VEHICLE SPEED SENSING AND SMOKE DETECTING SYSTEM

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Automatic monitoring of vehicle has become a very essential scenario in the recent years and it can become possible by implementing the following technology. The beginning of the 21st century was the time when importance for Environmental awareness was instigated. One of the major concerns regarding the environment is air pollution. The main pollutants from the vehicles are the oxides of carbon and nitrogen, which can be easily detected these days with the help of semiconductor gas sensors. The system consists of a global positioning system, an IoT module and a GSM board. The gas sensor detects the gas produced due to over pollution and the micro-controller board determines the proportion and if it is higher than the stated limit as per the Bharat Stage 6 norms, the GPS system sends the co-ordinates to the nearby RTO. The warnings received will be saved and if the warnings exceed more than three times or if the pollution level raises drastically the vehicle automatically provides navigation to a nearby safe zone. The safe zones are detected automatically with the help of IoT and GPS technologies. A vehicle speed monitoring sensor is used and is coupled with the IoT so as to reduce the speed of the vehicle at specific places, say school zones, hospitals, accident prone zones etc,. If this technology is employed the parameter of safety and reduction in pollution levels as well as prevention of accidents can be achieved.

Keywords -Arduino mega 2560, MQ 9 gas sensor, IoT, GSM Technology, GPS module, pollution control, Green city concept.

I INTRODUCTION

A.MOTIVATION FOR THE PROJECT

The beginning of the 21st century was the time when importance for Environmental awareness was instigated. One of the major concerns regarding the environment is air pollution. Air pollution contributes to the green houses gases, which causes the greenhouse effect, whose side effects are now well known to all of us after the findings about the hole in the ozone layer. Air pollution is not only harmful to the environment but, also to all other living beings on earth. Air pollutants that are inhaled have serious impact on human health affecting the lungs and the respiratory system; they are also taken up by the blood and pumped all around the body. These pollutants are also deposited on soil, plants, and in the water, further contributing to human exposure and also affecting the sea life. Vehicles are one of the major contributors to air pollution apart from industries. The main pollutants from vehicles are the oxides of carbon and nitrogen, which can be easily detected these days with the help of semiconductor gas sensors. Therefore, in this paper an idea is suggested, which would be very helpful in reducing the amount of pollution from vehicles.

Over the years, there have been several accidents occurring due to over speed, carelessness in driving, drunk and drive etc in places like school zones etcwhere many people cross roads frequently. Hence some technology has to be implemented to avoid such mishaps from occurring.

B.EXISTING TECHNOLOGY

The main pollutants from the vehicles are the oxides of carbon and sulphur, which can be easily

detected these days with the help of semiconductor gas sensors. The existing system has air pollution detection and indicates the vehicle using GPS, hence as a result the traffic authority can detect the vehicle and seizes. The existing technology provides alarm if the vehicle's emission rates are higher than the trigger limit, which is set up at the time of implementation and if the condition prevails, it automatically stops the vehicle by cutting the supply to the fuel injector and hence the vehicle comes to rest.

C.DEMERITS OF PREVAILING TECHNOLOGY

The previously prevailed technologies in monitoring the vehicle pollution lacked in several factors. They either only monitor and gives alarm signals to the vehicle or they are empowered to stop the vehicle at a certain distance. But both have many problems. If the vehicle is suddenly stopped in a unmanned highways and the person driving the vehicle has a problem say, heart attack and is in a medical emergency, in such situations the system fails to save the people. Hence the system has to be modified a bit and some new features has to be included to make it a success in real time implementation to vehicles.

D.PROPOSED SYSTEM

The overall block diagram of the proposed system is given in figure 1.1. The block diagram mainly consists of the following elements:

Fig 1.1

1. Detector
2. Microcontroller
3. Fuel Control unit
4. Global Positioning System (GPS)
5. Global system for mobile communication(GSM)

The system consists of a GPS positioning system, an IoT module and a GSM board. The gas sensor detects the gas produced due to over pollution and the microprocessor board determines the proportion and if it is higher than the stated limit as per the Bharat Stage 6 norms, the GPS system gets activated and the co-ordinates of the vehicle's location are noted and is transmitted to the nearby traffic control division and a warning signal will be received to the vehicle. The warnings received will be saved and if the warnings exceed more than three times or if the pollution level raises drastically the vehicle automatically provides navigation to a nearby safe zone. The safe zones are detected automatically with the help of IoT technology. In addition a speed monitoring sensor, which measures the engine speed and sends signals to the micro-controller board. Whenever any over populated zone is detected by the GPS and IoT the speed of the vehicle is reduced to the safe limit as prescribed.

E.CONCEPT OF THE PROJECT

Nowadays emission of gases from vehicle has become a major crisis and hence controlling and harnessing of emission is mandatory. Hence by implementing this system, which checks the flue gas outlet of the vehicle for CO emission frequently, and when a vehicle'srate of emission of gases is higher than the mentioned levels as per the Bharat Stage 6 norms, it makes an alarm and hence the over polluting vehicle could be identified easily. Thus pollution rates can be reduced due to vehicle smokes. The speed of the vehicle is monitored by the speed sensor and the speed is automatically reduced as soon as entering the accident prone and densely populated zones.

COMPONENTS AND ITS PROPERTIES

A.CARBON MONOXIDE SENSOR

The detector consists of three sub-blocks namely smoke sensor, transducer and ADC. The smoke sensor is the main component of the detector block which is embedded onto the exhaust of the vehicle. The sensor senses the amount of emission from the vehicle and feeds the data to the microcontroller through the transducer and the analog to digital converter at regular intervals of time. The transducer is used to convert the output of the sensor into an electrical signal. The analog electrical signal is then converted into a digital signal using an ADC, so that, it can be compared with the predefined values, in the microcontroller. In this system, carbon monoxide sensor (MQ-9) which can measure CO concentrations ranging from 10 to 10,000 ppm is considered. This sensor, basically finds usage in sensing carbon monoxide concentrations (ppm), in the exhaust of cars.

2.1.1. MQ9 GAS SENSOR

The MQ 9 Gas sensor is a detector consists of three sub-blocks namely smoke sensor, transducer and ADC is as shown in the Fig.2.1.

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Fig 2.1

2.1.2. TECHNICAL SPECIFICATION

Sensitive material of MQ-9 gas sensor is SnO2, which with lower conductivity in clean air. It make detection by method of cycle high and low temperature, and detect CO when low temperature (heated by 1.5V). The structure of the MQ 9 sensor is shown in the Fig.2.2.

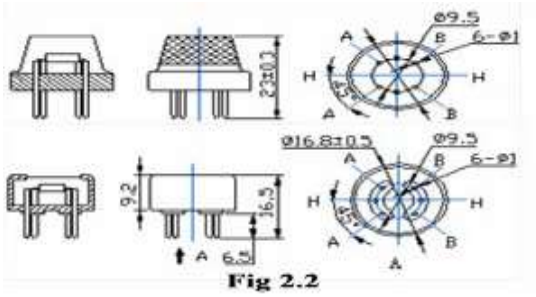
Fig 2.2

The sensor's conductivity is more higher, along with the gas concentration rising. When high temperature (heated by 5.0V), it detects Methane, Propane etc,. Combustible gas and cleans the other gases adsorbed under low temperature. By using simple electro-circuit, we can convert change of conductivity to correspond output signal of gas concentration. MQ-9 gas sensor has high sensitivity to Carbon Monoxide, Methane and LPG. The sensor could be used to detect different gases contains CO and combustible gases, it is with low cost and suitable for different application. The technical specifications are mentioned in the table 2.1.

Table 2.1 Technical specifications of MQ 9 Gas Sensor

Model No.	MQ-9
Sensor Type	Semiconductor
Standard Encapsulation	Bakelite
Detection Gas	CO and

			combustible gas
Concentration			10-1000ppm CO 100-10000ppm combustible gas
Circuit	Loop Voltage	Vc	≤10V DC
	Heater Voltage	VH	5.0V±0.2V ACorDC（High）1.5V±0.1V ACorDC（Low）
	Heater Time	TL	60±1S（High）90±1S（Low）
	Load Resistance	RL	Adjustable
Character	Heater Resistance	RH	31Ω±3Ω（Room Tem.）
	Heater consumption	PH	≤350mW
	Sensing Resistance	Rs	2KΩ-20KΩ(in 100ppm CO)
	Sensitivity	S	Rs(in air)/Rs(100ppm CO)≥5
	Slope	α	≤0.6(R300ppm/R100ppm CO)
Condition	Tem. Humidity		20℃±2℃; 65%±5%RH
	Standard test circuit		Vc:5.0V±0.1V; VH（High）: 5.0V±0.1V ; VH（Low）: 1.5V±0.1V

B.SPEED SENSOR

A vehicle speed sensor (VSS), as shown in the fig 2.3 generates a magnetic pulse in the form of a wave proportional to the speed of the vehicle (i.e,. imagine a vehicle moving at high speed, the VSS will generate a high – frequency signal directly proportional to this). The power control module uses the VSS frequency signal to manipulate multiple electrical subsystems ina vehicle, such as fuel injection, ignition, cruise control operation, torque, and clutch lock up.

Fig 2.3

The sensor used here works on the principle of hall effect. It is located on the differential gear housing and monitors the output speed of the transaxle. The sensor is made up of 12 volt sensor power, five volt signal and signal ground. The hall effect VSS uses a self employed reference voltage. The sensor is made up of an internal transistor activated by the moving (reluctor) wheel during movement of the vehicle.

C.ARDUINO BOARD

Arduino is an open-source platform used for building electronics projects[1]. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. Arduino ATMEGA is a microcontroller board based on the ATmega2560 which is shown in the fig 2.4.

Fig 2.4

An Arduino board consists of an Atmel 8-, 16- or 32-bit AVR microcontroller with complementary components that facilitate programming and incorporation into other circuits. An important aspect of the Arduino is its standard connectors, which lets users connect the CPU board to a variety of interchangeable add-on modules known as shields. Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I²C

serial bus—so many shields can be stacked and used in parallel. Official Arduino's have used the mega AVR series of chips, specifically the ATmega8, ATmega168, ATmega328, ATmega328-P, ATmega1280, and ATmega2560. A handful of other processors have been used by Arduino compatibles. Most boards include a 5 volt linear regulator and a 16 MHz crystal oscillator (or ceramic resonator in some variants), although some designs such as the LilyPad run at 8 MHz and dispense with the on-board voltage regulator due to specific form-factor restrictions. This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer[2]. Currently, optiboot boot loader is the default boot loader installed on Arduino ATMEGA.

2.2.1 SPECIFICATIONS

The technical specifications of the Arduino ATmega and other related specifications are described on the table 2.2.

Table 2.2 Technical specifications of Arduino Mega 2560

Microcontroller	ATmega2560
Operating Voltage	5 V
Input Voltage (recommended)	7 – 12 V
Input Voltage (limits)	6 – 20 V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	16 mA
DC Current for 3.3 V Pin	50 mA
Flash Memory	256 KB (ATmega2560) of which 8 KB used by boot loader
SRAM	8 KB (ATmega2560)
EEPROM	4 KB (ATmega2560)
Clock Speed	16 MHz
Length	101.52mm
Width	53.3mm
Weight	37g

A.GSM BOARD

GSM is an international standard for mobile telephones. It is an acronym that stands for Global System for Mobile Communications, shown in the Fig.2.5. It is also sometimes referred to as 2G, as it is a second-generation cellular network.

To use GPRS for internet access, and for the Arduino to request or serve webpages, you need to obtain the Access Point Name (APN) and a username/password from the network operator. See the information in Connecting to the Internet for more information about using the data capabilities of the shield.

Among other things, GSM supports outgoing and incoming voice calls, Simple Message System (SMS or text messaging), and data communication (via GPRS).

The Arduino GSM shield is a GSM modem. From the mobile operator perspective, the Arduino GSM shield looks just like a mobile phone. From the Arduino perspective, the Arduino GSM shield looks just like a modem.

B.INTERNET OF THINGS

The internet of things (IoT), shown in the Fig.2.6 is the internetworking of physical devices, vehicles, buildings and other items like embedded with sensors, actuators, electronics, software and network connectivity that enable these objects to collect and exchange data.

Fig 2.6

The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. As per a recent survey and study done by Pew Research Internet Project, more than 30 billion devices will be wirelessly connected to the internet of things by 2020. As such, it is clear that the IoT will consist of a very large number of devices being connected to the Internet. The ability to network embedded devices with limited CPU, memory and power resources means that IoT finds applications in nearly every field. Such systems could be in charge of collecting information in settings ranging from natural ecosystems to buildings and factories, thereby finding applications in fields of environmental sensing and urban planning.

C.GPS BOARD

A GPS navigation device or GPS receiver, as shown in the Fig.2.7, when used for vehicle navigation commonly referred to simply as a GPS, is a device that is capable of receiving information from GPS satellites and then to accurately calculate its geographical location.

Fig 2.7

A GPS device can retrieve from the GPS system location and time information in all weather conditions, anywhere on or near the Earth. A GPS reception requires an unobstructed line of sight to four or more GPS satellites, and is subject to poor satellite signal conditions. In exceptionally poor signal conditions, for example in urban areas, satellite signals may exhibit multipath propagation where signals skip off structures, or are weakened by meteorological conditions. Obstructed lines of sight may arise from a tree canopy or inside a structure, such as in a building, garage or tunnel. Today, most standalone GPS receivers are used in automobiles. The GPS capability of smartphones may use assisted GPS (A-GPS) technology, which can use the base station or cell towers to provide the device location tracking capability, especially when GPS signals are poor or unavailable. However, even A-GPS would not be available when the smartphone is outside the range of the mobile reception network.

III WORKING

When the vehicle's engine is ignited, the MQ-9 CO gas sensor and Microcontroller system are activated. The microcontroller is programmed to do three functions namely comparison, timer and triggering circuit. The microcontroller takes in two inputs; one from the smoke sensor's output and another being the pre-defined threshold value specified by the government as per the Bharat Stage 6 norms. When the smoke sensor output is more than the threshold value, the microcontroller triggers the timer circuit, IoT and GPS modules and an alarm is set off to inform the driver that his vehicle has some pollution related issues and also indicate that the vehicle will come to a halt as soon as the IoT detects a safe zone. Apart from the timer being triggered, a trigger is also given to the GPS, which helps in locating the nearest service station. Once the timer runs out, a trigger pulse is generated by the microcontroller which is fed to the engine control module of the vehicle, so as to control the fuel injector, which in turn reduces the flow of fuel to the engine, as a result of which, the speed of the vehicle is lowered down. The main function of the fuel

injector is to minimize the supply of fuel to the engine, when the pollution limit is breached.

When the pollution level reaches the maximum limit, a trigger pulse is given to GPS by the microcontroller. The GPS transmitting system is programmed in such a way that, when it receives a trigger pulse, it shows the nearest service stations where the vehicle can be taken for maintenance.

The MQ-9 gas sensor will calculate the smoke emission values. The emission values are compared with the pre-defined values. Alert message will be displayed and alarmed that the vehicle will stop as soon as reaching a safe zone. If vehicle is stopped by itself then the fuel control unit turns off the fuel inlet to the engine. If the vehicle does not stop in the safe zone, fuel control unit off the fuel inlet to the engine. GPS coordinates are tracked and SMS will be sent to the nearby RTO and owner of the vehicle.

GSM module will send the SMS to the RTO when the smoke value excides the pre-defined value. This SMS is an alerting message for the RTO to control the pollution.

The speed of the vehicle is monitored by the speed sensor and the speed is automatically reduced as soon as entering the accident prone and densely populated zones. Whenever any over populated zone is detected by the GPS and IoT the speed of the vehicle is reduced to the safe limit as prescribed by the government.

The previous technologies had a major drawback that if the vehicle's emission rate raises, it will stop at a certain distance and has to be towed to the nearby service station[3]. But this technology overcomes those demerits by intimating the nearby RTO by sending a message with the details of the vehicle, stating that the vehicle is over polluting and has to be monitored, which is possible with the help of the GSM board.

IV MERITS AND DEMERITS IN IMPLEMENTING THE VEHICLE AUTOMATION TECHNOLOGY

A. **MERITS**

- Reliable and cost efficient.
- The vehicle automation technology provides easy way to control global warming, due to usage of vehicles.
- High levels of safety regarding the pollution abadement due to over usage of the vehicle is ensured.

B. **DEMERITS:**

- Accuracy in controlling the vehicle depends mainly on signal strength.
- The sensor may occasionally fail and hence faulty signals could be sent to the microcontroller board.

Thus by implementing this technology, we can detect the over polluting vehicles easily at the toll booths and pollution levels due to vehicles can be reduced. It has the immense potential to detect the over polluting vehicles at a rate comparably faster than any other. As it is an automized technology, it doesn't require any manpower to work and the accuracy rates are high.

Our present scenario is a situation where global warming is occurring very rapidly due to industrialization and over usage of vehicles and as a result the ozone layer, which is a protective shield from the harmful ultra-violet rays has been depleted. Hence it is mandatory to reduce the emission which causes global warming. The main motive of this project is to detect the over polluting vehicles at a rate faster than any other.

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