CHAPTER 1

INTRODUCTION

Industrial pollution is a significant problem that affects not only the environment but also the health and safety of workers and nearby communities. Industries that produce chemicals, petroleum, and other pollutants have a responsibility to monitor and control their emissions to minimize their impact on the environment and the public. Traditional methods of pollution monitoring involve manual sampling and analysis, which can be time-consuming, expensive, and unreliable.

The Internet of Things (IOT) has emerged as a promising solution to this problem. IOT-based pollution monitoring systems allow industries to monitor and control their emissions in real-time. The system consists of a network of sensors that are placed in strategic locations within the industry, such as near the smokestacks and wastewater outlets. These sensors collect data on air and water quality, as well as other pollutants that may be present in the industry.

The data collected by these sensors is then analyzed in real-time using advanced analytics tools, such as machine learning algorithms. This allows industries to quickly identify any potential issues and take appropriate actions to mitigate them. Furthermore, these systems can be integrated with other industrial processes, such as production and supply chain management, to optimize operations and reduce costs.

The IOT-based industrial pollution monitoring system is a valuable tool for industries looking to minimize their environmental impact and improve their overall operations. By monitoring and controlling pollution levels in real-time, industries can ensure the safety and health of their employees and the surrounding community while minimizing their environmental impact.

The Internet of Things (IOT) is the network of devices such as vehicles, and home appliances that contain electronics, software, actuators, and connectivity which allows these things to connect, interact and exchange data. The IOT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets, to any range of traditionally dumb or non-internet-enabled physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled.

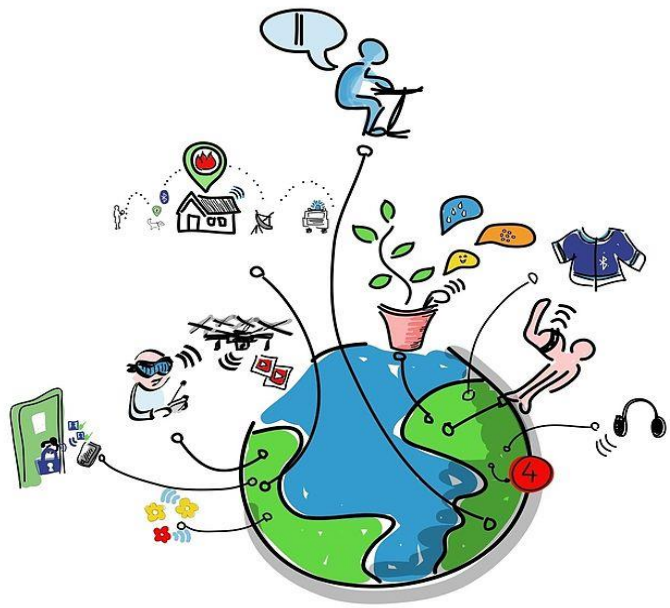


Fig:1.1 Representation of IoT

The definition of the Internet of things has evolved due to convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things.

CHAPTER 2

EXISTING METHODS

In proposed system, we combined PIC microcontroller with a several gas sensors, Noise. This designed system helps to monitor the air quality and provide immediate solutions like ventilation, noise reduction and cooling. It is capable of monitoring the industrial air temperature which is major problem in all the industries. It also takes information about the surrounding environment through sensors and upload it to the internet.

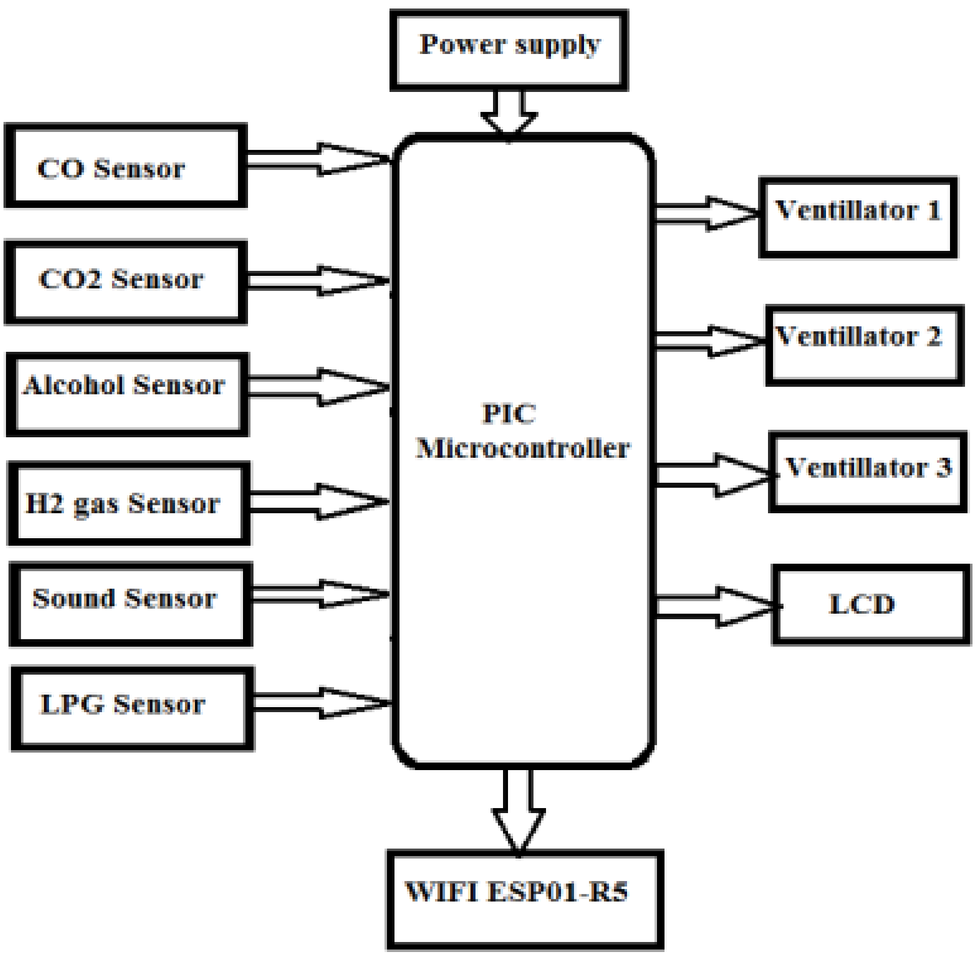


Fig. 2.1 EXISTING BLOCK DIAGRAM

DISADVANTAGES

- Sensor accuracy
- Maintenance

2.1 PROPOSED SYSTEM

The proposed IOT-based industrial pollution monitoring system for water quality (TDS sensor), air quality (CO_2 sensor), and sound quality (sound sensor) is designed to provide comprehensive and real-time monitoring of industrial emissions. The system consists of a network of sensors that are strategically placed within the industry to monitor water, air, and sound quality.

The TDS sensor is used to measure the total dissolved solids in water, which can be an indicator of the water's purity. The CO_2 sensor is used to measure the carbon dioxide levels in the air, which can be an indicator of indoor air quality. The sound sensor is used to measure the sound levels within the industry, which can be an indicator of noise pollution.

The data collected by these sensors is transmitted to a central control unit using IOT technology. The control unit analyzes the data in real-time and provides a comprehensive overview of the industry's emissions. The data can be displayed on a web-based dashboard, allowing users to monitor pollution levels in real-time. And also, all the sensor measurement level displayed on the LCD. If any sensor value is high buzzer will be on to intimate the persons.

The system can also be integrated with other industrial processes, such as production and supply chain management, to optimize operations and reduce costs.

The proposed IOT-based industrial pollution monitoring system for water quality, air quality, and sound quality is a valuable tool for industries looking to minimize their environmental impact and improve their operations. By monitoring and controlling pollution levels in real-time, industries can ensure the safety and health of their employees and the surrounding community while minimizing their environmental impact.

BLOCK DIAGRAM

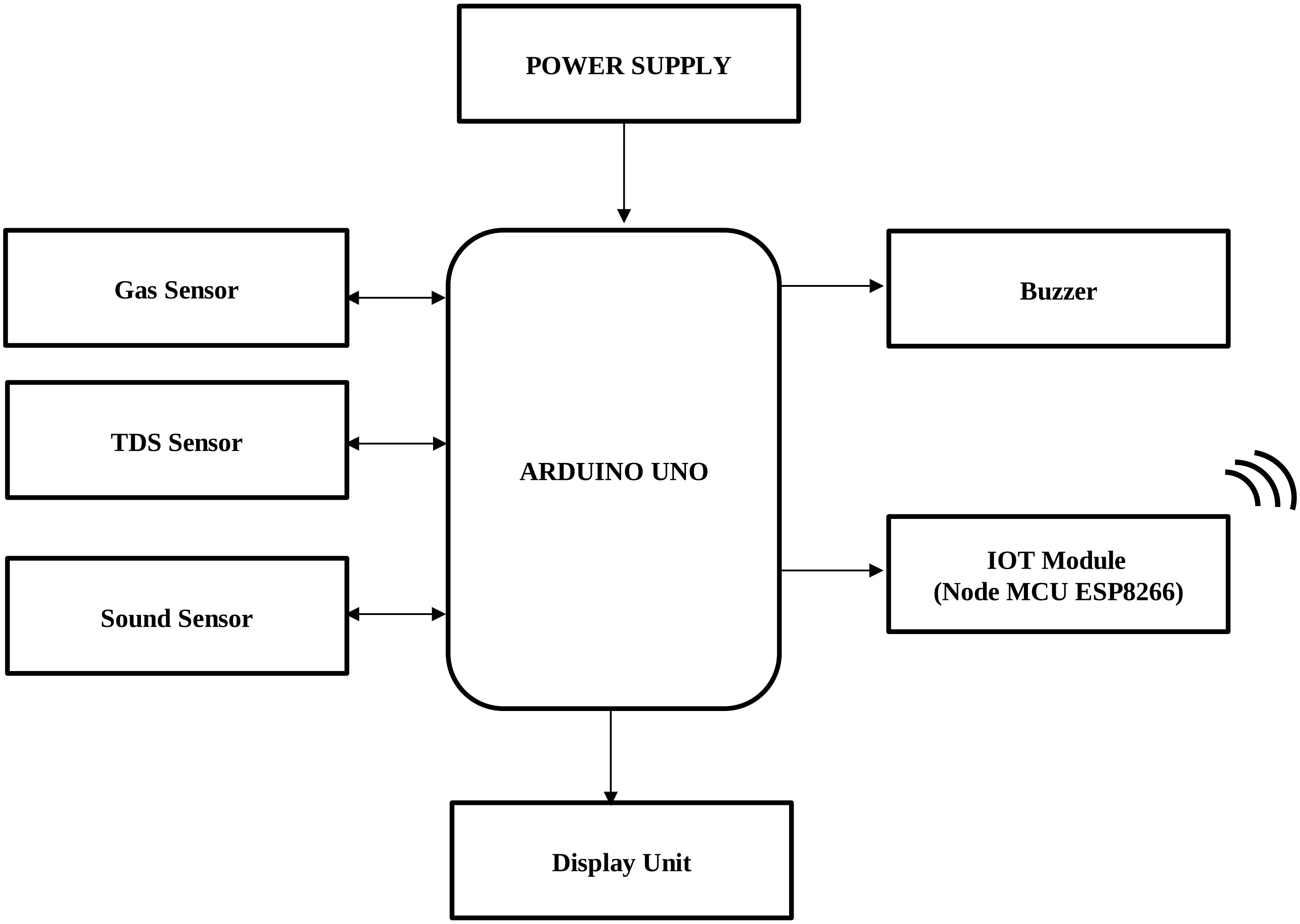


Fig. 2.2 PROPOSED SYSTEM

EXPLANATION

- This system IOT based industrial pollution monitoring system
- We are using the sound sensor, TDS sensor, CO_2 sensor.
- The sound sensor detects sound waves traveling through the air pollution through intimate the IOT.
- The TDS sensor sense the detects the Total Dissolved Solids (TDS) levels in the water which can be used to indicate the water quality.
- The CO_2 sensor sense the carbon dioxide level of industrial pollution.

- If the any sensor values are high to intimate the IOT and beep sound will be on automatically.

ADVANTAGES

- Real-time monitoring
- Cost-effective
- Remote monitoring
- Customizable
- Data analytics

CHAPTER 3

ARDUINO UNO

3.1 INTRODUCTION

Arduino is an open -source computer Hardware and Software Company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control objects in the physical world. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on the Processing project, which includes support for the C and C++ programming languages.

The first Arduino was introduced in 2005, aiming to provide an inexpensive and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include thermostats, simple robots and motion detectors.

Arduino boards are available commercially in preassembled form, or as do-it-yourself kits. The hardware design specifications are openly available, allowing the Arduino boards to be manufactured by anyone. Ad fruit Industries estimated in mid-2011 that over 300,000 officials Arduino had been commercially produced, and in 2013 that 700,000 official boards were in users' hands.

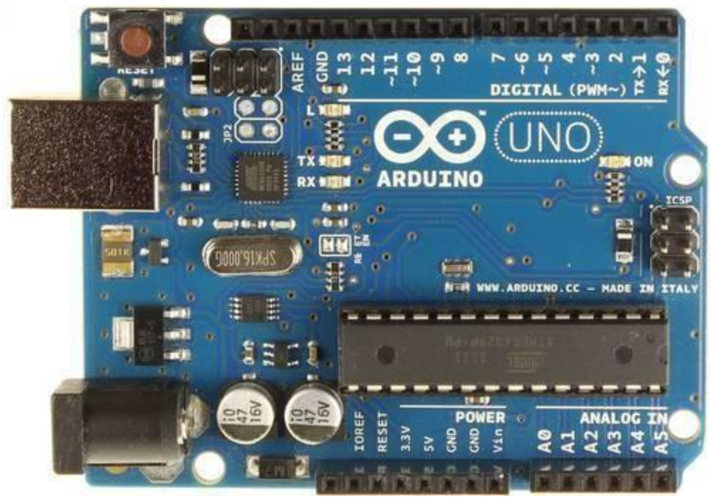


Fig: 3.1 Arduino UNO Board

3.2 MODULES

Various Modules available in Arduino UNO development board is listed

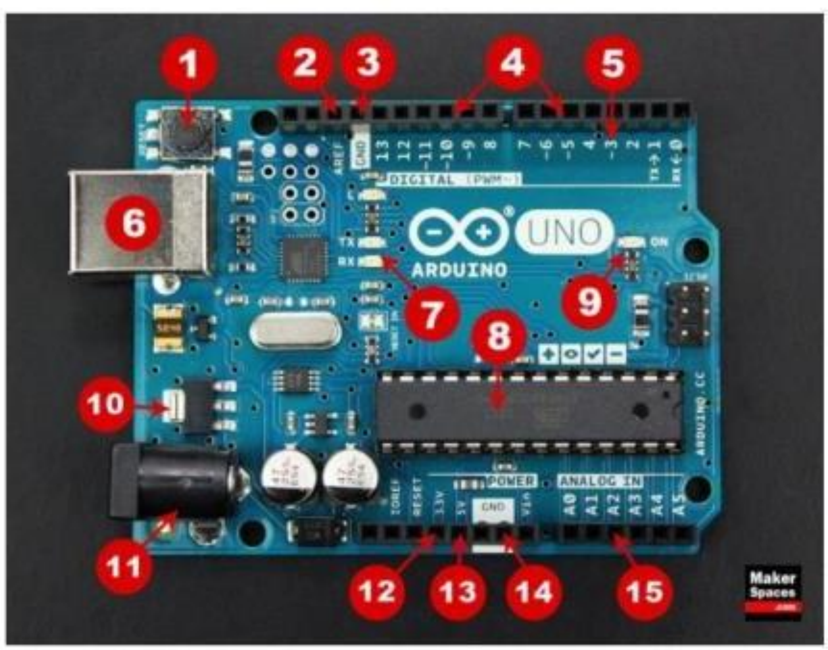


Fig: 3.2 Arduino UNO Parts

- Reset Button – This will restart any code that is loaded to the Arduino board.
- AREF – Stands for “Analog Reference” and is used to set an external reference voltage.
- Ground Pin – There are a few ground pins on the Arduino and they all work the same.
- Digital Input / Output – Pins 0-13 can be used for digital input or output.
- PWM – The pins marked with the (~) symbol provide pulse width modulated wave with varying on and off.
- USB Connection – Used for powering up on Arduino and uploading programs.
- TX/RX – Transmit and receive data indication LEDs.
- AT mega Microcontroller – This is the brain and is where the programs are stored.
- Power LED Indicator – This LED lights up anytime the board is plugged in a power source.
- Voltage Regulator – This controls the amount of voltage going into the Arduino board.
- DC Power Barrel Jack – This is used for powering on Arduino with a power supply.
- 3.3V Pin – This pin supplies 3.3 volts of power to the projects.
- 5V Pin – This pin supplies 5 volts of power to the projects.
- Ground Pins – There are a few ground pins on the Arduino and they all work the same.

- Analog Pins – These pins can read the signal from an analog sensor and convert it too digital.

3.3 SPECIFICATION

The technical specifications of the Arduino UNO are:

- There are 20 Input/ Output pins present on the Arduino UNO board. These 20 pins include 6 PWM pins, 6 analog pins, and 8 digital I/O pins.
- The PWM pins are Pulse Width Modulation capable pins.
- The crystal oscillator present in Arduino UNO comes with a frequency of 16MHz.
- It also has a Arduino integrated Wi-Fi module. Such Arduino UNO board is based on the Integrated Wi-Fi ESP8266 Module and ATmega328P microcontroller.
- The input voltage of the UNO board varies from 7V to 20V.
- Arduino UNO automatically draws power from the external power supply. It can also draw power from the USB.

Microcontroller	ATmega38P- 8bit AVR family Microcontroller
Operating voltage	5V
Recommended input voltage	7-12V
Input voltage Limits	6-20V
Analog Input Pins	6 (A0-A5)

Digital I/O Pins	14(out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pins	50 mA
Flash memory	32 KB (0.5 KB is used for Boot loader)
SRAM	2KB
EEPROM	1KB
Frequency (Clock Speed)	16MHz

Fig 3.3 ARDUNIO UNO SPECIFICATION

3.4 APPLICATION

The applications of Arduino Uno include the following: -

- Arduino Uno is used in Do-it-Yourself projects prototyping.
- In developing projects based on code-based control.
- Development of Automation System and Designing of basic circuit designs.

CHAPTER 4

NODE MCU

4.1 INTRODUCTION

Node MCU (**N**ode **M**icro***c***ontroller **U**nit) is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espress if Systems, and hardware which is based on the ESP-12 module. The term “Node MCU” by default refers to the firmware rather than the Devkit. The firmware uses the Lua scripting language. It is based on the Eula project, and built on the Espress if Non-OS SDK for ESP8266. It uses many open-source projects, such as leucosin and spiffs.

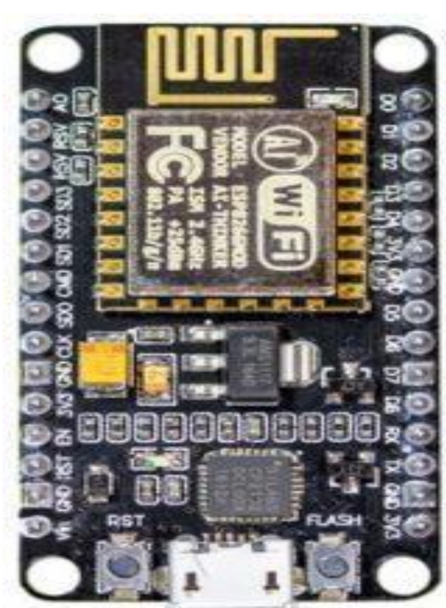


Fig: 4.1 Node MCU

4.2 FEATURES

- Version: Devkit v1.0
- Breadboard Friendly.
- Light Weight and small size.
- 3.3V operated, can be USB powered.
- Uses wireless protocol 802.11b/g/n.
- Built-in wireless connectivity capabilities.
- Built-in PCB antenna on the ESP-12E chip.
- Capable of PWM, I2C, SPI, UART, 1-wire, 1 analog pin.
- Uses CP2102 USB Serial Communication interface module.
- Arduino IDE compatible (extension board manager required).
- Supports Lua (a like node.js) and Arduino C programming language.
- 11digital input and output pins.
- 1 analog pin.
- Micro USB connection
- Compatible with Node MCU.
- Flash :4MB

4.3 HISTORY

- Node MCU was created shortly after the ESP8266came out.
- On December 30 2013, Espressif system began production of the ESP8266.
- The ESP8266 is a Wi-Fi SoC integrated with Tensilica xtensa LX106core, widely used in IOT application.
- Node MCU started on 13 October 2014, when Hong committed the first file of Node MCU –firmware to GitHub.

It is the one of the open hardware platforms when developer Huang Rcommitted the Gerber file of an ESP8266 board.

4.1 WI-FI MODULE

- It is a self-contained SoC with integrated TCP/IP protocols.
- It can give any microcontroller access to your Wi-Fi network.

The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking function from another application processor.

4.2 APPLICATIONS

Node MCU is mainly used in the Wi-Fi Applications which most of the other embedded modules fail to process unless incorporated with some external Wi-Fi protocol.

- Internet Smoked Alarm.
- VR Tracker.
- Octopod.
- Serial Port Monitor.
- ESP Lamp

CHAPTER 5

GAS SENSOR

5.1 INTRODUCTION

MQ2 gas sensor can be used to detect the presence of LPG, Propane and Hydrogen, also could be used to detect Methane and other combustible steam, it is low cost and suitable for different application. Sensor is sensitive to flammable gas and smoke. Smoke sensor is given 5 volts to power it. Smoke sensor indicate smoke by the voltage that it outputs. More smoke more output. A potentiometer is provided to adjust the sensitivity. Sn02 is the sensor used which is of low conductivity when the air is clean. But when smoke exist sensor provides an analog resistive output based on concentration of smoke. The circuit has a heater. Power is given to heater by VCC and GND from power supply. The circuit has a variable resistor. The resistance across the pin depends on the smoke in air in the sensor. The resistance will be lowered if the content is more. And voltage is increased between the sensor and load resistor.

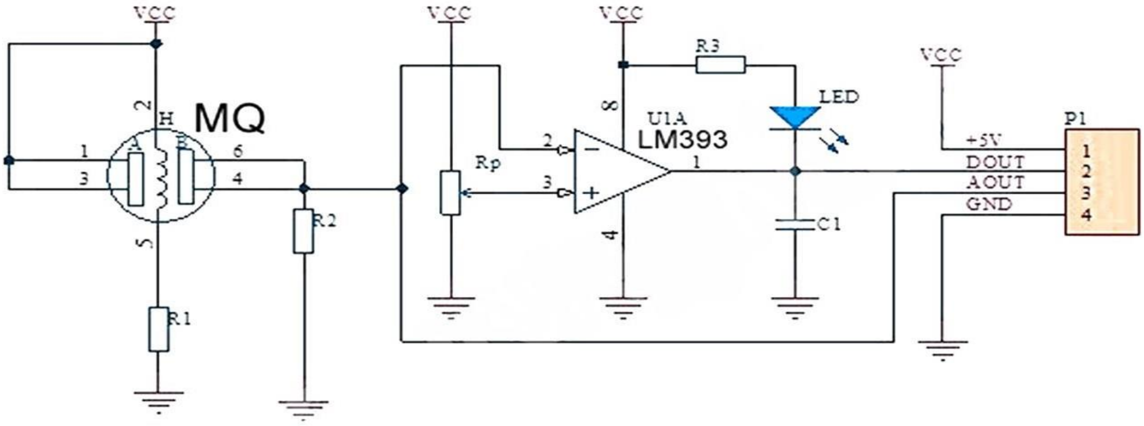


Fig. 5.1 circuit diagram of MQ2

5.2 SPECIFICATIONS

- Power Supply: 4.5V to 5V DC
- High sensitivity to Propane, Smoke, LPG and Butane
- Wide range high sensitivity to Combustible gases
- Long life and low cost
- Analog and Digital output available
- Onboard visual indicator (LED) for indicating alarm
- Compact design and easily mountable
- Simple 4 PIN header interface
- Drive circuit is simple.
- Sensor Type: Semiconductor
- Concentration: 300-10000ppm (Combustible gas)
- Supply voltage =5v
- Control of air quality
- Measurement of gas level
- Control of air quality
- Measurement of gas level

5.3 APPLICATION

- Safety of home
- Control of air quality
- Measurement of gas level

5.4 Working Principle

The MQ2 has an electrochemical sensor, which changes its resistance for different concentrations of varied gasses. The sensor is connected in series with a variable resistor to form a voltage divider circuit (Fig 1), and the variable resistor is used to change sensitivity. When one of the above gaseous elements comes in contact with the sensor after heating, the sensor's resistance change. The change in the resistance changes the voltage across the sensor, and this voltage can be read by a microcontroller. The voltage value can be used to find the resistance of the sensor by knowing the reference voltage and the other resistor's resistance. The sensor has different sensitivity for different types of gasses.

Fig. 5.2 MQ2 sensor

CHAPTER 6

SOUND SENSOR

6.1 INTRODUCTION

Sound level recognition (not capable to obtain precise dB value Nowadays, a lot of security events are initiated due to some sort of sound which includes gunshots, aggressive behavior, breaking the glass. But cameras with inbuilt sound exposure facilities can add huge value to the security system. Because they give an alert automatically when real and potential incidents occur. Then immediately they activate quick and appropriate actions to reduce the consequences. This article discusses an overview of the sound sensor module.

The sound sensor is one type of module used to notice the sound. Generally, this module is used to detect the intensity of sound. The applications of this module mainly include switch, security, as well as monitoring. The accuracy of this sensor can be changed for the ease of usage.

This sensor employs a microphone to provide input to buffer, peak detector and an amplify This sensor notices a sound, & processes an o/p voltage signal to a microcontroller. After that, it executes required processing.

This sensor is capable to determine noise levels within dBs or decibels at 3 KHz to 6 KHz frequencies approximately wherever the human ear is sensitive. In smartphones, there is an android application namely decibel meter used to measure the sound level.

6.2 PIN CONFIGURATION

This sensor includes three pins which include the following

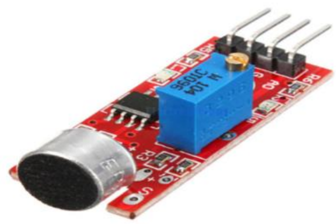


Fig 6.1 Sound Sensor

- Pin1 (VCC): 3.3V DC to 5V DC
- Pin2 (GND): This is a ground pin
- Pin3 (DO): This is an output pin

6.3 WORKING PRINCIPLE

The working principle of this sensor is related to human ears. Because human eye includes a diaphragm and the main function of this diaphragm is, it uses the vibrations and changes into signals. Whereas in this sensor, it uses a microphone and the main function of this is, it uses the vibrations and changes into current otherwise voltage.

Generally, it includes a diaphragm which is designed with magnets that are twisted with metal wire. When sound signals hit the diaphragm, then magnets within the sensor vibrates & simultaneously current can be stimulated from the coils.

6.4 FEATURES

The features of the sound sensor include the following

- These sensors are very simple to use
- It gives analog o/p signal
- Simply incorporates using logic modules on the input area

6.5 SPECIFICATIONS

- The range of operating voltage is 3.⅗ V
- The operating current is 4~5 mA
- The voltage gains 26 dB ((V=6V, f=1kHz)
- The sensitivity of the microphone (1kHz) is 52 to 48 dB
- The impedance of the microphone is 2.2k Ohm
- The frequency of m microphone is16 to 20 kHz
- The signal to noise ratio is 54 dB

6.6 APPLICATIONS

This sensor can be used to build various electronic projects with the help of an Arduino board. For instance, this project uses a grove sensor, which fundamentally gives your Arduino's ears. In this project, a microphone can be attached to an analog pin of the board. This can be used to notice the noise level within the nearby surroundings. The grove sensors support platforms like Arduino, Raspberry Pi, Beagle Bone Wio, and LinkIt ONE. This sensor plays an essential role while activating the light in your office or house by detecting a precise whistle or clap sound.

Some more applications of this sensor,

- Security system for Office or Home
- Spy Circuit
- Home automation
- Robotics
- Smart Phones
- Ambient sound recognition
- Audio amplifier

CHAPTER 7

TDS SENSOR

7.1 INTRODUCTION

The Grove - TDS Sensor detects the Total Dissolved Solids (TDS) levels in the water which can be used to indicate the water quality. The Grove - TDS Sensor can be applied in water quality applications such as TDS meter, well water, aquarium, hydroponics, etc.

It supports 3.3/5V input voltage and 0 ~ 2.3V Output Voltage making it easy to be compatible with all Arduino Boards. The sensor also provides a waterproof probe, making the testing process much easier to handle.

7.2 What is TDS and why should you care

TDS = Total Dissolved Solids, is a measure of the dissolved combined content of all inorganic and organic substances present in water. Typically, the higher the TDS value, the more substances dissolved in water. Hence, higher levels of Total Dissolved Solids (TDS) can indicate that water has more contaminants that can pose health risks.

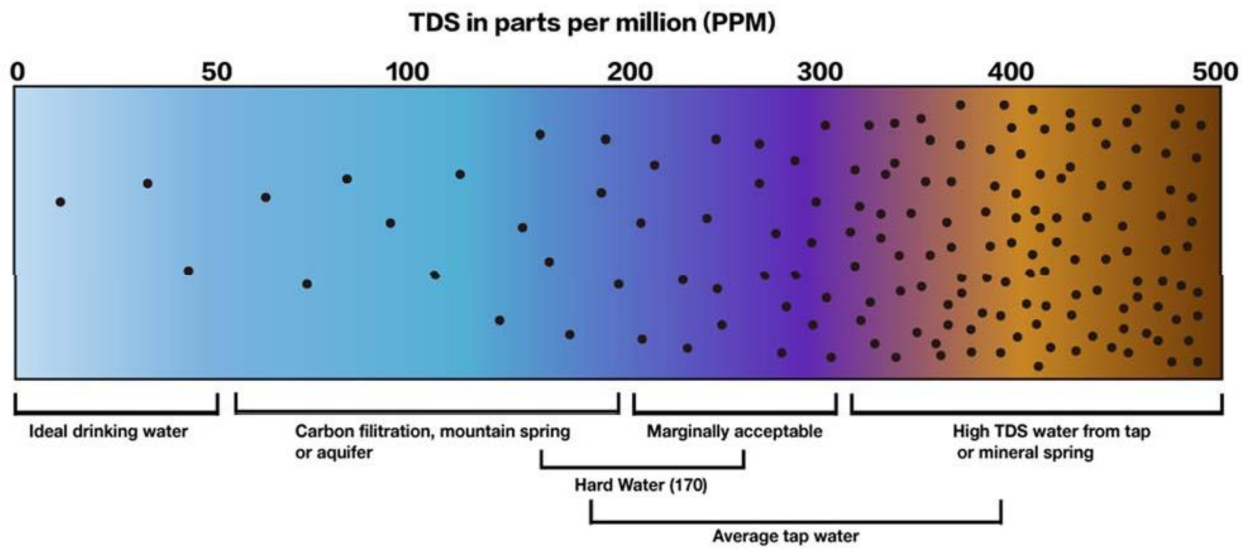


Fig. 7.1 water quality

7.3 Applications

- TDS meter/TDS tester
- Swimming pool
- Aquarium
- Well water
- Hydroponics

7.4 Specifications

Grove - TDS Sensor

- Input Voltage: 3.3/5V
- Output Voltage: 0 ~ 2.3V
- Working Current: 3 ~ 6mA
- TDS Measurement Range: 0 ~ 1000ppm
- Power indication LED
- Connection Interface: Grove 4-Pin / XHB 2.54mm 2P

Waterproof Probe

- Cable Length: 60cm
- Connection Interface: XHB 2.54mm 2P

7.5 Hardware Overview

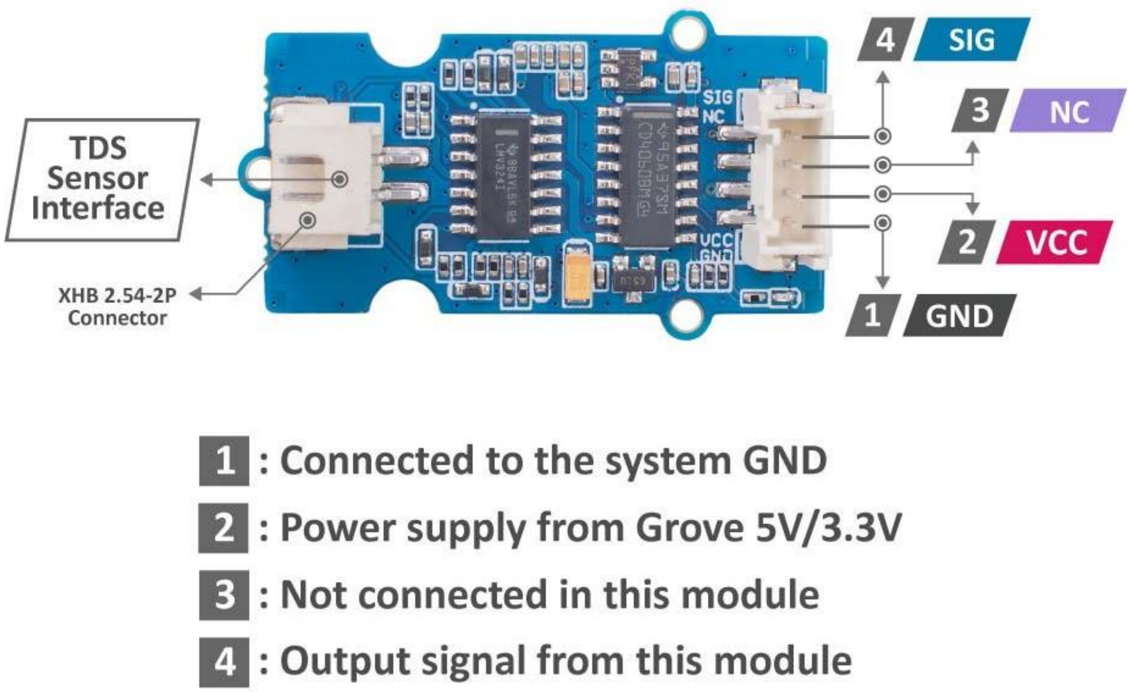


Fig.7.5 TDS sensor specification

CHAPTER 8

DISPLAY & BUZZER

8.1 LIQUID CRYSTAL DISPLAY

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary image are made up of a large number of small pixels, while other displays have larger elements. An LCD is a small low-cost display. It is easy to interface with a micro-controller because of an embedded controller (the black blob on the back of the board). This controller is standard across many displays (HD 44780) which means many micro-controllers (including the Arduino) have libraries that make displaying messages as easy as a single line of code.

Fig. 8.1.1 LCD display unit

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence.

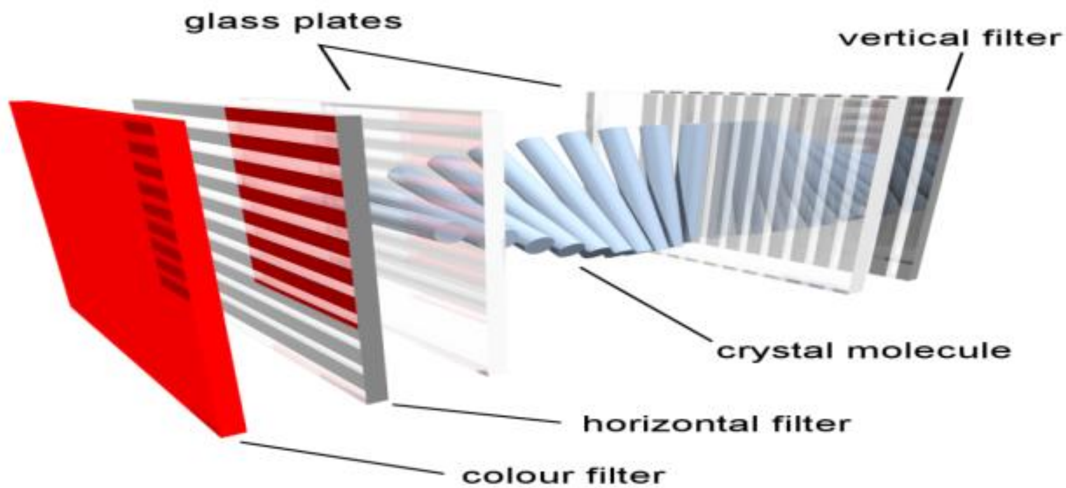


Fig. 8.1.2 Internal working of LCD unit

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	V_{CC}
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Table 8.1 LCD specification

8.2 BUZZER

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board.

Fig 8.2 Buzzer

Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a sound alert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off. In game shows it is also known as a "lockout system," because when one person signals ("buzzes in"), all others are locked out from signaling. Several game shows have large buzzer buttons which are identified as "plungers". The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep.

CHAPTER 9

POWER SUPPLY

9.1 INTRODUCTION

A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise orvoltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

All power supplies have a power input connection, which receives energy in the form of electric current from a source, and one or more power output or rail connections that deliver current to the load. The source power may come from the electric power grid, such as an electrical outlet, energy storage devices such as batteries or fuel cells, generators or alternators, solar power converters, or another power supply. The input and output are usually hardwired circuit connections, though some power supplies employ wireless energy transfer to power their loads without wired connections. Some power supplies have other types of inputs and outputs as well, for functions such as external monitoring and control.

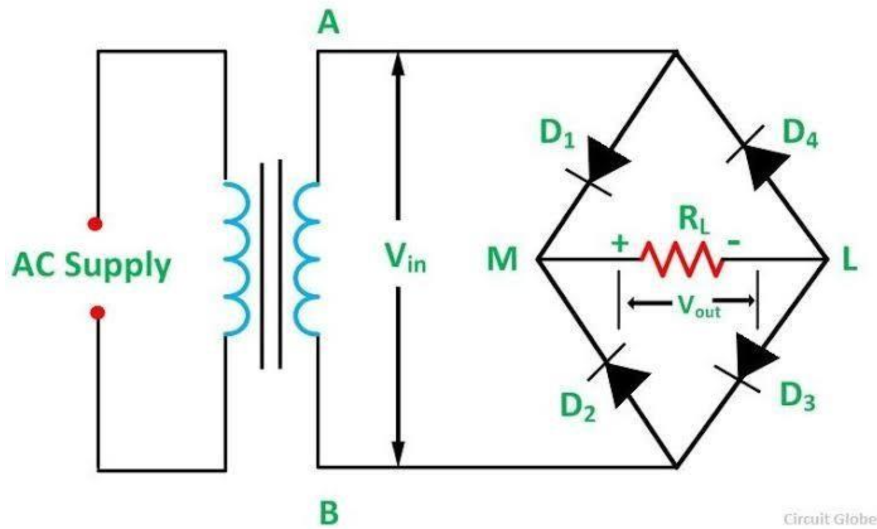


Fig 9.1 Circuit diagram of power board

9.1.2 APPLICATION

- Computers
- Electrical vehicles
- Welding
- Aircraft
- Automation
- Medical

9.2 TRANSFORMER

9.2.1 INTRODUCTION

A Step-down Transformer is a general-purpose chassis mounting mains transformer. A Transformer has 230V primary winding and non-center tapped secondary winding. The transformer has flying colored insulated connectingleads (Approx. 100 mm long).

9.2.2 PRINCIPLE

The transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (E.M.F) or voltage in the secondary winding. The transformer has cores made of high permeability siliconsteel.

9.2.3 CHARACTERISTICS

The primary and secondary coils are devoid of electrical connection (except for auto transformers). The transfer of power is through magnetic flux. No moving parts are required to transfer energy, so there are no friction or wind age losses as with other electrical devices.

The losses that do occur in transformers are smaller than those in other electrical devices, and include:

9.2.3.1 Copper loss (electrical power lost in the heat created by circulation of currents around the copper windings).

9.2.3.2 Core loss (eddy current and hysteresis losses, caused by lagging of magnetic molecules in response to the alternating magnetic flux within the core)

Most transformers are very efficient in delivering between 94 to 96% of energy at full load. Very high-capacity transformers may deliver up to 98%, especially if they operate with constant voltage and frequency.

9.2.4 APPLICATION OF TRANSFORMER

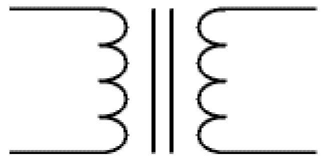
It can rise or lower (step-up or step-down) the level of AC voltage or current (when voltage increases, current decreases and vice versa because P =VI, where power is constant at both input and output sides). This setup is used in both power transformers and distribution transformers for transmission and distribution of the electric power in a power system for further utilization and applications.

It can increase or decrease the value of capacitor, an inductor or resistance in AC circuits i.e., a transformer thus acts as an impedance transferring device. It can be used to prevent DC from passing from one circuitto the other. In other words, they are used as ripple filters which compensate for the pulsating DC. It can be used to electrically isolate two electric circuits.

9.3 Linear Power supply:

An AC powered linear power supply usually uses a transformer to convert the voltage from the wall outlet (mains) to a different, usually a lower voltage. If it is used to produce DC, a rectifier is used. A capacitor is used to smooth the pulsating current from the rectifier. Some small periodic deviations from smooth direct current will remain, which is known as ripple. These pulsations occur at a frequency related to the AC power frequency (for example, a multiple of 50 or 60 Hz).

9.3.1 Transformer:



Transformer

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC.

Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage.

The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead, they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core.

Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up.

The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

9.4 Bridge rectifier:

A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called a full-wave rectifier because it uses the entire AC wave (both positive and negative sections). 1.4V is used up in the bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting, as shown in the diagram below. Bridge rectifiers are rated by the maximum current they can pass and the maximum reverse voltage they can withstand (this must be at least three times the supply RMS voltage so the rectifier can withstand the peak voltages). Please see the DIODES page for more details, including pictures of bridge rectifiers.

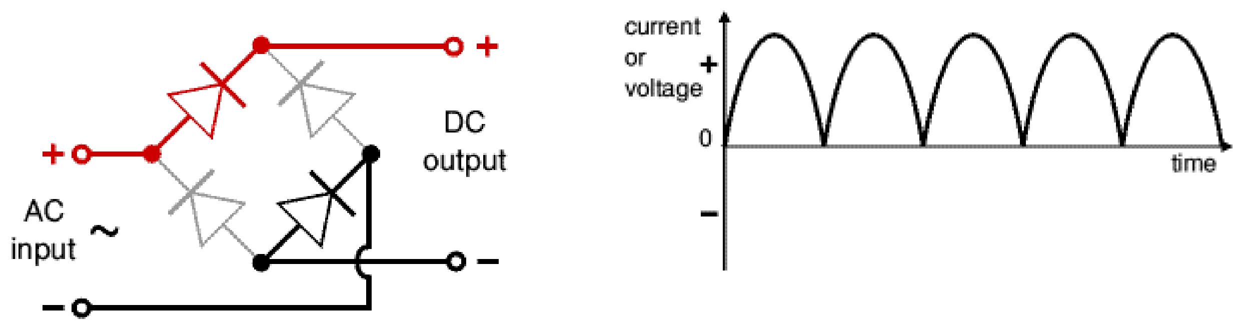


Fig.9.4.1. Bridge rectifier

- Alternate pairs of diodes conduct, changing over the connections so the alternating directions of AC are converted to the one direction of DC. Output: full-wave varying DC: (using the entire AC wave):

Smoothing:

Smoothing is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The diagram shows the unsmoothed varying DC (dotted line) and the smoothed DC (solid line). The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output.

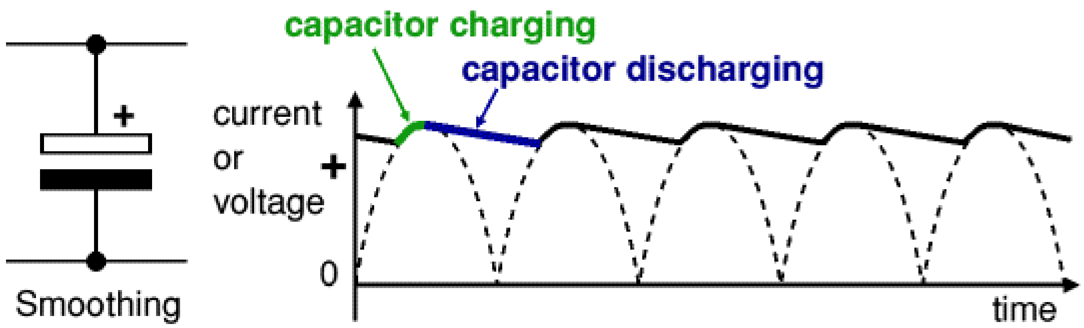


Fig.9.4.2. Smoothing

Note that smoothing significantly increases the average DC voltage to almost the peak value (1.4 × RMS value). For example, 6V RMS AC is rectified to full wave DC of about 4.6V RMS (1.4V is lost in the bridge rectifier), with smoothing these increases to almost the peak value giving 1.4 × 4.6 = 6.4V smooth DC.

Smoothing is not perfect due to the capacitor voltage falling a little as it discharges, giving a small ripple voltage. For many circuits a ripple which is 10% of the supply voltage is satisfactory and of the equation below gives the required value for the smoothing capacitor. A larger capacitor will give fewer ripples. The capacitor value must be doubled when smoothing half-wave DC.

Smoothing Capacitor for 10% ripple, C=5*10/vs

C = smoothing capacitance in farads (F)
Io = output current from the supply in amps (A)
Vs = supply voltage in volts (V), this is the peak value of the unsmoothed DC
f = frequency of the AC supply in hertz (Hz), 50Hz in the UK.

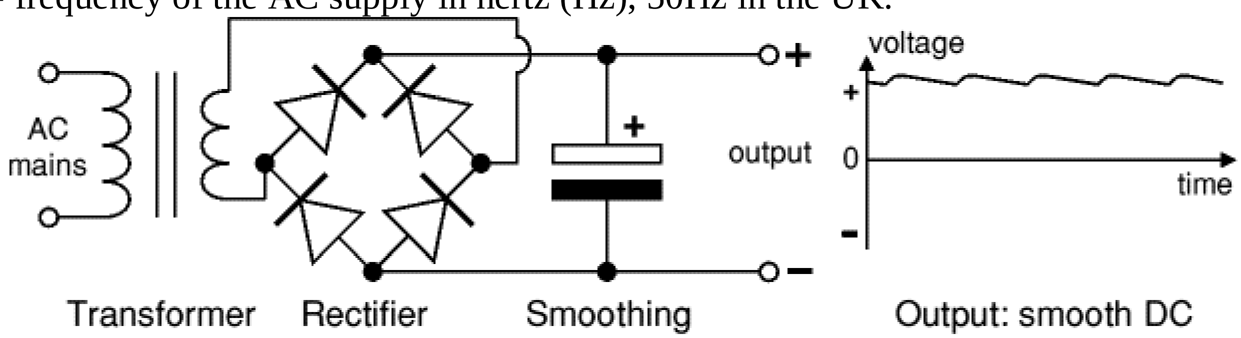


Fig. 9.4.3. power supply circuit

The smooth DC output has a small ripple. It is suitable for most electronic circuits.

9.5 Regulator:

Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection').

The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, Hi-Fi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators these devices can be used with external components to obtain adjustable voltages and current. Many of the fixed voltage regulator ICs has 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right. They include a hole for attaching a heat sink if necessary.

1. Positive regulator
    1. input pin
    2. ground pin
    3. output pin

   It regulates the positive voltage

2. Negative regulator
    1. ground pin
    2. input pin

3. output pin

It regulates the negative voltage

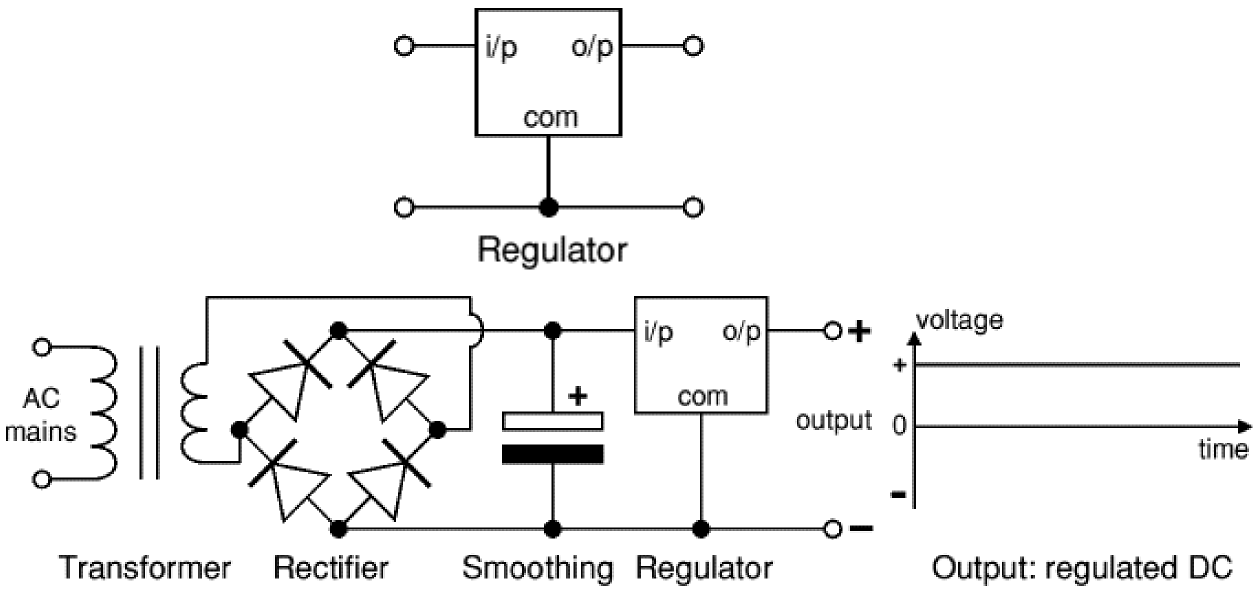


Fig. 9.5 Regulator

The regulated DC output is very smooth with no ripple. It is suitable for all electronic circuits.

CHAPTER 10

ARDUINO IDE

10.1 INTRODUCTION

Arduino programs may be written in any programming language with a compiler that produces binary machine code. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio.

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in Java. It originated from the IDE for the Processing programming language project and the Wiring project. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and provides simple one-click mechanism for compiling and loading programs to an Arduino board. A program written with the IDE for Arduino is called a "sketch".

Fig: 10.1 Arduino IDE

The Arduino IDE supports the C and C++ programming languages using special rules of code organization. The Arduino IDE supplies a software library called "Wiring" from the Wiring project, which provides many common input and output procedures. A typical Arduino C/C++ sketch consist of two functions that are compiled and linked with a program stub main () into an executable cyclic executive program:

setup (): a function that runs once at the start of a program and that can initialize settings.

loop (): a function called repeatedly until the board powers off.

After compilation and linking with the GNU toolchain, also included with the IDE distribution, the Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal coding that is loaded into the Arduino board by a loader program in the board's firmware.

10.2 BENEFITS

The main benefits of Arduino IDE can be seen in its ability to function as an on-premise application and as an online editor, direct sketching, board module options, and integrated libraries.

Arduino IDE lets users can come up with sketches from within its text editor.The process is simple and straightforward. Arduino IDE allows users to share their sketches to other programmers. Each sketch comes with their own online link for users to share with their colleagues or friends. This feature is only available in the cloud version.

CHAPTER 11

BLYNK

11.1 INTRODUCTION

Blynk is a new platform that allows everyone to build interfaces for controlling and monitoring the hardware projects from the iOS and Android device in no time. After downloading the Blynk app, a project dashboard is created and buttons, sliders, graphs, and other widgets are arranged onto the screen. Using the widgets, pins are turned on and off or display data from sensors.

11.2 TYPES

Blynk was designed for the Internet of Things (IoT). It can control hardware remotely, it can display sensor data and it can store data, visualize it and do many other cool things.

There are three major components in the platform:

- **Blynk App -** allows to create amazing interfaces for the projects using various widgets that are provided.
- **Blynk Server -** responsible for all communications between the smart phone and hardware. The Blynk Cloud is used and made to run on a private Blynk server locally. It is a open – source software and can handle thousands of devices in ease or it can even be launched on a Raspberry Pi.
- **Blynk Libraries -** For all the popular hardware platforms, the libraries enable communication with the server and process all the incoming and out coming commands.

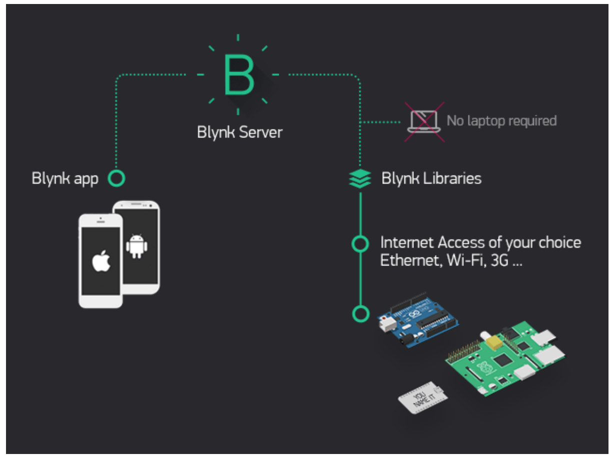


Fig: 11.2 BLYNK Server Diagram

11.3 APPLICATION

Blynk works over the Internet: This means that the hardware selected should be able to connect to the internet. Boards like Arduino Uno need an Ethernet or Wi-Fi Shield to communicate, others are already Internet-enabled: like the ESP8266, Raspberry Pi with Wi-Fi dongle, Particle Photon or Spark Fun Blynk Board. Or else it can be connected over USB to the laptop or desktop. Also, the Blynk App is a well-designed interface builder, that works on both iOS and Android.

CHAPTER 12

IOT BASED INDUSTRIAL POLLUTION MONITORING SYSTEM

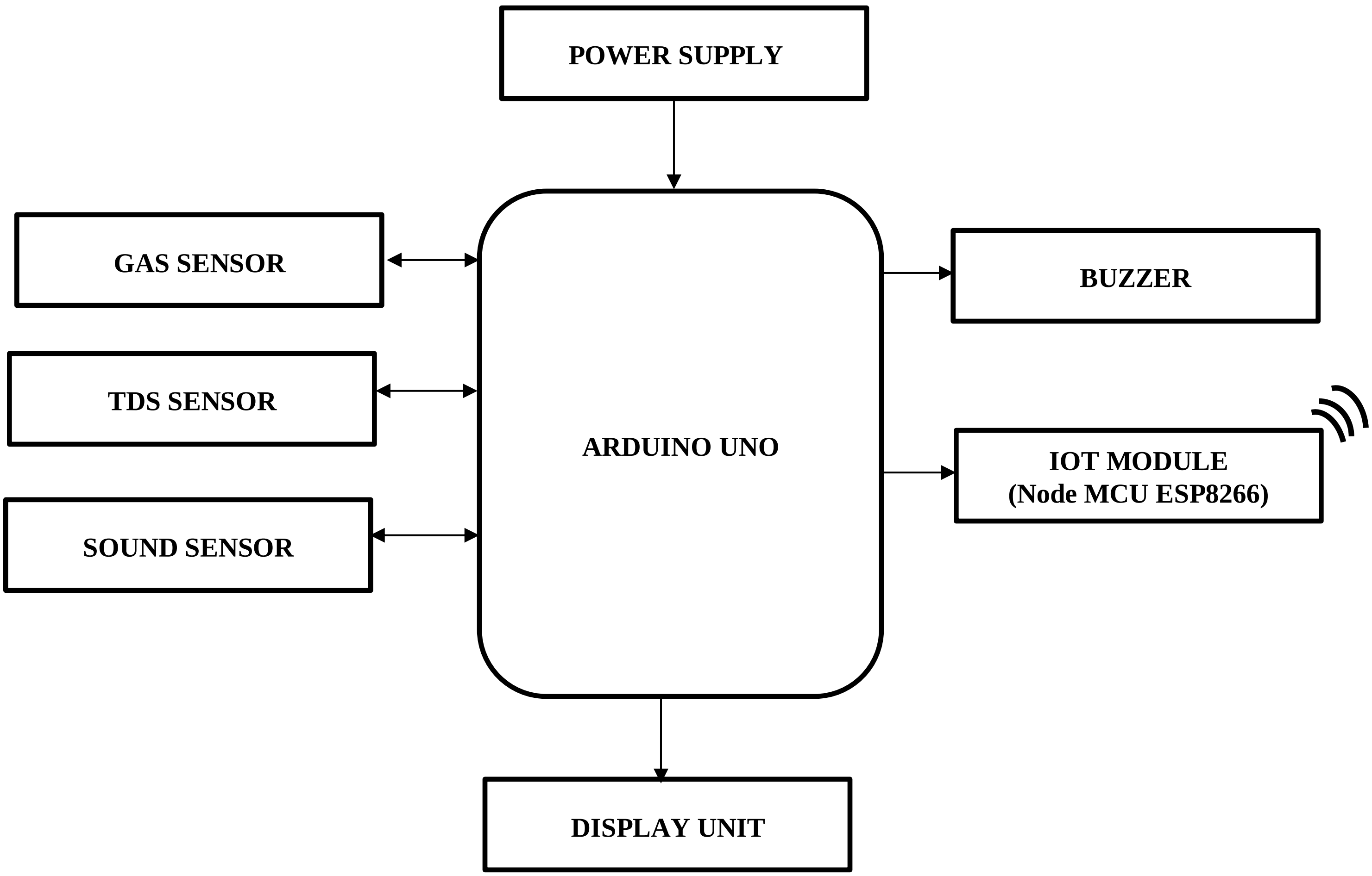


Fig. 12.1 Block Diagram

12.1PROJECT DESCRIPTION

This system IOT based industrial pollution monitoring system. We are using the sound sensor, TDS sensor, CO_2 sensor. The sound sensor detects sound waves traveling through the air pollution through intimate the IOT. The TDS sensor sense the detects the Total Dissolved Solids (TDS) levels in the water which can be used to indicate the water quality. The CO_2 sensor sense the carbon dioxide level of industrial pollution. If the any sensor values are high to intimate the IOT and beep sound will be on automatically.

CHAPTER 13

RESULT AND CONCLUSION

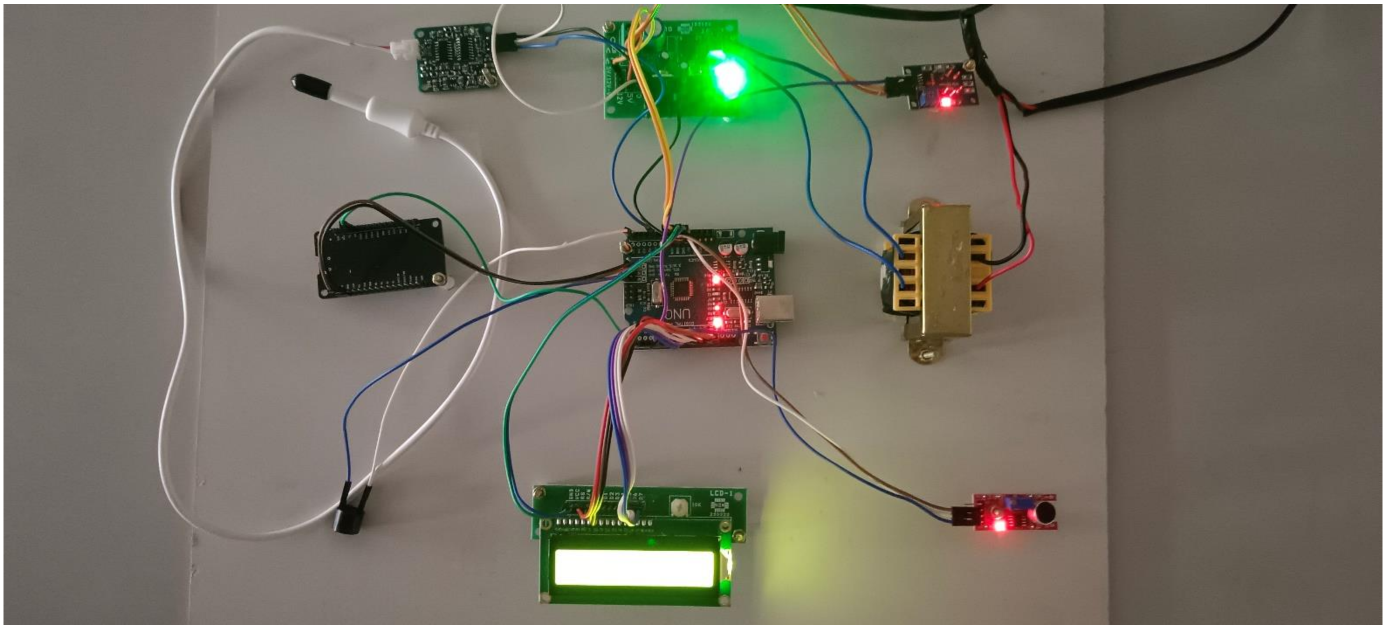


Fig 13.1 Project Module

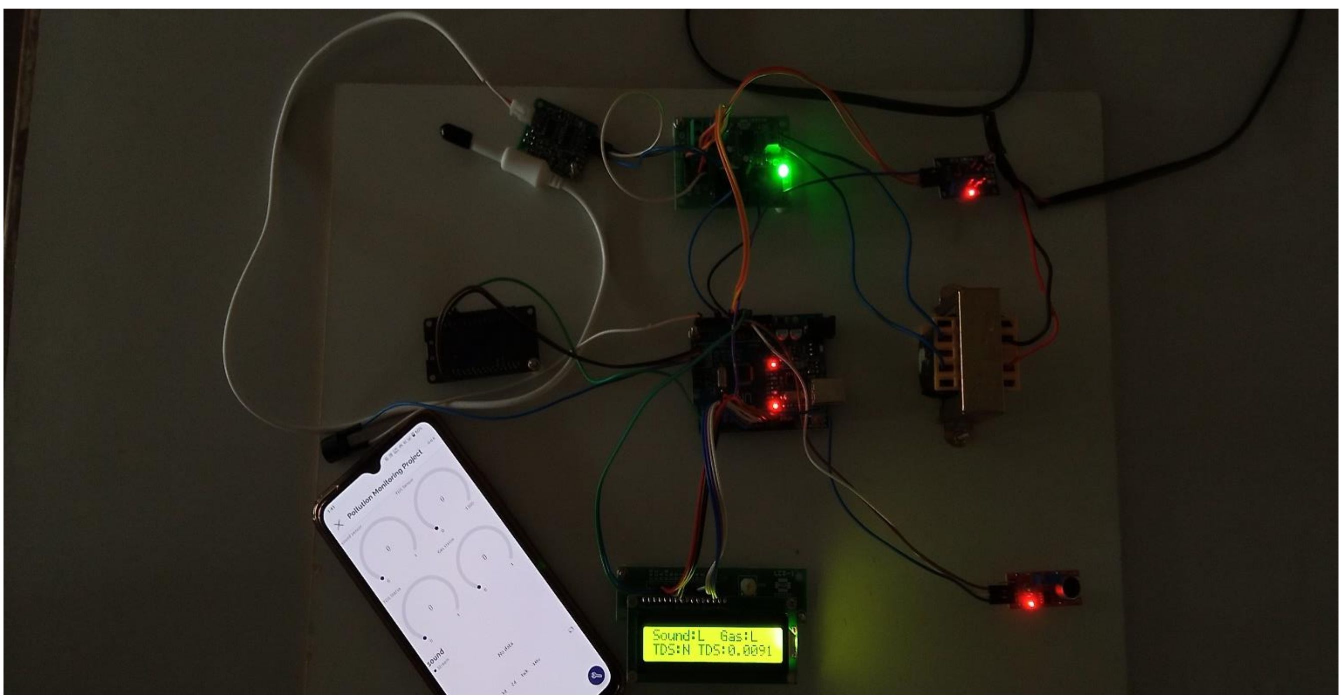


Fig 13.2 Project kit with Blynk app

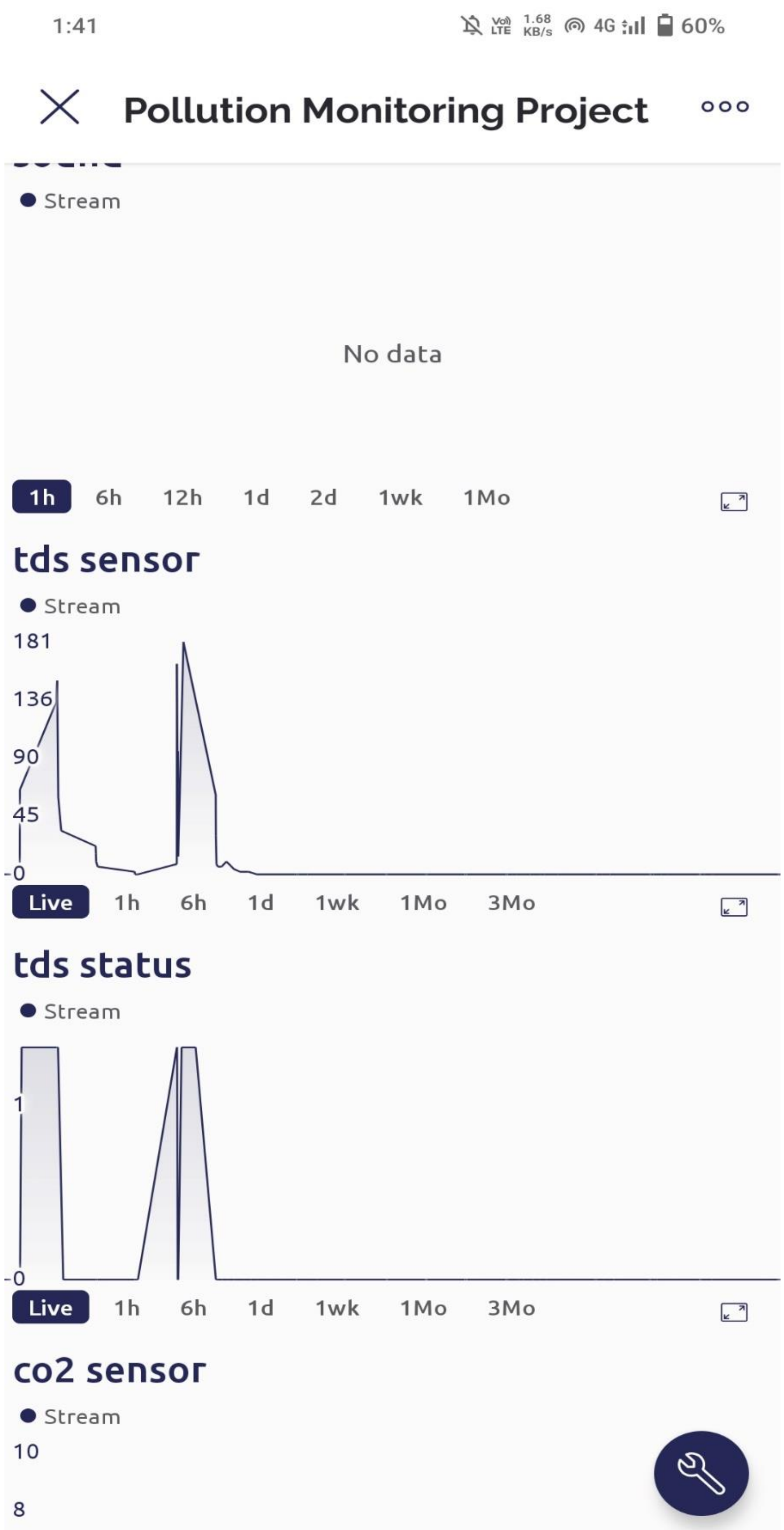


Fig 13.3 Blynk output

CONCLUSION

In conclusion, an IOT-based industrial pollution monitoring system is a powerful tool for industries to monitor and mitigate their environmental impact. By using sensors such as TDS sensors, CO_2 sensors, and sound sensors, industries can measure and monitor various parameters of pollution such as water quality, air quality, and noise pollution in real-time.

The data collected by these sensors can be transmitted to a central control unit using IOT technology and displayed on a web-based dashboard, allowing users to monitor pollution levels in real-time and take appropriate actions to reduce emissions and improve the overall environmental impact.

This technology is beneficial not only for the environment but also for the health and safety of employees and the surrounding community. By continuously monitoring pollution levels and taking proactive steps to reduce emissions, industries can operate more responsibly and sustainably, while also improving their bottom line by reducing waste and optimizing processes.

An IOT-based industrial pollution monitoring system is a crucial component of any modern industrial operation, helping industries to meet their environmental and social responsibilities while also improving their operational efficiency and competitiveness.

CHAPTER 14

APPENDIX

Arduino Code

```
#include<LiquidCrystal.h>

LiquidCrystal lcd(13,12,11,10,9,8);

///////////////////////////////////////////////////

#include <OneWire.h>


// Data wire is plugged into digital pin 2 on the Arduino

#define ONE_WIRE_BUS 2


// Setup a oneWire instance to communicate with any OneWire device

OneWire oneWire(ONE_WIRE_BUS);




#include <EEPROM.h>

#include "GravityTDS.h"

#define TdsSensorPin A1

GravityTDS gravityTds;
```

```
double temperature = 25, w = 0;

///////////////////////////////////////////////////////////////////



float volt;
float ntu;
///////////////////////////



void setup() {
  Serial.begin(9600);
  lcd.begin(16,2);

  pinMode(A1,INPUT);  // tds sensor

   pinMode(7,INPUT);  // mic sensor

  pinMode(5,INPUT);  // Gas sensor
```

```
  pinMode(A5,OUTPUT);//buzzer

  lcd.setCursor(0,0);
  lcd.print("IOT Based Pollution");
  lcd.setCursor(0,1);
  lcd.print("MonitoringSystem");
  delay(2000);
  lcd.clear();

}

void loop() {
  // put your main code here, to run repeatedly:
    gas();
   tdstemp();
   Mic();



}




void gas()
```

```
{
  int G=digitalRead(5);
  if(G==LOW)
  {
    lcd.setCursor(9,0);
    lcd.print("Gas:H");
    digitalWrite(A5,HIGH);///buzzer
    Serial.print('B');
    delay(50);
    }
    else
    {
      lcd.setCursor(9,0);
      lcd.print("Gas:L");
      digitalWrite(A5,LOW);//buzzer
      Serial.print('b');
      delay(50);
      }
}


void Mic()
{
```

```
  int M=digitalRead(7);
  if(M==HIGH)
  {
    lcd.setCursor(0,0);
    lcd.print("Sound:H");
    digitalWrite(A5,HIGH);///buzzer
    Serial.print('C');
    delay(20);
    }
    else
    {
      lcd.setCursor(0,0);
      lcd.print("Sound:L");
      digitalWrite(A5,LOW);//buzzer
      Serial.print('c');
      delay(20);
      }
}


void tdstemp()
{
//temperature = readTemperature();  //add your temperature sensor and read it
```

```
gravityTds.setTemperature(temperature);  // set the temperature and execute temperature compensation
gravityTds.update();  //sample and calculate
 w = gravityTds.getTdsValue();  // then get the value
lcd.setCursor(6,1);
lcd.print("TDS:");
lcd.print(w);
  Serial.print('w');
Serial.print(w);




delay(30);


if (w > 100)
{
lcd.setCursor(0,1);
lcd.print("TDS:AN");
Serial.print('H');
delay(30);
     digitalWrite(A5, HIGH);
    delay(100);
    digitalWrite(A5, LOW);
```

```
    }
    else
    {
      digitalWrite(A5, LOW);
    lcd.setCursor(0,1);
    lcd.print("TDS:N ");
    Serial.print('h');
    delay(30);
    }
}
```

IOT MODULE CODE

```
/*
water agriemail id:          @gmail.com
blynk password: projectiot2023
*/



/* Fill-in information from Blynk Device Info here */
#define BLYNK_TEMPLATE_ID "TMPL3QF7-e2K4"
#define BLYNK_TEMPLATE_NAME "Sound Project"
#define BLYNK_AUTH_TOKEN "ffuFwwwd7GbyLEXmIEtlC0RjHfX8c8rP"
```

```
/* Comment this out to disable prints and save space */
#define BLYNK_PRINT Serial



#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "projectiot2023";
char pass[] = "";



//Change the virtual pins according the rooms
#define VPIN_0    V0  // Sound
#define VPIN_1    V1  // TDS
#define VPIN_2    V2  // TDS high / Low
#define VPIN_3    V3  // GAS





BLYNK_CONNECTED()
```

```
{
  Blynk.syncVirtual(VPIN_0);
  Blynk.syncVirtual(VPIN_1);
  Blynk.syncVirtual(VPIN_2);
  Blynk.syncVirtual(VPIN_3);



}



void setup()
{
  // Debug console
  Serial.begin(9600);
  Blynk.begin(BLYNK_AUTH_TOKEN, ssid, pass);
  // You can also specify server:
  //Blynk.begin(BLYNK_AUTH_TOKEN, ssid, pass, "blynk.cloud", 80);
  //Blynk.begin(BLYNK_AUTH_TOKEN, ssid, pass, IPAddress(192,168,1,100),
8080);
}

void loop()
{
```

```
  Blynk.run();
  if (Serial.available()>0)
  {
  char a=Serial.read();
  //Serial.print(a);




// Temp Status
    if(a=='C')
    {
      Blynk.virtualWrite(VPIN_0,HIGH);
    }
    if(a=='c')
    {
      Blynk.virtualWrite(VPIN_0,LOW);
    }



if(a=='w')
{
 float w=Serial.parseFloat();
  Blynk.virtualWrite(VPIN_1,w);
```

```
}
///TDS Status
  if(a=='H')
   {
     Blynk.virtualWrite(VPIN_2,HIGH);
   }
  if(a=='h')
   {
     Blynk.virtualWrite(VPIN_2,LOW);
   }
  //Gas Level
  if(a=='B')
   {
     Blynk.virtualWrite(VPIN_3,HIGH);
   }
  if(a=='b')
   {
     Blynk.virtualWrite(VPIN_3,LOW);
   }
 }
}
```

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