iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** IV **Month of publication:** April 2022

DOI: https://doi.org/10.22214/ijraset.2022.41523

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue IV Apr 2022- Available at www.ijraset.com

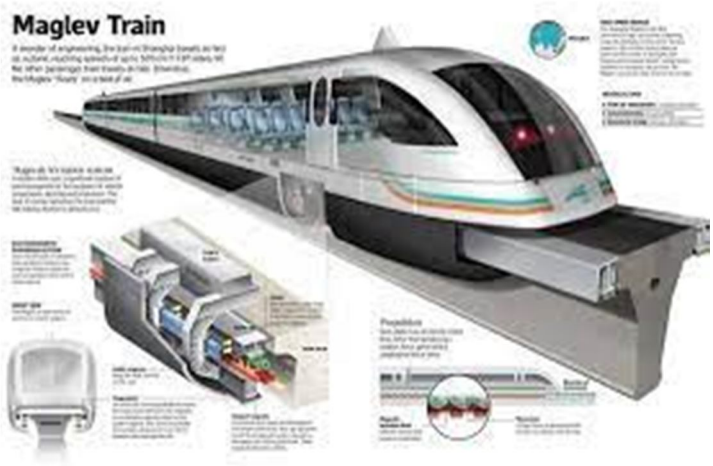
System Analysis and Working of Magnetic Levitation Trains

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***Abstract:** This paper involves the layout, hardware, era, software and destiny makes use of "Magnetic levitation trains." The maglev transportation machine is extra strong, quicker, financial, green. Maglev structures are presently in use for applications which includes bearings, excessive- speed trains, and manufacturing. Maglev is a way of propulsion that uses magnetic levitation to propel automobiles with magnets instead of with wheels, axles and bearings. With maglev, a vehicle is levitated a brief distance faraway from a manual manner the use of magnets to create both raise and thrust (levitation could not exceed above 10 centimetre's). In destiny those excessive-pace maglev trains would supply a massive competition to the aviation enterprise.*

I. INTRODUCTION

Maglev trains circulate greater easily and somewhat extra quietly than different traditional trains. And, they do not rely upon traction or friction , their acceleration and deceleration are quicker than conventional trains ,they're unaffected of climate. The power wanted for levitation is not at all of the large amount of the overall electricity intake; maximum of the electricity in these trains are used to triumph over air resistance (drag), as with each excessive velocity form of transport .those trains can circulate constantly excessive speeds than the traditional trains, they preserve and the Magnetic levitation has a completely advanced and efficient era. we are able to use of it in commercial purpose as well as in office and homelike as the fan in buildings, transportation, weapon(gun, rocketry), nuclear reactor, use of elevator in civil engineering, toys, pen. So it has many packages which might be the usage of within the entire world. It gives the easy power and it's all software gives the dearth of contact and for that reason no friction. Magnetic levitation improves performance and life of the machine. It reduces the maintenance costs of the gadget. With the assist of in this paper we tried to explain the advantage of it and the need of it in destiny engineering and the world. So we can say it is the future of flying trains and vehicles. The fastest means of rail transportation



II. MAGNETIC LEVITATION SYSTEM

This generation uses monorail music with linear vehicles , those trains flow on special tracks as opposed to the mainstream conventional teach tracks . they use very effective electromagnets to attain at higher velocities(Fig- 1) ,they go with the flow approximately 1- 10 cms above the guideway on a magnetic discipline .those trains are propelled via the guideways . once the educate is pulled into the subsequent phase the magnetism switches in order that the train is pulled on again . The electromagnets run the period of the guideway.

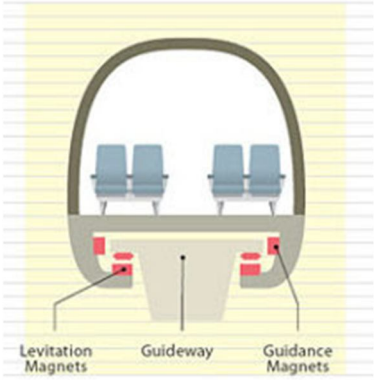
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III. TYPES OF MAGLEV TECHNOLOGY:

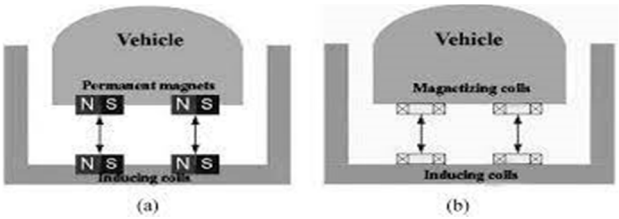
A. Elecromagnetic Suspension
B. Electrodynamic Suspension
C. Inductrack system

IV. ELECTROMAGNETIC SUSPENSION (EMS)



Electromagnetic suspension (EMS) is the magnetic levitation of an object executed with the aid of continuously changing the electricity of a magnetic discipline produced by means of electromagnets the usage of a remarks loop. In maximum cases the levitation effect is often due to permanent magnets as they don't have any strength dissipation, with electromagnets most effective used to stabilize the impact. Magnetic levitation technology is critical as it reduces power consumption, largely reduces friction. It additionally avoids wear and has very low upkeep requirements. The software of magnetic levitation is maximum generally regarded for its function in Maglev trains. Maglev also has the benefits of being quieter and smoother than wheeled transportations because of the removal of an awful lot of the bodily touch among wheels and music. considering the fact that maglev requires a guiding rail, it is more often than not used in railed delivery structures like trains for the reason that first commercial maglev train become opened in Birmingham, England in 1984, different industrial EMS maglev educate structures, which includes the M-Bahn and the Transrapid have also been placed into constrained use. (Maglev trains based on electrodynamic suspension generation have also been developed and deployed.) With the viable exception of the 30.5 km Shanghai Maglev teach, major lengthy-distance EMS maglev routes have been built.

V. ELECTRODYNAMIC SUSPENSION SYSTEM (EDS)



Electrodynamic suspension (EDS) is a form of magnetic levitation in which there are conductors that are uncovered to time-varying magnetic fields. This induces eddy currents in the conductors that creates a repulsive magnetic subject which holds the 2 gadgets apart those time varying magnetic fields can be as a result of relative motion between two objects. in many cases, one magnetic field is a permanent discipline, together with a everlasting magnet or a superconducting magnet, and the opposite magnetic field is brought on from the modifications of the field that arise because the magnet moves relative to a conductor within the different item. Electrodynamic suspension also can occur while an electromagnet driven by using an AC electric source produces the converting magnetic discipline, in some cases, a linear induction motor generates the sphere. EDS is used for maglev trains, along with the japanese SCMaglev. it's also used for some instructions of magnetically levitated bearings.

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VI. INDUCTRACK (A NEW TRACK IN RUNNING)

Inductrack is a passive, fail-safe electrodynamic magnetic levitation device, the usage of only unpowered loops of cord within the song and perslide magnets (arranged into Halbach arrays) at the automobile to acquire magnetic levitation. The music can be in certainly one of configurations, a "ladder music" and a "laminated track". The ladder track is made of unpowered Litz twine cables, and the laminated tune is created from stacked copper or aluminium sheets.

There are three designs: Inductrack I, that is optimized for high velocity operation, Inductrack II, that's more green at decrease speeds, and Inductrack III, that is supposed for heavy loads at low velocity.

Inductrack (or Inductrak) turned into invented by way of a group of scientists at Lawrence Livermore country wide Laboratory in California, headed via physicist Richard F. publish, for use in maglev trains, based totally on era used to levitate flywheels. At regular pace, strength is needed handiest to push the teach forward towards air and electromagnetic drag. Above a minimal pace, as the velocity of the teach increases, the levitation gap, raise force and strength used are in large part constant. The machine can carry 50 times the magnet weight.

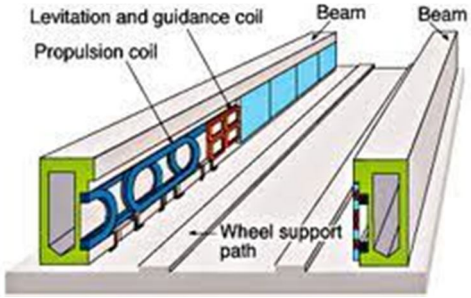
The call inductrack comes from the phrase inductance or inductor; an electrical tool crafted from loops of twine. As a Halbach magnet array passes over the loops of wire, the sinusoidal versions in the discipline induce a voltage inside the song coils. At low speeds the loops are a in large part resistive impedance, and consequently the caused currents are maximum where the field is changing maximum quickly, which is around the least intense parts of the sector, as a consequence little carry produced.

however, at speed, the impedance of the coils increases, proportionate to hurry, and dominates the composite impedance of the coil assemblies. This delays the segment of the present day peak in order that brought on current in the song has a tendency greater intently to coincide with the sphere peaks of the magnet array. The tune for this reason creates its personal magnetic area which traces up with and repels the everlasting magnets, developing the levitation impact. The song is well modeled as an array of series RL circuits.

whilst neodymium–iron–boron everlasting magnets are used, levitation is achieved at low speeds. The test model levitated at speeds above 22 mph (35 km/h), but Richard put up believes that, on actual tracks, levitation can be completed at "as little as 1 to two mph (1.6 to three.2 km/h)".[citation needed] underneath the transition velocity the magnetic drag increases with vehicle velocity; above the transition speed, the magnetic drag decreases with velocity. as an instance, at 500 km/h (310 mph) the lift to drag ratio is two hundred ways higher than any plane however an awful lot lower than conventional metallic on metallic rail which reaches 1000:1 (rolling resistance). This happens because the inductive impedance increases proportionately with pace which compensates for the quicker price of trade of the field seen by the coils, for that reason giving a constant present day flow and power consumption for the levitation.

The Inductrack II variant makes use of Halbach arrays, one above and one under the music, to double the magnetic discipline with out considerably growing the burden or location of the arrays, at the same time as additionally decreasing drag at low speeds. several maglev railroad proposals are based totally upon Inductrack generation. The U.S. national Aeronautics and area management (NASA) is likewise thinking about Inductrack technology for launching space planes.

Widespread Atomics is growing Inductrack era in cooperation with multiple research companions.



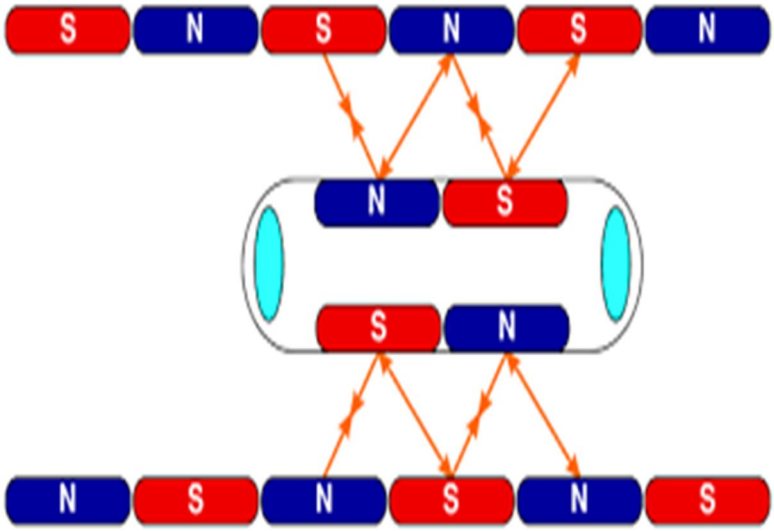
VII. PROPULSION SYSTEM

The propulsion of a magnetic levitation (Maglev) train is caused by a linear motor. In 1914, Bache let had the idea of the usage of a. c excited coils for levitation and propulsion and no longer till Fifties that maglev got a actual begin. The heart of a maglev machine is magnetic configuration which aid and propel maglev vehicle at designed speeds. In essence, a maglev machine is a linear magnetic gadget. The maglev gets its propulsion pressure as in linear motor, which is distinct from a conventional rotary motor.

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The history of linear motor (LM) may be traced again as a minimum as far because the 1840's to the paintings of Charles Wheatstone at King's college London. due to their overwhelming simplicity and reliability, LM has long been regarded as the maximum promising way of propulsion for destiny excessive-pace floor transportation systems . The proposed system, while no longer strictly qualifying as high-speed, nonetheless derives such a lot of blessings from the usage of a LM that no other propulsion method is being taken into consideration at this stage. For maglev application, two unique configurations of LMs are considered: the short-stator linear induction motor and the lengthy-stator linear synchronous motor. it's miles considerable that maglev has the tendency of becoming the global transportation gadget for the near future. it's miles necessary to be involved and apprehend the technologies of the propulsion subsystem of maglev machine; this paper discusses the magnetic propulsion generation



VIII. MAGNETIC PROPULSION GENERATION

The principle of operation of a linear motor is such that it produces a immediately movement, they perform very further to rotary ones . In reality, there may be as a minimum a form of linear motor for each type of rotary. Like rotary machines, linear ones include a transferring element and a desk bound element, the mover and the stator respectively. both the mover or the stator becomes the armature by generating a magnetic subject that travels linearly. the opposite a part of the motor is known as the area .

The propulsion of a maglev train is as a result of a linear motor. A linear motor may be defined as a rotary motor that has been 'cut open.' In a ordinary direct modern (d. c.) motor a rotor, stator and commuter can be located. The equal elements

are present in the linear d.c. motor, but its had been cut open, unwrapped and flattened out. The result is a magnetic track, alternating among north and south poles alongside its duration; a solenoid that is being propelled along the tune; and a commuter inflicting the solenoid to alternate poles in time. it is also feasible to switch the rotor and the stator. In this case the song modifications poles and the solenoid on the educate may be changed by means of a permanent magnet. There are the two primary concepts of a linear motor and hence the propulsion of the maglev trains.

The forces in a linear motor are both electro-dynamic or electromagnetic . in the first elegance are forces additionally referred to as Lorentz type forces which might be caused by putting modern-wearing conductors in magnetic fields as well as the ones caused by the interaction among a magnetic area and its reactionary subject generated through prompted currents, then again, electromagnetic forces are due to the interplay among the armature's traveling magnetic area and the sector's non-uniform magnetic residences . because of their planar nature, flat linear vehicles produce either thrust (or propulsion pressure) collinear to the journey, and a ordinary force perpendicular to the thrust . at the same time as the thrust is caused by the tour of the armature's magnetic area, the normal pressure depends at the structure and composition of the motor .In well known, this everyday pressure has components:

a) A repulsive force due to the interplay of subject's and armature's magnetic fields, and

b) An appealing pressure between the everlasting magnets and the ferromagnetic cores.

while normal forces are present, motor designers commonly restore the air gap period through employing linear bearings, electromagnetically managed suspensions, or air bearings. As mentioned before, the occurrence of those forces relies upon on the motor's structure, which determines its precept of operation. This principle of operation defines numerous classes of motors, i.e., induction, synchronous, and direct current.

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IX. POWER AND ENERGY USAGE

Power for the maglev trains is used to accelerate the educate, and the power could be regained whilst the teach slows down ("regenerative braking"). it is also used to make the train levitate and to stabilise the motion of the educate. the principle part of the energy is needed to pressure the teach through the air ("air drag"). also a few electricity is used for air con, heating, lighting and other miscellaneous systems.

At low speeds the share of energy (energy per time) used for levitation may be giant ingesting up to fifteen% extra electricity than a subway or light rail carrier.also for very quick distances the power used for acceleration might be sizeable. however the electricity used to triumph over air drag will increase with the cube of the velocity, and consequently dominates at excessive pace.

X. CONTROL SYSTEM

There are no signalling structures for high or low velocity maglev systems. there is no need considering these kinds of systems are laptop controlled. besides, on the extraordinarily high speeds of those systems, no human operator could react speedy sufficient to gradual down or prevent in time. this is additionally why these structures require dedicated rights of way and are typically proposed to be extended numerous metres above ground level.

two maglev system microwave towers are in contact with an EMS automobile always for two-way communication among the car and the valuable command centre's most important operations computer. There are not any want for educate whistles or horns, both.

XI. PRACTICAL EXPERIMENT

To portray the concept of magnetic levitation we did a small experiment where we used easily achievable household items to essentially make a rotating pencil. The two magnets are attached onto the pencil while it's kept on top of an opposite pole base as to make it rotate. This proceeded by making the tip come in contact with a small plastic sheet attached in the front to make it similar to that of an axel. Upon connecting it to a propeller, just via a little nudge we see that the the pencil keeps on rotating similar to those axels in the Maglev Trains.

XII. FLEXIBILITY & RELIABILITY

plane are theoretically flexible but industrial air routes are not. excessive-pace maglevs are designed to compete on journey instances with flights of 800 kilometres (500 miles) or much less. additionally, whilst maglevs can serve numerous cities in among such routes and be on time in all weather situations, airlines can not come near such reliability or performance. because maglev automobiles are powered by electricity and do no longer carry fuel, maglev fares are much less at risk of the heavy fee swings created via oil markets. visiting through maglev additionally gives a vast safety margin over air journey since maglevs are designed no longer to crash into other maglevs or go away their guideways. aircraft gas is a enormous hazard all through takeoff and landing as there are possibilities for injuries. In real-international situations the speed of maglev are much less than plane, however maglev nevertheless shop time due to less range of hurdles it takes to travel in them as compared to air tour. With air tour, people want to spend time at airports for test-in, safety, boarding, and many others. In air journey, time is also fed on (broadly speaking in busy airports) by using the plane for taxing, waiting in queue for take-off and touchdown, which might be negligible in case of maglev.

XIII. FUTURE ASPECTS

The new Magline in Canada uses the packet switching system, meaning there is no speed lost on the main line. With estimated top speeds around 311 mph (500 km/h), the journey from Edmonton to Calgary would be reduced from 3 hours by car to 45 minutes. Combining maglev with a vacuum tube would mean that the air resistance (drag) can be vastly reduced. Elon Musk’s much hyped about Hyperloop is based on this idea. The Hyperloop will have high-speed capsules that glide through tubes with partial vacuum.

XIV. CONCLUSION

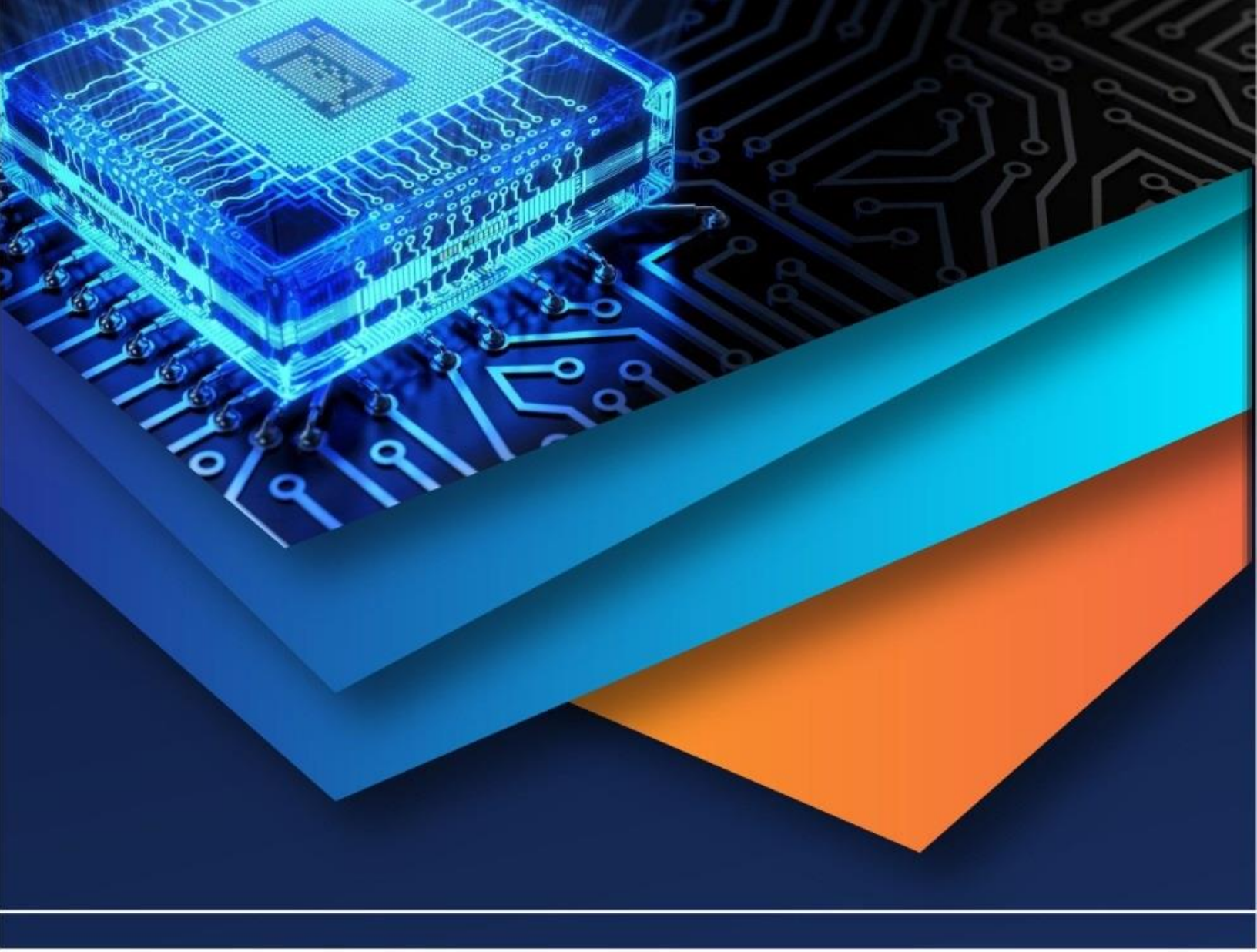
Magnetic levitation trains have loads of packages and blessings like they're fast exceeding the velocity of 300 mph . it has no gas consumption , cost is less expensive than flights , quicker , powerful , much less preservation . utilized in shipping both passenger and items , no fossil fuel used , much less noise , takes less area than traditional trains.

those trains eat very less power as compared to standard trains. They require no massive engine type of stuff as they run using linear automobiles . They flow plenty faster than normal trains because they're now not tormented by ground friction ; they could only have air resistance or drag resistance . they're incompatible with existing rail traces because they need aseperate track to levitate , not like the traditional excessive-velocity trains.first of all the price is very high however it could decrease in near future .

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