Gas Monitoring System for Safer Industries using Internet of Things (IoT)

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Abstract: In Industry upset, gas detecting innovation discovers its significance where gas sensors utilized for identifying the dangerous gases. This has been created and changed slowly to improve its sensitivity and selectivity. Convenient and exact checking of combustible and risky gases inside the mines can help averting mishaps. Different wired and remote correspondence with the sensor hubs like Zigbee. Convention have been built up in later part and executed with Internet of Things (IoT) yet with impediments. In this paper the MQ2 gas sensors exhibit utilizing basic technique is proposed for better sensing and alterability the Node MCU (ESP8266) is utilized as a Wireless Fidelity (WiFi) module. The proposed work could build selectivity and better proficiency the undertaking expects to coming about a superior danger the executives framework.We incorporated how node mcu and ardunio are used for the advanced gas monitoring systems.

Index Terms- Arduino,gas sensor,Node MCU, MQ2 sensor, security alert..

I. INTRODUCTION

In industrial processes they mostly involve in the use or manufacture of highly dangerous substances, particularly toxic gases and combustible gases and other gases. The gas occurs which when creates a potential hazard to the industrial plant, the employees and people living nearby [1]. Overall occurrences including suffocation, blasts and death toll are a consistent token of this issue.

While life safety is a major benefit if we make use of gas detection, don't forget that gas monitors also contribute to help the worker health, property protection and operational productivity, as all of which impact the bottom line. The industrial hygienist, as a proactive safety leader of the workplace, needs timely,the accurate warnings of a gas leak so that building occupants can be evacuated in time, if necessary, to be in a safe place, and so that gas leakage can be mitigated quickly to prevent the overtaking of property in the industry as well the human lives [2-4].
The gas leakage occasion may include peril forever. There have been numerous passings around the globe on account of gas leakage [1]. In this way, it is guaranteed that one doesn't need to stress over the gas leakages are getting so serious and

crazy that it can makes harm life or the encompassing condition and furthermore informing and alarming the workers or inhabitants about the gas leakage [7-9]. Arduino based MQ2 sensor which detect gas leakage. As we have seen the use of various number ofgases in various fields, if there is any leakage of any such gases are present, then it can be detected and a harm can be reduced [9-10]. It has a high response for LPG and natural gases. It also detects smoke but has a small sensitivity towards it. As any of these gases are detected the sensor will sense them.

Figure 1: Image of MQ2 sensor

The buzzer alarm will be turned on. And the alarm informs the locals that there is a leakage of gas somewhere so that they will take steps to minimize the harm[12-13]. If the problem rises even after the alarmand no steps are taken then owner of theplace will be informed and if still no action is taken then emergencyservices to be informed it could minimize the disaster.

Figure 2: Image of Ardunio

In this process of coding we need to set some minimum and maximum of ppm values for all particular gases. Such that in the process of detecting the smoke by the MQ2 sensor it is easy to identify the error which is beyond the specified range of values which are predefined [2]. the ardunio gives the information for various gases and smoke detection values. In the case of the mismatching of values the buzzer gets turned on [11-14].

Example:-A incense smoke is detected near the mq2 sensor at the value of 200 and then the buzzer is given.And after the detection of the gas through MQ2 sensor we need to display the PPM values of the smoke or LPG.
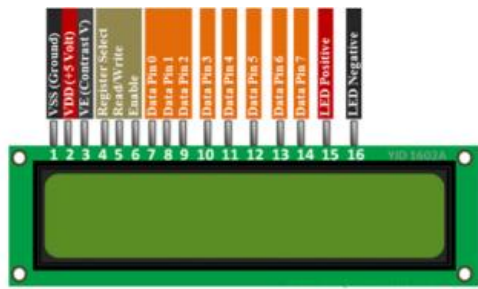

Figure 3: Image of LCD

After the completion of the MQ2 sensor based ardunio me need to extend it by replacing the ardunio with Node MCU for the internet communication for the people for their security alert purposes [9-11]. So, by using Node MCU me need to send the messages to the people when a problem occurs. These all things are monitored by the remote control devices [5].
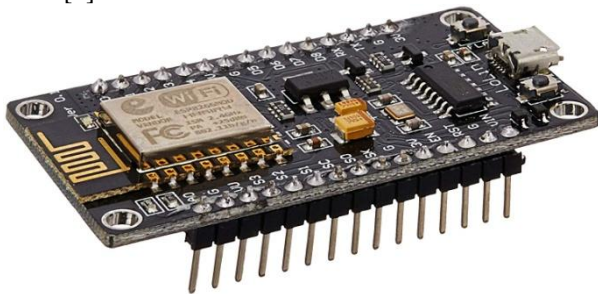

Figure 4: Image of Node mcu

The people in the neighbourhood need not worry and can likewise be remembered for instance of an emergency.MQ2 LPG gas sensor is utilized for input. A 5V ringer is associated alongside the circuit to demonstrate the client disconnected. The gas leakage leads to the event may involve danger for lives. There have been many deaths around the world because of gas leakage [14-16]. Thus, it is ensured that one doesn't have to worry about the gas leakage becoming so intense and out of control that it can causes damage to life or the surrounding environment and also notifying and alerting the employees or residents about the gas leakage [2].

II. STATEMENT OF THE PROBLEM

The work targets structuring a nearly minimal effort, simple to fabricate, compact yet proficient gas spillage and screen the frameworks that are happy to guarantee satisfactory security for workplaces, family units and ventures and so on.

III. HARDWARE IMPLEMENTATION

The aim of the project is to develop a smart automatic gas leakage detection and monitoring system. The system is designed for homes, offices, industries etc. It is designed to detect sudden gas leakage. It will contain necessary sensors for detecting gas leakage [4-9]. When the system detects the leakage of a gas in the room or industries it will be take care by the following steps they are:-

1. Sweep the gas through the gas sensor MQ2 and show in LCD after initiation of the sensor. The sensor will persistently detect the gas and show it on LCD show [5]. On the off chance that there is no gas sense through the sensor it will give some default esteem which is available in the climate.
2. Identification of gas:- If there is any gas going through the sensor then it shows the PPM estimation of that specific chemical(gas) [13-14].
3. Start caution.
4. On the off chance that there is any gas spillage in the room or industry this trial uses to identify the gas spillage and sends a notice through SMS or email that "Be alert you are in the threat zone".
5. These messages are send through Node MCU which is a wi-fi module.
6. It stops the alert and if there is no spillage of gas the gas sensor continues examining.
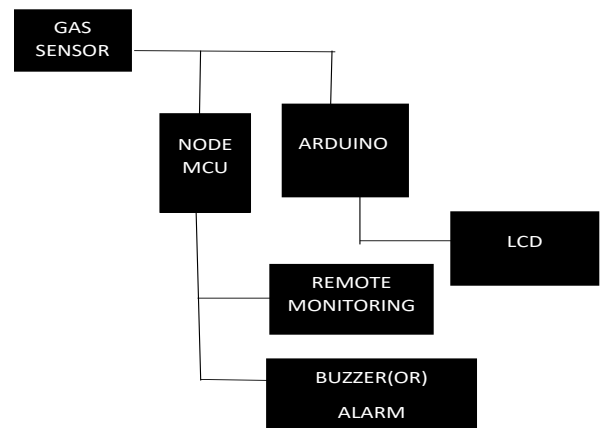
3.1 Connection withthe help MQ2 sensor

Figure 5: Block diagram of Ardunio connections

The MQ2 sensor uses to detect the suitable gases like H2, CH4, methanol, CO2, alcohol, smoke, propane etc [5-6]. Due to high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer [9].
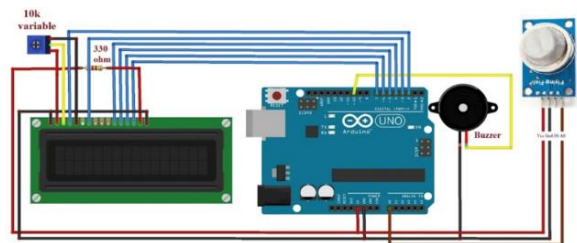

Figure 6: Ardunio and MQ2 sensor connections

As shown in the above circuit diagram the implementation for gas sensor detection is done through MQ2 sensor [10-15]. It contains Arduino board, LPG GAS Sensor Module, bell and 16x2 LCD module. Arduino controls the whole strategy of this system like scrutinizing LPG Gas sensor module yield, sending message to LCD and starting ringer. We can set the selectivity of this sensor module

by inbuilt potentiometer put on it [7-9]. LPG gas sensor module's A0 stick is authentically connected with A0 of Arduino and Vcc and GND are related with Vcc and GND of arduino. LPG gas sensor module contain a MQ2 sensor which perceives LPG gas [11-15]. This MQ2 sensor has a hotter inside which needs some radiator supply to heat up and it may involve to somewhere in the range of a chance to get ready for distinguishing LPG gas. A 16x2 LCD is associated with arduino in 4-piece mode. Control stick RS, RW and En are straightforwardly associated with arduino stick 2, GND and 3. LCD to ardunio show pins are 12,11,5,4,3,2 [11-13].

Discussion:-

The main use of ardunio in this project is to display the ppm values of the smoke on lcd and should sound the buzzer when there is any mismatch of the values in the pre-defined range of ppm. This error indicates that there is a leakage of gas in the room.

Further modification of this problem in the advanced way by decreasing the size of the circuit we need to make use of node mcu. Where node mcu acts as the wi-fi module it works as the remote monitoring system to send the messages anywhere in the world. For these alert messages through email for the quick problem solving we need to replace ardunio with node MCU.

3.2 Block diagram with Node MCU

NodeMCU Development board is featured with wi-fi capability, analog pin, digital pins and serial communication protocols.
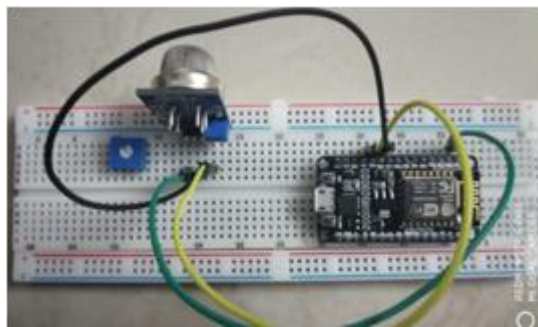

Figure 7: Connection through node MCU

We use Node MCU in this project is to connect the internet of things and need to get an alert message through thingspeak. It is used as a wi-fi module [10]. By connecting the MQ2 sensor with Node MCU we can make the things better and in the fast and simple way to save the people.

when the smoke is detect through the sensor in industries the workers need to get the message or e-mail that "you are in the danger zone" and the graph is generated in thingspeak showing the range of the smoke and we can control theproblemfrom the place we are in the world using remote control monitoring system [10-14].

Sensor Connection:-

1. Connect GND pin of the sensor to GND pin in the NODEMCU.

2. Connect VCC pin of sensor to VCC(3.3V) in the NODEMCU.
3. Connect the computerized yield to D8(any advanced stick of NODEMCU).

IV. WORKING

In the event that sensor distinguishes the gas, at that point its advanced yield will be 0 generally 1 yet in simple yield on the off chance that it recognizes gas, at that point the worth or voltage will be high and low when it doesn't identify any gas.

Table For Limit Of Gases

Gas	IDLH Limit	Health Effect
CO_2	50,000 ppm	(5-7)% - Stimulated respiration. >7%-unconscious
CO	200 ppm	>500ppm-Nausea, dizziness. >1000ppm-Death after one hour of exposure.
H_2S	100 ppm	Extremely flammable. >1000ppm-Death after a short exposure.
CH_4	<5%	Asphyxiant in high concentrations.
NO_2	50 ppm	>50 ppm-Respiratory problems.

V. RESULTS

5.1 RESULT IN ARDUNIO THROUGH LCD

Here we can observe the result in the LCD display were the output is measured in PPM(parts per million).
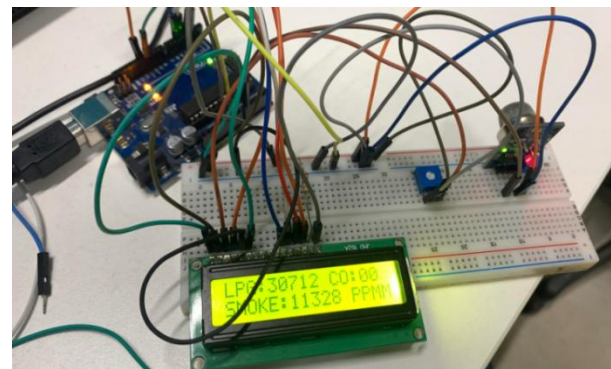

Figure 8: Result in LCD

And we can observe that which gas was detected either smoke or LPG or CO. Any type of gas is detected by the MQ2 sensor. And the pot is used for the voltage control for LCD display and its adjustment.

Pseudo code:-

```
#include <MQ2.h>
#include <Wire.h>
#include <LiquidCrystal.h>
LiquidCrystal
lcd(12,11,5,4,3,2);
int Analog_Input = A4;
```

```
int lpg, co, smoke;
MQ2 mq2(Analog_Input);
void setup(){
  Serial.begin(9600);
  lcd.begin(16, 2);
  mq2.begin();
}
void loop(){
  float* values= mq2.read(true); //set it false if you don't
want to print the values in the Serial
  //lpg = values[0];
  lpg = mq2.readLPG();
  //co = values[1];
  co = mq2.readCO();
  //smoke =
values[2];
  smoke = mq2.readSmoke();
  lcd.setCursor(0,0);
  lcd.print("LPG:");
  lcd.print(lpg);
  lcd.print(" CO:");
  lcd.print(co);
  lcd.setCursor(0,1);
  lcd.print("SMOKE:");
  lcd.print(smoke);
  lcd.print(" PPM");
  delay(1000);
}
```

Node MCU Code:-

```
#include <SerialESP8266wifi.h>
#include <ESP8266WiFi.h>
String apiKey = "L2N7EYH6255XHVII"; // Enter your Write
API key from ThingSpeak
const char *ssid = "AJ"; // replace with your wifi ssid and
wpa2 key
const char *pass = "ajay@123";
const char* server = "api.thingspeak.com";
WiFiClient client;
void setup()
{
Serial.begin(115200);
delay(10);
Serial.println("Connecting to ");
Serial.println(ssid);
WiFi.begin(ssid, pass);
while (WiFi.status() != WL_CONNECTED)
{
delay(500);
Serial.print(".");
}
Serial.println("");
Serial.println("WiFi connected");
}
void loop()
{
float h = analogRead(A0);
if (isnan(h))
{
Serial.println("Failed to read from MQ-5 sensor!");
```

```
return;
}
if (client.connect(server, 80)) // "184.106.153.149" or
api.thingspeak.com
{
String postStr = apiKey;
postStr += "&field1=";
postStr += String(h);
h=h/10;
postStr += "\"r\"n\"";
client.print("POST /update HTTP/1.1\n");
client.print("Host: api.thingspeak.com\n");
client.print("Connection: close\n");
client.print("X-THINGSPEAKAPIKEY: " + apiKey + "\n");
client.print("Content-Type:
application/x-www-form-urlencoded\n");
client.print("Content-Length: ");
client.print(postStr.length());
client.print("\n\n");
client.print(postStr);
Serial.print("Gas meter");
Serial.print(h);
Serial.println("%. Send to Thingspeak.");
}
client.stop();
Serial.println("Waiting...");
// thingspeak needs minimum 15 sec delay between updates,
I've set it to 30 seconds
delay(30);
}
```

5.2. **RESULT IN THINGSPEAK USING NODE MCU**

Sign up and login at Thingspeak,
Channels -> New Channel -> Enter name -> Description ->
Field1 (ex:gas level) -> save Channel
Note channel id
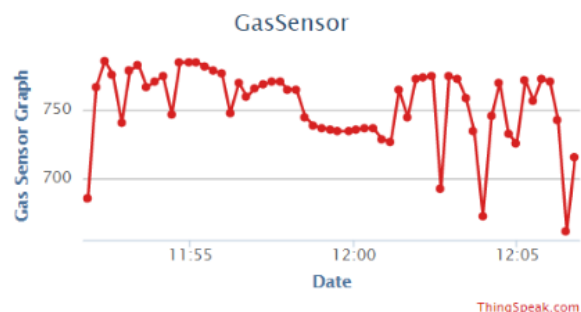GotoAPIKeys Copy Write API Key

Figure 9: Graph in thingspeak.

VI. CONCLUSION

Finally, by utilizing the MQ2 sensor we had show the smoke location in the ppm values with the help of ardunio and by utilizing node mcu we had watch the sensitivity of the gas by thingspeak. We use node mcu in this project is to interface the web of things and need to get an alarm

message through thingspeak. It is utilized as a wi-fi module. By associating the MQ2 sensor with node mcu we can improve the things and in the quick and straightforward manner to spare the individuals. Further change of this issue in the pushed way by lessening the size of the circuit we need to use hub mcu. Where node mcu goes about as the wi-fi module it fills in as the remote checking system to send the messages wherever on the world.

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