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Online Monitoring of Air Pollution using IoT

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Abstract-Every automobile has its own production of harmful gases, but the crunch occurs when the production is beyond the certain values. The main cause for production of emission level is the improper burning of fuel given to the engine which is cause of the rough maintenance of automobiles. The production from automobiles cannot be avoided, but it can be controlled. Nowadays, air quality by using Internet of Things(IOT) has been an major crunch in the recent years ,in Delhi during nowadays the air quality has been polluted lot hence they follow an odd number system, we consume air, water, food daily here we eat food after a clean processing sometimes they are also sometimes boiled hence they are free from germs or harmful substances similarly water is also cleaned before drinking but the air on the atmosphere are taken without any processing can cause serious issues here we use automated cloud based system to monitor the air quality the main aim of the project is to monitor the pollutants in the vehicle by using the pollution control circuit. This Pollution Control Circuit consists of various sensors like LM35, Humidity, MQ9,MQ3 and MQ2 are connected to a Controller. Those values are transmitted to the Cloud through IOT Modem.

Key words: Arduino Uno, Wireless Sensors, Internet of Things(IOT), Air Pollution, Global Positioning System(GPS)

1. Introduction

The Internet Of Things(IOT) allows various users to monitor and sense various devices remotely from anywhere in the world, The IOT allows creating opportunities for more direct integration between the physical world and Computer based Systems, and resulting in improved accuracy, efficiency and economic benefit.

Internet of Things(IOT) term was first composed byKevin Ashton in 1999. Internet of things has the network of physical and remote deviceswith the Electronics, Software, Sensors, Activator sand network connectivity with the objective of exchange data or collects the data. The IOT enables the articles to be detected or controlled remotely crosswise over existing system framework making the direct integration of physical world into PC based framework. The increasing generation needs empowered gadgets by wireless technology which includes Bluetooth, Radio Frequency Identification, Embedded sensors and many more. In that IOT Technology has grown from its beginning and now presently widely using it.

The Air Pollution is an important role in our life. Nowadays every human consumes more and more polluted air on daily basis it became very hard to handle the electricity requirements. Without electricity it's impossible to survive and also it is important to save the electricity loss .Energy crisis is one of the major problems that the world faces today.

The IOT is used to monitor the air quality from anywhere in the world without any physical contact with the apparatus ,it is used to determine the air quality and trigger an alarm when there are amount of harmful gases present in the air like Smoke, Alcohol, Benzene, Sulphur, CO, Nitrous oxide and LPG

This method uses an PPM(Hardness) Technique to check the air quality and determine the output on the LCD based on the PPM, Temperature and Humidity is sensed and monitored in the system using LM35 and SY-HS-220 Sensors,LPG Gas is detected using MQ3 Sensor and MQ9 Sensor is used for detecting the Air Quality as it senses most harmful gases and can measure their amount accurately. In this IOT project, we can monitor the air quality by using sensors and send the data to the online webserver using IOT and Trigger an Alarm when the limit of air quality is increased by certain limit beyond PPM and it will also send an SMS to the User based on the Data received

1.2. Methodology

1.2.1. Existing System

- Because the content of harmful gases is not checked there is no current way to check the air quality.
- The pollution will cause various diseases to the people in the pollution area
- It also causes various harmful effects to ozone properly and can't know the content correctly.
- Location update unavailable in current system.

1.2.2. Proposed System

- This data will be given in the web server. So, we can check the air quality anywhere through IOT.
- Web server is also to check the current pollution status.
- Location update available using GPS

1.3. Block Diagram Representation of IOT Based Air Pollution

1.3.1. Measuring Elements

The block diagram representation of IOT based air pollution as shown in the fig.1.1:the main elements are:sensors(Gas Sensor MQ9,Alcohol Sensor MQ3,CO Sensor MQ2,LM35 Temperature sensor,SY-HS-220 Humidity Sensor)are used in the measurement of air pollution

The Atmega 328p Microcontroller is used it is used for its bulk storage capacity it can be used to several programs at a same time.

The GPS stands for Global Positioning System used for remote tracking of the location it uses satellites to track the location of the remote place

Cloud based Automation is used to monitor the air pollution from remote location. It can process several data at a short time

1.3.2. Controller

The Microcontroller has a 14 Input and Output pin it has a USB port a power jack a reset button it contains needed to support Microcontroller it can be powered with the AC to DC adapter or a Battery. This Microcontroller differs from the all previous Microcontroller since it does not use FTDI USB to serial drive chip.This were the points on controller

1.3.3. Cloud based Automation

The value from microcontroller to the cloud based storage is used to monitor the air pollution from a remote location from any where by the usage of GPS Module.The cloud has very bulk storage compared to other storage devices.

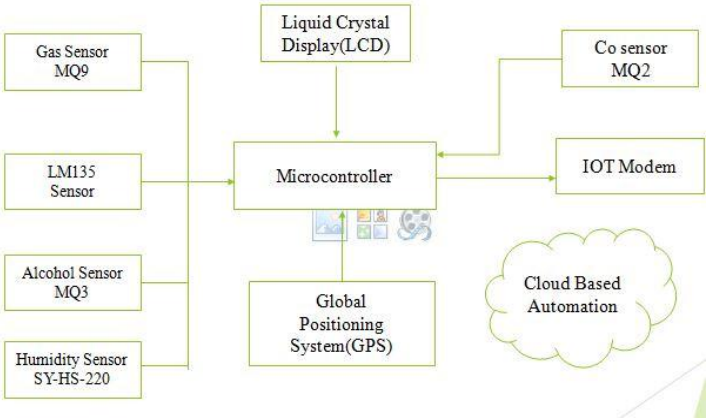

Fig:1.1:Block Diagram Of IOT Based AirPollution

1.4. Hardware Implementation

1.4.1. Sensors

In the broadcast definition, a sensor is a device, module, or a subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics ,the various sensor used here are LM35-Temperature Sensor,SY-HS-220-Humidity Sensor ,MQ9 Sensor ,MQ2 Sensor ,MQ3 Gas Sensor

1.4.1.1. Temperature Sensor:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The temperature sensor has a advantage from other sensor which are calibrated in kelvin here the calibration is done in centigrade which occupies us to free from the failure LM35 does not require any external calibration or trimming to provide typical accuracies of ±1/4C at room temperature and ± 3/4C over a full −55 to +150°C temperature range.

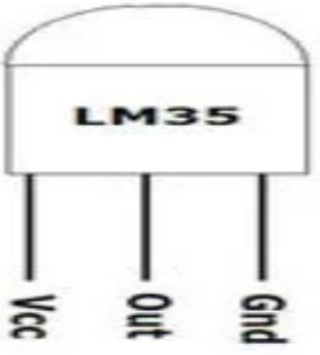

Fig:1.2: LM35(Temperature Sensor)

1.4.1.2. Humidity Sensor:

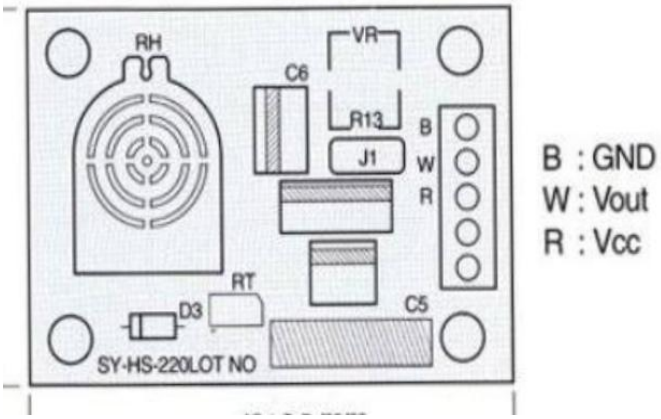

Fig:1.3: SY-HS-220(Humidity Sensor)

The humidity sensor is also called as SY-HS-220 is used to detect the moisture in the atmosphere, on its contact with the atmosphere it detects the level of water vapour in the atmosphere on sends the data to the microcontroller which on turn will fed the information to the LCD. The humidity sensor is important since the air pollution differs from one place to another based on density of water vapour in the system, it doesn't require any calibration, high stability and less cost.

1.4.1.3. MQ9, MQ3, MQ2 Gas Sensors

Fig:1.4: MQ2, MQ9, MQ3 GAS SENSORS

The MQ sensors can detect any harmful gases in the atmosphere based on conductivity they can detect harmful gases like CO,CO2,nitrous oxide sulphur,benzene,NOX,NH3,alcohol

i. **MQ9 GAS SENSOR-**The MQ9 Gas Sensor is based on lower sensitivity material of sno2,it gets conductivity increased on its contact with clean air ,when it contacts the clean the resistivity increases leading to the passage of current this current gives the corresponding voltage output which is given to the Atmeg328p microcontroller which is then given to the LCD, it detects harmful gases such as propane ,benzene, sulphur, NOX, NH3.

ii. **MQ2 GAS SENSOR-**MQ-2 Gas Sensor is also designed with same sensitive material of sno2 and it conductivity gets changed on its contact with clean air, they also provide the result to the LCD based on the harmful gases detected by the sensor

iii. **MQ3 GAS SENSOR-**MQ-3 Gas Sensor is designed with high sensitivity, it is based on the alcohol. on its contact with pure air in the presence of alcohol the resistivity of the sensor goes down the conductivity gets changed on its contact with the alcohol gas and provides corresponding output in the form passage of current, the responding output is given to the LCD

1.4.2. Controller

1.4.2.1. Arduino Uno

The Arduino Uno has a microcontroller which is Atmega328p it also has 14 input/output pins which is connected to (of which 6 can be used as PWM

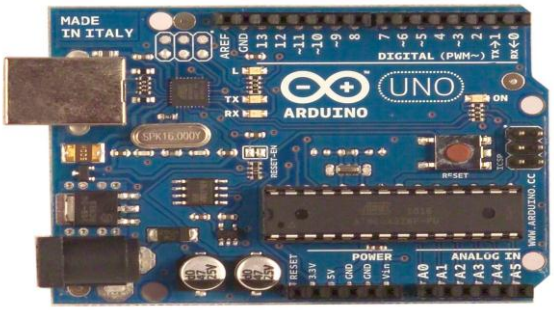

Fig:1.5: Arduino Uno

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. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

1.4.2.2. Global Positioning System(GPS):

The GPS is a satellite based radio navigation system ,it is a global navigation satellite system that provides geo location and time information to a GPS receiver

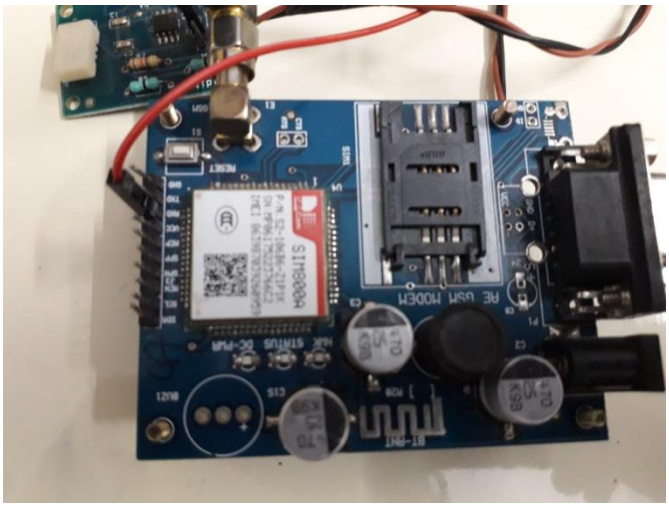

Fig:1.5.1: Global Positioning System (GPS)

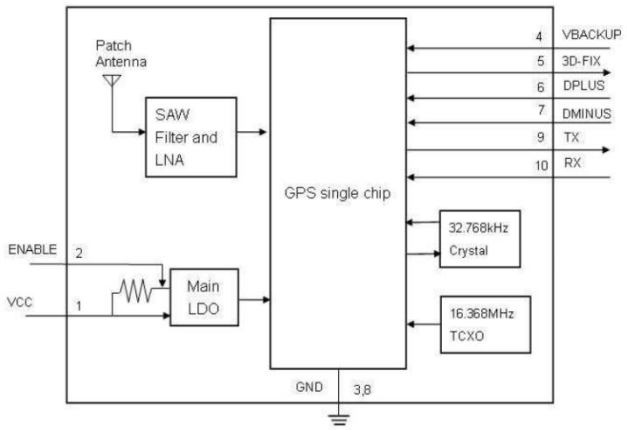

Fig:1.5.2:Block Diagram Representation OF GPS

The GPS does not require user to transmit data and it operates independently of at telephonic or internet reception, though these technologies can enhance the usefulness of GPS positioning information.

The GPS project was launched by US in 1973.The GPS concept based on Time and known position GPS specialized Satellites .Satellites carry very stable atomic clocks that are synchronized with one another and ground clock. In the manner the satellite locations are known with great precision .he GPS receiver has clocks as well but they are less stable and less precise.

1.4.3. Display Device

1.4.3.1. Liquid Crystal Display(LCD):

The LCD has 16 character 2 line method, it is used to display the output from the microcontroller based on the result obtained from the sensors, the LCD gives the output of LM35,SY-HS-220,MQ3,MQ2,MQ9 sensors

Fig:1.5.3:Liquid crystal Display(LCD)

1.4.4. Web Server Representation

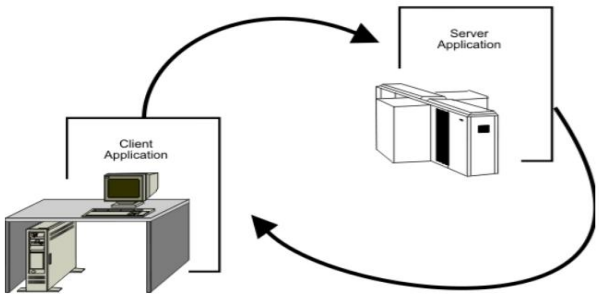

Fig.1.6: Web Server Representation

1.4.5. SOFTWARE REQUIRED

1) Thing speak cloud
2) Embedded c

1.5. Result and Discussion

Module 1: LCD OUTPUT

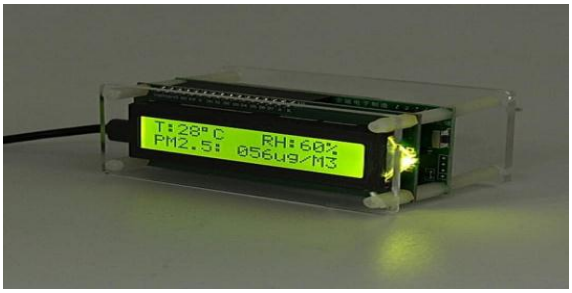

Fig:1.7:LCD display

Connections are made as per the circuit diagram and the corresponding output of the air quality is given to the LCD, then the values are given to the cloud, LCD continuously provides the air quality on display

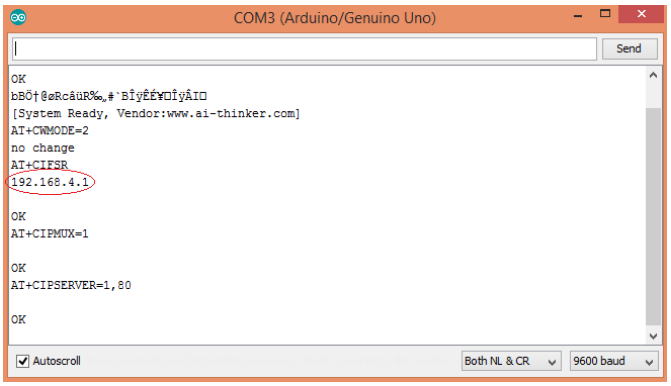

Fig:1.8:Coding for IP address

Before coding , we must upgrade the program to the system or the microcontroller ,a setup is given for the appropriate working of the system, hence to monitor the air pollution from anywhere in the world forward the port 80 to your local private IP address of your computer and mobile. After giving all the connections will be given to this local address and from this you can open this webpage from anywhere in the world by using proper public IP address.

Module 2: CLOUD BASED OUTPUT

Fig:1.9: Cloud Based display

With the help of IOT module we can obtain the result of the air quality on the mobile phone or the computer based on the cloud based automation

1.6. Conclusion

This method is used to monitor air quality from a remote location using IOT and feed the data to the cloud, the sensors MQ9,MQ3,MQ2,are used to sense the harmful particles in the atmosphere. The humidity Sensor and the temperature sensor are used to monitor the temperature and moisture content in the atmosphere. The obtained results are run by the microcontroller program and the corresponding output is obtained on the LCD and via the computer or mobile phone. The system monitor the air quality based on PPM.

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