

Encouragement of Member Contribution in Face-to-face Meetings through Co-editing Minutes

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Abstract

The goal of this research is to improve the level of understanding, ideas, and shared consensus in a discussion between the participants. For that purpose, this research focuses on record editing during a discussion as a method to collaborate information. We introduce a system which allows concurrent editing by multiple users in a face-to-face discussion, and created an environment where participants of the discussion can also participate in the editing of the discussion minutes. We implemented and tested a co-editing minutes system named EGITool (Evolutional Group Intelligence Tool) with several functions required for the encouragement. As a result, it became apparent that assigning the participants to discuss and co-edit minutes at once can be a burden. Furthermore, awareness functions required to encourage discussion contribution are investigated.

1. Introduction

With the advancement of computer networks during the recent years, the design of group communication has been changing. The two main reasons are as follows. First, due to the downsizing of personal computers, we are now able to use them as discussion tools anywhere within our social life. We can take and use them during any type of activity. This would not have been possible if we had to use a fixed computer such as a large desktop computer. Secondly, by the popularization of Wireless LAN devices using IEEE802.11a/b/g and the price reduction of Wireless LAN access points and Wireless cards, simple network construction in offices and homes or even in public spaces are possible. Considering these advancements, we design to support

collaborative activities in such ubiquitous computing environments.

The goal of this research is to improve the understanding and consciousness of the participants during a discussion. The main cause that restrains users to participate during a discussion is the difference in the level of understanding between the participants. The second cause is the lack of background knowledge on the topic discussed between the participants. The third cause is the group's organizational structure makes specific participants refrain from speaking. As a result, the discussion is carried out although some participants may not be understanding the topic and making those participants fade away from the discussion.

By the installation of text editing software that allows multiple users to edit the text during a face-to-face discussion, users will be able to participate in the discussion by simply editing the text. In this paper, we consider the method of co-editing and the functions required to encourage member's contribution to the discussion.

2. Supporting Face-to-face Collaboration

We focus on face-to-face environments and aim to support collaborative discussions in these environments.

2.1. Assumed Environment

This research improves a group discussion of several participants in a face-to-face environment. There are many types of cooperative working, but this research focuses on an environment where all participants gather in a face-to-face situation. The meeting is assumed to be an informal discussion, like a casual discussion at a research office. Each participant does not

have a fixed role, compared to that of a formal meeting.

Our system does not assume users to use existing electronic conferencing system requiring specific hardware to be installed, but use only each participant's laptop computer as their collaboration tool. More and more digital devices are owned and carried about, converged in the place where people come together such as office spaces or classrooms, and have a casual meeting to share information in order to work cooperatively[2]. This kind of meeting is often called together without notice, even outside of a workspace. We aim to support such informal discussions, not sorts of lectures or negotiations. In the situations of negotiation, the result is more important and the minutes of the meeting should be a sort of final agreement. Thus co-editing is not always useful in the cases. This research will establish an environment which adapts the current needs of discussions in ubiquitous computing environments.

2.2. The Goal of This Research

From the background information discussed above, in order to make group communication possible, there is a need of an environment that allows multiple users to collaborate with everybody, anytime, anywhere. A face-to-face discussion system with participants possessing a laptop computer with network attachability is considered. Recent downsizing of personal computers makes it possible for each individual to use a personal computer at the site of a discussion to note memos of the discussion. Therefore, the system discussed in this research will become an important tool in the near future.

We define "participation" as not only making remarks, but contributing to the group in any form during the meeting, such as understanding the outline of the discussion and supporting other members in making remarks or understanding. In complicated discussions, various factors disturb the remarks of the participants, and it is hard to keep the balance of the remarks from every participant. The main cause that restrains users to participate during a discussion is the difference in the level of understanding between the participants. The second cause is the lack of background knowledge on the topic discussed between the participants. The third cause is the group's organizational structure that makes specific participants refrain from speaking.

As a result, the discussion advances even though some participants may not be understanding the topic and makes the participants fade away from the discussion. The goal of this research is to improve the participants' level of understanding ideas, and encourage their "participation" during a casual meeting.

3. Approach

This section describes the main approach to co-editing minutes.

3.1. Information Sharing by Co-editing Minutes

In order to share information between participants during a discussion, information must be able to be shared and used immediately. The immediate use of information during the interaction keeps participants from falling behind and raises the efficiency of the discussion. The tool needed should take the role of a secondary media and hence does not interfere with the real-time conversation.

To meet the requirement above, this research focuses on record editing during a discussion as a method to collaborate information. Laptop computers are used to edit the minutes. Unlike ordinary minutes where there is a specific note taker, all the participants except for the speaker, are asked to take a role as the note taker to write down and organize the current topic.

Also in this research, the participants not only take their own notes but write and organize the shared document as a whole. In order to make this possible, we prepared an environment that allows all the participants to browse and add information to the minutes. Former conference minutes-editing methods keep the note taker from participating in the conversation because the note taker had to focus on the note taking. By making all the participants collaborate in taking the minutes, they all have a equal chance to join the discussion.

3.2. Assistance by Co-editing Minutes

Taking notes of a discussion collaboratively not only reduces the prolixity information but also has the three advantages discussed below.

First, by making all the participants take part of writing out the current topics and conclusions of the discussion, it makes it easier for everybody to keep up with the topic and level the bias of understanding amongst them.

Secondly, a participant that could not understand the details is able to look at the written information in order to catch up and obtain the missed information on the topic.

Thirdly, the speaker is able to see how well the note taker understood the topic to check to see if there are no misunderstandings. If there are any misunderstandings, the speaker can go back and edit or even go back to the topic to refine the discussion. With these points, this tool is able to assist the note taker.

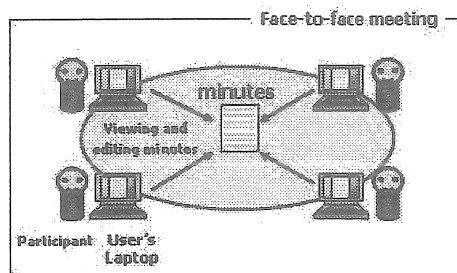


Figure 1. Face-to-face meeting based on co-editing minutes

In order to implement these functions, we designed and implemented a tool that allows collaborative editing of the minutes.

3.3. Discussion Model with Co-editing Minutes

The following are the procedures of a meeting using co-editing minutes proposed in this paper. Participants get together for a meeting with their laptops connected via wireless networks, and execute the text editor designed for co-editing minutes. A text file is created, shared and edited by every participant as the records of the meeting. Someone except the speaker notes a summary of the statement. Everybody can revise the records in such ways as correcting the summary or adding any additional information like references or URLs. By doing so, it is possible to prepare materials for the next agenda without disturbing the current discussion.

In this way, the participants can make full use of the records of the discussion. Like in a case of using a whiteboard, the participants can share ideas and organize them. However, unlike a whiteboard, when the meeting is over, each user saves the records and takes it with him/her. They can read the minutes over again in order to go over the contents of the meeting, to consider the topics and to refer materials. The discussion model with the co-editing minutes system is shown in fig.1.

3.4. Effect of This System

With this system, the topics below are to be resolved.

First, this system will enable the assembly of verbose notes into a refined minutes. By reading the well organized summary of the discussion, it allows the participants to understand the topics easily. Minutes is better than a whiteboard in a way that it is easier to understand information at a glance. Especially in a com-

plicated discussion where topics create new topics, and end up with a broad range of topics, it is difficult to organize all the ideas using a whiteboard. The structured minutes of the topic is easier to understand and easier to refer to later on.

Secondly, minutes made in text format is easier to reuse, re-edit and review the content of the discussion. It is also simple to distribute to others. Materials prepared beforehand by the participant may also be merged to the minutes as the discussion goes on during the session and re-used as a written report.

Thirdly, former minutes making tools required a specific record taker to concentrate on the minutes, resulting in the record taker falling out of the discussion. This tool allows all participants to edit the minutes, and thus allowing all users to join the discussion.

Fourthly, collaboration of the minutes between participants allows each user to become aware of others' activities and fill the gap of understanding amongst them.

4. Related Work

In this section, we review several works and conclude that designing specialized co-editing system is needed to carry out the encouragement model with co-editing minutes.

4.1. Shared Whiteboard

Many approaches mainly focus on supporting face-to-face meetings with electronic whiteboards. wb[4] runs on X-Window environment and consists of several workstations, and whiteboard applications. On the other hand, Tivoli[8] and Flatland[6] require whiteboard-like devices such as displays and screens. Tivoli is based on Liveboard, an electronic whiteboard device. Flatland detects some context in face-to-face meetings, and has several functions in addition to past researches. Also some products like NetMeeting by Microsoft Inc. have been released.

WirelessDAN[9] proposes "Nomadic Collaboration" which supports face-to-face meetings with laptops connected via wireless networks, and offers services and applications for the electronic whiteboard.

Electronic whiteboards are useful when two or more users write at the same time. However, the following problems arise when using them in meetings. First, the memos written on the whiteboard may not be summarized and be just gathered ideas from participants. Therefore the contexts and conclusions of the memos are not indicated clearly. Secondly, the memos on the whiteboards are usually saved as picture files, hence hard to handle and divert into other

documents. In order to make good use of the results of a meeting, the described minutes is the best material to keep and utilize the records of a meeting. Thirdly, since memos on a whiteboard are liable to become unorganized, it is hard to review the details of the discussion afterward.

4.2. Co-editing Tools

Application of general shared editors seems to be suitable in face-to-face meetings. Most of the shared editors aim to support asynchronous or distributed collaborative environments. An attempt to avoid the collision of editing operations was to give access control to one specific user, and the user monopolizes the right to edit the whole or partial text. Quilt[5] is designed for collaborative writing in an asynchronous environment, and the right to edit is based on the role assigned between the members in a group. PREP[7] also aims to support asynchronous co-editing but does not assume that each participant has a fixed role.

GROVE[3] allows multiple users to edit the text in a distributed environment. GROVE consists of an outline editor and a function of voice communication. The editor consists of three editing views: Private view, Shared view and Public view. GROVE like PREP, does not assume that each participant has a fixed role, and exclusive access control is supported in the level of the node. However, the user only sees the text appeared on the screen, and the detailed status of the other users is not provided.

Dourish indicates awareness in co-editing through the research of ShrEdit[1]. He points out that usual ways of presenting awareness information requires extra operation by the users and is troublesome for the users. Only the recipient benefits from the system and thus is not reciprocal. He also notices that whether awareness information is appropriate or not depends on the situation, so the way to present awareness information should be considered. ShrEdit aims to smooth co-editing a document with awareness information. Our research and ShrEdit have some similar functions. But ShrEdit's system still lacks the function to encourage the member's contribution. The difference in the functions between our research and ShrEdit is also mentioned in the next section.

Compared with the other researches of shared editor, we make a target to encourage every participant to contribute to the meeting. Toward the goal, we introduce the co-editing tool and it has to cover various requirements such as exclusive access control and awareness functions between users.

Text Editing Field

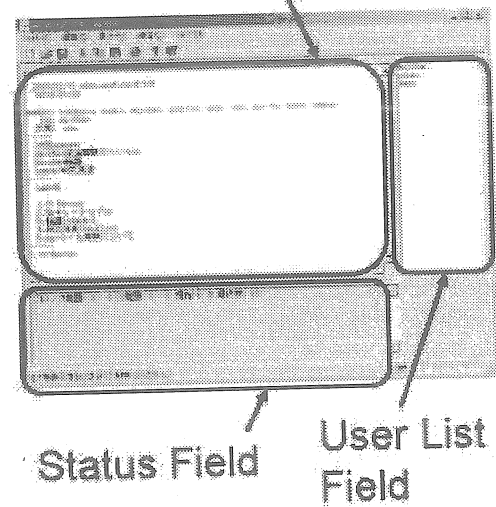


Figure 2. Screen image of co-editing tool

5. Design and Implementation of Co-editing Tool

In order to achieve the encouragement of member contribution in face-to-face meetings, we implemented a co-editing minutes system and named it EGI-Tool (Evolutional Group Intelligence Tool). This section describes the detail of the design and implementation, and several functions required for the encouragement.

5.1. Implementation Environment

The program can be run on Microsoft Windows 95 and after + Winsock1.1. It is text editing software with a server-client function. Implementation was done with Microsoft Visual C++ 6.0. The screenshot of the software is shown in fig.2. The upper-left part, Text Editing Field, is the text editing field used to type the minutes. Each user can scroll, read, write, alternate and delete any part of the text independently. In order to solve the problem of synchronization that occurs when two or more users try to edit the same line at the same time, exclusive access control is introduced. The detail of the access control are described in 5.2.

On the right side, User List Field, the list of participating users is shown. Status Field at the bottom shows the status of the minutes and this system. The Text Editing Fields of the clients are not synchronized so that the minutes shown on each client are different. This can cause the case of a user missing another users' editing operation. In order to solve the problem of missing and notify the behavior of a user to the

other users, several functions are introduced. The detail of the functions are described in 5.3.

This system determines one of the laptops brought by the users as a server, and the rest of them connect to the server as clients. Every operation like moving the cursor and editing the text is notified to the other clients via the server. The server also detects the collision of editing lines.

5.2. Exclusive Access Control of Collaborative Text Editing

To make simultaneous editing possible, exclusive access control is needed. Past attempts solve this problem by giving access right to one specific user to edit the whole or specific part of the editing text. In ShrEdit the user selects a certain range of the text. Another approach is changing the locked area dynamically when a user tries to edit the area. However, these approaches are not suitable for encouraging co-editing minutes. Any complicated, additional operations or difficulties for obtaining the right to edit a block of the text can be obstacles to co-editing. The locked area should be minimized not to disturb the other users, and the access right should be given to each user automatically without any additional operation. Declaring the beginning of a editing to the minutes to the other members in the meeting often interrupts the discussion, and becomes an disturbance to the meeting.

This tool solved these problems by automatically locking the line the cursor is placed by each user so that the lock mechanism does not interfere with the editing operation. When a user moves his/her cursor and focuses on a certain line, the line is marked and locked by the user. When a user attempts to lock the line that is already locked by another user, he/she can focus on the line but cannot edit the line. ShrEdit does not show cursors of the other users on the window, and in the case of the collision of editing lines ShrEdit sounds a beep and shows a pop-up message. Our system avoids the collision of editing operation by showing every user's cursor and no additional operation is required. If a user does not move his/her cursor for a long while, the lock of the line is canceled, assuming the user may be thinking or speaking. In the case of a user leaving the room while the meeting is carried out, a user can switch his/her mode to the Read Only Mode, which cancels the lock by the user and only supports minutes browsing.

5.3. Awareness Function between Others

This tool implements a function needed to participate in an active discussion. The awareness function during a collaborative work in a distributed environment is required in order to allow a user to recognize



Figure 3. Experiment of EGITool

the other users' operation. This is also important in a face-to-face environment as well.

In order to recognize the state of the other participants, the tool shows information of who is editing and where the cursor is, by expressing each user in a separate color. Also, in order to be aware of the erased text and which user erased it, a record of the edited text can be referred.

In User List Field, a user is marked as "the primary logger" that is a dictator of the current discussion. It is assumed that there is no particular user who edits the minutes from the beginning to the end, the dictator changes as the speakers changes. When the dictator is eager to tell his/her ideas, he/she calls on the next dictator for dictating his/her statement. This is aimed to avoid collisions of dictations in the current discussion. ShrEdit does not support the hand over of the dictator, so the participants had to request the exchange verbally. The marking does not affect any functions of the exclusive access control, compared with the other tools like Quilt.

6. Evaluation of the System

An evaluation of the system proposed in this paper is explained in this section. Eight undergraduate students and one graduate student were chosen as the experimental subjects. All of the students have and carry their own laptops and make good use of them in their daily study. Three groups of three members each are formed for a discussion. A problem solving discussion and a brain storming discussion topic were prepared beforehand. Each group discussed each topic for 15 minutes using EGITool. A photo of the site of the experiment is shown in fig.3. After the discussions, their thoughts on using EGITool and the contribution of all of the members including him/herself to the discussions are asked by a questionnaire. Co-edited minutes, logs of the system and the filled out questionnaire are presented for the evaluation. Table 1 shows the outline of the experiment.

The co-edited minutes range from 5 lines to 31 lines, and the average of them is 18 lines. The periods of time that someone was using the co-editing sys-

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|--|--|
| Subjects | 9 Persons (6 male and 3 female) |
| Task 1 Problem Solving (15 min.) | Simplifying the word "International disputes between ethnic groups" in order to teach the meaning to children. |
| Task 2 Brain Storming (15 min.) | This tool aims to support face-to-face meetings. Please discuss the merits and demerits when you try to introduce this tool to discussions. |

Table 1. Design of Experiment

tem ranges from 6 minutes and 23 seconds to 10 minutes and 12 seconds, and the average of them is 9 minutes and 3 seconds.

Considering that 15 minutes were given for discussion, the proposed system was not used enough. This was probably caused by the difficulty of discussing the topics and keeping the minutes in parallel. The parallel tasks are required by everyone, so pauses were often made and it took more time to continue the discussion. However, verifying and correcting the records of the remarks during the meeting seemed to encourage the understanding of the topics.

It is not usual to discuss topics and edit minutes in parallel. Therefore, for further evaluations, discussions in the proposed style are needed to be held over and over again, and users are required to get used to the style and to make full use of it.

From the questionnaire, we evaluated if co-editing minutes assist the comprehension ability of the discussion. As a result, this tool was able to enhance the understanding of the topic and refined the point under discussion. The problem of adaptation to the tool was minimal. However, the mechanism that checked the other users' state was much more necessary than what was expected at the site of design. Also, participants were overloaded when they had to discuss and take notes at the same time. A mechanism to share the direction of the discussion itself was needed in order to solve the overload.

7. Conclusion and Future Work

The goal of this research is to improve the level of understanding, ideas, and shared consensus in a discussion between the participants. We introduced software which allows concurrent editing by multiple users in a face-to-face discussion, and created an environment where participants of the discussion can also participate in the editing of the discussion minutes.

However, the types of the task and the number of subjects per a conference experiment still need more consideration. As for future work, training users to co-edit minutes and repetition of the experiment, quantitative data, validation of the awareness mechanism in detail, reconsideration of the record keeping method and load balancing of the participants' work is to be solved.

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