It’s Electric!

Jonathan Ballerano
Christian Ramirez
I Think I Can
What is it?

[Image of Thomas the Tank Engine + Image of Star Wars Luke Skywalker's Landspeeder]
What is it?

- Model Train, Targeted at Hobbyists
- Carriage, Track Segments, Stations
- Autonomous Operation
Components

- Reed Switches
- Hall Effect Sensors
- Electromagnets
- Microcontroller
- IR Transciever
- Accelerometers
Systems

Guide

Guide

Levitation

Carriage

Track
Levitation

• Full Scale
  • Superconductors at Low Temps
  • Induction Coils
• More Weight = Lift at Lower Speed
Levitation

- Model Scale
- Permanent Magnets
- Weight-Sensitive
- More Weight = Closer to Track, Less Stable
Systems

Guide

Levitation

Carriage

Stabilization

Track
Stabilization

- Carriage Must Remain on Track
- Inherently Unstable
- Manual or Automatic Compensation
- Test Different Configurations
Systems
### Signaling

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>00</strong></td>
<td><strong>Station Ahead</strong></td>
</tr>
<tr>
<td><strong>01</strong></td>
<td><strong>Station Ahead, Request Stop</strong></td>
</tr>
<tr>
<td><strong>10</strong></td>
<td><strong>At Stop</strong></td>
</tr>
<tr>
<td><strong>11</strong></td>
<td><strong>At Stop, Reverse Direction</strong></td>
</tr>
</tbody>
</table>
Signaling

Guide

Sensor

EM

Carriage

Switch

Nd

Track

Sensor

EM

Guide
Propulsion

- Goal: Electromagnetic
- Alternating Polarity
- Guide Rails or Levitation Rails
- Contributes to Stability
- Alternate Methods Available
Propulsion
Propulsion
Obstacle Detection

FLIR

Sensor

Sensor
Challenges

- Achieving Stable Levitation
- Operating Devices In Magnetic Fields
- Implementing Electromagnetic Propulsion
- Tracking Direction, Position, Speed
- Power Consumption
Controller Overview

- **Button (Stop Request)**
- **Hall Effect Sensor (Reset)**
- **Hall Effect Sensors (Signals)**
- **Hall Effect Sensors (Propulsion)**
- **Proximity Sensor (IR)**

Station Controller

- **Electromagnet (Train Signal)**

Carriage Controller

- **Propulsion (Electromagnets)**
Power

- Batteries on Carriage
- Batteries or AC for Stations
- Need Efficient Electromagnets
- Passive Track: All Power in Carriage
Thank You