Maglev

Sources:

https://www.theguardian.com/technology/2006/sep/07/technology1.transport
https://www.h2wtech.com/blog/linear-motor-how-it-works
https://www.youtube.com/watch?v=Yvfz51moMaQ

Ideas:

<mark>Conventional</mark>

I'm going to try making a maglev design that's as fast and cheap as possible.

Note: This article just covers how to make something *levitate*, it doesn't actually cover a linear induction motor at all. The video is better and I'm trying to adapt that for a carriage propulsion system.

"You can create a **linear induction motor** on your own at home. All you need is a piece of cardboard, some Perspex, a couple of dozen magnets and some sticky-backed tape. Stick 20 magnets to the tape as evenly as you can in parallel lines, making sure their poles are aligned (south to north, south to north and so on). Tape the magnets to the cardboard to create a guideway. Build a couple of walls out of Perspex to keep your Maglev on track and help you witness your experiment. Stick about six more magnets of reverse polarity to another piece of cardboard to create your train. Your train should then float above the track. Give it a gentle push, and it should zoom from one end to the other."

How to make a Linear Induction Motor (better tutorial)
https://www.youtube.com/watch?v=Yvfz51moMaQ

Materials

- X180 magnets about 1.5cm diameter (circular shape) ✓
- ~~X3~~ 2x 1kg roll PLA 3D print filament ✓
- ~~Some sort of adhesive~~ Superglue ✓
- Access to 3D printer ✓
- ~~1x small keyboard (temporarily)~~
- ~~1x small mouse (temporarily)~~

- ~~30x~~ 3x small alligator clips ✓
- 1x 9v battery ✓
- 1x spool of conductive copper wire ✓
- ~~1x Raspberry Pi Zero W~~
- ~~1x Raspberry Pi Zero W case~~
- ~~1x Raspberry Pi 800 mAh Rechargeable Battery~~
- 1x tape roll ✓
- ~~12x electromagnet (5V, 2.5kg holding power) (maybe from Adafruit Industries)~~

Plan (Dec 2, 2020)

1. Find a few regular magnets in a local store
2. Casual experiment
   a. Get 1 long piece of cardboard to act as the 'track'
   b. Get 1 shorter cardboard piece to act as the 'train'
   c. Tape magnets in pattern outlined in first article
   d. See if it propels itself
   e. If it does, then we can probably save a lot of money on supplies since it would vastly simplify the design.
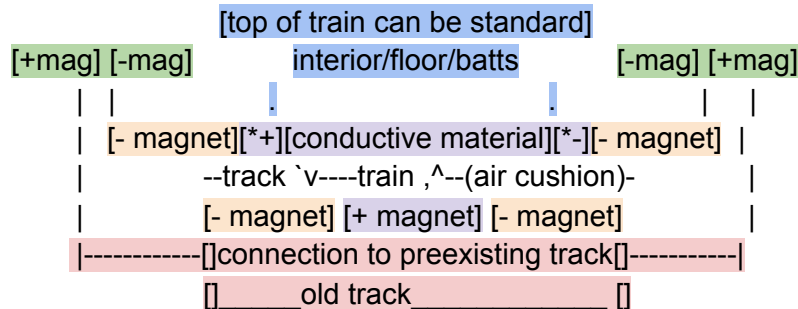   f. After that who knows what's the plan? (yet)

Plan

43.05mm width between rails
Rails: 3.5mm width

Dec 22, 2020

I've created a proper LIM design; I think. I'll explain it the best I can on a Google Doc...

```
                    [top of train can be standard]
[+mag] [-mag]          interior/floor/batts          [-mag] [+mag]
   |  |             .                      .              |   |
   |  [- magnet][*+][conductive material][*-][- magnet]   |
   |           --track `v----train ,^--(air cushion)-     |
   |           [- magnet] [+ magnet] [- magnet]           |
   |------------[]connection to preexisting track[]-----------|
                []_____old track_____ []
```

[*] represents electrified wire connected to conductive material (when the train is on; this is how it will be controlled).
[   ] = Adapter system to retrofit existing standard gauge employed by CTrain system (and most rail networks internationally) (1,435 mm)
[   ] = Levitation system; the part providing lift
[   ] = Propulsion system; the part actually providing linear motion
[   ] = Stability system; the part ensuring the train doesn't go off the rails or tip over
[   ] = Standard/habitable area; the interior of the train usable for just about anything (e.g. passenger cabin, cargo area, etc)

I'll be making the actual gauge 7.3cm for the model.

Update / Jan 5th 2021

It seems we've survived 2020, which means I need to finish this project. I've been having troubles with my 3D printer but I've cleaned it all down, got some new, fancier filament, recalibrated everything, and even tweaked my .CAD files themselves to get everything perfected. As I write this I'm starting a fresh attempt at printing more rails. I even added a fancy skirt for extra pad adhesion, just in case. Why not, right? After all, I just got two kilos of raw plastic off Amazon. This should last me ages, or at least one science fair projects' worth of nonstop printing.

It also seems we have until the 19th to have this project finished, trifold, prototype and all.

This is not good. I don't even know whether or not a 3D print job, with no errors, and overnight printing would be able to print an entire track by then. So far I have 16 cm of completed track. Conventional. Not even the refurbished bits. However, at least the fact that that isn't done yet should give me some time to work on the file for the fancy bits. Wish me luck.

Edit: Why am I treating my logbook like a journal? I might be going insane. Oh well. At least the judges will have something to read.

Jan 23rd, 12:33 am
Final 60-ish hours

It looks like I might need a soldering iron for the components inside the train (only conductive *glue* I can find is sold out), so I'm really glad next-day delivery is a thing right now. My printer is going overnight to create more maglev tracks, I'm going overnight to create the train itself, and I've switched to superglue again to avoid having to do magnet attachments in segments since I don't have the luxury of time anymore (thanks, another-essay-literally-every-day teaching styles). I had to spend hours trying to get the stuff off of my fingers last time I used it (Magnets in my hand jerked out of place and into an already-glued spot, which made a total mess), but I *think* I've refined my process; this time I will put the glue onto the slot instead of the magnet itself to avoid any finger-casualties if it gets misplaced. Wish me luck.

Jan 24th

The train design is complete. Everything worked. Finishing my presentation.