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ABSTRACT

In this project we are going to make an IOT Based Air Pollution Monitoring System in which we will monitor the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level.The air pollution monitoring device developed in this project is based Arduino UNO. The Arduino board connects with ThingSpeak platform using ESP8266 Wi-Fi Module. As the cities usually have Wi-Fi hotspots at most of the places, so the device can be easily installed near any hotspot for its operation. The ThingSpeak is a popular IOT platform which is easy to use and program. The sensor used for monitoring the air pollution is MQ-135 gas sensor. The sensor data is also displayed on a character LCD interfaced in the monitoring IOT device.

Table of Content

1)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. 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. IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet and will trigger an alarm when the air quality goes down beyond a certain threshold level, means when there is sufficient amount of ozone in the atmosphere. It will show the air quality in % on the LCD and as well as a graph will be shown on webpage so that it can be monitored very easily. We are using MQ123 gas sensor and finding out the ozone present in the atmosphere.

2)Body of the project and the Chapters

MQ135 sensor:

The MQ-135 Gas sensors are used in air quality control equipment's and are suitable for detecting or measuring of NH3, NOx, Alcohol, Benzene, Smoke, CO2. 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.

Sensitive material of MQ135 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, the sensors conductivity is more higher along with the gas concentration rising. MQ135 gas sensor has high sensitity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases. It is with low cost and suitable for different application.

It can sense NH3, NOx, alcohol, Benzene, smoke, CO2 and some other gases, so it is perfect gas sensor for air quality monitoring system. MQ135 gas sensor gives the output in the form of voltage levels which is converted into % by using a library for MQ135 gas sensor.

Arduino Uno:

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

When we will connect MQ135 to Arduino then it will sense the gases, and we will get the Pollution level in %. In this IOT device, 9 pins of the board are utilized. There are six pins used to interface the character LCD. There are two pins utilized to interface the ESP8266 Wi-Fi Module and an analog input pin is used to connect the MQ-135 sensor.

16x2 Character LCD:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The 16X2 LCD display is used to monitor the sensor values read by the Arduino board from MQ-135. It is interfaced with the Arduino Uno by connecting its data pins D4 to D7 with pins 5 down to 2 of the controllers respectively. The RS and E pins of the LCD are connected to pins 7 and 6 of the controller respectively.

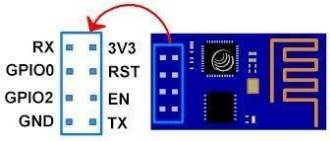
ESP8266 Wi-Fi Module:

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that 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 functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

ESP8266 Wi-Fi module gives our projects access to Wi-Fi or internet.

3.3V power supply is provided to ESP8266 Wi-Fi Module.



Buzzer:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

ThingSpeak:

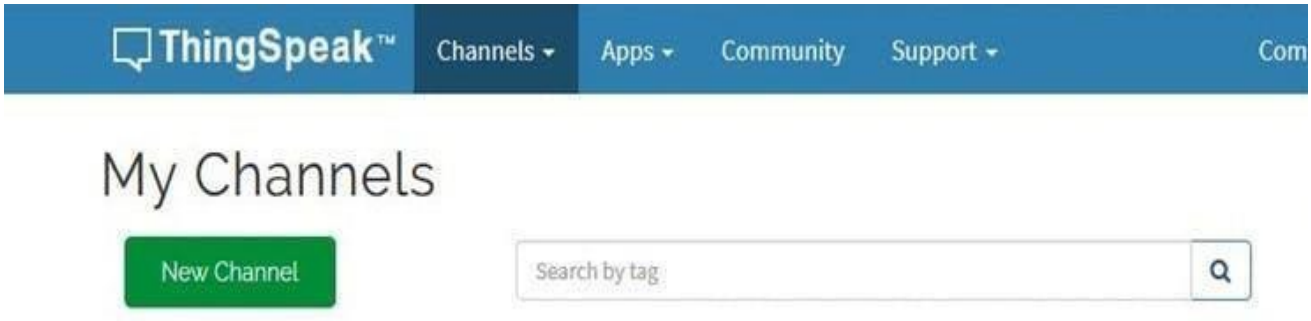
ThingSpeak is an Internet of Things (IoT) platform that lets you collect and store sensor data in the cloud and develop IoT applications. The ThingSpeak IoT platform provides apps that let you analyze and visualize your data in MATLAB, and then act on the data.

Firstly, we go to ThingSpeak website using the link given below.

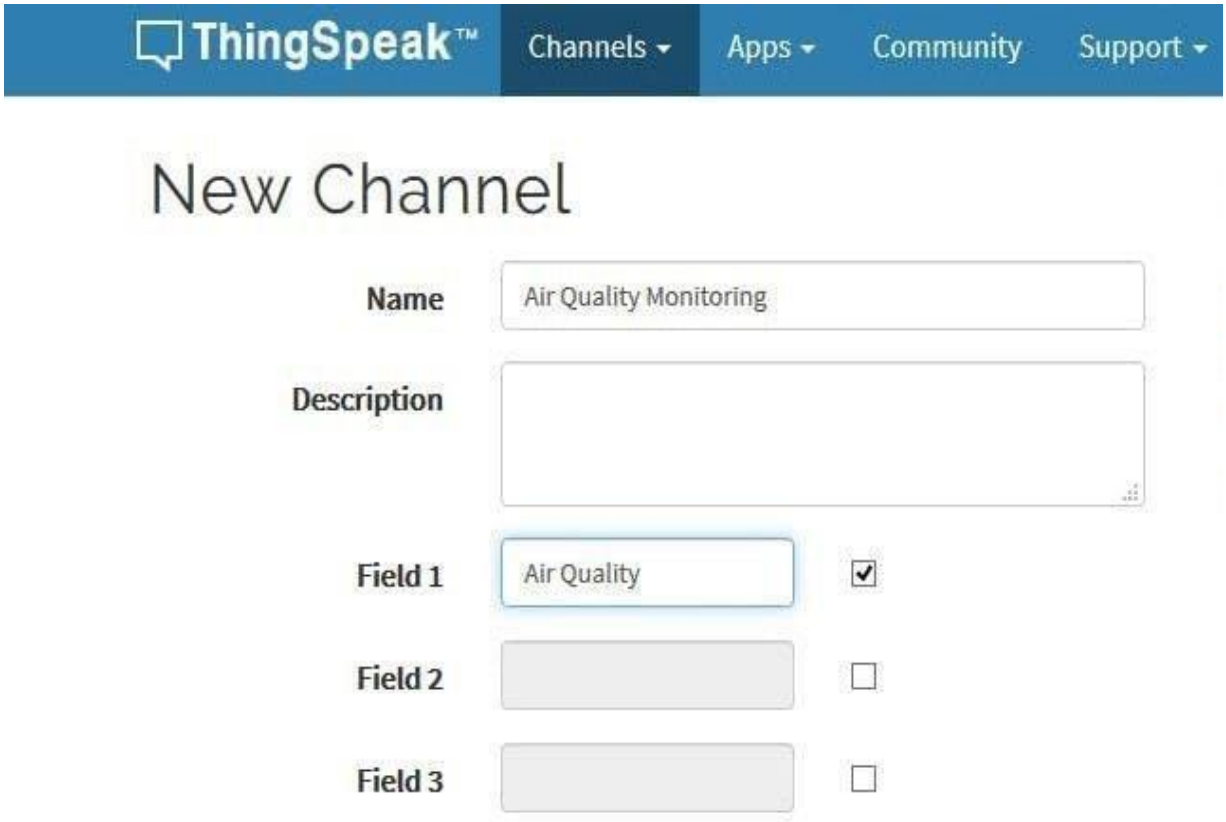
https://thingspeak.com/

Then we sign up or Login there.

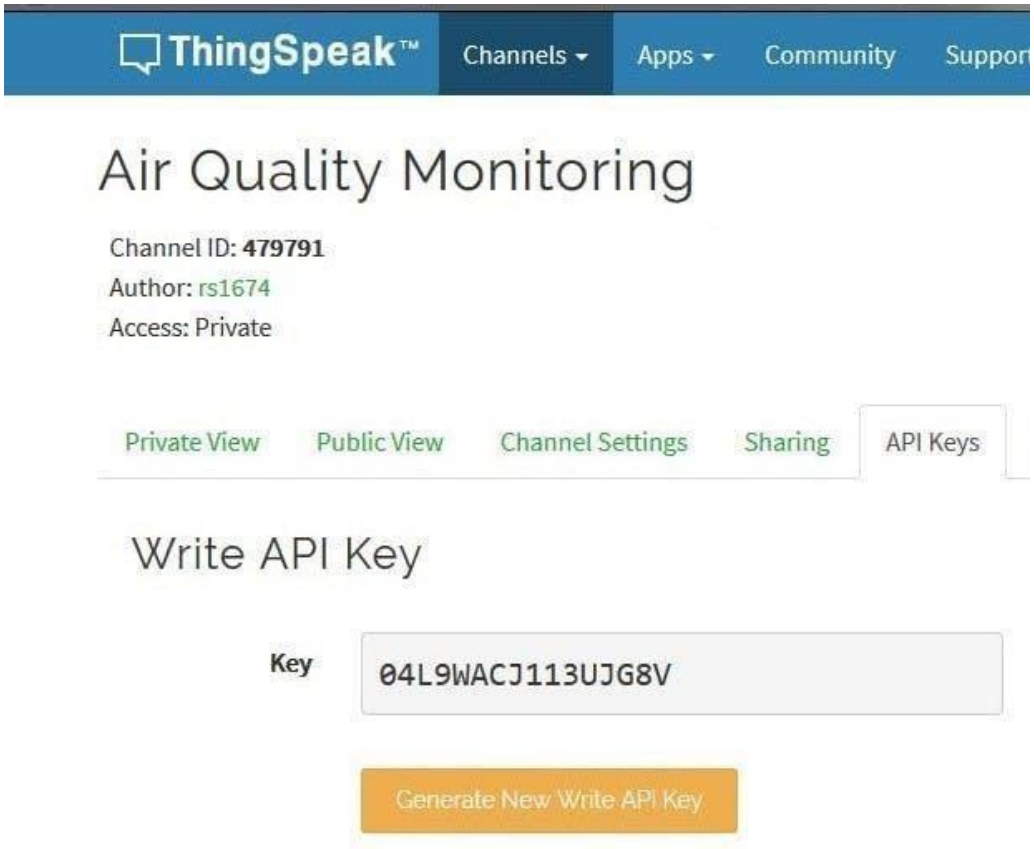
Then we create a new channel



Then we name it whatever we want to name it and give the field name.



For viewing API keys, we go API section



Working of the project:

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 sensor can be calibrated so that its analog output voltage is proportional to the concentration of ozone in percentage. 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.

3)Experimental Setup, Findings and Results

We write the following code in the Arduino sketch

Code used:

```
#include <LiquidCrystal.h>

#include "ESP8266.h"


#define SSID "OnePlus 5"     // "SSID-WiFiname"

#define PASS "nigga123"       // "password"


#define IP "184.106.153.149"// thingspeak.com ip

String msg = "GET /update?key=DC9GQKSA4K0Q2N5L"; //change it with your
api key like "GET /update?key=Your Api Key"


#define OZONE_PIN A0


ESP8266 ESP;

LiquidCrystal lcd(7, 6, 5, 4, 3, 2);


int ozoneLevel;


void updateLevel(){

  String cmd = msg ;
```

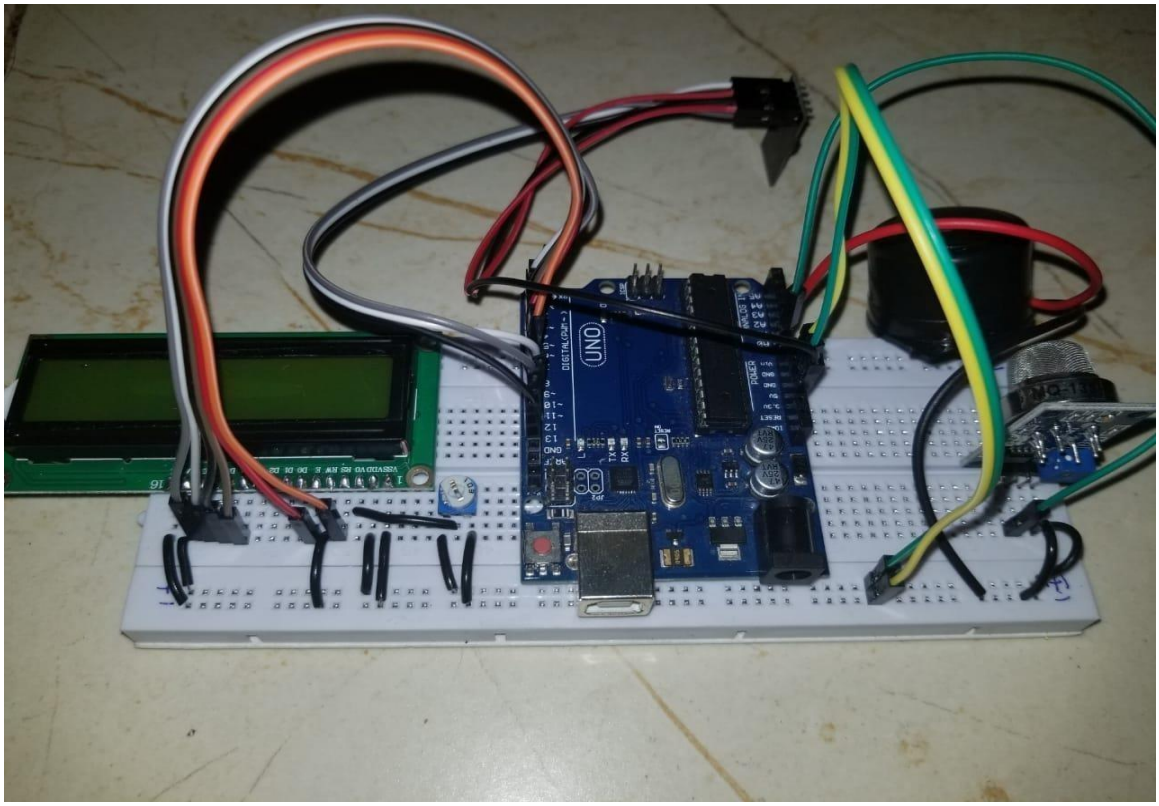
```
  cmd += "&field1=";
  cmd += ozoneLevel;

  cmd += "\r\n";
  if(ESP.get(IP, 80, cmd)){
//    ESP.serialDebug();
  }
}

void setup() {
  Serial.begin(115200);
  lcd.begin(16, 2);
  lcd.print("Initilizing!");

  ESP.preInit();
  while(ESP.connectWiFi(SSID, PASS)){
    Serial.print("Trying..");
    delay(500);
  }
  lcd.setCursor(0, 1);
  lcd.print("** ALL OK **");
  delay(2000);
}
```

```
void loop() {
  ozoneLevel = analogRead(OZONE_PIN);
  ozoneLevel = map(ozoneLevel, 0, 1023, 0, 100);

  Serial.print("Ozone : ");
  Serial.println("%");

  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Ozone:");
  lcd.print(ozoneLevel);
  lcd.print('%');

  updateLevel();

  delay(2000);
}
```

We do the following connection as shown in the figure:

Circuit Connection:

We will connect MQ135 to Arduino then it will sense the gases, and we will get the Pollution level in %. In this IOT device, 9 pins of the board are utilized. There are six pins used to interface the character LCD. There are two pins utilized to interface the ESP8266 Wi-Fi Module and an analog input pin is used to connect the MQ-135 sensor. 16x2 LCD display is interfaced with the Arduino Uno by connecting its data pins D4 to D7 with pins 5 down to 2 of the controllers respectively. The RS and E pins of the LCD are connected to pins 7 and 6 of the controller respectively.



After that we upload the code in Arduino

Finding and result:

The found the value of the ozone to be 5% in the normal atmosphere.

4)Conclusion and Future Scope:

The system to monitor the air of environment using Arduino microcontroller, 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, using the MQ135 and MQ6 gas sensor gives the sense of different type of dangerous gas and arduino is the heart of this project which control the entire process. Wi-Fi module connects the whole process to internet and LCD is used for the visual Output.

Applications:-

1) Industrial perimeter monitoring

2) Indoor air quality monitoring.

3) Site selection for reference monitoring stations.

4) Making data available to users.

Advantages:-

1) Easy to Install

2) Updates On mobile phone directly

3) Accurate Pollution monitoring

4) Remote location monitoring

Future scope:

In future the project can be upgraded in more than one way

Interface more than one sensor to know detail content of all gases present in the air.

Design webpage and upload data on webpage with date and time.

Interface SD card to store data.

Interface GPS module to monitor the pollution at exact location and upload on webpage