To: Professor David Chesney

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Subject: Section 002: Project Brad, Mobile Motion Capture Mouse

Summary

A group project to create a mobile system for Brad to be able to more effectively use other workstations other than his own. Included would be a USB connected video camera with software to track his hand movements to control a mouse. On his hand would be a glove that would allow him to click the different mouse buttons with finger taps. This should allow for a more effective use of his time if he is at other workstations.

Introduction

Brad suffered from an accident many years ago that left him in a state which only allows him to use his left arm and hand effectively. This also caused his speech to be reduced to a word every one or two seconds. Due to the accident, he now uses a motorized wheelchair for travel and scribes for much of his coursework. It is assumed that Brad does not do much, if any work, on workstations other than the one located for him in the Francis-Xavier Building.

Motion tracking of a glove can hopefully solve this problem. This system would replace the need for a mouse that may be awkward to use given his capacity to only use his left hand. The glove would allow the use of clicking by pressing individual fingers together with the thumb allowing him to use an onscreen keyboard without the need for his specialized one handed keyboard and mouse. Brad would then have access to many more computers than his own workstation and would heighten his experience at our university.

Pre-Work Questions

These questions were generated after both interviews and were unable to be answered before submission.

- Would Brad be comfortable being able to put on a glove that fits loosely or snuggly by himself?
- If the glove did not work, would he be able to click a touch screen to register the button operations?
- Does Brad have sufficient room near the wheelchair's joystick to move his hand around without hitting anything?

- If Brad can find a computer to use, will he have the capacity to set everything up by himself if he is alone?
- Brad has said that he has excellent fine motor skills in his left arm and hand, but how much effort can be exerted before his wrist or arm would become fatigued?

Solution

This solution will focus on the assumption that the glove will work. The software would need to work in such a way that it could be calibrated with little to no effort. This would be achieved with Brad only having to move workstations and placing the camera in a similar place each time, otherwise additional calibration may be needed. The software would need to be activated upon the video camera being plugged into the computer.

Specifications

This system would involve a video camera, a left-handed glove, circuits, and a software application to interface as the mouse. The glove would need to be made of a breathable material that would prevent any excess sweating by continued use or from a warm room. The center of the glove would be the best place to measure and the software should be able to either focus on a specific point with a ball (such as on a computer generated imagery suit) or would find the edges of the glove and take the average of the position to find the center. The software would need to find the vertical and horizontal average to find the center of the glove with this approach. Other systems that capture motion have had success using C++. This will be a good starting point with the immense libraries and tools available for development. The mouse control would be written in Python. Currently, there are libraries dedicated to mouse control in Python and would be a starting point for the software.

The glove would consist of some small circuits and a long lasting battery to identify any finger taps. This would also need some sort of wireless signal sender in the form of either Bluetooth, RF, or nano-wireless technology. The receiver would need to be attached to the end of the video camera for use on a single USB port and to make the system more portable. The hardware should either be easily removable for transfer between similar gloves or be embedded within the glove to prevent breakage.

Work Distribution

Group members would need to work on the motion capture software first, proceeded by the hardware, and finishing up with the mouse control. The motion capture software should be the most challenging section and all group members should be involved with writing the code.

Once that is working, one member should continue working on the motion capture, two should move onto the hardware, and the last should start on the mouse control. If the any section is finished early, the group should just focus on anything that needs to get done.

Image courtesy of Trim Fit Lite and Amazon

Conclusions

This system will allow Brad access to computers other than his workstation by using motion capture technology and an onscreen keyboard. This removes some problems of not being able to access computers other than his own and will improve the quality of his experience at our University. The system will be mobile and has minimal setup allowing Brad quick access when he is on the go. This system also can be integrated for the other hand and possibly feet allowing users with other disabilities or non-touch enabled computers without a mouse and keyboard to have access.