Air Suffocation Prevention Inside A Car Cabin

S.Shankar, V.G.Pratheep, G.Pranesh, P.Umesh, V.M.Vignesh

Abstract: Mostly individuals or people inside a car switch on the air conditioner (AC) to refresh or for resting when they felt tired. Few will use for sleeping when the engine is idle, tragically after a certain period of time the oxygen substance present interior the car will gets diminished. After that they will be persistently breathing the carbon dioxide which would be breathed out by them. So, after a certain time, since the car could be a constrained space settlement it will raise the chance of reduction in oxygen supply that's required to breathe or it will lead to suffocation and eventually passing, mostly lead to death. A solution is given to this issue with the assistance of an MQ 135 sensor that can be introduced interior to the car which can sense the sum of poisonous substance in the car regularly. If the carbon dioxide (CO_2) level within the car isn't up to the set point (i.e. underneath the required level), it will take the control activity by sending a flag to the controller. Based on the flag the controller gives control activity to the D.C. engine that's coupled with rack and pinion which is commonly utilized in opening and closing of the windows in automobiles. When the poisonous level within the car is disposed of at that point the engine will invert its direction (i.e. window will be closed). By this means, the gas level within the car will be monitored and it will be made to preserve the required level of oxygen by the implies of this whole setup/system.

Keywords: Power Window; MQ-135 Sensor; Rack and Pinion operation; Arduino Module; Relay Module; CO_2 Measurement.

1. INTRODUCTION

Normally poor air quality inside the car leads to several issues for the passengers (Szczurek, and Maciejewska 2015). A limited data is available about in-cabin air quality in air-conditioned private vehicles, and the car usage that may affect the air quality. Fifty-one vehicles were tested for particulate matter(PM0.3 and PM2.5), total volatile organic compounds (TVOCs), carbon monoxide (CO), carbon dioxide(CO_2), airborne bacteria, and fungi levels during their routine travel journey (Galatsis et al. 2000). Ten of these vehicles were further examined for PM0.3, PM2.5, TVOCs, CO, and CO_2 during engine idling. In general, during driving PM2.5 levels in-cabin reduced overtime, but not PM0.3. For TVOCs, 24% vehicles exceeded the recommended Indoor Air Quality (IAQ) level in offices and public places set by the Hong Kong Environmental Protection Department (Cha, 2018). The total volatile organic compounds (TVOC)concentration positively correlated with the age of the vehicle. Carbon monoxide (CO) levels in all of the vehicles were lower than the IAQ recommendation, while 96% vehicles exceeded the recommended CO_2 level of 1000 ppmv; 16% vehicles >5000 ppmv. Microbial counts were relatively low (Müller et al. 2011). TVOCs levels at idle engine were higher than that during driving. Although the time we spending vehicles is short, the potential exposure to high levels of pollutants should not be overlooked. Apart from this exposure to traffic-related particulate matter (PM) was a potential risk for most cardiovascular events (Chuang et al. 2013). Muda et al. 2009 reported a novel optical-fibre-based sensor based measurement of CO_2 gas emission concentrations in the exhaust systems of a vehicles. Several works focussed on this issue but till now any products or techniques successfully implemented in the commercial motor vehicle (Priyanka et al. 2017, Amin and Wertenbach 1999, Akshay et al. 2016, Batra and Batra 2018, Kaur and Panwar 2016, Prasad et al. 2017)

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In order to overcome the air suffocation in the car due to oxygen drop within the cabin, a suitable arrangement is provided in this work to solve the issue with the assistance of an MQ 135 sensor. This can be introduced to any car interior which can sense the presence of carbon pass on display. Within the car cabin, the presence of poisonous gas is frequently measured. This harmful air within the car should not exceed to the set value (i.e. underneath the required level or over the specified level) which is measured in this work using Arduino. If exceeds the required or set value, the flag was sent to transfer module in which the hand-off actuates the control and the control window opens the car window (Figure. 1). When cabin come to the normal position i.e. no poisonous substance within the car cabin then the Arduino sends a flag to the hand-off module that we utilized in which hand-off passes signal to the control window. Based on the signal, the controller provides control action to the D.C. motor that is coupled with rack and pinion which is commonly used in opening and closing of the windows in automobiles. Rack and pinion's objective is to change over the rotational movement of the engine to the straight movement of the windows. When the oxygen level is within the craved level at that point the engine will turn around its direction (i.e. window will be closed). By this means, the harmful substance within the car will be monitored and it'll be made to preserve the specified level of oxygen by the implies of this whole setup/system.

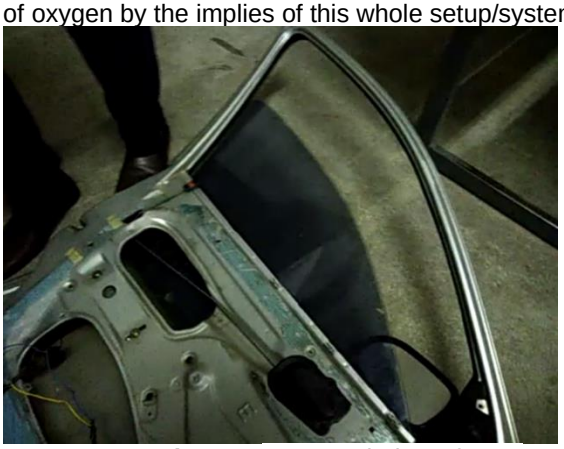

Figure 1 *Power Window of a car*

2. EXISTING AND PROPOSED MODEL FOR AIR SUFFOCATION PREVENTION

2.1. EXISTING SOLUTION

A household security and carport entryway system utilizes a gas sensor for recognizing the level of noxious gas inside the carport. When the gas level outperforms a foreordained edge the carport entryway is thus opened. Jolt out circuitry is given for foreseeing the entryway from being incidentally closed as long as the gas sensor distinguishes an expect level of noxious gas inside the carport. A two-button transmitter is utilized to progressively close the carport entryway with a security alarm subsystem. Caution contraptions are ordered on the off chance that the security caution is at lured to be set without the carport entryway and windows inside the residential being closed. Once the security alarm has been set, the jolt out circuitry additionally handicaps the carport entryway motor control circuitry until the security alarm is to start with deactivated. The transmitter produces a progressed beat plan concurring to a preselected code, with the operation of the twofold buttons changing the state of a particular control bit inside the beat get ready. A central control module inside the carport consolidates a collector with channel watching circuitry laid out to recognize the state of the control bit to begin assorted capacities, for case, the setting of the security caution and the enactment of the carport entryway. The system development incorporates a warm sensor inside the central control module and usefully businesses a line carrier to transmit status information with respect to the checked parameters to a more distant module inside the household. A most noteworthy run clock and motor over-burden affirmation for the motor control circuitry are as well revealed.

2.2 PROPOSED SOLUTION

As the existing arrangement is for the carport security framework, our framework bargains with the security of tenant interior a vehicle cabin. This framework doesn't have many electronic components as the existing framework. The preferences of this framework are financially and in fact doable; straightforward in plan and development, involves constrained space.

2.3.COMPONENT SPECIFICATIONS

The model consists of mechanical such as existing Power Window as well as Electrical components such as MQ-135 Gas sensor, Arduino module. Table-I provides the details of components mainly used in the system.

Table-1:*Specification of Component*

S.No	Components	Description
1	Power window	Used for window operation
2	Arduino UNO	Operating voltage :5V
3	MQ135 Gas Sensor	output voltage: 0V to 5V,Operating voltage:5V
4	2-channel Relay Module	Operating voltage:5v, 2 channel
5	Connectors	Used to connect component
6	Power supply	12v,5 A

2.4 Arduino UNO Specification

Operating Voltage: 5 Volts
Input Voltage: 7 to 20 Volts
Digital I/O Pins: 14 (of which 6 can provide PWM output)
Analog Input Pins: 6
DC Current per I/O Pin: 20 mA
DC Current for 3.3V Pin: 50 mA
Flash Memory: 32 KB of which 0.5 KB used by bootloader
SRAM: 2 KB
EEPROM: 1 KB
Clock Speed: 16 MHz
Length: 68.6 mm
Width: 53.4 mm
Weight: 25 g

2.5 Relay Specification

Relay Module; Model : 2 channel
Voltage to operate: 5V D
Color : Blue Relays on a black PCB
Load : 10A, AC 250V/ 15A, 125V
MQ-135 Gas Sensor Specification
Operating Voltage is +5V
Detect/Measure NH3, NOx, alcohol, Benzene, smoke, CO2, etc.
Analog output voltage: 0V to 5V
Digital output voltage: 0V or 5V (TTL Logic)
Preheat duration 20 seconds
Can be used as a digital or analog sensor

3. DEVELOPMENT OF MECHANICAL AND ELECTRICAL SET UP

3.1 CAD MODELLING

The SolidWorks design utilized in the present work is shown in figure 3.

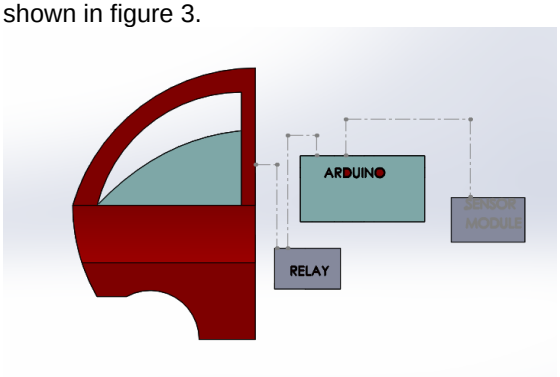

Figure 3 *3D model for air suffocation prevention operation*

3.2 ELECTRICAL INTERFACING

The electrical section consists of Arduino Atmega 2560 microcontroller circuit, 2 Channel Relay Circuit, MQ-135

Gassensor and Battery. The circuit connection are built using Proteus design. Based on the signal from the Gas sensor, the signals are fed to the Relay Module. The signal from relay is given to Arduino to control Power window. The real time electrical circuit is shown in the figure 4

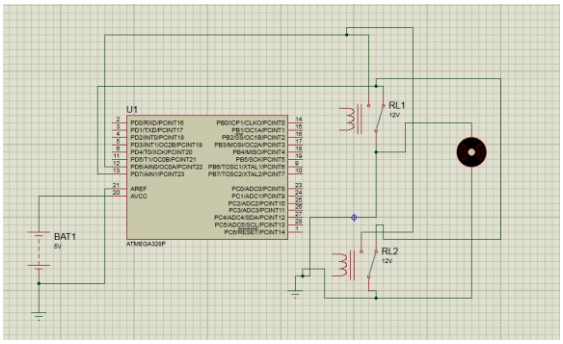

Figure 4 *Electrical Interfacing*

3.3 MECHANICAL STRUCTURE

The mechanical section consists of Power Window which forms the base of design to which Electrical Circuit and Power supply is connected.

3.4 FABRICATED MODEL

In this, the electrical and the mechanical setup are arranged together such that the sensor senses the poisonous gas and gives the feed back to relay and Arduino, which is shown in figure5.

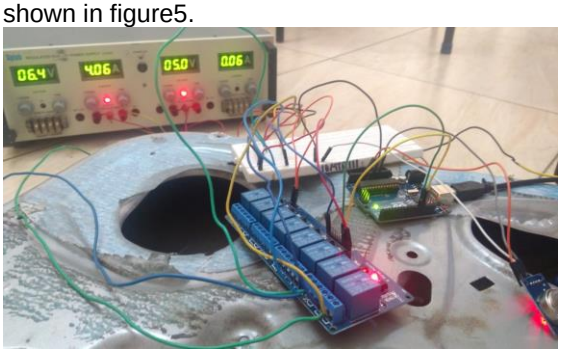

Figure 5 *Fabricated Setup*

3.5 WORKING PRINCIPLE

A few of us take a brief rest amid a long drive interior the car itself. One can kick the bucket of suffocation as the same air is reused inside the car. Besides the deplete of O_2 from your car make the passenger choke or unconscious. Mostly leads to death if the oxygen levels will come down. An MQ135 Gas sensor placed interior to the car cabin will sense the sum of carbon dioxide that's display interior the cabin.

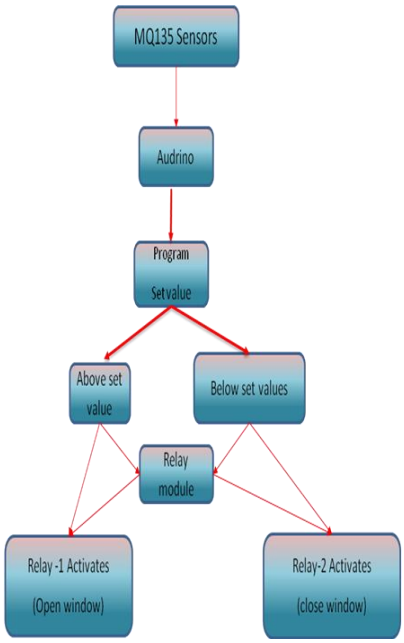

Figure 6 *Functional block diagram*

Limit esteem is characterized by the sensor within the program coded for the controller activity. The window activation is controlled by the Arduino UNO with the assistance of a hand-off module (Figure 6). At whatever point the sensor esteem obtained reaches the esteem past, the transfer that's initialized as LM1 gets incited and the control window will slide downwards. Once the sensor value attains an esteem rise to or less than the limit esteem, the hand-off that's initialized as LM2 gets activated and this time the control window will move upwards. The esteem that the sensor obtains in that specific environment will be observed and will be shown run time with the help of a serial monitor. The battery source that's given to the framework is of DC sort and a transfer is given for exchanging from the car's primary battery source for the manual operation of the control window to the external battery that's particular to the framework that works on the premise of the procured sensor values.

4. CONCLUSION

To ensure the safety of the passenger by eliminating toxic content inside a vehicle cabin, a suitable product is designed and developed. By using the simple mechanism of opening the power window by sensing poisonous gas, this method is highly efficient with less cost. Mostly it uses simple electronic devices like Audrino, relay the electric connections and understanding of mechanism is quite simple. This work will provide insight to the future researchers for developing low cost methods inside the car to reduce the death of passengers by inhaling poisonous gas.

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