Magnetic Levitation

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Objective

- The objective of doing this project is to learn how magnetic levitation in transport system is more efficient compared to locomotive train.
- We are trying to make a magnetic disk stable in air by using electromagnetism.

Introduction

- Magnetic Levitation (Maglev) is a way of using electromagnetic fields to levitate objects.
- Materials in magnetic field will become magnetized.
- Most materials like water,graphite and plastic are diamagnetic which means they are repelled by magnetic fields.
- This repulsive force however, is very weak compared with the attractive force for a ferromagnetic material such as iron will experience due to a magnetic field.
- When this repulsive force due to a magnetic field on a diamagnetic object is exactly equal to the weight of the object, then the object will be levitated in air.

Introduction

- Producing such large fields requires using superconductive magnets.
- Thus, maglev relies on superconductors in practical applications.
- Superconductors are ideal diamagnetics and completely repel magnetic fields at low temperatures.
- It is possible to levitate superconductors and other diamagnetic materials.

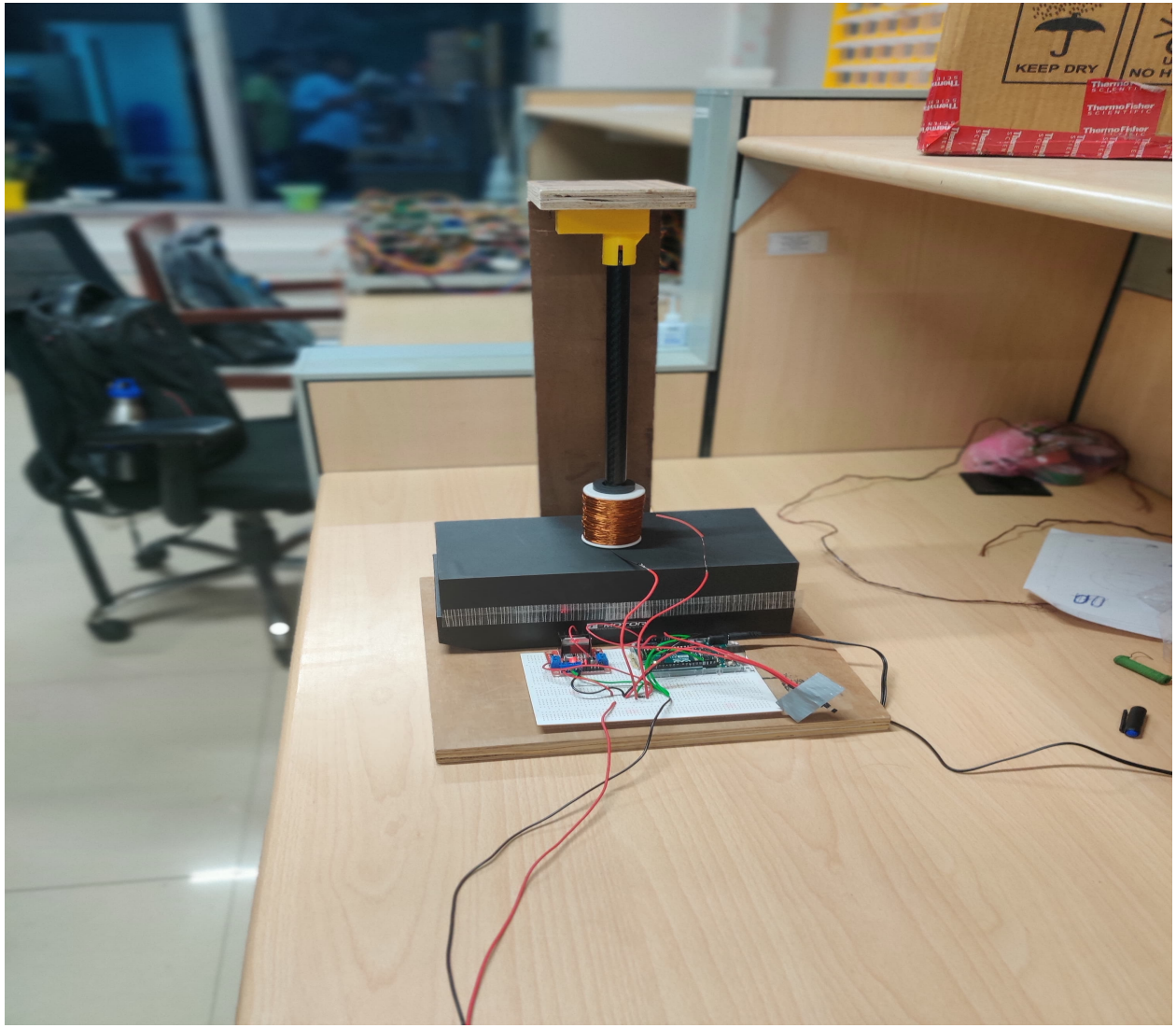
Problem statement

To design and develop a magnetic levitation system capable of levitating an ring magnet using electromagnetic principles. The system should achieve stable levitation of the object above a magnetic base, with the ability to remain stable. Key considerations include efficiency, cost-effectiveness, safety, and scalability for potential applications in transportation, manufacturing, or other relevant fields.

Components

- Arduino Uno microcontroller Board.
- 1k ohm resistence.
- 1N4007 Diode.
- 12V supply.
- Motor Driver L298N
- Pipe around which disk will be stable.
- Linear hall sensor.
- Coil.
- Permanent Magnet disk.

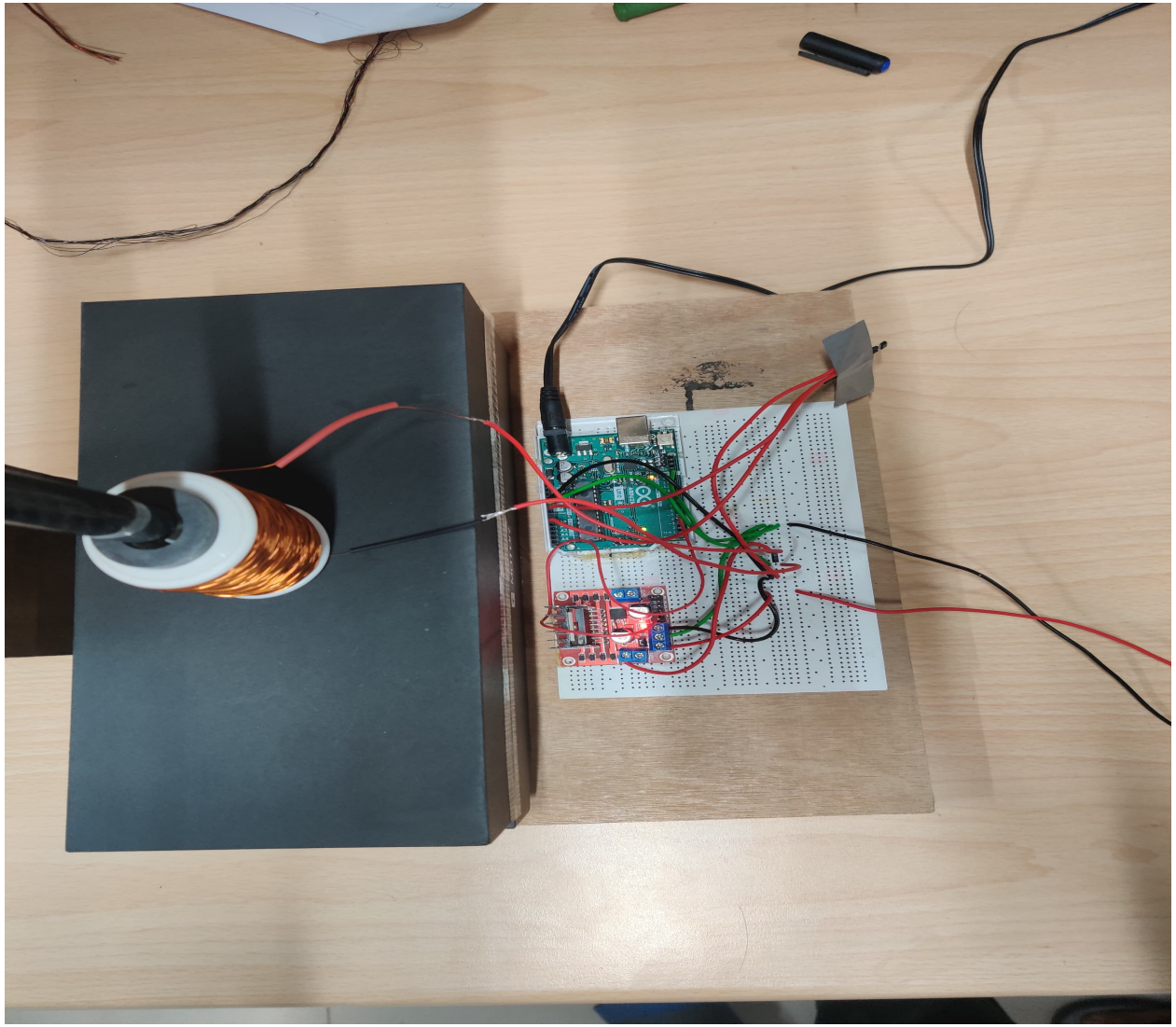
Experimental Setup



Methods

- First we had made the coil of approximately 500 turns but it is not sufficient to levitate magnet.Then we double the turns(approximately 1100 turns).
- Then we use a Arduino Uno R3 for programming.
- Firstly we had taken BJT(DB547) to use it as a switch but it has maximum current rating of 100 mA which was insufficient to levitate the magnetic disk.
- So we have used motor driver(L298N) .
- Here we have used linear hall sensor which can sense distance between coil and magnetic disk and adjust its height according to our requirement.

Circuit Diagram



Result

- We have lifted the magnetic disk upto a certain level.
- We have adjusted height of magnet by varying voltage in PWM.

Learning form this project

- Understanding the fundamental principles of electromagnetism and how they apply to magnetic levitation systems. This includes concepts like magnetic fields, Lorentz force, and electromagnetic induction.
- Learning how to design and construct the physical components of a magnetic levitation system, such as electromagnets, sensors, control circuitry, and the levitated object itself.
- Understanding how sensors are used to measure parameters such as position, distance, and magnetic field strength, and how this feedback is utilized to adjust the levitation system in real-time.