



## RFID Based Vehicle Emissions in Cities on Internet of Things

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### Abstract:

*The main intentions of this project are to design a system and placed inside of vehicle and maintain of database and graph for the system. The quantity of air pollution which is caused by the cars is increasing. In order to solve this serious problem, many countries and regions have already presented a series of emissions standards, meanwhile some methods has been developed, include update motor engine or improve the quality of the gasoline. However, these actions have not brought about striking effect as we expect. By applying the system, it is possible to smoothly realize a green traffic network. 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. 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.*

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**Keywords:** *Internet of things, Radio frequency identification, Vehicle emissions inspection*

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### 1. Introduction

With the increasing of automobile quantity, 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. As a result, a new system is proposed to deal with the thorny issues. Along with continually updated wireless communication and signal acquisition technologies through the concept of IoT, an effectively has been developed in this paper. It can realize real-time monitor all cars emissions information in a city. In the system, the cars need to be tagged with a unique identity (ID), their emissions information will be transferred with the ID to a backend system. Then, the authorities can smoothly judge which car fail to this test (exceed the standard) and give a notice (message & email) to ask drivers to repair their cars. RFID as a low-cost and mature wireless communication technology is employed in WINS. It is mainly responsible for collecting and transmitting emissions information of vehicles.

To specially mention, traffic light is also a critical role in the whole system. It is a central component in the traffic system that no car could avoid it to drive in a city. In order to achieve the goal that

monitoring closely all the motor vehicles, RFID reader will be installed on the traffic light. It is well known that every car must stop in front of the red light for a long time. The stopping time is also the best timing for RFID reader to collect the emissions information from cars. With the innovative idea of applying IoT to collect vehicle emissions data, it is possible to smoothly realize a green traffic network.

## **2. 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. Unlike a barcode, the tag does not necessarily need to be within line of sight of the reader, and may be embedded in the tracked object. Radio frequency identification (RFID) is one method for Automatic Identification and Data Capture (AIDC).

### **2.1 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. Emissions that are principal pollutants of concern include:

## **3. Functioning of the System**

### **3.1 Inspection system design**

Inspection system can be divided into data collection and data transport. RFID technology is well employed here. RFID tag is mainly responsible for data collection, while data transport can be realized via RFID reader.

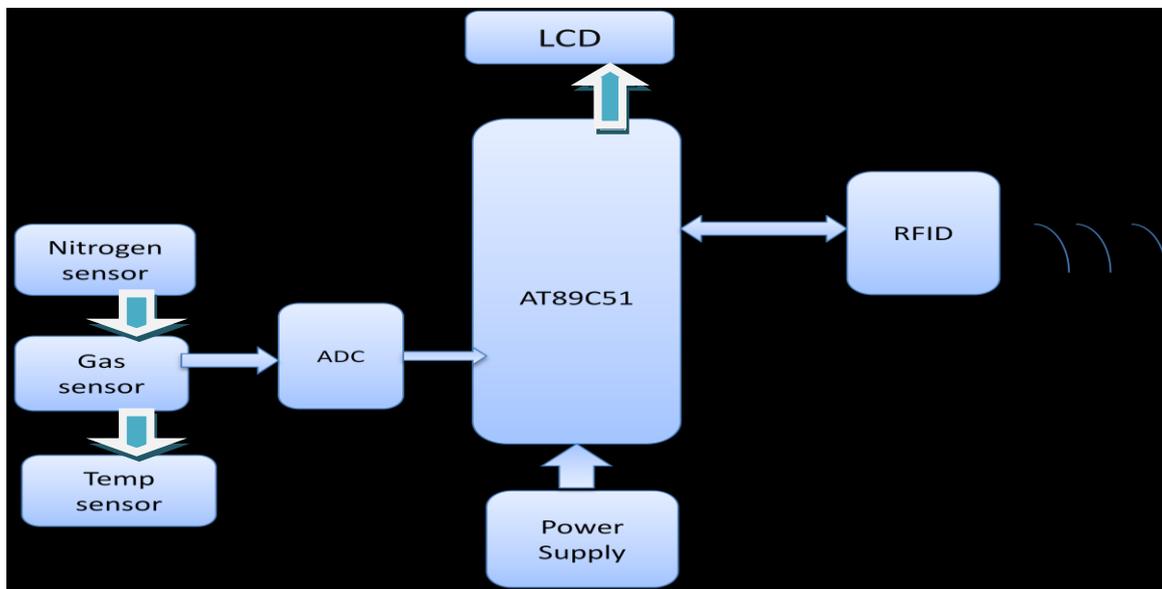
- Carbon monoxide (CO) - A product of incomplete combustion, carbon monoxide reduces the blood's ability to carry oxygen; overexposure (carbon monoxide poisoning) may be fatal. Carbon Monoxide poisoning is a killer in high concentrations.
- Nitrogen oxides (NO<sub>x</sub>) - Generated when nitrogen in the air reacts with oxygen at the high temperature and pressure inside the engine. NO<sub>x</sub> is a precursor to smog and acid rain. NO<sub>x</sub> is a mixture of NO, N<sub>2</sub>O, and NO<sub>2</sub>. NO<sub>2</sub> is extremely reactive. It destroys resistance to respiratory infection. NO<sub>x</sub> production is increased when an engine runs at its most efficient (i.e. hottest) part of the cycle.

## **4. Data collection**

The active RFID The active RFID tags 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. However, emissions data collection is also a problem worthy of study here:

In a typical vehicle exhaust system; there are usually two built-in nitrogen, gas, temperature sensors installed on the exhaust system. When is higher than its stoichiometric value, more nitrogen oxides would be produced; when is lower than its stoichiometric value, carbon monoxide and hydrocarbon emissions would increase significantly. This implies that the exhaust emissions can be reflected by. Therefore, the value is collected as the emissions data in WINS. 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 reflect the actual on-road engine emissions.

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.



**Fig. 1: Data transmission**

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. Therefore, another wireless communication technology need be introduced into RFID reader. 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. Therefore, based on these technologies, a prototype of the RFID interrogator is designed and provided.

#### **4.1 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,

#### **4.2 About Cloud Computing**

What is Cloud?

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

#### 4.3 About Internet of Things (IoT)

- Is also Cloud of things
- Refers to the interconnection of uniquely identifiable embedded computing like devices within the existing Internet infrastructure.
- IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications.

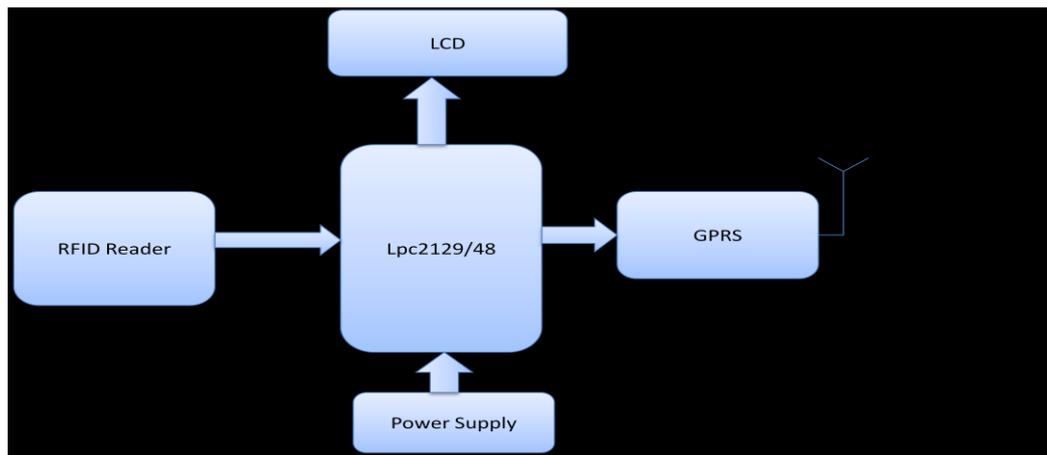


Fig. 2 RFID Reader and Transmitter to Cloud Server

#### 4.4 Effects on the Environment

Vehicle emissions can affect the environment in several ways. Cars emit greenhouse gasses, such as carbon dioxide, which contribute to global warming. Some air pollutants and particulate matter from cars can be deposited on soil and surface waters where they enter the food chain; these substances can affect the reproductive, respiratory, immune and neurological systems of animals. Nitrogen oxides and sulfur oxides are major contributors to acid rain, which changes the pH of waterways and soils and can harm the organisms that rely on these resources.

#### 4.5 Cloud

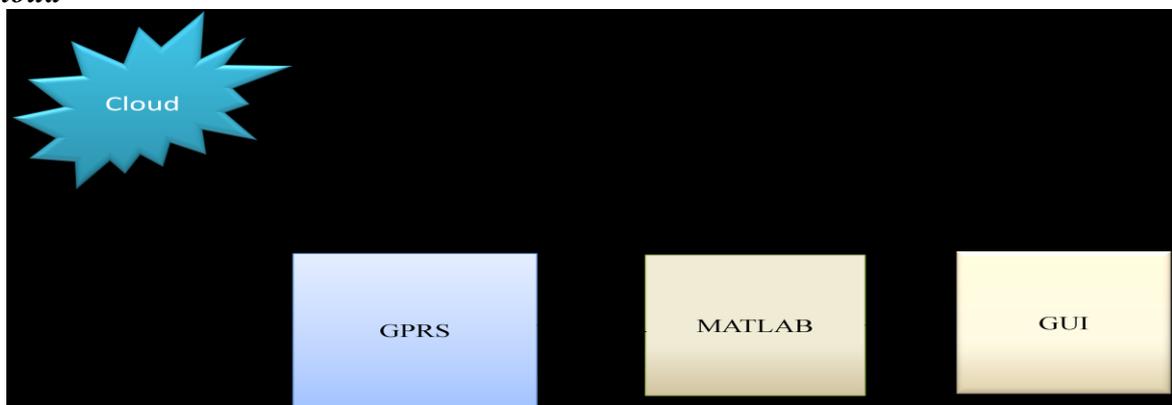


Fig. 3 cloud

#### 4.6 Hardware Requirements

- Microcontroller-32 bit LPC2129/48 and 8 bit AT89C51
- Power Supply

- Lambda Sensor 2 no's
- RFID Tag
- RFID Reader
- GPRS
- Dongle and Server PC

#### **4.7 Software Requirements**

- Kiel micro vision
- Flash Magic
- Embedded C Program

#### **4.8 Advantages**

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

### **5. 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. we will maintain the database and maintain graph for the data By monitoring the emissions data, the engine health can be easily inspected and examined.

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