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Reporting and Managing Pollution in Vehicles using IoT Technology

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Abstract

It is common that vehicles emit pollution. But when it is emitted beyond limits, the health risks of it are extremely serious. In 2013, transportation contributed more than half of carbon monoxide and nitrogen oxide into the atmosphere. The poor air quality due to the pollutants increase ailments like asthma and bronchitis. According to World Health Organization (WHO), the hazardous pollutants have been also linked to birth defects, cancer and other serious illness. Research estimates that vehicle tailpipe emissions are linked to about 3,61,000 premature deaths. This clearly indicated that the effects of pollution emitted from vehicles is a no-laughing matter. Our paper is not just about the controlling of pollution, but also reporting it. We have a sensing unit with the help of carbon sensor and an immediate action unit to control and report the pollution. We use Embedded as well as IoT technologies to provide a worldwide coverage.

Keywords; *World Health Organization (WHO), Internet of Things (IoT).*

I. INTRODUCTION

Pollution is one of the major threats in today's world. It has become so common that almost everyone acknowledges pollution continuously. It is caused mainly by human activities that harm the environment in ways more than one. The effects are noticeable already in the form of various natural calamities in various states in India. Therefore, there is a strong need for technical advancement to manage pollution. Pollution can be controlled as well as reported using sensor, microcontrollers and communication systems.

Fig 1.1- Problem Identification

II. LITERATURE SURVEY

1)Mr. K.S.E. Phala, Mr.Anujkumar, Mr.Gerhald P. Hanckeexplained in their paper, "Air Quality Monitoring system based on ISO/IEC/IEEE 21451 Standards"about an air quality monitoring system (AQMS) based on IEEE/ISO/IEC 21451 standards. In the development of AQMS, they have used the

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GSM wireless communication module. Their developed system is capable of real-time measurement of air polluted gases like CO2, CO, NO2 and SO2. The AQMS uses many sensors to take measurements of the ambient air surrounding it and wirelessly transmits the data to the base station. A graphical user interface (GUI), which makes it easy for end users to interact with the system.

2)Mr. Nihal Kularatna, Mr. B.H. Sudantha explained in their paper, "An Environmental Air Pollution Monitoring System based on the IEEE 1451 Standard of Low Cost Requirements"about monitoring the concentrations of major air pollutant gases that are developed. This system measures concentration of gases such as CO, NO2, SO2, and O3 using semiconductor sensors. The smart transducer interface module (STIM) was implemented using the analogue devices ADUC812 microconverter. Network Capable Application Processor (NCAP) was developed using a Personal Computer and connect it to the STIM through the transducer independent interface. Three gas sensors are calibrated using the standard calibration methods.

3)Mr. Ke Hu, Mr. Vijay Sivaraman, Ms. Blanca GallegoLuxan, Mr.AshfaqurRahmanexplained in their paper, "Design and Evolution of a Metropolitan Air Pollution Sensing System" about the design and evaluation of low cost participatory sensing system called HazeWatch. It uses a combination of Portable mobile sensor units, smart phones, cloud computing and mobile apps to measure, model, and personalize air pollution information for individuals.

III. PROPOSED IMPLEMENTATION

Firstly, the vehicle is turned on. As experienced in all vehicles, the vehicle tailpipe emits pollution. The vehicle works normally when the pollution rate is normal. But, when the vehicle produces pollution above the threshold level, it is then sensed by a carbon sensor (MQ-5) which is a viscous sensor. Thevehicle now uses its IOT (Internet Of Things) device ESP8266 and uploads a message that is set as per our program, for instance, "Vehicle No. PY 01 SM 1009's Pollution Level has crossed the Threshold level! Take Immediate Action!" and then uploads it to the RTO/ Pollution Control Department.In turn they can turn off their engine after giving a warning note. When the engine is made off, the LCD display that is fit in the vehicle near the speedometer displays a message to the user such as, "Vehicle is Not in proper Condition, kindly Service it! Engine will off in 2mins". After this note of warning, the vehicle engine is turned off. Even when the vehicle is made to start then this process is repeated and the engine is made off again. This switching off of engines will make the owners of the vehicles to service their mean of transport regularly.This in turn reduces the pollution amount in the air. This system can be installed in vehicles from small vehicles like motorbikes to massive ones like trucks.

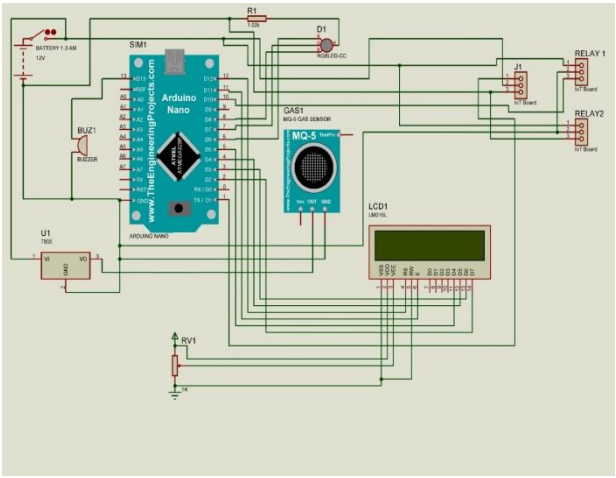

Fig 3.1- Circuit Diagram of the Sensing Unit

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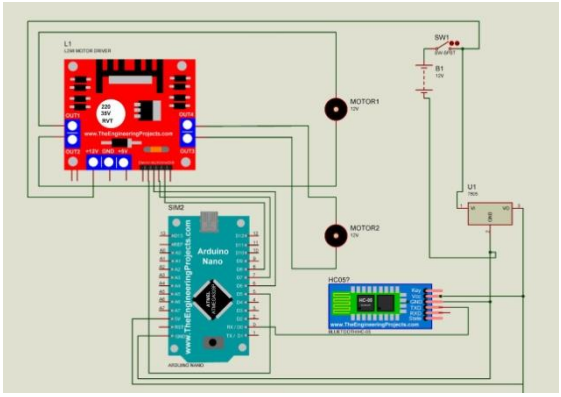

Fig 3.2- Circuit Diagram of Reporting unit

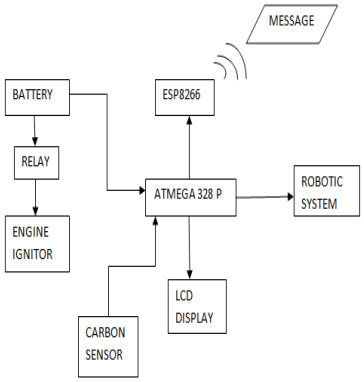

Fig 3.3- Block Diagram of our System

IV. SYSTEM BUILDING BLOCKS

1)ATMEGA 328P:

It is a low power and high performance, 8- bit microcontroller. It is fitted to the Arduino Nano in our system. It is the brain of this system. Whenever the sensor senses, the microcontroller detects it and performs the task as specified in the program.

2)ESP8266

It is a low cost WiFi microchip. It is a pre-processor that helps us send information to the Regional Transport Office (RTO) using Internet.

3)MQ-5:

MQ-5 is the carbon sensor. It is a viscous sensor that helps to sense the amount of pollution that is emitted by the vehicle. It can also detect methane, butane and petroleum.

4)LCD DISPLAY:

A 16x2 display is fitted near the speedometer of the vehicle. It displays the warning message to the user.

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5)ENGINE IGNITOR:

It is an ignition system component which is responsible for providing the signal for ignition coils to fire.

6)RELAY:

It is an electrically operated switch to control a high current circuit with a low current signal. A dual channel relay is used in this system.

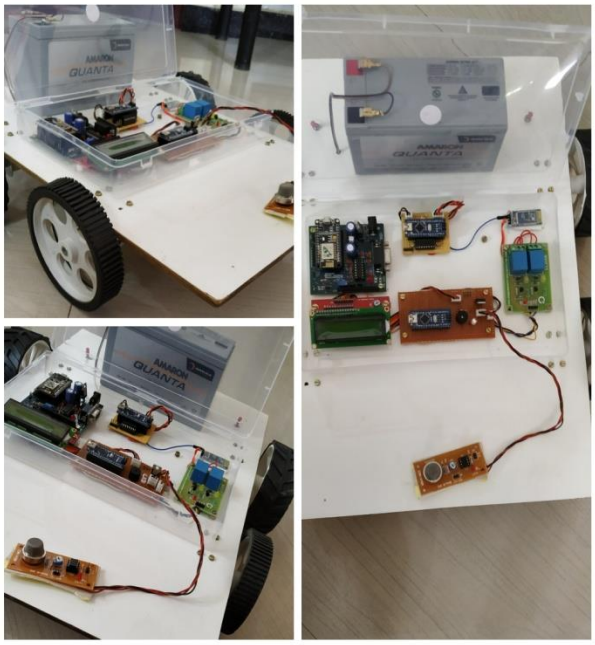
7)VOLTAGE REGULATOR:

It maintains a constant voltage level. A 7805 voltage regulator is used in this system to avoid "Load Balancing." It is the intermediate connector between the 12V power supply and the carbon sensor.

8)ROBOTIC SYSTEM:

It is the system in which the entire setup is fixed to.

V. IMPLEMENTATION



VI. CONCLUSION AND FUTURE ENHANCEMENT

Thus we developed this system for reporting and controlling pollution levels. The sensor and system designed during the process are possible to be implemented in real-time. The main part of the system is the Atmega328P Microcontroller which is designed by easy embedded C programming. The sensing unit is the carbon dioxide, methane, butane, and petroleum sensing unit whereas the communication unit is the IOT web server. This makes the system reachable throughout the world.

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Future enhancement can be helpful in reducing the pollution automatically thus making the environment pollution-free.

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