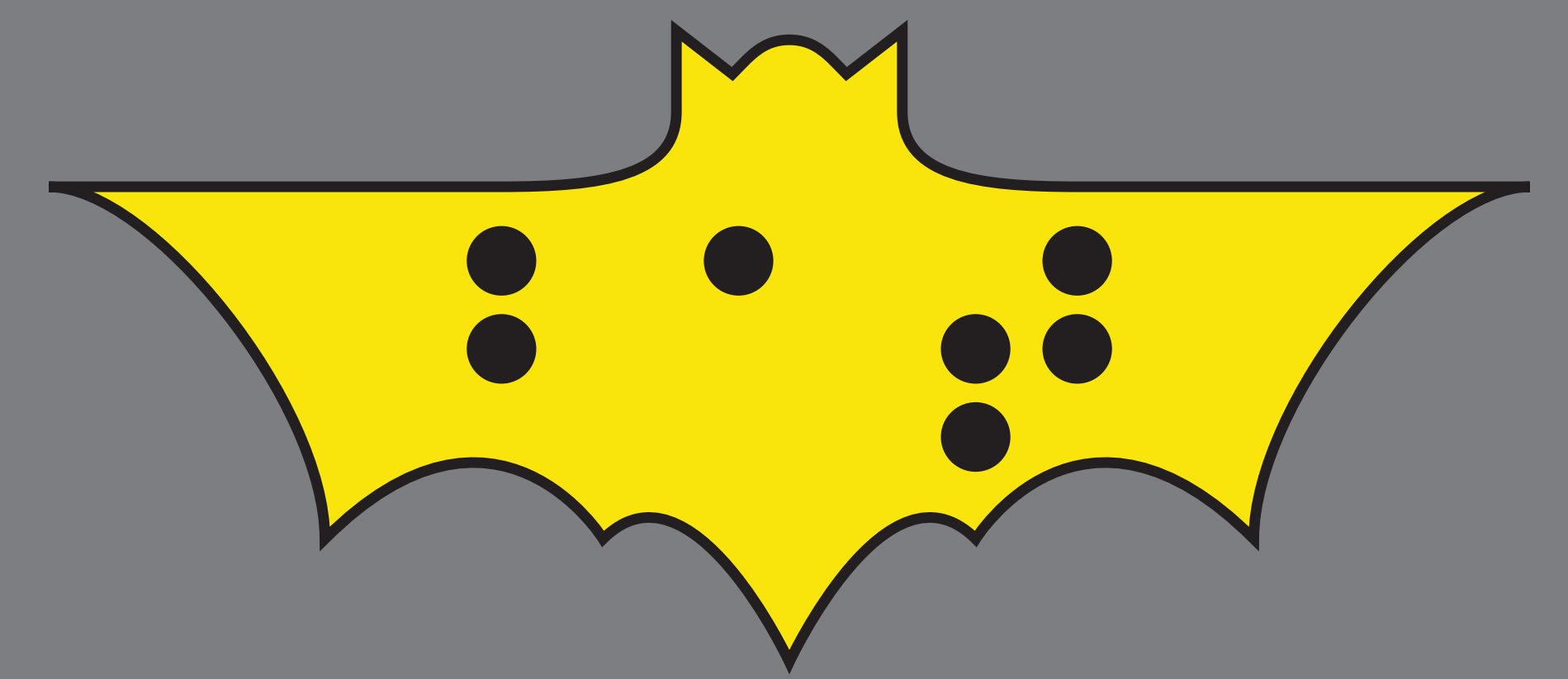


BRaille ASSISTIVE TEACHER

LEARNING DEVICE FOR THE VISUALLY IMPAIRED

ALEXANDER BOOTH, FELIPE GONZALEZ, AZRA ISMAIL, CONNOR NAPOLITANO, NHI NGUYEN, VICTORIA TUCK, ADVISOR: DR. AYANNA HOWARD

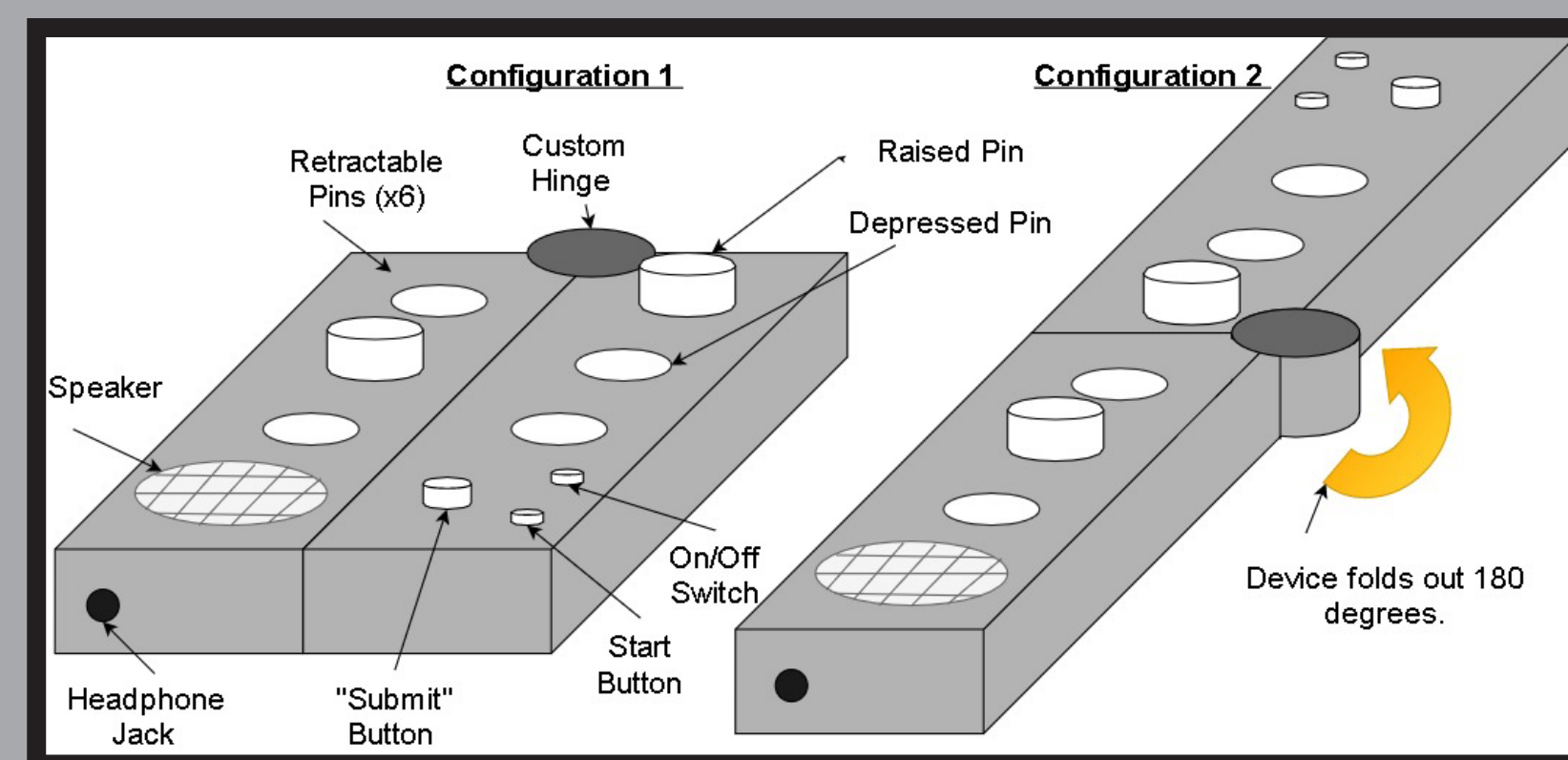


OBJECTIVE

Create a learning device to teach visually impaired individuals how to read and type braille

MOTIVATION:

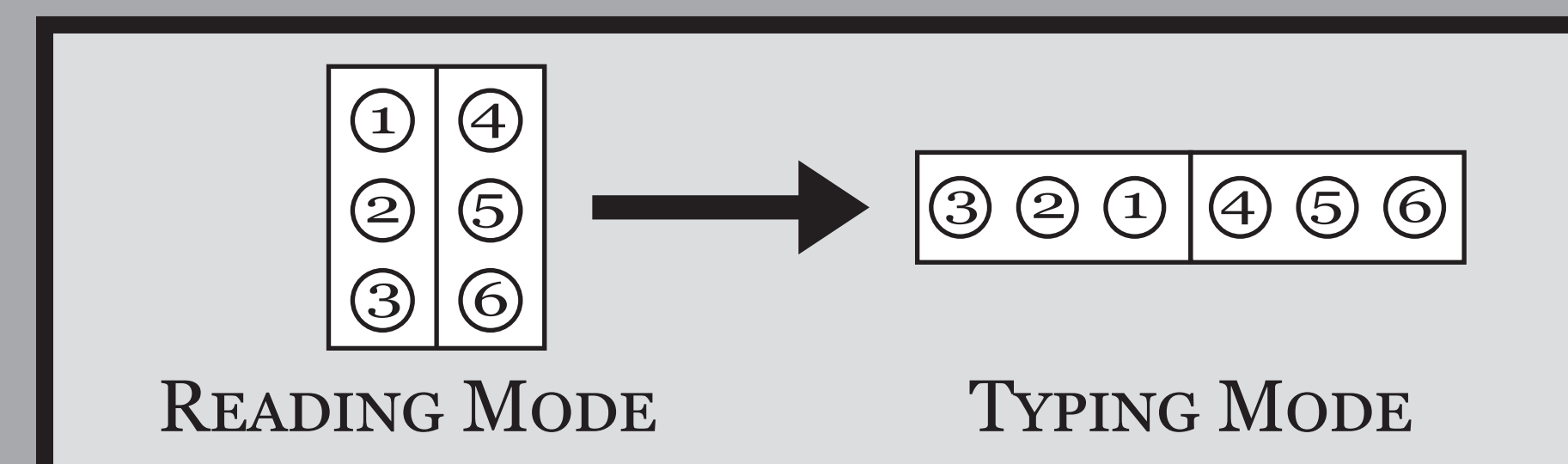
- Students need more practice interacting with braille
- Many visually impaired students fall behind in school when reading requirements are introduced
- The market lacks devices which teach both reading and typing braille since similar devices are only built to perform a single task
- Current devices for the visually impaired are bulky, expensive, or difficult to use



INITIAL DESIGN

GOALS

Design and prototype a flexible system that transitions from teaching visually impaired students how to read braille to teaching how to type braille.



The proposed device will include an audio feedback system that will guide students while using the system.

This design of the device should cater to the visually impaired, targeting primary school children.

DESIGN CONSTRAINTS:

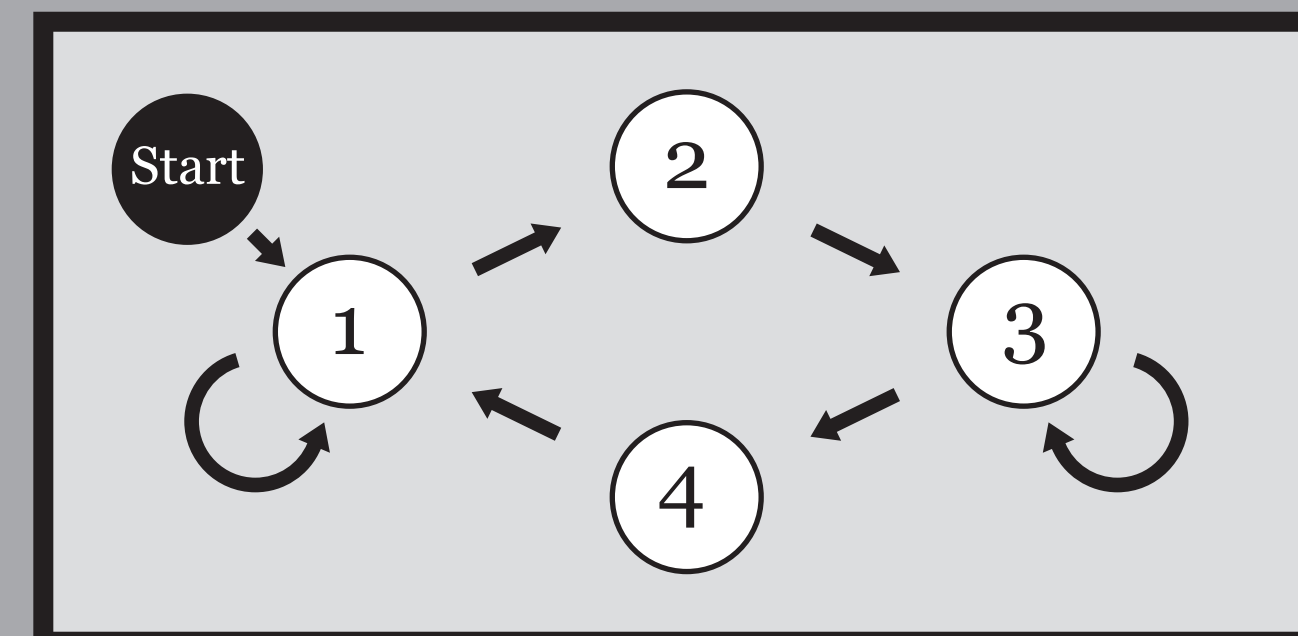
- Battery should last at least 4 hours
- Rechargeable
- Size of 6"x4.5"x2"
- Weigh less than 700 grams
- Comfortable design with no sharp edges
- Minimize cost

TECHNICAL DETAILS

FINAL PRINTED CIRCUIT BOARD DESIGN WITH MBED

- | | |
|---------------------------|------------------------|
| 1 - Text-to-Speech Module | 3 - SD Card Reader |
| 2 - Servo Header Pins* | 4 - Button Header Pins |

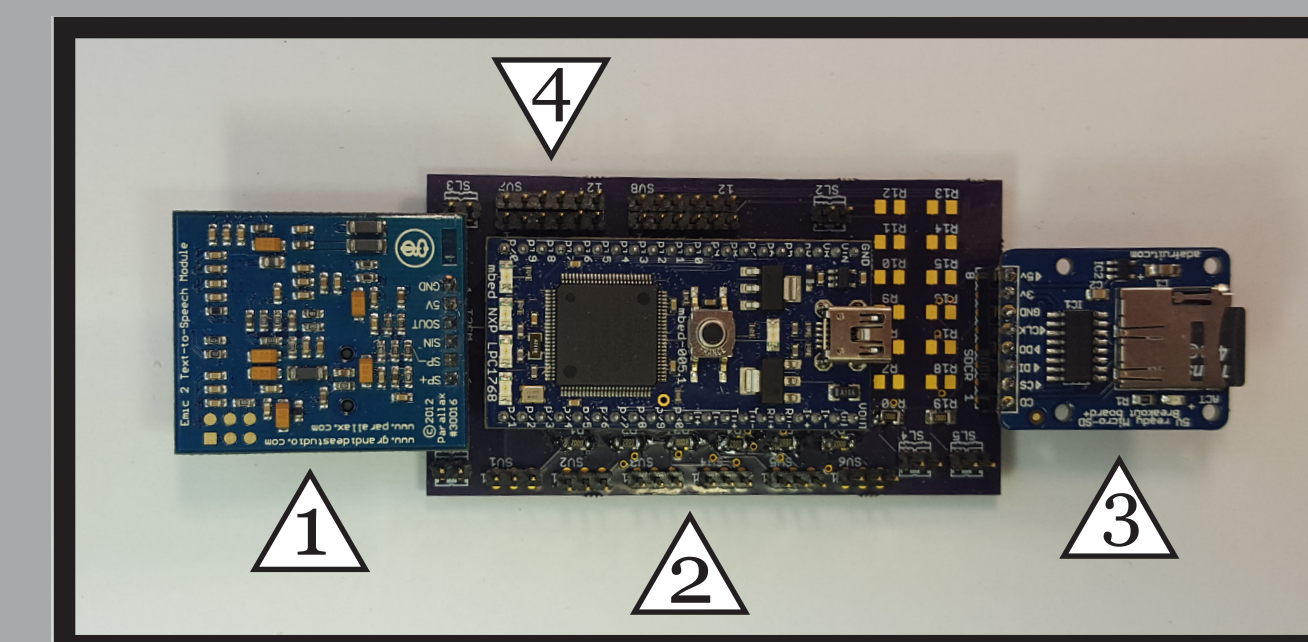
*To deal with the high current draw by the servos, we included two 5V rails. One rail powers the mbed and the other powers all other components.



CUSTOM BUTTON STATE MACHINE

Start - On reset, state machine begins by moving into state #1

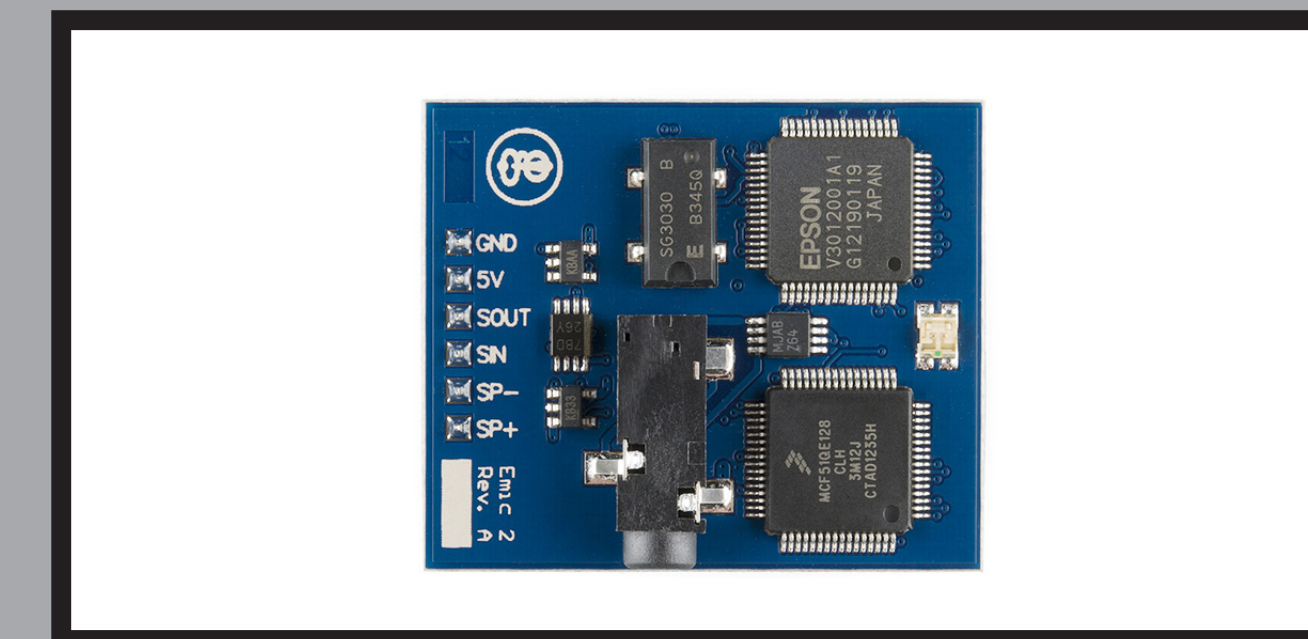
- 1 - Latching Button is up, stay here until the Push Button is pressed
- 2 - Push Button is pressed, turn servo to latch, wait until Push Button is released
- 3 - Latching Button is down, stay here until the Push Button is pressed
- 4 - Push Button is pressed, turn servo to unlatch, wait until Push Button is released



TEXT-TO-SPEECH MODULE

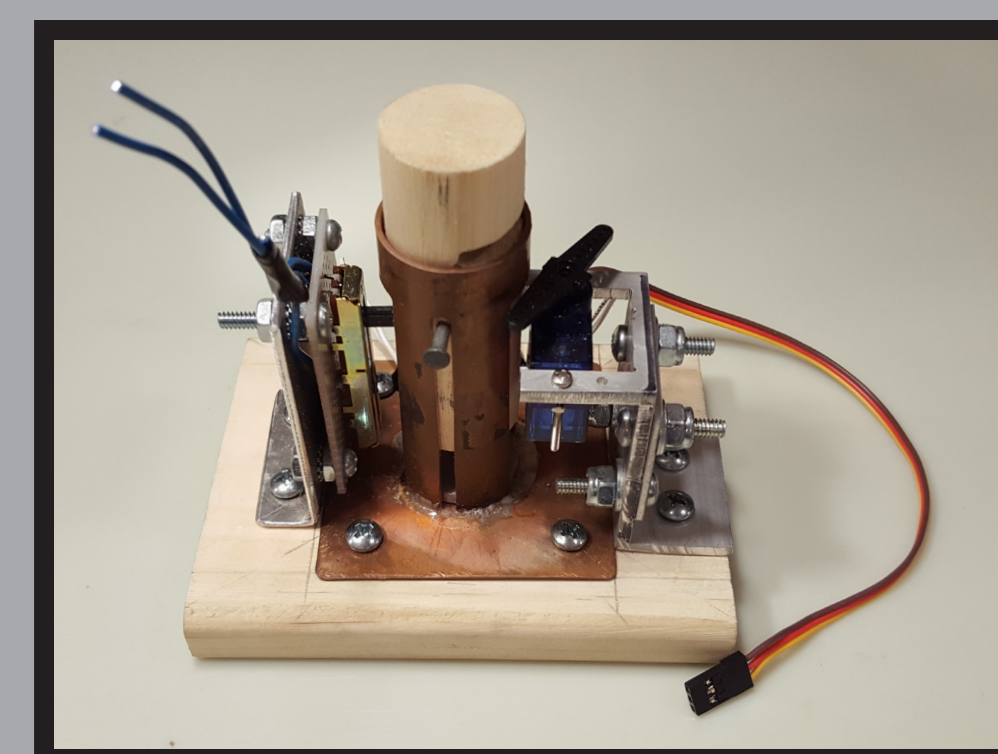
The text-to-speech module was added to improve versatility. Instead of loading sound files onto the SD card for different words and user messages, the text-to-speech module converts the current lesson plan file in real time.

The lesson plan file on the SD Card contains letters and words to be reviewed.

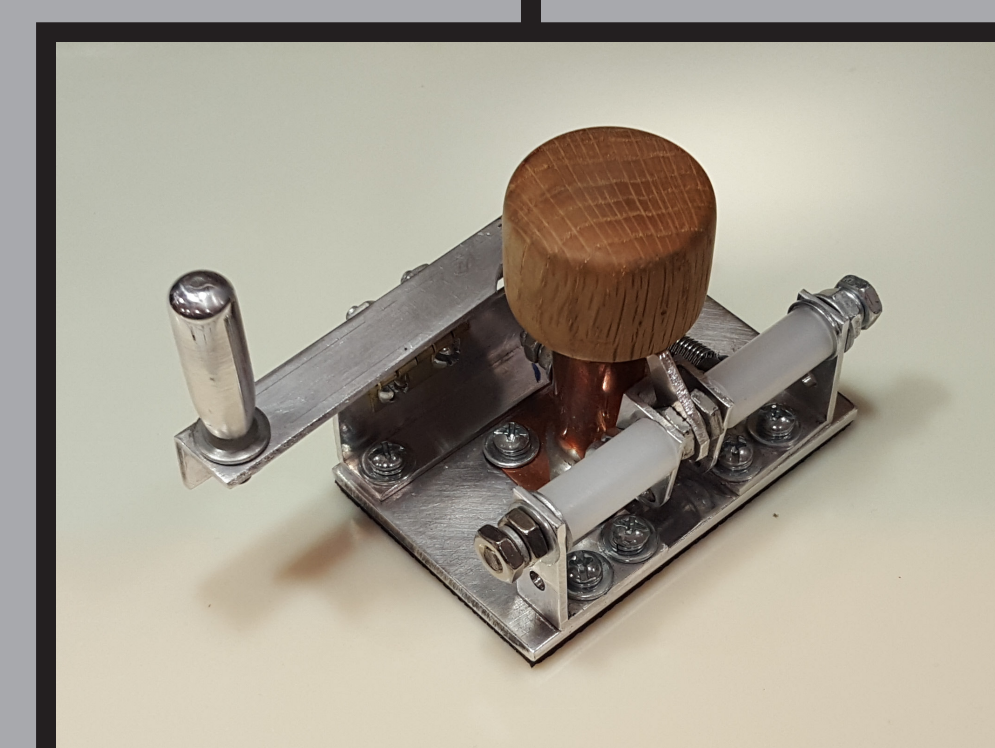
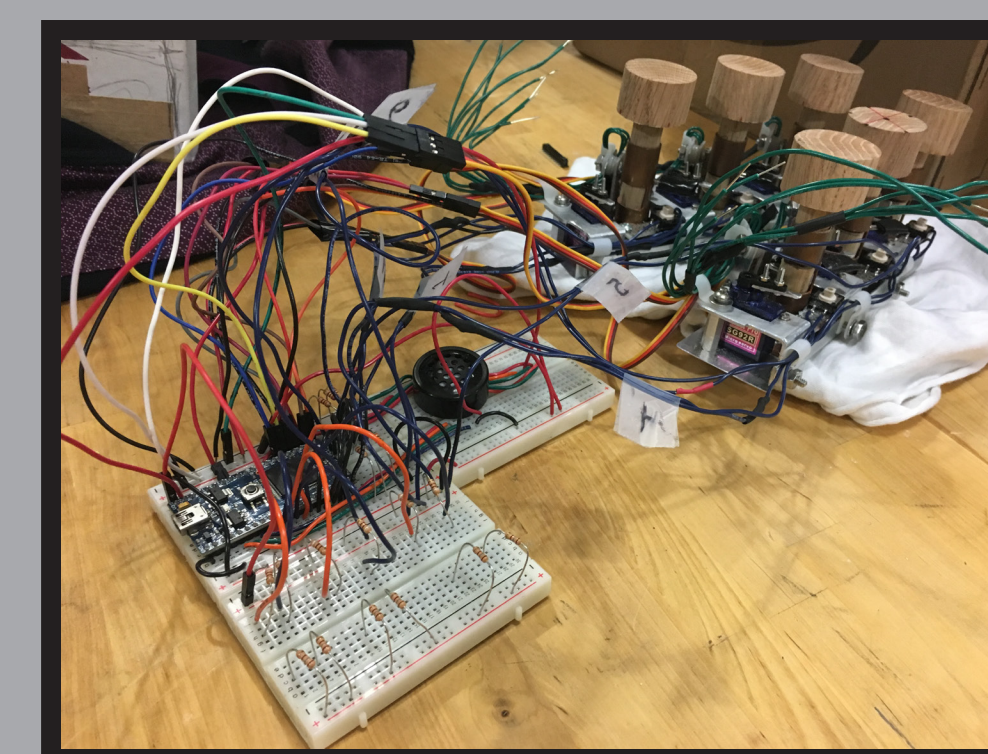


PROJECT TIMELINE

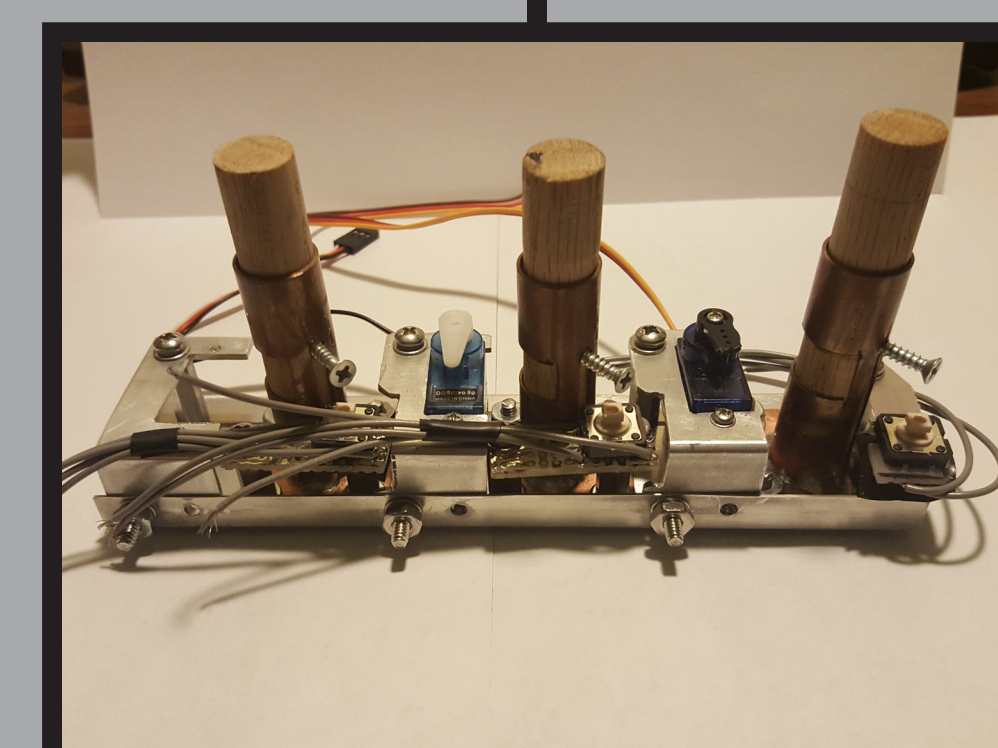
ELECTRICAL SOLUTION



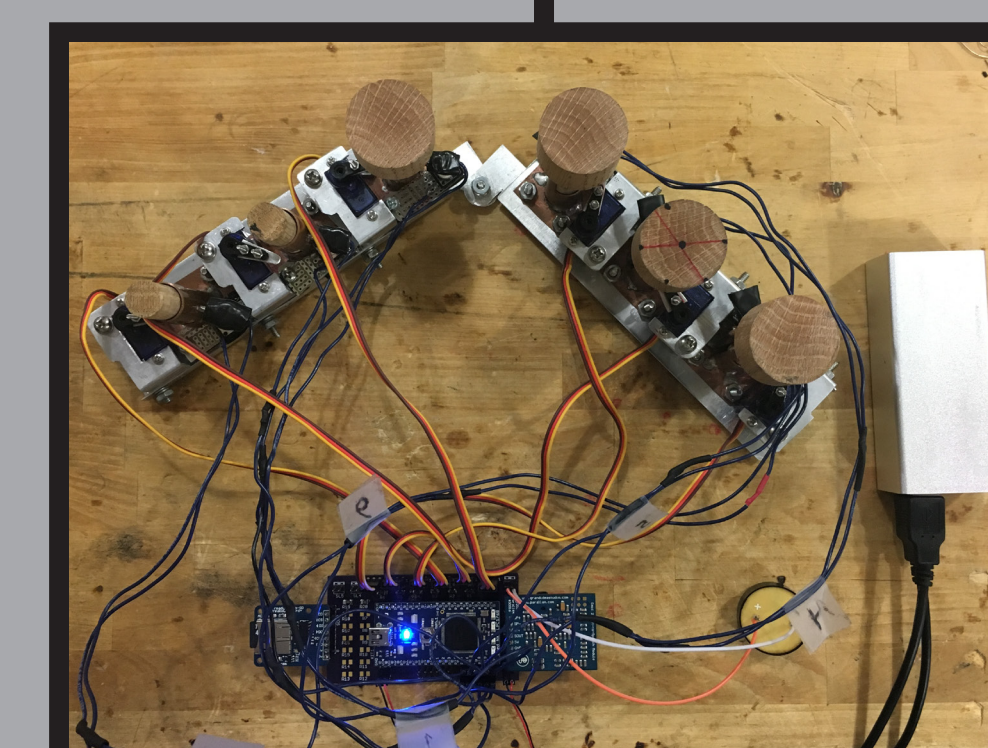
DEVICE ON PROTOBOARD



MECHANICAL SOLUTION



MULTI-BUTTON PROTOTYPE



DEVICE ON PCB

RESULTS



TECHNICAL RESULTS:

- Dimensions: 7.44" x 2.69" x 3.69"
- Mass: 3.86 kg
- Battery Life: 4+ Hours

CURRENT STATUS:

- Parses lesson files and knows the full braille alphabet
- Three different programs: Reading Letters, Typing Letters, and Typing Words
- Recognizes two different modes: Typing and Writing

KNOWN ISSUES:

- Mbed RAM is insufficient to run the full program including the text-to-speech module

NEXT STEPS

- Startup - Submitted application to the Georgia Tech Startup Launch 2018
- Microcontroller Upgrade - Increase RAM memory to be able to combine code architecture
- Mobile Application - Allow teachers to create and choose lessons
- Wifi Capability - Connect to mobile app
- Student Reports - Display student progress in the app
- Mechanics Redesign - Reduce weight, simplify manufacturing, and improve user interaction
- Lesson Development - Follow the Mangold Braille Program to improve comprehension
- Character Set Extension - Support punctuation, numbers, contractions, symbols, and other languages