

LIVELMS: A BLENDED E-LEARNING ENVIRONMENT, A MODEL
PROPOSITION FOR INTEGRATION OF ASYNCHRONOUS AND
SYNCHRONOUS E-LEARNING

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF INFORMATICS
OF
THE MIDDLE EAST TECHNICAL UNIVERSITY

BY

ERKAN ER

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF
MASTER OF SCIENCE
IN
THE DEPARTMENT OF INFORMATION SYSTEMS

SEPTEMBER 2009

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ABSTRACT

LIVELMS: A BLENDED E-LEARNING ENVIRONMENT, A MODEL PROPOSITION FOR INTEGRATION OF ASYNCHRONOUS AND SYNCHRONOUS E-LEARNING

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September 2009, 111 pages

In distance education, lack of face-to-face communication prevents instructors from observing students' activities efficiently, especially in crowded sessions, and consequently they fail to effectively assess the performance of distant learners. On the other hand, in spite of being physically distant, instructor should monitor students' activities and assess their performance effectively so that learners can be informed as quickly as possible of how well they are doing.

This thesis aims to develop an e-learning tool for distance education that integrates asynchronous and synchronous learning environments to offer an enriched e-learning

platform. The tool enables instructor to keep track of students' activities, assesses learners' participation during online synchronous sessions dynamically, and provides asynchronous access to assessment data after the lectures. In this way, it is aimed to monitor performance of distant learners by the instructor more efficiently.

Keywords: e-assessment, distance learning, synchronous online lecture, web conferencing, LMS

ÖZ

LIVELMS: HARMANLANMIŞ E-ÖĞRENME ORTAMI, BÜTÜNLEŞİK ASENKRON VE SENKRON E-ÖĞRENME İÇİN MODEL ÖNERİSİ

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Eylül 2009, 111 sayfa

Uzaktan eğitimde yüz-yüze iletişimin olmayışı sonucunda, öğretmenler öğrencilerin aktivitelerini özellikle de kalabalık oturumlarda gözlemlemekte zorlanmaktadır ve bunun sonucunda öğrencilerin performanslarını etkin bir şekilde değerlendirememektedirler. Ancak, öğrenciyle arasındaki uzaklığa rağmen öğretmen öğrencileri eş-zamanlı ders boyunca etkin bir şekilde takip ederek performanslarını değerlendirebilmelidir. Bu şekilde öğrenciler derse katılımları konusunda zamanında geri dönütlerle bilgilendirilebilir.

Bu tez, zengin bir e-öğrenme ortamı elde etmek amacıyla senkron ve asenkron öğrenme ortamlarının birleştirilerek bir e-öğrenme aracının geliştirilmesini

hedeflemektedir. Aracın belirli odađı, çevrimiçi senkron öğrenme ortamında öğrenci aktivitelerinin kaydı tutularak öğrencilerin katılım performanslarının dinamik olarak değerlendirilmesi, ve çevrimiçi dersler tamamlandıktan sonra değerlendirme bilgisine asenkron bir şekilde erişimin sağlanmasıdır. Bu şekilde öğrencilerin gelişimlerinin daha etkili bir şekilde gözlemlenebilmesi amaçlanmaktadır.

Anahtar Kelimeler: e-değerlendirme, uzaktan eğitim, eşzamanlı çevrimiçi ders, web konferans, LMS.

To METU,
To anybody involved in distance education

ACKNOWLEDGMENTS

I express sincere appreciation to my supervisor Dr. Ali ARİFOĞLU and to my co-supervisor Prof. Dr. M. Yaşar ÖZDEN for their guidance and insight throughout the research.

I am forever grateful to my family, especially to my sweetheart mother.

I would like to express my sincere thanks to my friends Gülgün AFACAN, İlkem Sekban ASLAN, Oğuzhan ALAŞEHİR, Halise ŞEREFÖĞLU, Bilgin AVENOĞLU, Ahmet COŞKUNÇAY, Emrah GÜLAY, Seda ŞALAP and Meryem Arzu ARUNTAŞ who let me feel their support and faith throughout my thesis study. I am also grateful to anybody who has any positive touch on my study directly or indirectly.

I would like to thank TUBITAK for their scholarship which helped me pursue my master study.

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LIST OF ABBREVIATIONS

AD	:	Active Directory
API	:	Application Programming Interface
HTTPS	:	Hypertext Transfer Protocol Secure
LMS	:	Learning Management System
MOLM	:	Microsoft Office Live Meeting
MS	:	Microsoft
Q&A	:	Questions and Answers
PC	:	Personal Computer
VoIP	:	Voice over Internet Protocol
WSS	:	Windows SharePoint Services
UC	:	Use Case
URL	:	Uniform Resource Locator
XML	:	Extensive Markup Language

CHAPTER 1

INTRODUCTION

1.1. Background

Various studies and researches have been conducted to improve the quality of education at all levels with the intensive and innovative use of information and communication technologies [1]. One of the major focuses of these efforts in education field is the distance education, which is a way of delivering education when instructors and learners are physically or timely separated. Quality of distance education is supported with the use of advanced technologies, especially with numerous web conferencing tools and learning management systems, in order to achieve a learning environment that is closer to one in traditional classroom.

There are various assessment strategies utilized in distance education. Types of e-learning technologies, which are synchronous technologies and asynchronous technologies (See 2.2 for details), used in distance education have a direct relation with the selection of the assessment strategies applied in distance education. Thus, in parallel with the types of learning technologies in distance education, assessment strategies can be categorized into asynchronous assessment activities and synchronous assessment activities.

In an online learning environment, mostly asynchronous assessment methods are utilized and this kind of assessment is achieved when instructor and learners interact

in different times [2]. Common methods for asynchronous assessment include discussion boards, e-mails, blogs and wikis.

Synchronous assessment, on the other hand, is an activity during which instructor and students interact in real-time [2]. Synchronous communication tools such as audio-conferencing, online chat, and instant messaging provide capability of real-time assessment by which instructor can predict how well students learn the course content [3]. In addition, Q&A sessions, offered by most of the web-conferencing tools used in distance education, can be included in this category.

To summarize, assessment is a way of monitoring the progress of each learner so that instructor can provide feedback in time. Especially in distance education, assessment gains more importance because students need to know that they are controlled and supported by the instructor in spite of distance. In this way, they are motivated and social presence is empowered.

1.2. Problem Statement

In traditional classroom environments, instructor has various opportunities for assessing students' performance during lectures. Thanks to face to face communication, instructor can observe the students' activities, such as raising hand, asking question and answering question, effectively and can conduct informal assessment in real-time regarding learners' participation. That means many indicators that shows what students know are obtained casually [4].

In distance education, learners can perform similar activities as well (e.g. raising hand and answering question, etc) during the synchronous e-learning sessions depending on the used technology. However, lack of face-to-face communication prevents instructor to effectively observe students' activities [5], and consequently s/he cannot perform assessment in synchronous learning environment adequately. This is one of the problems related to performance assessment in distance education. Students' activities during synchronous e-learning sessions are not automatically

assessed and not presented to instructor. Providing efficient performance assessment functionality can serve instructor to identify what students know and their attitudes and behaviors [4]. Instructors need to observe changes in student attitudes and behaviors in real-time so that s/he can assess current educational situation in class and react accordingly [5].

Another limitation of synchronous assessment in distance education is that generally a small part of learners can actively participate in online lecture. Lectures with the participation of a large group of students results in considerable number of passive students in the background neglected by instructor [3]. Overlooking students, who are tending not to participate much likely, occurs in distance education especially when instructor cannot see students [6]. In spite of being physically distant, instructor should communicate with students effectively and inform students as quickly as possible of how well they are doing. Students need dynamic feedback whether they are successful or not [3].

1.3. Approach

The aim of this study is to develop a web-based tool, called LIVELMS, that (1) has the capability of assessing distant learners' participation performance during synchronous sessions dynamically and that (2) stores these assessment data of each online lecture for asynchronous access so that instructor can monitor the performance of learners and can make a general assessment.

LIVELMS integrates a web conferencing tool with a learning management system to support both asynchronous and synchronous learning environments. Microsoft Office Live Meeting 2007 was used as the web conferencing tool and Windows SharePoint Services 3.0 was used as the learning management system.

In order to fulfill the aim of this study following objectives are defined:

- To achieve integration of LMS with web conferencing tool so that:

- Online lectures should be managed (i.e. created, deleted or updated) , finalized and joined using LMS,
- Lecture recordings and other resources should be accessible in LMS,
- Students' performance data obtained during synchronous sessions should be stored in LMS so that instructor can monitor the students' performance throughout the learning program.
- To develop a custom Q&A application to be used instead of default Q&A component of web conferencing tool,
 - Q&A application should enable students to raise hand, ask question and answer question,
 - Q&A application should enable instructor to ask question, answer question, and grade answers,
 - Q&A application should assess the participation of students dynamically according to
 - Number of raise hands,
 - Number of questions asked,
 - Number of answers provided,
 - Grade of answers given.
 - Q&A application should list students according to assessment results, from most active student to least involved student, and this list should be updated throughout the session,
 - Q&A application should display the performance details of the selected student on the fly.
- To embed custom Q&A application into web conferencing tool and synchronize the time they are initiated,
- To transfer Q&A session data of each online lecture into Performance module of LMS so that students' performance can be monitored asynchronously throughout the learning program,
- To propose other asynchronous capabilities in LMS, such as syllabus, announcements, lecture notes and discussion forum.

1.4. Thesis Structure

Chapter 2 provides the related research including distance education with focus on assessment of distant learners, review of web conferencing tools used in distance education. In addition, some e-learning case studies related to LMS and web conferencing integration are included.

In chapter 3, firstly an overview of LIVELMS is provided. Then, design of LIVELMS is explained under two main titles, Design of LMS and Design of Q&A Application. In each part, firstly database design and then software design of the system is provided.

Chapter 4 includes the implementation details of LIVELMS in a custom learning setup. In this chapter learning setup is described and implementation results are discussed.

Chapter 5 provides conclusion to the study and includes the future work directions for LIVELMS.

CHAPTER 2

RELATED RESEARCH

This chapter presents an overview of distance education with focus on assessment of distant learners. Additionally, web conferencing tools widely used in distance education are reviewed and compared regarding mainly their assessment capabilities. At the end of this chapter, some e-learning case studies related to integration of LMS and web conferencing are explained.

2.1. Distance Education

2.1.1. Definition

Distance education can be defined as an institution-based education system where learners and instructors are physically or timely separated and where interactive telecommunications systems are utilized to connect learners and instructors and to share resources. The components of the definition are given in Figure 2-1, and then descriptions of components are provided in the following part [3].

First component is that distance education is institutional based. Institution in this context could be both traditional educational school or college and also nontraditional institutions that provide education to distant learners.

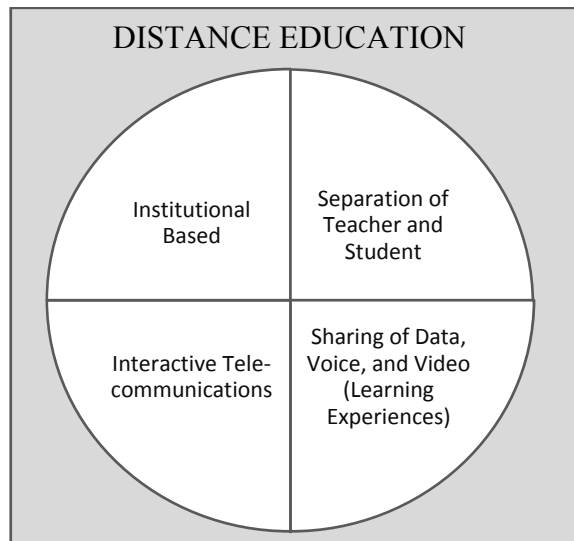


Figure 2-1 Components to the definition of distance education [3]

Second component of the definition is the separation of teacher and student. Separation implied in by the definition means not only being distant geographically but also means that teachers and students can be involved in education at separate times. This is, specifically, asynchronous distance education.

Third component of the definition of distance education is interactive telecommunications. In distance education, it is crucial to enable learners to interact with each other, with resources and with their teacher. Depending on the telecommunication media utilized, interaction can be synchronous (i.e. at the same time) or asynchronous (i.e. at different times). Telecommunications system used in distance education can be electronic media (e.g. television, telephone, and internet) as well as non-electronic media (i.e. letters, or other method of postal system).

The final component of the definition is connecting learners, teachers and resources. This component implies that teachers are able to interact with learners and also resources are accessible to all participants so that learning can occur.

2.2. Technologies used in Distance Education

In distance education, communication between learners and tutors can be synchronous or asynchronous and is provided by exchanging printed or electronic media, or using technology that allows real time communication [7]. Communication media used in distance education can be divided into two groups, synchronous and asynchronous e-learning technologies. These technologies have been outlined in Table 2-1 [8].

Table 2-1 Technologies used in Distance Education

Synchronous e-Learning Technologies (Real-time)	Asynchronous e-Learning Technologies (Anytime)
TV	Handouts
Radio	Textbooks
Webcast	Audiotape and videotape (VHS)
Podcast	CD and DVD
Videoconference\web-conference	Static web pages
Two-way interactive videoconference	Interactive web pages
Telephone	E-mail
Telephone conference	Fax
Live text-chat rooms	Commercial education platforms

2.3. Assessment for Distance Education

2.3.1. Explaining Assessment

Assessment can be described as a set of interactions that aims to identify how well students achieved in order to increase students' learning and development. Assessment can be performed in formal or informal ways [9].

Whereas there are numerous purposes for assessing learning gains, probably the most common purpose is to provide feedback to learners and instructors. Feedback to learners enables them to know how well they are doing. In this way, “they gain a sense of control and can take on greater responsibility for their own learning”. Feedback from frequent assessments to instructors, on the other hand, provides opportunity to identify if student needs additional assistance. At the same time, instructors can take advantage of this feedback to get idea about the effectiveness of the instruction. For example, if majority of learners have poor performance resulted from a common difficulty in a specific lecture, there is most probably a lesson design problem [3].

2.3.2. Assessment of Distant Learners

In face-to-face traditional classroom settings, generally instructor spares considerable amount of time for presenting content and related materials to the learners during lectures. In online settings, however, greater portion of the time is spared to utilize some strategies by which students can demonstrate what they know so that instructor can monitor and assess learners’ online performances [4].

In parallel with the types of learning technologies (see Table 2-2), assessment strategies in distance education can be grouped in two categories: assessment in asynchronous learning environment and assessment in synchronous learning environment.

2.3.2.1. Assessment in Asynchronous Learning Environment

One of the most common strategies used in asynchronous learning is discussion forum. Discussion forum is utilized to enable students to respond to questions and discuss course material. Secondly, blogs are used in asynchronous learning environment. The advantage of blog is its huge customization capacity (e.g. customizing who owns the page, who can read it or comment on it and when). As an

assessment tool, blogs also can be used like discussion platform in which students can respond to prompts, pose their own questions, summarize reading assignments, etc. Finally, another asynchronous tool that can be useful for assessment of distant learners is wiki. Wiki can be utilized as an assessment tool in such a way that “instructors can see which group member made which contributions or edits to the most recent version of the site” [3].

2.3.2.2. Assessment in Synchronous Learning Environment

One of the important advantages of synchronous assessment activities is sense of immediacy that is built between students and instructor. Immediacy means “the perception of social presence” and it especially has positive impact on learning of students working at a distance, which enhance instructional experience [3]. Furthermore, students have opportunity to get immediate feedback on their performance and get guidance to complete exercises, which motivates and increases student learning [10].

On the other hand, there are some limitations of assessing learners in synchronous learning environment. Firstly, students’ activities (e.g. raising hand, asking questions, answering questions, etc) cannot be monitored well by instructor as a result of the lack of face-to-face communication. These activities are helpful to do better informal assessment. So, instructors cannot effectively observe what is happening in their online classroom [5].

Another limitation of real-time assessment in distance education is that only small part of learners can take part in class activities simultaneously. The participation of large group of learners results in a certain number of passive students in the background neglected by instructor [3].

2.4. Web Conferencing Tools Used in Distance Education

In this section, some web conferencing tools, which are widely used for training purposes in distance learning, are investigated. The review of those conferencing tools is conducted using and testing them. Additionally, some resources on the internet have been benefited. The web conferencing tools that are reviewed are Microsoft Office Live Meeting 2007¹, Adobe Acrobat Connect², Cisco Webex³, Citrix GoToMeeting⁴ and DimDim Pro⁵.

2.4.1. Microsoft Office Live Meeting 2007

2.4.1.1. General Description

Microsoft Office Live Meeting 2007 provides an online meeting platform either under the control of Microsoft or under control of your organization internally. First option is operated by Microsoft in a subscription-based. On the other hand, the latter one is operated in Office Communications Server and it becomes available with the OCS deployment in the customer's servers.

2.4.1.2. Features

Microsoft Office Live Meeting (MOLM) 2007 has a rich set of conferencing features. Major conferencing features provided by MOLM 2007 can be listed as Microsoft Office integration/compatibility, whiteboard functionality, attendance reporting, real-time screen sharing/application sharing, record meetings, online calendar and meeting scheduler.

¹ <http://office.microsoft.com/en-us/livemeeting/FX101729061033.aspx>

² <http://www.adobe.com/products/acrobatconnect/>

³ <http://www.webex.com/product-overview/index.html>

⁴ https://www1.gotomeeting.com/en_US/pre/productOverview.tpl

⁵ http://www.dimdim.com/products/dimdim_editions_pro.html

One of the distinct conferencing features of MOLM is the “Streaming Media Custom Frame”. This feature provides a custom frame on meeting console into which a custom web application can be embedded. The critical feature of MOLM for developers is the Live Meeting Service API that provides programmatic access to most of the Live Meeting services.

For the assessment and evaluation of participants, attendance reporting is provided by MOLM. Generally, attendance reporting feature analysis the duration of attendance of all participants for each meeting and does not support synchronous assessment. Furthermore, MOLM provides variety of options for participants to collaborate and participate including Q&A sessions, user polls and feedback indicators.

2.4.1.3. Limitations

In terms of assessing distant students in synchronous environment, MOLM has no specific feature. Text-based Q&A feature of MOLM provides asking questions and answering opportunity in real-time; however, it does not keep record of details of Q&A logs to be used for assessment purposes in real-time e- learning environment or after the online lecture is completed.

2.4.2. Adobe Acrobat Connect

2.4.2.1. General Description

Adobe Acrobat Connect is a commercial web-conferencing solution with a comprehensive set of features. It can be licensed as an installed product, or a hosted product.

2.4.2.2. Features

Adobe Acrobat Connect provides limitless number of meeting rooms and full customization of them. It also supports VoIP, video conferencing, meeting recording, screen sharing (desktop, window or application sharing), white-boarding, video conferencing, notes, Q&A session, chat, user management, administration and reporting, polling [11].

In terms of tracking participants' performance, Acrobat Connect provides asynchronous performance assessment capabilities, such as simulations and quizzes. In addition, reporting tool of Acrobat Connect provides instructors with a clear view about progress of learners.

2.4.2.3. Limitations

As mentioned in features part, Acrobat Connect provides asynchronous performance assessment capabilities, such as simulations and quizzes. In addition, instructors can benefit from reporting tool to get information about attendance of learners. On the other hand, regarding synchronous assessment of participants, acrobat connect does not have any related features. It enables participants to ask question and answer question in real-time, but Q&A log is not processed to assess performance of participants in synchronous environment.

2.4.3. Cisco WebEx

2.4.3.1. General Description

Cisco WebEx is a commercial web-conferencing tool that mixes real-time desktop sharing with phone conferencing.

2.4.3.2. Features

The major feature that Cisco WebEx focused on is real-time screen sharing by which presenter can exhibit audiences and meeting attendees anything that is on their screen. Other features provided are record meetings, whiteboard functionality, public/private chat, optional chat moderation/designation, attendance reporting, Microsoft Office integration/compatibility, drawing/highlighting tools, specific application sharing, and file transfer to/from audience [12].

Furthermore, in terms of assessment and tracking students' participation, Cisco WebEx provides some useful features, which are online tests, quizzes, and detailed attendance reports.

2.4.3.3. Limitations

Whereas Cisco WebEx provides features intended to assess students' performance, it does not deal with synchronous participation performance of learners. For example, WebEx provides Q&A session and raise hand functionality but it does not process Q&A data in order to measure the performance of students during synchronous learning session.

2.4.4. Citrix GoToMeeting

2.4.4.1. General Description

GoToMeeting is a web-hosted online meeting service that enables individuals and organizations to meet online in order to collaborate, to present information and to perform live demonstrations in real time.

2.4.4.2. Features

Remarkable capability of GoToMeeting is management of latency and delay issues in real-time environment. Thanks to its powerful data compression ability which consumes low-bandwidth, it provides faster screen sharing and demonstrations regardless of platform, browser or bandwidth [13].

The other important capability of GoToMeeting is that it can be integrated with Microsoft Office products, as well as virtually every email and instant-messaging application. The other features offered by GoToMeeting are desktop viewing, share keyboard and mouse controls, instantly change presenters, drawing tools and chat, recording/playback, and attendance reporting [14].

In terms of assessing participants, GoToMeeting solely provides attendance reporting capability, which is an asynchronous assessment of participants.

2.4.4.3. Limitations

In general meaning, GoToMeeting does not have features that specifically focus on enhancement of learning environment. Regarding assessing learners asynchronously, it provides attendance reporting capability. On the other hand it has no feature intended to assess learners in synchronous environment.

2.4.5. Dimdim Pro

2.4.5.1. General Description

Dimdim Pro is a commercial web-conferencing solution, which has also open-source version. Dimdim Pro can be installed on customers' servers or it can be used as hosted.

2.4.5.2. Features

Generally, Dimdim aims to provide easy-to use interface and simplify meeting online. One of the important differences of Dimdim Pro from others is that it requires no installation and download to start web-conferencing because it is totally browser-based, requiring only a simple Adobe Flash plug-in for full recording functionality.

Basic features provided by Dimdim Pro are sharing & presenting documents, sharing computer screens, web pages, whiteboards, video (webcams), recording meetings, sending public & private messages, webinar widgets & reports [15].

2.4.5.3. Limitations

Dimdim Pro does not have any feature intended for attendance reporting as well as assessing participants. This limitation prevents instructors to learn the progress of distant students and assess their synchronous and asynchronous performance.

2.4.6. Comparison of Web Conferencing Tools

Comparing web-conferencing tools investigated in this study will be helpful in identifying limitations and advantages of each comparing with each other. In addition, most common web-conferencing features and the points that web-conferencing tools do not focus on much can be identified.

Table 2-2 compares five popular web-conferencing tools (i.e. MS Office Live Meeting, Adobe Connect Pro, Cisco WebEx, Citrix GoToMeeting and Dimdim Pro) with respect to set of features.

Table 2-2 Comparison of Web-Conferencing Tools [16]

Features	MS Office Live Meeting	Adobe Connect Pro	Cisco WebEx	Citrix GoToMeeting	Dimdim Pro
Real-Time Screen Sharing	x	x	x	x	x
Whiteboard Functionality	x	x	x	x	x
Record Meetings	x	x		x	x
Public/Private Chat	x	x	x	x	x
Attendance Reporting	x	x	x	x	x
Microsoft Office Integration/Compatibility	x	x	x		x
Specific Application Sharing	x	x		x	x
Drawing/Highlighting Tools	x	x	x	x	x
Video/Web Cam Integration	x	x	x		x
Q&A Session	x	x	x		
Assessment		x	x		
VoIP	x	x	x	x	x
Audio Streaming/Broadcast	x	x	x	x	
Audience Feedback Indicators	x	x		x	x
Online Calendar and Meeting Scheduler	x	x	x		
User Authentication	x	x		x	x
Polling	x	x	x	x	x
Custom Frame	x				

Firstly, it can be observed from Table 2-2 that web-conferencing tools has some common features in general, such as VoIP, real-time screen sharing, attendance reporting, etc. These features can be considered as default features for an adequate web-conferencing tool.

One of the important conclusions that can be drawn according to Table 2-2 is that features intended for assessment purposes are not generally provided. Only Adobe Connect Pro and Cisco WebEx have some features that can support assessment of meeting participants. In this regard, Acrobat Connect Pro provides some asynchronous performance assessment capabilities, such as simulations and quizzes. In addition, reporting tool of Acrobat Connect gives instructors a clear view about progress of learners. However, regarding synchronous assessment of participants, acrobat connect does not have any related features. On the other hand, Cisco WebEx provides some useful features, which are online tests, quizzes, and detailed attendance reports regarding assessment and tracking students' performance. However, it does not deal with synchronous participation performance of learners.

Furthermore, MS Office Live Meeting has a distinct feature called "Custom Frame". This feature enables integration of a web site into Live Meeting console by setting URL of custom frame property properly while scheduling a meeting. This feature can be used, for example, to embed a custom web application into a meeting console in order to enhance web-conferencing with a custom capability.

2.5. Case Studies on LMS and Web-Conferencing Integration

2.5.1. Adobe LMS Integration for Blackboard [17]

The basic purpose for the integration of LMS and Adobe Connect is to allow "instructors, teaching assistants and course builders to create meetings as part of their course offering; and allow students to see upcoming Adobe Connect Pro Meetings".

Adobe LMS Integration for Blackboard enables users to organize meetings and to access meeting information, reports and recordings. In details, there are three types of reports which are summary, session and attendee. Summary reports display information about a specific meeting including number of users invited, the number invited participants and guests that attend, etc. Session reports comprise start time,

end time and number of attendees. Finally, attendee reports display information about attendee list regarding time-in and time-out.

In conclusion, this integration mainly provides web interface for basic meeting operations, and does not add new dimension to functionality of Adobe Connect Pro.

2.5.2. Moodle-Dimdim Integration [18]

Moodle is a learning management system providing full functionality in terms of asynchronous e-learning; however, it lacks synchronous e-learning capabilities such as conducting synchronous online lectures. Moodle-Dimdim Integration aims mainly to support synchronous functionality of Moodle by providing virtual classroom capability so that Dimdim classroom sessions can be started directly from within Moodle.

2.5.3. Paideia Omogenwn [19]

Paideia Omogenwn, a case study at the University of Crete, is one of the most commonly explained projects in literature that combine synchronous and asynchronous e-learning. Paideia Omogenwn project aims to develop a complete e-learning system for the training of teachers who deliver Greek courses through e-learning. This tool supports both synchronous and asynchronous e-learning. Followings are the main objectives of this blended learning environment: (1) to enable learners to study learning materials through distance education, (2) to provide learners with the evaluation and self-assessment methods, and finally (3) to support distribution of necessary information to all users. There is an evaluation process incorporated in only asynchronous part of the tool and it is used in initial, middle and final stages of learning.

2.5.4. A Case Study with Web 4-M [20]

Robert F. Hodson's study, "Merging Asynchronous and Synchronous Learning Networks with Web 4-M" is another one that integrates asynchronous and synchronous methodologies. Document Library that ties asynchronous and asynchronous tools together is defined as the unique feature of this system. For example, slide shows, discussions and white boards can be archived for asynchronous access, which provides flexibility in time scheduling and real-time collaborative learning. Chat transcripts are used by instructors to assess the participation and comprehension level of students.

2.5.5. Exploring a Course/Classroom Management System Solution [21]

This study has been conducted in State University of New York, and its focus is mixing asynchronous and synchronous learning technologies. Main considerations of this study is (1) to enhance learning in the face-to-face traditional classroom setting, (2) to provide access to basic information about online courses and learning materials. In this study, ILINC's LearnLinc and I-Net (LLI-Net) tools are used to facilitate a synchronous learning environment. Post-assessment is considered and implemented in this study. Students' scores on exams, and midterm and final grades are main sources of post-assessment process.

2.5.6. Virtual Network Computing [22]

The motivation of this study is the lack of support for collaboration in lab activities in which colleagues, that are geographically or temporally separated, can participate. In this study, a new collaborative platform has been developed comprising synchronous and asynchronous capabilities. This system is able to "continuously project the screen of one computer onto that of another, so that two or more people can share workspace simultaneously".

To summarize, the main concern of this system is to enable desktop sharing for synchronous collaboration and to store session for asynchronous collaboration.

2.5.7. Integrating Synchronous and Asynchronous Interactions in Groupware Applications [23]

Another similar study in literature is “Integrating Synchronous and Asynchronous Interactions in Groupware Applications”. In this study it is intended to propose a data management system for integrating synchronous session in the context of a long-term asynchronous interaction.

2.5.8. Group cognition in online collaborative learning [24]

This study integrates synchronous and asynchronous support for group cognition in online collaborative learning. It focuses on integration of a wiki component into its chat and shared whiteboard system and also focuses on “the accomplishment of problem solving and knowledge-building tasks by small groups, particularly in online, distributed contexts”.

2.5.9. Conclusions on Case Studies on LMS and Web-Conferencing Integration

Investigation on studies that has similar aim with the thesis has showed that LMS and web-conferencing tools are integrated majorly to provide virtual classroom capability for LMS so that classroom sessions can be started directly using LMS. In terms of assessment of distant learners, Robert F. Hodson’s study, “Merging Asynchronous and Synchronous Learning Networks with Web 4-M” proposes a method which is keeping chat transcripts to enable instructor to assess the participation and comprehension level of students. In addition, the study conducted in State University of New York offers some post-assessment methods.

CHAPTER 3

LIVELMS TOOL

In this chapter, mainly software design of LIVELMS is described after its general description is explained. In addition, an overview of WSS 3.0 and Live Meeting Service API, which are core components of development, is provided.

3.1. General Description of LIVELMS

3.1.1. Overview of LIVELMS

LIVELMS is a web-based application which is developed using Visual Studio 2008. Programming language used during development is C#. Main components of LIVELMS system are Learning Management System, Web Conferencing Tool and custom Q&A application. Learning Management System is composed of following modules: Syllabus, Announcements, Lecture Notes, Performance, Discussion Forum, Assignments and Recordings. In the following figure these components are depicted.

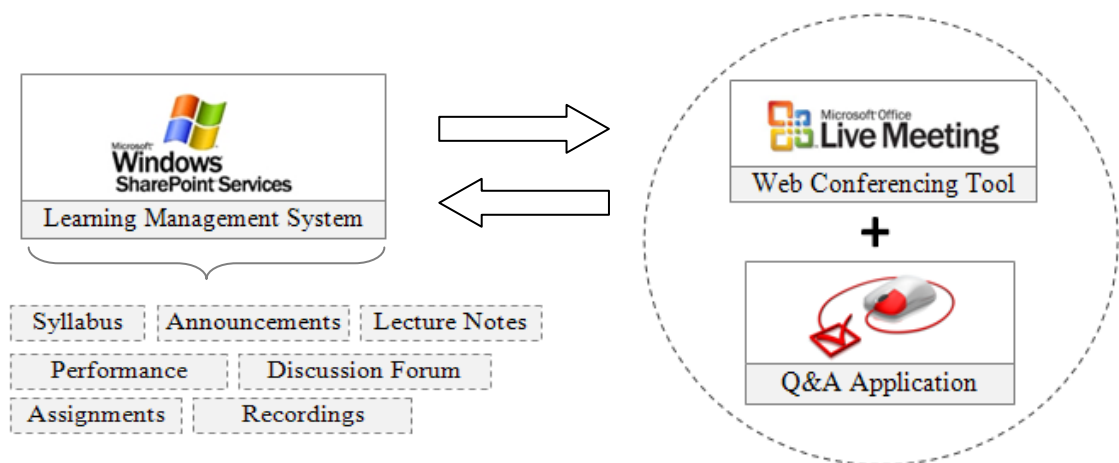


Figure 3-1 Main Components of LIVELMS

LMS is developed on top of Windows SharePoint Services 3.0 architecture and it communicates with Live Meeting with the help of Live Meeting Service API (*See 3.1.4*). This communication is required to schedule online lectures, manage lectures, join lectures and transfer attendance information of participant by using LMS.

Custom Q&A application is integrated with the web conferencing tool so that it can be automatically initiated when any online lecture, scheduled using LMS, is conducted by Live Meeting tool. When a lecture is finalized using LMS, its Q&A session data is transferred to Performance module of LMS for assessment purposes so that instructor can monitor the performance of each student comparing with the classroom average and also students can check his own progress regularly.

There are three types of user in LIVELMS, which are administrator, organizer and attendee. Organizer refers to teacher and attendee refers to student. These terms are used interchangeably throughout the text. LIVELMS users are created in active directory of windows server to attain better user management capability.

3.1.2. Constraints, Assumptions and Dependencies

The following assumptions have been made for the LIVELMS tool:

- It is assumed that organization/user has a valid MS Office Live Meeting subscription (i.e. Hosted Live Meeting); LIVELMS does not support Live Meeting deployed in Office Communications Server.
- It is assumed that Live Meeting Client is installed on the target computer on which the MS Office Live Meeting should run.
- It is assumed that each participant is geographically distant and participates in session using a single PC with a sound card and speaker.

3.1.3. Overview of WSS 3.0

During the development of LMS part of LIVELMS, we have mainly managed and customized software objects defined in WSS 3.0. For the customization, we mainly developed custom web parts and custom features and deployed them in SharePoint site appropriately. By using custom web parts and features, we were able to

- Interact with SharePoint objects,
- Transfer data within a website by establishing connections between web parts,
- Communicate with live meeting service processor,
- Update site content and customize web pages.

The physical objects hierarchy is shown in Figure 3-2.

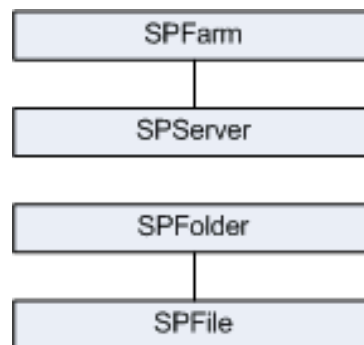


Figure 3-2 The Physical Objects hierarchy [25]

The following diagram shows the Windows SharePoint Services site architecture including site collections and objects. This is also the site architecture of our LMS.

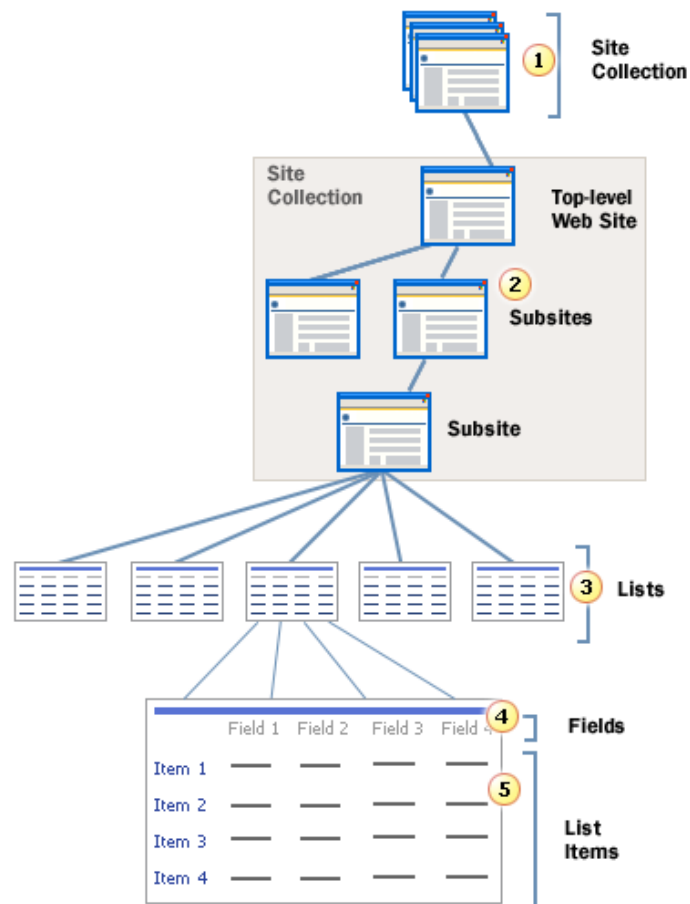


Figure 3-3 Site Architecture and Object Model Overview [26]

1. *SPSite* object represents a set of *SPWeb* objects which is generally called site collection.
2. Each site collection includes *SPWeb* objects, and each object has members that can be used to manage a site, including its template and theme, as well as to access files and folders on the site.
3. Each *SPList* object has members that are used to manage the list or access items in the list. The *GetItems* method can be used to perform queries that return specific items.
4. Each *SPField* object has members that contain settings for the field.
5. Each *SPListItem* object represents a single row in the list.

3.1.4. Overview of Live Meeting Service API [27]

Most of the functionalities provided in Live Meeting tool, can be achieved programmatically by using Live Meeting service API. It enables meeting management, user management, recording and content management, security services, and reporting.

Live Meeting service API can be used in various application with different languages, such as ASP.NET, Visual C#®, Visual C++®, and Java and for different platforms, such as Microsoft Windows®, Mac OS, and Linux/UNIX. Communication is based on the standard HTTPS protocol.

Conference Center

The Live Meeting conference center is the server that keeps all Live Meeting sessions organized by the user. When user registers a new Live Meeting account, a unique URL of the conference center is provided. Format of this URL is: https://www.livemeeting.com/cc/<conference_center>. On the other hand, a difference URL is required to manage meetings programmatically. This URL can be obtained by using an HTTPS GET operation with the following special URL:

```
https://www.livemeeting.com/cc/<conference_center>/xml/4.0/GetPostingURLRequest
```

After that operation a response containing the physical URL to the conference center's API is sent back. This response is sent as an XML document containing a GetPostingURLReply element. Content of GetPostingURLReply element is provided in following:

```
<GetPostingURLReply  
  url = "string"  
  release = "string">  
</GetPostingURLReply>
```

Sample codes for getting the URL to access a conference center and for sending a message by posting an xml element are provided in *Appendix A*. Additionally, Live Meeting API messages that are used in LIVELMS are provided in the Appendix.

3.2. Design of LIVELMS

The software design of LIVELMS is explained in two sub-sections. First section describes the design of LMS and second section focuses on the software design of custom Q&A application.

3.2.1. Design of LMS

In this part, firstly database design of LMS is provided and then its software design is explained.

3.2.1.1. Database Design of LMS

The LMS part of LIVELMS utilizes databases of WSS. WSS has two databases which are Configuration Database and Content Database. In this part mainly Content Database is explained. The information of both databases is provided in *APPENDIX B - SharePoint Database Tables*.

Design of WSS Content Database [28]

The main tables in content database and their descriptions are given in the Table 3-1.

Table 3-1 Main Tables in Content Database

Features	Holds information about all the activated features for each site collection or site.
Sites	Holds information about all the site collections for this content database.
Webs	Holds information about all the specific sites (webs) in each site collection.
UserInfo	Holds information about all the users for each site collection.
Groups	Holds information about all the SharePoint groups in each site collection.
Roles	Holds information about all the SharePoint roles (permission levels) for each site.
AllLists	Holds information about lists for each site.
GroupMembership	Holds information about all the SharePoint group members.
AllUserData	Holds information about all the list items for each list.

Following figure represents a high level entity relationship diagram of WSS content database.

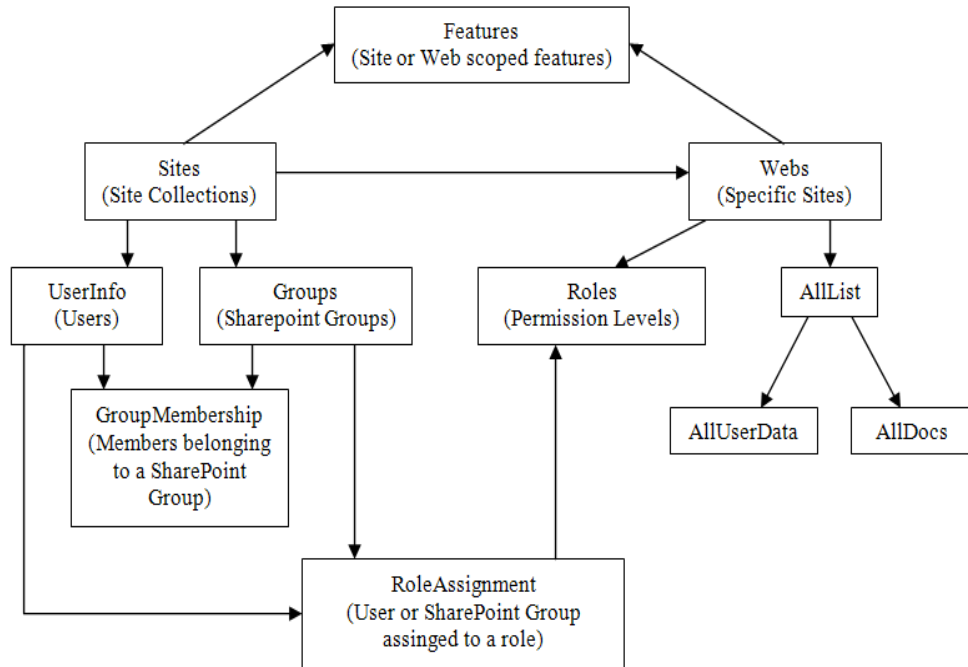


Figure 3-4 High Level ER Diagram of Content Database

3.2.1.2. Software Design of LMS

In this part, software design of LMS is provided. Use case diagrams and activity diagrams are used to describe each system operation.

Software design of LMS is based on the software objects of SharePoint and no additional software classes are developed. As a result, class diagrams are not provided in this part. Instead, used SharePoint software objects are provided.

Classroom Operations

Only the administrator is able to create new classroom, update classroom and delete classroom. These use cases are grouped under Manage Classrooms Use Case. Figure 3-5 is the use case diagram for classroom operations.

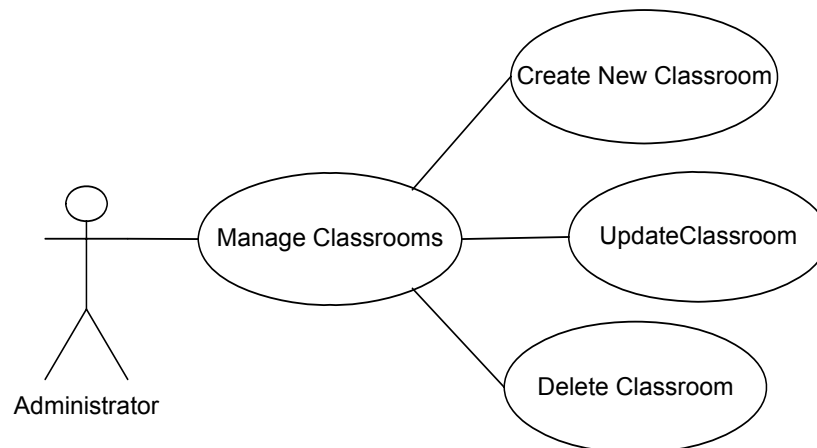


Figure 3-5 Use Case Diagram for Classroom Operations

SharePoint software object used in classroom operations is SPWeb. Each SPWeb object represents a classroom.

Create New Classroom

Administrator should create a new classroom to enable the LIVELMS to be used by users. Creating a new classroom means creating a new sub-site including following standard modules: assignments, syllabus, announcements, attend lecture, lecture notes, view performance, forum and watch lecture. In order to create a new classroom, administrator should choose the Create menu item in “Site Action” menu. Then, he should be navigated to a new page which contains various content options to create. He should select “Sites and Workspaces” option to create a classroom.

After that, he should fill the create classroom form comprising name, description, URL and site template fields. After submitting form successfully, a new page should be appeared to let the administrator select the instructor and students for the classroom being created. After selected intended users, classroom website should be created successfully. Data of new website should be stored in SharePoint database on SQL Server automatically. The activity diagram of this UC is depicted in Figure 3-6.

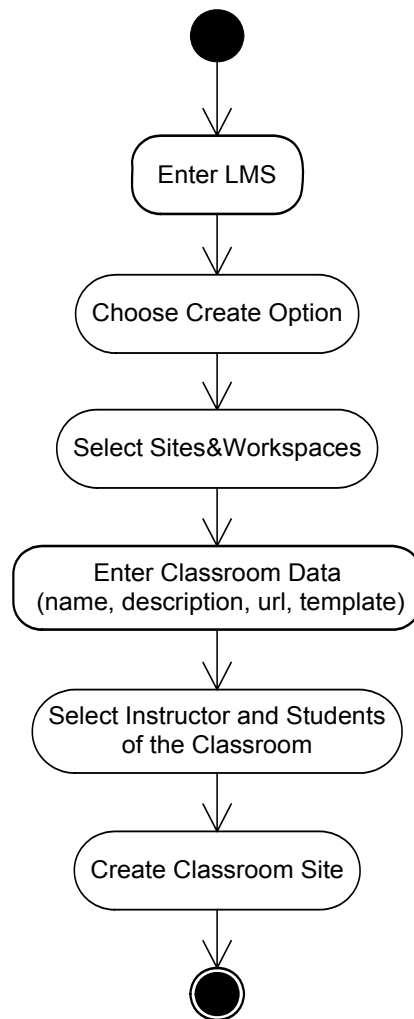


Figure 3-6 Activity Diagram of Create Classroom Operation

Update Classroom

Administrator can update classroom web pages with a variety of options which are grouped into four categories: Users and Permissions, Look and Feel, Galleries, Site Administration. In order to update a classroom, administrator should navigate to website of intended classroom. Then, he should enter the Management page which is the page that includes the variety options for update. After making necessary changes, administrator should submit the form. After the successful submission, classroom webpage is updated. Details of this use case are given in Figure 3-7.

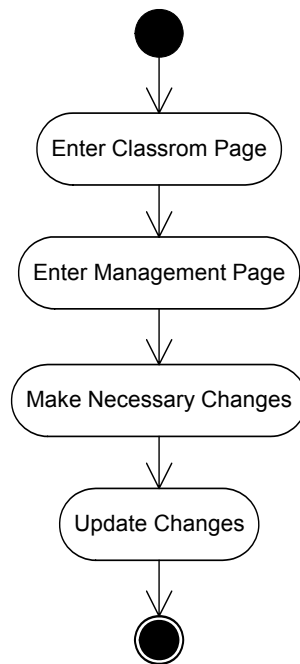


Figure 3-7 Activity Diagram of Update Classroom Operation

Delete Classroom

Administrator can delete any classroom. In order to delete a classroom, administrator first should navigate to “Classroom Management” page. Then he should select the classroom, and choose delete option to submit the form. After that, website of the classroom should be deleted completely. Activity diagram of delete classroom use case is given in Figure 3-8.

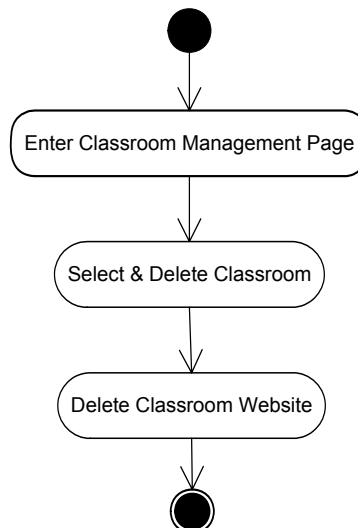


Figure 3-8 Activity Diagram of Delete Classroom Operation

User Operations

After the classroom is created, administrator should create and manage the members of classroom including instructor and students. Use case diagram regarding user operations is depicted in Figure 3-9.

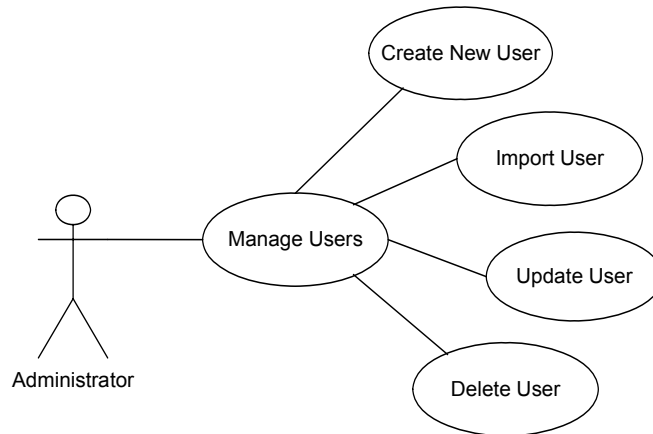


Figure 3-9 Use Case Diagram for User Operations

SharePoint software objects used in classroom operations are SPWebPartManager and WebPart objects. These objects are used to develop functions and methods required for user operations.

Create User

In order to create a new user, administrator should first navigate to “User Management” page.

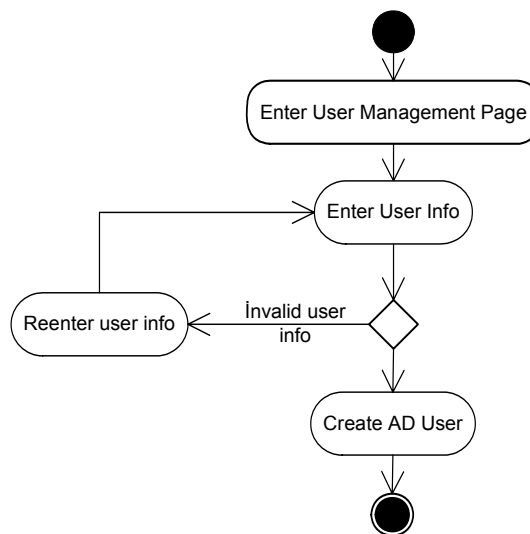


Figure 3-10 Activity Diagram of Create User Operation

Then administrator should fill the Create User form which consists of name, surname, username, password, and classroom (i.e. AD group) fields and submit it. If all fields contain valid data, then user should be created in AD. Related activity diagram is displayed in Figure 3-10.

Import User Data

Import user is another option that enables administrator to create new users. Source file that will be imported should be a text file or excel file that shall has a standard format. Representing this format, sample data are provided in Table 3-1.

Table 3-1 Sample Data for the Imported File

Name Surname	e-Mail	Password	Role
aaa bbb	aaa@abc.com	123456789	Attendee
ccc ddd	ccc@ddd.com	123456789	Organizer

In order to create new user by importing a file, administrator firstly should navigate to “User Management Page”.

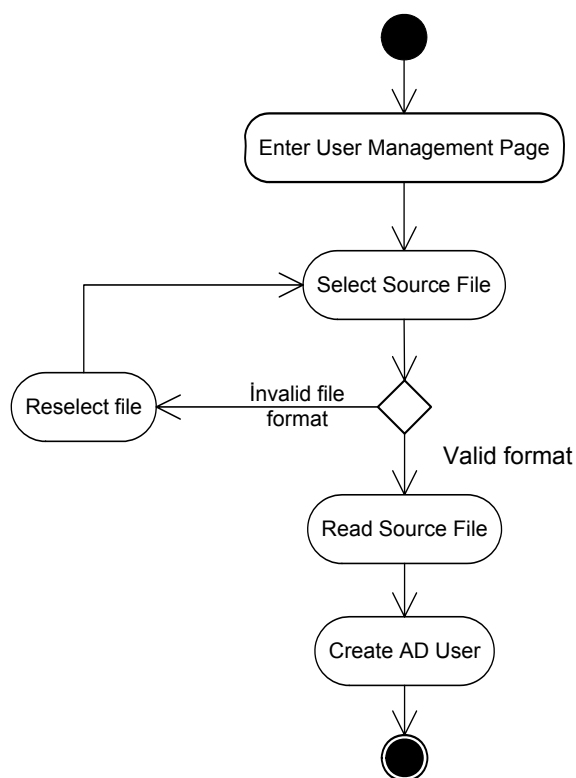


Figure 3-11 Activity Diagram of Import User Operation

Then administrator should choose the intended file by using file-upload control in the web page. If the selected file is valid, content of the file should be parsed. Then user(s) should be created in AD accordingly. Details of this operation are depicted as activity diagram in Figure 3-11.

Update User

Administrator can update user information comprising name, surname, username, password, e-mail and phone number. In order to update a user, firstly administrator should navigate to “User Management” page, and then select the intended classroom to see the list of students. When administrator selects the student, information of this student should be appear in update form to enable the edit of existing information. When administrator submits the update form, assuming that new user information is valid, AD user should be updated accordingly on the server. Figure 3-12 shows the activity diagram of update user operation.

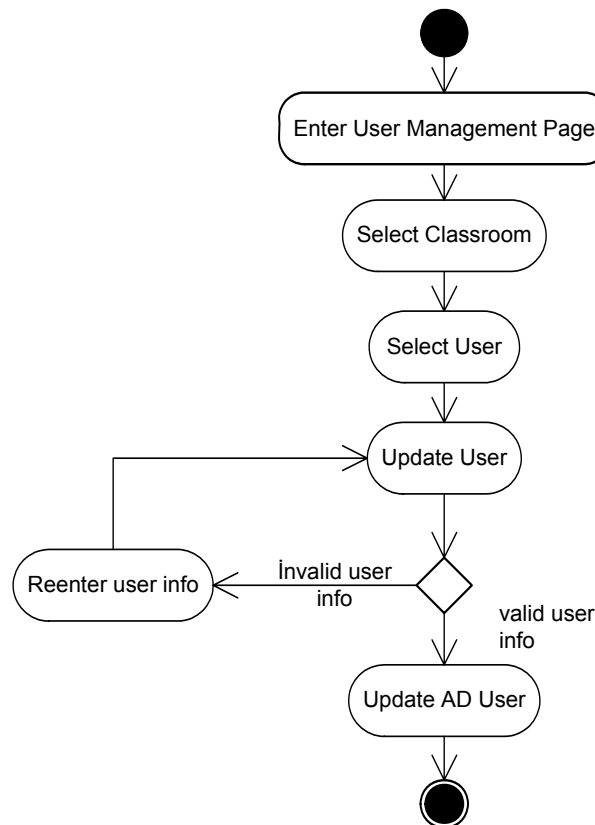


Figure 3-12 Activity Diagram of Update User Operation

Delete User

Administrator can delete an existing user completely. In order to delete a user, firstly administrator should navigate to “User Management” page, and then select the intended classroom to see the list of students. When administrator selects the student, and chooses the delete option, user should be deleted from AD. Figure 3-13 shows the activity diagram of delete user operation.

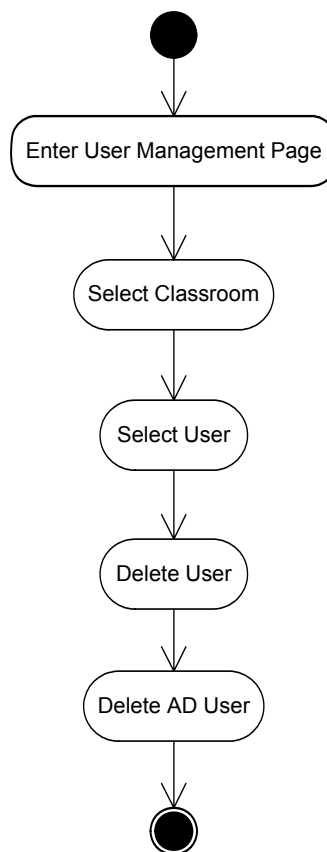


Figure 3-13 Activity Diagram of Delete User Operation

Lecture Operations

Lecture operations consist of Schedule Lecture, Update Lecture, Attend Lecture, Finalize Lecture and Delete Lectures. Related use case diagram is represented in the following figure.

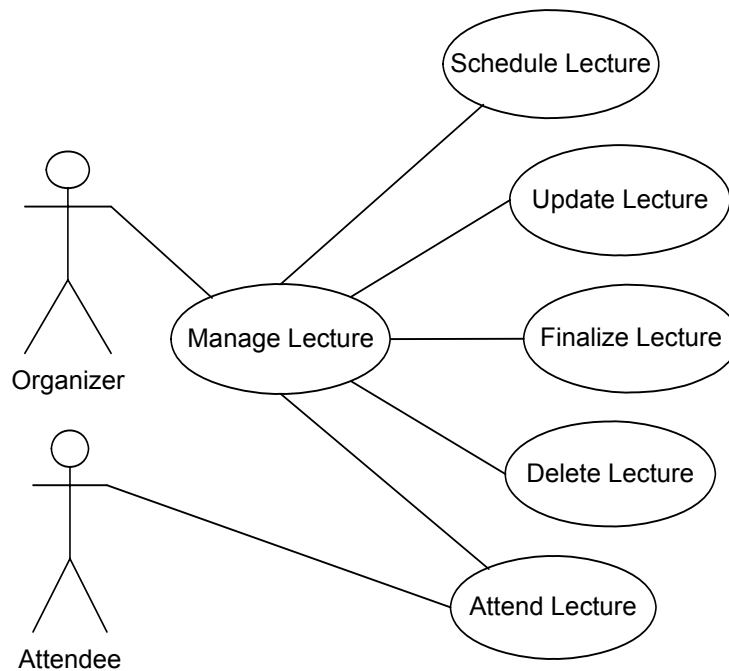


Figure 3-14 Use Case Diagram for Lecture Operations

In order to design lecture operations, mainly SPList object has been utilized and also SPWebPartManager has been used.

Schedule Lecture

Organizer (i.e. instructor) can schedule an online lecture, which is actually a live meeting on MS Office Live Meeting, to conduct classes with distant learners.

In order to schedule an online lecture, organizer should firstly navigate to “Lectures” page. Then, organizer should fill the “schedule lecture” form which consists of subject of the lecture, start date/time and end date/time. When this form is submitted, assuming that all form data are valid, an XML element should be created and sent to Live Meeting service API processor (See 3.1.4 for details). This XML element is called as CreateMeetingRequest which is defined in Live Meeting Service API to create meeting. The basic attributes and the syntax of the CreateMeetingRequest are given in Table 3-2. A sample CreateMeetingRequest message is provided in APPENDIX A – Live Meeting API Messages .

Table 3-2 Description of CreateMeetingRequest

CreateMeetingRequest	
Syntax	<pre> <CreateMeetingRequest name = "string" startTime = "yyyy-mm-ddThh:mm:ssZ" endTime = "yyyy-mm-ddThh:mm:ssZ" title = "string"> </CreateMeetingRequest> </pre>
Attributes	name, startTime, endTime, title,

If the request is processed without error, API processor should send an XML reply, called CreateMeetingReply, containing a *mid* value that the conference center assigns to the meeting just being created. The mid value can be used for latter requests associated with this meeting, such as update or delete meeting. Additionally, CreateMeetingReply includes password information for both audience and presenters. A sample CreateMeetingReply is provided in *APPENDIX A – Live Meeting API Messages* .

After successful creation of meeting on web conferencing tool, it should be inserted into LMS as an online lecture item with the same information (e.g. subject, start time and end time). At the same time, a new Q&A session record should be inserted into database of Q&A application (See 3.2.2 for details). This Q&A session should be started when the online lecture is conducted. Activity diagram of this operation is provided in Figure 3-15.

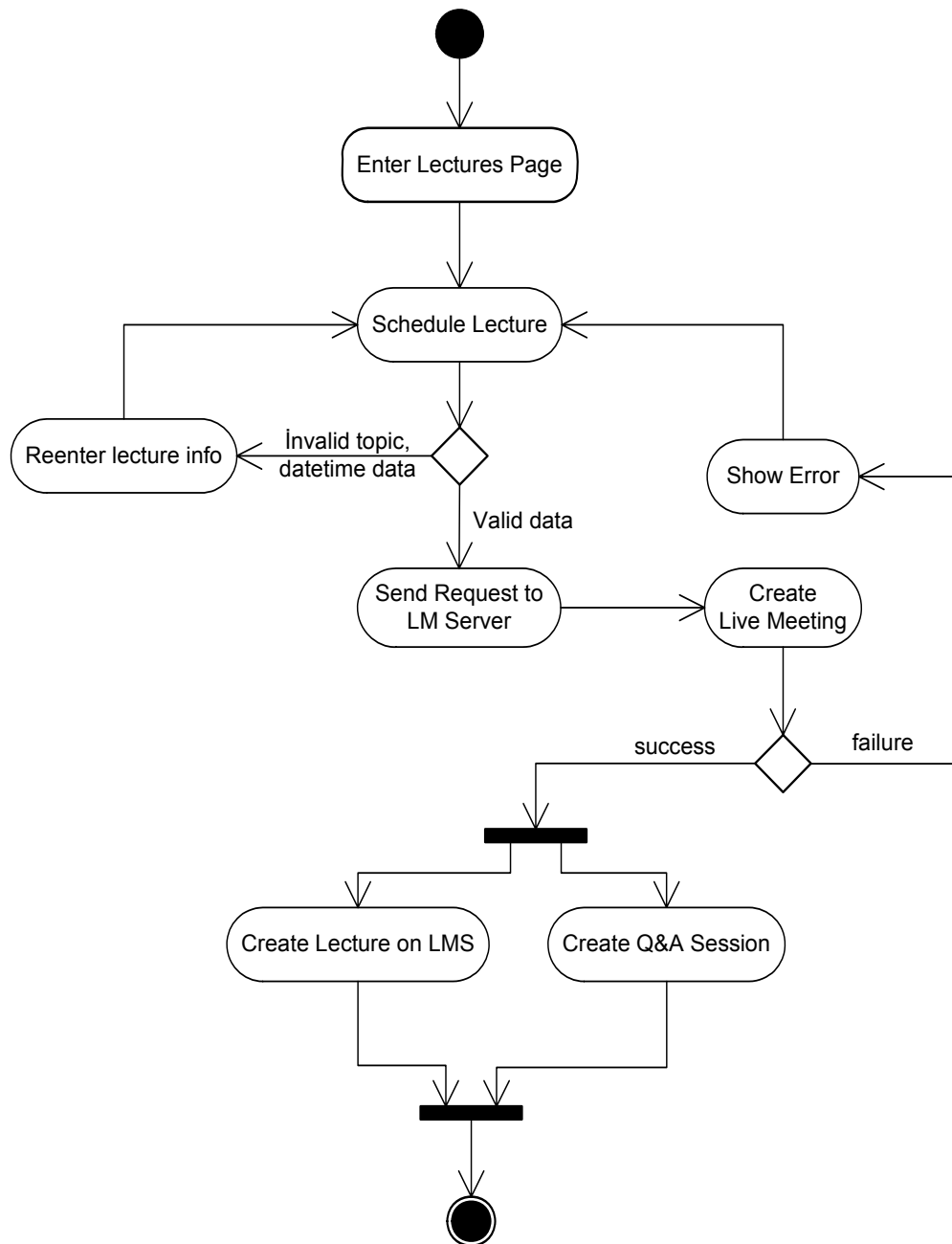


Figure 3-15 Activity Diagram of Schedule Lecture Operation

Attend Lecture

Organizer and attendees can attend online lectures using the Lectures page in LMS. A lecture becomes active for attending during 30 minutes before its start time, and 30 minutes after its start time.

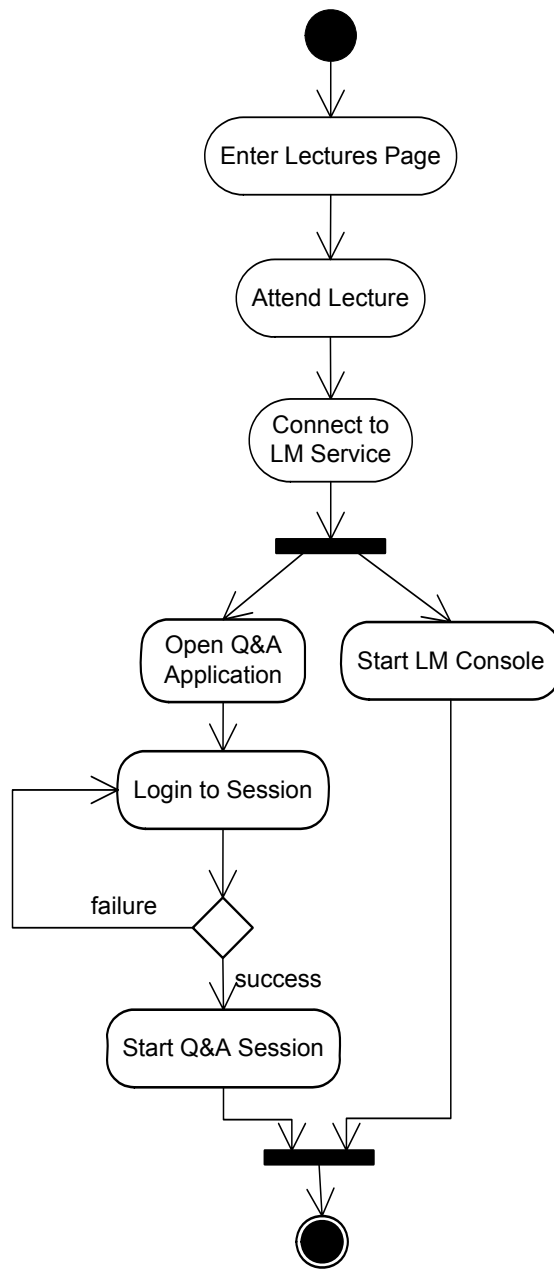


Figure 3-16 Activity Diagram of Attend Lecture Operation

In order to join an online lecture, user should navigate to Lectures page, in which all upcoming and past lectures are listed. When intended lecture is chosen, a connection should be established with Live Meeting Conference Center by using entry URL.

The entry URL syntax for the default windows-based console is as follows, where <conference_center> is the name of the conference center and <role> is attendee or organizer.

`https://www.livemeeting.com/cc/<conference_center>/<role>?<query-part>`

After that, Live Meeting console should be started and it should require user to provide login information for Q&A session, which is the same with LMS login information. After successful login, Q&A session should be started as well. The details of this operation are given in Figure 3-16.

Update Lecture

Organizer (i.e. instructor) can update an online lecture that he/she owns. In order to update an online lecture, organizer should firstly navigate to “Lectures” page, and then select the intended lecture to update. Completing required changes in lecture data, organizer should submit the form. After submission, if all form data are valid, an XML file should be created and should be sent to Live Meeting service API processor. This XML file contains an element called ModifyMeetingRequest which is defined in Live Meeting Service API to update meeting. The basic attributes and the syntax of the ModifyMeetingRequest are given in Table 3-3. A sample ModifyMeetingRequest message is provided in APPENDIX A – Live Meeting API Messages .

Table 3-3 Description of ModifyMeetingRequest

ModifyMeetingRequest	
Syntax	<pre><ModifyMeetingRequest newMid = "True" "False"> <OptionList> <StringOption name="title" value="?????"/> <TimeOption name="startTime" value="?????"/> <TimeOption name="endTime" value="?????"/> </OptionList> </ModifyMeetingRequest></pre>
Attributes	name, startTime, endTime, title,

If the request is processed without error, API processor should send back an XML reply, called `ModifyMeetingReply`, containing updated values of meeting. A sample `ModifyMeetingReply` is presented in *APPENDIX A – Live Meeting API Messages* . In Figure 3-17, activity diagram of update lecture operation is given.

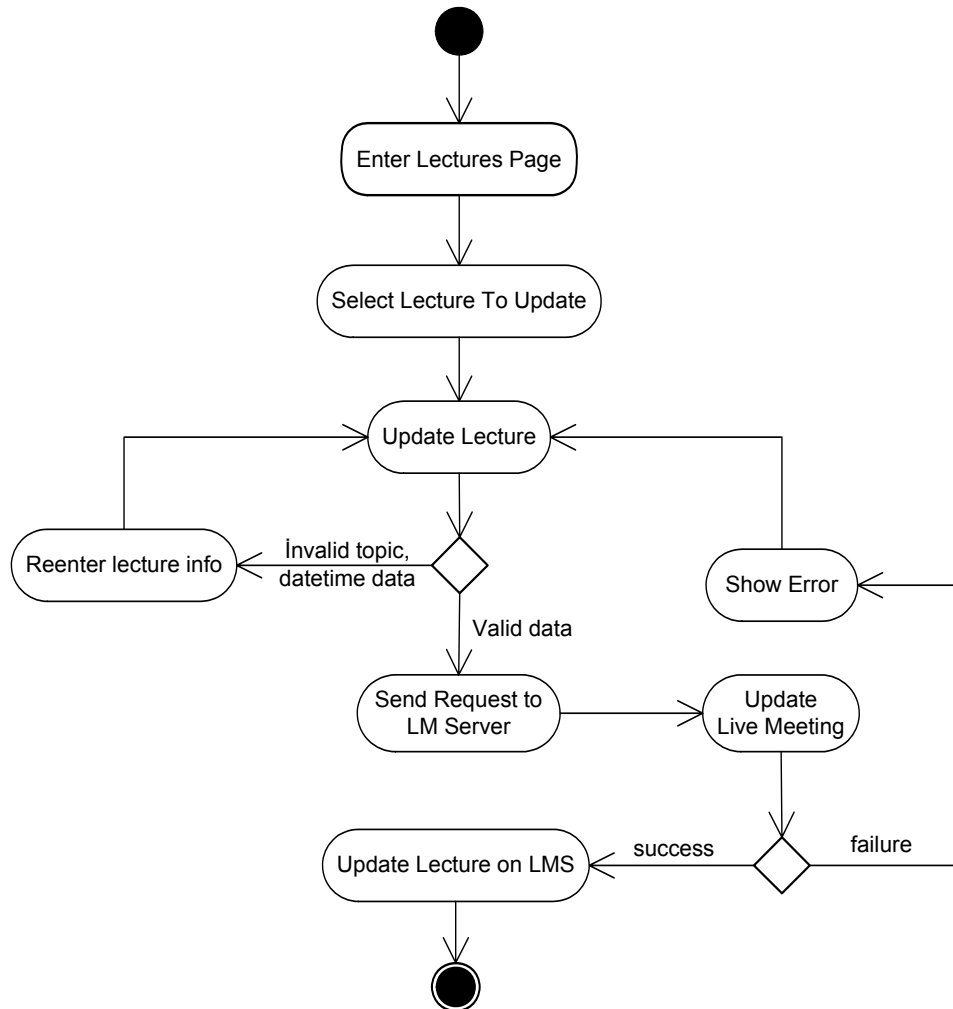


Figure 3-17 Activity Diagram of Update Lecture Operation

Delete Lecture

Organizer (i.e. instructor) can delete an online lecture that he/she owns. In order to delete an online lecture, organizer should firstly navigate to “Lectures” page, and then select the intended lecture to delete and system ask user for the approval of the deletion. After approving, to complete the deletion of meeting on Live Meeting Server, an XML element called `DeleteMeetingRequest` should be created and sent to Live Meeting service API processor. A sample `DeleteMeetingRequest` message is

provided in Appendix A. The basic attributes and the syntax of the DeleteMeetingRequest message are given in Table 3-4.

Table 3-4 Description of DeleteMeetingRequest

DeleteMeetingRequest	
Syntax	<DeleteMeetingRequest erase="true"> <StringListQuery fieldName="mid"> <String>jnbzqqkh63ms1tgv</String> </StringListQuery> </DeleteMeetingRequest>
attributes	Erase, mid

If the request is processed without error, API processor should send back an XML reply, called DeleteMeetingReply. A sample DeleteMeetingReply is presented in *APPENDIX A – Live Meeting API Messages* . In following figure, activity diagram of delete lecture operation is provided.

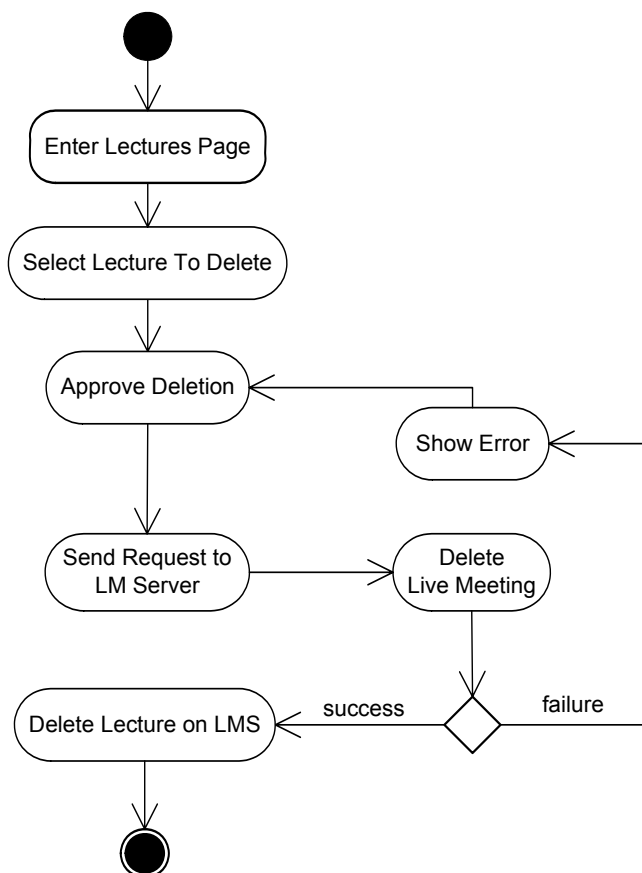


Figure 3-18 Activity Diagram of Delete Lecture Operation

Finalize Lecture

Organizer can finalize an online lecture that he/she owns two hours after lecture is ended in Live Meeting console. This is because attendance information in terms of total duration attended becomes available two hours after the lecture is ended. In order to finalize a lecture, organizer should navigate to Lectures page which contains the past lectures. Organizer should select the lecture to finalize. If lecture is not finalized before, two simultaneous processes should be started to complete the finalization process. Firstly, Q&A session should be finalized and synchronous performances of all attendees should be calculated taking into consideration Q&A session data. This calculation actually serves as assessment of students in synchronous environment. At the end of this process, all assessment data should be transferred to LMS. Secondly, attendance reports of participants should be started to be generated when organizer chooses to finalize lecture. Attendance report means the duration that participant stayed connected to an online lecture. Attendance information is requested from Live Meeting service API processor by using ListVisitorsRequest xml element provided by service API. ListVisitorsRequest is used to get a list of attendants at the specific meeting during specified time interval. The basic fields and the syntax of the ListVisitorsRequest are given in Table 3-5.

Table 3-5 Description of ListVisitorsRequest

ListVisitorsRequest	
Syntax	<pre><ListVisitorsRequest> <StringQuery fieldName="mid" operator="=" value="????"/> <TimeIntervalQuery fieldName="startTime"> <TimeInterval startTime="?????" endTime="????"/> </TimeIntervalQuery> <FieldList> <Name>endTime</Name> <Name>startTime</Name> <Name>userName</Name> </FieldList> </ListVisitorsRequest></pre>
Fields	StringQuery, TimeIntervalQuery

If the request is processed without error, API processor should send an XML reply, called ListVisitorsReply, containing the list of participants with time information that they were online during meeting. A sample ListVisitorsReply message is given in *APPENDIX A – Live Meeting API Messages* .

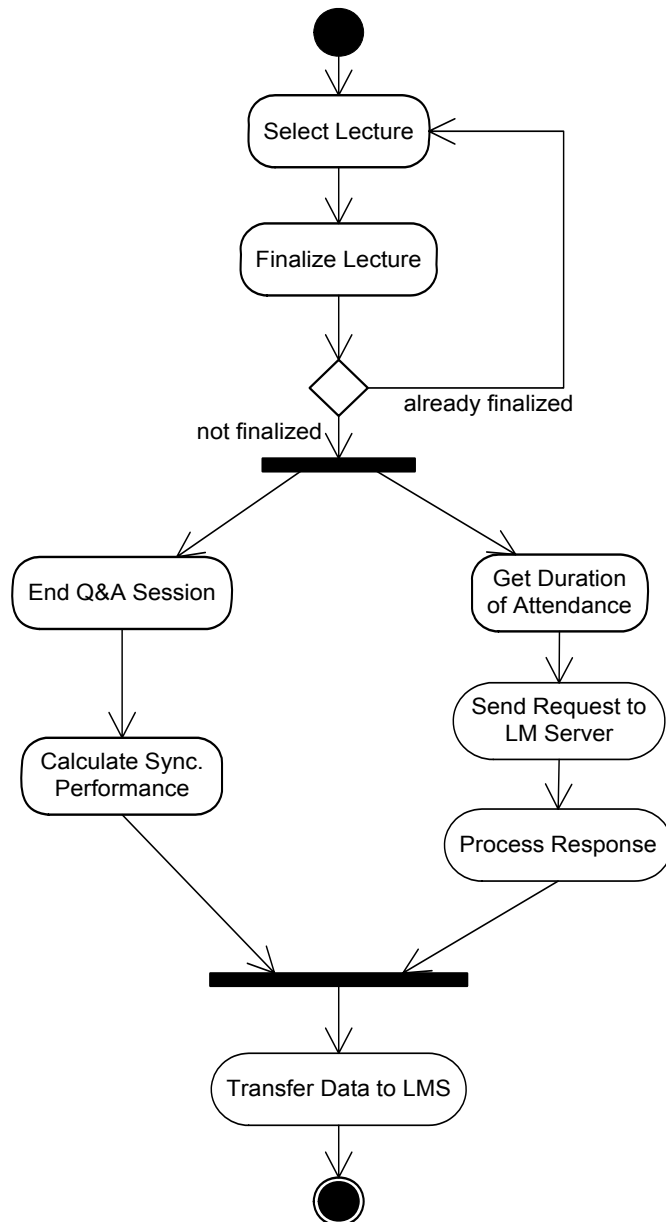


Figure 3-19 Activity Diagram of Finalize Lecture Operation

After the ListVisitorsReply message is returned, it should be parsed appropriately to calculate total attendance duration of each participant. Then this information should be transferred to LMS for asynchronous access. Activity diagram of this operation is provided in Figure 3-19.

Manage Syllabus

Organizer can create a new syllabus and view or update the existing syllabus by using Syllabus page. Attendee also can view syllabus of the lecture. Related use case diagram is provided in Figure 3-20.

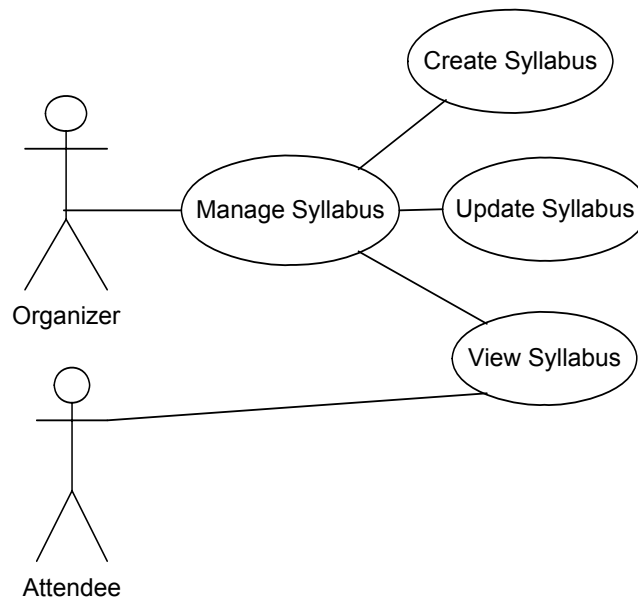


Figure 3-20 Use Case Diagram for Manage Syllabus Operation

In order to program operations related to syllabus, Content Editor WebPart object has been used.

View Syllabus

Both organizer and attendee can view syllabus. In order to view existing syllabus user should navigate to Syllabus page. Syllabus of the lecture should be directly displayed in this page. Activity diagram is provided in Figure 3-21.

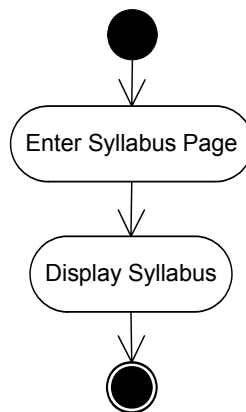


Figure 3-21 Activity Diagram of View Syllabus

Create Syllabus

In order to create syllabus, Organizer should first navigate to Syllabus page then select the “Edit Page” option from “Site Actions” menu. After that, organizer should click on “Rich Text Editor” button to create a syllabus. Then, organizer should enter the related content and save syllabus. Activity diagram of create syllabus operation is provided in Figure 3-22.

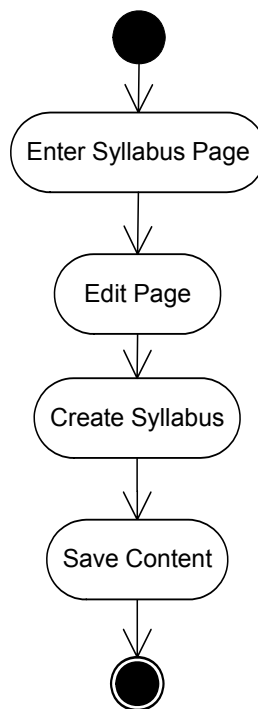


Figure 3-22 Activity Diagram of Create Syllabus

Update Syllabus

In order to update syllabus, Organizer should first navigate to Syllabus page then select the “Edit Page” option from “Site Actions” menu. After that, organizer should click on “Rich Text Editor” button to view syllabus in an editable form. Then, organizer should update content and save syllabus. Activity diagram of update syllabus operation is provided in Figure 3-23.

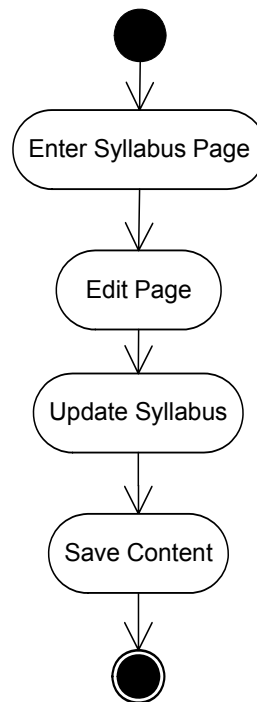


Figure 3-23 Activity Diagram of update Syllabus

View Performance

Organizer (i.e. instructor) can asynchronously access to attendees’ performance reports which comprises following attributes for each student: number of question asked, number of answer given, number of raise hand activity, average grade of answers, and total attendance duration. The performance report is provided for instructors to measure and assess the learners’ performances in synchronous environment after the online lectures are completed. In addition, attendees can display only their individual performance reports.

In order to view performance reports, organizer should navigate to Performance page, which list the performance details of each student for each previous online lecture conducted. At the same time, classroom average regarding performance data for each lecture should be displayed. Then, organizer should select a student to view the performance data for intended student.

Finally, bar charts should be generated dynamically based on the performance data of selected student and of the classroom average separately in order to provide instructor with better comparison functionality.

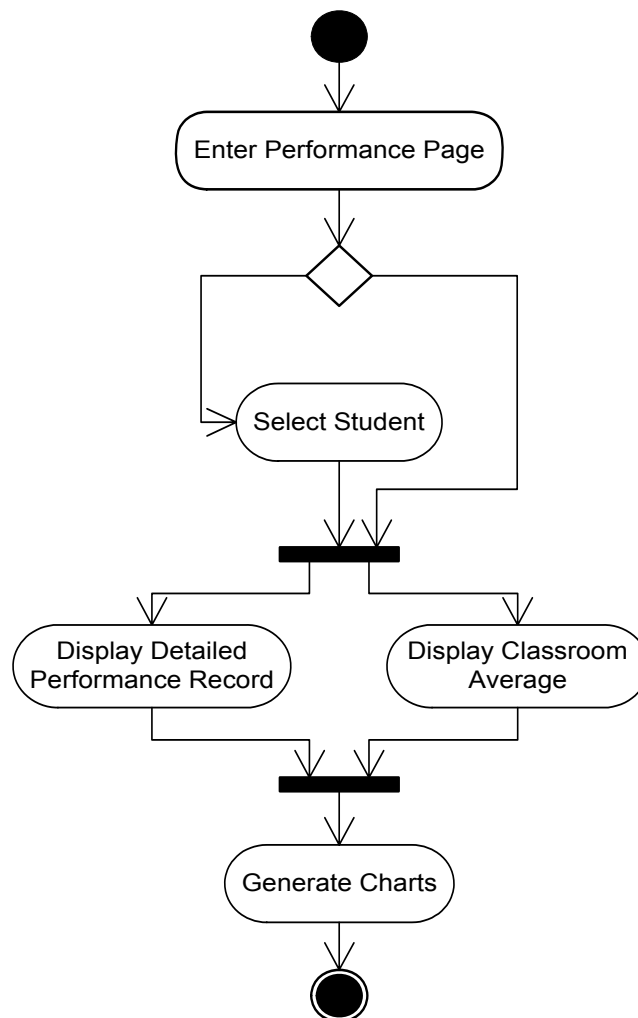


Figure 3-24 Activity Diagram of View Performance Operation

During the programming of view performance operations, mainly SPList and SPListItem objects have been utilized and also SPWebPartManager has been used.

Manage Lecture Notes

Organizer can manage lecture notes by uploading new documents related to course content and by deleting files or folders in the system. In addition, both organizer and attendee can download or open lectures notes. Use case diagram of manage lecture notes is provided in the following figure.

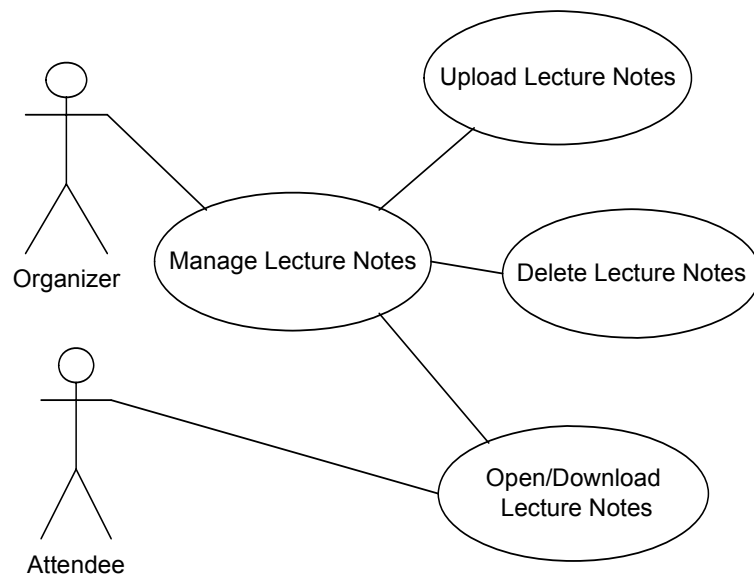


Figure 3-25 Use Case Diagram for Manage Lecture Notes Operation

In order to program operations related to lecture notes, mainly SPList, SPFolder and SPFile objects have been used.

View/Download Lecture Notes

Organizer or attendee can view or download lecture notes. In order to view/download a file user should navigate to lecture notes page, and then should select the intended file to open or download a copy.

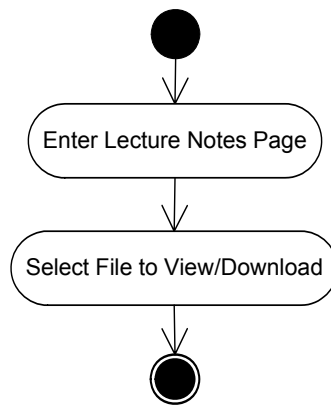


Figure 3-26 Activity Diagram of View/Download Lecture Notes

Upload Lecture Notes

Organizer can upload lecture-related resources into LMS. In order to upload a file, organizer firstly should navigate to Lecture Notes page. On this page, organizer should directly upload a file by using file browser, or organizer should create a new folder into which he can upload a file, or organizer should open an existing folder to upload a file inside the folder. Activity diagram of Upload Lecture Notes operation is given in Figure 3-27.

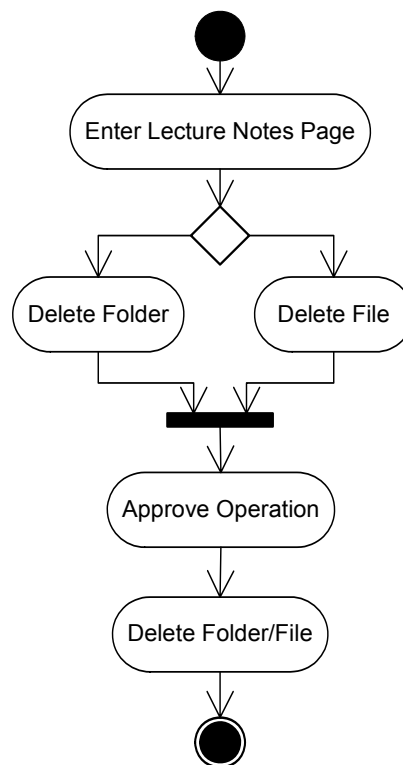


Figure 3-27 Activity Diagram of Upload Lecture Notes

Delete Lecture Notes

Organizer can delete lecture notes that he/she uploaded. In order to delete a file, organizer firstly should navigate to Lecture Notes page. On this page, organizer should select the file or whole folder to delete. Then, system should ask user to approve the operation. After approval, file or folder should be deleted successfully. Activity diagram of Delete Lecture Notes operation is given in Figure 3-28.

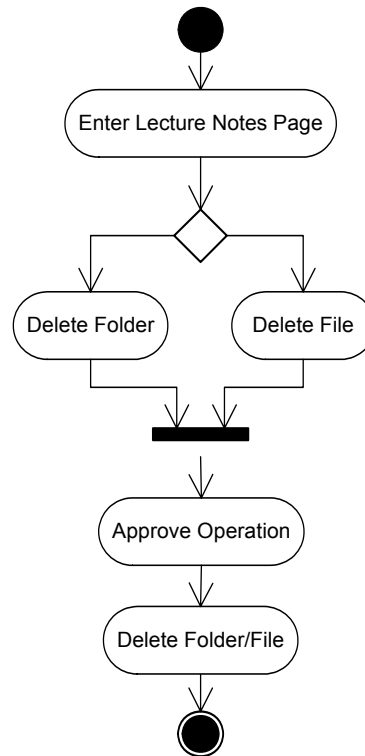


Figure 3-28 Activity Diagram of Delete Lecture Note(s)

Manage Announcements

Organizer can manage the announcements of his lecture. In order to manage announcement, organizer should navigate to Announcements page. In addition, attendee can display announcements as well. Related use case diagram is depicted in Figure 3-29.

In manage announcements operations, mainly SPList and SPListItem objects have been used.

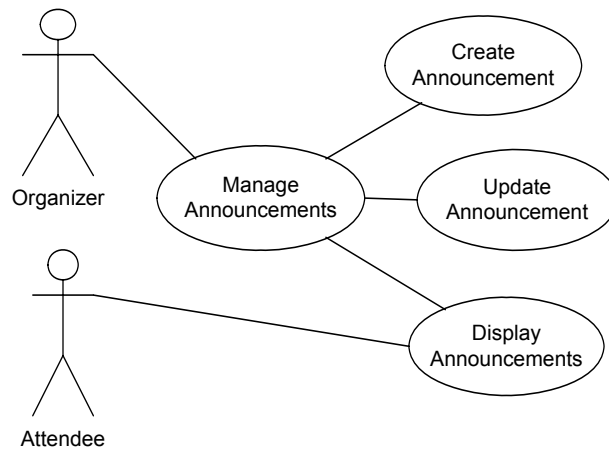


Figure 3-29 Use Case Diagram for Manage Announcements Operation

Create Announcement

Organizer can create new announcements for the lectures he owns. In order to create a new announcement, organizer should navigate to Announcements page and then should choose create announcement option. After that, a form comprising announcement title, body and expiry date fields should be displayed. When this form is submitted successfully, new announcement should be displayed in Announcements page. Activity diagram of this operation is provided in Figure 3-30.

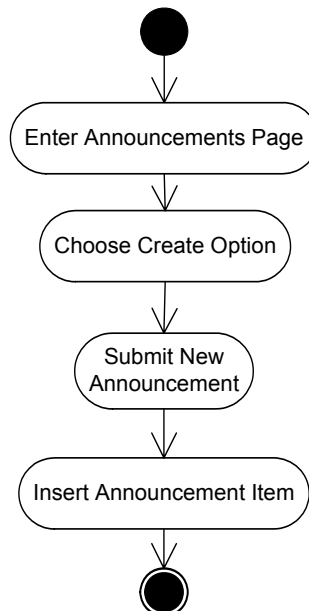


Figure 3-30 Activity Diagram of Create Announcements Operation

Update Announcement

Organizer can edit announcements that he created. In order to update an announcement organizer should first navigate to Announcements page. Then, he should select the announcement to be updated. After that, system should display the selected announcement in an update form to allow user to make changes. Assuming that user submits update form successfully, intended announcement should be updated accordingly. In addition, organizer should be able to choose to delete announcement displayed in update form. Activity diagram of update announcement operation is provided in Figure 3-31.

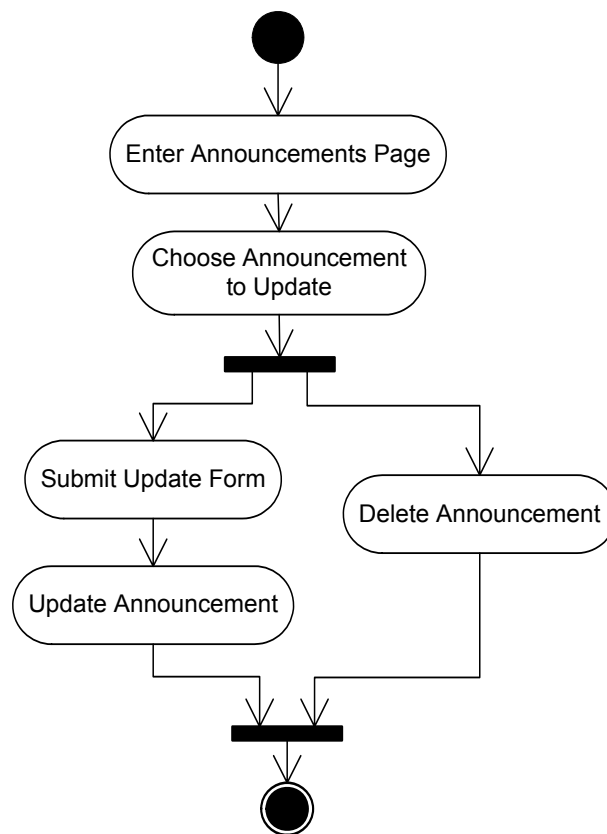


Figure 3-31 Activity Diagram of Update Announcements Operation

Display Announcement

Organizer and attendee can both display content of announcements. In order to display a specific announcement, user should navigate to Announcements page in which all announcements that are not expired are displayed. Then, user should select the intended announcement. After that system should display the body of the selected

announcement. Figure 3-32 displays the activity diagram of display announcement operation.

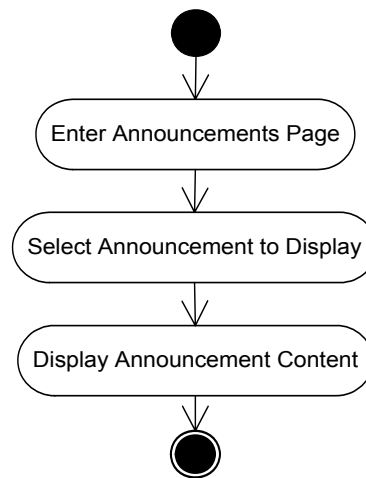


Figure 3-32 Activity Diagram of Display Announcement Operation

Manage Assignments

Organizer can manage assignments of his lecture. In order to create or update assignments, organizer should navigate to Assignments page. Attendee also can display assignments. Related use case diagram is depicted in Figure 3-33.

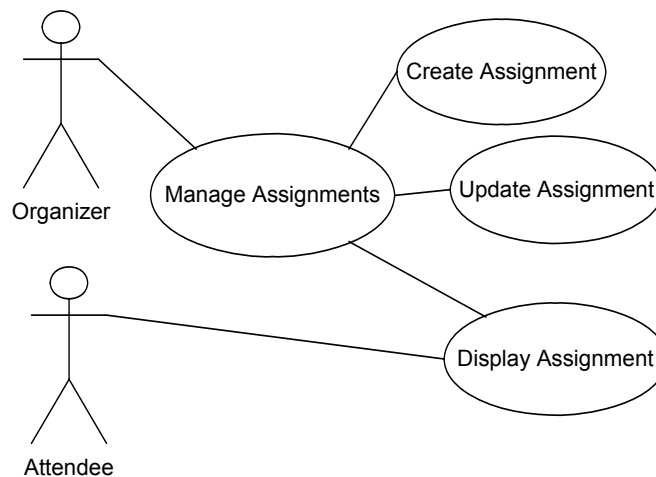


Figure 3-33 Use Case Diagram for Manage Assignments Operation

In order to program manage assignments operations, SPList and SPListItem objects have been used.

Create Assignment

Organizer can create new assignment for the lectures he owns. In order to create a new assignment, organizer should navigate to Assignments page and then should choose create assignment option. After that, a form comprising assignment title, description and due date fields should be displayed. When this form is submitted successfully, new assignment record should be added and displayed in Assignments page. Activity diagram of this operation is provided in Figure 3-34.

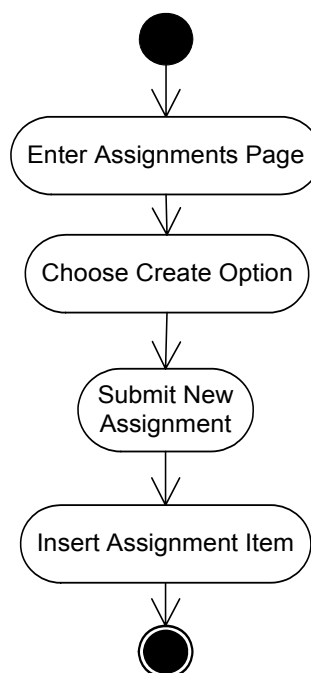


Figure 3-34 Activity Diagram of Create Assignment Operation

Display Assignment

Organizer and attendee can both display content of assignments. In order to display a specific assignment, user should navigate to Assignments page in which all assignments that are not expired are displayed. Then, user should select the intended assignment. After that system should display the body of the selected assignment. Figure 3-35 displays the activity diagram of display assignment operation.

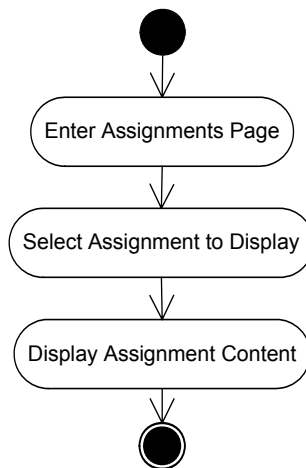


Figure 3-35 Activity Diagram of Display Assignment Operation

Update Assignment

Organizer can edit assignments that he created. In order to update an assignment organizer should first navigate to Assignments page. Then, he should select the assignment to be updated. After that, system should display the selected assignment in an update form to allow user to make changes.

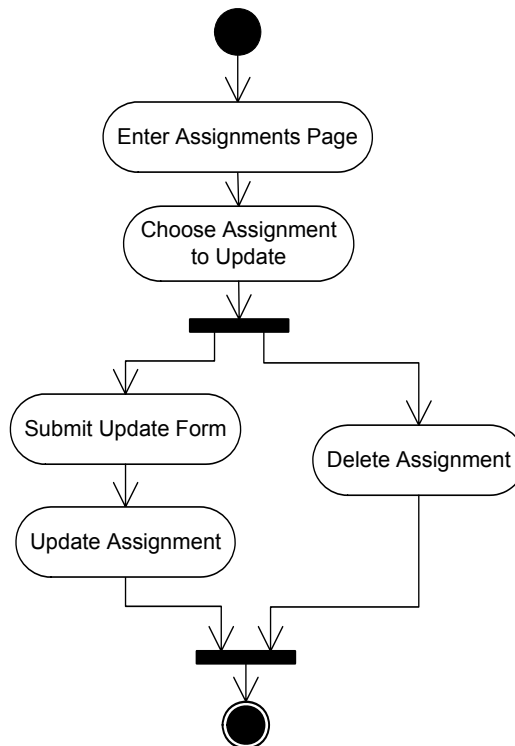


Figure 3-36 Activity Diagram of Manage Assignment Operation

Assuming that user submits update form successfully, intended assignment should be updated accordingly. In addition, organizer should be able to choose to delete assignment displayed in update form. Activity diagram of update assignment operation is provided in Figure 3-36.

Manage Discussion Forum

Organizer and attendee can create or update discussion and also can post a reply for discussions. Users should be able to only manage their own discussion items or messages. Related use case diagram is provided in the following figure.

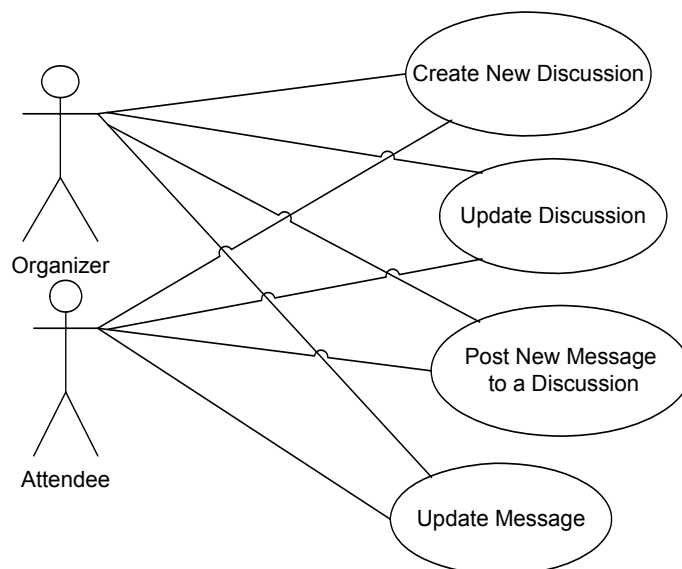


Figure 3-37 Use Case Diagram for Manage Discussion Operation

In order to program operations related to discussion forum, mainly SPList and SPListItem objects have been used.

Create New Discussion

In order to create a new discussion, user (i.e. attendee or organizer) should navigate to Forum page. Then, user should select “Create Discussion” option. After that, system should display form comprising subject and body fields in order to enable user to create new discussion item. After user successfully submit this form, new discussion item should be created. Figure 3-38 displays the related activity diagram.

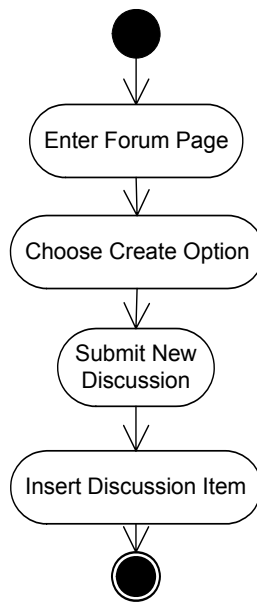


Figure 3-38 Activity Diagram of Create Discussion Operation

Update Discussion

Attendee or organizer can edit discussions that he created. In order to update a discussion user should first navigate to Forum page.

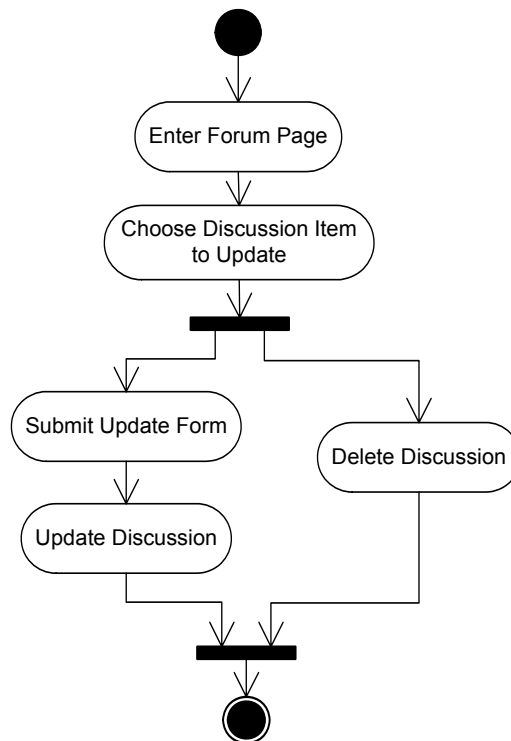


Figure 3-39 Activity Diagram of Update Discussion Operation

Then, he should select the discussion to be updated. After that, system should display the selected discussion in an update form to allow user to make changes. Assuming that user submits update form successfully, intended discussion should be updated accordingly. In addition, user should be able to choose to delete discussion displayed in update form. Activity diagram of update discussion operation is provided in Figure 3-39.

Post Message to a Discussion

In order to post a message to a discussion, user (i.e. attendee or organizer) should firstly navigate to Forum page. Then, user should select the intended discussion item to display it. After that, system should display selected discussion with a “Reply” option. User should choose reply option to post a message. After choosing reply option, system should display a form comprising subject and body fields in order to enable user to send a message. After user successfully submits this form, new message should be created under the current discussion item. Figure 3-40 displays the related activity diagram

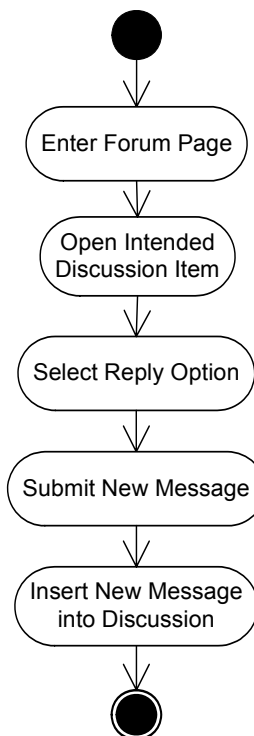


Figure 3-40 Activity Diagram of Post Message to Discussion Operation

Update Message

Attendee or organizer can edit messages that he posted. In order to update a message user should first navigate to Forum page. He should select the discussion to which message is posted and then should select the intended message to update. After that, system should display the selected message in an update form to allow user to make changes. Assuming that user submits update form successfully, intended message should be updated accordingly. In addition, user should be able to choose to delete message displayed in update form. Activity diagram of update message operation is provided in Figure 3-41.

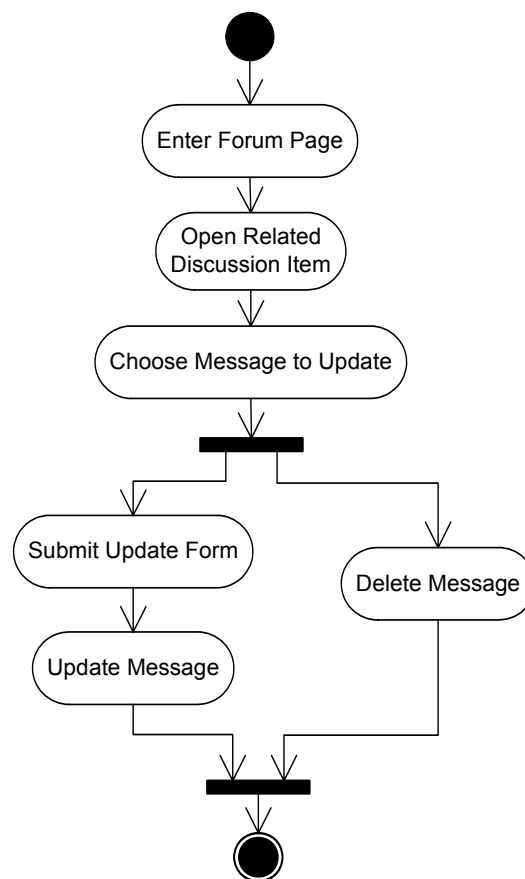


Figure 3-41 Activity Diagram of Update Message Operation

Manage Solutions for Assignments

Attendee can manage solution files uploaded for the assignments. Related use case diagram is depicted in Figure 3-42.

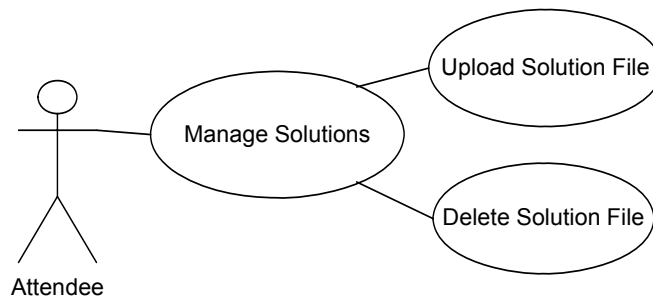


Figure 3-42 Use Case Diagram for Manage Solutions for Assignments

Upload Solution for Assignments

Attendee can upload solution files for the assignments that are not due. In order to upload a solution file, firstly attendee should navigate to Assignments page. Then he should choose the solution file using file browser and choose the intended assignment. After he submits, file should be uploaded into system. In the Figure 3-43, activity diagram is provided.

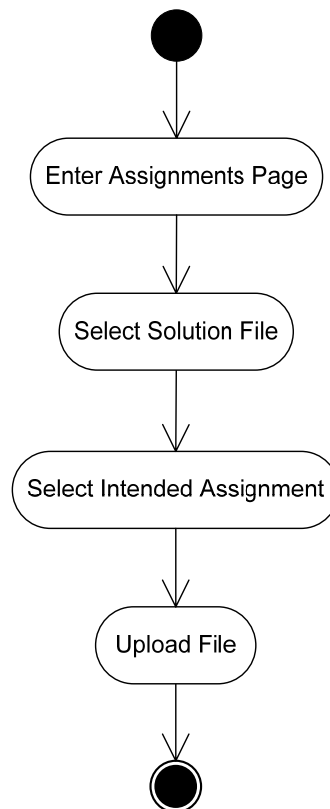


Figure 3-43 Activity Diagram of Upload Assignment Operation

Delete Solution File

Attendee can delete solution files uploaded for the assignments. In order to delete a solution file, firstly attendee should navigate to Assignments page. Then he should choose the intended assignment to list the related solution file. After he should choose intended file and choose delete option. Then, selected file should be deleted from system successfully. Activity diagram of this operation is provided in the following figure.

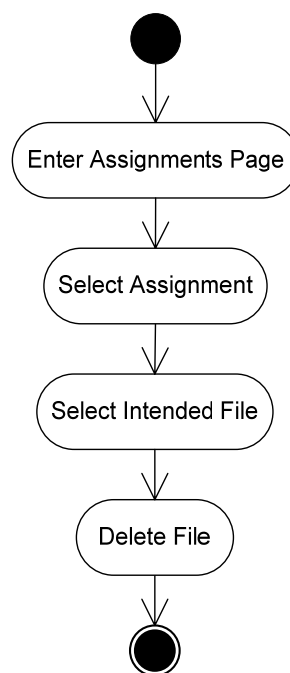


Figure 3-44 Activity Diagram of Delete Solution File Operation

Manage Lecture Recordings

Organizer can manage lecture recordings by uploading new recordings to LMS or by deleting existing recordings. In addition, organizer and attendee can watch lecture recordings. Related use case diagram is depicted in the following figure.

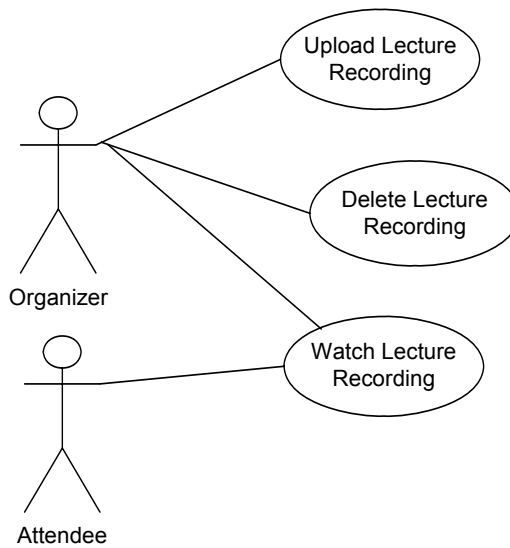


Figure 3-45 Use Case Diagram of Manage Lecture Recordings

Upload Lecture Recording

Organizer can upload recordings of completed online lectures into LMS. In order to upload a recording, organizer should firstly navigate to the folder that contains the intended lecture recording. After that, organizer should navigate to Watch Lecture page. In this web page, a specific area containing folders of existing lectures should be displayed in an explorer view. Organizer should drag and drop folder containing lecture recording to the area on the Watch Lecture page directly. System should keep a copy of the lecture recording for asynchronous viewing.

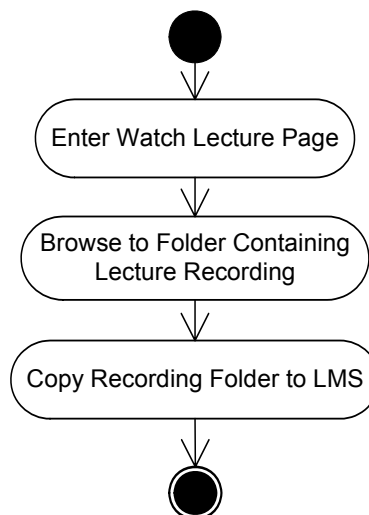


Figure 3-46 Activity Diagram of Upload Lecture Recording Operation

Delete Lecture Recording

Organizer can delete a lecture recording. In order to delete a lecture recording, organizer should navigate to Watch Lecture page. In this page, organizer should select the folder of the intended recording and delete it directly.

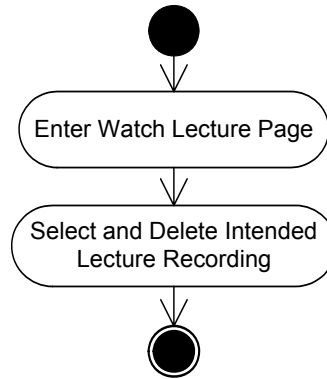


Figure 3-47 Activity Diagram of Delete Lecture Recording Operation

Watch Lecture Recording

Organizer and attendee can watch lecture recordings asynchronously. In order to watch a lecture, user should navigate to Watch Lecture page. Then user should select the intended lecture to watch. System should play the selected lecture recording. Related activity diagram is provided in the following figure.

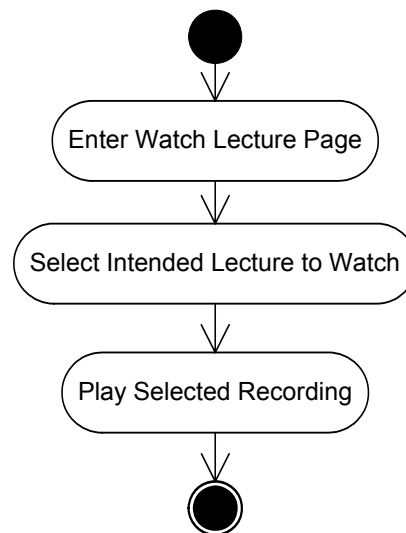


Figure 3-48 Activity Diagram of Watch Lecture Recording Operation

3.2.2. Design of Q&A Application

Custom Q&A application is developed to be used as a replacement for default Q&A feature of the web conferencing tool. It basically provides instructor and students to raise hand, to ask question, to answer question in text mode. In order to achieve the aim of this study, custom Q&A application offers additional real time capabilities that are lack in web-conferencing tool. In addition to its default features, custom Q&A application has some distinct capabilities, which are:

- Instructor is able to grade answers of students,
- Participation of students is assessed dynamically according to
 - Number of raise hands,
 - Number of questions asked,
 - Number of answers provided,
 - Grade of answers provided.
- Students are listed according to assessment results, from most active student to least involved student, and this list is updated throughout the session,
- Q&A session data of each online lecture can be transferred to Performance module of LMS so that students' performance can be monitored asynchronously throughout the learning program.

In order to embed custom Q&A application into web conferencing tool, “Streaming Media Custom Frame” option of web conferencing tool is used. This custom frame can display a web application during an online meeting, if URL attribute is set relevantly. Integration of custom Q&A application with web conferencing tool is achieved by embedding Q&A application into this frame; that is URL of custom frame is set to URL of our custom Q&A application. In the following sections, database design and software design are explained.

3.2.2.1. Database Design

Q&A application is develop separately from LMS and it has separate database. The entity relationship diagram of database is given in following figure.

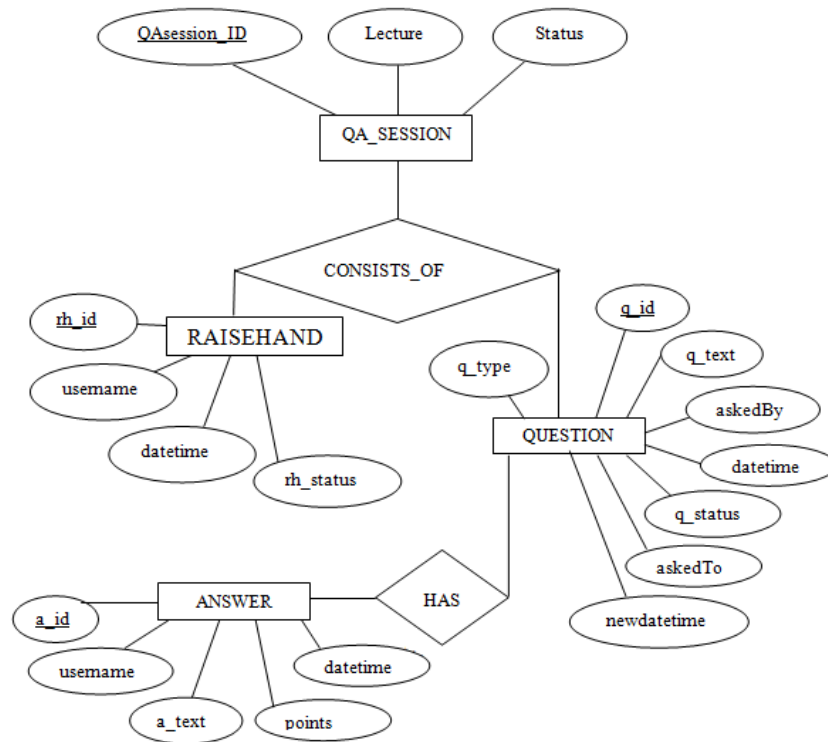


Figure 3-49 ER Diagram of Q&A Application

Database tables and their brief descriptions are given in the following table.

Table 3-6 Tables in Q&A Application Database

TABLE	DESCRIPTION
QA_SESSION	QA_SESSION keeps session information, such as session id, and lecture name, for each online lecture.
RAISEHAND	RAISEHAND keeps information regarding “raise hand” so that it can identified each student’s “raise hand” activity.
QUESTION	QUESTION keeps questions’ details such as asker, time of asking, etc.
ANSWER	ANSWER keeps details of answers provided for questions in QUESTION table.

3.2.2.2. Software Design

Q&A application is designed using object oriented design methodology. Additionally, its design is supported by low coupling and high cohesion software patterns. Classes defined in Q&A application are given in the following table.

Table 3-7 Classes defined in Q&A application

CLASS	DESCRIPTION
QA_Session	This class communicates with UI and manages UI messages and requests.
Performance	This class is dedicated to calculate performance and created by low coupling and high cohesion pattern.
ManageQuestion	This class deals with Question objects and created by low coupling and high cohesion pattern.
ManageAnswer	This class deals with Answer objects and created by low coupling and high cohesion pattern.
ManageRaiseHand	This class deals with RaiseHand objects and created by low coupling and high cohesion pattern.
Question	It represents question object.
RaiseHand	It represents raisehand object.
Answer	It represents answer object.
DB_Controller	This class deals with database operations. Other classes communicate with this class for database operations.

In the following figure, class diagram of Q&A application is provided.

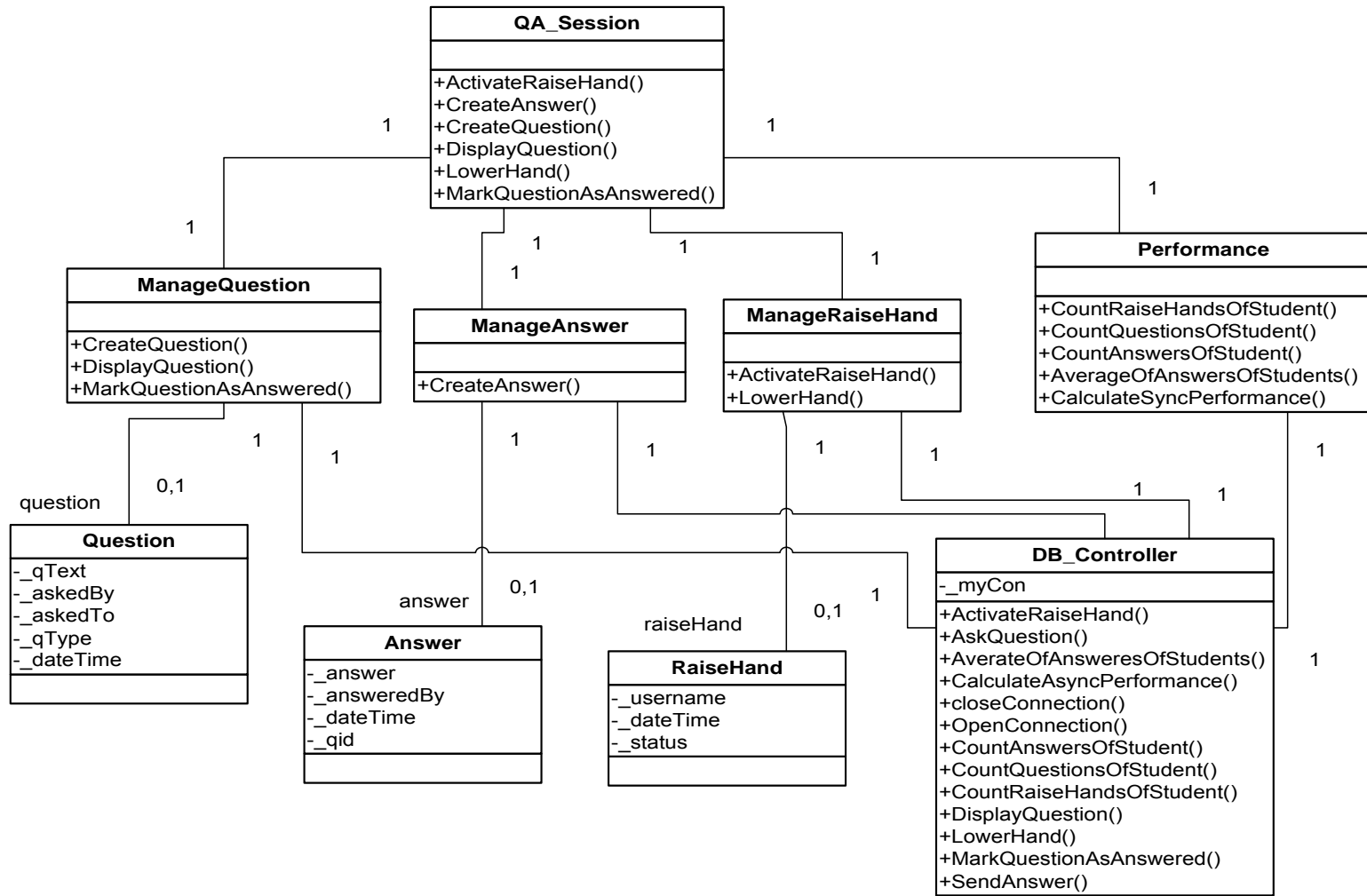


Figure 3-50 Class Diagram of Q&A Application

Attendee Operations

Attendee can raise hand, ask question and answer question by using Q&A application. Use case diagram of attendee operations is provided in Figure 3-51.

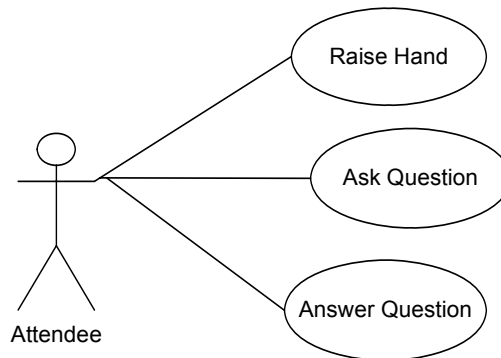


Figure 3-51 Use Case Diagram of Attendee Operations

Raise Hand

Attendee can raise hand by clicking on “Raise Hand” option. When attendee raises hand, organizer should be notified. That is, list showing attendees who raise hand should be updated accordingly so that organizer of the session can give floor to student who raised hand. Also, attendee performance score should be incremented by 1. When given floor, attendee should be able to ask text-based question. If attendee is not given floor during 15 seconds, then system should cancel raise hand operation.

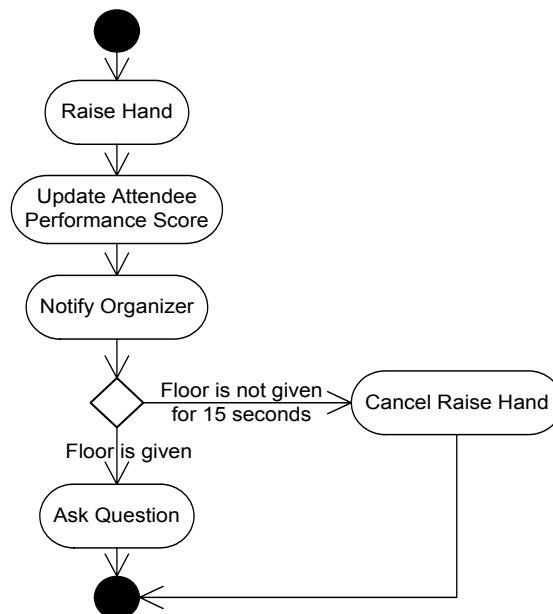


Figure 3-52 Activity Diagram of Raise Hand Operation

Ask Question

When attendee is given floor, then he should be able to ask text-based question. In order to ask question, attendee should write question text and set the scope of question either as private to organizer or public to anyone. When attendee sends question, other attendees and/or organizer should be notified. That is, new question should be displayed in questions list that is displayed on both organizer and attendees' pages accordingly. Attendees should be able to only display private questions they asked and all public questions. Organizer should be able to display all questions. In addition, performance score of attendee asking question should be incremented by 1. Activity diagram of ask question operation is provided in Figure 3-53.

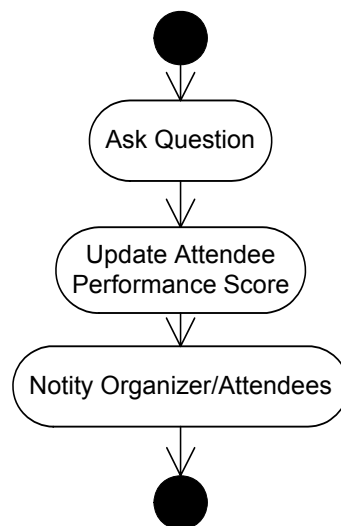


Figure 3-53 Activity Diagram of Ask Question Operation

Answer Question

Attendees can answer questions displayed in questions list. Attendee should firstly select the question to be answered. Then, he should write then answer and send it. Performance score of attendee answering question should be incremented by 1. Activity diagram of answer question is provided in Figure 3-54.

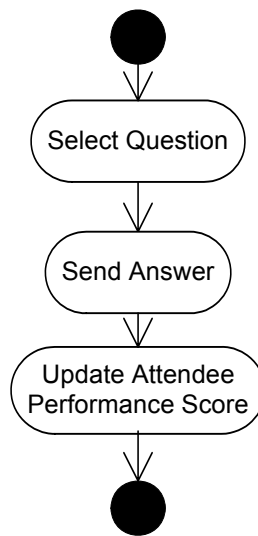


Figure 3-54 Activity Diagram of Answer Question Operation

Organizer Operations

Organizer can give floor to students who raise hand, ask question and answer question, grade answers and display attendees' performance data by using Q&A application. Use case diagram of organizer operations is provided in Figure 3-55.

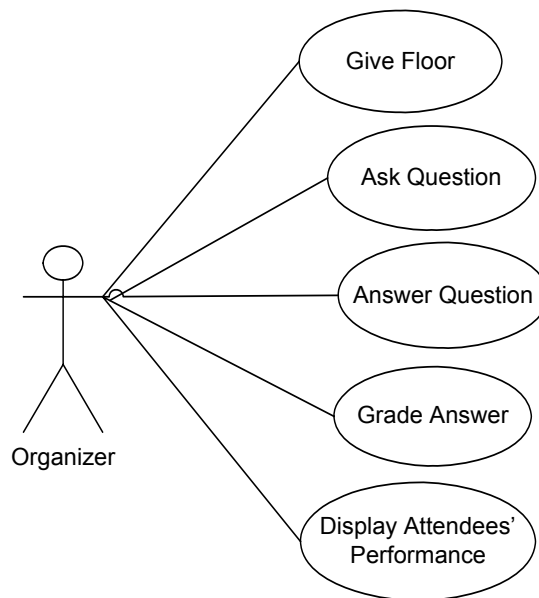


Figure 3-55 Use Case Diagram of Organizer Operations

Give Floor

Organizer can give floor to students who raise hand. In order to give floor, organizer should firstly select the attendee, who actively raised hand, then choose “Give Floor” option. After that, attendee who is give floor should be notified accordingly so that he can ask text-based question. The following diagram displays the activity diagram of this operation.

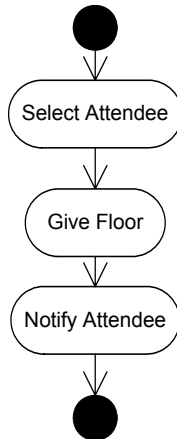


Figure 3-56 Activity Diagram of Give Floor Operation

Ask Question

Organize can ask question to all attendees or specific to selected attendee. In order to ask question, organizer should write question text and set the scope of question either as private to selected attendee or public to anyone. When organizer sends question, intended attendee(s) should be notified. That is, new question should be displayed in questions list that is displayed on attendees’ pages accordingly. Activity diagram of ask question operation is provided in Figure 3-57.

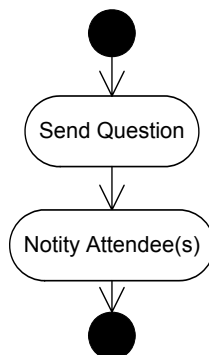


Figure 3-57 Activity Diagram of Ask Question Operation

Answer Question

Organizer can answer questions displayed in questions list. Organizer should firstly select the question to be answered. Then, he should write then answer and send it. Activity diagram of answer question is provided in Figure 3-58.

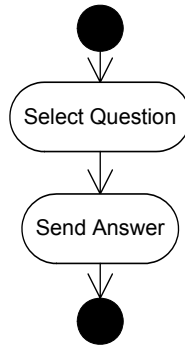


Figure 3-58 Activity Diagram of Answer Question Operation

Grade Answer

Organizer should be able to grade answers provided by attendees. In order to grade an answer, organizer should firstly select the question to display answers provided for the selected question. After that, organizer should choose any answer to edit. Then, he should enter grade for answer according to its correctness and should submit grade. When grade is submitted, score of attendee's performance should be incremented by the grade organizer assigned. Figure 3-59 shows the related activity diagram.

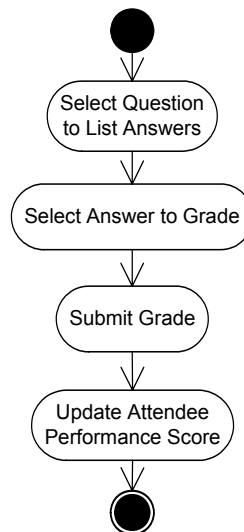


Figure 3-59 Activity Diagram of Grade Answer

Display Attendees' Performance

Organizer should be able to display the list of attendees with their participation performance details. Attendees should be ordered according to their performance score from low performance to highest performance score. Scores should be displayed next to each attendee name in the list. In addition organizer should be able to access student activity details, such as number of questions asked, number of raise hands, etc, by double clicking on attendee's name.

CHAPTER 4

IMPLEMENTATION OF LIVELMS

In order to prove its feasibility, LIVELMS has been tested on a sample learner group. The description of the learning program setup, to which LIVELMS is applied, and the results are explained in this chapter. During the implementation, mainly synchronous components of the system, especially features related to synchronous performance monitoring, have been focused. In parallel to implementation focus, results of the implementation comprise mainly performance data of learners in synchronous online lectures.

4.1. Learning Program Setup

The aim of the distance learning program created for testing LIVELMS is defined basically as teaching students the basic information technology concepts and applications and make them both computer and information literate students. For this purpose, content of Information Technologies and Applications (IS100) course, offered by the Department of Information Systems in Informatics Institute, has been benefited to deliver education during online lectures in this testing environment. In this implementation two online lectures have been conducted. The other details of learning program are provided in the following table.

Table 4-1 Details of learning program

	Subject of the Lecture	# of Registered Student
Lecture 1	Computer Basics	5
Lecture 2	Ms Office Word 2007	5

4.2. Results

In this section, results are discussed for each online lecture and then a comparison for two lectures is provided.

Monitoring of attendees’ (i.e. students’) performances during online lectures are performed regarding following indicators:

- Duration of Attendance in Minutes
- Number of Raise Hands
- Number of Questions Asked
- Number of Questions Answered
- Average Grade of Answers

4.2.1. Synchronous Online Lecture 1: Computer Basics

In the following figure, details of participation performance of each attendee during lecture 1 are listed. These details are provided to support assessment of learners regarding their performance during synchronous sessions.

Classroom Performances						
Student	Lecture	Attendance	NumberOfRaiseHands	NumberOfQuestionsAsked	NumberOfQuestionsAnswered	AverageOfAnswers
Lecture : Lecture 1 ↓NEW (5)						
student5 eeee	Lecture 1 ↓NEW	21	7	4	3	6
student4 dddd	Lecture 1 ↓NEW	31	8	3	4	6
student3 cccc	Lecture 1 ↓NEW	21	5	3	2	8
student2 bbbb	Lecture 1 ↓NEW	46	12	6	5	5
student1 aaaa	Lecture 1 ↓NEW	35	13	7	4	7

Figure 4-1 Students' Performance Data in Lecture 1

Figure 4-1 shows that student 2 is the attendee that shows higher participation in terms of duration attended. In addition, students who raised hand and who asked question most are student 2 and student 1. Furthermore, student 3 is the attendee that achieves higher score in grades of answers he provided.

For better evaluation of students' performances, classroom average of participation performances during online lecture 1 is provided in the following figure.

Lecture	Attendance	NumberOfRaiseHands	NumberOfQuestionsAsked	NumberOfQuestionsAnswered	AverageOfAnswers
Lecture 1 !NEW	31	9	4,6	3,6	6,4

Figure 4-2 Classroom Average of Synchronous Performances in Lecture 1

Comparison of values in Figure 4-1 with values in Figure 4-2 indicates that only student 1 achieved higher score than classroom average regarding each performance parameter. On the contrary, student 5 exhibited lowest performance regarding all activities.

A comparison of students' performances in lecture 1 is depicted in Figure 4-3 as column chart and line chart separately. Column chart shows that student 1 is the most successful student, whereas student 2 has the highest duration of attendance according to line chart.

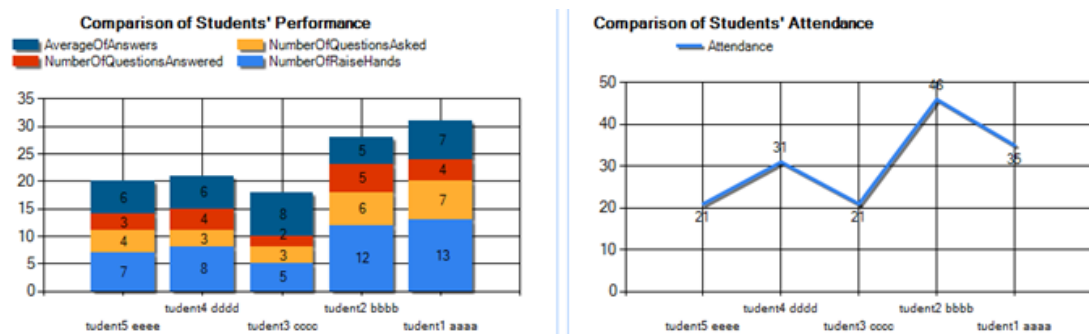


Figure 4-3 Comparison of Students' Performances in Lecture 1

Furthermore, column chart represented in Figure 4-3 indicates that student 3 is the most passive student as well as according to line chart he is the least attended student.

4.2.1.1. Conclusions Drawn from Performance Results of Lecture 1

Performance results of learners during lecture 1 show that student 3 needs to improve his participation performance during synchronous online lectures so that he can improve his learning progress. In addition, instructor should provide related feedback and support for student 3.

Furthermore, student 4 and student 5 are other students who need feedback to improve their performances. On the other hand, student 1 and student 2 are the most active students and can be provided with positive reinforcement to be motivated.

4.2.2. Synchronous Online Lecture 2: Ms Office Word 2007

Following figure represents the participation details of each attendee during lecture 2. These participation details help assessment of learners during the synchronous session.

Student	Lecture	Attendance	NumberOfRaiseHands	NumberOfQuestionsAsked	NumberOfQuestionsAnswered	AverageOfAnswers
Lecture : Lecture 2 NEW (5)						
student5 eeee	Lecture 2 NEW	19	11	8	7	7
student4 dddd	Lecture 2 NEW	25	4	2	1	8
student3 cccc	Lecture 2 NEW	20	3	2	9	6
student2 bbbb	Lecture 2 NEW	23	9	6	6	3
student1 aaaa	Lecture 2 NEW	28	3	2	8	4

Figure 4-4 Students' Performance Data in Lecture 2

According to Figure 4-4, although student 5 is the participant with the shortest duration, 19 minutes, he has the highest participation in the other activities such as number of raise hands, 11; number of questions asked, 8, etc.

In addition, the figure shows that student 1 is the attendee that shows higher participation in terms of duration attended whereas he could not achieve well in other activities. One of the interesting points about student 1 is that although he is unwilling to raise hand he was actively involved in answering questions although he could not provide correct answers (that is average grade of answers is 4). Furthermore, student 4 had poor performance during Lecture 2.

For better evaluation, classroom average of participation performances during online lecture 2 is provided in Figure 4-5.

Lecture	Attendance	NumberOfRaiseHands	NumberOfQuestionsAsked	NumberOfQuestionsAnswered	AverageOfAnswers
Lecture 2 !NEW	23	6	4	6,2	5,6

Figure 4-5 Classroom Average of Synchronous Performances in Lecture 2

When individual performances and classroom average of performances are compared, student 1 seems to be the attendee who has exhibited the best performance except duration of attendance.

Comparison of student's performance during lecture 2 is depicted in Figure 4-6, which is composed of two charts: a column chart and a line chart.

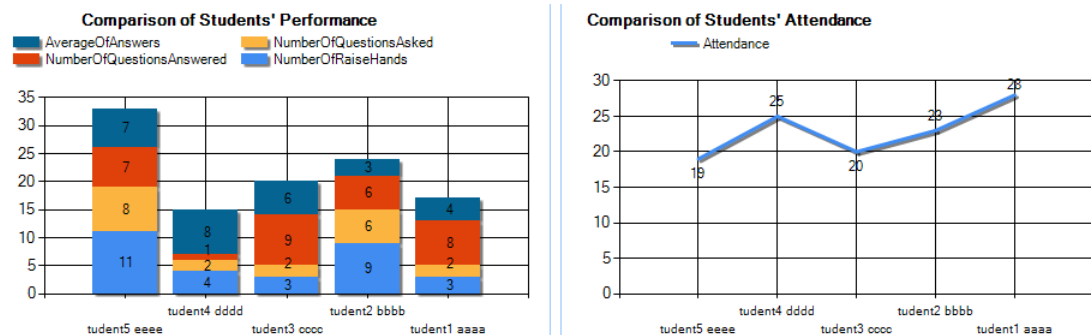


Figure 4-6 Classroom Average of Synchronous Performances in Lecture 2

Column chart shows that student 5 is the most successful student with a total score of 52, although he has the lowest duration of attendance according to line chart. This shows great willingness of student 5 during lecture 2. In addition, although student 1 has attended in lecture 2 with a longer duration, he has a bit poor performance.

4.2.2.1. Conclusions Drawn from Performance Results of Lecture 2

Regarding performance results of lecture 2, student 5 is the most involved student although his duration of attendance is shorter than other students' attendance. Instructor should keep student 5 motivated.

Moreover, student 3 needs to be encouraged because he seems to hesitate to participate in class activities. Although he tried to provide answers to questions as much as possible, he only asked 2 questions. Also, student 4 has low performance in general.

4.2.3. Comparison of Students' Performance in Lecture 1 and Lecture 2

Average performance of classroom has shown a decrease from Lecture 1 to Lecture 2. Column chart in figure 4-7 indicates that while in Lecture 1 overall performance score is 23.6, it is 21.8 in the Lecture 2. Attendance duration has also decreased. Line chart in figure 4-7 shows that attendance duration has decreased from 30.8 to 23.

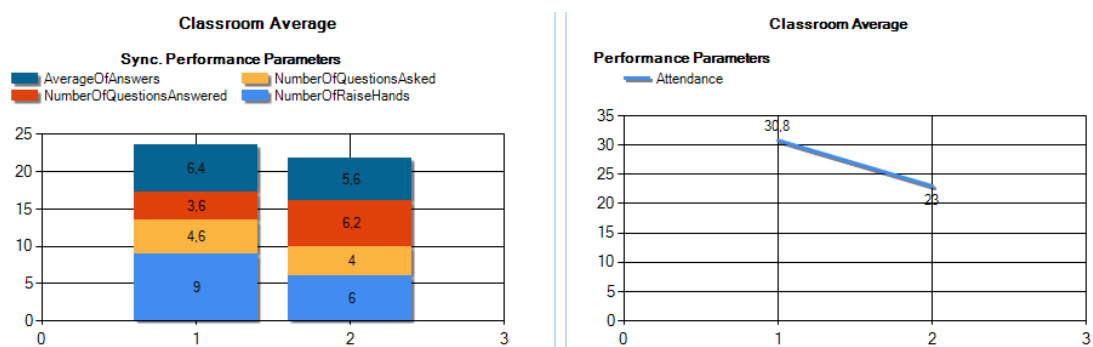


Figure 4-7 Average Performance in Lecture 1 and Lecture 2

General performance of student 1 has decreased in Lecture 2 compared to performance in Lecture 1. In figure 4-8, individual performance details and attendance information is depicted for better understanding.

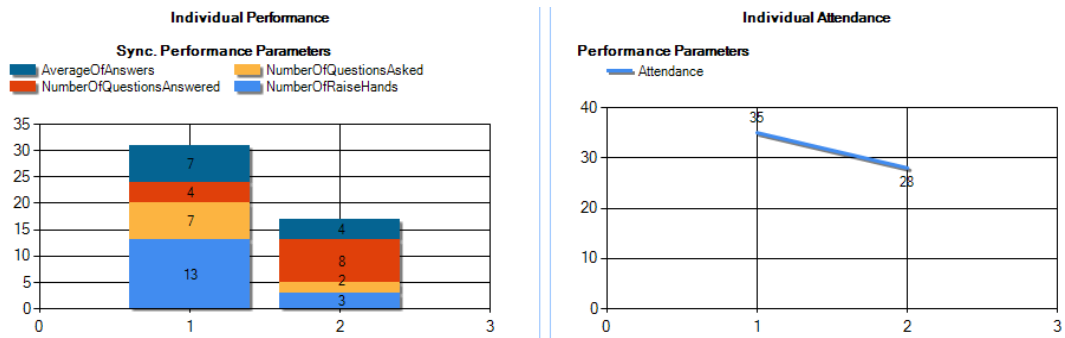


Figure 4-8 Performance Comparison of Student 1 in Lecture 1 and Lecture 2

Performance of student 2 has also decreased in Lecture 2 compared to performance in Lecture 1. Figure 4-9 illustrates the performance details and attendance information for better understanding.

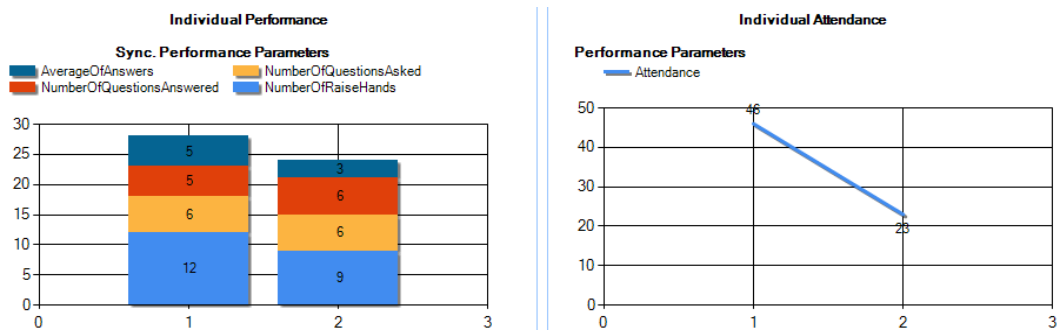


Figure 4-9 Performance Comparison of Student 2 in Lecture 1 and Lecture 2

Student 3 has improved slightly his involvement in lecture 2 compared to lecture 1. His general performance score is 18 in lecture 1, whereas his score in lecture 2 is 20. In figure 4-10, details of performance comparison of student 3 is depicted.

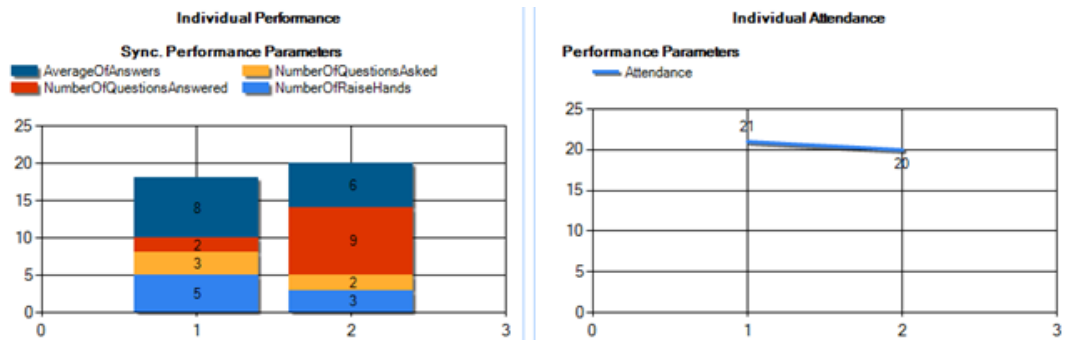


Figure 4-10 Performance Comparison of Student 3 in Lecture 1 and Lecture 2

General performance of student 4 has decreased in Lecture 2 compared to performance in Lecture 1. In figure 4-11, individual performance details and attendance information is depicted for better understanding.

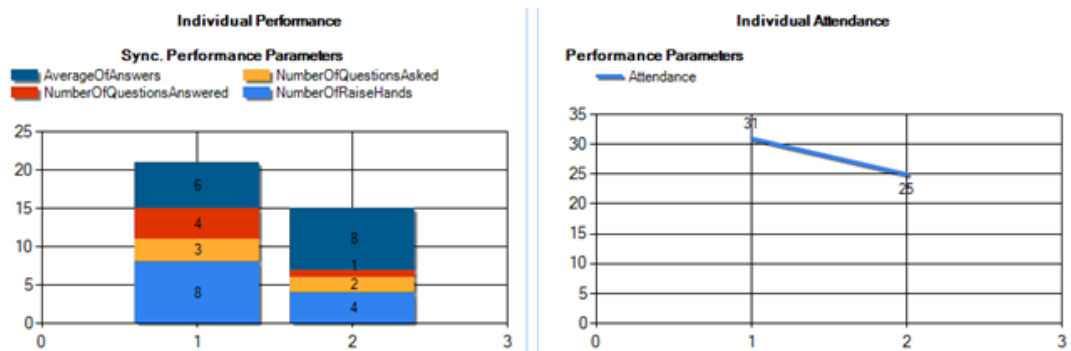


Figure 4-11 Performance Comparison of Student 4 in Lecture 1 and Lecture 2

Student 5 is the other student that has achieved progress in his general performance in online lectures although his duration attendance decreased in lecture 2.

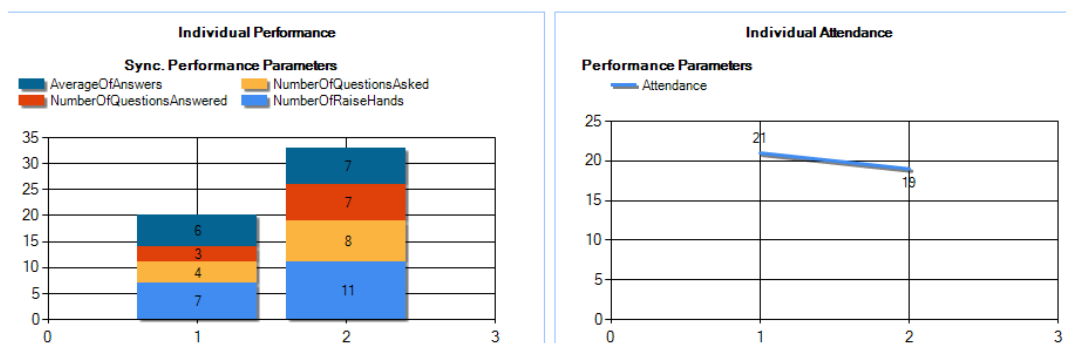


Figure 4-12 Performance Comparison of Student 5 in Lecture 1 and Lecture 2

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1. Conclusions

In distance education, assessment techniques used to assess learners regarding their participation during synchronous lectures has some limitations. Firstly, observing all students' activities without a face-to-face communication is difficult for instructors. In addition, instructor cannot identify passive students not participating much, especially in crowded sessions because their performance are not assessed to obtain their participation level. As a result, those students are not provided with feedback in time and neglected. Furthermore, assessment data of students are not kept to monitor the progress of the students asynchronously throughout the learning program.

The main focus of this study is to overcome these assessment limitations in synchronous online lectures in distance learning. LIVELMS tool, which merges asynchronous and synchronous e-learning environments, is developed for this purpose. LIVELMS proposes a new Q&A application, to be used instead of default Q&A feature of web conferencing tool, during online lectures. This new Q&A application has some features intended to perform assessment regarding students' activities during synchronous lectures. According to assessment data generated dynamically, students are listed according to their performance. This list, which is updated continuously, helps instructor to identify passive students or more involved students instantly. Additionally, this assessment data is transferred to LMS for

asynchronous access when online lecture is completed. By this way, instructor can monitor students' progress for each online lecture throughout the learning program.

In order to implement LIVELMS tool, custom distance education program comprising 2 lectures has been set up with the participation of 5 students. The aim of the learning program is basically teaching students the basic information technology concepts and applications. In the implementation, especially features related to synchronous performance assessment have been focused. Results of this implementation showed that with the help of LIVELMS instructor can assess students' performances in online lectures and monitor their learning progress so that students can be supported with in-time feedbacks.

5.2. Future Work

In the scope of this study, hosted Live Meeting service has been benefited to conduct online lectures. This means that all sessions conducted using Live Meeting was implemented in remote servers, and meeting information has been kept in these servers not in our server, which results in insufficient control in LIVELMS system. We were only capable of controlling this database using Live Meeting Service API. On the other hand, Live Meeting deployed in Office Communications Server enables whole control on web conferencing tool and provides faster online meetings. As a result of this, migrating LIVELMS to Office Communications Server could be considered as a future work.

Furthermore, assessment during synchronous sessions is mainly based on the Q&A session, which enables asking only one type of question, essay type. Including other question types, such as multiple choices, simulation, etc, will enhance the assessment methodologies. Improving LIVELMS in order to get various assessment techniques can be considered as another future work.

The other important feature work is testing LIVELMS by integrating it into an official distance learning program. In this way, effects of LIVELMS on learning process would be identified better. Also, its limitations and benefits could be identified with the help of constant feedbacks during learning program. Consequently, LIVELMS tool could be improved with the help of these feedbacks. Therefore, testing LIVELMS in a real distance learning environment can be considered as another important feature work.

Furthermore, preparing a help content explaining how to use features provided in LIVELMS could be considered as another future work.

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APPENDICES

APPENDIX A – Live Meeting API Messages [27]

Getting the Posting URL for Access Using the Live Meeting service API

The following C# code shows one way to implement this HTTP GET operation, with the help of the `HttpWebRequest` and `HttpWebResponse` classes supported by the Microsoft .NET Framework.

```
public String GetPostingURLRequest(string confCenter)
{
    string strUrl = string.Empty;
    string getPostingUrl = string.Empty;
    XmlDocument xmlDoc = new XmlDocument();

    // Get the posting URL.
    getPostingUrl = String.Format(

        "https://www.livemeeting.com/cc/{0}/xml/4.0/GetPostingURLRequest",
        confCenter);

    // Send the GetPostingURLRequest message to the conference center;
    HttpWebRequest myReq =
        (HttpWebRequest)WebRequest.Create(getPostingUrl);
    myReq.Method = "GET";
    HttpWebResponse myResp = null;

    try
    {
        // Get the response from the conference center
```

```

myResp = (HttpWebResponse)myReq.GetResponse();
Stream respStream = myResp.GetResponseStream();
if (myResp.ContentType == "application/xml")
{
    StreamReader reader = new StreamReader(
        respStream, Encoding.UTF8);
    xmlDoc.Load(respStream);
    // Retrieve the url attribute of <GetPostingURLReply>
    XmlNode attrUrl = xmlDoc.SelectSingleNode(
        "/PlaceWareConfCenter/GetPostingURLReply/@url");
    if (attrUrl != null)
        strUrl = attrUrl.Value;
}
}
catch (Exception e)
{
    // Log the error message or do other error handling routines.
    Console.WriteLine("Exception: {0}\nTrace: {1}",
        e.Message, e.StackTrace);
}
finally
{
    if (myResp != null)
        myResp.Close()
}
return strUrl;
}

```

Sending a Message by Posting an XML Element

When the posting URL is retrieved, a client application can send all other requests to the conference center by sending the corresponding request elements using an HTTPS POST.

The following is a C# implementation showing how this can be done using `HttpWebRequest` and `HttpWebResponse` classes supported by the Microsoft .NET Framework.

```

public XmlDocument PostXmlMessageRequest(XmlDocument xmldoc, string
postingUrl)
{
    ASCIIEncoding encoder = new ASCIIEncoding();
    XmlDocument xmlReply = null;

    // Post the <messageRequest> element to the conference center;
    HttpWebRequest myReq =
    (HttpWebRequest)WebRequest.Create(postingUrl);
    myReq.Method = "POST";
    myReq.ContentType = "application/x-www-form-urlencoded";

    HttpWebResponse myResp = null;
    try
    {
        // Write the XML message to the request stream and
        // send it to the conference center
        byte[] byteArray = encoder.GetBytes(xmldoc.OuterXml);
        myReq.ContentLength = byteArray.Length;
        Stream reqStream = myReq.GetRequestStream();
        reqStream.Write(byteArray, 0, byteArray.Length);
        reqStream.Close();

        // Get the response from the conference center
        myResp = (HttpWebResponse)myReq.GetResponse();
        Stream respStream = myResp.GetResponseStream();
        if (myResp.ContentType == "application/xml")
        {
            xmlReply = new XmlDocument();
            xmlReply.Load(respStream);
        }
    }
    catch (Exception e)
    {
        // Log the error or implement other error handling routines
        Console.WriteLine("Error: {0}\nStack trace: {1}",
            e.Message, e.StackTrace);
    }
    finally

```

```

    {
        if (myResp != null)
            myResp.Close();
    }
    return xmlReply;
}

```

Live Meeting Service API Messages Used in Development of LIVELMS

Create Meeting Message

The following is a request sent to a conference center to create meeting.

```

<?xml version="1.0" encoding="UTF-8"?>
<PlaceWareConfCenter authUser="" authPassword="">
    <CreateMeetingRequest maxUsers="100" name="" title="">
    <OptionList>

        <TimeOption name="startTime" value="" />
        <TimeOption name="endTime" value="" />
        <StringOption name="timeZone" value="Europe/Bucharest"/>
        <BooleanOption name="enableCustomFrames" value="True"/>
        <StringOption name="audienceCustomFrameURL" value="" />
        <StringOption name="presenterCustomFrameURL" value="" />
        <DecimalOption name="audienceCustomFrameHt" value="900"/>
        <DecimalOption name="presenterCustomFrameHt" value="900"/>
        <EnumerationOption name="meetingType" value="OneTime">
            <String>OneTime</String>
            <String>MeetNow</String>
            <String>Recurring</String>
        </EnumerationOption>
    </OptionList>
        <FieldList>
            <Name>mid</Name>
            <Name>audiencePassword</Name>
            <Name>presenterPassword</Name>
        </FieldList>
    </CreateMeetingRequest>
</PlaceWareConfCenter>

```

The following shows a reply returned from the conference center when the corresponding request for creation is processed successfully

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<PlaceWareConfCenter>
  <CreateMeetingReply>
    <MeetingReply>
      <OptionList>
        <StringOption value="tc8k2sjvs0r96kpn" name="mid">
        </StringOption>
        <StringOption value="s:{B4W&gt;5G" name="audiencePassword">
        </StringOption>
        <StringOption value="F,R(r9`4M" name="presenterPassword">
        </StringOption>
      </OptionList>
    </MeetingReply>
  </CreateMeetingReply>
</PlaceWareConfCenter>
```

Modify Meeting

The following shows a request sent to a conference center to modify a meeting.

```
<?xml version="1.0" encoding="UTF-8"?>
<PlaceWareConfCenter authUser="" authPassword="">
  <ModifyMeetingRequest>
    <StringQuery fieldName="mid" operator="=" value=""/>
    <OptionList>
      <StringOption name="title" value=""/>
      <TimeOption name="startTime" value=""/>
      <TimeOption name="endTime" value=""/>
    </OptionList>
    <FieldList>
      <Name>mid</Name>
    </FieldList>
  </ModifyMeetingRequest>
</PlaceWareConfCenter>
```

The following shows a modify meeting reply returned from the conference center when the corresponding request for creation is processed successfully

```
<PlaceWareConfCenter>
  <ModifyMeetingReply>
    <MeetingReply>
      <OptionList>
        <StringOption name="mid" value="k77balgqvew2"/>
      </OptionList>
    </MeetingReply>
  </ModifyMeetingReply>
</PlaceWareConfCenter>
```

List Visitors Message

The following is a request sent to a conference center to list attendees of the meeting. The **mid** value is the same value received when the meeting was created.

```
<PlaceWareConfCenter authUser="" authPassword="">
  <ListVisitorsRequest deletedOK="True">
    <StringQuery fieldName="mid" operator="=" value=""/>
    <FieldList>
      <Name>endTime</Name>
      <Name>startTime</Name>
      <Name>userName</Name>
      <Name>vid</Name>
    </FieldList>
  </ListVisitorsRequest>
</PlaceWareConfCenter>
```

The following is a reply returned from the conference center and contains a list of attendants at the specified meeting during intended time interval.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<PlaceWareConfCenter>
  <ListVisitorsReply>
    <Visitor>
      <OptionList>
        <TimeOption value="2009-06-13T15:00:00Z" name="endTime">
```

```

</TimeOption>
<TimeOption value="2009-06-13T14:42:52Z" name="startTime">
</TimeOption>
<StringOption value="AAA BBBB " name="userName">
</StringOption>
<StringOption value="hc3lpz dj2r2rdb7s" name="vid">
</StringOption>
</OptionList>
</Visitor>
<Visitor>
<OptionList>
<TimeOption value="2009-06-13T15:00:00Z" name="endTime">
</TimeOption>
<TimeOption value="2009-06-13T14:48:04Z" name="startTime">
</TimeOption>
<StringOption value="CCCC DDDD" name="userName">
</StringOption>
<StringOption value="hgv63zqn01k3msqg" name="vid">
</StringOption>
</OptionList>
</Visitor>
</ListVisitorsReply>
</PlaceWareConfCenter>

```

Delete Meeting Message

The following is a request sent to a conference center to delete meeting.

```

<?xml version="1.0" encoding="UTF-8"?>
<PlaceWareConfCenter authUser="" authPassword="">
  <DeleteMeetingRequest>
    <StringQuery fieldName="mid" operator="=" value=""/>
  </DeleteMeetingRequest>
</PlaceWareConfCenter>

```

The following shows a reply returned from the conference center when the requested meeting is deleted.

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>

```



```
<PlaceWareConfCenter>  
  <DeleteMeetingReply>  
  </DeleteMeetingReply>  
</PlaceWareConfCenter>
```

APPENDIX B - SharePoint Database Tables

Database Tables

The following is a list of database tables used in a Microsoft Windows SharePoint Services topology.

Table B-1 Content Database Tables

Name	Description
Categories	Associations among documents and their assigned areas.
ComMd	Document discussions.
Deps	Document dependencies.
DiskWarningDate	Date and time of last warning about disk quota.
Docs	Documents and document folders.
DocVersions	Version history of documents from document libraries.
EventCache	Cache for alerts.
EventLog	Log for alerts.
ImmedSubscriptions	Alerts that are set to be sent as soon as the changes occur.
Links	Links to be recalculated during a site recalculation.
Lists	Lists in the site.
NavNodes	Nodes that are displayed in the navigation bars.
Personalization	Personalization done to Web Parts.
SchedSubscriptions	Alerts that are set to be sent on a daily or weekly basis.
SiteGroupMembership	Members of cross-site groups.
SiteGroups	Cross-site groups.
Sites	Sites in the content database.
TimerLock	Locking scheme that determines which server locks which database.
UserData	List data.
UserInfo	Info about each user added to the site.
WebCat	Links between Web sites and areas.
WebGroupMembership	List of members of the site groups.
WebGroups	Site groups (such as Administrator, Web Designer) for the site.
WebMembers	Members of a site.
WebParts	Web Parts available for the sites. A view is a Web Part.
Webs	Subsites associated with a site.

Table B-2 Configuration Database Tables

Name	Description
AntiVirusVendors	Antivirus software vendors.
CustomTemplates	Templates that appear in the global templates list (template picker).
Databases	Content databases and associated settings.
Globals	Settings that apply to all sites on the physical server within a Windows SharePoint Services topology.
InstalledWebPartPackages	Web Part Packages that are available to the virtual server.
Servers	Physical computers in the Windows SharePoint Services topology.
Services	Services such as database, Web, and mail services that are included in the Windows SharePoint Services topology.
Sites	Sites in the Windows SharePoint Services topology.
VirtualServers	Virtual servers and their associated settings.
WebPartPackages	Web Part Packages that are installed in a topology.

APPENDIX C – LIVELMS Screen Shots

Create Cancel

Title:
IS100

Description:
Information Technologies and Applications

URL name:
http://144.122.98.49/is100

Select a template:

Collaboration Meetings Custom

Sample Course Template
General Classroom Template
LIVELMS Classroom Template

Create a new group Use an existing group
Attendee

Create a new group Use an existing group
IS10011 Members
EDMER\administrator

Create a new group Use an existing group
IS10011 Owners
EDMER\administrator

OK

Figure C-1 Create classroom

Create User
 All fields are mandatory!

Name : Erkan
 Surname : ER
 Username : erkan.er
 Password : ●●●●●●●●
 Confirm Password : ●●●●●●●●

Add to group : IS100 ▼

Submit!

Figure C-2 Create User

Update User
 SELECT user in the list to update!

Name : student1
 Surname : aaaa
 Username : student1
 Password : ●●●●●●
 Confirm Password : ●●●●●●

e-Mail : -
 Telephone : -

Move to group : None ▼

Update!

Figure C-3 Update User

Delete User
 First select the user(s) to be deleted.
 The selected users will be deleted permanently.

Are you sure to delete user(s): Delete!

Figure C-4 Delete User

Import User From Source File

Choose the group: CEIT 440 ▼

Choose the source file: C:\Users\HP\Documents\ Gözat..

Submit

Figure C-5 Import User

LIVELMS (Blended e-Learning Environment) > IS100 > Lectures > New Item

Lectures: New Item

OK Cancel

* indicates a required field

Title *

StartDateTime *

EndDateTime *

OK Cancel

Figure C-6 Schedule Lecture

Upcoming Lectures

Lecture	Start Date,Time	End Date,Time	Attend
Lecture 5	05.08.2009 07:30:00	05.08.2009 11:00:00	<input checked="" type="checkbox"/>

Past Lectures

Lecture	Date, Time	Watch	Performance
---------	------------	-------	-------------

There is no lecture completed.

Figure C-7 Attend Lecture

Home **Attend Lecture** Lecture Notes Syllabus Announcements Assignm

Manage Lectures

Lecture	StartDateTime	EndDateTime	Edit
Lecture 5 !NEW	05.08.2009 07:30	05.08.2009 11:00	

- View Item
- Edit Item
- Manage Permissions
- Delete Item
- Version History
- Alert Me
- Finalize Meeting

time	End Date,Time	Attend
7:30:00	05.08.2009 11:00:00	<input checked="" type="checkbox"/>

Lecture	Date, Time	Watch	Performance
---------	------------	-------	-------------

There is no lecture completed.

Figure C-8 Finalize Lecture

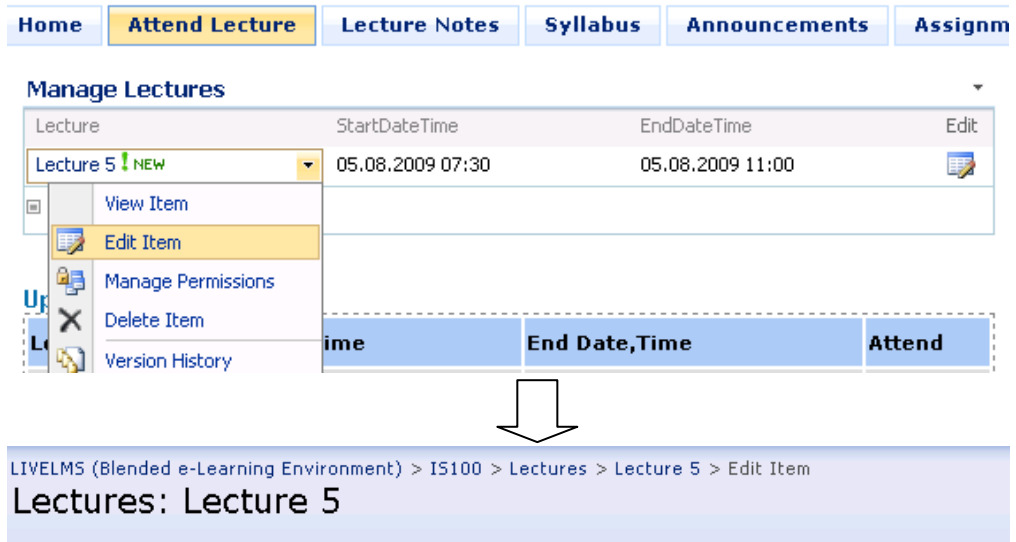


Figure C-9 Update Lecture



Figure C-10 Watch / Manage Lecture Recordings

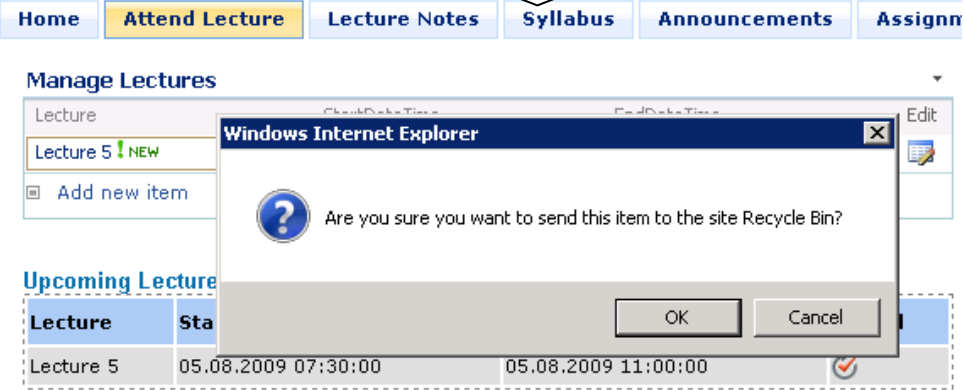
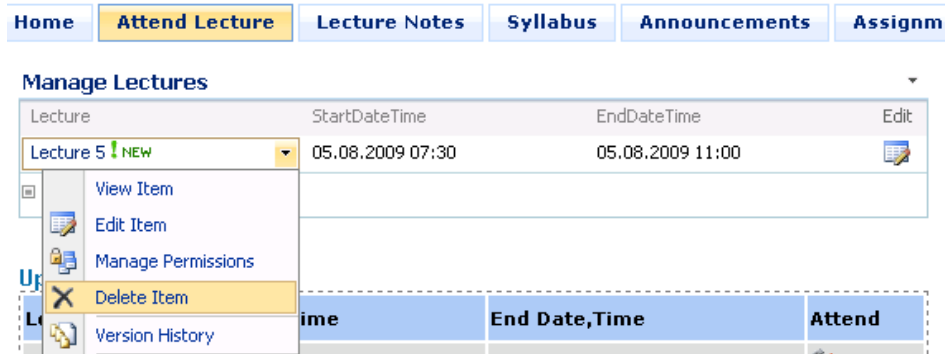


Figure C-11 Delete Lecture

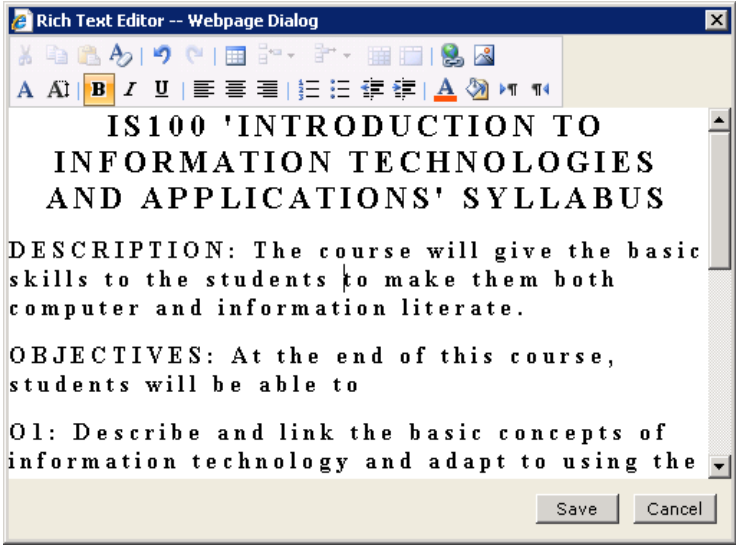


Figure C-12 Manage Syllabus

Choose the student: Erkan ER

Classroom Performances						
Student	Lecture	Attendance	NumberOfRaiseHands	NumberOfQuestionsAsked	NumberOfQuestionsAnswered	AverageOfAnswers
Lecture : Lecture 1 (1)						
Erkan ER	Lecture 1	38	12	10	6	8
Lecture : Lecture 2 (1)						
Erkan ER	Lecture 2	13	6	5	4	5
Lecture : Lecture 3 (1)						
Erkan ER	Lecture 3	9	4	4	4	7
Lecture : Lecture 4 (1)						
Erkan ER	Lecture 4	33	7	6	8	4
Lecture : Lecture 5 (1)						
Erkan ER	Lecture 5	54	5	3	3	7

Classroom Average						
Lecture	Attendance	NumberOfRaiseHands	NumberOfQuestionsAsked	NumberOfQuestionsAnswered	AverageOfAnswers	
Lecture 1	27	7,5	6,5	5	6	
Lecture 2	17	7,5	6	6,5	7	
Lecture 3	33	9	8	6	7,5	
Lecture 4	33	7,5	5,5	7,5	5	
Lecture 5	42	4,5	2,5	3	6,5	

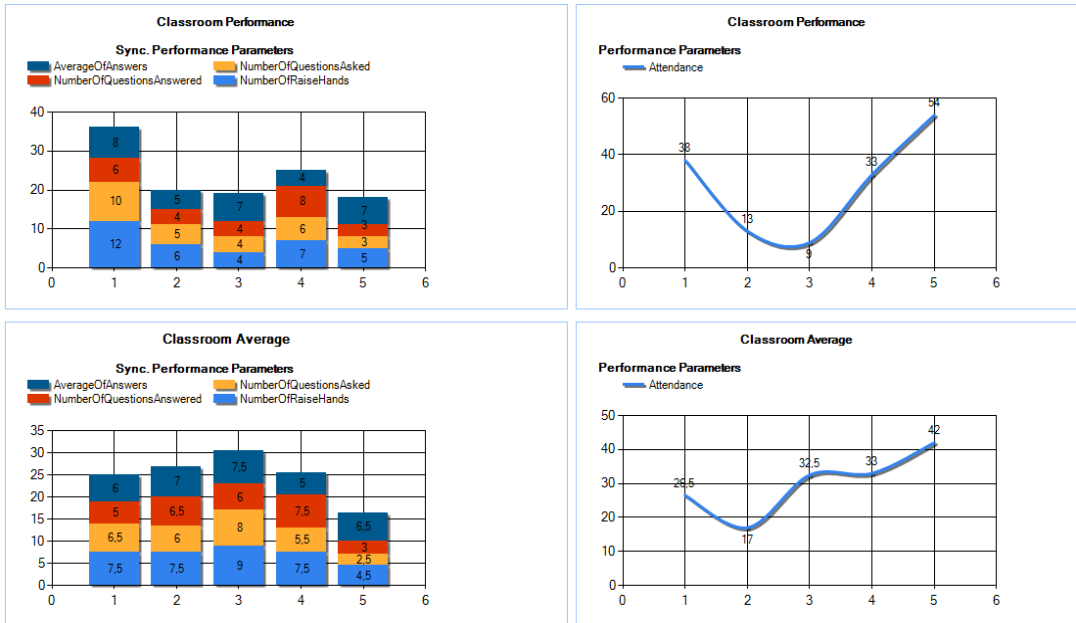


Figure C-13 View Performance

Lecture Notes

New | **Upload** | Actions | Settings

Type	Name	Title
Folder	Week 1	Week 1
Folder	Week 2	Week 2
Document	Managing courses is easy with !NEW	Managing courses is easy with
Document	MyThesis !NEW	



Upload Document: Lecture Notes

Upload Document
Browse to the document you intend to upload.

Name:

[Upload Multiple Files...](#)

Add as a new version to existing files

Version Comments
Type comments describing what has changed in this version.

Version Comments:



LIVELMS (Blended e-Learning Environment) > IS100 > Lecture Notes > 1 > P21_Report > Edit Item

Lecture Notes: P21_Report

The document was uploaded successfully. Use this form to update the properties of the document.

Delete Item * indicates a required field

Name * .pdf

Title

Version: 1.0
Created at 05.08.2009 07:28 by EDMER\administrator
Last modified at 05.08.2009 07:28 by EDMER\administrator

Figure C-14 Upload Lecture Note

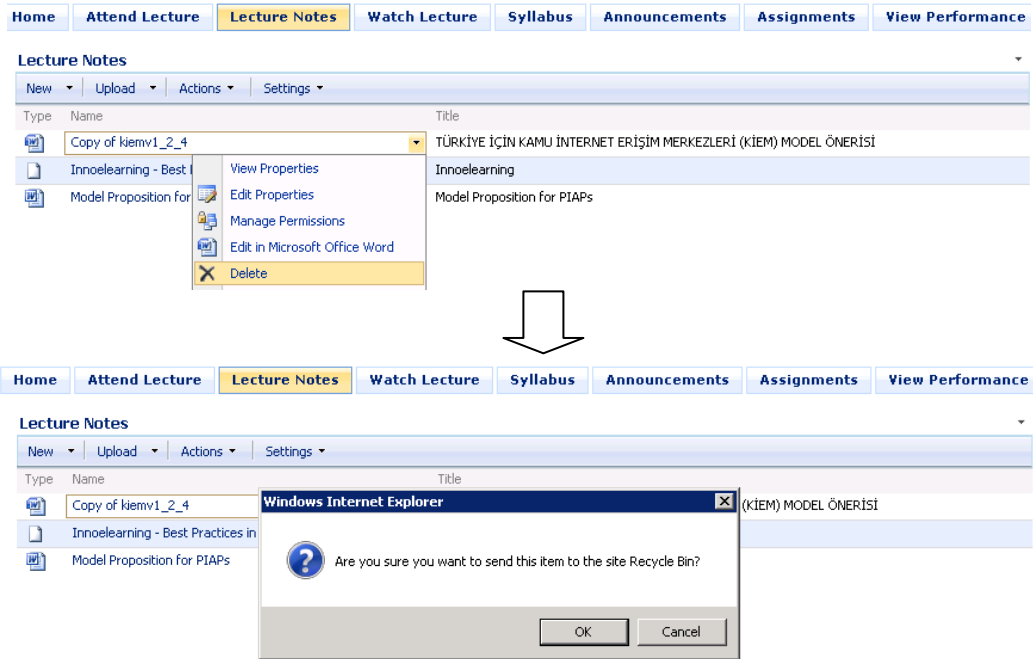


Figure C-15 Delete Lecture Notes

Lecture Announcements: New Item

OK Cancel

Attach File * indicates a required field

Title * Exam is postponed !!!

Body

Midterm is postponed to 1st August.

Expires 14.08.2009

OK Cancel

Figure C-16 Create Announcement

Lecture Announcements: Exam is postponed !!!

OK Cancel

Attach File | Delete Item * indicates a required field

Title * Exam is postponed !!!

Body

Midterm is postponed to 1st August.

Expires 14.08.2009

Created at 05.08.2009 07:36 by EDMER\administrator
 Last modified at 05.08.2009 07:36 by EDMER\administrator

OK Cancel

Figure C-17 Update / Delete Announcement

Assignments: New Item

OK Cancel

Attach File * indicates a required field

Title * Assignment 4

Description

Please write your comment about...

Due Date 20.08.2009

OK Cancel

Figure C-18 Create Assignment

Assignments: Assignment 4

OK Cancel

Attach File Delete Item * indicates a required field

Title * Assignment 4

Description

Please write your comment about...

Due Date 20.08.2009

Created at 05.08.2009 07:40 by EDMER\administrator
 Last modified at 05.08.2009 07:40 by EDMER\administrator

OK Cancel

Figure C-19 Update / Delete Assignment

Discussion on Lecture: New Item

OK Cancel

Attach File * indicates a required field

Subject * ms word - page numbers

Body

How can I set the page numbers started from 5?

OK Cancel

Figure C-20 Create Discussion

Discussion on Lecture: ms word - page numbers

OK Cancel

Attach File Delete Item * indicates a required field

Subject * ms word - page numbers

Body


How can I set the page numbers started from 5?

Created at 05.08.2009 08:01 by EDMER\administrator
Last modified at 05.08.2009 08:01 by EDMER\administrator

OK Cancel

Figure C-21 Update / Delete Discussion

Started: 05.08.2009 08:31 View Properties Reply


EDMER\administrator

ms word- page numbering
How can I use pagination with different format?

Body

How can I use pagination with different format?

From: EDMER\administrator
Posted: 05 Ağustos 2009 Çarşamba 08:31
Subject: ms word- page numbering

How can I use pagination with different format?

OK Cancel

Figure C-22 Reply to Post/Discussion

	Student	Time	Status
Select	student1 aaaa	11.08.2009 09:28:53	Active

Give Floor To

	By	Type	Status
Select	student2 bbbb	Public	Answered
Select	student3 cccc	Public	Answered
Select	student5 eeee	Public	Answered
Select	instructor1 ffff	Public	Answered
Select	student2 bbbb	Public	Answered
Select	student3 cccc	Public	Answered

Performance-Meter	Ask Question
<ul style="list-style-type: none"> student5 eeee(20) student2 bbbb(18) student3 cccc(15) student1 aaaa(14) student4 dddd(0) 	Type your question: <input style="width: 100%; height: 20px;" type="text"/> <input type="radio"/> Private to selected user <input type="radio"/> Public Question <input type="button" value="Ask Question"/>

Questions and Answers Log Refresh - View All

```


[Q]10:30:40 student5 eeee asked 'hocam verilen cevaplar arada bir guverendirmesi gerekiyor .'
[A]10:42:40 student1 aaaa answered 'evet'
[A]10:42:20 student2 bbbb answered 'hocam b. cevap iyi'
[A]10:41:40 student3 cccc answered 'ben de performansta m'
[A]10:40:14 student5 eeee answered 'hocam acaba bu sorulari soru'de atama olabilir mi'
[A]10:40:00 student2 bbbb answered 'hocam "impossible porting" headless olabilir mi?'
[Q]10:37:10 student5 eeee asked 'hocam, poli direkt okunuyor?'

```

Figure C-23 Instructor View of Q&A Application

Performance Report of student5 eeee

Number of "Raise Hand" :	5
Number of Questions Asked :	3
Number of Answers Given :	2
Average Grade of Answers :	0
Total Sync. Performance :	10
Ranking in class :	1



Questions asked by:

Time	Type	Question
07.08.2009 10:30:40	Public	Hocam verilen cevaplar arada bir guverendirmesi gerekiyor .
07.08.2009 10:37:10	Public	Hocam, poli direkt okunuyor?
07.08.2009 10:30:40	Public	Hocam, verilen cevaplar arada bir guverendirmesi gerekiyor .

Answers given by:

Question	Answer	Grade
Hocam, verilen cevaplar arada bir guverendirmesi gerekiyor ?	Ben hocamla ilgili yabik cevap verdim .	0
Hocam, poli direkt okunuyor?	Okunuyor ama ya da direkt okunmami san	0

Figure C-24 Individual Details of Q&A Application

