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Carbon Monoxide Detection and Warning System for Four Wheel Vehicle Cabin

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Abstract: We regularly read about several deaths due to carbon monoxide when people accidently inhale large amount of poisonous gas. There is no system inbuilt in vehicles to warn people about the presence of Carbon Monoxide (CO) especially when so many exhaust pipes are only inches away from adjacent vehicles.Our project is to make a system which will detect and warn about the presence of Carbon Monoxide (CO) as well as Carbon Dioxide (CO2) in vehicle. A digital meter which displays the level of dangerous gas presence in the level of 1 to 25. It also have a warning system which alerts the drivers about the poisonous gas for two minutes then it automatically stop the engine and start the exhaust fan, when poisonous gas quantity reached normal level then automatically it starts the engine. If this system is implemented in real world it can save huge numbers of lives Worldwide.
Index Terms- Carbon Monoxide, Carbon Monoxide sensor, warning system, digital meter, exhaust fan.

I. INTRODUCTION

Vehicle Cabin pollution and its corresponding poisoning and death is very common. We often listen of deaths due to car poisoning. Pollutants find their way into the cabin via the ventilation system, also known as the Heating, Ventilation and Air Conditioning (HVAC) system. Independent studies have shown that vehicle cabins commonly show concentrations of toxic gases such as carbon monoxide (CO), hydrocarbons (HC), volatile organic compounds (VOC), and oxides of nitrogen (NO*x*) higher than safety limits set by Occupational Safety and Health Administration (OSHA) and World Health Organization (WHO).

Fig. 1.1: Carbon Monoxide Poisoning

Low O2 levels can impair judgment, increase heart rate and impair muscular coordination. Another overlooked issue concerning vehicle cabin air quality is motor vehicle exhaust gas suicides caused by CO poisoning. Of the 2,320 suicides registered for the year 2002 in Australia, statistics indicate that 416 persons (18%) died from motor vehicle exhaust gas. Many deaths are also attributed to unintentional CO poisoning in and around motor vehicles. A study of U.S. deaths found that 57% of unintentional CO poisoning deaths occurred in automobiles. In recent years, new innovative sensors, systems and aftermarket products have been introduced in an attempt to alleviate vehicle cabin air quality concerns. The sensors and systems that achieve this will be the focus of this chapter.

A. *Vehicle Cabin Air Quality Monitoring (AQM)*

To summarize, vehicle cabins air quality concerns are usually generated by the following four scenarios:

1) Pollutant gases entering the vehicle via the ventilation system.
2) A lack of fresh airflow resulting in low O2 and high CO2 concentrations due to occupant breathing process.
3) Pollutant gases entering from the external environment via window openings, imperfect seals and other holes.

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4) Toxic gases entering the vehicle cabin by redirected exhaust fumes for self-harm purposes.

Currently, no system or aftermarket product addresses all four vehicle AQM concerns. Only two commercial

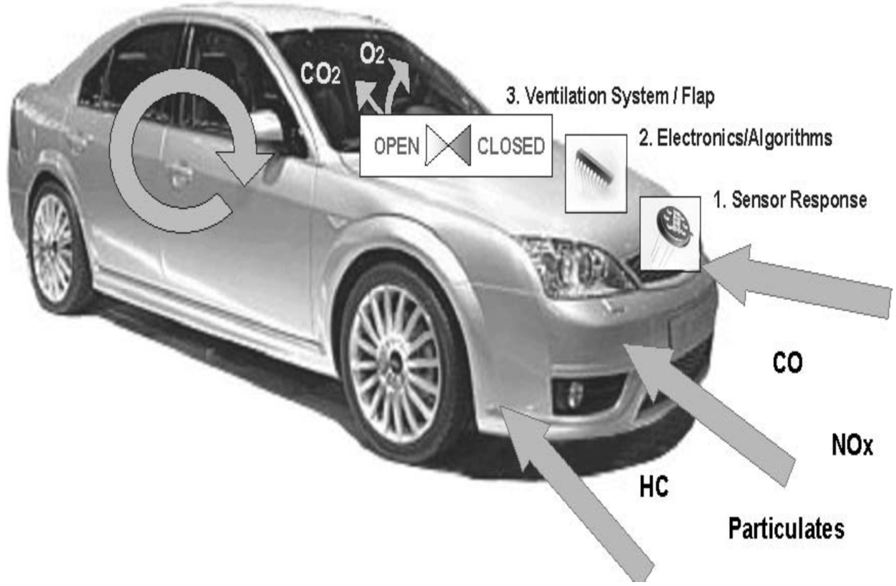

Fig.1.2 An overview of a typical HVAC AQM system.

Mounted in the air intake of the HVAC system, the AQM sensor sends a signal to the fresh air inlet flap to close when pollutant gases are detected and automatically reopen when the external air quality returns to an acceptable level. Although a driver could close the air inlet manually, forgetting to reopen it could cause the O2 concentration in the cabin to decrease and CO2 levels to increase. Therefore, a compromise must be reached. Typically, the AQM system maintains the ventilation flap in the open position. Only when high concentrations of pollutant gases are sensed, is the flap closed. Intelligent algorithms based on the gas concentration rate of change efficiently achieve this, without the need to calibrate the system to absolute gas concentrations. Features offered by AQMs include dynamic adaptation to various driving environments (e.g., city, outback, heavy traffic, underground tunnels), automatic sensor sensitivity control via software to continuously adapt to ambient pollution levels, automatic compensation for sensor tolerances yielding consistent sensor performance over the life of the vehicle, self-diagnostics, various interface specifications for Pulse Width Modulation (PWM) or bus-compatible applications. Such integrated AQM systems are effective in improving vehicle air quality; however, the shortfall is that they cannot ensure the vehicle cabin air quality remains within health and safety standards.

B. Vehicle Cabin AQM gas sensors

At the heart of the AQM system, are the gas sensors. The sensor detects target gases, and then converts the information into an electrical signal for processing. There are numerous ways to sense gas. However, as cost, size and simplicity are critical sensor attributes, only three sensing technologies can be considered for vehicle cabin air quality monitoring:

1) Semiconducting Metal Oxide (SMO) Technology

2) Electrochemical (EC) Technology

3) Infra-Red/Optical Technology

First are common Semiconducting Metal Oxide (SMO) gas sensors. These sensors are heated, causing reducing/ oxidizing gases to react with the surface of the metal oxide film and changing the semiconductor's conductivity proportionally to the target gas concentration. Second are electrochemical gas sensors. Electrodes placed in contact with a liquid electrolyte to form an electrochemical sensor. As the gas diffuses it reacts with the working electrode, changing its potential proportional to the gas concentration. And thirdly are IR optical sensors where the optical sensing element undergoes light transmission changes when exposed to the target gas. Table 1 compares the technologies against seven key AQM criteria. Both metal oxide and optical sensors are good candidates as AQM sensors. Electrochemical sensors on the other hand fall short as they have a maximum lifetime of approximately 2–5 years, rendering them unacceptable for AQM applications. Today, most AQM sensors employ SMO gas sensors. However, as the cost of IR based sensors rapidly decrease, they will more readily be found in integrated and aftermarket AQM

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solutions.

Table 1.1 Comparison of three gas-sensing technologies with respect to vehicle air quality monitoring criteria.

Criteria	Infra Red–Optical	Electrochemical	Metal Oxide
Cost	$15US	$10US	$10US
Life time	>6 years	2–5 years	>6 years
Sensitivity	Very Good	Very Good	Very Good
Selectivity	Excellent	Very Good	Poor
Response time	seconds	seconds	seconds
Size	Medium	Medium	Small
Ease of use	Good	Excellent	Excellent

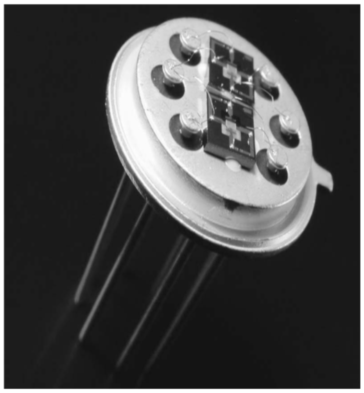


Fig. 1.3 Dual element gas sensor

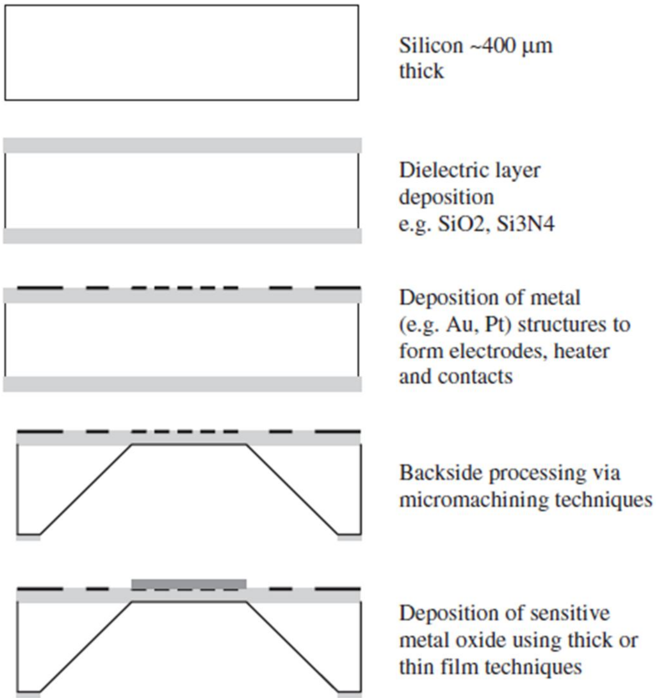


Fig. 1.4 Generic Si membrane gas sensor structure.

In parking structures, CO and NO2 are two of the most abundant airborne contaminants and poses significant safety concerns.

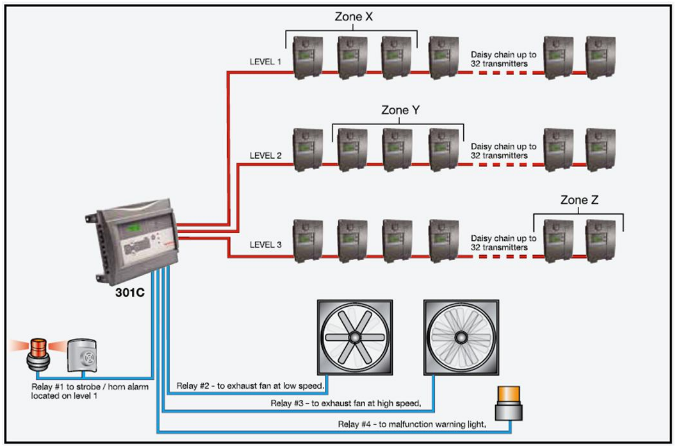


Fig. 1.5 Parking Lot System

The CO and NO2 levels must be controlled or ventilated when concentrations approach unsafe levels. Various gas monitors are available for use in parking structure applications. The specifics of the design determine what type of monitor or monitoring system best suits the application. This detailed, easy-to use guideline assists the design engineer in the selection of an optimal gas detection solution. Only on some countries it's compulsory to have carbon monoxide detectors in mall and theatre parking to get license. For vehicles it's not available and it makes very dangerous when drivers use vehicle air conditioner to sleep in cars.

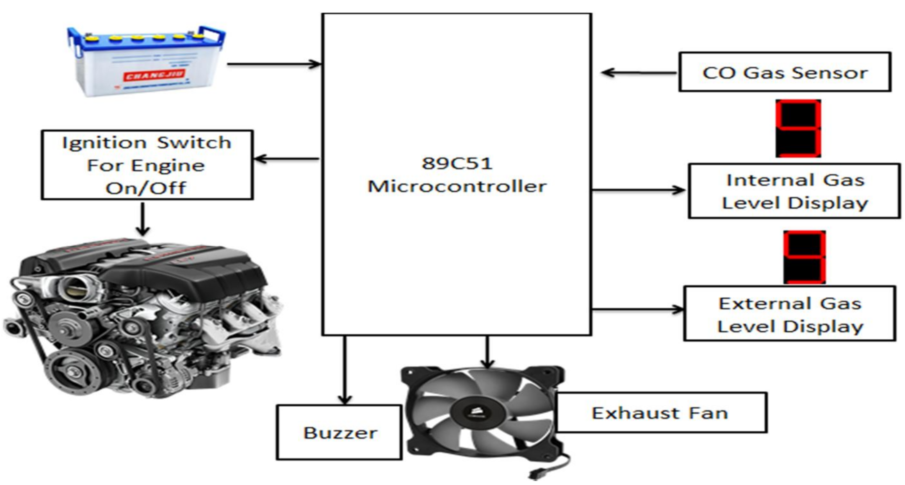
II. WORKING PROCEDURE

A. Vehicular Cabin Poisonous Carbon Monoxide (CO) Detection and Warning System

1) Our system automatically checks the level of poisonous gas and displays it in the digital form (0-100).
2) Once it reaches above the dangerous level (25) it warns us with the alarm.
3) Then it gives some time of 2 minutes to driver to make car in side if running and off the ignition. Then too if driver does not off the engine it automatically stops the engine and starts the exhaust fan to throw the gas from vehicle.
4) If this system is implemented in real world it can save huge number of lives worldwide.

B. Advantages of Vehicular Cabin Poisonous Carbon Monoxide (CO) Detection System

1) Real time project with instant gas level display.
2) Automatic engine stop when carbon monoxide is detected.
3) Automatic exhaust fan starter to throw poisonous gas out of vehicle cabin to save human life.
4) Can be readily implemented in any vehicle. Even two wheelers can use then to know whether they should wear gas masks while riding.



Block Diagram

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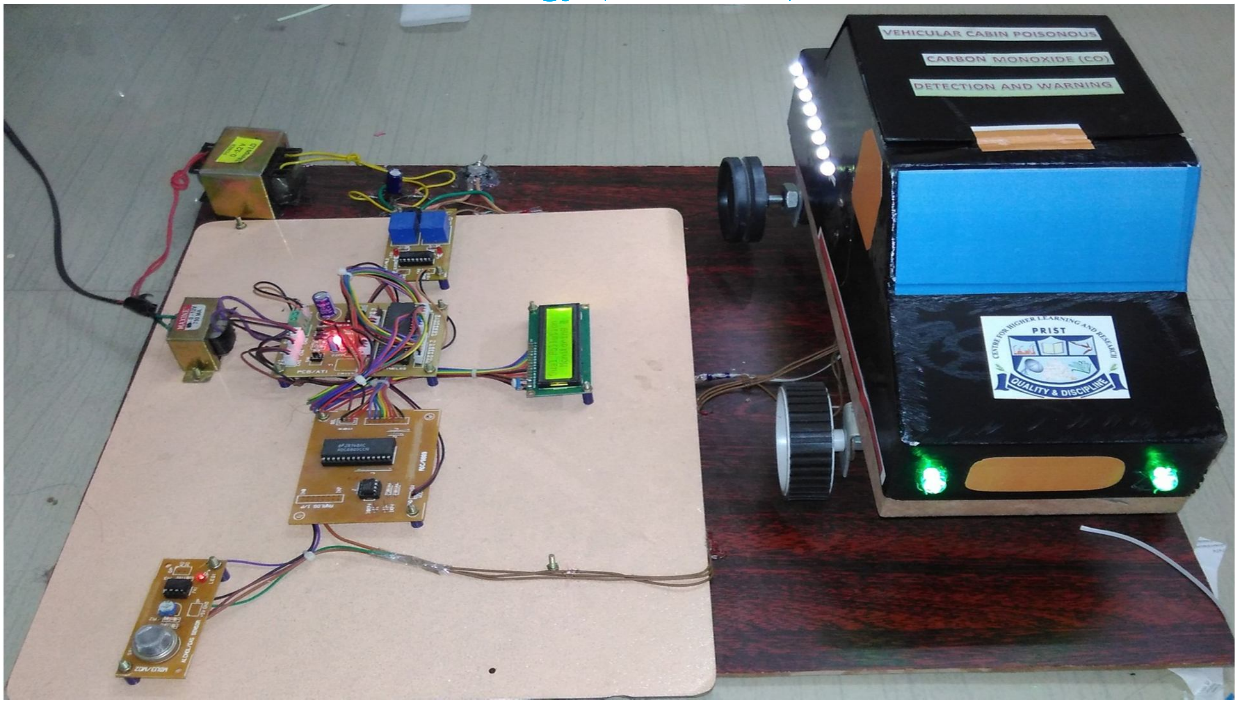
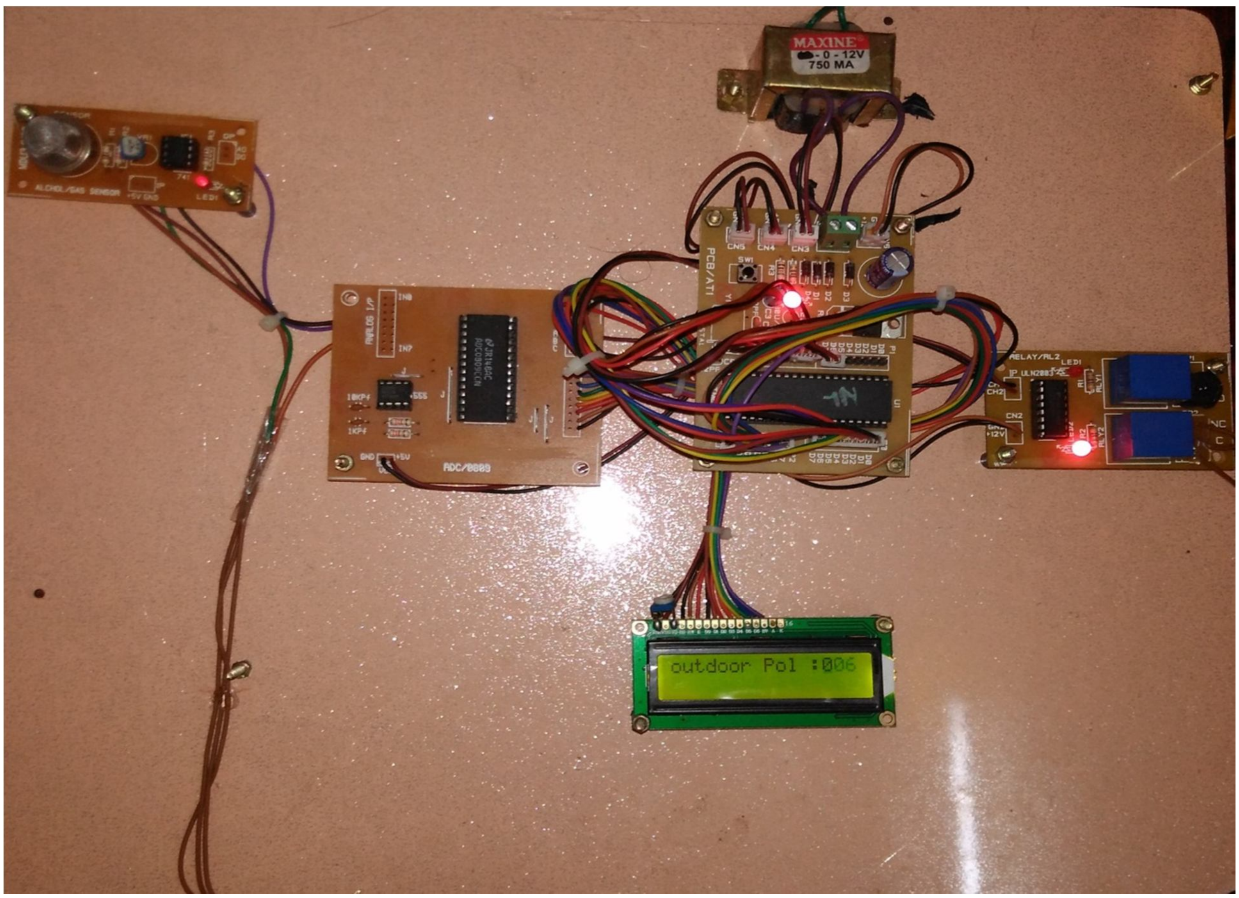


Overall Unit



SENSOR UNIT

III. FUTURE ENHANCEMENT

Carbon monoxide (CO) which is potentially a very harmful substance is found almost everywhere in and around the atmosphere. This is toxic and odor less for the mankind and other living being. When this poisonous gas will be inhaled it affects the function of our brain and hence CO is being hindrance for the people lives which may even be fatal. So, our project is designed in the way of detecting and also eliminating the toxic gas Carbon Monoxide more than the normal range present in and around the vehicles and other transportation system. If this project will be implemented commercially it will save many lives of the people who drive and travels. This project ensures an healthy lifestyle to all the people as protection away from harmful gases such as the CARBON MONOXIDE.

IV. RESULT AND CONCLUSIONS

Air Quality Monitoring (AQMs) will be found in more and more vehicles in the coming years. Manufacturers will demand reliable, low cost sensors that will be able to detect sub-ppm gas concentration levels. The systems will become smarter by automatically selecting ventilation settings and will provide both visual and audible alarm capabilities to prevent driver fatigue. Other safety features such as automatic engine shut-down has the potential to prevent exhaust gas suicides. Considering the high road fatality statistics directly attributed to fatigue, and the potential safety benefits AQM systems can provide, it is likely that AQM systems may one day find themselves as a standard vehicle safety feature similar to seat belts, air bags and anti-skid-brakes. Manufacturers will have to educate consumers on the merits of such systems as the benefits versus incremental cost must be justified.

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BIOGRAPHY

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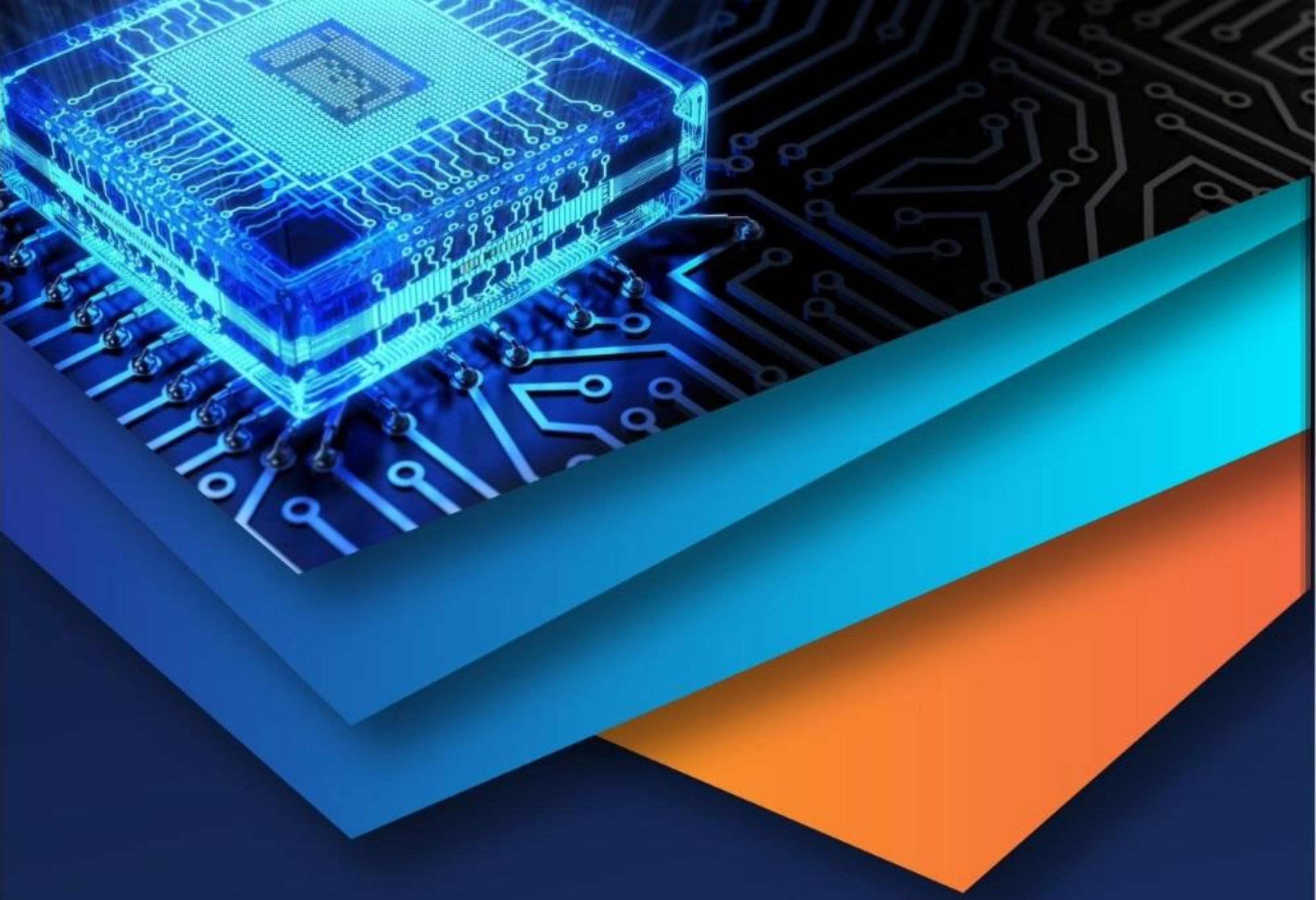

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