Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

HCI EMPOWERED AUTOMOBILES PERFORMANCE BY REDUCING CARBON-MONOXIDE

DILAWAR HUSSAIN
Department of Computer Science, Superior University Lahore, Pakistan.
Email: MSSE-S21-002@Superior.edu.pk

SHAHARYAR RAFIQ
Department of Computer Science, Superior University Lahore, Pakistan.
Email: Msse-s21-004@superior.edu.pk

USAMA HASEEB
Department of Computer Science, Superior University Lahore, Pakistan.
Email: MSPM-S22-005@superior.edu.pk

MUHAMMAD WASEEM IQBAL*
Ph.D., Associate Professor Department of Software Engineering, Superior University Lahore, Pakistan.
Email: Waseem.Iqbal@superior.edu.pk

KHALID HAMID
Ph.D. Scholar, Department of Computer Science, Superior University Lahore, Pakistan. Lecturer Computer Science at NCBA & E East Canal Campus Lahore. Email: khalid6140@gmail.com

SALMAN UBAID BHATTI
MPhil, Lecturer at Department of Computer Science, SABAQ College Lahore, Pakistan.
Email: salman.bhatti51@gmail.com

MUHAMMAD AQEEL
Assistant Professor, Department of Software Engineering, Superior University, Lahore, Pakistan.
Email: aqeel@superior.edu.pk

Abstract:

Automated vehicles are the main method of transport where the vehicles with climate control systems assume a significant part. The quantity of unforeseen passing incidents because of the gigantic admission of carbon monoxide (CO) has at present increased. This paper centers around the plan and improvement of Smart CO detect - an Arduino-based brilliant machine for a vehicle lodge that identifies CO gas and shows it on the LCD screen. Assuming the CO measure outperforms the particular edge limit, a caution consequently rings and, if needed, the window for ventilation is started right away. A notice through GSM is shipped off the proprietor/owner's number enlisted with the Smart CO detect framework after getting the reaction from the owner, the control unit conveys the message promptly to the control circuit of the vehicle's window to give ventilation. It likewise gives security and help to an inhabitant in the vehicle cabin. The benefit of this mechanized CO identification method balance with the manual strategy is that it gives quick reaction time and exact identification of a crisis circumstance. The method is assessed by various classes of clients to accumulate data about the degree of fulfillment with Smart CO detection.

Keywords: Carbon Monoxide; Automobile; Software Projects; Kubernetes.

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

1. INTRODUCTION

Roadway traffic wounds place a big social and economic load on worldwide and public economies. The financial expense of street accidents and wounds is assessed to be 1% of the gross public item (GNP) in low-pay nations, 1.5% in center-pay nations, and 2% in big-time salary nations [2].

A few days ago, there were many deaths in Murree due to a lack of functionalities inside the vehicle. Many lives were lost due to high levels of carbon monoxide inside the automobile. We did a lot of research on this issue to solve this problem. We need to improve the automobile interface. Some methods have to be used to check or capture the quantity of carbon monoxide in automobiles. If the amount of carbon monoxide is high inside the vehicle then there is an alert generator on the interface. So that the people inside the car can find out and reduce carbon-monoxide by closing the hitter or in various ways. We will go ahead and explain what technology we can use to avoid it.

Intelligent Transport Systems (ITS) address advances in the use and transmission of data applied to ship structures and vehicles. ITS can reduce casualties by 40% across OECD countries [4]. The existing independent Advanced Driver Assistance System (ADAS), which represents a subset of ITS, is reminiscent of a role model. For example, identifying pedestrians with poor visibility. In most cases, various sensors such as radars, cameras, and lasers are used to collect context / situational data about the vehicle's environmental factors (such as pedestrian approach) and provide appropriate countermeasures (such as warnings and failures). To do. Nevertheless, such frameworks often have special limitations. For example,

Sensor detection and detection are limited to the momentary area of the vehicle, which can be obscured. Carbon monoxide (CO) is an uncolored, scentless, bland, non-aggravation, and undetectable gas that is somewhat less thick than air. It is poisonous to people and creatures. It is frequently alluded to as the "covered-up gas" since it is exceptionally difficult to distinguish. It can move toward perilous fixations inside when fuel-it is not as expected vented, worked, or kept up with to consume gadgets. In high fixations, it can kill in a few minutes or less. As per the Centers for Disease Control and Prevention, over 500 individuals kick the bucket in the United States every year from inadvertent CO harm and more than 2000 from deliberate self-destructive openness [1] at low absorption, CO [3] may bring about weariness in solid individuals and chest trouble in individuals with cardiac illness.

Moderate fixations might bring about angina, debilitated vision, and diminished mind work. At higher focuses, weakened vision and coordination; cerebral pains; tipsiness; disarray, sickness, and may cause influenza-like side effects. Intense impacts are because of the arrangement of carboxyhemoglobin in the blood, which hinders oxygen consumption. Red platelets get CO speedier than they get oxygen if there is a great deal of CO in the air, the body might supplant oxygen in blood with CO. This squares oxygen from getting into the body. Consequently, it can harm tissues and result in death. CO can likewise join with proteins in tissues, annihilating the tissues and causing

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

injury and passing in dangerous gatherings: Certain individuals in a family might be impacted by CO harming more rapidly than others. Those at specific gambles include Babies and little youngsters, pregnant ladies, People with heart or breathing issues, and Pets who might be quick to give indications of CO harm because they are helpless against the impacts of CO gas. CO spillage in a vehicle ordinarily occurs because of one of the two occasions. To start with, the first exhaust framework has been modified for a specific explanation. Typically, a standard vehicle has a long exhaust framework yet adjusted exhaust frameworks are generally a piece more limited. Because of this, it is accepted that the CO figures out how to saturate the vehicle's inward chamber through its extractor exhaust framework all the more effortlessly contrasted with standard exhaust. Second, the cooling framework in a vehicle works by separating air from an external perspective before it is utilized. Notwithstanding, it is prescribed not to switch on the cool framework while the motor standbys or while the vehicle is still. Vehicle climate control systems might accumulate CO gas while the motor standbys. An opening in the suppressor can likewise cause the fumes gases in the vehicle to saturate the vehicles inside. Spills in the tail-pipe license CO to spread vertically into a car and it has been shown that CO tracks down its direction into the vehicle without hardly lifting a finger and recurrence on the off chance that the tail-pipe doesn't stretch out past the rear of the vehicle. It turns into the greatest danger when the carbon mono oxide is a piece of the exhaust. Re-dissemination of air, in a vehicle, and forced air systems can cause destructive CO to develop. Openings on the vehicle metal floor are additionally the significant justification for CO inside the lodge.

2. LITERATURE REVIEW

There are different CO observation and disturbing systems which initially distinguish the presence of Carbon Monoxide (CO) and afterward raise caution and a couple of them even tell the vehicle proprietor by sending an SMS on his portable number [10]. A. Kulkarni and T. Ravi [11] proposed and have operated a framework for the screening and control of toxic substances in vehicles using pollution control loops. This pollutant control circuit includes various sensors such as smoke sensors, temperature sensors, GSM, and devices such as GPS, all integrated and connected to the control unit. Normally, when a vehicle reaches an explicit emission limit, the engine is turned off, an SMS is created and the above-reserved number in memory is sent via the GSM module. It is predominantly centered on three squares. They are paying attention to smoke, microcontrollers, and fuel injectors. Attention when smoking reliably detects toxins (CO, NOx, etc.). The microcontroller contrasts the degree of toxins and the Specified level permitted by the public authority. Whenever the pollution level outperforms quite far, it passes a message on to the fuel injector. On getting a sign from the controller, the fuel injector stops the fuel supply to the engine after a particular period. A sensor framework proposed by (Athare, et al) recognizes the degree of contamination and demonstrates it on the LCD show [12]. Assuming the contamination level goes past the limit level, there will be a buzz that demonstrates that the vehicle will

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

stop after a few times and a certain time is given for the driver to leave the vehicle. During this time, GPS begins finding the closest assistance station. After the time expires, the vehicle stops and must be taken to the assistance station. The entire cycle is controlled and executed by the microcontroller. (Ramya, et al) planned and executed an implanted framework for a vehicle lodge that detects the gases like CO and oxygen and showcases it on an LCD screen [13]. On the off chance that the level of the CO increments than the typical level (30ppm) or the level of the oxygen diminishes than the ordinary level (19%), an alert is produced consequently and ventilation is given right away. An admonition message is shipped off to the approved client through GSM. In the perspective on review framed in Fig. 9, different examination holes have been found and these are talked about underneath. Existing frameworks are short in raising caution and imparting cautioning messages to the vehicle proprietor. The main method of correspondence utilized is through SMS (Short Message Subscriber) which one can't depend open. The vehicle proprietor might be able to peruse that SMS and regardless of whether he peruses the message, it is very conceivable that the vehicle may not be in that frame of mind at that point. These days, everybody conveys a cell phone, and no endeavor has been made such a long way in the past work to use this office as this is the most solid and moment approach to imparting advance notice messages to the vehicle proprietor. In addition, the portable call never gets disregarded however SMS might bomb once in a while to stand out enough to be noticed by the client. The focal point of all the past work done is on giving the data about recognition of CO gas yet no endeavors have been made such a long way to manage it and give life security to vehicle inhabitants. No arrangement to give ventilation in the vehicle, if, CO (Carbon Mono Oxide) surpasses its normalized limit has been referenced in any of the past work as far as the author could know. Any of the recently proposed and carried out frameworks doesn't work, on the off chance that the vehicle is running. The vehicle ought to end for the CO identification framework to work proficiently which may not be imaginable when the vehicle is on the parkway or encircled by various running vehicles out and about.

A 37-year-elderly person was tracked down dead in his Santro vehicle at Adambakkam (India) with the climate control system on. Pramod Kumar Mahapatra, a programmer from Odisha was observed dead after breathing in noxious gas in the vehicle left at the 36th Street Junction in Thillai Ganga Nagar in June 2012 [9]. The inward breath of deadly measures of CO had caused the demise of the three celebrating young people, including a young lady, whose rotted bodies were seen as close to a Maruti Zen vehicle left inside the covered carport of a house in the city on December 2012 [10]. Loved ones of the casualties expressed that At Fort McMurray, no less than two out of three individuals were found dead in a left vehicle on Tuesday passed on from CO harm on Jan 2018 [11]. Inner a snow and chilled squeezed vehicle in Passaic, New Jersey a mother, 23-year-old Sashalynn Rosa, and her child, Messiah acknowledged their last heaves as CO filled their vehicle [12]. Three people who were abandoned in their vehicle at G.N. Chetty Road were tracked down dead early morning on Sunday. As per the posthumous report, the passing was because of suffocation as it is thought that CO

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

leaked in and the climate control system continued to run with the vehicle in water. Police needed to coercively open the vehicle entryway on Oct 2006 [13]. In addition, no less than 28 individuals have passed on from CO harm throughout recent years after keyless ignition equipment was left standing by in their carports, another report says. The issue being raised stems from the multiplication of vehicles with remote key dandies, otherwise called nearness keys that permit them to be worked by squeezing a button, instead of requiring an actual key be embedded into a start and turned. In these deadly models, the drivers left their vehicle with the coxcomb but neglected to switch off the motor as they did and the exhaust vapor ultimately raised the grouping of CO in their homes to hazardous levels [14]. Three managed 59, 75, and 88 were found in various pieces of the city dead or oblivious in their vehicles on March 16, 2017. For each situation, the men had been scooping snow to get to their vehicles and had had some time off from scooping by sitting in their still snowbound vehicles with motors running and windows shut [15].

2.1 Classification and Exhibitions of Thermostats

Temperature monitoring uses the shield and metal heat resistance control method, thermostat method, thermocouple mode, heat sensitive ferrite switch mode, bimetallic hot switch mode, wax mode, and various sensors. The first three types are basic temperature sensors.

2.2 Alloy Warm Resistance Method

A thermistor is made as per the thermistor effect, and that suggests that the resistivity of a substance is changing close to its temperature of it. Considering the material, the thermistor can be divided into metal warm resistors and thermistors. The sensors that are delivered utilizing metal expert parts, they are requiring materials remembered for high hindrance temperature coefficient, stable physical and compound properties, and high self-resistivity. Platinum, copper, and nickel are the ideal and most used obstacle materials. Considering the low check of the metal material, they should be taken care of into thin metal wire or film to show up at the useful resistance. At this moment, the materials used in metal warm resistor sensors are platinum and nickel [16].

2.3 Thermistor Mode

Thermistors are made using high-temperature impurities from ignited semiconductor devices and compounds involving various metal oxides. There are three types of equality relationships between thermistor and temp. The first is a negative temperature coefficient thermistor (NTC), which blocks as the temperature increases. The second is a positive coefficient (PTC) thermistor, which, as shown, extends to the most critical temperature where the control is possible. The third is a critical temperature coefficient (CTR) thermistor, which has a maximum impedance reduction at high temperatures. The above relationship is shown in Figure 1.

NTC thermistors are used in most vehicle temperature sensors, and the connection between impedance and temperature can be solved as

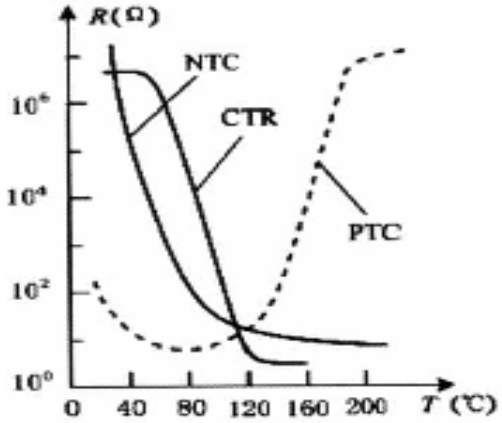
Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

B T

RT Ae =/(1)

T is the base temperature; T R is the base temperature in the resistor T, A, and B are material and plan subordinate constants. Figure 1 shows that the temperature changes contrarily to the block and as far as possible are falling. Not at all like protection from hot metals, are the possible additions of the semiconductor thermistor the high-temperature coefficient of opposition; least volume; high inability; clear craftsmanship. Its downside is the restricted temperature ID range. With various materials, thermistors can be made for low and high-temperature locations [17].

Fig 1. Obstruction and Heat curve of thermistor



Something like 28 individuals has passed on from carbon monoxide in HOUSTON, TX harming throughout recent years after keyless start-prepared vehicles were left sitting in their carports, another report says. That was the number that The New York Times concocted by looking over media and crisis reaction reports, as no administration office keeps a thorough bookkeeping of this sort of mishap. The report didn't detail the years in which every passing occurred [20]. In this paper, the Author tells that Men, particularly the youthful, are the primary casualties of TCs' demise all over the place. Among the potential reasons for this mortality power in youngsters is the foolish way of behaving in rush hour gridlock notwithstanding an expanded utilization of alcohol21-22, 23-24. The fact that men drive more makes another related speculation just. Notwithstanding, even in the wake of managing distances driven, an enormous sex distinction remains, and this distinction relies upon age [26][27]. Anyway, expanded openness is additionally important for the clarification of why they kick the bucket more. All in all, how to make sense of this error? If men face more challenges by presenting themselves more to and in rush hour gridlock, there should be a reason for this default conduct [28][29].

Proof has been filling as of late that lessening the accessibility of the strategies for committing suicide decreases the pace of self-destruction and the pace of incidental passing utilizing those techniques. For instance, Lester and Murrell' found that states

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

with stricter weapon control guidelines have lower paces of a gun falling to pieces and lower paces of synchronous guns. All the more as of late, Clarke and Lester2 have likewise noticed the utilization of vehicle exhaust in confidential vehicle destruction diminished just marginally from 1968 onwards, notwithstanding decreased harmfulness of vehicle exhaust because of outflow controls. Accordingly, we chose to analyze incidental passing from vehicle exhaust to see whether these passing's had become less successive as of late [30].

3. METHODOLOGY

The plan and improvement of Smart CO detection comprise different equipment and programming devices which are point by point underneath. Different equipment apparatuses utilized for the plan and improvement of Smart CO detectors are introduced in Fig. 2. The Arduino Mega2560 is utilized as a microcontroller board in Smart CO detectors for its minimal expense [14]. The Arduino Mega2560 [15] depends on ATmega2560 and has many capacities to speak with a PC, another Arduino, or other microcontrollers. It has 54 computerized IO pins, 16 simple information sources, a reset button, a USB association, a power jack, an ICSP header, and a 16 MHz gem oscillator [15]. Ultrasonic sensors use sound to activate the distance between the sensor and the closest in its manner [16]. This sensor is utilized in the Smart CO detection framework to recognize the inhabitant inside the vehicle lodge. The receiver end of the ultrasonic detector produces high repeat sound waves and computes the reverberation which is gotten by the beneficiary end. The sensor computes the hour between sending and getting the reverberation and ascertains the distance to an article.

CO sensor is utilized to distinguish CO in industry or vehicle [17]. It is a minimal expense, has a long dotage, a simple circuit, and has adequate responsiveness to CO in wide reach [18]. MQ-7 is utilized in Smart CO detect framework to distinguish the expanded degree of CO inside the vehicle lodge. DTMF is a Dual-Tone Multi-Frequency module and is typically associated with contact tone phones [19]. At the point where a number is pressed on a touch-tone telephone, two sine waves at frequencies: 697 Hz and 1209 Hz are combined to transmit a unique DTMF signal that can be sent over the telephone line [6]. The MT8870 DTMF module can recognize this character as information and untangle it to pass an equal result. DTMF circuit in Smart CO detect framework is an ideal little module that licenses to merge DTMF advancement into an Arduino board and to recognize the number dialed by the proprietor of the car.16x2 LCD screen is an electronic presentation module with 16 sections and 2 columns. It is used in an expansive scope of implanted applications because of its minimal expense and accessibility [20]. LCD show utilized in Smart CO detection shows the alarm message when CO gas surpasses the characterized edge esteem. GSM module resembles a versatile Terminal Equipment (TE). It includes a sim card holder, network status LED, configurable baud rate, strong TCP/IP convention stack for web information move, and double band GSM/GPRS 900 [8]. This module can be utilized to settle on sound decisions, SMS sending and getting, go to the approaching calls, and web access

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

through basic AT orders [21]. GSM Sim 900A is utilized in Smart CO detect framework to send SMS and settle on a decision to predefined proprietors portable number when CO surpasses the specific edge esteem. A gear DC Motor is a machine intended to change over energy into helpful mechanical movement. In Smart, CO detects framework the engine is utilized to control the twofold post twofold toss switch of force window. The gear DC engine is an expansion of the Dc engine and is very simple to use. It has gear gathering secure to the engine that helps with extending the force and bringing down the energy [22].

Arduino IDE for Arduino Mega2650 is utilized for prearranging the code for different sensors interacting with the regulator board. Arduino IDE is an open-source program that makes it simple to compose code and transfer it to the Input/yield board [23]. It runs on Linux, Windows, and Mac OS X. The Arduino programming contains a chronic screen that licenses to send ordinary text-based information to and from the regulator board [23]. After ordering and running the total code written in Arduino IDE, the Smart CO detect framework recognizes the presence of CO in the vehicle lodge and sends the crisis-ready notice to the predefined proprietor's number. Implanted C is intended to connect execution irregularities between the standard C and the inserted equipment and application engineering [24]. It expands the C language with the natives. The Arduino code is a bunch of C/C ++ capacities that can be called from our code. The equipment I/O augmentation is a coordinated movability work and is expected to empower the exchange of gadget driver code between frameworks. Environmental air pollution issues like haze and photochemical smog have a large population of automobile exhaust as a contributing factor. [25] Nitrogen oxide (NOX), carbon monoxide (CO), hydrocarbons (HC), and inhalable particulate matter (PM) are among the contaminants found in vehicle exhaust. To lessen the number of dangerous gases and particulate matter in the atmosphere and to alleviate photochemical smog, it is required to research PM 2.5 adsorption pavement materials and automotive exhaust purification. Acid rain also has an urban heat island impact. The "Biodiversity Strategy by 2030" and "Strategies for Energy System Integration" specific programmers, under the pertinent schedule, to tackle climate change, the Commission identified sustainable [26] bioenergy as a key strategy. Along with solar and wind energy, it is deemed a top priority for change. Moreover, biomass has been recognized as a catalyst for carbon collection, storage, and usage that can help the accomplishment of the no-net-greenhouse-gas (GHG) emission goal.

3.1 Implementation & Testing

Smart CO detects the System as displayed in Fig 2. Is planned and created utilizing an Arduino Mega2560 regulator board for vehicle lodges. CO sensor communicated in the Smart CO detect System recognizes the presence of CO inside the vehicle lodge. As displayed in Fig 3. When the CO level ranges over the edge esteem, an admonition message for opening the window is shown on the LCD screen and as displayed in Fig 4. A similar message is shipped off the predefined proprietor's number utilizing a GSM pack. The GSM Kit module settles on a decision on the predefined proprietor's number

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

by utilizing AT orders and the answer from the proprietor is gotten in the DTMF circuit. DTMF circuit creates a parallel succession in light of the vital squeeze by the owner. As displayed in Fig. 4 proprietor is approached to squeeze 14 numbers for opening the window. DTMF produces a 00010100 grouping number against the number 14 squeezed by the proprietor. After getting the control signal from mega ULNIC, a loop of hand-off begins pivoting. After the beginning of hand-off, it gives a 12V power supply to outfit the DC engine. Gear DC engine conveys messages to open the power window switch. The power switch goes down for sure-fire ventilation and the warning for opening the window is shown on the LCD screen (see Fig 5). The trial and error were completed at MMDU, Mullana to assemble the fulfillment level with Smart CO detection.

Fig 2. Smart CO detects framework

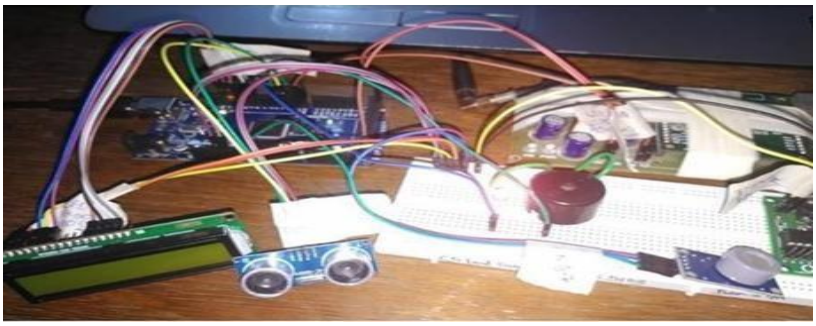
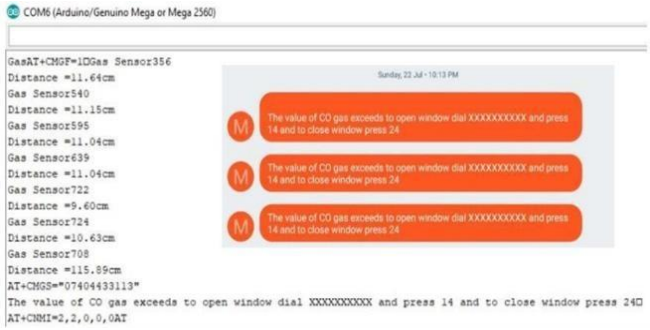


Fig 3. Alerting when CO surpasses the limited esteem

Fig 4. The message got on the predefined proprietor's Mobile Number



Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

Fig 5. Opening Window on getting signal from Car proprietor's predefined Mobile Number

3.2 User Interaction & Results

The Smart CO detection is exposed to be tried with 50 school personnel individuals from MMDU, Mullana who were put in two distinct classes given their specialization. 25 staff individuals were from the software engineering, hardware and mechanical division who knew about the innovation utilized and 25 individuals have a place with the applied sciences office and humankind division who were curious about the workplace of the Smart CO detect. The staff individuals were approached to test the Smart CO detection given the various boundaries asked in the critical study as displayed in Fig 6. Criticism gathered from all the staff individuals is displayed in Fig 7. Results obtained on end-client communication are analyzed in light of the t-test and are talked about in later areas. A portion of the current frameworks has been examined whose audits are talked about beneath and summed up in Fig 8 [11-25].

Fig 6. Survey for analyses

Q.No.	Question
1	The time required to connect to the SmartCOdetect is less than 5 Sec.
2	The delay in detection of carbon Mono oxide in car cabin is less than 2 Sec
3	The time required to display warning message is less than 5 sec after the detection of CO gas in the car cabin.
4	The time required to generate an alarm is less than 5 sec after the detection of CO gas in the car cabin.
5	The time required to send message on registered mobile number is less than 30 sec after the detection of CO gas in the car cabin.
6	The time required to make a call on registered mobile number is less than 50 sec after the detection of CO gas in the car cabin.
7	The time required to get the acknowledgement from the registered mobile number is less than 30 sec.
8	The time required to open the window by SmartCOdetect after getting acknowledgement from the registered mobile number is less than 10 Sec

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

Fig 7. Reactions collected from various arrangements of workers.

Question Number	Staff Members (Computer Science, Electronics and Mechanical)				Staff Members (Applied Sciences and Humanity)			
	Total	Agree	Neutral	Disagree	Total	Agree	Neutral	Disagree
Q1	25	22	2	1	25	20	4	1
Q2	25	21	2	2	25	17	5	3
Q3	25	24	1	0	25	23	1	1
Q4	25	23	1	1	25	21	2	2
Q5	25	20	3	2	25	18	5	2
Q6	25	19	2	4	25	16	4	5
Q7	25	23	1	1	25	20	3	2
Q8	25	24	1	0	25	22	2	1

Fig 8. Correlation of related work

Parameters	Embedded Technology for vehicle cabin safety Monitoring and Alerting System[10]	Automated System for Air Pollution Detection and Control in Vehicles[11]	Human Safety and Air Pollution Detection in Vehicles[12]	Embedded System for Vehicle Cabin Toxic Gas Detection and Alerting[13]	Proposed Model
Alarm	Yes	Yes	-	-	Yes
Microcontroller	Atmel 89c51	-	PIC16F877 microcontroller	ATMEL 89C51 microcontroller.	-
LCD Display	yes.	-	Yes	Yes	Yes
SMS	yes	-	No	yes	Yes
Mobile Call	no	No	No	No	Yes
Automatic Ventilation	Not Defined	Not Provided	No	Not Defined	Yes
sensor	-	MQ-2,lm 35 temp. sensor	MQ-7	MQ-7	MQ-7
Vehicle halted	Not mentioned	Halted	Halted	Not mentioned	No

CONCLUSION & FUTURE WORK

In this paper, we presented a plan and improvement of Smart CO detection for vehicle lodge to recognize the unsafe poisonous gas (Carbon-Monoxide) utilizing Arduino Mega 2560 microcontroller. Carbon monoxide gas is not so much as reasonable and imperceptible to natural eyes which is a major danger to clients' lives. In the overall framework, when the degree of CO is past the edge esteem then the Smart CO detection shows the worth of CO on the LCD screen and creates an alert in the vehicle. All the while, an advance notice instant message is sent by the GSM pack and gotten by the DTMF circuit, and the control unit conveys the control messages to give prompt ventilation by opening the power window of the vehicle consequently. In this way, the principal expectation of planned Smart CO detection is to keep away from the most terrible and basic circumstances inside the vehicle lodge. Future work centers around the joining of strain sensors with Smart CO detection to screen the effect of environmental tension on the CO amassing inside the vehicle and consequently its impact on the human body.

References

1. Hayes, James, and Corrinna Hayes. "Automatic gas detection system." U.S. Patent No. 6,072,398. 6 Jun. 2000.

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

2. Pickering, Carl A., Keith J. Bumnham, and Michael J. Richardson. "A review of automotive human machine interface technologies and techniques to reduce driver distraction." 2007 2nd Institution of Engineering and Technology International Conference on System Safety. IET, 2007...
3. Risavi, Brian L., et al. "A novel method for continuous environmental surveillance for carbon monoxide exposure to protect emergency medical service providers and patients." The Journal of Emergency Medicine 44.3 (2013): 637-640.
4. Batra, Neera, Jasleen Kaur, and N. K. Batra. "SmartCOdetect: An Automated Car Window Opening System on Detection of Carbon Monoxide." International Journal of Vehicle Structures & Systems 12.4 (2020): 398-404.
5. Kulkarni, Anita, and T. Ravi Teja. "Automated system for air pollution detection and control in vehicles." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering 3.9 (2014): 12196-12200.
6. Batra, Neera, Jasleen Kaur, and N. K. Batra. "Smart CO detect: An Automated Car Window Opening System on Detection of Carbon Monoxide." International Journal of Vehicle Structures & Systems 12.4 (2020): 398-404
7. Ramya, V., and B. Palaniappan. "Embedded system for Hazardous Gas detection and Alerting." International Journal of Distributed and Parallel Systems (IJDPS) 3.3 (2012): 287-300
8. Techie found dead in car with AC. 2012. Retrieved from: https://timesofindia.indiatimes.com/city/chennai/Techie-found-dead-in-car-with-AC-on/articleshow/14108810.cms.
9. Penney, David G., ed. Carbon monoxide poisoning. CRC Press, 2007.
10. Iqbal, M., Ahmad, N., Shahzad, and S.K.: Usability evaluation of adaptive features in smartphones. Procedia Comput. Sci. 112, 2185–2194 (2017). https://doi.org/10.1016/j.procs.2017.08.258
11. Hamid, K.; Iqbal, M.W.; Nazir, Z.; Muhammad, H.A.B.; Fuzail, Z. Usability Empowered By User's Adaptive Features In Smart Phones: The Rsm Approach. 2022.
12. Naqvi, Muhammad Raza, et al. "Study of block chain and its impact on internet of health things (IoHT): challenges and opportunities." 2020 International Congress on Human-Computer Interaction, Optimization and Robotic Applications (HORA). IEEE, 2020.
13. Hamid, K. & Muhammad, H. B & Iqbal, M. W. & Hamza, M. & Bhatti, S. U. and Hasan, S. (2022). Extendable banhatti sombor indices for modeling certain computer networks. Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition). 41. 69-87. 10.17605 /OSF.IO/U9P3B.
14. Hamid, K. & Muhammad, H. A. B. & Iqbal, M. W. and Bhatti, S. U. (2022). TOPOLOGICAL ANALYSIS EMPOWERED BRIDGE NETWORK VARIANTS BY DHARWAD INDICES. Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition). 41. 53-67. 10.17605/OSF.IO/89QUS.
15. K. Hamid, M. W. Iqbal, H. A. B. Muhammad, Z. Fuzail, Z. T. Ghafoor et al., "Usability evaluation of mobile banking applications in digital business as emerging economy," International Journal of Computer Science & Network Security, vol. 22, no. 1, pp. 250–260, 2022.
16. K. Hamid, M. W. Iqbal, H. A. B. Muhammad, Z. Fuzail, Z. T. Ghafoor et al., "Detection of brain tumor from brain MRI images with the help of machine learning and deep learning," International Journal of Computer Science & Network Security, vol. 22, no. 5, pp. 709–721, 2022.
17. Hamid, K., Iqbal, M. waseem, Muhammad, H., Fuzail, Z., Ahmad, Z.: Anova Based Usability Evaluation Of Kid's Mobile Apps Empowered Learning Process. Qingdao Daxue XuebaoGongcheng

ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

JishubanJournal Qingdao Univ. Eng. Technol. Ed. 41, 142–169 (2022). https://doi.org/10.17605/osf.io/7fnz

18. Hamid, Khalid & Iqbal, Muhammad waseem & Nazir, Zaeem & Muhammad, Hafiz & Fuzail, Zubair. (2022). USABILITY EMPOWERED BY USER'S ADAPTIVE FEATURES IN SMART PHONES: THE RSM APPROACH. Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/Journal of Tianjin University Science and Technology. 55. 285-304. 10.17605/OSF.IO/6RUZ5.
19. Mumtaz, G., Iqbal, M.W., Aqeel, M. and Septyanto, A.W., "Challenges in deployment of 5GGCRNs for IoTs", The 7th International Conference on Next Generation Computing 2021
20. W. Iqbal, "Business Process Model for IOT Based Systems Operations", Research Journal of Computer Science and Information Technology, vol. 5, no. 4, pp. 1-10, Dec. 2021.
21. B. Mustafa, M. W. Iqbal, M. Saeed, A. R. Shafqat, H. Sajjad and M. R. Naqvi, "IOT Based Low-Cost Smart Home Automation System," 2021 3rd International Congress on Human-Computer Interaction, Optimization and Robotic Applications (HORA), 2021, pp. 1-6, doi: 10.1109/HORA52670.2021.9461276.
22. M. Mubeen, M. W. Iqbal, et al 2021 IOP Conf. Ser.: Earth Environ. Sci. **704** 012041
23. Aqeel, Muhammad & Ali, Fahad & Iqbal, Muhammad waseem & Rana, Toqir & Arif, Muhammad & Auwul, Md. (2022). A Review of Security and Privacy Concerns in the Internet of Things (IoT). Journal of Sensors. 2022. 1-20. 10.1155/2022/5724168.
24. Maqbool, Sidra & Iqbal, Muhammad waseem & Naqvi, Muhammad Raza & Arif, Khawaja & Ahmed, Muhammad & Arif, Muhammad Rehan. (2020). IoT Based Remote Patient Monitoring System. 1255-1260. 10.1109/DASA51403.2020.9317213.
25. Two found dead in car due to CO poisoning. 2018. Retrieved from: https://edmontonjournal.com/news/localnews/two-of-three-found-dead-in-car-near-conklin-diedof-carbon-monoxide-poisoning-say-family.
26. [27] Mom, child die of CO poisoning. 2016. Retrieved from https://abc7chicago.com/news/mother-child-die-ofcarbon-monoxide-poisoning-after-snow-blocks-cartailpipe/ 1173192/.
27. [28] Three die of suffocation in stranded car. 2012. Retrieved from: https://www.thehindu.com/todays-paper/three-dieof-suffocation-in-stranded-car/article 3067973.ece.
28. [29] 28 deaths linked to CO poisoning. 2018. Retrieved from: https://www.fox13news.com/news/28-deaths-linked-tocarbon-monoxide-poisoning-by-idling-cars-with-keylessignitions.
29. Carbon monoxide killed three men in snowbound cars: coroner. 2018. Retrieved from: https://montrealgazette.com/news/local-news/carbon-monoxide-killed-threemen- in-snowbound-cars-coroner.
30. Xu, Zun, and Lili Liu. "The application of temperature sensor in automobile." 2011 International Conference on Control, Automation and Systems Engineering (CASE). IEEE, 2011.
31. Yuqun, Wang, et al. "Characteristic Analysis of the Temperature Sensor Used in Car." Agricultural Equipment & Technology (2009).
32. Goelles, Thomas, Birgit Schlager, and Stefan Muckenhuber. "Fault detection, isolation, identification and recovery (fdiir) methods for automotive perception sensors including a detailed literature survey for lidar." Sensors 20.13 (2020): 3662.
33. Daly, Steven. Automotive air conditioning and climate control systems. Elsevier, 2011.
34. 28 deaths linked to CO poisoning. 2018. Retrieved from: https://www.fox13news.com/news/28-deaths-linked-tocarbon-monoxide-poisoning-by-idling-cars-with-keylessignitions.

ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 12-2022
DOI 10.17605/OSF.IO/S5X2D

35. Tavris, Dale R., Evelyn M. Kuhn, and Peter M. Layde. "Age and gender patterns in motor vehicle crash injuries: importance of type of crash and occupant role." Accident Analysis & Prevention 33.2 (2001): 167-172.

36. World Health Organization. Global status report on road safety 2015. World Health Organization, 2015.

37. Saldanha, Raquel Forgiarini, et al. "Differences between attendance in emergency care of male and female victims of traffic accidents in Porto alegre, Rio Grande do Sul state, Brazil." Ciência & Saúde Coletiva 19 (2014): 3925-3930.

38. Andrade, Selma Maffei de, and Maria Helena P. Jorge. "Victims' characteristics by road accidents in a city of Southern Brazil." Revista de Saúde Pública 34 (2000): 149-156.

39. Li, Z., Guo, T., Chen, Y., Yang, K., Dong, X., Wang, D., Wang, J. and Jin, L., 2022. Research of new Preventive maintenance materials based on automobile exhaust gas purification and PM2. 5 absorption. Materials Research Express, 9(7), p.075501.

40. Available online: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en (accessed on 16 February 2021).

41. Barisano, D., Canneto, G., Nanna, F., Villone, A., Fanelli, E., Freda, C., Grieco, M., Cornacchia, G., Braccio, G., Marcantonio, V. and Bocci, E., 2021. Investigation of an Intensified Thermo-Chemical Experimental Set-Up for Hydrogen Production from Biomass: Gasification Process Performance—Part I. Processes, 9(7), p.1104.

42. Lester, David, and Mary E. Murrell. "The preventive effect of strict gun control laws on suicide and homicide." Suicide and Life-Threatening Behavior 12.3 (1982): 131-140.

43. Lester, David, and Ronald V. Clarke. "Effects of the reduced toxicity of car exhaust on accidental deaths: A comparison of the United States and Great Britain." Accident Analysis & Prevention 21.2 (1989): 191-193.

44. Clarke, Ronald V., and David Lester. "Toxicity of car exhausts and opportunity for suicide: comparison between Britain and the United States." Journal of Epidemiology & Community Health 41.2 (1987): 114-120.

45. Asconcellos, Eduardo Alcântara. "Urban development and traffic accidents in Brazil." Accident Analysis & Prevention 31.4 (1999): 319-328.

46. Massie, Dawn L., Kenneth L. Campbell, and Allan F. Williams. "Traffic accident involvement rates by driver age and gender." Accident Analysis & Prevention 27.1 (1995): 73-87

47. Massie, Dawn L., Paul E. Green, and Kenneth L. Campbell. "Crash involvement rates by driver gender and the role of average annual mileage." Accident Analysis & Prevention 29.5 (1997): 675-685