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Four Wheel Steering using Chain Drive

Ganesan Thangasamy[1], Dinesh Nambi[2], Durai Raj Sampath[3], Venkatramanan Krishnamoorthy[4]
[1]*Department Of Mechanical, Saveetha Institute of Medical And Technical Sciences, Saveetha University, Chennai,*
[2]*Department Of Mechanical, St. Peter's college of Engineering and Technology, Chennai,*
[3]*Department Of Mechanical, Dhanalakshmi College of Engineering, Chennai,*
[4]*Department Of Mechanical, Panimalar Institute of Technology, Chennai,*

Abstract: ***The four-wheel steering controlled vehicle is a new innovative concept which is mainly used for four wheeler vehicles. Four-wheel steering is a system used to improve steering response of the four wheel vehicles it also helps to increase the stability of the vehicles while moving at very high speed. It also helps to decrease the turning radius at low speed. Controllers and actuators are used to steer the rear wheels of the vehicles using four wheel steering system. This system in the vehicle allows turning in a significantly smaller radius, sometimes it also helps large trucks, tractors and vehicles with trailers. So we are designed a small model of four wheeler steering system using chain drive through this project. The project consists of the following parts chain drive, frame, sprockets, wheel and DC motors.***
Keywords: Improve steering, Controller, Actuators, Smaller radius, chain drive.

I. INTRODUCTION

The main objective of our project is to rotate the four wheels with the help of chain drive and motor. These components would help the company to minimize the cost of production so that the industry may run profitably.

A. Recent Trend In Automobile Sector

In early part of the 20th century in automotive field, most of the studies were concentrated on performance of engines and gear boxes. Recently, due to stringent pollution norms, many works are carried out in engines. Extensive study on alternate fuel for engines and fuel cells are being carried out to reduce the use of fossil fuels, which is fast depleting in the earth and causes global warming due to release CO, CO2 and other harmful gases along with thermal radiations. Crashworthiness, total vehicle weight reduction to cut down fuel consumption, aesthetic appearance of body are given due importance nowadays. In the area of materials, increased uses of composites, high strength steels and aluminium alloys are also the recent trend in automotive sectors, due to many advantages. New tribo-materials are being developed for automotive components to meet high temperature, high pressure and increased velocity conditions. Use of sensors and electronic gadgets to improve performance of vehicle and passenger safety aspects are given due importance in recent years. 22 Global competitions have initiated aggressive industrial and economic progress. This trend demands higher productivity levels in automotive manufacturing sector. Since there is a demand to improve the performance and reliability of two wheelers, especially motorcycles, there is a need to improve its components' performances also to increase the total reliability. Transmission chains used in two wheelers are single strand roller chains with mostly 12.7 mm and 15.875 mm pitches. Smaller pitch chains are suitable for high speed applications compared to larger pitches due to small variation in velocity, whereas larger pitch chains are suitable for transmitting high torques. Two wheeler manufactures use different design parameters to highlight their product features, with different engine power, torque and acceleration characteristics and the total number of chain links for each model are either same or different. Chains are lubricated with grease and are totally enclosed in two wheelers, to avoid dirt and dust particles accumulation, thereby reducing the wear rate. The main problem associated with transmission chain is elongation due to wear. Even though wear is inevitable, any reduction in wear will reduce the chain elongation and consequently reduce noise due to impact and vibrations. The following are the contributions in the literature on timing and transmission chains, tribological aspects of wear and lubricants by many scholars.

B. Principle

Chain drive, frame, sprockets, wheel and motors are the main components involved in this project. With the help of bearing and DC motor are connected with the wheel and also in each corner of the vehicle frame. They are also connected with the front side of the vehicle. Sprockets are placed under the bearing near the wheels and single chain drive is used to connect all the sprockets so that if we turn the steering all the wheels turn simultaneously according to the rotation of the steering wheel because of the chain drive. With the help of battery power supply the vehicle is moved.

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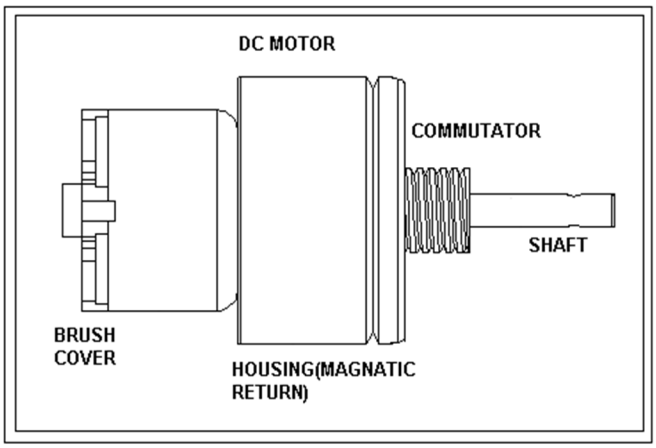
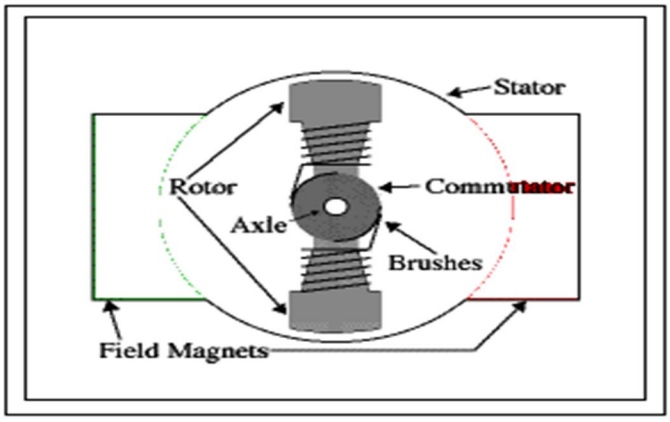
II. DESCRIPTION OF EQUIPMENT

A. Motor



B. Principles Of Operation

In any motor,operation is predicated on straightforward electromagnetism. A current-carrying conductor generates a force field; once this can be then placed in associate external magnetic field, it'll expertise a force proportional to the present within the conductor, and to the strength of the external force field. As you're cognizant of from wiggling with magnets as a child, opposite (North and South) polarities attract, whereas like polarities (North and North, South and South) repel. the inner configuration of a DC motor is intended to harness the magnetic interaction between a current-carrying conductor associated an external force field to get motion Let's begin by watching an easy 2-pole DC motor (here red represents a magnet or winding with a "North" polarization, whereas inexperienced represents a magnet or winding with a "South" polarization).



Every DC motor has six basic components -- shaft, armature, commutator, stator, field magnet, and brushes. In most typical DC motors, the external field of force is created by high-strength permanent magnets. The stator coil is that the stationary a part of the motor -- this includes the motor casing, additionally as 2 or additional magnet pole items. The rotor (together with the shaft and hooked up commutator) rotates with relevancy the stator coil. The rotor consists of windings (generally on a core), the windings being electrically connected to the electric switch. The higher than diagram shows a standard motor layout -- with the rotor within the stator coil (field) magnets.

The pure mathematics of the brushes, electric switch contacts, and rotor windings area unit specified once power is applied, the polarities of the energized winding and therefore the stator coil magnet(s) area unit misaligned, and therefore the rotor can rotate till it's virtually aligned with the stator's field magnets. because the rotor reaches alignment, the brushes move to subsequent electric switch contacts, and energize subsequent winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, resulting in a "flip" of the rotor's field of force, driving it to continue rotating.

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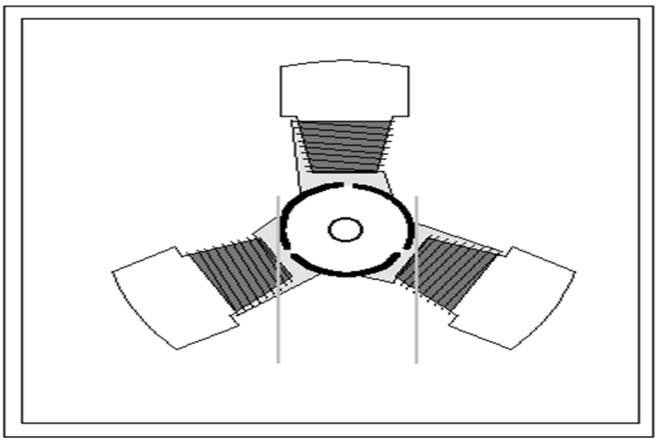
In reality, though, DC motors can forever have over 2 poles (three may be a quite common number). especially, this avoids "dead spots" within the electric switch. you'll be able to imagine however with our example two-pole motor, if the rotor is strictly at the center of its rotation (perfectly aligned with the sphere magnets); it'll get "stuck" there. Meanwhile, with a two-pole motor, there's an instant wherever the electric switch shorts out the ability offer. this might be dangerous for the ability offer, waste energy, and harm motor parts additionally. one more dis-advantage of such a straightforward motor is that it'd exhibit a high quantity of torsion "ripple" (the quantity of torsion it may manufacture is cyclic with the position of the rotor).

A few things from this -- specifically, one pole area unit totally energized at a time (but 2 others area unit "partially" energized). As every brush transitions from one electric switch contact to subsequent, one coil's field can speedily collapse, because the next coil's field can speedily upset (this happens inside a couple of microsecond). We'll see additional concerning the consequences of this later, however within the meanwhile you'll be able to see that this is often an immediate results of the coil windings' series wiring:

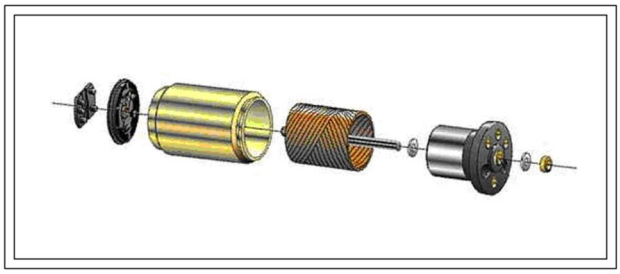


There's in all probability no higher thanks to see however a median DC motor is placing along, than by simply gap one up. Sadly this can be tedious work, further as requiring the destruction of a superbly smart motor. This can be a basic 3-pole DC motor, with two brushes and 3 electrical switch contacts.

The use of associate iron core coil (as within the Mabuchi, above) is kind of common, and incorporates a variety of benefits. First off, the iron core provides a robust, rigid support for the windings -- a very necessary thought for high-torque motors. The core conjointly conducts heat far from the rotor windings, permitting the motor to be driven more durable than may preferably be the case. Iron core construction is additionally comparatively cheap compared with different construction sorts.

But iron core construction conjointly has many disadvantages. The iron coil incorporates a comparatively high inertia that limits motor acceleration. This construction conjointly leads to high winding inductances that limit brush and electrical switch life.

In tiny motors, an alternate style is usually used that options a 'coreless' coil winding. This style depends upon the coil wire itself for structural integrity. As a result, the coil is hollow, and also the static magnet may be mounted within the rotor. Coreless DC motors have a lot of lower coil inductance than iron-core motors of comparable size, extending brush and electrical switch life.



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The coreless style additionally permits makers to create smaller motors; in the meantime, thanks to the shortage of iron in their rotors, coreless motors square measure somewhat liable to warming. As a result, this style is mostly used simply in tiny, low-power motors. Beamers can most frequently see coreless DC motors within the sort of electronic device motors. Again, disassembling a coreless motor is instructive -- during this case, my miserable victim was an inexpensive electronic device vibrator motor. the heart of this disassembled motor square measure on the market (on ten lines / cm graph paper). this is often (or additional accurately, was) a 3-pole coreless DC motor.

C. Linear Bearing

A linear-motion bearing or linear slide may be a bearing designed to supply free motion in one dimension. There square measure many alternative sorts of linear motion bearings and this family of product is usually dampened into 2 subcategories: rolling-element and plane.

Motorized linear slides like machine slides, XY tables, roller tables and a few dovetail slides square measure bearings emotional by drive mechanisms. Not all linear slides square measure motorized, and non-motorized dovetail slides, roller bearing slides and roller slides offer low-friction linear movement for instrumentality high-powered by inertia or by hand. All linear slides offer linear motion supported bearings, whether or not they square measure ball bearings, dovetail bearings or linear roller bearings. XY Tables, linear stages, machine slides and different advanced slides use linear motion bearings to supply movement on each X and Y multiple axis.

D. Steering System

The mechanism is to attain angular motion of the front wheels to barter a flip. this can be done through linkage and gear that convert the move of the handwheel into angular motion of the front road wheels.Secondary functions of the mechanism are:

1) To supply directional stability of the vehicle once going straight ahead.
2) To supply excellent steering condition, excellent rolling motion of the road wheels the least bit time.
3) To facilitate straight ahead recovery once finishing a flip. to reduce tyre wear.

Till recently all vehicles were steered by turning the front wheels within the desired direction, with the rear wheels following. However, latterly all-wheel-steering has been designed and utilized in some selected vehicles. Here solely front wheel steering would be mentioned that is getting used universally until these days.

The requirements of fine mechanism are:

a) The steering system ought to be terribly correct and straightforward to handle.
b) The hassle needed to steer ought to be marginal and should not be deadening to the motive force.
c) The steering system ought to conjointly give directional stability. this suggests that the vehicle ought to have a bent to come back to straight ahead position once turning.

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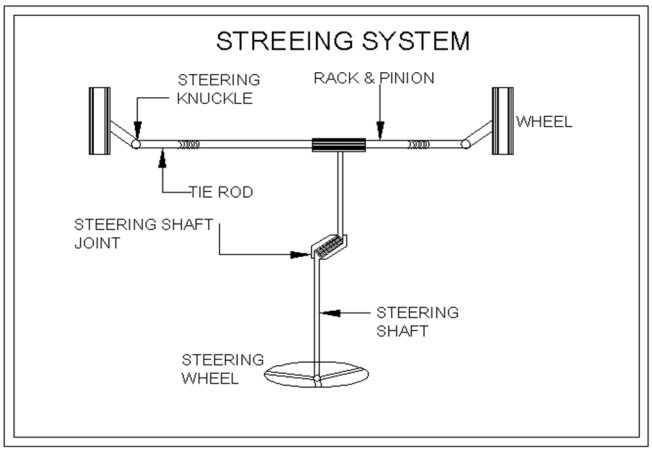
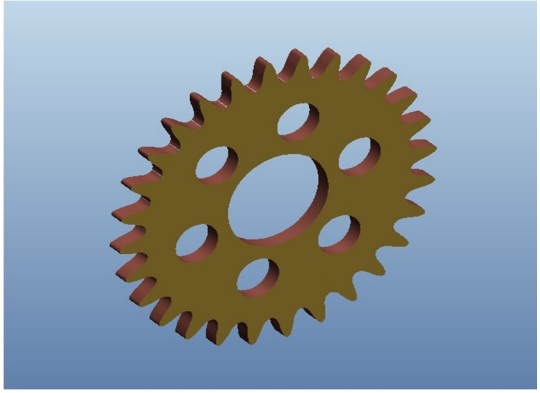


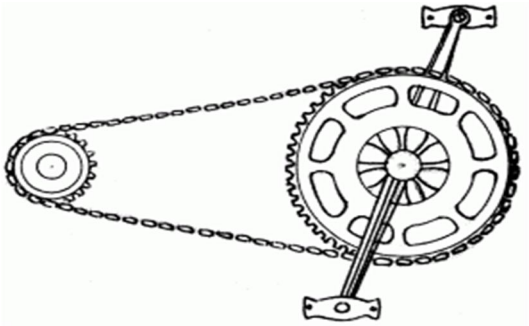
E. Chain Drive

Chain drive may be a method of sending mechanical power from one place to a different. it's typically wont to convey power to the wheels of a vehicle, significantly bicycles and motorcycles. it's additionally employed in a good kind of machines besides vehicles. Most often, the ability is sent by a roller chain, referred to as the drive chain or transmission, passing over a sprocket gear, with the teeth of the gear meshing with the holes within the links of the chain. The gear is turned, and this pulls the chain swing mechanical force into the system. Another sort of drive chain is that the Morse chain, unreal by the Morse Chain Company of Ithaca, New York, USA. This has inverted teeth.

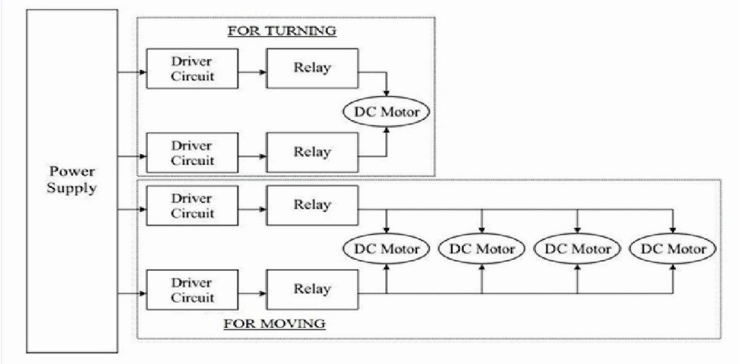
Sometimes the ability is output by merely rotating the chain, which might be wont to carry or drag objects. In different things, a gear is placed and also the power is recovered by attaching shafts or hubs to the present gear. tho' drive chains ar typically easy oval loops, they'll additionally go around corners by inserting over 2 gears on the chain; gears that don't place power into the system or transmit it out ar usually referred to as idler-wheels. By variable the diameter of the input and output gears with relation to one another, the gear quantitative relation may be altered. as an example, once the bicycle pedals' gear rotate once, it causes the gear that drives the wheels to rotate over one revolution.

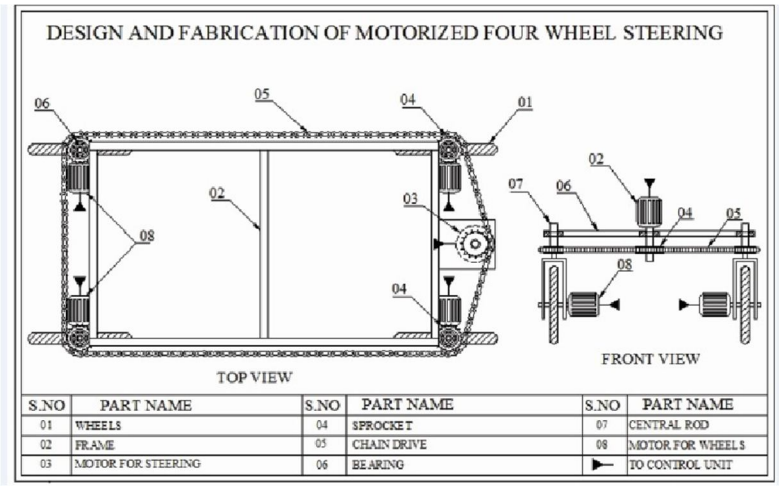


The recognition of the chain-driven safety bike led to the ending of the penny-farthing, and remains a basic feature of bicycle style nowadays.



III. DESIGN AND MODEL





A. *Applications*

1) Used for easy parking in four wheelers
2) It is applicable for all four wheeled vehicles

B. *Advantages*

1) Easy maintenance
2) mode change is easy
3) Implementation is easy

C. Disadvantages

1) Gear arrangement adds weight to the vehicle.

IV. CONCLUSION

The project carried out by us to reduce the turning radius of the vehicle so that it may help the truck, lorry and heavy vehicles drivers. It may also helps to park the vehicle easily.

We also made this project for the reduction of cost for the production industries by using simple motors. And the cost of developing this concept is low.

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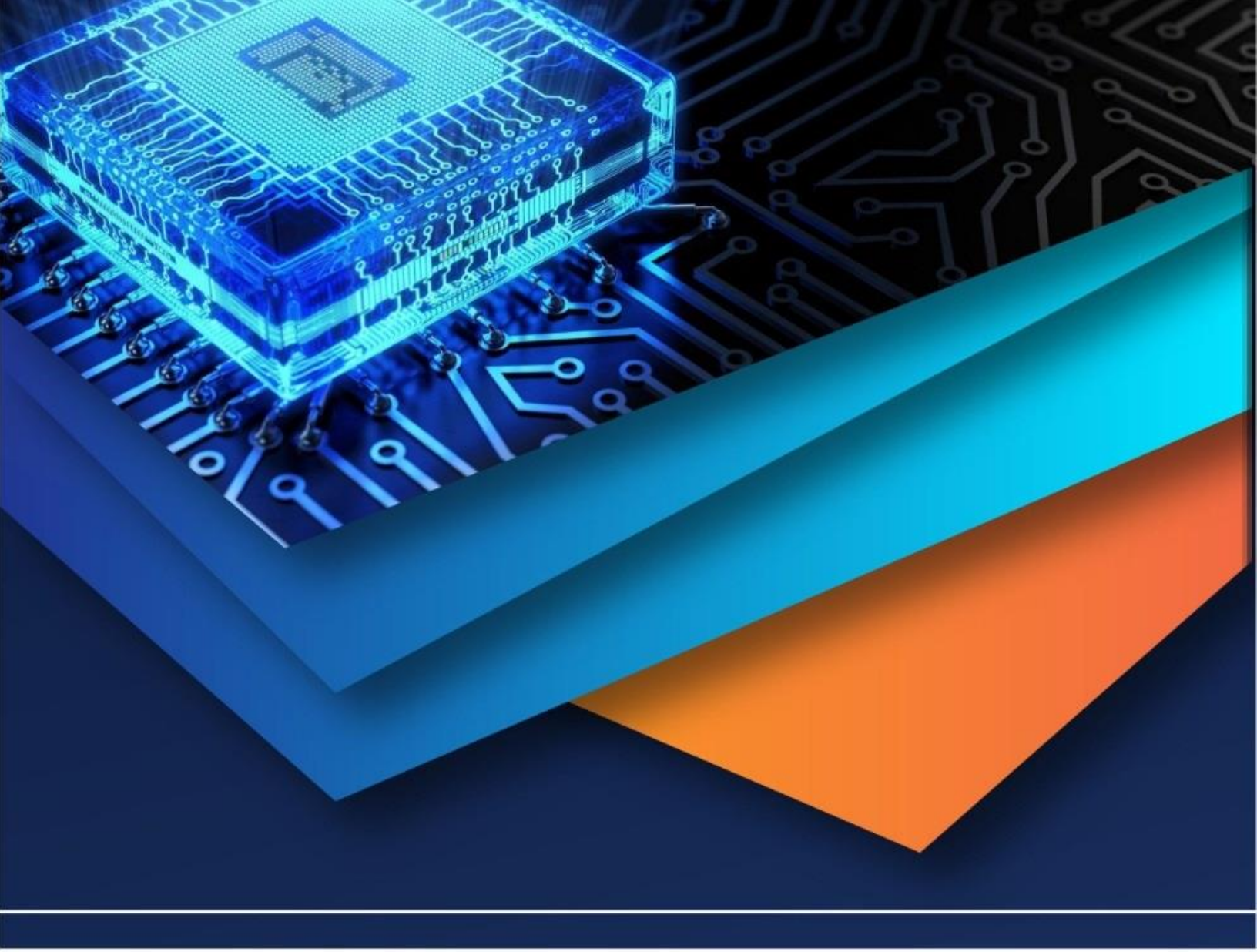

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