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Efficient Model for Gas Leakage Detection Using IoT

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Abstract: ***In today's world, safety is critical, and good safety systems must be put in place. The principal objective of this study is to design a harmful gas sensing and warning system based on embedded systems. LPG is used for cooking and in industries. Since LPG is stored in a bottle, it is easily damaged. In any case, when the gas cylinder, controller, and tube are not in great state, breaks occur, resulting in a issue. Accidents can cause problems such as suffocation and can start of fire.***
Installing gas leakage detectors in vulnerable areas is the most important measure to avoid accidents caused by gas spill. The primary purpose of this study is to propose a framework for detecting and eliminating gas spills in vulnerable areas. The gas spill sensor is one such way of detecting and alerting people to gas spills in their initial stages. The gas leak detection system includes a GSM module that sends SMS messages when a gas leak is noticed.
Keywords: Node MCU, MQ6 Sensor, Liquid crystal display, ESP8266 WIFI, Servo Motor, GSM module.

I. INTRODUCTION

As a result of LPG gas detection, many incidents, such as explosions and fires, have occurred. Such incidents can have serious consequences. This leakage detection system will detect external leaks and send data to a module. IoT systems do not need human intervention.

A system with large electric and mechanical power is used to detect gas. This detection system will notify us of the leakage and also turn off the gas cylinder's lever, preventing any further leakage. This technology also sends an email and a text message to the person who is affected. In every case, this improves the safety of any gas system.

Any flammable substance on the site that comes in touch with gas can result in property loss, harm lives and other consequences. Automobiles such as cars and buses, as well as the areas where they are manufactured, are among the primary sectors under constant threat.

II. OBJECTIVES

LPG leaks are now a concern both in home and in the workplace. It is unavoidably dangerous if the problem is not identified and corrected as soon as possible.

The project's major purpose is to use the IoT devices to spot gas leaks from Gas cylinders. which are common in Indian homes, and to alert the user and the surrounding area. A servo motor will also turn off the supply gas, as will the knob, reducing the risk of an accident. A gas sensor is used as input.

III. LITERATURE SURVEY

Azibek [12] investigated a smart home care system that monitors the safety of old people. If abnormal health rate vitals are discovered, it sends an email to medical personnel. This home care system also includes sensors for identifying fires and a camera for detecting burglars. The system sends notifications to people struggling from short term memory loss concerning daily routine duties. Yoshida (2009) examines a fuel power supply system that consists of a fuel battery into which a reactive gas is supplied to generate power, a pipe connecting to the fuel battery, and a technique for sensing a gas leakage in the fuel power source. The primary goal was to improve performance. A system which can identify methane leaks in residences is described by Fraiwan[11]. The system is comprised of two primary components: the first checks to see if the vapor pressure exceeds a predefined limit, and the second checks to see if the gas concentration is below a predefined limit. Ilshak [13] proposed a cordless gas leakage unit that can be used to detect LPG leaks in the home. The module checks the sensor to see if the value of the gas has risen above a certain threshold. When this happens, the alert is triggered, and a SMS is sent to a specified user.

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"PORTABLE GAS DETECTION DEVICE WITH WARNING SYSTEM" by Tarun Joseph
The authors of this paper have explained a gas detection method that will regularly monitor the toxic gases around them, the results may be viewed on our Mobile application.

The below fig1 illustrates the system architecture:

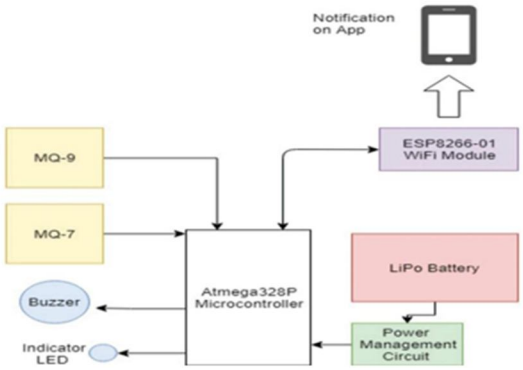


Fig1. System Architecture

IV. PROPOSED SYSTEM

Many incidents, such as fires or explosions, have occurred as a result of LPG gas leakage. If the leak is not noticed early enough, such accidents might have catastrophic implications. The Microcontroller and IoT-based LPG leakage sensor is a project that will help detect gas in the environment while also providing data. An IoT and Arduino-based LPG leakage detection system uses an LPG gas sensor to detect LPG gas. Notification is triggered from sensor to MCU.
LCD has a connection to MCU. Buzzer also has a connection to MCU. In this IoT LPG leakage detector project, the ESP8266 chip is employed.
GSM module is triggered to send message. Things speak displays the live data which has been analyzed. It has api keys for authentication. It is created on a private channel and the changes cannot be made without the api keys. Turning off of the cylinder knob is done using servomotor. It turns 180 degrees which in result turns off the knob.

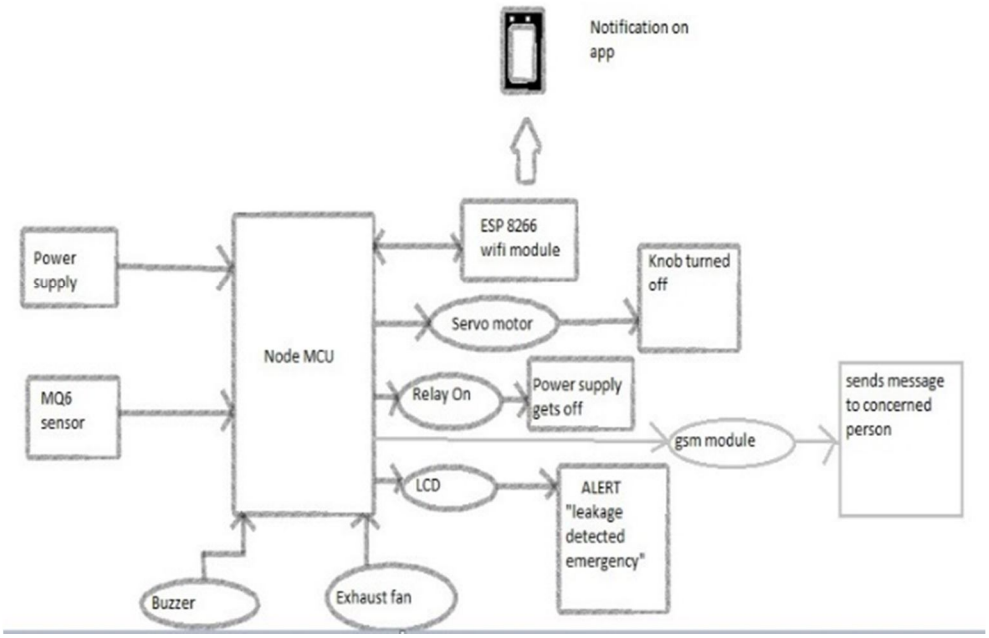


Figure.1 Shows the architecture of the proposed system

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A. Hardware Components

1) ESP8266 NODE MCU: Node MCU is an open-source platform based on the ESP8266 that allows objects to be connected and data to be transferred using the Wi-Fi protocol.



Figure.2 ESP8266 NODE MCU

2) MQ6 Sensor: This sensor can detect or measure gases The MQ-6 sensor consists of a Digital Pin The below **figure 3** shows the MQ6 sensor.



Figure.3 MQ6 Sensor

3) GSM Module: This is used as a interface between a computer and a GSM system. The GSM is a mobile communication architecture that is used in the most of the countries.

A GSM MODEM can carry out the following tasks:

a) In a SIM, you can accept, convey, or discard messages.
b) Read, add, and search the SIM's phonebook entries.
c) Make, receive, or decline a voice call.

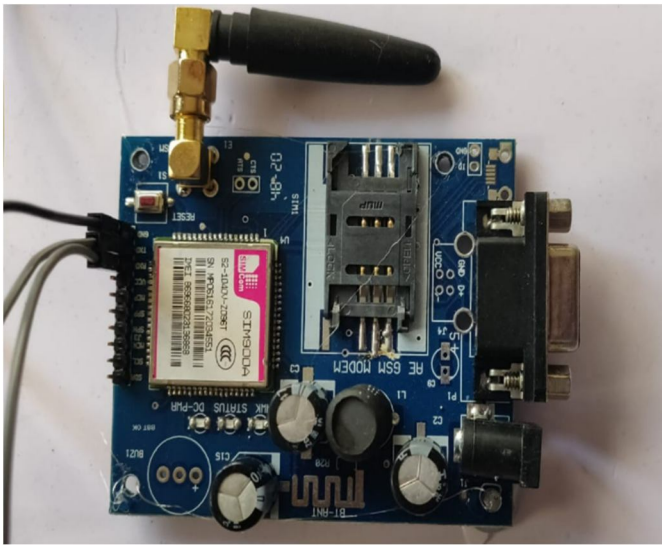


Figure.4 GSM Module

4) LCD Display: An LCD is a type of electronic screen that uses liquid crystal to generate a visible image. The 16x2 LCD display is a simple module that is commonly used in circuits to display characters.



Figure.5 LCD Display

V. WORKING SYSTEM

The proposed system has the following components:

A. Circuit for Power Supply

This circuit is made up of a 9V DC battery that powers the Node MCU.

B. The Sensing Circuit

The sensing circuit includes an MQ6 sensor with high sensitivity to Propane, Butane, LPG, and Natural Gas. The sensor can detect a variety of combustible gases. The sensor detects the value and sends it to the Node MCU to be updated in the app, and the sensor-derived gas value is displayed on the LCD screen.

C. Transmit Circuit for GSM

GSM module is used to trigger SMS. A message will be sent to the user.

D. Circuit for Threat Awareness and Mitigation

A buzzer and an exhaust fan make up this module. A buzzer is used to alert neighbours and people in the area of a leak. Exhaust Fans are used to remove excess gas from the atmosphere.

E. Relay and Servo Motor

The knob is connected to a servo motor; when the leakage is detected, the node MCU causes the servo motor to rotate 180 degrees, causing the knob to be turned off.

In our project, we used two relays: the first is connected to the buzzer and the fan, and the second is connected to the power supply. When there is an indication of a gas leak, both relays will be activated, acting as a switch; the first relay will power on the fan and buzzer, while the second relay will cut off the power supply to the entire system, preventing further accidents.

The figure 6 and figure 7 below illustrates the dataflow of the proposed system

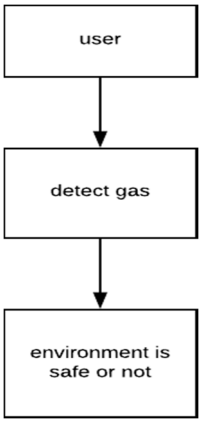


Figure 6. Dataflow diagram at 0^{th} level

The system is started by the user by connecting to a hotspot or a WIFI connection. The sensor will sense or detect the gas value in the atmosphere and, based on that, determine whether the environment is safe or not, and a message will be sent accordingly.

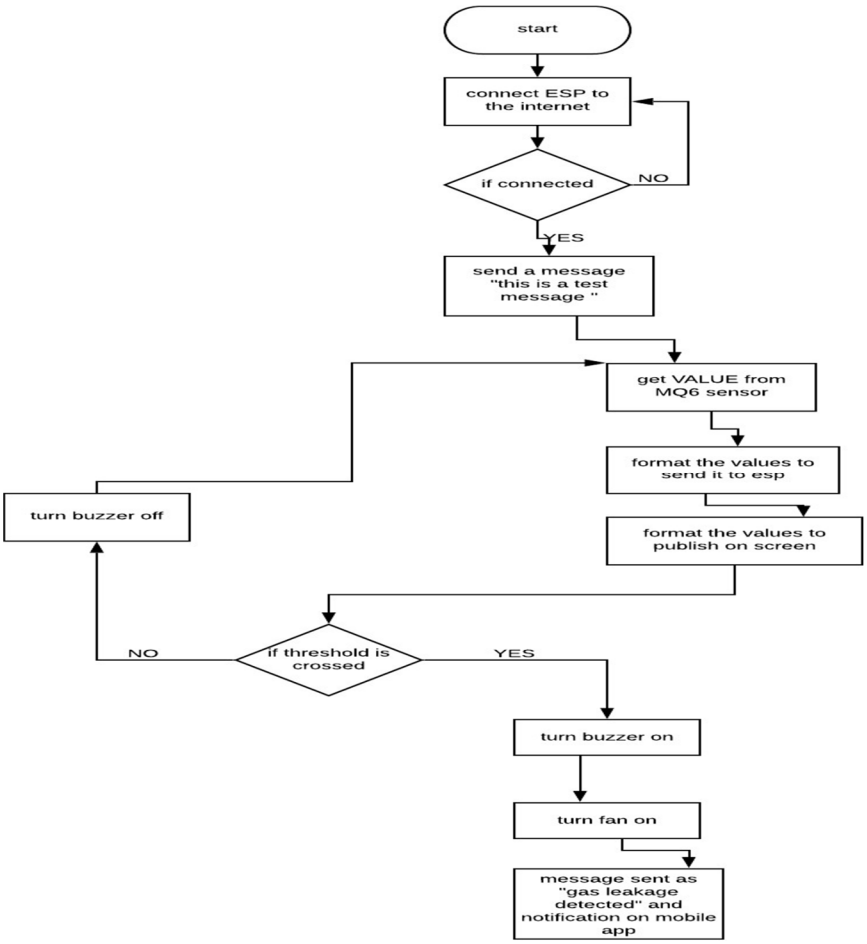


Figure 7. Data flow diagram at 1st level

The MQ6 sensor detects the gas value in the atmosphere and sends the information to the Node MCU, which sends the information to the LCD screen, which displays the gas content in the atmosphere at all times. This data is also sent to the Thingspeak where it is displayed. A certain threshold value will be established; if the calculated value is less than the threshold value, the system takes no action and continues to sense the gas value in the atmosphere. If the calculated value exceeds the threshold value. The Node MCU will then tell the buzzer to ring, the exhaust fan to turn on, and the servo motor to rotate, causing the knob to be turned off. Concerning the gas leak, a message will be sent to the concerned user.

VI. RESULTS

The Gas Detection system is developed using IoT. Uses node MCU and GSM module.

First the components are connected to the WIFI module.



Figure 8: Connecting to WIFI Module.

The initial value of the gas is noted

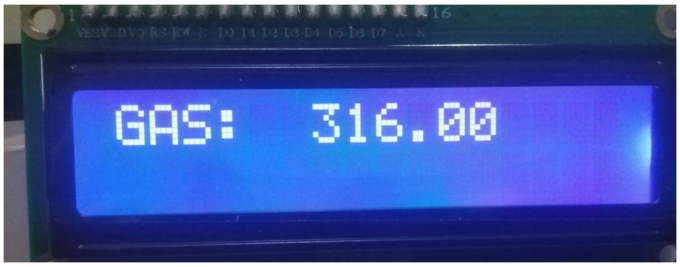


Figure 9: Initial Gas Value

When the threshold value is reached, that value is shown and the buzzer is switched on, servo motor will turn 180 degrees which in result turns off the knob.

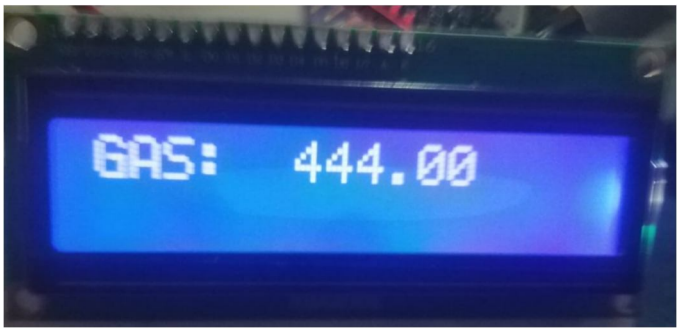


Figure 10 shows the threshold value

A private channel has been created on Thingspeak where all the data which has been collected from the objects will be displayed. As it is a private channel, we need an API key for authentication.

API key allows us to read to or write from a private channel.

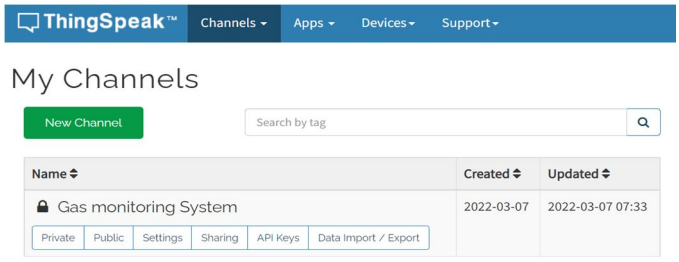


Figure 11 shows the private channel

The data analyzed is displayed on Thingspeak.

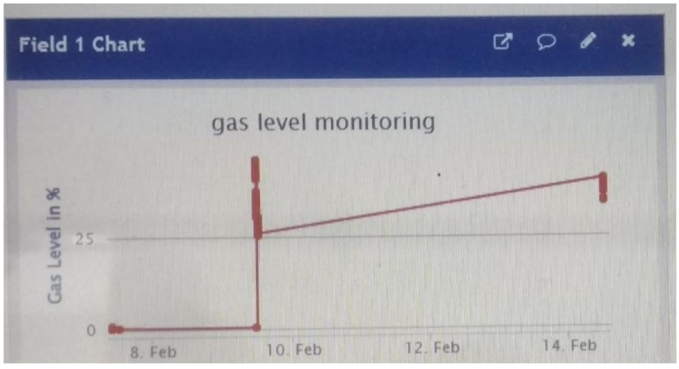


Figure 12 shows the live data.

VII. CONCLUSION

This project aims to develop a monitoring and detection system to meet safety standards and avoid free accidents caused by leakage. The system detects gas in the atmosphere and will continuously update and display the gas value, which the user can easily see via the mobile app.

This system has a faster response rate and can disseminate critical information faster than manual methods. In the event of a leak, the system alerts and responds quickly by sending SMS to the appropriate authority.

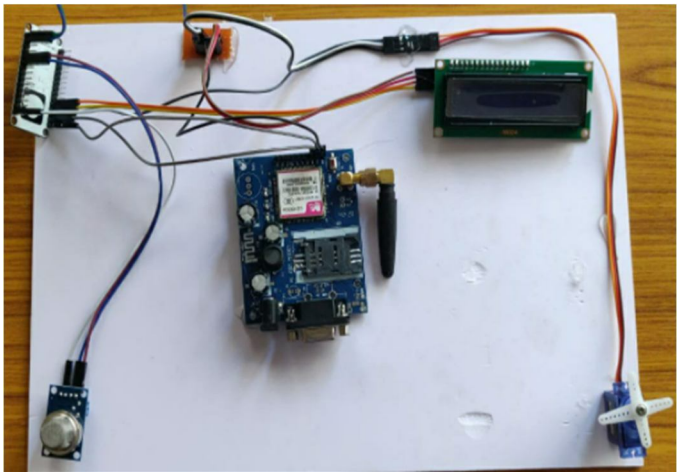


Figure 12 shows the circuit connection

VIII. FUTURE ENHANCEMENT

In addition to the gas sensor, a temperature sensor can be used which detects the high-pressure gas and display the alert SMS when a high temperature is reached. The use of a pressure sensor along with the system can provide an extra feature of automatic gas booking. Further development in industries.

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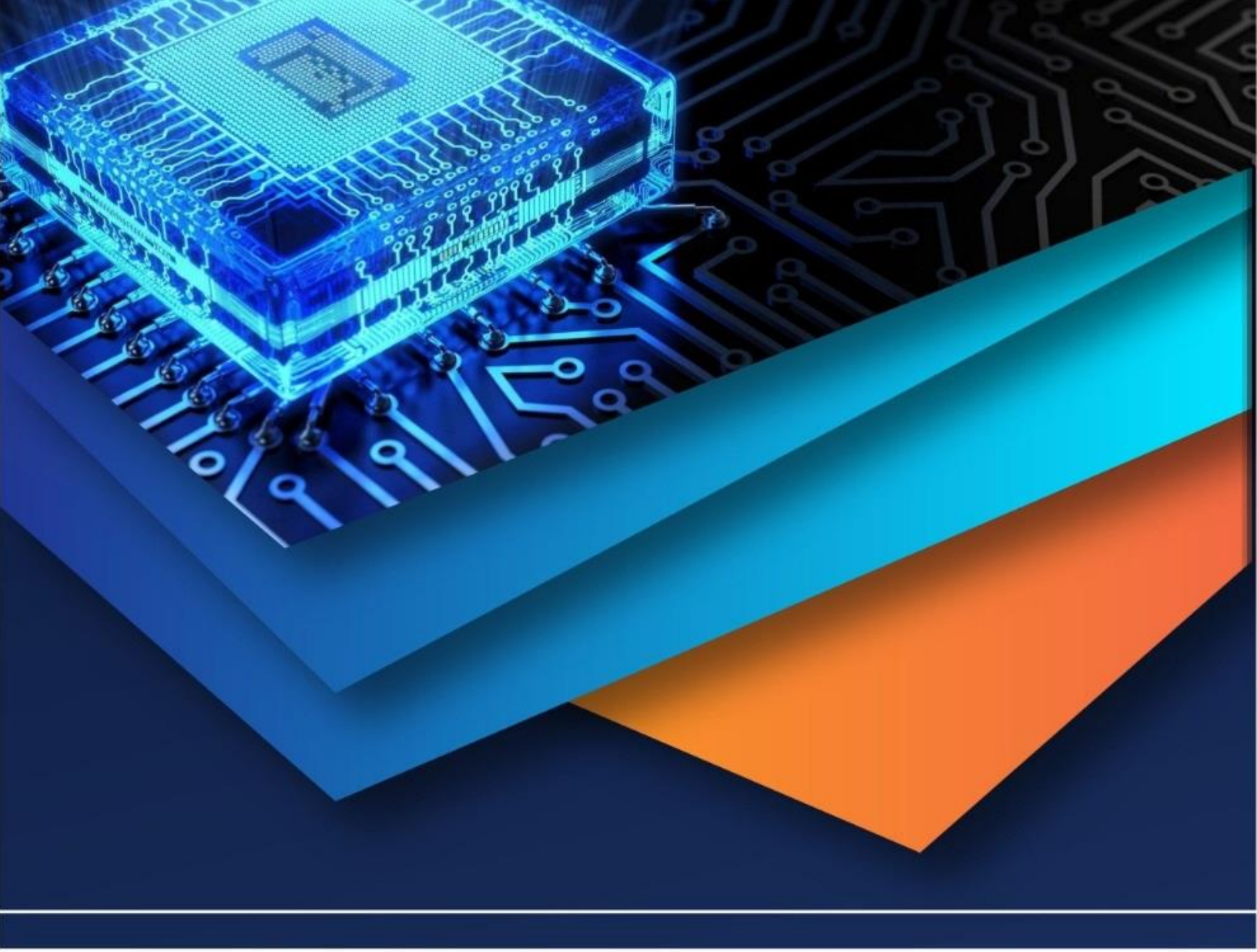
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