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Design and Implementation of 4-In-1 Luggage Bag

Dexter L. Duat[1], Mario C. Bebelone[2], Jeffrey M. Gallego[3]
[1, 2, 3]*Department of Electronics and Communications Technology, University of Science and Technology of Southern Philippines*

Abstract*: This study outlines the development and innovation of a 4-in-1 luggage bag. It highlights the biometric lock, the GPS (Global Positioning System) tracker, built-in emergency power bank, and the luggage bag's kick scooter. The study was designed and made for the travellers to be reliable while travelling or during any occasion that uses luggage bags. While providing convenience to the travellers, the prototype also features a security of the luggage bag through the biometrics. The fingerprint scanner was used to access and open the luggage bag, whereas the GPS device was used to track the luggage bag which has a built-in power bank that makes the luggage bag a charging station for gadgets. The luggage bag also features a kick scooter that is attached to the luggage bag for an easy and convenient carrying of the luggage. The prototype was implemented and tested at a bus terminal in the locality. The results of the study yielded positive affirmation on its functionality, operability, aesthetics and safety category validating the need to innovate and reproduce the luggage bag.

Keywords*: 4-in-1 Luggage Bag, Fingerprint Scanner, GPS (Global Positioning System, Power Bank, Solenoid Lock.*

I. INTRODUCTION

Travelling is very popular nowadays. Travel agencies and airline companies even make travelling easier and cheaper to everyone. Tourism is one of the reasons to travel. People love to visit new places, meet new people, learn new things and discover different cultures. Others define travelling as a measure to relax from the world full of anxieties. However, there are also travels related to business and visiting a family or meeting an old friend. Thus, travelling becomes more and more common today and millennials are one of the constant travellers. According to the Global report on The Power of Youth Travel by World Tourism Organization [1], most of the young travellers of today come from the generational cohort born between the early 1980s and 2000s, the millennials. Price [2] also agrees that the millennials travellers are the endless explorers thirsty for knowledge and prefers to travel to learn something new. O'Kelly [3] also stated that millennials are more interested in travelling than older generation. Problems encountered while travelling is inevitable. There are lost luggage, the need to recharge empty battery gadgets, being stressed out in carrying heavy luggage, theft and the like. Many travellers have experienced losing their luggage upon their arrival not to mention the worries of losing something valuable inside it. Lost luggage is very frustrating. It could ruin the whole trip. Today's traveller wants to stay connected while on trip. They are very dependent to technology. They make travelling and communications go hand in hand. According to Shall cross[4], aside from deftly using social media to plan their trips, millennials have a nearly endless supply of Smartphone apps at their disposal while exploring—everything from language translation apps to maps, meet-ups/hook-ups, ride-sharing, bicycle-renting, photo-enhancing, and of course, travel booking. However, none of these apps are useful when the Smartphone is out of juice. Empty battery gadget means losing connections, it makes them anxious. On the other hand, heavy luggage requires extra effort, instead of maximizing the time after reaching the destination, taking a rest is the first thing a traveller wanted to do because of the exhausted feeling carrying or dragging their baggage from terminal to terminal. Travelling activities could be adventurous. Packing light and choosing the right luggage to fit all the necessary things is the measure of a good traveller Steves [5]. It also means hassle free. To a feasible extent, everyone wants to travel light. Carrying heavy loaded luggage is stressful and a characteristic of a typical tourist. The integral part of travelling is choosing the right bags. The role of bags cannot be underestimated, it is very essential. Hence, the present study is conducted to design and implement a luggage that could provide the needs of travellers today. This luggage is a 4-in-1 luggage that embedded system features that ensure the security of the belongings and provide convenience to the traveller. This study also assessed the traveller's insights on the features embedded on the luggage.

A. Theoretical Considerations

Figure 1 shows the conceptual framework of the study. Problems like lost or stolen luggage, empty battery gadgets and inconvenience in carrying the heavy bags reckoned to be as input. The output is a seamless travel experience through the featured GPS, finger print scanner, built in battery charger embedded in the luggage bag with a scooter.

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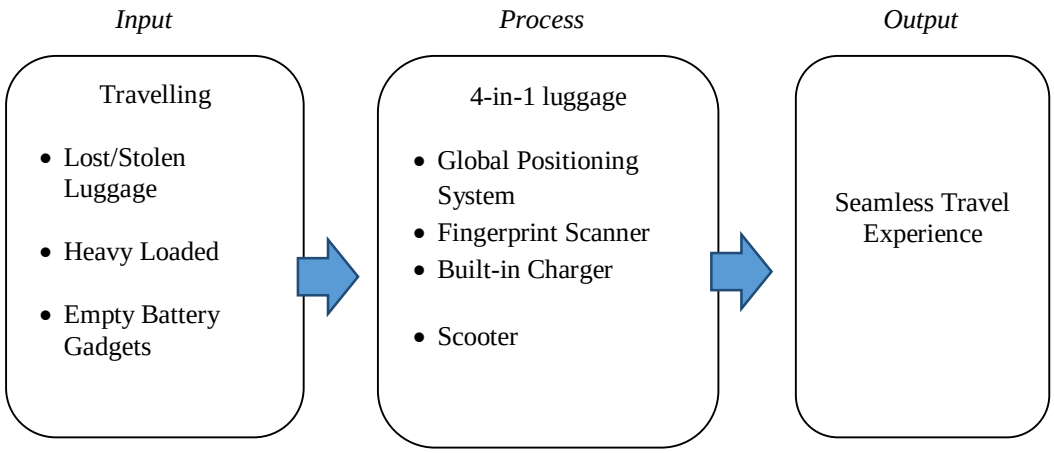

Fig. 1 Conceptual framework of the study

This study anchored on several related concepts derived from several pertinent theories and principles. Gone are the days when your luggage served one function: to get stud from point A to point B hopefully unscathed and with bonus points if unwrinkled. PR Newswire [6] stated that technology and design meet the next generation of travel luggage. The *Style* section of Esquire Magazine also published a picture of Smart Carrier, it says "The next generation of rolling carry-on doesn't just transport your goods – some can even charge your phone". Barnwell [7] agrees that luggage is finally getting smarter, and the options for connected suitcases and related gadgets from start-ups to market leaders like Samsonite, Rimowa and Delseyu are beginning to catch hold. Muoio[8], quoted Ramesh Tainwala, CEO of Samsonite during his interview for the Guardian online magazine that, Smart luggage will soon communicate on one side with the owner and on the other with the carriers handling it. Everything will be connected.

II. METHODOLOGY

Travellers often find it difficult to travel with a heavy luggage bag but sometimes having a heavy luggage bag is not the issue, the real issue lies with their item's safety and security. Figure 2 shows the block diagram of the 4-in-11 Luggage Bag. The battery in the diagram is a Lithium-ion rechargeable battery that supplies power on some of the Luggage bag's components and also generates power for the Power Bank Circuit then straight to the USB Charging Port; this makes an emergency power supply for drained mobile phones. The Lithium-ion battery is also connected to the Arduino, and Solenoid. The Arduino acts as the main brain of the biometric lock which is the fingerprint sensor and solenoid lock. The Arduino supplies the fingerprint sensor and activates the solenoid driver circuit which also activates the solenoid when the fingerprint sensor identifies the right fingerprint. The solenoid needs a higher voltage in order to function but in order to control the solenoid the solenoid driver circuit is needed. The GPS module is the Luggage bag's tracker whenever the bag gets misplaced or stolen; it is connected directly to the battery charger because the GPS module has its own power supply/battery. The Luggage bag has its own battery charger; its DC output is connected directly to the battery while the AC input is connected to the AC Adapter outside of the Luggage bag for the owner to be able to recharge the battery hassle free.

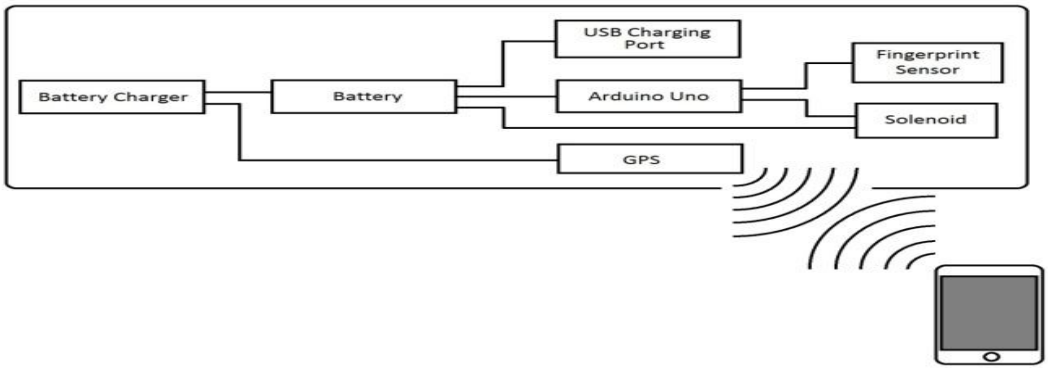

Fig. 2 Block diagram of the 4in 1 luggage bag

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Figure 3 shows the connections of the main component of the 4-in-1 Luggage bag; the fingerprint sensor, the solenoid and the solenoid driver which controls the solenoid through the Arduino. Then the battery is connected to the battery charger attached inside the luggage bag which is connected to the AC adapter outside the luggage bag. The battery is also connected to the power bank circuit which produces 5v supply, enough to charge mobile phones. Switch is used to give the owner an option which is turning on the power when opening or using the luggage bag's built-in power bank. LED's white, green, blue and red are indicators for the biometric lock. The white LED is to indicate the users attempt to eradicate or change the current registered fingerprint ID. The green LED is to indicate the solenoid's functionality whether it open or not. The blue LED is to indicate the default program which is the "identify" program, it means that the fingerprint sensor is ready to identify the registered fingerprint ID. Then the red LED indicates the "unregistered fingerprint" program, it means that the inputted fingerprint is unregistered. The two tack switch allows the owner to change and reset the program to default. Switch1 is to change the current registered fingerprint, after changing; pressing the second switch (Switch2) reset's the program to default.

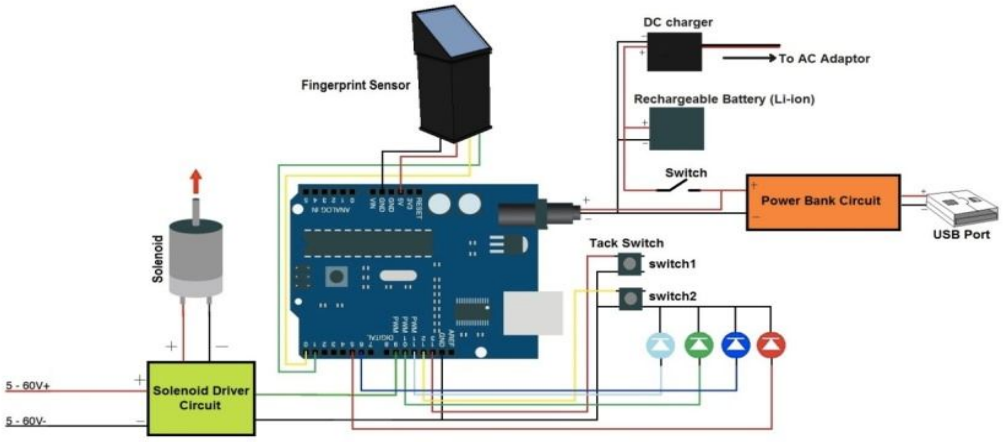

Fig. 3 Components and circuit layout

Figure 4 shows the process flow of the 4-in-1 Luggage Bag, the luggage bag has a power switch that controls some of the luggage bag's components. If the power switch is ON, the Arduino Uno and a 5v power bank activates. When the Arduino Uno activates, the fingerprint and two tack switch also activates. The fingerprint sensor/module is set to a default program which is ready to identify the registered fingerprint, if the inputted fingerprint does not match the current registered fingerprint, it will automatically return to the default program which is the "identification".

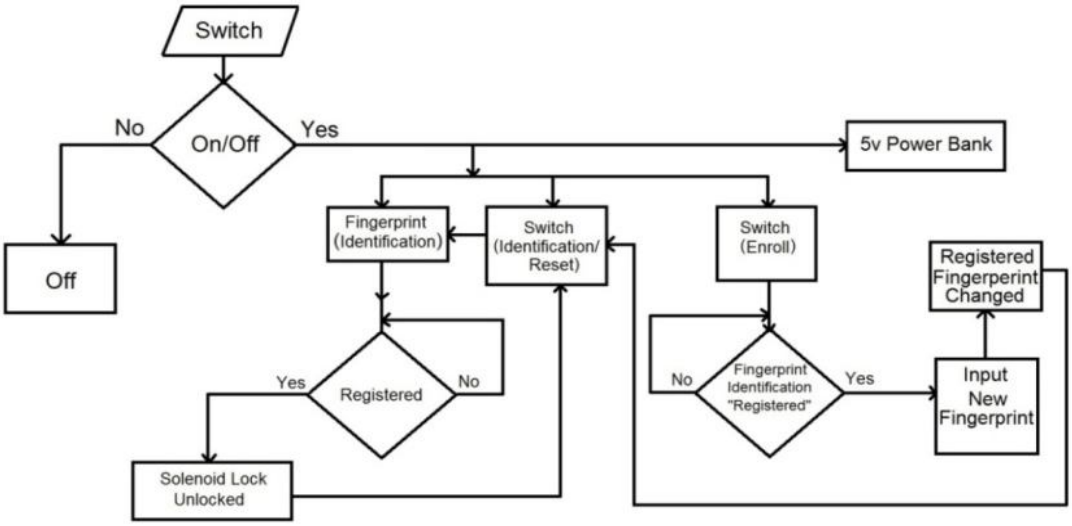

Fig. 4 Biometric lock process flow

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However, if the fingerprint sensor accepts the inputted fingerprint, it will trigger and open the solenoid lock. In order to close the solenoid lock, pressing the identification/reset button returns the program to default. The other button, which is the Enroll button, allows the owner to change the current registered fingerprint. But then, it needs the current registered fingerprint to enroll a new fingerprint. And in order to reset the program to default or lock the solenoid lock, pressing the switch1 reset's and return's the solenoid lock from its current state to its default state.

Figure 5 show the process flow of the Global Positioning System (GPS). When the GPS module turns, sending a text message (begin<space>GPS password) to the GPS module's number activates the GPS module to stand by. After text message, the GPS then replies "begin OK!" this indicates that the GPS module is ready to receive a call from the messenger. When calling the GPS module's number, the call automatically ends after the call ends the number of the GPS module then sends a message containing the information in terms of a message (longitude, latitude and Google Map link).

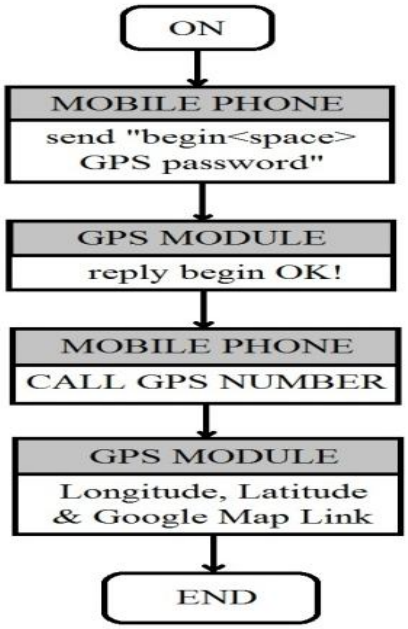

Fig.5 Global Positioning System (GPS) process flow

Figure 6 show the digital design sketch of the project, first figure from the right shows the power switch, followed by the AC adapter which serves as the bridge from the outlet to the battery charger, then followed by the last image which shows the fingerprint sensor, identify and enroll button, USB port, and solenoid lock.

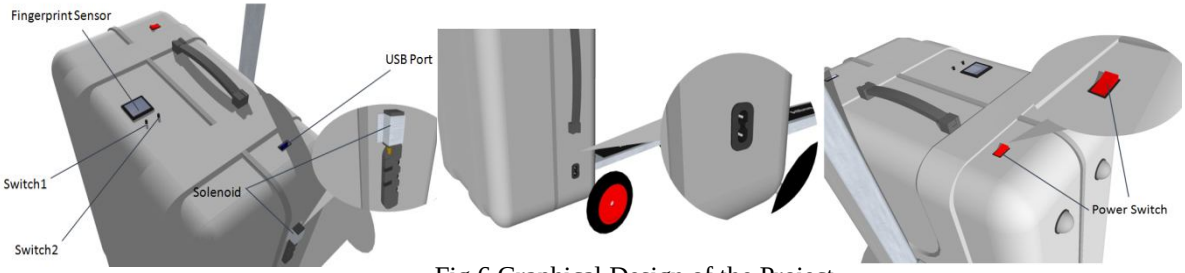

Fig.6 Graphical Design of the Project

This project will be evaluated whether it will aid the travellers with efficiency and convenience. As to Functionality, its function is to provide not only convenience but also safety and security of the items inside. As to Aesthetic, the luggage bag's devices and components are well hidden and installed inside the luggage bag, and the scooter that is attached to the luggage bag is made

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presentable enough to carry around. As to Operability of this project, the fingerprint scanner/sensor was programmed easy enough to operated and to be a user friendly, it operates one to two days max with the battery fully charged because the luggage bag has a power switch so the user can have an option whether to turn on or turn off the device and it only needs to be turned on when the user use the USB port for recharging mobile phones and when opening the luggage bag .And as to Safety, wirings are well installed and well protected inside the luggage bag. The scooter also well wielded, there are no sharp object that can accidentally hurt the user.
The 4 in 1 luggage bag is evaluated using quantitative data utilizing survey, observation or analysis of the subject and measures the data gathered from a range of selected respondents.

A. Functionality, the evaluation was conducted through observation on the function of the devices inside the luggage. Whether the instructions stated by the researchers true and correct or whether the devices functions.
B. Operability, the evaluation of the 4 in 1 luggage bag in providing the reliable operational instructions for easy usage of the consumer. Whether the operating these devices safe and easy to operate.
C. Aesthetics, evaluation of the prototype's physical outlook within the external and internal outlook proficiency. The luggage bag's entire outlook; internal and external.
D. Safety, evaluation of the prototype as to the safety of the machine operations and harmless to users.

III.RESULTS AND FINDINGS

The results and findings of the study are based on the stipulated methodology involved in the conduct of the study that highlighted the design, development and evaluation of the 4 in 1 Luggage Bag.
Figure 7 shows the actual physical appearances of 4 in 1 luggage bag with scooter. It depicts the input and output components of this project. This project is accessible, as to functionality and purpose. The external components are firmly attached to the project. These devices are Fingerprint Scanner, Arduino module, GPS Tracker and built-in power bank for mobile phone charging. The prototype was developed for security and emergency purposes. This project gives us convenience especially to those who accompanied with their children's or elders because of the scooter attached to this project.

Fig. 7 Four-in-One Luggage Bag

The researchers successfully designed and implemented the four-in-one (4-in-1) luggage bag to the 50 travellers of Agora Bus Terminal. This innovative luggage bag has 4 features embedded to it, such as Biometric Lock, GPS Tracker, Portable Charger and Built-in Kick Scooter. The features are user friendly and it functions very well, its physical appearance is very presentable. The respondents were satisfied and amazed with the prototype when they are asked to evaluate the features embedded to it. Regarding these matters, basing on the evaluation survey rating and respondent's suggestions, the project or prototype should undergo some adjustment and recommendations; that the prototype should have at least 2 ports for the charging facilities, a battery and charger indicator for the purpose of avoiding battery overcharging and lastly these devices should be properly installed and organized.

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Parameter	Mean
1. The devices in the luggage bag functions as the researcher instructed.	4.6
2. The luggage bags automated lock only open with the registered fingerprint.	4.8
3. The luggage bags automated lock opens as soon as the fingerprint sensor detects the right fingerprint.	4.7

Table 1 Mean Responses in terms of Functionality

Table 1 shows the result of this survey and it's mean with functionality as its main parameter. Data shows the respondents rated the functionality of the devices with a total mean of 4.7, where the respondents rated the 4-in1 luggage bag in terms of its device's functionality. Mean ratings did not reach the highest remarks, some respondents did not understand the functionality and instructions of the luggage bag where the researchers would state while conducting the implementation.

Parameter	Mean
1. Ease of use of the luggage kick scooter.	4.8
2. The luggage bag and its devices are easy to use or operate.	4.9

Table 2 Mean Responses in terms of Operability

Table 2 shows the evaluation of the device in terms of its operability. The table illustrates the mean and total mean responses of the respondents in rating the operability of the 4 in 1 luggage scooter. The respondents rated operability of the device with a total mean of 4.85, operability did not reach its excellent remarks. Some respondents complained about the scooter's balance.

Parameter	Mean
1. The luggage bag is presentable and neat.	4.4
2. The luggage bags devices properly installed.	4.5

Table 3 Mean Responses in terms of Aesthetics

Table 3 shows the result of survey from different chosen respondents in terms of the devices aesthetics. The table implies that the respondents are rating the device in terms of its aesthetics. The respondents rated a total mean of 4.45 for the luggage bag's neatness and device's attachments.

Parameter	Mean
1. The luggage bags devices and items harmless and safe.	4.4

Table 4:Mean Responses in terms of Safety

Table 4 shows the result of survey from different chosen respondents in terms of its safety. The table depicts the mean responses of the respondents in rating the safety of the device. The safeness of the machine upon usage has a total mean of 4.4.

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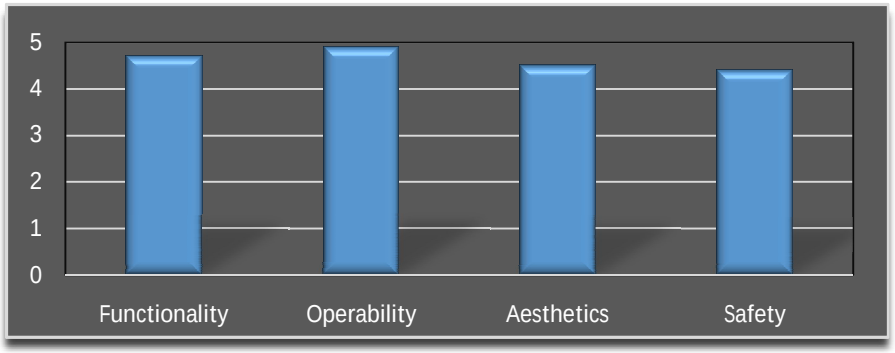

Figure 8 Mean Responses Evaluating the 4-in-1 Luggage Bag

Figure 8 describes the graphical responses of the respondents in the evaluation of the evaluation of the device base on the data. The bar graph shows the mean responses evaluating the 4-in-1 Luggage Bag in four distinct categories. The mean result on the category functionality is 4.7, thus, it indicate that the respondent rated excellent in terms of the luggage bags components functionality. Also device operability has a numerical rating of 4.85 corresponding to excellent rating which indicate that the overall operations of the device is conductive and easy for the respondents to use or operate. Moreover the aesthetic category has 4.45 total mean responses, having anvery satisfactoryrating, describing that the overall appearance of the device is presentable. Furthermore, on the Safety of the machine, 4.4 numerical rating was rated by the respondents corresponding to anvery satisfactory rating indicates the safety operations of the mahine.

IV. CONCLUSIONS

The researchers successfully designed and implemented the four-in-one (4-in-1) luggage bag to the 50 travellers of Agora Bus Terminal. This innovative luggage bag has 4 features embedded to it, such as Biometric Lock, GPS Tracker, Portable Charger and Built-in Kick Scooter. The features are user friendly and it functions very well, its physical appearance is very presentable. The respondents were satisfied and amazed with the prototype when they are asked to evaluate the features embedded to it.

V. ACNOWLEDGEMENT

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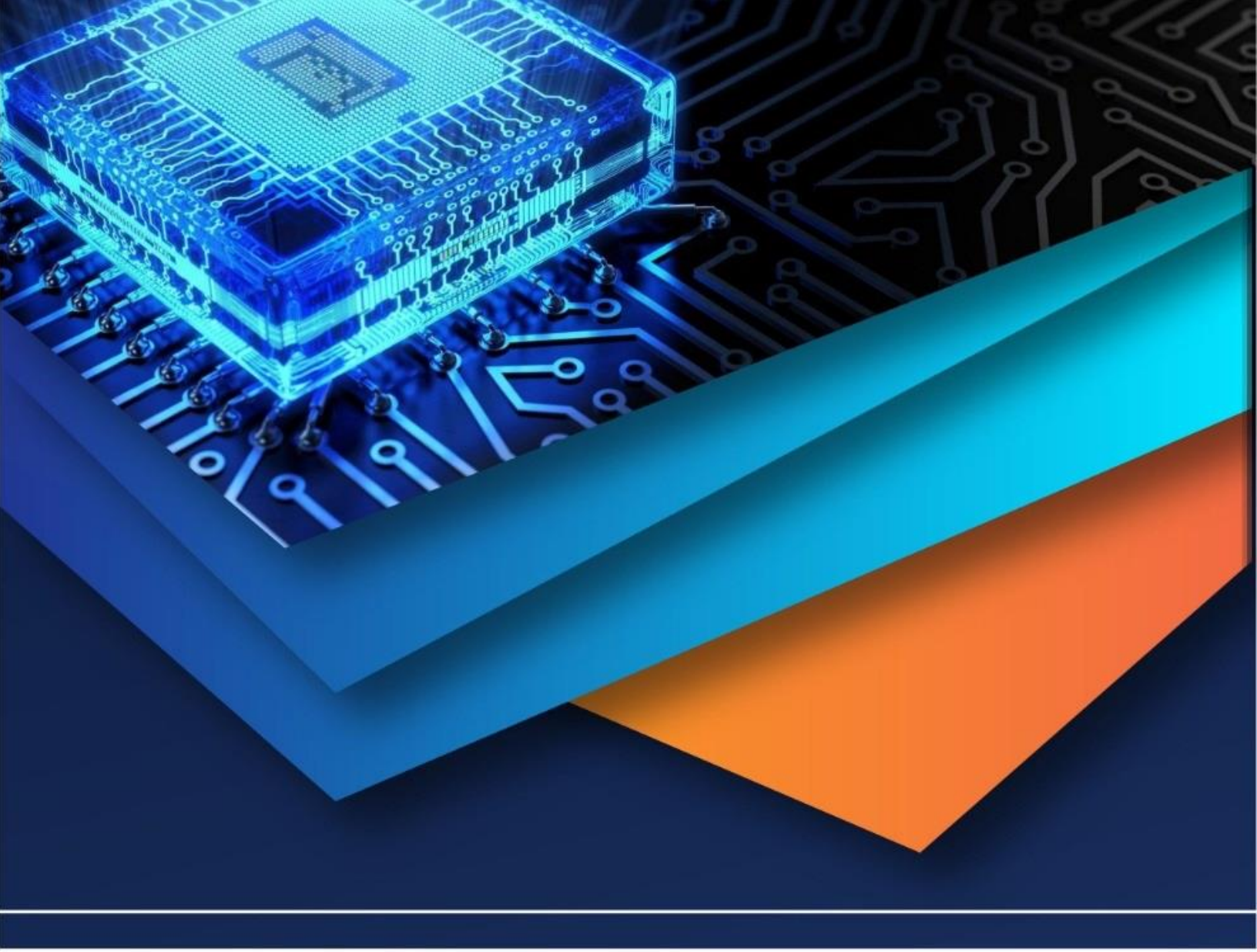

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