Smart Vehicular Pollution Monitoring System

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Abstract— Wireless sensors are used in most of the in real time applications for collecting physical information. The impossible measurements in typical ways have currently become attainable using the wireless technology. The main source of atmosphere pollution happens due to vehicles. The vehicles in urban areas causing more air pollution and decreasing air quality that leads to severe health diseases. The main objective of the paper is to introduce vehicular pollution monitoring system using Internet of Things (IoT) which is capable of detecting vehicles causing pollution on the city roads, measures various types of pollutants, and its level in air and takes preventive measures. This systems also assures the existence of wireless sensors for vehicle pollution system that specialize in a straight forward accessibility of real time data through internet using IoT. The measured data is also shared to vehicle owner, traffic department and agencies of national environment. This system is a low cost and provides good results in controlling the air pollution especially in the urban areas

Index Terms— Internet of Things, Radio Frequency transceiver, Vehicular pollution monitoring system, wireless Technology

I. INTRODUCTION

The main supply of pollution in cities is because of vehicles. the rise use of vehicles in cities leads to important increase within the emission load of varied toxins into air. As a result increase in environmental issues which is able to have an effect on the human health in urban places [1]. Air pollutants from taxies, cars and buses end in the harm of ground level gas and alternative metabolism downside like respiratory disorder attacks. Transportation is main supply for generating CO that contributes seventy two of total pollution within the metropolitan cities like Calcutta, Mumbai, and Delhi.

At present, the Indian pollution panel has created the fitness certificate as mandatory for public and industrial vehicles once during a year to manage the pollution. Pollution in check (PUC) certificate for each 3 months is obligatory for all cluster vehicles from the date of registration [2]. so as to manage the pollution, the number of pollution has to be monitored and vehicles liable for polluting ought to be known. IoT is become useful in cities for observation pollution from vehicles and additionally knowledge associated with the number of pollution on completely different roads of a town is gathered and analyzed.

Recent approaches in sensing technology, particularly within the space of Wireless detector Networks (WSNs), it currently empower environmental observation in real time at special and temporal scales [3]. This paper specially designed to work the system exploitation detector network and gather the knowledge concerning waste levels discharged by the vehicles. IoT may be a new technology which pulls the thought for each domain and business. IoT is realised as a network of things, each of which can be label

using unique ID and convey based on standard communication protocols. IoT accord objects to communicate with one other, to approach information on the web, to store and collect data, and to collaborate with users, thereby creating smart, ubiquitous and perpetually connected environment. To achieve such intelligence within the environments, big technological innovations methods and developments are needed. The researchers sense that it will be potential to detect a newly built shape to IoT, collect with the crack of pervasive devices in the future. The view of IoT is that of everyday life such as vehicles, roadways in public transport systems, wireless pill-shaped cameras in the system of digestive tracks for healthcare applications, air conditioner, or other household things can be attached with sensors, used to track data regarding these things.

IoT has a unique addressable things and their virtual illustration on an internet like structure. Such things can add to data about them, or can send real-time sensor information about their state or other properties combined with the things. The unique address things are connected to the web, and the data can send using the protocol that communicates computers to the internet. Since the things can sense the environment and communicate and may generally enable automatic reply to challenging scheme without human interference. The more numbers of objects meanwhile produce information from the environment in an automatic way and enable common and ubiquitous computing.

In [4], the design of environmental pollution monitoring system using a wireless sensor network to

control quality of air in the city of Nagpur is proposed. This system uses the network simulator for measuring pollutant information from sensor nodes. The air quality index is calculated to evaluate health level in a specific area. This is a low power consumption method and gives real time sensor values more accurately.

In [5], a new technique to control the vehicle causing air pollution in the cities has been developed. This proposed system is designed with ARM processor that controls the engine of vehicle. Any vehicle with beyond the threshold level of pollution in an area then the engine of the vehicle will automatically switched off by the circuit. The vehicles inbuilt with this system are only controlled but the proposed system do not control the pollution generated by other vehicles. This is only the limitation of the system. IoT is conceived as an integral part of future internet. The research objective key issues are identification, privacy and security. In order to setup fast advancement in technologies similar to IoT, thus, the combination of big data, cloud technologies and future networks like 5G with IoT must also be preferred into admiration [6]. This paper proposes an embedded system using wireless sensor network that provides a framework for collecting the sensor data at anyplace using IoT. Wireless sensor along with active RFID is used in the proposed wireless sensor system to monitor the vehicular pollution based on IoT also focuses on nearby emission station available. The paper is organized into five sections. The design of the proposed system is explained in section II. Section III presents the experimental setup of the proposed system and the expected results are discussed in section IV. Finally, conclusions are drawn in section V.

II. DESIGN OF THE PROPOSED SYSTEM

The frame work of the proposed system uses IoT to address the vehicular pollution in real-time applications. Gas sensor MQ-7 is used to monitor the pollutants continuously to maintain the quality of the air. The block diagram of the Present air pollution monitoring system is shown in Fig 1.
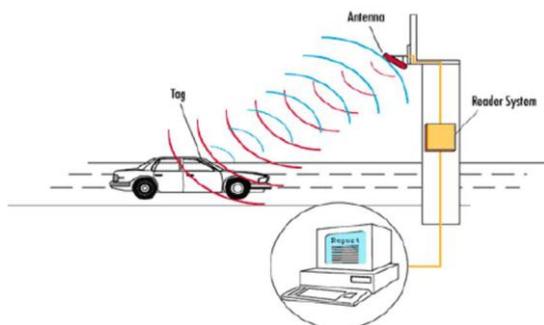

Fig 1: present monitoring system using RFIDs

At the monitoring section RF transmitter is integrated and the RF receiver is integrated in the vehicle to have continuous updates of the nearby emission station availability. The vehicles is equipped with pollution monitoring system through the sensor node and the sensors continuously measures quality of the air produced by that vehicle. The sensed data is sent continuously to the microcontroller for verification of the pollution level of the vehicle. The microcontroller verifies the levels of the pollutants of the air produced by the vehicle. If the pollutants levels are above the threshold levels, then it sends the warning message to the vehicle owner. The same knowledge is displayed on the liquid show (LCD) additionally provides information concerning close pollution station availability. The information concerning the amount of carbon monoxide, vehicular number, time and date of car area unit also sent to the server of the licensed agencies. This information is keep within the server info for future analysis. If vehicle is exhausting gas more than the threshold then after some time engine of the vehicle slows down. Related work of conveyance pollution system using IoT is shown Fig 2.
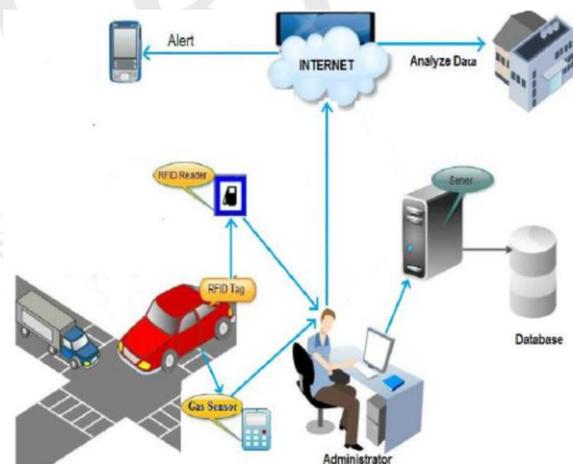

Fig 2: Projected pollution monitoring system using IoT

If any vehicle exceeds the pollution level in a neighborhood, then the proposed system send warning message to conveyance owner that contains pollution level of the vehicle and additionally sends the amount of fine needs to paid exploitation IoT application. This system also produces warning message if driver tries to get rid of monitoring device fitted within the vehicle and additionally offers warning message if vehicle produces a lot of sound.

III. EXPERIMENTAL SETUP OF THE SYSTEM

`The block diagram of the projected system for observation vehicle pollution is shown in Fig 3. The development of the projected system is categorized into two parts: (i) hardware implementation and (ii) software package implementation.
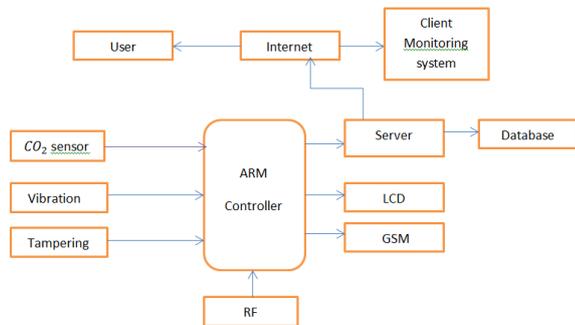
Fig 3: diagram of conveyance pollution observation system

a. Hardware implementation:

The hardware of the projected pollution monitoring system mainly consists of arm microcontroller board, LPC2148 microcontroller, MQ Gas sensors, RF Tx and RF Rx. The developed conveyance pollution monitoring system is shown in Fig 4.

i. LPC2148 microcontroller: It is a low power and high performance microcontroller used to read and control the data from sensors and RFID reader. It sends the data to server and LCD display for displaying the pollution level and RFID ID.
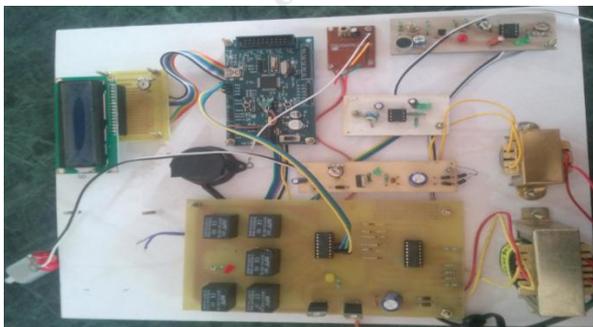
Fig 4: Integration of Arm with RFTx, Rx and CO gas sensor Module

ii. Wireless Gas Sensors: In this research work MQ-7 gas sensor is used to measure the carbon monoxide concentration in air. It is simple and low cost gas sensor. There are widely used because of they provide high performance and better accuracy.

iii. Radio Frequency Tx and Rx:
The RF transmitter and receiver is built around the ASIC and common passive and active components, which are very easy to obtain from the material shelf. The circuit works on Very High Frequency band with wide covering range. The Carrier frequency is 147 MHz and Data frequencies are 17 MHz, 19 MHz, 22 MHz & 25 MHz It should be noted that ASIC or Application Specific Integrated Circuit is proprietary product and data sheet or pin details or working principles are not readily available to the user. The server is developed using the java language. It uses Receiver Transmitter Communication (RxTxComm) library. This RxTx Comm is used for serial communication between server and client.

The server performs four main functions. These are: (i) receives and displays the data of the wireless sensors through microcontroller, (ii) stores sensors data within the knowledgebase for future analysis, (iii) sends the sensors data to shopper to investigate the knowledge the information, and (iv) sends warning messages to vehicle homeowners once the pollutants levels exceeds intensity level. the primary operate of the server may be a real time assortment of knowledge from sensors on the road once a vehicle passes through the node. The second operate is for storing the information of vehicles pollution levels. The last 2 functions area unit for creating the information on the market to any or all the users and control agencies through IoT. The shopper page is enforced in java language. The page uses library of RxTxComm. The main operate of shopper is to receive wireless sensors knowledge from server exploitation IoT. shopper page analyses the information that contains pollution levels of vehicles during a given space.

IV. RESULTS

Smart pollution observation system is designed and developed to obtain following results. The Vehicle ID is sent through SMS and through Iot to the traffic agencies. The observation system displays the pollutants levels of the vehicle and is shown in Fig 5. The controller sends the details of the vehicle and the pollutant values to server for monitoring the pollution levels of vehicle. This system also gives alert message about nearby station availability as shown in fig 8

Fig 5: Displaying Pollution detection on LCD

Fig 6: Locating nearby station

Fig 7: Tampering of the device

Fig 8: sound pollution

The server displays the details of the time and date at which the pollutants are measured, vehicle registration number, mobile number of the vehicle owner along with vehicle pollution . This data is stored for future analysis. This system also produces warning message if driver tries to remove monitoring device fitted in the vehicle and also gives warning message if vehicle produces a lot of sound as shown in fig 7 and fig 8.

The client receives pollutant values from the server using IoT and client analyses the pollutant levels in a speficied area. The client window with the pollutant levels and vehicle registration number is shown.

If any vehicle exceeds the permissible pollution level then a message is sent to the vehicle owner that advices pollution level of vehicle and also penalty for causing pollution.

V. CONCLUSIONS

This paper presents the planning and development of IoT based vehicular pollution monitoring system. The hardware design and software package implementation area unit discussed long. The proposed smart intelligent environmental system monitors the pollutants made by the vehicles and additionally warn the vehicle homeowners to manage the pollution, locates nearby emission station available. The system additionally sends the waste level knowledge to the server for future analysis. Additionally to the present projected system also produces warning message if driver tries to get rid of monitoring device fitted within the vehicle and also offers warning message if vehicle produces more sound . The pollution agencies will ready to analyze the information and additionally sight the vehicle registration numbers that causes a lot of pollution within the atmosphere. The projected system may be a low price, simple to operate and is well inserted in any locations.

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