iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** VI **Month of publication:** June 2024

DOI: https://doi.org/10.22214/ijraset.2024.63458

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue VI June 2024- Available at www.ijraset.com

Automatic Load Sharing of Distribution Transformer (IOT)

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Abstract: ***As we have move in new Era of AI, automation & innovative infrastructures that leads to escalate the demand for power exponentially over the last century. Also increased population is the major reason in demand growth. Automatic Load sharing of Distribution Transformer, using IOT One of the method through which today's energy crisis like power demand and protection of Transformer ultimately Protection of Distribution system can be addressed. The primary goal of load division is to shield the transformer from overloading. Due to overloading the effectiveness of the transformer decreases as a result frequent power failure occurred, the winding become overheated and may be burned. As a result the transformer failure rate increases. And replacement of transformer with new one is the major task, it require huge money and man power. Protection of Distribution from overloading, maintain reliable power supply to Industry and household is the key assignment to handle to Distribution Company. Automatic Load sharing is one of the best solution, this will be accomplished by using a microcontroller. Two Distribution Transforms are connected through parallel including the active role of Microcontroller. The load on the first transformer is compared to a reference value by the microcontroller. When the load exceeds the reference value, the additional load is shared by the second transformer.***

Keywords: DHT11- Digital Humidity Temperature sensor, ESP8266 Microcontroller

I. INTRODUCTION

The prime motive of a Automatic Load sharing of Distribution transformer is to shield it from Overloading then to facilitate reliable power supply to Industrial, commercial & Residential Pocket. In India Even at AI Era the major challenge faced by power distribution sector is continuous power failure owing to overloading, follows the Man & Money loss to distribution sector as well to power beneficiaries. Automatic Load sharing of Distribution Transformer (IOT) facilitating below features,

Automatic Load sharing of Distribution Transformer (IOT) revolve around enhancing the efficiency, reliability, and safety of power distribution systems.

Protects the infrastructure, optimizes operations and supports modern energy management practices. By leveraging real-time monitoring, data analytics, and automated control, IOT- based load sharing.

Protects transformers from overload and related issues, also enhances the overall performance of the power grid.

II. SYSTEM DEVELOPMENT

The proposed Automatic Load sharing of Distribution Transformer (IOT) module integrates Transformer, advanced Electronic circuit (Micro controller), sensors, with IoT (Cloud & App) connectivity, and data analytics to enable real-time energy monitoring, intelligent load management, and energy efficiency improvements. The Microcontroller get data from CT & DTH Sensor, which are transmitted wirelessly to a central monitoring system, By utilizing IOT connectivity. This module empowers operator to access Distribution Transformer status remotely via mobile applications or web portals. And it will leads to optimize the life of transformer, curtail expenses over repairing of transformer, and pleased industrial & household Electricity consumers ultimately take share in healthy national growth.

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III. BLOCK DIAGRAM

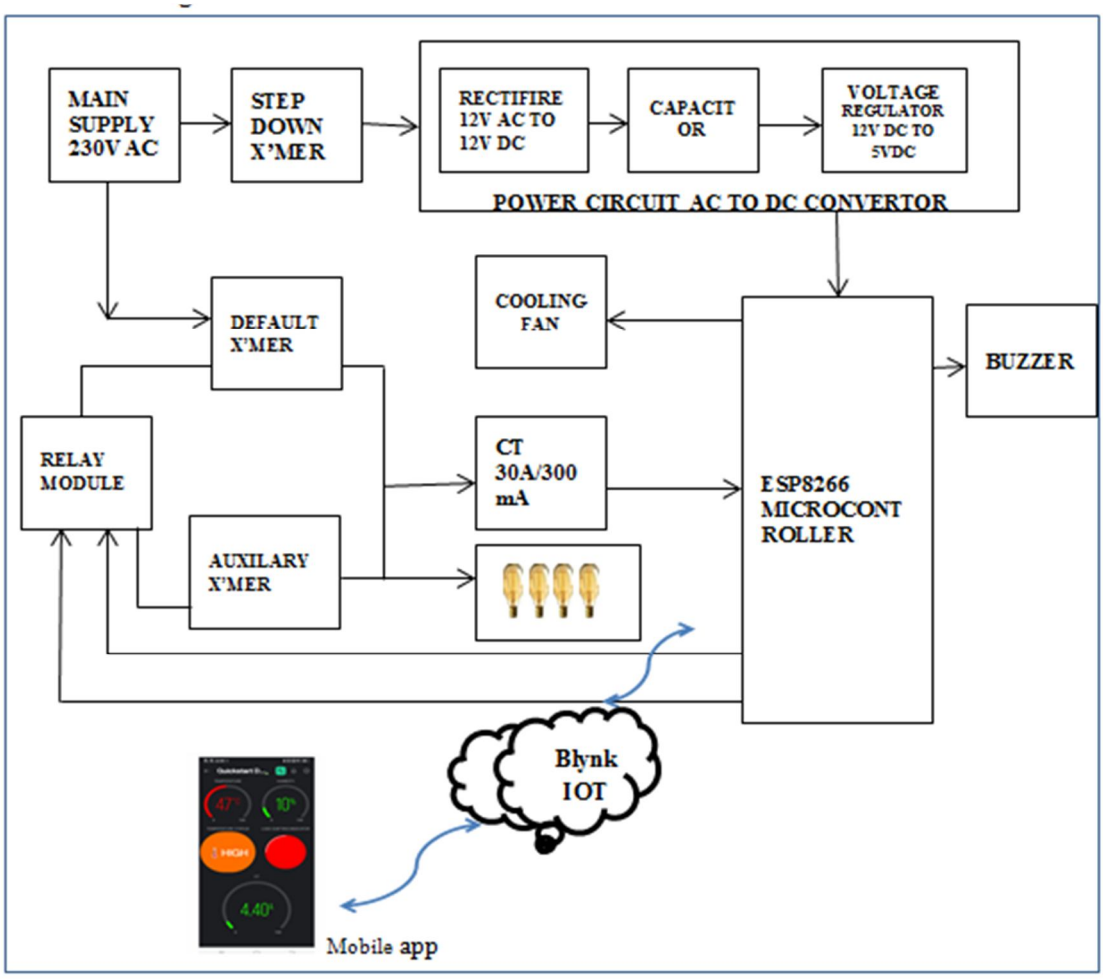


Fig.1 Block Diagram

IV. WORKING

The current module purpose is to automatic share the load of Default transformer by using Auxiliary Transformer and real-time monitoring system with the help of IOT.

System Module circuit consist of hard ware components like Transformer (Three in Nos), Power Circuit, Relay Module, Micro Controller WI FI Unit, Temperature Sensor DHT11, Current sensing unit, indication system (LED, Buzzer), Cooling system, Mobile App (IOT Cloud), Load, 4 switches etc.

And in Software part Arduino IDE (Integrated Development Environment) application, Blynk App (in Mobile),

For successfully implementation of this module we have to place the components at their proper places. In this module we are using the Parallel operation of transformers for this, we have connected the Two transformers i.e Default Transformer & the Auxiliary Transformer in parallel by making Primary of both the transformer common with placing relay module between the Primary. And at the secondary side, secondary made common by placing Current transformer between them to measure the load current. The placing of Current & the relay is important to switch on the auxiliary transformer & get it in to the operation. As the Microcontroller is operated on 5V DC take the benefit from Power circuit which convert the 12V AC to 5V DC, which will help to operate the Microcontroller unit & all the electronic equipment's situated at this module.

Main components used,

Default Transformer (230V /110V),

Auxiliary Transformer (230V/110V),

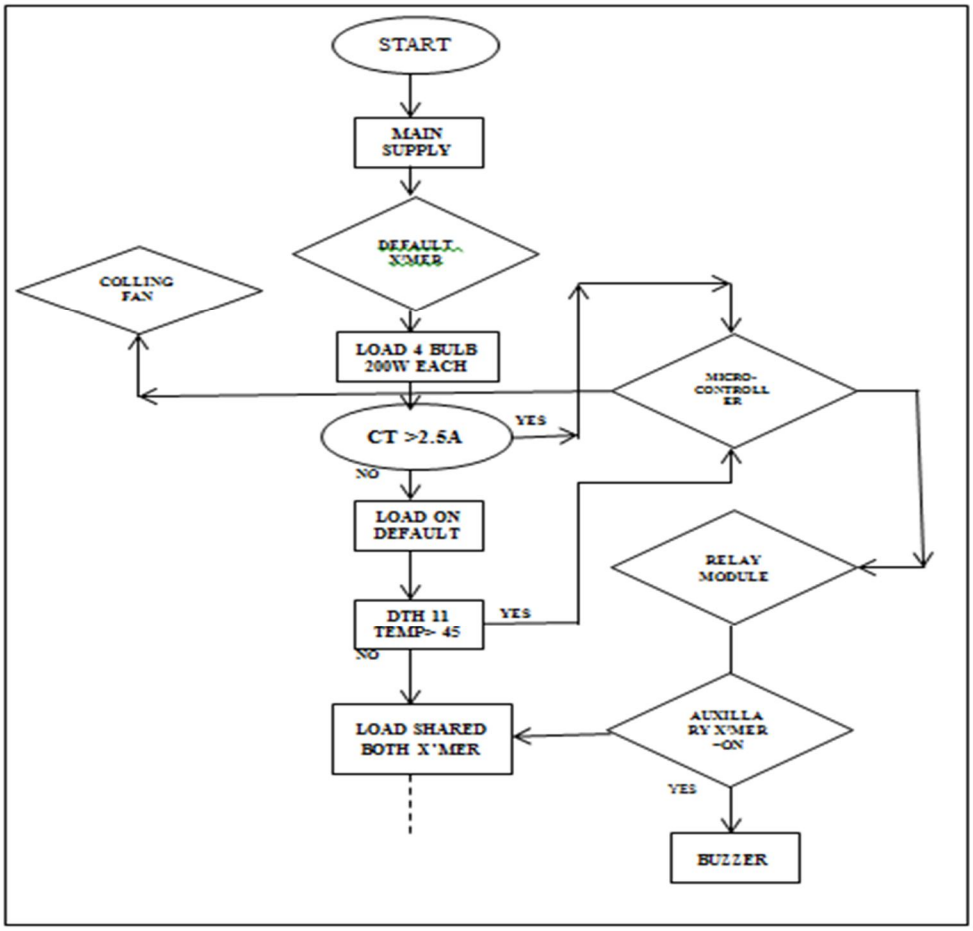
Power Circuit- (Step Down Transformer (230V/ 12V), Bridge Rectifier (to 12V AC to 12V DC), Capacitor, Voltage Regulator (12V DC to 5V DC).

Relay Module (Two Relay), Current Transformer (30A /300mA),
Micro Controller ESP8266,
Temperature Sensor DHT11,
Buzzer, Cooling Fan,
Mobile App, Cloud (IOT),
4 Bulb (200Watt each) as a load, 4 switches etc.

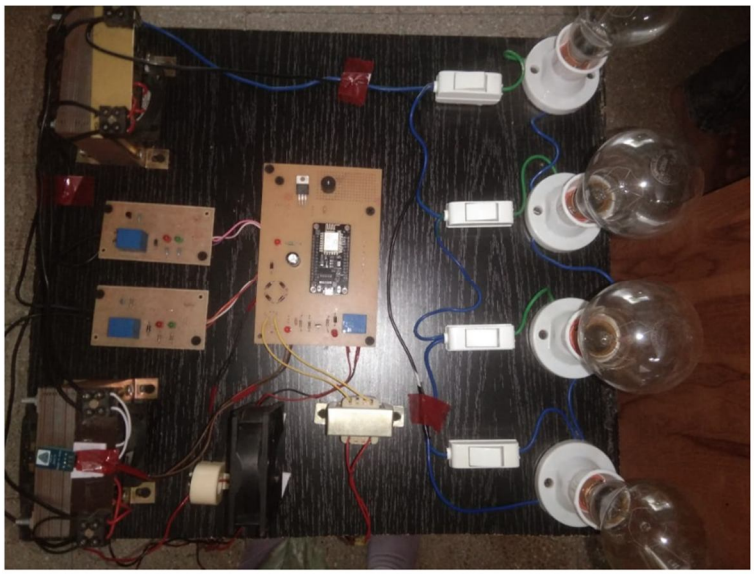
Subsequently placing all above units at their proper places we can complete the circuit by connecting all the components & programming of NOD MCU WiFi module. Our circuit is ready for the operation. After switching on the power supply First Default circuit is get the power, and gradually if we gradually increase the load i.e first Bulb & then second bulb switch ON, mobile app indicate normal status of current, Temp, Humidity & Load shift parameter. After switching on the Third Bulb current Transformer senses the over current value i.e it was already predefined in the Microcontroller, which leads to send the control signals to relay module and push to Auxiliary Transformer in to the picture to bear the excess load on default Transformer.

Similarly to protect the Default Transformer from high Temperature this module designed the Cooling system same time. i.e continues use at some time if Default Over heated due to Overloading to protect the coil of transformer, DHT 11 sensor placed at the Core of Default Transformer to sense the Temperature & Humidity of the Transformer. This DHT11 send the control signals to the Microcontroller and in response to that Micro controller send command to the cooling FAN to switch ON, this way we can Protest our Main Transformer from the overheating and further loss from it. Here is the lead role of Microcontroller ESP8266, which sends and receive the digital signals as per pre-defined program which was already uploaded in to the Microcontroller by using the Arduino IDE. Arduino IDE i.e (Integrated Development Environment) is a software application that support writing & the uploading program to Arduino. It is a cross-platform application available for Windows, macOS, and Linux operating systems. (IDE) is predominantly coded using the C and C++ programming languages.

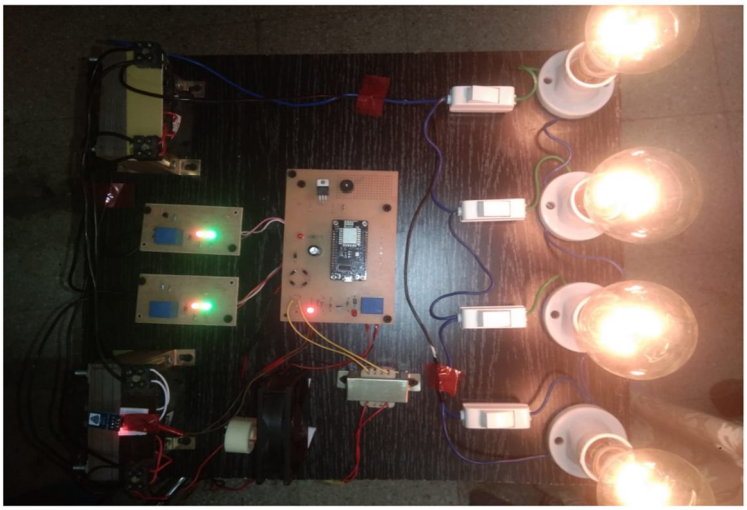
A. Flow Chart:



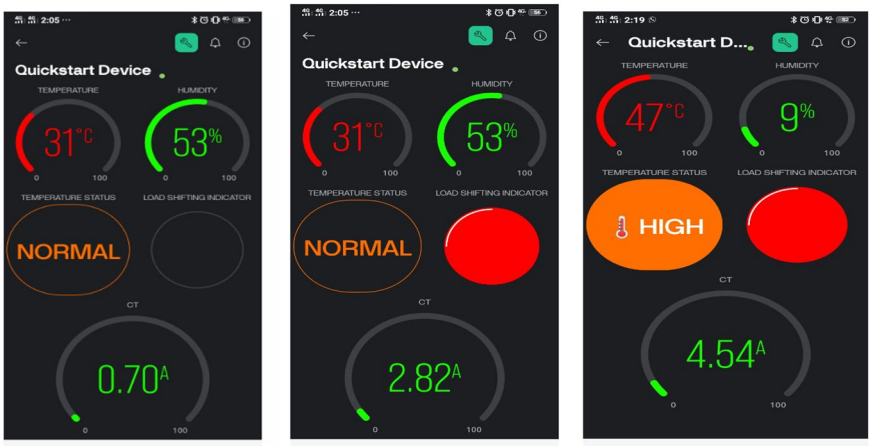
B. Circuit Connections



C. Working Module:



D. Mobile App status:



V. RESULT

Sr. No	Circuit Parameter				Mobile App				
	Default X'mer	Auxiliary X'mer	Load	Status	Temperature	Humidity	Temperature Status	Load Shifting Indicator	CT
1	ON	OFF	Bulb 1	ON	31	53	Normal	OFF	0.7
			Bulb 2	OFF					
			Bulb 3	OFF					
			Bulb 4	OFF					
2	ON	OFF	Bulb 1	ON	31	53	Normal	OFF	0.7
			Bulb 2	ON					
			Bulb 3	OFF					
			Bulb 4	OFF					
3	ON	ON	Bulb 1	ON	31	53	Normal	ON	2.82
			Bulb 2	ON					
			Bulb 3	ON					
			Bulb 4	OFF					
4	ON	ON	Bulb 1	ON	47	9	HIGH	ON	4.54
			Bulb 2	ON					
			Bulb 3	ON					
			Bulb 4	ON					

VI. CONCLUSION

In conclusion, Automatic load sharing of transformers (IOT) plays a crucial role in ensuring balanced distribution of load and optimal performance in power distribution systems. The performance analysis of automatic load sharing helps to assess the effectiveness, efficiency, and reliability of the load sharing mechanism. By evaluating parameters such as load distribution accuracy, response time, voltage and frequency control, fault tolerance, and energy losses, engineers and operators can gain valuable insights into the system's performance. This analysis allows for identifying areas of improvement, optimizing system settings, and enhancing the overall performance of the power distribution infrastructure. An efficient and reliable load sharing system prevents overloading or underutilization of transformers, thereby maximizing their life span and ensuring reliable power supply. It helps maintain stable voltage and frequency levels and enables the system to adapt to faults or failures, minimizing disruptions in power distribution.

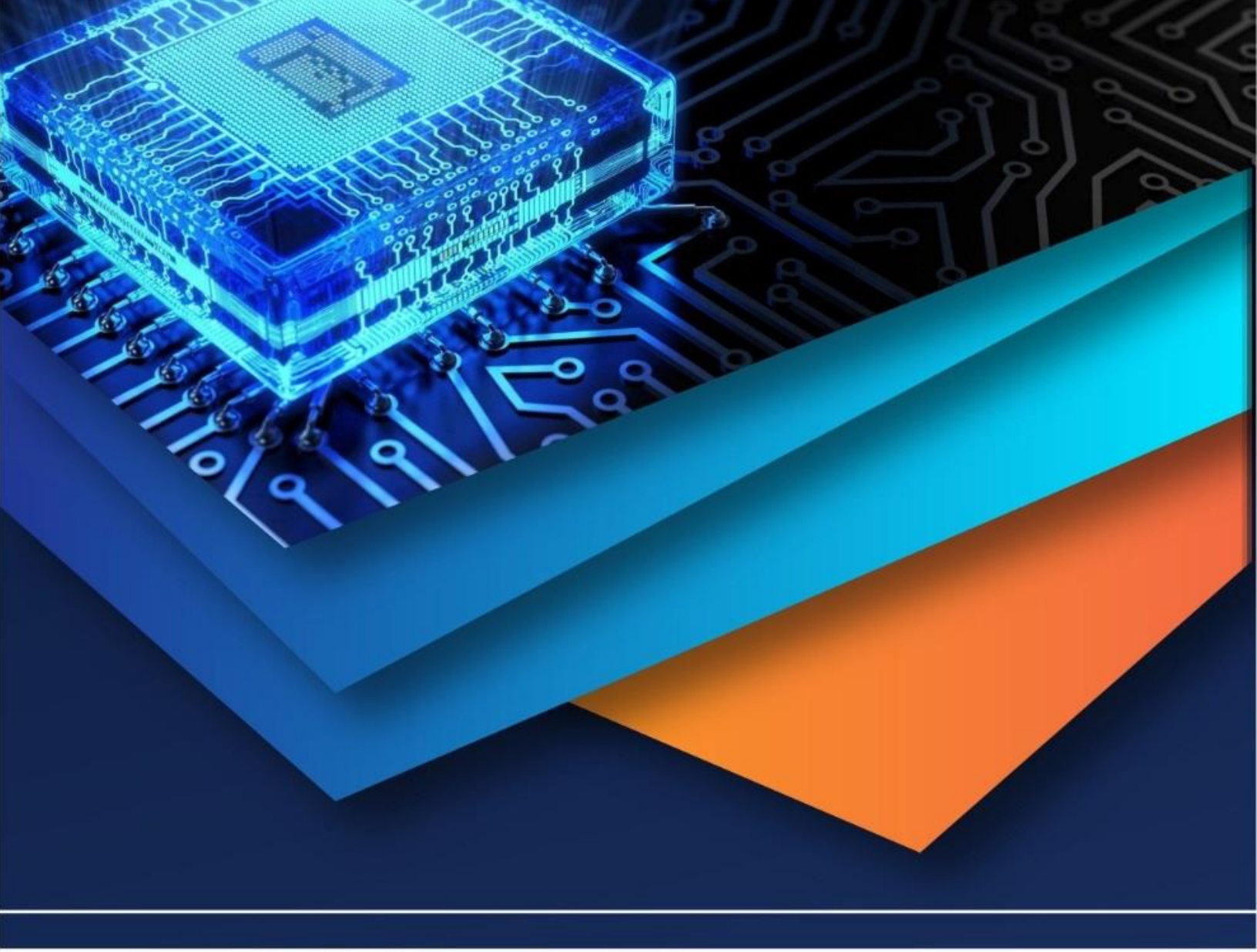
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