Web Based Learning Object

Repository for

Hakahinna Maha Vidyalaya

A dissertation submitted for the Degree of Master of Information Technology

W.D.Jayakanthi

University of Colombo School of Computing

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Declaration

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute.

To the best of my knowledge it does not contain any material published or written by another person, except as acknowledged in the text.

Student Name   : W.D. Jayakanthi

Registration Number   : 2014/MIT/023

Index Number   : 14550232

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Signature: Date:

This is to certify that this thesis is based on the work of Ms. W.D. Jayakanthi under my supervision. The thesis has been prepared according to the format stipulated and is of acceptable standard.

Certified by:

Supervisor Name   : Dr. Enosha Hettiarachchi

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Signature: Date:

Abstract

Evolution of the Information and Communication Technology (ICT) has affected on most of the sectors around the world. E-learning is one of the resultant area in education that affected by the immerging technologies of ICT. Traditional way of teaching and learning are out dated and new ways, methods arriving at due to the technological enhancements.

Unfortunately, due to the lack of facilities, we Sri Lankans had only adopted a very few in the process of teaching and learning. Recent years this situation seems to be changed in our system of education. The specialists have identified that it cannot be survived without ICT and our next generation should be facilitated with these technologies in order to win the world. New reforms in education are arriving at and many projects are deployed towards this. Many institutions are willing and trying at their best to go online and to do their tasks electronically.

These reasons led to propose a system in which electronically store and retrieve learning objects that could be used as visual aids in teaching and learning process. Since our school also interested with the idea, a need analysis was conducted. A positive response was given by the need analysis making a starting point with the proposal to develop a Web Based Learning Object Repository.

The system will facilitate the teachers, students as well as the guest by providing access to Learning Objects. This would ease the tasks of the teachers and students towards a better tomorrow.

Object oriented methodologies were employed and the MVC framework was used to structure the development of the system. At the end of the project, a properly tested, working system was developed and deployed successfully.

This thesis describes the complete system development process of the Hakahinna Learning Object Repository (HLOR) from identification of system requirements to the end of evaluation process.

Acknowledgement

First of all, I am extremely grateful to my supervisor Dr. Enosha Hettiarachchi for her valuable supervision and the corrective suggestions towards completion of the project throughout the time.

Next I would like to acknowledge the project coordinator and the staff members of the UCSC for their useful discussions and corrective guidelines from the beginning to the end of the project.

I should offer my sincere gratitude to the staff and the students of Hakahinna Maha Vidyalaya for their supportive feedback.

I would like to thank my friends and the family members for their constant support, encouragement without which I would not be able to carry out the project work successfully.

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List of Abbreviations

ICT   -   Information and Communication Technology

LO   -   Learning Object

LOR   -   Learning Object Repository

HLOR -   Hakahinna Learning Object Repository

FAQ   -   Frequently Asked Questions

UCSC -   University of Colombo School of Computing

ICDL   -   International Computer Driving License

CAL   -   Computer Aided Learning

MVC   -   Model, View and Controller Architecture

Chapter 1: Introduction

Information and Communication Technology (ICT) has been receiving more and more attention in the field of education. Educators, together with ICT professionals, work hands in hand to enhance the teaching and learning process more effectively and efficiently. Many technologies have been developed and evolved for many decades. Those recent advancements have a great influence on the field of education, especially in e-learning. One such is Learning Object Repository that helps the teaching and learning process in many ways.

Motivation

Many educational institutions tend to practice some kind of e-learning technology for their teaching learning process. The technology they are using and how they are using it depends on their institutional goals, vision and mission.

My school, though it is a rural school with minimal facilities, tries at their best to use the technology for the teaching learning process efficiently and effectively. They use ICT for administrative purposes such as creating the time table, a bell system for automate routine activities within the school. The principal is so enthusiastic with ICT and willing to take challengers as well. Since all the staff members were trained to use ICT by the government, they also in a position to use ICT productively in their teaching learning process. Furthermore, the school is in a position to carry out their teaching and learning with ICT.

It is a proven fact, that the learner can achieve higher retention rate by offering multimedia presentations such as video, animation, simulations. Such should be created and stored in order to reuse since creating such is time consuming task. The organization lacks for a proper mechanism to store and retrieve such learning objects. This was motivated to find a proper solution using ICT, which would be able to solve the issue.

Statement of the Problem

The teachers use the computer lab for their lessons and students also seems very much interested to learn in that way. In order to succeed with this process, learning objects must be available. They create their own learning objects or use some freely available learning objects. What is learning objects and how they are created are discussed in the next chapter, Background.

Each time they teach, they have to create or search for learning objects on the web or in their own computer since there is no proper mechanism to store and retrieve such. It is a time consuming work and doing the same thing again and again is not productive as well.

It is a waste of money as well as time that could have used for some other task. Therefore, we had to find a solution for this issue and preliminary study was done to identify such solutions. At the end of the study, a digital repository was proposed where the teachers can store, retrieve, and share learning objects within the institute.

Need of Learning Object Repository for Hakahinna Maha Vidyalaya (HMV)

Hakahinna Maha Vidyalaya is a government school where conducts classes from grade 6 to grade 13. The school possesses a fully equipped computer laboratory. All the teachers in the school are computer literate. They develop PowerPoint presentations for their lessons. The same lesson is developed by several teachers. There is no proper way of storing and retrieving such in the school. Furthermore, there is no proper mechanism to share such resources among teachers and students digitally.

The school also maintains an "assignment bank" which teachers put some assignments when they take leave. It is a fully manual system. Each and every class has an assignment bank. Preparing and maintaining such in a manual way has lot of difficulties.

- Each teacher has to prepare the same assignment (learning object) several times if there are several parallel classes.
- So many assignments for the same lesson by several teachers.
- The assignments may inaccessible due to student activities. (Students may not put the assignment back to the bank and they may not put it onto the correct folder (Each class has its own folder)).

If they had a Learning Object Repository, they could have stored each of those learning objects in it making possible to share resources thorough the internet.

Aims and Objectives

The aim of the project is to develop a user friendly Learning Object Repository (LOR) that is capable of storing, retrieving Learning Objects (LO) online to support e-learning within the school.

The main objective of the project is to provide an online web space that is able to store the LO's and retrieve those LO's when and where needed. The other objectives of the project are as follows,

- Help the user to find a Learning Objects when and where it is required.
- Store and share Learning Objects to help the teachers and students.
- Support with easy navigation throughout the system making it easy to use.
- Reduce the recreating same type of learning objects.
- Increase reusability of LO.
- Manage version control providing editing and improving the LO possible without affecting the original.
- Encouraging the students for self learning with e-learning contents.

Scope of the Project

The proposed system will provide an overall solution to handle learning objects within the school online. It consists of the following modules,

Search Module:

- The system should support simple search enabling keyword search
- Advanced search facilitating searching for a specific LO using some criteria.

Upload Module:

- It should support with storing LO into the system with a user friendly environment.
- Uploading several LO's at once (bulk upload) also should be possible.

User management Module : System maintains a Admin role which is capable of

- adding users
- assign role to added users
- create new user roles as needed
- modifying user roles
- enabling or disabling user accounts
- Generate specified reports.

Login Module:

- A registered user has to log into the system in order to perform most of the tasks.
- The user shall logout of the system at the end of the session or system should logout the user upon session time out.
- The user should be able to edit his personal profile and update.

Learning Object Module:

- Rating and commenting for a LO
- Top rated LO should come first

Reports

- User log reports
- LO related reports
  - o Mostly viewed LO's
  - o Recent uploads
  - o Top rated LO's
  - o List LO by author, subject, time(day, week, month, year)

Help

- User manual
- FAQ

Brief Overview of the Upcoming Chapters of the Thesis

Chapter 2 : Background

Provides a review related to the proposed system and comprehensive study of relevant literature and theoretical analysis of the requirements.

Chapter 3 : System Analysis

This chapter provides a detailed analysis of the proposed system. It contains what is analysis and identified functional and non functional requirements of the developing the system.

Chapter 4 : System Design

This chapter provides a detailed design of the proposed system. It contains what is design and design documentations to the developing the system.

Chapter 5 : System Development

This chapter provides system development details of the system. It contains how the system is being developed.

Chapter 6 : Testing

This chapter provides testing details of the system. It contains what the testing is and the test cases designed and used during the testing of the software.

Chapter 7 : Testing and User Evaluation

This chapter provides details of the conducted usability testing and user acceptance testing.

Chapter 8 : Conclusion and Future Works

This chapter talks about the findings, lessons learnt, achievements at the end of the project and how the developed software could be further extended to provide more facilities to the users.

Chapter 2 : Background

Introduction

The background of the system to be developed is discussed within this chapter. It addresses about the terminology being used in the system development such as what is learning object and what is learning object repository. It also discusses about metadata standards, similar systems that are available and their limitations.

What is Learning Object Repository?

Learning Object Repository is a digital collection of learning objects that enables sharing, managing, and using educational resources over the internet. Creating a learning object is a tiresome task. If we discard such learning object after one time use, it might be an utter waist of our time, knowledge and skills. The same learning object might be reused in an instance with just simple modifications if only we kept it in some place securely.

There came the existence of learning Object Repository (LOR) to cater into that requirement. With the usage of a LOR, once created a learning object, it is an investment for the future, making it available online for using, reusing, again and again. The following figure 2.1 illustrates the components of a LOR.
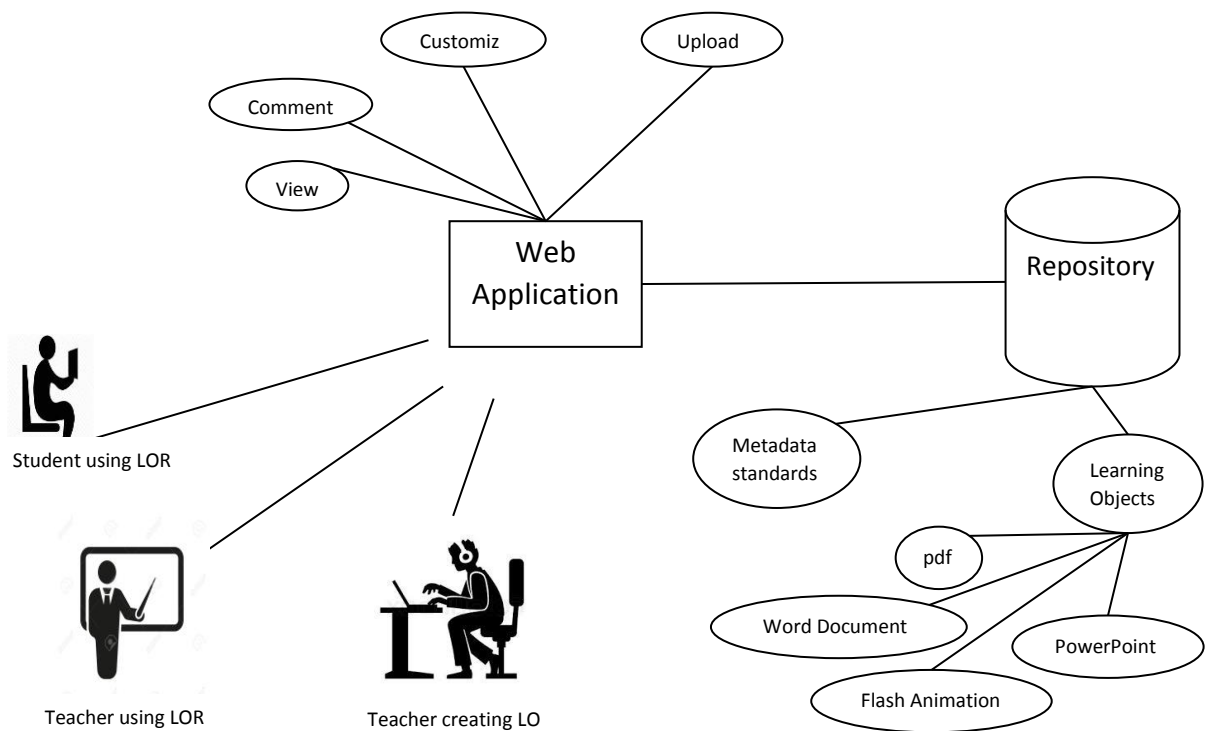
Figure 2. 1 Learning Object Repository

There are design considerations that should be taken into account while developing a learning object repository. With reference to [1], learning object repository must be designed for reuse providing reinvention of duplicative materials are minimized, customized, version controlled. It should enable social functionality so that it enables user comments to encourage the LO developer. Search ability with various discovery approaches such as keyword, topic/subject, educational level, type of resource (online tutorial, assignment, animation, quiz, etc.) as well as format (PDF file, PowerPoint, jpg, Flash animation), should be available to make it lot easier to find the relevant LO without much effort.

It is better if we can put the LO's into the repository with free of copyright restrictions and governed by creative commons license. This makes easy to changing and modifying an existing LO for better productivity **[1].** By introducing a Netiquette for the community may develop well disciplined personals that would use the shared resources efficiently and effectively. That would minimize the problems that may arise by giving freedom with LO editing.

Learning Objects

Learning object may be a video, assessment, PowerPoint presentation, animation, or in any other kind of material that is suitable for educational context. They are created with including metadata enabling efficient and effective searching making easy discoverability of the learning objects (LO).

Conceição and Lehman [2] defined learning object as "Any entity, digital or non-digital, that can be used, re-used or referenced during technology-supported learning". These digital chunks of information take on many forms: text, video, audio, graphics, and multimedia and include tutorials, scenarios, simulations, lesson modules, case studies, and assessments. The accepted term for these small units of learning is learning objects. To enable their accessibility, reusability, share ability, durability, and scalability, meta-tagging standards has to be employed.

Metadata Standards

There are many metadata standards that can be used when creating a learning object. Some of such metadata standards are LOM (Learning Object Metadata formalized as IEEE 1484.12), SCORM (Sharable Content Object Reference Model by the U.S. military's Advanced Distributed Learning Organisation).

The usage of standards enables the usability and reusability of learning object in any system which supports the standard. Therefore it is important to follow a well-defined standard when creating learning objects.

Critical Review of Similar Systems

NHS E-LeariningRepository [3] : The eLearning Repository is an extensible search and discover platform. It provides a centralized platform for discovering for shared learning objects in helth. It has a user friendly environment to support the learning activities. But the source code is not available and not customizable.

DSpace [4] : DSpace is a non-profit, and open digital repository. It is free and easy to install and completely customizable to fit the needs of any organization. DSpace preserves and enables easy and open access to all types of digital content including text, images, moving images, mpegs and data sets. But it is highly research and academic oriented software most suitable for higher educational institutions.

MERLOT [5] : Multimedia Educational Resource for Learning and Online Teaching is governed by a well disciplined based community. It has a range of LO's stored for achieving online. The LO's are reviewed for better productivity. It has three communities such as Academic Discipline Communities, Academic Support Communities and Partner Communities. This is a commercial product and not available for free.

Drawbacks identified in Similar Systems

Though there were systems, which support the general requirements of the proposed project, there were some drawbacks for using the existing systems.

MERLOT is a identified system which was commercial products and not meant to adjust for specific requirements.

DSpace is an open source, free and customizable system but it is mainly designed to cater for higher educational institutions. The proposed system will be developed for a secondary educational institute.

NHS E-LeariningRepository is not customizable since it does not provide with the source

Chapter 3 : System Analysis

Introduction

System analysis helps the developer to proper understanding of the system to be developed leading towards a successful development of the product which is efficient and effective. This chapter consists of the system analysis of the proposed learning object repository including requirement analysis, feasibility study, identified functional and non functional requirements.

Requirement Analysis

During the system analysis it is necessary to determine the functional and non functional system requirements for the proposed system. Analysis refers to breaking a whole into its parts with intend of understanding the part's nature, functions and interrelationships [6]. According to Roth [6] there are three steps involved in system analysis phase. They are as follows.

- Understand the existing situation
- Identify improvements
- Define requirements for new system.
  During those steps mentioned above, the analyst has to gather information about the problem domain. In order to gather information it is required to use fact gathering techniques.

Fact Gathering techniques

There are seven [7] fact finding techniques. Those are sampling, research and site visit, observation, questionnaires, interviews, prototyping, and joint requirement planning. Out of those techniques,

- Research and site visit,
- Observation of the work environment,
- Interviews,
- Prototyping,

were used for requirement gathering of the project.

Research and site visit

Some other people may have faced with similar type of problem. Thorough research on the problem domain may help to find a solution quickly and easily. Therefore a thorough research was done for similar systems through the web.

Observation of the work environment

A fact finding technique wherein the systems analyst either participates in or watches a person perform activities to learn about the system [6]. Observations were carried out to understand the current manual system which operates in the school.

Interviews

People gather requirements directly through face to face interactions. A lot of communicational skills are needed to conduct effective interviews. A number of teachers and students were interviewed in order to gather the system requirements.

Requirement Analysis for HLOR

The existing system is analyzed using the above mentioned fact gathering techniques such as research and site visit. Furthermore interviews with selected employees were carried out to identify the required improvements for the proposed system. Finally the list of functional and non functional requirements for the proposed system could be obtained.

Functional Requirements

The system should be able to support with the following functional requirements.

- Searching
    - Simple search which enable the user to search the system just by entering a word or word phrase.
    - Advanced search which enable the user to limit the output by restricting with specified criteria making it easy to find the required LO efficiently. Criteria include language, subject, author, published in, ratings, file type.

- Uploading
  - Single uploading where the registered user is able to upload a single LO to the repository.
  - Bulk uploading where the registered user be able to upload several LO's at the same time.
  - System should automatically provide author name, timely information and detect file type by default.
  - Publishing the LO uploaded by the user requires the recommendation by the manager.
- Downloading
  - The registered users should be able to download the LO from the repository. A log has to be operated for each download.
- Commenting
  - The registered user may comment on an LO and comments are viewed bellow the LO.
- Rating
  - Each registered user can rate a LO only at once and edit the own rating at any time. The average of the ratings for the LO should be visible with the LO.
- Viewing
  - Guest also should be able to view the LO's. But download, comment, rate should not be accessible by the guest user.
  - When searching the list of LO's should be visible to the user according to the higher order of the ratings.
- User management
  - The registered user should be able to sign in, sign out, and update profile.
  - The guest user may request for sign up into the system.
  - Register new user requires the user validation and admin approval.
  - There are user types such as student, teacher, admin, manager, and guest.
  - According to the user type, the capabilities should be changed accordingly.
- Learning Object
  - The system should identify the file type of the LO when uploading the LO.
  - Editing a LO should be reflected by the version and a small description of the changes done to the LO.

- Comments and average rating for a particular LO should be visible with that LO.
- Help
    - User manual should be available in case of the user needs some help on how to do some task.
    - FAQ's should be included in the system.
    - Timely specified help should be available throughout the system.

Non functional Requirements

- Usability
    - User friendly, easy to navigate system
    - Follow user interface guidelines when designing the system.
    - Timely support.
- Reliability and security
    - Detect errors and notify the user
    - Avoid misleading contexts while designing such as placing a button in a wrong place
    - Use database techniques to secure information from outsiders
    - High Password protection
- Performance
    - System response time should be reasonable.
    - Available online
- Platform support
    - Windows

Feasibility Study

A feasibility study is the study in which assess the practicability of a proposed project. "Should we proceed with the project idea? All activities of the study are directed toward helping answer this question. [8]". Identifying whether the proposed project work or not at the earliest possible, saves money, time, and resources.

Therefore a Technical and operational feasibility study was done for the proposed HLOR project in order to identify whether the system is feasible within the organization or not.

Technical Feasibility

The proposed project has to be questioned against several questions such as

- Is the proposed technology or solution practical?
- Do we currently possess the necessary technology?
- Do we possess the necessary technical expertise?

  In our case, the school has a computer lab which is equipped with modern computers, internet and multimedia projector. All the teachers have a computer or a laptop computer or a smart phone or all of the above which can be used for connecting to internet. Students also possess some kind of connectivity to the internet. All the staff members are trained to operate a computer and to use ICT in their teaching learning process.

  Therefore our institute is technically feasible with the proposed project.

Operational Feasibility

At which level of success could be achieved in operational level if the system is developed and deployed would be measured here. During this, we question the project against several questions as below.

- Does the management support the system?
- What is the level of accepting to changes in end users?
- How the end users feel about the system?

  The principal is so enthusiastic with the ICT and its usage. He is interested with using ICT in the process of teaching learning as well as the administrative perspectives. Therefore the management level the system is feasible. The staff in the other hand well educated and tries to implement new strategies in order to teach the student efficiently. The students, the new generation by instinct are well fitted with new trends and technologies. The only problem identified was that the students are used to use the internet for fun like things. Therefore we have to introduce them online learning experience with some fun in it.

  Institute is operationally feasible with the proposed system when considering with the overall outcome of the study.

Final Outcome of the Feasibility Study

Therefore implementing the LOR would help the development of the teaching and learning process positively. Care must be taken in order to making the process successful by providing proper guidance to encourage the school community positively towards the LOR.

Chapter 4 : System Design

Introduction

System design is the process of modelling the system according to the system specifications that was created during the analysis phase. According to Whitten and Bentley [10], "It is called physical design. Thus, whereas system analyst emphasized the business problem, system design focuses on the technical or implementation concerns of the system."

The system designers use system design strategies to design the system. There are many strategies that could be used for system design. Some of them are modern structured design, information engineering, prototyping, JAD, RAD, and object oriented design [10]. The object oriented system design concept is adopted most of the system design process of the HLOR.

Since the system to be developed is a web based system, web design strategies are also being used.

System Design of the HLOR

Object oriented design concepts such as use case modelling and class diagram were used while designing the system. Furthermore, web architecture structure and user interfaces also designed.

Use Case Modelling

Use cases model a system from user's point of view. Use cases and use case diagrams helps to get the system users get involved with the system design. It guarantees that the system developed will cater for the user's needs and expectations.

Use Case Diagram for HLOR

Use case diagram depicts how the users interact with the system. "The use case is a construct that helps analysts work with users to determine system usage. A collection of use cases depicts a system in terms of what users intend to do with it.[11] "

According to the gathered requirements, use case diagrams were drawn and refined. The following figure 4.1 shows the high level use case diagram for the LOR.
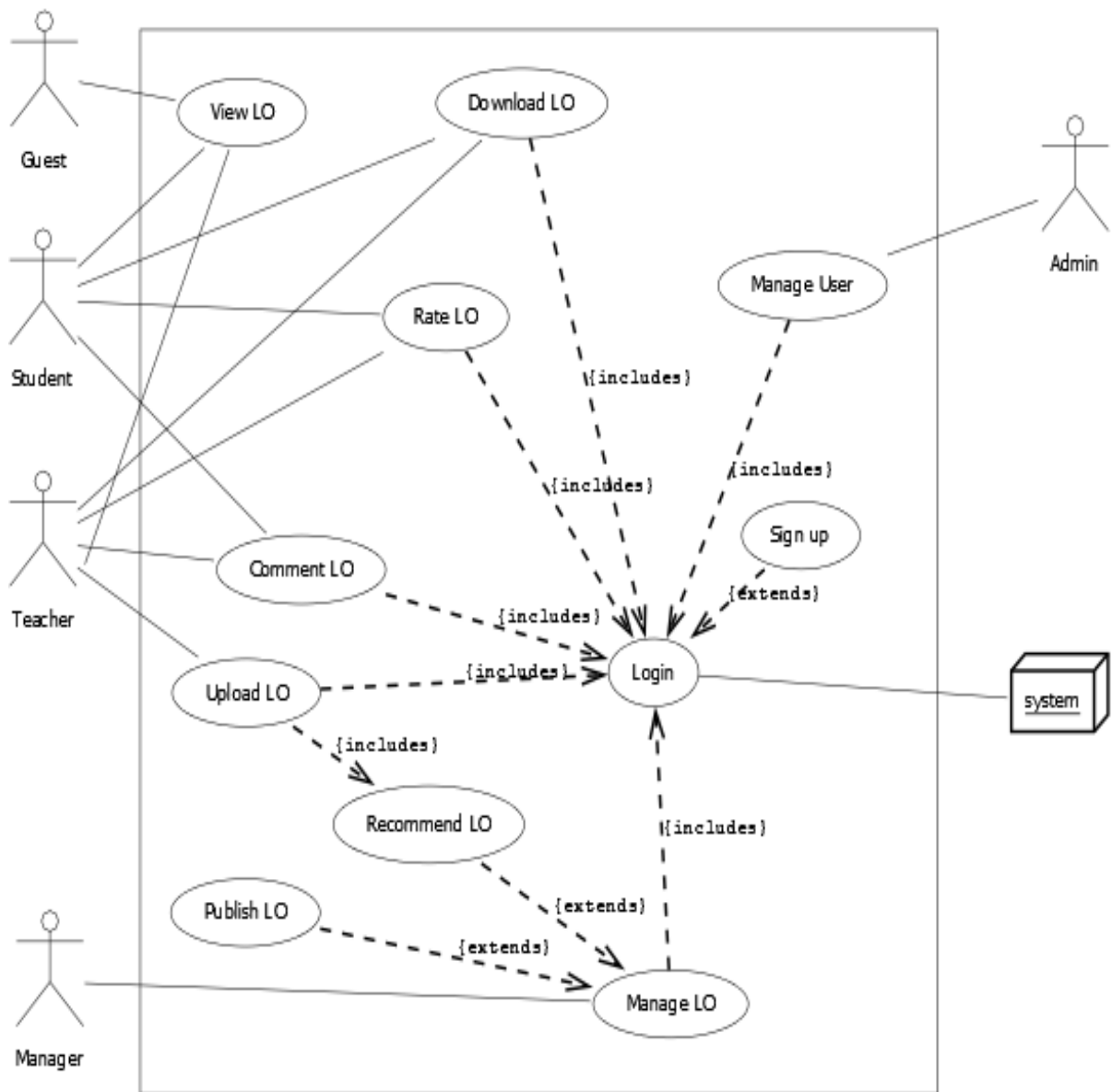
Figure 4. 1 High Level Use Case Diagram for HLOR

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Use case narrative describes each use case in detail. These narratives help the developer get a proper understanding leading towards developing the product requested by the client. Initially high level use case narratives were drawn for each use case and latter expanded into detailed use case narratives. Following figure 4.2 shows the high level use case narrative and figure 4.3 shows the corresponding detailed use case narrative for login use case.

Author : W.D. Jayakanthi	Date : 22/07/2016
	Version : 1

Use case Name	Login
Use Case Id	001
Priority	High
Primary Business Actor	Student, Teacher, Guest
Other participating Actor	System
Description	This use case describes the event of a user log into the system. User name and password is validated against the information store in the database.

Figure 4. 2 High Level Use Case Diagram for Login Use Case

Author : W.D. Jayakanthi	Date : 22/07/2016
	Version : 2

Use case Name	Login
Use Case Id	001
Priority	High
Primary Business Actor	Student, Teacher, Guest

| Other participating Act.	System	
Description	This use case describes the event of a user log into the system. User name and password is validated against the information store in the database.	
Precondition	The one who initiate the use case must be a member registered.	
Trigger	This use case initiates when the user does the following actions. • Upload learning object • Download learning object • Comment on a learning object • Rate a learning object	
Typical course of Events	Actor Action	System Response
	Step 1: User clicks on the button provided for the action Step 4: User enters his username and password	Step 2: System checks whether the user is logged in Step 3: If the user not logged in, display the login page Step 5: System checks the username and password exists in the system Step 6: Allow the user to perform the action.
Alternate Courses	Step 6: If the user entered username or password not correct, the system generates an error massage informing the user about it. Step 7: If the user triggers the action more than three consecutively, login for that user will be terminated and user account will be disabled by the system until the administrator enables it on user request.	

Figure 4. 3 Detailed Use Case Narrative for Login Use Case

Class Diagram

Following figure 4.4 shows top level class diagram which shows the classes identified and their connection to each other. The class diagram shows the static view of the system. The detailed class diagram could be found in the Appendix A.
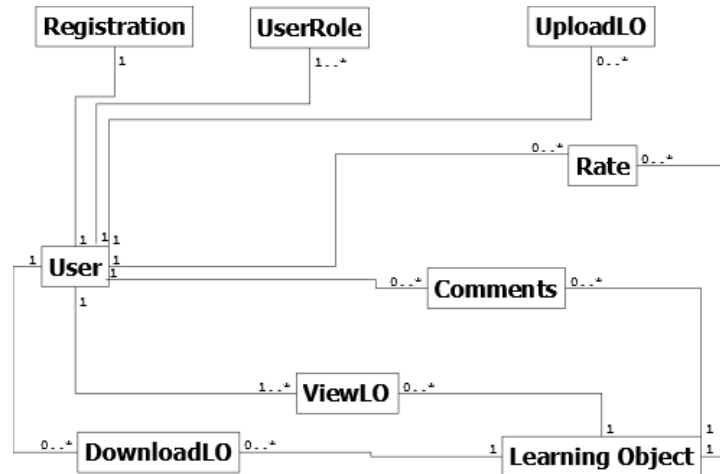
Figure 4. 4 Top Level Class Diagram for the LOR

Web Architecture of the HLOR

The system is being designed to use MVC framework. Mainly it consists of components Model, View and Controller. Interfaces, which interact by the clients, are kept in the views folder. Following figure 4.5 illustrates how the framework does its operations.

Figure 4. 5 MVC Framework

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The following figure 4.6 depicts the design of web architecture for the HLOR using the MVC.

Figure 4. 6 Web Architecture for the HLOR

Database Design

The following figure 4.7 shows the database table structure and its dependencies in the HLOR.

Figure 4. 7 Database diagram for HLOR
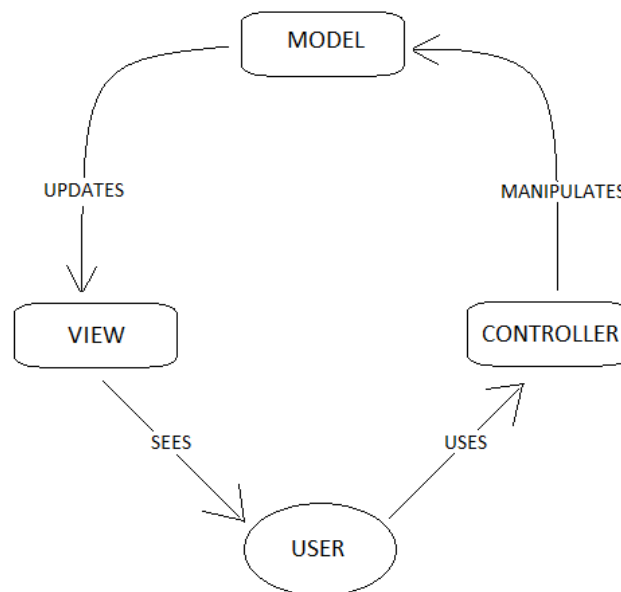
User Interface Design

User interfaces allows the user to interact with the system. Therefore, the designer has to concern intensely about the user interface designing in order to make the customer pleased about the system. Good user interface is a must for succeeding a software project.

Pressman [13] has introduced five quality attributes for designing user interfaces. They are usability, functionality, reliability, Efficiency, maintainability.

He [13] also has introduced a web design pyramid which consists of design activities that should be incorporated during the user interface design. It consists of activities such as interface design, aesthetic design, content design, navigation design, architecture design, and component design. Following figure 4.8 [13] was taken from his book to complete with the idea.
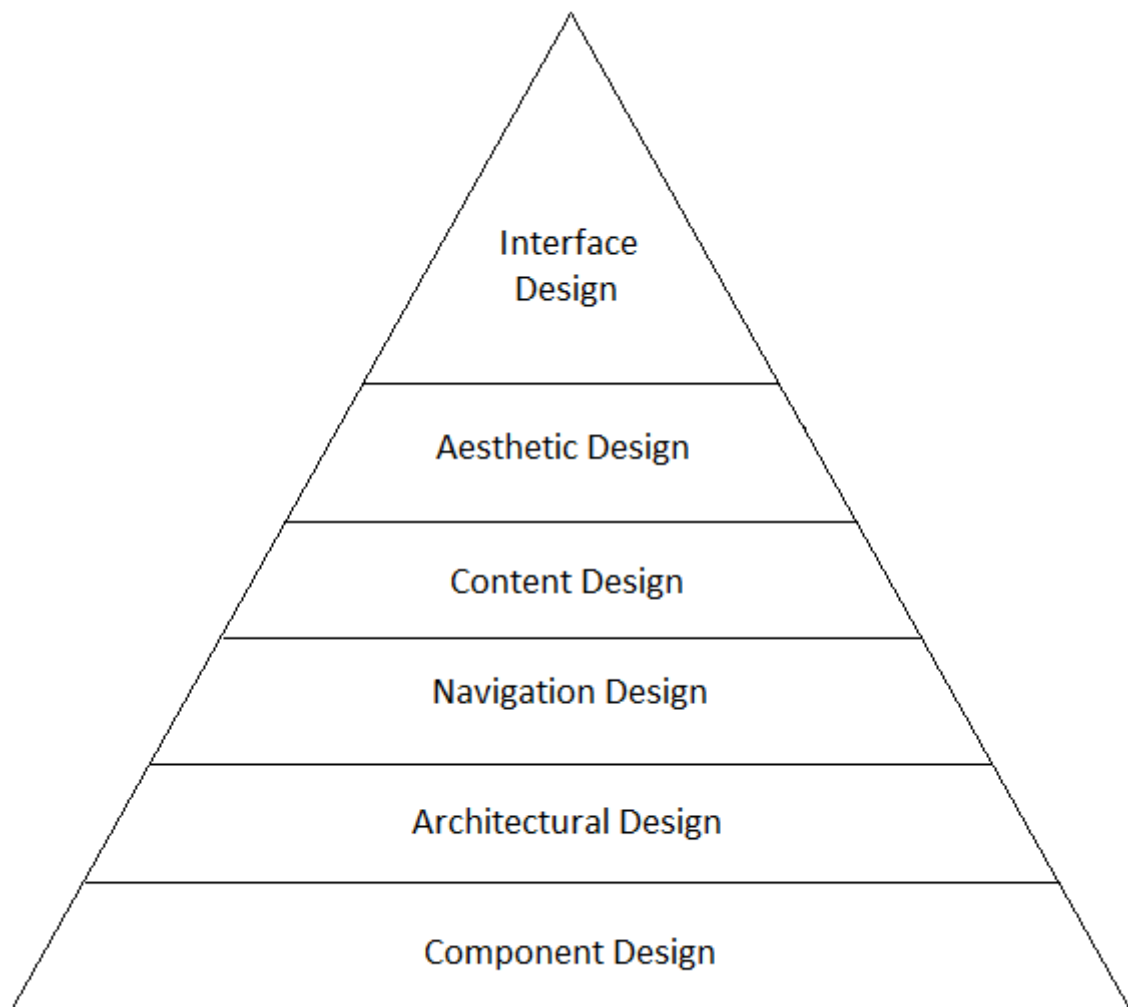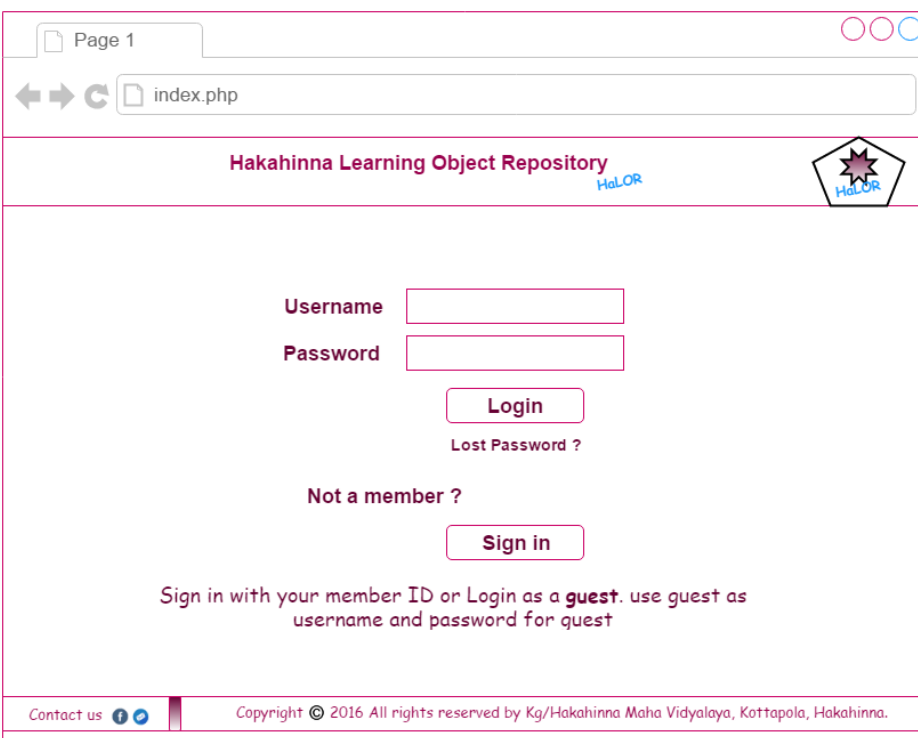
Figure 4. 8 Web Design Pyramid

That means we have to consider each of the design constraints and the quality attributes for a better design of user interface.

User Interfaces for HLOR

Care has been taken to design user friendly and efficient user interfaces by using afore mentioned quality attributes and design constraints. Following figures from 4.9 to 4.13 covers some of the user interfaces designed at this phase.

Figure 4. 9 User Interface for Login to the HLOR
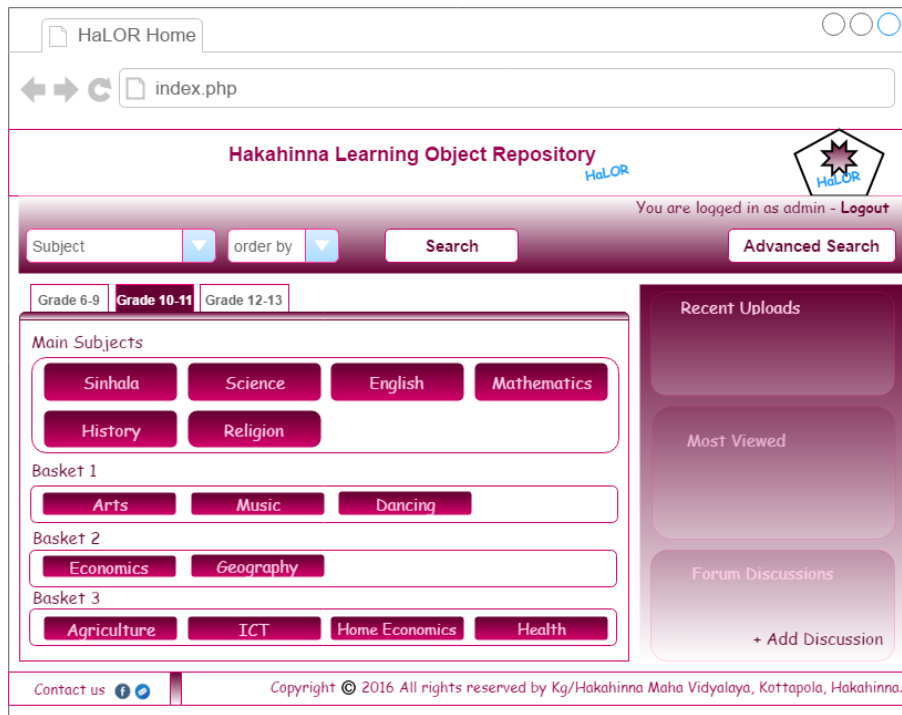
Figure 4. 10 User Interface of the Home Page of the HLOR
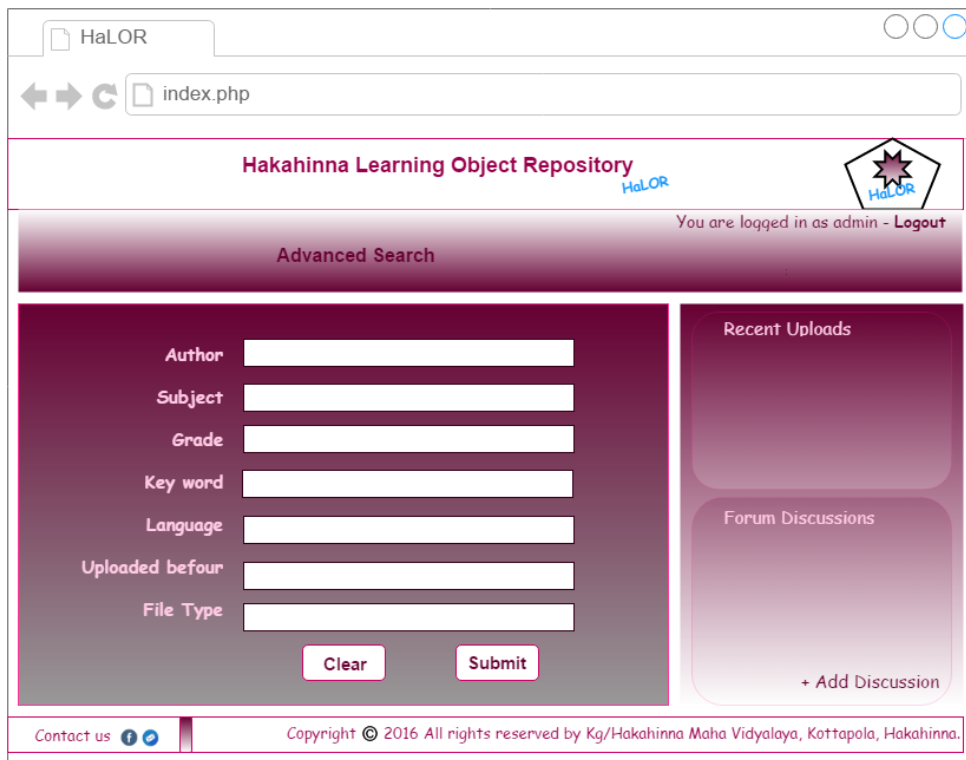
Figure 4. 11 User Interface for Advanced Search in the HLOR
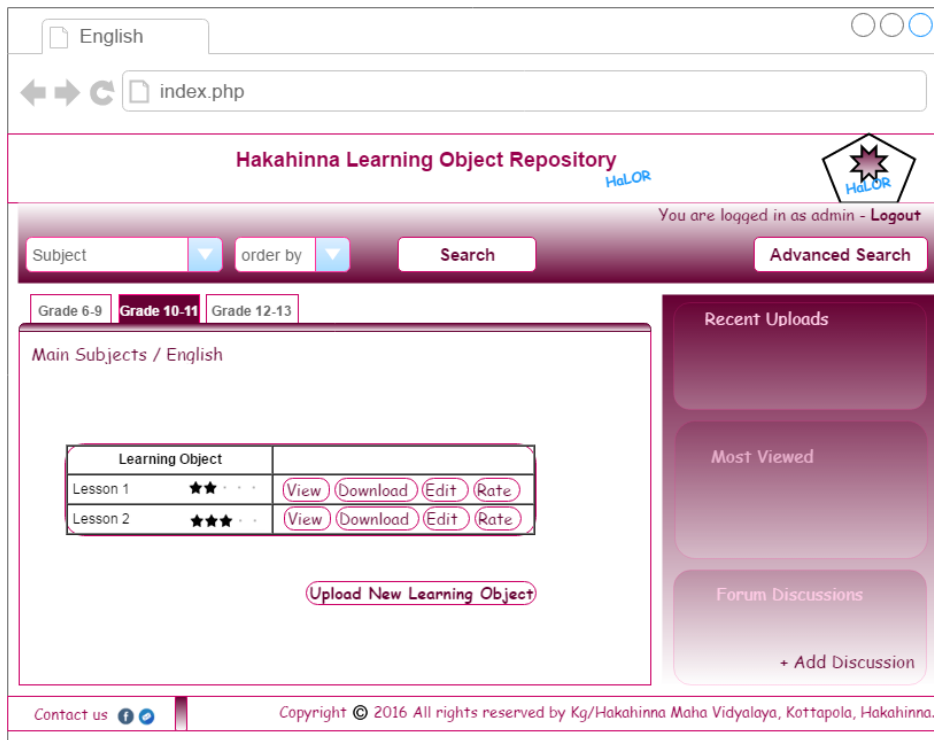
Figure 4. 12 User Interface to View The Learning Object for a search result
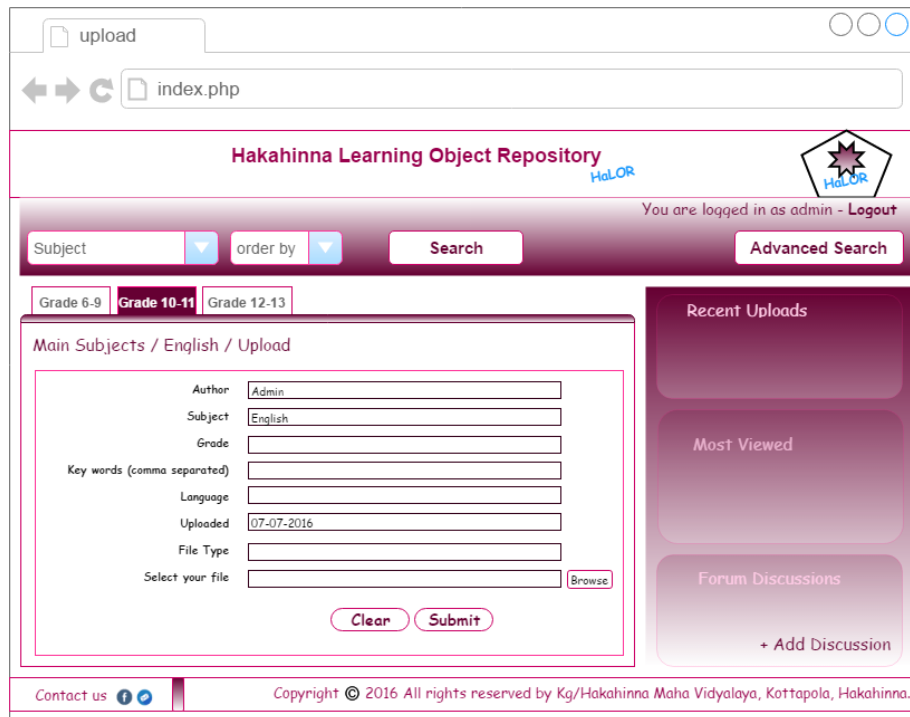
Figure 4. 13 User Interface for Uploading LO into the HLOR

Chapter 5 : System Development

Introduction

System development involves construction of the software product aligning with the system design documentations. Programmers convert the designed system that is in the form of diagrams into executable programmes. Those executable programmes should be tested thoroughly providing that it does what the customer needs.

In this chapter, the way the system is being developed, languages used and editing tools used are discussed.

How the System Being Developed

The system development was done using the MVC framework which was discussed in the former chapter, system design. Php, a server side scripting language was used with the use of HTML which helps to structure the web pages. SQL which is a quarry language is used to connect to the database and do the database operations.

Wampserver is used which consists with Apache server, PhpMyAdmin(Database), and php built in. In Wampserver, there is a web root called 'WWW'(folder). Inside that was created the website folder "HLOR" which is the base for our system.

Object oriented methodologies such as abstraction, inheritance, and polymorphism were implemented during the system development.

Abstraction : Programmer hides unnecessary information from the user reducing the complexity and increasing efficiency.

Inheritance : enables new objects to use the properties of existing object.

Polymorphism : ability to process objects differently depending on their data type or class.

Encapsulation : process of combining data and functions into a single class. Data is not accessed directly but through functions. Attributes are kept private and functions are kept public allowing data hiding possible.

The Languages Used

Php

Hypertext Pre Processor (Php) is a widely used open source, general purpose scripting language. It allows the developers to create dynamic contents with interacting databases. It supports most of the web servers running.

HTML

Hypertext Markup Language (HTML) structures the web pages using markups. The pages in the developed system are created using HTML and Php. The Php code segments are embedded using the code block "<?php" , "?>" to add required functionality to the system.

CSS

Cascading Style Sheet (CSS) describes how the HTML elements are displayed. Separate CSS file is used for styling for managing the consistency of the pages throughout the system. It also makes easy to update the styling once the system is developed and deployed.

The Server

Apache HTTP Server which is commonly known as Apache is open source software available free. It handles the client requests, which are sent through the system.

Database

MySQL is an open source relational database management system (RDBMS). It stores the details of the learning objects and related data organized into relational database supporting the queries sent by the clients and the system.

Editing Tools Used

SublimeText 2

SublimeText is used for coding the system. It allows the developer to manage a project efficiently. It is a proprietary cross platform source code editing software.

Adobe Photoshop

In order to edit the images throughout the site, Adobe Photoshop was used.

Wampserver

Wampserver is a freely available windows web development environment which allows you to create and test web applications on your own computer. It consists with Apache web server, Php, MySql applications. It also provides the database facility through PhpMyAdmin.

Web Folder Structure with MVC

MVC Framework is used for the structuring the application with object oriented php. Mainly it consists of components Model, View and Controller. Interfaces, which interact by the clients, are kept in the views folder. 'Controllers' folder consist controller classes that are extended from 'controller.php'. Extended classes from 'model.php' are in the 'models' folder that interacts with the database.

Following figure 5.1 shows the basic folder structure for HLOR web site.
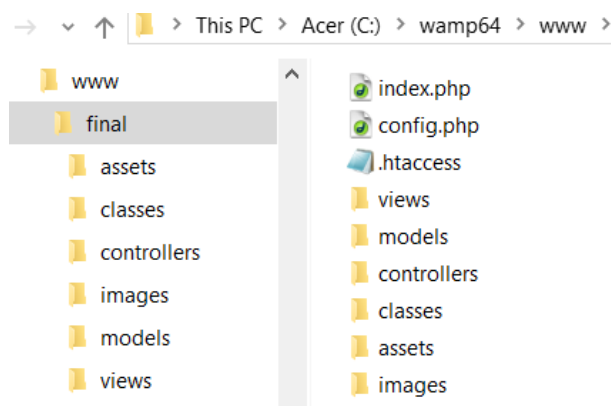
Figure 5. 1 Folder Structure for the HLOR

Web Site Structure

Following figure 5.2 shows the basic web site structure for HLOR.
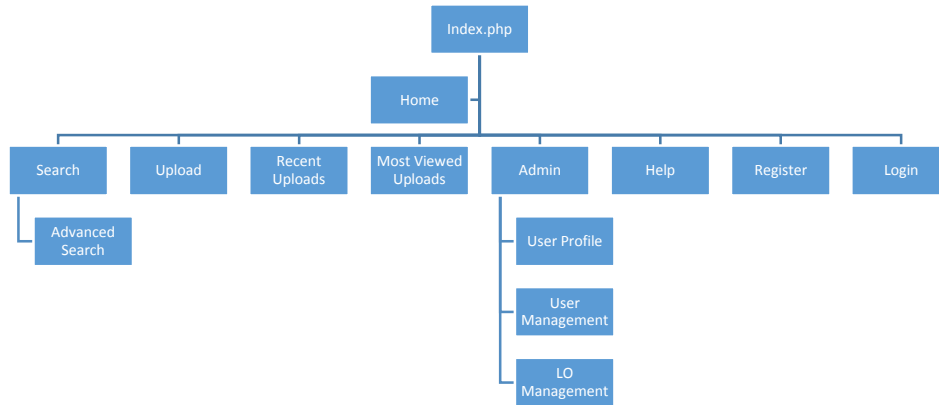
Figure 5. 2 Web Site Structure for HLOR

Chapter 6 : Testing

Introduction

The goal of the testing is to find errors. Testing proves that the customer is provided with a error free (at least for some extend, since human cannot work 100% accurately) software product at the end of the process. Test cases have to be designed in order to find errors as possible not only to prove that the system is operating well but also to prove that the system is error free. The user may react to a system response other than the developers (as programmers expected), creating an error. In order to mitigate that, we have to perform a through testing intensely.

There are strategies that need to be incorporated while designing a test case. Test cases should guarantee the user providing with the right system requirements as well as the logic behind the code also to be correct.

Therefore test case designers use two approaches in test case designing. They are "White Box Testing" and "Black Box Testing".

White Box Testing

Internal program logic is exercised by using the white box testing. That means the result or the outcome should be thoroughly tested against expected outcome.

Black Box Testing

Software requirements are exercised by using the black box testing. Tests for whether the requirements specified are achieved at the end of the development process.

Validation Vs Verification

Validation

"Are we building the right system?", is a common question we have to ask from in order to obtain the validation.

It evaluates the system, in order to check whether the system satisfies its business requirements.

Validation of a software product is achieved through Black Box Testing.

System Testing

After completing the development, the whole system has to be tested against previously identified test cases in order to guarantee the proper functioning of the system. This testing is done by the developer at his own site.

Acceptance Testing

The developed system must totally agree the user requirements. Therefore after complete the development of the system; the tested and properly functioning software should be given to the user in order to get the feedback from the user. If the user is satisfied with the system, that could be implemented in the organization.

Verfication

"Are we building the system right?", It evaluates whether the logic behind the coding would really generate what is expected.

Verification is achieved using White Box Testing.

Unit Testing

Each and every unit that could be tested, was tested for the accuracy of the end result while developing the system. Until there is no error and the expected functionality is achieved, that unit is tested.

Integrate Testing

Every unit of the program that is tested and successfully passed the unit testing phase, will be integrated into the system. After the unit is connected to the system, it should be tested for correct functionality. This process is called integrate testing.

Test Cases

Test cases were designed and implemented on developed software in order to make sure that the developed software is error free. The following table 6.1 displays some of the test cases and corresponding results obtained. Rest of the test cases could be found in the Appendix B.

No	Test Case	Pre- Condition	Expected Outcome	Result
01	Login to the system	User Registered	If the user name and the password match with the database, user logged into the system.	Success
02	User Registration- fail	-	When the user clicks 'submit' button, and the required fields are empty, display an error massage.	Success
03	User Registration- success	User has filled all the required fields.	When the user clicks 'submit' button, display success massage and pending for approval.	Success
04	User Registration- approved	User has submit the user registration form.	Generate an email notifying the user that he/she can access the system.	Success
05	Upload Learning object (LO)	Logged in user	Display a success massage and pending for approval.	Success
06	Upload LO – approved	-	Display the LO to the user	Success

Table 6. 1 Test Cases and Test Results

Chapter 7 : Testing and User Evaluation

Introduction

Testing and user evaluation is a very important milestone in the process of software development. Usability and user acceptance testing are two of the tests that could be used to evaluate the system against customer expectations. If a system does not cater for the customer expectations, though it is very advanced system, it will not be useful and usable.

Therefore usability tests were conducted at end of developing each major module of the system and at the end of the software development process user acceptance test was conducted.

Usability Testing

System is tested to find out how easy to use by using the real users. The users were given a list of five tasks to be completed in a given time (30 minutes) period while observing them.

Sampling of Subjects

Users were selected from the users making some participation of each user category as possible. Therefore a group of users that sums up 17 were selected in each user category as following table 7.1.

User Category	Number of Participants
Students	10
Teachers	5
Admin	2
Total No. Users Selected	17

Table 7. 1 Selection of users for the Usability Testing

Evaluation Scenarios

Total of five tasks were given for each user to complete within 30 minutes of period. Sample task sheet given to the students is given in Appendix C. An evaluation form was prepared and it was given to the evaluator to complete during the usability test. The evaluation form is consisted the following scenarios listed below for each task. The evaluation form used during the evaluation is given in the Appendix D

Scenario 1 :   Time taken to complete each task

Scenario 2 :   Completion of the task

Scenario 3 :   User's facial expressions

Scenario 4:   How often the user requested for help

Scenario 5:   Difficulty level of the task according to user (extremely easy, easy, not

easy)

Scenario 6:   User review on the each task at the end (extremely satisfactory,

satisfactory, need modifications and what, none)

Tools Being Used

- A computer (Desktop/laptop)
- A Evaluation form
- A sheet of paper and pen to take notes if necessary for the user

Critical Analysis of the Result

The data collected during the usability test was thoroughly analysed to check whether the system is successes or does have weaknesses init. The all data related to all tasks were analysed and a summary for each scenario was developed by using SPSS. Following describes the test results for each scenario.

Scenario 1 :   Time taken to complete each task

Following figure 7.1 shows the amount of time taken by each user for each task
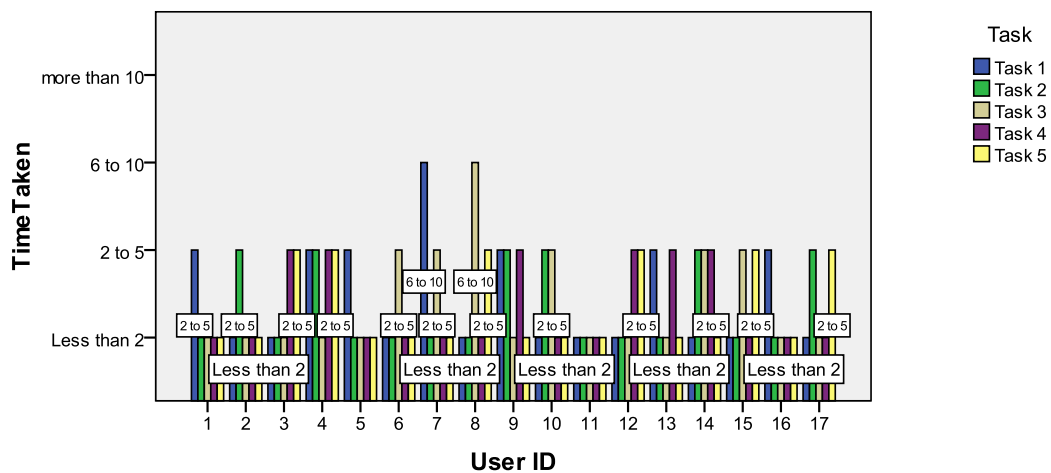
Figure 7. 1 Amount of Time Taken by each User for each Task

34

Following figure 7.2 depicts the percentage of time taken for each task. The whole time given for all the tasks to be completed was 30 minutes. At an average level, each task has taken similar amount of time in general.
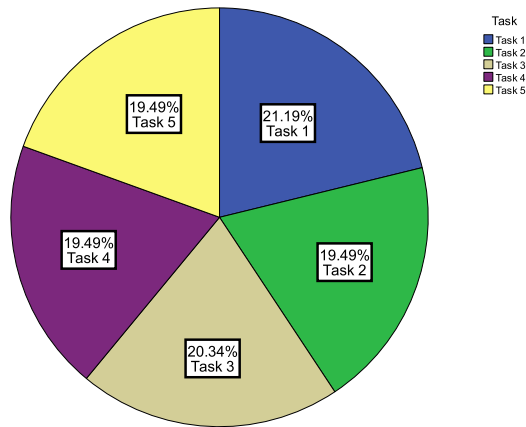
Figure 7. 2 Percentage of Time Taken for each Task

Scenario 2 :   Completion of the task

The following figure 7.3 shows the completion of each task by each user. According to the following bar chart, all the users have completed each task successfully.
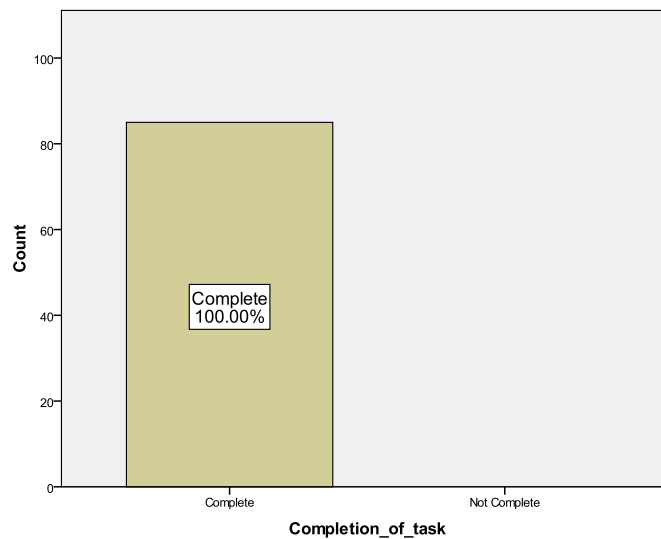
Figure 7. 3 Completion of tasks by each User

Scenario 3 :   User's facial expressions

Users facial expressions tell us more about the usability than words. Words could be misleading. The following figure 7.4 depicts the summary of the facial expression for each task as a whole.
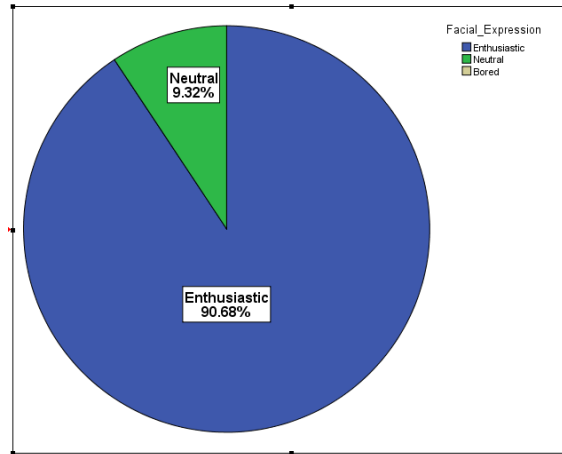
Figure 7. 4 Facial Expression according to the Task

Scenario 4:   How often the user requested for help

The percentage of user requesting for assistance is shown in the following figure 7.5. According to this figure, the instruction given by the system is in a acceptable level since 74.12% of the time, user did not request for a assistance.
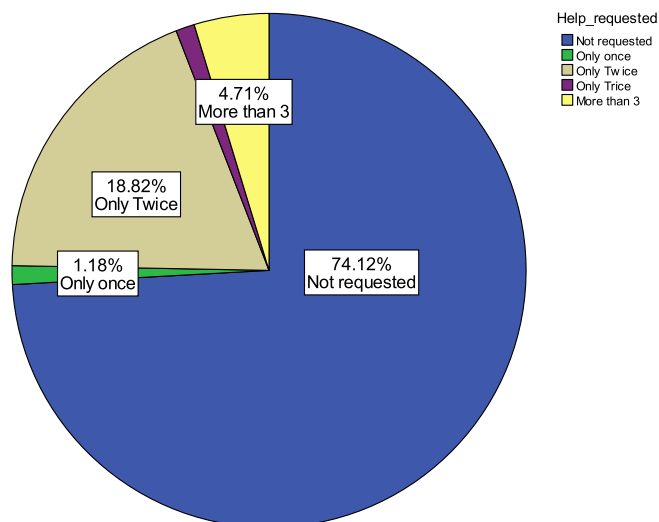
Figure 7. 5 Help Requested

Scenario 5:   Difficulty level of the task according to user

As a whole tasks were done easily by the 98.83%. The following figure 7.6 depicts that information.
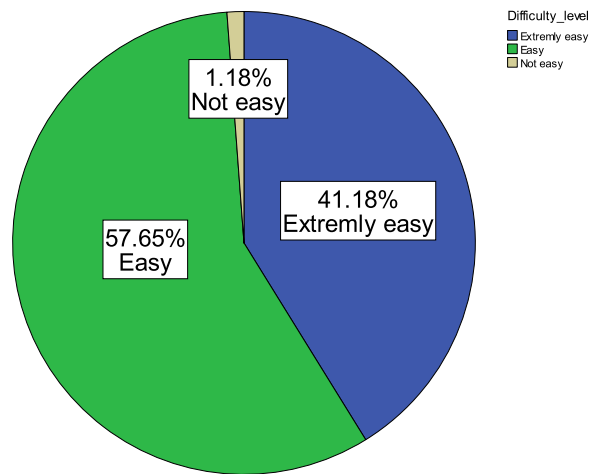
Figure 7. 6 Difficulty Level of The tasks

Scenario 6:   User review on the each task at the end

According to the following figure 7.7, all the users were satisfied with the system.Satisfactory level is 100%.
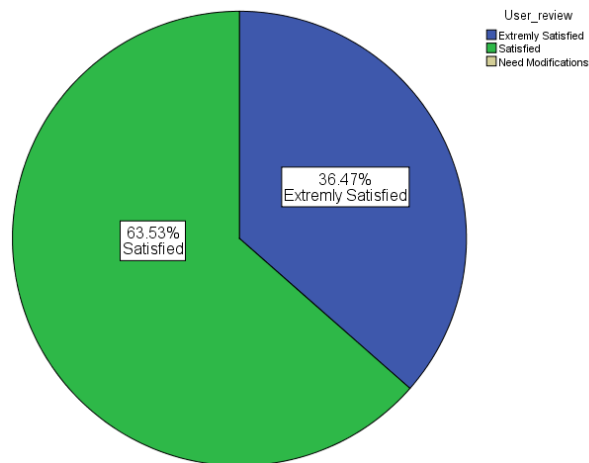
Figure 7. 7 User Satisfactory Level

User Acceptance Testing

Overall system acceptability is tested by user acceptance testing. The selected users were given a one week of time to use the system. At the completion of the period, a questionnaire was given to each participant. The questionnaire that was used is given in Appendix D

Sampling of Subject

Five students, five teachers and two admin were selected for the acceptance testing from the users on voluntarily basis. They were given a one day training focussing on demonstration of the system functionality.

Evaluation Scenarios

> Scenario 1 :   ease of using the system
>
> Scenario 2 :   Level of satisfaction towards the system
>
> Scenario 3 :   Likelihood of recommending the system to someone else.

Tools Being Used

> Computers – Desktop/laptop
>
> Questionnaire

Critical Analysis of the User Acceptance Testing

Scenario 1 :   ease of using the system

The following figure 7.8 depicts the overall system usability on users' point of view. Majority of the users opinion on the system was "it is easy to use". Not a single user have selected that the system is not easy to use.
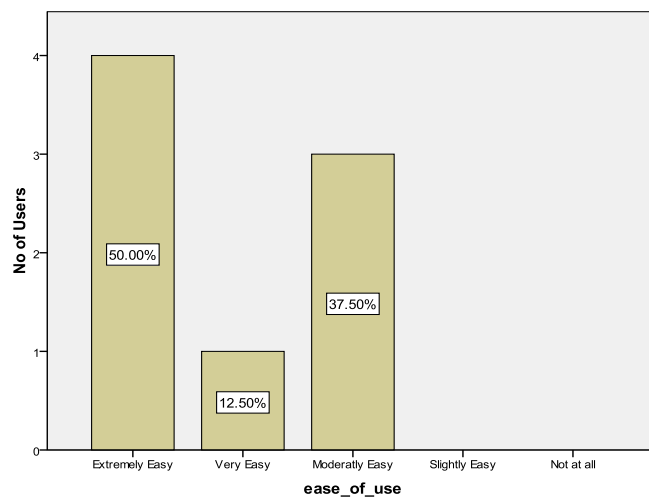
Figure 7. 8 System : Ease of Use

Scenario 2 :   Level of satisfaction towards the system

The following figure 7.9 shows that almost all the users are satisfied with the system.

No of Users

Extermely Satisfied	50.00%
Moderately Satisfied	12.50%
Satisfied	37.50%

satisfactory_level
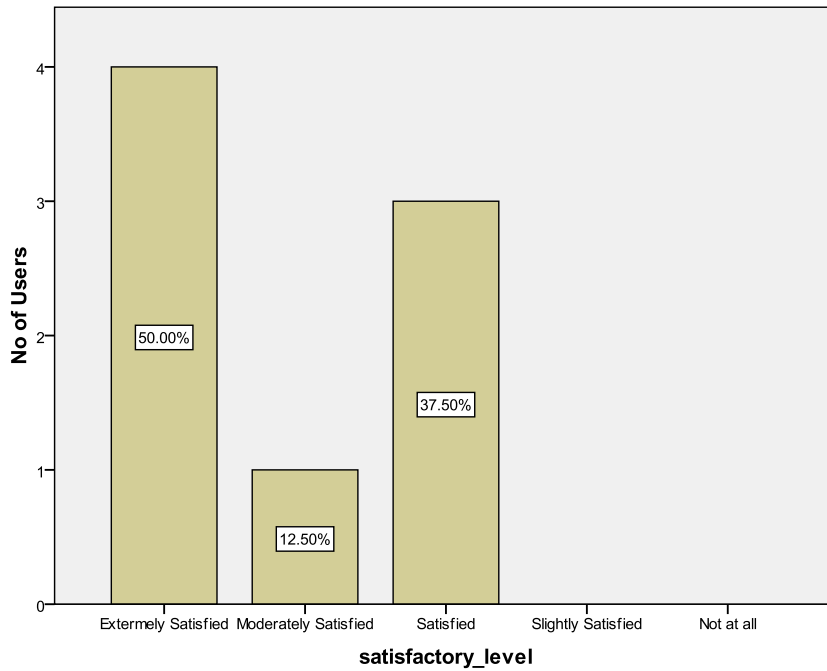
Figure 7. 9 System : User Satisfaction

Scenario 3 :   Likelihood of recommending the system to someone else.

According to the following figure 7.10, it is very likely to be recommended by 88.24% of the users.

Recomond_to_other
■ Very Likely
■ Likely
□ Not at all

11.76% Likely

88.24% Very Likely
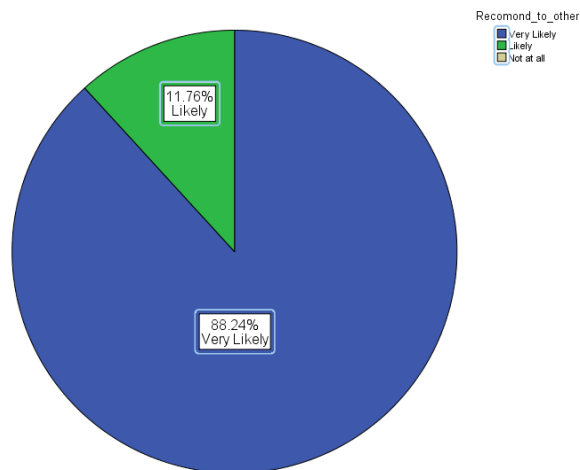
Figure 7. 10 System : User Recommending the system to another

Chapter 8 : Conclusion and Future Work

Major Findings

Object oriented methodology was used with MVC framework. PHP language together with HTML, CSS, and SQL quarries were used to develop the system.

The MVC framework helps to structure the website into model, view and controllers making it possible to practice object oriented principles within the system.

The user interacts with the system through views. The controllers and models support the view to provide user interfaces which the user interacts according to the user requests.

Lessons Learnt

Following a SDLC helps to organize the project work better

Using a framework for building software makes lot easier.

Clarity of coding saves time in future

Proper planning makes successful completion of a project

Deep understanding of how to build software on one's own from the scratch

Achievement of Objectives

Major objective of the project was providing online web space that is able to store and retrieve learning objects. HLOR was developed successfully making the main objective a success.

Other objectives such as share learning objects, reducing recreating LO's with same content, saving valuable time and money of the user's were also being achieve through HLOR.

Since the system was adopted user interface design techniques and principles a user friendly, easy to use, efficient user interfaces were developed. Proper navigation structure was used to connect all the pages with one another providing the user with easy navigability.

Therefore, it can be concluded that all the objectives were achieved successfully and the software was developed and deployed in the institute successfully.

How to extend the project in future

The developed system is operating on English language. Most of the users prefer to use Sinhala as the system language. Therefore the system should be converted into a multi lingual web site that enables the user to select the preferred language and work with HLOR using that language.

That could be done through language translators. But human translators are more preferred to convert the content since they are more accurate than the program. The same programming coding and structure would be able to use by adding some views that supports the preferred language.

The developed software does not support creating learning objects within the site. It would be great if it is possible to do so. That could be achieved through introducing templates to use for learning object creation.

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Appendix A

Detailed Class Diagram for HLOR
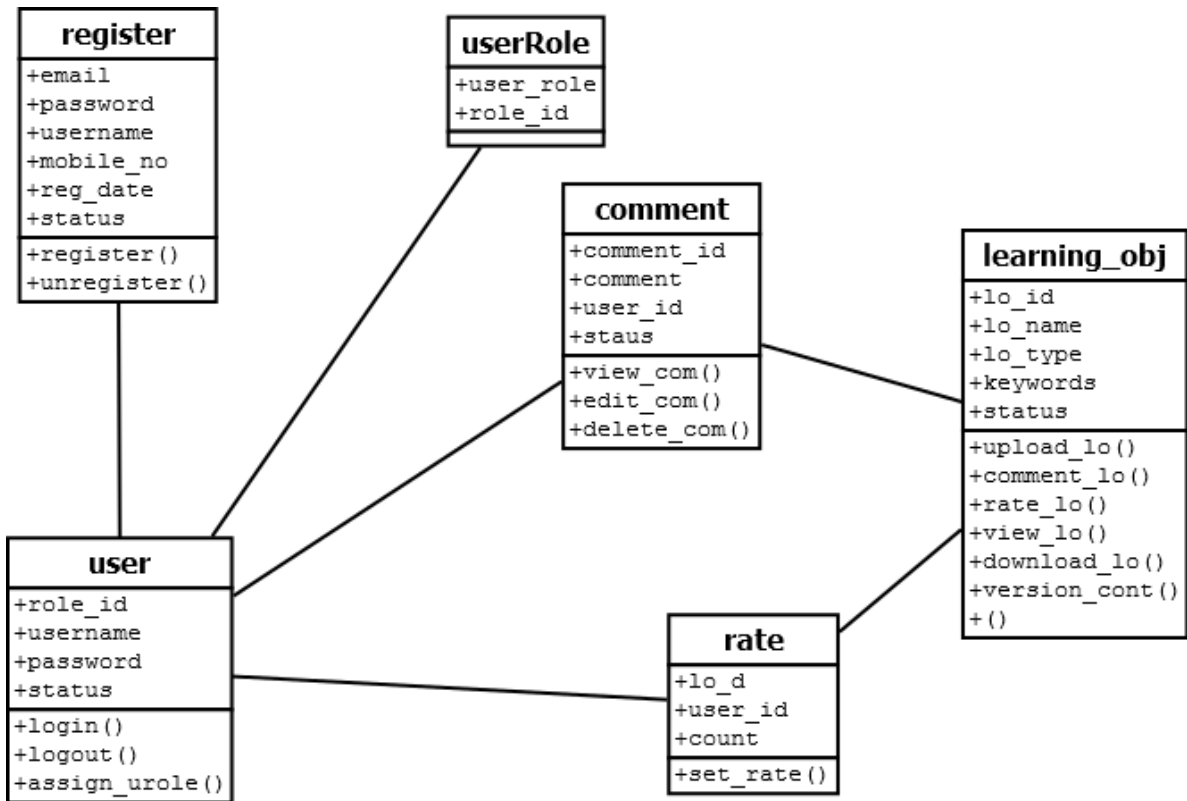
Appendix B

Rest of the test cases are as follows

06	View LO	-	The LO is opened	Success
07	Download LO	Logged in user	LO is downloaded to the client machine.	Success
08	Rate LO	Logged in user	Select the rating and submit. The self-rating should be displayed with the LO	Success
09	Update rating	LO is rated by the logged in user	Change the rating and display the self-rating with the LO	Success
10	Display Rating	-	The average rating for a LO should be displayed with the LO	Success
11	Add Comments to LO	Logged in user	Clicking the 'Add Comments' button, user should be able to type the comment and press enter, it will be submitted and display the comment in the comments section.	Success
12	Edit Comments to the LO	LO is commented by the logged in user	'Edit' button is displayed with the comment and successfully edited the comment	Success
13	Search for a LO	-	Clicking the 'Search' button, a list of available LO's should be displayed.	Success
14	Advanced Search	-	Clicking the 'Advanced Search' button, a form for advanced search should be displayed. At the end it should display a list of LO's	Success

			according to the search.	
15	Most Recently added LO's	-	Clicking the 'Most Recent LO's' tab, it should display the list of most recently added LO's	Success
16	Display User Profile	Logged in user	The personal details of the logged in user will be displayed	Success
17	Update User Profile	Logged in user	The personal details of the logged in user can be updated and the updated user profile is displayed upon the submission.	Success
18	Approve the registered user	Logged in as admin	The list of pending registered users will be displayed and clicking the 'Approve', email is sent to the user and update the database.	Success
19	Edit User role	Logged in as admin	Search a user by email and edit his user role. Display success massage and inform the user through the mail.	Success
20	Approve the LO	Logged in as subject expert	A list of uploaded LO's will be displayed. One by one, the LO can be viewed and press 'Approved'. After pressing the button, it should display a success massage and display the LO to the user.	Success
21	Remove a LO	Logged in as	By clicking 'Remove' button	Success

		subject expert or the owner of the LO	and confirm the action by the user, the LO will be removed from the database. A notification is sent to the owner's email.	

Appendix C

Customer Feedback Form

Customer Feedback Form

- o Name   : …………………………………………………………………………………
- o Designation : …………………………………………………………………………………
- o The part of the system developed is
    - ☐ Strongly Accepted
    - ☐ Accepted
    - ☐ Need Modifications

    Please suggest …………………………………………………………………………………
    ……………………………………………………………………………………………………
    ……………………………………………………………………………………………………
    ……………………………………………………………………………………………………
    ……………………………………………………………………………………………………

- o Any other new requirements you think useful …………………………………………..
    ……………………………………………………………………………………………………
    ……………………………………………………………………………………………………
    ……………………………………………………………………………………………………

    Date : …………………………..   Signature : ……………………………………

Task Sheet

<div style="border: 1px solid black;">

Task Sheet for Usability Test 1

Important : You are registered to the system.

Task 1:

        Your username is your NIC number

        Your password is 1234

Log in to the system using above mentioned credentials.

Please mark the difficulty level of the task(how difficult was the task for you)

- ☐ Extremely Easy
- ☐ Easy
- ☐ Difficult

Please mark the level of satisfaction about the task.

- ☐ Extremely Satisfied
- ☐ Satisfied
- ☐ Not satisfied, Please state why ....

Task 2:

Change your password.

Please mark the difficulty level of the task(how difficult was the task for you)

- ☐ Extremely Easy
- ☐ Easy
- ☐ Difficult

Please mark the level of satisfaction about the task.

- ☐ Extremely Satisfied
- ☐ Satisfied
- ☐ Not satisfied, Please state why ....

Task 3:

Find a learning object related to science and view it.

Please mark the difficulty level of the task(how difficult was the task for you)

- ☐ Extremely Easy
- ☐ Easy
- ☐ Difficult

Please mark the level of satisfaction about the task.

- ☐ Extremely Satisfied
- ☐ Satisfied
- ☐ Not satisfied, Please state why ....

</div>

Task 4:

Add a comment to the viewed learning object

Please mark the difficulty level of the task(how difficult was the task for you)

- ☐ Extremely Easy
- ☐ Easy
- ☐ Difficult

Please mark the level of satisfaction about the task.

- ☐ Extremely Satisfied
- ☐ Satisfied
- ☐ Not satisfied, Please state why ....

Task 5:

Rate the learning object viewed and logout of the system.

Login to the system again and logout.

Please mark the difficulty level of the task(how difficult was the task for you)

- ☐ Extremely Easy
- ☐ Easy
- ☐ Difficult

Please mark the level of satisfaction about the task.

- ☐ Extremely Satisfied
- ☐ Satisfied
- ☐ Not satisfied, Please state why ....

Evaluation Form for Usability Test

	Time Taken				The Task		Facial Expression			Help needed				Difficulty level				Satisfaction			
	Scenario 1				Scenario 2		Scenario 3			Scenario 4				Scenario 5				Scenario 6			
	Less than two minutes	2 to 5 minutes	6 to 10 minutes	more than 10	Complete	Not Complete	Enthusiastic	Neutral	Bored	Once	Twice	Trice	More than 3	Extremely Easy	Easy	Difficult	Reason for difficult	Extremely Satisfied	Satisfied	Not satisfied	Reason for not satisfied
Task 1																					
Task 2																					
Task 3																					
Task 4																					
Task 5																					

End User Evaluation Form

<div style="border:1px solid;">

User Evaluation Form

1. I am a

   ☐ Student   ☐ Teacher   ☐ Administrator

2. How long have you being using computer

   ☐ Less than one years

   ☐ Less than two years

   ☐ Less than five years

   ☐ Less than ten years

   ☐ More than ten years

3. How easy to use the system is

   ☐ Extremely easy

   ☐ Very easy

   ☐ Moderately easy

   ☐ Slightly easy

   ☐ Not at all

4. Are you satisfied with overall capability of doing the intended tasks (According to your identification) ?

   ☐ Extremely satisfied

   ☐ Moderately satisfied

   ☐ Satisfied

   ☐ Slightly satisfied

   ☐ Not at all

   If you have any suggestions please let us know

   …………………………………………………………….........................………….

   ……………………………………………………………………………………………

   ……………………………………………………………….

5. Instructions given within the system is…….

   ☐ Extremely satisfied

   ☐ Satisfactory

   ☐ Acceptable

   ☐ Not acceptable

</div>

If you think the way instructions given should be changed, please let us know what you expect …………………………........................…………………………
…………………………………………........................…………………………..
…………………………………………...........…………………………………..
…………………………………

6. How likely you would recommend the system to others?
   ☐ Very likely
   ☐ Likely
   ☐ Not at all

****

Thank you very much for spending your valuable time for completing this feedback form. Your ideas value us lot.