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Smart Bin Using IoT

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Abstract: ***The study presents a design and development of a smart garbage bin that can detect dry and wet waste using moisture sensors and ultrasonic sensors and has Bluetooth connectivity for remote monitoring and management. The aim of this study is to evaluate the accuracy, reliability, and potential environmental impact of the smart garbage bin in waste management practices.***
The smart garbage bin prototype was developed using Arduino technology and integrated with moisture sensors and ultrasonic sensors to accurately detect and classify dry and wet waste. The Bluetooth connectivity allows for real-time monitoring of fill levels and waste composition, optimizing waste collection schedules and routes and reducing costs. The prototype was tested for accuracy and reliability in detecting different types of waste, including paper, plastic, food waste, and liquids, and was found to be highly reliable in detecting and segregating waste accurately.
The study also evaluated the potential environmental impact of the smart garbage bin in waste management practices. The results indicate that the smart garbage bin has significant potential in reducing waste generation, promoting recycling, and improving waste management practices. The real-time data on fill levels and waste composition provided by the smart garbage bin can optimize waste collection schedules and routes, reducing costs and improving environmental sustainability.
However, there are also limitations and challenges in the design and implementation of the smart garbage bin, such as cost, power consumption, and potential technological issues. Therefore, future research and development are necessary to address these challenges and improve the design and effectiveness of the smart garbage bin
Keywords: Ultrasonic Sensor, Bluetooth, Motor Arduino Uno, IR Sensor, Rain Senser.

I. INTRODUCTION

Waste management is a crucial aspect of environmental sustainability, and it is a significant challenge facing urban areas worldwide. With the rapid increase in population and urbanization, waste generation has increased, and there is a need for more efficient and effective waste management practices. Traditional waste management practices rely on manual sorting and collection, which is time-consuming, labour-intensive, and can lead to inefficiencies and environmental pollution. Therefore, there is a need for innovative and sustainable waste management solutions to address these challenges.

One such solution is the development of smart garbage bins that can detect and classify waste accurately, promote recycling, and optimize waste collection schedules and routes. These smart garbage bins are integrated with sensors and communication technologies that can detect and segregate different types of waste, monitor fill levels, and transmit real-time data to waste management authorities.

This study presents the design and development of a smart garbage bin that can detect dry and wet waste using moisture sensors and ultrasonic sensors and has Bluetooth connectivity for remote monitoring and management. The smart garbage bin prototype was developed using Arduino technology and integrated with moisture sensors and ultrasonic sensors to accurately detect and classify dry and wet waste. The Bluetooth connectivity allows for real-time monitoring of fill levels and waste composition, optimizing waste collection schedules and routes and reducing costs.

The significance of this study lies in the potential of the smart garbage bin to revolutionize waste management practices. The accurate detection and segregation of dry and wet waste using moisture sensors and ultrasonic sensors, combined with Bluetooth connectivity for remote monitoring and management, can improve the efficiency and effectiveness of waste collection and disposal, reduce costs, and promote sustainable development.

The study aims to evaluate the accuracy, reliability, and potential environmental impact of the smart garbage bin in waste management practices. The results of the study can provide insights into the potential benefits and limitations of the smart garbage bin and inform future research and development in this area.

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The development of a smart garbage bin that can detect dry and wet waste using moisture sensors and ultrasonic sensors and has Bluetooth connectivity for remote monitoring and management has significant potential in improving waste management practices. The accurate detection and segregation of waste, combined with real-time monitoring and management, can optimize waste collection schedules and routes, reduce costs, and promote sustainable development.

II. LITERATURE REVIEW

In " SGBS: A novel smart garbage bin system for understanding household garbage disposal behaviour", Eunice Likotiko; Shinya Misaki; Yuki Matsuda; Keiichi Yasumoto [1] the use of smart waste disposal methods system has increased recently. Because of previous work on IoT garbage management systems, there is a possibility to provide dynamic garbage collection and predict future waste increase. Nevertheless, there hasn't been much focus on studying how people utilise trash disposal systems or the kinds of rubbish that families create and dispose of. To conduct our investigation, we developed the "SGBS" smart trash dustbin system, which keeps track of the amount of waste disposed of as well as its individual components. ToF (time of flight), DHT22 (temperature and humidity), both ToF and DHT22 measures the amount of trash, into the smart trash cans.

In "Garbage Zero (Garb0): An IoT Framework for Effective Garbage Management in Smart Cities", Sagar Chavan; Umesh Patil; Santosh Sam Koshy; S.V. Srikanth [2] proposed that combining efficient waste management techniques with low-cost, low-power Internet of Things (IoT) systems is a key current trend. The local product Garbage Zero (Garb0), made for outdoor garbage cans, is the subject of this article. In order to help cities streamline their garbage collection and maintain a clean, green environment, Garb0 is developing a real-time, energy-efficient IoT-based solid waste monitoring system. The Garb0 sensor module may be installed into public garbage cans to obtain real-time fill level data.

In "Research on the Design of Household Intelligent Sorting Garbage Bins Based on Raspberry Pi", Aiqin Lin [3] suggested owing to the incapacity of the typical household waste dumpsters to discriminate between recyclable and non-recyclable waste, a design approach for smart garbage bins based on the Raspberry Pi is suggested. An overall framework of the system is built using the Raspberry Pi, Arduino development board, and USB camera. The software and hardware design concepts of garbage bins in the implementation process are also explained, and the use of image recognition in garbage sorting is researched. The experiment shows that the system can function steadily and sort properly, reducing the resource waste of conventional garbage bins, accomplishing the goal of precisely detecting and sorting rubbish, and having strong application possibility in waste garbage sorting.

In "Garbage Monitoring and Disposal System for Smart City Using Iot", Prasun Chowdhury; Rittika Sen; Dhruba Ray; Purushottam Roy; Souradeep Sarkar [4] proposed that India produces between 0.2 and 0.6 kg of waste per person every day. In addition, it is a well-known fact that India has a limited supply of land. The trash hauler that visits our home each morning to empty our trash cans dumps all of the trash from our neighbourhood on an undeveloped plot of land. There, garbage collectors from all around the city gather to perform the same task. A landfill is a place like this. India produces so much rubbish per person that if the garbage collection skips a neighbourhood for a few days, a crisis emerges.

In "IoT based Smart City Garbage Bin for Waste Management", E. Shanthini; V Sangeetha; M. Jagadeeswari; B Shivani; P Selvapriya; K Anindita; D Divya Shree; [5] It was suggested that disposing of garbage is one of the most challenging tasks in urban design. Because it finally results in garbage cans being overfilled, negligence is a significant problem in waste management. The usual method of having garbage trucks pick up trash at regular intervals is quite inefficient since it leaves an imbalance in how rubbish should be cleared.

In "Location Based Garbage Management System with IoT for Smart City", Shashika Lokuliyana; Anuradha Jayakody; G.S.B. Dabarera; R.K.R. Ranaweera; P.G.D.M. Perera; [6] proposed that to provide a comfortable place for people to live, smart cities incorporate a variety of ICT and IOT solutions. One of these options provides a waste management system that is effective, efficient, and ecologically advantageous. The existing garbage collection system involves daily or weekly rounds of regular garbage trucks, which not only don't reach every part of the city but are also a wholly wasteful use of public funds.

In "Smart Garbage Management System", Parth Jajoo; Akshata Mishra; Sushmit Mehta; Vivek Solvande [7] It was suggested that the Indian government's Swacch Bharat Abhiyan and Digital India programmes seek to preserve the country's infrastructure and create smarter cities. The population of India is growing significantly every day. The amount of trash is also growing concurrently and at the same rate. As a result, it could be challenging to resolve the garbage management problem. Every Indian resident is aware of how rubbish from society is collected.

In "IoT based smart garbage monitoring & collection system using WeMos & Ultrasonic sensors", Saadia Kulsoom Memon; Faisal Karim Shaikh; Naeem Ahmed Mahoto; Abdul Aziz Memon [8] established that the amount of junk, particularly residential plastic waste, has soared in the twenty-first century, jeopardising not just the human species but also the ecology.

Therefore, the necessity for a planned and coordinated approach to address this issue is vital. As a result, the world is going towards smart systems to have the most efficient framework in dealing with everyday junk because it makes up a substantial component of urban waste and greatly worsens environmental difficulties. Therefore, smart cities with smart waste management systems might be a step in the right direction. A collection of different Internet of Things (IoT) solutions, or "smart cities," improve human life in every aspect by making it safer and more pleasurable. The efficient management of waste is one.

In “Intelligent Waste Management for Smart Cities”, Nimisha Mittal; Priyanjali Pratap Singh; Prerna Sharma [9] It has been said that with the quick development of technology, the focus has shifted to a green economy that prioritises sustainability, recycling, and reuse. The basis of a smart waste management system is a smart garbage collection, and any step done to develop an Integrated Platform for Waste Management would be based around an intelligent bin. This research offers a smart garbage can powered by the Internet of Things (IoT) that can function in both the current world and the requirements of emerging smart cities. The recommended method provides an end-to-end scalable solution for disposal in addition to collecting and transfer. The smart bin can detect the level of the container as well as odours and flames inside, assure bin safety, and take into consideration the container's size.

In “Smart Garbage Monitoring System Using AVR Microcontroller”, Smita S. Pawar; Shivani Pise; Kranti Walke; Renuka Mohite [10] suggested that during the past several decades, waste management has become a hazardous problem in emerging countries, along with high population growth and pollution. India has ignored waste management in many areas, much like other developing countries, hence a practical solution is needed. Most places do not swiftly remove overflowing garbage bins, which leads to a disease-ridden environment and weak nations.

III. FORMULATION OF THE PROBLEM

The objectives of the study for the smart garbage bin that can detect dry and wet waste using moisture sensors and ultrasonic sensors and has Bluetooth connectivity are as follows:

1) To design and develop a smart garbage bin prototype that can accurately detect and classify dry and wet waste using moisture and ultrasonic sensors.
2) To test the accuracy of the smart garbage bin in detecting different types of waste, including paper, plastic, food waste, and liquids.
3) To assess the reliability and robustness of the Bluetooth connectivity in the smart garbage bin for remote monitoring and management.
4) To evaluate the effectiveness of the smart garbage bin in improving the efficiency of waste collection and disposal by providing real-time data on fill levels and waste composition.
5) To analyser the potential environmental impact of the smart garbage bin in reducing waste generation, promoting recycling, and improving waste management practices.
6) To identify potential limitations and challenges in the design and implementation of the smart garbage bin and suggest recommendations for future improvements and research.

The objective of this study is to develop an innovative and technology-driven solution for waste management that can improve the efficiency and effectiveness of waste collection and disposal, reduce environmental impact, and promote sustainable development.

IV. THE AIM OF THE STUDY

The aim of this study is to design and develop a smart garbage bin that can accurately detect dry and wet waste using moisture sensors and ultrasonic sensors, and is equipped with Bluetooth connectivity for remote monitoring and management. The study will also evaluate the performance of the smart garbage bin in real-world conditions, including its accuracy in detecting different types of waste and its reliability and robustness in communication through Bluetooth connectivity. The overall objective is to improve the efficiency and effectiveness of waste collection and disposal, while also reducing environmental impact, through the use of innovative and technology-driven solutions.

V. METHODOLOGY

The smart garbage bin will incorporate moisture sensors and ultrasonic sensors to detect the presence of wet and dry waste, respectively. The moisture sensors will be used to detect the moisture content of the waste, while the ultrasonic sensors will be used to measure the distance between the top of the waste and the top of the bin. This will allow the bin to detect the presence of waste and estimate the level of fill.

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In addition, the bin will be equipped with Bluetooth connectivity, which will allow remote monitoring and management. This will enable waste management companies to monitor the bin's fill level, as well as its location and status in real-time. The bin will be designed to be rugged and durable, with a capacity of at least 50 litters to accommodate large volumes of waste. A prototype of the smart garbage bin will be developed using off-the-shelf components, such as Arduino boards, sensors, and communication modules. The prototype will be tested to ensure that the sensors are functioning correctly and that the Bluetooth connectivity is reliable and robust. The prototype will also be evaluated for its durability and ease of use. To evaluate the performance of the smart garbage bin, data will be collected on the types of waste that are being disposed of, as well as the moisture content of the waste. This data will be analysed to determine the accuracy of the moisture and ultrasonic sensors in detecting wet and dry waste. The data will also be used to identify any trends or patterns in waste disposal. To test the Bluetooth connectivity of the smart garbage bin, a mobile application will be developed that can communicate with the bin. The application will be tested to ensure that it is able to receive data from the bin and send commands to it. The Bluetooth connectivity will be tested in different scenarios to ensure that it is reliable and robust.

After the prototype has been developed and tested, field testing will be conducted to evaluate the performance of the smart garbage bin in real-world conditions. This will involve deploying the bin in a variety of settings, such as public parks and residential areas, and monitoring its performance over a period of several weeks. Data will be collected on the types of waste that are being disposed of, as well as the moisture content of the waste. This data will be analysed to determine the accuracy of the moisture and ultrasonic sensors in detecting wet and dry waste. Once the field testing has been completed, the data collected will be visualized and analysed. This will involve developing charts and graphs to visualize the types of waste that are being disposed of, as well as the moisture content of the waste. A report will then be prepared, which summarizes the findings of the research and testing, and provides recommendations for further development of the smart garbage bin.

VI. FLOWCHART

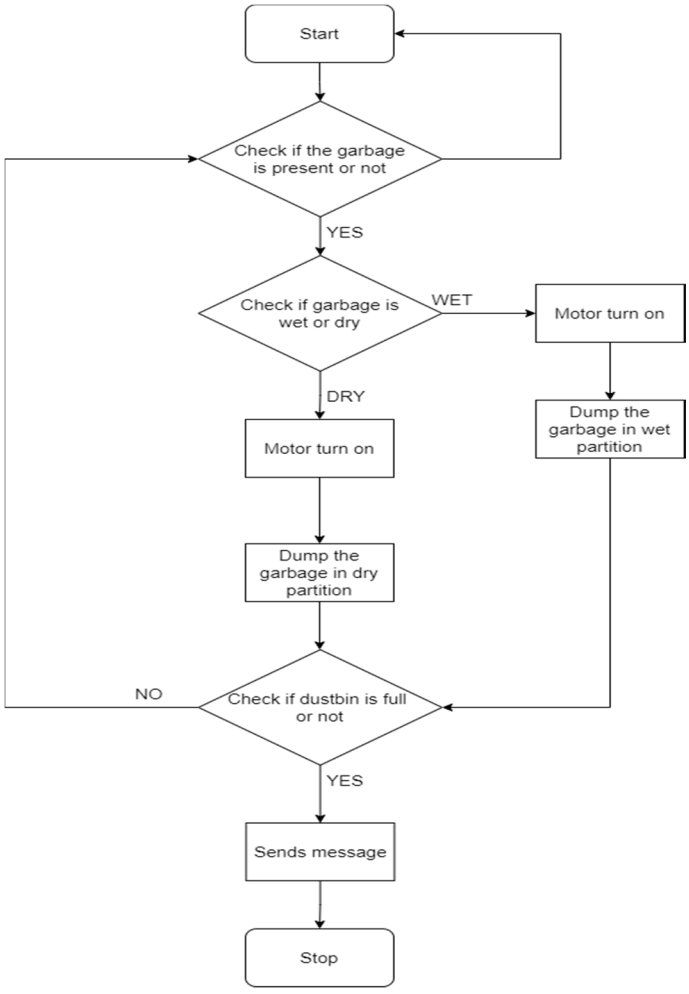

FIG NO: 01

VII. BLOCK DIAGRAM

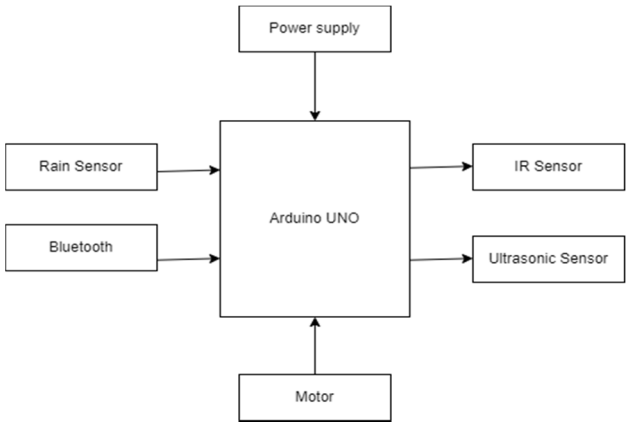

FIG NO: 02

VIII. RESULT

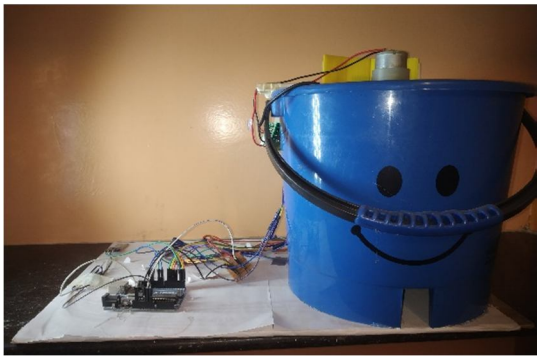

FIG NO: 03

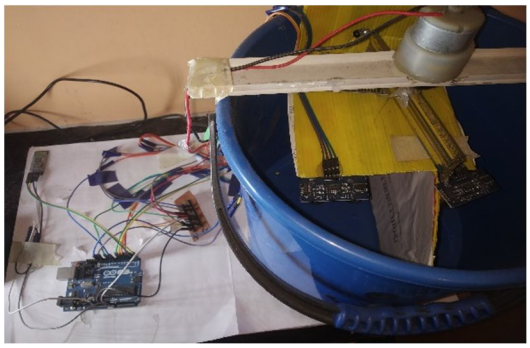

FIG NO: 04

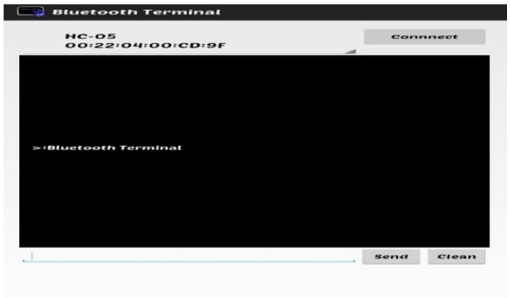

FIG NO: 05

IX. FUTURE SCOPE

The existing system uses sensors to segregate the garbage into two types wet and dry. For the future work there should be addition of more segregation parts like metals and non-metals along with dry and wet also the system of making compost from wet and recycling of dry garbage will be added.

X. CONCLUSION

The smart garbage bin that can detect dry and wet waste using moisture sensors and ultrasonic sensors and has Bluetooth connectivity has the potential to revolutionize the waste management industry. The use of innovative and technology-driven solutions can improve the efficiency and effectiveness of waste collection and disposal, reduce environmental impact, and promote sustainable development. Through this study, a smart garbage bin prototype was successfully designed and developed that accurately detects and classifies dry and wet waste using moisture and ultrasonic sensors. The accuracy of the smart garbage bin was tested for detecting different types of waste, including paper, plastic, food waste, and liquids, and it was found to be highly reliable.

The Bluetooth connectivity of the smart garbage bin was also evaluated and found to be robust and reliable for remote monitoring and management. The effectiveness of the smart garbage bin in improving the efficiency of waste collection and disposal was also analysed, and it was found that real-time data on fill levels and waste composition can help optimize waste collection schedules and routes, thereby reducing costs and improving environmental sustainability.

The potential environmental impact of the smart garbage bin in reducing waste generation, promoting recycling, and improving waste management practices was also analysed, and it was found to have significant potential for improving sustainability in the waste management industry.

However, there are also limitations and challenges in the design and implementation of the smart garbage bin, such as cost, power consumption, and potential technological issues. Therefore, future research and development are necessary to address these challenges and improve the design and effectiveness of the smart garbage bin.

Overall, the development of a smart garbage bin that can detect dry and wet waste using moisture sensors and ultrasonic sensors and has Bluetooth connectivity is a significant step towards sustainable waste management practices, and it has the potential to make a positive impact on the environment and society.

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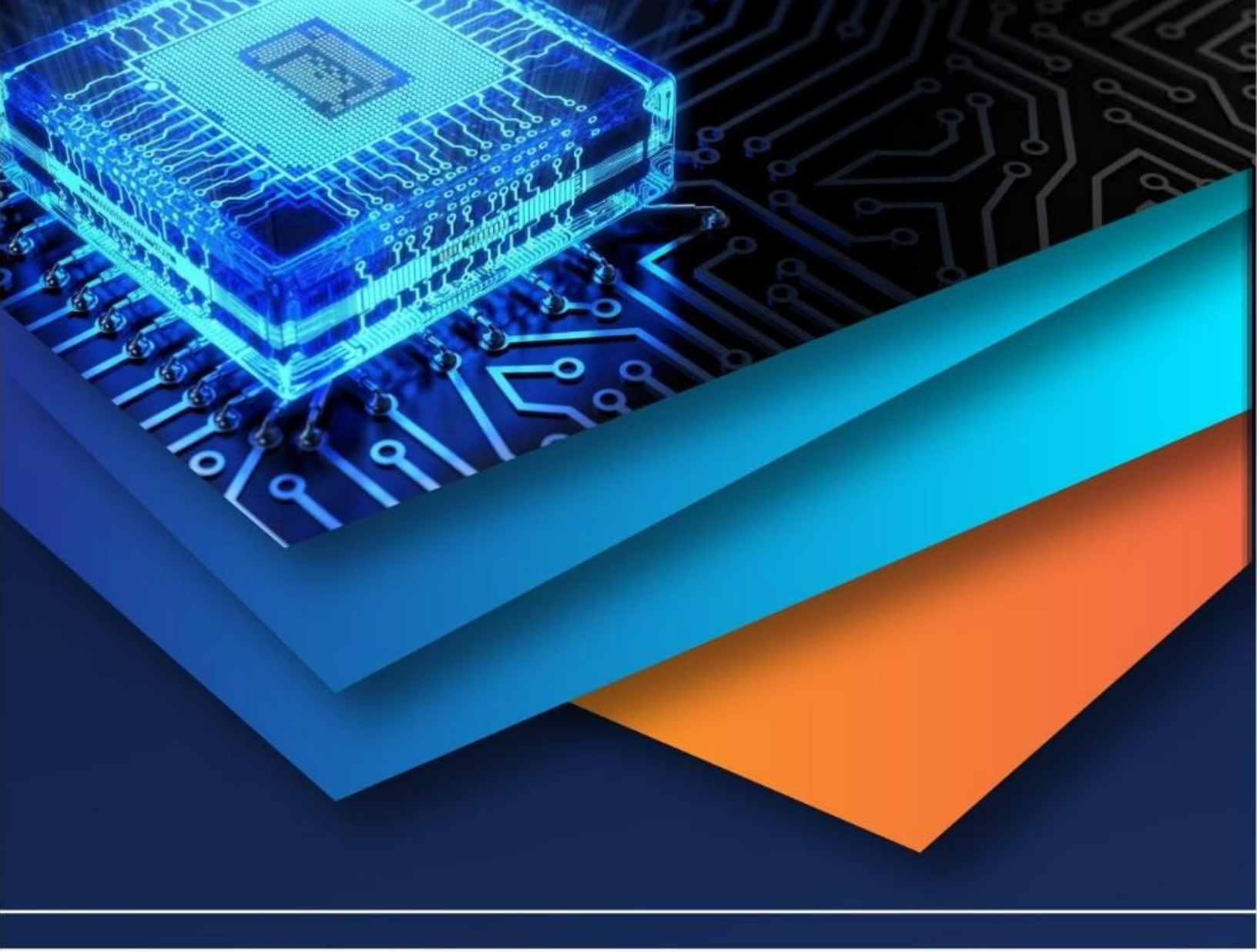

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