



Project Report
On
LU Exam Hive

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A project paper submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering.

CERTIFICATION OF REPORT

This is to certify that the work presented in this report is the outcome of the investigation carried out by the candidates under the supervision of Minhazul Haque Bhuiyan (Assistant Professor & Assistant Proctor of the Department of Computer Science & Engineering).

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Preface

Our first and foremost gratitude is to our GOD Almighty who has been with us all along and giving us the strength to complete the Final Year Project successfully.

We like to share our sincere gratitude to our project supervisor, Minhazul Haque Bhuiyan for his continuous support towards this project.

During the work we faced many challenges due to our lack of knowledge and experience. And our supervisor helped us to get over from all the difficulties and in final compilation of our idea to a shaped sculpture. His suggestions and guidance helped us a lot to prepare this report in a well-organized manner.

We are also thankful to our whole class and most of all to our parents who have inspired us to face all the challenges and win all the hurdles in life.

The report documents of this project work performed in the course CSE-4800 & CSE-4801 “Project II/Thesis” by Mohammed Saduzzaman Sadi, Toufique Ahmed, and Mohi Uddin Pabel. Project II/Thesis counts for 6 credit points and is executed by dividing it into two parts in two semesters. In the 11th semester CSE-4800 for Project Proposal which is 3 credit and in the 12th semester CSE-4801 for the Project Submission which is also 3 credit. Total 6 credits.

The project intends to give Leading University an Online Exam Platform for teachers to take exams and students can give exams remotely.

Supervision Agreement

The program outlined in the project is adequate for the degree of Bachelor of Science in Computer Science and Engineering. The supplies and facilities are available and we are willing to supervise and evaluate the project work.

Supervisor Signature

Minhazul Haque Bhuiyan

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LU Exam Hive

Abstract

The purpose of the project “LU Exam Hive” is to create a web based online examination system. The website is supported in both Desktop and Smartphone platform.

Exam questions can be created by the teachers once they are logged into their account. Question type can be chosen and number of questions is dependent on the teacher’s preference. Questions are displayed in tabular format in the dashboard. Teacher can edit or delete a question. Questions will be available for students once the teacher posts it in a publicly viewed post page that is visible for both teacher and students.

Students have to register to the website first in order to gain log in access. After log in the can see all the available questions in the post page in a tabular format with all the required information about the question. From there they have to choose their course teachers question, which can be identified by the information given on the question.

Once student selects the question, it will redirect to the answer script where they will have to fill up a little form about themselves to verify that he/she is an actual student. Then they can write or choose the answer of the questions that are available and given by the teacher. Once they are finished, they can submit the answer script.

Teacher can specify a time as a deadline for submitting the answer script. They can decide to accept the answer script or not based on the time given and there will be the exact timestamp of when the student submitted the script.

The significance and purpose of this work is to provide a user friendly and reliable web based online examination system for the teachers and students of Leading University.

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Chapter – 1

Introduction

1.1 The Project

The Internet has revolutionized communications, to the extent that it is now our preferred medium of everyday communication. In almost everything we do; we use the Internet. And this happens through what is called the web or web application. It's also having a greater impact on the education systems too. Also, in recent times, the COVID-19 outbreak sent the world spinning into complete and utter chaos. Going outside was restricted and industries, offices, educational institutions were closed for a long time.

Especially educational institutions are closed till now. At that time educational institutions had to find an alternative way of taking exams and keep other educational activities running. For that, almost every institution had to teach and take exams remotely via various websites. Zoom, Classroom, and other web-based applications became more renowned. The impact is so big that every university is relying on those websites to continue academic activities.

The objective behind developing this website was to facilitate the exam system for Leading University's teachers and students so that they don't have to rely on other third-party web applications for taking exams. The website will allow teachers to take exams and students can attend and give exams remotely. The project is developed mainly with PHP programming language from scratch.

1.2 Website

A website (also written as web site) is a collection of web pages and related content that is identified by a common domain name and published on at least one web server. Notable examples are wikipedia.org, google.com, and amazon.com.

All publicly accessible websites collectively constitute the World Wide Web. There are also private websites that can only be accessed on a private network, such as a company's internal website for its employees.

Websites are typically dedicated to a particular topic or purpose, such as news, education, commerce, entertainment, or social networking. Hyperlinking between web pages guides the navigation of the site, which often starts with a home page.

Users can access websites on a range of devices, including desktops, laptops, tablets, and smartphones. The software application used on these devices is called a web browser.

The World Wide Web (WWW) was created in 1990 by the British CERN physicist Tim Berners-Lee. On 30 April 1993, CERN announced that the World Wide Web would be free to use for anyone. Before the introduction of the Hypertext Transfer Protocol (HTTP), other protocols such as File Transfer Protocol and the gopher protocol were used to retrieve individual files from a server. These protocols offer a simple directory structure which the user navigates and where they choose files to download. Documents were most often presented as plain text files without formatting or were encoded in word processor formats.

1.3 Web Project

A web project is the process of developing and creating a Web site, activities in a network which are aimed at a pre-defined goal. The network can be both accessible for everyone, as in the Internet, or only for certain people, as an intranet. The goal of Web projects is the transfer of static and dynamic content - both directly to end users, as well as indirectly through means of various kinds of interfaces. Web projects are based on TCP/IP (Transfer Control Protocol/Internet Protocol) technology and concern the transfer of static and dynamic content.

1.4 Highlights of Web Project

A Web project involves many aspects, including programming and the accompanying software development, Web business, Web server and network administration, hosting, graphics/design, the development and administration of databases, construction of interfaces, project management and quality assurance, and much more.

Programming for a web project may be accomplished using one or more markup languages (such as HTML, CSS, XML), scripting languages (JavaScript, Perl, PHP for example).

When hosting a Web project, the primary objectives include the provision of the necessary hardware and software infrastructure, and an assurance that the highest possible levels of availability and reliability are offered. Graphic/Web design for Web projects must offer a high quality of use for persons interacting with the website. Agile project management methods (e.g., Scrum) are used for the management of modern Web projects in order to respond to changes in customer requirements and constraints as the project progresses. The project manager is responsible for the efficient and result-oriented programming of the Web project.

1.5 Problem Definition

The project is to anticipate the impact of using the traditional web-based online examination systems for our university. All the systems that are used to continue the academic activities, especially during this pandemic, are third party programs that have both advantages and disadvantages. Also, most of them, especially programs that used to take exams, have many limitations. As a result, faculty members have to use different web applications to teach the students and take exams.

1.6 Project Contribution

The main contribution of the project is to present an extensive understanding of how to bring about the examination system remotely through a web platform. Now a web platform is supported in almost all kinds of devices that can access the web. However, the goal of this project is to construct a website for devices that are helpful for online exams like laptops, tablets, and smartphones. The final prototype covers the basic design and functionalities of LU Exam Hive like generating questions, posting them, process of student giving exam and retrieving the result.

Chapter – 2

Background

2.1 Primary Focus

The modern education system has been favored a lot by web technologies. Now educational institutions making automated systems that easy to maintain and bring flexibility to the infrastructure. As for taking exams, almost all educational institutions were following the traditional method of taking exams at the exam hall which they should. But in the recent time when the COVID 19 started spreading out and institutions has to close unexpectedly. We had no choice but to stay at home and institutions started their academic activities online like taking classes and tests. They were using various web apps and websites that make the work easy for them. But these various web apps or websites were different from each other. Some have many features, some have less, some are very complex, some are so simple that they missed out on a lot of things. And most lot of them require money for to use their advanced features.

We came up with the idea of creating a web-based online examination system for our final year project that is for our university which would not have any kind of special requirement or anything that makes taking an exam online inflexible for the teachers. Our main focus is to create a web-based online examination system for our university, so the teachers do not have to depend on other third-party websites to take exams. And we believe as Leading University is one of the most prestigious university in Sylhet and in whole Bangladesh, we should have our own online platform for teachers and students to take part in exams. And the recent time had shown us how things could change at any time. So, it's always good to have an alternative way of taking exams for the university. And the most efficient, reliable way would be through websites or web-based online examination system.

2.2 Prerequisites and Key Reasons

Our proposed project, the "LU Exam Hive," is essentially an online examination system for Leading University. And the core reasons are:

- Leading University does not have its online examination system.
- The sudden pandemic occurrence made us realize we need an online solution for taking exams remotely.
- Other third-party solutions are inflexible for a lot of reasons.
- Leading University could have their own solution.
- Leading University teachers do not have to rely on third-party solutions.

The prerequisites would be to have a better understanding of how the web works. Then plan a solution for the whole scenario. Then construct a design of the solution. Then to put this on the web and provide it its required functionalities. Implement with the markup, programming language, creating database, and all other necessary things that require to full fill the project. And the most important thing is to make sure that we can do it.

2.3 Execution Plan

First up, we have to acquire the essential knowledge of the fundamentals like the required programs, programming languages, and other necessary things to build the project. The Scrum approach would be followed to execute the project. The Scrum approach is a general Agile method and its focus on managing iterative development rather than specific agile practice.

Three phases of Scrum:

- The initial phase, the planning where the objectives for the project and software architecture design are established.
- Followed by a series of sprint cycles, where each cycle develops an increment of the system.
- The last phase, the project closure phase wraps up the project, completes required documentation such as system help frames and user manuals.

It is expected to conclude the project in time, within a number of sprint cycles. The project work will be conducted by our project supervisor 'Minhazul Haque Bhuiyan'. Supervisor would be reported, after the development of a major increment of the project.

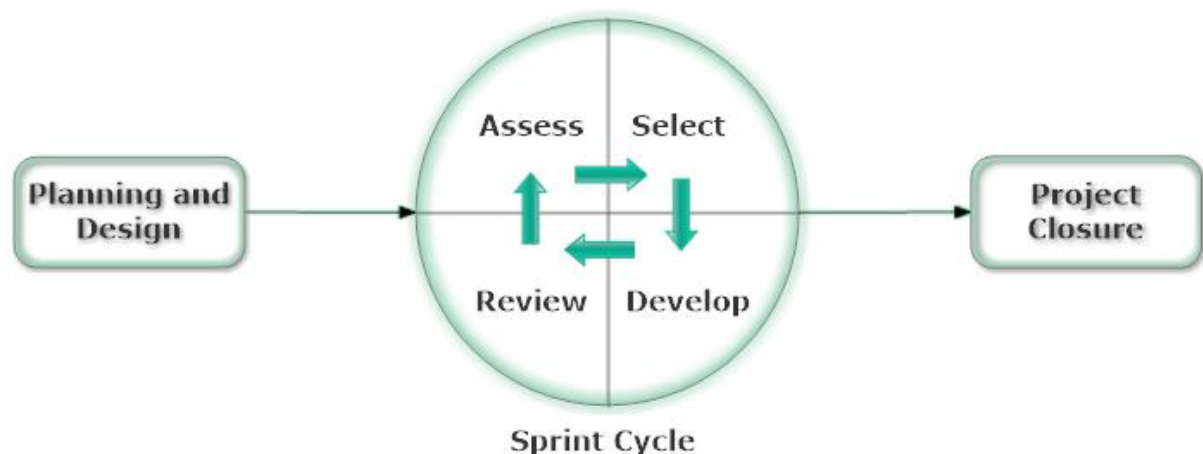


Figure 2.1: The Sprint Cycle of Scrum.

2.4 Expected Outcome

As we proceed throughout the final year project, obviously we need to set the goal of what we want to achieve. The proposed project LU Exam Hive is an online examination platform. And as we stated in the project proposal, the desired outcome of the project would be to; provide a fully functional web-based online examination system for Leading University. It will have three types of users. 1. Teacher, 2. Student, 3. Admin.

Primarily as of our plan, the users will have the following functionalities:

1) Teacher:

- Login and logout.
- Create questions and make them available for students.
- A dashboard to manage questions, and other functionalities.
- Edit the question before making them available for students.
- See the answer script of students and mark them.

2) Student:

- Login and logout.
- See available questions.
- Select and write answers for the specific set of question.
- Submit the answer script.

3) Admin:

- Login and logout.
- Receive and review contact messages.
- Modify, change, delete, or add data through an UI rather than doing it from the database.

Chapter – 3

System Analysis

3.1 Existing System

Throughout our university time, especially during the pandemic situation. We have experienced the use of many web-based online examination systems. The most notable of them are the Google Form and the FlexiQuiz. Though there are many systems like these are available, these two are very common and used widely. Other websites like the "think exam" have many features like Question Bank, Candidate Management, Test Creation, Monetize, Test Taker Panel, Optimum Reporting System, etc. Per questions, a user can have only 30 other people take the exam in the free trial, which is also only for 30 days. SpeedExam is another popular platform for taking exams online and just like "think exam," it requires money to get advanced features. Every system has somewhat identical features but most of them vary from one another. Google Form is mainly a service that helps someone to take surveys via form and it is one of the best. As it is a survey administration software or system it is not very effective for taking academic exams. As a result, our faculty members use FlexiQuiz along with Google Form for its flexibility in taking exams and providing results.

3.2 Drawbacks of Existing System

- Features of them vary from one another.
- Some have most of the features but, features are limited for non-premium users.
- Free systems do not have most of the required functionalities.
- One system that does not provide a particular service, may be available in another system.
- As a result, users may have to use more than one system.
- All of these systems are third party and none of them belong to Leading University.
- User data including all data of student's exams are stored in a third-party database.
- Full version systems are paid one.

3.3 Proposed System

The proposed system entitled "LU Exam Hive" is going to be an own product Leading University. That would be maintained by the staff including; faculty members of Leading University. And also, would be used by the students for the exams that require to take online. As of now, it will only be available for the Department of Computer Science and Engineering. Teachers can have a platform to take the exam remotely with advanced features and they do not have to pay for it.

3.4 Advantages of Proposed System

- Teachers would not have to pay to use its advanced features.
- Almost all required features are available.
- Any modification or any features can be included, according to user's need.
- Leading University stuff will have full control over the system.

Chapter – 4

Requirement Specification

Having explored a few existing web-based online examination systems and determining the functionalities of LU Exam Hive. We have initially come to a conclusion. And this chapter describes all the requirements for LU Exam Hive. Our team will develop the Online Examination System for Leading University

4.1 Overall Description

4.1.1 Product Function

The Online Examination System LU Exam Hive (LUEH) provides a range of features and functionalities. It is a system that enables the students and teachers of Leading University to take online exams more conveniently. Following are a list of some of the functionalities that the website will provide:

- Administrator user.
- Supports multiple users.
- The administrator can control users.
- User registration and login.
- OTP Verification.
- Dashboard for all users.
- Create questions.
- Manage questions.
- Take exam.
- Prepare result.
- Displaying individual results.
- Lists of posted questions.
- Personalized table of questions.

4.1.2 User Classes and Characteristics

LUEH General Members and non-members:

Most of the general users of the LUEH are familiar with web browsers and web-based interfaces and interactions.

Teachers and Students:

Teachers and Students are good enough in almost all web-based online examination system operations as well as familiar with the basic interactions of websites.

System Manager:

The system manager is a technical person who has expert knowledge to operate the online examination system. He is also familiar with website management operations.

4.1.3 Constraints

The following are a general list of constraints that would delimit the developer's options while building the LUEH:

1. The system shall be able to use the MySQL database.
2. The system shall be able to run on most web browsers like Chrome, Opera, Firefox, Safari, Microsoft Edge.
3. The system shall be able to run on mobile devices like Android and IOS.
4. The system shall never store historical data of a user only information related to exams and management purposes.

4.1.4 Assumptions and Dependencies

As website reliability depends on its server and good server with higher performance is very costly. We assume that we will have to "pave our own way" concerning programming the majority of the website and the database, due to the mostly closed-source and secretive nature of major online examination systems. For what we cannot find from open documentation and research, it is assumed that we will have to deduce how LUEH standards and database work from observing external behaviors found in existing online examination systems, and we will have to replicate the results using our own code and design.

4.2 External Interface Requirements

4.2.1 User Interfaces

User interfaces for all users will be graphical user interfaces (GUI). These GUI will be web-based and accessible via a web browser.

Teachers:

The teacher interface would enable the teacher to perform all the functionalities which the system provides for this type of user. Teachers will be able to log in, create questions, see submitted answers, make results, log out, etc.

Students:

This interface allows the students to register, log in, see personalized questions, take exams, logout. These features will also be available through the web interface.

System manager or Admin:

The system manager interface would enable the manager to perform all the functionalities which the system provides for this type of user. The system manager will be able to perform the same tasks that the other users. Moreover, he will also be able to control the database and take action if required.

Non-members:

Any outsider who's not a teacher, student or a stuff of leading university, will just be able to interact with and visit the index page of the website.

4.2.2 Hardware Interfaces

1. Regular PC:

- **Processor:** Dual Core or Higher (SSE3 capable).
- **Ram:** 2GB or Higher.
- **Hard Disk Space:** 1GB or Higher.

4.2.3 Software Interfaces

To build the website it will require some software that helps to make a website. A modern browser, a text editor, a local server software, etc. More about software interface will be discussed in Chapter 6: Software Requirements.

4.3 System Features

4.3.1 Functions

4.3.1.1 Authentication

Requirements ID	Functions.Authentication.Login
Title	Login
Description	The users shall be able to login into the LUEH by entering their email and password
Identifier/Source	Minhazul Haque Bhuiyan, Project Supervisor, in a virtual meeting on 02.11.2020
Rationale	The system would have to distinguish users so that they are only authorized to view the data that is meant for them
Restrictions & Risks	User might forget username/password
Dependencies	For Student: Functions.Authentication.Register

Requirements ID	Functions.Authentication.Logout
Title	Logout
Description	The logged in users shall be able to logout of the system
Identifier/Source	Minhazul Haque Bhuiyan, Project Supervisor, in a virtual meeting on 02.11.2020
Rationale	Authorized users may want to leave LUEH
Restrictions & Risks	N/A
Dependencies	Functions.Authentication.Login

Requirements ID	Functions.Authentication.Register
Title	Register
Description	The student user shall register into LUEH by entering their email and student info before gaining access to other functionalities
Identifier/Source	Team members, in virtual meetings.
Rationale	The system would have to distinguish users so that they are only authorized to view the data that is meant for them
Restrictions & Risks	Student user may try to register more than once
Dependencies	For Students: Functions.Authentication.OTP

Requirements ID	Functions.Authentication.OTP
Title	OTP
Description	The student user shall verify their email by using the OTP sent to their email during registration
Identifier/Source	Team members, in virtual meetings.
Rationale	The system would have to identify users as real person
Restrictions & Risks	Valid email address required
Dependencies	N/A

Requirements ID	Functions.Authentication.Forget.Password
Title	Forget Password
Description	The student user shall reset their password by the link sent to their email in case they forget it.
Identifier/Source	Team members, in virtual meetings.
Rationale	Users may forget their password
Restrictions & Risks	Valid email address required
Dependencies	Functions.Authentication.Register

4.3.1.2 Manage Question

Requirements ID	Functions.ManageQuestion.Create Question
Title	Create Question
Description	The teacher user shall be able to add or create new question to the LUEH database
Identifier/Source	Minhazul Haque Bhuiyan, Project Supervisor, in a virtual meeting on 02.11.2020
Rationale	This is needed to add data regarding new question
Restrictions & Risks	N/A
Dependencies	N/A

Requirements ID	Functions.ManageQuestion.Post Question
Title	Post Question
Description	The teacher users shall be able to post the created questions
Identifier/Source	Team members, in virtual meetings.
Rationale	The teacher users shall be able to post the question so it will be made available for the student users.
Restrictions & Risks	N/A
Dependencies	Functions.ManageQuestion.Create Question

Requirements ID	Functions.ManageQuestion.View Question
Title	View Question
Description	The users shall be able to view a list of available questions
Identifier/Source	Team members, in virtual meetings.
Rationale	All the users shall be able to view the question so they know what questions are currently available. The student user can then select the particular question and take the exam.
Restrictions & Risks	N/A
Dependencies	Functions.ManageQuestion.Post Question

Requirements ID	Functions.ManageQuestion.Edit Question
Title	Edit Question
Description	The teacher users shall be able to edit the created questions
Identifier/Source	Team members, in virtual meetings.
Rationale	The teacher users shall be able to edit the question before posting.
Restrictions & Risks	Once a question is posted, it shall not be edited
Dependencies	Functions.ManageQuestion.Create Question

Requirements ID	Functions.ManageQuestion.Delete Question
Title	Delete Question
Description	The teacher users shall be able to delete the created questions
Identifier/Source	Team members, in virtual meetings.
Rationale	The teacher users shall be able to delete the question before posting or after the exam is done and after publishing the result.
Restrictions & Risks	Question shall not be deleted during exam.
Dependencies	Functions.ManageQuestion.Create Question

4.3.1.2 Manage Answer

Requirements ID	Functions.ManageAnswer.Submit Answer
Title	Submit Answer
Description	The student users shall be able to submit the answer.
Identifier/Source	Team members, in virtual meetings.
Rationale	The student users shall be able to submit the answer for the particular posted question so teacher will get it.
Restrictions & Risks	Student might try to submit answer twice for the same question.
Dependencies	Functions.ManageQuestion.Post Question

Requirements ID	Functions.ManageAnswer.Generate Result Document
Title	Generate Result Document
Description	The teacher users shall be able to generate result document format.
Identifier/Source	Team members, in virtual meetings.
Rationale	The teacher users shall be able to generate the result in a document format. Preferably in PDF document format.
Restrictions & Risks	Naming constraints might affect the document format.
Dependencies	Functions.ManageAnswer.Submit Answer

4.3.1.2 Manage Users

Requirements ID	Functions.ManageUsers.Add users
Title	Add users
Description	The admin shall be able to add new users.
Identifier/Source	Team members, in virtual meetings.
Rationale	This is needed to add the information about the new members into the LUEH so that they can use the features of the website.
Restrictions & Risks	The admin may add incorrect information about the member
Dependencies	Functions.ManageUsers.Add users

Requirements ID	Functions.ManageUsers.View User Information
Title	View User Information
Description	The admin shall be able to view user's information
Identifier/Source	Team members, in virtual meetings.
Rationale	This is needed so that the admin can see their information if anything goes wrong that needed to be fixed.
Restrictions & Risks	User may not desire to share some informations
Dependencies	Functions.ManageUsers.Add users

Requirements ID	Functions.ManageUsers.Remove Users
Title	Remove Users
Description	The admin shall be able to remove users.
Identifier/Source	Team members, in virtual meetings.
Rationale	This is needed so that the admin can remove users when necessary.
Restrictions & Risks	N/A
Dependencies	Functions.ManageUsers.Add users

4.3.1.3 Backup

Requirements ID	Functions.Backup.Backup data
Title	Backup data
Description	The admin shall be able to back up the entire database of the LUEH.
Identifier/Source	Team members, in virtual meetings.
Rationale	This is to prevent data loss if the system data gets corrupted
Restrictions & Risks	The admin may not always be available for backup.
Dependencies	N/A

4.3.1.4 Performance Requirements

Requirements ID	PerformanceReq.SimultaneousAccess
Title	Simultaneous access to system
Description	The website shall be able to handle up to 100 users simultaneously accessing the system
Identifier/Source	Team members, in virtual meetings.
Rationale	The system won't be busy when people want to access the system
Restrictions & Risks	The web server may not be able to handle that much users.
Dependencies	Web Server

Requirements ID	PerformanceReq.Total users
Title	Total users
Description	The website shall be able to have 1500 members
Identifier/Source	Team members, in virtual meetings.
Rationale	So LUEH can register new members, potential in all Leading University is 6000, CSE Dept. has around 800 or more members
Restrictions & Risks	The web server may not be able to handle that much users.
Dependencies	Web Server

Requirements ID	PerformanceReq.Throughput
Title	Throughput
Description	The website shall be able to have 1500 members
Identifier/Source	Team members, in virtual meetings.
Rationale	The throughput time of internet shall be a maximum of five seconds
Restrictions & Risks	Users internet may not be reliable
Dependencies	Users ISP or Internet Service Provider

4.4 Website Attributes

4.4.1 Reliability

1. The LUEH should perform its operations and functionalities without any crash.
2. The LUEH should be able to recover from data loss during website down period, etc.

4.4.2 Availability

1. The LUEH website should be available at all times, even during database backups and recoveries. And except during the server down time which should not be long.

4.4.3 Security

1. There will be proper user privileges according to the user type i.e., Teacher or Student.
2. Users will be able to login into the system only by using his or her email and password.
3. Passwords will be encrypted, even admin will not see or understand user's real password.
4. No historical data about users will be saved in the system.

4.4.4 Maintainability

The system manager or admin may need to maintain and monitor the website when too many users try to access and performs various functionality.

4.4.5 Portability

1. The LUEH website will run its web interface on any operating system that has a web browser installed.
2. LUEH will be fully responsive so any device with a browser can run it.
3. The LUEH web server would be portable to any other server that supports Apache.

Chapter – 6

Software & Other Tool Requirement

It requires a number of tools like programming language, scripting language, markup language, and some software to write the programs, host a server locally, etc. In this chapter; the software, tools, and other components that are used to construct the LU Exam Hive website are discussed.

6.1 XAMPP

XAMPP is an open-source software distribution that provides a local server to host a website directly from your local machine or computer, database, command-line executables, and other modules.

We used XAMPP version 8.0.0 for windows that comes with Apache web server, phpMyAdmin MySQL database, Php as command-line executable.

6.2 HTML5

Hypertext Markup Language (HTML) is the standard markup language for documents designed to be displayed in a web browser. It is a system that allows the modification of the appearance of web pages, as well as making adjustments to their appearance. It also used to structure and present content for the web. HTML5 is the latest version of HTML. We used HTML5 to mark up the web page components of LU Exam Hive.

6.3 CSS3

Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language such as HTML. While HTML is used to structure a web document defining things like headlines and paragraphs, and allowing you to embed images, video, and other media, CSS comes through and specifies your document's style like page layouts, colors, and fonts are all determined with CSS.

Essentially, we used Bootstrap which is a CSS framework, to style the markup of LU Exam Hive.

6.4 Bootstrap 4.6

Bootstrap is the most popular CSS Framework for developing responsive websites. It is a free and open-source CSS framework directed at responsive, mobile-first front-end web development. It contains CSS- and (optionally) JavaScript-based design templates for typography, forms, buttons, navigation, and other interface components. At the time of building LU Exam Hive, Bootstrap version 4.6 was the stable version. And we integrated it in our website.

6.5 JavaScript

JavaScript is a dynamic computer programming language. It is lightweight and most commonly used as a part of web pages, whose implementations allow client-side script to interact with the user and make dynamic pages. It is an interpreted programming language with object-oriented capabilities.

JavaScript is:

- Light Weight Scripting language
- Dynamic Typing
- Object-oriented programming support
- Functional Style
- Platform Independent
- Prototype-based
- Interpreted Language
- Async Processing
- Client-Side Validation
- More control in the browser

The JavaScript code is executed on the user's processor instead of the web server thus it saves bandwidth and load on the web server. Any JavaScript-enabled browser can understand and interpret JavaScript code. Any JavaScript code can be executed on different types of hardware a JavaScript program written for. It encompasses all the capabilities of a procedural language. Branching, looping, condition checking are some of those capabilities that can be executed on a web page.

It has a number of plugins and libraries available to make JavaScript simpler. jQuery is one of them. Bootstrap 4.6 uses the jQuery plugin.

6.6 jQuery

jQuery is a JavaScript library designed to simplify HTML DOM tree traversal and manipulation, as well as event handling, CSS animation. The main purpose of jQuery is to provide an easy way to use JavaScript on website to make it more interactive and attractive. It is also used to add animation.

Its features include:

- HTML manipulation
- DOM manipulation
- DOM element selection
- CSS manipulation
- Effects and Animations
- Utilities
- AJAX
- HTML event methods
- JSON Parsing
- Extensibility through plug-ins

Bootstrap 4.6 behind the scene uses jQuery. Bootstrap uses jQuery for JavaScript plugins like modals, tooltips, etc. To make this work with Bootstrap, the jQuery CDN is added in the project files. LU Exam Hive has some Bootstrap components that works with jQuery but we didn't have to write the jQuery codes as it is already working behind the scene when we include the particular component or utilities of Bootstrap.

6.7 PHP

PHP is a server-side scripting language, that is used to develop Static websites or Dynamic websites or Web applications. PHP stands for Hypertext Pre-processor, which earlier stood for Personal Home Pages. PHP scripts can only be interpreted on a server that has PHP installed. The client computers accessing the PHP scripts require a web browser only. PHP is well suited for web development and can be embedded into HTML. It is most popular and frequently used worldwide scripting language, the main reason of popularity is; It is open source and very simple. PHP is:

- Very simple, compared to other scripting languages.
- PHP is an interpreted language. So, there is no need for compilation.
- PHP is faster than other scripting languages like ASP and JSP.
- It is open-source, meaning one does not have to pay to use PHP.
- PHP is platform-independent. it will run on every platform.
- PHP has some predefined error reporting constants that are very useful while debugging.
- PHP supports variable usage without declaring its data type. It will be taken at the time of the execution based on the type of data it has on its value.
- PHP has inbuilt support for working hand in hand with MySQL database management systems and it also can be used with other database management systems like Postgres, Oracle, etc.

The PHP that comes with our version of XAMPP is PHP 8.0 which is the latest version of PHP that more reliable and comes with some new features.

A PHP file can be identified with the .php file extension. An example of the basic syntax of PHP code is given below:

```
<?php
    echo "Hello World";
?>
```

As PHP is well suited for website development and it can be embedded into HTML. It is easier to maintain the web page markup; HTML codes, and the required PHP script of that web page in the same document instead of creating separate document files for HTML and PHP code. Both can be embedded in the same file that is a PHP file with .php extension.

All of the web view document files of LU Exam Hive that are PHP files that contains both of the page markups and php scripts.

6.8 MySQL

LU Exam Hive is a web-based online examination system that will have a lot of data to deal with. For that, we have DBMS or database management system. LUEH used to the MySQL DBMS. MySQL is an open-source relational database management system (RDBMS). A relational database organizes data into one or more data tables in which data types may be related to each other; these relations help structure the data.

SQL:

SQL is a language programmer use to create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an operating system to implement a relational database in a computer's storage system, manages users, allows for network access and facilitates testing database integrity and creation of backups.

MySQL is free and open-source software under the terms of the GNU General Public License and is also available under a variety of proprietary licenses. It has stand-alone clients that allow users to interact directly with a MySQL database using SQL, but more often MySQL is used with other programs to implement applications that need relational database capability.

Reasons for using MySQL:

- MySQL consists of a solid data security layer that protects sensitive data from intruders. Also, passwords are encrypted in MySQL. Although we used other password techniques to encrypt passwords for more security.
- It follows the working of a client/server architecture. There is a database server (MySQL) and arbitrarily many clients (application programs), which communicate with the server; that is, they can query data, save changes, etc.
- It is considered as one of the very fast database languages, backed by a large number of the benchmark test.
- MySQL allows transactions to be rolled back, commit, and crash recovery.
- Provides a unified visual database graphical user interface tool. We can access the MySQL GUI by starting the MySQL module on the XAMPP software.
- MySQL is faster, more reliable, and cheaper because of its unique storage engine architecture.
- MySQL is free and comes with the XAMPP software.
- It provides very high-performance results in comparison to other databases without losing an essential functionality of the software.
- It has fast loading utilities because of the different cache memory.

PHP works very well with MySQL. LU Exam Hive used MySQL that comes with XAMPP 8.0.0.

Storage Engine:

Storage engines are MySQL components, that can handle the SQL operations for different table types to store and manage information in a database. LU Exam Hive database management system used the InnoDB storage engine. InnoDB is mostly used general-purpose storage engine. InnoDB is a robust storage engine that offers:

- Full ACID compliance.
- Commit, rollback, and crash-recovery.
- Row-level locking.
- FOREIGN KEY referential-integrity constraints.
- Increase multi-user concurrency (via non-locking reads).

With the above functionality that InnoDB offers, it is obvious why it is the default MySQL engine. It is an engine that performs well and offers many of the required attributes that any database would need.

6.9 Apache

Apache is a free and open-source cross-platform web server software. It is a powerful Web server program with features that compare to its high-priced competitors. The software includes an administration control panel, customizable error messages, and authentication schemes. The virtual hosting module allows you to run multiple websites from the same server. The resources for Apache are available on multiple websites around the world. This allows server owners to access reference articles and live help whenever necessary. This gives Apache a major advantage over programs that only have a company website as a source of support. When a new bug is found, the open-source user community typically creates a patch to fix it and posts the solution for free on forums and social media websites.

LU Exam Hive uses Apache web server that comes with XAMPP software. This XAMPP Apache server gives a suitable environment for testing MYSQL, PHP, and Perl projects on the local computer. During the building process of LU Exam Hive, we constantly used it to test the website in our local computer server. And we used Apache as server, it will be easy to transfer the website in a live Apache web server after the completion of the LU Exam Hive project.

Reasons for using Apache:

- Compatible with PHP.
- Loadable dynamic modules.
- Handling of static files.
- Auto-indexing.
- Supports HTTP/2.
- FTP connections, etc.

6.10 Git & GitHub

Git:

Git is software for tracking changes in any set of files, usually used for coordinating work among programmers collaboratively developing source code during software development. Its goals include speed, data integrity, and support for distributed, non-linear workflows. It is the most commonly used version control system. Git tracks the changes that are made in files, so the user has a record of what has been done, and the user can revert to specific versions if they ever need to. Git also makes collaboration easier, allowing changes by multiple people to all be merged into one source. Git software runs locally. Users' files and their history are stored on their computer. Users can also use online hosts such as GitHub or Bitbucket to store a copy of the files and their revision history.

GitHub:

GitHub is a cloud-based project management and organization platform that incorporates Git's version control features. Meaning, all GitHub users can track and manage changes being made to the source code in real-time while having access to all of the other Git functions available to them at the same place.

GitHub essentials are:

- Repositories
- Branches
- Commits
- Pull Requests
- Git (the version control software GitHub is built on)

GitHub can be used for free and it requires payment for some advanced features. But the free version is the overall package that is used by many developers.

GitHub Desktop:

GitHub Desktop is a software that provides a graphical user interface to interact with GitHub from the desktop. Instead of typing commands in GitHub CLI, GitHub desktop can be used which saves time and is easy to interact with.

GitHub Desktop supports:

- Attributing commits with collaborators.
- Checkout branches with pull requests.
- Push to your remote Git repositories.
- Syntax highlighted diffs.
- And almost everything that GitHub can offer.

We used GitHub to keep track of our project work and GitHub desktop to interact with GitHub cloud instead of depending on the browser. And as we had to go through the pandemic situation and team members could not conduct any meeting together being physically in a place, GitHub

helped to monitor our works and if anything went wrong, we could easily revert back to a previous version of the project.

6.11 PHPMailer

PHPMailer is an open-source PHP library to send emails with. It is a way of sending emails programmatically with PHP. Sending emails directly by PHP code requires a high-level familiarity to SMTP standard protocol and related issues and vulnerabilities about Email injection for spamming. PHPMailer is one of the popular solutions for these matters on PHP.

Some of features PHPMailer include:

- Plain text, HTML and multipart batched files.
- SSL and TLS (Secure Sockets Layer and Transport Layer Security).
- SMTP, Qmail, POP3.
- Debugging system.
- PHP sendmail and mail methods.

We integrated PHPMailer in LUEH in order to achieve the functionality of sending OTP verification code during student registration automatically to verify their email. Also, to send reset password link automatically in users email if they request for that from the LUEH website. And to receive emails if someone contacts us using the contact us UI in LUEH.

6.12 Summernote

Summernote is a JavaScript library that helps to create WYSIWYG editors online. Summernote can embed into any website to create a WYSIWYG editor by the CDN or downloading the files directly.

Summernote has a few special features:

- Paste images from clipboard
- Saves images directly in the content of the field using base64 encoding, so you don't need to implement image handling at all
- Simple UI
- Interactive WYSIWYG editing
- Handy integration with server
- Supports Bootstrap 3 and 4 integrities
- Lots of plugins and connectors provided together

For creating questions in LU Exam Hive online examination system, we have embedded Summernote that will provide the teacher users to format the question page just like any other word program like MS Word.

6.13 FPDF

FPDF is a PHP class which allows to generate PDF files with pure PHP. So, essentially it is PHP library that allows to generate PDF files. F from FPDF stands for Free. We have added FPDF in LUEH to generate the exam results in PDF document.