Vehicular Pollution Monitoring and Controlling using IoT

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ABSTRACT: *This paper present a model for detecting and controlling the air pollution that is occurring from vehicles. For that intention there is a CO, CO_2, SO_2 gas sensor at the exhaust of vehicles which detects the level of pollutants. When the emission level goes beyond the already set threshold level, by using GSM and GPRS, a message will be send on the drivers mobile number as well as website, the vehicle to indicate that the limit has been cross . After the counter of timer runs out, the fuel supplied to the engine of vehicle will be cut-off by using relay switch (fuel injector circuit) and the vehicle has to be repairing for the nearest service station. .With the advent of Internet of Things (IoT), this GPRS based pollution control system is implemented as interconnected network. This system will benefit the society and help in reducing the air pollution. When implemented as a real project.*

KEYWORDS: *IoT (Internet of Things), Vehicle Pollution.*

I. INTRODUCTION

The environmental problems are growing rapidly. Air pollutants from cars, buses and trucks growing rapidly, which causes respiratory diseases and trigger asthma attacks. Transportation can be responsible for more than 50 percent of carbon monoxide in the air. The air pollution may lead to Chronic Obstructive Pulmonary Disease (COPD) and increase risk of cancer[1]. The public health is affected due to pollution from cars and trucks can also be very high in the large metropolitan cities. One of the major reasons of air pollution is emission of polluting gases from vehicles which is responsible for 70% of the total air pollution[2]. In order to control the air pollution, the amount of air pollution needs to be monitored and vehicles responsible for polluting should be identified. Internet of Things may become helpful in cities for monitoring air pollution from vehicles and also data related to the amount of pollution on different roads of a city can be gathered and analysed.

II. SYSTEM ARCHITECTURE

This system unit consists of single chip of microcontroller. The main pollutants from vehicles are the oxides of carbon and SO_2 which can be easily detected these days with the help of semiconductor gas sensors. The total equipment of this project is placed inside a vehicle. In this project we have four sensors which are interfaced to the Ardunio. Those are temperature sensor, smoke detector, SO_2 and CO_2 sensor. Through which we can measure the temperature and amount of CO_2 released from the vehicle. These values are also displayed on LCD. ADC (Analog to Digital Converter) is used to convert the analog data from the sensors to digital form. Whenever these values exceed the threshold then intimation is given to the vehicle owner and RTA including vehicle's exact position. Also send the alert message and e-challan send to the vehicle owner.After certain time period the

power supply of the vehicle will be cut-off by using realy switch. And vehicle will send to the nearest service station.

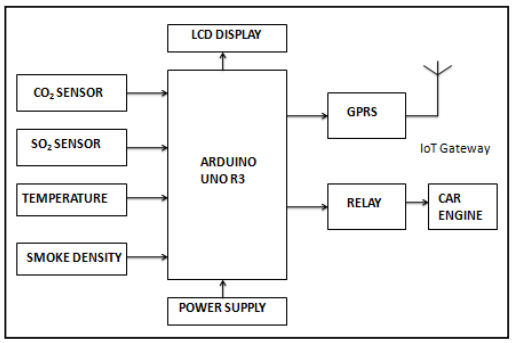

Fig.1.1.1: Block diagram of Vehicular Pollution Monitoring and Controlling Using IoT

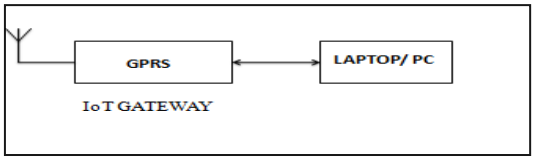

Fig 1.1.2:Remote Monitoring Unit

A. ARDUNIO MODULE(Microcontroller AT mega 328)

This microcontroller belong to AVR family we use this because it is compatible with Arduino module. Its has High Performance, Low Power Atmel®AVR® 8-Bit Microcontroller Family. Its depends on advanced RISC architecture. The ATmega328P provides 32K bytes of In- System Programmable Flash with Read-While-Write capabilities, 1K bytes EEPROM, 2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART Serial Interface, SPI port, and interrupt system to continue functioning. Up to 20 MIPS throughput at 20 MHZ. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset.

Fig 1.1.3: Arduino Module

B. LCD DISPLAY(16*2)

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, video display. Uses the light modulating properties of liquid crystals. The 16 *2 intelligent alphanumeric dot matrix display is capable of displaying 22 different character and symbol. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays. Its low electrical power consumption enables it to be used in battery-powered electronic equipment.

C. GPRS

General Packet Radio Services .GPRS is based on GSM.12V/2 Amp current provided. GPRS provide the data rate of 35-171Kbps.GPRS was widely deployed to provide a realistic data capability via cellular telecommunication technology. Wireless communication service that promises data rates from 56 up to 144 kbps. Using GPRS communication is fast.

D. CO_2 SENSORS

Chemical CO_2 gas sensors with sensitive layers. Very low energy consumption.
Can be reduced in size to fit into microelectronic-based systems. Size of the sensor is 35H×53W×17D mm. Response time is about 200 milliseconds. Heating current is 200 map , heating power is 1200mw.

E. GAS SENSOR

Simple and cost effective sensors useful for sensing gases in the air .Detects a specific gas like Methane, LPG , CO2 , etc.MQ9 gas sensor module is connected to the Arduino Uno board using jumper wires. The Analog pin on the sensor is connected to the analog pin 0 on the Arduino board, while the +5V and GND pins on the sensor module are connected to the 5V Vcc and GND (ground) pin respectively on the Arduino board. The Arduino Uno board is then connected to a computer system using USB connection and RS232 interfacing.

Fig. 1.1.4: Gas Sensor

F. GSM

This GSM Modem can work with any GSM network operator SIM card just like a mobile phone with its own unique phone number. Benefit of using this modem will be that for communication its RS232 port can be used and for developing embedded applications. The modem can either be connected to PC serial port directly or to any microcontroller through MAX232. The SIM900A is a complete Dual-band GSM/GPRS solution in a SMT module [1]. Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900A can fit in almost all the space requirements. GSM module will send the message to the drivers mobile number indicating that pollution limit has been crossed when the smoke value excides the pre-defined value.

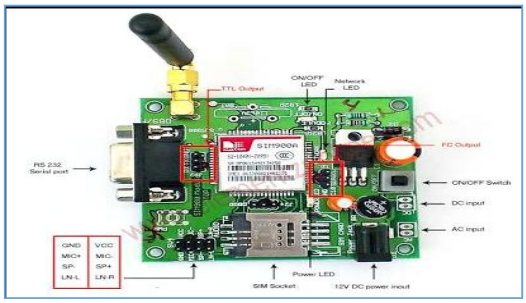

Fig 1.1.5: GSM Module

G. RELAY

A relay is a electrically operated switch.
Relay are used where it is necessary to control a circuit by a seperete low pow signal.
Relay is a electromagnetic device which is used to isolate two circuit electrically and connect them magnetically.The relay switch can be divided into two parts that is input and output.

Fig 1.1.6:Relay

III. INTERNET OF THINGS

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 goes beyond machine-to-machine communications (M2M) and covers a variety of protocols[2] domains, and applications. The IoT allows people and things to be connected Anytime, Anyplace ,with Anything and Anyone ,ideally using any path/network and Any service.

IV. PERFORMANCE ANALYSIS

A. Software Requirements

- Proteus 8.1
- Embedded C
- Arduino complier
- MY-SQL
- PHP.

B. Result

Present paper is designed using ATmega328 microcontroller in the Arduino environment. It is proposed to design an embedded system which is used for IoT applications. After uploading the code into the Arduino the computer window shows the results. The result shows that, it will work well for all kinds of applications and responds immediately to the user's commands.

The signals acquired from the smoke sensor are compared with the user defined set point crossing the threshold limit the pollution level gets displayed in the LCD and when it exceeds the set point it gives a alert message indication following the motor gets off after certain time period. The table below shows the sample of results obtained from the system:

- **System shows the following results:**

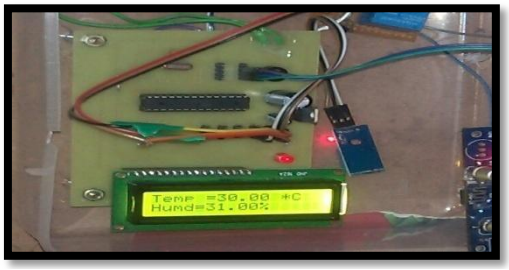

Fig 1.1.7:LCD Displaying temperature and humidity value.

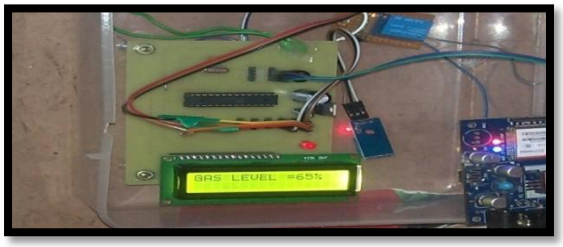

fig 1.1.8: LCD displaying gas level value

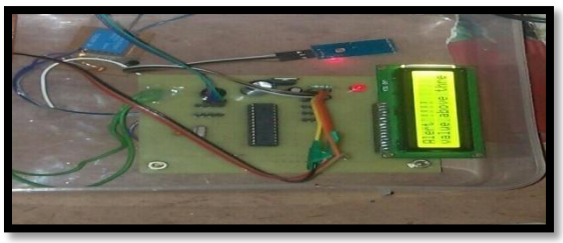

Fig 1.1.9:LCD displaying a alert message

Fg1.1.10: Current vehicle pollution data shows on website

Fig1.1.11: website shows vehicle pollution data

C. CONCLUSION:

An embedded system for air pollution detection has been implemented. Here only carbon monoxide gas has been detected as vehicle's exhaust gases contains maximum 65% of CO gas. The gas sensors and the critical level of the relevant gas should be recognized, and then this system can be implemented for detecting pollution level. This system provides quick response and the dispersal of the critical situation can be made faster than the manual methods.

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