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Smarting Emission Standards and Sharing Vehicle Information Using Internet of Things

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Abstract: The proportion 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 a striking effect as we expect. There are also some situations to fail implement these emissions standards. In this paper, a wireless inspection and notification system (WINS) through the concept of Internet of Things (IoT) is proposed. By applying the system, it is possible to smoothly realize a green traffic network. Taken into consideration the real environment, an efficient and innovative method is also presented to select suitable traffic lights aim to reduce the number of vehicles pollution (more economy) and guaranteed the whole urban cars can be monitored (simple & safety). Along with continually updated wireless communication and signal acquisition technologies through the concept of IoT, an effectively wireless inspection and notification system (WINS) 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 owner of the vehicles. ZIGBEE as a low-cost and mature wireless communication technology is employed in WINS. It is mainly responsible for collecting and transmitting emission information of vehicles to Server of the respective Department. 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, ZigBee 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 ZIGBEE 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. However, in order to practically implement WINS, an important issues need to be considered. The 'infinity' number of ZIGBEE will be required as there are 'countless' traffic lights in the traffic network of a city, especially in international urban and metropolitan areas worldwide.

Keywords: Internet Of Things, Zigbee, LPC2148 (ARM7) Microcontroller, AT89S52 Controller, Gas Sensor, Display Unit.

I. INTRODUCTION

With the increasing of automobile quantity, especially in some metropolis, it is very impending to resolve the problem of air pollution resulting from automobile exhaust gas. In Beijing, 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. Further more, 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 wireless inspection and notification system (WINS) 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. 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, 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 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.

II. SYSTEM ARCHITECTURE

A. Block Diagram

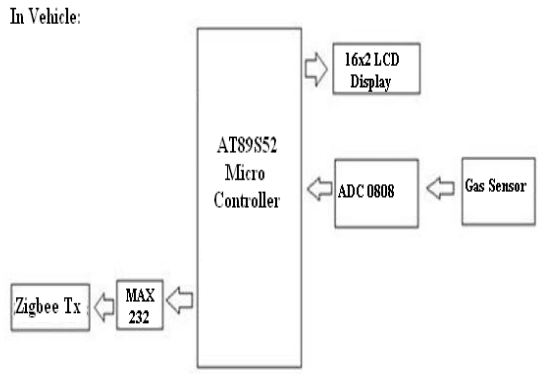

Fig.1.Block Diagram of Vehicle Module.

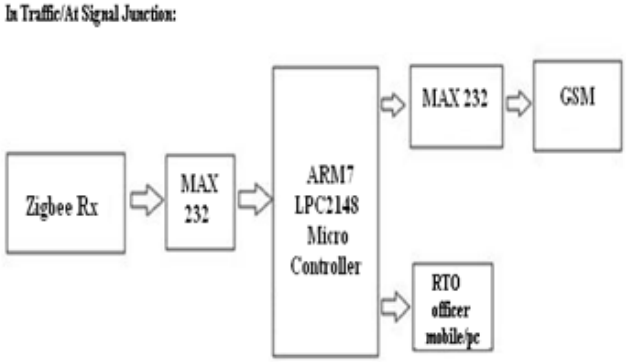

Fig.2.Block Diagram of Traffic Junction Module.

B. Over View Of Block Diagram

The block diagram of the proposed system is as shown in above Figs.1 and 2. The design & development of the proposed system carried out in two different modules such as vehicle module and traffic module. The design of traffic module is arranged in traffic junction and design of vehicle module is arranged in vehicle and then this module is used to checks the vehicle engine emissions continuously. Along with continually updated wireless communication and signal acquisition technologies through the concept of IoT, an effectively wireless inspection and notification system (WINS) has been developed in this paper. It can realize real time monitor all cars emissions information in a city. The proposed system is arranged in the vehicle and traffic junction, that particular vehicle is entering to the traffic junction or signal junction that vehicle engine module is automatically communicates to traffic junction module through ZIGBEE. 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).

The traffic junction modules immediately send a warning message to drivers/owners and then repair their cars. That particular vehicle is don't repair to entering to the traffic junction, that traffic module again send a second warning message to the owner of vehicle to repair their cars. Again that particular vehicle is don't repair to entering to the traffic junction, the traffic module send a message to RTO officer and owner of the vehicle. Those particular RTO officers immediately stop the vehicle and then seize the vehicle to collect the penalty as per traffic rule. That particular vehicle owner pay penalty at RTO office and then collect the vehicle. By applying the system, it is possible to smoothly realize a green traffic network. Taken into consideration the real environment, an efficient and innovative method is also presented to select suitable traffic lights aim to reduce the number of vehicles pollution (more economy) and guaranteed the whole urban cars can be monitored (simple & safety).

C. Existing Method

Every vehicle has its own emission of gases, but the problem occurs when the emission is beyond the standardized values. The primary reason for this breach of emission level being the incomplete combustion of fuel supplied to the engine which is due to the improper maintenance of vehicles. This emission from vehicles cannot be completely avoided, but it definitely can be controlled. The proportion 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 a striking effect as we expect. There are also some situations to fail implement these emissions standards.

D. Proposed Method

In this paper, a wireless inspection and notification system (WINS) through the concept of Internet of Things (IoT) is proposed. By applying the system, it is possible to smoothly realize a green traffic network. Taken into consideration the real environment, an efficient and innovative method is also presented to select suitable traffic lights aim to reduce the number of vehicles pollution (more economy) and guaranteed the whole urban cars can be monitored (simple & safety). Along with continually updated wireless communication and signal acquisition technologies through the concept of IoT, an effectively wireless inspection and notification system (WINS) 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. ZIGBEE as a low-cost and mature wireless communication technology is employed in WINS. It is mainly responsible for collecting and transmitting emissions inform-ation 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, ZigBee 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 ZIGBEE 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. However, in order to practically implement WINS, an important issues need to be considered. The 'infinity' number of ZIGBEE will be required as there are 'countless' traffic lights in the traffic network of a city, especially in international urban and metropolitan areas worldwide.

III. HARDWARE IMPLIMENTATION

A. ARM7 LPC2148

The ARM7TDMI-S is a general purpose 32-bit micro-processor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set. ARM7TDMI-S processor has two instruction sets

- the standard 32-bit ARM set.
- A 16-bit Thumb set.

The Thumb set's 16 bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM performance advantage over a Traditional 16-bit processor using 16-bit registers. This is Possible because Thumb code operates on the same 32-bit register set as ARM code. Thumb code is able to provide up to 65 % of the code size of ARM, and 160 % of the performance of an equivalent ARM processor connected to a 16-bit memory system. The LPC2148 incorporates a 128 KB and 256 KB Flash memory system respectively. This memory may be used for both code and data storage. Programming of the Flash memory may be accomplished in several ways. It may be programmed In System via the serial port. The application program may also erase and/or program the Flash while the application is running, allowing a great degree of flexibility for data storage field firmware upgrades, etc. When on-chip boot loader is used, 120/248 KB of Flash memory is available for user code. The LPC2148/LPC2129 Flash memory provides a minimum of 100,000 erase/write cycles and 20 years of data retention. On-chip boot loader (as of revision 1.60) provides Code Read Protection (CRP) for the LPC2148/LPC2129 on- chip Flash memory. When the CRP is enabled, the JTAG debug port and ISP commands accessing either the on-chip RAM or Flash memory are disabled. However, the ISP Flash Erase command can be executed at any time (no matter whether the CRP is on or off). Removal of CRP is achieved by erasure of full on-chip user Flash. With the CRP off, full access to the chip via the JTAG and/or ISP is restored. On-Chip static RAM may be used for code and/or data storage. The SRAM may be accessed as 8-bits, 16-bits and 32-bits. The LPC2119/LPC2129 provides 16 KB of static RAM. Which indicate that interfacing of CAN bus to microcontroller that gives structural view of the CANbus protocol communication.

B. AT89S52 Controller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in- system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the indus- try-standard 80C51 instruction set and pin out. The on- chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly- flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two- level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

C. GAS Sensor

MQ6 flammable gas and smoke sensor detects the concentrations of combustible gas in the air and outputs its reading as an analog voltage as shown in Fig.3. The sensor can measure concentrations of flammable gas of 300 to 10,000 ppm. The sensor can operate at temperatures from -20 to 50°C and consumes less than 150 mA. Connecting five volts across the heating (H) pins keeps the sensor hot enough to function correctly. Connecting five volts at either the A or B pins causes the sensor to emit an analog voltage on the other pins. A resistive load between the output pins and ground sets the sensitivity of the detector. Please note that the picture in the datasheet for the top configuration is wrong. Both configurations have the same pin out consistent with the bottom configuration. The resistive load should be calibrated for your particular application using the equations in the

datasheet, but a good starting value for the resistor is 20kΩ.

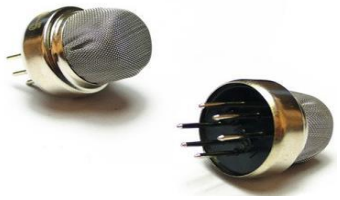

Fig.3. Gas sensor.

D. ZIGBEE

The chemical composition that adversely affects the functionality of natural. The result in undesirable environmental, health effect of living and Non-living crates may be tensed or pollution one of the pollution. Air pollution and is the result of vehicle emissions and other volatile organic compounds. The IEEE so 2.15.4 standard define three function band of operation of zigbee.868MHz, 916MHz and 2.4GHz bands out of which 2.4GHz bands is mostly available wireless communication pollutants the world and this band also offers the highest data rate of 250 kbps and 16 channel between 2.4GHz and 2.4835GHz as physical layer. ZigBee module empty dipole type antenna to increase gain of antenna

- Frequency band =2.4GHz
- Data rate =250 kbps and 16 channel
- Transmission distance
- Environment =30m in indoor non loss
  =100m in loss Environment

In the air pollution monitoring system is developed by using ZigBee. We get easily data on display continuously and we analysis the data by observing generation of air pollutant. The main advantages of ZigBee are the particular area monitoring is possible.

IV. RESULTS

WINS is appeared to be more successful, helpful and practical than conventional test program for vehicle emanations investigation. Along these lines, with a specific end goal to use WINS better in genuine activity arrange, it is important to concentrate on the introduced area of ZigBee per used in the following segment as shown in Figs.4 to 6.

A. At Signal Junction

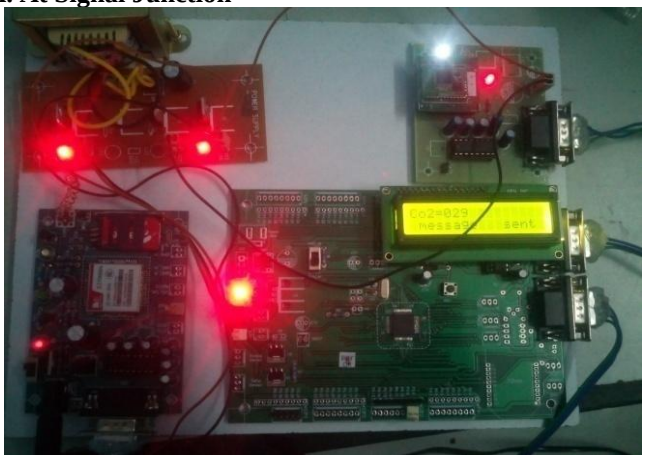

Fig.4.Hardware Implementation of Traffic module.

B. In Vehicle

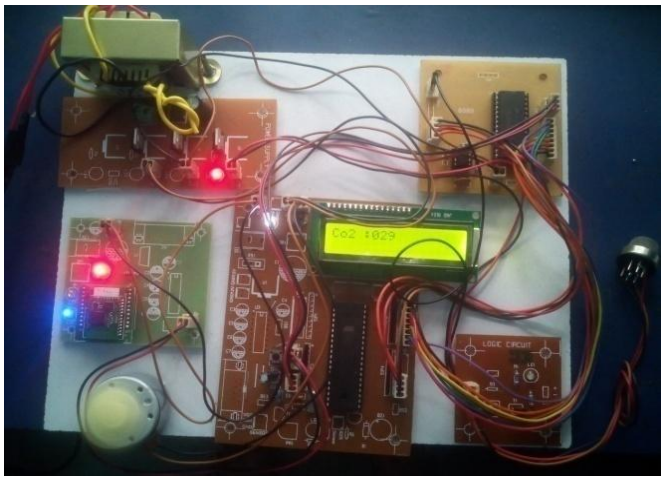

Fig.5. Hardware Implementation of Vehicle module.

C. Output Results

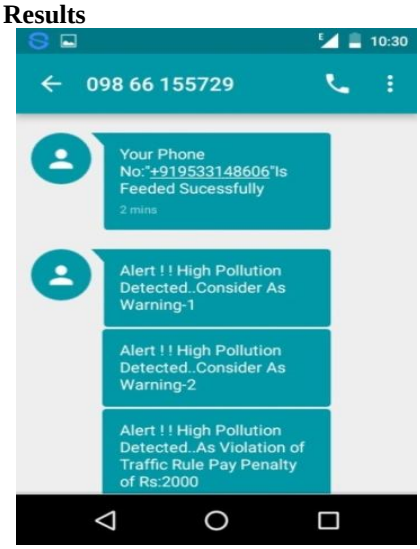

Fig.6. Output Results.

Server Updation:

```
AT+CMGS="+918754082374"
Your Phone No:"+918754082374"Is Feeded Sucessfully•AT
Alert ! ! High Pollution Detected..Consider As Warning-1
•AT
Alert ! ! High Pollution Detected..Consider As Warning-2
•AT
Alert ! ! High Pollution Detected..As Violation of Traffic Rule Pay Penalty
s:2000
•AT
```

V. IMPLEMENTATION ISSUES

A. Security

Security is fundamental for ensuring the vital individual data, particularly while transmitting through open territory remotely. Be that as it may, the present information transmission involves just two basic segments: label ID and vehicle outflows information. None of them can uncover any imperative data without the back-end server and the database of the vehicle proprietors. Consequently, no dangers about security are obvious at current time however it might be left for further studies later on.

B. Governance and Legislation

Another essential pre-imperative for the proposed data framework is administration and enactment.

VI. CONCLUSION

In this project, WINS under the concept of IoT for mandatory vehicle emissions inspection is proposed. IoT is an emerging networking concept within the pervasive or ambient things or objects are connected to provide a smart or intelligent service to make human life easier and happier. By monitoring the emissions data, the engine health can be easily inspected and examined. Experimental results show that the proposed system is effective and reliable for Vehicle emissions inspection. Meanwhile is also proposed to determine the amount of traffic lights on which the GSM with ZigBee should be installed. the core idea of "Green IoT" can be realized. It not only effectively takes an advance the environmental quality, but also helps vehicle owners to save a lot of unnecessary troubles compared to the traditional emissions inspection test. Furthermore, since WINS may be provided to the governmental authorities for vehicle emissions control, some implementation issues are analyzed.

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