DOCUMENT RESUME

ED 470 127 IR 021 566

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TITLE Relate@IU>>>Share@IU: A New and Different Computer-Based Communications Paradigm.

PUB DATE 2001-11-00

NOTE 11p.; In: Annual Proceedings of Selected Research and Development [and] Practice Papers Presented at the National Convention of the Association for Educational Communications and Technology (24th, Atlanta, GA, November 8-12, 2001). Volumes 1-2; see IR 021 504.

PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)

EDRS PRICE EDRS Price MF01/PC01 Plus Postage.

DESCRIPTORS *Computer Mediated Communication; *Computer System Design; Educational Technology; Higher Education; Information Systems; Information Technology; Shared Resources and Services; Technological Advancement; Telecommunications; User Needs (Information)

ABSTRACT

The purpose of this study was to examine problems with the current computer-based electronic communication systems and to initially test and revise a new and different paradigm for e-collaboration, Relate@IU. Understanding the concept of sending links to resources, rather than sending the resource itself, is at the core of how Relate@IU differs from the traditional communications models. Instructional Systems Technology faculty and students were invited to participate in focus group sessions where they were presented with an initial prototype of Relate@IU. Findings from the focus group sessions indicated that the current electronic communication systems are meeting user needs, while generating new needs that currently are not being met. This report reveals these newly generated needs stemming from the problems with current electronic systems. Following the initial testing of the Relate@IU prototype, an updated computerized version was developed, named Share@IU. The authors are currently developing PHP (PHP: Hypertext Preprocessor) scripts which will be tested on small scale. (Author/AEF)

Relate@IU >>> Share@IU: A New and Different Computer-Based Communications Paradigm

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Abstract

The purpose of this study was to examine problems with the current computer-based electronic communication systems and to initially test and revise a new and different paradigm for e-collaboration – Relate@IU. Understanding the concept of sending links to resources, rather than sending the resource itself, is at the core of how Relate@IU differs from the traditional communications models. Instructional Systems Technology faculty and students were invited to participate in focus group sessions, where they were presented with an initial prototype of Relate@IU.

Our findings from the focus group sessions indicated that the current electronic communication systems are meeting user needs, while generating new needs that currently are not being met. This report reveals these newly generated needs stemming from the problems with current electronic communication systems. Relate@IU is intended to solve many of these emerging problems.

Following the initial testing of the Relate@IU prototype, we developed an updated computerized version of Relate@IU, named Share@IU. We are currently developing PHP scripts which will be tested on a small scale.

Introduction

Technology utilization in higher education has been witness to a dramatic increase in recent years. Two main areas of increase have been in electronic mail (Email), and Web technologies. "Three-fifths (59.3 percent) of all college courses now utilize electronic mail, up from 54.0 percent in 1999, 44.0 percent in 1998 and 20.1 percent in 1995. Similarly, two-fifths (42.7 percent) of college courses now use Web resources as a component of the syllabus, up from 10.9 in 1995, 33.1 percent in 1998 and 38.9 percent in 1999. Almost a third (30.7 percent) of all college courses have a Web page, compared to 28.1 percent in 1999, 22.5 percent in 1998 and 9.2 percent in 1999" (The Campus Computing Project).

Well-known problems exist with e-mail and asynchronous conferencing systems. Many people get flooded with e-mail messages they do not want in their inboxes ("e-mail assault" or "Spam"). Negotiation in advance between a sender and a recipient to agree to communicate is not allowed under the current e-mail paradigm; e-mail filters are often marginally effective. Furthermore, if one sends a large attachment to a group, then a copy of the attachment is delivered to each recipient's inbox and may cause inboxquota overflows as well as network congestion.

While we have seen a dramatic increase in the utilization of communication technologies, there has been a distinct absence of new communication paradigms to match the current needs of users. Current literature suggests that "...communication may be a more important use and determinant of participants' commitment to the Internet than is information acquisition and entertainment" (Kraut, Mukhopadhyay, Szczpula, Kiesler, and Scherlis, 1998). Problems still reside with the current electronic communication systems and a better paradigm needs to be considered.

Literature Review

Computer-Based Communication Systems

Computer-based communication systems require three basic components: hardware, software, and telecommunication lines (Harasim, Hiltz, Teles, & Turoff, 1995). Hardware components include a personal computer or workstation and an Internet connection. A Second component is the software used for group interaction (e.g., bulletin boards, electronic mail, and computer conferencing system). Lastly, telecommunication lines are needed to link the computers to groups of people to communicate and learn together.

Problems with the Current Computer-Based Communication Systems

E-mail. An E-mail system is an electronic data transfer tool to exchange messages over networks. Most E-mail systems have capabilities for attaching files to messages to facilitate the exchange of large amounts of information (Harasim et al., 1995). The distributive nature of E-mail has lead to some of the current problems being experienced by users. One such example of this is the phenomenon of attachments. Graphical E-mail applications such as Microsoft Outlook and Eudora allow for documents to be attached to an E-mail message with ease. This attached document, however, has the potential to spread information, or a virus, with extreme speed. Also, the file size of attached documents is large relative to a normal E-mail message. This large size can lead to an over-quota status of the recipients E-mail account. When such accounts are over-quota, other electronic messages cannot be delivered. There are numerous other examples of the problems users face every day with E-mail which will not be discussed here.

Computer collaboration systems. According to Harasim et al (1995), computer collaboration systems allow joint collaboration in a method other than exchanging isolated pieces of information (i.e. Email attachments). It provides groups with specific spaces inside the software that can be tailored to their needs. Each group communication space has access privileges set by the person who creates the space. Each collaboration space provides lists that allow participants to tell who has accessed what material. Changes on earlier contributions and notifications of changes are also possible. Contrary to such strengths, however, computer collaboration systems have some weaknesses. The most common difficulty is technical problems: people do not know how to use collaboration systems. They are lost in a system, fail to edit online, and have difficulties uploading and downloading documents (Harasim et al., 1995). These problems relate to the specifics of the collaboration system or the interface between the hardware and software – there are various types and versions of collaboration systems. Another problem is communication anxiety, which comes from lack of immediate or appropriate responses within a reasonable time. This is especially true for asynchronous environments where immediate interactions are not possible. People also have difficulties managing increased information flows. With networking and increased access to education and information, the key challenge becomes learning how to manage the information overflows.

Transformation to Peer-to-Peer Computing

Peer-to-Peer computing provides individual users with direct connections to desktop computers for communicating. This is in contrast to the more familiar centralized model of computing used for broadcasting information and electronic commerce. In the following passage, Lewis (2000) describes the transformation from a centralized model of computing to a peer-to-peer model.

"The Internet transformed the world by linking computer networks. The World Wide Web transformed the Internet by making it easy to link files on those computers. Now another major transformation is occurring. By enabling millions of computer users to search for files and transfer them from one desktop computer to another, instead of the current model in which files are typically stored on and retrieved from a central Internet computer called a server, the balance of power shifts from the commercial interests that now dominate the Internet to the individual." (Lewis, 2000)

Since the spring of 2000, peer-to-peer computing has been gaining momentum in the business community. This spur in momentum is largely to due the growing popularity of Napster, the music exchange service. One company who has been leading the way with peer computing innovations is Groove Networks. They have developed an Internet communications software program called Groove, which allows people with shared interests to make direct connections for real-time interaction. According to the company, "Groove moves beyond the World Wide Web paradigm, leveraging the two-way capabilities of the Internet to provide a peer computing platform for use by individuals and small groups, in both a business and personal context."

According to Groove Networks, peer computing innovations have come in three different flavors: Direct access to information, Direct access to computing power and Direct access to people. At the core of these three peer-to-peer innovations is the type of ACCESS we as individuals require/enjoy. Peer-to-Peer computing places the user in control. It is clearly a user-centered approach to computing. People are attracted to peer computing for (a)

creating a shared context among a group, (b) having the flexibility to add functions on an as needed basis, and (c) making connections without having to go through a centralized resource. These reasons naturally combine to allow people to gather together to make informed decisions quickly.

Purpose of the Study

The purpose of this study is to examine major problems and needs with the current computer-based communication systems and to initially test and revise a new and different paradigm for e-collaboration – Relate@IU.

Research Questions

This research focused on two sets of questions. The first set focused on the general use of the current electronic communication systems. The second set focused on the capabilities of Relate@IU. The general questions were: (a) How are you using electronic communications technologies? (b) What major problems have you encountered with electronic communications technologies? (c) What types of improvements would you like to see in the future? (d) If you could dream of a system, any system, that could make your communication life simpler, what would it look like? and (e) Do you feel that current online collaboration tools are meeting your needs? The specific questions related to Relate@IU were: (a) Are there any aspects of the prototype that still need clarification? (b) What problems do you see with the current state of the prototype? (c) What critical characteristics of online collaboration are missing from the prototype that you would like to see included? and (d) How would you improve the interface?

Methodology

Relate@IU

Relate@IU is not the same as e-mail, the Web, or asynchronous conferencing as typically implemented. It is a new e-collaboration tool that is distinguished from the current computer-based electronic communication system.

Table 1. Current Computer-Based Communication Systems vs. Relate@IU

	Current Systems		Relate@IU
	E-mail	Collaboration Tool	
Relationship	Not negotiated	Negotiated	Negotiated
Location of Files	Multiple E-mail Servers	Shared Server	My Web Space
Ownership	Creator & Recipients	Creator & Recipients	Creator
Item Exchanged	Message, File & Link	Message, File, & Link	Subject Line & Link
Number of Copies	Number of recipients	One	One

Negotiation of relationships. With the current computer-based electronic communication systems, relationships are not negotiated. With e-mail addresses, anyone can send another person as much information or as many files as they like. Regarding unwanted e-mails, people spend several hours a week just deleting them. No control exists between a sender and a recipient, and it makes people suffer from such problems as "e-mail assault", over-quota in the recipients' e-mail inboxes, etc. In order to increase effective and efficient use of electronic communication systems, selective information needs to be exchanged with selective people. With the new system, it is envisioned that negotiation must occur among people who agree to collaborate.

File linking system. With our current electronic communication systems, we send out messages, files, or links. Besides unwanted e-mails, what slows down swift communication is the exchange of large files. Under the current e-mail systems, files are sent out as attachments. If modification is needed after a file is sent out, a different version of file is sent out. If modifications are made frequently, outdated files pile up in the recipient's mailbox until the recipient deletes them; this can cause the mailbox to reach its quota and in worst case, new e-mail messages are rejected by the system. Under the new system, people never send out files; what is sent to others in the collaborating

group is a link to the owner's file. The new system is a file linking system, and the access to the file is restricted exclusively to the collaborating group.

One file in one place – control on ownership. With the current electronic communication system, exchanged files reside in e-mail servers or, in the shared server of an electronic collaboration system. In order to distribute a file to multiple individuals, essentially the initiator is making multiple copies of that file. Under Relate@IU, every person saves his own files on his Web space and can exercise controls on the relationships with people in terms of accesses to the files: read-only or modification-enabled. Files are never sent out and remain property in possession of the owner, and people are given permission to view and/or modify the files. However, once another person is viewing a file, he or she normally cannot be prevented from saving it on his/her own storage device (i.e., cannot be prevented from making a duplicate copy).

Design Prototype

The researchers held a brainstorming session to begin to conceptualize the fundamental principles of the new electronic communications system, Relate@IU. One of the important products of our brainstorming session was a comparison table highlighting the key conceptual differences between the current electronic communications systems and the Relate@IU system (see Table 1). Also, sketches of the initial prototype and development notes were developed during the brainstorming session. From these sketches, we were able to design an initial prototype to present during our focus group sessions.

Fortunately, our focus group audience understood the nature of rapid prototyping, and that this initial prototype, although presented in an electronic form (Microsoft PowerPoint), was just the first of many iterations.

Configurations of current electronic mail (e-mail) systems drove the development of the Relate@IU prototype. Current e-mail systems can organize messages in ascending or descending order by when the message was received, who sent the message, if the message was red flagged (used to note high importance), or if the message contains an attachment. Beyond this, users also have the ability to sort their messages into sub-folders. This organizational structure was also incorporated into the Relate@IU prototype. Our prototype presents users with sub-folders that represent each relationship they belong to. From this point, requests are presented in the order that they were received; however, they could be re-organized in ascending or descending order by action requested (read or review), subject, file location, or date received.

At this point, a functional overview of the current prototype may be beneficial. To start, a user would open their Relate@IU web page, and then be prompted to log into the system. The next screen to be displayed would have a list of current relationships on the left, a toolbar to create relationships and send requests at the top, and the main information display window located to the right of the relationships list. The main information display area contains two types of information, requests that individuals or groups have made to you, and your requests to individuals or groups. The content that is displayed in this area is controlled by your selection of an existing relationship from the relationships list on the left of the screen. The tool menu at the top of the screen also affects the relationship that has been selected from the relationships list on the left side of the screen.

Forming relationships can be done at any time by selecting the "Create / Modify Relationship" tool. A pop-up window appears and allows the user to enter a title of the relationship, who is involved in the relationship, and what privileges they have at the folder level (read only or modify).

The Relate@IU system differs from the traditional e-mail system in the fact that it does not send an actual message. This new system sends a subject line and a link to a file. This file could be anything from a word processing document, to a digital image, to an audio file.

Understanding the concept of sending links to resources, in place of sending the resource is at the core of how Relate@IU differs from the traditional communications models. In order to facilitate our focus group participants understanding of this concept, we first asked them a series of questions designed to have them think about their experiences with current electronic communications systems.

Next, we presented a comparison table highlighting the key conceptual differences between the current communications systems and the Relate@IU system. At this point, we showed the focus group participants our prototype, and talked through a scenario of how the tool would be used.

The Focus Group Interview

We used focus groups as a primary method of data collection in order to stimulate new ideas, creative concepts, diagnose potential problems and to generate impressions of our new electronic communications system, Relate@IU. We conducted three separate focus group interviews. Two of these sessions were student focus

groups, and the third session was a faculty focus group. We collected the data during the focus groups by video taping the sessions. Stewart and Shamdasani (1990) recommend ordering the guiding questions from general to more specific. An agenda containing guiding questions for the focus group sessions was designed by the researchers to guide the flow of the discussion. Each participant was provided with a copy of the agenda. The researchers decided to conduct the focus group sessions prior to the one on one interviews in order to solve initial conceptual problems with the prototype. In addition, the researchers wanted to gather data that would aid in improving the interface of the prototype, prior to presenting it in a one on one interview situation. According to Morgan (1997) "...follow-up interviews can help provide depth and detail on topics that were only broadly discussed in group interviews." Focus groups are a somewhat informal technique that can help assess user needs and feelings both before interface design and long after implementation (Nielson, 1997).

Research Site

Participants for this study were drawn from the Indiana University Bloomington (IUB) campus, and more specifically the Instructional Systems Technology Department (IST). The IST Department is located within the School of Education. We conducted our focus group sessions in the main IST classroom.

Research Participants

A purposeful sampling approach was used in this study in order to maximize variation among the research participants. Purposeful sampling is used as a strategy when one wants to learn something and come to understand something about certain select cases without needing to generalize to all such cases (Patton, 1980). Each participant was contacted via e-mail, informed of the purpose of the study, and was asked to participate. In particular, we were interested in selecting a variety of IST masters and doctoral students, early or late in their program, spoke English as a first or second language and were male or female. In addition, we were also interested in selecting IST faculty.

Study participants include three masters, four doctoral, and three faculty. Among the students, three were male and four were female, and among the faculty, one was a female and two were male. All except for two participants spoke English as a first language.

Results

General Questions

Below are the general questions from the focus group interview, followed by key points that were raised.

1. How are you using electronic communication technologies?

All participants indicated that they utilized SiteScape Forum (SSF) for document sharing with classes. E-mail was also used by all participants for academic and personal communications. One participant stated that File Transfer Protocol (FTP) was still utilized for posting documents to a server space. Most participants stated that they utilized online search engines to locate information and updates on the World Wide Web (WWW).

2. What major problems have you encountered with electronic communications technologies?

A majority of participants reported problems with a lack of system interoperability (e.g. MS Word and WordPerfect, Macintosh and PC platforms). This was mirrored by a large number of participants reporting difficulties in moving a document from one system to another.

Electronic mail was another source of difficulties for our participants. Few reported problems with junk mail (Spam), about half reported difficulty with reading attachments (associated with the PINE e-mail system). Quickly reaching the maximum quota (file storage allotment) was also of concern to about half of our participants. A few participants commented about the difficulty in replying to challenging e-mails, stating that they don't know how to answer or what to do with the message.

When dealing with multiple communications systems, a majority of participants had commented on the tedium of logging in to multiple forums, specifically with SSF, and then having to remember not only multiple passwords, but also which forum to access. A few participants had difficulty with the unintuitive interface with SSF. Our faculty focus group noted that there is no integration between the various commonly used communications systems such as SSF and e-mail. SSF server downtime was noted by a just under half of our participants as a major source of difficulty.

3/4. What would your dream system look like?

Although we did receive a range of responses to this question, there was no one feature that was repeated with a high frequency. Almost half of the participants had indicated that they wished to have greater control of how, and with whom, they collaborate. One third of the participants would like to see human-like intelligence with advanced filtering, prioritizing, and automatic archiving of electronic mail and data. The ability to customize the system, and visual communications were both mentioned by one fifth of our participants. There were a number of responses that were unique. These suggestions ranged from a seamless integration of the most commonly utilized systems, to having a system be able to recognize what type of file is being used, to a tracking and check-in / check-out system for working with documents in an online collaborative file sharing environment. One common dream was that of unlimited storage space

5. Do you feel the current system is meeting your needs?

Half of all participants responded that yes, the current communications systems are meeting their needs. However, there were a number of conditions that were placed on this response. One condition was that collaboration at a distance works with a relatively small number of people. Another condition is that the current technology is forcing users to follow specific rules, in other words users are submissive to the technology. One participant stated that due to limited experience with electronic collaboration, that they were uncertain as to what there needs were, and therefore was uncertain if the current systems were meeting those needs. Another participant was not satisfied with the inadequacies in the discussion type tools, particularly for students and classes. A few participants made the comment that current online collaboration tools are meeting many of my needs and generating new needs that are not being met.

Responses to the Prototype

Below are the focus group responses to the current Relate@IU prototype.

Comment 1: If you send a link to 10 people, how do you know who read it if when one person reads it and it changes to non-bold?

At the present time there is no understanding on our part as to how this tool could display which members of a group have opened the document, and who has not.

Comment 2: Would it send you some sort of notification (if someone sends you a request to collaborate)?

The current system was designed with the idea that it would be its own system, not tied into other IU systems. People would agree to work together via current methods, and then go to the Relate@IU tool to assist them in their collaboration. Relate@IU was not viewed as an initial step; however there is room for redesign.

Comment 3: I'm thinking four people in a group, 3 classes, that's 12 individuals – do I want to set up 12 relationships?

For three different groups you would have to form three different relationships. It is possible to have multiple individuals involved in one relationship. SiteScape Forum (SSF) might be a more appropriate tool for collaboration in cases similar to this.

Comment 4: So this wouldn't be for sharing documents with a group, I would share my stuff, but it's not a place where the group has...

A group of individuals may have access to read or modify documents that currently exist in your web space; however, the current design of the system does not allow users to place a file in another user's space. One member of a group can send a link to the file, and other members of the group can access the file, but there is no central repository for the group to store documents.

Comment 5: (A) Problem would be that there is no identification of who is sending a request when multiple people belong to a group (i.e. project team)

Currently, the system recognizes users as either an individual user, or as one user accessing an account that has multiple users. The system can be redesigned to utilize usernames to identify the individual who sent the request, as well as to identify which users have accessed documents.

Comment 6: All most everyone I know I have multiple types of relationships with, how would I manage that?

Comment 7: What I'm seeing is that the relationships are all about document sharing.

Relate Becomes Share@IU

A paper prototype was built to simulate the functions that were determined in the Relate@IU research study. Usability tests were conducted with this paper prototype. Some problems were found with the paper prototype and users suggested some changes to this prototype. Due to the nature of this study, we were open to ideas and suggestions of the users. Furthermore with the considerations of these problems and suggestions, two more computer prototypes were developed and further usability tests were done. During this development stage, we were determined to develop a user-friendly system. If this new system is seen as a new tool to learn or require training, people might resist using it. We wanted to make sure that it was usable by various types of computer users and we tested this with a wide variety of users.

When we started to mock up Share@IU, we identified the critical functions required for the system. We recognized that there were fundamentally three different categories of functions: File management, communication and group functions. We identified the sub functions under these categories. The File Management system is similar to Windows Explorer or generic FTP programs. We developed a similar interface for the File Management System part of Share@IU. Communication and group level functions were added to this interface.

In the File Management Functions, the user (owner of Share@IU space) can create a folder, upload files, determine where s/he is working, navigate between folders (up a level or down to subfolders), and determine the files in the folder with their size and modification date. In the Group Functions, the user can determine who can have access to that specific folder. In the Communication Functions, the user can send a message to the group about the uploaded files (see Figure 1).

In the following figures, some shots of the electronic prototype of Share@IU are shown. This is the view of a Share@IU owner. If the user sends a message to his/her group, they don't see the files in this way they just follow the link, and can see what is allowed for him/her.

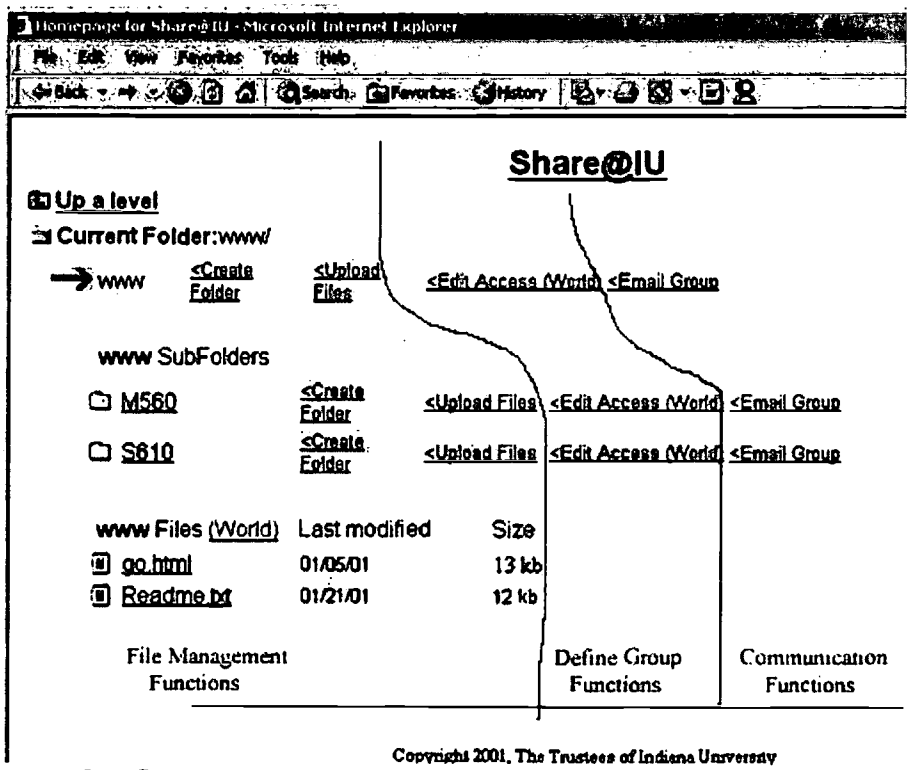

Figure 1: Share@IU Computer Prototype: General View (Separator lines are superimposed here, but not seen by user)

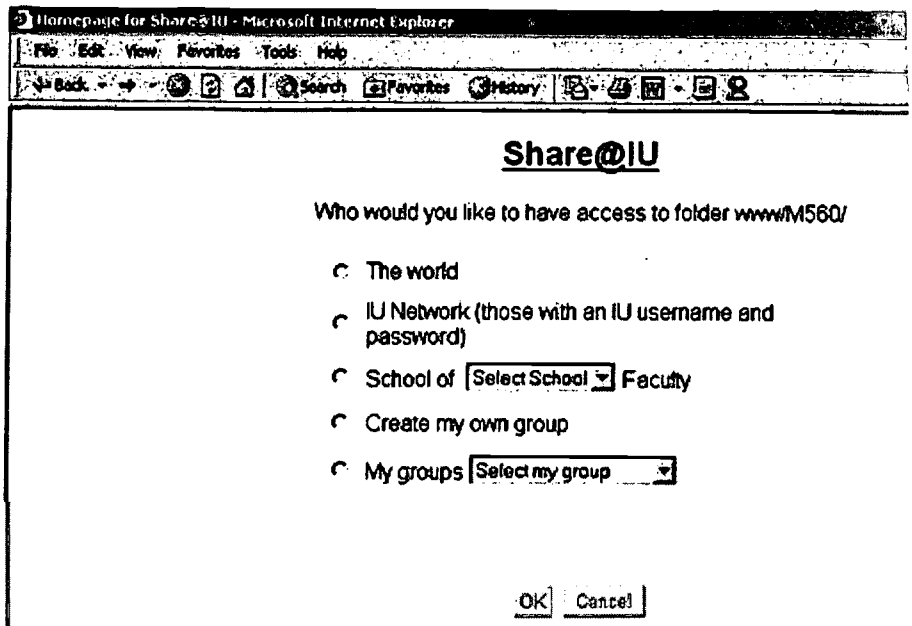

Figure 2: Share@IU Computer Prototype: Choosing a GroupType

The user determines his/her folder access level. S/he can choose either of these options and accordingly sets the folder accessibility to the defined group (see Figure 2).

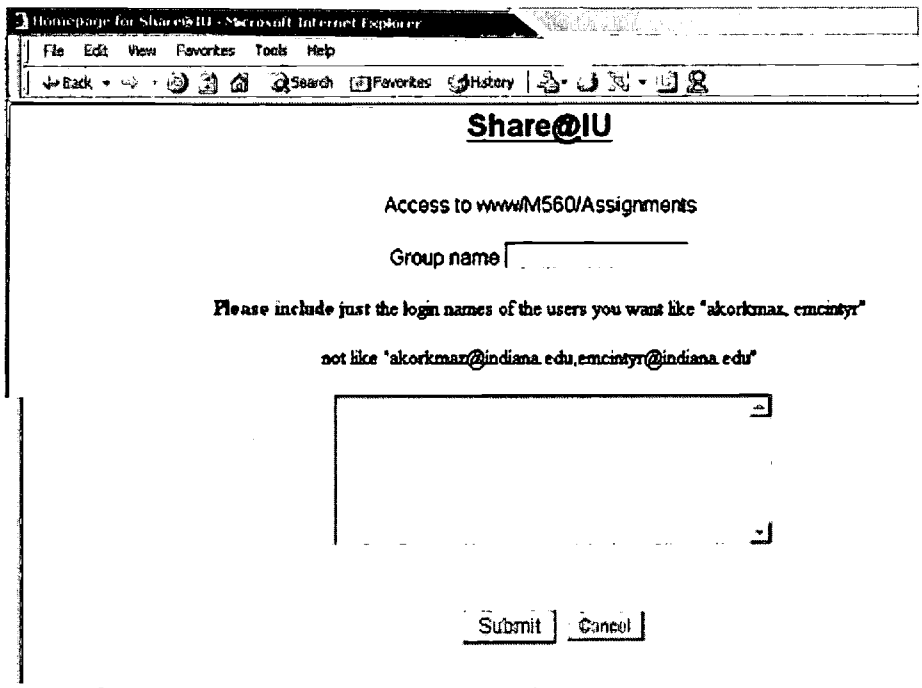

Figure3: Share@IU Computer Prototype: Creating Own Group

If the user wants to determine specific users, s/he can choose "create my own group" option (see Figure 2) and determine the user ids and add them to the list (see Figure 3).

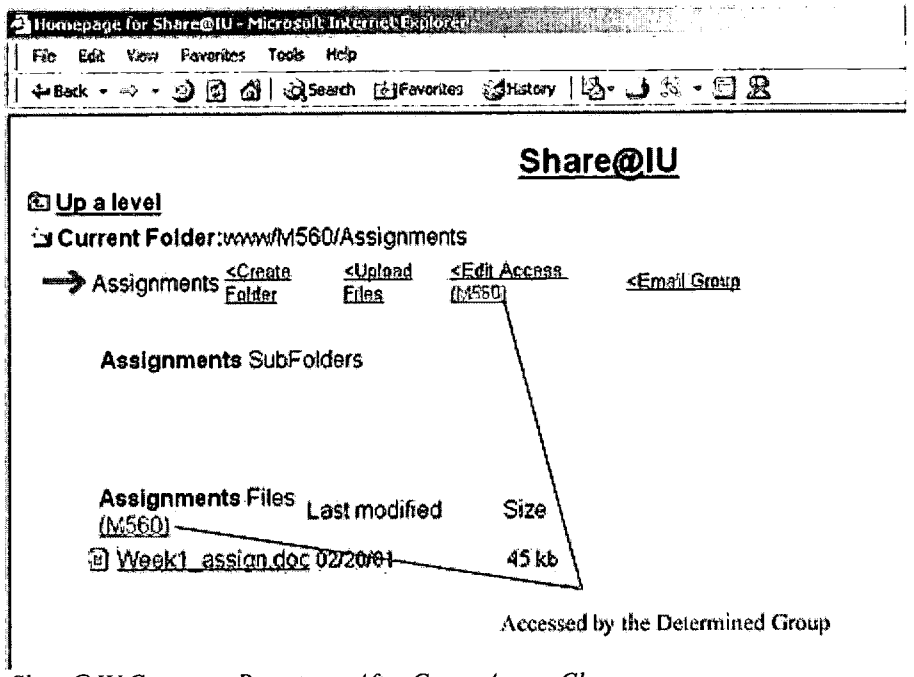

Figure4: Share@IU Computer Prototype: After Group Access Changes

After user determines the accessibility of the folder, the folder's accessibility level changes and files and folders in that folder change automatically (see Figure 4).

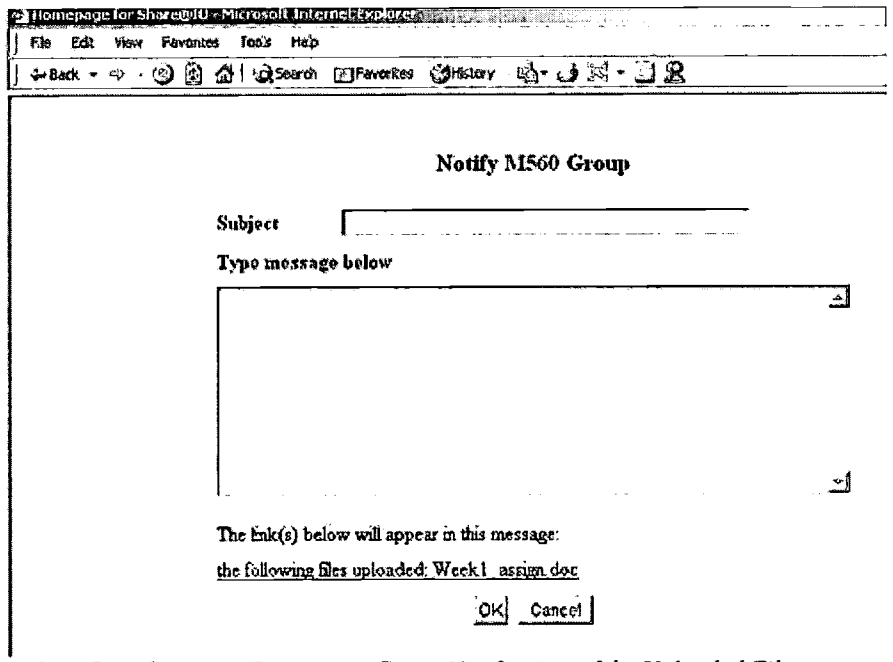

Figure 5: Share@IU Computer Prototype: Group Notification of the Uploaded Files

If the user wants to inform the group about the uploaded files, s/he can send a message by clicking on "E-mail group" option (see Figure 4). They can add a message and subject for their e-mail (see Figure 5)

Limitations and Future Plans

Due to purposive sampling in the initial qualitative study, generalizability of findings beyond the specific group investigated is not warranted. The results were nonetheless useful in shaping the direction of subsequent prototypes, and further usability testing of those prototypes helped to improve their design.

Share@IU is still a prototype (simulation) that has not yet been implemented as a working product. As we develop a functioning product, additional usability tests will be conducted to refine the design. It is our hope that Share@IU can be implemented on a variety of operating systems (e.g., Unix, Linux, MS Windows, Macintosh) running standard Web servers (e.g., Apache, IIS). Scripts will be written in PHP, which will run as CGI applications on the server side. Users will be able to access Share@IU through standard Web browsers (e.g., Netscape, Explorer, AOL, Opera) with normal Internet connections (PPP), and read messages generated by Share@IU with any standard e-mail system (e.g., Eudora, Outlook, Messenger).

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