ECE 445

Self Solving and Self Scrambling Rubik's Cube

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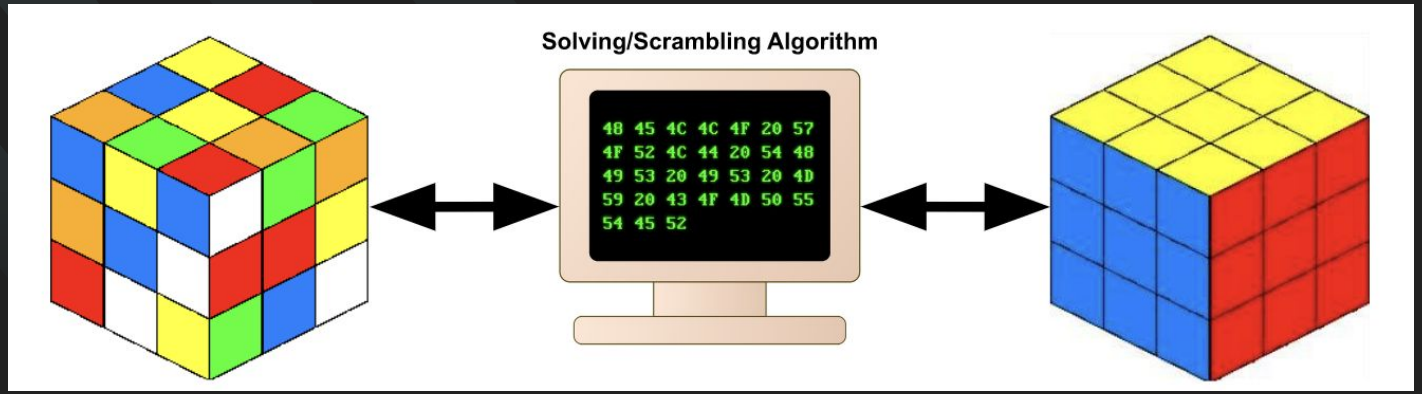
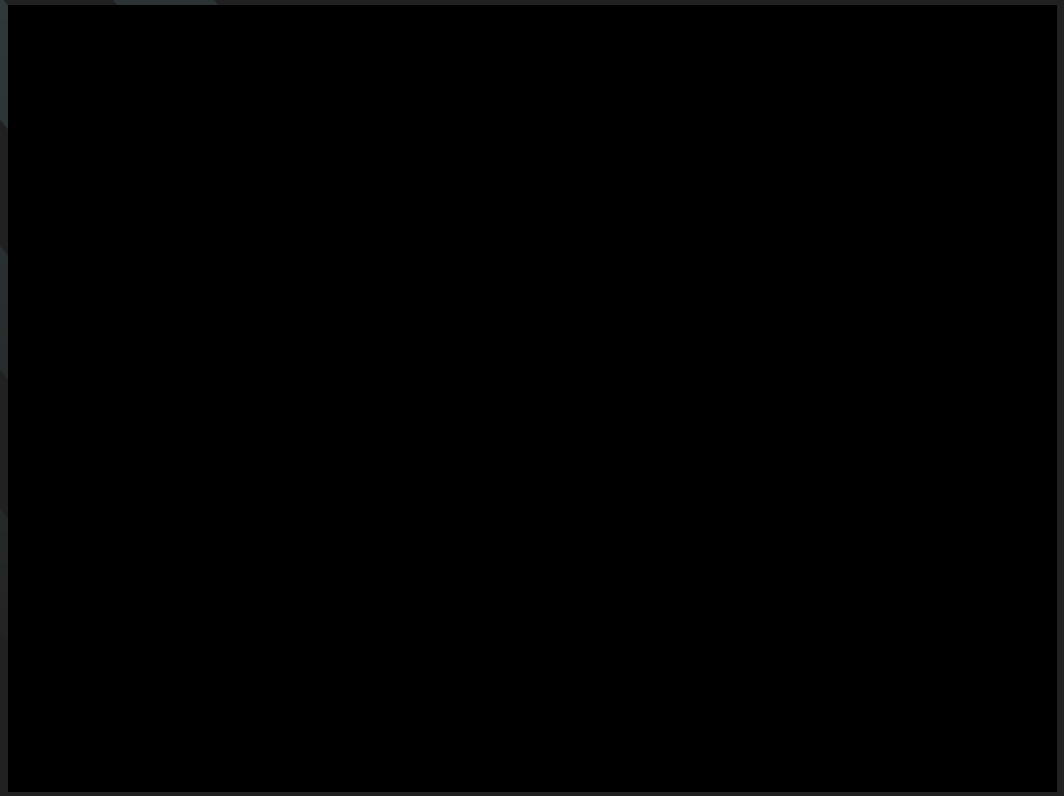
Project Objectives

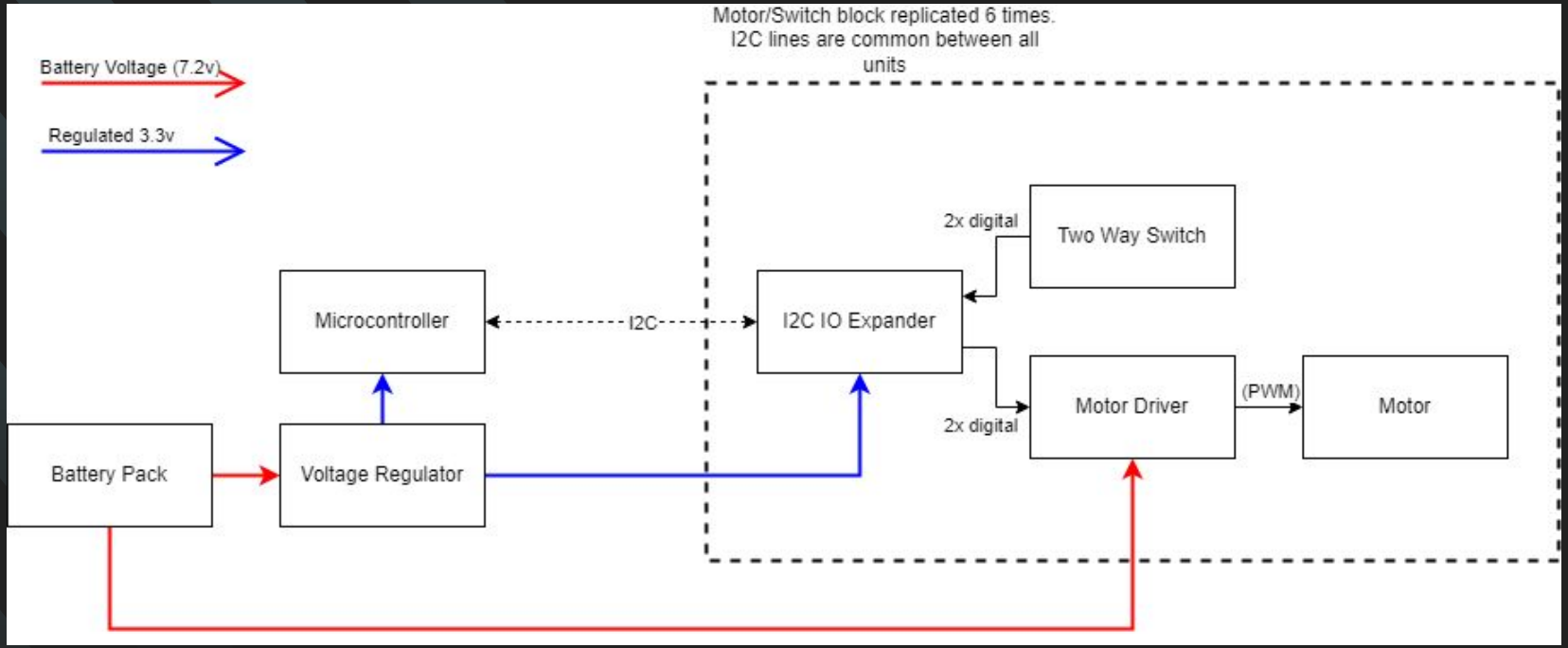
1. The cube must be able to function as a normal Rubik’s cube would, independent of the electronics inside of it.
2. The cube must be no larger than 150mm x 150mm x 150mm
3. The cube must be able to solve and scramble itself in under a minute.



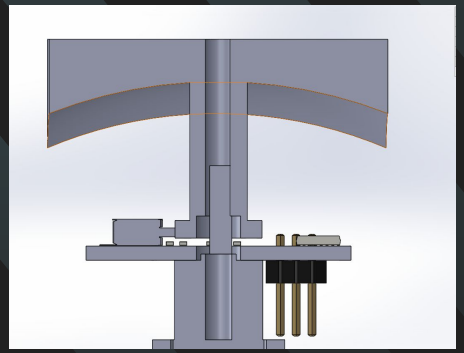
Project Demo Video

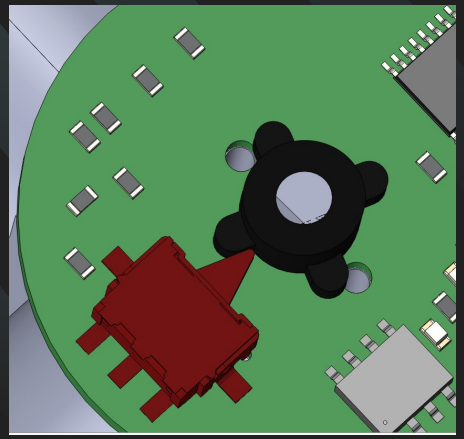


Block Diagram



Original Design Plan: Mechanical/Hardware

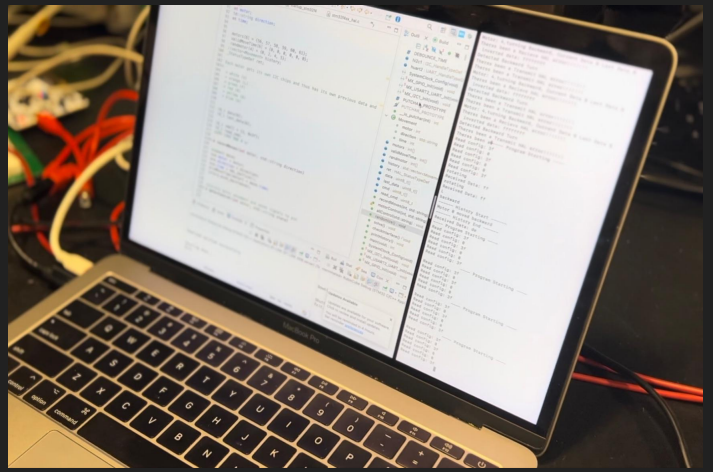




- DC Motors rotate faces
- Bi-directional switch detects rotations
- Software back tracing algorithm and pseudo random scrambling
- 3D printed cube to hold components in

Original Design Plan: Software

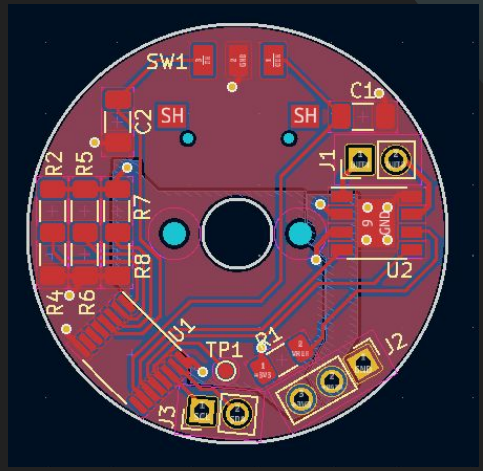
- Detect every 90 degree face rotation
- Randomize Rubik’s cube to 20 moves
- Self solve through optimized algorithms
- User trigger interactions

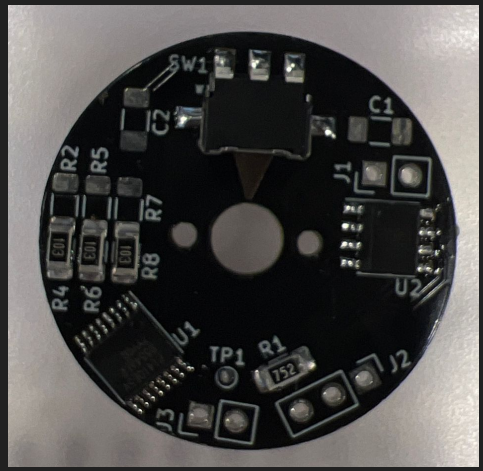


Project Results: Hardware

- Results
  - 90 degree motor control
  - Addressable through I2C bus
  - Functional through battery power at 7.4 V

- Challenges
  - PCB delays
  - Switch module PCB grounding issues
  - Center PCB

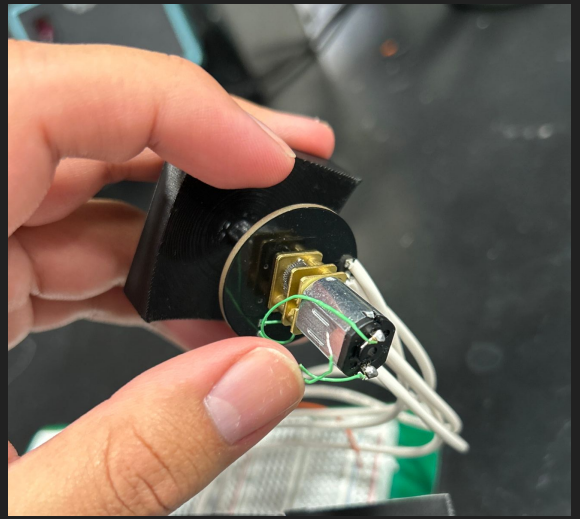




Project Results: Mechanical

- Results
  - 115mm side length
  - Motor rotation independent of electronics

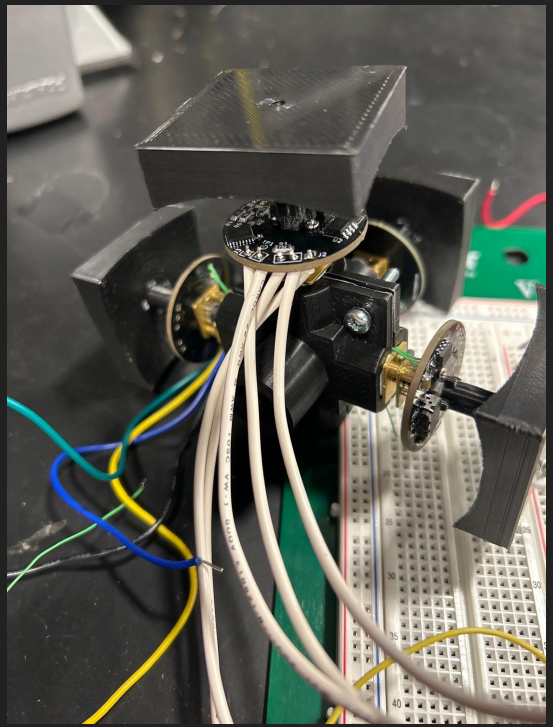
- Challenges
  - 3D printing quality issues
  - Motor core design issues
  - Fragile wiring



Project Results: Software

- Results
  - Successful self scrambling and self solving
  - Working back tracing algorithm
  - Program can remember human scramble moves
  - Debouncing

- Challenges
  - Optimized solving algorithm



Conclusion

- Met most project goals despite setbacks
- Great work from everyone

Revisions and continued work:

- Beveled 3D prints with better supports in mind
- Changing PCB designs to prevent unintentional grounding
- Optimized solving algorithms
- Fully implemented control and power systems

Thank You