

Hands-free Computer Control for 6.835 Term Project

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Problem

For many tasks that involve a computer, the user must transfer hands from something else that they are doing or from keeping their hands still to the keyboard or mouse to control the computer. For example, when you are reading a PDF on your computer, your hands are often stationary while you are reading. If you are doing homework, you are often reading on the computer screen while your hands are busy writing. However, there often are times when you must lift your hands from your other task to control the computer, which is distracting.

The goal for this project is to allow for hands-free control of your computer. If you are doing homework, you should be able to switch tabs or windows without lifting your hands. If you are reading a PDF, you should be able to scroll down and easily continue reading. The details are still undetermined, but my initial idea is that the user can use both speech commands (e.g. “switch windows” or “scroll down”) and head tilts (e.g. a sharp nod to scroll down).

Background

There would be three main components of this system: the speech recognition component, the head tilt analyzer, and the component that controls the computer.

Using speech commands to control computers is fairly common. All common OS's come shipped with ease of access tools that include using speech recognition. Furthermore, there are multiple speech-to-text libraries that allow for implementation of this component.

The head tilt analyzer would be slightly more complex. There have been many face detection algorithms recently studied, as reviewed by Zhang and Zhang. Furthermore, there has been previous

research by Waber, Magee, and Betke that indicates that it is possible to use head tilt to control a computer. This project would implement a similar algorithm to obtain head tilt control.

Controlling the computer with a program has been implemented, and is available by use of classes like `java.awt.Robot`, documented here:

<http://docs.oracle.com/javase/7/docs/api/java/awt/Robot.html>

Planned Implementation

Since Java offers easy manipulation of computer inputs and there exist libraries in Java for speech recognition and face detection, I would program this in Java. As was mentioned, there are three main components: the speech recognition component, the head tilt analyzer, and the computer controlling component. This offers an easy architecture for my implementation. I plan to make those three components in each of their own classes with another overarching class that runs the program.

My largest concern with this project is that it is too small of a project. I seem to only be implementing other libraries/algorithms and combining them together in a single application, and I don't know if that is adequate work for the final project. I would appreciate feedback on that aspect.

Thank you!

Resources needed

I would only need a webcam, a microphone, and a computer. Luckily, these are all provided on my own personal computer.

Planned Experiments

Since this is mostly development of an application, I would perform usability studies. I would find some test subjects and ask them to perform some basic tasks using the application. I would time

the subjects' actions as well as observe how easily they use the application. This could then be compared to the performance without using the application. In addition, I would interview the subjects, asking them to compare completing tasks without using the application to completing tasks while using the application.

References

Waber, Magee, and Betke. "Fast Head Tilt Detection for Human-Computer Interaction".

<http://www.cs.bu.edu/techreports/pdf/2005-023-head-tilt.pdf>

Zhang and Zhang. "A Survey of Recent Advances in Face Detection".

<http://research.microsoft.com/pubs/132077/facedetsurvey.pdf>