Specifications

Freely Adjustable and Accessible Keyboard & Joystick

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Introduction and Overview

This project is being designed for a student at Hampton Elementary School in Connecticut who has cerebral palsy. The student is non-verbal and relies upon typing to communicate with his teacher and classmates, and to complete his educational tasks. His condition also affects his speed and ability to type efficiently on normal keyboards. His hand is distorted in such a way that when attempting to type a letter, he occasionally hits multiple keys at a time due to the proximity of the keys on standard keyboards. His movement can also be sporadic at times, and he often slams the keys, endangering himself and the keyboard. The position of the keyboard, horizontal to the table, also makes it difficult for him to type. Due to these factors, his speed and accuracy at typing is extremely reduced, which in turn slows down his primary means of communication.

This project is in response to the client’s inability to use a standard keyboard. The purpose of the device that is being designed is to increase the client’s ease, speed and accuracy of typing. A keyboard specifically designed to accommodate the restrictions imposed on the client because of cerebral palsy should fulfill this purpose. The finished device will contain far fewer keys than the average keyboard. Only the alphabet and number keys, along with certain required keys such as “enter” and “space” will be included in the keyboard. All the other symbols that require keys on regular keyboards will become secondary keys, that can be used by pressing shift and main keys. Having fewer keys on the keyboard will allow for larger keys: this will make typing easier for the client. The keys will also be made more durable, accounting for the uncontrolled hand movements of the client. Using a stand, the keyboard will be raised vertically (orthogonal to the desk). The client specifically requested this, because the distortions in the hand make it much easier to reach out than down to press keys.

A joystick will also be implemented in the design, to take the place of a mouse. The condition of the client makes use of a mouse practically impossible. Certain joysticks, however, can be used, and because of this, a joystick will be used in our design.

The finished device will look very different from the average keyboard. It will contain fewer keys, and these keys will be much larger than standard keys. They will also be durable, able to withstand much force. The keyboard will also be raised up, positioned vertical to the desk. The joystick will be positioned around the keyboard, and will work as a computer mouse. The keyboard and the joystick will connect to the computer through Bluetooth. 

Realistic Constraints

There are many factors that need to be taken into consideration, which include: economic, environmental, sustainability, manufacturability, ethical, health, safety, social and political. Economically, the project must be able to fall within the allotted budget of $750.00. The device must be able to operate under normal classroom conditions (temperature and atmospheric), and be able to withstand storage conditions as well. The client is in 5th grade right now, and this device should be made to last throughout his whole education. This means that a minimum of seven years is required, and it should be able to last much longer. The device must not be too complex that it is unable to be manufactured within the budget’s limits. The design should be simple enough that a
team of two, with only limited machine shop training will be able to manufacture it successfully. The device must also be durable enough to withstand mild abuse, so no small parts can break off and cause injury to anyone around. The electronics must also be manufactured well so as to pose no electrical hazards. In addition to these constraints, the client has requested that the device should look “cool”, so he doesn’t feel awkward when using it in the classroom. This requires that the finished device must not only work, but be aesthetically pleasing as well.
Technical Specifications

Electrical Parameters
- Power: 9V Batteries
- Switch Type: Rubber Dome
- Lighting: Backlight
- Voltages
- Impedences
- Gains
- Power Output
- Power Input
- Ranges
- Power Consumption

Joystick
- Input: 5 V DC or 10-30 V DC
- Output: Max (+) Travel: 4.0 V DC
- Max (-) Travel: 1.0 V DC
- Centered: 2.5 V DC
- Output Impedance: 220 OHMS

Mechanical Parameters
- Connector: Bluetooth
- Key Size: 25mm (l) x 25mm (w) x 10mm (h)
- Keyboard Size: 0.6m (l) x 0.3m (w) x 0.03m (h)
- Stand Size: Base: 0.15m (d)
- Height: 0.1m - 0.3m

Joystick
- Travel: On-Axis ± 20°
- Between Axes: + 27°

Environmental Parameters
- Operating Temp.: 0° to 50° C
- Storage Temp.: -20° to 60° C

Joystick
- Temperature: -40° to 85° C
- Weather Resistance: Control is weather tight