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RC Maglev Trains

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Background

Magnetic Levitation Trains (**Maglev**) trains, utilizing electromagnetism fundamentals, revolutionize travel by achieving levitation above magnetic surfaces, eliminating friction with the trackway and enabling propulsion at remarkable speeds.

Use Case

Problem: Resources for learning about Maglev trains are either expensive or inaccessible for the average enthusiast or electromagnetics beginner. Many models lack interactivity hindering the learning experience as users do not have control over the train's movement along the track.

Solution: Develop an affordable, accessible, and remote-controlled Maglev train intended for train enthusiasts and beginners alike.

Areas: Signals and Systems, Circuits, Software, and Devices

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Use-Case Requirements

- **User Testing will determine benchmarks**
- Speed (0.6 mph minimum for early prototype [450 cm diameter])
- Levitation (0.8 - 1.2 inches)
- Response Time (5 seconds)
- Stability (Carrier doesn't shake as it moves along on the track)
- Detects objects blocking track (stops when an object in front of the carrier)
- Speed Detector (5% error threshold)

Technical Challenges

Arduino

- Determining and varying the amount of current needed in the propelling coils to make train movement smooth

Sensors

- Carrier’s sensors consistently detect objects while moving

Levitation

- Constant levitation between train and track, stability

Technical Challenges

Slopes and turns

- Speed stays consistent going up and down slope and through turns

Train stops

- Approaching/departing a stop, speeding up/slowing down, etc.

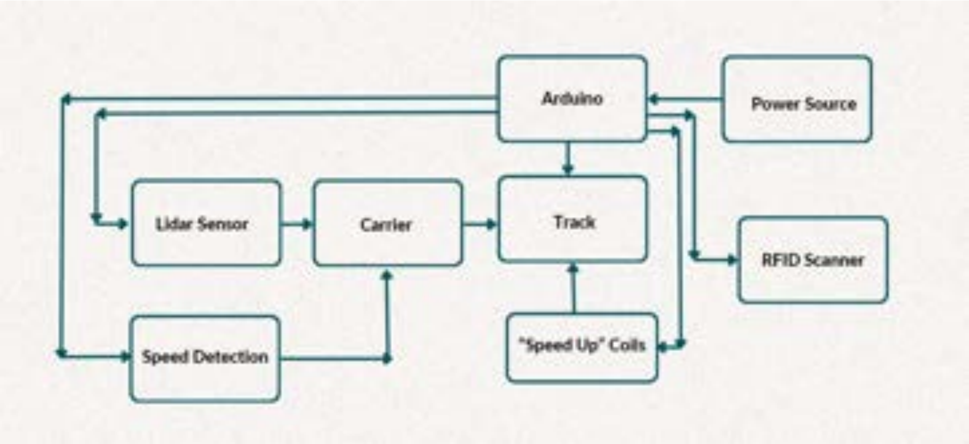
Solution Approach

Train Stops

- RFID System
  - Card coded with train stops
  - Communicates with Arduino
  - Manipulate current and speed

Detecting Blocked Track

- LiDAR
  - Detect 360 degrees (filter to appropriate range)
  - Communicates with Arduino
  - Stops train, cuts current off



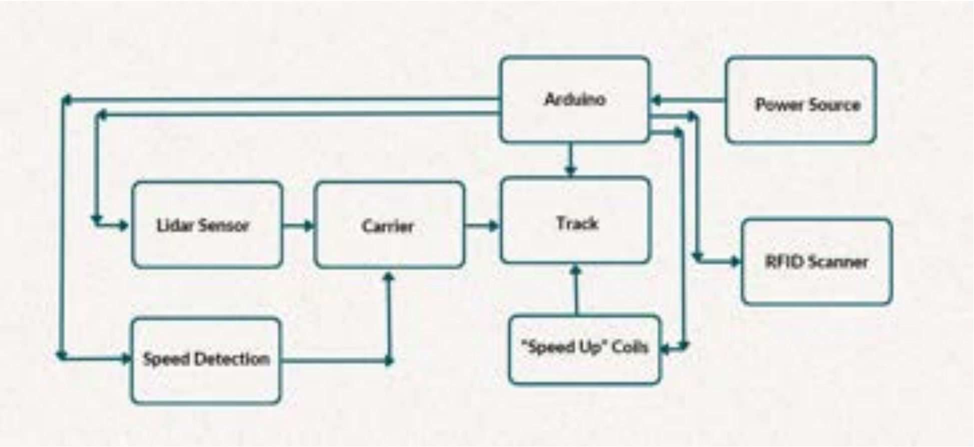
Solution Approach

Speed

- Digital Potentiometer
  - For propelling coils
  - Connected to Arduino
  - Manually increase/decrease current
    - Increase/decrease speed

Levitation Stability

- Lengthened Sides
  - Contacts with side of track
  - Keeps train on track



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Testing, Verification and Metrics

Speed

- Using Arduino configured speed detector (IR sensor configuration)

Levitation

- Visible height above the track, no signs of contact with the track

Stability

- Remains on track at high speeds and curves

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Testing, Verification and Metrics

Response Time

- RFID signal to Arduino - Have Arduino print out time offset
- Arduino to Circuit - Time manually

Speed detection

- Manually calculate speed in straight ways, compare with the Arduino speed detector

LiDAR Sensor

- Manually calculate distance of obstructing object, compare to the LiDAR sensor

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Division of Labor

Angel

- Design the track and carrier
- Adjust magnets to maximize levitation and propulsion of the system
- Design circuit for “propelling” coils
- Create speed detection circuit

Areas: Devices/Circuits

Emanuel

- Design the track and carrier
- Design circuit for “propelling coil”
- Arduino Integration
    - Digital Potentiometer
    - Power Source Distribution

Areas: Devices/Circuits

Myles

- Design the track and carrier
- Arduino Integration
    - RFID Scanner
    - LiDAR Sensor
    - Speed Detector

Areas: Software/Circuits

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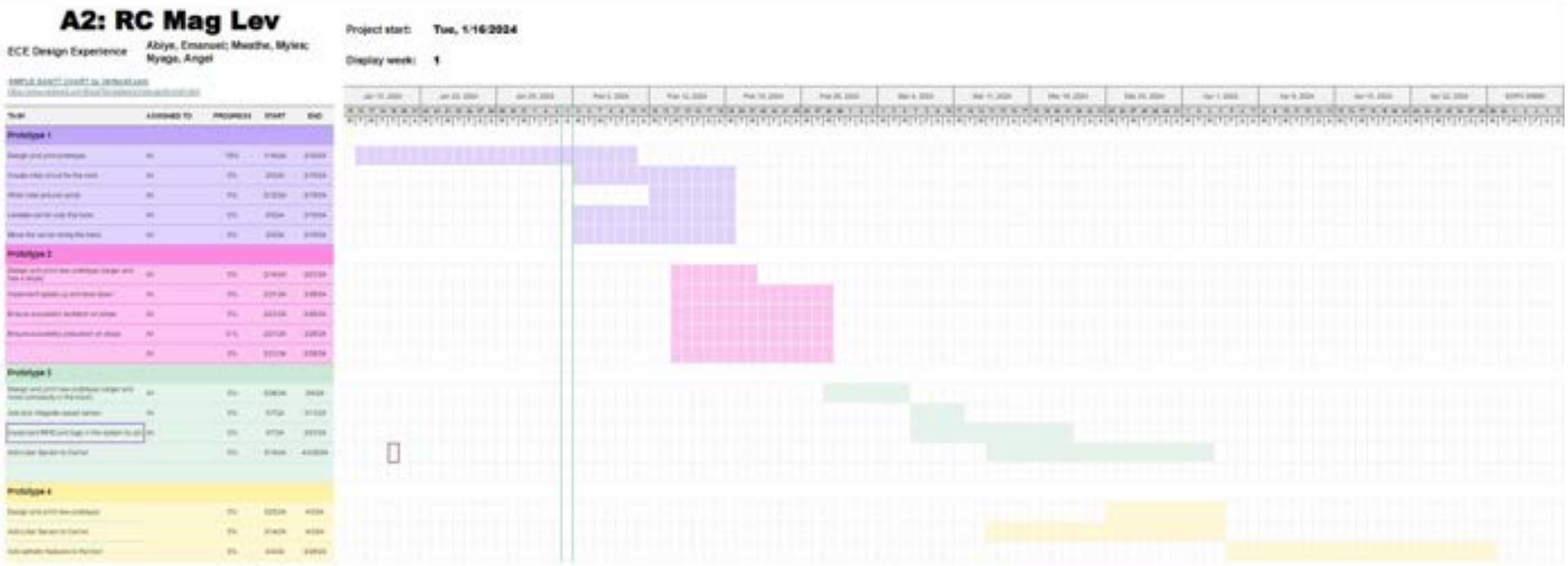
Schedule



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