Class: ME 3350
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Computing Final Project: LED Cube

<u>Explanation</u>

For our final project we constructed an "LED cube" (see Figure 1). An LED cube is a 3-dimensional light display made of simple 5mm Light Emitting Diodes (LED's). We built a 4x4x4 blue LED cube that has 64 LED's total. The cube is soldered and wired together electrically such that it can be controlled with 20 general purpose input/output (GPIO) pins on a Raspberry Pi 3 Model A+. Using python and the Spyder text editor, we defined 20 functions and created 10 patterns. The functions can turn on/off individual LED's, individual planes, individual axes, individual transistors, and more. The fundamental code of our cube is a coordinate system ranging from 1 to 4 in each direction (x, y, z) for convenient pattern creation. All these patterns are combined to make up a light show lasting roughly 2.5 minutes. We added some background music with the song, "Lights−Bassnectar Remix", by Ellie Goulding.
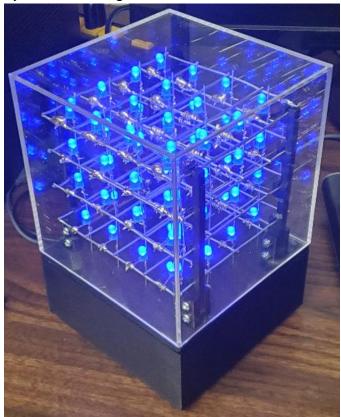

Figure 1: LED Cube.

Components

1" square 15-ft x 2-ft 15ga. galvanized steel welded wire fencing (Qty: 1)	19-ga x 50-ft galvanized steel picture frame wire (Qty: 1)	22ga. breadboard wire lead (Qty: 40)
M3x20 round head screw (Qty: 12)	M3x20 locknut (Qty: 12)	220 Ohm resistor (Qty: 16)
3mm diffused blue LED (Qty: 64)	1kg black PETG filament (Qty: 1)	10 kOhm resistor (Qty: 4)
Raspberry Pi 3 Model A+ (Qty: 1)	BB400 solderless plug-in breadboard (Qty: 1)	2222NPN transistor (Qty: 4)
3 oz. lead-free silver bearing rosin core solder (Qty: 3)	10" full-size clear hot glue stick (Qty: 1)	5" cube clear acrylic display case (Qty: 1)
3/4-in brown felt furniture pad (Qty: 4)		

Contributions

Ethan: material selection, design, construction, functions, patterns, comments, report, video editing
Ryan: material selection, GPIO & raspberry pi research, design, patterns, comments
Dan: material selection, design, patterns, comments, raspberry pi research

Limitations

Some light combinations are electrically impossible since each LED is connected to nearby LED's rather than on its own dedicated loop. For example:
>>on(1,1,1)
>>on(2,2,2)
>>time.sleep(.1)
>>alloff()
This code would cause 4 LED's to flash rather than 2 like it's supposed to. We had to take this into account for all of our patterns. Some of our ideas weren't feasible with this setup. Another limitation is that our cube can only run if the program is manually operated through Spyder; the cube cannot simply be plugged in and start running through patterns.