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Designing a Smart Bag Using Cyber Physical Devices

Prince Sharma[1], Himanshu Kumar Jaiswal[2], Prashant Tyagi[3], Pulkit Mittal[4], Shubham Shukla[5]
[1, 2, 3, 4, 5]*Department of Electronics and communication KIET Group of Institutions, Ghaziabad, India*

Abstract: ***A smart bag is a specially designed bag that is tailored to a certain use and can benefit practically everyone in society. Smart implies clever, and the bag will be capable of carrying out a variety of functions for regular use. The bag developed uses renewable source of energy.***
The solar panel on the front of the backpack will not only charge electrical devices such as phones and laptops, but will also provide energy to the complete system. This energy helps in activating our cyber-physical device which consists of microcontrollers, sensors.
As soon as the zip of the bag is opened, the microcontroller transmits the information to the user, using an android based application. It also sends a notification about the percentage of battery charged, in the bag using the solar panel to the user on their device
Keywords: Smart bag, Microcontroller, Solar panel, Internet of Thing, sensors.

I. INTRODUCTION

In today's world, a bag is only used to carry items from one place to another, but imagine what happens when the bag itself can protect your items from being stolen or misused. It is possible through the use of technology, which converts conventional bags into smart bags. It can be achieved by using components like microcontrollers, solar panels, batteries, and some sensors.
At present, there are some smart bags present in the market but they are designed for specific functions. For example, some bags are designed for only tracking, some are built for anti-theft mechanisms, etc., but one common thing about these bags is that they are charged using a non-renewable source of energy, which is limited and is harmful for the world, but in our smart bag we not only use a renewable power source but also contain many features which make it a multipurpose smart bag.
The first objective was to use an energy source which is renewable energy source. Power bank used in this project gets discharges frequently and requires charging in short interval and also have to be charged separately on daily basis. Solution to this problem can be using an energy source which is abundantly and easily to get and safe to use. Solar Energy is best suitable for this requirement. The solar panel on the outside of the bag will not only charge electrical devices such as phones and laptops, but will also provide electricity to the complete system.
The Second objective was to develop a system which help in the preventing the bag from being theft which carries important documents, valuable device, wallets and cards etc. The solution to this objective was achieved using the microcontroller which we have fitted in the bag that sends the information to the user as soon as someone opens the zips of the bag without permission. It also informs the user about the percentage of battery charged using solar panel.
The last objective was to find the location of the bag if it is lost or misplaced in any case. To find the solution of this objective, we have used a global positioning system also known as GPS which is connected with the microcontroller and sends the specific location of the bag to the user's device.

II. EXISTING SYSTEM

A. Solar Bag Pack

These are branded bags that range in price from Rs. 5000 to Rs. 25000 and can charge all sorts of phones, MP3 players, laptops, and other devices. They are lightweight and water resistant.

B. Personal Safety Apps

This mobile app's features are designed to help with personal security. Receiving text messages or emails containing the victim's whereabouts, setting off an alarm, and so on are examples of this.

C. Server

A server is a computer that shares information with other computers. It may send data across the Internet to computers on a local area network (LAN) or a wide area network (WAN).

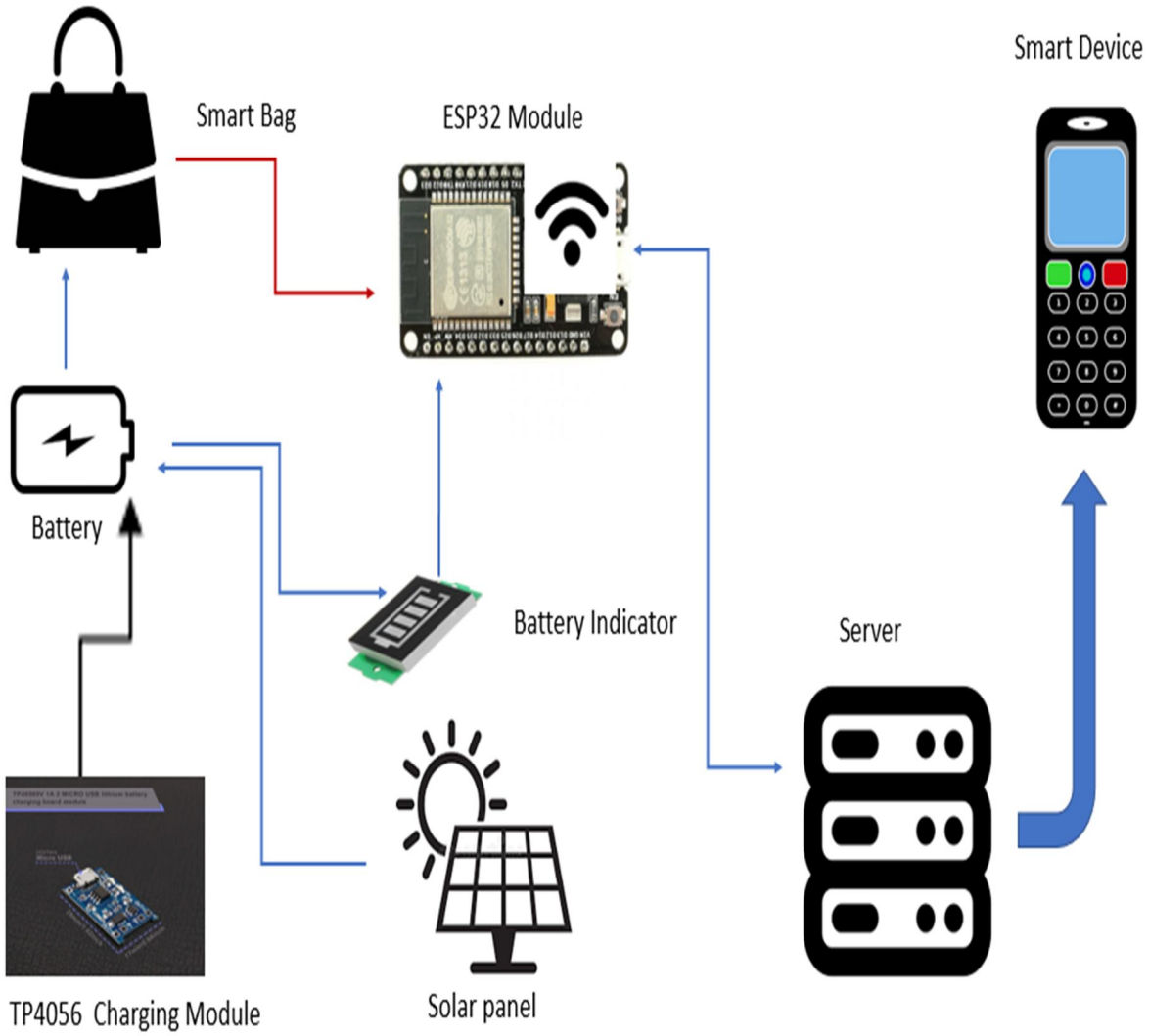
There are many different sorts of servers, such as web servers, mail servers, and file servers. Each kind runs software that is specific to the server's function.

For example, a Web server might run Apache HTTP Server or Microsoft IIS, both of which enable Internet access to websites. An application like Exim or mail, which offers SMTP services for sending and receiving email, can be installed on a mail server. To distribute files over a network, a file server could utilize Samba or the operating system's built-in file sharing capabilities. Server software, on the other hand, is unique to the server.

While server software is particular to the server type, server hardware is less so. In reality, with the right software, a typical desktop computer may be transformed into a server. A computer linked to a home network, for example, can be set up as a file server, print server, or both.

III. PROPOSED SMART BAG

A. Block Diagram



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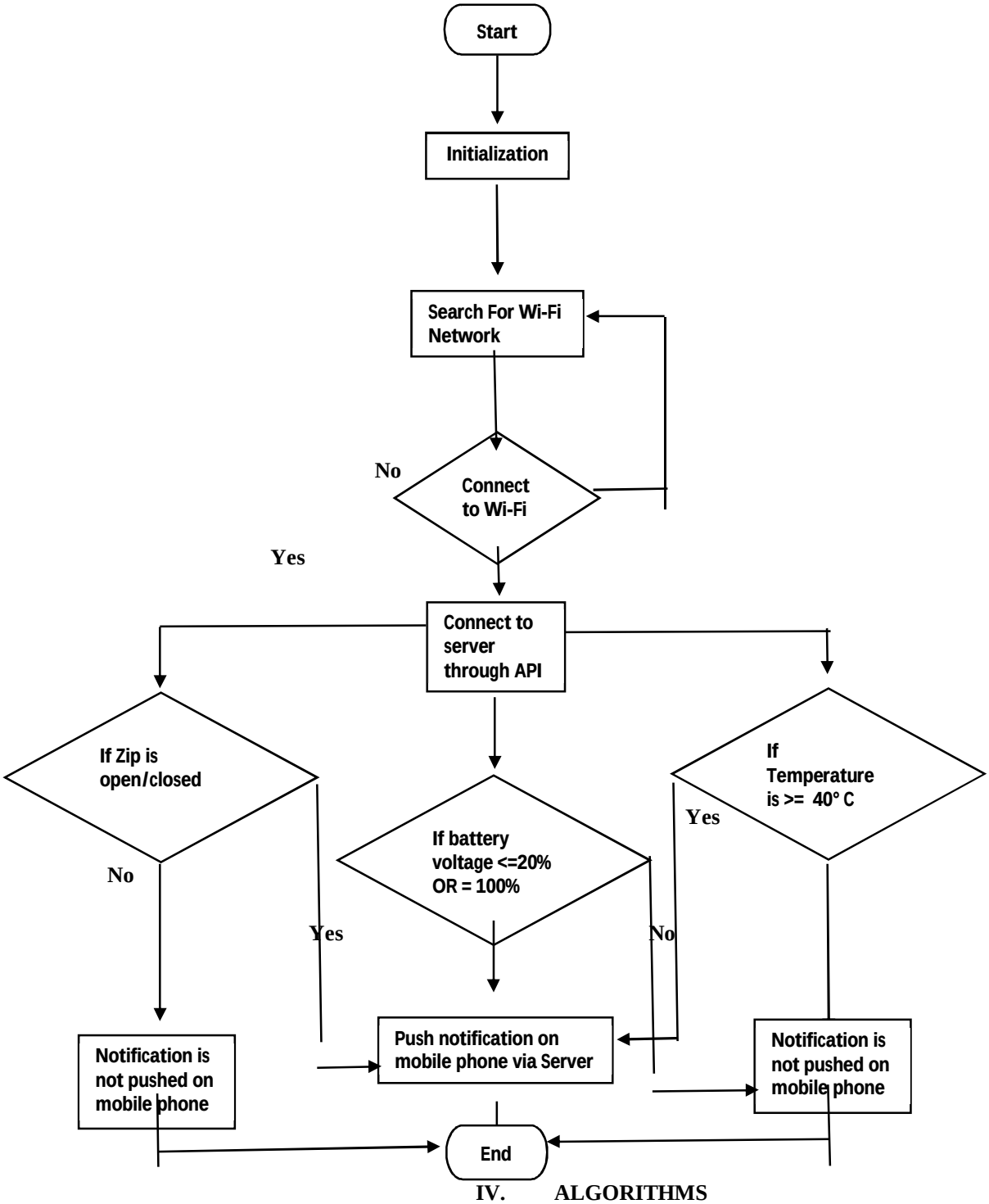
B. Flow chart



IV. ALGORITHMS

A. Algorithm: MONITORING MODE

Step 1: START
Step 2: IF Monitoring Mode ON
Step 3: THEN Check Continuously Zip Status
Step 4: IF Zip opened send Notification to Server
Step 5: Server Notification to User's Mobile
Step 6: STOP

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B. Algorithm: SMART CHARGING

Step 1: START
Step 2: Check for sunlight
Step 3: IF Sunlight available then charge smart bag
Step 4: ELSE charging can be done by Adapter
Step 5: Send notification to the user's phone when full charged
Step 6: IF discharge
Step 7: THEN send battery discharge notification to user's phone
Step 8: STOP

V. PROPOSED SYSTEM

The solar panel that will be placed to the front of the backpack will be 12 Volt, 5 Watt. The solar panel's charge is temporarily stored in a 12 Volt lead acid rechargeable battery. The voltage regulator 7805 converts this voltage to 5 volts. The ESP 32 module and associated electronics are powered by the battery, which also charges the electrical equipment.

Bag's zip may be opened and closed. The ESP32 module delivers a signal to the server, which subsequently displays a notice on the mobile phone.

The ESP32 module communicates wirelessly with a mobile phone to determine the victim's position using the phone's GPS.

VI. HARDWARE REQUIREMENTS

A. Microcontroller (ESP32 module)

A microcontroller is a miniature computer with a CPU core, memory, and programmable input/output peripherals that is integrated on a single chip. Espressif Systems' ESP32 is a low-cost System on Chip (SoC) Microcontroller. The ESP32 is commonly thought of as a metal-cased module.

LX6 32-bit microprocessor, single or dual-core, with a clock frequency of up to 240 MHz. SRAM: 520 bytes, ROM: 448 bytes, and RTC SRAM: 16 bytes. With speeds up to 150 Mbps, it supports 802.11 b/g/n Wi-Fi networking. Both the Classic Bluetooth v4.2 and the Bluetooth Low Energy (BLE) standards are supported. Up to 18 12-bit SAR ADC channels and 2 8-bit DAC channels are available.

For physical LAN communication, Ethernet MAC is used (requires external PHY). PWM for motors and LEDs with up to 16 channels. Secure Boot and Encryption of the Flash Memory There are two buttons on the schematic. The ESP32 is put into deep sleep mode by pressing the sleep button, then it is woken up by pressing another switch. In PIN 16 and PIN 33, both buttons are linked. Both buttons are active. When both buttons are pushed, they are set to active low, resulting in an extra pull-up. However, LED is linked to IO Pin 4 to determine if the ESP 32 is in sleep state or normal functioning mode. The ESP32 features an inbuilt Bluetooth module, which is a benefit...

B. Solar Panel

A solar panel consists of one or more solar photovoltaic (PV) modules that are electrically coupled to one another. They're attached to a support framework. Thin-film solar panels are best for single-device applications, such as recharging a battery-operated gadget or powering a single appliance. Photovoltaic (PV) technology converts solar energy into electricity using solar cells or solar photovoltaic arrays. Solar cells convert the sun's rays into direct current energy, which may subsequently be used to operate devices or replenish batteries. Each module has a rating based on the DC output power it produces under conventional test settings, which generally varies from 100 to 320 Watts.

C. Charging module

The TP4056 module is a lithium-ion battery linear charger. This module is capable of charging single-cell batteries. Most notably, it offers charging modes with constant current and constant voltage. Both modalities are available to users. This module has a charging current of 1 amp. Almost every electronic item is powered by a battery. Also, these batteries have the potential to be discharged. As a result, chargers are utilized to charge them by supplying electricity. A battery charger with a set charge voltage of 4.2 volts is the TP4056...

D. Battery level Indicator

The number of LEDs illuminated by the battery level indicator will reflect the status of the device's battery. It will provide you information on the condition of your battery. As a result, you'll be able to recharge your battery before it runs out. This circuit has the benefit of not requiring a power supply; instead, it will take power from the device's battery.

E. Temperature sensor

A temperature sensor is a device that helps in calculating the temperature of its surroundings and converts the input data into electronic data to record, monitor, or communicate temperature changes.

F. Zip magnet

If a magnet comes into touch with the zip, the zip is closed; otherwise, the zip is open.

G. Battery/Power Bank

Lead-acid batteries have a modest starting cost and are almost universally available. As a result, they are the most popular option in PV systems. They are available in a variety of sizes and configurations, but the most crucial distinction is whether they are deep cycle or shallow cycle batteries. Car batteries are shallow cycle batteries that provide a lot of power to start the car. Deep cycle lead acid batteries are divided into two categories:

1) Deep-cycle lead-acid batteries with a sealed case

2) Batteries with a sealed gel cell (gelled-electrolyte)

Both types of deep-cycle lead acid batteries do not require any maintenance. AH, or amp hours, is the unit of measurement for lead acid batteries. They typically vary from 1 ah to 300 ah. These batteries are utilized in a variety of applications, including emergency lighting, solar micro systems, and other small projects.

VII. SOFTWARE REQUIREMENTS

A. Arduino IDE

We need to utilize software to write distinct routines for different interface devices in addition to the hardware design needs. Writing code and uploading it to the board is simple with the open-source Arduino software (IDE). Any Arduino board may be used with this software. There are a certain number of lines of code in the Arduino IDE. For the interpretation of a signal, these instructions are uploaded into the ESP32 Module. It's a versatile and simple-to-use system.

VIII. IMPLEMENTATION

A. PCB Design and etching

PCBs (printed circuit boards) are custom-made for each circuit. These are not only more compact, but also less expensive than ready-made modules or boards. The schematic of the circuit may be drawn using a variety of software packages available on the Internet. The schematic was created with the help of Proteus. Proteus is a free and open-source programme.

A power indicator LED and a battery level indicator are included into the circuit. The ESP32 module is attached to the PCB board and is powered by the Power Bank. The PCB board requires a direct connection to the Microcontroller's Serial Rx pin and is powered by 5 V. The PCB board, ESP32 module, and Power Bank are placed in the bag, and the solar panel output is used to charge the Power Bank.

Comparison Table

S. No	*Previous Smart Bags*	*Present Smart Bag*
1	No Zip lock system	Smart Zip lock system
2	No notification system	The notification system is available
3	No Monitoring Mode	Monitoring Mode
4	No Charging module	Charging module, we can use in emergency

B. Result obtained

The PCB for the development board, the ESP32 module, and the battery level indicator are all etched and soldered. The solar panel is attached to the Power Bank, and the bag has an ON/OFF switch. When the switch is turned on, the power indicator LED on the Development Board and the Reader Module illuminates, showing that the circuit is operating properly. As a result, the Power Bank charging process begins. When opening and shutting the bag's zip. The ESP32 module transmits a signal to the server, which causes a notice to appear on the mobile phone.

IX. CONCLUSION

The number of new inventions in science and technology has been steadily growing. This solar-powered Smart Bag is simple to use and has all of the essential functions. This backpack is simple and small, making it ideal for managing demanding jobs. Because this bag is user-friendly, individuals of all ages may utilize it to meet their needs. The study primarily focuses on two aspects of the suggested system. The most important aspect of this concept has been realized: solar energy is used to power the whole circuitry and charge mobile phones. Another feature connected to the Zip of the Bag is that if stealing attempts to open the Zip of the Bag, we receive a notification on the mobile phone through server. These two capabilities address the issue of forgetting and battery depleting quickly. The weight of the electronics in the bag can be reduced thanks to new technological technologies.

X. FUTURE SCOPE

A. Smart bag will help in preventing the bag from being theft which carries important documents, valuable device, wallets and cards etc.

B. Smart bag uses global positioning system also known as GPS which is connected with the microcontroller and sends the specific location of the bag to the user's device.

C. Smart bag will use renewable source of energy i.e. Solar Energy which is abundant, easily to get and safe to use.

D. Smart bag can charge a power bank, mobile phone, tablet, and mp3 player as well as other electronic equipment and can easily be used as school and traveling bags

XI. ACKNOWLEDGMENT

I'd like to express my heartfelt gratitude to Dr. Shubham Shukla sir, project guide professor and Information Technology project coordinator, for providing us with the opportunity to work on this fantastic project on the topic of Smart Bag using cyber-physical devices. He also assisted us in conducting extensive research and providing us with all of the resources we needed for this project.

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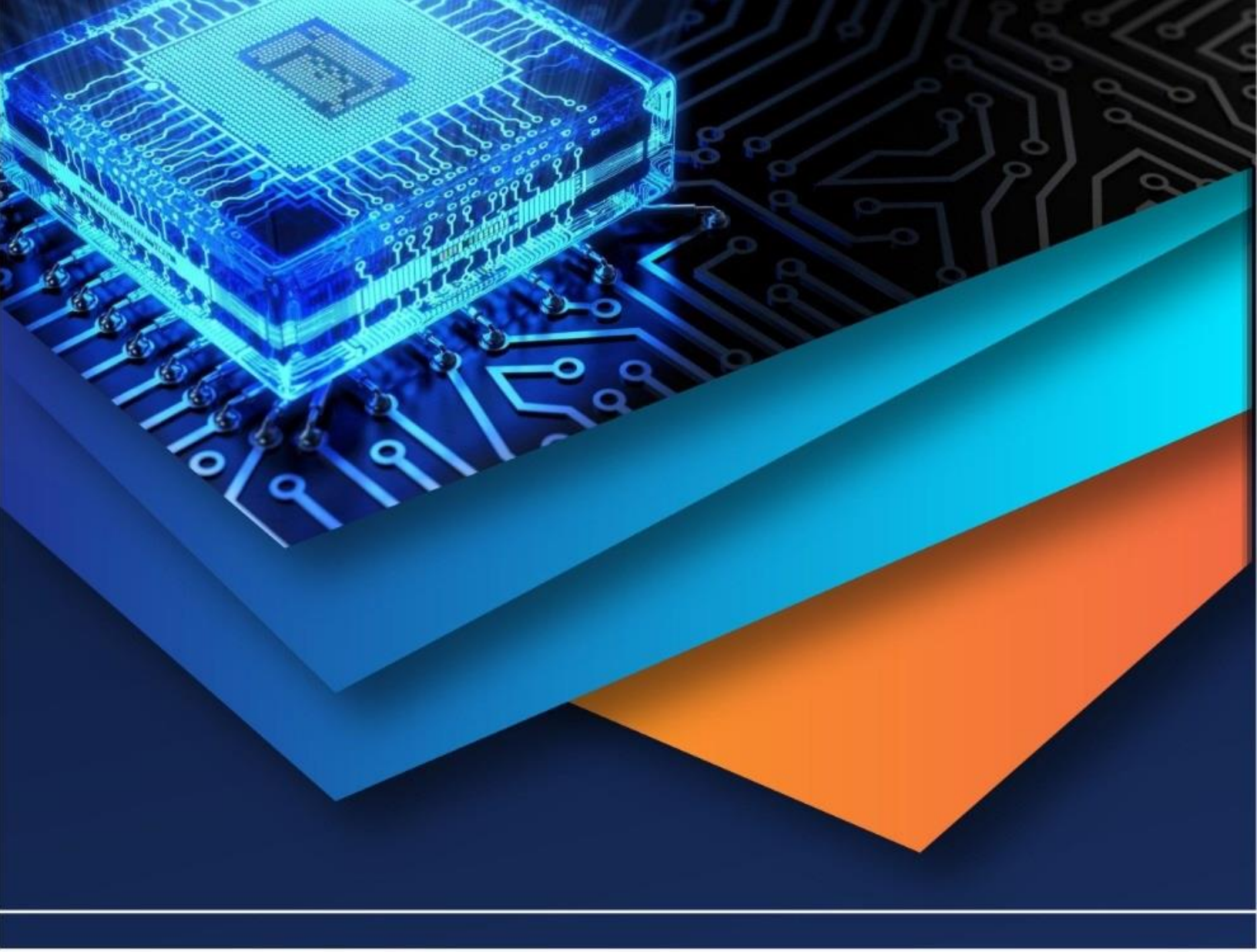

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