Project 1 Description

I want to recreate the Afterlife cube. It's a fully-functional rubiks cube, but all the tiles are initially blank and light up when they are on the correct face (See: https://www.kickstarter.com/projects/mvented/afterlife-cube-an-otherworldly-challenge). The details for this one are a little up in the air. After talking to Peter today, I think it would make the most sense to make one whose faces don't move, but one that you can 'turn' with some capacitive touch wizardry (for example, double tapping on one sticker, and then another coplanar sticker to signal a move of that face) or having buttons on each tile. For basic functionality purposes, such as powering on, resetting, or maybe even a 'show colors' functionality, I would use either buttons on the center pieces or another capacitive touch ability.

Elements

Inputs

Buttons or touchscreen ability. Buttons aren't too hard to make work, and capacitive touch sensors/displays are available online. The problem with touchscreen is finding something that's translucent and small enough to fit in my design.
Difficulty: 1 to 2

Outputs

Lights going on and off - this part will be hard. I'm not sure yet what the best way to design/build this is. I can see a few options. (a) putting LED lights within the cubelets and under some translucent tiles and turning on LEDs when certain conditions are met. The main problem is this is super hard if the cube is moving because the LEDs in the individual pieces wouldn't really be connected to a power source. (b) shining light from the core. Interesting and possible, but not sure how it would work yet. (c) having some LCD or TFT display on the tile.
Difficulty: 3

Processing

You can model a Rubik's cube pretty easily in software. Given a read change in encoders, I can calculate the change in the state and then output to LEDs as necessary. Shouldn't be too hard.
Difficulty: 1 to 2

Physical build

Rubik's cube pieces - this part isn't too bad because I know the inner mechanism of a 3x3 pretty well and there are public models for 3d printing cube pieces already. The challenge will come in modifying these pieces to work with electronics. Since I'm going to make this a solid cube, the challenge will lie in designing for assembly and disassembly.
Difficulty: 2

Designing with space in mind - since this is a relatively small build I'll need to be pretty precise in allocating space for electronics in design. I feel like it's possible but might be kinda hard.
Difficulty: 2

Sanity check Qs

- Does your project need to be battery powered?

Probably. I don't want this to have be plugged in to be usable. I'm not sure what the best way to insert a battery would be (I suspect a round battery is best)

- If you need to purchase parts, are they inexpensive enough?

Haha I'm not sure

- If you need to purchase parts, are they in stock?

Haha I'm not sure

- Will you be able to test your project in the classroom?

Yes. I think I could scramble and solve in the room.

- Do you have access to the tools you need to build the project?

I think so

Project 2 Description

A literal printer. I think it would be cool to make a device that takes in a piece of paper and can automatically draw a pattern with a Sharpie on it. Or a device that takes in some sketched input (like with a touchscreen) and recreates it on paper.

Elements

Inputs

- A piece of paper (probably not full size? unsure)
- Either a usb with some files on it that I can have the processor read and draw OR some pre-set options that I hardcode. I would hope i can have it try to print anything though
    - Another idea: a separate input space (maybe touchscreen?) where I draw something and my device mimics it
- Probably some buttons for choosing options and power on/off
- A way to reliably put in/replace a Sharpie

Difficulty: 1

Outputs

- LCD screen for displaying options -
    - shows a list of bullet points for options of filenames or hardcoded patterns to print
    - Displays printing progress, etc
    - Could have an LED flash when it's done
- The piece of paper to use
    - Will probably use actuated rollers to intake the paper and hold it in place

Difficulty: 1

Processing

There isn't too much processing in this idea. If I go with the "stick in a USB, choose some file" route, the processing will involve reading that file and having the processor plan how to actuate the motors to make the sharpie draw that pattern.
Difficulty: 2

There is also some processing involved with putting the paper in. Using some rollers to suck in and spit out the paper, there has to be a way to detect when the paper is fully in the printing area and how to stop it reliably. My guess is there's some way to do the detection of "being in

the printing zone" with a beambreak sensor or having the paper it a movable hard stop. Spitting out the paper is as simple as removing the hard stop and then actuating the rollers until the whole paper is out.
Difficulty: 2

Physical build

Printing mechanic - I'm imagining a build similar to a 3d-printer, where instead of a nozzle that spits out melted plastic, I have a Sharpie holder that is actuated along a 2-d plane with either 2 bars on belts or a rack and pinion system. I forget how the the 3rd axis (vertical) is usually done, but I'm fairly confident that it is possible.
Difficulty: 2

Paper mechanic - As described earlier, I'm envisioning a rolling feeder similar to actual printers.
Difficulty: 2

Enclosure - I can see this working with a frame of laser cut wood that looks like a box. I'd probably go for the hobbyist/DIY look with this.
Difficulty: 1

Sanity check Qs

- If you use any motors, are they strong enough? Can you calculate the torque needed?

They should be because I don't think this will be much harder than a DIY 3d printer. I will do the math if I choose this option.

- Can you get a power supply that is powerful enough? Is there something with high voltage or current requirements?
- Does your project need to be battery powered?
- If you need to purchase parts, are they inexpensive enough?

They should be - I don't imagine there are any super expensive parts needed

- Will you be able to test your project in the classroom?

Yes, I should be able to

- Do you have access to the tools you need to build the project?

Most likely yes. I will just need to learn and practice laser cutting for the finish