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A Highly Intelligent into System to Monitor the Petrol flow the Petrol Tank

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Abstract*—Petrol has become one of the most basic fuel requirements of every individual to run their day-to-day life. In a developing country like India, the total economy of the country depends on the petroleum products. At most of this petrol produced is being used for the transportation purpose, that too for the bikes and cars. Also the economy of the individual depends on their petrol consumption. In such a kind of situation, some of the petrol bunks are cheating the customers by adjusting the display meter in the petrol bunks. Thus this thesis describes a highly intelligent system to measure the flow of petrol into the petrol tank. This approach utilizes ultrasonic flow meter to measure the rate of flow of petrol into petrol tank. The proposed system displays the total volume of petrol that is being inlet into the petrol tank. This also displays the various parameters such as temperature of petrol that is being inlet into the tank. The system also indicates the level of petrol in the petrol tank.

Keywords— Doppler Effect, Floating-point arithmetic, Fluid flow, Fluid flow measurement, Ultrasonic transducers, Volume measurement.

I. INTRODUCTION

India is a developing country with the population of 1.252 billion, ranking 2nd in the world. Most of the people come under the category of Middle Class. Also the petrol, being the fundamental demand of every individual is now-a-days becoming costlier.

A *Petrol* or *Gasoline* is one of the transparent liquid, which is a petroleum derived product. It is most commonly used a fuel in Internal Combustion Engines which are installed in all most all the vehicles. It is an Organic compound. It is obtained by the fractional distillation of petroleum. Such type of processing is done in Oil Refinery.

As said earlier, it is used as a fuel in Internal Combustion Engines. For day-to-day life, petrol is commercially available in petrol bunks. In all the petrol bunk, the amount of petrol entering into the petrol tank is displayed. But it can be controlled by the external factors and adjust the display and customers can be cheated. Thus there occurs the necessity to propose a system that monitors the volume of petrol entering into the tank.

The total consumption of petrol in India is **3,292,000 Barrel/day**, which is **386,308,845 Liters/day.** The following diagram shows the history of petrol consumption in India.

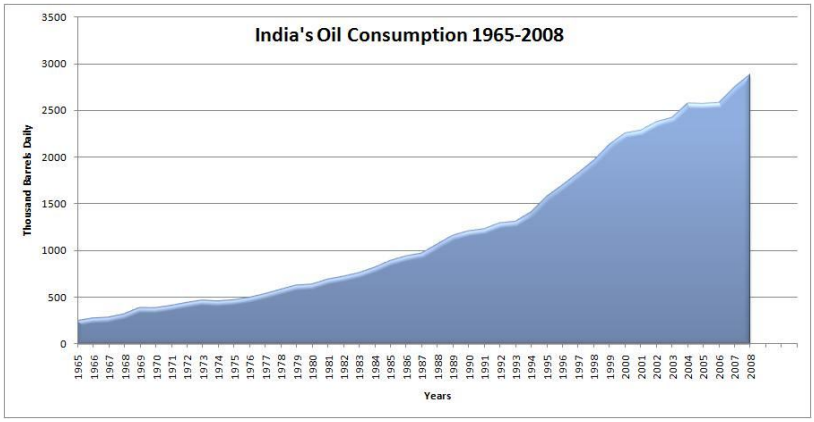


Figure 1. History of Petrol Consumption in India

As said earlier, if by chance there occurs a malpractice by adjusting the display meters in bunks, even a small scale theft can lead to a large effect (i.e) Consider 1 percent of theft of total petrol consumed in India per day is Quite high value, which in turn

indirectly goes to the heads of Middle class people.

Hence to increase the reliability of the petrol being consumed by the consumers, a paper is proposed here.

Thus the proposed system utilizes a ultrasonic flow meter to measure the flow rate of petrol via the tube, so as to measure the volume that is entering the petrol tank, along with the help of the regulator.

In addition to monitoring the petrol entering the tank, the proposed system also monitors the level of the petrol in the petrol tank and provides an indicator. The whole system is operated with the help of the 8051 microcontroller.

II. LITERATURE SURVEY

***"Design and calibration of a fuel consumption measurement system for a diesel tractor Maintaining the Integrity of the Specifications"* by H. Fathollahzadeh, H. Mobli , A. Jafari D. Mahdavinejhad, S.M.H. Tabatabaie.**

This system utilizes the Flowmeter to measure the rate of consumption of fuel, so as helps to study the running condition of vehicle. The above studied paper monitors only the fuel consumption system. It does not tell us the amount of petrol that is being inlet into the petrol tank. Also many papers are available, but none of them suggest a technique to calculate the accurate flow of petrol into the tank.

III. PROPOSED SYSTEM

A. Ultrasonic flow meter

The proposed system consists of Ultrasonic Flowmeter, which is used to for volumetric measurement of rate of flow of liquid. It is placed at the inlet of the petrol tank. An Ultrasonic Flowmeter is one of the prominent type of a Flowmeter, the helps us to measure the velocity of liquid and also the rate of flow of liquid in volumetric terms. Hence is gives the amount of liquid that is moving per time. It uses the ultrasonic transducers, to measure the velocity of propagating liquid by calculating the differential transit time of pulses that are transmitted into and against the direction of flow of liquid, or by measuring the frequency shift from the Doppler Effect.

Figure 2. Practical Ultrasonic Flowmeter

Here the two basic parameters that can be calculated are,

Velocity of flow

Volumetric flow

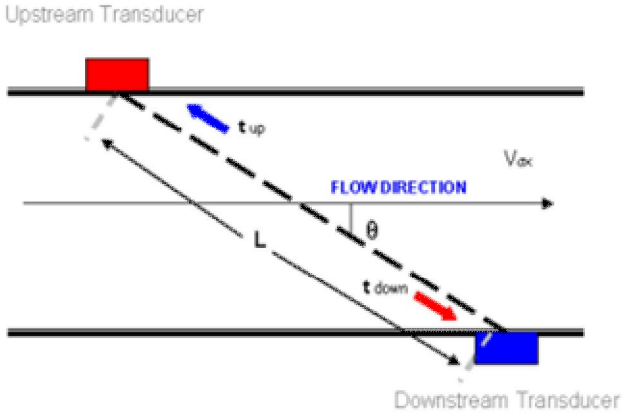


Figure 3. Inner structure of Ultrasonic Flowmeter

B. Calculation

The differential transit time of ultrasonic pulses propagating in and against the direction of flow is used to calculate the velocity of the flow, which is shown below:

$$v = \frac{L}{2Sin\alpha}\frac{tup - tdown}{tup.tdown}$$

Where,

v is the average velocity of the fluid along the sound path,

L is the distance between receiving and transmitting transducers,

tup and $tdown$ are two transit times,

α is the inclination angle.

Now the volumetric flow is given by the following equation,

$$Q = v.A$$

Where,

Q is the Volumetric flow,

v is the Velocity of flow, and

A is the cross sectional vector area or surface area.

This above equation is applicable only for flat, plane cross sectional area. In general cases, including the curved surfaces, it becomes the surface integral. Hence the equation becomes,

$$Q = \iint_A v.dA$$

This can be expressed as,

$$Q = v.ACos\theta$$

Where,

θ is the angle between the velocity vector v and unit normal vector n.

Normally, in our case of consideration the angle θ becomes 0º, and hence the equation becomes,

$$Q = v.A$$

Also, we can relate the volumetric flow with density and hence we can calculate the mass flow of the fluid. Here the fluid taken into consideration is the petrol and hence its density,

ρ = 719.7 kg/m^3 ; 0.026 lb/in^3; 6.073 lb/US gal; 7.29 lb/imp gal.

Hence the Mass flow rate is given by,

$$m = v.\rho \text{ Kg/s}$$

Thus the volumetric flow of the fluid (i.e) petrol is calculate using the Ultrasonic Flowmeter.

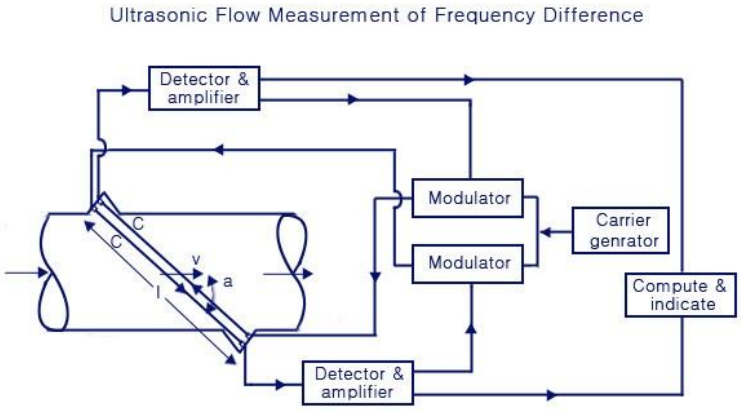


Figure 4. Frequency difference measurement

C. Programming using microcontroller

The system consists of a 8051 microcontroller to control the operations of the proposed system. Considering this volumetric flow as a Floating point value, it is stored in the General Purpose Registers (GPR) of the 8051, say R1.

IN P0

MOV R1,P0

Also in this proposed model, it needs a digital stop clock to calculate the time of flow of the fluid, so as to calculate the total volume of petrol that is entering into the tank. This stop clock can be constructed using the counters of 8051 microcontroller. The system consists of motion sensor inside the tube which is connected to the Port 1 (P1.0). Thus this pin acts as a reset pin for the stop clock and hence the value of the stop clock is converted into second format and it is stored in the temporary registers, called General Purpose Registers of 8051, say R2. Also the above value of stop clock is considered as floating point number.

Hence the total volume of the petrol that entered into the petrol tank is calculated using the following c code, from which Hex file can be created and loaded into the microcontroller.

```
Void floatmul()
{
    float R1,R2, R3;
    R3=R1*R2;
}
```

This multiplied value gives the total volume of the petrol that entered into the petrol tank. Now the LCD display is interfaced with the 8051, so as to display the volume of inlet petrol to the consumer.

Also this system consists of sensors on the inner surface both at top and bottom of the petrol tank, so as to indicate the level of

the petrol in the tank. The sensor at the top is connected to P2.0 and the sensor at the bottom is connected to P2.1. So this is further connected to LED with buzzer indicator to intimate the consumer.

When P2.0 is set, the Red LED with Buzzer which is connected to P2.2 is Set.

```
LOOP1:    JNB    P2.0,LOOP1
          SETB   P2.2
```

Also, when P2.1 is set, the Yellow LED with buzzer is connected with P1.3 is Set.

```
LOOP2:    JNB    P2.1,LOOP2
          SETB   P2.3
```

Hence, the system indicates the consumer when the level of petrol in the tank is in the exhausting level and also it indicates when the tank is to be filled with the petrol.

The system also has a temperature sensor, which is place in the inner surface of the tank. This value is sent to the microprocessor via the input port, and it is displayed in the separate LCD Display.

```
IN P2.4
MOV R4,P2.4
```

Here the value in R4 is sent to the LCD Display.

IV. FLOW DIAGRAM

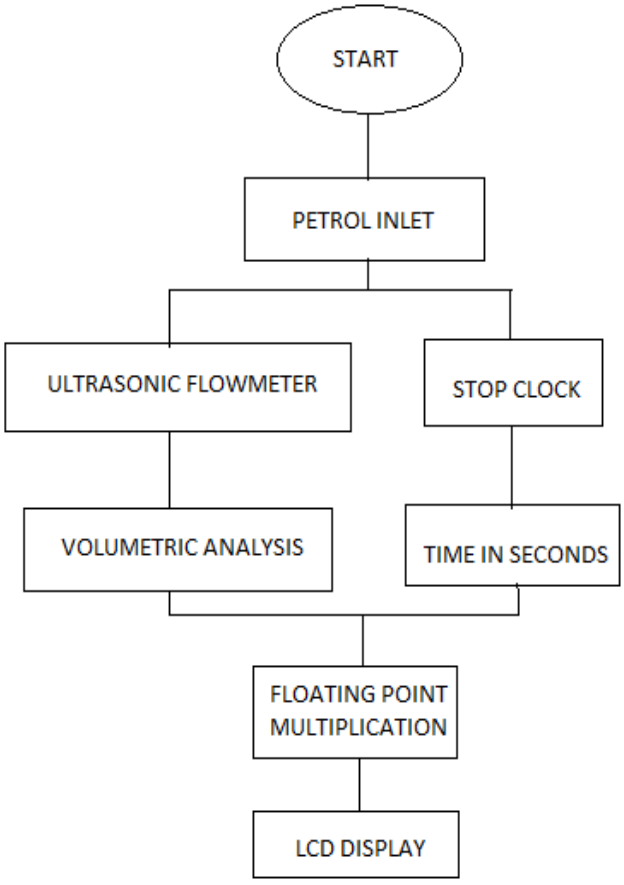


Figure 5. Flow Diagram of the proposed system

V. PROTOTYPE MODEL

The proposed model which is discussed above is placed at the entry point of petrol into the petrol tank. Here the microcontroller is operated from the supply that is available from the battery of the vehicle which is inbuilt in the vehicle.
Here the proposed model is connected to the sensors which are also discussed above. Thus the following diagram shows the complete prototype of the proposed system.

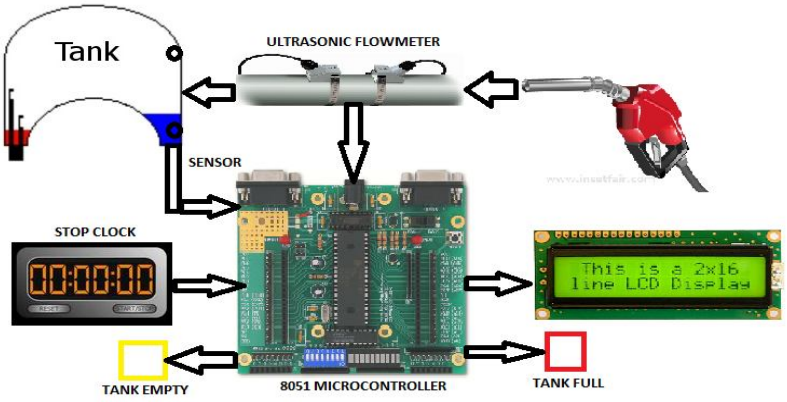


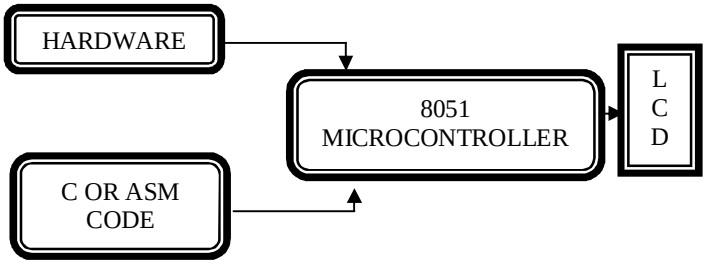
Figure 6. Prototype model for proposed system

VI. EXPERIMENTAL SETUP

The components used to design the proposed system are as follows:

A. Ultrasonic Flowmeter
B. 8051 Microcontroller
C. Level monitoring sensor
D. Temperature sensor
E. 16 X 2 LCD Display
F. LED's
G. Buzzer
H. Valve with Regulator

Here the microcontroller is needed to be loaded with the operating logic, so as to obtain the optimum operation of the proposed system. Here the required operating logic can be either written as 'C' Coding or as ASM Coding. These coding are written in Keil C. Then these codes are converted into the HEX file (i.e) hex file is created from the C Code or ASM Code. Then this file is loaded into the 8051 microcontroller using the Flash Magic Software.
Here for simulation purpose, we use NI Multisim so as to simulate and verify the optimal operation of the proposed system. Here in order to maintain the Velocity of the flow of liquid, a valve with regulator is used, so as to maintain the flow of the petrol into the tank, and also prevents the backflow of the petrol to the storage tank in the bunk.
Here the Figure 7 shows the schematic of the proposed system simulated in NI Multisim. Here the Microcontroller is also either C coded or Assembly coded, so as to perform the desirable operation in the proposed system. Here the Microcontroller is also provided with the necessary initial, stop and reset condition (i.e) the microcontroller should be provided with the instructions that when the timer should start counting the seconds and when it should stop and reset the Timer.
Once the Petrol is flowing into the tank the timer should start counting, so that it should be provided with the Sensors whose output should be assigned to the ports of the Microcontroller.



The following shows the schematic diagram of the system simulated using NI Multisim:

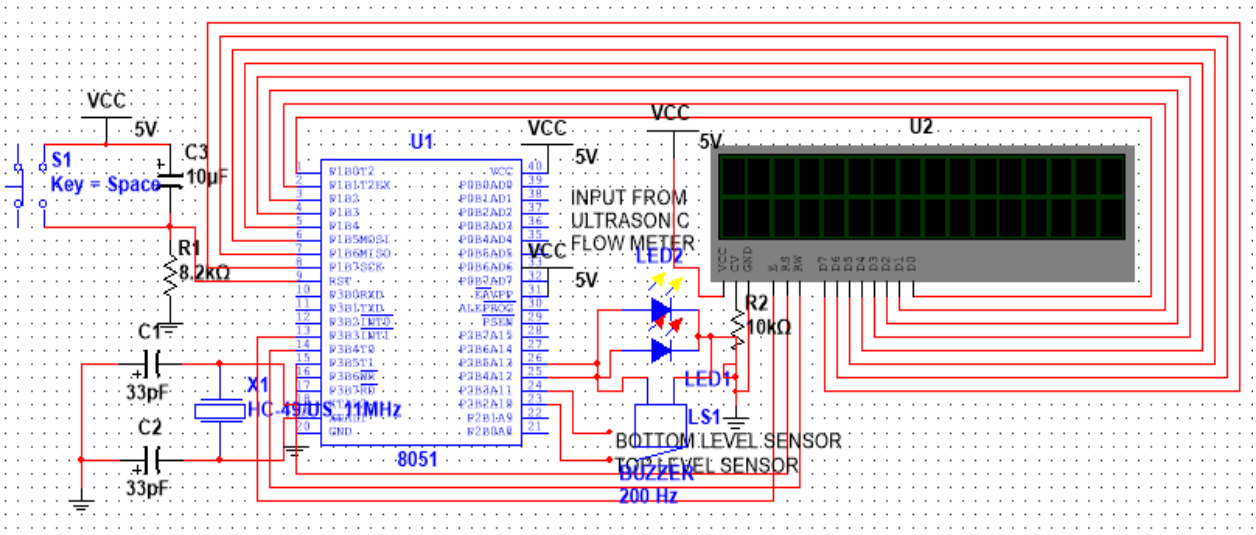


Figure 7. Capture scress of simulated proposed system

VII. EXPERIMENTAL RESULTS

The following diagram shows the implemented diagram which displays the petrol consumed.

Figure8. Implemented Diagram

TABLE I.

Inspection Time		Standard Deviation
Average Inspection Time	*Longest Inspection Time*	0.56ms
12.56ms	16.30ms	

VIII. CONCLUSION

Thus the proposed system intelligently monitors the flow of petrol into the petrol tank. Today no such system hardly measures the volume of petrol that is entering into the petrol tank. This system safeguards the consumers from being cheated.

Moreover this system also indicates the Temperature inside the petrol tank, so as to indicate in case of any fire. Also the proposed system monitors the level of petrol in the petrol tank.

Thus it indicates the consumer either when the volume of petrol in the tank is decreasing of when the tank is full.

Also the cost of the proposed system is reasonable and hence the proposed system is much efficient to monitor the petrol flow into the tank.

IX. ACKNOWLEDGEMENT

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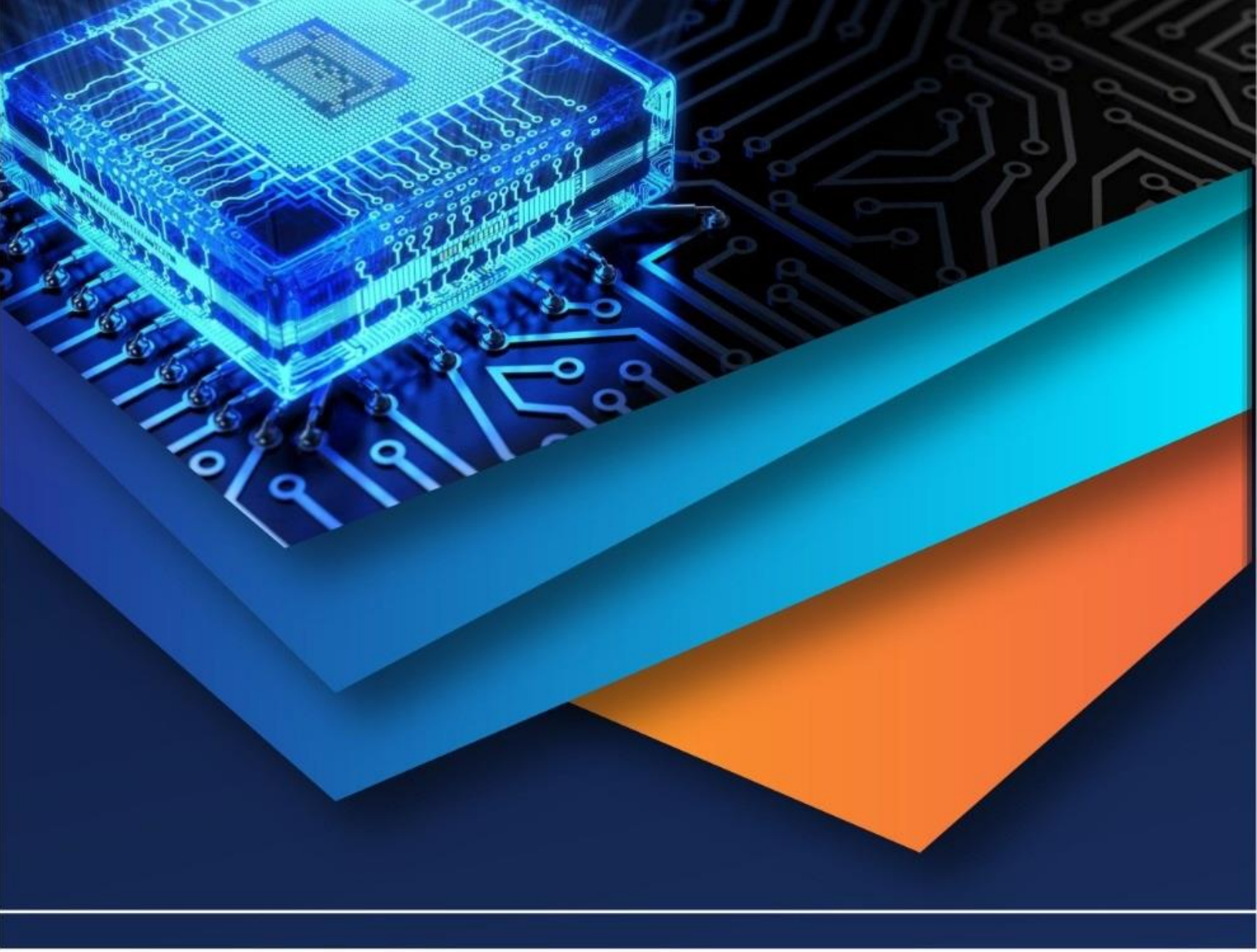

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