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Real-Time Monitoring of CO Emission in Vehicle Using Cognitive IoT with Temperature and Alcohol Detector

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ABSTRACT

Today we are facing the greatest environmental problem of air pollution in the world is global warming caused by the emission of greenhouse gases. Carbon dioxide, which is an important constituent of the environment is causing a warming effect on the earth's surface. Environment to save by us by continuous monitoring and controlling these changes is a big challenge nowadays. Terms for controlling CO emission at their source is a more and a long-range desirable and effective method through preventive and control technology. The main objective of this paper is to implement IoT to measure the CO emission from public transport, industries, and forest fires using Raspberry pi which is sensitive to CO. The amount of Carbon dioxide emitted is sensed continuously in a city and also finding the area which is polluted the most. Also, implement a smart system for early detection of forest fires or wildfires. Wildfires, are uncontrolled fires occurring in wild areas and cause significant damage to natural and human resources and the wildfires emit more CO gas than assumed in state climate target. These are then integrated into the IoT which is more securable and many services can be used along with it. This would enable a Simple Notification Service (SNS) to the mobile phone if the particular area is causing a higher level of CO.

1. INTRODUCTION

The life and health of all living beings are correlated with the prevailing climatic conditions. Carbon dioxide can stay in the atmosphere for nearly a century, so the earth will continue to warm in the coming decades. The survey of CO emissions from vehicles in India reveals that major vehicle contributors to CO are cars, taxis, and MUVs. The proposed design is hence based on cars and taxis. We can reduce risks by continuous monitoring of CO emissions. The new concept of the Cognitive Internet of Things (CIOT) brings an opportunity for the creation of Innovative applications.

The new concept of the Cognitive Internet of Things (CIOT) brings an opportunity for the creation of innovative applications that integrate

the all too familiar traditional digital technologies. The CIOT is about interfacing these autonomous devices to communicate without human intervention and generate integrated data. Intelligence is then required to process this integrated data and make it available to humans for decision-making. [4] This concept of CIOT has been applied to monitor greenhouse gases released by vehicles. CO2 sensors are available but no system is available for real-time monitoring and thus controlling the CO2 emission levels with the help of the control center. The amount of CO2 emissions has to be reduced by having a check on the transport system or industries with the help of governing bodies. The proposed model helps in real-time monitoring of CO2 emissions. The decision-making can happen at the central server at the environment board or the Pollution control board. CO2 can be controlled and thus helps in reducing global warming

2. RELATED WORK

In this section, three existing systems will be analyzed and compared to find more suitable solutions to be adopted into the project to solve the problems. Car Indoor Gas Detection System is a low-cost Arduino-based carbon monoxide detection and alarm system that can be installed in a vehicle easily [7]. The system can measure the level of carbon monoxide in a vehicle cabin using two MQ-7 gas sensors [8]and an Arduino Mega 2560[9]. An Android app is connected to the Arduino via Bluetooth connection. The system will activate the buzzer alarm and blink the LED and show the warning message in the Android app to alert the user when there is a leak of carbon monoxide inside the vehicle. If the user does not respond to the alarm for 10 s, the system will send a warning text message to emergency contacts with the geographic coordinate of the vehicle, which is detected using the smartphone GPS [10]. Embedded System for Vehicle Cabin Toxic Gas Detection and Alerting is designed to detect the level of carbon monoxide and oxygen in the vehicle cabin by using an Atmel 89c51 microcontroller, carbon monoxide sensor, and oxygen sensor [11]. The level of the carbon monoxide and oxygen in the vehicle is read every second and is displayed on the LCD screen. The audible alarm circuit is designed to alert the user when the level of carbon monoxide reaches 30 PPM and the level of oxygen is below 19.5 %. The system can send a warning text message to the authorized user via the GSM module and provide ventilation automatically when the toxic gas reaches the maximum threshold level [12]-[13]. An Intelligent Green Gas Detector model is designed to monitor the emission of carbon dioxide and carbon monoxide in vehicles in real-time using the Cognitive Internet of Things (CIOT) [14-16]. The CIOT has been used to interface the devices to communicate without human intervention and generate integrated data that will be processed by intelligence for decision-making. The system uses Raspberry Pi, MQ7 gas sensor, MQ135 gas sensor, MySQL server, and PHPMyAdmin. The system consists of two modules, which are the owner module and the central board module.

3. MATERIAL AND METHODOLOGY

A. Components Used

Alcohol Detection of Drunk Drivers: These days majority of road accidents are caused by drunk driving. Drunk Drivers are in unstable conditions and so, rash decisions are made on the highway which endangers the lives of road users, the driver inclusive. The enormity of this menace transcends race or boundary. However, effective monitoring of drunken drivers is a challenge to the policeman and road safety officers. There is therefore the need for an automatic alcohol detection system that can function without the restriction of space and time. This prototype system integrates the following hardware components in the design. An LCD, the MQ-3 alcohol sensor, and two LEDs are integrated into the micro-controller. The Circuit board is interfaced with the MQ-3 alcohol sensor module, GSM, LCD, and DC motor. The LCD acts as the display while the DC motor was employed as a model for specifying the ability of the mechanism to lock the engine every time alcohol is sensed.

CO Sensor: A carbon dioxide sensor or CO sensor is an instrument for the measurement of carbon dioxide gas. The most common principles for CO sensors are Infrared gas sensors (NDIR)and chemical gas sensors. Chemical CO gas sensors with sensitive layers based on polymer or hetero poly silicone have the principle advantage of very low energy consumption, and they can be reduced in size to fit into micro-electronic-based systems. Here we are using MQ- 135 sensors for monitoring CO gas.

Figure 1: MQ-135 gas sensor

The CIOT is about interfacing these autonomous devices to communicate without human intervention and generate integrated data. Intelligence is then required to process this integrated data and make it available to humans for decision-making. This concept of CIOT has been applied to monitor greenhouse gases released by vehicles. The proposed model helps in real-time monitoring of CO emissions. CO can be controlled and thus helps in reducing global warming.

Alcohol Sensor: An alcohol sensor detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The sensor can activate at a temperature ranging from -10 deg to 50 deg with a power supply is less than 150 Ma to 5 V. The sensing range is from 0.04mg/L to 4mg/L, which is suitable for breath analyzer.

Figure 2: MQ-3 Alcohol sensor

Temperature Sensor: A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record monitor or signal temperature changes. There are different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors).

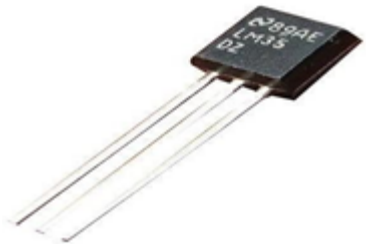

Figure 3: LM35 Temperature Sensor

Micro-controller: It is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash Programmable and Erasable Read-Only Memory (ROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the MCS-51. Instruction set and pinout. The chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. Combining a versatile 8-bit CPU with Flash on a monolithic chip, it provides a highly flexible and cost-effective solution so many embedded control applications.

GSM Modem: GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. Here we are using it only for transmitting and receiving the messages. GSM wireless data module is used for remote wireless applications, machine to machine or user to the machine, and remote data communications in many applications. micro-controller sends AT commands to GSM modem and accordingly it operates.

Relay: Mechanical Relays are used to interface the micro-controller with high power devices such as motors. These relays and motors are used to open and close the valve of the motor.

Motor Driver: L293D is a dual H-Bridge motor driver integrated service (IC). Motor drivers act as current amplifiers since they take a low current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

ADC: A/D converter is that it can continuously follow the input signal and give updated digital output data if the signal does not change too rapidly. In addition, for small input changes, the conversion can be quite fast.

Power Supply: Initial stage of every electronic circuit is a power supply system that provides the required power to drive the whole system. The specification of the power supply depends on the power requirement and this requirement is determined by its rating. For our project were quire +5 volt.

B. Working Methodology

• All the three sensors CO sensor, Alcohol Sensor, and Temperature Sensor interfaced with the micro-controller.

• CO sensors sense the amount of CO coming from the exhaust of the vehicle.

• Alcohol sensor senses the amount of alcohol and alerts the driver of the vehicle accordingly.

• Temperature sensor senses the temperature of the Engine and displays it on LCD.

• The processor used is a micro-controller. Here sensor could be connected with the help of wires.

• The program coding is loaded into a microcontroller to read the sensor values. Some configuration should be established to enable the interface, relay, etc. The data would be obtained from a micro-controller to analyze the value for each sensor.

• If the value exceeds the limit value, then the alert notification will be sent to the owner of the vehicle.

• is an indirect measure of the temperature of an object (non-contact temperature sensors).

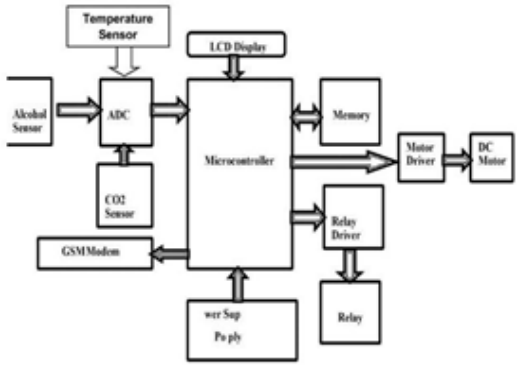

Figure 4: Block Diagram of setup

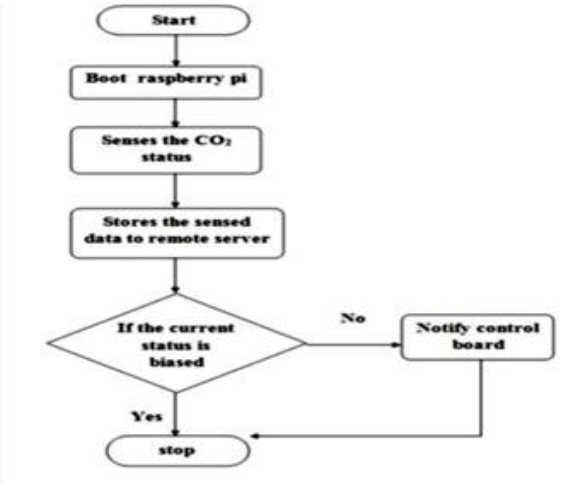

Figure 5: Flow chart of CO Sensor

The system comprises three main steps. The first is to boot up the system, next is the measuring state, this stage measures the amount of CO gas from the exhaust. A prescribed set limit will be given as input to the micro-controller, once the CO gas exceeds the safe limit it will notify the owner of the vehicle.

Step 1: Start the device. Step 2: Boot micro-controller Step 3: Senses the CO gas

Step 4: Stores the sensed data into a micro-controller database

Step 5: If CO is above the limit value

Step 5.1: Notify Vehicle Owner

Step 6: Else

Step 7: It is ok

Step 8: Go to step 1

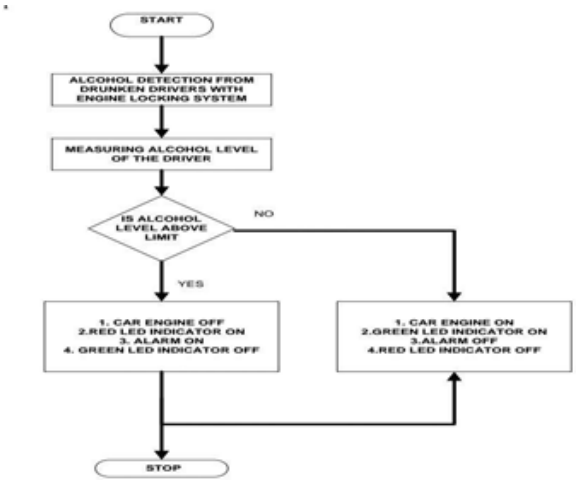

Figure 6: Flow Chart of Alcohol Sensor

The system comprises three main steps. First to boot up the system, next is the measuring state, this stage measures the amount of alcohol level from the drivers. A prescribed set limit will be given as input to the micro-controller, once the alcohol level exceeds the limit the car will not start.

Step 1: Power on the system.

Step 2: Checks for alcohol concentration.

Step 3: If alcohol is detected

Step 3.1: Turn off the car engine

Step 4: Else

Step 5: Car engine running

Step 6: Go to step 1

C. Working on CO Sensor

When the CO sensor is kept in the exhaust to detect the CO and sense the level of CO in terms of PPM, the amplifier will amplify the signal from the CO sensor and will send this to ADC. CO value will be in analog input. This analog input value will go

into the ADC and this value will get converted into a digital value by ADC. Then this value will go into the micro-controller and also the value will be shown on the LCD display. The LED light will glow when this process is taking place. The Program Interface which is installed in the micro-controller will read the value and check if it is within the specified value or not, that is 600 ppm. If the value exceeds 600ppm then the PI sends a notification to the registered mobile number of the owners of a vehicle. This notification is like a warning message given to the owner, so that owner can rectify the vehicle's condition and do maintenance on the vehicle.

C. Working of Alcohol Sensor

The Alcohol sensor is fitted in the front of the driver's seat near the steering wheel to detect and sense the alcohol amount drunk by the driver. This sensed value of alcohol will be analog. This analog input value will go into the ADC for converting from Analog to Digital by ADC. The amplifier will amplify the sensed value and then it will go into the ADC. The digital output value will then be displayed on the LCD and it goes to the micro-controller where the PI compares the alcohol amount with the safe limit value. The LED is on during the process. The program checks whether the value is within the safe limit or not. If the value is below the limit value, then there will be no alert to the driver, but if the value exceeds the safe limit value, then the buzzer will be on and will alert the driver for drink and drive. The safe limit value we are talking about is 0.05 mg/L to 10mg/L of alcohol.

4. RESULT ANALYSIS

A. Testing and observation of Alcohol sensors

We took the readings from different deodorants praying on the Sensor. The values came out to be

Table 1: Reading of Alcohol Sensor

Sr. No	Alcohol Contents (mg/L)
1	0.42
2	0.36
3	0.34

B. Testing and Observation of Temperature Sensor

We used a hot soldering rod for sensing the temperature. The room temperature is found to be

Table 6.3 Readings of Temperature Sensor

Sr. no.	Time Gap (Min)	Temperature Value (0C)
1	5	60.1
2	5	56.7
3	5	45.3

- The CO sensor MQ-135 detects the CO gas correctly and the average value of CO from our observation is found to be 571.33ppm.
- The Alcohol sensor MQ3 detects the Alcohol amount correctly and the average value of Alcohol is found to be 0.37 mg/L.
- The temperature sensor LM35 detects the temperature correctly and the average temperature value is found to be54^0C.

CONCLUSION

Pollution check has to be done every 6months and hardly people get it done. Our model has to be installed one time and goes on for 10 years. Also, the model adheres to real-time monitoring of CO which can reduce greenhouse gas as compared to the existing system in the environment of pollution check. This product can cut down and control the emission considerably. The temperature sensor, humidity sensor, and carbon sensor sense the temperature, humidity, and CO level respectively between the given interval of time. The sensed data are passed to the raspberry pi connect along with sensors. The Raspberry pi is well programmed using python in order to send the information to a secure server with connection protocol IPV6. The remote server collects all the information and stores it in the corresponding tables in the predefined database. Users are able to check the history and current Atmospheric status stored in the database.

By applying an alcohol sensor, it will detect the alcohol percentage of the human beings and if it crossed the threshold value the dc motor will stop working. By fitting this alcohol sensor into the car, we can save the life of the driver and also the remaining passengers. We proposed a Procedure to sense the presence of alcohol from the breath of drivers and curtail the catastrophic effects it can have on peoples' lives. The system was designed and implemented successfully via the use of a micro-controller and MQ-3 sensor. An experimental evaluation of the system showed that the alcohol sensor was able to deliver a fast response when alcohol is detected. Temperature sensors will help to know the temperature of the

engine through which the burning of oil film gases and the damage to components of the engine can be avoided.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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