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IOT Based Vehicular Pollution Monitoring System

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ABSTRACT: Wireless sensors are used in most of the in real time applications for collecting physical information. The impossible measurements in typical ways have currently become attainable using the wireless technology. In this technology, the measurement of air quality is one of the difficult areas for the researchers. The main source of atmosphere pollution happens due to vehicles. The high inflow of vehicles in urban areas causing more air pollution and decreasing air quality that leads to severe health diseases. 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. This paper also reports the status of air quality whenever needed to the environmental agencies. The proposed systems also assures the existence of wireless sensors for vehicle pollution system that specialize in a straight forward accessibility of real time data through internet using IOT. The measured data is also shared to vehicle owner, traffic department and agencies of national environment. This system is a low cost and provides good results in controlling the air pollution especially in the urban areas.

KEYWORDS: Node microcontroller, IOT, Wireless Gas sensors, Cloud server.

I. INTRODUCTION

An air pollutant is a substance in the air that can have adverse effects on humans and the ecosystem. The substance can be solid particles, liquid droplets, or gases. A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary. Primary pollutants are usually produced from a process, such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhaust, or the sulfur dioxide released from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants.

HUMAN ACTIVITY INCLUDE-

Carbon dioxide (CO_2)- Because of its role as a greenhouse gas it has been described as "the leading pollutant" and "the worst climate pollution". Carbon dioxide is a natural component of the atmosphere, essential for plant life and given off by the human respiratory system. This question of terminology has practical effects.

Sulfur oxides (SO_x) - particularly sulfur dioxide, a chemical compound with the formula SO_2. SO_2 is produced by volcanoes and in various industrial processes. Coal and petroleum often contain sulfur compounds, and their combustion generates sulfur dioxide. Further oxidation of SO_2, usually in the presence of a catalyst such as NO_2, forms H_2SO_4, and thus acid rain.

Nitrogen oxides (NO_x) - Nitrogen oxides, particularly nitrogen dioxide, are expelled from high temperature combustion, and are also produced during thunderstorms by electric discharge. They can be seen as a brown haze dome above or a plume downwind of cities. Carbon monoxide (CO) - CO is a colorless, odorless, toxic yet non-irritating gas. It is a product of combustion of fuel such as natural gas, coal or wood. Vehicular exhaust contributes to the majority of carbon monoxide let into our atmosphere. It creates a smog type formation in the air that has been linked to many lung diseases and disruptions to the natural environment and animals. Chlorofluorocarbons (CFCs)- harmful to the ozone

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layer; emitted from products are currently banned from use. These are gases which are released from air conditioners, refrigerators, aerosol sprays, etc. On release into the air, CFCs rise to the stratosphere. Here they come in contact with other gases and damage the ozone layer.

II. PROPOSED SYSTEM

The frame work of the proposed system uses IoT to address the vehicular pollution in real-time applications. Two gas sensors CO, NO are used to monitor the pollutants continuously to maintain the quality of the air. The block diagram of the proposed air pollution monitoring system is shown in Fig 1.

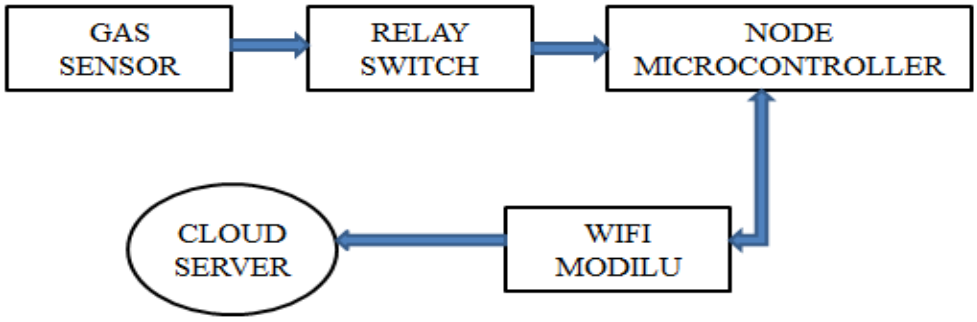

Figure 1-Proposed Method

At monitor location, wireless gas sensors are integrated along with microcontroller. This entire system is placed in either of the road. Whenever the vehicles passed through the sensor node, Sensor reader presented in the monitoring system detects the vehicles and the sensors measures quality of the air produced by that vehicle. The sensed continuous data is sent to the microcontroller for verification of the pollution level of the vehicle. The microcontroller verifies the levels of the pollutants of the air produced by the vehicle. If the pollutants levels are beyond the threshold levels, then it sends the warning message to the vehicle owner. The same data is displayed on the Admin Web Page. The information about the levels of COand NO, vehicular number of the vehicle and time and date of vehicle are also sent to the server of the authorized agencies. This information is stored in the server database for future analysis.

HARDWARE REQUIREMENTNODE
MICROCONTROLLER – NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-FiSoC from and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, , such as lua-cjson, and spiffs are shown in fig 2.

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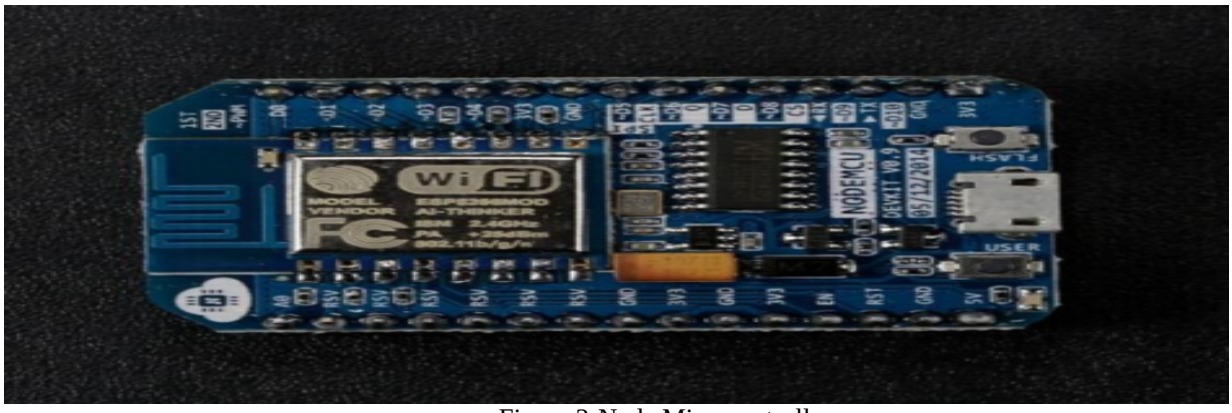

Figure 2-Node Microcontroller

ESP8266 Arduino Core - As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate tool chains to allow Arduino C/C++ to be compiled down to these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino language. Some creative ESP8266 enthusiasts have developed an Arduino core for the ESP8266 WiFi SoC that is available at the GitHub ESP8266 Core webpage. This is what is popularly called the "ESP8266 Core for the Arduino IDE" and it has become one of the leading software development platforms for the various ESP8266 based modules and development boards, including NodeMCUs.

WIRELESS GAS SENSORS - Air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases. It is with low cost and particularly suitable for Air quality monitoring application.

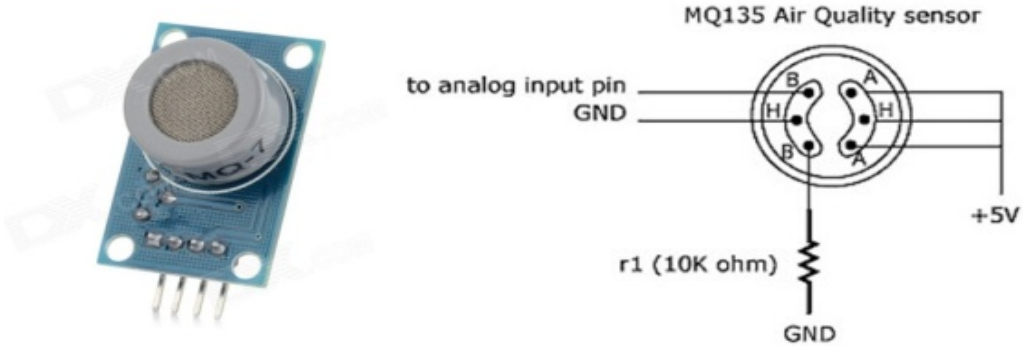

Figure 3-Gas Sensors and Pin Connections.

III. BLOCK DIAGRAM OF PROPOSED SYSTEM

The proposed air pollution monitoring system mainly consists of arduino microcontroller development board, ATmega328 microcontroller, MQ Gas sensors. The developed vehicular pollution monitoring system is shown in 4.

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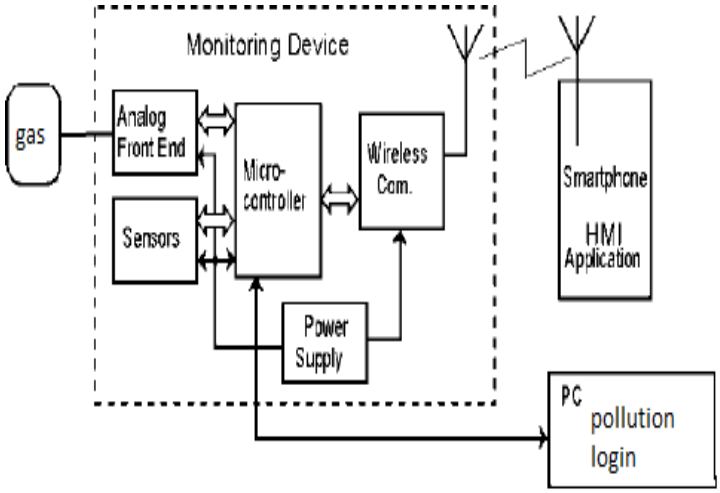
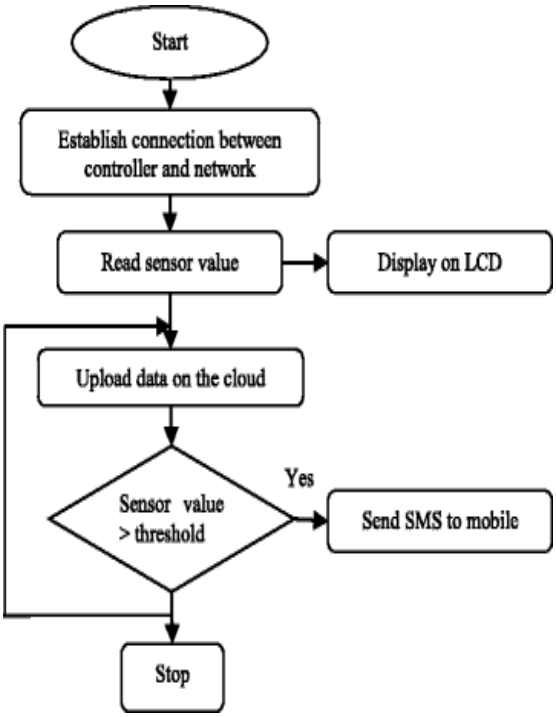


Figure 4 -Block diagram

FLOW CHART OF EXPERIMENTAL SYSTEM



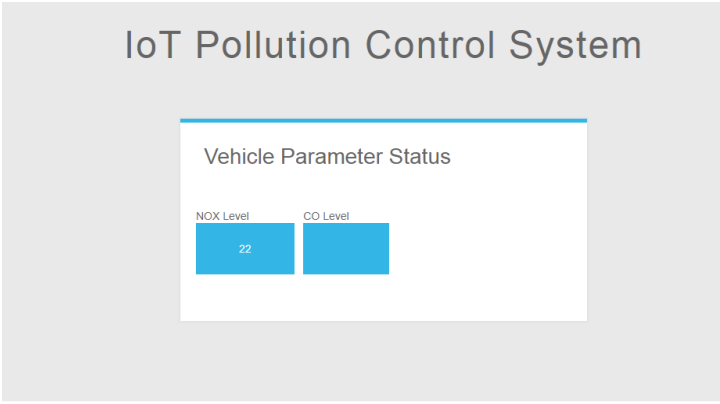


Figure 5 -Flow Chart of proposed system

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PROJECT DESIGN

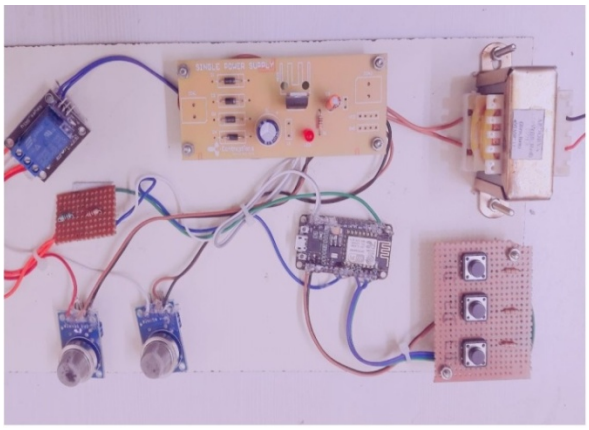

Figure 6- Project design

OUTPUT

IoT based pollution monitoring system is developed and the performance of the developed system is verified successfully for various vehicles.The display of the vehicle number that passes through the monitoring system with sensor node. The monitoring system displays the pollutants levels of the vehicle .The controller sends the details of the vehicle and the pollutant values to server for monitoring the pollution levels.

Figure 7 -Output Page

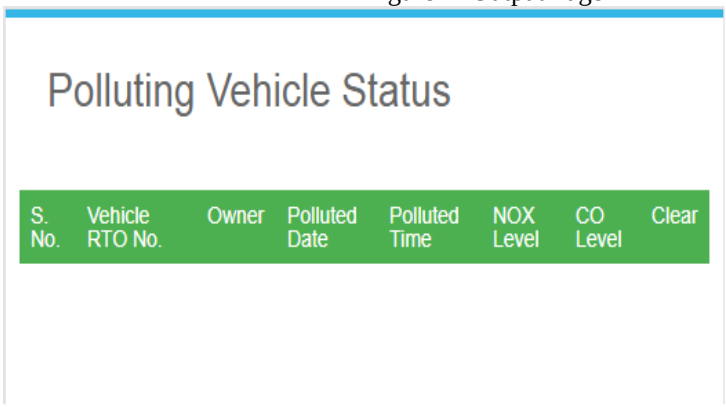

Figure 8 -Admin Output Page

IV. CONCLUSION

The design and development of IoT based vehicular pollution monitoring system for green revolution. The hardware architecture and software implementation are discussed in length. The performance of the system is also verified using IoT technology. The designed smart intelligent environmental system monitors the pollutants produced by the vehicles and also warn the vehicle owners to control the pollution. The system also sends the pollutant level data to the server for future analysis. The air pollution agencies can able to analyze the data and also detect the vehicle registration numbers that causes more pollution in the atmosphere. The developed system is a low cost, simple to operate and is easily inserted in any locations. The developed system provides better accuracy with low cost than the existing system.

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