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Design and Fabrication of Beach Cleaning Robot Vehicle

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Abstract: ***The beaches in the coastal region are the main draw for visitors and it is also home to one of the biggest natural habitat in the world, the sea creatures; so it must be kept clean in all costs. It is also noted that due to the severe difficulties faced in keeping the beach clean manually, we have designed and fabricated a beach cleaning robot which can do the said task automatically. The machine mainly consists of a motor connected to the chassis of the vehicle and which drives the chain and sprocket mechanism. The waste is collected through conveyor blade along with the sand which falls of through the gap of the hooks on the conveyor back to the sand bed; Then the waste, picked up by the rake, are collected in the waste bin which is attached at the back of the cleaner vehicle.***

Keywords - vehicle, cleaning, beach

I. INTRODUCTION

In the recent times, plastic waste disposal has increased exponentially throughout the years and it has become a worldwide concern as well. The voluminous quantity of plastic waste that resides in shores/beaches is destroying the natural habitat of aquatic animals on a large scale. Since plastic is infamously known for taking 1000 years to decompose/degrade, they pose as a threat to the natural habitat of aquatic animals. Over 1 million marine animals are killed each year due to plastic pollution. It is also noted that more that 8 million tons of plastic are dumped into the ocean each year. In which a large amount of portion washes up at the shores. In order to take on the problem we have proposed a beach cleaning robot vehicle which will help in collecting plastic waste without much human labour.

II. REASONS FOR USING BEACH CLEANING ROBOT VEHICLE

A. Our proposed model will be remote controlled; hence less manual labour will be required.
B. Our proposed model will be cost effective than other industry models.
C. Since our proposed model will be fully automated, from the picking of the plastic waste to disposing it in the dustbin. It reduces human contact and hence there will be less spread of diseases caused by plastic pollution
D. Since our proposed model will have simple construction. No perquisite skills will be required to grasp the working of it.
E. One of the factors that keeps a machine up and running smoothly is regular maintenance. And sometimes regular maintenance can be costly, but since our proposed model has only one main working technology, i.e. chain and sprocket mechanism, monthly greasing is only required which is very cheap.

III. OBJECTIVES

The basic purpose of this project is to provide beach cleaning authorities with beach cleaning robot that helps the authorities to reduce their time and effort in cleaning the plastic waste and can increase their cleaning efficiency and accuracy with reduced cost.

IV. LITERATURE REVIEW

1) Title Of The Paper: DESIGN AND FABRICATION OF BEACH CLEANING MACHINE
a) Authors: PROF. ROHIT PATIL, VIVEK DHOLE, AJITKUMAR KAKADE
i) The device is placed on the sand bed of the ocean so that only beach sand can get through the lower basement.
ii) Floating waste like bottles, plastic cans, covers any kind of waste, etc. Is lifted by lifters which are connected to the chain. The chain revolves with the sprocket wheel which is driven by the motor.
iii) The energy provided to the motor is electrical energy.
iv) When motor runs the chain starts to circulate making the lifter to lift up.
v) The wastage material are lifted by lifter teeth and stored in collecting box.
vi) Once the collecting box is full, the waste materials are removed from the box.
2) Title Of The Paper: ECO BEACH CLEANER
a) Authors: A. K YADAV, ANIMESH SINGH, M. A MURTAZA, AJENDRA KUMAR SINGH
i) The machine comprises a more or less standard form of track laying tractor or vehicle.
ii) Which is mounted a conveyor belt having a plurality of sets of rakes extending around the belt.
iii) One part of this belt being swing-able to engage the beach surface.

iv) With varying degrees of pressure they progress around the conveyor belt and will effectively pick up bottles, paper of various sizes and other matter which is likely to be dropped upon the beach by pleasure seekers.

3) Title Of The Paper: AUTONOMOUS GARBAGE COLLECTING ROBOT WALL - E

a) Authors: Mr. Rakshith ranganath, Ms. Bhawna sharma, Ms. Pooja AR, Mr. Rohan C Jadhav, Ms. Asha A

i) A cost effective garbage cleaning robot is developed and that is named as "Thooyan".

ii) The system (road cleaning robot) consists of very simple but highly efficient mechanism.

iii) The main components consist of a rotating brush assembly (rake), a unique tilting wedge, a conveyor system and a garbage collection unit.

iv) Robot is programmed in a certain pattern so as to navigate automatically and detect obstacles to move in a free path.

4) Title Of The Paper: MODULAR ROBOT USED AS A BEACH CLEANER

a) Authors: FELIPPE SCHMOELLER DA ROZA, VINICIUS GHIZONI DA SILVA, PATRICK JOSE PEREIRA, DOUGLAS WILDGRUBE BERTOL

i) The designed body of the robot was made of a 3mm thick aluminium plate.

ii) Its dimensions are 350 x 410 x 240 mm. Its construction and design, together with the materials used, grant the desired durability and endurance for a wide range of possible working environments.

iii) A frontal claw was designed and attached to the robot enabling it to collect cans from the ground.

iv) Its design was made in the shape of an excavator dumper, a well-known configuration used in dump trucks to collect trash.

v) The last mechanical module of the robot is the storage compartment.

5) Title Of The Paper: LOW COST FREQUENCY CONTROLLED ROBOT FOR ENVIRONMENTAL CLEANING ROBOT

a) Authors: MR. M. MUTHIAH, MR. K. NIRMAL, MR. RK. SATHIENDRAN

i) RF(Radio Frequency) concept is used in this robot as it can be used in various industries and radiation labs.

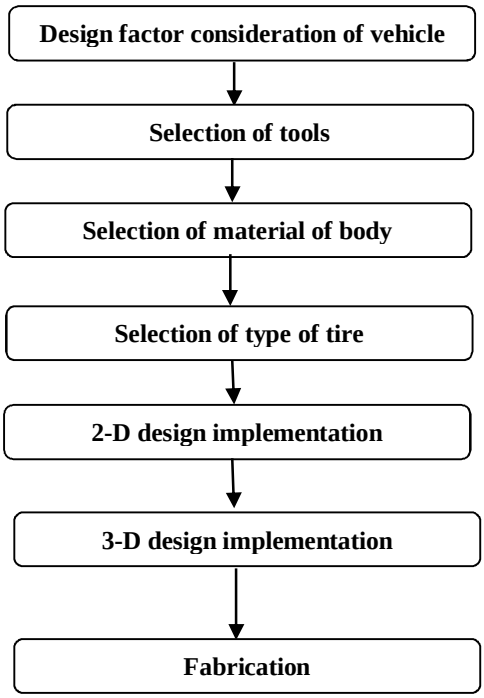
ii) The same robot can be controlled by Dual Tone Multiple Frequency (DTMF) signals but the disadvantage is that the mobile network coverage cannot be guaranteed.

iii) The Induino R3 is a low cost Arduino used in this robot.

iv) Ultrasonic sensors (also known as transceivers when they robot send and receive, but more generally called transducers) work on principle similar to radar or sonar,

v) Which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively.

V. PROPOSED METHODOLOGY



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A. Design factor Consideration of Vehicle

The first and foremost step of this project is to consider the design factors. In this case the design factors were:

1) The dimensions of the chassis: The chassis needs to be designed in a way to hold and support the load of the components attached to it.

2) The dimensions of the rake: The dimensions of the rake needs to be made in such a way that it can pickup different types of plastic waste such as (plastic bottles, plastic forks, plastic spoons, plastic cans etc)

3) Clearance of the rake from the ground: Clearance of the rake from the ground also needs to be considered such that, the rake is too high from the ground that it cannot pickup the waste; also it should not be too low that it gets stuck at any point when the vehicle in functioning.

B. Selection of Tools With Their Concepts

The tools required in functioning of the beach cleaning robot are taken into consideration. They are:

1) *DC Motor:* DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy.

2) *Shaft:* A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power.

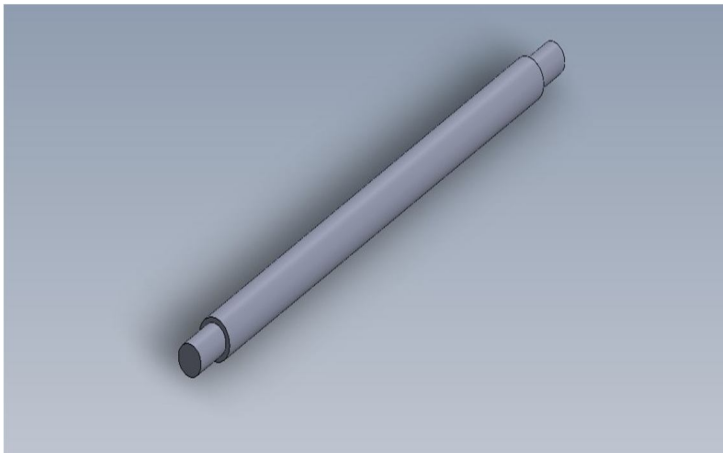

Fig 1: shaft

3) *Chain:* Chain drive is used to transmit mechanical power from one place to another. The power is conveyed by a roller chain, known as the drive chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain.

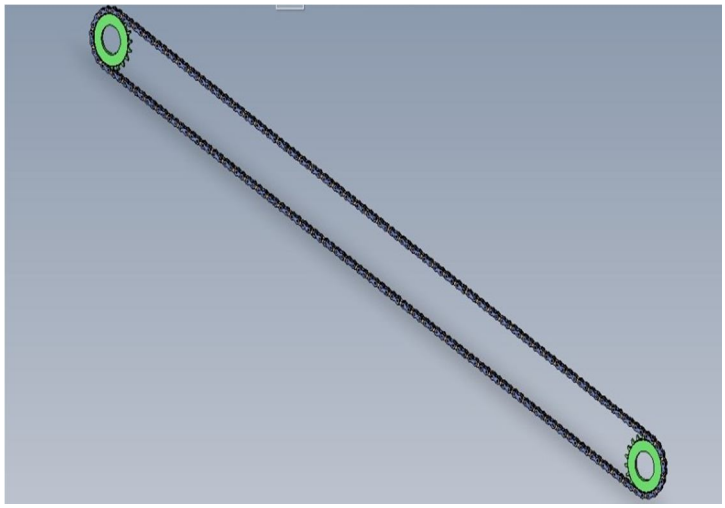

Fig 2: Chain and sprocket

4) *Sprocket:* Sprockets are rotating parts with teeth that are used in conjunction with a chain and, almost always, at least one other sprocket that will be used to transmit torque. Sprockets and chain can be used to change the speed, torque, or original direction of a motor. This sprocket will be used in the chain and sprocket mechanism.

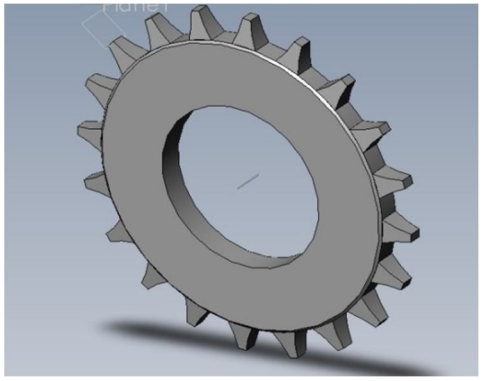

Fig 3: Sprocket

5) *Bearing:* The bearings are used to allow rotation or linear movement and are also used to reduce friction between two objects. The ease of movement reduces friction and improves the speed and efficiency of the object.

6) *Sand Tires:* Sand tires to be used to provide better traction, while operating on loose sand terrains.

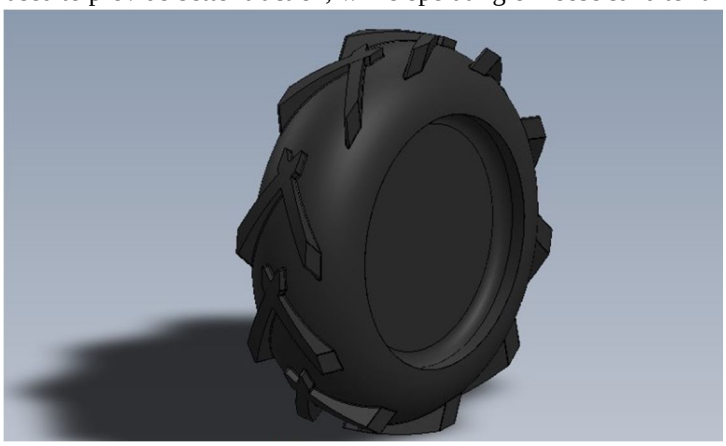

Fig 4: Sand tires

7) *Vehicle Frame (Chasis):* The main component which will give a bass to vehicle and support all the tools.

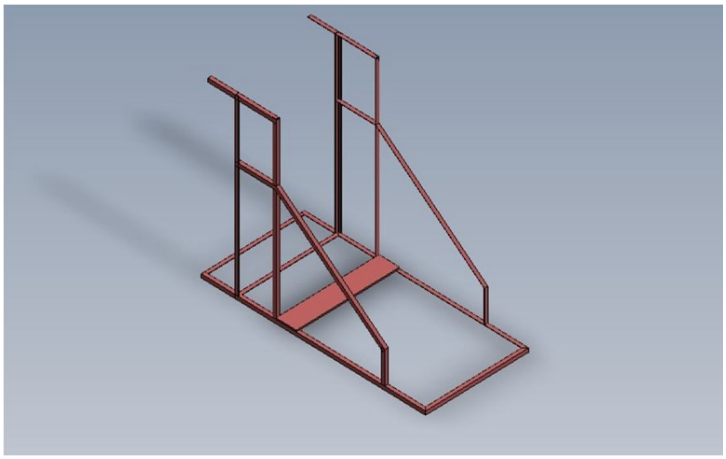

Fig 5: Frame of vehicle

8) *12V Battery(12V, 2.5A):* A battery is a device consisting of one or more electrochemical cells with external connections, it will be used in powering the DC rotor.

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C. Selection of Material for Body

Selection of material of body is one of the crucial steps in methodology, as the material should have high load carrying capacity. Hence the material used here was MILD STEEL.

D. Type of Tire Selection

Another important step was to select the type of tire, since the machine needed to work on loose beach sand, normal tires won't work as it will get stuck at any point of time during the functioning of the vehicle and also it will not provide enough traction. Hence SAND TIRES will be used.

E. 2-D Design Implementation

After the design factors were taken into consideration, a 2-D drafting was done using AutoCAD.

F. 3-D Design Implementation

After the 2-D sketches were done, it was followed by 3-D modelling using **SOLIDWORKS.**

G. Fabrication

After all the dimensions and 3-D modelling was done. The last and the final step is to fabricate it; taking the reference of the 2-D sketches and 3-D models.

VI. TECHNOLOGIES USED

The technologies used in 2-D drafting and 3-D modelling are:

A. AutoCAD
B. SOLIDWORKS

VII. WORKING

The main mechanism in the beach cleaning robot vehicle is the chain and sprocket mechanism, which will be attached to the bearing shafts as shown in the Fig 6.

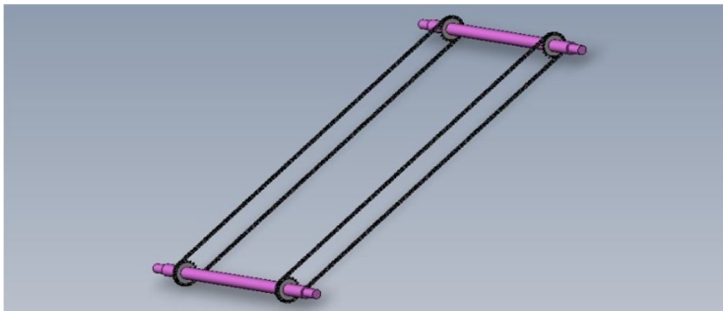

Fig 6: Chain and sprocket mechanism attached to bearing shaft

As the sprocket starts rotating the chain; the number of rakes attached to it will also start following the chain in a similar manner. The rake which starts from the bottom will pick up the plastic waste with it's pointed ends and push it upwards as the chain rotates. When it reaches at the top it will dump the waste in the dustbin (refer Fig 7), which will be placed at the back of the vehicle frame (refer Fig 8).

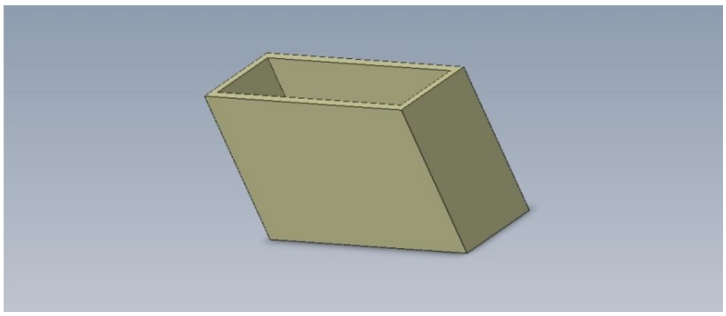

Fig 7: Dustbin

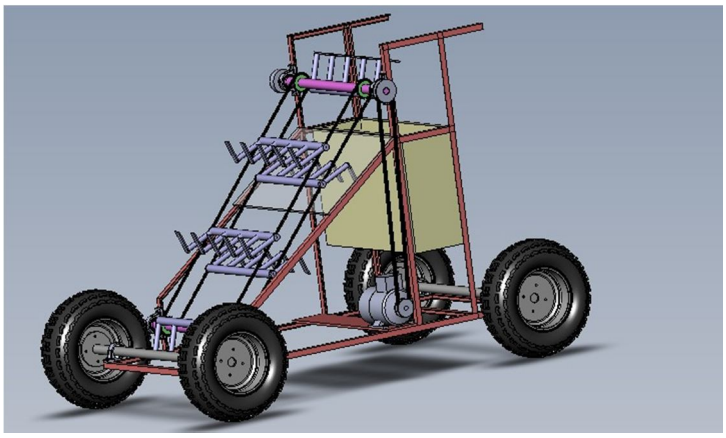

Fig 8: 3-D view of beach cleaning robot vehicle (1)

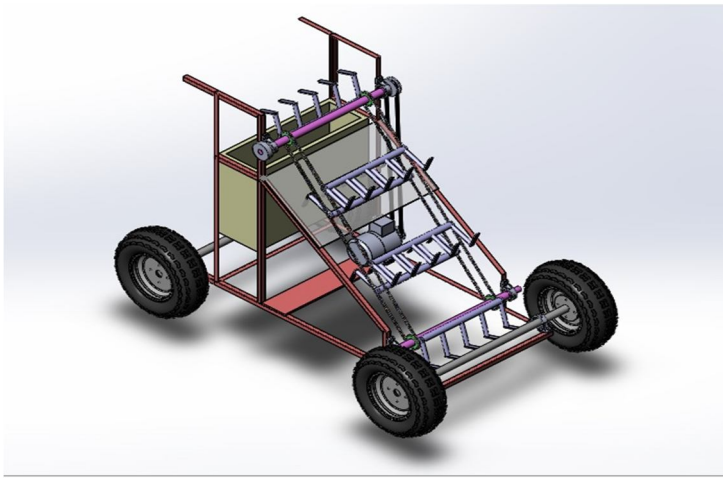

Fig 9: 3-D view of beach cleaning robot vehicle (2)

VIII. CONCLUSION

The project entitled design and fabrication of beach cleaning robot vehicle is completed and the results obtained are satisfactory.

A. The proposed system helps in removing the plastic waste from the beaches and oceans.

B. Since very less human labour and human contact is required, it will also reduce the transmission of hazardous diseases from plastic waste to humans.

C. Since the proposed system is automatic, it is very less time consuming compared to the conventional method.

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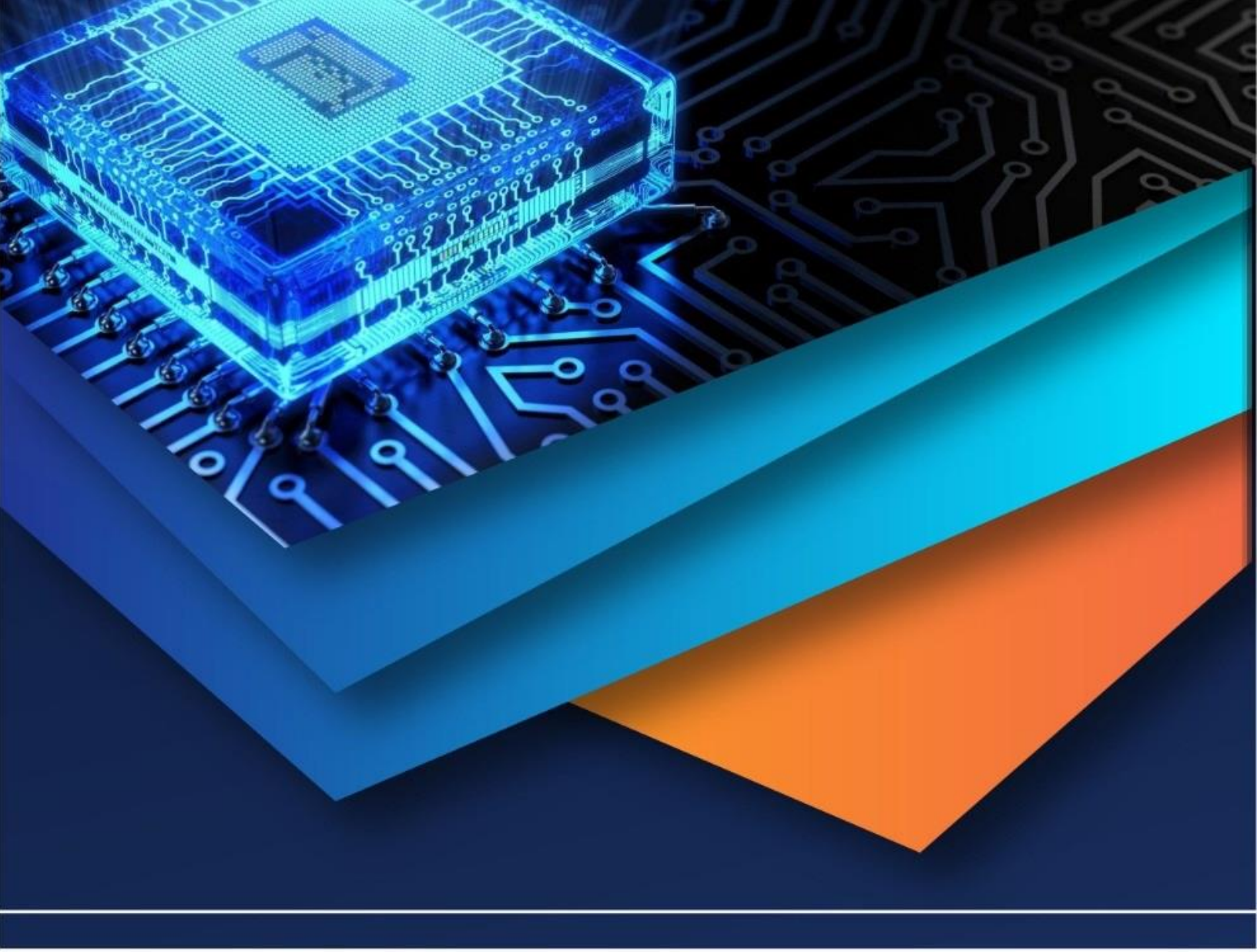

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