Adaptive Auditory Feedback: A New Method for Desktop Assistance of the Visual Impaired People

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Poster: Adaptive Auditory Feedback: A New Method for Desktop Assistance of the Visual Impaired People

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Abstract
This paper presents a new technique of adaptive auditory feedback in desktop assistance for the people with visual impairment. Adaptive auditory feedback is based on switching between speech only and non-speech only (i.e., Spearcons) sounds. The auditory feedback adaptively changes that changing based on user mode. Active users are assigned with speech only while the engaged users with the non-speech only auditory feedback. Ten participants perform tasks on desktop computers using within-subject design. The proposed adaptive auditory feedback is more efficient in comparison to speech only and non-speech auditory feedbacks. It can also improve a user experience in the desktop environment. Finally, it may help different researchers to use adaptive auditory feedback as a substitute for speech only or non-speech auditory feedback during the designing of accessibility softwares, tools, and systems.

Author Keywords
Speech only; non-speech only; adaptive auditory feedback; desktop assistance; visually impaired.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

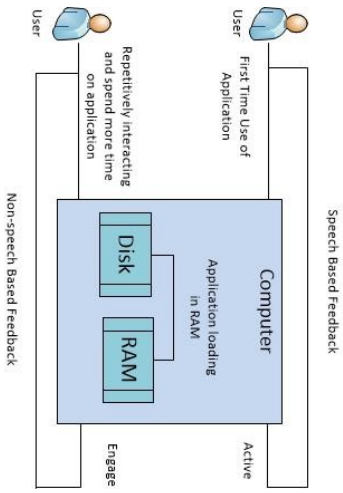

Figure1: shows the abstract view of our proposed method where the Active state of user depicts the program loads from hard disk to RAM. However, engage state demonstrates the program is already in RAM and user repetitively interact with it. When the state is active then feedback in form of speech based instructions and when the state is Engage then feedback in the form of non-speech based instructions.

Introduction

Enhancements in auditory interfaces are very useful for providing desktop assistance to the visually impaired people. They rely on audio in absence of vision to obtain the surrounding environment information. There are two types of auditory interface, speech-based and non-speech based. Non-speech based includes musical, environmental artificial and Spearcons based sounds. Spearcons are short and pleasurable as compare to speech. Spearcons was produced by speed up the spoken phrase until this phrase was not recognized by speech [7]. Anyhow they are insufficient for presenting critical and comprehensive information. Speech-only interfaces consist of the human voice. Speech conveys information about the environment but repetitive speech based instructions make listener inconvenience [4]. Initially, our work based on conversion of sound from speech only to non-speech only feedback on the basis of user state (active, engage) enhance user ability to perform desktop-based activities. We proposed an adaptive feedback technique for desktop assistance in which feedback is used to convey the information in form of both speech-based and non-speech based sounds. For first time users, the state is active and feedback in the form of speech only send to the users. For consistent users, the state is engaged and non-speech only feedback sends to the users. The proposed approach automatically recognizes the user state. By using this approach, the user can get meaningful information with minimum irritation. Thus, we are delivering auditory feedback to the user in the adaptive form.

Related Work

Different researchers use sound as an auditory feedback for the desktop assistance of visually impaired people. These people perform different activities and tasks on the desktop like web browsing, communication, editing, composing, gaming and reading. Many applications exist for their assistance to perform these tasks in a desktop environment. For accessing online information of websites, different challenges are faced by visually impaired people like the design of web pages, which are normally created by keeping in mind the visual interaction with the user [2]. WebAnywhere [1] is a speech-based web browser which facilitates the blind users to access online information from any computer. There is no need for any software installation on the system for accessing functionalities of WebAnywhere. Users can complete their task on such system which is not their own. Different websites use Adobe Flash and Dynamic HTML but visually impaired people cannot access these types of contents, aiBrowser by [5] use for overcoming this problem. This browser has two features, first one is non-visual multimedia audio controlling and second is multiple user interfaces. Blind users can increase or decrease and stop or pause audio sounds. The blind user also has dynamic interfaces like DHTML and Adobe Flash. JavaSpeak [6] is a plugin for Eclipse which provides a facility for non-visual java programming. Sound feedback provides navigational cues to visually impaired programmers for hierarchical structures. I. Hussain [3] proposed a hybrid auditory feedback technique which provide help in mobility assistance of visually impaired people. It is more effective then non-speech only feedback and more pleasant then speech only feedback.

Experimental Evaluation

We perform an experimental study to understand user behavior with adaptive auditory feedback listing during

performing desktop based task. Participants repeat that task twelve time in their specific time slots. The task was to fill a form on the desktop computer. Participants listen to auditory feedback during form filling until the form is submitted. We enroll ten participants (9 male, 1 female, average ages=21.3, Standard Deviation (SD)=1.85) for this study. Participants were recruited through local blind departments in universities and through oral communication between different people. We perform experiments on participants in four days. They repeat that activity on computer three times first time with speech-only feedback second-time non-speech-only feedback and third time with adaptive auditory feedback. Before performing the activity, participants open the task which is already installed on the desktop computer. We provide the instructions to analyses the audio listing throughout the activity. During listing, there are three types of feedback sound: Speech-only, non-speech-only and adaptive auditory feedback. At the ending of every activity, a questionnaire is provided to all users. The questionnaires have five types of impression measures with respect to every action based on each type of sound, Comfortable (8)–Uncomfortable (2), Like (9)–Dislike (1), Fun (8)–Hearted (2), Interesting (8)–Painful (2) and Satisfy (9)–Unsatisfied (1). The number written in parentheses shows the total sum of that impression measures. We also collect and record the data regarding their choice for a listing of feedback message.

Results and Discussion

One way analysis of variance (ANOVA) and within-subject design used for results analysis. Independent variable is the feedback factor like speech-only, non-speech-only and adaptive auditory Feedback. For "Feeling Comfortable-Uncomfortable", a statistical test conducted which shows that speech-only and non-speech-only are uncomfortable than adaptive auditory feedback ($F(2,27) = 7.89$, $p<0.05$). For "Like-Dislike", a statistical test conducted which shows that speech-only and non-speech-only are more dislike than adaptive auditory feedback ($F(2,27) = 7.26$, $p<0.05$). For "Fun-Hearted", a statistical test conducted which shows that speech-only and non-speech-only are uncomfortable than adaptive auditory feedback ($F(2,27) = 4.97$, $p<0.05$). For "Interesting-Painful", a statistical test conducted which shows that speech-only and non-speech-only are painful than adaptive auditory feedback ($F(2,27) = 3.54$, $p<0.05$). For "Satisfy-Unsatisfied", a statistical test conducted which shows that speech-only and non-speech-only are less satisfied than adaptive auditory feedback ($F(2,27) = 5.9$, $p<0.05$).

An interview conducted with participants after performing experiments. Above results and interview data shows that adaptive auditory feedback is more convenient and enjoyable as compare to speech-only and non-speech only feedback. Non-speech only cannot convey meaningful information. Speech only takes more time and participants feel irritation during repetitive use. Whenever adaptive auditory feedback takes less time during use and produces minimal irritation for participants.

Figure 2 results show that time completion time by using adaptive auditory feedback. Ten participants information available in it. This information clearly shows that adaptive auditory feedback is better as compared to speech only and non-speech only feedback. Because its take less task completion time as compare to others.

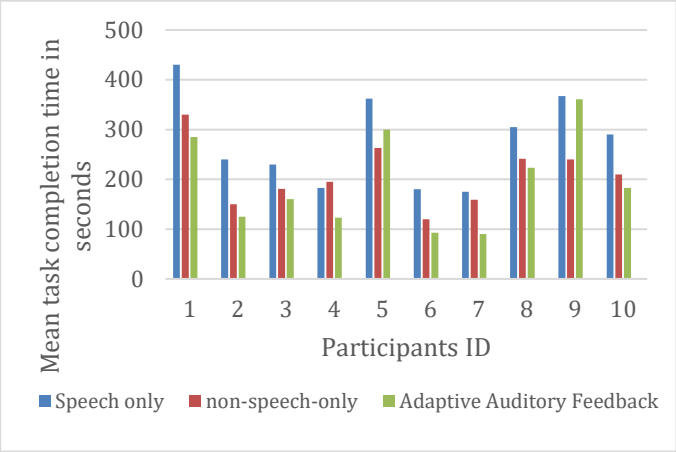

Figure 2: Time completion time using speech-only, non-speech-only and adaptive auditory feedback

Conclusion and Future Work

This paper presents a new approach of auditory feedback in desktop assistance for people with visual impaired. Speech only is a better choice for feedback but repetitively use of speech only creates annoyance for users. Furthermore, non-speech only also not beneficial for conveying meaningful information in a critical situation. However, with the use of adaptive auditory feedback users irritation can be minimized. This approach provides dynamic information in desktop assistance for the visual impaired. Initial result from the experiment and interview with ten participants represents that adaptive auditory feedback is clearly understandable as compare to non-speech and speech only feedback. This is more suitable and less irritating as compare to other auditory feedbacks. In future, we can conduct studies for a large number of participants and adaptive auditory feedback will be evaluated in mobile application assistance.

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