

A Web Browser for People with Quadriplegia

Hunter Larson and James Gips

Computer Science Department, CSOM
Fulton Hall 460
Boston College
Chestnut Hill, MA 02467

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Hunter Larson

James Gips

Computer Science Department, CSOM
Fulton Hall 460
Boston College
Chestnut Hill, MA 02467
USA

hunterlarson@yahoo.com

james.gips@bc.edu

Abstract

In response to the desire of young people with severe physical disabilities to access the web and their difficulty in using existing browsers with eye and head control access technologies, a new browser, called WebForward, was developed. The problems encountered using traditional browsers are reported as are the features of WebForward designed to overcome the problems. The browser has been used extensively by seven people with severe physical disabilities.

1 Introduction

The Web holds tremendous potential for people with quadriplegia. It promises a whole new world with opportunities for entertainment, information, education, communication.

The use of a traditional mouse or touchpad or trackball or joystick requires a certain amount of manual dexterity. Depending on their physical capabilities, many people with quadriplegia use a pointing device that is controlled by movements of the eyes or head. Several devices of these types are available. We have developed two at Boston College.

EagleEyes (www.bc.edu/eagleeyes) allows people to control the mouse pointer by moving their eyes. With EagleEyes five electrodes are placed on the person's head around the eyes. EagleEyes works by measuring the person's horizontal and vertical EOG (electro-oculographic potential), which is proportional to the angle of the eyes in the head.

The Camera Mouse (www.cs.bc.edu/~gips/CM, www.cameramouse.com)¹ allows people to control the mouse pointer with small movements of the head. The Camera Mouse uses a USB video camera to track a feature on the head, for example the tip of the nose or the cleft of the chin.

These technologies, as do several others on the market and in development, work as a general mouse substitute in a Windows computer. Mouse clicks are generated using "dwell time". That is, if the mouse pointer is held in a certain small region of the screen for a certain period of time then

¹ The Camera Mouse technology has been licensed from Boston College by CM Solutions, Inc. of Austin, Texas. JG has a minor financial interest in CM Solutions.

a click is generated. Since the technologies work as general mouse substitutes, they work with standard Windows application software, for example Internet Explorer and Netscape Navigator.

2 Problems Encountered

When people with quadriplegia actually tried to browse the web using Internet Explorer and Netscape Navigator with these eye and head control access technologies, several problems became apparent:

- The buttons on the screen are small and people lack the fine control necessary to use them by moving their eyes or head. For example, the scroll buttons are very small. Even standard buttons like Back and Home are too small to be used easily.
- The links can be very close together on the page and people can inadvertently click on the wrong link.
- While people are looking through a new page they may inadvertently click on a link.
- Some of the operations in the web browser may require more than moving the mouse and issuing a single left click.
- Many of the people have vision problems so they cannot distinguish the text in a web page.
- Most of the people with whom we work are not strong readers and would prefer to have the contents of the web page read to them by the computer.

Often people found that after a very short while they had inadvertently pressed several links and found themselves on an unknown and unwanted page with no easy way to get to where they wanted to be. Even the back button was relatively small and in a relatively inaccessible location in the top left corner of the window. Typing a web address with an onscreen keyboard would be very difficult and tedious.

3 Various Approaches

There are several possible approaches to this problem.

At the operating system level, Microsoft does provide some useful accessibility programs with Windows XP, including a magnifier program for people with vision problems, a narrator program for reading text aloud and an onscreen keyboard. All are useful, but taken together do not solve the problems.

At the website level, the Web Accessibility Initiative (www.w3.org/WAI) provides important guidelines for designing and developing websites for use by people with disabilities. These guidelines do not address all of our concerns and of course the guidelines are strictly voluntary. Few websites conform to the guidelines.

4 Our Approach

Our solution to these problems was to design and implement a new browser. WebForward is a web browser specifically designed to be used with head and eye pointing devices instead of with a mouse. WebForward is implemented in Visual Basic and uses the basic browsing engine in Internet Explorer.

In answer to the above problems, WebForward features:

- A few, large buttons, such as a Home button, a Back button, and Up and Down scrolling buttons. The buttons have both text and icons.
- “Do you really want to go to this link?” with large colored Yes and No buttons whenever a link is clicked.
- A customized Home page for each user with a few favorite linked sites in large type.
- A simplified design for the browser that is run by clicks on buttons and links.
- A button to progressively enlarge the text on a page.
- Use of the Microsoft text reader to automatically read the text in a webpage. A single large button on the browser controls the reader. The text that is being read is displayed in a box.

5 Use of WebForward

Initially three people tried WebForward at our facility at the Campus School at Boston College. The Campus School is a non-residential school for children with severe disabilities.

The first person to test WebForward is a 20 year old student with severe cerebral palsy. He uses EagleEyes to access the computer. He was excited about the web and would look at sports sites when friends and family would take control using the mouse. But he was frustrated using Internet Explorer. In the first trial, the student showed facial approval for WebForward (he cannot speak) and spent twenty-five minutes using the software to explore the web with little frustration, in comparison to the maximum time of five minutes he previously had spent using Internet Explorer. After successive runs with the browser he now spends 50 minutes or more without breaks in navigation.

The second user was a 26 year old young man with traumatic brain injury from an automobile accident. He has little voluntary movement and cannot speak. He used EagleEyes to access the computer. He became a big fan of WebForward. He was moved to an institution 100 miles away and his use of EagleEyes and WebForward has stopped.

The third user is a 22 year old man with severe cerebral palsy. He uses EagleEyes to access the computer. He successfully uses WebForward. He is especially interested in information pertaining to sports.

After initial trials, we sent a copy of WebForward to the Holly Bank School in West Yorkshire, UK, for further testing. The next step after testing at our own facility is to send it to a facility where we cannot personally intervene. The Holly Bank School (www.hollybanktrust.com) is a residential school for young people with disabilities. Holly Bank also uses EagleEyes and Camera Mouse.

Here is the report of Debbie Lees, the head of Assistive Technology at Holly Bank, on WebForward:

[A] aged 19 who has CP and uses non verbal communication. A has been using EagleEyes / Camera Mouse for over 4 years and is by far our most experienced user. A has used Internet Explorer in the past with limited success. Prior to A using WebForward a number of sites will have been placed in My Favourites so he can access them easily. A will then be asked to go and find information regarding a particular subject. E.g. A is planning a visit to Bradford City Football Club, so he was asked to go to the site and find the address so he could write to them. He then copy types the information into a word processor. A has had more success with WebForward than Internet Explorer because a) he can change the size of the text if he chooses and b) it reads the page to him. A can access all the buttons in an appropriate way and can be left unattended for periods of time to work independently.

[B] aged 17 again has CP and has some verbal communication. B has been using Camera Mouse for about 18 months and finds WebForward particularly useful because he has limited literacy skills and his vision is questionable at times. B uses WebForward to access an Online course by the BBC which is complemented by TV shows. B has some success, however he often needs help to get to some areas and struggles to hit the read button and the larger and smaller buttons because of their position. B isn't able to work independently yet.

[C] aged 18, CP and is a non verbal communicator. C has been using EagleEyes / Camera Mouse for about 3 years. C tried the BBC Online course but didn't like them so he uses WebForward mainly for accessing radio stations and watching live shows. C has limited literacy skills so find the read facility useful, however he finds the voice highly amusing and tends to miss most of what is said the first time because he laughing too much, so he has to listen again. C cannot reach the larger / smaller buttons, but can be left for short periods of time to work independently. We also use the confirm link option with C.

[D] aged 18 who has Duchenne Muscular Dystrophy and uses verbal communication. D has only been using Camera Mouse for about 9 months and achieves amazing results. D uses WebForward occasionally but complains that it isn't fast enough! However D can access all the buttons and can be left to work independently, provided games are not available on his favourite list !!!

Our goal is to enable as many people with quadriplegia as possible to use the web. The software is available free of charge from the authors.