Proceedings: ***International Invention, Innovative & Creative (InIIC) Conference, Series 1/2021***
eISBN: 978-967-18412-5-9 (Publication Date: 30 June 2021) *MNNF Publisher*

Design of Power Window Vehicle Safety System

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ABSTRACT

Two common vehicle safety can be divided into active and passive safety systems. The primary purpose is to minimize the possible risks for a vehicle's drivers and passengers from an accident. However, one aspect should be considered in preventing unknown hazardous such as the deaths caused by the respiration system's failure due to a high level of carbon monoxide (CO) concentration in the vehicle cabin. Therefore, this project proposed an embedded technology of an automatic power window integrated with the sensing element to monitor the car cabin's air composition. The CO sensor will measure the CO gas concentration and activate the relay switch if the CO concentration reaches its maximum level. The power window will be operated, and open the window to allow fresh air circulation in the cabin. Besides, the car passengers also will be notified by the activation of the alarm.

Key Words: *Vehicle safety, CO sensor, automatic power window*

1. INTRODUCTION

The current generation of a new car is design systematically with multiple integrations of safety features. It has become one of the essential criteria in the automotive engineering area to prevent road accidents. Indonesia, Malaysia, and Thailand are recorded as high-rank countries with the highest road accident recorded in ASEAN by the WHO. Many factors contribute to increasing the rate of roadway tragedy (Che-him et al., 2018; Liu et al., 2018; Rolison et al., 2018; Yousif et al., 2019). Most of the significant factors are due to safety component malfunction, driver behavior, and road condition. However, the biggest threat or silent killer for the vehicle passenger is caused by high-level carbon monoxide concentration in the cabin. Recently, news from Astro Awani on 17th September 2020 reported that the cases drowned death in cars with the engine running for a short sleep after a long journey at the gas station involving five adults. This case is increasing every year; unfortunately, the awareness of the dangerous sleeping in the car without a proper air ventilation system is still low. Therefore, strategic action in vehicles' safety cases, primarily cars, is necessary with relevant responding work to optimize safety features by introducing vehicle power windows with the CO detection system.

Most cases, commonly related to harmful gas to our respiration system, were reviewed. The most common issue is carbon monoxide, which can kill a human without any visible color, odorless, and tasteless flammable gas from our vision. The air contains around 78% nitrogen and 21% oxygen, 78% nitrogen, 16% oxygen, 0.09% argon, and 4% carbon dioxide from human inhalation. For a human being, CO concentration cannot be more than 5% in our body. It will start to give side effects such as blood pressure, breathing difficulty, and anxiety if it increases. Besides, it will cause headaches, dizziness, hearing disorders, perception disorders, tachycardia, excessive sweating, and conjunctival congestion and even bring to death if a human is trapped in a closed system with a high level of CO concentration for a longer time (Zulauf et al., 2019).

Therefore, studies related to the vehicle cabin safety system have been conducted by the researchers. An example of a cabin safety system is proposed by Che Soh et al. (2010). Once the carbon monoxide level is detected is higher from the predefined parameter, it will transmit data to the gas sensor circuit and the microcontroller onboard system. It will be passed to the logic detector to enable the alarm

system to be ready to output sound to alert the driver or passenger in the car to know that there is leakage of carbon monoxide leakage in the vehicle cabin (Che Soh et al., 2010). The alert system proposed by the author might have functioned for a specific group of people. Some kinds of people may not be sensitive to the surrounding condition or sound while sleeping. Therefore, this project proposes an external safety mechanism where the window will automatically open when the CO concentration level reaches the maximum amount, as explained in section 3.1.

2. METHODOLOGY

2.1 Product Design and Development

This chapter explains the development of the integrated vehicle power window's integrated design with CO and its mechanism. The system requires programming an Arduino UNO as an ECU unit connecting both the hardware and sensor. Arduino was applied as the control unit and was attached to the hardware. The basic Arduino code logic was an "if-then" structure divided into a few blocks as the setup. It will usually be written in the Arduino code setup section and performs what needs to be done only once, such as with a motor. The input was required at the beginning of the loop, and this input would be read. Values, such as the ambient light reading from an LDR using the analog Read (), were used as the conditions ("if"). Figure 1 shows the first complete installation of the CO Detection System With a Power Window, and Figure 2 is the schematic diagram for the system.

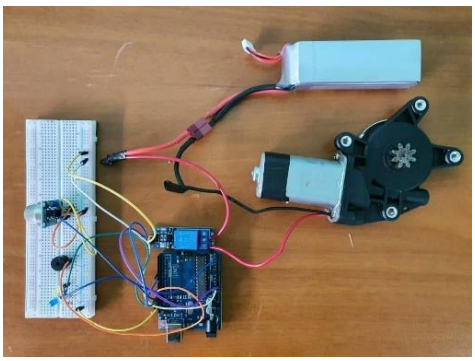

Figure 1: Installation of CO Detection System with Power Window

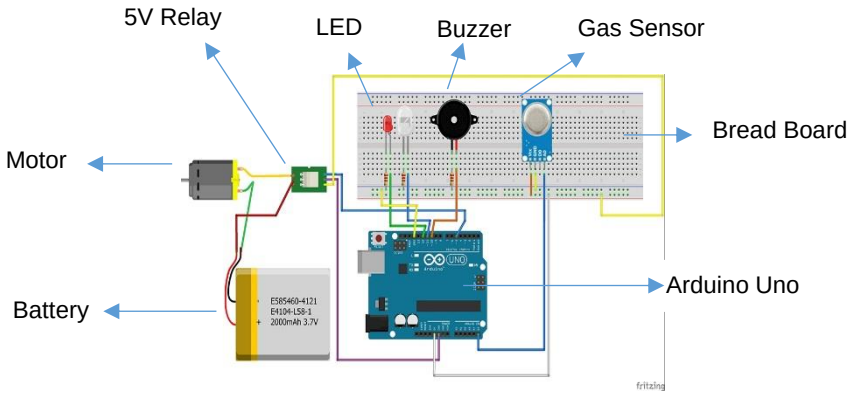

Figure 2: Integration of Power Windowand CO Sensor Schematic Diagram

3. RESULTS & DISCUSSION

The proposed design of cabin safety starts with measuring the CO concentration level read by the CO sensor. As long as the reading recorded is below the maximum CO level, the system will remain silent with a green LED indicator. Once the red LED and alarm system is activated, the car cabin's CO concentration is maximum. The relay switch will allow current flow from an external power supply to open the power window through its circuit. The decision programming flow process for the proposed device in this project is shown in Figure 3.

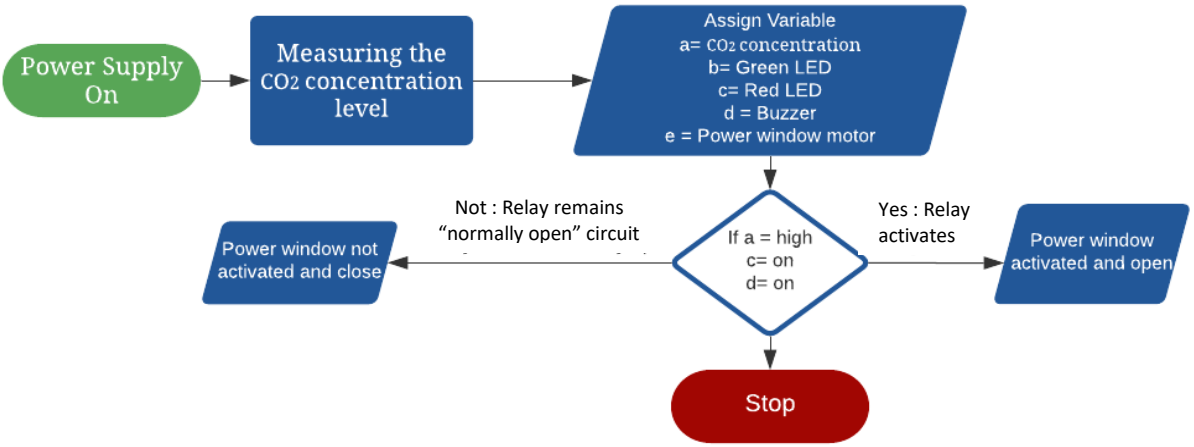

Figure 3: Decision Programming Flow Process

4. CONCLUSION & RECOMMENDATION

The system has been successfully operated and functions accordingly as designed to reach the objective of this project. However, the CO detection system could be improved by analyzing the minimum requirement for window opening by experimental and airflow simulation. Therefore, it provides additional safety features from theft and builds up more confidence in the driver while using this device in the future.

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