

IOT Based Vehicle Emission Monitoring System and Pollution Detection

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Abstract: Degradation of air quality in cities is the result of a complex interaction between natural and anthropogenic environmental conditions. With the increase in urbanization and industrialization and due to poor control on emissions and little use of catalytic converters, a great amount of particulate and toxic gases are produced. The objective of this paper is to monitor air pollution on roads and track vehicles which cause pollution over a specified limit. Increasing number of automobiles is a serious problem that has been around for a very long time. This paper proposes use of Internet of Things (IoT) to address this problem. Here, combination of Wireless Sensor Network and Electrochemical Toxic Gas Sensors and the use of a Radio Frequency Identification (RFID) tagging system to monitor car pollution records anytime anywhere. An increase in automobile vehicle increase in air pollution since automobiles are the main source of environmental pollution. The smoke emitted from the vehicle consists of gases like nitrogen oxides (NO_x), carbon monoxide (CO), and hydrocarbon (HC). approximately one-half of the nitrogen oxide gases, carbon monoxide and one-fourth of hydrocarbon gases in our environment are emitted from automobile vehicles, which leads to global warming. Due to poor vehicle maintenance and ignition defect. the gases emitted from the exhaust may increase. In order to reduce environmental pollution and to increase vehicles life, we can use this system.

Keywords: Internet of Things, Vehicle Emission Monitoring System

I. INTRODUCTION

Environmental pollution in India turns out to be a serious issue in the 21st century. The main source of pollution in India is due to automobile vehicles. Government of India made many regulations to control environmental pollution caused due to vehicle emission, but most of them turn to be unsuccessful. Government of India instituted a standard called Bharat stage emission standard (BSES) to regulate the air pollution from motor vehicles. BS- 4 standard is following in India since April 2010. To speed up the green initiative, government made order to move from BS-4 to BS-6 in 2020. The Indian pollution control board has made FC (Fitness certificate) and PUC (Pollution under control certificate) is compulsory for commercial and public vehicles to control air pollution. Carbon monoxide, hydrocarbon and nitrogen oxides are the gases emitted from the exhaust. The content of this paper is based on the problem that the society is facing nowadays. Pollution continues to be a significant issue for our environment. The pollutants from vehicles can impact the atmosphere in a variety of ways. This project suggests a valuable route for sensing engine emissions, particularly CO gas emissions. This involves Gas sensor to identify Motor Vehicle Pollution. This helps to track the data in real time and with low costs. The vehicle owner can identify the emission level easily in advance. We used Think speak cloud to store the data and to read the data at any time.

II. LITERATURE SURVEY

A Geographical Information System (GIS) is a computer system designed to integrate, store, edit, analyse, share and display geographically referenced data. A wireless sensor network (WSN) is a wireless network of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. This paper presents the integration of these two technologies to create a system able to detect measure and transmit information regarding the presence and quantities of internal combustion derived pollution and the geographical location in real time with the aim of creating pollution maps in urban environments journal of physics conference series (vol 76, No 1, p.012019). IOP publishing [1].

To alleviate the air pollution problem caused by vehicle emissions, different vehicle inspection programs have been introduced, in which vehicles are examined by undergoing a number of emission tests. However, these emission tests are usually cost-ineffective and time-consuming. It is also difficult to enforce the vehicle owners on monitoring the health of their engines daily and taking immediate action to fix their vehicle emission problems. Therefore, this paper proposes a new vehicle emission inspection and notification system to help daily monitoring of engine health through the concept of Internet of Things. As there are numerous traffic lights in an urban area, they are employed to play an important role in the proposed system. By the fact that every car must stop in front of red lights, reliable reading of air ratio (λ) from a vehicle, which indicates the engine emission status, can be interrogated wirelessly through mature and low-price radio frequency identification (RFID) technology. To enforce the vehicle owners on monitoring the health of their engines daily and taking immediate action to fix their the vehicle emission problem therefore a new vehicle emission inspection and notification system to help daily monitoring of engine health through the concept of internet of things. Application journal of electrical and computer engineering volume 2017 [2].

A kind of environmental monitoring system based on wireless mesh network with the core of embedded system ARM9 S3C2410 microprocessor is presented in the paper. The flexible and self-organizing wireless mesh network is used to achieve the real time acquisition and multi-hop wireless communication of parameters of the monitoring atmospheric environment such as SO₂, NO₂, NO, temperature, humidity and air pressure, etc. The network structure of the system is established, the hardware architecture of the system is designed, and the system working procedures is given. The entire monitoring system can be quickly arranged and rapidly withdrew without support of base station and has a strong self-healing capability and network robustness and can be used for a variety of occasional atmospheric environmental monitoring. Environmental issues are the major crisis in the fast moving world. These environmental issues may cause adverse effect in the social life of the people. It may have great impact on the health of the people. Thus to monitor the parameters of the environment such as temperature, humidity, pressure, pollution causing gases and many more which vary according to the observed environment, a wireless environmental monitoring system is developed. The system is also very useful in industries where some sections cannot be monitored manually. A Wireless Mesh Network (WMN) is the very important in environmental monitoring system. It may have more than one node which is wirelessly connected in mesh topology. To transmit and receive the data from the nodes Zigbee module is used which is reliable in delivering the data between the sensor nodes. The Zigbee module is based on the IEEE standard 802.15.4 [3].

Air pollution is one of the most serious problems in the world. It refers to the contamination of the atmosphere by harmful chemicals or biological materials. There is a need to implement air quality management plans to ensure compliance with the pollution limits established by governments and institutions, so to improve air quality and reduce the severe health impacts causing millions of deaths worldwide. The task of air quality monitoring (AQM) are performed in most cases by reference stations in urban areas, which are costly, bulky and of complex operation and hence not suited for applications where ubiquity and low consumption are required. In addition, spatial and temporal resolution measurements of the order of one meter and one minute respectively are required to determine the actual exposure of each individual to pollution. The work presents a network for indoor and outdoor air quality monitoring whose nodes include tin dioxide sensor arrays connected to an acquisition and control system with Wi-Fi communication capabilities. To increase the gas concentration measurement accuracy and to prevent false alarms, two gas sensor-influencing quantities, temperature and humidity, are also measured. Advanced processing based on multi-input single-output neural networks is implemented at the network sensing nodes in order to obtain temperature and humidity compensated gas concentration values. Anomalous operation of network nodes and power consumption Instrumentation and Measurement IEEE transaction and volume 58[4].

Internet of things is a system where we can connect smart devices with surrounding, now a day's one of major problem is global air pollution and major cause of global air pollution is harmful pollutant emitted by vehicles. Problem arises when the vehicle's emission exceeds standard limit. The actual cause for the violation of emission level is incomplete combustion of fuel overcome this problem a system is made which continuously monitors the emission level of individual vehicles. An IOT kit is made using gas sensors, and a Wi-Fi module. This kit can be physically mounted in exhaust system of every vehicle. Gas sensors connects data about vehicle emission and send it to the controller which transmit the data to cloud through WIFI module. The environmental concerns are on the rise these days. Car, bus, and truck air pollutants can worsen respiratory diseases and cause asthma attacks. Transportation is responsible for airborne carbon monoxide at more than 50 per cent. JETIR Jun2021 volume 8[5].

III. EXISTING SYSTEM

This paper measures the emissions standards in a real-time process using various sensors namely smoke sensor which is placed at the exhaust of the vehicle. These methods are applicable to gather only the average air quality rather than identifying the individual polluting vehicles. While going for the deployment and cost wise, this method involves more protocol hierarchy algorithms to filter out the noise and duplicated signals resulting in more complex nature. The control strategy coding for calculating the emitted gas limits has been done in PIC Microcontroller which analyzes the data and yields the statistics which are then compared with the standard values. The Gas sensor is installed in the proposed control system by indicating the values provided in the Liquid Crystal Display (LCD).

IV. PROPOSED SYSTEM

An increase in automobile vehicle leads to an increase in air pollution since automobiles are the main source of environmental pollution. The smoke emitted from the vehicle consists of gases like nitrogen oxides (NO_x), carbon monoxide (CO), and hydrocarbon (HC). Approximately one-half of the nitrogen oxide gases, carbon monoxide and one-fourth of hydrocarbon gases in our environment are emitted from automobile vehicles, which leads to global warming. Due to poor vehicle maintenance and ignition defect, the gases emitted from the exhaust may increase. In order to reduce environmental pollution and to increase vehicles life, we can use this system. When the rate of gases emitted from the vehicle exceeds the threshold limit set by the government, our system will alert to the user through LCD. Using IOT, the emission level is also displayed and stored in the database of a vehicle owner. When the vehicle owner ignores it, the report will send to the transport office with entire details. Combination of Wireless Sensor Network and Electrochemical Toxic Gas Sensors and the use of a Radio Frequency Identification (RFID) tagging system to monitor car pollution records anytime anywhere.

4.1 Advantages

- It helps to track data in real time
- It is a system with low costs
- Tested in advance by the vehicle owner without a visit to RTO office
- Time on getting the alert message regarding pollution level.

4.2 Description of Modules

- RFID Reader
- GAS sensor
- Noise sensor
- Microcontroller units
- LED display
- SIMCOM GSM/GPS module

V. INPUT MODELS

5.1 RFID Reader

RFid Reader is powered via a development system it is connected to. The presence of the power supply is indicated by a LED marked power. When the RFid Reader is turned on, a 125kHz voltage is supplied on its antenna. As a result, the antenna starts emitting an electromagnetic field necessary for reading the RFid identification card. As passive RFid card doesn't have its own power supply, it features a coil where the voltage is automatically induced by approaching the card to the RFid Reader's antenna. This voltage is necessary for the chip featured on the RFid card to work. The memory chip on the RFid card contains a unique identification code. This code is sent by the card when it is placed close to the RFid Reader's antenna. The code is received via this antenna. Then, it is sent to the microcontroller for further processing.

5.2 Gas Sensor

In current technology scenario, monitoring of gases produced is very important. From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. Gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration

of molecules at gaseous state. The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it. The connecting leads of the sensor are thick so that sensor can be connected firmly to the circuit and sufficient amount of heat gets conducted to the inside part. They are casted from copper and have tin plating over them.

5.3 Noise Sensor

The IoT Sens sound sensor is able to record noise levels, due to its integrated microphone. It is able to analyse the surrounding ambient sound in the audible frequency spectrum for the human ear, showing collected data in dBA. This information is essential in spaces with high levels of noise pollution or with restrictions on noise levels. The Noise sensor module can accurately measure the noise levels in the ambient air. The lightweight sound level monitor design is capable to monitor the ambient noise on a real-time basis. The advanced support electronics of this sensor makes it compact and reliable. The low noise electronics allows stable and reliable measurement of the ambient sound level. This sound level meter provides a direct reading of sound level in decibels (dB). This sound level module works on the principle of capacitance. It provides a uniform response to sounds arriving from different angles simultaneously.

VI. PROCESSING MODULES

6.1 Microcontroller Unit Arduino

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. The project is based on microcontroller board design, produced by several vendors, using various microcontrollers. These system provide sets of digital and analogy input/output (I/O) pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++.

6.2 LED Display

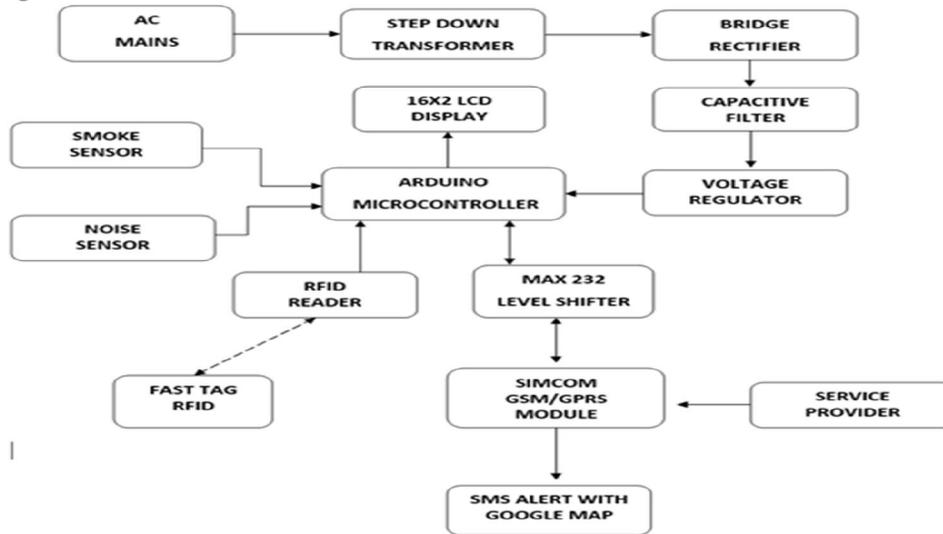
This is an LCD Display designed for E-blocks. It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 5V power supply. Please take care not to exceed 5V, as this will cause damage to the device. The 5V is best generated from the E-blocks Multi programmer or a 5V fixed regulated power supply. The 16 x 2 intelligent alphanumeric dot matrix displays is capable of displaying 224 different characters and symbols.

6.3 SIMCOM GSM/GPS Module

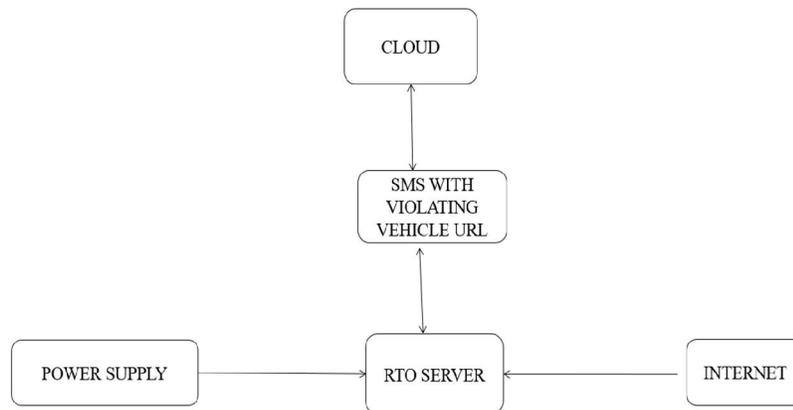
This GSM Modem can work with any GSM network operator SIM card just like a mobile phone with its own unique phone number. Advantage of using this modem will be that its RS232 port can be used to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily using this This GSM Modem can accept any GSM network act as SIM card and just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. The SIM800C is a complete Dual-band GSM/GPRS solution in a SMT module featuring an industry-standard interface, the SIM800CS is a quad-band GSM/GPRS module that works on frequencies GSM850MHz, delivers performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.



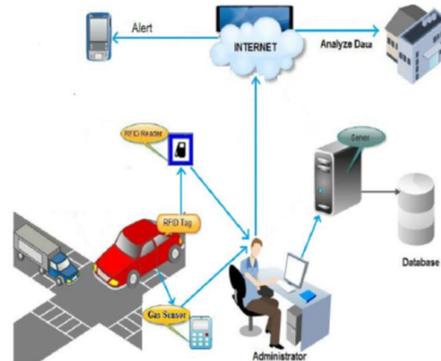
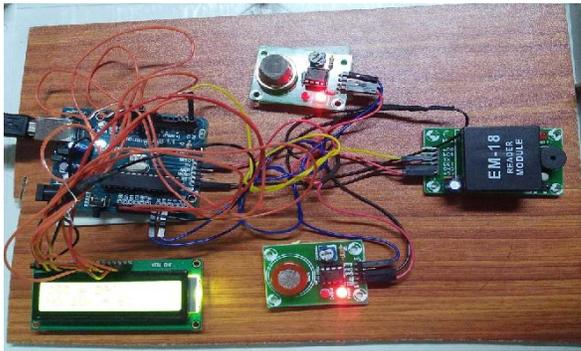
6.4 Block Diagram



6.5 Receiver Section



VII. IMPLEMENTATION



VIII. CONCLUSION

RFID technology, as one of the enabling technologies of IoT (Internet of Things), is employed to develop the information system. RFID reading can be interrogated along with the corresponding tag ID through a wireless connection among traffic lights and vehicles. This will maintain the database and graph for the data by monitoring the emissions data, the engine health can be easily inspected and Examine.

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