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IOT BASED AIR POLLUTION MONITORING SYSTEM

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Abstract:

Air pollution is mixing of harmful pollutants into the air. Air pollution is the biggest problem to tackle for every nation, may it be 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. In the way to enhance their living standards, humans are deteriorating the quality of air. The suspended particles in the air proves fatal for the health of humans. Adverse effects of air 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 on human health. Further the air pollutants mix up with the water vapour in the air causing acid rain. There is a requirement of a proper system to keep a check on air pollution. An IOT based air pollution monitoring system is proposed that uses MQ 135 gas sensor interfaced to node MCU; the system is connected through ESP8266 wifi module to the think speak cloud to analyze the sensor data. This proposed model can be utilized in a number of ways; the main idea involves the system to be installed in every vehicle so that emission of every vehicle remain under set level. IOT based framework can be the best solution to fight back problems such as global warming.

Keywords:

Arduino, MQ135 Gas Sensor, IOT, Node MCU.

1. INTRODUCTION

Air contamination causes loss of living beings . As per 2012 survey; nearly 7 million people lost their life as consequence of various ailments such as bronchitis, obstructive pneumonia and other breathing problems. The WHO has set the limits of several pollutants such as ozone(O_3), nitrogen dioxide(NO_2), sulphar dioxide(SO_2). There are several causes of air pollution. Vehicles contribute a large section in air pollution. Infact it may be referred as the major cause of affecting human health, there are various measures taken by government to control the increasing pollution but the public is reluctant in following the norms. The pollution caused by every individual negligence result hazardous latter. The conventional methods prove irrelevant in tackling the current scenario. Primitive method involves the use of semiconductor device that is inserted into the exhaust of vehicles to record emission levels of every vehicle. Conventional method involves high human intervention therefore possibility of error is high. The disadvantages of the conventional monitoring tools are their large size, heavy weight and extraordinary expensiveness. There is chance of data being mishandled for personal gains. These lead to exploitation of pollution norms. In order to be effective, the system must involve minimum human intervention. The proposed model involves the installment of Iot based pollution monitoring system into the exhaust of the vehicles. Through this way a proper management of vehicular emissions of every vehicle can be kept and observed at any point of time. In case the emission level rise above a threshold limit; the owner will be informed to go for a proper check up of his car. IOT Based Air Pollution Monitoring System monitors the emission levels of a vehicle over a web server using internet and will trigger an alarm when the pollution levels goes up a certain level, means when the amount of harmful gases such as CO2, NO2, smoke, SO2, NH3 rise beyond the set mark; these can be sensed by MQ135 gas sensor. The system will show the air quality index in PPM over the LCD display and as well as on webpage so that it can be monitored very easily. The gas sensor is to be connected to the node MCU; the gas sensor returns the pollution level in voltage that is to be converted into the ppm (parts per million).

2. LITERATURE REVIEW

There had been several primitive ways that were used to monitor the pollution levels of vehicles. The pollution centres are the most common way of keeping air pollution under control but all efforts in vain. The method involves recording the emission of automobile and on the basis of which a pollution certificate is issued with a validity of 6 months. But the method is old school and does not allow real time analysis of data from every vehicle.

The real time pollution monitoring framework will allow examination of all the vehicles at any point of time. This aims at designing an air pollution monitoring system which can be installed in every vehicle and to enhance the system from the previously developed systems beating the earlier disadvantages by developing an

android app available for the public. This app can be used by anyone to get in live updates about the pollution levels of his individual vehicle. It uses node MCU integrated with individual MQ 135 gas sensor. Sensor can measure the quality of air which is displayed in ppm. Node MCU proves to be better for the proposed model as it single handedly can serve the requirements of arduino and wifi module. Node MCU combines the feature of a microcontroller alongwith a WiFi breakout board and provides the entire package as a single development board, officially called Node MCU Devkit. It includes an ESP8266 based system on a chip and is designed for Iot projects. As the emission level reach the threshold there is buzzer that alerts vehicle's owner.The collected data is uploaded to the cloud using thing speak platform at regular time intervals for real time investigation. Therefore a lower cost model is obtained that measure harmful gases through a multi layer system involving Node MCU, MQ135 gas sensor and other components.

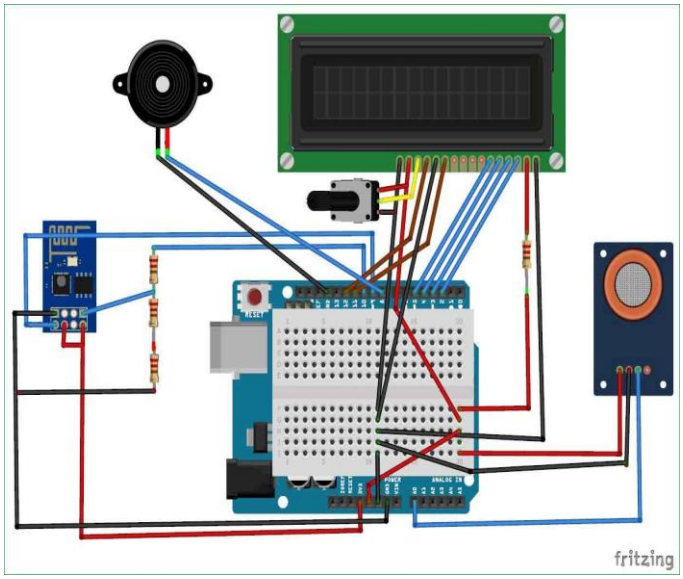

Fig 1(diagram)

3. HARDWARE REQUIREMENTS

3.1) Node MCU

It is an open source Iot platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is predicted on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits, and built on the Espressif Non-OS SDK for ESP8266.

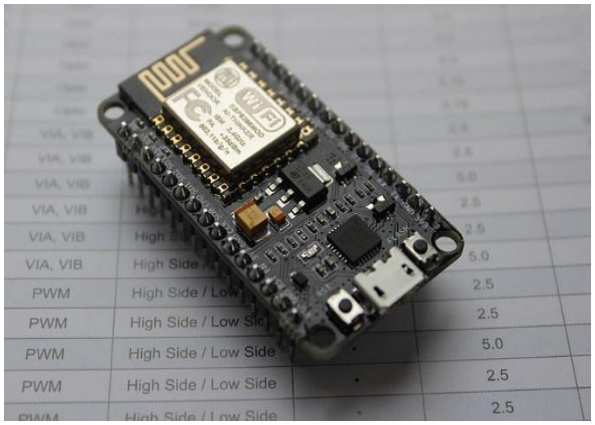

Fig 2(NodeMCU)

3.2) MQ135 Gas sensor

The Sensitive material utilized in MQ135 gas sensor is SnO2. The conductivity of this material is lesser in clean air. The sensor conductivity goes up with hike in concentration of target pollution gas. MQ135 can monitor different kinds of toxic gases such as sulfide, ammonia gas, benzene series steam and CO2. The detection range varies between 10- 10,000 ppm along with voltage rate of about 5.0V±0.1V AC or DC.

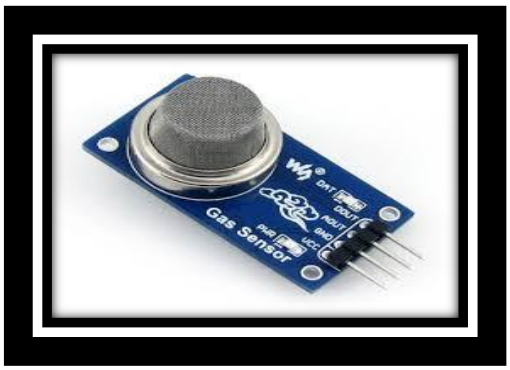

Fig 3 (MQ135 Gas Sensor)

3.3) Wi-Fi Module

The Wi-Fi Module is a self-contained SOC with integrated IP protocol stack that can give any microcontroller access to your Wi-Fi network. Wi-Fi module is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Every module comes pre-programmed with an AT command set firmware, meaning, we can simply connect to the Arduino device. The module is an extremely cost-effective board. The Wi-Fi Module is used to connect with any available internet hotspot and transfer sensor data to Thing Speak Platform via Wi-Fi. The Wi-Fi Module may be a self-contained SOC with integrated TCP/IP protocol stack which will give any microcontroller access to a Wi-Fi network

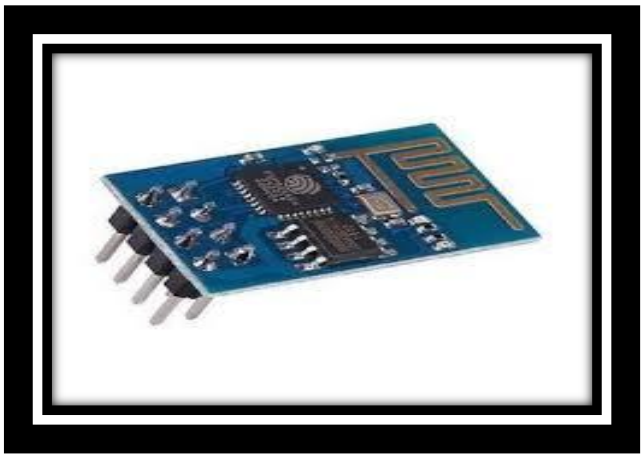

Fig 4 (Wi-Fi Module)

3.4) Arduino Uno

It is the foremost flexible hardware platform used supported ATmega328P which may can be programmed consistent with the function where it is to be used. It has 6 analog inputs, 14 digital input/output pins (6 pins of these can be used as PWM outputs), a USB connection, a 16 MHz quartz crystal, SPI, serial interface, a reset button, a power jack and an ICSP header. The Arduino microcontroller isn't just for technical audience but is meant for designers and artists also due to its focus to usability supported its design which helps to achieve the intended goal.

Fig 5 (Arduino Uno)

3.5) LCD Display

LCD (Liquid Crystal Display) is an electronic display module: A 16x2 LCD display is very basic module and is very commonly used in different types of devices and circuits. These modules are advantageous and have better performance over seven segments and other multi segment LEDs.

Fig 6(LCD Display)

The 16X2 LCD display is employed to watch 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 6 down to 3 of the controllers respectively.

3.6) Buzzer

A Buzzer or beeper is an audio device. Whenever the pollution goes above the edge level the Buzzer starts beeping indicating Danger.

Fig 7 (buzzer)

4. WORKING

Proposed Air Pollution Monitoring System is based on the block diagram as shown in Fig 8.Model is to be installed into every vehicle to get real time pollution data of individual vehicle. The data of emission level is recognized by MQ135 gas sensor. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2, SO2 etc. So it is a dynamic gas sensor for our Air pollution Monitoring system. When it will be connected to Node MCU then it will sense all gases, and it will give the Pollution level. MQ135 gas sensor will give the output in form of voltage levels; which have to be convert into PPM(parts per million). Gas sensor reads the value in voltage which is to be converted into ppm. If the level of emission from vehicles reach above the set limit the buzzer will start beeping

Node MCU is a very cheap device and do serve the need of ESP8266. The system is connected to think speak. ThingSpeak is an IoT analytics platform service that permits you to aggregate, visualize and analyse live data streams within the cloud. ThingSpeak provides instant visualizations of knowledge posted by your devices to ThingSpeak.

Sensor gives value of 90 when there is no gas near it and the emission level safe till 350 PPM and it should not exceed 1000 PPM. When it will exceed the limit of 1000 PPM, it will cause Headaches, sleepiness and stagnant, stuffy air. If it exceeds beyond 2000 PPM then it will cause increased heart rate and many different diseases. When the number are going to be but1000 PPM, then the LCD and webpage will display "Good Air". When the numbers will increase from 1000 PPM, then the buzzer will start beeping and therefore LCD and webpage will display "Poor Air, Alert". And when it will increase 2000, the buzzer will keep beeping and give an alert message on smartphone through GSM.

IOT Air Pollution Monitoring System

Air Quality is 977 PPM

Good Air

Fig 8 (Blynk app)

The LCD and webpage will display "Danger! Move to pollution centre". According to the model the sensor works as input data, they transmit data for knowing which gas it is, what is the temperature and humidity. LCD and Buzzer are the output devices. LCD shows the data of the gases in ppm (parts per million) and Buzzer is used when ppm crosses above a threshold limit.

Blynk is an Iot technology used to regulate Arduino, Raspberry Pi and therefore the like over the web. In this project Blynk makes a digital dashboard available on our smartphone that displays real-time air quality values for the immediate surroundings.

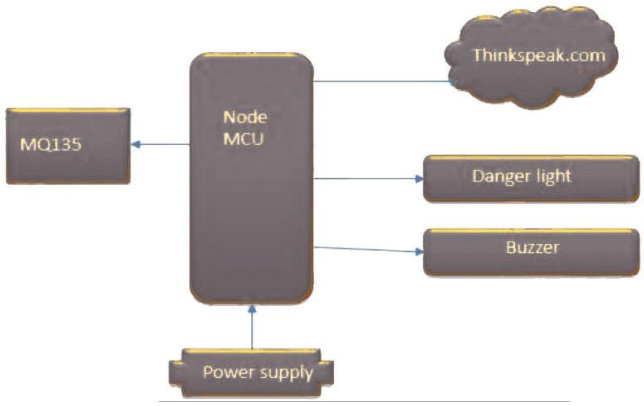

Fig 9 (block diagram)

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