Toward a New Algorithm for Hands Free Browsing

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Abstract

The role of the Internet in the life of everyone is becoming more and more important. People who usually use the internet are normal people with use of all physical parts of their body. Unfortunately, members of society who are physically handicapped do not get access to this medium as they don't have the ability to access the internet or use it.
The Integrated Browser is a computer application that browses the internet and displays information on screen. It targets handicapped users who have difficulties using a standard keyboard and/or a standard mouse. In addition, this browser, unlike the conventional method, works by responding to voice commands.
It is characterized as an economical and humanitarian approach because it is handicap-friendly and is especially helpful to those who cannot use their hands. The Integrated Browser is a state-of-art technology that provides better and faster Internet experience. It is a program that will facilitate and enhance learning of slow or/and handicapped learners

Keywords: Internet Browsing, Handicapped, Computer Application, Voice.

1. INTRODUCTION

Internet is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide [1].
A web browser is a software application for retrieving, presenting, and traversing information resources on the World Wide Web [2].
The handicapped person is a person who has a special condition that markedly restricts his ability to function physically, mentally or socially [3]. The IB (Integrated Browser) application tries to combine these three terms (Internet, web browsing and handicapped) to work all together and become a reality.
There are several different web browsers available in the internet world. The several types of browsers could be used by normal people who can use their hands. Internet usage has become a part of the daily life in a society that contains different types of people such as children, adults, and handicapped, each with their different abilities. Unfortunately, the handicapped faces difficulties in using the different general browsers. There is a need to create a special browser to target these people. This paper aims to develop an internet browser with a new approach in the technology world. The change in the routine style of browsers is a state-of-art design which provides a multifunction process through combining voice.
This paper has worked out to combine the voice with the internet browsing, which would help the handicapped to use the internet in an easy and direct way. Assuming that the computer's operating system is running on and that the program is in the startup programs, the focus would be on browsing the WWW through voice commands.
A new focus on accessibility should be kept in mind as speech technology has "always" (at least since the mid-1990s) implicitly addressed users with visual or mobile disabilities, sometimes

"disguised" as a more general goal of enabling eyes-free/eyes-busy or hands free/hands-busy access to web browsing and other applications [4].

What makes the IB a different browser is its backbone algorithm that supports the voice commands. The paper will discuss an algorithm which will develop a voice command browser that targets handicapped people. In addition, the IB can be used by any individual, not only the handicapped.

The IB has its own new style of browsing that is shown in the new design of the browser. It has many built in functions, such as News Line, Add Rotator, Games, Quick Search Button, Quick Email, and other useful functionality.

Bringing up the idea of having a voice command browser is one way of assisting and supporting the handicapped. There are other approaches of developing a voice command browser, but the idea discussed in this paper is to develop the IB by applying a new algorithm technique.

1.2. Technical Objectives

1. To allow the handicapped to interact and navigate the web using their voice.
2. To investigate the possibility of using the voice Recognition Technology, which is a special technique, needed to achieve success and use special components such as the programming language and specific grammar to match the key words.
3. To help workers multitask. If a worker needs to type, explore or navigate the internet all at one time, the voice would help achieve this simultaneously.
4. To investigate the difference between other browsers we used different functions and applications imbedded to show the IB different style such as:
   - The voice recognition for facilitating the work on browsing the internet.
   - The ability to change the background color through a choice of different colors to allow for personal style.
   - The particular style of other browsers was avoided through using different menus on different locations and adding the advertisement rotator.
   - A rotating line for news was added.
   - The user has many other facilities in this browser such as making pop ups optional, selecting size and other additional features.

2. LITERATURE REVIEW

2.1 Definition of the Internet Browser

A browser is a software program that allows you to view and interact with various kinds of internet resources available on the World Wide Web (WWW). A browser is commonly called a web browser [5]. Internet browsers are of different types and designs; some are closed source (i.e. Internet Explorer) and some are open source (i.e. Mozilla Firefox). Also, browsers are available with different add on tools that facilitate their functions and usability.

2.2. Significance of the Voice Internet Browser

Access to information has become a major economic and social factor [6]. Voice browsing technology is a rapidly-growing field. Whether or not it proves to be the next internet, it deserves a careful examination in its present form [7], as the need for an easy and direct way to access the internet has become a demand for many types of people, especially the handicapped. From this, the idea of the paper was raised in order to help implement a voice command IB browser.

2.3. Previous Work and Algorithms

In many studies, algorithms and applications have been implemented to facilitate the internet browsing or to revolutionize the traditional way of surfing the www in different angles. One application was implemented to display enumerated links in the browser window and to have also a compass mouse with a curser positioned over a mouse-over pull-down menu by speech recognition [8].

On the other hand there was an implementation for a multi-model browsing system that allows adding automatic speech recognition functions to standard Internet browsers. It was designed for a real Web Application designed for a medical domain [9].

Other implementation for a speech recognition system based on an Internet client-server model as a Java Applet that records voice at the client computer sends the recorded speech file over the Internet, and the server on the end point recognizes the speech and displays the recognized text [10].

In addition there was a contribution for Navigation by Speech system in which allows the user to control by speech a subset of navigation facilities like the basic tool bar commands, URL spelling, following hyperlinks and page printing [11].

This paper will track the voice browsing in a new algorithm approach through the "vMatrix" algorithm.

3. Design and Implementation Criteria

3.1. Methodology Adopted in This Research
A combination of the case study and the personal interview was deemed appropriate for this research. The case study is an in-depth examination of a behavior, concept, or phenomenon. Complementary aspects of the case study are experiments and surveys. This research approach can be helpful in analyzing a real situation, and can serve as a strong basis for debate.

Interviews with system analysts were conducted to clarify their ideas about browsers, understand the main performance and applications of browsers and to gain an insight into the main problems they may have faced through working with such applications. In addition, interviews with handicapped people were also conducted to know their demands for such a browser and the degree they like to navigate the internet. A group discussion with some computer academics took place in order to discover the algorithm efficiency to be implemented.
From all the previous interviews conducted, a clear idea was forming about browsers' applications, their performance, and the user requirements needed for that application.
IB user interface was designed using a visual programming language (Visual Basic 6.0). A flash programming application (Swish max program) was used in addition to the pictures in order to create an attractive style. The sound was enhanced inside the browser which would facilitate many functions and improve the efficiency of the browser.
The IB explores and navigates the internet in a user friendly way that will synchronize the feature requests.
Questioners were distributed to a selection of individuals in the research area for the purpose of gathering the names of the most popular and enjoyable websites navigated. Then we added what was suggested to the implemented browser as a step in developing the algorithm.

There are two options to start the IB software. The first option is to add it to the active task bar, while the second option is to install a small tool that converts the operating system functions to voice.

In this paper, an algorithm solution on how to open and navigate websites only was provided. This means that the system will operate on a one voice command and browse the internet. This will be done without the interaction within the website which also can be implemented using the same algorithm technique.

4. Requirements Analysis

4.1. System Requirements
The system requirements set out the system's functions, services, and operational constraints in detail, and they should be precisely expressed, and define exactly what is to be implemented. They are often classified as functional requirements and non-functional requirements.

4.2. Non-Functional Requirements

4.2.1. Operational Requirements
The software will operate in a Visual Basic environment.
The software will be able to import .Jpeg and .Gif graphics files.
The software will be able to import .WAV sounds files.
The software will be a portable one (instable on a CD)
The software will be able to import .swf files (flash).
The software will be able to interact with the internet.

4.2.2. Security Requirements
Users are not allowed to make any changes to the system. Only programmers have the key to modify and change the system.

4.2.3. Cultural and Political Requirement
No special cultural and political requirements were included, but the system can be enhanced to cater to the Arabic culture and/or political environment.

4.2.4. Usability of the System
Since the system targets handicapped people, implementing a user friendly interface was taken into consideration during the design and the implementation phase. In this application we used a comic character that assists the users in using the voice system, redistributed the functional buttons, and color controlled the background. These are key in a user friendly interface which would make it easier and preferable.

4.3. Functional Requirements
1. The user can interact with the interface of the system to find what he/she wants and the system will response directly.
2. The user can select by voice the sites he/she would like to navigate.
3. The user can have the choice to enable/ disable pop ups on the sites.
4. The user has the option to turn the voice On/Off in order to minimize noise effect.

5. Design
The design phase is a part of the System Development Life Cycle (SDLC), which is a blue print for the new system. Also, it guides the project team through planning.
An important initial part of the design phase is the examination of several design strategies to decide which would be used to build the system. The next step would be designing the user interface, system inputs, and system outputs, which involve user interaction with the system.

5.1. Design Strategy (Methodology)
The study of this software has revealed that the appropriate approach to create the new system is to use the custom development. Through this approach, there was room for flexibility and creativity how business problems were resolved. Also, it helps build technical and functional knowledge within the team.
The business need of the software is to build an effective, useful, and compatible package for the internet browsers.

5.2. Architecture Design
Software Specification:

	Standard client	Standard App. window
operating System	Windows	Windows
special Software	VB Components Swish Flash	Visual Basic 6.0

TABLE 1: Software Specifications

6. IMPLEMENTATION

This section discusses the activities needed to successfully build an information system that consists of programming and coding. Programming is often seen as the focal point of system development as system development is basically writing programs. It is the reason why all the analysis and designs are done.

6.1 Coding

During designing the user interface, different objects and items were inserted. Behind each of these objects and items, codes were added to activate and make them work properly.

6.2 Interface Design

Interface Design is the process of defining how the system will interact with the external entities (system users or other systems). It describes the layout of the pages and the flow of events. It is also concerned with where and how data are represented on the pages [12].

However, in a User Interface Design, needs, experience, and capabilities of the system users must be taken into account. In addition, the designers should be aware of the users' physical and mental limitations (e.g. limited short-term memory and people's tendency to make mistakes) [13].

The following illustrates some of the system's graphical interfaces.

- **News Line:** This Line displays the latest news from all around the world. It is just an RSS linker that is linked to a news agency.
- **Address Bar:** This allows the user to type the site he/she would like to navigate.
- **Add Rotator:** This is called the Advertisement Rotator, which is used to display the different online advertisements.
- **Search Button:** This button will take the user to a search engine page which will help him/her to search for any information.
- **E–Mail:** This button will take the user to an E–Mail Editor Form that enables the user to write an E–Mail and send it.
- **Add to Favorite Button:** This button helps the user to store any sites to quickly reference them without the need to retype their URL in the Address Bar again.
- **Games:** This is a button which allows the user to choose from different types of games to play.
- **Micro – Browser:** This is a button when clicked, will allow a Micro (smaller) size of the IB to appear in front of the old one but in a smaller size.
- **Calculator Button:** This button will display a Mathematical Calculator.
- **Speak Help:** This is a hint that facilitates the usage of the voice browser.
- **Site Display Area:** This is the area on which the navigated site will be displayed for user.

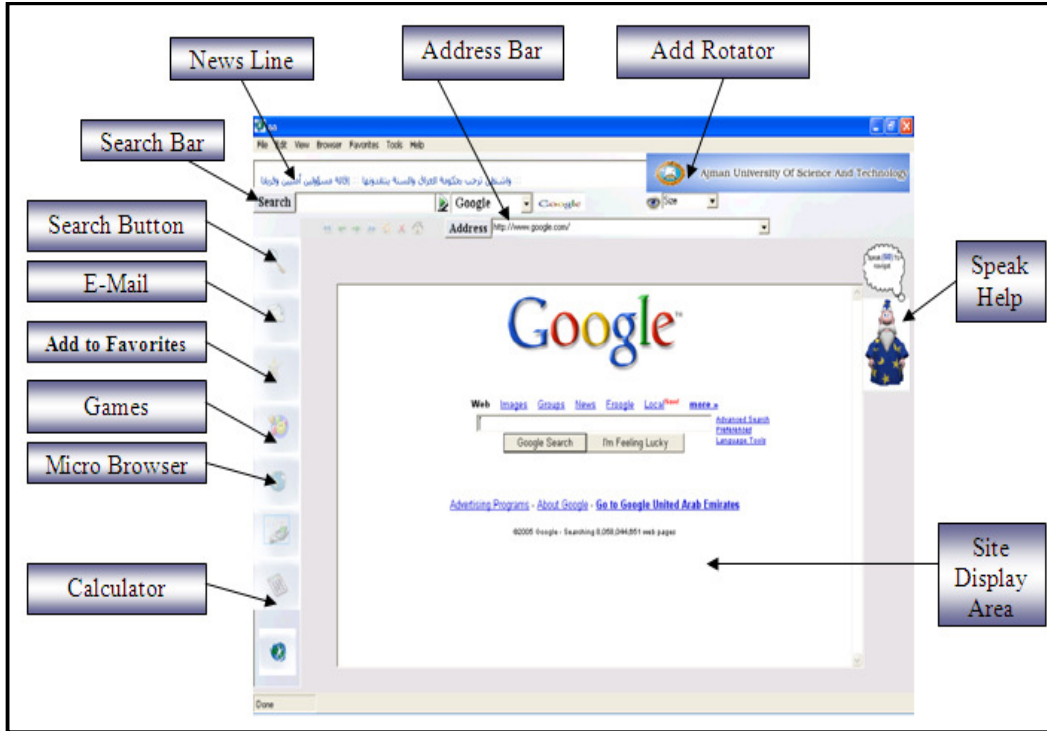IB begins with a main page which has Buttons and Components as shown in Figure 1 below:

FIGURE 1: User Interface Design Shows Interaction between the System and the User.

7. Algorithm Behind

An Algorithm named "vMatrix Algorithm", which stands for the voice matrix idea, was implemented. A grammar was implemented as our database engine. A survey was conducted for the most favorite websites, using a random sample of students, faculty, and staff at a university. Then, a form of one matrix (which can be expanded) was implemented. The row and column headings were alphabeticized sequentially from a to z , because we implemented only a sample of database websites (36 websites), that were fit in a 2-D matrix inside 1 form (window) as shown in Figure 2, the headings were selected of the rows and columns to start from a up to f.

FIGURE 2: Implementing Form of One Matrix.

Once the IB user sees the Comic Character (Speak Help Picture), the above form will be displayed just once for the user to speak or utter the word "Go". The matrix would help the user choose the site he would like to navigate by matching the intercept of the column and row. For example, if the speaker says "ca", then the system will respond and open the "Hotmail" site and so on each time the user navigate a different website.

In addition, the user has the ability to say "ON", which would switch the microphone on or say "OFF" which would turn the voice recognition of the microphone to the off mode.

Also, the functionality of the IB was enhanced by enabling the user to deal with the browser functions such as (Home, Refresh, Backward, and Forward) through voice command control. For example, the user can say "Home" and the browser will respond and take the user to his/her home page.

8. RESULTS AND DISCUSSIONS
The "vMatrix" algorithm can efficiently facilitate the voice recognition of the website spoken but it depends on the characters announced rather than words. For example if the user wants to go to "Hotmail", he/ she is not going to say "Hotmail" instead he/ she will say "c" "a" as two consequence characters. In this way the proficient of recognizing the voice will be easier and less confusion. While if the user will pronounce "Hotmail" the system may recognize it as two words like "Hot" "mail", and may think that there is another site that starts with the word "Hot". The 2-D "vMatrix" algorithm character recognition is more efficient in this case and less noise and confusion.

 Also if compared to other implementations, most had just attempted to apply voice for a static single web-page but not for surfing different websites, like adding numeric points beside the links inside the webpage or just say the links as words. Others tried to have a compass mouse algorithm which put reasonable numbers on the website in compared to our user interface which simply has no numbers to search for in order to pronounce them. In our user interface and our algorithm efficiency the user will reach the site he /she desires through an easy and forward steps and spoken tokens.

9. CONCLUSION AND FUTURE WORK
These days, internet is playing a major role all over the world. The main gate to access the internet is browsing. As browsing was designed to cater to only normal people with no physical disabilities, the physically handicapped were isolated from accessing the internet. IB was developed to help enable the handicapped to browse the internet easily. This objective was achieved through a combination of voice commands with internet browsing; IB is a voice command driven browser for the disabled.

It should be recognized that working using voice commands would give us opportunities to find ideas that could be developed in the near future. Some of these ideas can be the diversity and difference of the pronounced accent while searching, interaction between the methods of the net browser with the matrix system, and the work of the PC by recognizing the eyes of the user (the vision method) as long as he/she is browsing the net.

10. ACKNOWLEDGEMENT

11. REFERENCES

[1]   Wikimedia   Foundation,   I.   (2001).   "Web   browser".   Available   at: http://en.wikipedia.org/wiki/Web_browser [Accessed 7th November 2010]

[2]   Wikimedia   Foundation,   I.   (2001).   "Internet".   Available   at   Wikipedia: http://en.wikipedia.org/wiki/Internet [Accessed 10th October 2010]

[3]   Farlex,   I.   (2004,   December).   "Handicapped   person".   Available   at: http://www.thefreedictionary.com/handicapped+person [Accessed 21st December 2010]

[4]   T. Brøndsted, E. Aaskoven. "Voice-controlled Internet Browsing for Motor-handicapped Users. Design, and Implementation". Eurospeech, 9th European Conference on Speech Communication and Technology, Lisbon, Portugal. 2005. pp. 185-188.

[5]   Consulting,   N.   C.   (2000).   "Internet   Browser".   Available   at: http://www.netdigix.com/gloss/browser.php. [Accessed 22nd September 2010]

[6]   K.Peter, C. Wootton, I. Wechsung, S. Moller. "Evaluation of a Voice-Based Internet Browser with Untrained and Trained Users". In proceedings of the 5th International Conference on Universal Access in Human-Computer Interaction. 2009. pp 482-491.

[7]   Community,   A.   M.   (2000).   "Voice   Browsing".   Available   at: http://www.wirelessdevnet.com/channels/voice/features/voicebrowser.phtml.   [Accesssed 12th December 2010]

[8]   T Brondsted, E. Aaskoven. "Voice-controlled Internet Browsing for Motor-handicapped Users". Annual Conference of the International Speech Communication Association – INTERSPEECH. 2005. pp. 185-188.

[9]   C. Eccher, L. Eccher, D. Falavigna, L. Nardelli, M. Orlandi, A. Sboner. "ON THE USAGE OF AUTOMATIC VOICE RECOGNITION IN AN INTERACTIVE WEB BASED MEDICAL APPLICATION". IEEE International Conference on Acoustics, Speech, and Signal Processing. 2003. pp 289 - 92 vol.2.

[10] Z. Tu, P. Loizou. "SPEECH RECOGNITION OVER THE INTERNET USING JAVA". IEEE International Conference on Acoustics, Speech, and Signal Processing. 1999. pp 2367 - 2370 vol.4.

[11]   L.J. Adams, R.I. Damper, S. Harnad and W. Hall. "A System Design for Human Factors Studies of Speech-Enabled Web Browsing". In: ESCA Workshop on Interactive Dialogue in Multi-Modal Systems, Kloster Irsee, Germany. 1999. pp. 137 – 140.

[12]   Wixom., A. D. (2009). "Systems Analysis and Design", John Wiley & Sons, Inc.

[13]   T. Lemlouma, N. Layaida. "Context-Aware Adaptation for Mobile Devices".In Proceedings of the 5th IEEE International Conference on Mobile Data Management. Barkeley, California, USA, 2004.