Rapid Design and Assembly Challenge: MagnoBoard

Problem: Repetitive strain injuries (RSI) result from repeatedly exercising the same movements over an extended period, causing pain, numbness, and/or limited mobility. 9% of adults experienced RSI. 44% of adults experiencing RSI had to limit their daily activities, and 51% of adults who limited their ability as a result of RSI sought professional help (CDC, 2023). Besides the recreational causes, the major reason is occupational, especially factory line machine work and jobs requiring an extended period of typing.

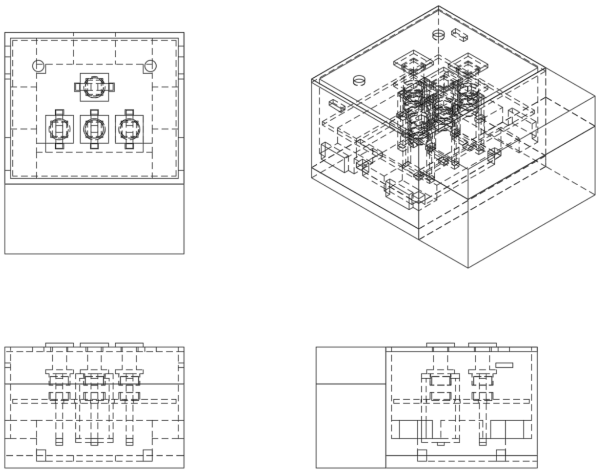
Solution: In tackling the major cause of RSI within professions with heavy demands of typing, a keyboard allowing for wide variations of typing experience can remove the repetitive trait in typing. In turn, this reduces the likelihood of developing RSI.

Project Goal: To create a keyboard with adjustable tactile forces using magnets as key switches, combined with a sonic feature, adjustable spam speed, and wrist rest.

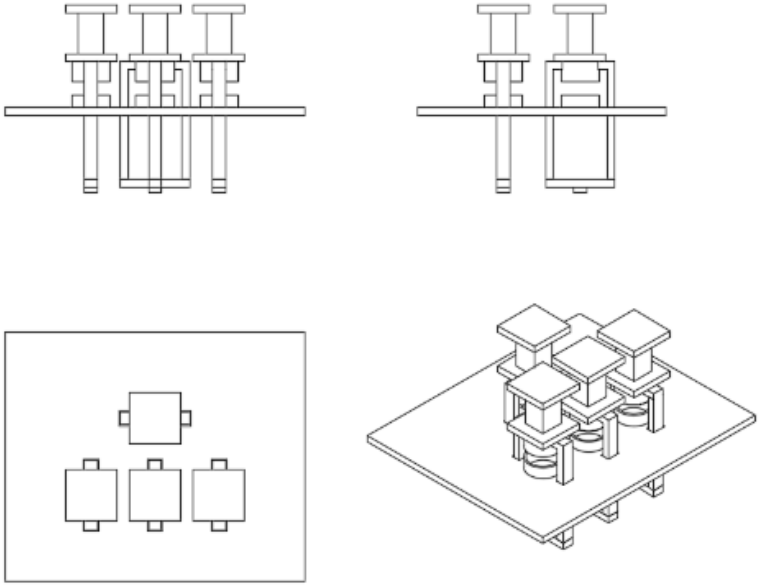
Constraint: 10 weeks, $100 budget.

Role: Head of Programming and Design, Team Lead

Design:

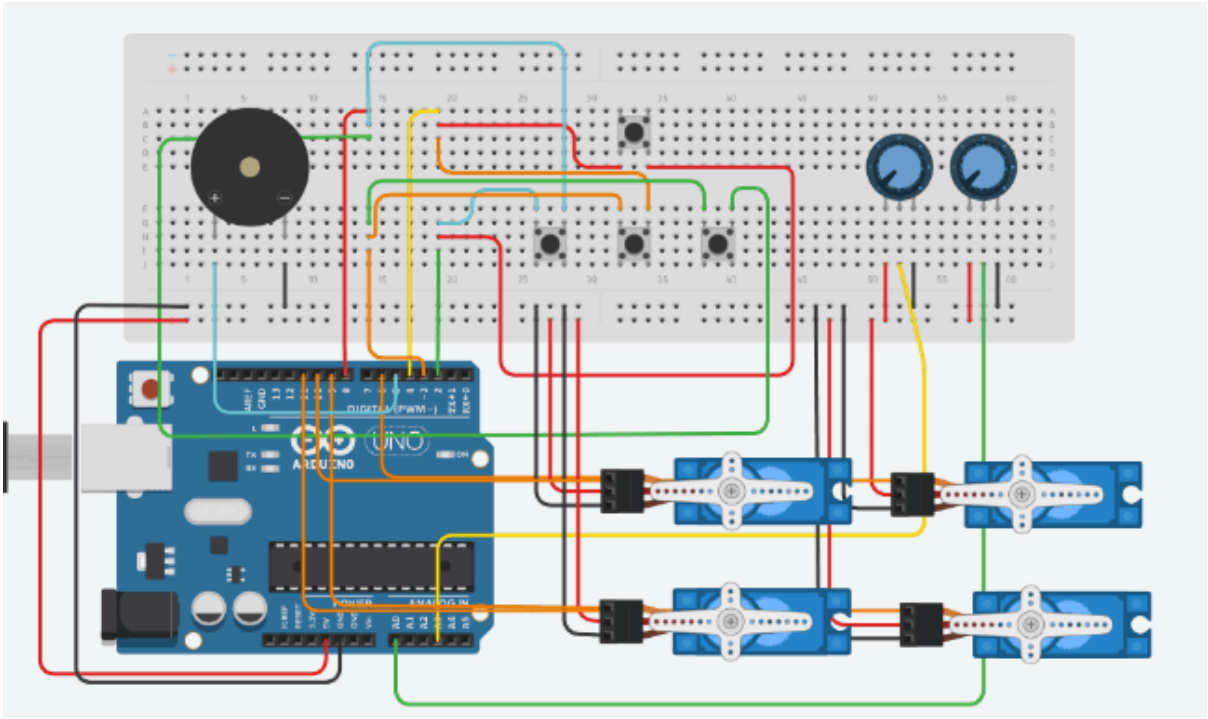


CAD Model Drawing



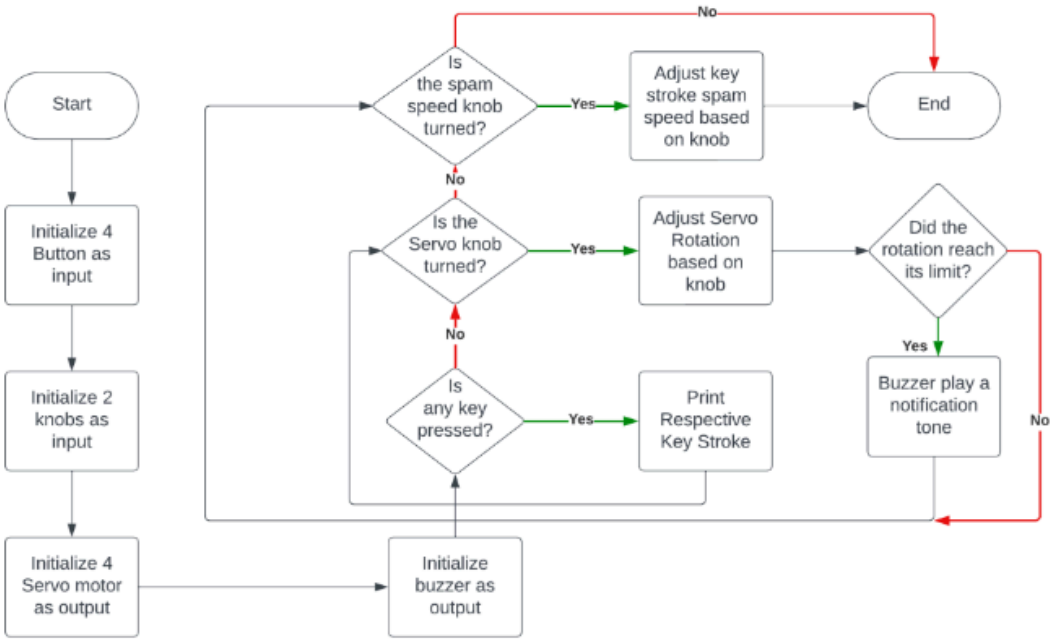
CAD Drawing of Magnetic Switch Mechanism

For each key, magnets are placed on the socket attached to the key caps and the plate with repelling sides facing each other. Since magnetic force required to press the key increases inversely to the distance between the magnets, by adjusting the elevation of the plate using servo motors, the tactile feeling can be adjusted.



Circuit Wiring of Design

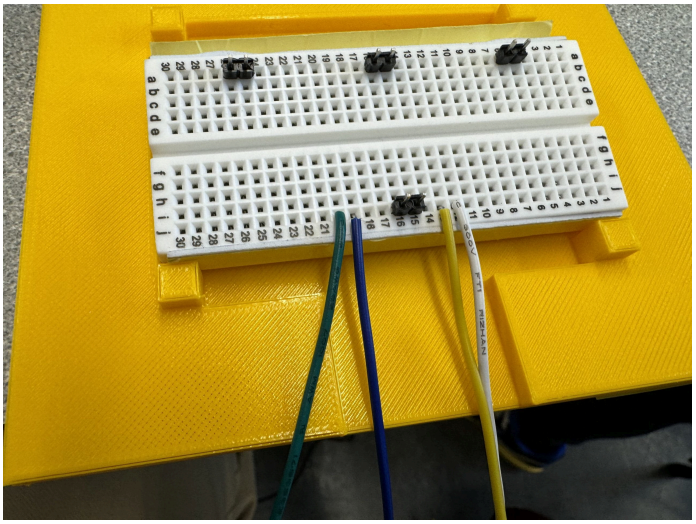
Keyboard wired in matrix to reduce pin usage if key amount was to be expanded. Two potentiometer, one controlling rotations of servo motor, one controlling the key stroke spam speed. Buzzer alarms once servo reach its maximum rotation.



Code Logic Flow Chart

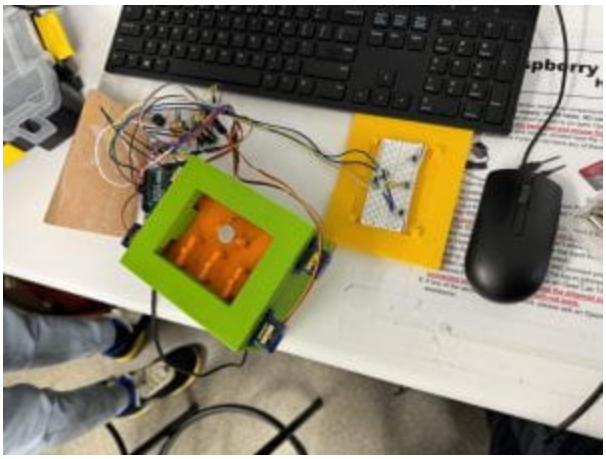
Note this is one cycle of the code, as the Arduino IDE reiterates the code within its main loop section.

Physical Prototype:



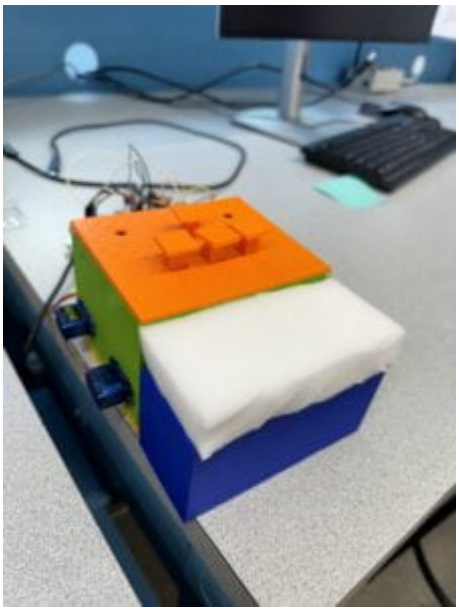
Wiring of Matrix During Production

Rather than button, the pins extending outward represented points at which the contact metal from the key cap will contact and create a connection to, in turn registering a key stroke.

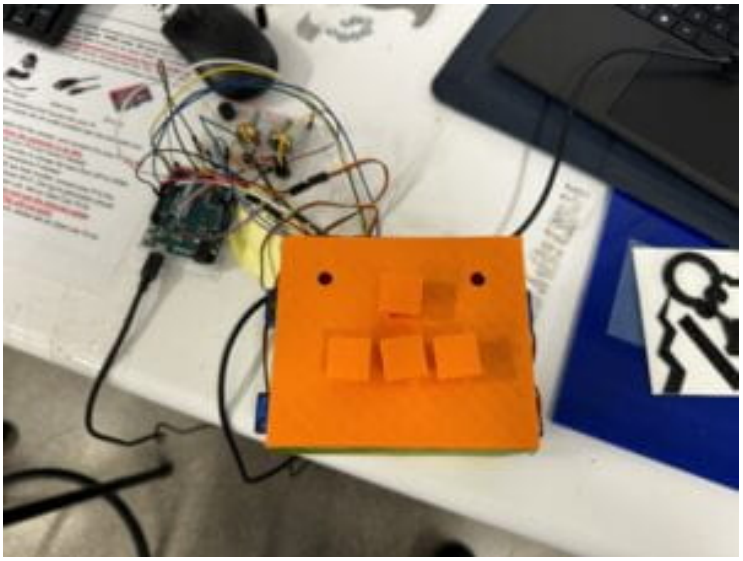


Assembly Process

Additionally, foam were purchased and used to create the wrist rest as seen in the first design image.



Physical Design Using WASD



Physical Model Top View

The full assembly are as shown, completing benchmarks A & B, three milestone demos, and commissioning. The prototype was successfully delivered and pitched to faculty members. Demonstration Video

Reference:

Garnett, Matthew F., Nazik Elgaddal, and Merianne Rose Spencer. *Repetitive Strain Injuries in Adults in the Past 3 Months: United States, 2021. National Health Statistics Reports*, no. 189, 25 July 2023, National Center for Health Statistics, Centers for Disease Control and Prevention, https://www.cdc.gov/nchs/data/nhsr/nhsr189.pdf

Designed with Fusion 360. Available at www.autodesk.com/products/fusion-360

Programmed with Arduino IDE. Available at arduino.cc/en/software/