

IOT BASED VEHICLE EMISSION MONITORING SYSTEM AT TOLL PLAZA USING RFID AND CLOUD SERVICES

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ABSTRACT

The main aim of this project is to reduce pollution by measuring the concentration of pollutants in the vehicles emission and notifying the vehicle owner if the concentration of pollutants exceeded the standard norms like Bharat stage emission standards. Earlier the pollution for each and every vehicle is measured by using mobile pollution testing van. By this method there are problems like getting certificate for heavy vehicles is difficult. In order to overcome those problems this method is used. In this method a system is placed near toll plazas which consists of some sensors like mq7,mq135,mq2 and a Arduino and a Wi-Fi module(ESP8266). With the help of sensors the concentration of carbon monoxide (CO), nitrogen oxides(NO_x) and smoke is measured. If these pollutants exceeded the Bharat stage emission standards then with the help of RFID the respective vehicle number and their pollutants concentration is noted in the thing speak software and also the respective vehicle owner gets notified in order to attain the proper maintenance of the vehicle. If the same problem repeats for 5 times then the vehicle numbers are sent to RTO office so that they may control this by imposing fines. The whole framework is controlled by the Arduino Uno.

I. INTRODUCTION

Pollution is the one of the major problem that we are facing in our day to day life. There are many kinds of pollutions like air pollution, Water pollution, soil pollution, Noise pollution. The one and only major source for air pollution is vehicles. As the number of vehicles is getting increased then the pollution caused due to those vehicles is also increased. The reason for this drastic increase in number of vehicles is, in olden days people used to travel from one place to another either by walk or by bullockcarts which are eco-friendly. After some days people used to travel by means of city buses, at that moment pollution is somewhat increased. But now in this modern society each and every house consists of two or more vehicles. With this pollution is increased drastically. First of all let us know "what is meant by pollution?". The pollution arises whenever the concentration of pollutants exceeded beyond its limits. Each and every vehicle emits pollutants, It's common. But the problem arises only when they exceeded to its standard norms. This is due the incomplete combustion of fuels ,poor fuel quality, use of old and improper vehicles. This problems can be minimised by proper maintenance of vehicles.



Fuel Type	Pollutant Gases	BS6 (BSVI)	BS4 (BSIV)
Petroleum Distillate Vehicle	Nitrogen Oxide (NOx) Limit	60 mg	80 mg
	Particulate Matter (PM) Limit	4.5 mg/km	-
Diesel Fuel Vehicle	Nitrogen Oxide (NOx) Limit	80 mg	250 mg
	Particulate Matter (PM) Limit	4.5 mg/km	25 mg
	HC + NOx	170 mg/km	300 mg

Fig 1:BS-4 and BS-6 Standards in India

II. WORKING

At first this device is placed in the toll plazas. If a vehicle came near to the toll gates to pay the fast tag the emission released from the vehicles is getting sensed by the sensors present in the device. The mq7 sensor senses the carbon monoxide percentage, mq2 sensor senses the nitrous oxide percentage and the mq135 sensor senses the smoke percentage present in the emission. By doing some calculation the average value of each pollutant is calculated and sent to the Arduino. In the Arduino the emission levels are compared with the Bharat stage emission standards and identifies the one which exceeds the standard norms with the help of code written in it. And then the identified data of first Arduino is sent to th another Arduino for detecting the vehicle number of respective vehicle with the help of RFID.

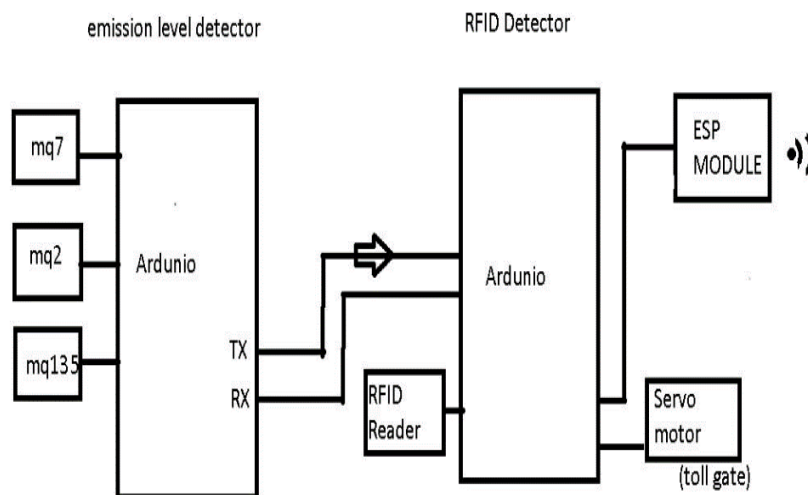
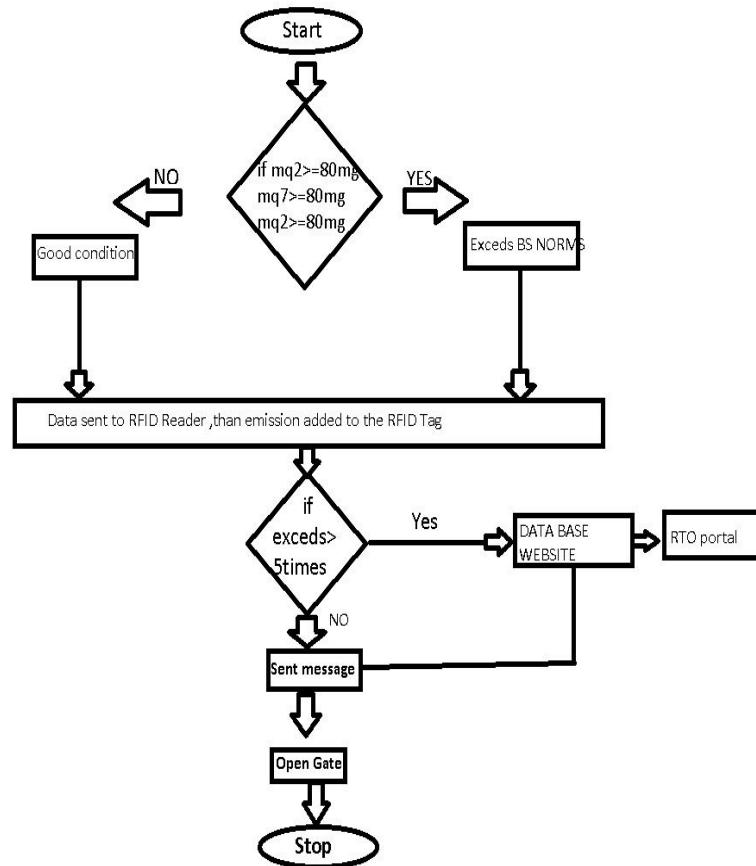


Fig 2: Block diagram

As per the Code written in the Arduino the vehicle owner get notified for attaining proper maintenance of vehicle. If this repeats for 5 times the vehicle number is noted and sent to the RTO office with the help of WI-FI module.

FLOWCHART: The below flow chart shows the flow of operation.



I. MATERIALS AND METHODS:

[1] Arduino Uno:

The Arduino Uno 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.^[4] It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts



Fig 3. Arduino Uno

[2] ESP8266 WIFI Module

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT (Internet of things) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is a SOC (System On-chip) integrated with a TCP/IP protocol stack, which can provide microcontroller access to any type of Wi-Fi network.



Fig 4. ESP8266 ESP-01S

[3] MQ-7 Sensor

MQ7 sensor has an acute sensitivity to Carbon Monoxide(CO) and can detect the concentration of carbon monoxide in the surroundings. MQ7 sensor has a small heater inside with an electrochemical sensor to measure different kinds of gas combinations. Thus, it can be calibrated. We can use the gas sensor module at room temperature.



Fig 5 .MQ7 Carbon Monoxide (CO) Gas Sensor

[4] MQ-2 Sensor

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, pro- pane, methane, hydrogen, alcohol, smoke and carbon monoxide.



Fig 6. MQ-2 Sensor

[5] MQ-135 Sensor

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



Fig 7. MQ-135 Sensor

[6] Internet of Things

The Internet of things (IoT) describes physical objects (or groups of such objects) with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the internet or other communications networks. Internet of things has been considered a misnomer because devices do not need to be connected to the public internet, they only need to be connected to a network and be individually addressable.



Fig 8. Internet of Things

[7] ThingSpeak

ThingSpeak is an open-source software written in Ruby which allows users to communicate with internet enabled devices. It facilitates data access, retrieval and logging of data by providing an API to both the devices and social network websites. ThingSpeak was originally launched by ioBridge in 2010 as a service in support of IoT applications.

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. You can send data to ThingSpeak from your devices, create instant visualization of live data, and send alerts.

It will do the following functions:

- Collect - Send Sensor data privately to Cloud.
- Analyze - Analyze and Visualize your data with MATLAB.
- Act - Trigger a Reaction.

7.1 Creating a Channel

- Sign In to ThingSpeak™ using your MathWorks® Account credentials, or create a new account.
- Click Channels > MyChannels.



Fig.9. Creating a channel

- On the Channels page, click New Channel.
- Check the boxes next to Fields 1–3. Enter these channel setting values:
- Name: IOT based Arduino Vehicle Pollution.
- Field 1: Smoke
- Field 2: Carbon Monoxide
- Field 3: Nitrogen Dioxide
- Click Save Channel at the bottom of the settings.

You now see these tabs:

- Private View: This tab displays information about your channel that only you can see.
- Public View: If you choose to make your channel publicly available, use this tab to display selected fields and channel visualizations.

- Channel Settings: This tab shows all the channel options you set at creation. You can edit, clear, or delete the channel from this tab.
- Sharing: This tab shows channel sharing options. You can set a channel as private, shared with everyone (public), or shared with specific users.
- API Keys: This tab displays your channel API keys. Use the keys to read from and write to your channel.
- Data Import/Export: This tab enables you to import and export channel data.

7.2 API Key

The User API Key enables channel-level operations using the API. The User API Key is necessary to create and delete channels and to view information for private channels. To get your User API Key: Click Account > My Profile. If your API Key is compromised, you can generate a new key: Click Generate New API Key.

Write the API key as shown in the figure:

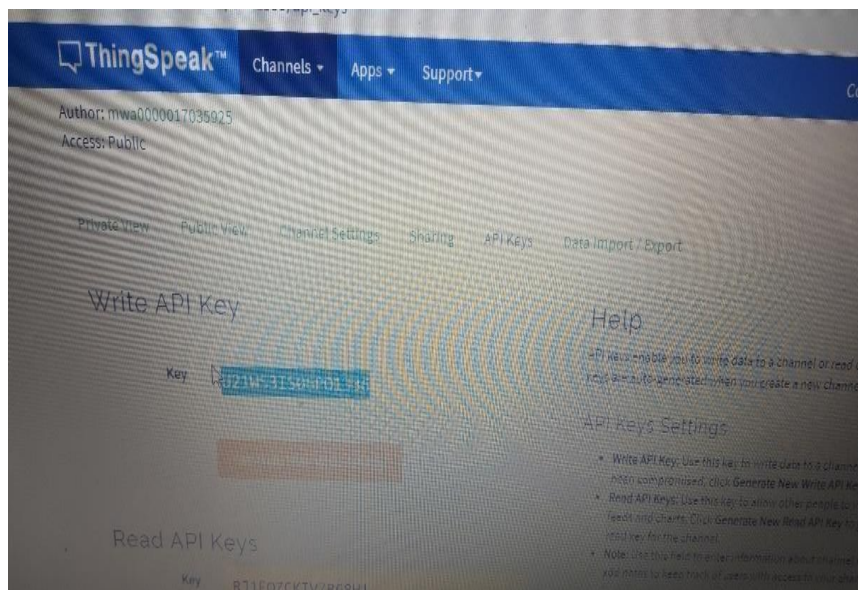


Fig.10. Writing API key

7.3 Program

Dump the following code into the Arduino and change the following highlighted credentials in the program.

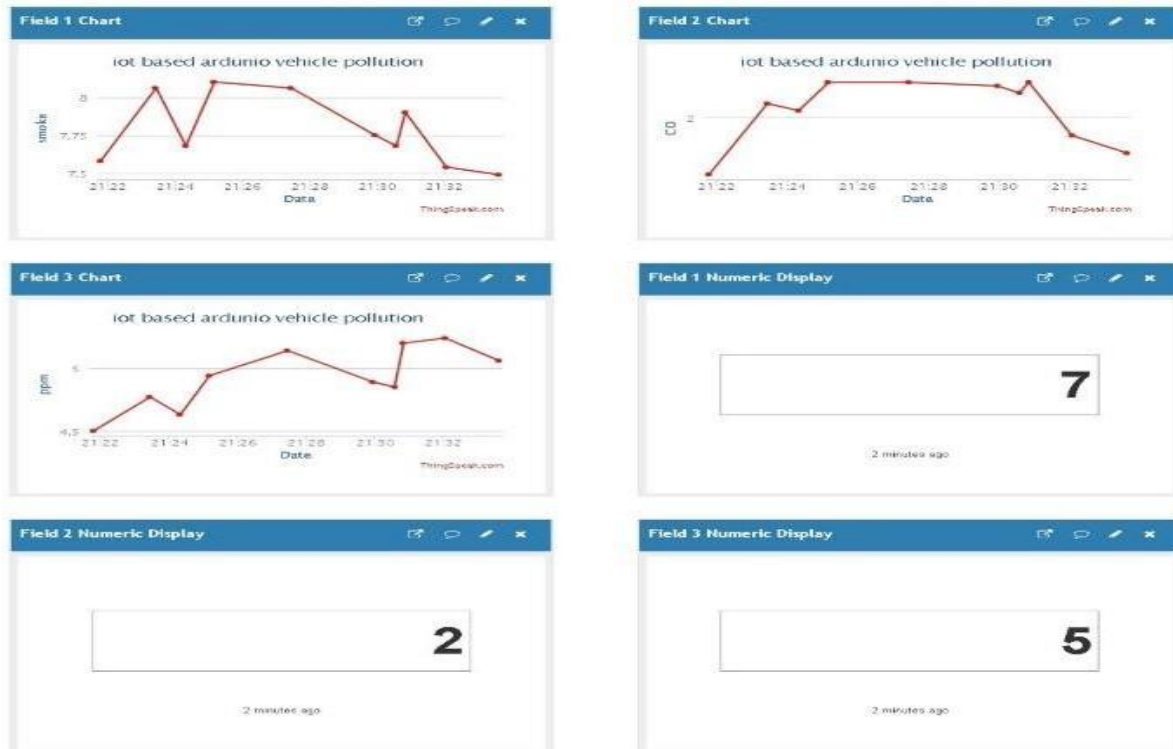
```

esp4
#include <ThingSpeak.h>
#include <SoftwareSerial.h>
#define RX 2
#define TX 3
String AP = "jinu"; // AP NAME
String PASS = "Archana.singh"; // AP PASSWORD
String API = "U21WS3IS06P0133d"; // Write API KEY
String HOST = "api.thingspeak.com";
String PORT = "80";
//String field = "field1";
int countTrueCommand;
int countTimeCommand;
boolean found = false;
SoftwareSerial esp8266(RX, TX);
int redled = 10;
int coThres = 50;
int noThres = 80;
    
```

Fig.11.Program

II. RESULTS

When the device is placed nearer to the vehicle smoke due to the sensors present in the device , The result will be as follows



III. CONCLUSION AND FUTURE SCOPE

In our environment the pollution is mostly because of the emission of harmful gases from the automobiles. This can be reduced only by strictly monitoring the concentrations of harmful pollutants like CO, NOX, smoke etc. It is difficult to check that manually. At that time this system is very useful to calculate the concentrations of harmful gases and to inform the vehicle owner and the transport department which helps in proper maintenance of the vehicles.

IV. REFERENCES

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