



# DESIGN AND IMPLEMENTATION OF A WEB BASED DISTANCE EDUCATION IN ETHIOPIA

By

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ADDIS ABABA UNIVERSITY  
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## **Abbreviations**

WBDEE:	Web Based Distance Education in Ethiopia
JSP:	Java server page
UDL:	Universal Design for Learning
CGI:	Common Gate Interface
IIS:	Internet Information Server
HTTP:	Hyper Text Transfer Protocol
Moodle:	Modular Object-Oriented Dynamic Learning Environment
W3C:	World Wide Web consortium

## **Abstract**

This project work is about design and implementation of a web based distance education in Ethiopia. The effectiveness of any learning activity bases on proven learning theory. The web based distance learning is not any different. There are basically four types of learning theories: learner centered, Knowledge based, assessment based and collaborative based. The work focused primarily on assessment based strategy. It also considered the collaborative based learning strategy as a secondary learning strategy. The assessment based strategy is supported using online chapter based examinations. Whereas the collaborative is supported using chat rooms. The chat rooms are designed for each and every departments or subject area of study.

# Chapter One

## Introduction

### 1.1. Background

Education can be formal or informal [8, 9]. Formal education is the one with hierarchically structured, chronologically graded education system, running from Kindergarten up to university [14]. The Informal education is truly an endless process whereby every one gains attitude, values, skills and knowledge from daily experience in the environment [9]. The formal education is a rapid and an organized one, when compared with that of the informal education.

The experience, culture, religion and politics of different countries have made education to incorporate different topics and to be launched using different techniques and manners, but all having similar goals. That is educating their citizens with required skill. The difference in the topics and in the techniques has forced countries to have different curricula, even if some countries try to adopt other countries curricula.

Education is a means of teaching and learning specific skills, and knowledge [9]. Traditionally, the formal education takes place within class rooms using chalk and talk. Since the arrival of postal service (19th century) another alternative way of disseminating education called distance education has come to existence [8]. Distance education is defined as any formal approach to learning in which a majority of the instruction occurs while educators and learners are at a distance from one another [14, 8]. These days different universities in different countries are providing distance education at various levels from certificate to PhD [9, 7].

Ethiopia is no exception to distance education. Currently, a number of institutes do provide distance education in this country [7, 11]. However the delivery of distance education in the country is being done using paper based or by combining it with that of the face to face tutors [7].

## **1.2. Statement of the problem**

The role of education for the development of a country is indispensable and countries like Ethiopia, countries with very large number of population, with backward technology and few numbers of educators, are expected to invest more on this sector so as to get educated citizens with quality and quantity [7]. One means of doing this is through increasing the number of universities with adequate human and material resources. Even this may not meet the demand as there are always learners with different constraints which are beyond the capability of universities, moreover the establishment of a university is costly and time taking tasks. So providing education in distance with the existing institutes and academicians can be taken as a best alternative.

However the provision of distance education in Ethiopia, which mainly uses paper as means of delivery, is so passive that there is no interactivity among the students themselves and with tutors [7, 11]. This lack of interactivity is considered as one of factors that affects the quality of distance education. The application of computer assisted distance education can bring the missed interactivity using different tools. In addition to the interactivity, such technique can provide progressive follow ups of the students and avoid the distance barriers in providing the materials. Therefore, this project aims to come up with a

web based distance education so as to alleviate or minimize the stated limitations of distance education.

### **1.3. Objective**

#### **1.3.1. General Objective**

The general objective of this project is to develop a web based distance education system.

#### **1.3.2. Specific Objective**

The specific objectives of the project are to:

- Provide course material on time and with different media types (audio, text and video).
- Provide online exams.
- Provide upcoming events.
- Generate grade report.
- Provide a chat room.

### **1.4. Methodology**

So as to achieve the above stated objectives various methods and tools have been used. The following list will describe the methods and the tools used in this work:

### **1.4.1. Literature Review**

- The literature review part has focused on reviewing the basic learning theories along with that of the related works.

### **1.4.2. Data collection**

- For the purpose of requirement determination of the system a secondary data from the different institutes, which provide distance education in Ethiopia, has been collected and reviewed.

## **1.5. Limitations**

The collaboration between servlet is a vital task. This task can be done using Java's system-wide Properties list, found in the `java.lang.System` class [3]. Since this property list uses a string class based key it has a limitation in supporting the other class types. This limitation has caused a challenge while developing the prototype.

## **1.6. Document organization**

The document consists of seven chapters including this chapter. Chapter two gives an overview on web based application. The learning theories along with related works to this project are reviewed in chapter three. Chapter four discusses about the requirement determination and requirement analysis. This chapter draws out the business model and specification of the problem domain. The system design is detailed in chapter five. The implementation is discussed in chapter six. The last chapter is all about conclusions and recommendations.

## Chapter Two

### Overview of Web based Applications

The World Wide Web (commonly known as the Web) is a system of interlinked hypertext documents accessed via the Internet, a networking infrastructure which interconnects the globe [6, 14]. The World Wide Web to function accordingly the following two main components are required besides the network infrastructure, these are the Web browser, which enables the client to browse the information, and the web server, which provides the service through web pages [3,6]. The server after receiving the request from the browser can then communicate with different servers. Those servers can be database server or application servers. The above fact is depicted in fig 2.1 [6].

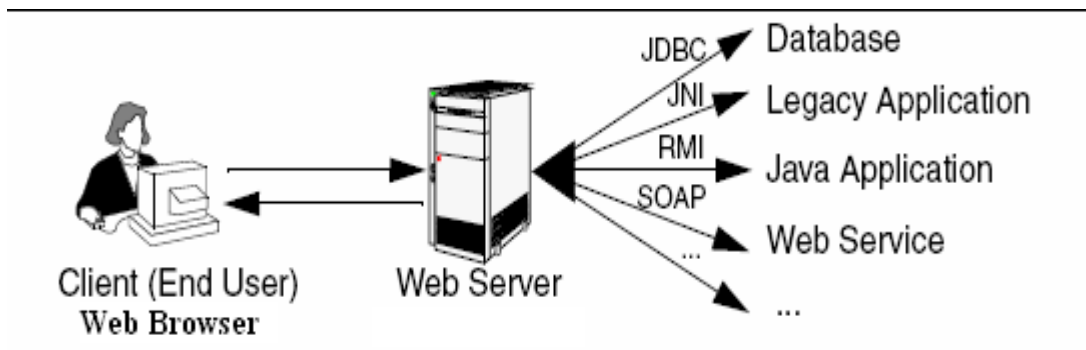


Figure 2-1 Web Browser and web server communications

The web based applications are of two types, these are static web based applications and dynamic web based applications [13]. The static web based application targets at providing information, which is more or less flexible and permanent in its nature. The technologies which can realize the static web application are many among such technologies HTML can be mentioned [13, 14].

The demand for non-static and temporary information has requested a new type of application. It is called dynamic web based application [13, 20]. These days there are different technologies that enable the development of dynamic sites, among such technologies CGI, FastCGI, mod\_perl, JSP, ASP and Servlets can be mentioned [3,6].

The nature of a problem domain determines which type of web based application and the web technology to be applied. The choice of the technology can then determine which web server technology to choose. The server technologies are of different types, the commonly known ones are IIS of Microsoft and apache [3, 14]. The differences in the web servers could be the number of request that they can serve concurrently, degree of authentication and hardware requirements. When it comes to distance education, the domain forces one to apply dynamic web based application. Web based education is a general term used to refer to a form of learning in which the instructor and student are mainly separated by space where the gap between the two is bridged through the use of online technologies [8].

The Web based distance education enables students to work with course materials on individual basis or in collaboration with mates using the different tool, which facilitate group works, chat and discussion groups (bulletin boards) are some of these tools [14, 15].

# Chapter Three

## Literature Review

### 3.1. Learning Theories

The development of effective web based learning is expected to be based on proven and sound learning theories [1]. When a web based distance learning is to be dealt with, it will be important to talk about the different learning theories. The effectiveness of any learning process is framed within the convergence of four overlapping theories [1, 18]. These are learner centered, knowledge centered, assessment centered, and community centered.

#### 3.1.1. Learner centered

Learner Centered is the one in which the learner is to be considered as the role player and makes the tools to go with the learners' cultural attributes and language values [1]. It is said to be a strategy of building unique cognitive structures and understandings of learners [9, 18]. Such type of strategy is very expensive to bring it into practicability, because the heterogeneity of the learners is very large in size. When we consider such theories for online learning it requires a large bandwidth for making the learning process individualistic.

#### 3.1.2. Knowledge Centered

It is really an accepted fact for one to have a generalized thinking and upgrade himself with that, but teaching a generalized skills and techniques is a useless activity outside of a particular knowledge domain in which they can be grounded [1, 18]. The whole idea about this theory is that the learning has to be categorized according to discipline. This learning theory has neither advantages

nor disadvantages when comparing the online learning with that of the campus based learning [1].

### **3.1.3. Assessment Centered**

The other view of learning strategy focuses on assessment. The assessment strategies can be formative or summative assessment [1]. Both types of assessments are targeting at which learning can be made effective through corrective evaluation. The disadvantage of this type of learning strategy for the campus based learning is that it has a workload on teachers. Unlike the campus based learning the web based will not face such disadvantage.

### **3.1.4. Collaborative Centered**

The fourth type of strategy is the so called collaborative-centered. It permits us to include socialism of learning in the strategy [1]. This strategy is also known as community centered strategy. The idea of socialism in the learning strategy is bringing support and challenge to the members of learning community, so that it can bring effective and relevant knowledge construction [1, 23]. When we consider such strategies for the campus based, it requires a pre-built relationships and requires interpersonal skills of the students, whereas for the web based learning there is no need for such relationships.

## **3.2. Related works**

There are a number of varies works on web based distance learning using different learning theories along with the different technologies; the commonly known ones are Moodle and WebcT.

### **3.2.1. Moodle**

Moodle is one of course management systems, which is free open source software [15]. It facilitates a collaborative (community) based learning strategy. The collaborative strategy, which is also referred as community based, focus on non-individual based works. Furthermore Moodle focuses on the following factors:-content delivery of course, intended use of group work, communication, sharing, and activities [10, 16]. It is less efficient in the areas of teacher-centered control of the learning process such as triggering and testing as compared with the proprietary learning software like that of WebCT. It is asynchronous type of learning. This type of learning does not restrict the learners on receiving the learning materials, even if the learners don't pass the exams of the previous lessons. Moodle is developed using the PHP, apache web server and the MYSQL database [15].

### **3.2.2. WebcT**

The WebcT allows instructors to post course information, course materials, and assignments and it also provides basic discussion functionality [16, 10]. It is the first virtual learning system, which is mainly designed for teacher directed delivery of content especially planned for lower level courses [16]. The learning theory focuses on learner based strategy unlike that of Moodle. WebcT is criticized for it reflects less flexibility and power of the system [19]. It is a synchronous type of learning where students are restricted in getting materials, that is the student get course materials if the student has passed the previous lessons [10]. The system is designed using the UDL toolkit. UDL is used to develop individualized learning strategy. It can run on apache, IIS web servers.

Our current work primarily focuses on progress assessment learning strategy followed by the collaborative learning. It provides evaluation on chapter base and support the evaluation activity of the teaching and learning process. The exams are activated by the coordinator/tutors. The collaboration is achieved through providing chat rooms. It is asynchronous type of learning like that of Moodle, where students are allowed to take course materials as well as the chapter based examinations at any time the student fills to do so. The work is developed using the servlets and java server page technologies. This enables the work to run on any existing web servers with or without the need for a plug-in.

# Chapter 4

## Requirement Determination and Analysis

### 4.1. Overview

This chapter deals with requirement of WBDEE. It states and draws the business model and the specification of the requirements. The requirements are of two types these are: - functional and non-functional requirements.

### 4.2. Functional requirement

Functional requirement explains and describes the interaction between the system and the users or in general with the environment. The product consists of the following the functional requirements:

- Provision of Online Examination
- Provision of Online Chat room
- Provision Online course material with different media types
- Online grade reporting
- Provision of timely information/news

### 4.3. Non-Functional requirement

Non-Functional requirement explains and describes the user visible aspects of the system. The following lists states the non functional requirements.

- The system does not allow unauthorized users.
- The system follows the W3C consortium standardization.
- The system should be platform independent.
- The system should be extendable.

#### 4.4. Use case Diagrams

It is used to describe the functionality of the system from an external point of view. The use case model is one which is considered as a functional model.

Figure 4.1 depicts the use case model.

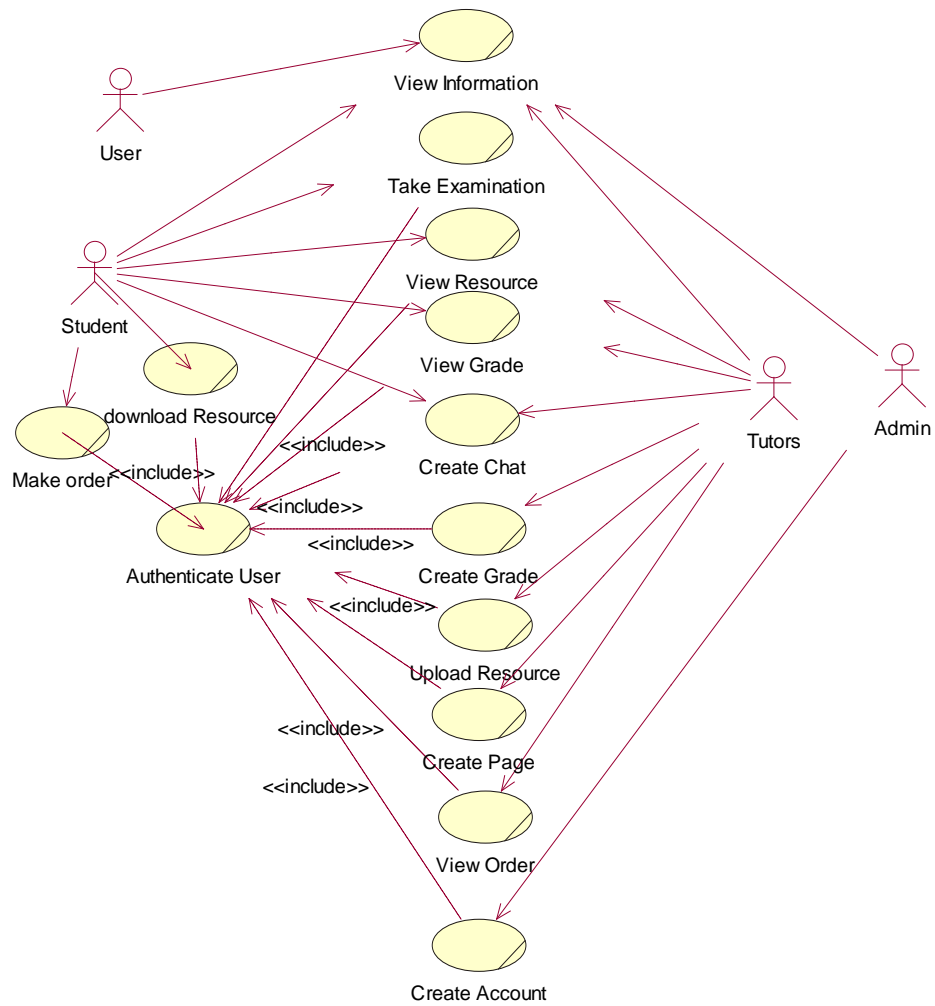


Figure 4-1 Use case diagram of the system

#### 4.4.1. Use case description

The descriptions briefly explain how the functionalities precede using natural language in a step wise manner. It is for the all use case which is stated in figure 4.1.

Use case description for View Information use case

Use case Name	View Information
Participating Actors:	Guest, Student, Tutor and Administrator (user)
Pre-condition	The user initiates the browser.
Entry condition	<ol style="list-style-type: none"><li>1. The user activate WDEE from his terminal using his browser</li><li>2. WDEE responds by presenting the home page along with the different links to the faculties and department</li><li>3. The user view the information and click on his preference link</li><li>4. WBDEE presents the clicked link</li></ol>
Exit condition	<ol style="list-style-type: none"><li>5. The user views the information and close the browser</li></ol>
Post-condition	The user has accessed the home page and get access to none restricted sites.

Use case description of authenticate user use case.

Use case Name       Authenticate user.

Participating Actors:   Student, tutor and Administrator.

Pre-condition            The user of the system has activated WBDEE and s/he must have a user account.

Entry condition           1. The user activates the authenticate users functionality from home page by click on login link.  
                                  2. WBDEE displays a login page.  
                                  3. The user adds his user name and password followed by click on ok button.[Alternate A]  
                                  4. WBDEE displays the user's department official page.[Alternate B]

Exit condition            5. The user views the page and closes the browser.

Post-condition            The user has reached to the official page of his department.

Alternate A.              3. A. The user clicks on cancel button.  
                                  4. A. WBDEE displays the home page.

Alternate B.              4. B. WBDEE detects un-authorized user and display the home page.

#### Use case description for View Resource use case

Use case Name           View Resource

Participating Actors:   Student and Tutor (user)

Pre-condition            The user of the system has already activated authenticate user functionality and the user is on her/his department official page.

Entry condition           1. The user clicks the resource button from his department official page.  
2. WBDEE displayed student's the course list page of the department.  
3. The user clicks on the course of his preference.  
4. WBDEE display the course page.  
5. The user clicks on the chapter with the media of his preference.  
6. WBDEE displays the respected request.

Exit condition           7. The user views the resource and closes the browser.

Post-condition           The user has viewed the resource.

#### Use case description for View grade use case

Use case Name           View grade

Participating Actors:   Student and Tutor (user)

Pre-condition            The user of the system has already activated authenticate user functionality and the user is on

her/his department official page.

Entry condition	<ol style="list-style-type: none"><li>1. The user clicks on grade-report button form the official page of his department.</li><li>2. WBDEE displays the grade report page.</li><li>3. User click on the Report button.[Alternate A]</li><li>4. WBDEE displays the pop-up for a user to enter his pass key. [Alternate B ]</li><li>5. The user enters the pass key and click on ok.</li><li>6. WBDEE displays the grade report.</li></ol>
Exit condition	<ol style="list-style-type: none"><li>7. The user views the report and closes the browser.</li></ol>
Post-condition	The grade is displayed for the user.
Alternate A.	<ol style="list-style-type: none"><li>4. A. The user clicks on the grade information button.</li><li>5. A. WBDEE displays the grade information page.</li><li>6. A. The user views the information and closes the page.</li></ol>
Alternate B.	<ol style="list-style-type: none"><li>4. B. The user clicks on the cancel button.</li><li>5. B. WBDEE displays the official page of the department.</li></ol>

## Use case description for Create chat use case

Use case Name	Create Chat
Participating Actors:	Student and Tutor (user)
Pre-condition	The user of the system has already activated authenticate user functionality and the user is on her/his department official page.
Entry condition	<ol style="list-style-type: none"><li>1. The user clicks on the chat button from his official page of the department.</li><li>2. WBDEE displays a chat-login page.</li><li>3. The user enters a chatting name and click ok button.[Alternate A]</li><li>4. WBDEE presents the chat room labeled using the user name.</li></ol>
Exit condition	<ol style="list-style-type: none"><li>5. The user chats and closed the browser.</li></ol>
Post-condition	The message is transmitted among chat makers.
Alternate A.	<ol style="list-style-type: none"><li>4. A The user clicks ok without a chat name.</li><li>5. A WBDEE displays the chat room with un-labeled user name.</li></ol>

## Use case description for Create grade use case

Use case Name        Create Grade

Participating Actors:    Tutor

Pre-condition            The user of the system has already activated authenticate user functionality and the user is on her/his department official page of staff.

Entry condition        1. The tutor clicks on grade-make button form his official page of the department.  
2. WBDEE displays a pop-up form for a user to enter his pass key and the course code.  
3. The tutor enters the pass-key and selects the course code.  
4. WBDEE checks the account and presents the grade making page.  
5. The tutor inters the scale and click ok button.  
6. WBDEE calculate the grade for each student registered for the course and display the grade for the tutor.

Exit condition        7. The tutor views the grade and closes the page.

Post-condition        The grade of the students are saved in the database

Use case description for take exam use case.

Use case Name        Take exam

Participating Actors:    Student

Pre-condition        The user of the system has already activated authenticate user functionality and the user is on her/his department official page.

Entry condition        1. The user clicks the exam button from his department official page.  
2. WBDEE displayed the course list page of the department.  
3. The user clicks on the course that s/he wants to take exam for.  
4. WBDEE display the course page.  
5. The user clicks on the exam link.  
6. WBDEE displays the chapter selector page.  
7. The user selects the chapter and enters his pass key.  
8. WBDEE checks whether the user has taken the exam before or not and display the exam of the chapter.[Alternate A]  
9. The user answers the questions and click ok.  
   [Alternate B]  
10.WBDEE accepts the answers and evaluates the

	answers and displays an acknowledgment.
Exit condition	11. The user views the acknowledgment and closes the page.
Post-condition	The result of the exam is stored in the database.
Alternate A.	8. A. WBDEE has detected that the user has take the exam before and display an error message. 9. A. The user has view the message and close the page.
Alternate B.	9. B. The time give to the exam expire and WBDEE display an error message. 10. B. the user views the message and closes the page.

#### Use case description for upload resource use case

Use case Name	Upload Resource
Participating Actors:	Tutor
Pre-condition	The user of the system has already activated authenticate user functionality and the user is on her/his department official page.
Entry condition	1. The tutor clicks on the upload-resource button. 2. WBDEE displays the course list page. 3. The tutor selects the course the material belongs too.

- 4. WBDEE display the uploading page.
- 5. The tutor selects the paths and click ok.
- 6. WBDEE upload the file and acknowledge the tutor.
- Exit condition 7. The Tutor views the message and closes the page.
- Post-condition The resource is available in server.

Use case description for create account use case

Use case Name Create Account

Participating Actors: Administrator

Pre-condition The user of the system has already activated authenticate user functionality and the user is on administrator page.

- Entry condition
- 1. The administrator clicks on the create user button.
  - 2. WBDEE displays account creator form page with the username, password, and id fields.
  - 3. The administrator adds an account and click ok.
  - 4. WBDEE displays the acknowledgement message.

Exit condition 5. The administrator views the message and closes the page.

Post-condition The user account is created on the database.

Use case description for Make Order use case

Use case Name Make Order

Participating Actors: Student and Tutor(user)

Pre-condition The user of the system has already activated authenticate user functionality and the user is on her/his department official page.

Entry condition

1. The user clicks on the order button.
2. WBDEE displays the order page.
3. The user fills the order type, order by and the details and click ok.
4. WBDEE checks the order and display an acknowledgement message.
5. The user click on Make order link.
6. WBDEE displays the courses list and order type.
7. The user selects the course, media type and click ok. [Alternate A]
8. WBDEE save the order and displayed acknowledgment to the user.

Exit condition

9. The user views the message and closes the browser.

Post-condition The user has made the order.

Alternate A.

7. A The system redisplay the order page.

Use case description for Create Page use case.

Use case Name Create Page

Participating Actors: Tutor

Pre-condition	The user of the system has already activated authenticate user functionality and the user is on her/his department official page.
Entry condition	<ol style="list-style-type: none"> <li>1. The tutor clicks on the create page button.</li> <li>2. WBDEE displays the create form page.</li> <li>3. The tutor inserts the requested information name, address and hobbies.</li> <li>4. WBDEE verifies the inserted data and display acknowledgment.[Alternate A]</li> </ol>
Exit condition	5. The tutor views the message and closes the page.
Post-condition	The tutors profile is saved.
Alternate A.	<ol style="list-style-type: none"> <li>4. A. WBDEE detects a wrong date and display and asks the user for reentry</li> <li>5. A The tutor resubmit the data.</li> </ol>

Use case description for View Order use case

Use case Name	View Order
Participating Actors:	Tutor (user)
Pre-condition	The user of the system has already activated authenticate user functionality and the user is on her/his department official page.
Entry condition	<ol style="list-style-type: none"> <li>1. The tutor clicks on view order button form her/his department official page of staff's.</li> <li>2. WBDEE displays the order list.</li> </ol>

Exit condition

3. The tutor views the orders and closes the browser.

Post-condition

The user has viewed the order.

#### 4.4.2. Sequence Diagram

The sequence diagram is used to formalize the behavior of the system and to visualize the communication among objects of the system. It is the one that shows the dynamic model for this work. The sequence diagram for most use cases is shown in the upcoming diagrams. The label below the figures describes to which use case the sequence diagram belong too.

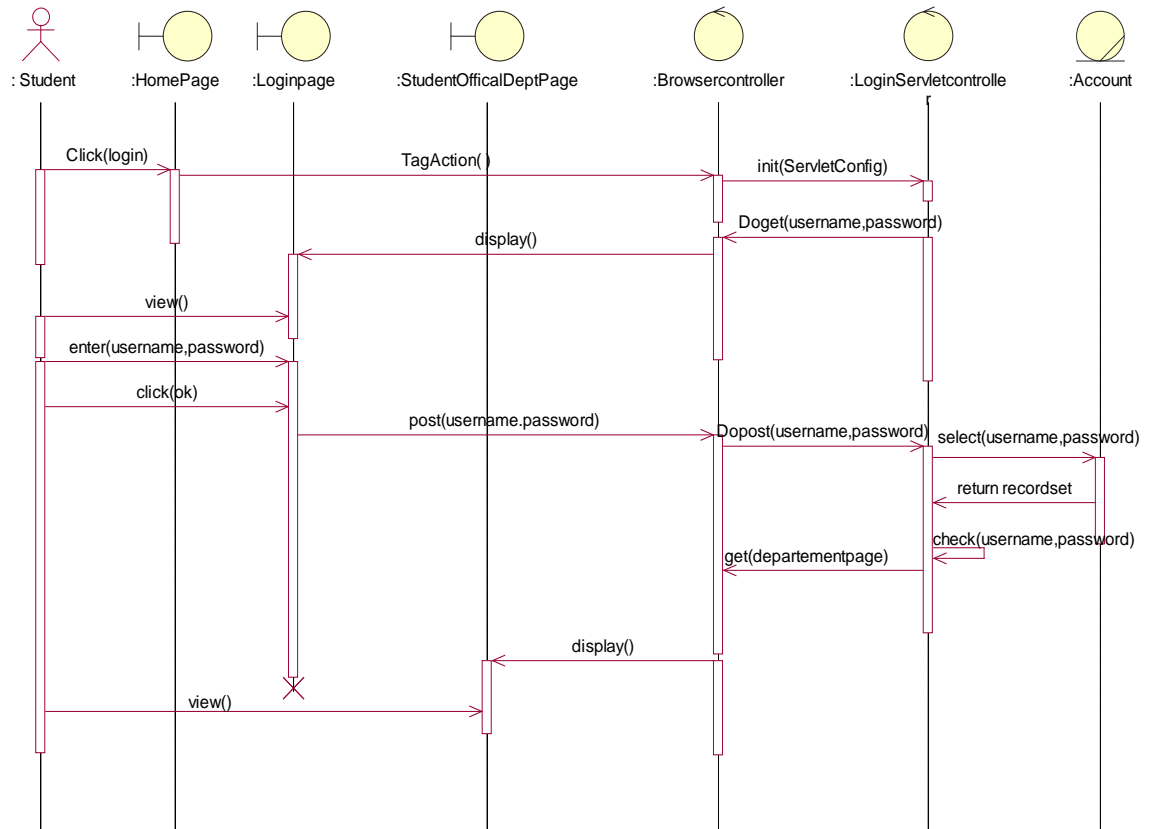


Figure 4-2 Sequence Diagram for Authenticate user Use case.

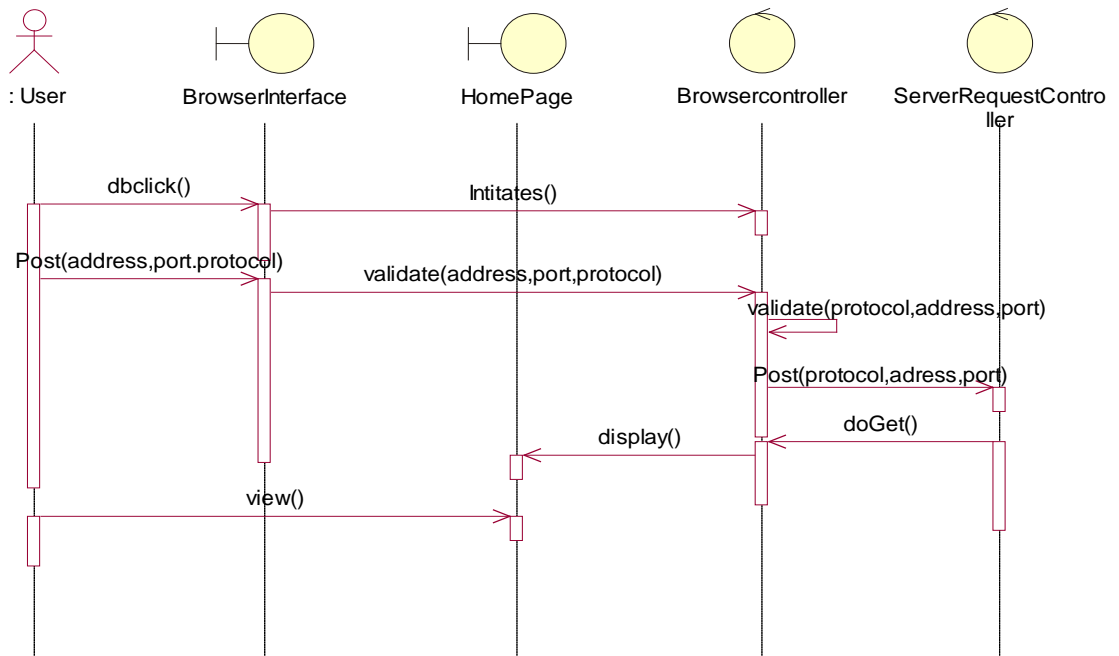


Figure 4-3 Sequence Diagram for view Information Use case.

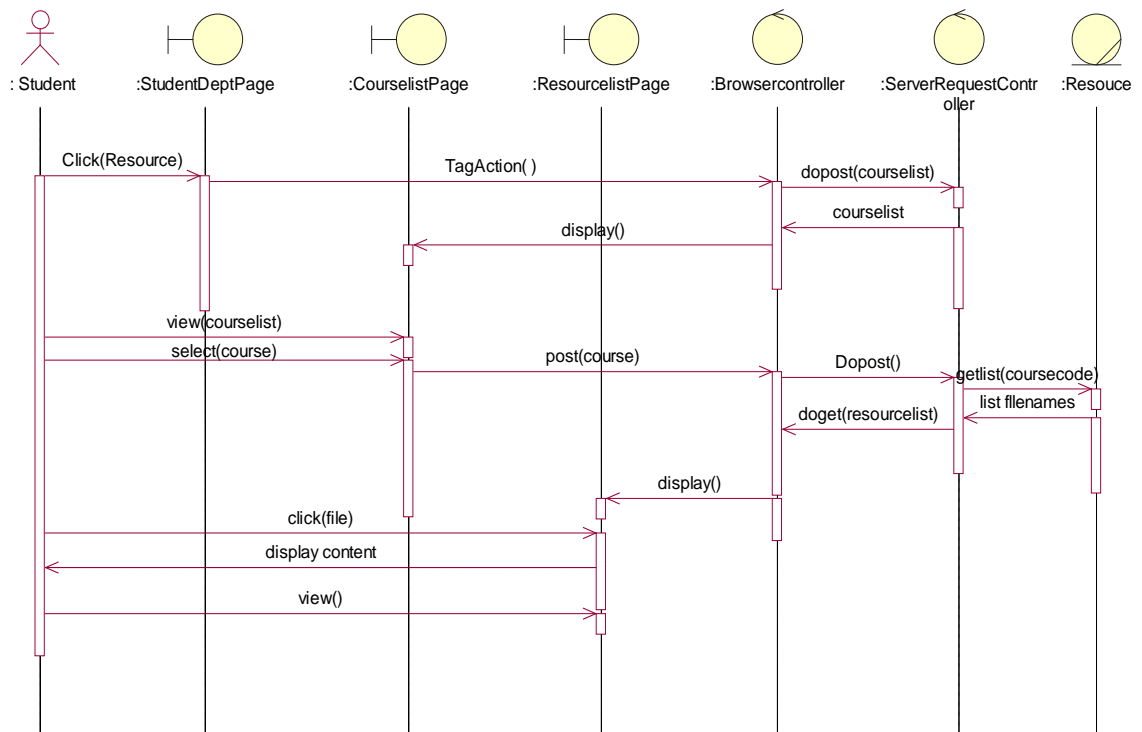


Figure 4-4 Sequence Diagram for view Resource Use case.

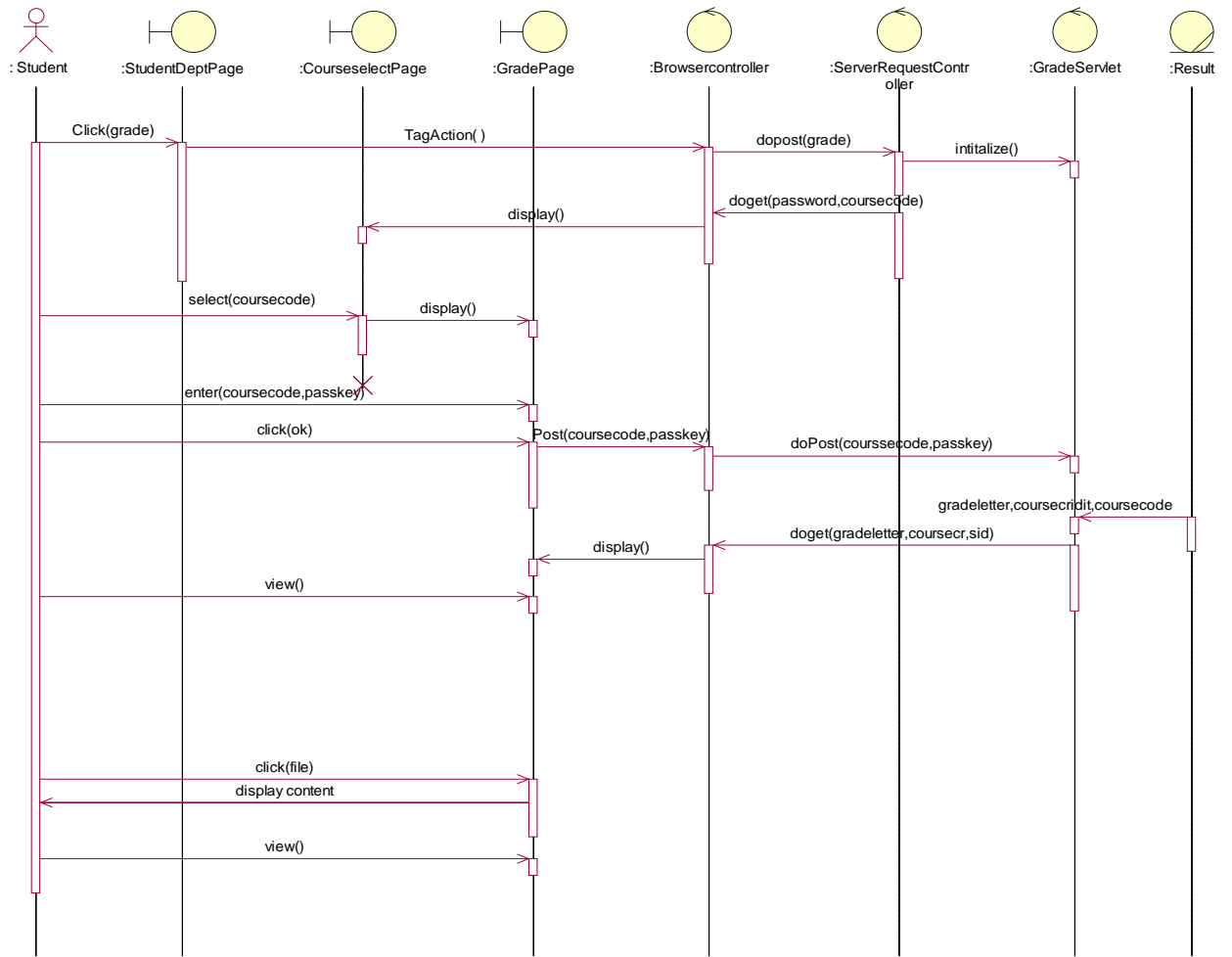


Figure 4-5 Sequence Diagram for view Grade Use case

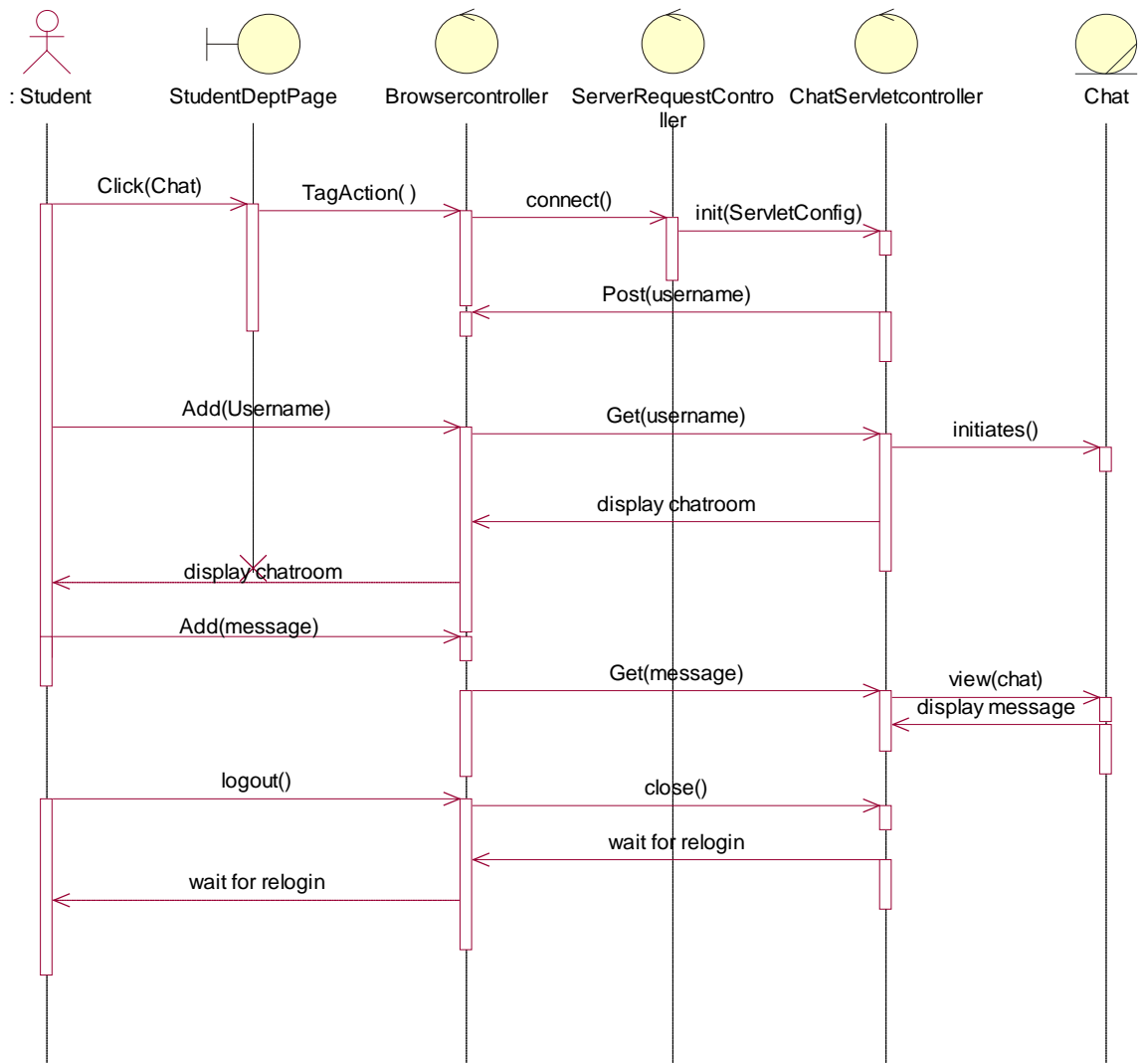


Figure 4-6 Sequence Diagram for Create chat Use case.

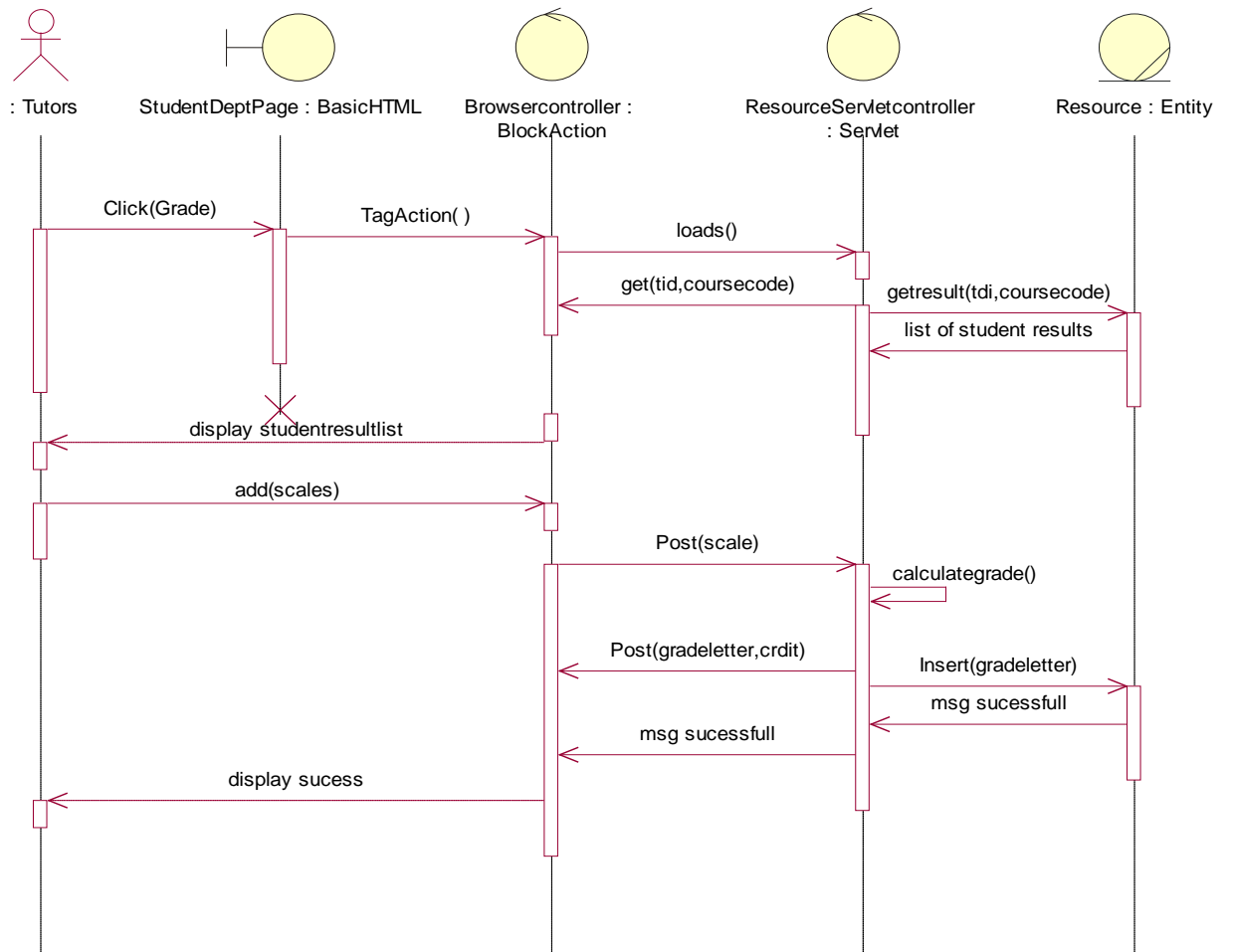
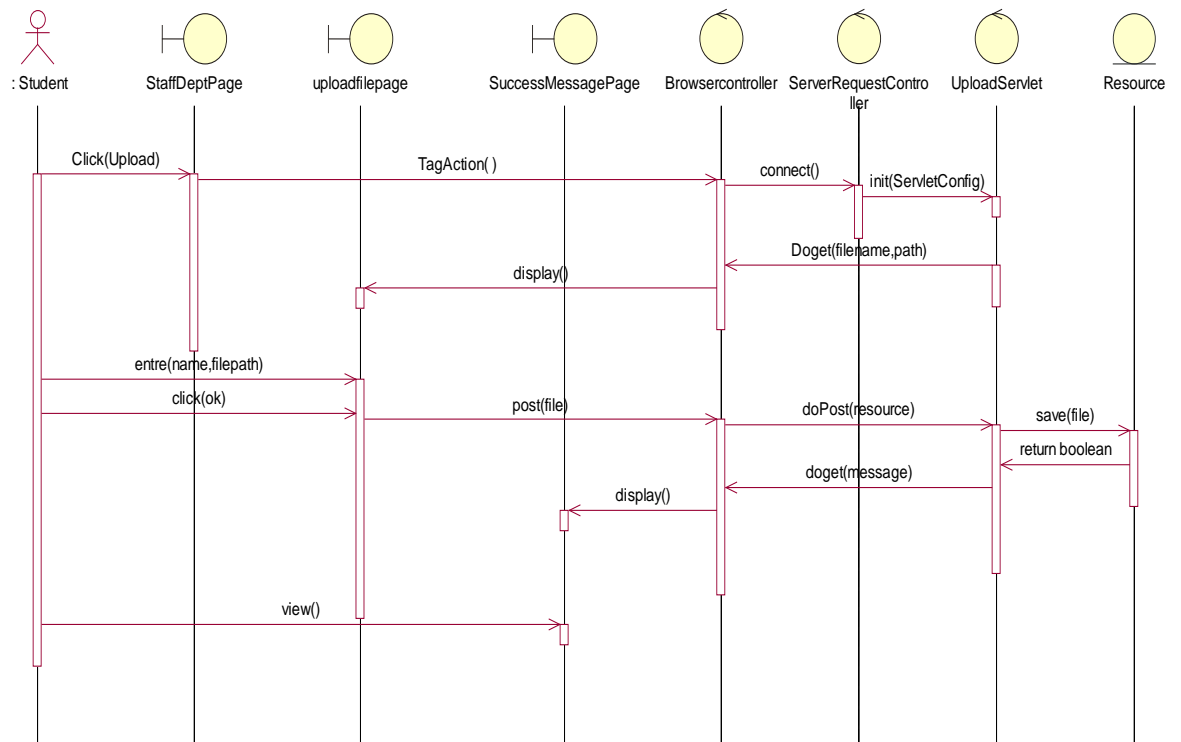


Figure 4-7 Sequence Diagram for Create Grade Use case.



**Figure 4-8 Sequence Diagram for Upload resource Use case.**

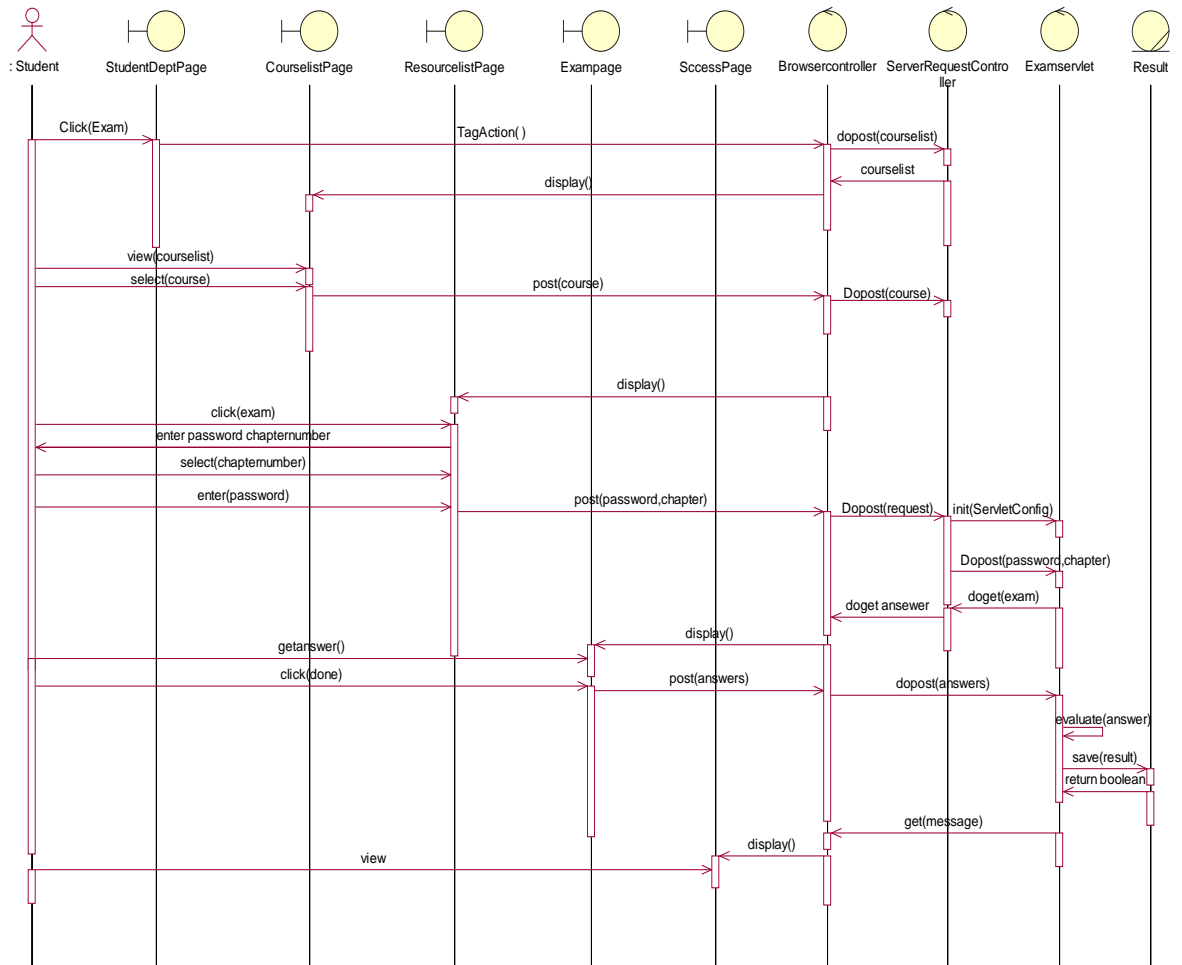


Figure 4-9 Sequence Diagram for take exam Use case.

### 4.4.3. Activity Diagram

The description of the system in terms of activities is shown using activity diagram. The activities represent the execution of a set of operations. The diagram shown below depicts the activity diagram of the WBDEE system.



#### 4.4.4. Class diagrams

It describes the structure of the WBDEE system using classes and objects of the system. The classes are used to represent the object of the system in an abstract form. The diagram shown below depicts the class diagram of the WBDEE.

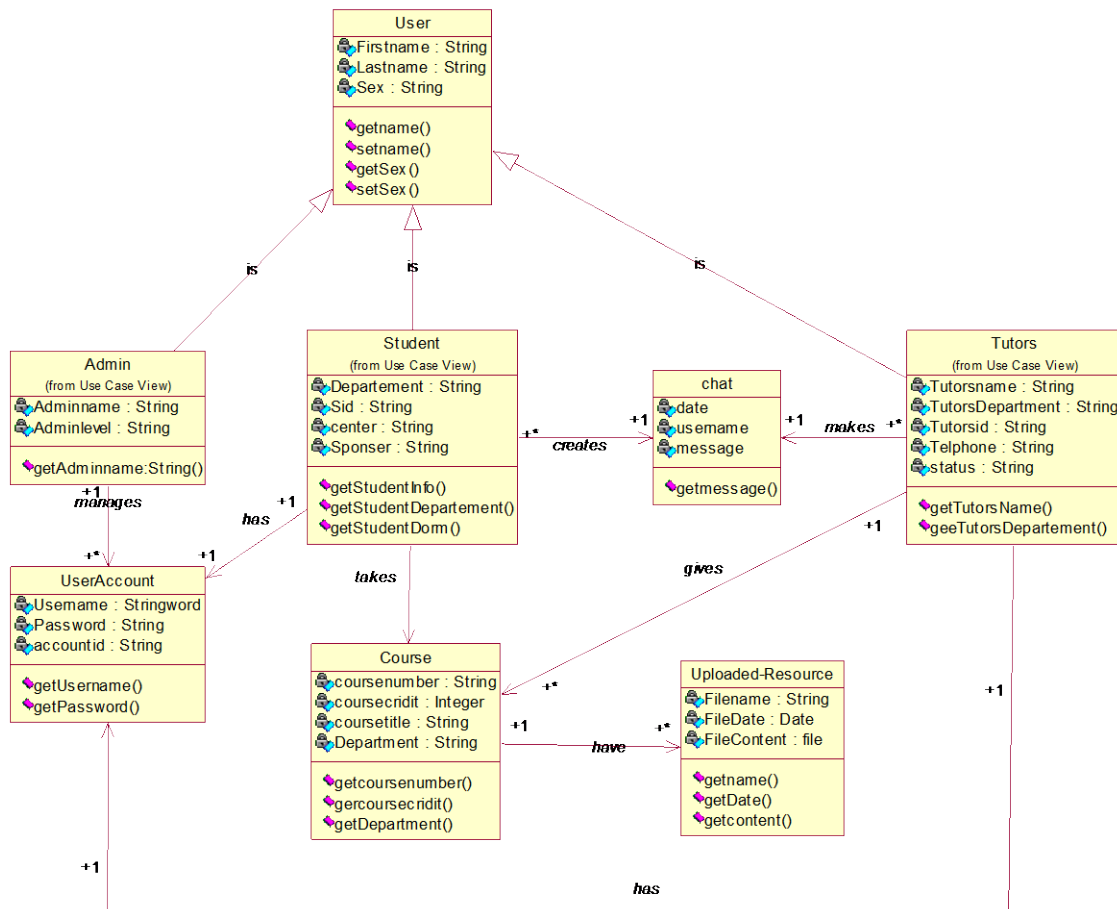


Figure 4-11 Class diagram of WBDEE system.

# Chapter 5

## System Design

After the determination of the requirements, it is the design that follows. The design is all about stating the design goals of the system and subdividing the system into smaller parts so as to tackle the problem in a modular approach. The output of this phase includes description of each subsystems and the deployment of the subsystems.

### 5.1. Design goals

The design goals are derived from the non-functional requirements of the system, which were stated in chapter four of this document. They describe the qualities of the system. These goals consider the following criteria.

#### 5.1.1. Performance Criteria

Performance considers different factors and these throughput, speed and bandwidth requirements of the system can be mentioned. This work considers the throughput issue.

**Responsive time:** The java zip compression technique has been applied. The compress can reduce the size by ten times for the original size, which by then enables the work to response faster.

**Throughput:** The system considers the issue of concurrency from two points of access corners: - these are access which requires database and those which does not require the involvement of database. The accesses which require the database accept 10,000 users at a time. The other part is the one that does not require the database is lifted up to the capacity of the bandwidth, hardware and the web server to be used. This constraint is a must for the number of students is very large and to avoid frustration of interest from the students.

### 5.1.2. Maintenance criteria

The maintenance criteria show and determine the difficulties that the system faces, when the system is in use. The question of adding components to the system, modifiability and portability are the ones to be considered in the maintenance criteria.

**Extensibility:** the system should enable the addition of new functionality without any restriction. This constraint enables the system to have the acceptance of users, for it does not restrict the future expansion of the system.

**Portability:** the system should work in different platforms, for there could be platform shifting in the future and the work to have the acceptance of different institutes having the different platforms. It is important to have this constraint attempted.

**Security:** the system does not allow non-authorized users using a form based authentication.

### 5.1.3. End User Criteria

**Usability:** the question of usability is considered as one of a determining factor for users' acceptance of a given system. Hence this work to establish the usability followed the W3C standardization.

## 5.2. Architecture

It is the architecture that determines the type of interactions that the components are going to have. The architecture that this work uses is client/server architecture. In this type of architecture the server is responsible to receive a request from the client and respond to the request, where as the client is responsible to interact with that of the users of the system.

The server parts of this work are of two types. The first type is a web server, which is responsible to receive browsers' request through http protocol and

responds accordingly. Where as the second type of server is a database server, which is responsible to provide the requested database services to the web server. The database server is generally responsible for modification and insertion of data to the database. It can only communicate with the web server.

The client side is a web browser which receives requests from the user of the system and responds to the request by communicating with the web server. If the user has a request on data, the browser passes the request to the web server then the web server pass the request to the database server. Figure 5.1 shows the architecture of the system.

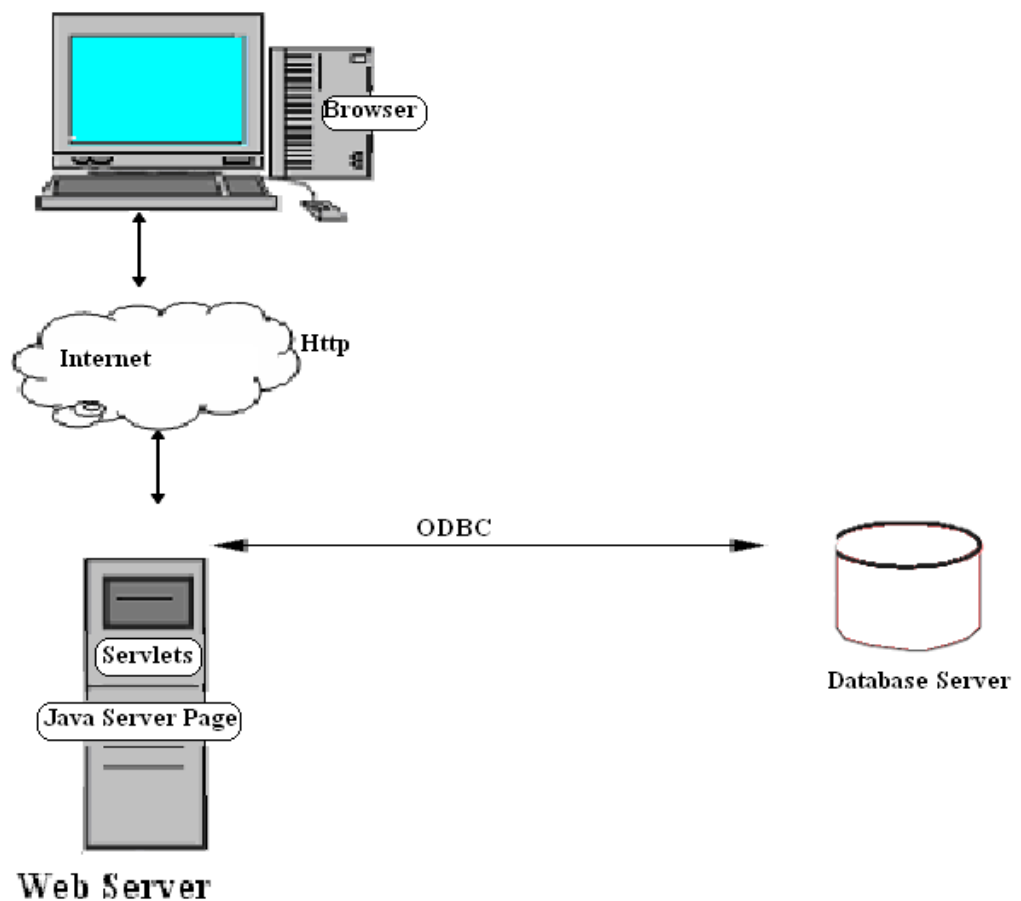


Figure 5-1 The architectural view of WBDEE.

### 5.3. Subsystem Decomposition

In order to simplify and minimize complexity of the solution domain, the system has been divided into three subsystems. These are learning subsystem, Reporting Subsystem and Administration subsystems. The decomposition of the system is represented in figure 5.2.

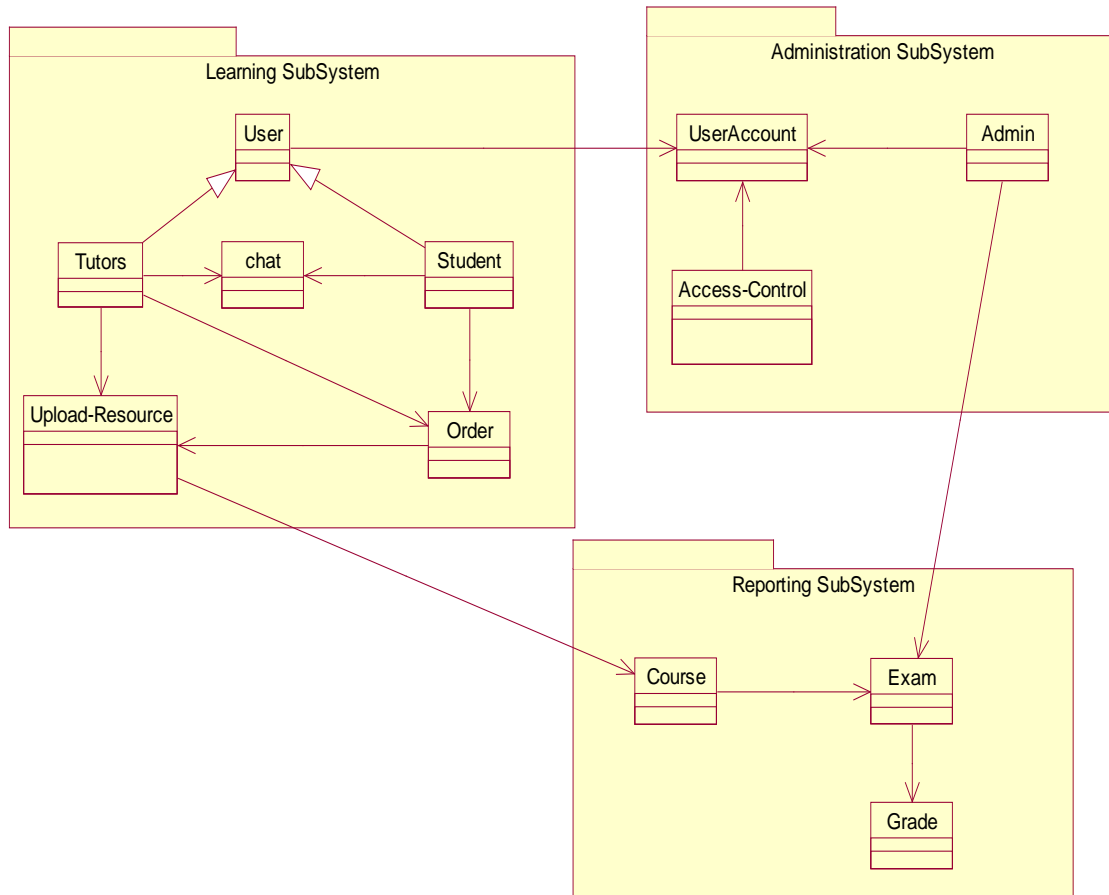


Figure 5-2 The subsystem decomposition

#### 5.3.1. Learning subsystem

The learning subsystem is responsible for providing communication and receiving order service. The communication is the one that bring the interactivity for the system. It is organized into departments and due to that every communication takes place under specified department. This service is for both

tutors to student and student to student interaction. The class which is responsible to establish this communication service is the chat class. This class interacts with both the student and the tutors' class so as to get information about the chat making groups or parties. The student class is responsible for providing students information through the get method of the class. The same is true for that of the tutor's class.

The other service of this subsystem is order receiving. The student or tutor can make an order for a resource. The order class is the one that is in charge of this task. It requests the student /tutor to specify the course that the resource belongs to and the media type of the resource that is going to be ordered. After receiving this information by interacting with the different class it keeps track of the records. It is also responsible for displaying the recorded order.

### **5.3.2. Reporting Subsystem**

It is the Reporting subsystem, that is responsible in providing the examination and grading services. The exam is given in chapter levels and it has a timer which makes the exam to expire, if it exceeds the time limit. The exam class gets services from the course class about the course information like that of the course code. The grade class is responsible for displaying the grade report and making the grade. This class to achieve its service has to interact with the course and the student class.

### **5.3.3. Administration subsystem**

This subsystem enables the administrator to manage user accounts. The management includes creation of new accounts, removing the existing accounts and modification of accounts. The management of user account is the responsibility of the account class. The account class is the one that creates displays and modify the user account. This class to provide its service has to interact with that admin class.

This subsystem also enables the determination of who has access the official page of the system at what time. The class that is responsible to establish such a service is called the access-control class. It is keep track the time and date along with the user accessing the login page, if the user has successfully login in. it also display the recorded information to a user with the administrator privilege.

#### 5.4. Deployment Diagram

The deployment diagram describes the relationship of components with that of hardware nodes. It gives a high-level view of each component. Figure 5.3 shows the deployment.

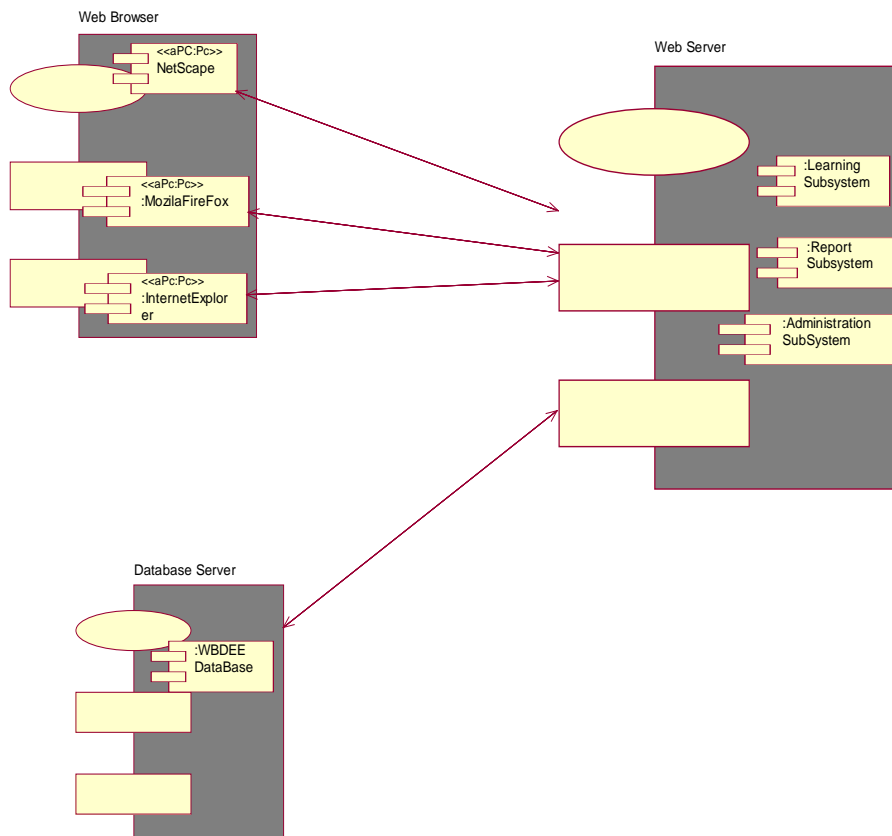


Figure 5-3 The Deployment Diagram of WBDEE

## **5.5. Persistent Data Management**

The students' examination result and the respected grade values have to be persistently kept in the database; otherwise it can not be possible for one to make assessment with out having the recorded results. The user account information, which keeps data of the user name, pass keys and user levels, is the one that will enable the system to provide the access rights according the user level. The other important data which has to be stored is the course materials, which includes lecture notes and recorded audio and video lectures along with the references.

The data managements that this project applies are of two types. The first type is the relational database system which is going to manage the grade, exam results and the account data. The data are obtained from the classes identified above. The second type of data management is a flat file system, which is responsible to manage the course materials.

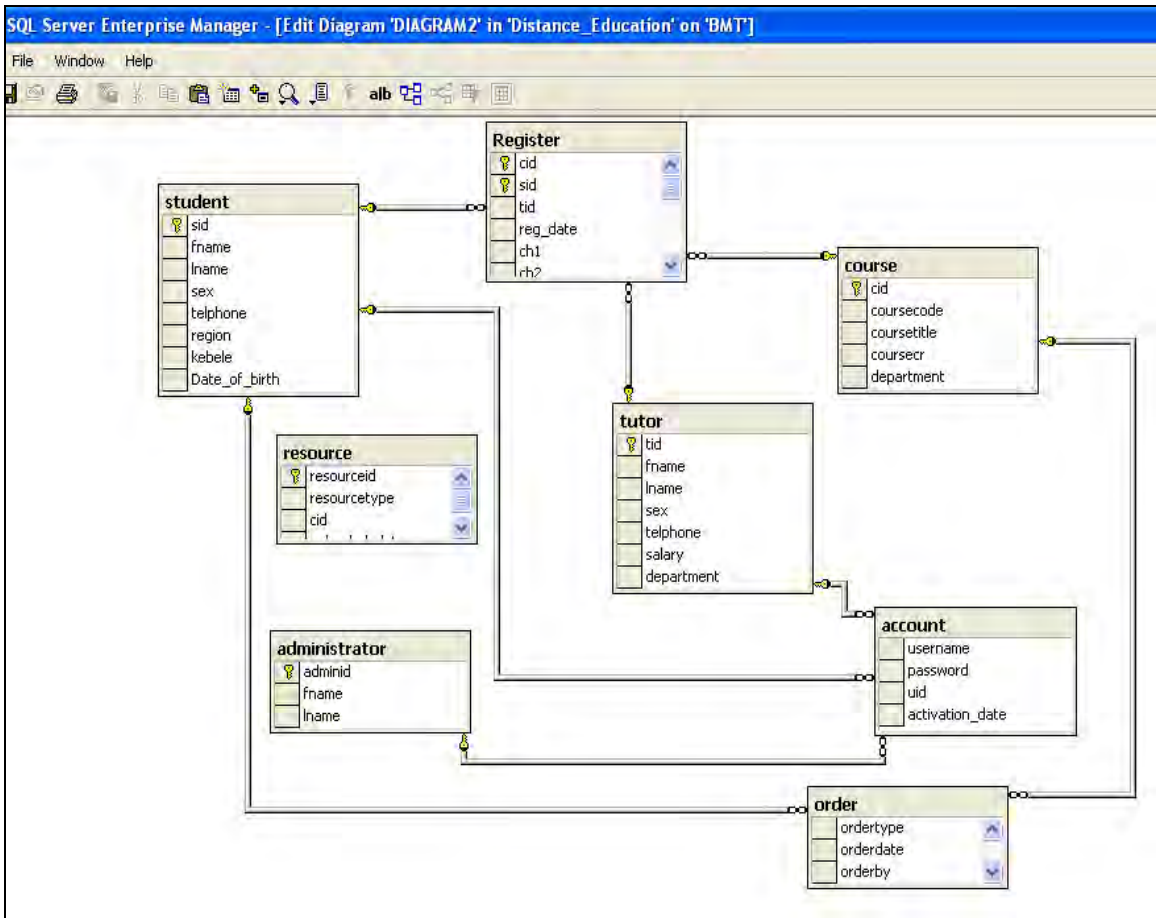


Figure 5-4 Relationships between the tables.

# Chapter 6

## Implementation

This chapter is about the implementation of the WBDEE. The sub-topics, which will be discussed in this chapter, are the programming tools, development environment.

### 6.1. Programming Tool

The web-based application is becoming a turning point of solution for the industry world when a distributed application becomes an issue. It is a multitier application by its nature, where functionalities are divided into tiers. This nature of the application enables the task division easy and increases flexibility. The web-based applications requirements of technology are categorized into two; these categorizes are the client technology and the server technology. The client technology is referred as browser technology. The browser technology is left to the client be it Internet explorer, Fire fox or any. The server technology requirements are basically seen from three technology corners; these are the web server, the web pages and database.

The development of the web pages can be made possible using the different technology of preference. The java technology is one of them, which is the technology choice of this work. The java technology has three technology components in supporting the web-based applications. These are the servlets java server pages and applets. From these technology components the first two

along with that of the web server will be discussed in the following paragraphs and will diagrammatically be described in figure 6.1.

### **6.1.1. Servlet**

This technology component extends the web servers functionality by allowing the server to generate dynamic contents. The dynamic contents enables in achieving security and easy interaction with that of a database. It uses the HTTP request – response model of communication between the client tier and the server tier.

### **6.1.2. Java Server Page (JSP)**

It is an extension of the servlets technology. JSP unlike that of servlets, it separates the presentation from the contents. JSP has four parts; these are directive, actions, scripting element and tag libraries. The processing on JSP-enabled server is: - As the server receives the request the JSP container translates the JSP into servlet that handles the current request.

### **6.1.3. Web Server**

The web server is the one that handles the request from the browser. The choice of such servers depends on many factors. For this work their capacities of handling concurrent requests and freedom of choice in the platform they run are the ones considered. It is the apache web server which is selected. The apache web server is free open source software. It has the capability of running on different platforms.

## 6.2. The WBDEE

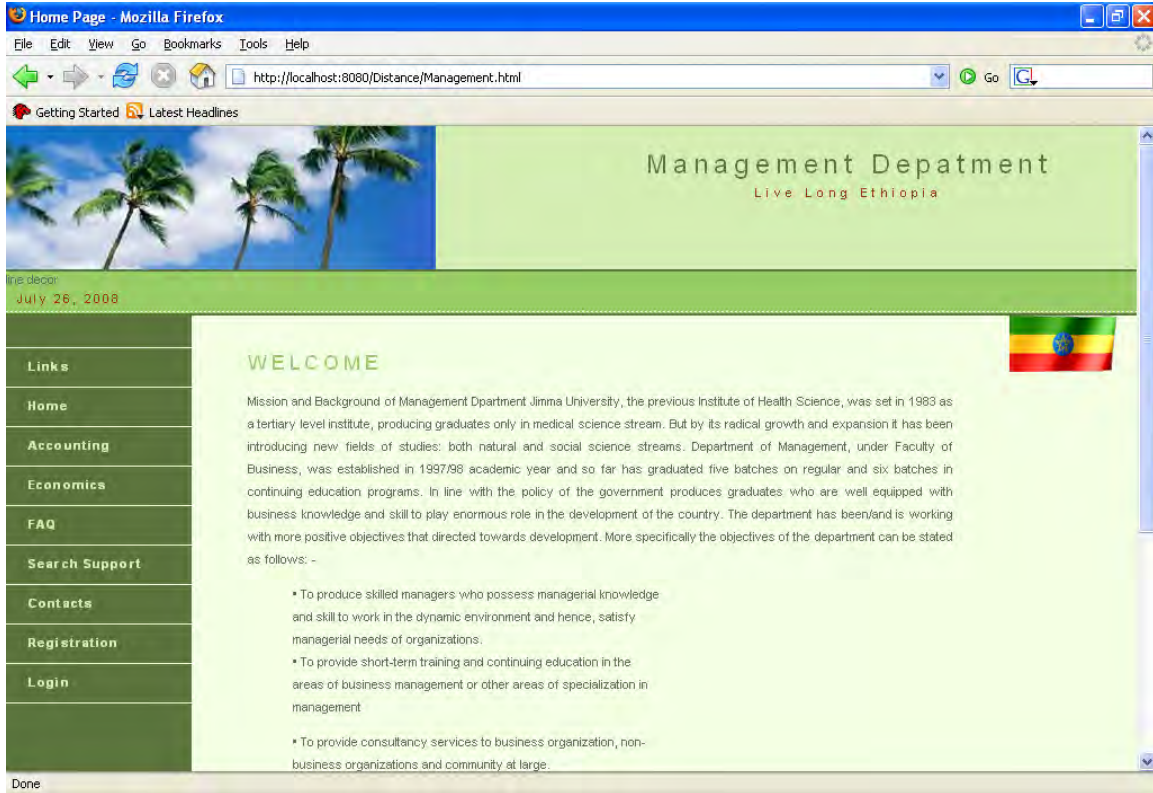
This subsection of the implementation phase is about how to go through this work. As it is mentioned in chapter five of this document the interfaces are categorized in to four main interface components. This section will consider the guest, student and the tutor's parts. Here the discussion is all about how to go through those components by taking particular scenario.

When the system is being activated, the home page of the system is displayed as shown in figure 6.1.



Figure 6-1 WBDEE Home page

The client can go to the institute followed by the faculty of his preference and can then go to the department of his choice. Figure 6.2 shows the department of Management department.



**Figure 6-2 Management Department Home page**

If the client clicks on the login link, WBDEE will display a login page followed by the official department page according to the user level and the department of the user as shown in figure 6.3 and 6.4.

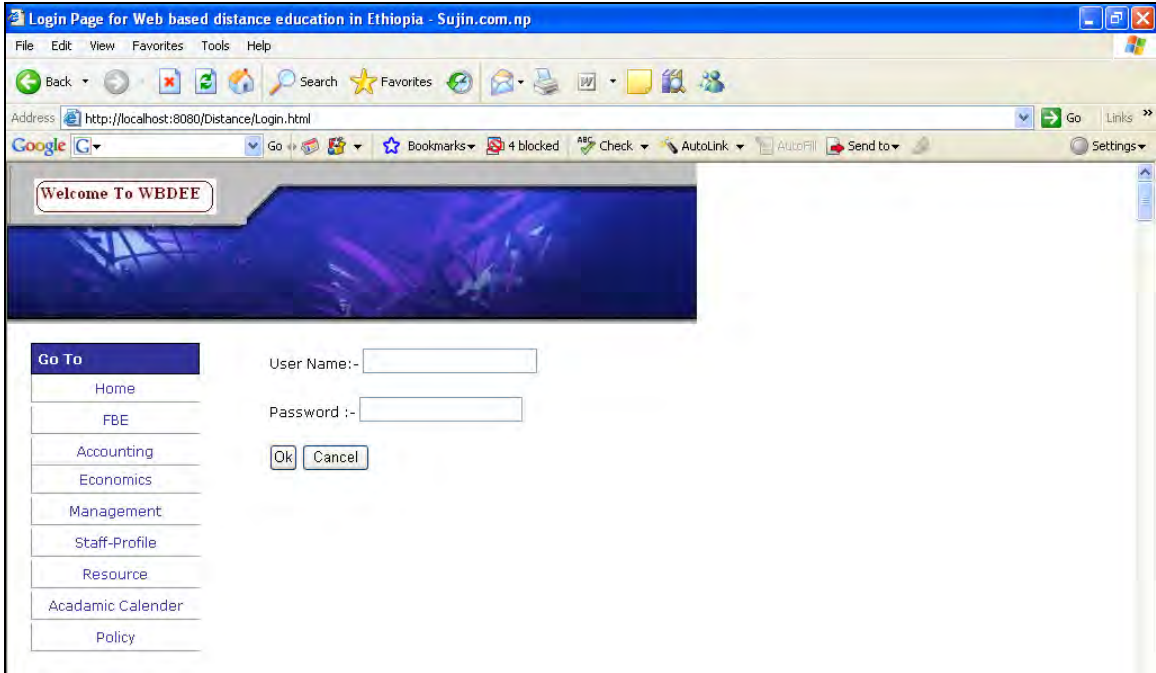


Figure 6-3 Login page for WBDEE.

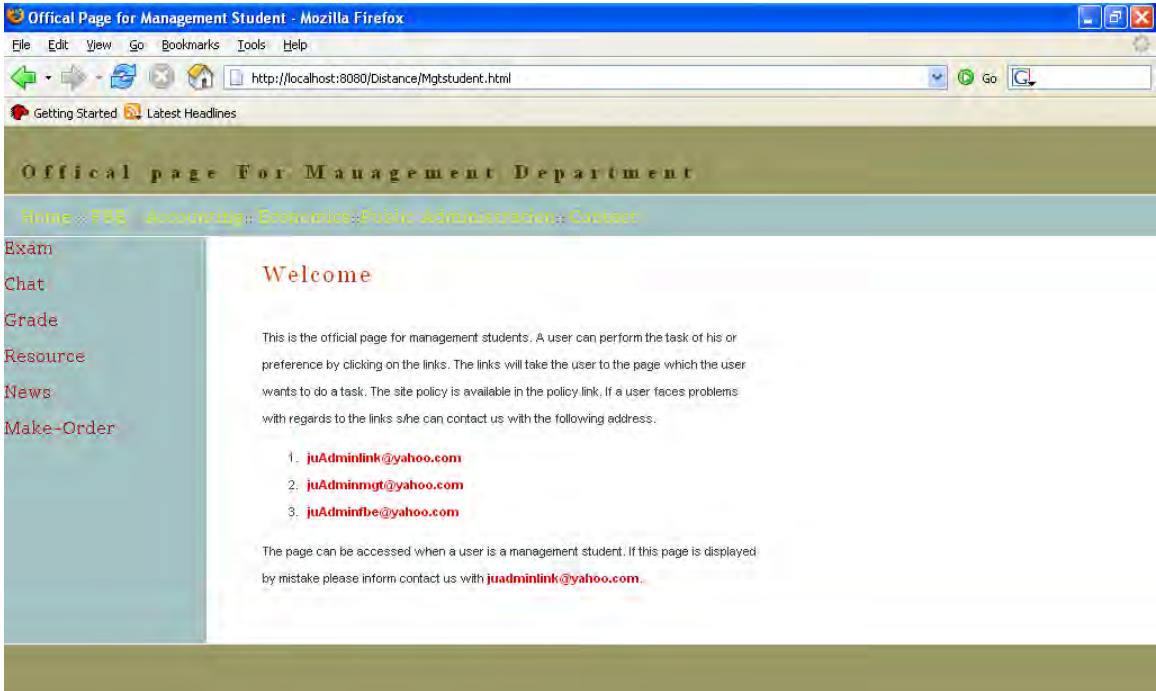
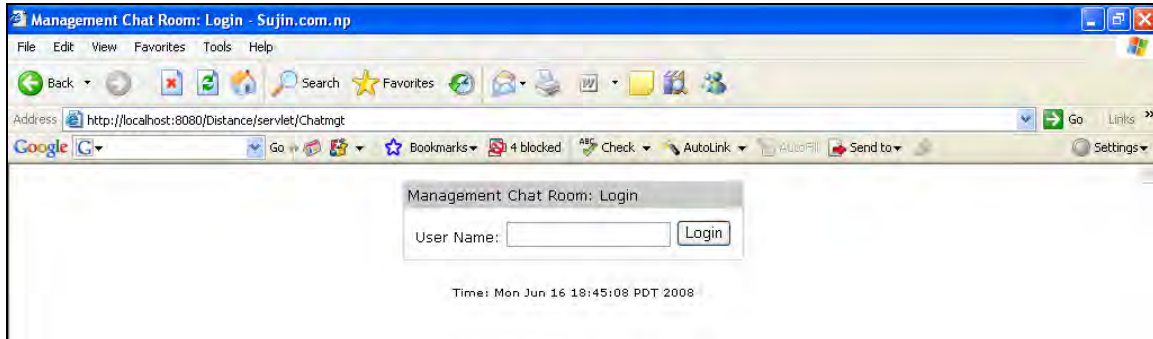
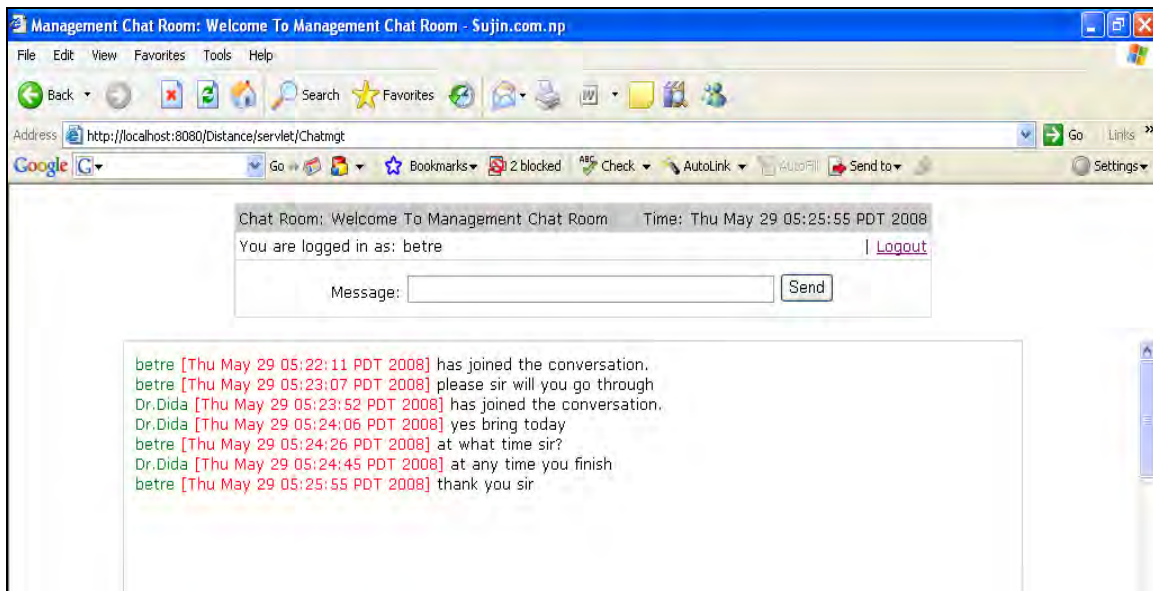


Figure 6-4 The official page for Management student.

If a student wants to make chat with other student or with tutors, s/he can do so by click on the chat link. Figure 6.5 and 6.6 shows the chatting process.



**Figure 6-5 Chatting login page for Management Department**



**Figure 6-6 Chatting room for Management Department**

The user gets the resource of a course by click on the resource button from the official page of the department. S/he can access the resource with media type of her or his preference. Figure 6.7 and 6.8 show the implementation.

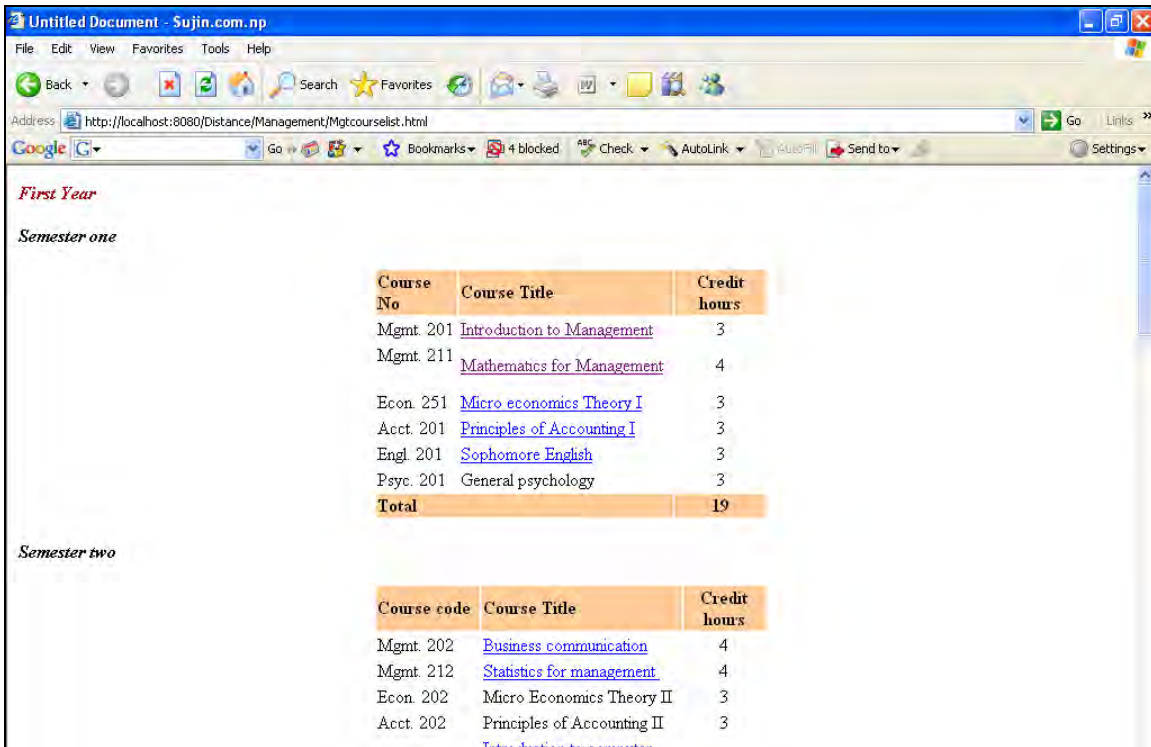


Figure 6-7 The Management course list page.

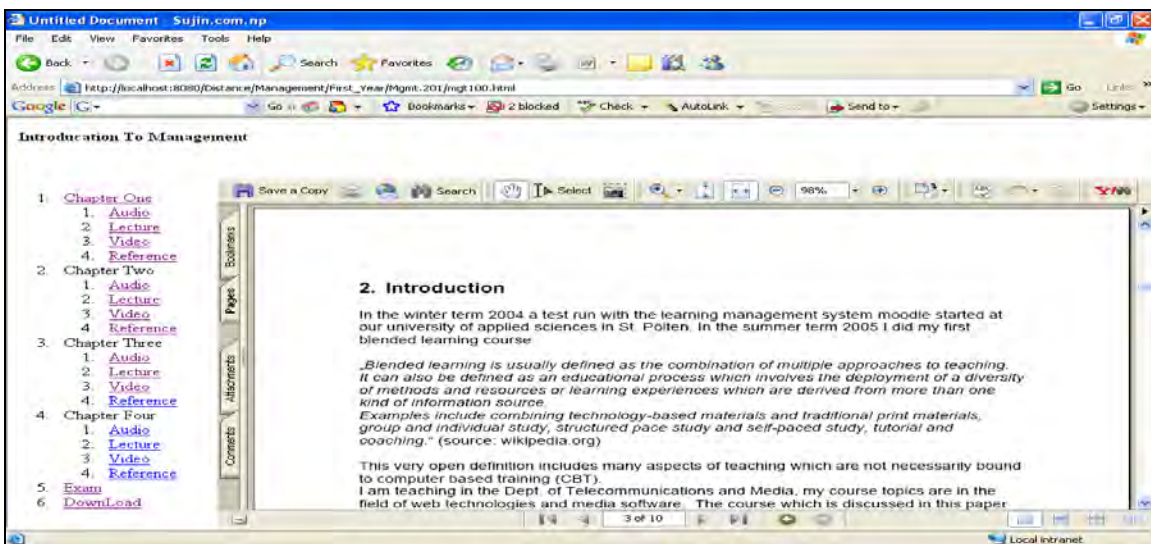


Figure 6-8 Text based resource.

To view grades, the student clicks on the grade report link, and view his grade as shown in figure 6.9.

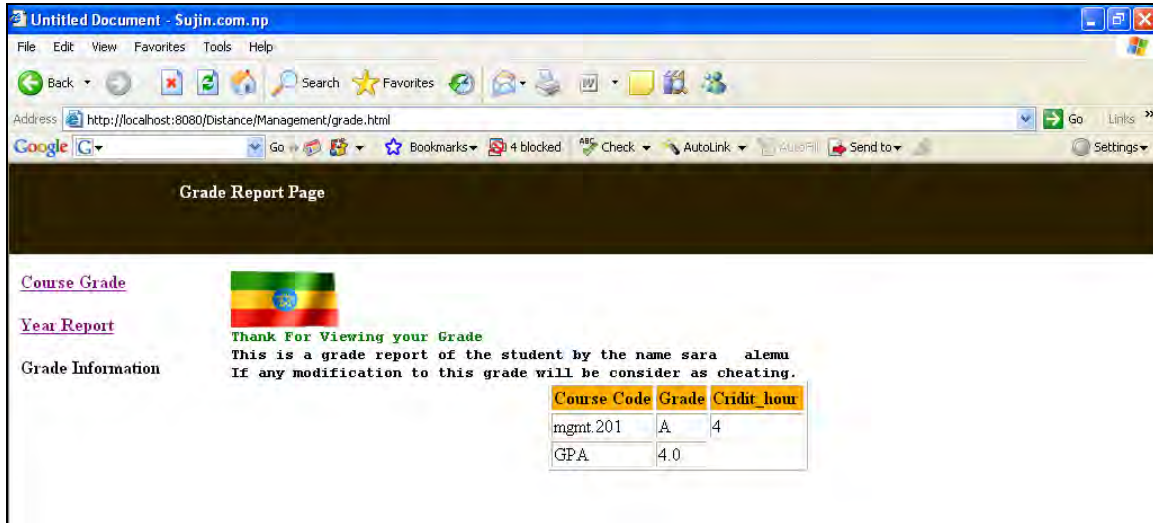
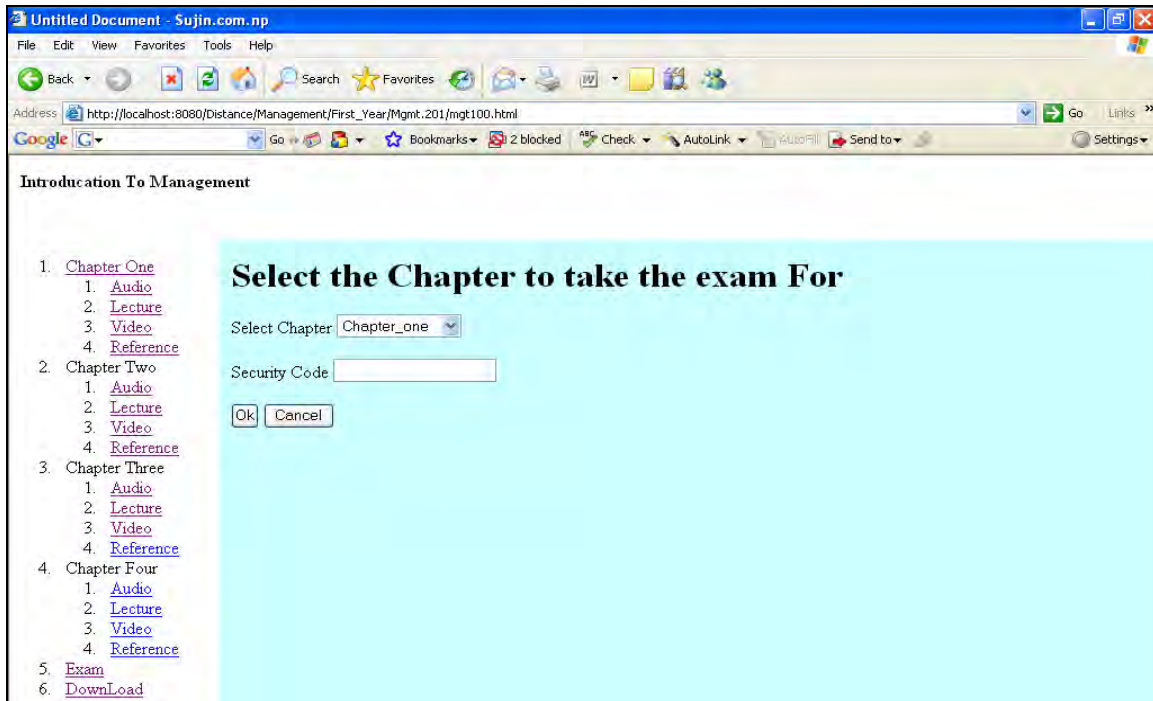


Figure 6-9 Grade reporting Pages.

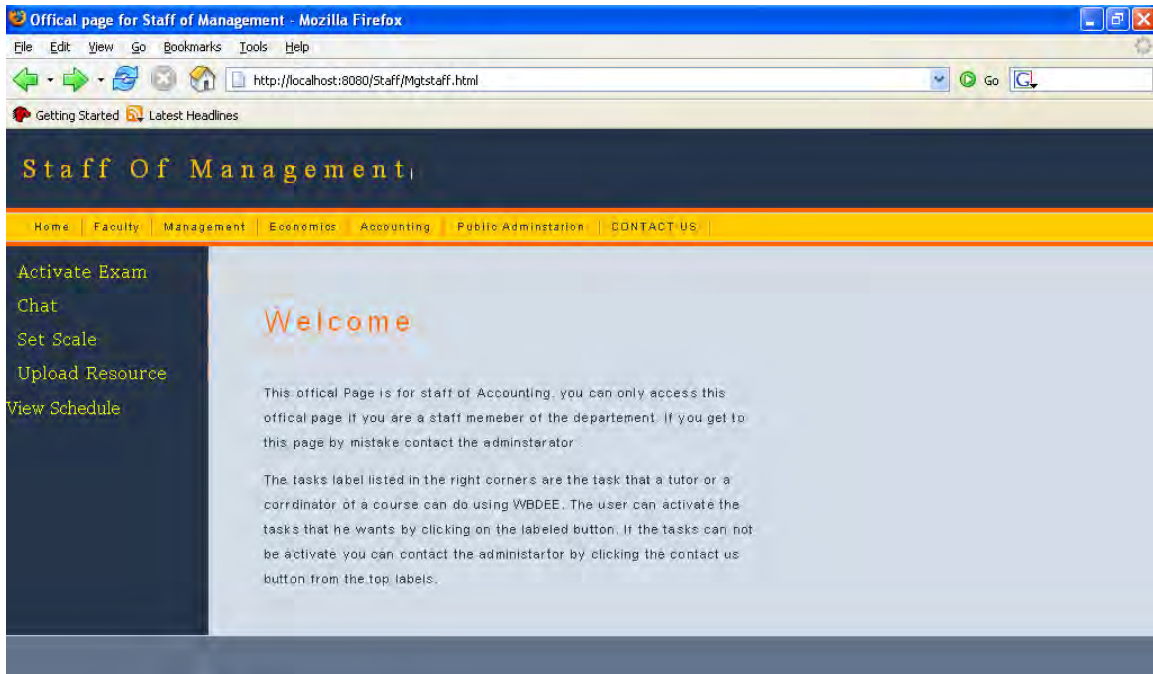
If the student wants to take a chapter based examination s/he has to click on the exam link from the course page. The system will then display the chapter selector page if the student is registered for the course and has not taken the exam before. Figure 6.10 show the chapter selector page.



**Figure 6-10** The chapter selector page.

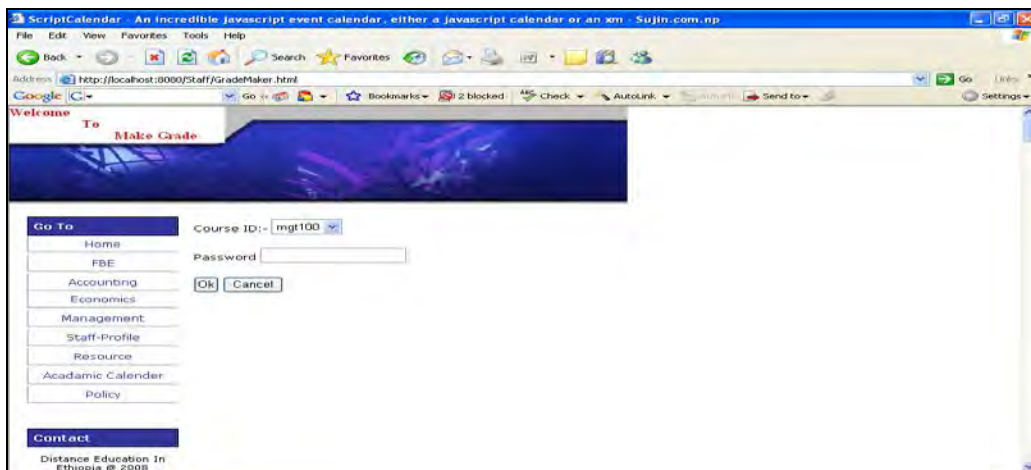
The tutor on other hand can do his or her on tasks. The tutor logs on from his terminal and the system displays the respected official page of the department.

Figure 6.11 shows the official page of the management department.

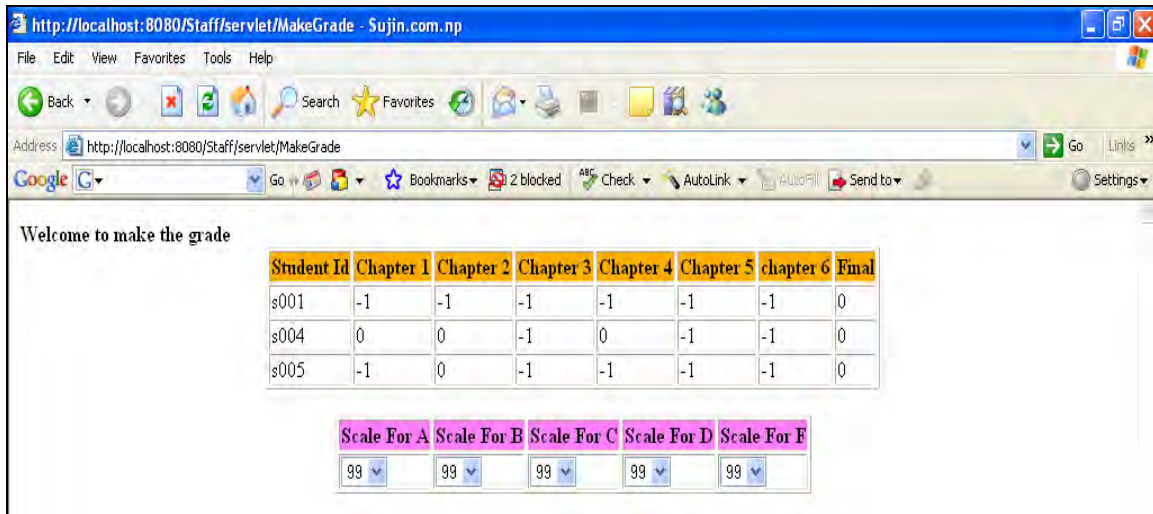


**Figure 6-1 The official page of the Management staff.**

The tutor can do the tasks that are listed as links on the pages. If the tutor wants to make grade for the course that s/he coordinate, he has to click on grade link then the system display the course selector page followed by the grade maker page. Figure 6.12 and Figure 6.13 shows these pages.

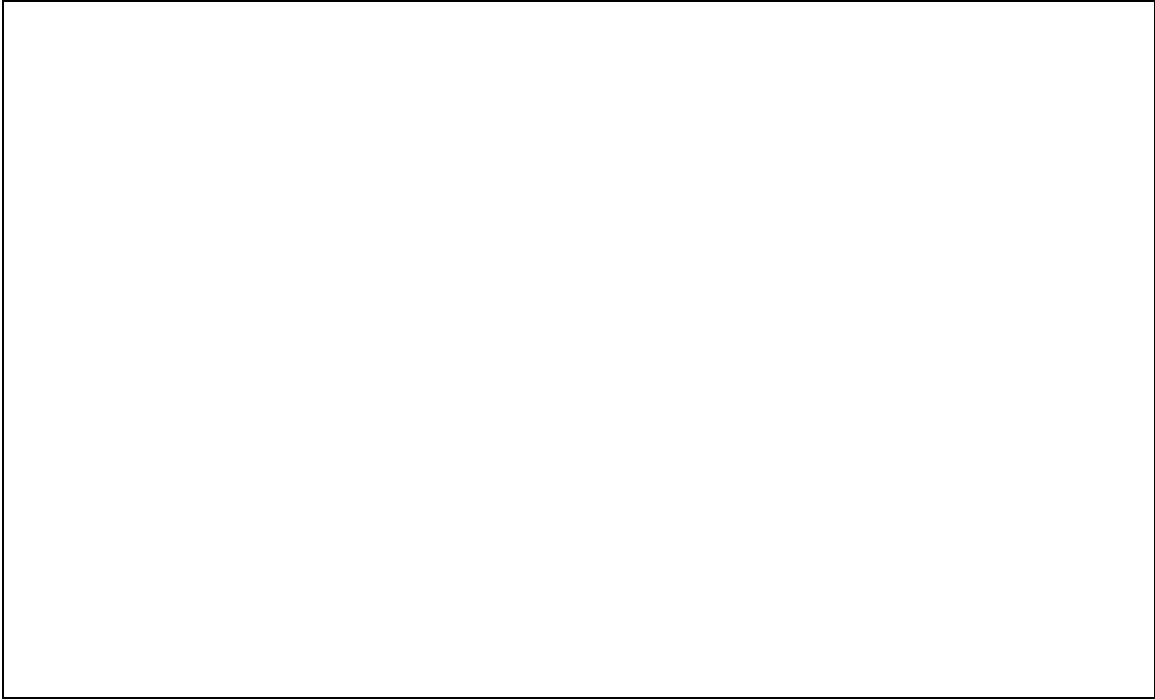


**Figure 6-2 The course selector for grade making**

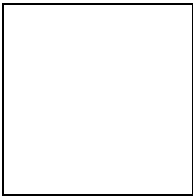


**Figure 6-3** The grade maker page.

The tutor can also upload a resource to the students. The tutor can upload the resource by clicking on the upload link. The system will present list of course to be selected. The tutor can select one of the courses then the system will present the uploading page. Figure 6.14 and figure 6.15 shows the pages.



**Figure 6-4 The course list page for upload.**



**Figure 6-5 The uploading page.**

## **Chapter 7**

### **Conclusions and Recommendations**

The development and advancement of computer technology makes computers to be part of every day human life activities. Education is an area where the human is involved in a day to day activity of his life. It is an area which requires due attention, for it deals with behavioral, attitude and skill changes. The same is true for the use of computer in education. This work has enabled the delivery of learning materials to be efficient and it has also achieved interactivity among students and tutors. Furthermore it has established the assessment based learning theory along with the collaborative based to be applicable for the distance education in Ethiopia.

The work is developed using the java web technology. This technology choice has enabled the work to have portability, extendibility and security. The portability enables the work to be deployed on a given platform and work with the currently existing web servers with or without plug-ins. The extendibility can be expressed as features for the work to tolerate the future expansions on the sector. The security features of the java language can be incorporated to the level of requirement in need.

This work can be considered as gate opener on computer assisted education for this country, but not the closer. The area is still open for research and it is a topic of discussion world wide. The question of whether there should be new type of pedagogy for computer based learning is not yet answered. The other issue on the

area can be having an agent based systems. Questions of such types can be taken as indicator for the gap in the area. Future research work on area could come up with solutions for the above questions and related ones.

The quality of distance education has been an issue since its birth. This work to meet the expected outcomes regarding the quality issue requires the active and responsive roles of the concerned parties in the sector. It is our recommendation for the institutes involved in distance education and the government to organize a central body to manage and upgrade the system. Furthermore Organizations, which are involved in providing a training service, can utilize and upgrade this work for solving their problems. The transportation authority, which is involved in providing the driving license training and authentication, can be taken as an example of such organizations.

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