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Advanced CO2 Sensing Device in Vehicle

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Abstract: This paper represents advanced co2 sensing device in vehicle. This system is used for sensing co2 level in vehicle and actuating the oxygen pump if the level of co2 goes high by sensing message. Main function of this system is to alert the person about the co2 level in the vehicle. Modern growth and economic transformation of Indian society resulted in increased vehicle and passenger health issues. The aim of the present study is to develop a system that will make car rider safer. In this system we basically focus on the safety of passengers in the vehicle. It has modern GSM chip system which sends the message to the owner of the vehicle that the level of co2 in their vehicle is increasing. Also in high altitudes the oxygen level in atmosphere decreases rapidly and therefore breathing problem like suffocation, nasal congestion may take place. To eliminate these problems in vehicle at high altitudes, when co2 level increases beyond the limit this system immediately sends the message and starts the oxygen pump. This helps the driver to get the time to drive the vehicle in safe place.

I. INTRODUCTION

The advanced new technology are leading to various improvement in the automobile sector. Out of these, safety in modern vehicles is a main aspect. There is no hard and fast rule for what type of safety devices are we using in car. But the basic thing is to provide safe and sound ride to the passenger. Actually the disadvantage associated with the conventional vehicle technology is they don't mainly emphasis on the safety of the passengers. This difficulty that is associated with the conventional method causes the unsafely ride of passengers and make the ride uncomfortable. Due to this, modern technology in vehicles starts developing the different safety devices like, air bags, parking alarm, parking camera and many more.

According to the study of Swedish sensor manufacturer Senseair, there results says that if there is 4 passengers in car, co2 level reaches 1,000 ppm in 90 seconds,2,500 ppm in 5 minutes, and 6,000 ppm after almost half an hour even there is fresh air ventilation. Many research studies says that high level of carbon dioxide slacken cognitive abilities, decrease response times, and weaken the ability for an individual to make strategic decisions.

Drowsiness also explains for between 10%-30% of all automobile accidents yearly, and high carbon dioxide levels are known to be a cause. A 2016 USA Today study showed that 12-20 police men or women deaths per year because of lack of improper ventilation and high level of co2 inside the police vehicle. The use of advanced Co2 sensing device is a sure way of controlling the ventilation and even saving lives.

This paper presents the design of advanced co2 sensing device which detects the co2 level in the vehicle and alert the owner of the vehicle Advanced co2 sensing system is one of the device which enhance the safety of the person specially those who have small kids or have elderly person who sometimes get troubled during the high altitude ride. Also if there is sudden fire inside the vehicle, this device senses the co2 level and open this windows of vehicle so that passengers can escape as soon as possible without any harm. So in this way this system is useful in different ways and it is able to provide safe ride.

Work by the National Institute of Environmental Health Sciences[1] reported that the high level of CO2 may have an effect on human cognition.

Researcher performed an experiment to track and evaluate cognition of the subject in an enclosed office setting where the carbon dioxide gas was distributed to the location. When the CO2 level reached above 1,400 ppm (high concentration) the subject was confronted with the severe judgment question.

Another work done by Fisk et al. on indoor air pollution found that higher CO2 concentrations in an enclosed environment lead to erroneous human cognition[2].

The car's driving speed could influence the level of CO2 concentration in the cabin. It has found that different CO2 concentration levels were produced for vehicles which have the same ventilation system setting but were driven with different speeds. Concentration of CO2 compared with vehicle with lower speed

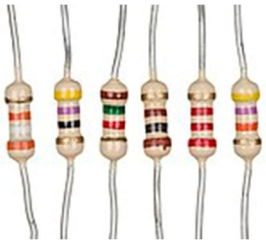
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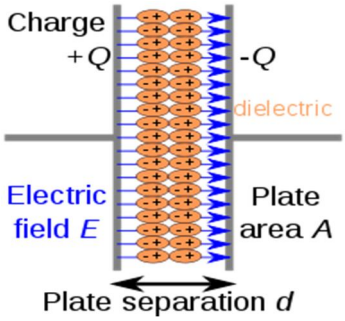
II. PROTOTYPE EXPERIENCE

In this section, we present our prototyping experience. We have used the following few components in building this safety system for vehicles those components are as follow:-

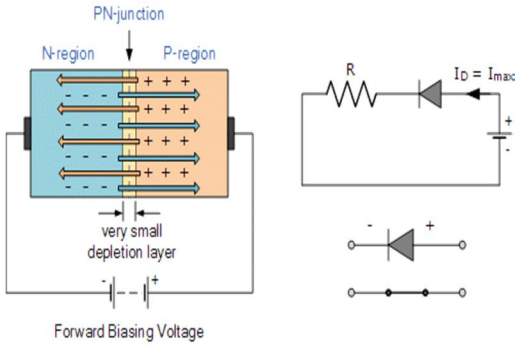
1) *DC Motor:* In the vehicle one DC motor are provided in each wheel to move forward and backward direction. The specification of motor used is 12V, with 60. When power supply from battery to DC motor the DC motor rotate in clockwise direction and when reverse current supply from battery to DC motor then DC motor will rotate in anticlockwise direction. Which will forward and backward movement of vehicle.
2) *Electrical Resistance:* The electrical resistance of an object is a measure of its opposition to the flow of electric current. The inverse quantity is electrical conductance, and is the ease with which an electric current passes. Electrical resistance shares some conceptual parallels with the notion of mechanical friction. The SI unit of electrical resistance is the ohm (Ω), while electrical conductance is measured in siemens (S).



3) Capacitor: The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally known as a condenser or condenser. This name and its cognates are still widely used in many languages, but rarely in English, one notable exception being condenser microphones, also called capacitor microphones.



4) *P-n Junction Diode:* A *PN Junction Diode* is one of the simplest semiconductor devices around, and which has the characteristic of passing current in only one direction only. However, unlike a resistor, a diode does not behave linearly with respect to the applied voltage as the diode has an exponential current-voltage (I-V) relationship and therefore we can not described its operation by simply using an equation such as Ohm's law. Reverse bias mode- Connecting the *p*-type region to the negative terminal of the battery and the *n-type* region to the *positive* terminal corresponds to reverse bias. If a diode is reverse-biased, the voltage at the cathode is comparatively higher than at the anode. Therefore, very little current flows until the diode breaks down.



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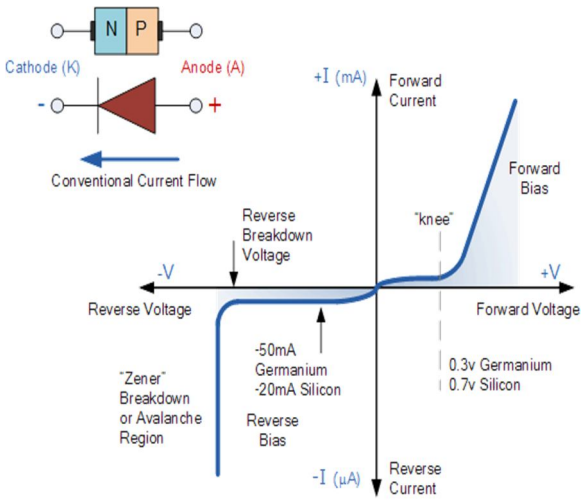
5) *Potentiometer:* Potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat. The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.



6) *Relay:* A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

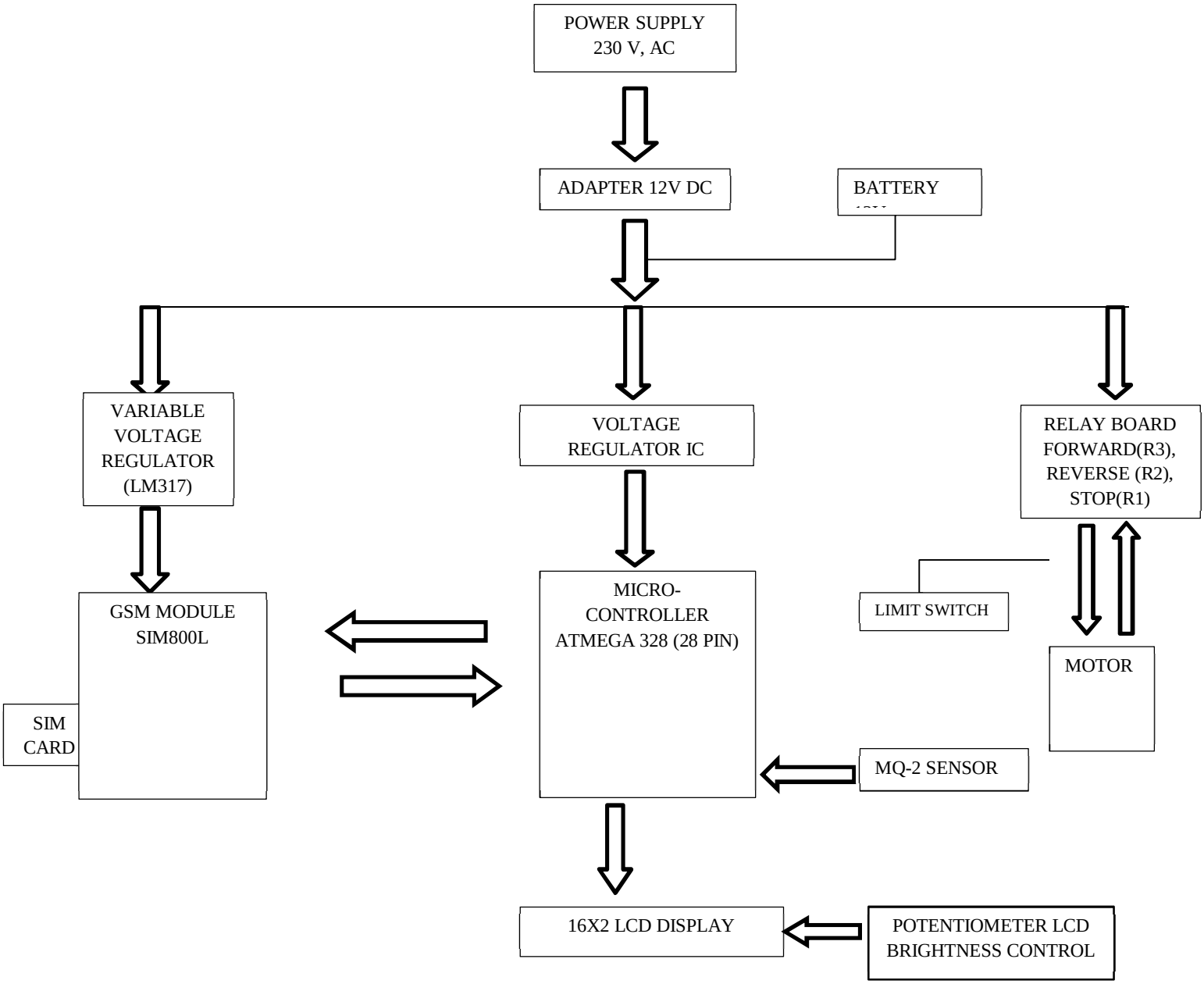
7) *Voltage Regulator IC:* A voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Electronic voltage regulators are found in devices such as computer power supplies where they stabilise the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

8) *Light Emitting Diode:* A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.



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9) *Transistor:* A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits.



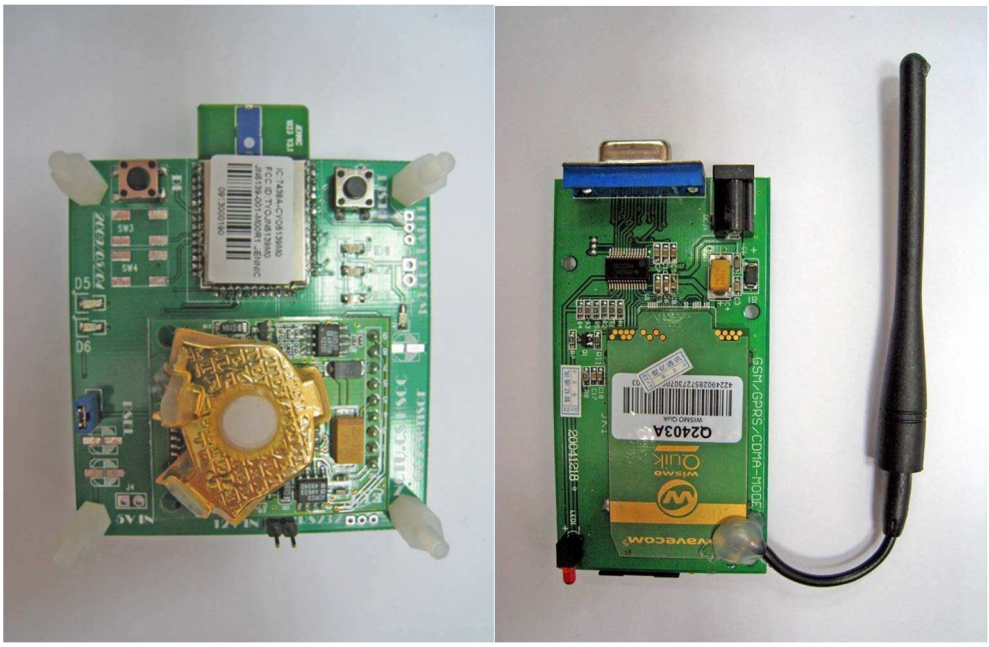
Block diagram of advanced co2 device in vehicle

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III. DESIGN OF ADVANCED co2 DEVICE

Fig 1 explains the block diagram of advanced co2 system, where there are number of components are used in this device. Starting from Power supply of 230V passing Alternating current which goes to adapter which convert 230V to 12V direct current or directly 12v battery can also be used. Now 12 v direct current goes to variable voltage regulator, voltage regulator and relay board. Variable voltage regulator controls the voltage and decrease it to 3.9v and send 3.9v to GSM module, voltage regulator (integrated circuit) gives +5V DC to micro-controller, simultaneously relay board which has 3 relay forward reverse and stop which operates knob and connected to motor. There is limit switch which give feedback to relay board either knob is open or closed. Here Micro-controller is the heart of this device which sends signal to GSM module when co2 level gets high as per setting for example 220ppm.GSM module have Sim card which send message to particular number, GSM module is connected to micro-controller. There is a MQ-2 gas sensor which is also called Co2 gas sensor. Further 16x2 LCD display is their, which shows whether the network is available or not in sim and It is connected to Potentiometer LCD Brightness Control which control brightness of LCD screen.



CO_2 sensing module GSM communication module

A. *Working*

The advanced co2 sensing system works on the principle of concentration of gas (mainly) inside the system with respect to ambient surrounding. When the concentration of co2 rises above a certain level inside the vehicle, then the co2 sensor activates and sends a signal to the micro controller chip.

As soon as the micro-controller receives the signal it gets converted into digital signal and then further transfers of the integrated circuit (I.C) which analyses the signal and gives required command to the relay. The relay consists of three units-(a) main relay (b) ON relay (c) OFF relay. The main relay usually known as stop switch, stops current flowing through it as per the requirement.

The ON relay flows the current in positive direction and on the other hand the OFF relay flows the current in the opposite direction. When the current flows in positive direction the ON relay passes the signal to the actuator to start the DC motor which moves forward and pushes the knob of the oxygen sensor as soon as the motor presses the knob, oxygen gets released in the vehicle. The system is designed so as to send the vehicle owner a SMS after 10 seconds of oxygen pumping inside the vehicle. If the owner wants to switch OFF the system, then the system can be switched

OFF manually or through an electronic remote. The motor keeps on pressing the oxygen tank knob for about 1-1.5 hours after sending the SMS if the owner doesn't't switch OFF the system. After completion of 1 hour the cut off relay generates a negative polarity across the DC motor which starts moving back and release the knob as the current starts flowing in the other direction. The oxygen tank can be refilled manually with the help of an air compressor or it can be replaced by a new one.

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IV. CONCLUSION

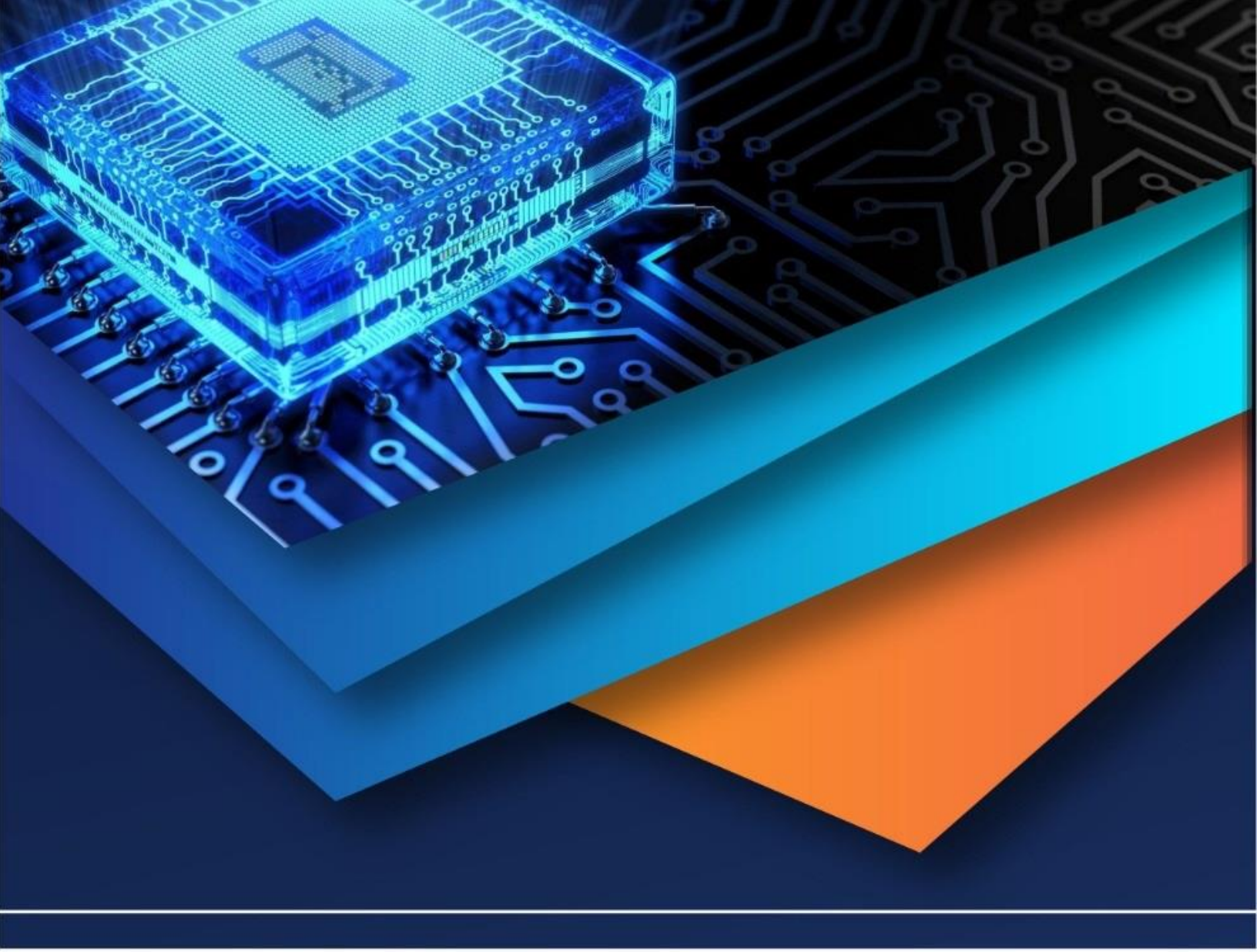
A prototype for the proposed approach was developed by integrating advanced co2 sensing system into the vehicle by testing the level of co2 in the car, and by triggering the oxygen pump by sending an warning to the passenger. This prototype has been found to be able to provide safe ride in the modern vehicle and to remove the risk of rising co2 to the level desired.

This program leads to modern vehicle safety and strengthens the safety regulations as per the rules. However, on the other hand check also clearly shows places where enhancements, modifications, adjustments in requirements and additional device functionality are expected to fit the intended purpose better. Valuable data and hint to be obtained in connection with issues such as o2 detection control method, sensor mounting merits and disadvantages, cost, handling, electronic system between device and vehicle, maintenance , service and easy adjustment.

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