Design and Implementation of a Virtual Machine Video Conferencing Application

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Abstract: Videoconferencing today is faced with the challenge of limited number of participants per time, and also the need for large and fully equipped conference rooms. This might not be a problem to a large enterprise, but for the small to medium-sized business, access to a videoconferencing facility involves either a very costly rental fee or is completely impossible. The aim of this work is to design and implement a videoconferencing prototype (OpenMeeting) with added functionalities which will solve problems facing the traditional way of conducting meetings.

Keywords: Audio conferencing, OpenMeeting, UML, Video conferencing, Virtual Machine

1.0   Introduction

Teleconferencing is the live exchange of information among several persons through an electronic medium. The need to be able to communicate without having to travel long distances in order to hold important business meetings, seminars, conferences and in some cases interviews online brought about one of the best tools for business communication which is known as teleconferencing. The saving of time and money is one of the greatest advantages that teleconferencing has brought to the business world, this is because they are the two things the business world never seems to have enough of. The ability of businesses to be able to readily communicate with the rest of the world plays an integral role in the company's survival and success. In order for a business to compete at the highest level, it has to be kept on the cutting edge of technological advancement [1]. The two most popular types of teleconferencing are Audio-based teleconferencing and Video-based teleconferencing. Audio-based teleconferencing involves the use of a telephone or VOIP (voice over internet protocol) call in which several people in different locations are connected, as opposed to regular phone conversation, which is limited to two connected parties. The conversation takes place in real time, is heard only by participants, and is not visually presented like a video-conference session. It is sometimes referred to as ATC (Audio Teleconference). Video-based teleconferencing is a form of teleconferencing done through mediums that support video and audio communication. It is a live video connection between people in separate locations for the purpose of communication or interaction. It involves the use of real-time video and audio streaming to enable people conversing over the internet to be able to hear and see each other [2]. In order to have full color videoconferencing for analog signals, a bandwidth of 6 megahertz (MHz) is required, so also for digital signals bandwidth of 1.5Mbps is required. Videoconferencing protocols are governed by the ITU-TSS standard H.261 and its successors [3]. The motivation behind this project is to propose a means to be able to create

one fully integrated multimedia teleconferencing room, where every piece of equipment works in a seamless collaboration to create an end-to-end video conferencing solution.

2.0 Materials and Methods

In this work, we made use of the following tools:

SWF tools: shock wave flash

Red5 media server: Red5 is an open source Flash RTMP server written in Java.

Virtual Machine

JOD Converter

This video-conferencing system is a web database application which uses Apache 2.0 application server. Apache is an open-source http web server software which means its source code is freely available and can be shared. It is a full featured server; its major work is to fetch any file requested by a browser and displays the correct results according to codes within the file.

Converting files from one format to another is one of those problems that sound simple but actually is very complex to solve [4]. In this work, we needed to convert word document, Excel document as well as Power point document to PDF to Flash and we used the Java Open Document Converter. This converter offers variety of usage options – it can be used as a Java library, as a web service it automates conversions between office document formats including: Microsoft Office to OpenDocument, and vice-versa, any format to PDF, OpenDocument Presentation (odp) to flash; PowerPoint to Flash, RTF to OpenDocument; WordPerfect to OpenDocument etc [5].

Another software used is the SWF (shockwave flash) [6], it is an Adobe flash file format used for multimedia, vector graphics and Action script [7] Originating with software, then transferred to Macromedia, and then coming under the control of Adobe, SWF files can contain animations or applets of varying degrees of interactivity and function. Currently, SWF is the dominant format for displaying "animated" vector graphics on the Web [8]. PDF to SWF is another function of the SWF converter, a PDF to SWF Converter generates one frame per page, it enables you to have fully formatted text, including tables, formulas, graphics etc. inside your Flash Movie.

Red5 media server was also used, red5 is a leading open-source media streaming server implemented in Java,[9] which provides services similar to those offered by the proprietary Adobe Flash Media Server [10] which includes:

Streaming Audio/Video (FLV and MP3)

Recording Client Streams (FLV only)

Shared Objects

Live Stream Publishing

Remoting (Action Message Format)

At the initial stage of choosing the appropriate virtual machine, some of the processes reviewed were:

Vmware workstation 9.0

Vbox player

Vmware Vsphere client

The design and configuration of the virtual machine is the initial step in the video-conferencing process. It is the virtual machine that the software sits on. The virtual machine used in this project was the Vmware workstation 9.0. Virtualization uses hardware abstraction layer i.e. it sits on the hardware on the system and gains direct access to resources on the host machine. The virtual machine must be able to support hyper threading for a successful virtual operation. The programming languages used in the development of this application are XML, HTML and Java Script. The block diagram of the system is shown in figure 1.
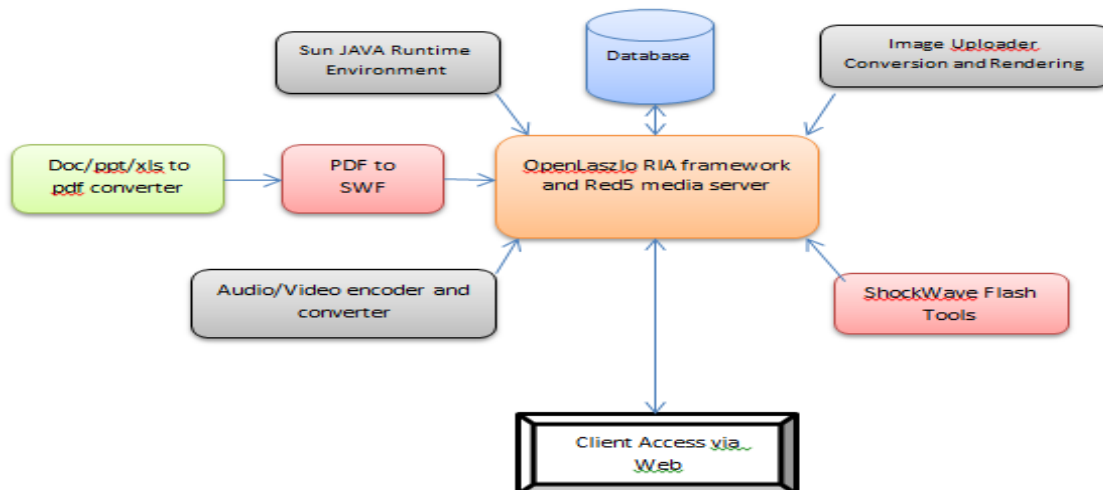
Fig. 1: Block Diagram of the System (OpenMeetings)

A formal model of the proposed system is done using a Unified Modeling Language (UML). The UML is a modeling system that provides a set of conventions that are used to describe a software system in terms of objects. It offers diagrams that provide different perspective views of the project. UML use case diagrams can be used in describing the main processes in a system, the interactivity between the main processes (use cases) and external individuals called "actors" [11].
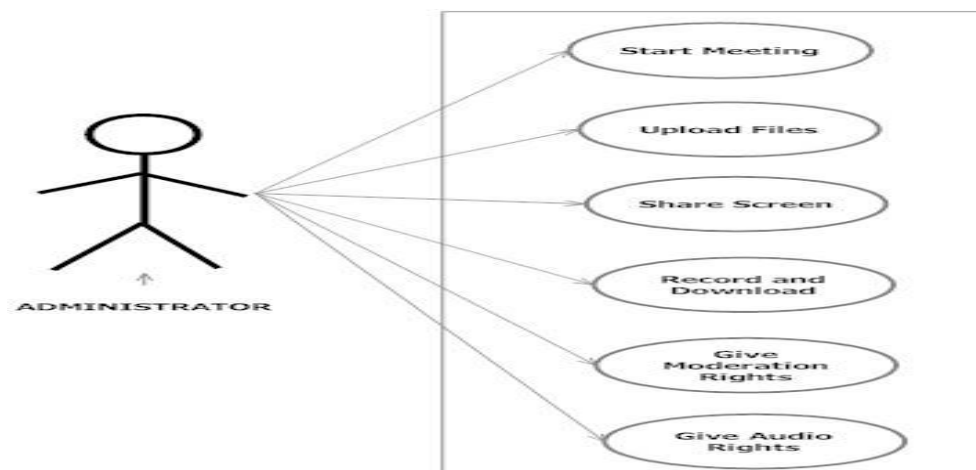
Fig. 2: Use Case Diagram Showing the Administrator Functionality in the System
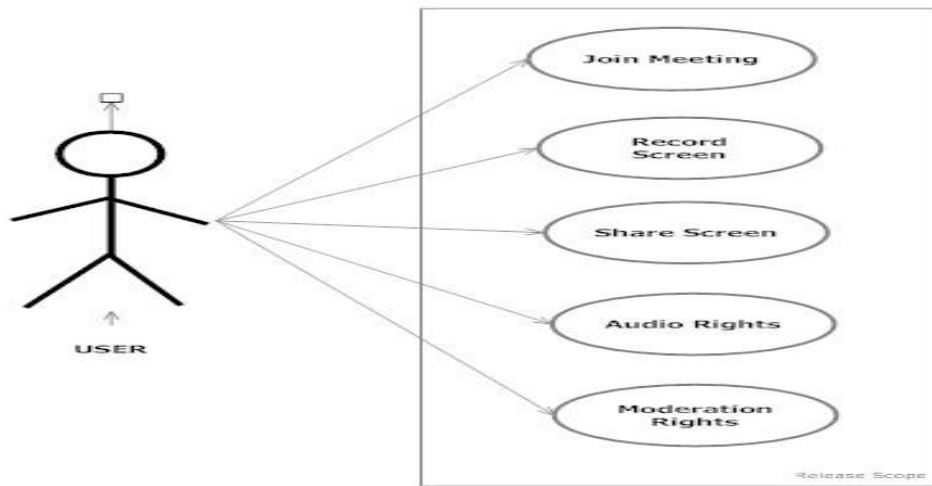
Fig. 3: Use Case Diagram Showing Functionality of User

In figures 2 and 3 the video-conferencing model is described, from the administrative and user page. The separation of both the user and administrator shows that the activities of the users do not interfere with the activities of the admin.

On the administrator diagram, the administrator gains access to every part of the model and are permitted to make changes when necessary, add and remove moderation rights, allow or deny the users to draw on the white board, allow or deny the users screen sharing or recording, allow or deny audio rights to users, give exclusive audio right to self and upload files.

The user is only permitted to join the meeting when invited via an email, record screen, share screen, use the white board, and audio when given permission by the administrator.
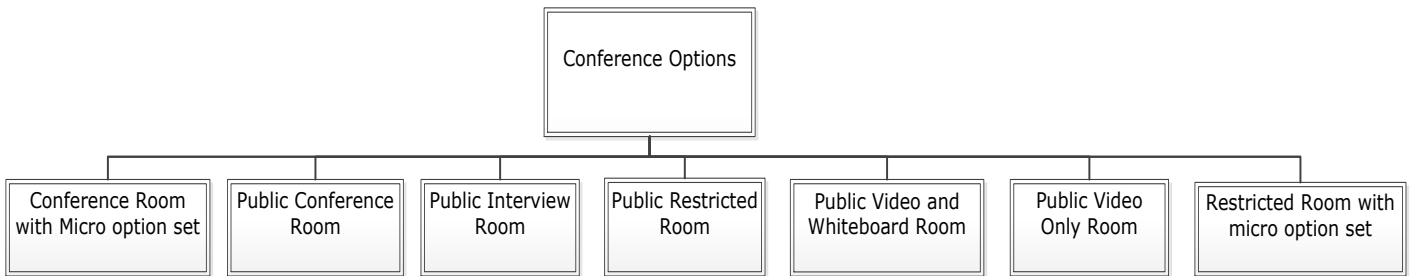
A class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes.
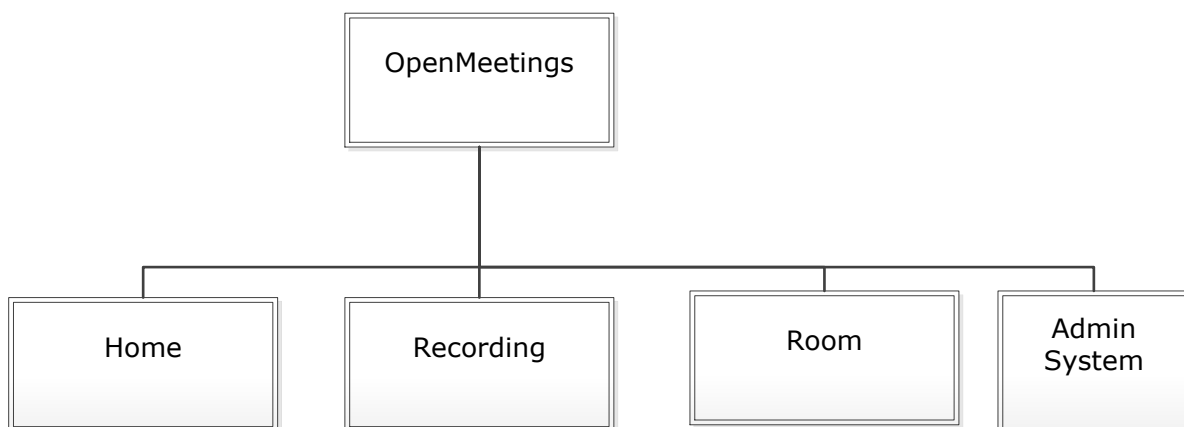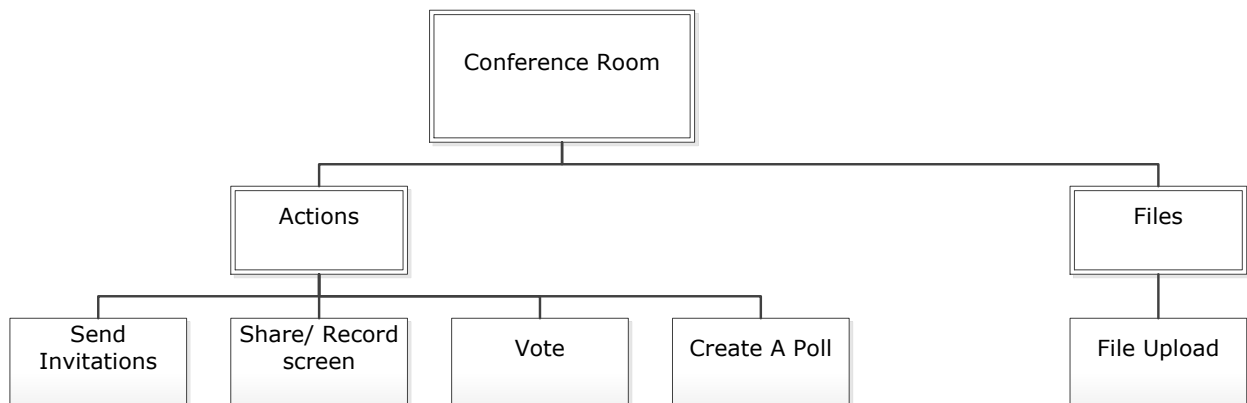

Fig .4: Class Diagram for OpenMeetings
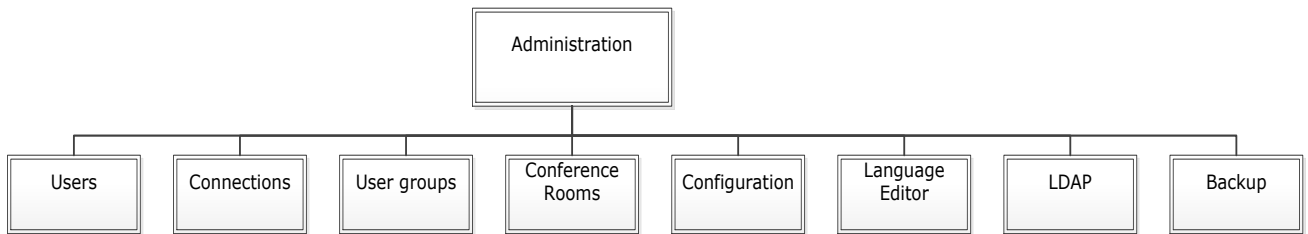
**Fig. 5: Class Diagram for Administration System**

Fig. 6: Class Diagram for Conference Options

Fig. 7: Class Diagram for Conference Rooms

A flow chart is a means of visually presenting the flow of data through an information processing systems, the operations performed within the system and the sequence in which they are performed [12]. The flow chart for the system is shown in figure 8.
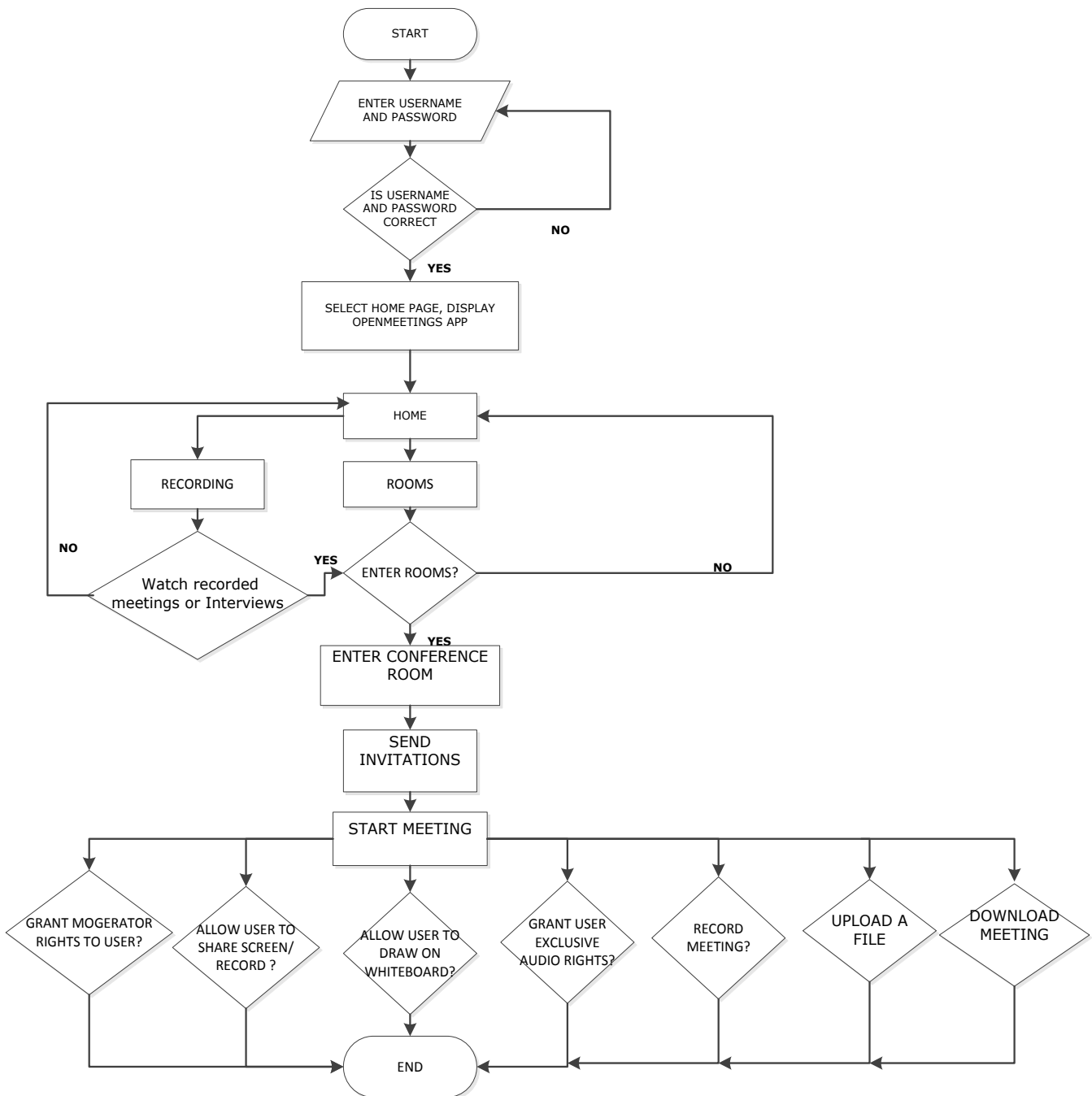
Fig. 8: Flow Chart Diagram for OpenMeetings

3.0   Results

3.1   Running and Accessing the Red5 Media Server Using Port 5080

After the administrator logs into the Linux OS, he runs the red5 media server. The media server is run by using the following commands: cd /usr/src/om and sh red5.sh. After running the media server, you will need to call it up from the server and this is done by inputting the IP(internet protocol) address of the Linux CentOS (operating system) together with the default port number which is 5080 in your browser as shown above.
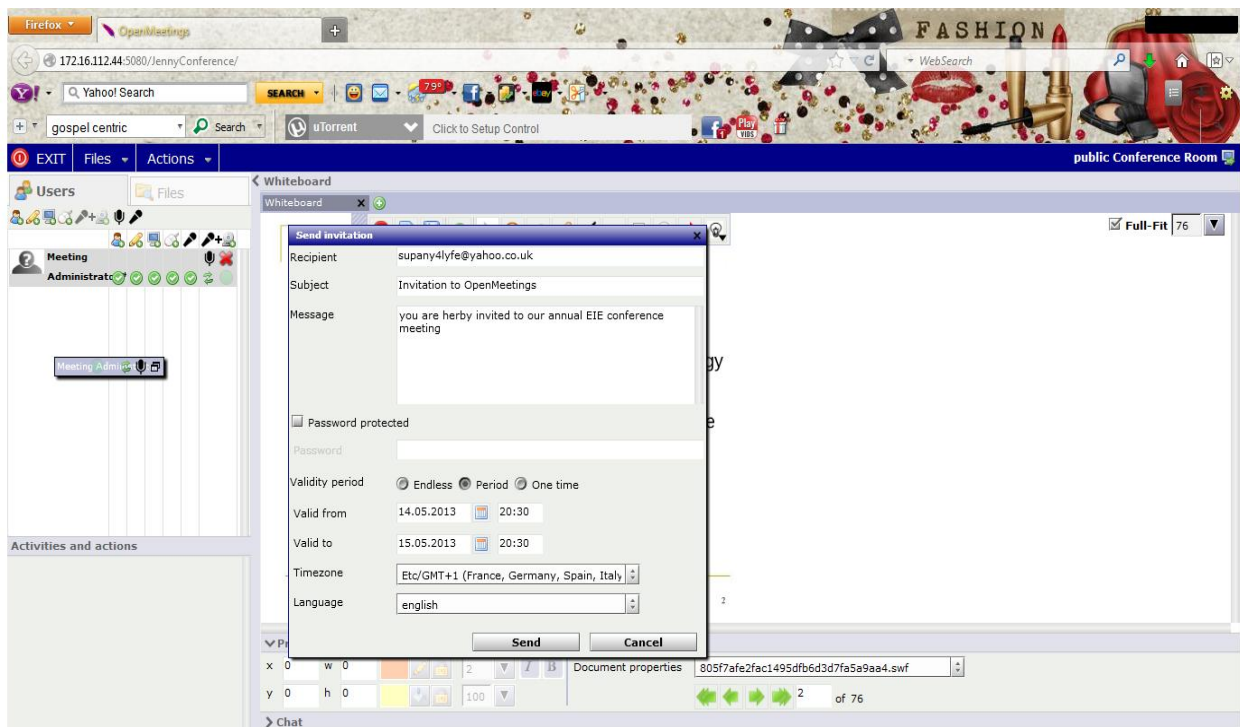
3.2   The Startup of a Meeting
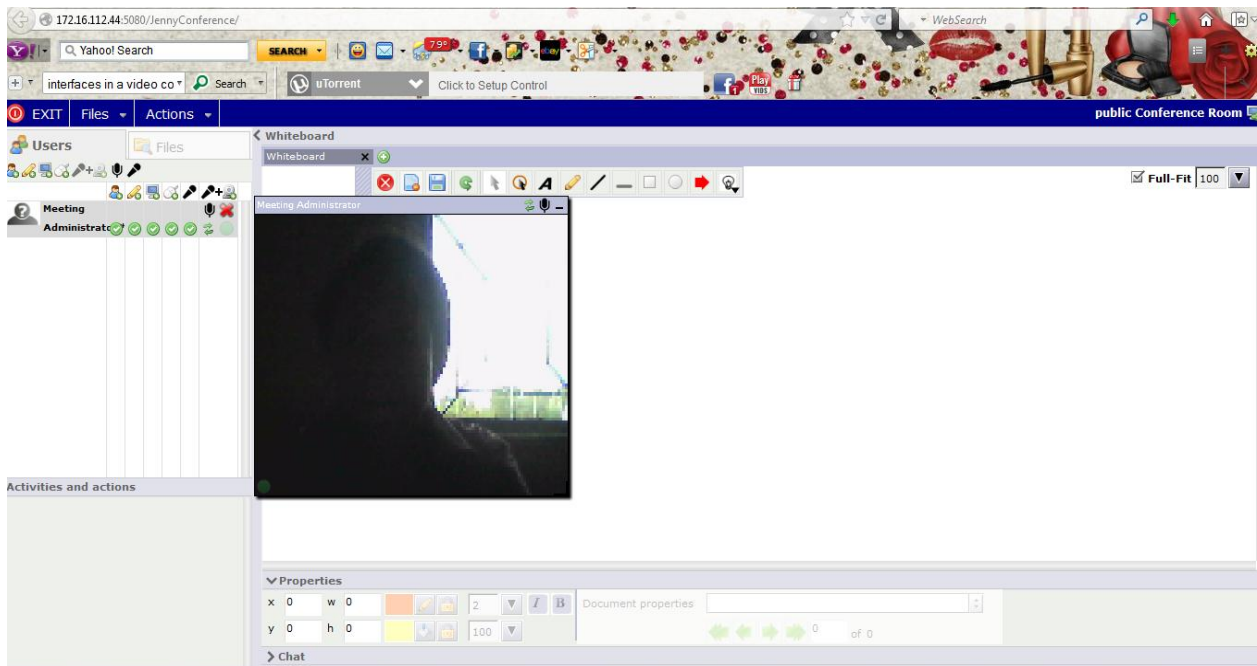
Fig. 9: Screenshot of the Meeting Startup

The above screenshot shows the moderator before the meeting commences. The moderator must be able to view himself and certify that the connection is okay before he sends out invitations.

3.3 Inviting a User to Join the Meeting

Fig. 10: Screenshot of the Invitation of a User

In order for a participant to join the meeting or interview, he must first be invited and this is done by the moderator using the participants e-mail address. The invitation sent contains the link that would be used by the participant to connect to the meeting. When an invitation is sent, it is done using the participants e-mail address, when the intended participant views his or mail, a link would be available that links him to the meeting. It is important to note that the participant must

have java installed in his browser for him to be able to join the meeting through his browser.
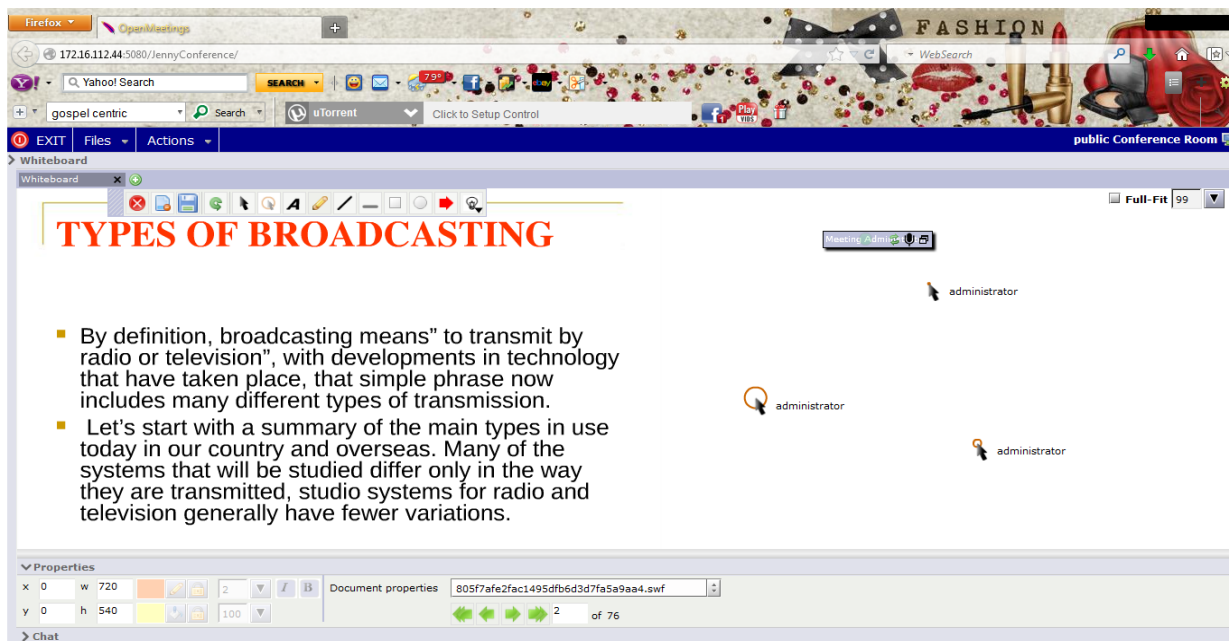
3.4 Uploading a File for Presentation

Fig. 11: Screenshot of an Uploaded File to the White Board for Presentation

This application allows for upload of files for presentation either in the form of Microsoft excel, Microsoft word or Microsoft power point. The uploaded file is automatically converted first to a PDF (portable document format) format and then to flash, this is the format in which it would be seen by the participants. It also allows for pointers, that is the moderator is able to highlight where or what exactly he is talking about
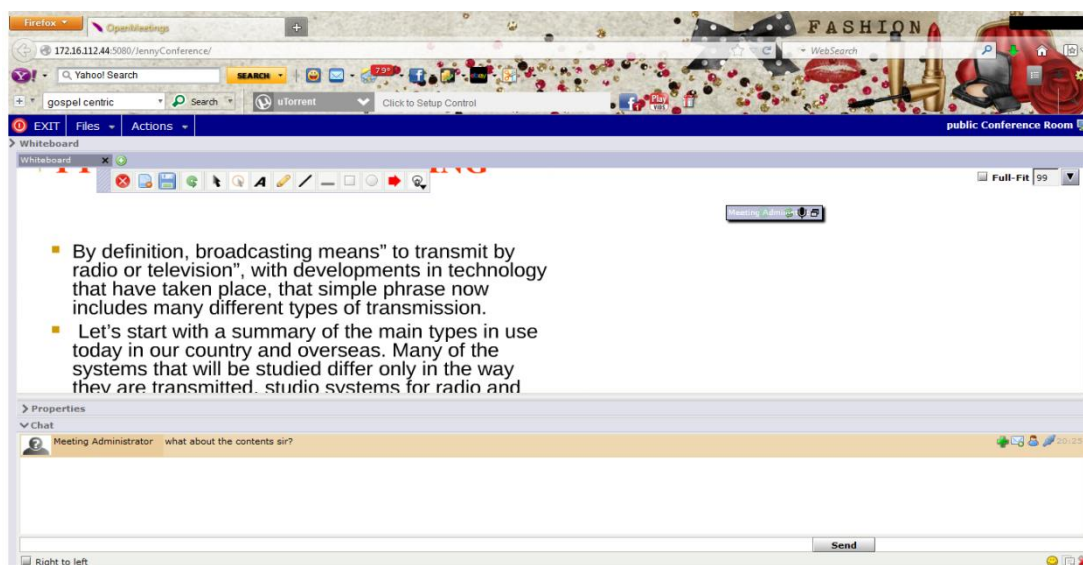
.3.5 A Platform for Questions

Fig. 12: Screenshot Showing a Question Being Asked

This application provides a platform for questions to be asked during an ongoing meeting or presentation inform of a chat, and these questions are answered by the co-moderator who must be given the right to do so by the moderator.

The video conferencing application developed in this work is called OpenMeetings, some of the various video conferencing applications already in existence include: Anymeeting, citrix GotoMeeting, IBM Lotus Sametime, Skype, Yuuguu, AccuConference, BuddyMeeting, and Cisco WebEx. OpenMeetings has some added features when compared with some of the above listed video conferencing applications.

Table 1: Comparison Between OpenMeetings and other Video Conferencing Applications

PROGRAM	SIMULTANEOUS USER CAPACITY SIMULTANEOUSLY	WHITE BOARD	UPLOAD PPT/ PDF	RECORDING CAPABILITIES	EXCLUSIVE AUDIO/ VIDEO RIGHTS SUPPORT	DESKTOP SHARING SUPPORT	MOBILE DEVICE SUPPORT
OpenMeetings	1-25	YES	YES	YES	YES	YES	YES
Skype	1-25	NO	YES	NO	NO	NO	YES
IBM Lotus Sametime	-	NO	YES	NO	NO	YES	YES
Anymeeting	1-200	NO	YES	YES	NO	YES	YES
BuddyMeeting	1-10	YES	YES	NO	NO	YES	NO
citrix GotoMeeting	1-1000	NO	NO	YES	NO	YES	YES
Yuuguu	1-30	NO	NO	NO	NO	YES	NO
Cisco WebEx	1-3000	YES	YES	YES	NO	YES	YES
AccuConference	1-1000	NO	YES	YES	NO	Moderator only	NO

4.0   Conclusion

With this application, we have been able to solve the problems that traditional meeting and interviews face. It is beneficial in offices and companies that have good internet access and as such desire a quick and effective way of conducting meetings and even interviews. The application was able to achieve its purpose, it allowed the use of 25 users simultaneously and it was demonstrated in a LAN (local area network).

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