AUTOMATED CONTROL SYSTEM FOR AIR POLLUTION DETECTION IN VEHICLES

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Abstract- Vehicles have become an integral part of everyone's life. As we know that a coin has two sides that have their own effects, one of the main side effects is air pollution. Every vehicle is having emission but the problem occurs when it is beyond the standardized level. This emission from vehicles cannot be completely avoided but, it definitely controlled. Now a day accidents is a common feature of deaths. The common feature of accidents will be rash driving, drunk and driving, due to minor drivers etc. Rash driving is a nature of driver which causes panic in the traffic and finally leads to accidents. These are critical things to control so we aim to develop a system that reduce rash driving. As a solution to the above problems we aim to build an automated control system for air pollution detection and rash driving prevention in vehicles. This emission of hazards gases can be control by the evolvement of semi-conductor sensor system. Sensors in the system detect the level of pollution gases along with level of ethanol in driver's breath & indicate it on the display. If the pollution level goes beyond the threshold level the microcontroller alerts the buzzer and displays pollution level on LCD. At the same time, microcontroller activates the timer that indicates vehicle will be stopped after predefined time if appropriate action is not taken by driver. When timer run-out, the vehicle will be get stop due to the fuel supply to engine get stop. For that a relay circuit is used. The GSM sends the alert SMS at registered mobile number with vehicle current location using GPS in the latitude & longitude values.

KEYWORDS: Semiconductor Sensors, Microcontroller (LPC2148) board, GSM & GPS Modules, LED'S, and LCD Display etc.

I. INTRODUCTION

Now a day's air pollution is the biggest problem to manage due to heavy increase in number of vehicles. Vehicles are the primary source of the air pollution the emission from vehicle will produce polluted air having serious impact on human health affecting the respiratory system and lungs. Similarly air pollutants contribute to environmental issues such as, green house gases, which affect the ozone layer. The main pollutants from vehicles are different oxides of carbon and nitrogen, which can be detected with the help of semiconductor gas sensors. Therefore, in this paper we proposed a system that useful in reducing the amount of pollution from vehicles. The proposed automated control system uses CO sensor & smoke sensor to measure the percentage of pollutants like carbon, nitrogen, hydrogen, & different oxides. These sensors are fixed at the end of exhaust of vehicle from where smoke is released into the environment. The CO sensor & smoke sensor detects the percentage of pollutant gases and gives it to microcontroller to check the maximum percentage of pollutants content in smoke released by vehicles. So the controller checks the percentage of different pollutants and if it is more than the threshold level which is already predefined the microcontroller triggers the buzzer to inform driver the percentage of pollutant is excides then the threshold. At the same time microcontroller trigger the timer circuit when the timer run out the fuel supply to engine cut off & vehicle comes to halt. The GSM will trigger sends the notification SMS along with vehicle location where it is stop. The same system implementation is used for rash driving prevention. Now a day's rash driving is common feature of accidents these are critical things to control for this alcohol sensor is used it measures the ethanol contain in driver breath. If it is more than threshold the microcontroller triggers buzzer also GSM module sends the SMS with vehicle Number.

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percentage of pollutants content in smoke released by vehicles. So the controller checks the percentage of different pollutants and if it is more than the threshold level which is already predefined the microcontroller triggers the buzzer to inform driver the percentage of pollutant is excides then the threshold. At the same time microcontroller trigger the timer circuit when the timer run out the fuel supply to engine cut off & vehicle comes to halt. The GSM will trigger sends the notification SMS along with vehicle location where it is stop. The same system implementation is used for rash driving prevention. Now a day's rash driving is common feature of accidents these are critical things to control for this alcohol sensor is used it measures the ethanol contain in driver breath. If it is As advancements in technology continue, new possibilities that increase people's safety are being developed. These advancements range from robotic surgeons to automated factories and can be distributed in environments that are typically hostile to humans. Oil and gas facilities are often located in hostile environments. Whether it is the frigid cold of the frozen north, the extreme heat of the Middle East, or the isolation of an ocean, each location provides its own unique risks. The oil and gas infrastructure consists of four major components: extraction, refinement, distribution, and transportation in between each component. Each stage presents its own unique risks, from drilling practices during extraction, volatile explosions at refineries, to contamination during transportation and distribution. This work aims at reducing risk of human operators at the oil and gas refinement level. More specifically, this work considers oil and gas refineries in Abu Dhabi, United Arab Emirates (UAE), which is among one of the biggest oil and gas industries in the world. Hazards are numerous when it comes to oil and gas refineries in Middle East. Temperatures exceed 50o C for the majority of the summer, which combines with the high humidity of the region. Workers who are exposed often fall victim to heat stroke and related injuries. Sandstorms also ravage the area, reducing visibility to meters, and result in the erosion of equipment. Gas and steam leaks that are invisible to human senses can be fatal if humans are exposed. These leaks can also result in fire or even in an explosion of high-pressure vessels, leading to catastrophic failure. While there exists technology to monitor such environments, these devices are prone to failure. If a refinery is forced to shut down to address a failure, the effects on revenue are substantial. Even if a refinery is forced to shut down for a day, millions of dollars are lost in revenue. To avoid these significant losses, routine inspection is performed on a daily basis.The rapid development and wide application of environmental informatics has significantly improved environmental monitoring, management efficiency, and effectiveness. However, both the DSSs and enterprise information systems (EISs) (or IEISs) were implemented to help locate and analyze environmental problems rather than to solve any environmental problems in reality. In the last decade, the Internet of Things (IoT), a concept describing how the Internet extends into people's everyday lives through a wireless network of uniquely identifiable objects [1], is predicted to be able to promote the entire process of environmental monitoring, modeling, and management, as well as to support sustainable decision-making. This paper focuses on the IoT application in the new generation of environmental informatics, and provides a new paradigm for environmental monitoring and management in the future.

II. RELATED WORK

Integrated environmental monitoring and management based on IoT is an enduring and active topic, not only for the scientists and engineers, but also for the public and the administrators, and it covers broad issues and involves many technologies in the computer and information sciences. In this section, existing environmental monitoring and management issues are discussed with a focus on environmental informatics, corresponding EISs [2], and integrated information systems (IIS), as well as IoT, are also reviewed to clarify the essence of this work.
The proposed diagram is shown in Fig 1

Fig 1. Proposed Block diagram

The smoke detector detects carbon and gives it to the Microcontroller to check the maximum percentage of carbon content in the smoke released by vehicles. Temperature sensor can be used to sense the temperature in the vehicle. So the controller checks the percentage of carbon and temperature, if it exceeds the threshold level the system gets triggered and the engine comes to hault state and then it sends SMS about this to the nearby pollution control office through GSM.

The government of India made several regulations to control the pollution levels from vehicles. The Central Pollution Control Board under the Ministry of Environment & Forests set standards and timeline for implementation to

control emission level. The duty of this board is air quality monitoring. The government of India created the Bharat Stage Emission Standards for air pollution control from motor vehicles. Bharat stage emission standards are emission standards that used to regulate the output of air pollutants from internal combustion engine equipment, including motor vehicles. Several emission norms were come to control the emission levels from vehicles since last two decades. There are many people who research on the air pollution detection in vehicles. In 2002, the authors K. Galatsis,W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi, has chosen the commercially available gas sensors for the toxic gases detection which are compared with the fabricated MOO3-TiO2 and MOO3- WO3 thin films [1]. In 2010, George F. Fine, Leon M. Cavanagh, Ayo Afonja and Russell Binions said that the metal oxide semiconductor gas sensors that are utilized in variety of different roles in industries. [2]. these are relatively inexpensive compared to other sensing technologies, robust, lightweight, long lasting and quick response times. In 2012, Siva Shankar Chandrasekaran, Sudharshan Muthukumar and Sabeshkumar Rajendran described an embedded system for vehicle cabin toxic Gas detection and Alerting. The system is developed using GSM and GPS modules for detecting pollutant gases with vehicle location [3]. In 2013 Anitha Kulkarni, T. Ravi Teja developed an automated control system for air pollution detection for vehicles. In this system a relay circuit is used for the control of ON and OFF position of the fuel pump. GSM and GPS system are used for sending data and locating nearest work station for vehicle servicing [4]. Road accidents claim a staggeringly high number of lives every year. From drunk driving, rash driving over speeding and over-crowding of vehicles, in majority of road accidents According to the report on “Road Accidents in India, 2011” by the Ministry of Transport and Highways, Government of India, approximately every 11th person out of 100,000 died in a road accident and further, every 37th person was injured in one. This situation makes it a necessity to target the root cause of road accidents in order to avoid them. “Road Accident Prevention Unit” is a step design to monitors the driver's state using multiple sensors and looks for triggers that can cause accidents, such as alcohol in the driver's breath and driver fatigue or distraction. When an alert situation is occurred, the system informs the driver and tries to alert him.

III. PROPOSED WORK

The overall block diagram of system is mainly consists of following blocks shown in fig.1 here microcontroller LPC2148 is the main heart of the system followed by CO sensor, Smoke sensor, Alcohol sensor, GSM, LCD, Buzzer, power supply unit etc.

A. ARM7 Controller

The LPC2148 microcontrollers are based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/2/4/6/8 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

• 8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory.128 bit wide interface/accelerator enables high speed 60 MHz operation.

• In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms.

• Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high speed tracing of instruction execution.

• USB 2.0 Full Speed compliant Device Controller with 2 kB of endpoint RAM. In addition, the LPC2146/8 provides 8 kB of on-chip RAM accessible to USB by DMA.

• One or two (LPC2141/2 vs. LPC2144/6/8) 10-bit A/D converters provide a total of 6/14 analog inputs, with conversion times as low as 2.44 µs per channel.

• Single 10-bit D/A converter provide variable analog output.

• Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.

• Low power real-time clock with independent power and dedicated 32 kHz clock input.

Fig 2. ARM 7 controller

• Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities.
• Vectored interrupt controller with configurable priorities and vector addresses.
• Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
• Up to nine edge or level sensitive external interrupt pins available.
• 60 MHz maximum CPU clock available from programmable on-chip PLL with settling time of 100 µs.
• On-chip integrated oscillator operates with an external crystal in range from 1 MHz to 30 MHz and with an external oscillator up to 50 MHz
• Power saving modes include Idle and Power-down.
• Individual enable/disable of peripheral functions as well as peripheral clock scaling for Additional power optimization.
• Processor wake-up from Power-down mode via external interrupt, USB, Brown-Out Detect (BOD) or Real-Time Clock (RTC).

B. CO2 Sensor

- ✓ High sensitivity to LPG, natural gas , town gas
- ✓ Small sensitivity to alcohol, smoke.
- ✓ Fast response .
- ✓ Stable and long life
- ✓ Simple drive circuit

They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, natural gas, town gas, avoid the noise of alcohol and cooking fumes and cigarette smoke.

C Alcohol Sensor (MQ-3):

Alcohol detector is also called as MQ3 sensor which is made up off SnO2. The MQ-3 gas sensor is used to detect alcohol percentage with different concentration. Initially conductivity of sensor is low. As the alcohol gas rises, the concentration of sensor also increase.MQ3 is highly sensitive to the alcohol and has good resistance to disturb of gasoline smoke and vapor. It is with low cost and suitable for different applications.3

Figure 3: Alcohol Sensor

D. Fuel Injection Control:

The main function of the fuel injector is to cut the supply of fuel to the engine, when sensors values are more than threshold values. A relay circuit is used to control the ON/OFF position of the fuel pump. Here microcontroller is programmed in such way that when microcontroller sends a trigger pulse after the timer runs out relay should get back to its original position. Which cutoffs fuel supply to engine.

IV. RESULT ANALYSIS

The developed system is mainly used for controlling the air pollution from motor vehicles along with rash driving prevention when the values of sensors reach its maximum threshold value. The implementation of the developed system is shown in fig.5 and the working of the system is explained below.

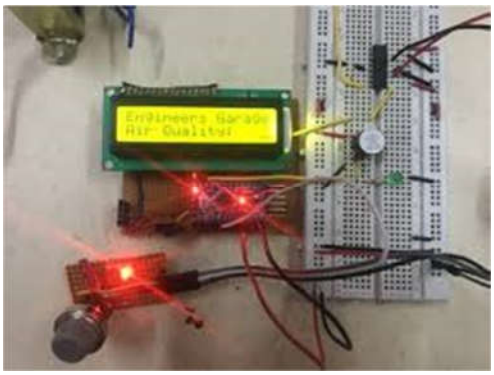

Figure 4: output

The working starts with the sensing of the sensor in this system there are three sensors which are MQ2 and MQ3. They sense carbon monoxide, methane, hydrogen, butane & alcohol (ethanol) respectively. They give analog output as per the concentration of gas present near by the environment and gives analog output to microcontroller. The microcontroller takes the analog input and converts it into digital output using ADC. After this microcontroller gives command to the liquid crystal display to print the values of sensors on it.

And there is a limit specified in the program of these sensors of its concentration (standard values). If the limit of concentration of these sensors is under the specified standard values then it consider the normal condition & under this condition the vehicle is normally running indicating with ON of green LED light. If the limit of concentration of these sensors crosses the specified standard values then a buzzer sounds at the same time yellow LED light will ON indicating that level of pollution is increase. The command to buzzer is given by the microcontroller. After pre-defined time interval the vehicle comes to halt if appropriate action is not taken, indicating with ON of red LED light. Simultaneously microcontroller gives command to the GSM which is used to inform the alert text message along with vehicle location in terms of latitudinal and longitudinal values to owner of the vehicle. By this the owner gets a message on his mobile and he has to take appropriate action. Thus in this way system can maintain less pollution, avoiding road accidents and keep our surrounding safe. The above figure shows the schematic of notification messages. The owner of vehicle with registered mobile number will get alert SMS along with vehicle location in latitude & longitude format when the sensors values more than the threshold values.

V. CONCLUSION

There is an increase in the level of air pollution over last couple of decades, leading to several environmental problems. Which are resulted in Ozone layer depletion leading to green house effect. Air pollution also affects the human health causing the lungs and respiratory system problems. So, the developed system will be highly beneficial in curbing this problem. The second thing is the rash driving prevention, as we know rash driving is the main reason of accident. So the system will more helpful to provide more public safety. The system helps to keep the environment free from vehicular emission. Also this system is just add-on, it does not need to change configuration of engine, will makes easier to employ this system in existing vehicles.

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