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An Approach for Design and Fabrication of Solared Powered Terrain Vehicle Under Rocker Bogie Mechanism

Yogesh Vaidhyanathan[1], Lokesh T[2], Mohammed Shafi S[3], Mohan Kumar K[4]
[1]*Assistant Professor,* [2, 3, 4]*Under Graduate Scholars, Department of Mechanical Engineering, Vel Tech High Tech Dr. Rangarajan Dr. Sakunthala Engineering College, Avadi Chennai 600 062, Tamil nadu, India*

Abstract: ***Rocker bogie is important for conducting in-situ scientific analysis of objectives that are separated by many meters to tens of kilometers. Current mobility designs are complex using many wheels or legs. They are open to mechanical failure caused by the harsh environment on mars. A six wheeled rover capable of traversing rough terrain using an efficient high degree of mobility suspension system. The primary mechanical feature of the rocker bogie design is its drive train simplicity which is accomplished by using only two motors for mobility. Both motors are located inside the body where thermal variation is kept to a minimum, increasing reliability and efficiency. Six wheels are used because there are few obstacles on natural terrain that require both front wheels of the rover to climb simultaneously. A series of mobility experiments in the agriculture land, rough roads, inclined, stairs and obstacles surfaces concluded that rocker bogie can achieve some distance traverses on field.***
Keywords: Rocker Bogie; Wheel Type Mobile Robot, Rover.

I. INTRODUCTION

There is an increasing need for mobile robots which are able to operate in unstructured environments with highly uneven terrain. These robots used for task which human cannot do and which are not safe. In order to achieve the tasks, any mobile robot needs to have a suitable mobile system according to each situation. Among these mobile systems, it's the rocker bogie suspension system that was first used for the mars rover and its currently NASA's favored for rover wheels suspension. The rocker bogie suspension is a mechanism that enables a six-wheeled vehicle to passively keep all six wheels in a contact with surface even driving on severely uneven terrain. There are two key advantages to this feature. The first advantage is that the wheels pressure on the ground will be equilibrated. This is extremely important in soft terrain where excessive ground pressure can result in the vehicle sinking into the driving surface. The second advantage is that while climbing over hard surfaces, all six wheels will nominally remain in contact with the surface and under load which helps to propel the vehicle over the terrain.

Exploration rovers take advantage this configuration by integrating each wheel with a drive actuator maximizing the vehicles motive force capability. One of major shortcoming of current rocker bogie rover is that they are slow. In order to able to overcome significantly rough terrain (i.e., obstacles more than a few percent of wheel radius) without significant risk of flipping the vehicle or damaging the suspension, these robots move slowly and climb over the obstacles. While performance on rough terrain obstacle is important, it should be also considered situations where the surface is flat or it has almost imperceptible obstacles where the rover should increase its speed to arrive faster.

Solar Based Rocker-Bogie Mechanism K. Jadhav, N. A. Dange, H. Kadu, S. S. Dhamane. This paper presents an innovative locomotion concept of six wheel based "Solar Rocker-Bogie Mechanism". The rocker bogie suspension mechanism is currently NASA's favored design for 4-wheel mobile robots mainly because it has robust capabilities to deal with the obstacles and because it uniformly distributes the payload over its 6 wheels at all times.

Research on the step-climbing performance of a multi-constraint quadrilateral suspension rover based on the λ chain mechanism. Step-climbing performance is an important index when evaluating the comprehensive performance of a planetary rover. Based on a comprehensive analysis of the existing planetary rover, the step-climbing performance was determined with regard to the suspension configuration of the rover. On the basis of the configuration of the parallel frame spring fork suspension, a multi-constraint quadrilateral suspension (MCQS) that is based on the λ (lambda) chain mechanism was proposed. The trajectory model of the end point of the λ linear mechanism was established along with a mathematical model of the interaction between each wheel and step in the step-climbing process.

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Bing cheng Ji told rover is an effective method to investigate the moon information and in recent years it has approached great developments. The application of wireless power transfer system in lunar rover is to reduce the heat leakage from rover instrument to outside circumstances. In the present work terrain vehicle has been fabricated under rocker bogie mechanism utilizing solar as an energy source.

II. MATERIALS & COMPONENTS

The components required are 60 rpm, Flat rod, Arduino, Bluetooth, channel relay, Square tube, Wheel, 6v Battery, Solar panel

A. Motor

A DC motor is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism either electromechanical or electronic to periodically change the direction of current in part of the motor.

B. Arduino

Arduino is an open-source hardware and software company project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices.

C. Bluetooth

Bluetooth module is a module designed for wireless serial communication. It is a slave module meaning that it can receive serial data when serial data is sent out from a master blue tooth device (Device able to send serial data through the air: Smart phones & PC). When the module receives wireless data, it is sent out through the serial interface exactly at it is received.

D. Two Channel Relays

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms such as make contacts, break contacts or combinations.

E. Square Tube

Rectangular and square HSS are also commonly called tube steel or box section. Circular HSS are sometimes mistakenly called steel pipe, although true steel pipe is actually dimensioned and classed differently from HSS. Square tubes are generally used for maintenance and structural purposes.

F. Wheel

A wheel is a circular component that is intended to rotate on an axle bearing. The wheel is one of the key components of the wheel and axle which is one of the six simple machines.

G. Battery

A 6-Volt battery commonly known as a “lantern battery,” is a rechargeable lead-acid type cell made of a collection of four larger cells mostly D batteries with a 1.5V per cell.

H. Solar Panel

Figure 1. Solar Panel

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III. MODELLING, DESIGN AND FABRICATION

A. Design Working

In order to go over an obstacle, the front wheels are forced against the obstacles by the rear wheels. The rotation of the front wheel then lifts the front of the vehicle up and over the obstacle. The middle wheel is pressed against the obstacle by the rear wheel and pulled against the obstacles by the front, until it is lifted up and over. Finally, the rear wheel is pulled over the obstacle by the front two wheels. During each wheel's traversal of the obstacle, forward progress of the vehicle is slowed or completed halted. These rovers move slowly and climb over the obstacles one portion at a time.

B. Model Design

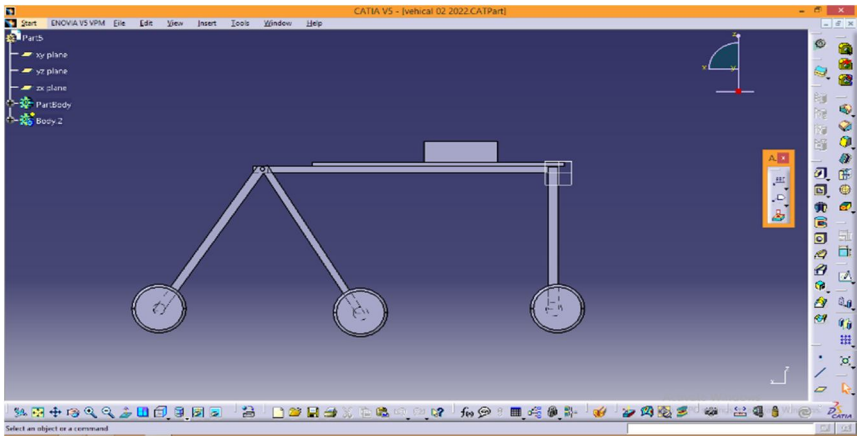

Figure 2. Side view

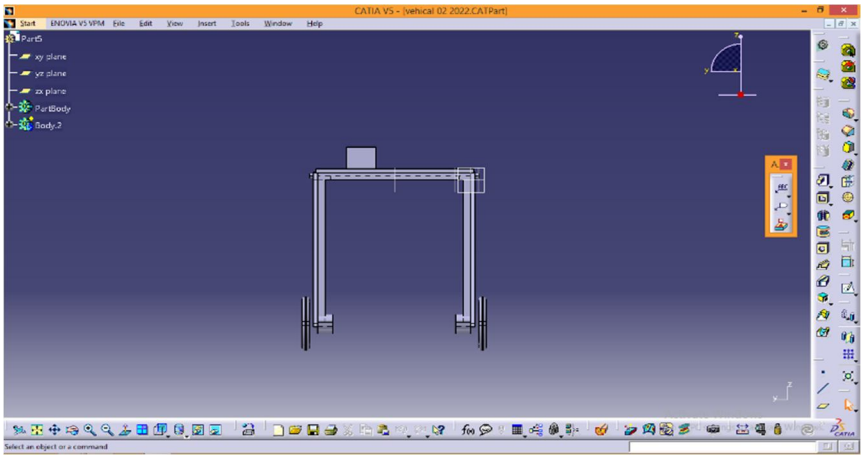

Figure 3. Front view

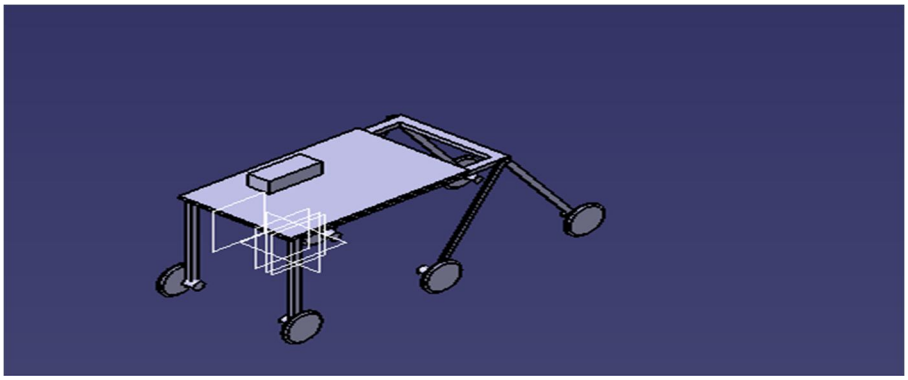

Figure 4. Top view

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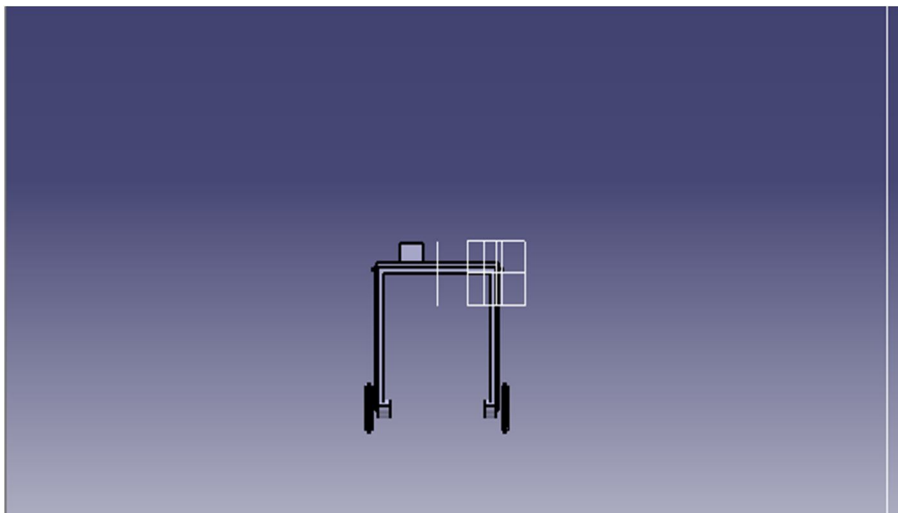

Figure 5. Top view showing solar panel

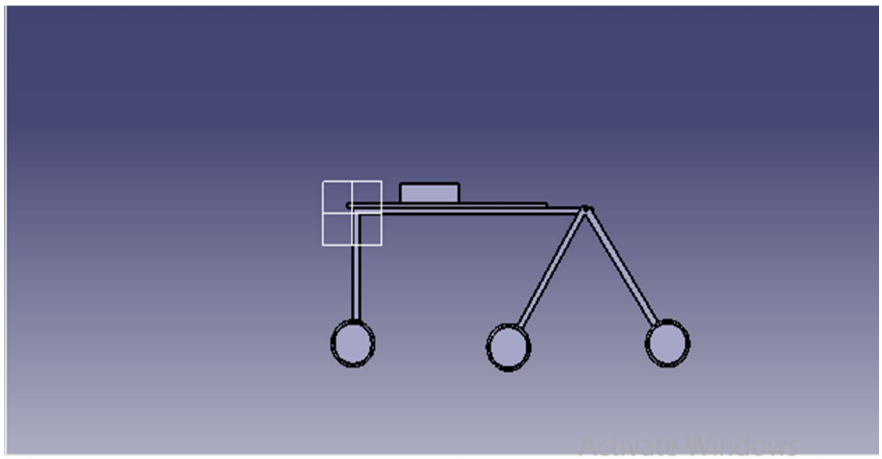

Figure 6. Side view showing bogie link

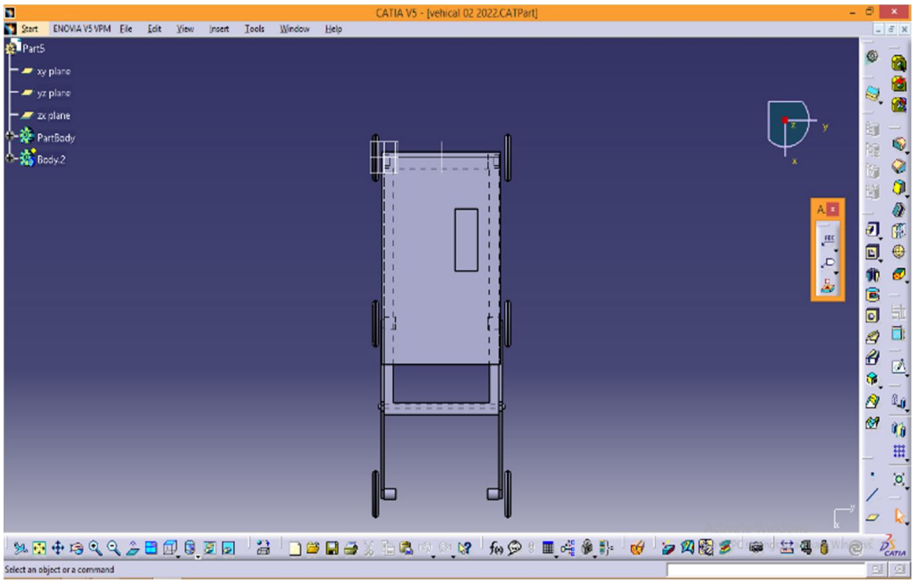

Figure 7. Top view showing six wheels

C. Fabricated Set-Up

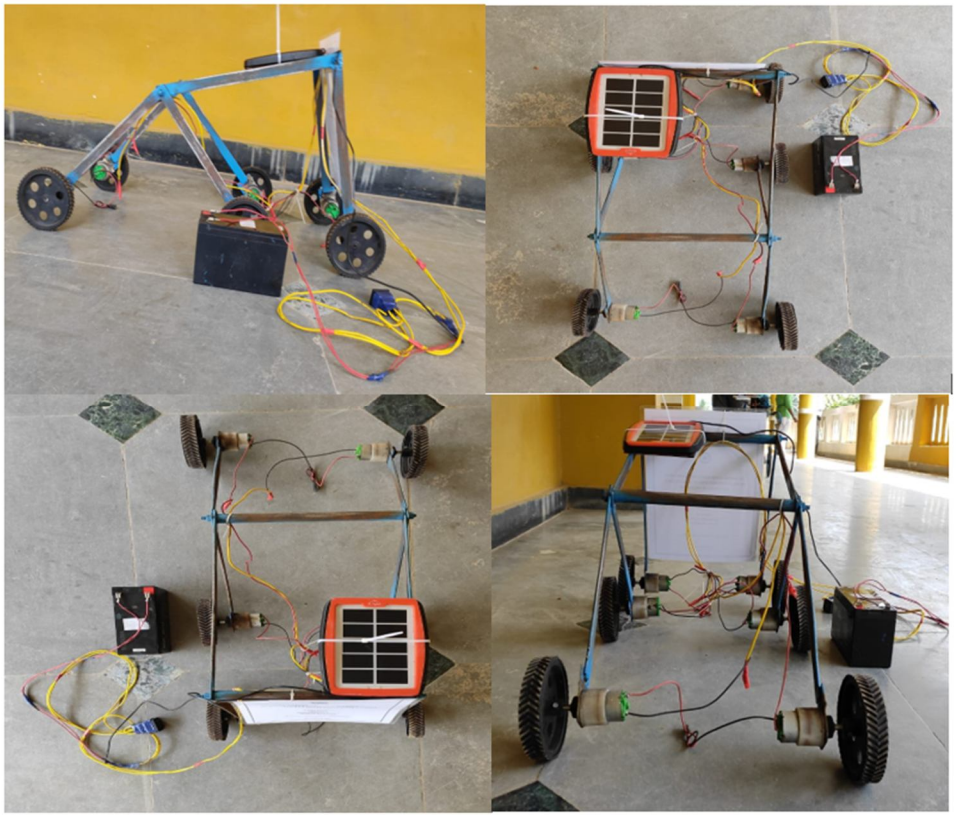

Figure 8. Terrain Vehicle under rocker bogie mechanism

IV. CONCLUSION

1) The background knowledge to carry over the current work is gained from previous research articles
2) The necessary components & materials were prepared and checked for its technical specifications
3) The components is then arranged together in proper proportion to bring out assembled rocker bogie mechanism
4) The battery rechargeable through solar is adopted with the assembled rocker bogie
5) The rocker bogie is then tested for its operating condition over the rough surfaces

V. FUTURE SCOPE

1) Its future application will be assisting astronauts during space operations; it will act as a path finder too.
2) It can be useful in space mission too, recently it is used in Mars Rover. This mechanism takes consideration on unevenness of the surface it is driving on.
3) This rover has larger wheel as compared to obstacles; it can easily operate over most of the Martian rocks.
4) It is also used in coal mines, act as a spy robot and in military operation too.
a) *Declaration of Competing Interests:* The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.
b) *Statement about Contents:* It is confirmed that all of the figures, images, and tables that appear in this article are original and author-created.

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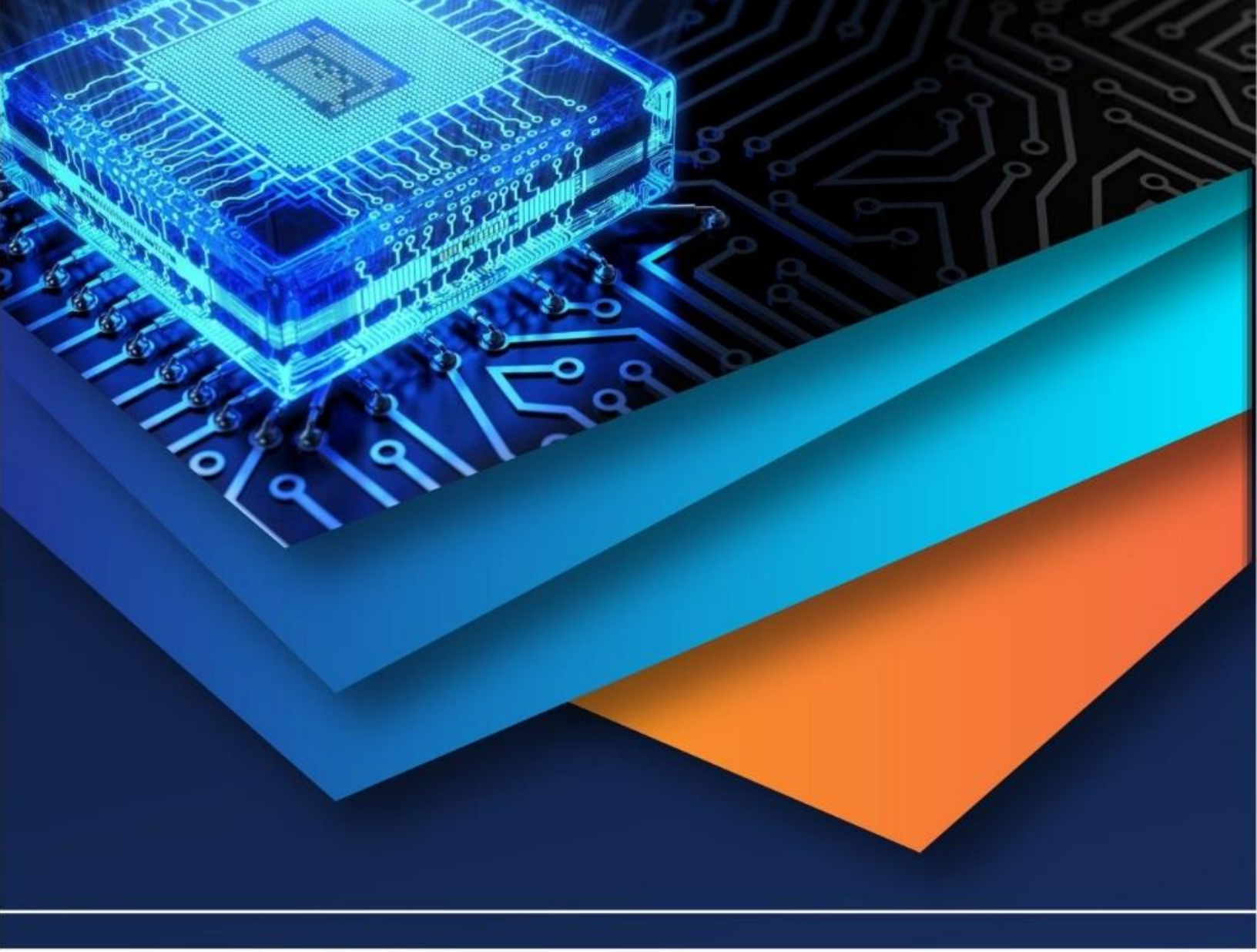

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