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Vehicular pollution and status monitoring using RFID

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ABSTRACT

Vehicles on the road are the primary cause of atmospheric pollution. With the increase in vehicles, the air quality has been degraded to such a level that it causes various health issues like asthma, bronchitis, etc. These vehicles release many poisonous gases like carbon monoxide, nitrogen oxides, sulfur dioxide which leads to harmful effects on human health by causing lung irritation and various respiratory diseases. This degradation of air quality has also made our environment more vulnerable to some serious environmental issues like global warming. The project basically focuses on vehicle pollution monitoring. In this project, we demonstrate the idea of pollution control in the vehicle from a remote location. If any person who is driving a car and needs to check his car's pollution level then he can check it using our app. The project monitors the pollution level on roads by using RFID technology and also measures the various types of pollutants and their level in the air.

Keywords— *RFID, IoT, VB, Vehicular pollution, Gas sensor*

1. INTRODUCTION

Due to the air pollutants released from various vehicles like cars, buses and trucks the environmental problems are increasing quickly. Transportation has its own advantages and disadvantages. Transportation has increased more than 50 per cent of carbon monoxide in the air. Human health is affected due to the harmful release of these gases from the vehicles. Long-term exposure to these harmful releases may lead to Chronic Obstructive Pulmonary Disease (COPD)

In today's time, if any person wants to check the pollution level of his car he has to visit a pollution check station and in order to renew the pollution certificate, he needs to visit the centre after every 3 months which is a very time-consuming process. The Internet of Things (IoT) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure.

Typically, IoT is expected to Offer advanced connectivity of devices, systems, and services that go beyond Machine-To-Machine communications (M2M) [1] Also the visit is successful only if the server works at the pollution check station. In order to overcome this problem of constantly visiting after every 3 months and also the proper working of a server, we proposed a model: Vehicular Pollution and Status Monitoring Using RFID. It is a low cost and efficient project. The project uses technologies like RFID and the Internet of Things (IoT) which makes it a little more efficient. Internet of Things (IoT) connects individual embedded computing devices in current Internet infrastructure. Usually, IoT is for the connectivity of advanced devices, services, that not only has to Machine To Machine communications but also follows different types of protocols. IoT is used for gathering and analyzing the data of pollution from vehicles on the road where RFID is used for access control and identification of vehicles. IoT lets the objects to communicate to the Internet directly or indirectly.

2. SYSTEM ARCHITECTURE

Gas sensors work by detecting amounts of specific gases in ppm, or parts per million. Ppm is a unit of concentration in the immediate surrounding area. You can calculate per cent from ppm by dividing the ppm by 1,000,000 and multiplying by 100. So if you can detect 800ppm of oxygen in the air, the air is 8% oxygen. These sensors use a Wheatstone bridge to detect gases, which is essentially two voltage dividers in parallel with each other. As you can see in the diagram, two pins are connected to a heating element, whereas the other two are connected to the sensor itself. The sensing element for gas sensors is coated with a metal oxide, and the Figaro models I am interested in using Tin oxide specifically (SnO_2). When the heating element receives power, the SnO_2 becomes oxidized and donates electrons to the Oxygen yielding positively charged SnO_2 molecules on the coating of the sensing element.

This situation causes a barrier to electron flow, increasing resistance of the sensor. When a deoxidizing gas is introduced in the equation (such as ethanol, or C_2H_5OH) the amount of available oxygen decreases. This means that there is less oxygen to accept the donor electrons from the SnO_2 coating, which reduces the resistance of the sensor due to the SnO_2 not being as positively charged. The actual gas levels in ppm are measured by determining the voltage across a load resistor which is put between the negative pin of the sensing element and ground.

3. INTERNET OF THINGS

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. Projections for the impact of IoT on the Internet and economy are impressive, with some anticipating as many as 100 billion connected IoT devices and a global economic impact of more than $11 trillion by 2025. Typically, 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 [2],

At the same time, however, the Internet of Things raises significant challenges that could stand in the way of realizing its potential benefits. Attention-grabbing headlines about the hacking of Internet-connected devices, surveillance concerns, and privacy fears already have captured public attention. Technical challenges remain and new policy, legal and development challenges are emerging.

This overview document is designed to help the Internet Society community navigate the dialogue surrounding the Internet of Things in light of the competing predictions about its promises and perils. The Internet of Things engages a broad set of ideas that are complex and intertwined from different perspectives. Key concepts that serve as a foundation for exploring the opportunities and challenges of IoT include:

- **IoT definitions:** The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition.
- **Enabling technologies:** The concept of combining computers, sensors, and networks to monitor and control devices has existed for decades. The recent confluence of several technology market trends, however, is bringing the Internet of Things closer to widespread reality. These include Ubiquitous Connectivity, Widespread Adoption of IP-based Networking Computing Economics, Miniaturization, Advances in Data Analytics, and the Rise of Cloud Computing.
- **Connectivity models:** IoT implementations use different technical communications models, each with its own characteristics. Four common communications models described by the Internet Architecture Board include Device-to-Device, Device-to-Cloud, Device-to-Gateway, and Back-End Data-Sharing. These models highlight the flexibility in the ways that IoT devices can connect and provide value to the user.
- **Transformational potential:** If the projections and trends towards IoT become reality, it may force a shift in thinking about the implications and issues in a world where the most common interaction with the Internet comes from passive engagement with connected objects rather than active engagement with content. The potential realization of this outcome – a "hyper connected world" — is a testament to the general-purpose nature of the Internet architecture itself, which does not place inherent limitations on the applications or services that can make use of the technology.

4. RFID

An RFID tag works by transmitting and receiving via an antenna and a microchip — also sometimes called an integrated circuit or IC. The microchip on an RFID reader is written with whatever information the user wants. There are two main types of RFID tags they are battery-operated and passive. As the name suggests, battery-operated RFID tags contain an onboard battery as a power supply, whereas a passive RFID tag does not, instead of working by using electromagnetic energy transmitted from an RFID reader. Battery-operated RFID tags might also be called active RFID tags. Passive RFID tags use three main frequencies to transmit information: 125 – 134 KHz, also known as Low Frequency (LF), 13.56 MHz, also known as High Frequency (HF) and Near-Field Communication (NFC), and 865 – 960 MHz, also known as Ultra High Frequency (UHF). IoT devices can be used to monitor and control the mechanical, electrical and electronic systems used in various types of buildings (e.g., public and private, industrial, institutions, or residential). Home automation systems [3], the frequency used affects the tag's range. When a passive RFID tag is scanned by a reader, the reader transmits energy to the tag which powers it enough for the chip and antenna to relay information back to the reader. The reader then transmits this information back to an RFID computer program for interpretation. There are two main types of passive RFID tags: inlays and hard tags. Inlays are typically quite thin and can be stuck on various materials, whereas hard tags are just as the name suggests, made of a hard, durable material such as plastic or metal.

Active RFID tags use one of two main frequencies — either 433 MHz or 915 MHz — to transmit information. They contain three main parts, including a tag, antenna, and interrogator. The battery in an active RFID tag should supply enough power to last for 3-5 years. When it dies, the unit will need to be replaced, as the batteries are not currently replaceable. There are two main kinds of active RFID tags: beacons and transponders. Beacons send out an information ping every few seconds, and their signal is readable from several hundreds of feet away. Because they are sending out data so frequently, their battery tends to deplete quicker. Like passive RFID tags, transponders require the use of a reader to transmit information. When within range of one another, a reader first sends out a signal to the transponder, which then pings back with the relevant information. Because they only activate when near a reader, transponders are much more battery-efficient than beacons.

5. SYSTEM IMPLEMENTATION

This system is built with two specific units they are vehicle unit and remote monitoring units, vehicle unit is inserted in the gas releasing part of the vehicle, vehicles release CO_2, LPG GAS which is sensed in the sensor and the readings are converted into numeric form by Arduino board, RFID tags are present in each and every vehicle that will be giving the MAC address of the vehicle that will identify the vehicular number. Remote monitoring unit will be monitoring the pollution level emitted by the vehicle. [4] GSM (Global System for Mobile Communications, originally Group Special Mobile), is a standard developed by the

European Telecommunications Standards Institute (ETSI) to describe protocols for second-generation (2G) digital cellular networks used by mobile phones. As of 2014, it has become the default global standard for mobile communications

6. BLOCK DIAGRAM

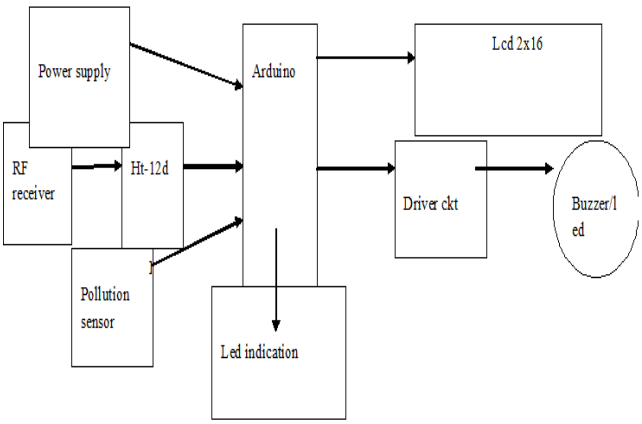


Fig. 1: Block diagram

7. HARDWARE INTERFACE REQUIREMENT

- Embedded system platform: it includes mega 328 and GSM modem.
- Arduino board: it is a microcontroller board and is grounded on at mega 328. The number of digital input/output pins is 14, it has 6 analogue inputs, a ceramic resonator of 16 MHz, and it also has an USB connection, a reset button to reset the values, a power jack.
- Bluetooth module: it is used for the connection of RFID tag and android app.
- Sensors: they compare the standard and measured ppm.
- **LCD display:** pollution level of the car is displayed on the LCD
- **RFID reader:** it identifies the id of the RFID tag.

8. SOFTWARE INTERFACE REQUIREMENT

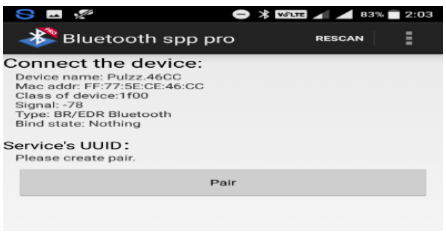
Bluetooth is used to connect the android app with the device. The app has all the information about the vehicle and the modules. The statistical information on the pollution test conducted on a vehicle is also stored in this app. For interface coding of Arduino module embedded c will be used.

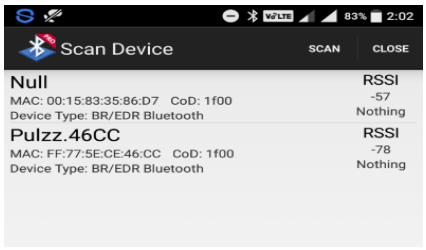
9. SECURITY

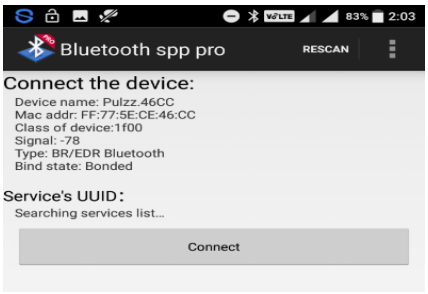
RFID is a technology that is used to track or to locate any product, vehicles etc. To track any vehicle whose pollution level is higher than the standard value RFID technology is used in this project. The transponder also known as tags are Silicon Chip attached to an antenna. Tags are of two types of tags: active tags and passive tags. Active tags are those tags which are powered by a battery and passive tags are powered by the reader field. Message passing takes place between the tag and silicon chip connected to an antenna. Passport protection, animal identification are some apps that make use of this system.

10. RESULTS AND DISCUSSION

This system is designed using a microcontroller in an Arduino environment. In this system is an example of IOT. The Arduino code has to be inserted in the system then the output will be displayed using VB application.







11. CONCLUSION

This system is cost-effective solution for vehicle emission problem and can be used for other application once it mounted on a vehicle. Security at the server side can be maintained as an only authorized person can only know the information on pollution through vehicles. This system has the potential to only provide pollution data to authorized person so authorized person cannot edit any information of vehicle owner this thing makes the system highly secure at server side also. As the system requires a database of vehicle owner so to implement the system willingness of government required.

12. FUTURE WORK

In this system we can work on the elements like Bluetooth connectivity further can be converted into IOS module the range of anti-theft and the elements of the system.

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