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# Design of Smart Electric Meter Based on IOT

Dr. V. Saravanan[1], J. Deepika[2], M. Gopika[3]
[1,2,3]Department of ECE, Jeppiaar Srr. Engineering College, Chennai, India

***Abstract:*** ***in this growing modern world everything has been under the influence of internet but the process of monitoring electric meter reading is still a manual process which drains most of the human power resulting in less accuracy. In order to overcome such situation this paper has come up with the smart electric meter based on iot. This smart electric meter makes use of arm microcontroller for monitoring the power consumption of load and node failure through iot. This smart meter also allows the user to frame budget for his/her power consumption so that once the power consumption has crossed the budget the meter will automatically turn off. In addition peltier sensor is used to supply power to the inverter instead of using normal battery.***

***Keywords: GPRS, URL, IOT***

## I. INTRODUCTION

Around 1.3 billion people do not have access to electricity and 2.9 billion make use of traditional heating and cooking fuels. These people are widely living in rural areas. Electrification programmers have been developed in a number of countries to bring power to the people. However, even with ambitious schemes such as the Ravi Ghandi Rural Electrification Programmed in India, people, especially the rural poor, are still going to be 'under the cable': that is unable to afford to connect to the grid. It is expected that by 2035 the number of people without access to electricity will not decline owing to population growth.

IOT is the system of interrelated computing devices which has the ability to transfer data over a network without requiring human to human or human to computer interaction. It is an advanced stage of wireless communication and its development is due to huge increase in address space of IPV6 which has an large address space so that even when all atoms on the surface of the earth are assigned an address but still it will have enough addresses left to do another 100+ earths.

The aim of this paper is development of an open access monitoring device for off-grid renewable energy systems. The objective is to design and build the monitoring device as well as to test the device. Conclusions and future work are reported.

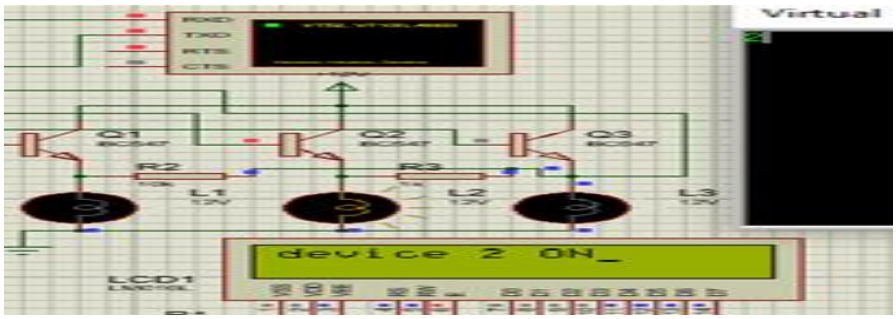
## II. RELATED WORK

Proteus 8 software is an Electronic Design Automation (EDA) tool including schematic capture, simulation and PCB layout modules. This Proteus has many inbuilt tools within it which can be used to check whether the hardware module will produce correct output after providing necessary connection between the components. This is an useful software which will give prior idea about the output which is going to be produced. This software has been used to check the output of this proposed module and it produced a successful expected output of this smart electricity meter.

While testing the connection between hardware components and its result the following outputs has been obtained. After giving proper connection in the Proteus testing tool the coding for the module is downloaded into LPC2148 and the simulation is being processed to obtain virtual terminal which is similar to URL page in system.

In the virtual terminal when input 1 is given the first load will come to its ON position and it will glow followed by it will also display its current and power consumption. Similarly when input 2 is given then the load 2 will glow respectively followed by it will also display its corresponding current and power consumption details.

For example, when the input is given as 2 in virtual terminal the output will be like in image as follows.



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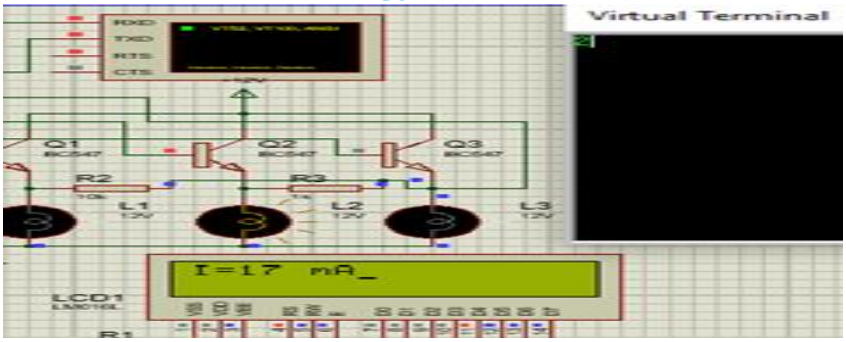
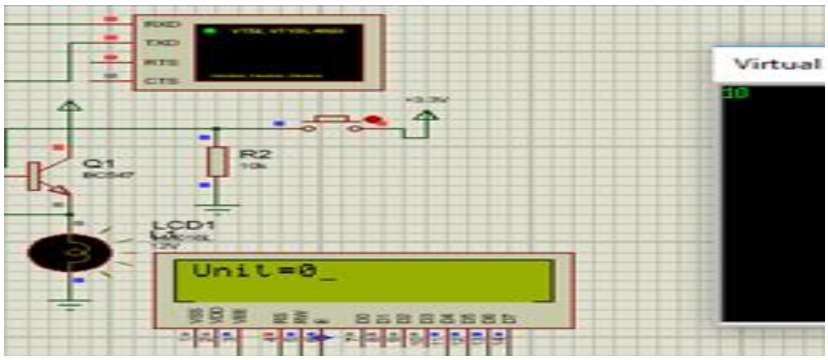
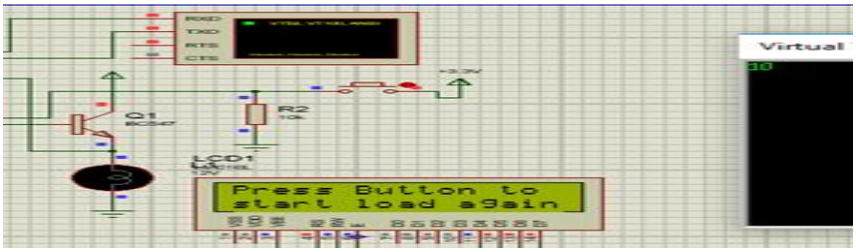



In case of budget framing concept, the number of watts to be consumed is given as input in virtual terminal. For example if the input is 10 watts, the units to be consumed by the meter will start from unit 0. When it reaches unit 9, the meter will stop its consumption and display the message as Press Button To Load Again. After viewing this message if the user want to continue his/her consumption, he/she can start the load again by giving input.








## III. MODULE DESIGN

In this module the components such as LPC2148 microcontroller, GPRS_GSM module, rectifier, transformer, LCD, Peltier sensor, boost converter, inverter and bulbs has been used. The URL page to monitor the power consumption has been created using JAVA coding through which the load can be changed from ON to OFF or from OFF to ON condition. Along with this the user can enter the amount of watts to be consumed by the load in the URL page itself so that once the framed level has been reached the device will automatically turn off and display its status both in LCD and in URL page.

In addition, off grid renewable energy concept has also been implemented in this module so that the inverter is supplied with power through Peltier sensor instead of regular process.

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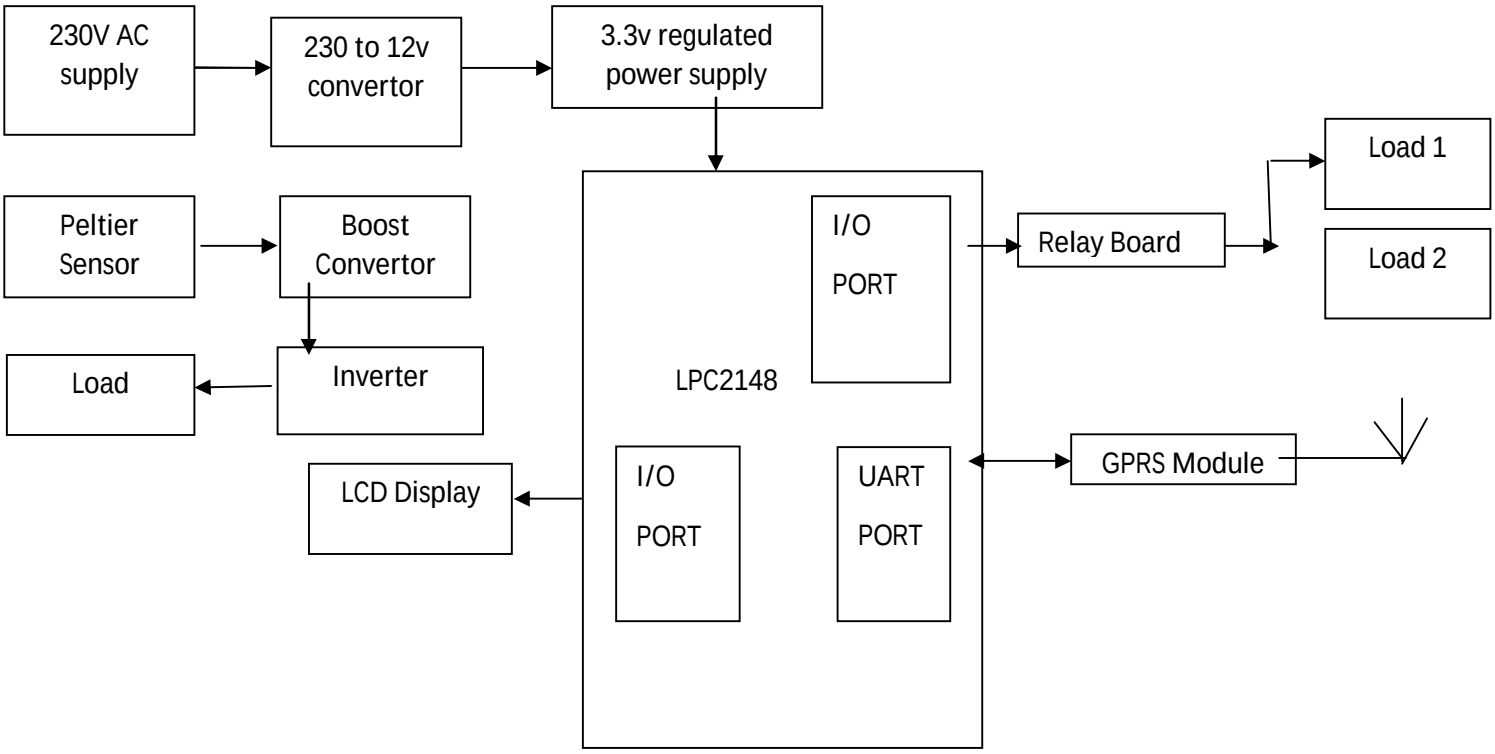


*A. LPC2148 Arm7 Microcontroller*

The LPC2148 is a microcontroller which is based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB.It has many features such as serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTs, SPI, SSP to ICs, and on-chip SRAM of 8 kB up to 40 KB, which make this device well suited for this application of smart meter design. This controller provides both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADCs, 10-bit DAC, PWM channels and 45 fast GPIO lines or level sensitive external interrupt pins are present in this controller. The pin connect block allows selected pins of the microcontroller to have more than one function. Configuration registers control the multiplexers to allow connection between the pin and the on chip peripherals.In the module, this controller plays an important role like a heart of the whole system. It helps to communicate with GPRS module and to be interfaced with LCD display to pass the information regarding power consumption and it is connected with relay board to prevent from high voltage supply. The rectifier helps to provide 3.3V operating voltage needed for this controller.

*B. GPRS Module*

Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. It is one of the data standards used in wireless modems.It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. This module helps to throw the information to the URL and to communicate between LPC2148 controller. To make use of this module, SIM card with net pack and minimum talk time balance have to be inserted. Then only this GPRS module will work efficiently to transfer the information to the URL.

*C. Relay Board*

The Relay module is a separate hardware device used for remote device switching. Relays are generally used to switch smaller currents in a control circuit. In this module, relays are used to prevent the controller from getting high voltage supply by back EMF. It is connected to loads and controller to prevent from getting damaged by high voltages.

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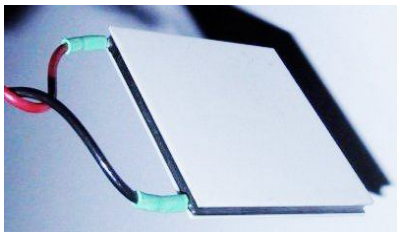
*D. Peltier Sensor*



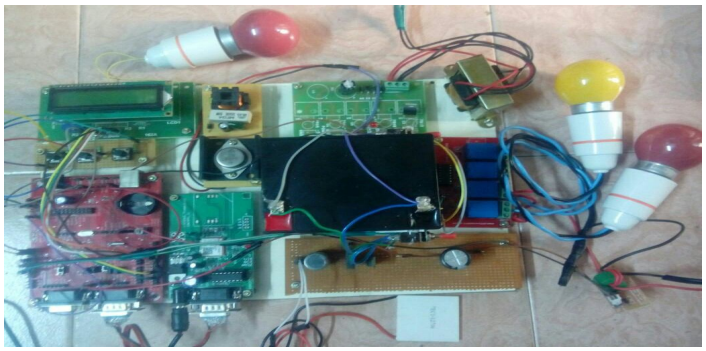
It is a thermoelectric device which creates voltage when there is a different temperature between two sides. In this module, we use padded Peltier sensor. It is connected to boost converter. And the energy produced by the Peltier sensor is stored in the battery and it is connected to the inverter as a source of supply. Using this stored energy, we can able to give supply to the load.

*E. Boost Converter*

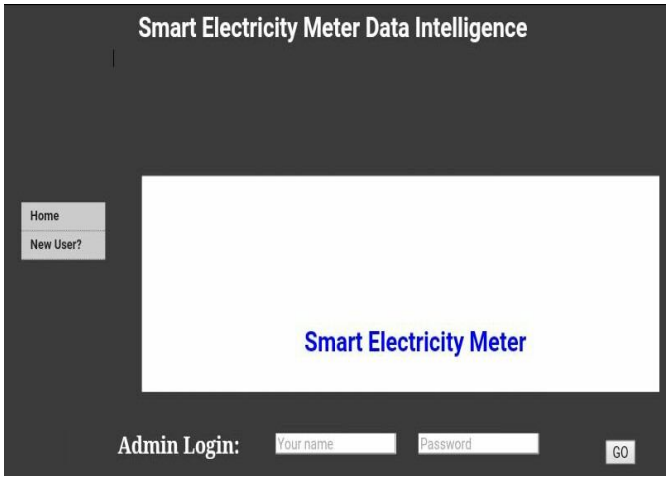
It is a switch mode DC to DC converter in which the output voltage is greater than the input voltage. In this module, boost converter is connected to Peltier sensor because the energy produced by the Peltier sensor is less in amount. So it helps to increase the energy and it is connected to the inverter for further more process. This circuit consists of Capacitor and NPN transistor.

## IV. RESULTS

After finishing the design of smart electric meter the image of the kitifollows.



Using JAVA coding the webpage has been created with IP address 122.165.20.55/Electricity. When this URL is accessed through computer or mobile phone the following page will be opened. Before accessing this URL page the kit must be in on condition. After supplying power to the module, the first switch has to be pressed in module to access the monitoring page through URL page.




In this URL page, initially a new user must be registered by providing their name, password, mobile number and email id for

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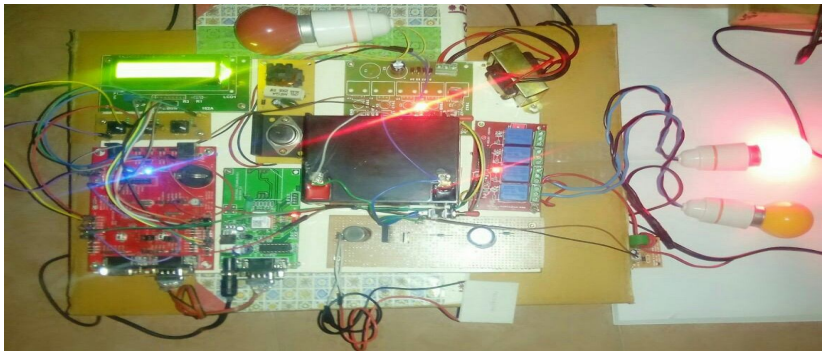
secured monitoring purpose.


After finishing registration the user must login to enter the monitoring page.


When Device1 ON button is pressed in URL page, the load 1 connected to the kit will come to its on condition and display its voltage, current and power consumption details along with the status of the load.

Similarly, the same process has to be followed for other devices to make it on or off.
For budget framing concept, the second button in the module has to be pressed until the URL switch to its budget webpage.

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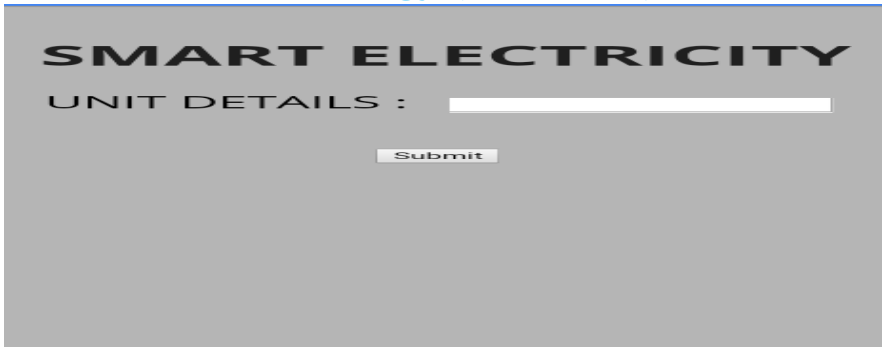
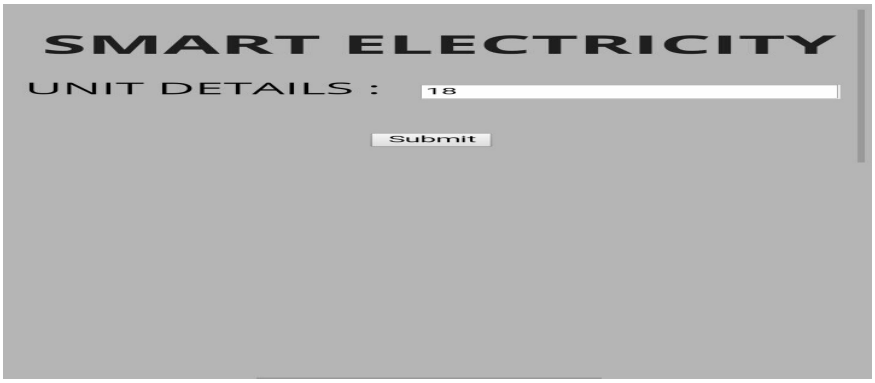



For example, if 18 watts is given in this unit details box the meter will run up to 18 watts and once the consumption reaches 19 watts the device will turn off by producing status as power exit in status bar of URL page.





## V. CONCLUSION

This smart electric meter based on IOT allows the user and EB person to monitor the power consumption of a home through internet. In addition it also helps in avoiding power wastage by providing the facility of budget framing technique. This module has overcome the disadvantage in the existing system of monitoring the power consumption by visiting each and every home by the EB person. Instead of supplying inverter with normal power supply in this module Peltier sensor has been used to supply the module with renewable power source.

## VI. FUTURE WORK

The proposed smart electric meter can withstand the load which can consume current of about 1A. Since this module involves LPC2148 microcontroller it can handle load of about 1A only. In future work heavy devices can also be monitored through IOT which consumes high current using advanced microcontroller which can handle high current so that it can result in highly efficient system.

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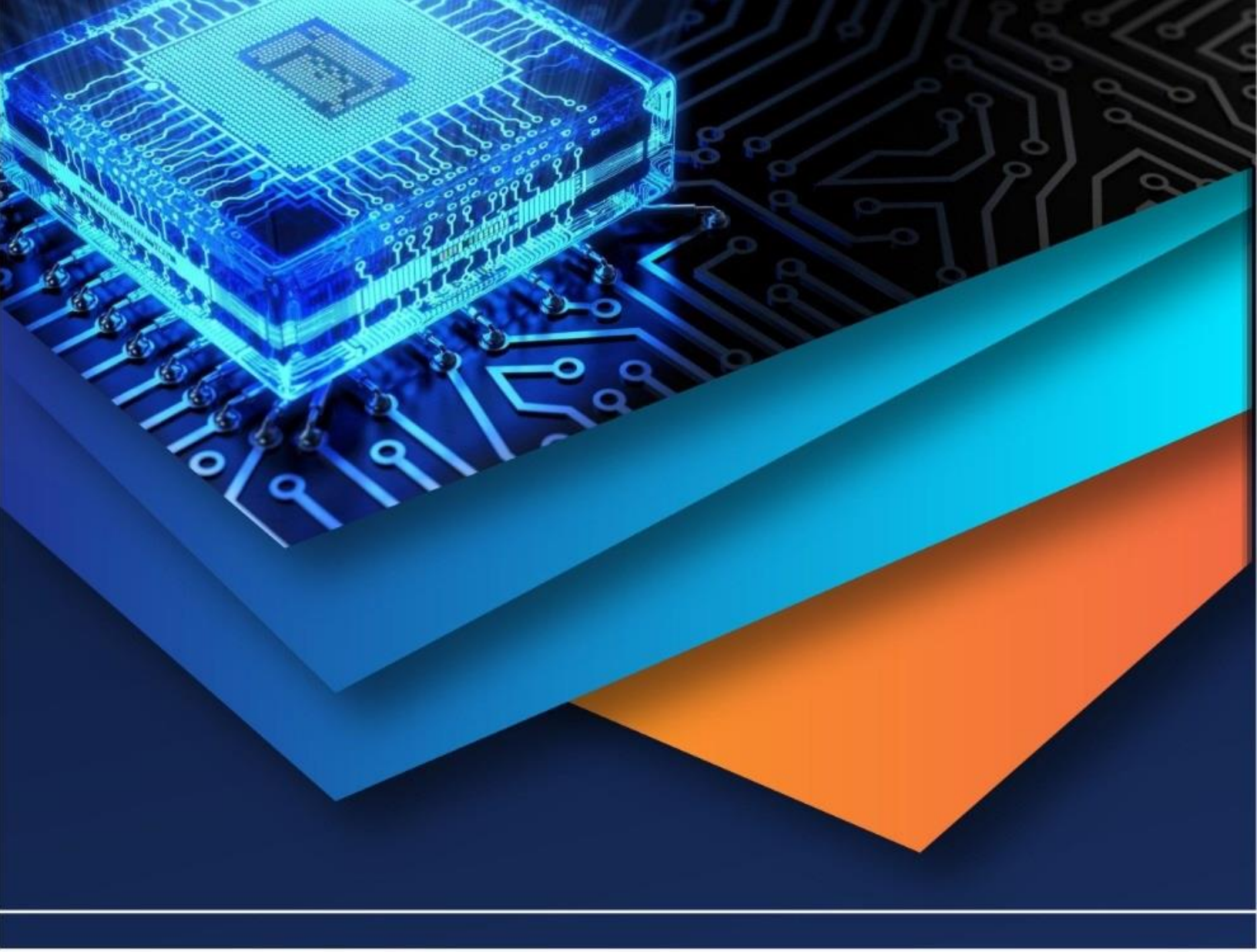

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