Floor Control Arbitration for a Hybrid Voice/Text Web-board

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Abstract: - **We have built a hybrid voice/text web–board that utilizes floor control for handling resources such as microphone and interface events. The aim of this research is to determine the most appropriate floor control mechanism for a hybrid communication tool that allows conventional text and audio users to communicate with one another using a common interface. Research on floor control mechanisms provides many implementations for arbitration that are application-specific. Myers proposes a categorical explanation of the most widely used mechanisms for providing floor control and discusses these different dimensions with respect to a project called Pebbles. We have chosen to model our arbitration policies along these categories. The application will be implemented as a Java applet and gives users a view of both the text and audio aspects of the exchange. To facilitate the multi-modality of the system we will provide media conversion, using the Nuance system's Java API. Our hypothesis is that well–known multi-tasking arbitration protocols such as FCFS, Round Robin, Token – based, and many more can be adapted to create a conferencing floor control policy for the interface of a hybrid communication environment so as to facilitate free–flowing multi-modal conversation. Measurements to determine which floor control implementation provides the best arbitration in terms of user interaction with the system will be calculated using RPT, ORT and usage tests based on the Kirkpatrick Model. We hope to show that users benefit more from an implicit arbitration mechanism than they do from an explicit one.**

Index Terms - arbitration, floor control, hybrid voice/text, web-board

I. INTRODUCTION

The aim of this research is to determine the most appropriate floor control mechanism for a hybrid voice/text communication tool. A hybrid chat system facilitates communication between users with disparate input media, specifically voice and text. By this we mean that the tool allows conventional text and audio users to communicate with one another within a unified interface. The application uses various arbitration policies to provide floor control based on multi-tasking arbitration mechanisms, such as First Come First Served (FCFS), Token passing, Round Robin and Queuing. These protocols administer the voice/text exchange and provide controlled access to a persistent thread tree as well as the microphone in the case of audio input.

We believe that the best arbitration policy in a hybrid environment is one where textual input is treated on a FCFS basis while audio input is treated in much the same way, where the system sends an implicit trigger to the server for a request. The difference is that audio input also needs some form of rule–based arbitration that prevents the conversation from becoming confusing. This paper provides a brief look at what has been done in the field of Floor Control for distributed systems as well as an overview of the Hybrid Communication Tool. It concludes with the methodology used to prove the research hypothesis and the expected results from experimentation.

II. RELATED WORK

A. Floor Control Policies

According to Myers [3], floor control policies can be divided into three dimensions: releasing, acquiring and handling of request. They then go on to discuss these different dimensions with respect to each one's various options. The options are as follows.

Mechanisms	Release	Acquire	Request Handling
Options:	Explicit Release	Moderator	Immediate grant
	Implicit Release	Explicit Request	Queued
	Explicit Loss	Implicit Request	Ignored
		Rule -based	

Table 1: Adapted from Myers, et. el [3]

Using combinations of the various options for each dimension, almost all of the existing floor control policies can be constructed. This exact set of floor control policies was applied to a project called Pebbles' where users were requested to solve a puzzle using the various implementations of floor control policies. The results showed no noticeable difference in performance for the various arbitration policies. However, users rated explicit release as the one they perceived to provide the best arbitration.

The arbitration policies we will implement within our Hybrid Tool will be loosely based on the above-mentioned mechanisms. They include implicit request (activity sensing) , explicit request (hand-raising) and human moderation.

Another interesting application that utilizes a floor control protocol is TattleTrail [2]. This application developed by Kim, uses mobile communications to connect a distributed workforce. TattleTrail uses an explicit floor control protocol in that users need to press a button to indicate the need to make a contribution. This protocol seems to work best for purely voice applications as it gives users a sense of confirmation that it is indeed their turn to speak, and also prevents collisions, back-off and retry and general confusion in the discussion.

III. TECHNICAL OVERVIEW

To illustrate the functionality of the hybrid communication tool, we use the following scenario. A group of 20 users, 10 of which are not able to use speech (i.e. no head-phones and microphone) and 10 of which are. The system allows each user to use her/his preferred method of communicating and relays the responses to all other users in that same medium as well as the lesser of the two mediums, text. Thus the audio user will be able to hear whoever else is communicating with speech as well as read the text entries. On the other hand, the text user will be able to read everything on her/his display including whatever is spoken as all communication is converted to text.

A. *Multi-modal Conversion* - The application is entirely web-based and we have chosen to implement it using Java applets because of its platform independence and ease of integration. The interface should give users a view of both text and audio contributions to the discussion. Both text and audio users will need to position themselves within the thread structure at the point where the contribution is to be added. Once a text user inputs text that needs to be transmitted to audio users, the text must be converted into synthesized voice with a Text to Speech (TTS) tool. In the same way, audio input needs to be converted to text with Automatic Speech Recognition (ASR) software for the visualization process. We have elected to use the Nuance system that provides a Java API to provide both Speech Synthesis and Speech Recognition.

B. *Floor control* - Because of the large user domain we need to introduce the concept of moderation. The system will be synchronous for the duration of the lecture and hence the content will be user moderated. The moderator will not be expected to adjust the content in any way because our aim is to measure the effectiveness of the arbitration protocol and not to measure the moderator's ability. As floor control can be seen as a means to avoid communication breakdown and support the management of group work [1], we will provide a means of implicit arbitration where users' requests are time stamped and then queued for update to the interface. No two users will be able to contribute to the same position within the thread structure. Hence a mechanism is introduced that sends signals to the interface of the various users that controls user interaction with the system.

C. *Persistent Threading* - All input, whether audio or text, will be represented in a thread-like structure. These threads will then be stored by date for later retrieval. Each thread will also have an accompanying audio file that can be played back for those with audio capabilities. These archives can then be accessed through searches, for either the text or the audio file.

IV. RESEARCH METHODOLOGY

The main research question focuses on which arbitration policy will provide the best floor control in hybrid voice /text environment. Our hypothesis is that well–known multi-tasking arbitration protocols such as FCFS, Round Robin, Token–based, can be adapted to create a conferencing floor control policy for the interface of a hybrid communication environment so as to facilitate free–flowing conversation.

Because of our application domain, KEWL (http://kewl.uwc.ac.za), we have decided that the application will be best tested within a task-based scenario where users will need to complete a given task using the hybrid tool with the various implementations of floor control. We will then use measurements such as Request Processing Time (RPT) and Observed Response Time (ORT) to determine which floor control implementation provide the best arbitration in terms of user interaction with the system.

Given that the arbitration is meant to improve the consistency of the exchange we will combine our measured results with usage tests that are based on the Kirkpatrick Model [5]. This model consists of the following four levels: Reaction, Learning, Behaviour and Results. The reason for using the two methods is that even though the measurements (ORT and RPT) may provide us with an accurate assessment of the functionality of these floor control policies, we also need to consider the users perceived level of satisfaction with each policy so as to determine which one is most beneficial to the user.

V. EXPECTED RESULTS

The research project will produce an application where users are able to join in an Internet classroom environment and communicate with media of their choice. We hope to show that users benefit more from an implicit arbitration mechanism than they do from an explicit one. Specifically for our application where voice and text is combined within a unified environment, we expect to find that users prefer to let the interface dictate when a contribution is allowed rather than letting a more rigid policy such as token-passing, explicit loss or moderator controlled arbitration be the control policy.

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