RFID based Vehicle Emissions in Cities on Internet of Things

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Abstract:The objective of this paper is to monitor air pollution on roads and track a vehicle which causes pollution. In order to solve this problem, many countries and regions have already presented a series of emissions standards, meanwhile some methods has been developed, including update motor engine or improving the quality of the gasoline. However, these actions have not brought about striking effect as we expect. In this system, Radio frequency identification (RFID) technology as a low-cost and mature wireless communication method is adopted to collect and transmit emissions information of vehicles and Internet of Things (IoT) concept is proposed. Moreover, The RFID devices need to be installed on the traffic lights so that reliable reading of emissions signals from a vehicle can be interrogated when the vehicles stop in front of the red light .By applying the system, it is possible to smoothly realize a green traffic network.

Keywords: Inspection system design, Internet of things, Radio frequency identification

1. INTRODUCTION

The Internet of Things (loT) is a new concept which has attracted the attention of both academia and industry. Internet of Things (loT) is implemented as a network of interconnected objects, each of which can be addressed using unique id and communicates based on standard communication protocols. Carbon monoxide, nitrogen oxides, are released when fuel is burned in an internal combustion engine and when air/fuel residuals are emitted through the vehicle tailpipe. Gasoline vapors also escape into the atmosphere during refueling and when fuel vaporizes from engines and fuel systems caused by vehicle operation or hot weather. The effects of these exhaust gases are described in more detail below:

CO - Carbon monoxide reduces the blood's oxygen carrying capacity which can reduce the availability of oxygen to key organs. Extreme levels of exposure, such as might occur due to blocked flues in domestic boilers, can be fatal. At lower concentrations CO may pose a health risk, particularly to those suffering from heart disease.

NOx - Oxides of nitrogen react in the atmosphere to form nitrogen dioxide (NO_2) which can have adverse effects on health, particularly among people with respiratory illness. High levels of exposure have been linked with increased hospital admissions due to respiratory problems, while long term exposure may affect lung function and increase the response to allergens in sensitive people.

A. Radio-frequency identification (RFID)

Radio-frequency identification (RFID) is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information. Some tags are powered by electromagnetic induction from magnetic fields produced near the reader. Some types collect energy from the interrogating radio waves and act as a passive transponder. Other types have a local power source such as a battery and may operate at hundreds of meters from the reader.

B. Internet of Things

The **Internet of Things** (**IoT**) is the network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing internet infrastructure.

C. General Packet Radio System

General Packet Radio System is also known as GPRS is a third-generation step toward internet access. GPRS is also known as GSM-IP that is a Global-System Mobile Communications Internet Protocol as it keeps the users of this system online, allows to make voice calls, and access internet on-the-go. Even Time-Division Multiple Access (TDMA) users benefit from this system as it provides packet radio access. GPRS also permits the network operators to execute an Internet Protocol (IP) based core architecture for integrated voice and data applications that will continue to be used and expanded for 3G services.

GPRS supersedes the wired connections, as this system has simplified access to the packet data networks like the internet. The packet radio principle is employed by GPRS to transport user data packets in a structure way between GSM mobile stations and external packet data networks. These packets can be directly routed to the packet switched networks from the GPRS mobile stations. In the current versions of GPRS, networks based on the Internet Protocol (IP) like the global internet or private/corporate intranets and X.25 networks are supported.

D. Vehicle Emissions Control

Vehicle emissions control is the study of reducing the

motor vehicle emissions—emissions produced by motor vehicles, especially internal combustion engines. Emissions of many air pollutants have been shown to have variety of negative effects on public health and the natural environment.

E. About Cloud

• The term **Cloud** refers to a **Network** or **Internet**. In other words, we can say that Cloud is something which is present at remote location. Cloud can provide services over network i.e. on public networks or on private networks i.e. WAN, LAN or VPN.

• Applications such as **e-mail, web conferencing, customer relationship management (CRM),** all run in cloud.

• Cloud term commonly used in Science and technologies as large resource objects.

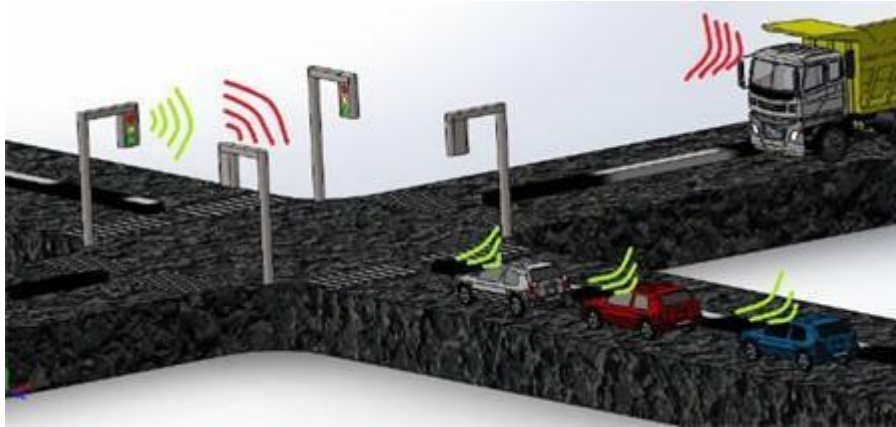Fig. 1 Road situation of data communication

F. Radio-frequency identification (RFID) Tag

An RFID tag is a tiny radio device that is also referred to as a transponder, smart tag, smart label or radio barcode. The word transponder is derived from the words transmitter and responder. The tag responds to a transmitted or communicated request for the data it carries. The tag comprises a simple silicon microchip (typically less than half a millimeter in size) attached to a small flat aerial and mounted on a substrate.

2. EXISTING SYSTEM

With the increasing number of automobiles, especially in some metropolis, such as Europe and America, it is very impending to resolve the problem of air pollution resulting from automobile exhaust gas. In Europe, air pollution has reached levels judged as hazardous to human health. To fight this problem, the motor emissions standards have been established and promoted in many developed countries for many years. Furthermore, some improved measures in vehicle engines or the quality of gasoline have also been developed by researchers. However, these methods seem not to solve radically the emissions pollution problems. The motor emissions standard is very difficult to implement in real-life. Although government forces all cars for testing or examining periodically as the local standard, the actual vehicle on-road emissions are usually much higher than those which are measured during the emission inspections.

3. PROPOSED SYSTEM

The active RFID and the active RFID tag are designed to collect the emissions data from the vehicle exhaust system. RFID reader will receive emissions data when the vehicles which are installed on RFID tag drive into inspect range. However, most traffic lights in a city are just connected and controlled for shifting signals which do not provide the capability of data transmission. Once the RFID reader receives the data from the tags, the most cost-effective way for data transmission is 3G. It can steadily transmit these data to the control system. In many cities, 3G data transmission is more popular compare to other wireless communication technologies and the price for 3G transmission is also inexpensive. Collected data from ADC will send to ARM Microcontroller and then to RFID tag to Cloud Data Base Centre through GPRS and Cloud Web Server it may located in remote place, the GPRS Establish the connection with Cloud Web Server through Dongle.

4. DETAILED DESCRIPTION

The implementation of the system has been described below:

A. Block Diagram

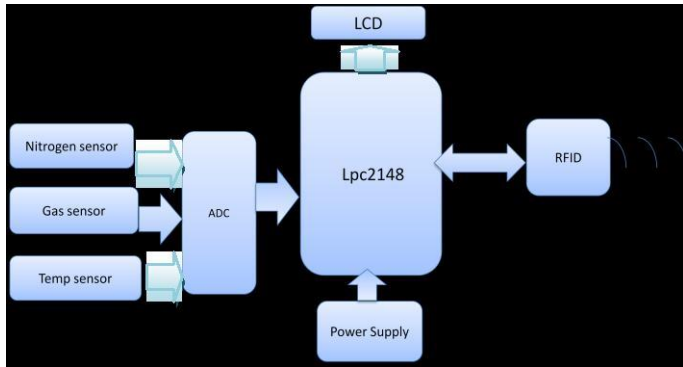The blocks in the diagram depict the major components of the system and their interconnections.

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Fig. 2 Data Collection and Transmitter

Fig. 3 RFID Reader and Transmitter to Cloud Server

Data collection

The active RFID the active RFID tag are designed to collect the emissions data from the vehicle exhaust system. Although active RFID tag has a lifetime which is limited by the onboard power source, it is not an issue for WINS because there is already a power supply in every vehicle.

In a typical vehicle exhaust system, there are usually to built-in nitrogen & gas, temperature sensors installed on the exhaust system. Therefore, the value is collected as the emissions data. In particular, the three sensors in the exhaust system of an automobile, the one is settled before the catalytic converter and the other one after it to evaluate if the catalytic converter works well.

To collect emissions data from the downstream sensor better, an analog-to-digital converter (ADC) is also designed to connect RFID tag. It is a device that uses sampling to convert a continuous quantity into a digital number and has been widely used for signal conversion problems. With ADC, the voltage signal (values) being outputted from the lambda sensors is first converted into digital signal, and then stored in the RFID tag directly via the wires. A prototype of the RFID tag with ADC is made and shown in Figure 2.
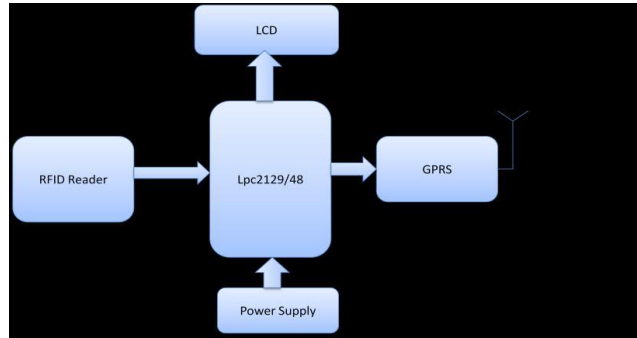
Cloud Web Server and Cloud Data base Centre

Collected data from ADC will send to Cloud Data Base Centre through GPRS and Cloud Web Server it may located in remote place, the GPRS Establish the connection with Cloud Web Server through Dongle, which is connected with Cloud Web Server.

Then this cloud data can store into Data base centre can browse by any authenticated client from remote location, Cloud Web Server Act as Intermediate between Data Collection system, Cloud data base Centre and Cloud Web browser.

Fig. 4 Cloud

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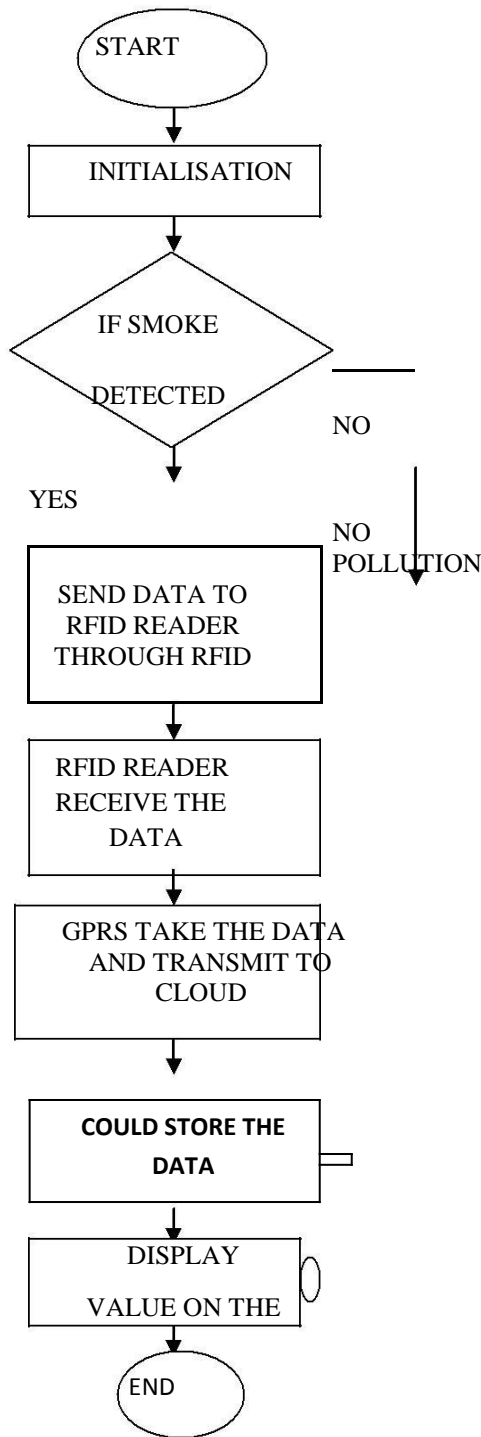**ICRET - 2016 Conference Proceedings**

B. Flow Chart

Fig. 5 Flow chart

C. Implementation Methodology

1. Hardware Requirement
- Two Microcontroller-32 bit LPC2148 Power Supply
- Sensor 3 no's
- RFID Tag RFID Reader GPRS
  Dongle and Server PC

2. Software Requirement

Kiel micro vision Flash Magic Embedded C Program Drop box

D. Advantages

- Green environment can create in the city.
- Remotely data could access.
- Remotely data could store.
- To reduce the human inspection

5. HARDWARE IMPLEMENTATION
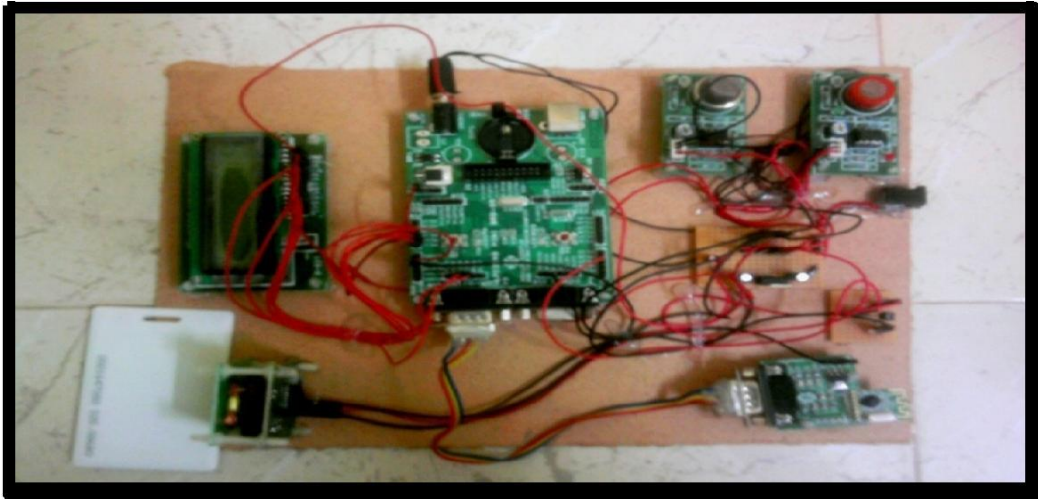
A. Transmitter Side

Fig. 6 Transmitter Side

In this section, we would like to present effective use of Internet of Things to address the issue of vehicular pollution. Continuous monitoring of air quality is necessary to ascertain level of pollution and presence of certain harmful pollutants. Three sensors are placed to detect temperature, gas, nitrogen. Whenever the sensor sense abrupt rise in pollution, search is initiated for concerned RFID tags, i.e. vehicles causing pollution are identified using the RFID tag attached on them. Here we are using ZIGBEE to transmit data and RFID reader and the RFID tag are designed to collect data. This process will display in LCD.
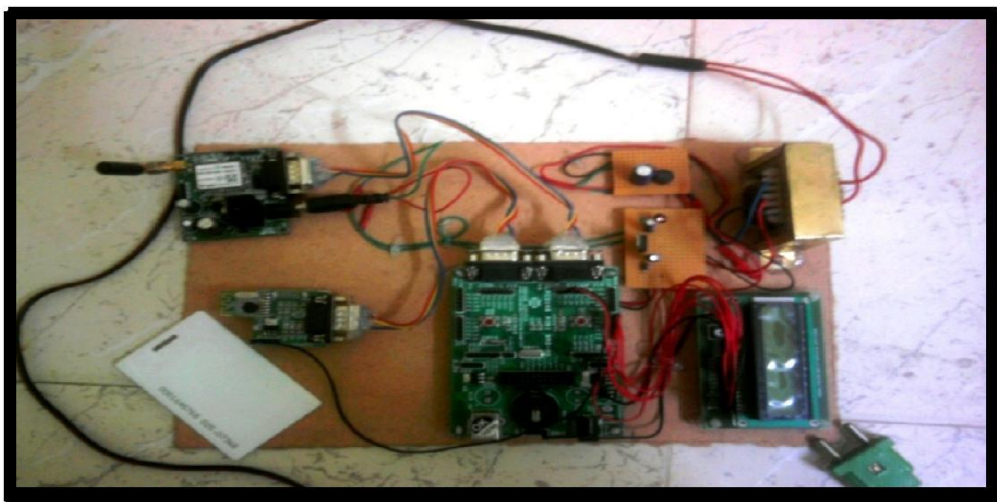
B. Receiver Side

Fig. 7 Receiver Side

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The RFID readers identify corresponding tag and transmit the same via the GPRS modem to the server. This framework also generates alert when pollution level increases. Authorities may take appropriate actions accordingly.

Collected data from ADC will send to Cloud Data Base Centre through GPRS and Cloud Web Server it may located in remote place, the GPRS Establish the connection with Cloud Web Server through Dongle, which is connected with Cloud Web Server.

C. Experimental Results

1. RFID Based Emission Detection Using Cloud Computing

Here we detect the Gas & Nitrogen value from that we know the smoke is emitting or not. Hence the gas & Nitrogen sensors are digital sensors, when we detect '1' as output it means it is polluted (Gas Nitrogen). And the analog sensor which is Temperature will detect the engine temperature.
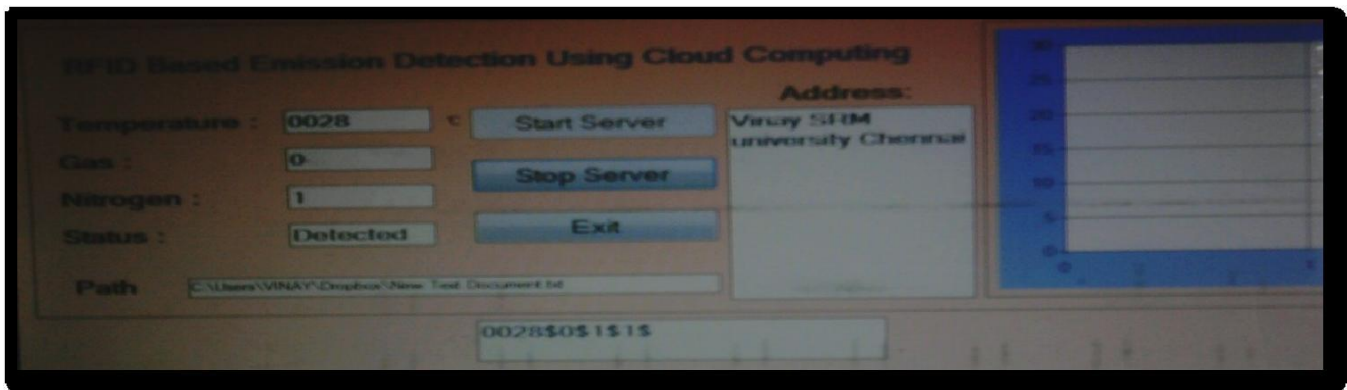

Fig. 8 RFID Based Emission Detection Using Cloud Computing

1. Database

For the particular car tag, we remotely data could be stored like time, temp, gas, Nitrogen, decision. Decision means address of the particular vehicle.
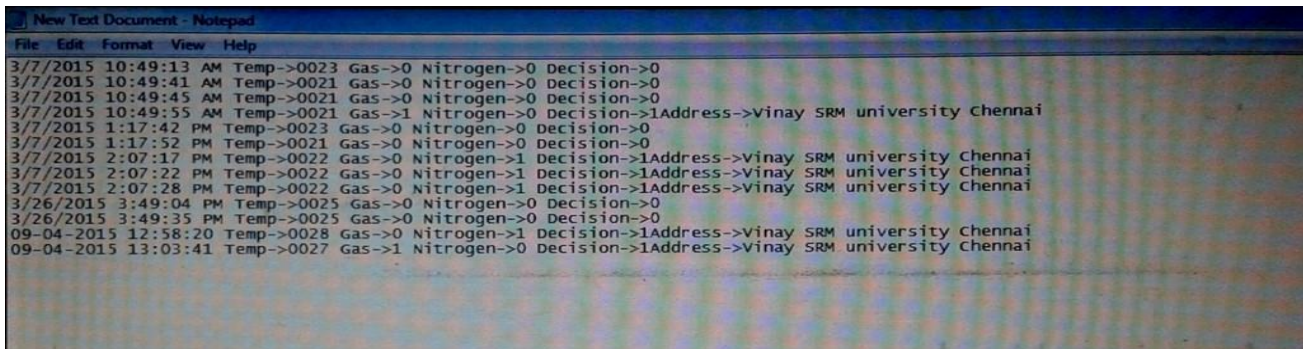

Fig. 9 Database

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6. CONCLUSIONS

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