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CHAPTER 1: INTRODUCTION

1.1ABSTRACT

In this project, we develop an air quality monitoring system using NodeMCU, integrating the MQ135 gas sensor for detecting air quality and the DHT11 sensor for measuring temperature and humidity. The system provides real-time monitoring of environmental conditions through both local and remote interfaces.

The NodeMCU ESP8266 serves as the central controller, connecting the sensors and facilitating data transmission. The MQ135 sensor measures air quality by detecting various gases, while the DHT11 sensor provides temperature and humidity readings.

Locally, the system displays the real-time values of air quality, temperature, and humidity on an LCD display. Simultaneously, it interfaces with the Blynk application, enabling users to monitor environmental conditions remotely through their smartphones.

Data acquisition involves reading analog voltages from the MQ135 sensor and digital signals from the DHT11 sensor. Calibration ensures the accuracy of air quality measurements, while stable internet connectivity enables seamless communication with the Blynk app.

Through this project, users gain insight into their immediate surroundings' air quality, temperature, and humidity levels, fostering awareness and facilitating informed decision-making regarding environmental well-being.

1.2 INTRODUCTION

Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants.

Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone.

Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide. Here to make an IOT Based Air Pollution Monitoring System in which we will monitor the Air quality over a web server using internet and will trigger a alarm when the air quality goes down beyond a certain level, means when there are sufficient amount of harmful gases are present in the air like CO2, smoke, alcohol ,benzene and NH3.

It will show the air quality in PPM on the LCD and as well as on webpage so that we can monitor it veryeasily. Previously we have built the LPG detector using MQ6 sensor and Smoke detector using MQ2 sensor but this time we have used MQ135 sensor which is the best choice for monitoring Air Quality as it can detects most harmful gases and can measure their amount accurately.

In this project, you can monitor the pollution level from anywhere using your computer or mobile. We can install this system anywhere and can also trigger some device when pollution goes beyond some level, like we can switch on the Exhaust fan or can send alert SMS or mail to the user

1.3 PURPOSE:

Air pollution occurs when harmful substances including particulates and biological molecules are introduced into Earth's atmosphere. It may cause diseases, allergies or death in humans; it may also cause harm to other living organisms such as animals and food crops, and may damage the natural or built environment.

Human activity and natural processes can both generate air pollution.We propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution in an area through IOT.

System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data. Also, system keeps measuring sound level and reports it.

This allows authorities to monitor airpollution in different areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas.

Air pollution is one of the most common issues in the world. Severe Health issues have been recorded in the past few years due to urbanization and growing number of automobiles which release of lot of air pollutants. The harm caused by these pollutants include many allergic conditions to human health such as irritation in the throat, eyes and nose and also some serious problems like bronchitis, heart diseases, pneumonia, lung and asthma.

Our system mainly focusses on monitoring the harmful pollutants in air using wireless gas sensors and Wi-Fi module which helps in monitoring the results. Air pollution is growing day-by-day and it is high time that we consider this as an issue and find a solution

1.4 PROJECT OBJECTIVE:

Nowadays the air condition is very polluted. In recent years, car emissions, chemicals from factories, smoke, and dust are everywhere.

That is the reason why now air condition is very polluted. The effect of air pollution is very bad for our health, especially for a place where the air in our body is taken for breathing. Air pollution cannot be detected by human feelings.

Air pollution may contain a lot of dangerous substances such as ozone, particulate matter sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead.

This proposed system uses a wireless sensor network with low-cost sensors and hardware components along the necessary software to effectively monitor the air pollution phenomenon.

Air pollution is the worst environmental problem and it causes a multitude of adverse effects on human health, water bodies, and climate. The main source of air pollution in all major cities is due to vehicles and the second major source remains the industries.

The air pollution monitoring system is installed in a particular locality where there are traces of acute air pollution to detect the constituent gases of air which may lead to harmful effects on human health and other leaving beings.

Substances in the polluted air are very dangerous. For example, if the carbon monoxide is above 100ppm, it makes humans feel dizzy, nauseous, and within minutes they could die.

This research makes humans find out which content of the air is polluted. With module node MCU esp8266, we can monitor the air pollution remotely, because there is a Wi-Fi module in node MCU esp8266. This makes the air condition can be monitored every time

CHAPTER – 2 LITERATURE SURVEY

2.1 LITERATURE REVIEW:

The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g. construction activities) and location dependent (e.g., the traffic choke-points have much worse air quality thanaverage).

IOT Based Air Quality Monitoring System monitors the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level, means when there are amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, NOx and LPG.The system will show the air quality in PPM on the LCD and as well as on webpage so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system.

2.2 PROBLEM STATEMENT:

How can we create an affordable and user-friendly air quality monitoring system to provide real-time data on air quality, temperature, and humidity, enabling individuals to monitor and manage their immediate environmental conditions effectively?

2.3 AIM:

To prevent, control and abate pollution of streams, wells, land and air to protect the environment from any degradation by effective monitoring and implementation of pollution.

2.4 EXISTING SYSTEM:

The commercial meters available in the market are Fluke CO-220 carbon monoxide meter for CO, Amprobe CO2 meter for CO2, Forbix Semicon LPG gas leakage sensor alarm for LPG leakage detection.The researchers in this field have proposed various air quality monitoring systems based on WSN, GSM and GIS. Now each technology has limited uses according to the intended function, as Zigbee is meant for users with Zigbee-receiver, Bluetooth.

2.5 PROPOSED SYSTEM:

In this project we are going to make IOT based Air Pollution Monitoring System in which we will monitor the Air Quality over a web server using internet and will trigger a alarm when the air quality goes down beyond a certain level, means when there are sufficient amount of harmful gases are present in the air like CO2, smoke, alcohol, benzene and NH3. It will show the air quality in PPM on the LCD and as well as on webpage so that we can monitor it very easily.

CHAPTER 3: COMPONENTS

3.1 ESP8266 WIFI MODULE:

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT (Internet of things) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is used to enable the internet connection to various applications of embedded systems.

Espressif systems designed the ESP8266 Wi-Fi module to support both the TCP/IP capability and the microcontroller access to any Wi-Fi network. It provides the solutions to meet the requirements of industries of IoT such as cost, power, performance, and design.

It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network.

The ESP8266 Wi-Fi module is highly integrated with RF balun, power modules, RF transmitter and receiver, analog transmitter and receiver, amplifiers, filters, digital baseband, power modules, external circuitry, and other necessary components. The ESP8266 Wi-Fi module is a microchip

A set of AT commands are needed by the microcontroller to communicate with the ESP8266 Wi-Fi module. Hence it is developed with AT commands software to allow the Arduino Wi-Fi functionalities, and also allows loading various software to design the own application on the memory and processor of the module.

The processor of this module is based on the Tensilica Xtensa Diamond Standard 106 micro and operates easily at 80 MHz. There are different types of ESP modules designed by third-party manufacturers. They are,

- ESP8266-01 designed with 8 pins (GPIO pins -2)
- ESP8266-02 designed with 8 pins (GPIO pins -3)
- ESP8266-03 designed with 14 pins (GPIO pins- 7)
- ESP8266-04 designed with 14 pins (GPIO pins- 7)

The ESP8266 Wi-Fi module comes with a boot ROM of 64 KB, user data RAM of 80 KB, and instruction RAM of 32 KB. It can support 802.11 b/g/n Wi-Fi network at 2.4 GHz along with the features of I2C, SPI, I2C interfacing with DMA, and 10-bit ADC. Interfacing this module with the microcontroller can be done easily through a serial port. An external voltage converter is required only if the operating voltage exceeds 3.6 Volts. It is most widely used in robotics and IoT applications due to its low cost and compact size.

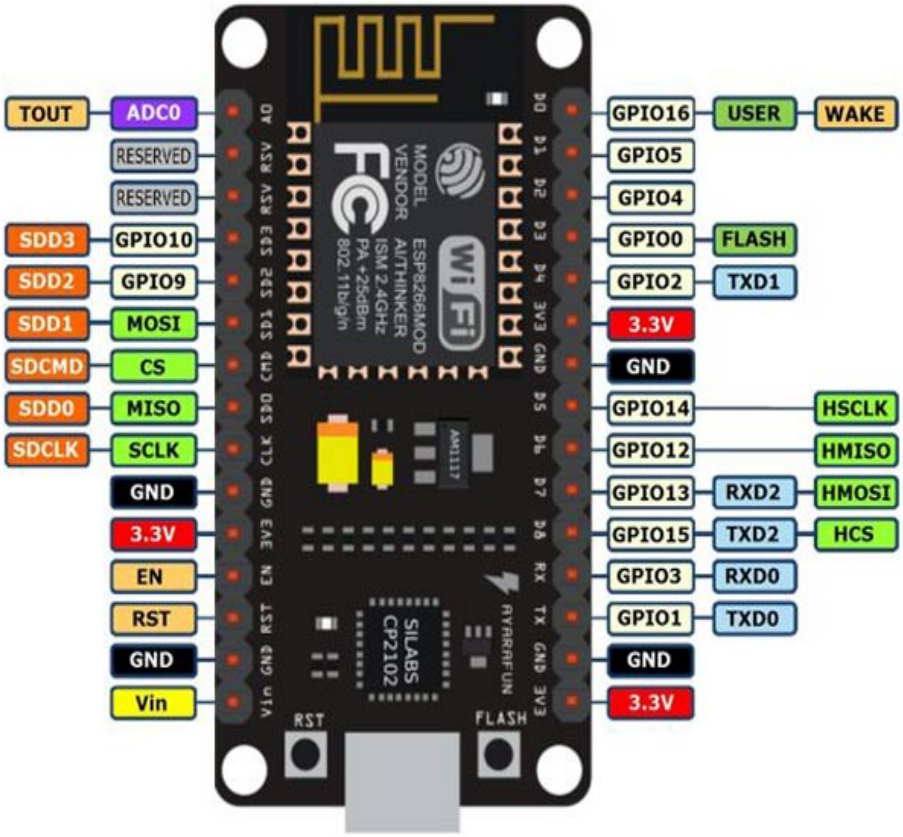

Fig.Node MCU ESP8266 Pinout

Node MCU Development Board Configuration :

Pin Category	Name	Description
Power	Micro-USB, 3.3V, GND, Vin	**Micro-USB:** NodeMCU can be powered through the USB port **3.3V:** Regulated 3.3V can be supplied to this pin to power the board **GND:** Ground pins **Vin:** External Power Supply
Control Pins	EN, RST	The pin and the button resets the microcontroller
Analog Pin	A0	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	GPIO1 to GPIO16	NodeMCU has 16 general purpose input-output pins on its board
SPI Pins	SD1, CMD, SD0, CLK	NodeMCU has four pins available for SPI communication.
UART Pins	TXD0, RXD0, TXD2, RXD2	NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
I2C Pins		NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

ESP8266 Wi-Fi Module Specifications

The ESP8266 Wi-Fi module specifications or features are given below.

- It is a powerful Wi-Fi module available in a compact size at a very low price.
- It is based on the L106 RISC 32-bit microprocessor core and runs at 80 MHz
- It requires only 3.3 Volts power supply
- The current consumption is 100 m Amps
- The maximum Input/Output (I/O) voltage is 3.6 Volts.
- It consumes 100 mA current
- The maximum Input/Output source current is 12 mA
- The frequency of built-in low power 32-bit MCU is 80 MHz
- The size of flash memory is 513 kb
- It is used as either an access point or station or both
- It supports less than 10 microAmps deep sleep
- It supports serial communication to be compatible with several developmental platforms such as Arduino
- It is programmed using either AT commands, Arduino IDE, or Lua script
- It is a 2.4 GHz Wi-Fi module and supports WPA/WPA2, WEP authentication, and open networks.
- It uses two serial communication protocols like I2C (Inter-Integrated Circuit) and SPI (Serial Peripheral Interface).
- It provides 10- bit analog to digital conversion
- The type of modulation is PWM (Pulse Width Modulation)
- UART is enabled on dedicated pins and for only transmission, it can be enabled on GPIO2.
- It is an IEEE 802.11 b/g/n Wi-Fi module with LNA, power amplifier, balun, integrated TR switch, and matching networks.
- GPIO pins – 17
- Memory Size of instruction RAM – 32 KB
- The memory size of instruction cache RAM – 32 KB
- Size of User-data RAM- 80 KB
- Size of ETS systems-data RAM – 16 KB

The applications of the ESP8266 Wi-Fi module are given below

- Access points portals
- IoT projects
- Wireless data logging
- Used in learning the networking fundamentals
- Sockets and smart bulbs
- Smart home automation systems

The ESP32 is an alternative ESP8266 Wi-Fi module. It is a standalone and most powerful module.

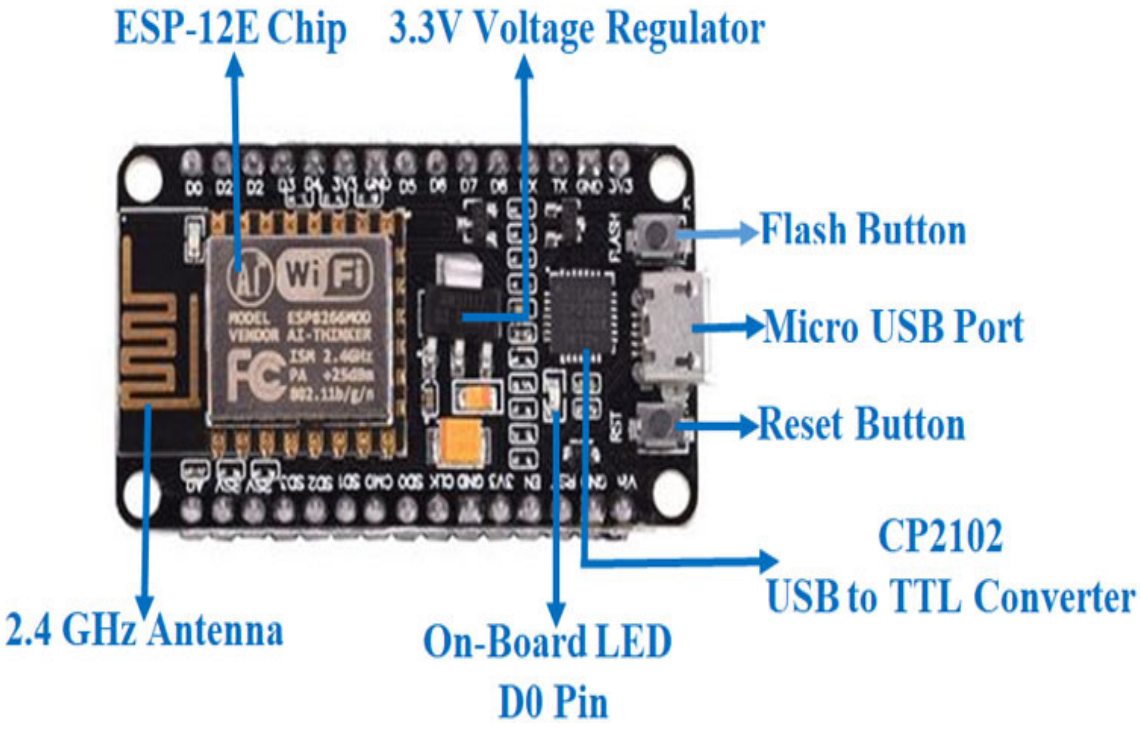

Fig.ESP8266 pinout

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

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

3.2 DHT11 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.

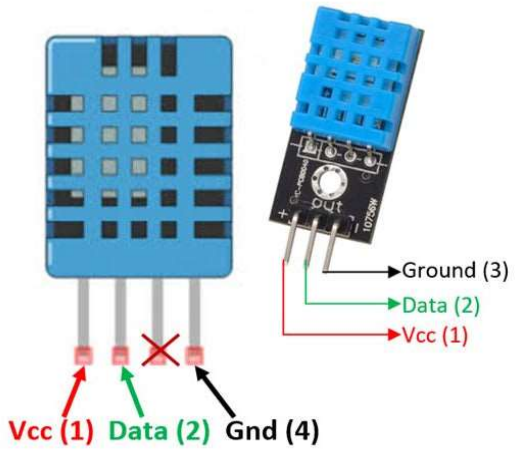

Fig.DHT11 sensor pinout

Working Principle of DHT11 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.

The temperature range of DHT11 is from 0 to 50 degree Celsius with a 2- degree accuracy. Humidity range of this sensor is from 20 to 80% with 5% accuracy. The sampling rate of this sensor is 1Hz .i.e. it gives one reading for every second. DHT11 is small in size with operating voltage from 3 to 5 volts.

The maximum current used while measuring is 2.5mA DHT11 sensor has four pins- VCC, GND, Data Pin and connected pin. A pull-up resistor of 5k to 10k ohms is provided communication between sensor and micro- controller.

Pin Identification and Configuration :

Pin No	Pin Name	Description
1	VCC	Power supply 3.5V to 5.5V
2	DATA	Outputs both Temperature and Humidity through serial Data
3	NC	No Connection and hence not used
4	GROUND	Connected to the ground of the circuit

DHT11 Sensor module :

1	VCC	Power supply 3.5V to 5.5V
2	DATA	Outputs both Temperature and Humidity through serial Data
3	GROUND	Connected to the ground of the circut

Applications

This sensor is used in various applications such as measuring humidity and temperature values in heating, ventilation and air conditioning systems. Weather stations also use these sensors to predict weather conditions.

The humidity sensor is used as a preventive measure in homes where people are affected by humidity. Offices, cars, museums, greenhouses and industries use this sensor for measuring humidity values and as a safety measure.It's compact size and sampling rate made this sensor popular among hobbyists. Some of the sensors which can be used as an alternative to DHT11 sensor are DHT22, AM2302,SHT71.

DHT11's power supply is 3-5.5V DC. When power is supplied to the sensor, do not send any instruction to the sensor in within one second in order to pass the unstable status. One capacitor valued 100nF can be added between VDD and GND for power filtering.

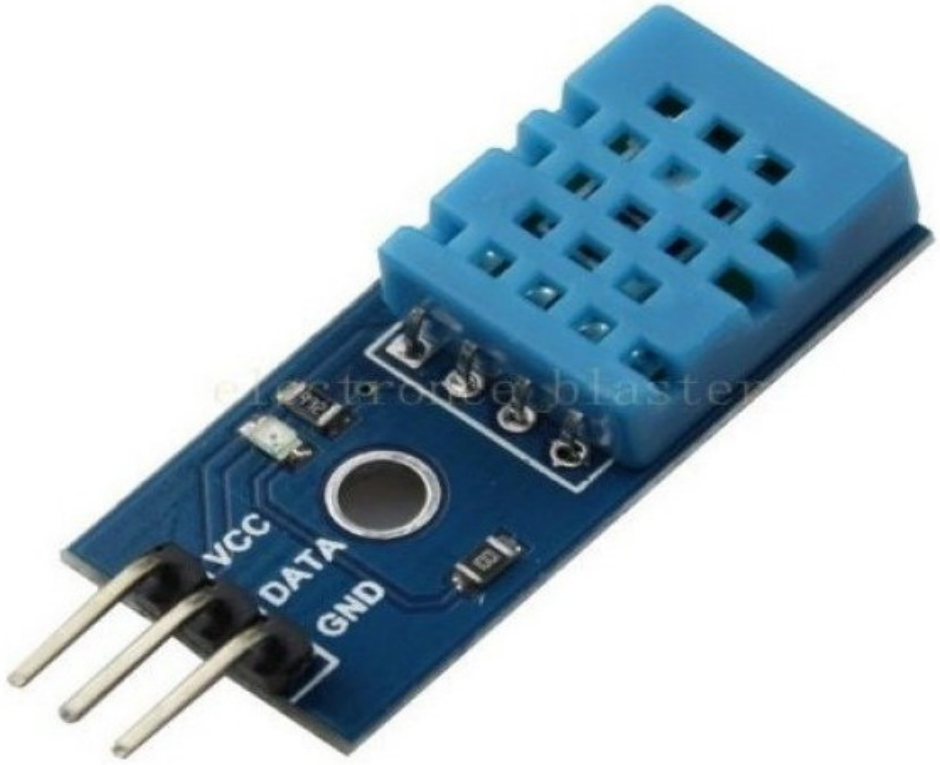

Fig. DH11 temperature and humidity sensor

3.3 GAS SENSOR MQ135 :

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability.

They are often part of a larger embedded system, such as hazmat and security systems, and they are normally connected to an audible alarm or interface. Because gas sensors are constantly interacting with air and other gasses, they have to be calibrated more often than many other types of sensors.

Fig. gas sensor MQ135

Depending on their intended environments and functions, the physical makeup and sensing process can vary notably between sensors. The MQ-135 sensor module comes with a Digital

Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas.

It is highly sensitive to ammonia (NH3), sulphide and benzene steams, smoke, NOx and CO2. Low cost sensor. To measure the gases in PPM we need to use analog pin. Sensitive for benzene, alcohol, smoke. Output voltage boosts along with the concentration of the measured gases increases.

It gives a Fast response and recovery period is very small too. The sensitivity of the MQ135 gas sensor is adjustable. It also contains an output indicator and provides the signal to the user. Ideal sensor to detect the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. This unit can be easily incorporated into an alarm unit, to sound an alarm or give a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time

The gas sensor output terminals are connected to non inverting input terminal of 29 the comparator. Here the comparator is constructed with operational amplifier LM 358. The reference voltage is given to inverting input terminal. The reference voltage depends on the desired gas intensity. When there is no leakage the non inverting input is greater then inverting input so the output of the comparator is positive voltage which is given to the base of the switching transistor BC 547. Hence the transistor is conducting. Here the transistor acts as switch so the collector and emitter will be closed. The output is taken from collector terminal. Now the outputis zero which is given to hex inverter 40106.

Pin Configuration

Pin	Pin Name	Discription
1	VCC	Used to power the sensor, Generally the operating voltage
2	GROUND	Used to connect the module to system ground
3	DIGITAL OUT	You can also use this sensor to get digital output from this pin, by setting a threshold value using the potentiometer.
4	ANALOG OUT	This pin outputs 0-5V analog voltage based on the intensity of the gas

For Sensor

Pin	Pin Name	Description
1	H-Pin	Out of the two H-pins, one pin is connected to supply and the other to ground
2	A-Pin	The A-pins and B-pins are interchangeable. These pins will be tied to the Supply voltage.
3	B-Pin	A pins and B pins are interchangeable. One pin will act as output while the other will be pulled to ground.

Specifications of MQ135 Gas Sensor Module:-

- Working voltage:DC 5V
- Working Current: 150mA
- DOUT: TTLoutput
- AOUT: Analog output
- Preheat time: Over 20s
- Dimension: 32mm x 22m x 27mm(HIGH 27mm)

MQ-135 Sensor Features:

- Wide detecting scope
- Fast response and High sensitivity
- Stable and long life
- Operating Voltage is +5V
- Detect/Measure NH3, NOx, alcohol, Benzene, smoke, CO2, etc.
- Analog output voltage: 0V to 5V
- Digital output voltage: 0V or 5V(TTL Logic) 20
- Preheat duration 20 seconds
- Can be used as a Digital or analog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

You can either use the digital pin or the analog pin to do this. Simply power the module with 5V and you should notice the power LED on the module to glow and when no gas it detected the output LED will remain turned off meaning the digital output pin will be 0V.

Remember that these sensors have to be kept on for pre-heating time (mentioned in features above) before you can actually work with it. Now, introduce the sensor to the gas you want to detect and you should see the output LED to go high along with the digital pin, if not use the potentiometer until the output gets high. Now every time your sensor gets introduced to this gas at this particular concentration the digital pin will go high (5V) else will remain low (0V).

You can also use the analog pin to achieve the same thing. Read the analog values (0- 5V) using a micro controller, this value will be directly proportional to the concentration of the gas to which the sensor detects. You can experiment with this values and check how the sensor reacts to different concentration of gas and develop your program according.

How to use MQ-135 sensor to measure PPM?

MQ-135 gas sensor applies SnO2 which has a higher resistance in the clear air as a gas-sensing material. When there is an increase in polluting gases, the resistance of the gas sensor decreases along with that. To measure PPM using MQ-135 sensor we need to look into the (Rs/Ro) v/s PPM graph taken from the MQ135 datasheet

MQ-135 for several gases. in their: Temp: 20, Humidity: 65%, O2 concentration 21%,

RL=20kΩ, Ro: sensor resistance at 100ppm of NH3 in the clean air.

Rs:sensor resistance at various concentrations of gases.

The value of Ro is the value of resistance in fresh air (or the air with we are comparing) and the value of Rs is the value of resistance in Gas concentration. First you should calibrate the sensor by finding the values of Ro in fresh air and then use that value to find Rs using the formula.

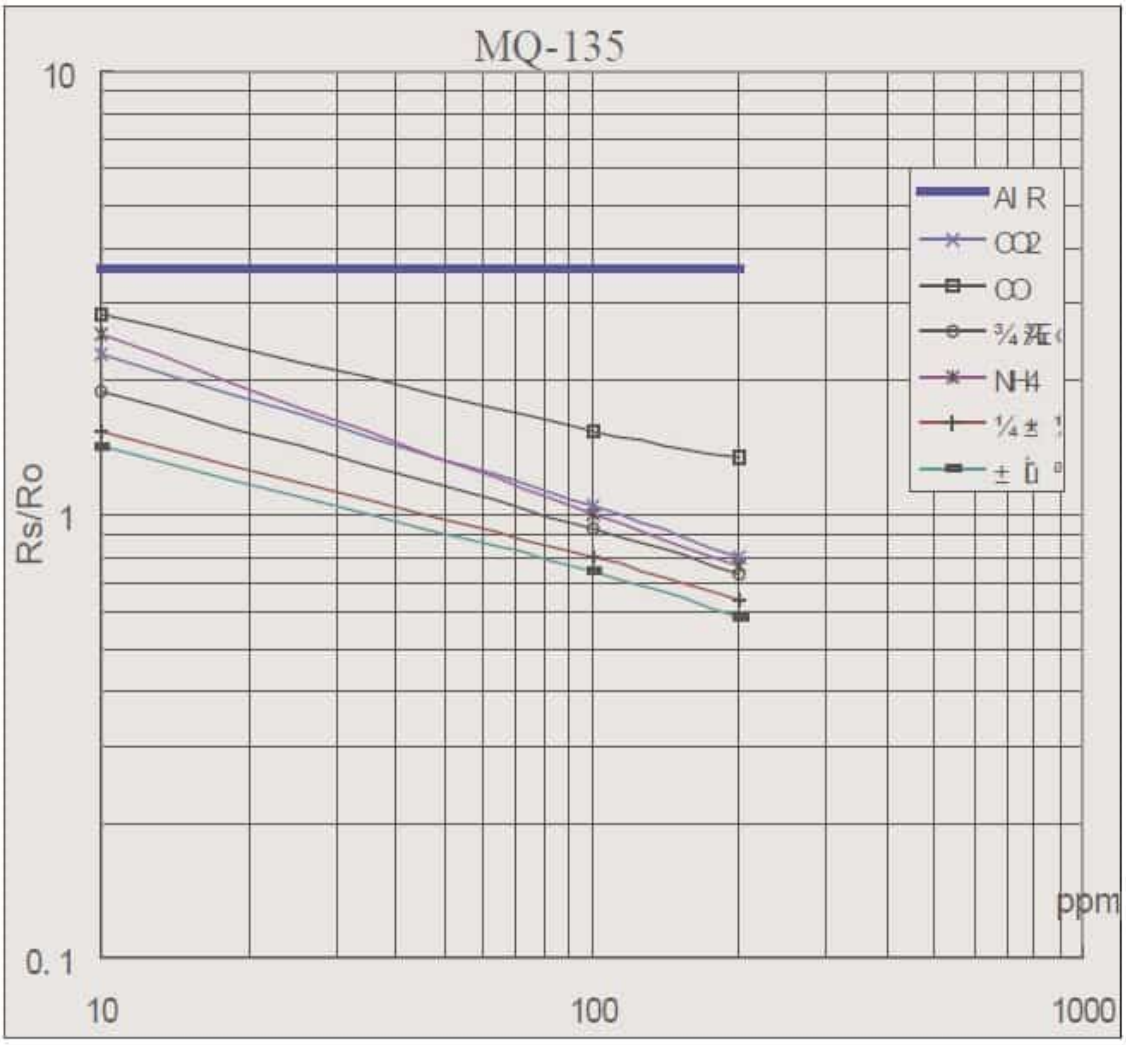

Fig. sensitivity characteristics of the MQ135

3.4 LCD DISPLAY :

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers.

Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications.

Fig. LCD display

A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. A

liquid crystal display (LCD) has liquid crystal material sandwiched between two sheets of glass.

Without any voltage applied between transparent electrodes, 32 liquid crystal molecules are aligned in parallel with the glass surface. When voltage is applied, they change their direction and they turn vertical to the glass surface.

They vary in optical characteristics, depending on their orientation. Therefore, the quantity of light transmission can be controlled by combining the motion of liquid crystal molecules and the direction of polarization of two polarizing plates attached to the both outer sides of the glass sheets. LCDs utilize these characteristics to display images

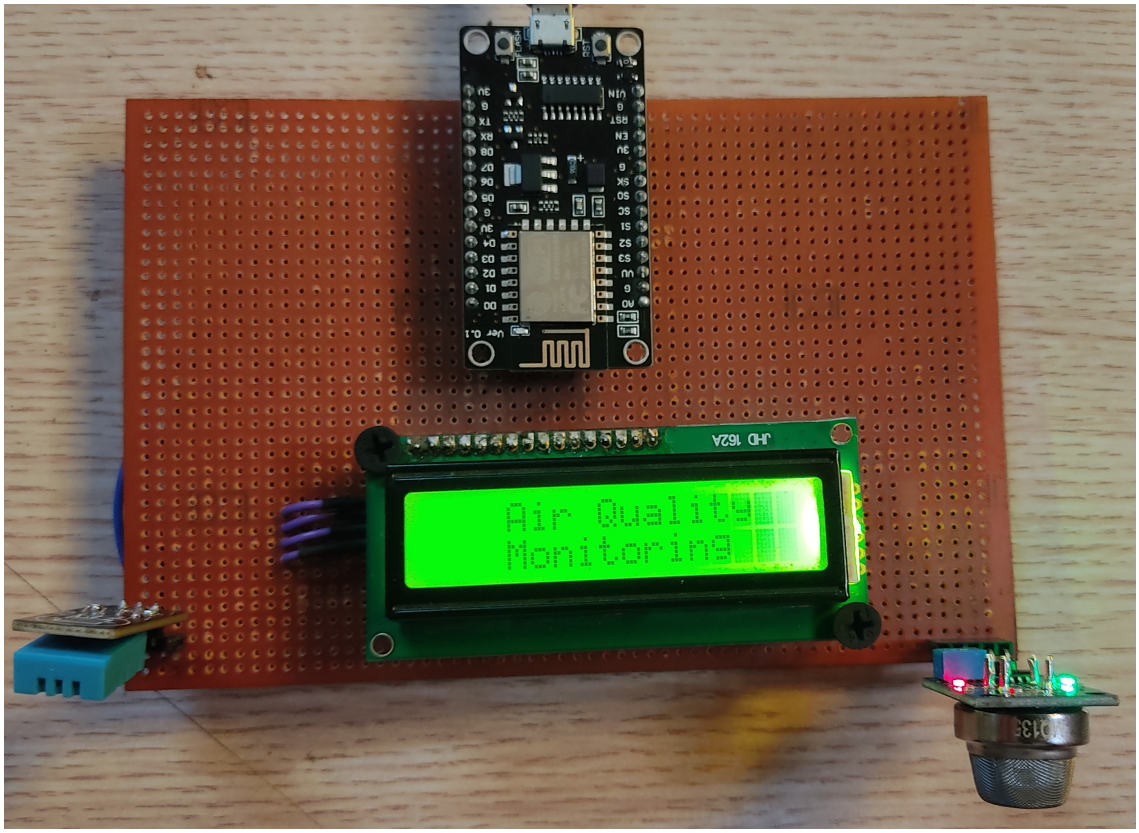

Fig. LCD display

3.5 I2C MODULE:

For electronics enthusiasts navigating the realm of microcontroller communication, the 12C Serial Interface Adapter emerges as a powerful bridge, simplifying data exchange and expanding the potential of your projects. This article delves into its technical intricacies, equipping you to harness its capabilities and unlock a diverse range of creative possibilities.

12c serial interface icd module has a Inbuilt PCF8574 120 chip that converts 12C serial data to parallel data for the LCD display 120 lcd modules are curreritly supplied with a default 12C address of either 0x27 or 0x3F. To determine which version you have check the black 12C adaptor board on the underside of the module. if there a 3 sets of pads labelled A0, A1, & A2 then the default address will be 0x3F. If there are no pads the default address will be 0x27.

The module has a contrast adjustment pot on the underside of the display. This may require adjusting for the screen to display text correctly. All Character Modules sold on our site support 4-bit mode, and nearty all commercially available 16x2 and 20x4 line character modules support it too

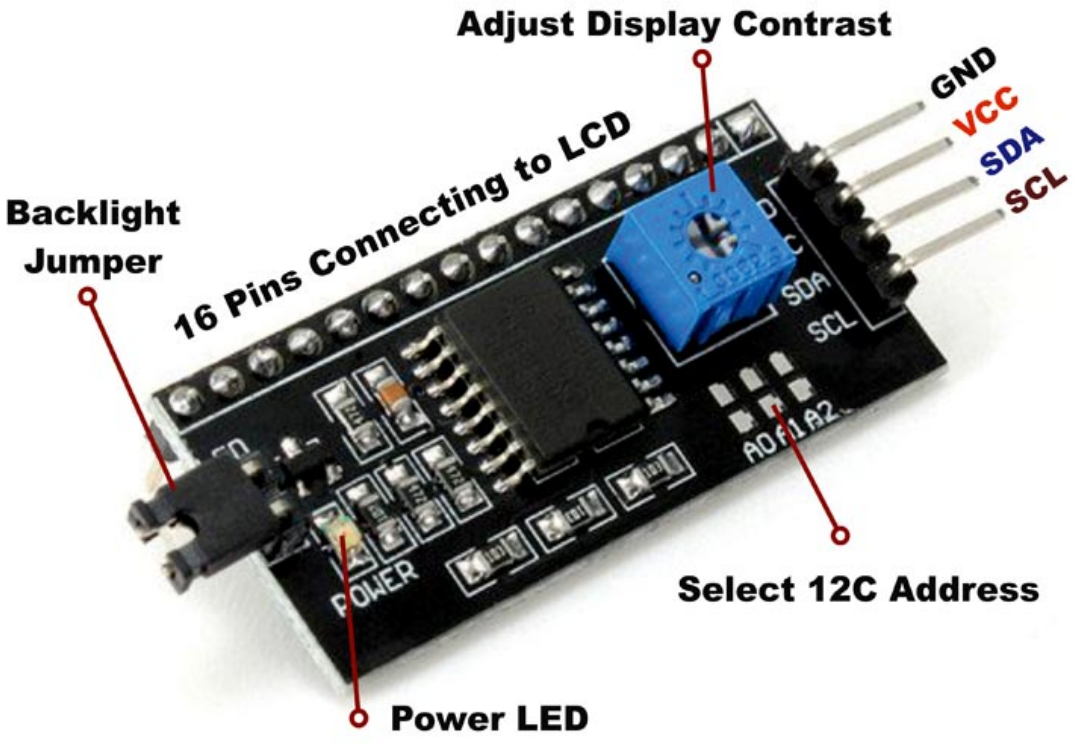

Fig.I2C module pinout

Pin Name	Pin Type	Pin Description
GND	Power	Ground
VCC	Power	Voltage input
SDA	I2C data	Serial data
SLC	I2C Clock	Serial clock
A0	Jumper	I2C Address selection 1
A1	Jumper	I2C Address selection 2
A2	Jumper	I2C Address selection 3
Backlight	Jumper	Control backlight of panel

Key Features of 12C Serial Interface Adapter:

12C Bridge: The adapter acts as a seamless intermediary, enabling communication between microcontrollers and 120 peripherals like LCD displays, sensors, and memory modules

Simplified Wiring: By utilizing just two signal lines (SDA and SCL), the adapter significantly reduces wiring complexity, promoting clean and organized project layouts.

Versatile Compatibility: Designed to work with diverse microcontrollers and 12C devices, the adapter offers broad compatibility and empowers the integration of various components into your projects.

Compact and Efficient: Often characterized by a small and lightweight design, the adapter integrates seamlessly into space-constrained projects without compromising performance.

Cost-Effective Solution: Offering reliable data exchange at an accessible price point, the adapter presents itself as a valuable asset for boidget-conscious projects

Technical Specifications of I2C Serial Interface Adapter:

Interface Protocols: 12C

Input Voltage: Typically 3.3V or 5V DC

Operating Temperature Range: Varies depending on model (typically 0°C to 70°C)

Contras is adjustable

The backlight can be turned on and off using sorting jumper

Compatible with 16x2 and 20x4 LCD display

Can have 8 modules on a single 12C bus (change address via solder jumpers)address, allowing.

Saves resources using only 4 pins

Applications of I2C Serial Interface Adapter:

LCD Display Control: Drive LCD displays for visual feedback and user interaction in your projects.

Sensor Integration: Utilize various sensors like temperature, pressure, and light sensors to gather data and respond to environmental changes

Memory Expansion: Add external memory modules to your microcontroller for increased data storage capacity.

Robotics and Automation: Introduce reliable communication between microcontrollers and actuators in your robotic creations.

DIY Project Powerhouse: From custom data loggers to interactive art installations, the adapter empowers a wide range of creative endeavors.

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3.6 BLYNK IoT:

Blynk is an IoT platform that simplifies building IoT applications. With a drag-and-drop interface, it enables users to create control interfaces for devices without extensive coding. It supports various hardware platforms, offers built-in widgets for device control and monitoring, and facilitates data logging and notifications. Users can get started by creating an account, downloading the Blynk mobile app, and setting up projects. Blynk has been used in projects ranging from home automation to smart gardening systems, offering versatility and ease of use in IoT development.

Blynk is an internet of things platform which allows controlling electroncs devices remotely using its ios and android apps. It provides dashboard by which user can create graphics interface using different widgets. Blynk can also store and display sensor data. Blynk provides libraries for most of the popular hardware platform like Arduino,ESP8266,etc.

It allows you to create amazing interfaces for your projects using various widgets which are provided. It is responsible for all the communications between the smartphone and hardware. You can use the Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices. It enables communication, for all the popular hardware platforms, with the server and process all the incoming and outcoming commands.

The process that occurs when someone presses the Button in the Blynk application is that the data will move to Blynk Cloud, where data magically finds its way to the hardware that has been installed.

The NodeMCU module is a compact board that is very small and has the ability to be programmed and connected to networks via wireless. In other word, The NodeMCU board is a System On Chip (SOC) with integrated TCP / IP the protocol. In a network, NodeMCU can function as a server, client or both. In server mode, NodeMCU applies as hosting and in client mode NodeMCU can request on the server. In addition, NodeMCU has input / output pins that can be connected to sensors or actuators so that data from sensors can be sent to the server and able to activate the actuator based on the data received. The NodeMcu microcontroller is used as a link between equipment and sensors at home with the Raspberry pi. NodeMcu reads sensor data and sends it to the server. The server responds to requests for smartphones that have been installed by the Blynk framework. This system is designed to have an automatic mode when the homeowner is offline, and also has all the system log data.

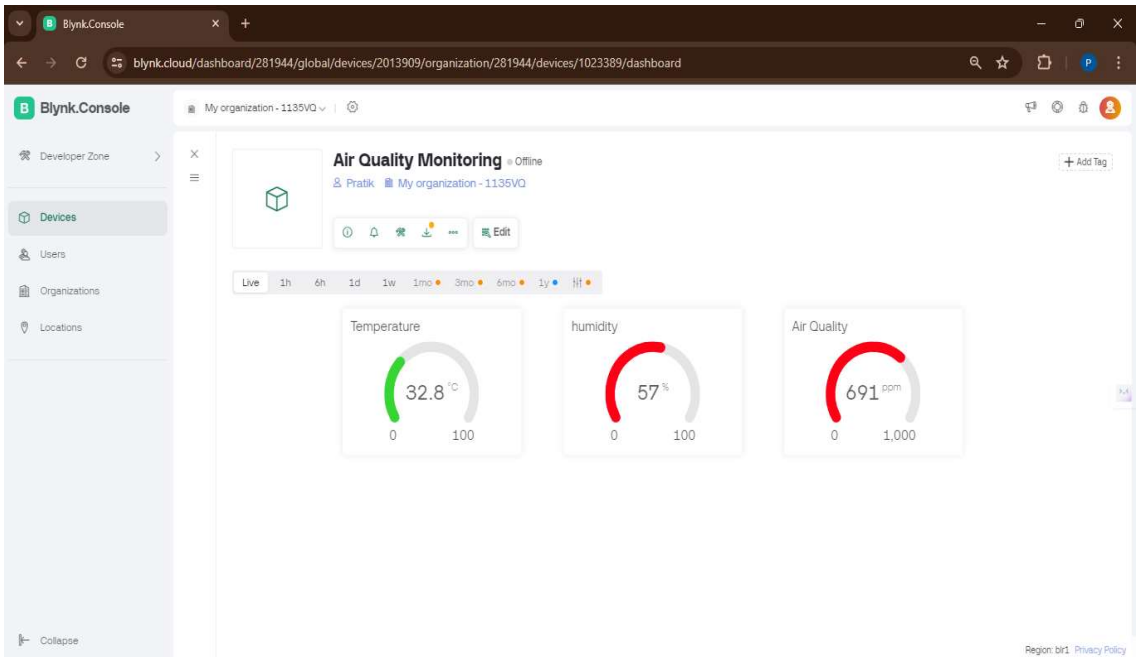

Fig Blynk interface on PC/Laptop

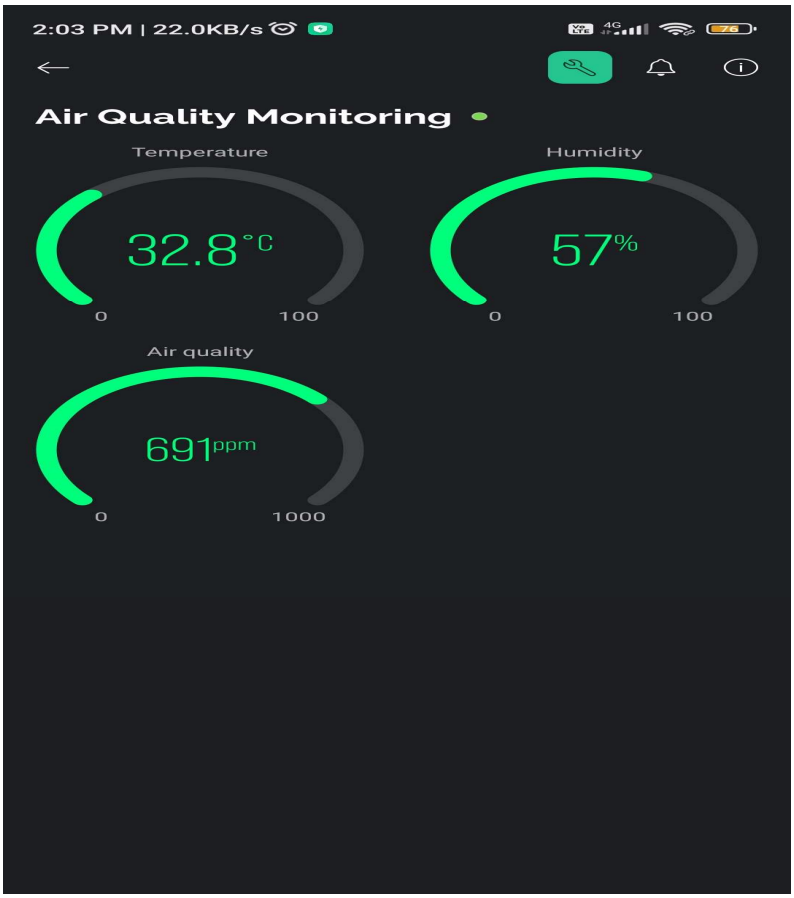

Fig Blynk Interface

CHAPTER 4: WORKING

4.1 BLOCK DIAGRAM:

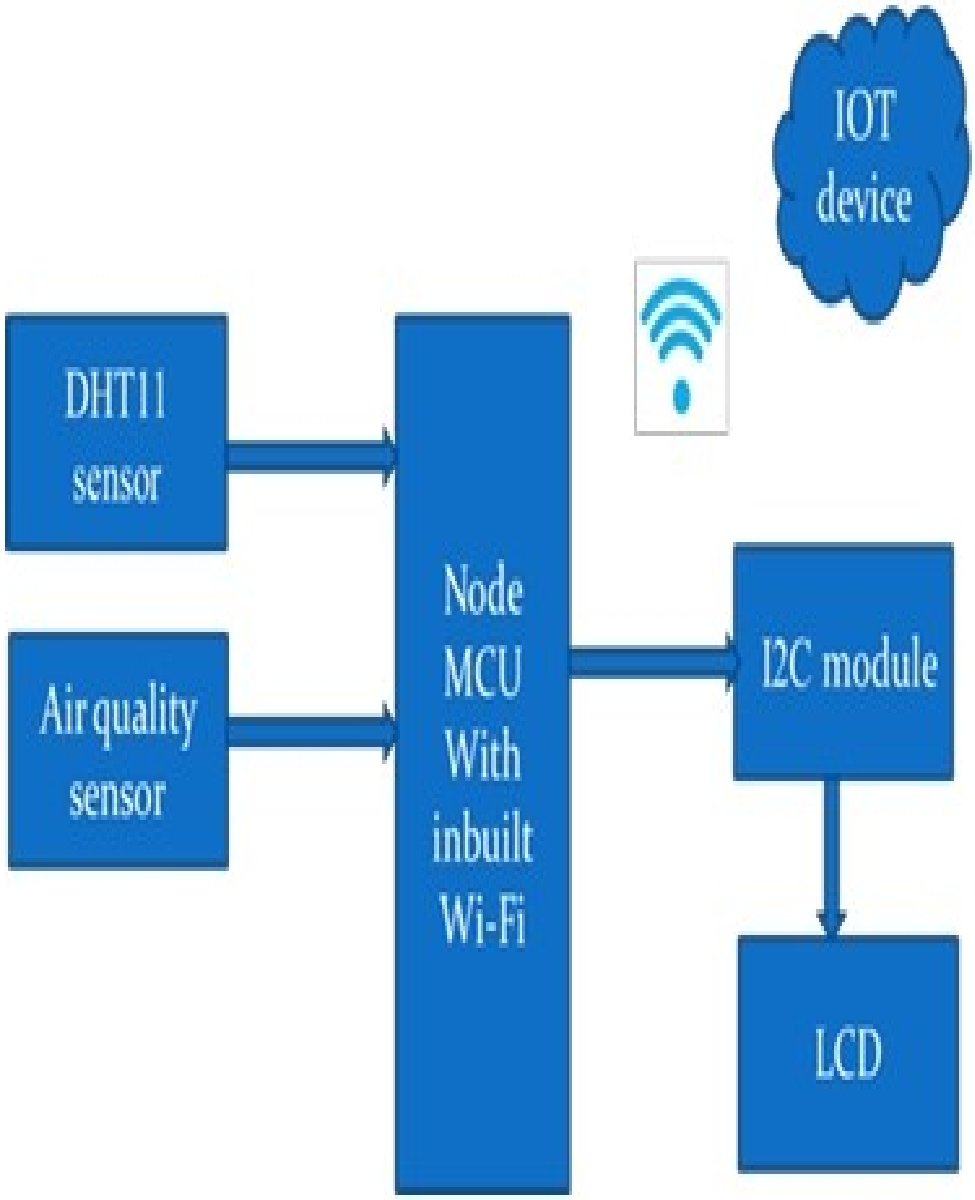

Fig. Block Diagram

4.2 CIRCUIT DIAGRAM:

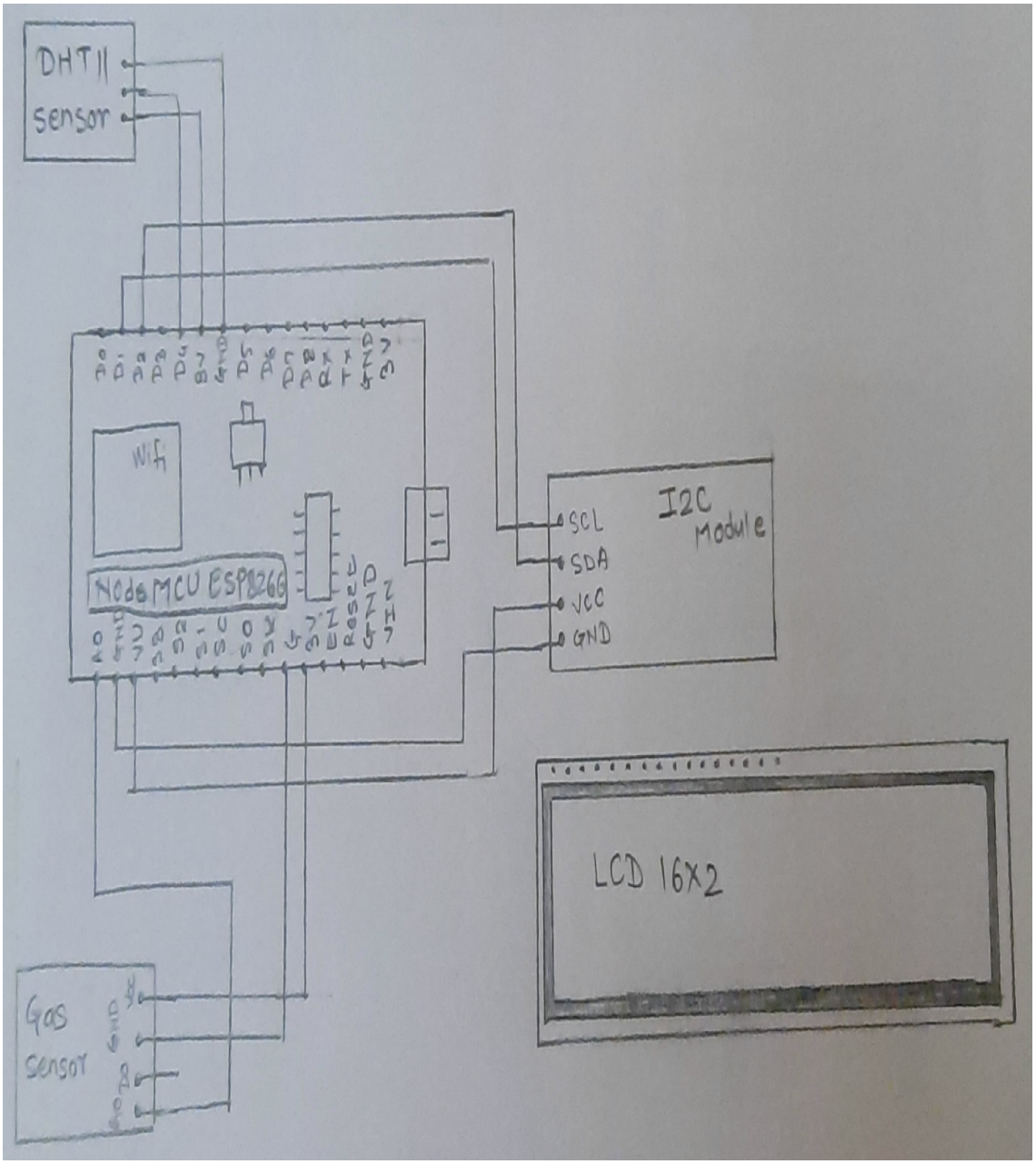

Fig. Circuit diagram

4.3 WORKING:

Here's a detailed working of the air quality monitoring system using NodeMCU, MQ135 gas sensor, and DHT11 sensor.

1. Hardware Setup:

- NodeMCU ESP8266: Used as the main controller for data acquisition and transmission.

- MQ135 Gas Sensor: Measures air quality by detecting various gases like ammonia, benzene, and carbon monoxide.

- DHT11 Sensor: Measures temperature and humidity.

- LCD Display: Displays real-time readings of air quality, temperature, and humidity.

- Blynk Application: Installed on a smartphone for remote monitoring.

2. Sensor Connections:

- Connect the MQ135 sensor to an analog pin of the NodeMCU to read analog voltage signals.

- Connect the DHT11 sensor to a digital pin of the NodeMCU to read digital signals.

- Connect the LCD display to the NodeMCU for local visualization of the data.

3. Data Acquisition:

- Read analog voltage from the MQ135 sensor to determine air quality levels.

- Read digital signals from the DHT11 sensor to obtain temperature and humidity readings.

4. Calibration:

- Calibrate the MQ135 sensor to convert the analog voltage readings into meaningful air quality index values. This calibration process may involve exposing the sensor to known concentrations of gases and correlating the sensor's response to these concentrations.

- No calibration is required for the DHT11 sensor, as it provides temperature and humidity readings directly.

5. Data Processing:

- Process the raw sensor data to ensure accuracy and reliability.

- Convert the analog voltage readings from the MQ135 sensor into air quality index values using calibration data.

- Organize the temperature and humidity readings obtained from the DHT11 sensor.

6. Local Display:

- Display real-time readings of air quality, temperature, and humidity on the LCD display.

- Update the display periodically to reflect any changes in environmental conditions.

7. Blynk Integration:

- Install the Blynk library in the Arduino IDE and set up a Blynk project.

- Obtain the authentication token from the Blynk project.

- Use the Blynk library to send sensor data (air quality, temperature, humidity) to the Blynk app using the authentication token.

- Configure widgets in the Blynk app to display the received sensor data in real-time.

8. Remote Monitoring:

- Access the Blynk app on a smartphone to remotely monitor air quality, temperature, and humidity.

9. Power Supply:

- Ensure a stable power supply to the NodeMCU and sensors to maintain continuous operation.

10. User Interaction:

- Provide users with a user-friendly interface on the Blynk app for easy monitoring and interaction with the system.

- Allow users to set thresholds for air quality parameters and receive alerts if these thresholds are exceeded.

CHAPTER 5: OTHER

5.1 ADVANTAGES:

1.Health Protection: Monitoring systems provide real-time data on air pollutants, allowing authorities and individuals to take proactive measures to reduce exposure to harmful substances. This helps protect public health by minimizing the risk of respiratory problems, cardiovascular diseases, and other health issues associated with poor air quality.

2.Environmental Awareness: Monitoring systems raise awareness about the state of the environment and the impact of human activities on air quality. By visualizing pollutant levels and trends, they encourage individuals, communities, and policymakers to take action to reduce emissions and mitigate environmental degradation.

3.Regulatory Compliance: Air quality monitoring is essential for regulatory compliance, helping governments enforce air quality standards and regulations. 4.Early Warning Systems: Monitoring systems serve as early warning systems for environmental emergencies, such as wildfires, industrial accidents, or hazardous material spills

5.Data-driven Decision Making: Monitoring data provides valuable insights for decision-making processes related to urban planning, transportation, energy production, and public health.

6.Resource Allocation: Air quality monitoring helps prioritize resources for pollution control and mitigation efforts. By identifying areas with the most significant air quality challenges, governments and organizations can allocate resources efficiently to address the most pressing environmental concerns and protect vulnerable populations.

7.Public Engagement: Monitoring systems engage the public in environmental stewardship by providing access to air quality data and fostering citizen science initiatives. By empowering individuals to monitor air quality in their

8.Economic Benefits: Improving air quality through monitoring and pollution control measures can lead to economic benefits, including healthcare cost savings, increased productivity, and enhanced property values. By investing in air quality monitoring and management

5.2 DISADVANTAGES:

1.Cost: Setting up and maintaining air quality monitoring systems can be expensive. This includes the initial investment in equipment, installation costs, ongoing maintenance, and data management expenses. For some communities or regions, the cost of implementing and operating monitoring

2.Complexity: Air quality monitoring involves sophisticated equipment and technical expertise to operate effectively. Ensuring the accuracy and reliability of monitoring data requires trained personnel and regular calibration of instruments.

3.Limited Coverage: Air quality monitoring systems typically cover specific geographic areas, such as urban centers or industrial zones, leaving other areas underserved. As a result, some communities, particularly those in rural or remote locations, may lack access to real-time air quality data.

4.Maintenance Requirements: Monitoring equipment requires regular maintenance to ensure accurate and reliable data collection. This includes calibrating sensors, cleaning instruments, and replacing worn-out components.

5.Data Interpretation Challenges: Interpreting air quality data can be complex, especially for non-experts. Understanding the significance of pollutant concentrations, interpreting trends, and assessing potential health risks require specialized knowledge and expertise in environmental science and public health..

6.Technological Limitations: While air quality monitoring technology continues to advance, certain pollutants, such as ultrafine particles or volatile organic compounds, may be challenging to detect accurately in real-time

7.Privacy Concerns: Some air quality monitoring systems, particularly those deployed in urban areas, may incorporate surveillance technologies, such as cameras or sensors, raising privacy concerns among residents.

8.Dependency on External Factors: Air quality monitoring systems rely on external factors, such as funding, political support, and collaboration with regulatory agencies, to operate effectively. Changes in funding priorities, shifts in political leadership, or regulatory changes

5.3 APPLICATIONS:

1.Environmental Protection: Monitoring air quality is essential for protecting the environment by tracking pollutant levels and identifying sources of pollution. This information enables authorities to develop strategies for pollution control, implement regulatory measures, and mitigate environmental impacts on ecosystems and natural resources.

2.Public Health: Monitoring air quality helps protect public health by assessing the concentration of harmful pollutants in the air. By identifying areas with poor air quality, policymakers can implement measures to reduce exposure to pollutants and minimize the risk of respiratory diseases, cardiovascular disorders, and other health problems associated with air pollution.

3.Urban Planning: Air quality data informs urban planning decisions related to land use, transportation, and infrastructure development. By considering air quality impacts during the planning process, cities can design more sustainable and livable environments, reduce traffic congestion, promote active transportation modes, and enhance public spaces.

4.Industrial Compliance: Many industries are required to monitor air quality to comply with environmental regulations and permits.

5.Transportation Management: Monitoring air quality is crucial for managing transportation-related emissions, including those from vehicles, ships, and aircraft. By measuring pollutant levels near transportation corridors and urban centers, authorities can develop transportation policies and infrastructure investments to reduce vehicle emissions, improve fuel efficiency, and promote alternative transportation modes.

6.Healthcare Facilities: Air quality monitoring is important in healthcare facilities to maintain indoor air quality and protect patients, staff, and visitors from exposure to airborne pollutants and contaminants. Monitoring systems help identify sources of indoor air pollution, such as volatile organic compounds or particulate matter, and implement ventilation and filtration solutions to improve indoor air quality.

8.Climate Research: Air quality monitoring contributes to climate research by measuring greenhouse gas emissions and atmospheric aerosols that affect climate change. Monitoring systems help scientists understand the interactions between air quality, atmospheric chemistry, and climate dynamics, informing climate models and projections for future climate scenarios.

CHAPTER 6:

CONCLUSION AND FUTURE SCOPE

The system to monitor the air of environment using Node MCU ESP8266, IOT Technology is proposed to improve quality of air. With the use of IOT technology enhances the process of monitoring various aspects of environment such as air quality monitoring issue proposed in this paper.

Here the using of MQ135 gas sensor gives the sense of different type of dangerous gas and ESP8266 is the heart of this project which controls the entire process. Wi-Fi module connects the whole process to internet and LCD is used for the visual Output

The Automatic Air management system is a step forward to contribute a solution to the biggest threat. The air monitoring system overcomes the problem of the highly- polluted areas which is a major issue.

It supports the new technology and effectively supports the healthy life concept. This system has features for the people to monitor the amount of pollution on their mobile phones using the application. Our system mainly focussed on monitoring the harmful pollutants in air using wireless gas sensors and esp8266 wi-fi module which helps in monitoring the results. The proposed system is very much easy to implement.

The concept is much new and we detect number of gases. The nodemcu and sensors are very less expensive so we can implement this system in high pollution areas. In futurethis type of systems have to be implemented because with help of this sytem we can actually detect and monitor the pollution of air and sound. In big cities this system is very much useful because implmentation cost is very much less these the big systems. So we have to think about future and make world pollution free

CHAPTER 7:

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