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# MAGNETIC LEVITATION

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***Abstract:*** The population is growing, and as the world gets bigger and more crowded, the transportation system must likewise be more pleasant in the modern era. Permanent Magnet Bar has made it possible for us to build a magnetic levitation train known as "MAGLEV" that floats right on the track, making transportation easier. This has the ability to produce trains that are quick and require little upkeep. The goal of this experiment is to determine the prerequisites for creating a levitation train using magnetic levitation. The friction force in a levitation train is affected by the load or overall weight. The friction in standard automobiles, railroads, and boats will rise as the weight increases. In order for the magnets to repel one another, one path of block magnets is glued to the wood base and the other to the train. Because the train magnets and rail's North Pole are facing each other, the train should levitate if it is placed on the rail. Side rails can also be used to control the train's potential to slide to the left or right. The experiment illustrates the magnetism concept of like poles repelling. When two magnets with the same poles face one another, their distance from one another affects the repelling force between them. The closer two magnets are to one another, the stronger the repelling force is. Since maglev trains glide in today's technologically advanced world, magnet levitation has practical applications.

***IndexTerms*** **- Magnetic Levitation (MagLev), Electromagnetic Suspension (EMS), Magnetic Bearing, Levitation Control, Electromagnetic Actuator, Magnetic Force Control, Permanent Magnet.**

## I. INTRODUCTION

Magnetic levitation, also known as maglev, is a cutting-edge technology that suspends items in midair using magnetic forces, doing away with the need for support or physical contact. Our Magnetic Levitation project sought to illustrate the intriguing nexus of physics, engineering, and creativity by designing, constructing, and demonstrating a working magnetic levitation system.

Often abbreviated as "maglev," magnetic levitation is a revolutionary mode of transportation that uses magnetic forces to propel, guide, and suspend vehicles without making physical contact with rails or the ground. Maglev is essentially a train that glides effortlessly over its track, appearing to float in midair.

Here is a summary of the main ideas:

Levitation: The vehicle is raised a specific distance above the track by using powerful magnets with like poles facing one another to produce a repulsive force powerful enough to overcome gravity.
Guidance: Extra magnets on the car and along the track provide lateral stability, which keeps the car centered and stops it from wavering.
Propulsion: The vehicle moves ahead smoothly and effectively thanks to linear electric motors built into the track and the vehicle that employ alternating magnetic fields to provide a pushing and pulling action.
Decreased Maintenance: Because there is less physical touch, the car and the track experience less wear and tear, which results in fewer maintenance expenses.

Energy Efficiency: Because rolling resistance is eliminated, maglev systems can be more energy-efficient at high speeds, albeit needing a significant initial infrastructure investment.

Environmental Benefits: When combined with renewable energy sources, maglev trains, which are electrically propelled and emit no direct emissions, may help create a more sustainable transportation system.

A major development in transportation technology, magnetic levitation offers the possibility of quicker, smoother, and more effective travel. Maglev is still a fascinating field of study and development for the future of high-speed transit, despite ongoing difficulties with infrastructure costs and widespread adoption.

## II. METHODOLOGY

Levitation: The train was raised by the repulsion process using permanent magnets. Additionally, there is levitation between the train and the track.
Motor: The battery (6–8 volts) is linked to the motor. Additionally, it transforms electrical energy into mechanical energy so that the train may move forward.

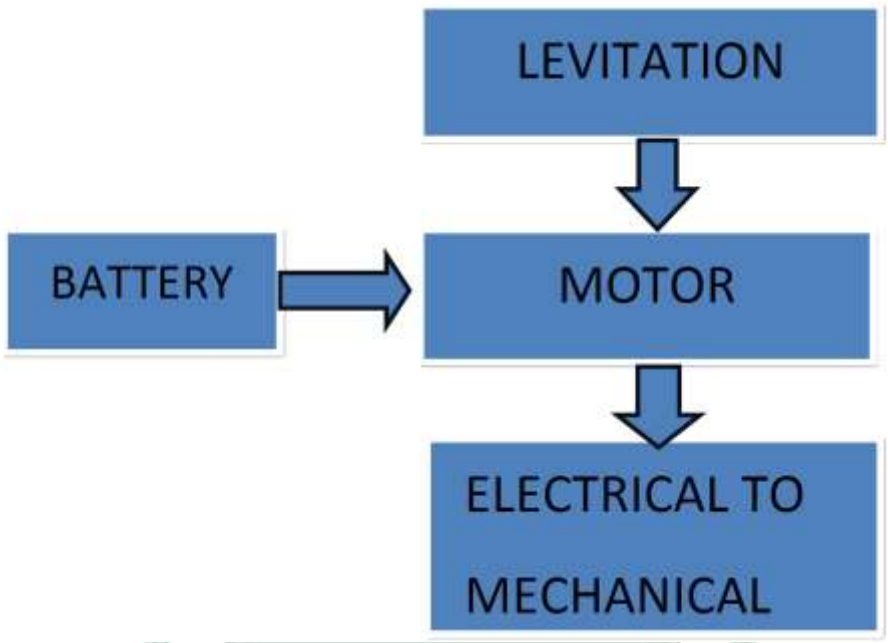


Figure-1 Block diagram of Magnetic Levitation

## III. HARDWARE COMPONENTS

1. Permanent magnet
2. Gear motor
3. 18650 lithium battery
4. PVC sheet
5. Play wood
6. Switch

### 3.1 PERMANENT MAGNET

Figure 2 Permanent Magnet

The dimensions of a permanent ferrite magnet are 30 mm in length, 15 mm in width, and 10 mm in thickness. A ferrite block magnet can be used for a variety of magnetic tasks, including handling or holding flat metal objects. Ferrimagnetism, a form of magnetism in which aligned magnetic moments in different directions partially cancel each other out and produce a net magnetic field that is weaker than in ferromagnetism, is exhibited by ferrite magnets.

### 3.2 GEAR MOTOR

The gear motor runs between 4 and 6 volts. DC motors are perfect for models and robots. Its maximum torque is 800g/cmat at a minimum of 3V, and its gear ratio is 1:48. Electrical energy is transformed into mechanical energy by a DC motor. To produce a particular speed and torque output, a gear motor combines an electric motor (DC or AC) with a gearbox. Usually, the motor's output is altered by the gearbox, which is made up of a number of gears.

Figure 3 Gear motor

### 3.3 18650 lithium battery

Figure 4 lithium battery

Model: 18650 lithium battery. Output Voltage: 7.2v to 8v. Output Current: 2A. 2 cell connect in series. The theoretical life of the 18650 lithium battery is 1000 cycles of charging.

### 3.4 PVC SHEET

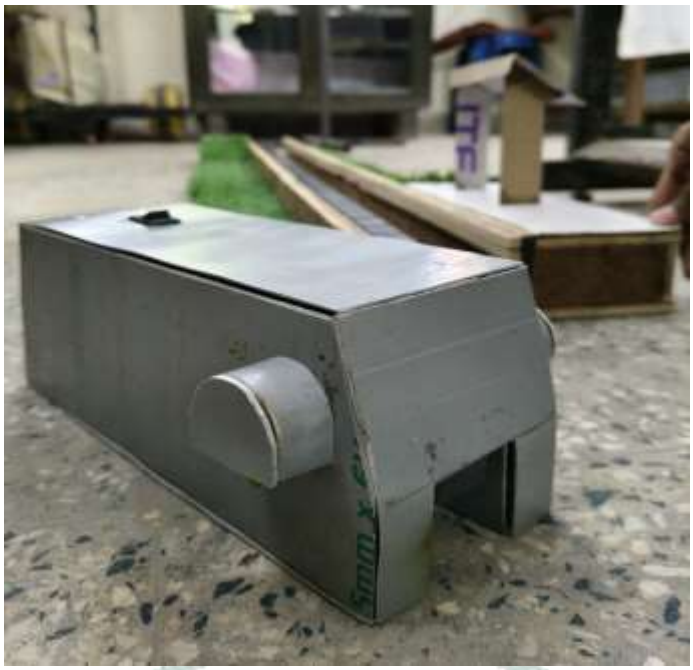

Figure 5 PVC sheet

With the help of PVC pipe, the engine by heating up the pipe converted into the shape of engine. Gear motor connected on the sides of the engine to run the engine on the track.

### 3.5 PLY WOOD

Figure 6 plywood

By using 5ft Ply wood the track made for Magnetic Levitation. Dimension: 54feet X 1feet.

### 3.6 SWITCH

Figure 7 switch

Switch is used to control the Gear motor (to turn on or off). Current capacity: 5A. Voltage Capacity: 230V. An "open switch" prevents current flow, essentially breaking the circuit, while a "closed switch" allows current to flow, completing the circuit.

## IV. TESTING OF LEVITATION

Assemble the magnets on a single path glue them with the wooden base and the other to the train in such a way that the magnets repulse to each other. If the train is placed on the rail it will levitate due to the North Pole of rail and train magnets is faced to each other.

Figure 8 Testing of Levitation

## V. TESTING OF HARDWARE

Figure 9 Testing of Motor

Lithium iron battery is connected with the gear motor and showing it is in the running condition.

Figure 10 Running condition

Testing of Train while moving on the track with levitation.

Figure 11 Final layout of Magnetic Levitation

The train uses PVC pipe, which is heated and given a distinct engine shape before being glued and linked in the engine shape. The track is composed of plywood, and magnets are positioned in the middle of the track to create a force of repulsion between the track and the train base, allowing the train to levitate and be propelled by a gear motor.

## VI. Conclusion

The levitation of magnetism the effective use of magnetic forces to suspend an object in mid-air while avoiding friction and physical contact is demonstrated by magnetic levitation. This technique could be used in many different sectors and has broad ramifications. Draw the conclusion that a train can run on the track in mid-air using permanent magnets and a motor to move it forward based on this magnetic levitation stabilized the train under the right direction.

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