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INTRODUCTION

The Indoor air pollution has been constantly considered by the US Environmental Protection Agency (EPA) to be among the top five reasons which are causing environmental public health related issues. As it very well known that air the most important and primary source which is necessary and essential for the existence of all the living beings on the Earth. Air pollution today in India is arising due to the major sources such as burning of fossil fuels, and the emissions from factories such as disposal of wastes and toxic and harmful gases released and also the emissions from the vehicles.

Approximately, 1.5 million of the total deaths is due to the polluted indoor air. Carbon di Oxide is primarily one of the most harmful gas which is mostly responsible for the indoor pollution. It not only causes the pollution, but it is causes greenhouse effect and global warning. Apart from CO2 gas, humidity is also responsible for the indoor air pollution. Hence this Home Air Quality Monitoring using Arduino UNO consists of temperature + humidity sensor and CO2 sensor. This project helps the user to measure the quality of air in a house or an apartment. Both the sensors and the sensing device are connected with the equipment or the system present inside the room and hence it helps to find the room temperature, humidity level and CO2 (Carbon-di-Oxide) level. An LCD screen is attached to the whole system on which all these data are displayed.

OBJECTIVES

1. The objective is to be able to monitor and control the air quality of the home.
2. Proposed technology can be used in many public places, malls or big buildings as well as in home to enhance the humidity, temperature and quality of air. This project helps the user to measure the quality of air in a house or an apartment.
3. This air quality detector not only measures the Carbon Dioxide (CO2) level in the air, but also measures the level of humidity and temperature both inside the room and outside environment.
4. Study the detailed datasheet of Arduino UNO as well as MQ 135 Sensor.
5. Enhance the applications which makes humans day to day life more easy.
6. To study the detail working of breadboard, 16*2 LCD display as well as Arduino UNO and MQ 135 gas sensor

LITERATURE REVIEW

1. Air quality using ZigBee

- This paper discusses a monitoring system that gives information about environmental conditions and briefly touches the technological advancements in monitoring the environment and bringing out the new scope in monitoring the current environmental problems.

- The system is developed using Arduino, Raspberry Pi 3, and Zigbee which proves to be cost-ineffective and having low power consumption.

- The sensors will gather the data of various environmental parameters and provide that data to Raspberry Pi via ZigBee from the Arduino. The sensors will gather the data of various environmental parameters and provide it to the raspberry pi which acts as a base station. Realization of data gathered by sensors is displayed on Raspberry pi 3 based Webserver.

- Experimental results demonstrated that the system can accurately measure the concentrations of carbon monoxide, carbon dioxide, combustible gases, smoke, and air quality.

2. Air Quality Monitoring Using Raspberry Pi

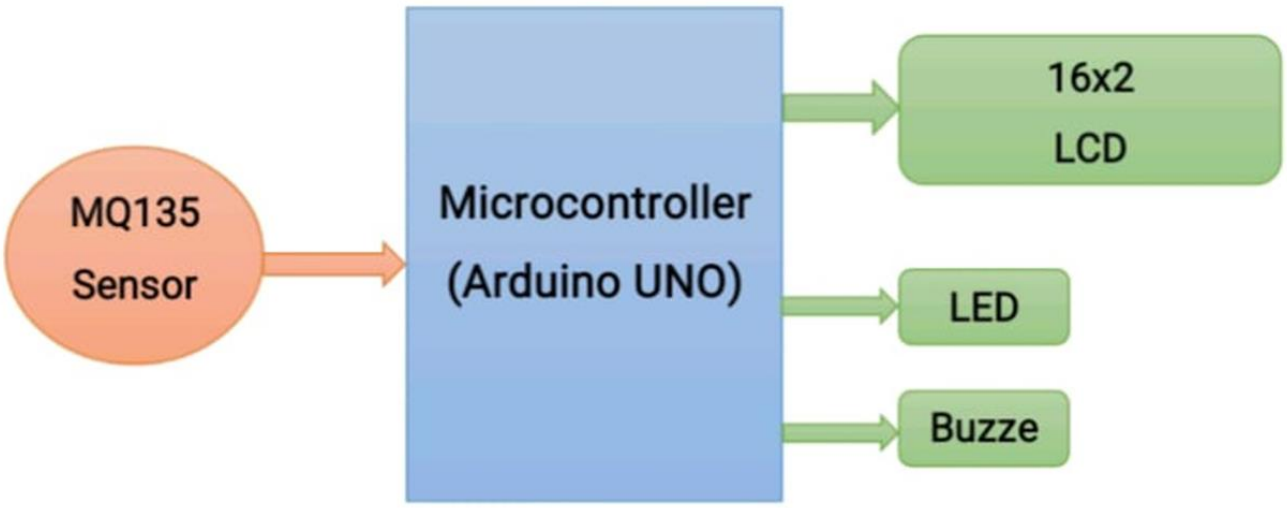
- A prototype for an Environmental Air Pollution Monitoring System for monitoring the concentrations of major air pollutant gases has been developed.

- The system uses low-cost air-quality monitoring nodes comprised of a low-cost semiconductor gas sensor with a Wi-Fi module. This system measures concentrations of gases such as CO, CO 2, SO 2, and NO 2 using semiconductor sensors.

- A MEAN stack is developed to display data over a website.

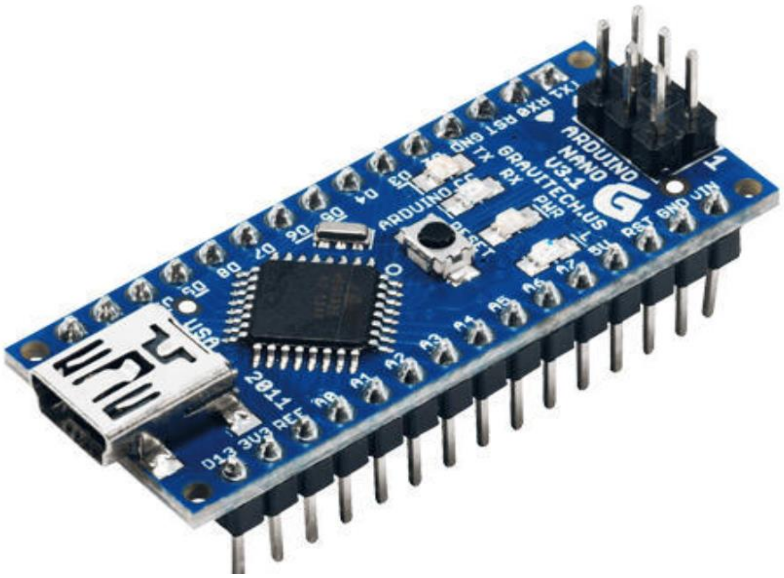
- The fundamental aspect of the proposed work is to provide a low-cost infrastructure to enable data collection and dissemination to all stakeholders.

BLOCK DIAGRAM



COMPONENTS

1. ARDUINO NANO



The **Arduino NANO** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. The ATmega328 on the board comes pre-programmed with a bootloader that allows uploading new code to it without the use ofan external hardware programmer.

2. MQ 135 SENSOR

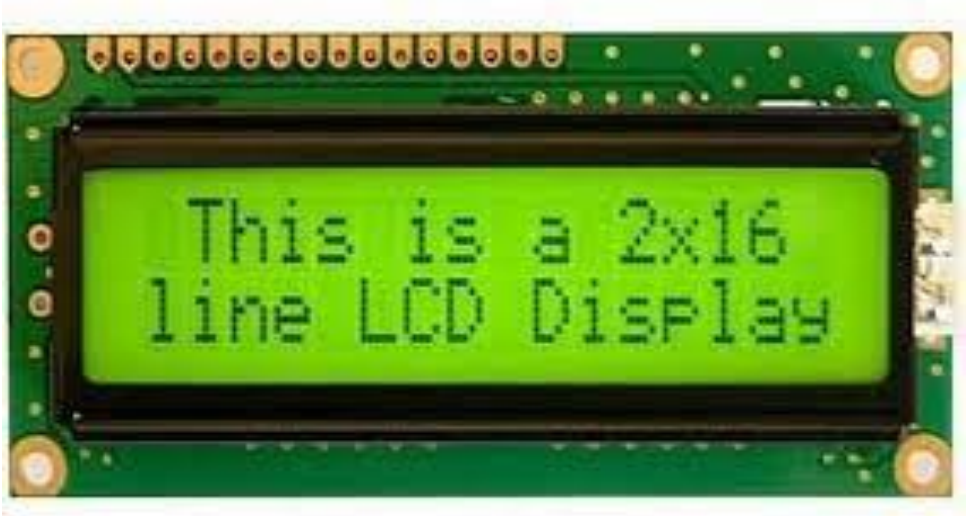
The **MQ-135 Gas sensor** can detect gases like Ammonia (NH3), sulfur (S), Benzene (C6H6), CO2, and other harmful gases and smoke. Similar to other MQ series gas sensor, this sensor also has a digital and analog output pin. When the level of these gases go beyond a threshold limit in the air the digital pin goes high. This threshold value can be set by using the on-board potentiometer. The analog output pin, outputs an analog voltage which can be used to approximate the level of these gases in the atmosphere.

The MQ 135 air quality sensor module operates at 5V and consumes around 150mA. It requires some pre-heating before it could actually give accurate results.

Technical Specifications of MQ 135 Gas Sensor

- Operating Voltage: 2.5V to 5.0V
- Power consumption: 150mA
- Detect/Measure: NH3, Nox, CO2, Alcohol, Benzene, Smoke
- Typical operating Voltage: 5V
- Digital Output: 0V to 5V (TTL Logic) @ 5V Vcc
- Analog Output: 0-5V @ 5V Vcc

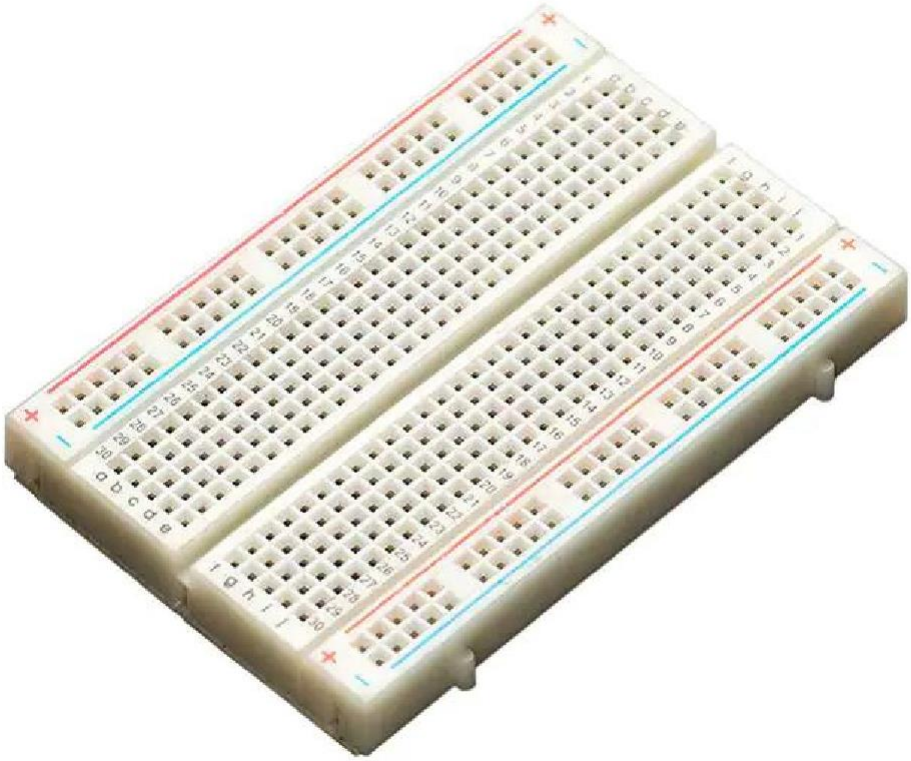
3. LCD DISPLAY (16 x 2)



An electronic device that is used to display data and the message is known as LCD 16×2. As the name suggests, it includes 16 Columns & 2 Rows so it can display 32 characters (16×2=32) in total & every character will be made with 5×8 (40) Pixel Dots. So the total pixels within this LCD can be calculated as 32 x 40 otherwise 1280 pixels.

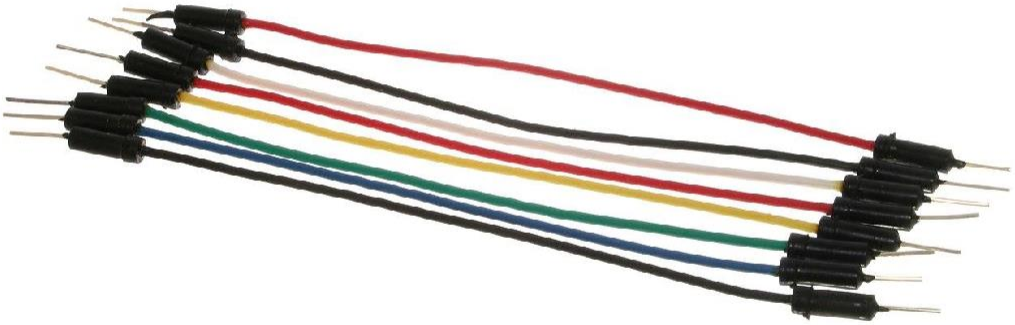
In LCD 16×2, the term LCD stands for Liquid Crystal Display that uses a plane panel display technology, used in screens of computer monitors & TVs, smartphones, tablets, mobile devices, etc. Both the displays like LCD & CRTs look the same but their operation is different. Instead of electron diffraction at a glass display, a liquid crystal display has a backlight that provides light to each pixel that is arranged in a rectangular network. Every pixel includes a blue, red, green sub-pixel that can be switched ON/OFF. Once all these pixels are deactivated, then it will appear black and when all the sub-pixels are activated then it will appear white. By changing the levels of each light, different color combinations are achievable.

4. HALF-SIZE BREADBOARD



This is a half size breadboard, good for small projects. It's 2.2" x 3.4" (5.5 cm x 8.5 cm) with a standard double-strip in the middle and two power rails on both sides. You can pull the power rails off easily to make the breadboard as thin as 1.4" (3.5cm) and stick it onto an Arduino proto shield. You can also cut these in half with a saw to create 2 tiny breadboards, or "snap" these breadboards together either way to make longer and/or wider breadboards.

5. JUMPER WIRES



A **jump wire** (also known as **jumper**, **jumper wire**, **DuPont wire**) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

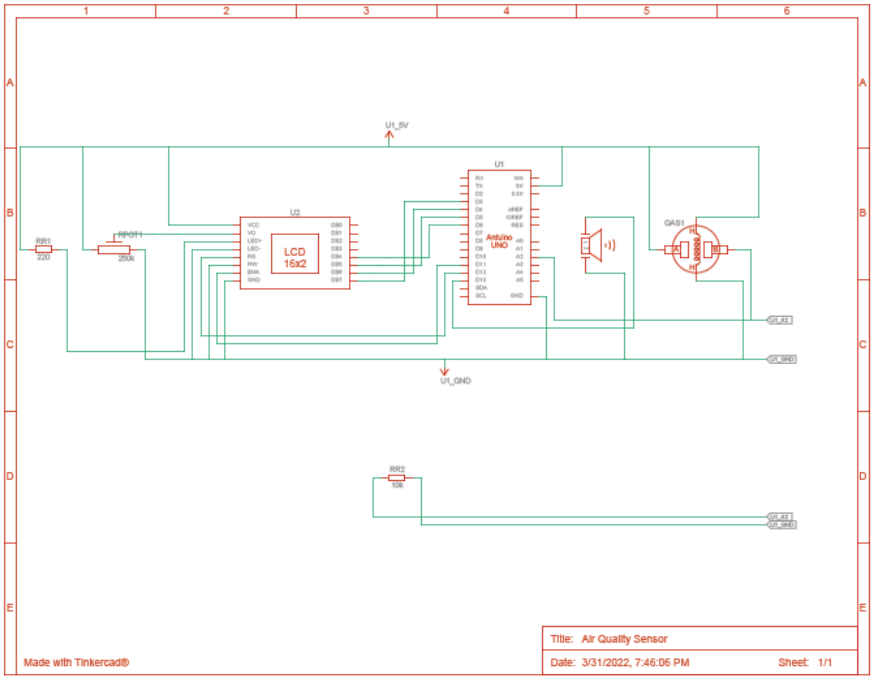
6. BUZZER

Buzzer Specifications :

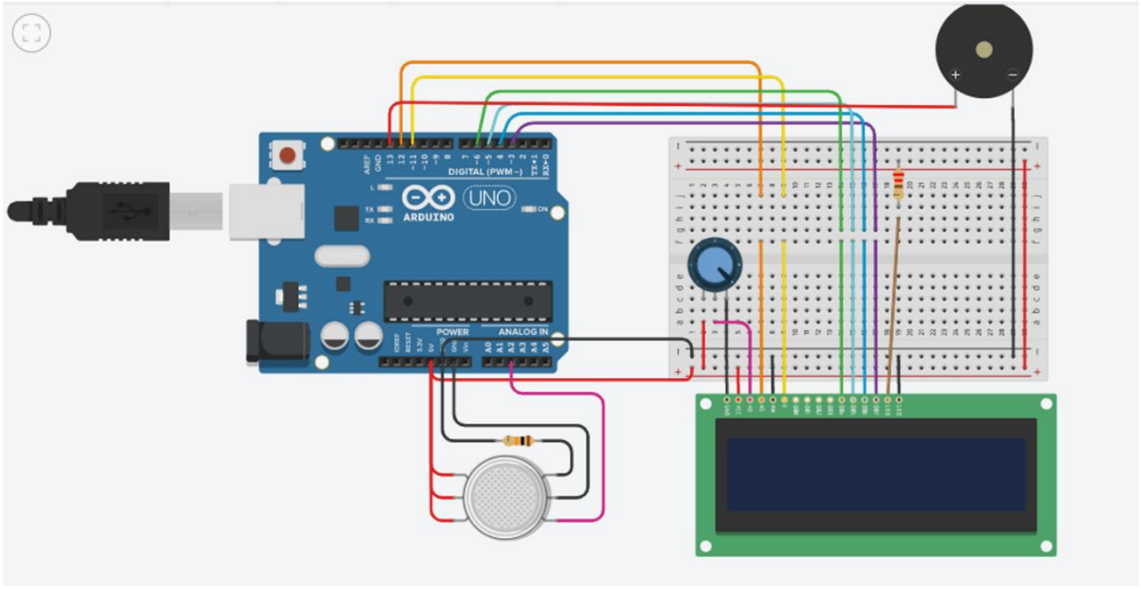
- Sound Type: Continuous Beep
- Rated Voltage: 6V DC
- Resonant Frequency: ~2300 Hz
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Small and neat sealed package
- Breadboard and Perf board friendly

CIRCUIT DIAGRAM AND SIMULATION

CIRCUIT DIAGRAM :



SIMULATION :



WORKING

Connections :

- DTH11's voltage, ground is connected to +5V and 0V and signal can be connected to any Digital Pin 8 of Arduino Uno.
- MQ135's voltage and ground are connected to +5V and 0V and analog output pin is connected to analog Pin A0 of Arduino Uno.
- LCD RS pin to digital pin 12, Enable pin to digital pin 11,D4 pin to digital pin 5, D5 pin to digital pin 4, D6 pin to digital pin 3, D7 pin to digital pin 2, R/W pin to ground, VSS pin to ground, VCC pin to 5V, 10K resistor ends to +5V and ground and wiper to LCD VO pin.
- The data pins of DHT11 are connected to Digital pin of Node MCU and that of MQ135 is connected to Analog Pin.
- The other connections are kept the same.

Working :

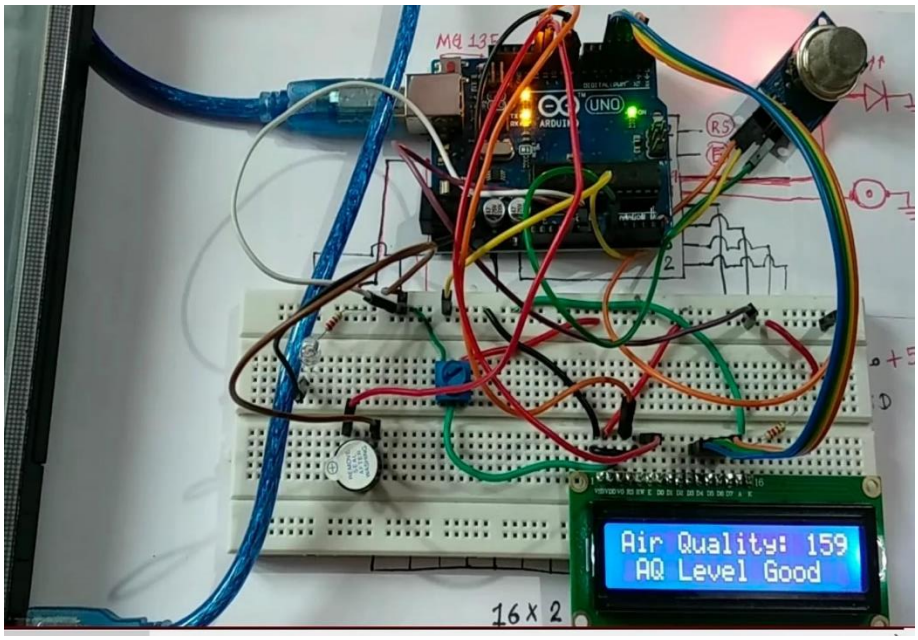
The device developed in this project can be installed near any Wi-Fi hotspot in a populated urban area. As the device is powered, the Arduino board loads the required libraries, flashes some initial messages on the LCD screen and start sensing data from the MQ-135 sensor. The sensitivity curve of the sensor for different combustible gases is already mentioned above. The sensor can be calibrated so that its analog output voltage is proportional to the concentration of polluting gases in PPM. The analog voltage sensed at the pin A0 of the Arduino is converted to a digital value by using the in-built ADC channel of the Arduino. The Arduino board has 10-bit ADC channels, so the digitized value ranges from 0 to 1023. The digitized value can be assumed proportional to the concentration of gases in PPM. The read value is first displayed on LCD screen and passed to the ESP8266 module wrapped in proper string through virtual serial function. The Wi-Fi module is configured to connect with the ThingSpeak IOT platform. ThingSpeak is an IOT analytics platform service that allows to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by the IOT devices to ThingSpeak server. With the ability to execute MATLAB code in ThingSpeak one can perform online analysis and processing of the data as it comes in.

CODE

```
#include <LiquidCrystal.h>
#define GasSensor 2

LiquidCrystal lcd(12, 11, 6, 5, 4, 3);

void setup() {

  lcd.begin(16, 2);
  pinMode(GasSensor, INPUT);
  pinMode(13,OUTPUT);
  lcd.setCursor(0, 0);
  lcd.print("Loading...");
  delay(2000);
  lcd.clear();
  lcd.setCursor(3, 0);
   lcd.print("Created by");
  lcd.setCursor(3, 1);
  lcd.print("Shubham.. ");
  delay(5000);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Air Quality:");
}

void loop()
{
  digitalWrite(13,0);
  int gas = analogRead(GasSensor);
  lcd.setCursor(13,0);
  lcd.print(gas);
  if(gas<600)
  {
    lcd.setCursor(0,1);
       lcd.print("AQ Level Good");
  }
```

```
else
{
  digitalWrite(13,1);
  lcd.setCursor(0,1);
     lcd.print("AQ Level High");

}
delay(1000);

}
```

RESULT AND DISCUSSION



Here, we complete our project successfully .This helps us for detecting the quality of the air in the room. It scuccessfully displays the quality of the air in the room.This air quality detector not only measures the Carbon Dioxide (CO2) level in the air, but also measures the level of humidity and temperature both inside the room and outside environment.

Proposed technology can be used in many public places, malls or big buildings as well as in home to enhance the humidity, temperature and quality of air. This project helps the user to measure the quality of air in a house or an apartment.

PROJECT EXPENDITURE

Sr. No.	Component Name	Price
1	Arduino NANO	Rs. 700
2	MQ 135 Sensor	Rs. 152
3	LCD Display (16 X 2)	Rs.157
4	Half breadboard	Rs. 90
5	Jumper wires	Rs. 100
6	9V Battery	Rs. 20
7	UNO cable	Rs. 45
	TOTAL	Rs. 1264 /-

ADVANTAGES and APPLICATIONS

1. The data collected from air quality monitoring helps us assess impacts caused by poor air quality on public health.
2. Air quality data helps us determine if an area is meeting the air quality standards devised by CPCB, WHO or OSHA.
3. The data collected from air quality monitoring would primarily help us identify polluted areas, the level of pollution and air quality level.
4. Air quality monitoring would assist in determining if air pollution control programmes devised in a locality are working efficiently or not.
5. Air quality data helps us understand the mortality rate of any location due to air pollution. We can also assess and compare the short term and long term diseases/disorders which are a result of air pollution.
6. Based upon the data collected control measures can be devised for protection of environment and health of all living organisms.

CONCLUSION

- This system is used to send gas like benzene, alcohol, smoke, etc. using the MQ135 Gas Sensor.
- To monitor the air of the environment using an Arduino microcontroller, IOT Technology is proposed to improve the quality of air. The use of Io technology enhances the process of monitoring various aspects of the environment such as the air quality monitoring issue proposed in this paper.
- The system This board has a Wi-Fi module that acts as the internet connector and informative access for the air quality. This measures the air quality in real-time using MQ135 Gas Sensor with Node MCU.
- Node MCU will send the data to things peak platform which is connected with Twitter, so whenever the air quality goes below a certain level it will send the Twitter notification, thus warning people in that particular area.
- Here the use of the MQ135 gas sensor gives the sense of the different types of dangerous gas and Arduino is the heart of this project which controls the entire process.
- Wi-Fi module connects the whole process to the internet and LCD is used for the visual Output It supports the new technology and effectively supports the healthy life concept. This system has features for people to monitor the amount of pollution on their mobile phones using the application.

FUTURE SCOPE

1. The air quality data can be evaluated by health professionals to support the decision process on medical diagnostics. Moreover, it will be possible to associate patient diseases with their environmental conditions.
2. The incorporation of notifications using mobile devices is essential to alert the building occupations or city managers on time.
3. This current study has identified several limitations, however, the main results are significant, and future research on IAQ monitoring systems will promote Enhanced Living Environments and sustainable smart cities.
4. Similarly there are other studies where wireless sensor networks and IoT are used for precision agriculture and home applications as like air quality respectively [137,138]. In future, same study can be applied to monitor the air quality in agriculture fields and area's near to different industries.

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