Project Identity

Freely Adjustable and Accessible Keyboard and Arrow Pad for Client with Cerebral Palsy

Work Completed

Due to the incorrect compatibility of the cherry-mx switches, Steve and I have decided to return them in exchange for a new brand. The current brand was purchased at PI Engineering; however since they do not carry the desired brand in stock, the switches will be purchased from DigiKey.

![Figure 1: Previous switch model, without fixation pins, with LED](image1)

![Figure 2: New switch model, with fixation pins, without LED](image2)

The original switches were standard force, linear, faceplate mount and contained an LED setup. The desired switches are standard force, linear, PCB mount and do not have the holes to harbor an LED. See Fig 1. and Fig 2. above. The reason for not using the LED switches is that our keyboard design will have the LEDs positioned along the edges of the keys instead of underneath the keycaps. Furthermore, upon testing it was noticed that the LEDs were not very effective under the keycaps.

PCB mounting will now replace the original design of faceplate mounting. Though PCB mounting is more expensive, it was determined that this method would be more feasible, cleaner and aesthetically better. The switches being purchased will contain two fixation pins that will allow for clean and simple mounting that can be seen in Fig. 3 on the next page. The PCB mounting was researched on pcbexpress.com and our group is in the process of purchasing the required materials. Taking into account the number of keys, their diameter, and the preferred space between each key, we were able to determine a rough estimate of how much the PCB will cost.
Without the proper switches, we worked on designing the LED circuit. Our next step was to link several LEDs. In order to use LEDs, there must be a resistor after the voltage source, or direct voltage can damage the LED. Figure 4 displays a basic circuit tested. Using Kirchoff’s Voltage Law (KVL) and the LED requirements we were able to determine the proper resistance needed.
\[ KVL: \]
\[ V = IR \]
\[ R = \frac{Vs - Vo}{I} \]
\[ R = \frac{9V - 2.4V}{0.2A} \]
\[ R = 330\Omega \]

\[ I = \text{LED current rating} = 20mA = 0.2A \]
\[ Vo = \text{LED voltage rating} = 2.4V \]

After this circuit was created, we experimented with a potentiometer. The potentiometer was placed after the voltage source and regulated the current flowing through the LED. This will be helpful when dimming the LED lighting.

![Figure 5: LED/resistor and potentiometer design and picture](image)

The new CD drive in our computer allowed for us to install the Control Board software. With the assistance of Bill, he was able to provide us access to the program since it can only be installed on an administrative setting. I was able to read the program's tutorials and understand how the programming of a device such as a computer keyboard works. Below in Fig 6, is the screen that allows for the keyboard programming.

![Figure 6: Keyboard Program Template](image)
One of the questions I needed to learn was how the keyboard will make a lowercase versus an upper-case letter. The “shift” key on the standard keyboard can be altered in this program. Two layers, marked by green and red LEDs on the keyboard controller, are the different locations to code for upper-case or lowercase letter. It can also code for shifting to other characters.

**Future Work**

The next step is to complete the return of the originally purchased switches for the desired switches. Once these parts come in, Steve and I will be able to initiate the programming on the keyboard. This will allow for the integration of more complete circuit. The switches will be connected in series on a protoboard with the diodes and tested in conjunction with the control board. When the PCB is ordered complete soldering of the necessary components can begin. The electrical aspect of this program is the first and most important aspect to this project. Without the completion and perfect of the electronics, the keyboard is useless. Until the electronics is finalized, the external design can be constructed from the PVC received.

**Project Review**

Our project has had a slow start, but Steve and I have taken the proper precautions to ensure that the keyboard will be designed in time. Once the correct parts come in, our progress will rapidly increase. It was essential that the CD drive was fixed and the control board programming installed. To wait for the finalization of the keyboard would be too risky. It was also good to get familiar with the program and discover which settings work best.

**Hours Works:**

~6