Enhanced pollution monitoring system for vehicles using cloud based wireless sensor network

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Abstract-- *Pollution has been put out by rapid growth in population, industrialization and higher levels of energy utilization. Air pollution has a significant influence on the concentration of constituents in the atmosphere directing to effects like global warming and avid rains. They also produce harmful effects on humans. To avoid such adverse imbalances in nature, air pollution monitoring system is most important. WSN is a network of devices that can communicate the information collected from a monitored field through wireless links. Data collected from the sensors can be transferred through multiple nodes via gateway. These networks can be used in monitoring the concentration of CO2 from the vehicle exhaust. WSN are used in monitoring pollution level at both indoors and outdoors. WSN have also been implemented in predicting forest fires in advance by sensing the level of CO2 emitted by trees and the moisture in the surrounding. In all these implementations, a network of sensors is used with few nodes acting as intermediary while others collecting data. Data collected is transferred to the sink node using an efficient algorithm.*

Keywords--*Wireless Sensor Network, Arduino UNO, Infrared Radiations, ThingSpeak, Twilio*

I   INTRODUCTION

Air pollution is a common phenomenon these days. In recent days many metropolitan cities in India like Delhi, Mumbai and Chennai have been facing environmental challenges due to pollution. Air pollution has adverse effects on human health and also environment. Burning of fossil fuels in the vehicle is the major cause for air pollution. Countries all over the world are actively coming forward to eliminate air pollution. Many European countries have decided to replace petrol and diesel vehicles into electric vehicles by 2030. Even India has aimed to do so by 2025 [1].

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As cloud computing contain a greater number of information such as in government documents, emails, etc. By storing the data in the cloud, the owners can access from the data storage. Servers are designed to store and manage data, run applications or deliver content or a service. Vast network of remote servers around the globe hooked together and meant to operate as a single system. Provides remote access to the data via internet-enabled device.

Information can be made available from anywhere at any time. Monitoring the vehicle pollution in metropolitan areas is necessary. We have planned to address this problem by developing a vehicle pollution monitoring system using WSN technique. Arduino board connects with Thing Speak which used to connect the Wi-Fi module. Data posted by the sensors can be viewed instantly using Thing Speak. As it includes the ability to execute MATLAB code, we can also perform online analysis. It can handle our data and trigger a reaction in order to communicate it using third-party messaging services.

This sensor measures the concentration of CO_2 gas emitted from vehicle exhausts using infrared rays. An IR source is located at one end of the sensor which emits IR rays. While the other end contains the IR sensor which measures the amount of radiation emitted unabsorbed by the CO_2 gas. As a result, the temperature of the sensor increases generates a voltage. It is waterproof and anti-corrosion. This sensor is also resistant to water vapor interference. Therefore, it is highly suitable for harsh environments like vehicle exhaust.

II LITERATURE SURVEY

This paper gives us the solution to monitor the amount of pollution released from the carburettor of the vehicle. The growth of the technology has been rapidly increasing and several innovations are made in the field of Internet of Things.

As the technology has been rapidly increasing effect of the pollution has been increased. The major pollution among this is air pollution which causes environmental change that affects human beings and it has to be controlled. The major cause of the air pollution is the smoke released from Industries and carburettor of the vehicle.

In this paper they discussed about the sensing devices to monitor the amount of the pollution released from the carburettor of the vehicle.[4].

First when the engine is Started It will read the Gps Location in the form of latitude and longitude. Then using the gas sensor, the pollution range is checked. For this solution they used IOT technique and implemented using Raspberry Pi and Arduino.

Then they have used gas sensor to detect the amount of gas released from the carburettor of the vehicle and the data has been sent to the Raspberry Pi board using serial communication in python. The Arduino will be continuously sending sensor data for comparing the pollution values. A particular range of value has been set to monitor the pollution if the value crosses set range then the email copy about the car will be sent to the RTO to take appropriate action.

The data measured will be sent to the vehicle owner and the traffic department and agencies of national environment by taking this appropriate action the air pollution can be controlled especially in the urban areas.

This implementation directly warns the RTO about the polluting vehicle and block the vehicle. This is a drawback of the system. Instead we can be warning the user to service his engine in order to reduce the carbon emission of his vehicle. In case of a prolonged rate of pollution is observed then the vehicle can be reported to RTO and blocked.

This paper tells us about the recent approaches in sensing technology. Air pollution is one of the most serious environmental concerns in a country like India due to the huge level of population it also reduces the quality of air. The transportation is responsible for more than 50 percentage of carbon monoxide in the air this leads to risk of cancer. So, they designed a device to gather the pollutant level discharged from the vehicles.

The helps us to sense the pollutant levels discharged from the vehicles. If the sensed value goes beyond the given threshold value then the alert message to the owner of the vehicle using WIFI enabled module in addition to that buzzer has been added for driver notice.

Table 1: Literature survey summary

S.NO	Title	Author	Remarks
1.	Vehicle pollution monitori-ng using IoT 2015	Prof. Ghewari M. U , Tejaswini Mahamu ni , Pooja Kadam , Anupama Pawar .	It is an IOT based device allows us to detect the amount of pollution released by the vehicle.
2.	IoT based vehicle emission monitori ng system	Abinaya Balasund aram, Aishwary a UdayaKu mar, Baladhar shini Gopalan, Kaaviya Bhaskath nisha, Abdul Muthalip	Pollution level of the vehicle is sensed using IoT and if pollution level goes beyond threshold a buzzer is used to notify the driver

III OBJECTIVE

Air pollution has significant concentration of constituents in the atmosphere leading to effects such as global warming and acid rains. To avoid this adverse imbalance of nature, an air pollution monitoring system is very important. Wireless Sensor Networks is an excellent technology that is used to sense, measure and gather information from the world. These networks allow the physical environment to be measured at high resolutions. Greatly increase the quality and quantity of real-world data and information for applications like pollution monitoring.
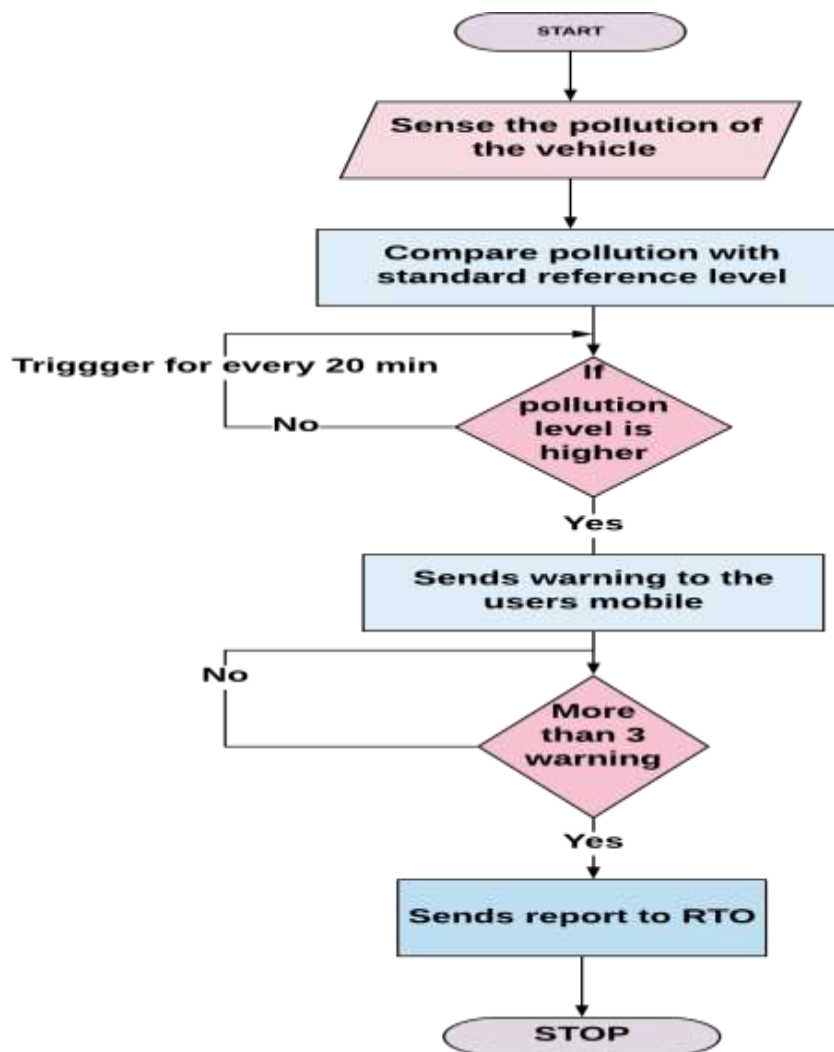
Figure 1: Flowchart of pollution monitoring in vehicle

The analog CO2 sensor is used to sense the rate of CO2 emission from vehicle exhaust. Data gathered by the analog sensor is input to the Arduino UNO board via analog pins. Using Wi-Fi module, the data collected is exported to ThingSpeak cloud.

The data collected from Arduino board is processed in the ThingSpeak platform. Pollution level is compared with standard reference level. If the pollution level is higher than the standard refence level then we trigger a message to the user's mobile.

Simultaneously, we also need to keep track of the number of warnings triggered. If the warnings generated to that particular user is more than three, we need to inform the RTO. We monitor the rate of pollution by performing a trigger to collect the data from the active Arduino for every 20 minutes. We upload this data to ThingSpeak and perform further analysis in the platform.
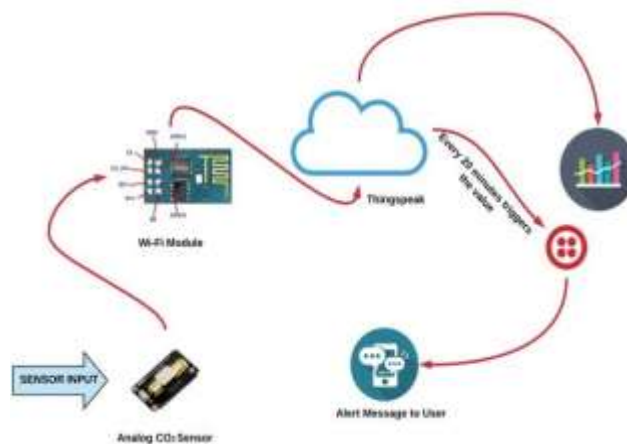
Figure 2: Architecture

IV HARDWARE DESCRIPTION

This sensor measures the concentration of CO_2 gas emitted from vehicle exhausts using infrared rays. An IR source is located at one end of the sensor which emits IR rays. While the other end contains the IR sensor which measures the amount of radiation emitted unabsorbed by the CO_2 gas. As a result, the temperature of the sensor increases generates a voltage. It is waterproof and anti-corrosion. This sensor is also resistant to water vapor interference. Therefore, it is highly suitable for harsh environments like vehicle exhaust.

Arduino perceives its environment with the help of sensors and affects its surroundings via actuators. It is an open-source. It is user-friendly hardware and software components. Arduino UNO board is the most commonly used board. It has own microcontroller. Arduino has six analog input pins. Pins A0-A5 helps in collecting data from the analog CO_2 sensor. TX pin of the Arduino board can transmit data from the Arduino board to the cloud. We use Wi-Fi module to transmit data to ThingSpeak.
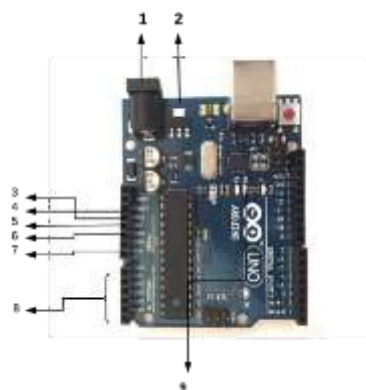

Figure 3: Arduino UNO

ESP8266 is the Wi-Fi module that is used in Arduino to connect it with the internet. It can be connected easily with a serial communication or UART interface. This is used to upload data to ThingSpeak regularly. ESP8266 serves as Access Point. It provides access to Wi-Fi network and connects them to a wired network further [1].
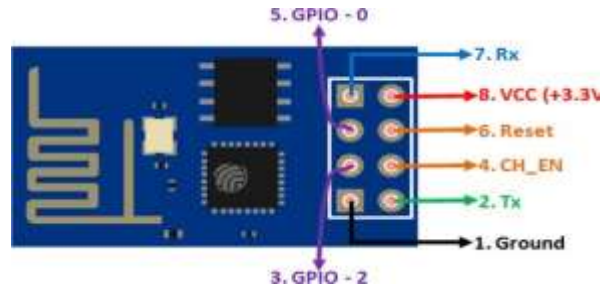
Figure 4: ESP8266

GSM module is a chip or circuit used to establish communication on mobile device. It is a 2G or 3G cellular communication system.[5] It enables us to connect with interned via GPRS.. It is suitable for SMS and for Data transfer. It allows as to create wide range of unregulated power supply. Using this modem we can make audio calls SMS read SMS and can also access internet using some simple commands it also consumes less power consumption and simple and compact.

V SOFTWARE DESCRIPTION

Data posted by the sensors can be viewed instantly using ThingSpeak. As it includes the ability to execute MATLAB codes we can also perform online analysis. It can handle our data and trigger a reaction in order to communicate it using third-party messaging services.

It is a cloud communications platform. The web services API provided by Twilio can be programmed to make phone calls, send or receive text messages. Twilio provides connectivity between HTTPS and public switched telephone network (PSTN) by deploying Amazon Web Service telephony infrastructure.

VI CONCLUSION

Our project is used to monitor the pollution rate of vehicles. It can be useful to check the pollution from individual vehicles. This can help us overcome the pollution caused by vehicles. We can promote this monitoring technique among the citizens, only with the support of government. After enough warnings being sent to the user the system conveys the problem to RTO if this rate of polluting is prolonged. In future this system can also be improved such that RTO can directly block the vehicle which is polluting too heavily.

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