Project Statement

Freely Adjustable and Accessible Keyboard and Joystick for Client with Cerebral Palsy

By:
Stephen Heussler
Nolan Skop

Client Contact:
Miriam Kurland (speech pathologist)
Hampton Elementary School
380 Main St., Hampton, CT 06247
(860)455-9409
Statement of Need

Cerebral palsy is a neurological physical disability affecting the basic motor functions of victims, requiring assistive devices to perform basic everyday tasks. It begins at the fetal or infant stage, occasionally resulting in death. In most cases the need for a wheelchair is essential. Many people with this disorder have limited control over their appendages. Hand and arm movements can become distorted or unusable due to neuromuscular weakness. Walking becomes virtually impossible for most and daily tasks that the average person takes for granted, such as using their hands to grab an item, becomes extremely difficult. Children at school have it worse because writing or use of the computer becomes problematic. Typing on a keyboard is arduous when the hands are twisted almost 180 degrees and the fingers are bent in an awkward position. Most patients cannot use a single finder to press the keyboard, resulting in a slamming of multiple fingers when attempting to type.

Using a keyboard is something that is undervalued by the typical person, but is very difficult for most people with cerebral palsy. Motor control is very limited, and the actual position of the hand can be altered, forcing it into an unnatural position. Trying to type using a hand that is twisted and distorted is a complex challenge for people with cerebral palsy. This can be very frustrating, as they cannot type nearly as fast as a normal person. The position the arm is stuck in can also put much strain on muscles supporting the arm. Because of this, typing for an extended period can become uncomfortable and eventually unbearable for a person with cerebral palsy.

Basic Preliminary Requirements

The client involved in this senior design project is a ten year old student at Hampton Elementary School. His degree of cerebral palsy includes a complete lack of lower body movement and his upper body has limited control. The child is also unable to verbally communicate and has difficulty in writing. He mostly relies on a computer keyboard to convey his thoughts, however with his spastic condition, this is not easy. The student is slow typing and struggles on the average keyboard because the contorted fingers hit undesirable keys when reaching for a specific letter.

The position his hand is stuck in makes it easier for him to type if the keyboard is almost orthogonal to the desk, although his present keyboard cannot be raised up to a vertical level. Also, his motor control is limited; leading him to slam the keys on the keyboard, which eventually causes damage to the keys. By the end of the day, his arm becomes so tired from typing that his control is worsened and he is only able to type with his thumb. A keyboard is needed that can be positioned in a way that is desired by the client, eliminating stress on his hands. The keys need to be made bigger than average, and also extremely durable, so they are able to handle the force of his typing. Removing the keys
and replacing them with touch sensors is another option that could be utilized. Providing some sort of support for the client’s arm would be another way to reduce the stress on his muscles. The main goal of the keyboard is to create a device that is suited to the client’s needs, so the speed and ease of typing is dramatically increased, while excessive strain on the muscles is eliminated.

A current product available for patients with disabilities is called FrogPad, which is developed by FrogPad Inc. This is a keyboard that is designed for use with only one hand. The keys are big, but each key contains 4 symbols, which will not meet the needs of the client. It also cannot be positioned vertically and its buttons are not durable enough for his condition.

Regular keyboards cannot be used because the keys are too small, and as previously mentioned, they cannot be positioned vertically, which is required by our client.

Limitations

In order to fit the needs of the child, there are certain limitations placed on the device. The keyboard must be wireless, light and appropriately sized. A wired and bulky keyboard creates a difficult setting when transporting it from each classroom. In addition, the aesthetics of the keyboard are important. The student wants to fit in with the other children, and a keyboard that makes him stand out in a negative way can cause emotional damage. It must be simple to use as well. In other words, the numbers and letters can be made larger, and buttons that are mostly obsolete or perform unnecessary functions can be eliminated.

Other Data

The client is a student at Hampton Elementary School located in Hampton, CT. The staff assists him at this school includes a physical therapist, occupational therapist, speech pathologist, special education teacher, and other classroom teachers. Every Wednesday at 12:30, this team organizes a meeting to discuss the client’s situation, progress or future plans.

Questions

When researching this project, certain questions arose that need further investigation. The arrangements of the letters on the keyboard are yet to have been decided. The design team needs to determine which arrangement (standards QWERTY format, or an A through Z) should be applied depending on the client’s needs. The precise keys that will be maintained, eliminated or added to the keyboard is another question that must be answered. It is also necessary to observe the client’s exact typing method, so the keyboard can be designed accordingly.