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Gas Level Alert and Automatic Cut-Off in a Stove

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Abstract— this paper proposes a technique which lets us to completely eliminate any mishappenings that generally occur with the leakage of gas in a daily base Gas stove system. The system can be operated in a way as to check whether there is any utensil placed on the stove or not by implementing a proximity sensor and if there is no utensil on the stove, the gas supply is immediately switched off. In a similar fashion, we can also switch the supply off in instances where we happen to see that the weight of the gas cylinder is lower than the set threshold which indicates the quantity of the gas in the cylinder is low which is done using a strain gauge load cell. Any leaks of gas can also be detected with the proposed system. In addition, it is also possible to detect whistles, count them and then shut the supply off and also a facility to set a predefined time to cook in synchronous with the utensil being placed on the stove can be provided.

Keywords— Arduino UNO, Solenoid valve, MQ6 Sensor, Strain gauge load cell, OLED Screen, Proximity sensor, HX711 A/D converter, Sound detector, 4x4 matrix membrane Keypad.

I. INTRODUCTION

In this fast paced world and the lifestyle that is being employed by the current generation of mankind, it is essential to be safe first than to be comfortable, considering the daily usage of the machines and systems to fulfil our needs some of which may devour our lives. To add, the time and efforts that are put in cooking these days, by the new generation are to be considered with a pinch of salt that safety becomes a primary issue in doing things quickly. Also for the fact that people wish to put least efforts into doing things, automation becomes indispensable in employing the daily systems and machines. Thus, our paper proposes a system which takes care of all the needs mentioned above. The above mentioned methodology is implemented as follows. An Arduino UNO module controls all the components attached to it in a network conjunction with the gas supply cylinder. The network of components includes the IR proximity sensor which senses the presence of a utensil on the stove and acts accordingly. The strain gauge load cell measures the weight of the cylinder and sends signals to the arduino to take action. Any gas leakage is detected with the help of a MQ6 gas sensor. Whistles of a cooker can be detected using a microphone and a timed act can be accomplished by using an onboard timer on the arduino board and after a preset time, the gas gets turned off. The selection of all these options can be done with a 4*4 matrix membrane keyboard where all the processes are visible on an OLED screen.

II. DESCRIPTION OF COMPONENTS

Components include Arduino UNO, MQ6 Sensor, Strain gauge load cell, Solenoid valve, OLED Screen, Proximity sensor, HX711 A/D converter, Sound detector, 4x4 matrix membrane Keypad.

A. Proximity Sensor

This sensor has in built transmitter and receiver that send out IR signal and checks for reflected IR signal. If the signal got reflected it indicates there is an obstacle in front of sensor module.

Fig. 1 IR Sensor

B. Arduino Uno

Arduino is a development board which comes with various series of microcontrollers. The best part about using arduino is the microcontroller architecture can be ignored. The Uno is a microcontroller board based on the ATmega328P.It has 14 digital i/o pins,

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6 analog inputs, a 16 MHz quartz crystal, a USB connection.

Fig. 2 Arduino Uno

C. MQ-6 Sensor

Response time is high. Gas can be detected ranging from 195-9945ppm.This Sensor is used to detect gas leakage. High sensitivity and low power consumption. Analog resistance output.

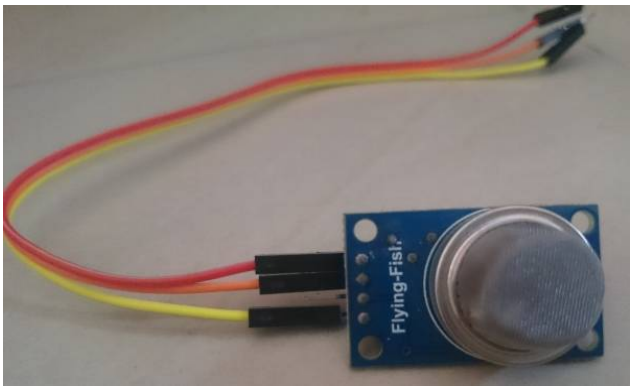

Fig. 3. MQ-6 gas sensor

D. Strain Gauge Load Cell

Strain Gauge Load Cell is a transducer of which When it is stretched, its resistance increases. Several strain gauges elements are present in Load cell. Whenever it experiences a force, the resistance value changes. The signal generated is in the order of a few millivolt .So the amplification of signal is necessary.

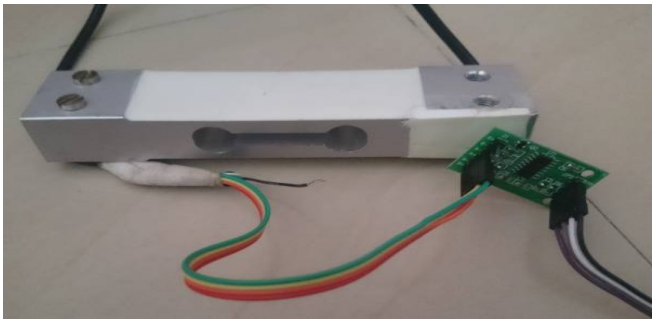

Fig. 4. Strain Gauge Load Cell

E. Organic Light Emitting Diode (OLED)

High resolution, Wider view angle, Low power consumption are some of its advantages. It is compatible to 3.3v and 5.0v chip I/O level.

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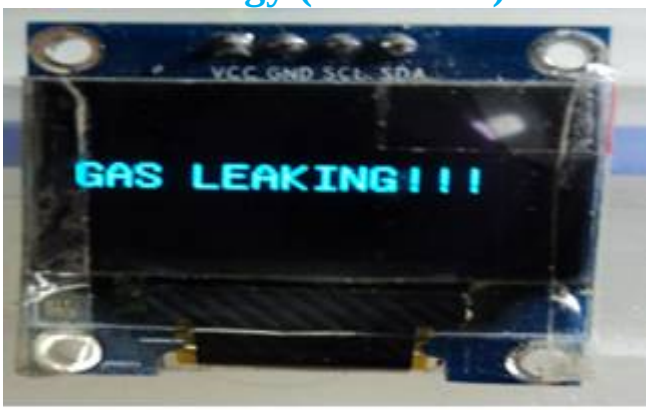

Fig. 5. OLED

F. HX711 A/D converter

The output from the strain gauge lad cell is in the analog form. So this signal has to be converted into digital format using this A/D converter and is given to the arduino for further action.

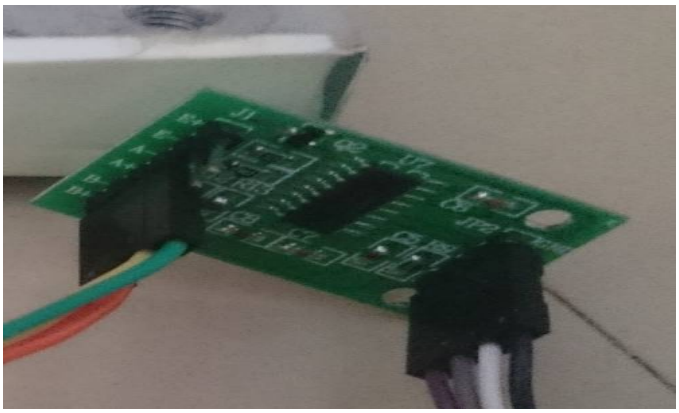

Fig. 6. Analog to Digital Converter

G. Sound detector

Sound detector is a small with four different outputs. It provides both audio output and binary indication of the presence of sound. The 4 pins are Vcc supply, GND (ground), analog output and digital output. Sound detector is a transducer.

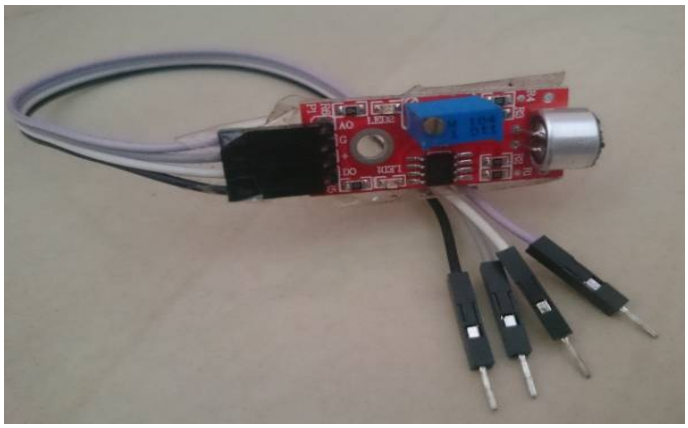

Fig. 7. Sound Detector

*H. 4*4 Matrix Membrane Keypad*

This is a 16-button keypad. It is used to provide input details while in timer mode or in any other mode where ever input details are needed.

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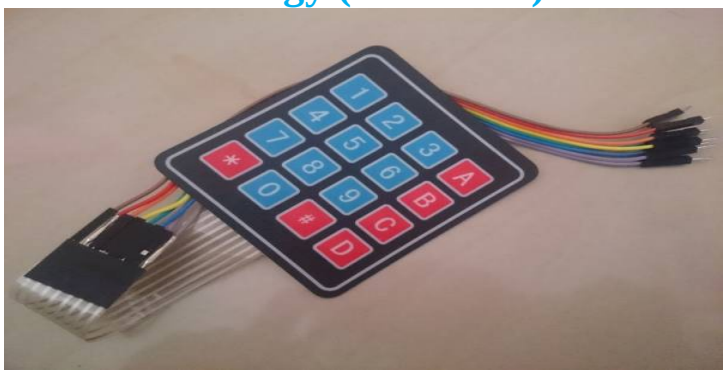

Fig. 8. 4*4 matrix keypad

I. Solenoid Cell

A solenoid valve is an electromechanically controlled valve. It may either have 2 valves or 3 or many as a matter of fact as per the usage of the user. The valve is controlled with a current being sent to the solenoid such that it opens and closes accordingly opening and closing the valve. Their tasks are to shut off, release, dose, distribute or mix fluids. Solenoids offer fast and safe switching, high reliability, Long service life, good medium compatibility of the materials used, low control power and compact design.

III. BLOCK DIAGRAM

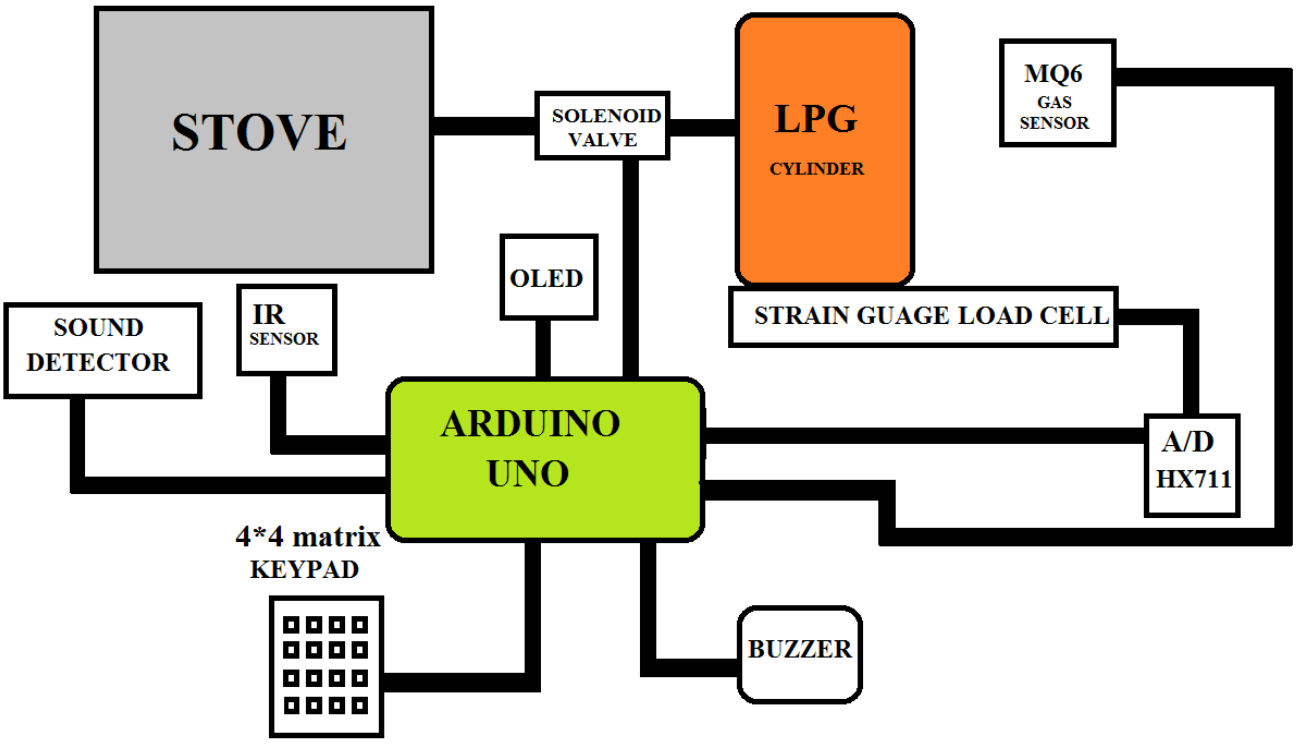

Fig. 9.Block diagram of proposed system

IV. EXPLINATION

All the components that make up the system are as shown above and each of the components is held together by a controller Arduino UNO which holds a preloaded program given by the user which has all the thresholds and other parameters to detect anomalies set. The program works well and can be best explained by considering the scenarios where various events of tragedy are possible as follows. If at all there is leakage of gas, there is an MQ6 sensor whose characteristics are described earlier in the components description section, which is sensitive enough to detect the leaking gas and turn the supply off immediately which so

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can be done with the implementation of a solenoid valve placed in between the stove and the cylinder. A signal is sent to the Arduino from the MQ6 sensor saying that there is a leak and the Arduino board happens to send an electrical signal to the solenoid valve which shuts off the inlet valve of the gas. Also, there is a buzzer which is excited whenever such emergencies occur along with the gas cut-off process. Another anomaly detection includes an IR proximity sensor which senses the presence or absence of a utensil i.e., if any of them are placed on the stove or not. If there is no utensil present on the burner, or if the utensil has been taken off the burner, the supply of gas is shut off instantly which is the result of a signal being sent from the IR proximity sensor to the Arduino board which in turn sends a signal to the solenoid to shut off the valve. Another amendment in the proposed system is that a strain gauge load cell is placed under the gas cylinder and the weight is checked when the cylinder is filled with gas to a full and a threshold of weight is set in the program which indicates the lowest quantity of gas present in the cylinder such that when that threshold is reached, it indicates that the weight is reduced on the strain gauge which is a resistive load connection indicating the variation in current which triggers an action to close the solenoid valve whenever it happens and thus, preventing any malicious happenings. There is also a facility to choose modes of operation which include the timer mode, whistle mode and the usual gas% mode. All of the options are displayed on an OLED display, which are open to choose from a 4x4 matrix membrane keypad. All of these components are yet again attached to the Arduino board. If the timer mode is selected, the user is prompted to choose the desired amount of time the gas is to be supplied to the burner and is supplied so unless if the utensil is lifted up which pauses the action and can be later resumed whenever the utensil is placed again on the burner. The whistle mode is implemented using a small microphone module which is also pre-calibrated to only detect the whistles of a cooker. The count of whistles is chosen and after the count is reached, again the gas supply is cut-off. The usual Gas% mode is as described earlier which says the quantity of gas left in the cylinder and works manually without any of the restrictions from the user and is a freestyle operation mode. The above is the implementation methodology applied to achieve the results as follows.

V. WORKING MODEL

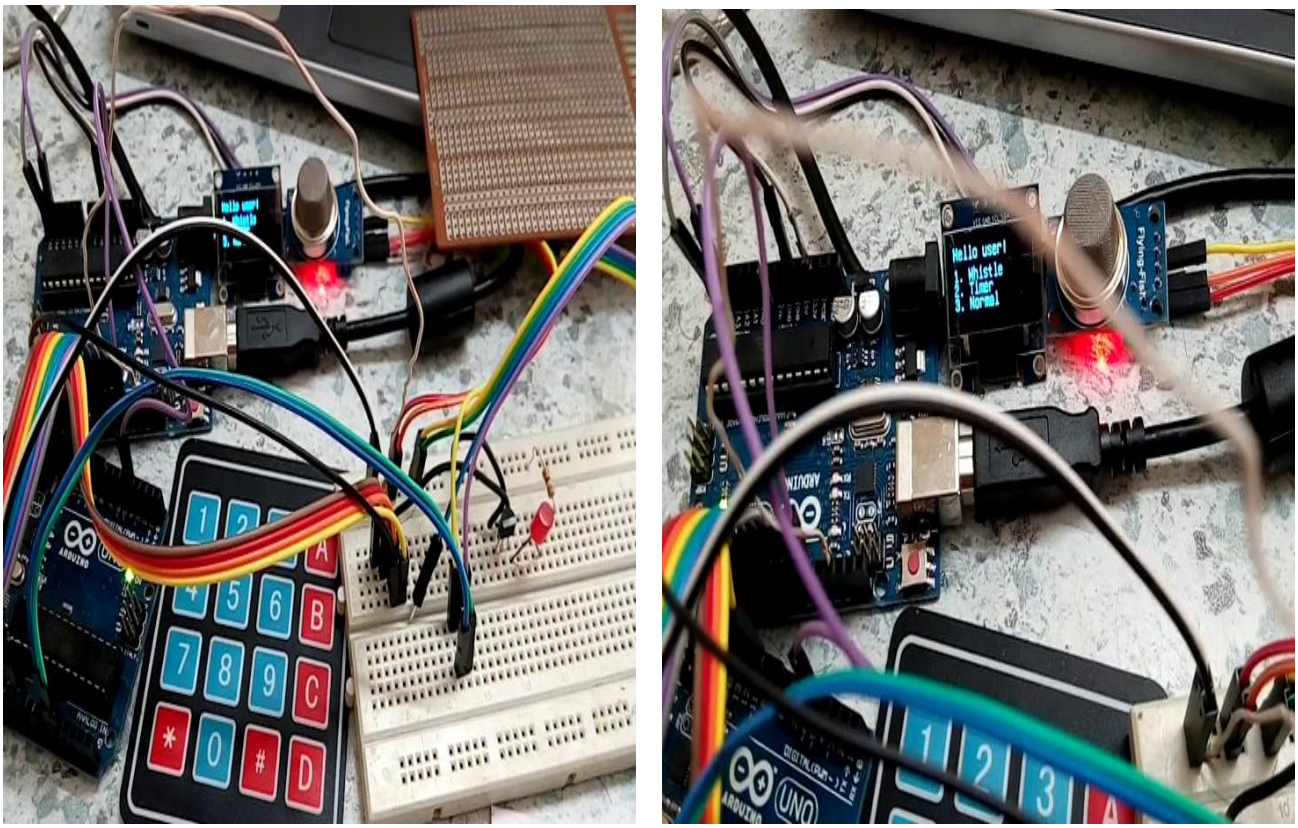

Fig. 10.Working prototype of proposed system

The Working prototype is very simple to develop. Care should be taken while placing MQ-6 gas sensor and Sound sensor in their respective positions.The Simulation graphs of above prototype are drawn with respect to time.

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VI. SIMULATION RESULTS

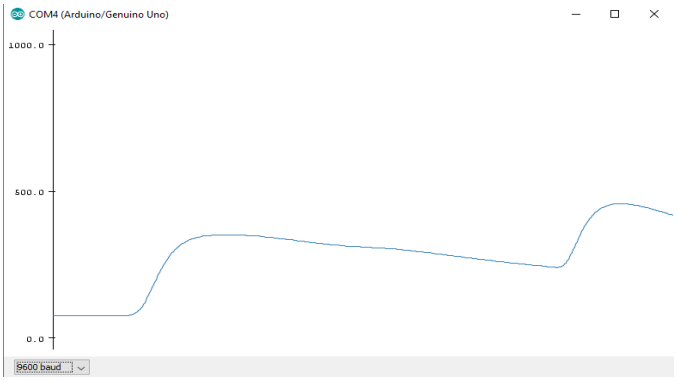

Fig. 11. MQ-6 sensor detecting gas leakage in ppm vs time

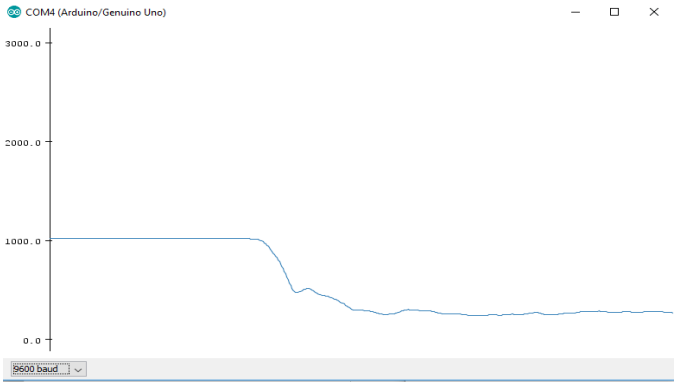

Fig. 12. IR sensor detecting the presence of utensils vs time

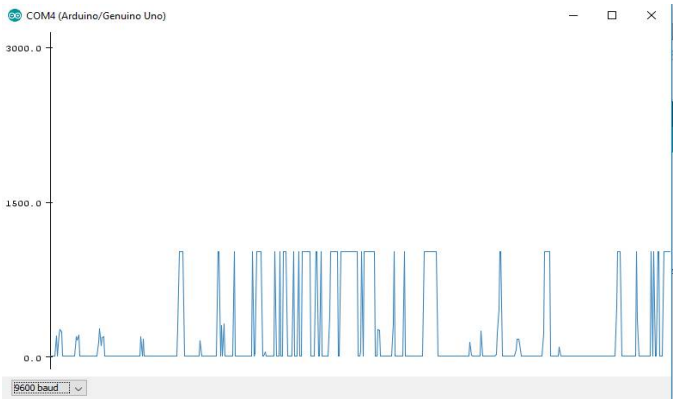

Fig. 13. Sound detector detecting the whistles vs time

VII. CONCLUSION

LPG is used in many applications because of its desirable properties like homes, hostels, industries, vehicles. This method of automation reduces the human interference and wastage of LPG. The advanced safety features provide more safety warnings during the leakage of LPG.

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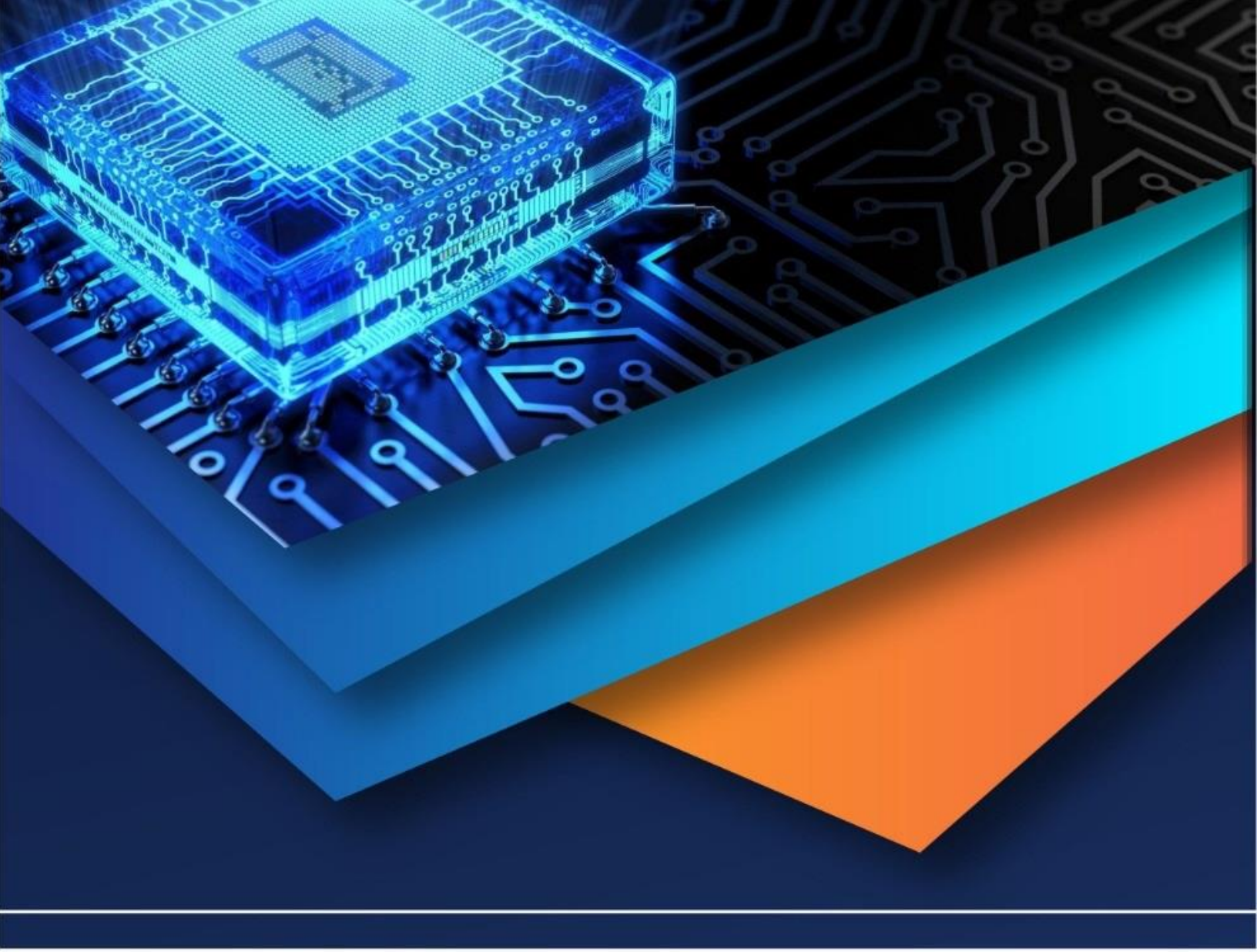

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