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IOT-Enabled Air Pollution Meter with Digital Dashboard on Smart-Phone for Vehicles

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Abstract: Air pollution is one of the main environmental issues nowadays. Airpollution is a most serious problem of the current time all over the world especially in the large cities because of industrialization and huge number of vehicles. The release of gaseous pollutants from burning fuel of motor vehicles is one major reason of air pollution. Vehicles release harmful gaseous like Carbon Monoxide (CO), Carbon Dioxide (CO2) which accounts for 50% of the total atmospheric pollutants. This project focuses on the monitoring and controlling the air pollution generated by vehicles. It is an real-time embedded system in which, a device will be attached to Silencer of vehicle. When pollution generated by vehicles goes beyond the threshold value, sensors will detect and then device will give intimation to the owner of vehicle through android app. If owner doesn't repair his/her vehicle and vehicle again generates pollution above threshold, then second intimation will be given to owner. And if the same repeats for third time, then device will lock the vehicle after 10 kilometers and send the details of the vehicles to RTO.
Keywords: Carbon Monoxide (CO), Sensors
Carbon Dioxide (CO2), Embedded System, Internet of Things (IOT).

I. INTRODUCTION

The environmental and social problems are growing rapidly. Te air pollution has many effects on human health and because of that many people die mostly in metropolitan cities. The main reason for pollution is vehicles. The 6th largest manufacturer of motor vehicle is India. The There are many diseases which are affecting human health adversely due to pollution like coronary artery diseases or
congestive , heart failure , asthma, emphysema The causes of air pollution are Carbon Dioxide(CO2), Carbon Monoxide(CO) , Nitrogen Dioxide(NO2) , Sulfur Dioxide(SO2) , Lead(Pb) , Ammonia(NH3) , Particulate Matter(PM) , Ground Level Ozone (O3).The Internet of things(IoT) allows objects to be sensed or in controlling. Things, in the IoT, refers to variety of devices such as heart monitoring implants, automobiles with built in sensors, etc.
Development of air pollution monitoring system will help to control and measure pollution related parameters. Some of the strategies to control air pollution parameters are costly.
we will implement air pollution detection in vehicles that is pollution is high or low because of combustion of fuel in vehicle .we will build it up and implement it using Raspberry Pi and other components. This system is becoming increasingly important in air pollution detection in vehicles. The vehicles produces Carbon Dioxide(CO2) , Carbon Monoxide(CO).We are using Hypertext Transfer protocol (HTTP) , Message Queue Telemetry Transport protocol (MQTT) for communicating and transferring data and also assures that data is not manipulated and 100% transmission of data. For storing details of all vehicles IoT cloud is used. IoT cloud is a Salesforce platform that is designed to store and process Internet of Things data.

II. LITERATURE SURVEY

A. IoT- Based Air Pollution Monitoring and Forecasting System

Using empirical analysis, conventional air automatic monitoring system has high precision, but large bulk, high cost, and single datum class make it impossible for large-scale installation. This paper introduces Internet of Things (IoT) into the field of environmental protection and it puts forward a kind of real-time air pollution monitoring and forecasting system. The system can be laid out in large number in monitoring area to form monitoring sensor network. [1]

B. Wireless sensor network for real-time air pollution monitorin

This paper presents the system which consists of several distributed monitoring stations that communicate wirelessly with a back end server using machine-to-machine (M2M) communication. The back end server collects real time data from the stations and converts it into information delivered to users through web portals and mobile applications. [2]

C. Air pollution monitoring using wireless sensor network

The main aim of this paper is to develop a low cost multisensor node for air pollution measurement, and to develop WSN protocols for data gathering and data integration. We have designed and fabricated such a board. To maintain data accuracy, calibration of each sensor is performed by comparing data transmission using any of the multiple radio technology with fault-tolerant topology control. [3]

D. Urban Air Pollution Monitoring System With Forecasting Models

This paper presents the Air Pollution Monitoring System and its forecasting module. The causes of Air Pollution are ground level ozone (O3), nitrogen dioxide (NO2), and sulfur dioxide (SO2). The system uses low-cost air-quality monitoring motes that are equipped with an array of gaseous and meterological sensors. These motes wirelessly communicate to an intelligent sensing platform that consists of several modules. The modules are responsible for receiving [4]

E. Efficient Data Gathering and Estimation for Metropolitan Air Quality Monitoring by Using Vehicular Sensor Networks:

This paper focus on a vehicular sensor network (VSN) to monitor cities air quality and develops an efficient data gathering and estimation (EDGE) mechanism on VSN. With the help of probabilistic reporting, it allows cars to collect air quality on more different positions and mitigate potential network congestion. Experimental results demonstrate the significant effectiveness of the EDGE mechanism, under various scenarios. [5]

F. Air quality monitoring in urban environments

Air pollution is both an environmental and a social problem, as it leads to a multitude of adverse effects on human health, ecosystems and the climate. Taking accurate decisions in a timely period depends on the measurement and analysis of the parameters of the air, which creates the need for the development of real time air quality monitoring. This paper presents an approach for cost-effective measurement of relevant environmental parameters, based on a sensor array with integrated ampex and infrared gas sensors.[6]

G. A low cost georeferenced air-pollution measurement system used as early warning tool

The whole system is connected to a low cost board with inbuilt Wi-Fi allowing to send the data to the IoT cloud in real-time using MQTT protocol, and thus the georeferenced data can be published on an open access platform, using IoT. The governmental measurement systems are limited because of expensive in nature and they are typically located in big cities. This work presents the development and implementation of a low cost georeferenced air-pollution measurement system that offers information of particulate measurement PM1, PM2.5 y PM10 by scatter. [7]

H. Monitoring vehicles and pollution on road using vehicular cloud environment

India is having numerous amounts of vehicle's owner and more than that 50% of vehicles are continuously running on a road. The paper focuses on the vehicular cloud environments can be the future technological changing model that offers economically possible solutions by using smart vehicular networks with automatic traffic condition information, self-vehicle control on road and develop opinion systems to prevent an accident as well as analysis of amount of toxic gases emitted from a vehicle on a road.[8]

I. Optimal Deployment of Wireless Sensor Networks for Air Pollution Monitorin

The paper proposes, two integer linear programming formulations based on real pollutants dispersion modeling to deal with the minimum cost WSN deployment for air pollution monitoring. We depicted the concept by applying our models on real world data, namely the Nottingham City street lights. We compare the two models in terms of execution time and show that the second ow based formulation is much better. [9]

J. Development of IoT based vehicular pollution monitoring system

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 and measures various types of pollutants, and its level in air. The measured data is also shared. This system is a low cost and provides good results in controlling the air pollution especially in the urban areas. [10]

III.SYSTEM ARCHITECTURE

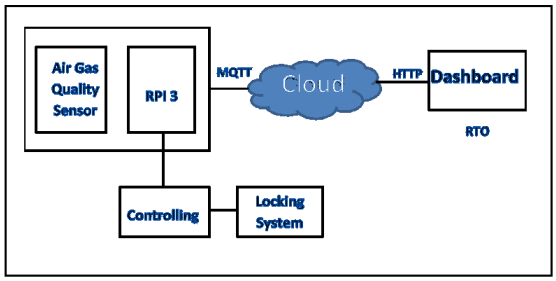

Fig :(a) System Architecture

Our system contains Air Quality Sensor, RPI 3, IoT Cloud, Dashboard, Locking system and controlling.

The air quality sensor is the MQX sensor which will sense the gas produced by the vehicles .It is the important part of the system. It will sense the pollution after 10kms of drive. The RPI 3 (Raspberry PI version 3) is used which is less in cost and have features like Bluetooth and Wi-Fi.It is an interface between the sensor and other things. It will intimate the driver as well as the owner of the vehicles which are generating pollution and the intimation will be send 2 times and 3rd time no intimation will be given and the starring will be locked by controlling and locking system and the details will be send to the RTO. The MQTT (Message Queue Telemetry Transport) is lightweight messaging protocol which gives the 100% transmission of data with high speed. The IoT cloud (Internet of Things)is a Salesforce platform which stores large amount of data. It stores details of all vehicles and it will only pass the details of those vehicles which are generating gas above the threshold value to the RTO. HTTP (Hypertext Transfer) protocol is used to send the details from cloud to dashboard. RTO is using the dashboard which is an Android application used to display the details of vehicles which is send by IoT cloud.

IV.MATHEMATICAL MODEL

Mathematical modeling is used for measurement of how the system is implemented mathematically. It provides flexible i.e. mathematical thinking and use of concepts of set theory. Formal set of notation description, informal English description (Set of all inputs) gives:

Let, S be the System such that,

S={SN,D,V,U}

where,

SN={SN1,SN2,...SNn}Set of Sensors

D={D1,D2,…Dn}Set of Devices

V={V1,V2,…Vn}Set of Vehicles

U={U1,U2,…Un}Set of Dashboard users

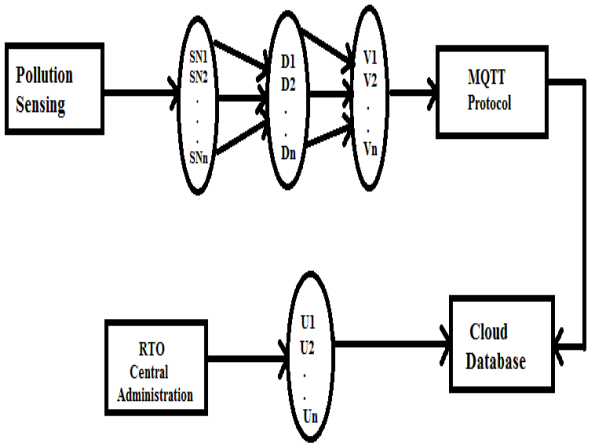

Fig :(b) Venn Diagram

V. FUTURE SCOPE

In this system we will add alcohol sensing and tracking system which makes the drive more secure.
It will also detect the accidents which are nowadays a serious issue .We will also add GPS tracking to our system.

VI.CONCLUSION

We will implement air pollution detection in vehicles that is pollution is high or low because of combustion of fuel in vehicles. We will build it up and implement it using raspberry pi and other components.

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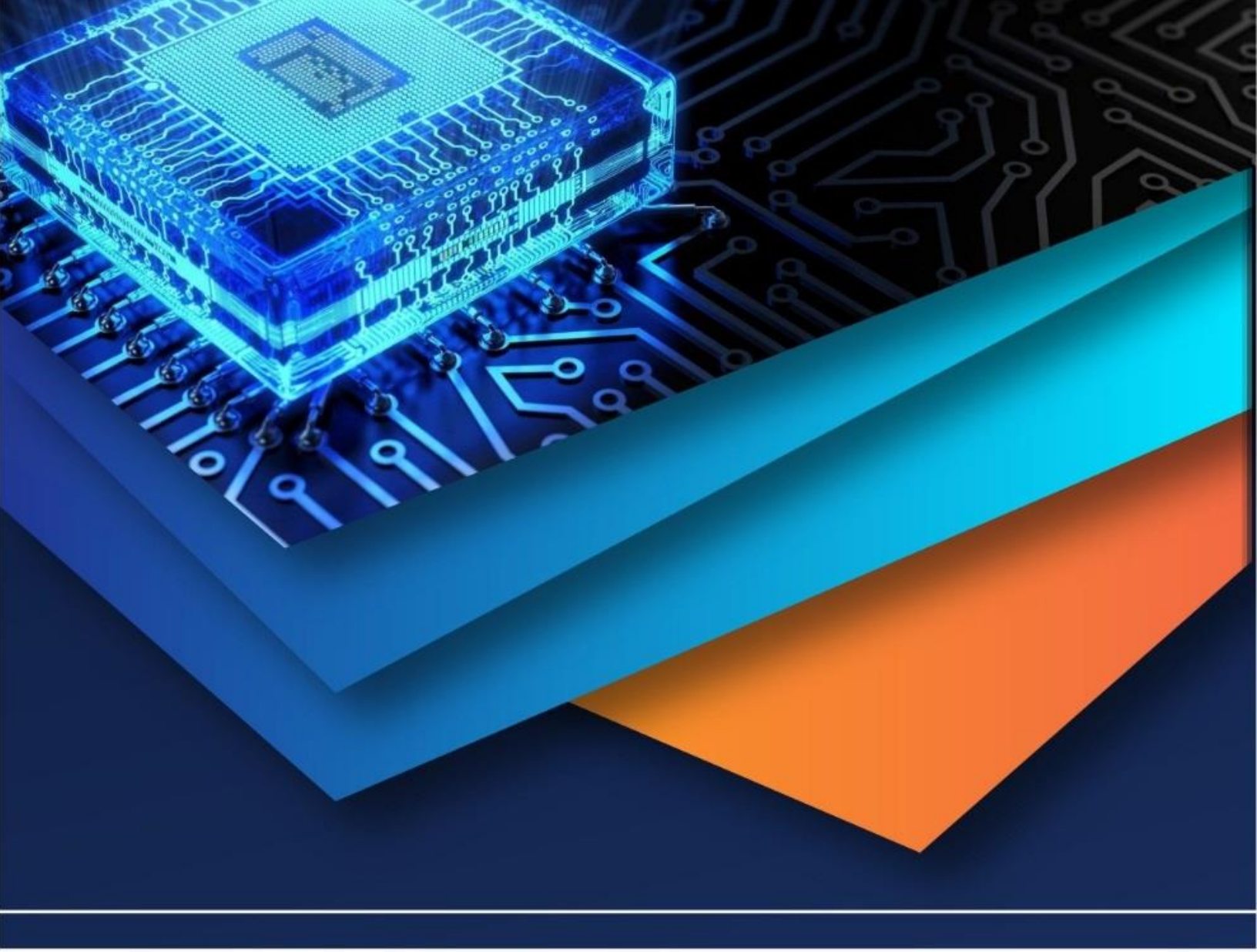

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