



COMPUTER INPUT DEVICE FOR INDIVIDUAL WITH MUSCULAR DYSTROPHY



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Abstract

Muscular Dystrophy is a strongly disabling disease that can leave its victims crippled. The worst part of the disease is that it doesn't affect your mind, so those who suffer through feel that they are trapped in their own body. Our client still has enough motor control to work a computer input device, but not efficiently or well. The goal is to build a device to improve the accessibility of the computer input device for the client. Our system must also be setup quickly and without confusing components. We decided that a small joystick would be best to control the on-screen cursor and an adjustable platform would be used to support the client's forearms while using the device. Future work includes designing a left hand clicking device, finalizing the arm support, and finally buying and customizing the device to optimally suit our client's needs.

Problem Definition

- Decrease setup time
- Increase sensitivity to account for diminished motor skills of client
- Complete control of computer to be done with maximum 1cm range of motion
- Improve computer access by any and all means
- Emphasis on adjustability for quick and accurate set up
- Durable enough for daily use

Background Information

Our client has advanced Muscular Dystrophy. He is bed ridden and, to communicate with others, can only speak with the help of the respirator. Therefore, communication with the outside world is via his computer. Unfortunately, his disease took a turn for the worse last year and he is now unable to use a keyboard. Towels prop up his forearms because he is unable to lift his wrist or elbow enough to resist gravity. He has resorted to moving a trackball with a pencil eraser, but even this is hard and slow. What the client can do is move three fingers on each hand. With his right hand he grips the pencil and is able to make circles just greater than 1cm in diameter.



Current Device

- Trackball and pencil for cursor movement with right hand
- Multiple movements required to traverse screen
- Two clicks with left hand
- On-screen keyboard
- Setup time up to 30 minutes
- Great precision required
- Both hands set up simultaneously

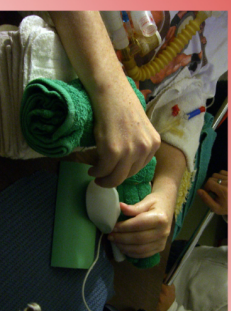
Design Criteria

- Provide comfortable and safe wrist and forearm support
- Quick and easy set-up
- Connect to home computer via USB
- 1-cm of movement must reach entire screen
- Finger posture on buttons and joystick easily maintained

Final Design



- Mouse Click (Left Hand):**
- Two button mouse click for optimal accessibility
 - Adjustable base angle and height
 - Left and right hands separate for easy setup
 - USB interface



- Cursor Movement (Right Hand):**
- Modified PC game controller
 - Attached pen with joint for better operating angle
 - Adjustable base angle and height
 - USB connection for simple interface with computer



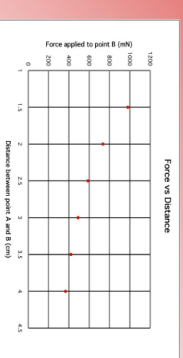
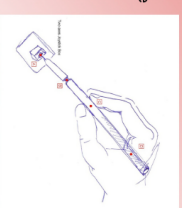
Armrest:

- PVC and tempurpedic foam
- 10" length
- Edges and corners sanded for safety
- Adjustable height for faster setup



Testing

In order to analyze the mechanical properties of the final design, the force required for the client to move the joystick was measured by setting different distances between the points shown in the figure. The distance between A and B was set to 3.5 cm, and force required to move the point B was about 420 (10-3)N and torque was calculated to be 14.7 (10-3)Nm. From this data the graph was constructed.



Future Work

- Fine tune software settings for sensitivity
- Adjust height and angle of mouse and joystick to final positions
- Add additional wrist support for forearms

Acknowledgements

- John Webster Ph.D., Advisor
- Mary Sesio Ph.D., PT, Client
- Richard Kuntz, Patient