iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** III **Month of publication:** March 2018

DOI: http://doi.org/10.22214/ijraset.2018.3712

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

Recharging Load with Constant Monitoring and Control by IOT

C.T. Manikandan[1], R. Harish[2], K. Harish[3], S. Vibin[4]. C.T. Vigneswaran[5]
[1]*AP/EEE Department of EEE, Panimalar Institute of Technology, Chennai*
[2, 3, 4, 5] *UG Student Department of EEE, Panimalar Institute of Technology, Chennai*

Abstract: ***Energy meter reading is a tedious and an exclusive affair. The meter reader has to go and take the reading manually in the customer premises to issue the bill, which will later be uploaded in the software to automate the billing and payment system. If the proposed method is achieved, it would have reduced the laborious task and financial wastage by automate the manual meter reading process and bill data entry process. This paper proposes a new network communication system for energy meter reading by internet communication technology and software system along with the existing meters. A IOT modem will be integrated with electronic energy meter to read the usage of electricity and uploaded on server or website. Energy meter deliver the reading details and it is uploaded on the website instantly. This communication system is further useful for electricity regional/sub-regional office, which can monitor the value and power consumption of individual load. And they cut the power supply for any specific load, which are not in use. Moreover, this power cut control system is done by using same website which is used for monitoring. In this design we are going to provide energy by the recharging system, the consumer can view the load consumption power and can recharge through website. If the power consumption reaches maximum limit then automatically an alert message is send to consumer through IOT MODEM.***

Index terms: Arduino controller, IoT MODEM, Relay, Current sensor and LCD display

I. INTRODUCTION

Electricity generation is the method of generating electric power from the of renewable or nonrenewable energy sources. For electric utilities in the electric power industry, it is the primary stage considers the delivery of electricity to end users, the other stages are considered to be the transmission, distribution, energy storage equipped devices and also recovery using pumped storage devices of the transmission network in customer premises. A property of electricity is that it is not a primary energy freely present in nature in remarkable amounts and it must be produced. Production is conveyed out in power plants. Electricity is usually generated at a generating station through electrical generators. In which heat energy produced by combustion or nuclear fission is converted into electrical energy. Sometimes kinetic energy of water and wind flow is also used to generate electric energy. Nowadays solar panels are mostly used to generate the power.

II. TRANSMISSION AND DISTRIBUTION

The electric power transmission is the method of transmitting electrical energy from a generating location such as a power plant to an electrical substation of that region. The interconnected lines which enables the electrical energy transfer are known as a transmission network. This is individual from the local wiring among high-voltage substations and customer premises of a particular region which is typically referred to as electric power distribution. This combined transmission and distribution network is known as the "power grid". Electric power distribution is the last stage in the delivery of electric power; it transmits electricity from the transmission system to individual consumers. Distribution substations connect to the transmission system and lower the transmission voltage to standard voltage ranging between 2 kV and 35 kV with the usage of the of transformers in the system. Primary distribution lines carry this average voltage power to distribution transformers located near the customer's premises. Distribution transformers once more lower the voltage to the utilization voltage used by lighting, industrial equipment or household appliances. Often several customers are delivered from one transformer through secondary distribution lines. Commercial and residential customers are joined to the secondary distribution lines through service drops. Customers demanding a much larger amount of power may be linked directly to the primary distribution level or the sub transmission level.

A. Difficulties in Power Generation

Over the past sixty years or so India has taken fast strides in the development of the electricity sector both in terms of enhancing power generation as well as in making power available to extensively distributed geographical boundaries. In order to meet the

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growing demand for electricity, to fuel the economic growth of the country, large additions to the mounted generating capacity and growth of associated transmission and distribution network are required.

However, during the past years, the power sector facing some fundamental weaknesses, which is needed the initial reforming process in the power sector. Even though a number of policy creativities have been put in place, the task of transforming the power sector is yet to be succeeded.

Limited fuel, Equipment Shortage, Land Acquisition and Environment Clearance, Transmission & Distribution Losses, Aging Power Plants and Transmission network are other problems.

III. INTERNET OF THINGS

IoT (Internet of Things) is an innovative automation and analytics system which adventures networking, sensing, big data, and artificial intelligence technology to provide complete systems for a product or service. These systems achieve greater transparency, control, and performance when it is applied to any industry or system. IoT systems have many applications across industries through their unique flexibility and ability to be appropriate in any environment. They enhance data collection, automation, operations, and much more through smart devices and powerful facilitating technology.

IoT systems which allow users the to attain the deeper mechanization, examination, and integration within a system. They achieve the reach of these areas and their accuracy. IoT uses existing and emerging technology for sensing, networking, and robotics. IoT achieves the recent advances in software, falling hardware prices, and modern attitudes towards technology. Its new and advanced elements which bring major changes in the delivery of products, goods, and services; and the social, economic, and political effect of those changes.

IV. EXISTING SYSTEM

The increased public consciousness of energy conservation in recent years has generated a huge interest in home energy consumption observing. According to a recent market the research report of the consumers shows substantial interest in tools that can help them manage their household energy use and expenses. An acute link to address this need is the smart meters. However, the smart meters are currently available in the market which provide the energy consumption data of a whole house. But it cannot tell which appliances in the household consume the most energy or are least efficient. Also, to take full benefit of time-of-use rates, householders need to be learned of their usage patterns. Such information is really essential for a household to make sound energy saving decisions and participate in value demand response programs.

A. Smart Grid System

High reliability and quality in electric power supply systems are necessary because of a rise in the standard of living. A “smart grid” is recommended as one of the solutions of this problem. A T and D system is cool, calm and collected of many apparatuses that are usually aged individually, and suitable maintenance that confirms the reliability of a T and D system is essential. The reliability of a T and D system frequently increases with maintenance cost. Alternatively, the cost of an event such as an accident or an outage decreases as the system reliability increases. In addition, when electric power flows through low-efficiency apparatus and long-distance transmission lines, the power delivery cost will increase simultaneously. To enhance the balance between cost efficiency and quality improvement in an electric power supply, it is essential to analyze the present condition and to estimate the future performance of operating apparatus in the T and D system founded on a condition monitoring and diagnosis (CMD) system. Most of significant parameters in terms of the reliabilities and reduction in reliabilities of materials are taken from works suggest the point of view of performance and ageing of insulation materials. Our determination is to operate a T and D system effectively by maintaining a balance among cost and quality from a short time frame to long periods of years. As a process that solves this problem, an Intelligent Grid Management System (IGMS).

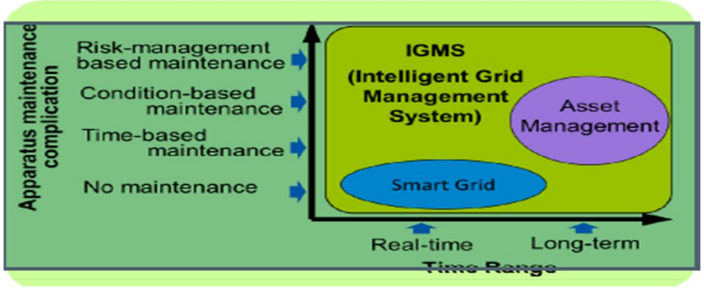

Fig.4.1 Description of IGMS

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The research on the IGMS is carried out for several years. The main objective function of the IGMS includes both: 1) the costs of T and D loss and the outage loss corresponds to the present performance, 2) the costs of the failure loss and apparatus maintenance cost by future performance of the entire T and D system optimization. Thus, the optimal control that consist of the present power flow and the future maintenance of a T and D system is succeeded. Consequently, IGMS is the combination of power flow control and maintenance technology based on condition observing of power apparatus.

B. Nonintrusive Load Monitoring System

Nowadays due to the growth of the economic development, electricity energy demand invited from downstream sectors in a smart grid continuously increases. To meet such the electricity energy request by monitoring and managing residential and commercial individual appliances efficiently, power utilities improved traditional power grids to be the smart ones. In a smart house linked to a smart grid, with reacting to demand response (DR) programs expressed by power utilities and delivered through advanced metering infrastructure, the Home Energy Management System (HEMS) organizes renewable energy facilities and individual household appliances equipped with a power quantity unit communicating with the HEMS.

In a smart house, individual household applications connected by a communication network interact with the HEMS for making a better use of the electricity energy. However, consumers get unsatisfied when the house gets overloaded with many appliances. In addition, the assembly of this type of load monitoring approaches is a complex task to consumers. Therefore, to streamline the load monitoring approach, researchers developed NILM methods that no access to individual appliances is necessary. By smoothly analyzing the composite electrical current and voltage signals measured using a current sensor and a voltage sensor at the main power service entry in a field, the NILM is capable of disaggregating the entire power load into several ends uses. Fig 3.2 schematically shows the idea of the NILM, recognizing how much power goes into each of major separate applications used in a smart house. ID among appliances can be realized, since each appliance has its exclusive profile. The NILM algorithm is executed on a computer acted as a home gateway in the field. Info retrieved from a home gateway with the NILM is very valuable to consumers for reacting to separate appliances, energy auditors for inspecting and analyzing energy flows, power utilities for making public policies, and appliance companies for upgrading traditional appliances to be intelligent ones. This proposes an upgraded NILM policy that combines a multiresolution ST-based transient feature extraction scheme with a modified 0–1 MKA-based load identification method

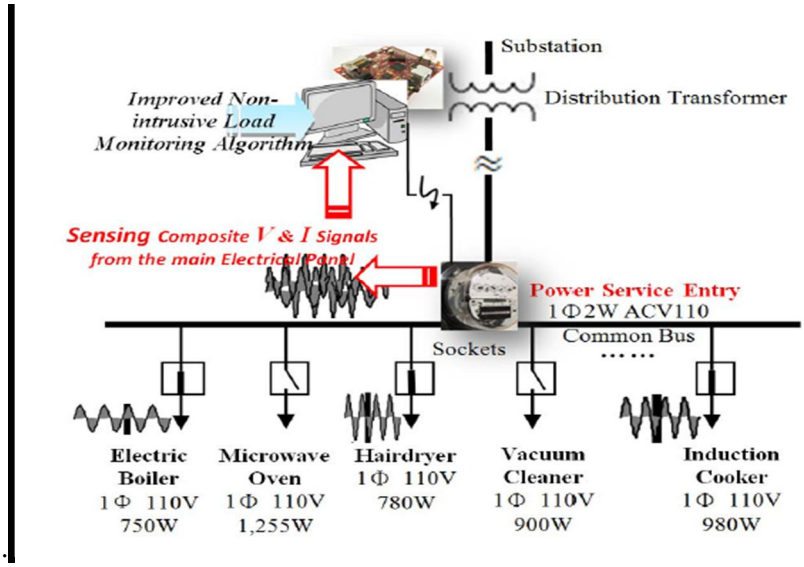

Fig.4.2 NILM algorithm conducted in smart house

C. Nonintrusive Appliance Load Monitoring Systems

It concentrates on how to monitor residential appliances, especially their operating states, by noticing the whole load current and voltage at the power access point of the household. Fig.4.2 shows the concept of the NIALM system. The bottom layer specifies data measurement of appliances at the power access point according to a smart meter or other instruments. Nearly all of them use a microcontroller and/or DSP based hardware which are integrated with Wi-Fi, ZigBee or PLC (Power Line Communication) to

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transfer data to the gateway of the house. The gateway layer delivers communication protocols that enable the communication between the smart device and the server.

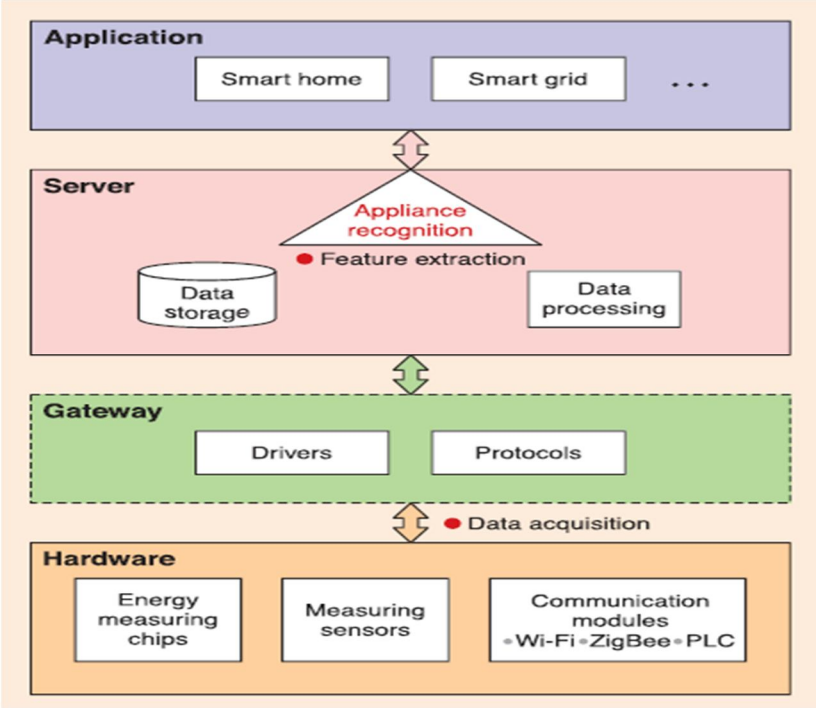

Fig.4.3 NIALM system architecture

In the server layer, the data of appliances are managed and acknowledged. The top layer discovers potential applications and recognized. The top layer explores potential applications and improves new services for users. In this scheme, the main problem is how to differentiate individual appliances and recognize their operating states from a composite signal measured at the power access point, so the appliance state recognition is very essential for NIALM systems. Recently, many NIALM techniques have been proposed. Though different techniques are used in these methods, they have some collective components: data acquisition, feature extraction and appliance recognition.

D. Observation

In existing system, human power is used as remainder to note the energy meter reading for each house and enter the system of regional office. This system is too complicate and need more human power to notice the energy meter of each and every house. In this system human can't now the reading uneasy the date of bill payment. Human power is again used for controlling the load by cut down the power of customer who had not paid the electric bill. Due to human usage there is possibility of occurring error.

E. Disadvantages

Lack of time**,** High maintenance cost**,** Lack in monitoring**,** Human error**,** Customer can't view the reading instantly**,** Power can't be directly controlled by officers.

V. PROPOSED SYSTEM

Conserving electricity helps in two ways which includes serving stop global warming and saving a lot of money over time. Take a look around your home and office: any appliance that functions on electricity can be made more energy efficient. By insulating your home and altering your day today habits are also allowing real ways to decrease the amount of electricity that we are using in customer premises. So that we are proposing the method of prepaid electricity or recharging the load to preserve electricity. The recharging of the load can be completed on the basis of customer need or demand. It is similar to the mobile data recharging system that we are using in our ay today life. Here IOT is used, so that the customer can able to know the recharged power. Once the recharged power reaches 80% customer will receive the notification (IOT) so that they can plan their future usage or can recharge the required demand. To provide high accuracy on energy measurement individual loads are monitored.

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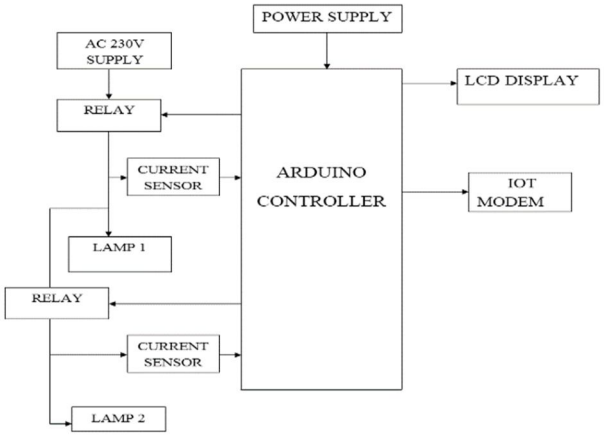
A. Block Diagram



1) *Block Diagram Explanation:* In this system, the energy meter reading are calculated and uploaded to server through IOT using controller. The individual load of home can be controlled through the website by customer like ON/OFF based on payment of electric bill or power consumption. Current sensor is used to read the current drawn by the load from the power supply. Relay is used to control the power ON and OFF to the home. Using the current sensor, the power consumption is identified by the ARDUINO microcontroller and these data are uploaded to the server or website through IOT modem. If the power consumption reaches maximum limit then automatically an alert message is send to the customer. Customer or consumer can recharge to their load through website using IOT modem.

B. Circuit Diagram

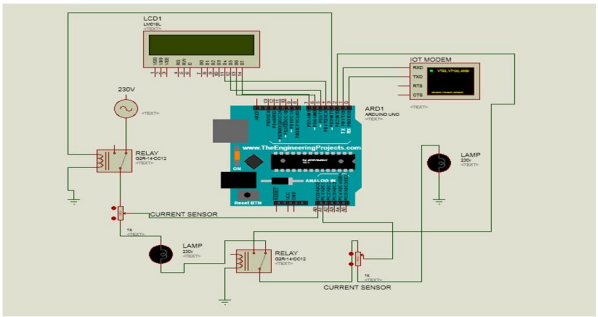


Fig 5.1 Proposed circuit with IOT MODEM

1) *Circuit Diagram Explanation:* Arduino board designs use a different type of microprocessors and controllers. The boards are prepared with sets of digital and analog input/output(I/O) pins that may be interfaced to numerous expansion boards or Breadboards (shields) and other circuits. The boards facilitate the serial communications interfaces, it also includes the Universal Serial Bus(USB) on some models, which are also used for the purpose loading programs from personal computers. The microcontrollers are usually programmed using a dialect of features from the programming languages C and C++.

A relay is an electrically activated switch. Different types of relays are existing and the relays are using electromagnet to automatically operate the switch. And some other operating principles are also used here, such as solid-state relays. Relays are used where it is essential to control a circuit by an isolated low-power signal, or where several circuits should be controlled by one signal.

A current sensor which is a device that senses electric current in the wire. It produces a signal proportional to that current. The produced signal may be in the form of analog voltage or current or even a digital output. The generated signal can be then used to show the measure and calculated current in an ammeter, or that can also be stored for further examination in a data acquisition system or can be used for the determination of control.

A Liquid-Crystal Display (LCD) is a flat-panel display. It is also described as electronically modulated optical device. It practices the light-modulating belongings of liquid crystals. Liquid crystals does not emit light directly, instead they are using a backlight or reflector to produce images in color or monochrome. LCDs are available to show continuous images. That also shows fixed images with small information content, which can be shown or it can also hide which considers preset words, digits and 7-

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segment displays, as in a digital clock. The practice is similar basic technology, excluding that arbitrary images are made up of an enormous number of small pixels, while other shows larger elements.

C. Advantages

No human is used to read and payment, Power theft can be identified, Accuracy, Low cost Instant monitoring and control

VI. RESULTS AND DISCUSSION

Here the Arduino AT MEGA 328 and IoT MODEM is interconnected through the required current sensor and relays to the loads. The Arduino is programmed by using c language. IoT MODEM is used to upload the processed data from Arduino to the web page. A LCD display is used to show the output data from the Arduino for local monitoring.

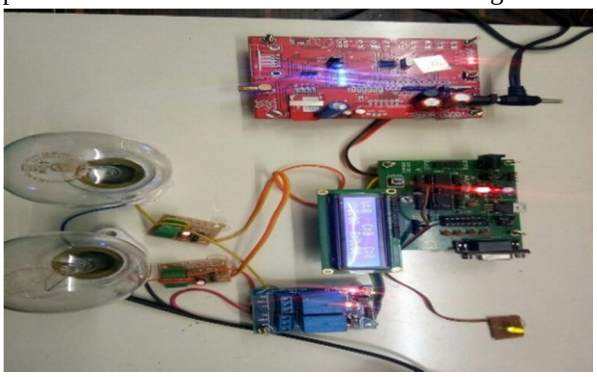

Fig.6.1 Hardware kit

IoT page is used to display the values or data which is from the Arduino. The output data may include the following data such as date, volt, current consumption by individual load, units and rate.

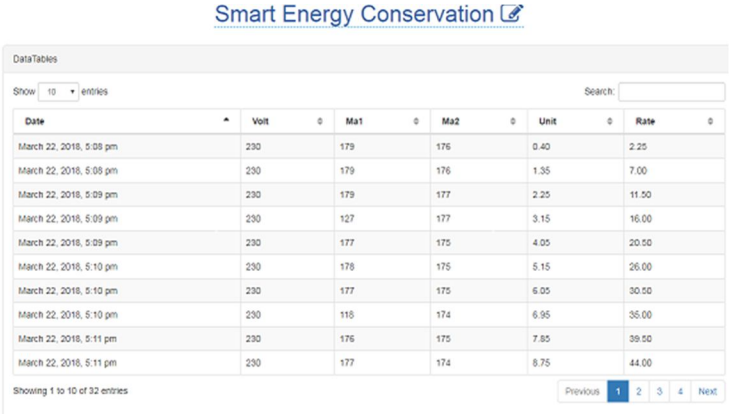

Fig.6.2 IoT page

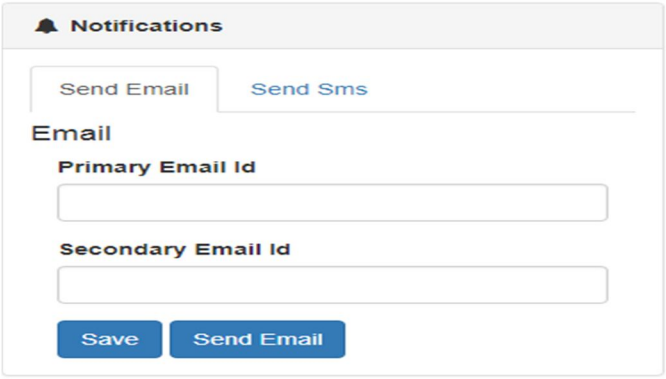

Fig.6.3 Notifications

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A customer or user can get notification on their load usage through email id or mobile alert message. For this the customer should feed their mobile number or email id to the respective columns.

Fig.6.4 Date Time Vs Variables

There is a chart which is used to show the variation in the load usage with respect to date and time. The chart is based on certain variables such as date, volt, current consumption by individual load, units, rate and it will be updated on the time period of two minutes.

VII. CONCLUSION

As per the proposed idea a new network of communication system for energy meter reading by internet communication technology and software system along with the existing meters is implemented successfully. A IOT modem will be integrated with electronic energy meter to read the usage of electricity and uploaded on server or website. Energy meter deliver the reading details and it is uploaded on the website instantly. The power cut control system is done by using same website which is used for monitoring. Moreover, in this project we are going to provide energy by the recharging system, the consumer can view the load consumption power and can recharge through website. If the power consumption reaches maximum limit then automatically an alert message is send to consumer through IOT MODEM.

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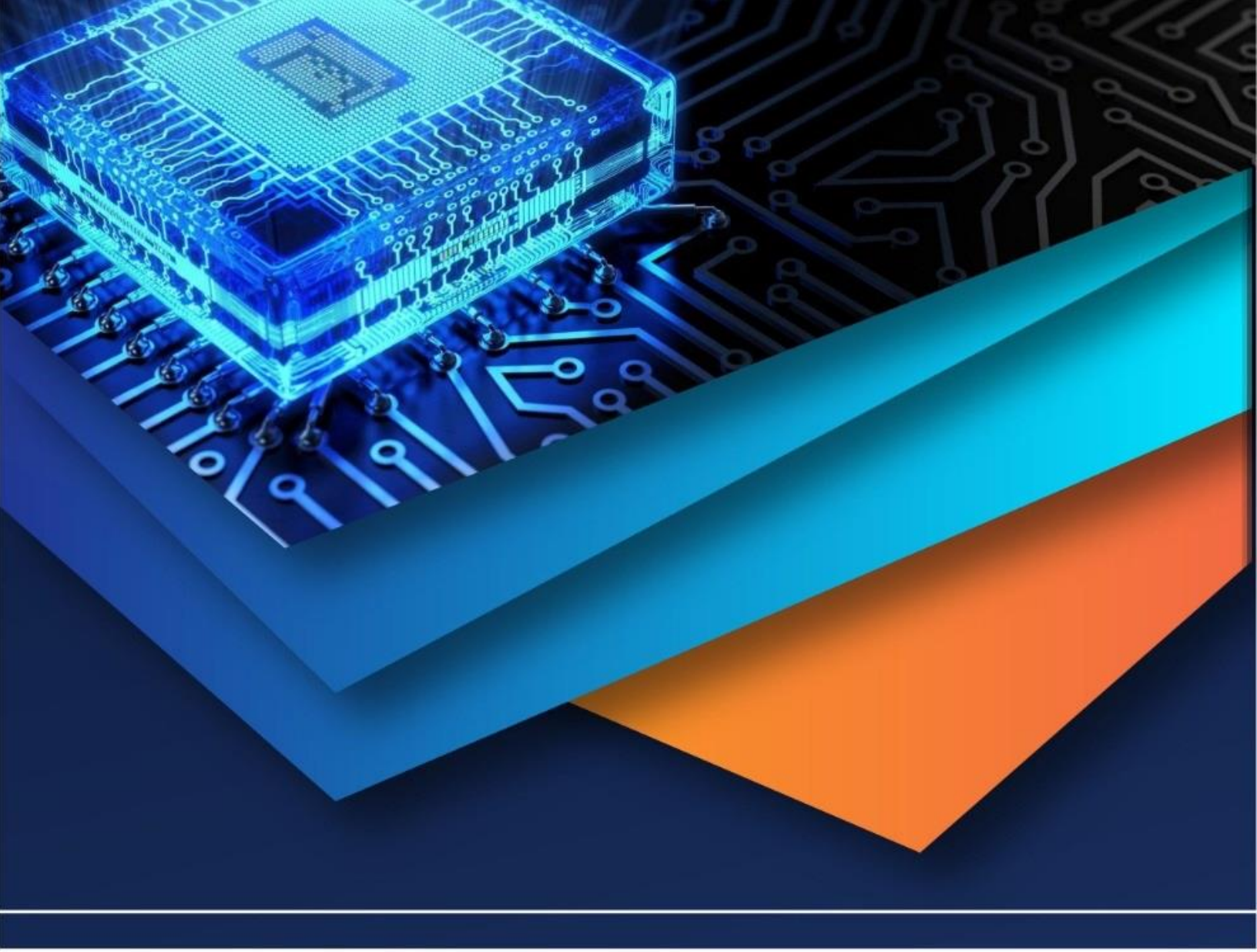

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