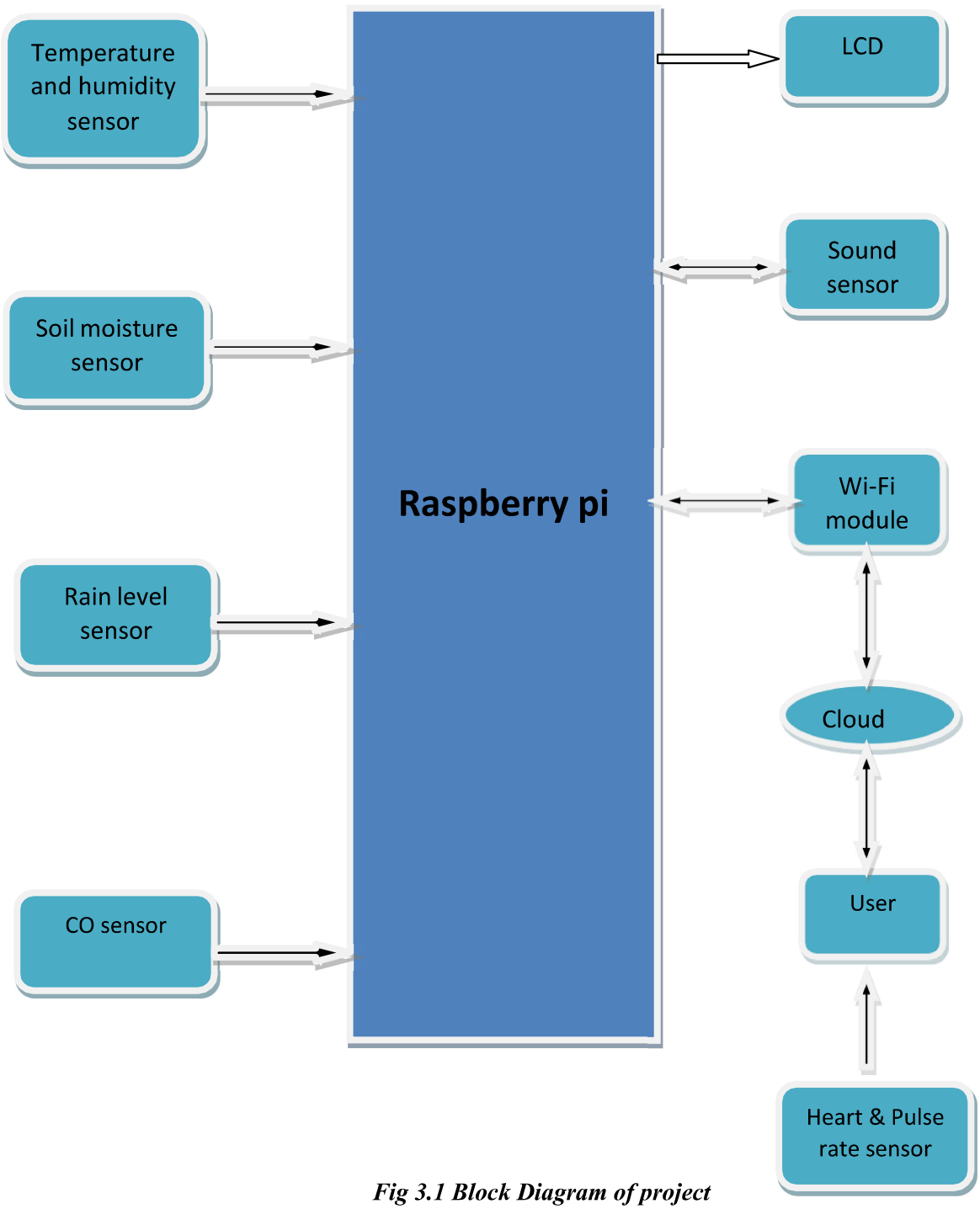


Fig 3.1 Block Diagram of project

The above shows the block diagram of our project "Weather and Pollution Monitoring System". It consist of a hardware components and sensors that is Raspberry pi, room and humidity sensor, soil moisture, rain level, wind sensor, CO sensor, heart & pulse rate sensor, Wifi module, sound sensor, LCD.

RaspberryPi

The Raspberry Pi 3 Model B is the earliest model of the third-generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February 2016.

The raspberry pi 3, it is a quad core 1.2 GHz 64 bit CPU, 1 GB of RAM, wireless LAN and Bluetooth low energy,40 pin are used for GPIO, 4 USB 2 Ports, 4pole stereo output, full size HDMI these are available in raspberry pi 3.

Soil Moisture Sensor

The Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The soil moisture sensor is pretty straight forward to use.

If the area is dry or wet it will be displayed on the LCD display.

Heart & Pulse Rate Sensor

The working of the **Pulse/Heart beat sensor** is very simple. The sensor has two sides, on one side the LED is placed along with an ambient light sensor and on the other side we have some circuitry.

CO Ssensor

A **Carbon Monoxide monitor** is essential for CO detection for a number of reasons. Primarily because it detects the presence of CO which can prevent carbon monoxide poisoning. The gas is tasteless, odorless, and colorless, and therefore it cannot be detected by vision or smell, which makes a CO sensor vital.

Rain Level Sensor

A rain sensor is one kind of switching device which is used to detect the rainfall. It works like a switch and the working principle of this sensor is, whenever there is rain, the switch will be normally closed.

Temperature & humidity sensor:-

Each DHT11 is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programmers in the OTP memory, which are used by the sensor's internal signal detecting process.

Buzzer

We have used a Piezo buzzer , it gives a sound so that the rescue team can alert.

LCD Panel

Liquid Crystal Display s used to display the readings of the sensor, so that the rescue team can continuously monitoring and if any variation in the readings so immediately the employee can move from that place.

Chapter 4

HARDWARE COMPONENTS

4.1 Rasbperry Pi

Raspberry Pi 3 is just like a small computer that comes with CPU, GPU, USB ports and i/o pins and can be connected with external peripherals and helps in running number of operations like regular computer. First generation Raspberry Pi was developed in 2012, with the intention of making computer learning easy for school students. Learning advanced computer functions in the beginning of computer learning process is not easy for everyone. This tine computer was introduced, so everyone can get a hint of some initial functions advanced computer is capable of doing. Let's dive in and explore each and every feature of Raspberry Pi 3

- **Raspberry Pi 3** is tiny single board computer, introduced by Raspberry Pi Foundation, that comes with CPU, GPU, USB ports and i/o pins and capable of doing some simple functions like regular computer.
- This tiny computer was developed with the purpose of making computer learning process easy so an average student can get benefit and anticipate what an advanced computer can do.
- Raspberry Pi 1(first generation Model B) came into play in 2012, and soon got a renowned reputation in terms of ease of use and availability. Similarly, Raspberry Pi 2 was introduced in Feb,2015 will little improvement in design with added RAM than its previous version.

Introduced in 2016, **Raspberry Pi 3 Model B** comes with a quad core processor that shows robust performance which is 10 times more than Raspberry Pi 1. And speed exhibits by Raspberry Pi 3 is 80% more than Raspberry Pi 2

- The Raspberry hardware has gone through a number of variations in terms of peripheral device support and memory capacity. Every new addition comes with a little improvement in terms of design where advance features are added in the device so it can do as many function as possible like a regular computer.
- WiFi and Bluetooth that lack in older versions (Pi 1 and Pi 2), are added in the new addition of this device (Pi 3), allowing to maintain the connection with the peripherals without the involvement of any physical connection.
    - These are the 40 GPIO pins that are used for connection with other devices.

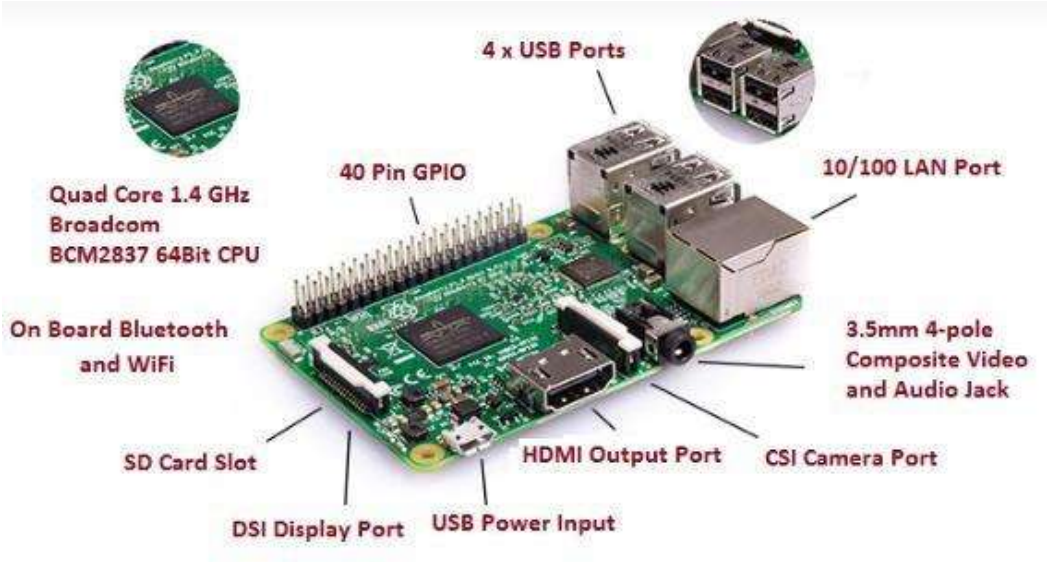


Fig 4.1(A) Physical appearance

- Raspberry Pi Foundation recently launched **Raspberry Pi 3 Model B+** on 14 March 2018, which is the most recent version of Raspberry Pi 3 that exhibits all the specifications introduced in Pi 3 Model B, with the additional improvement including Network boot, USB boot, and Power over Ethernet which make the device useful in hard to reach places.

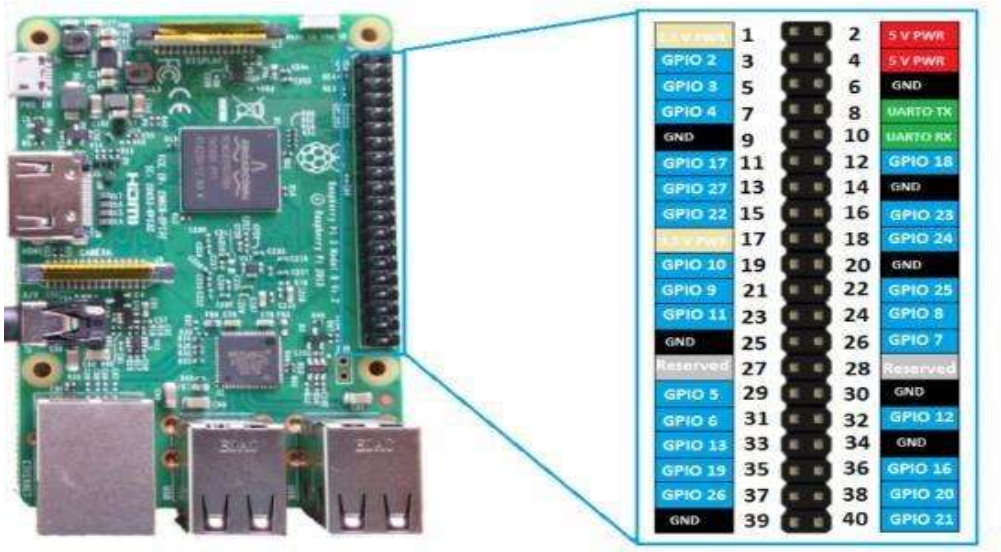


Fig 4.1(B) Pin configuration

- You can see from the figure above, the UART pins are the serial input output pins that are used for serial communication for data and for the conversion of debugging code.

Hardware Specification

- Raspberry Pi 3 Model B comes with **64 bit quad core processor**, on board WiFi and Bluetooth and USB features.
- It has a processing speed ranging from 700 MHz to 1.4 GHz where RAM memory ranges from 256 to 1GB.
    - The **CPU** of this device is considered as the brain of the device which is responsible for executing numbers of instructions based on mathematical and logical operation.
    - The **GPU** is another advanced chip incorporated in the board that carries out function of image calculation. The board is equipped with Broad cam video core cable that is mainly used for playing video games through the device.
    - The Pi 3 comes with **GPIO** (General Purpose Input Output) pins that are essential to maintain connection with other electronic devices. These input output pins receive commands and work based on the programming of the device.
    - The **Ethernet port** is incorporated on this device that sets a pathway for communicating with other devices. You can connect Ethernet port to the router to maintain a connection for internet.
    - The Board has four **USB ports** that are used for communication and **SD card** is added for storing the operating system.
    - **Power source connector** is a basic part of the board that is used to provide 5 V power to the board. You can use any source to set up a power for the board, however, it is preferred you connect power cable through laptop USB port for providing 5 V.
    - The Pi 3 supports two connection options including **HDMI** and **composite**. The HDMI connector is used to connect LCD or TV, that can support 1.3 and 1.4 version cables. Composite video connection is used to connect the older version of TV with the device that uses the 3.5mm jack socket for the audio production.
    - The new device comes with a video core multimedia **3D graphics** which is capable of playing 1080 MP video. This feature puts this advice ahead of its predecessors where video quality was not that much upgraded.
    - The **USB hard drive** incorporated on the board is used to boot the device, similar to PC hard drive where windows is used to boot the computer hard drive.

Features:

- 1.4 GHz 64 bit, Broadcom BCM2387 ARM Cortex-A53 Quad Core Processor, which is 10 times faster than Raspberry Pi 1.
- 1GB RAM (LPDDR2 SDRAM) which allows you to run more advanced applications
- On-board wireless LAN, used to connect device through wireless
- On-board Bluetooth
- 4 USB ports for communication
- 300Mbit/s ethernet
- 40 GPIO pins
- Full size HDMI 1.3a port
- 10/100 BaseT Ethernet socketbr
- Fully HAT compatible
- Combined 3.5mm analog audio and composite video jack
- Camera interface (CSI), for connecting camera
- Display interface (DSI) used for connecting Raspberry Pi touch screen display
- Micro SD slot for storing data
- Micro USB power source
- Full size HDMI
- Video Core IV multimedia/3D graphics core @ 400MHz/300MHz

4.2 Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners.

Technologies commonly used to indirectly measure volumetric water content (soil moisture) include Frequency Domain Reflectometry (FDR): The dielectric constant of a certain volume element around the sensor is obtained by measuring the operating frequency of an oscillating circuit.

Time Domain Transmission (TDT) and Time Domain Reflectometry (TDR): The dielectric constant of a certain volume element around the sensor is obtained by measuring the speed of propagation along a buried transmission line.

Neutron moisture gauges: The moderator properties of water for neutrons are utilized to estimate soil moisture content between a source and detector probe.

Soil resistivity: Measuring how strongly the soil resists the flow of electricity between two electrodes can be used to determine the soil moisture content.

Galvanic cell: The amount of water present can be determined based on the voltage the soil produces because water acts as an electrolyte and produces electricity. The technology behind this concept is the galvanic cell.

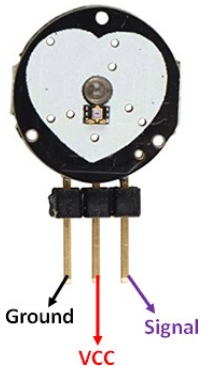
Soil Moisture Sensor / Water Detector

4.2 Physical appearance

The Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The soil moisture sensor is pretty straight forward to use. The two large exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance, and a higher SIG out. To get the Soil Moisture Sensor functioning all you will need is to connect the VCC and GND pins to your Arduino • based device (or compatible development board) and you will receive a SIG out which will depend on the amount of water in the soil. One commonly known issue with soil moisture sensors is their short lifespan when exposed to a moist environment. To combat this, we've had the PCB coated in Gold Finishing (ENIG or Electro less Nickel Immersion Gold). We recommend either a simple 3•pin screw pin terminal or a 3•pin jumper wire assembly (both can be found in the Recommended Products section below) to be soldered onto the sensor for easy wiring.

4.3 Heart & Pulse Rate Sensor

4.3(A) Physical appearance



4.3(B) Pin Configuration

The working of the **Pulse/Heart beat sensor** is very simple. The **sensor** has two sides, on one side the LED is placed along with an ambient light sensor and on the other side we have some circuitry. This circuitry is responsible for the amplification and noise cancellation work. The LED on the front side of the sensor is placed over a vein in our human body. This can either be your Finger tip or you ear tips, but it should be placed directly on top of a vein.

Now the LED emits light which will fall on the vein directly. The veins will have blood flow inside them only when the heart is pumping, so if we monitor the flow of blood we can monitor the heart beats as well. If the flow of blood is detected then the ambient light sensor will pick up more light since they will be reflect ted by the blood, this minor change in received light is analyzed over time to determine our heart beats.

Pin Configuration

Pin Number	Pin Name	Wire Colour	Description
1	Ground	Black	Connected to the ground of the system
2	Vcc	Red	Connect to +5V or +3.3V supply voltage
3	Signal	Purple	Pulsating output signal.

Using the pulse sensor is straight forward, but positioning it in the right way matters. Since all the electronics on the sensor are directly exposed it is also recommended to cover the sensor with hot glue, vinyl tape or other non-conductive materials. Also it is not recommended to handle these sensors with wet hands. The flat side of the sensor should be placed on top of the vein and a slight presser should be applied on top of it, normally clips or Velcro tapes are used to attain this pressure.

To use the sensor simply power it using the Vcc and ground pins, the sensor can operate both at +5V or 3.3V system. Once powered connect the Signal pin to the ADC pin of the microcontroller to monitor the change in output voltage. If you are using a development board like Arduino then you can use the readily available code which will make things a lot easier. Refer the datasheet at the bottom of the page for more information on how to interface the sensor with Arduino and how to mount it. The schematics of the sensor, code and processing sketch can be obtained from the Sprakfun product page.

Applications

- Sleep Tracking
- Anxiety monitoring
- Remote patient monitoring/alarm system
- Health bands
- Advanced gaming consoles

4.4 Rain Level Sensor

Nowadays, conserving water as well as its proper usage is essential in everyone's life. Here is a sensor namely rain sensor which is used to detect the rain and generate an alarm. So, we can conserve water to use it later for different purposes. There are several methods available for conserving water like harvesting, etc using this method we can increase the level of underground water. These sensors are mainly used in the field like automation, irrigation, automobiles, communication, etc. This article discusses a simple as well as reliable sensor module which can be available at low cost in the market.

A rain sensor is one kind of switching device which is used to detect the rainfall. It works like a switch and the working principle of this sensor is, whenever there is rain, the switch will be normally closed.

The rain sensor module/board is shown below. Basically, this board includes nickel coated lines and it works on the resistance principle. This sensor module permits to gauge moisture through analog output pins & it gives a digital output while moisture threshold surpasses.

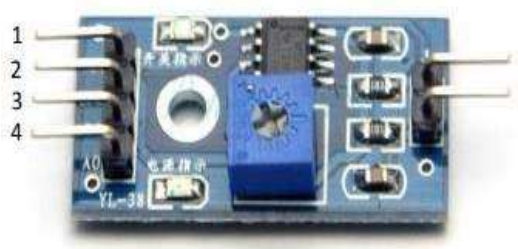


Fig 4.4(A) Physical appearance

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

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

Pin Configuration

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

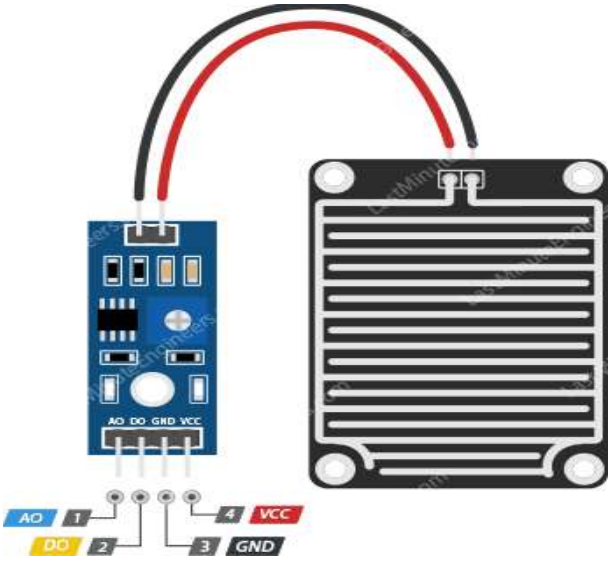


Fig 4.4(B) Pin configuration

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

Specifications

The specifications of the rain sensor include the following.

- This sensor module uses good quality of double-sided material.
- Anti-conductivity & oxidation with long time use
- The area of this sensor includes 5cm x 4cm and can be built with a nickel plate on the side
- The sensitivity can be adjusted by a potentiometer

- The required voltage is 5V
- The size of the small PCB is 3.2cm x 1.4cm
- For easy installation, it uses bolt holes
- It uses an LM393 comparator with wide voltage
- The output of the comparator is a clean waveform and driving capacity is above 15mA

4.5 Temperature and Humidity Sensor:-

This module integrates DHT11 sensor and other required components on a small PCB. The DHT11 sensor includes a resistive-type humidity measurement component, an NTC temperature measurement component and a high-performance 8-bit microcontroller inside, and provides calibrated digital signal output. It has high reliability and excellent long-term stability, thanks to the exclusive digital signal acquisition technique and temperature & humidity sensing technology.

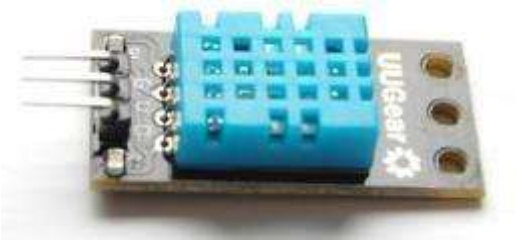
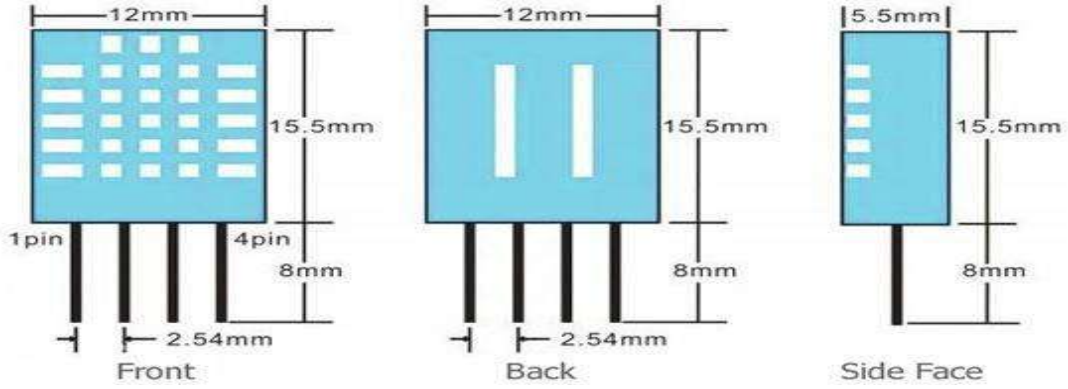


Fig 4.5(A) physical Appearance

Each DHT11 is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programmes in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request.



The module is actually a PCB that has DHT11 component soldered with a few components, and it is a 3-wire module:

Fig 4.5(B) Pin configuration

1. VCC connected to +3.3V~5V
2. DATA connected to the microcontroller IO port
3. GND connected to ground

Technical Specifications

Power Supply： 3.3~5.5V DC

Output： 4 pin single row

Measurement Range： Humidity 20-90%RH, Temperature 0~50℃Accuracy

： Humidity +-5%RH, Temperature +-2℃

Resolution： Humidity 1%RH, Temperature 1℃

Interchangeability： Fully Interchangeable

Long-Term Stability：<±1%RH/year

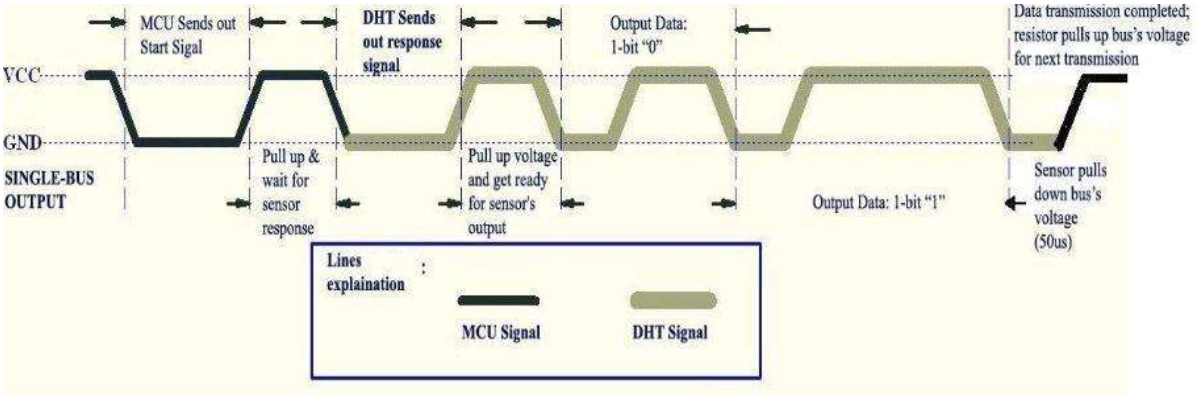
How to Process the Data

Single bus data format is used for the communication and synchronization between MCU and the DHT11 sensor. Each communication process will last about 4ms.

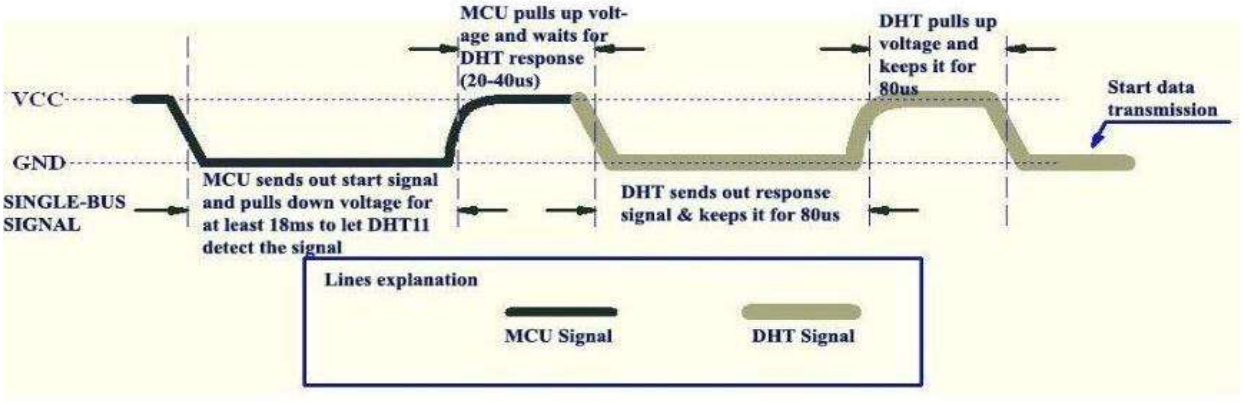
The data is transmitted in this format:

- 8bit integral RH data +
- 8bit decimal RH data +
- 8bit integral T data +
- 8bit decimal T data +
- 8bit check sum.

If the data transmission is correct, the check sum should equals to the lower 8bit of the result of "8bit integral RH data + 8bit decimal RH data + 8bit integral T data + 8bit decimal T data".



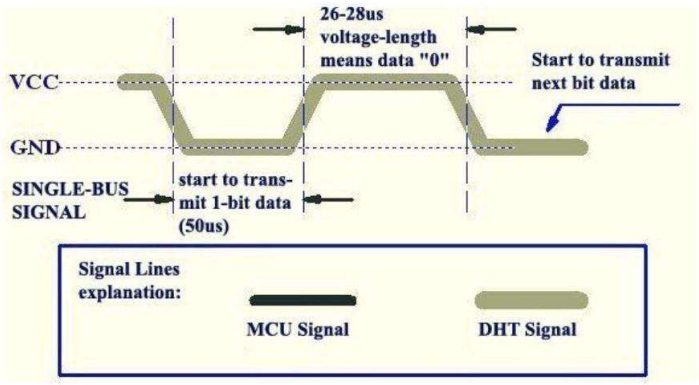
The default status of the DATA pin is high. When the communication between MCU and DHT11 starts, MCU will pull down the DATA pin for least 18ms. This is called "Start Signal" and it is to ensure DHT11 has detected the signal from MCU. Then MCU will pull up DATA pin for 20-40us to wait for DHT11's response.



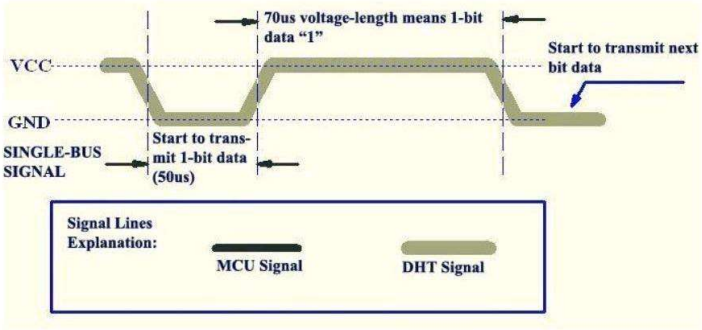
Once DHT11 detects the start signal, it will pull down the DATA pin as "Response Signal", which will last 80us. Then DHT11 will pull up the DATA pin for 80us, and prepare for data sending.

During the data transition, every bit of data begins with the 50us low-voltage-level and ends with a high-voltage-level signal. The length of the high-voltage-level signal decides whether the bit is “0” or “1”.

Data bit “0” has 26-28us high-voltage length:



While data bit “1” has 70us high-voltage length:



Connection with GPIOs on Raspberry Pi

Besides the VCC and GND, you just need to use one GPIO pin on the Raspberry Pi to make use of the DHT11 module.

Raspberry Pi	DHT11 Module
3.3v P1	VCC (V)
GND P6	GND (G)
GPIO4 P7	DATA (S)

4.6 Co Sensor

Carbon Monoxide is a chemical compound which consists of one carbon atom and one oxygen atom. It is a colourless, odourless and flammable gas at room temperature, and can be detected using a CO sensor.

Fig 4.6(A) Physical appearance.

When carbon monoxide is encountered in concentrations of over 35 ppm it is toxic to humans and animals that use hemoglobin as an oxygen carrier. Carbon monoxide causes harm by combining with hemoglobin to form carboxyhaemoglobin, which prevents the blood from carrying oxygen.

CO is produced during the incomplete burning of organic matter. This can occur from motor vehicles, heaters, or cooking equipment that run on carbon-based fuels. It can also occur from exposure to methylene chloride. Therefore, Carbon monoxide is spatially variable and short lived in the atmosphere, where it has a role in forming ozone at a ground level.

A **Carbon Monoxide monitor** is essential for CO detection for a number of reasons. Primarily because it detects the presence of CO which can prevent carbon monoxide poisoning. The gas is tasteless, odorless, and colorless, and therefore it cannot be detected by vision or smell, which makes a CO sensor vital.

Applications for a Carbon Monoxide Monitor

Carbon monoxide sensing using a CO sensor takes place across a number of different applications.

- Carbon Monoxide detection for Gasification
- Endothermic Process and Heat Treatment Furnaces
- Process Control
- HVAC

4.7 Piezo Buzzer

Piezo buzzer is an electronic device commonly used to produce sound. Light weight, simple construction and low price make it usable in various applications like car/truck reversing indicator,

computers, call bells etc. Piezo buzzer is based on the inverse principle of Piezo electricity discovered in 1880 by Jacques and Pierre Curie. It is the phenomena of generating electricity when mechanical pressure is applied to certain materials and the vice versa is also true. Such materials are called Piezo electric materials. Piezo electric materials are either naturally available or manmade. Piezo ceramic is class of manmade material, which poses Piezo electric effect and is widely used to make disc, the heart of Piezo buzzer. When subjected to an alternating electric field they stretch or compress, in accordance with the frequency of the signal thereby producing sound.

The Piezo buzzer produces sound based on reverse of the piezoelectric effect. The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principle. These buzzers can be used alert a user of an event corresponding to a switching action, counter signal or sensor input. They are also used in alarm circuits. The buzzer produces a same noisy sound irrespective of the voltage variation applied to it. It consists of piezo crystals between two conductors. When a potential is applied across these crystals, they push on one conductor and pull on the other. This, push and pull action, results in a sound wave. Most buzzers produce sound in the range of 2 to 4 kHz.

Fig 4.7(A) Physical appearance

The above image shows a very commonly used Piezo buzzer also called Piezo transducer operating at DC voltage. Encapsulated in a cylindrical plastic coating, it has a hole on the top face for sound to propagate. A yellow metallic disc which plays an important role in the producing sound can be seen through the hole.

4.8 LCD (Liquid Crystal Display)

LCD (Liquid Crystal Display) is made of nematic liquid crystals sandwiched between layers of filter glass, electrodes and polarizing film kept in front of mirror. Normally this crystal are in twisted state and allow light to pass through them so when there is no current, light entering through the front of the LCD will simply hit the mirror and bounce right back out.But when the circuit supplies current to the electrodes, the liquid crystals between the common-plane electrode and the electrode shaped like a rectangle untwist and block the light in that region from passing through. That makes the LCD show the rectangle as a black area.

16 X 2 lines LCD are Common-plane-based LCD which is simplest LCD in market and most of them are backlit by LED. To control the functioning of LCD there is a onboard controller H44780 Character LCD is a industry standard liquid crystal display (LCD) display device designed for interfacing with embedded systems. These screens come in a variety of configurations including 8x1, which is one row of eight characters, 16x2, and 20x4.

These LCD screens are limited to text only and are often used in copiers, fax machines, laser printers, industrial test equipment, networking equipment such as routers and storage devices. Character LCDs can come with or without backlights, which may be LED, fluorescent, or electroluminescent. Character LCDs use a standard 14-pin interface and those with backlights have 16 pins. The pinouts are as follows:

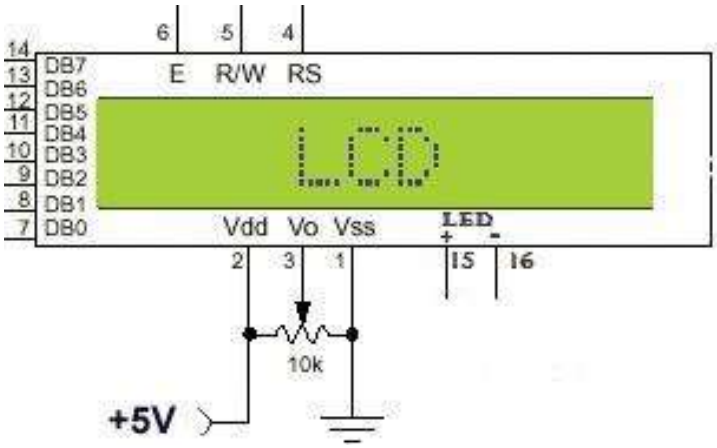


Fig 4.8(A) Physical apperance

Pin No.	Name	Description
Pin no. 1	**VSS**	Power supply (GND)
Pin no. 2	**VCC**	Power supply (+5V)
Pin no. 3	**VEE**	Contrast adjust
Pin no. 4	**RS**	0 = Instruction input 1 = Data input
Pin no. 5	**R/W**	0 = Write to LCD module 1 = Read from LCD module
Pin no. 6	**EN**	Enable signal
Pin no. 7	**D0**	Data bus line 0 (LSB)
Pin no. 8	**D1**	Data bus line 1
Pin no. 9	**D2**	Data bus line 2
Pin no. 10	**D3**	Data bus line 3
Pin no. 11	**D4**	Data bus line 4
Pin no. 12	**D5**	Data bus line 5
Pin no. 13	**D6**	Data bus line 6
Pin no. 14	**D7**	Data bus line 7 (MSB)
Pin no. 15	**LED+**	Anode of LED for Backlit
Pin no. 16	**LED-**	Cathode of LED for Backlit

Instruction	Decimal	HEX
Function set (8-bit interface, 2 lines, 5*7 Pixels)	56	38
Home (move cursor to top/left character position)	2	02
Move cursor one character left	16	10
Move cursor one character right	20	14
Turn on visible underline cursor	14	0E
Turn on visible blinking-block cursor	15	0F
Make cursor invisible	12	0C
Blank the display (without clearing)	8	08
Restore the display (with cursor hidden)	12	0C
Clear Screen	1	01
Entry mode : Shift Cursor Right	6	06

Algorithm to send data to LCD:

1. Make R/W low
2. Make
   - RS=0 ;if data byte is command
   - RS=1 ;if data byte is data (ASCII value to displayed on LCD)
3. Place data byte on data bus
4. Pulse E (HIGH to LOW)
5. Check BF or give some safe delay
6. Repeat the steps to send another data byte

Interfacing Microcontroller to LCD:

The 44780 standard requires 3 control lines as well as either 4 or 8 I/O lines for the data bus. We are going to use 8 bit mode, here 8-bit data bus is used, and the LCD will require a total of 11 data lines.

The three control lines are EN, RS, and RW and 8 data lines. Note that the EN line must be raised/lowered before/after each instruction sent to the LCD regardless of whether that instruction is read or write, text or instruction.

Chapter 5

ADVANTAGES AND APPLICATIONS

5.1 Advantages

- Main advantage of using weather station in Mines is to get accurate measurement of current weather condition for a particular location and surroundings.
- This project is fully automated. It does not require any human intervention.
- We can get prior alert of the weather & health conditions.
- Enhanced for monitoring & controlling of atmosphere conditions.

5.2 Limitations

- Technology

5.3 Applications

- Used in Mines & bio gas manufacturing centres for monitoring & reporting.
- This project has application to farmers as well. The weather forecasting plays very important role in the field of agriculture.
- Industrial purpose.
- Weather & pollution monitoring in congested locations.

Chapter 6

RESULTS AND DISCUSSION

6.1 Hardware Setup

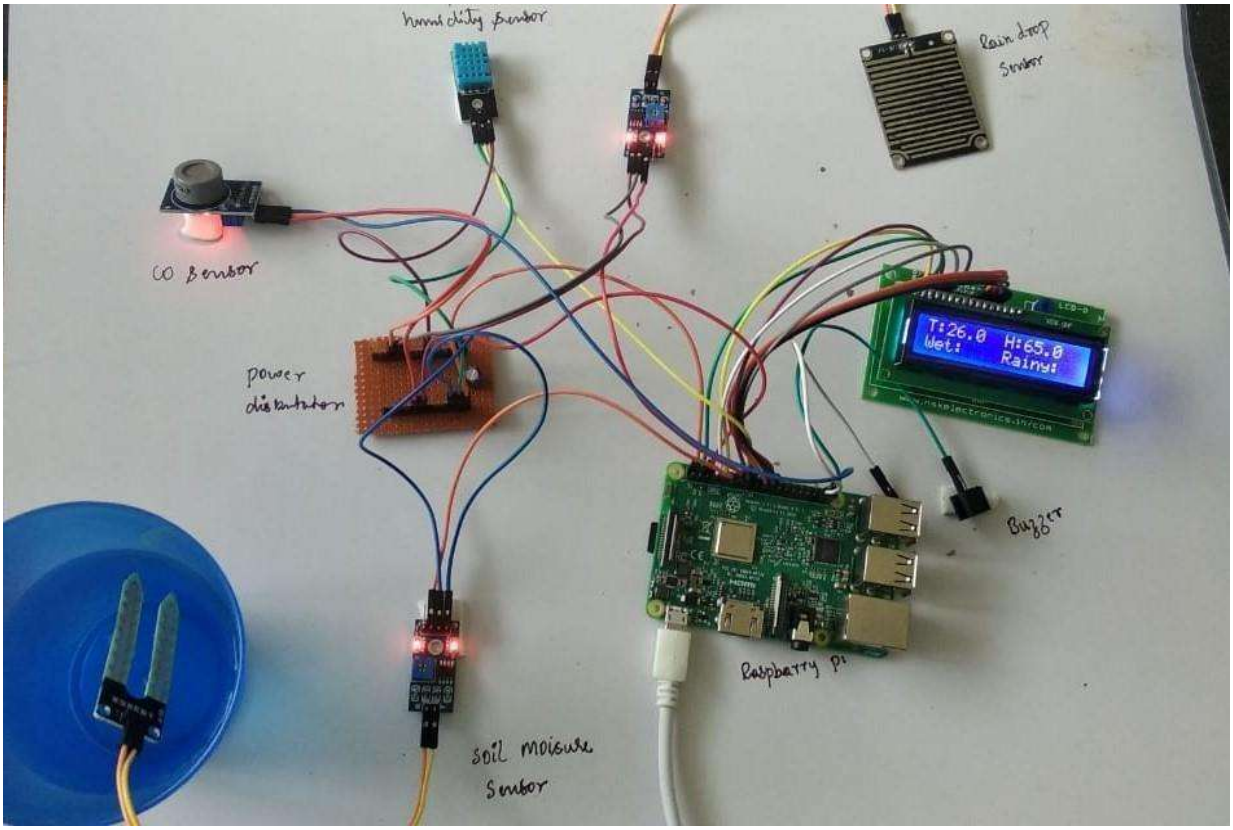


Fig 6.1: Hardware setup

The hardware setup in built for Weather and Pollution Monitoring System for mines.

6.2 Temperature and Humidity

When the temperature goes lower than 20 degrees and exceeds 40 degree, an alert will be given through buzzer indicating the temperature in the working environment is not suitable for workers to continue.

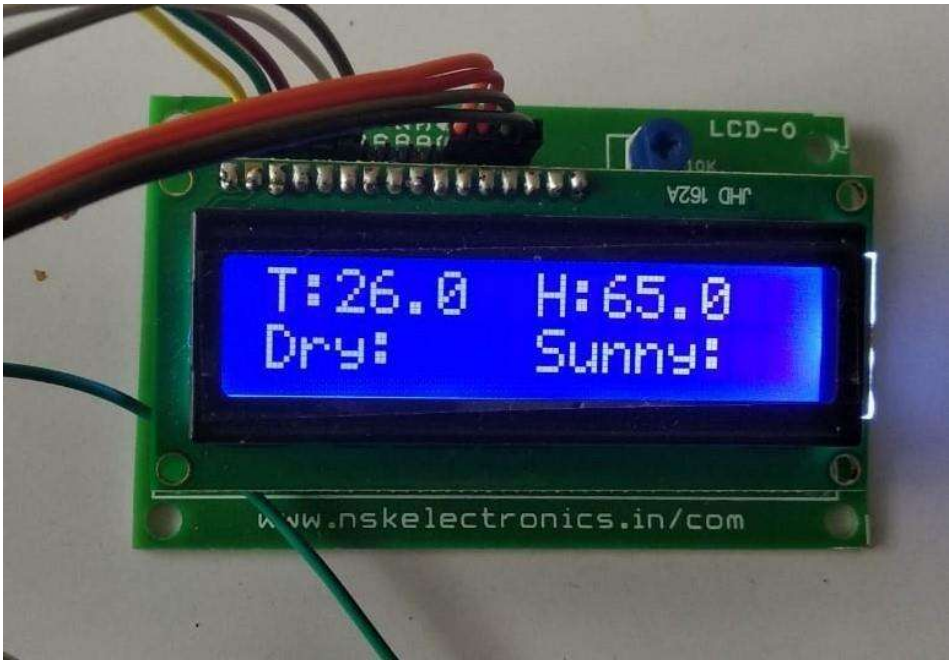


Fig 6.2: Temperature & Humidity value

6.3 Soil Moisture

By using a soil moisture sensor we can find out the soil is dry or wet.

Fig7.3(a): Soil moisture is showing a wet

Fig7.3(b): Soil moisture is showing a soil is dry

6.4 Rain Level Sensor

Using this sensor, the amount of rainfall occurred and whether rainfall has started or not, can be determined.

Fig 6.4(a): The rain level sensor is showing rainy.

Fig7.4(b): The rain level showing is sunny

6.5 CO Sensor

Fig 6.5: Co sensor

By using this sensor we can find out carbon monoxide level in the certain area, if the carbon monoxide level is more, it should alert a rescue team by using a buzzer.

6.6 Liquid Crystal Display (LCD)

LCD panel is used to display the sensor outputs so that the rescue team can monitor the mining environment with these sensor parameters.

Fig7.6: 16x2 Display

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