Web Based Industrial Training Management System (ITMS) for National Water Supply & Drainage Board

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Web Based Industrial Training Management System (ITMS) for National Water Supply & Drainage Board

A dissertation submitted for the Master Degree of Information Technology

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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.

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This is to certify that this thesis is based on the work of **Mr. K.G.D.C. Thilakarathna** under my supervision. The thesis has been prepared according to the format stipulated and is of an acceptable standard.

Certified by:

Supervisor Name: **Prof. G.K.A. Dias**

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Abstract

Providing Industrial Training for several different subjects to fulfill industrial training, is one of the core activities of the Manpower Development & Training Division in National Water Supply & Drainage Board. Approximately 500 students from NWS & DB around the country participate in many different internship & on-the-job trainings per year. Previously, industrial training-related tasks such as trainee enrollment as well as issuing agreement, assignment letters and trainee records, requesting certificates, and so on were all done manually. Completing these job tasks takes a long time and requires additional staff. Another drawback of this manual procedure has been the maintenance of several types of papers in hardcopies, which makes it challenging to search information & prepare MIS reports when needed.

The main objective of this system was to provide a "Web-Based Industrial Training Management System (ITMS)" to automate the activities carried around the internship & on-the-job training process by the manpower development & training division of the NWSDB, in a more secured, accurate and efficient way. In addition to that, this new system provided an accurate, reliable, efficient and user-friendly system for users.

Major activities such as registering for requesting industrial training, requesting the service of a new trainee, assigning for industrial training, keeping attendance and work records, issuing a certificate were done very easily by this web-based ITM system. All the above-mentioned manual tasks are converted to function via the system by the developed web-based system and made the whole process zero paper based. This web-based system was developed using web development tools such as the PHP framework, MySQL, & Apache web server, etc. The ITMS manages every data & information through a central server, & only authenticated users could access that data and services via the internet.

Finally, the major objective of this system which is to provide a "Web-Based Industrial Training Management System (ITMS)" to automate the activities carried around the internship & on-the-job training process by the manpower development & training division of the NWSDB, in a more secured, accurate and efficient way is achieved. And apart from that, new system provided a reliable, efficient and user-friendly system for users. It should be emphasized that the major goals were achieved by the developed web-based ITMS.

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List of Acronyms

Addl. GM (P&P)   Additional General Manager (Policy & Planning)

AGM (MD&T)   Assistant General Manager (Manpower Development & Training)

CEWAS   Centre of Excellence for Water and Sanitation

CFK   Center for Knowledge

ITMS   Industrial Training Management System

MDTD   Manpower Development & Training Division

NWSDB   National Water Supply & Drainage Board

UCSC   University of Colombo School of Computing

Chapter 1: Introduction

1.1 Problem & Motivation

In every year, National Water Supply & Drainage Board (NWS & DB) is providing Industrial Training for several different subjects for fulfill internship & on-the-job training. Around 500 students from NWS & DB head office, project office & regionals centers around the country will be participating in many different internship & on-the-job trainings per year. Currently, those following industrial training processes are operating manually & paper based.

Those students will participate in different occupational areas such as Engineering, Quantity Surveying, Construction Technology, ICT, Accountancy and etc. In every year, the total number of students and occupations will be increased gradually. This on-the-job training process is getting harder and harder without implementing proper IT solutions.

Therefore, it is more convenient to use information system-based solutions to organizations, collect data and process them according to the needs of the management. This proposed Web Based Industrial Training Management System (ITMS) converted the existing manual processes like registering students for internship & on-the-job training, issuing training assign letter, Record trainee attendance, issuing training certificate and providing required management information reports, and all other internship & on-the-job training related activities to an automated system.

After successful implementation of the system, it will reduce the time taken for the internship & on-the-job training processes by converting the entire manual tasks to an IT system and it is support to increase the staff's productivity. In addition to that, it will increase the accuracy of the reports & minimized paper-based works. Finally, students may receive their certificates without any delay.

1.2 Objectives & Targets

This project aims to develop a web based industrial training management system (ITMS) for the NWSDB-MDTD to improve the activities related to the current internship & on-the-job training process.

The main objective of this system is to provide a "Web-Based Industrial Training Management System (ITMS)" to automate the activities carried around the internship & on-the-job training process by the manpower development & training division of the NWSDB, in a more secured, accurate and efficient way. In addition to that, this new system will provide an accurate, reliable, efficient and user-friendly system for users.

With the successful completion of this ITMS project it is expected to achieve the following objectives.

- To enhance the quality of the industrial training management process by introducing web based online solution. It will convert the entire industrial training process activates to Web Based Industrial Training Management System (ITMS).
- To enable trainees to submit their industrial training requirements online to the NWSDB Training Division without having to physically visit the Training Division from anywhere in Sri Lanka.
- To improve the quality of the industrial training management process.
- To mitigate the time, consume, paper-based activities & repeating records.
- To increase the cost efficiency by mitigating the above activities & making it go eco-friendly.
- To enhance the accuracy & quality of the management information reports.
- To reduce Users' workload of the industrial training management manual process activities.
- To improve communication (sharing of information) between internship/on-the-job providers, participants, & MDTD.
- To improve the "**Work from Home**" concept.

1.3 Project Scope

The scope of the proposed project is to replace the manual process of industrial training management with a web-based system. It will convert the entire industrial training process activates to Web-Based Industrial Training Management System (ITMS).

This system will provide user credentials with user authentication levels such as training providers, students & training staff. After then, students and internship/on-the-job training providers may be

able to register using this online system. It refers to MDTD internships and on-the-job training for management professionals to undertake a range of activities.

This system facilitates the management of internships and on-the-job training related activities such as Administrator Module, Industrial Training / OJT Module, Trainee Module, Enrollment Module, Management Information Report Module.

After performing the above activities, the user needs sign out of the session, which the system permits. It will boost system security by preventing illegal access to the ITMS.

1.4 Chapter structure of the dissertation

These chapters under this dissertation are relevant to the planned project and are completed at different stages of the project. Every chapter will describe the knowledge needed to understand the TRIMS system design and implementation milestones.

- **Chapter 2 - Background**
  The background chapter explains the specifics of current comparable systems across the world. It also provides information on emerging technologies that are relevant to the planned project.

- **Chapter 3 – Design**
  The development approaches utilized to achieve the objectives are described in the design chapter. Object oriented provides a framework throughout the project was detailed, including design diagrams and descriptions of the key client interfaces.

- **Chapter 4 - Implementation**
  The implementation chapter outlines the implementation methodologies & tools of the system analysis & design. In this section will discuss the programming language used, database query language & where the database connection is set up. The software & hardware requirements will also be explained.

- **Chapter 5 - Testing and evaluation**

   The testing and evaluation chapter describes the system's testing and evaluation methods & procedure. This was also explained several test methodologies and how to evaluate the system's functionalities using specific test cases. This testing & evaluation are critical components of the system's long-term errorless functionality. This chapter also includes user feedback in this system.

- **Chapter 6 – Conclusion**

   In this last chapter, the conclusion chapter discusses the overall results of the system, which includes project results, a general appraisal of the jobs completed, achievements and proposed future improvements.

Chapter 2: Background

2.1 Introduction

Many information technology software solutions have been created to improve the quality of the activities in the training management in order to identify the issues of the manual method of training administration. This chapter describes the aspects of existing comparable systems. Furthermore, it highlights the most recent technologies in use throughout the world as well as alternative technological solutions that may be applied to the project.

2.2 The ITM's manual processes

In every year, National Water Supply & Drainage Board (NWS & DB) is providing Industrial Training for several different subjects to fulfill internships & on-the-job trainings. Around 500 students from NWS & DB head office, project office and the regionals centers around the country will be participating in many different internship & on-the-job trainings per year. Currently, those following industrial training processes are operating manually and paper based. Figure 2.1 represents summary of the current manual ITM process.

Received training request from students who required an industrial training.	Matching trainee requirements & training request.	Assign trainees to sectional heads NWSDB as per requirement.

Prepare training certificate / Issue training certificate to trainee.	After completion of the training, Received training certificate request from trainee.	Record trainee attendance / Work done / undisciplined activists

Figure 2. 1 summary of the existing manual process

2.2.1 Industrial Training / On-the-Job Training (OJT)

Industrial Training was provided to 500 apprentices (Undergraduates, NDT/HNDE students, Craft Apprentices, Students of Technical Colleges, Institute of Charted Accountants, AAT, Vocational Training Authority, National Apprentices and Industrial Training Authority (NITA) etc. Under this, training was provided for 100 Undergraduates, 300 Technical Trainees, 75 Accounting Trainees and 25 clerical/other trainees covering around 120,000 Man Days. Often this training is limited to six months.

Considered the internship training request received from students in government universities technical colleges and other NWS&DB approved Institute Manpower development and Training Division to collect details of Industrial Training Apprentices request for following subject categories.

- **Engineering Undergraduates -**

    Civil / Mechanical / Electrical / Electronic / Chemical / Earth source / Software & Hardware

- **Non-Engineering Undergraduates –**

    Science / Chemistry / Biology / Geology / Information Technology / Management / HR / Accounting / Sociology

- **Diploma Engineering (NVQ Level 5) –**

    Civil / Mechanical / Electrical / Contraction / Quantity Surveyor / Draftsmen

- **Certificate Engineering (NVQ Level 4) –**

    Electrician / Mechanic / Construction / Plumber

- **Diploma / Certificate (Non-Engineering) - NVQ Level 4/5**

    Management / HR / Accounting / Network & Hardware / Secretary / ICT Technician (Word Processing)

2.2.2 Disadvantages of the existing manual process

The main problem is that students from all areas of Sri Lanka have to come to the training division in Ratmalana to do all these activities & all activities are done manually. Lack of a centralized database to support on-the-job training and a large amount of time to prepare management information reports and accuracy of the prepared reports could be low.

The staff of the Manpower Development & Training Division (MDTD) has to do lots of paperwork to manage one student and it consumes lots of energy of the staff and time wasting. Further, they need to develop many different MIS reports for the top management. It may also create some errors due to lack of staff and work overload. Another challenge is number of students may increase year by year.

During the last two years due to the Covid-19 disaster, students from various areas of Sri Lanka could not come to the training division to perform the above activities related to industrial training / on-the-job training and the training officers have been tasked with carrying out their duties from home. However, due to their inability to perform their duties related to industrial training / on-the-job training, it stopped completely.

The Training Division was unable to provide information related to the industrial training / on-the-job training activities of the previous years required for the annual reports prepared by the Ministry of Water Supply and Drainage.

2.2.3   Web-based system versus existing system comparison

Accuracy

There may be many mistakes while collecting student information manually, however, by using validation for online forms, these errors may be eliminated. Thereafter, the accuracy of the data will be improved.

Time wasting

Manual processes take longer to complete and need more human resources to manage. All data is stored in a single database, and users may control their activities using user-friendly interfaces. Then, managing all activities takes less time and needs the use of fewer people.

Anywhere / Anytime

The additional benefit is that ITMS users may manage activates virtually at any time and from any location. Furthermore, this unified database will assist in producing more accurate reports in less time and with fewer individuals involved.

NWSDB training staff also have the opportunity to develop the concept of "work from home".

Security

All information is now maintained in physical files without proper protection in this procedure. These documents might be lost, making it impossible to browse for and update the information. Another problem is the difficulty of locating a secure location to keep the information. As a response to these security concerns, the suggested system will manage all data in one database with greater protection. Users get access to the data based on their permission levels.

Storing data

Physical space consumes a lot of space to store files. There is also the possibility of various damages. Data storage in electronic media consumes very little space and can be easily backed up. It is also possible to access this data from anywhere at any time. The cost of storing data and information is also very low.

2.3   Analysis of the system requirements

Identifying the specific requirements for the system is the most difficult process in the system development life cycle. The requirement collection and analysis are a continuous process that requires domain understanding, with constant input from one action toward to the next.

The requirements for this project were gathered through numerous meetings, discussions (Addl. GM (CS), AGM (MD&T), Manager (T), Training Officers, Managers and Trainees in the NWSDB) and observations of industrial training methods conducted by the Manpower Development and Training Division.

AGM (IT) was also questioned to determine the organization's present information technology infrastructure. Those conversations were really beneficial in terms of gaining a clear understanding of the needs. Following those successful sessions, the manual system process was recognized for conversion to an automated solution.

2.3.1 Analysis of functional requirements

This specifies the actions that a web-based system must perform. In addition, these functional requirements have highlighted the user's requirement. This specification describes all of the web-based system's functionality.

The facilities provided by the system for functional requirements are as follows based on users.

Below are some of the main interfaces provided by the system to perform the main functions related to the user.

User Role – Administrator

The system facilitates the following function/activity when login in as an Administrator. Those functions/activities are given below in table 2.1.

No	Module	Function / Activity
1	MIS Reports	• Count of Current User Role • MDTD Staff Users
2	Administrator Module	• Manage User Accounts • Change Password • Staff Registration • View Pending Staff Reg • Manage User Role
3	Trainees Management	• Trainees Designation
4	OJT Management	• Subject Area Registration • Programme Registration • Discipline Category
5	Institute Management Module	• Pending Institute Registration • View Institute • Pending NWSDB Office Registration • View NWSDB Office

Table 2.1 **Function / activity when login as an Administrator**

User Role – Trainees

The system facilitates the following function / activity when login as a trainee. Those functions/activities are given below in table 2.2

No	Module	Function / Activity
1	MIS Reports	• Training Summary • Training Days & Work done • Discipline Variolations
2	Administrator Module	• Update Profile • Change Password
3	Training Management Module	• Record Attendance • View Training Assign Letter • Certificate Request

Table 2. 2 Function / activity when login as a Trainee

User Role – Training Officer

The system facilitates the following function / activity when login as a training officer. Those functions/activities are given below in table 2.3

No	Module	Function / Activity
1	MIS Reports	• Current Trainee – Subject • Current Students – Institute • Current Trainees – Office • Completed Students – Year • Dropped out Students – Year • Disciplinary Violation Summary
2	Administrator Module	• Change Password
3	Training Management	• Pending Trainee Requests
4	Trainees Management	• Pending Training Request

No	Module	Function / Activity
		• Pending Certificate Request
		• Prepare Certificate
		• View Active Trainees
5	OJT Management	• Programme Registration
		• Subject Registration
		• Disciplinary Category
6	Enrollment Management	• Pending Enrollment
		• Select Trainees (Tr)
		• Assign Trainees (System)
		• Assign Trainees (TO)
		• Assign Trainees
7	Institute Management Module	• View Institute
		• View NWSDB Office / Project

Table 2. 3 Function / activity when login as a Training Officer

User Role – NWSDB Office / Project

The system facilitates the following function / activity when login as a NWSDB Office / Project. Those functions/activities are given below in table 2.4

No	Module	Function / Activity
1	MIS Reports	• Current Trainees
		• Pending Request
2	Administrator Module	• Change Password
		• Update Profile
3	Training Management	• Pending Trainees Request
4	Trainees Management	• Trainees Request

No	Module	Function / Activity
5	Enrollment Management	• Current Enrollment
6	OJT Management	• Record Dripline Violation • Approve Attendance / Work Done

Table 2. 4 Function / activity when login as a NWSDB Office / Project.

User Role – Manager (Training)

The system facilitates the following function / activity when login as a Manager (Training). Those functions/activities are given below in table 2.5

No	Module	Function / Activity
1	MIS Reports	• Current Trainee – Subject • Current Students – Institute • Current Trainees – Office • Completed Students – Year • Dropped out Students – Year • Disciplinary Violation Summary
2	Administrator Module	• Change Password
3	Trainees Management	• Certify Certificate
4	Enrollment Management	• Certify Trainee's Assign
5	Institute Management Module	• View Institute • View NWSDB Office / Project

Table 2. 5 Function / activity when login as a Manager (Training)

User Role – AGM (MD&T)

The system facilitates the following function / activity when login as a AGM (MD&T). Those functions/activities are given below in table 2.6

No	Module	Function / Activity
1	MIS Reports	• Current Trainee – Subject • Current Students – Institute • Current Trainees – Office • Completed Students – Year • Dropped out Students – Year • Disciplinary Violation Summary
2	Administrator Module	• Change Password
3	Trainees Management	• Approve Certificate
4	Enrollment Management	• Approve Trainee's Assign
5	Institute Management Module	• View Institute • View NWSDB Office / Project

Table 2. 6 Function / activity when login as a AGM (MD&T)

User Role – Institute

The system facilitates the following function / activity when login as an institute. Those functions/activities are given below in table 2.7.

No	Module	Function / Activity
1	MIS Reports	• Current Trainees • Institute List
2	Administrator Module	• Change Password • Edit Institute Profile
3	Enrollment Management	• View Current Trainees

Table 2. 7 Function / activity when login as an institute.

User Role – Guest

The system facilitates the following function / activity when login as a guest. Those functions/activities are given below in table 2.8.

No	Page	Function / Activity
1	Home Page	• Verify Certificate

Table 2. 8 Function / activity when login as a guest.

2.3.2 Analysis of Non-functional requirements

Availability, safety, correctness, reliability, user-friendly, effectiveness, & ease of maintenance will be non - functional characteristics. Non - functional requirements should indeed be considered during the development of the system.

The facilities provided by the system for non-functional requirements are as follows.

- When an issue occurs, the system should be dependable to use and deliver meaningful messages.
- The graphical user interface (GUI) should be user-friendly and consistent.
  Web page fonts, sizes, and colors should be user-friendly.
- Processing time for data should be reduced.
- Web page fonts, sizes, and colors should be user-friendly.
- The navigation of a website should be simple and straightforward.
- Some knowledgeable employees should be able to easily maintain the system.
- User passwords should be kept in a secure way (encrypted) in the database.
- The system should be just requiring the minimum of hardware.
- Data & information has to be correct.

2.4 Analysis of similar web-based systems.

A considerable amount of effort and time was put in to find out other similar systems and approaches to study their plus and negative aspects, in order to implement the system in an effective and efficient manner. Features of the available system are outlined as follows. Some features of the existing systems are improved and some are very significant to the proposed ITMS system. The following examples are some similar systems.

2.4.1 Arlo Training Management Software

The features and modules of the Arlo training management software system includes the following, (https://www.arlo.co/, 2022)

Back-office administration features / modules,

- **Organize course logistics and resources**
  for example, schedule courses, presenters and rooms

- **Automate manual tasks**
  for example, send registration confirmations, reminder emails and surveys

- **Manage finances**
  for example, capture orders, accept payments online and issue invoices

- **CRM and record management**
  store each customer's upcoming and past training, financials, and sales interactions

- **Reports and business intelligence**
  run reports to provide information to make data-driven business decisions

Front-of-house features / modules,

- **Website**
  build a website from scratch or integrate a TMS into an existing site

- **Online registration**
  accept online registrations and make your shopping cart a stress-free experience

- **Customer portal**
  provide a self-service portal for registrants and a company portal for team managers

2.4.2 Smart Company Cloud-Based Training Web Application

"Employee Training Manager is a cloud-based employee training management system that manages the training data for your employees. With training tracking software, you can track the complete training history for all your employees in one central database. Our training manager software has been a market leader for a number of years in the management of employee training data and hosts many features and benefits to support your business. Our popular desktop course management system is now also available as a cloud-based application and can be used in your web browser and is accessible from anywhere." (https://www.smartcompanysoftware.com, 2022)

The features and modules of the Smart Company Cloud-Base training management software system includes the following,

Features & Modules

- **Employee / Trainee Detail**
  Details of the employee, including demographics, employment, training courses attended and licenses.

- **Course Search**
  Search for courses that you can filter by various fields such as name or description. Decide what order the courses returned should be displayed in.

- **Training Class Detail**
  Create a training class for a course. Enter details of the class such as date, time and trainer. Assign employees who will attend the training.

- **Assign Employees / Trainee to a Class**
  Assign employees to a training course. Do this individually by employee or by department and job role. See what employees are due to attend or have attended a training course.

- **Courses Attended by Employee / Trainee**
  Within the employee records, view the training courses the employee has already attended or has been allocated to attend in upcoming training classes.

- **Course Summary Report**
  The course summary reports return all training courses. Filter the records returned using the selection criteria dialog screen.

2.4.3 MYCLASSCAMPUS

The MYCLASSCAMPUS training management software system is another training management solution wear found. (https://myclasscampus.com/, 2022)

The features and modules of the MYCLASSCAMPUS training management software system includes the following,

Features & Modules

- **Institute Management**
  - Account details
  - Institute setup
  - User management
  - Rights management
  - Bulk registration
  - Global import

- **Online Admission**
  - Custom Admission forms
  - Form due dates
  - Form fee collection
  - Mapped with Inquiry CRM
  - Admission merit
  - Admission communication

- **Inquiry Management**
  - Inquiry CRM
  - Inquiry stages
  - Inquiry follow-up
  - Assign inquiry
  - Inquiry communication
  - Inquiry to admission

- **Attendance Management**

  Manual & automatic

  Class / subject wise

  Attendance on App

  Real-time update

  Attendance reports

- **Complaint / Grievance Management**

  Complaint registration

  Status management

  Assign to concerned

  Resolution status

  Follow-ups

2.5 Comparison of the suggested web-based system with similar existing systems.

The ITMS includes all of the systems indicated above. Using various essential criteria, the following table compares similar systems in previous studies with the proposed system. The table indicates the gaps in similar systems and the shortcomings that the proposed system may fill based on the criteria.

The Comparison of the suggested web-based system with similar existing systems are given below in table 2.9.

The ✓ sign indicates that the system met the criteria, whereas the X sign indicates that it did not.

Criteria \ System	Arlo Training Management System	Smart Company Cloud-Based Training Web Application	MY CLASS CAMPUS	Suggested web-based system - ITMS
Online Registration	✓	✓	✓	✓
Assign Trainee	✓	✓	✓	✓
Disciplinary Record	✗	✗	✓	✓
Attendance Record	✗	✓	✓	✓
Institute Management	✓	✓	✓	✓
MIS Reports	✓	✓	✓	✓
Online Verifying Certificate	✗	✗	✗	✓

Table 2. 9 The Comparison of the suggested web-based system with similar existing systems.

2.6 Technology used

A web-based solution was proposed for this new solution. The front and rear end of the system have been developed using current web-based technology.

2.6.1 Cloud server

These three services can be chosen based on the needs of the client. The cloud owner will be in charge of all highly secure data. Cloud owners be in charge of the complete infrastructure of this situation. As a result, even if it offers a wide range of services, a client organization must determine whether to retain confidential data on in-house or in the cloud. The following are three of the most widely used cloud computing services.

- Software as a Service (SaaS),
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

2.6.2 Bootstrap

Bootstrap is the front-end programming framework for building web applications. To make the building of responsive applications easier, this framework was designed using CSS, HTML & JavaScript. The biggest advantage of bootstrap is mobile responsiveness. This will recognize the client's device's screen resolution and adjust the web page accordingly without decreasing quality of the content. Furthermore, this is a free front-end application development platform that's also open-source.

2.6.3 Apache webserver

Apache is a free and open-source web server that runs many websites on the internet. The Apache Software Foundation maintains and develops Apache HTTP Server.

The basic goal is to build a connectivity among a server and user's web browser. Furthermore, Apache is a cross-platform application running on Linux & Windows.

2.6.4 PHP

PHP is a server-side programming language that is freely available. This has been used to build a static website, as well as a webpage & web-based application. PHP scripts could only be translated on a server which has PHP loaded, and PHP scripts could only be accessed via a web browser on client PCs. That can be used in HTML codes because that was decoded at runtime.

2.6.6 MYSQL

MySQL is a relational database management system that supports the SQL. Many open-source PHP programs classified it as having fast processing, verified reliability, ease of use & flexibility.

2.6.7 HTML & CSS

Hypertext Markup Language (HTML) & Cascading Style Sheets (CSS) are two of the most used technologies used to develop web pages and web apps. CSS has been used to captivate the web page by applying fonts, colours & styles. Another advantage of CSS is that it can be used for several web pages with the same CSS file, which improves website consistency.

2.7 Feasibility study

The feasibility analysis is necessary to determine whether the project of a web-based industrial training management system is financially, technically, and operationally feasible. Then it would be fulfilled with the organization's existing expectations and will also accommodate future adjustments. The feasibility assessment is performed by applying following categories.

2.7.1 Operational feasibility

In terms of user-friendliness, this new system is totally GUI-based and user-friendly, and people can simply comprehend its operation. This was discovered that the majority of the users lacked technological expertise. As per the analysis, the organization feels comfortable utilizing this method, and will aid in reducing the workload of OJT operations.

2.7.2 Technical feasibility

The ITMS system was created as a web-based application. The system was hosted on a free open-source web server named Apache, as well as the database was MYSQL. The system was built using a PHP framework. Those technologies do not require a lot of hardware resources. An internet connection was necessary to join the system from outside the MDTD, although within in-house users may utilize a local network.

2.7.3 Economic feasibility

MDTD is totally self-funded by NWSDB, it has a restricted budget for this type of development. This online system development is managed at a minimal budget by using free and open-source technologies. Furthermore, the system is deployed using current hardware. The ITMS software is achieved through a cost-effective approach.

2.7.4 Schedule feasibility

The time for this project was already set from start to finish, and the program has already been performed out step - by - step, including requirement gathering, analyzing, planning, implementing, testing, maintaining & documenting of the system.

2.7.5   Implementation feasibility

MDTD already has adequate in-house and cloud servers to deploy this system. These servers are new & have high-speed internet access. As a result, this project may be readily made available online even without thought given to the hardware and software. A fast broadband connection with a web browser is necessary from the user's perspective. This database and software must be installed on the admin side & level. When the installation is complete, the administrator and other users will be able to access the system from anywhere in the world over the internet in real time.

2.8 Summary

Throughout this chapter, an overview is given regarding the present manual industrial training management system and conduct a literature review to investigate similar systems used for training management. Before adopting a new system, it is critical to investigate the nature of the industrial training management system, the quality aspect of the industrial training system, the many stages of the industrial training process, and the limits of manual industrial training process. Through to the requirement analysis, the particular results required for the proposed model that are necessary to address present problems are identified. Further, started to research innovative methods that will be used to construct a new platform to address the identified gaps and problems.

Chapter 3: Design Architecture

3.1 Introduction

"Systems design is the process of defining the architecture, product design, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis, systems architecture and systems engineering." (Wikipedia, n.d.)

This system design needs more effort since it is the main significant aspect of the project. This chapter includes the modeling approach, architecture of the system, schema, methodology, DB design, interface design, and protection, which are all utilized to create a web-based industrial training system.

3.2 Model development approach

There're several process developments models that may be used to lead current software projects, including the Spiral model, Agile approach, Prototyping model, Iterative development model & Rapid Application Development. The Rapid Application Development model is selected from there are several other types of process development models.

3.2.1 The rapid application development (RAD) model

RAD Model or Rapid Application Development model is a software development process based on prototyping without any specific planning. In RAD model, there is less attention paid to the planning and more priority is given to the development tasks. It targets at developing software in a short span of time. (Martin, 2022)

The Rapid Application Development Approach may be effectively used for software development projects with defined modularization. The RAD approach provides faster service by reducing total project duration because of component reusability & concurrent development. The RAD allows developers to make several iterations & modifications to the software without having to build from zero each time.

The RAD method has the following advantages,

- Evolving situations could be addressed.
- Advancement could be quantified.
- System development time could be reduced.
- System components could be reused.
- Initial reviews could be conducted quickly.
- The RAD model is most useful for projects with uncertain or unclear requirements.

The RAD method has the following disadvantages,

- More suitable for projects that require rapid development projects.
- More suitable for component-based system development projects.
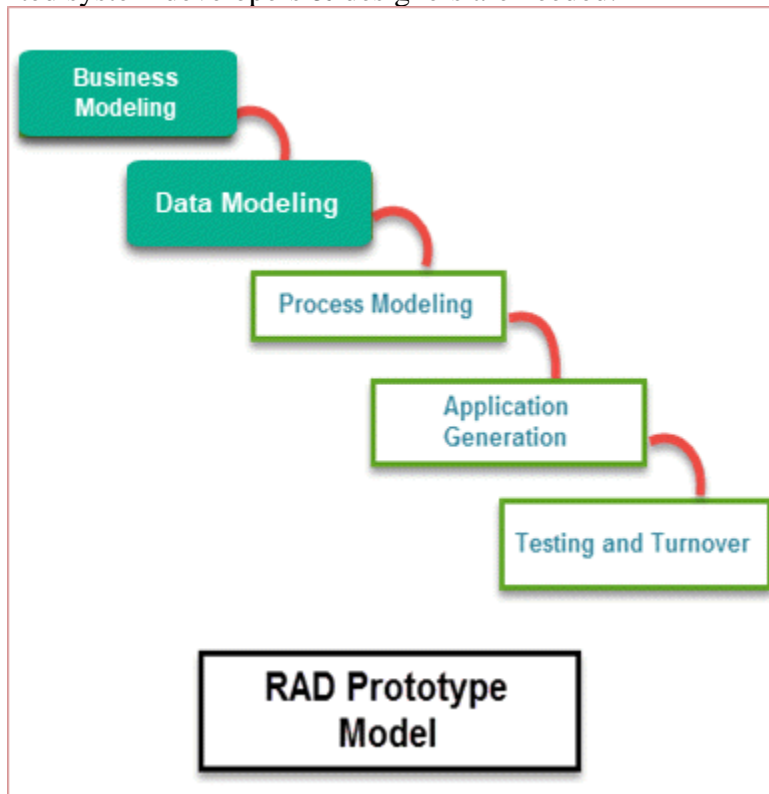- Talented system developers & designers are needed.

Business Modeling

Data Modeling

Process Modeling

Application Generation

Testing and Turnover

RAD Prototype Model

Figure 3. 1 RAD software development model

3.2.2 Selection of system design approach

Even though explained previously, each design style provides advantages and disadvantages. As a result, a combined (blended) technique was chosen and implemented across the system. That combines the formal framework of Model-Driven Architecture with the speed & flexibility of rapid application development approach.

The proposed system is being built as a postgraduate project, so it may be developed in a more structured way, providing for upcoming projects if necessary. Therefore, the end-user should be engaged across the system development lifecycle. Furthermore, Object-Oriented System Development in conjunction using the Agile system development strategy might be utilized in conjunction with the rapid application development approach.

3.2.3 The structure of the system

The system's structure design describes the web-based ITMS's architecture, functionality, & additional perspectives. The design provides a high explanation of a system's detailed definition and description, arranged in a manner that allows for understanding more about the system's architecture and operations.

Figure 3.2 illustrates a design model used to describe the typical structure of the ITMS as well as the restrictions, interactions & limits among elements.
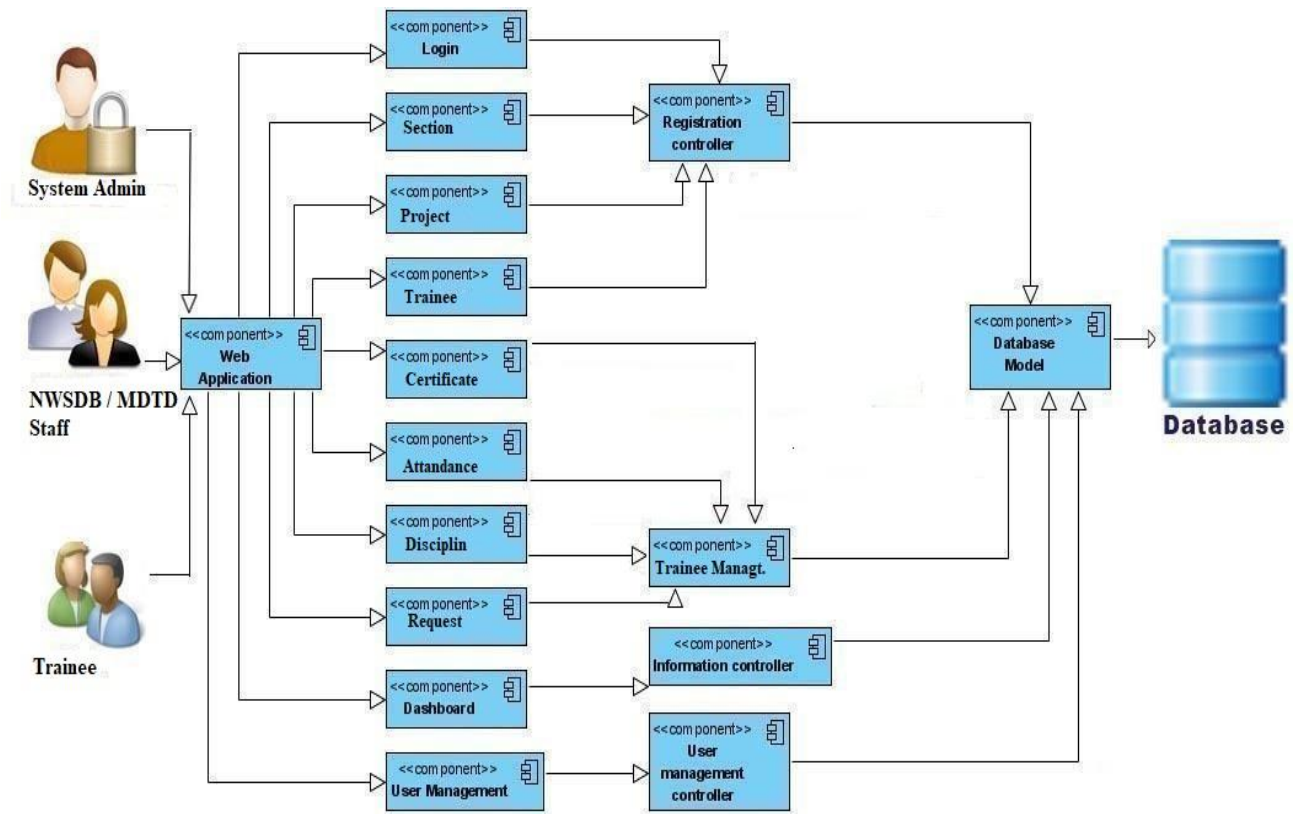
Figure 3. 2 Structure diagram

3.3 Design patterns

Many design patterns & approaches can be identified for web-based development projects as follows;

- Microservices pattern
- Model-View-Controller (MVC) pattern
- Client-server pattern
- Layered pattern
- Controller-responder pattern

The MVC design pattern is suitable for any web-based development project. A summary description of this model is given below. Some features of this model have been used for this project.

3.3.1 Model - View - Controller (MVC) design pattern

"MVC (Model-View-Controller) is an architectural design pattern that encourages improved application organization through a separation of concerns. It divides an interactive application into three components: Model / View and Controller. It enforces the isolation of business data (Models) from user interfaces (Views), with a third component (Controllers) traditionally managing logic, user-input and coordinating both the models and views." (Visual-Paradigm, n.d.)

- Model - This component controls the program's data and actions. This allows the construction of a database connection that facilitates the web-based software application's data format.

- View - The component of View refers to the model's presentation in a certain layout. It controls the functionality that interacts with the user's interfaces.

- Controller – The system interacts with human input and reacts with the data objects. It interconnects with the model component & the view component. The controller component returns data from the model to the view for the viewer to see in a nice representation.

Every one of the components created under the MVC architecture model is not dependent on each other. So, it allows the developer to quickly reuse these modules and scripts for other applications. This process is simple to test, edit, & upgrade scripts.

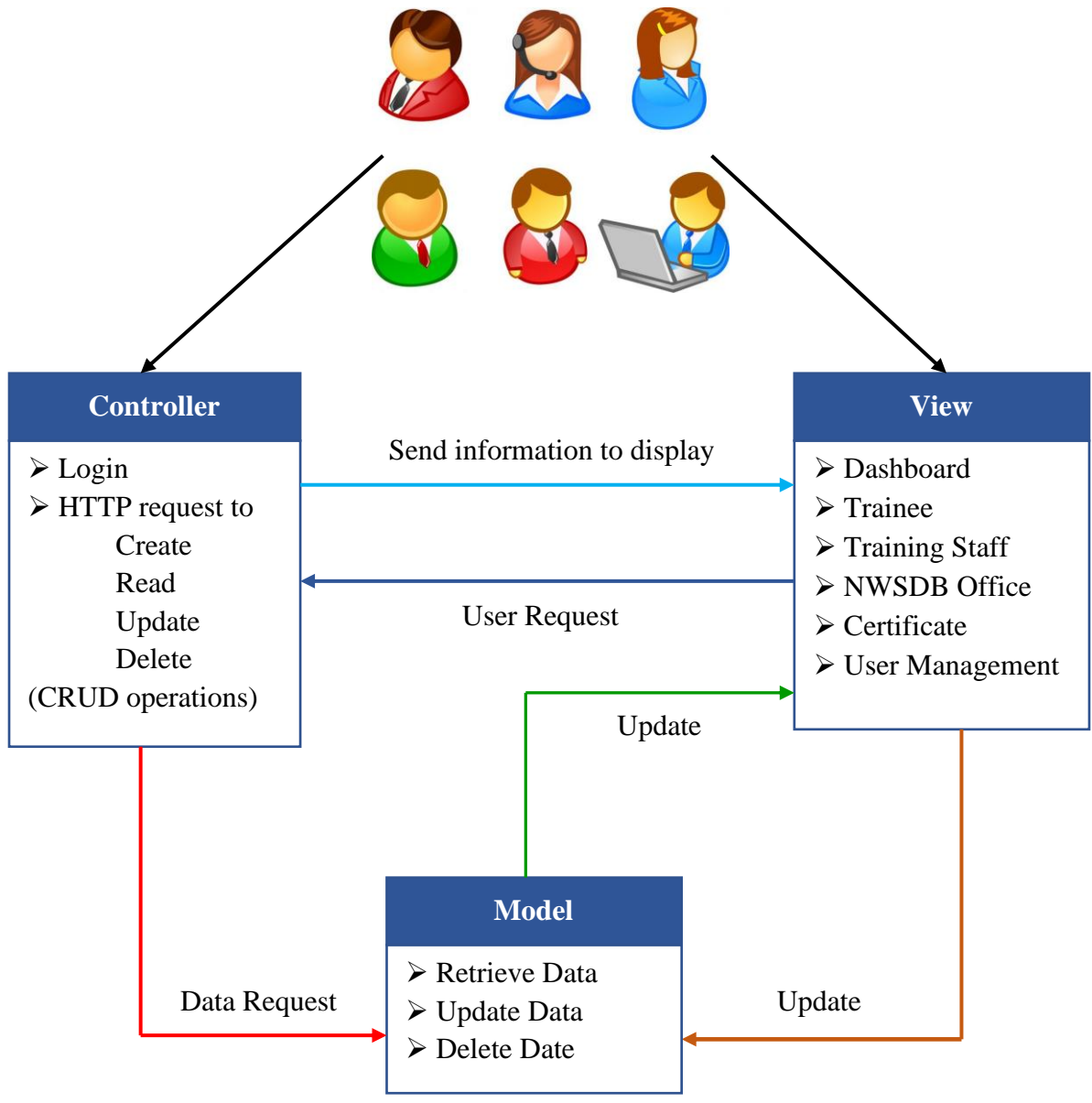The MVC architectural approach is shown in Figure 3.3

Figure 3. 3 MVC architectural approach

3.4 Design Methodology

The following main object classes & diagrams were applied inside the system design for the Web-based industrial training management system.

- **Use case diagram,**

The use case diagram describes a system's activities from the perspective of the users.

- **Use case narratives,**

The use case narrative is an explanation in words of the user & their activities in the system.

- **Class diagram**,

The class diagram illustrates the structure of classes & relations.

- **Sequence diagrams,**

The sequence diagram illustrates process interactions in chronological order.

- **Activity diagrams,**

Activity diagrams is the graphical illustrates of processes of sequential activities & operations.

- **Database design diagram,**

Database design diagram is a graphic that illustrates the structure & the relationship of the database in the system.

- **User interface design,**

User interface design represents the graphical user view or graphical user interface of the system.

3.5.1 Use case diagram

According to Wikipedia.com, Generally, case diagrams are used to illustrate the interaction among actors and an application platform in order to complete a task. Users, internal operations, and other external entities can all become actors. Furthermore, relations like as include, extend, and generalization was dependent upon this system's behaviors. The use case diagram in Figure 3.4 illustrates the high-level use case diagram that specifies various actions performed inside the ITMS.

User logging is an essential precondition for the use cases that need to proceed.
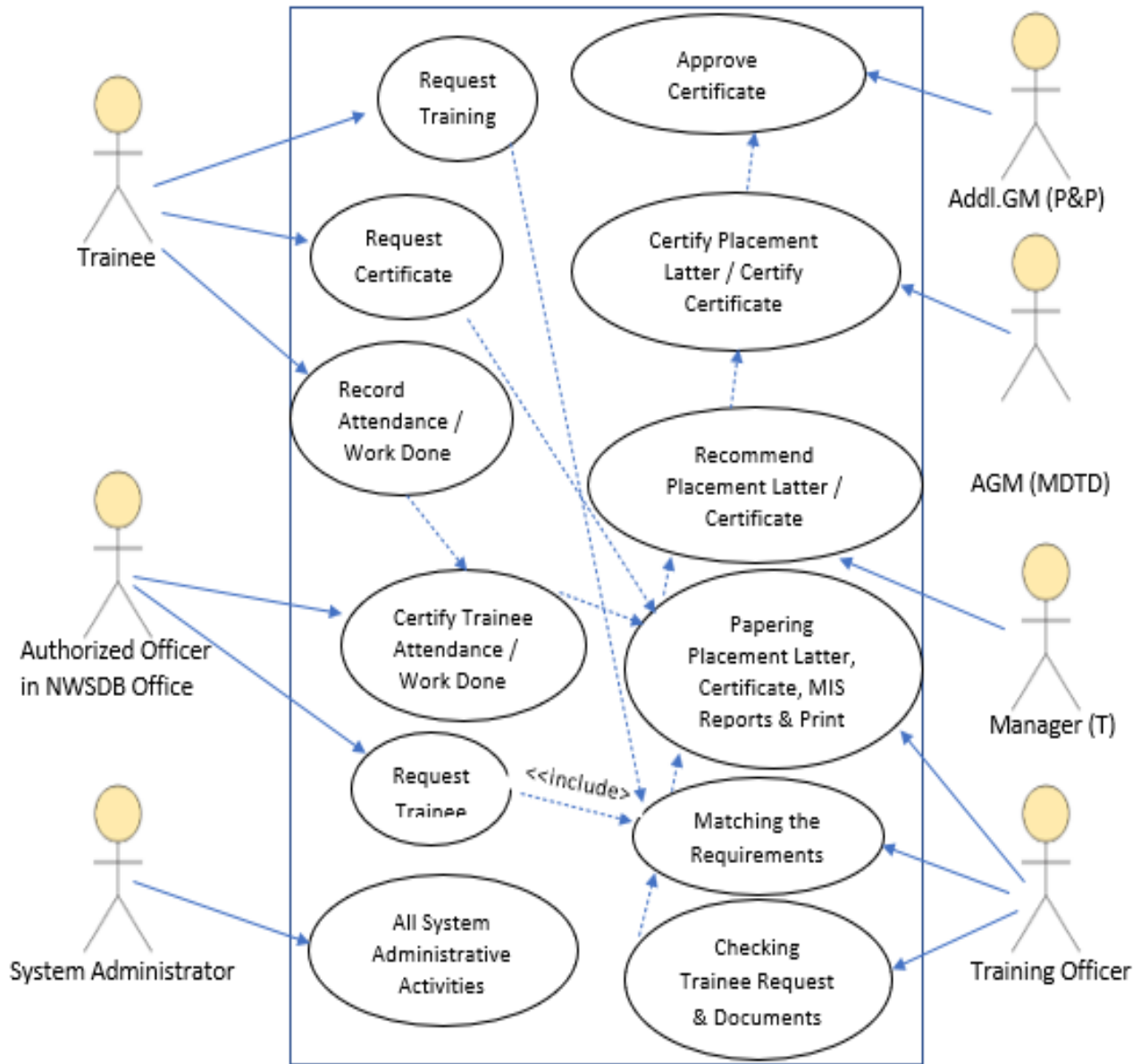Use case diagram for a web-based ITMS at a high level is shown in Figure 3.4.

Figure 3. 4 Use case diagram for a web-based ITMS at a high level.

3.5.2 Narratives of Use cases

Detailed Use Cases for user registration is given below in table 3.1.

ID:	01
Name:	User Management
Actor:	Admin user
Description:	The use case explains the establishment of each actor's authentication level by the admin user. **Registration of Users:** Users (Trainees / NWSDB Office & Projects) could submit their requests through the web-based portal, and the administrator will accept the enrollment after confirmation. Furthermore, admin could make users active or inactive status. **User Login:** The system will be identified automatically all users by a unique user ID (email ID) & password. **Forgot the Password:** Enabled the users to reset the missed password by providing their registered user ID (email ID). **Change the Password:** Enabled the users to change their passwords.
Preconditions:	Open a web browser with a stable Internet connection and access the ITMS's URL. Should have an active user account.
Postconditions:	Users should have an active user account & Others do not have permission to access the ITMS.
Normal Course:	User Registration: ● Open web browser. ● Enter ITMS's URL on the address bar. ● Select the relevant user registration category on the home page. ● User submits the relevant data. ● ITMS verifies that all data seems to be in the right format. ● After that, a notification will be shown for the system admin to a new user registration request. ● If the applicant-provided data is an acceptable level, the administrator activates the user account. ● ITMS will be sent the account activation information to the registered user's email address. Login: ● Enter the user ID & user password on the sign-in screen. ● If user ID & password are mismatched according to user data, the system displays an error notification.

	• If user ID & password are matched according to user data, the system redirected to the user's main page based on the user authentication level.
Alternative Courses:	If the entered user ID (email address) has previously registered, ITEMS appears an error notice & redirected to the home page. To update the email ID, the User should contact the system admin.

Table 3. 1 Detailed Use Cases for user registration

Detailed Use Cases for Request Trainee is given below in table 3.2.

ID:	02
Name:	Request Trainee
Actor:	NWSDB / Project Officer
Description:	The use case explains the trainee requirement for the NWSDB / Project duties & activities.
Preconditions:	Open a web browser with a stable Internet connection and access the ITMS's URL. Should have an active NWSDB / Project user account.
Postconditions:	NWSDB / Project users should have an active user account & Others do not have permission to make a trainee request.

Normal Course:	• Open web browser.
	  • Enter ITMS's URL on the address bar.
	  • Sign in to the user account as per NWSDB / Project user.
	  • Navigate to Trainee Requirement.
	  • To make trainee request:
	    ○ Select subject field.
	    ○ Enter the no of vacancies.
	    ○ Enter the required time period.
	    ○ Enter the special remarks if available.

Alternative Courses:	N/A

Table 3. 2 Detailed Use Cases for Request Trainee

Detailed Use Cases for Request training certificate is given below in table 3.3.

ID:	03
Name:	Request training certificate
Actors:	Trainee
Description:	The use case explains the making request for the OJT training certificate end of the training period.
Preconditions:	Open a web browser with a stable Internet connection and access the ITMS's URL. Should have an active trainee user account.
Postconditions:	Trainee users should have an active user account & Others do not have permission to make an OJT training certificate.
Normal Course:	- Open web browser. - Enter ITMS's URL on the address bar. - Sign in to the user account as per trainee user. - Navigate to Request Training Certificate. - To Request Training Certificate, - Enter Training Certificate requesting date - Make sure training activities are recorded using the radio button. - Make sure attendance is recorded using the radio button. - Make sure the supervisor's confirmations are complete using the radio button.
Alternative Courses:	If the trainee is not qualified to request the final certificate, the system will not allow the request to be completed.

Table 3. 3 Detailed Use Cases for Request training certificate

3.5.3 Class diagram

According to Tutorialspoint.com, The UML class diagram illustrates classes, characteristics, actions, and relations to provide a perspective of this software application. Additionally, the graphic illustrated the various kinds of objects inside the system as well as their interconnections.

The Class diagram are an important element in the analysis and design focused on the object. Class diagrams show the classes of the system, the relationships of these classes with the classes, activities and features (aggregation/inheritance/association). Class diagrams, including design/concept modeling and detailed design modelling, are used for a number of different purposes. This concept is illustrated in the following class diagram (Figure 3.2).
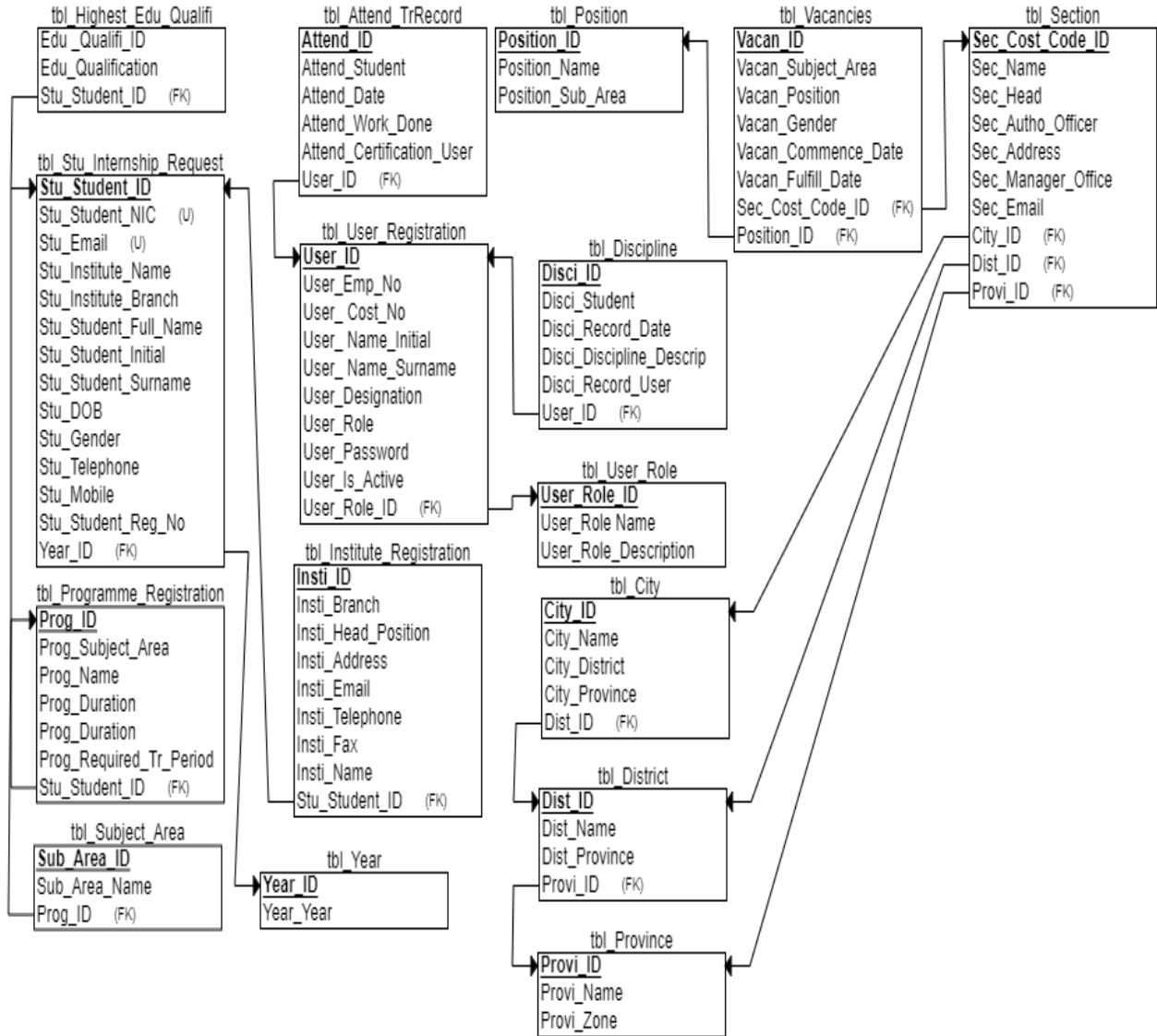
Figure 3. 5 Class diagram for the proposed system

3.5.4 Sequence diagram

According to Ibm.com, the sequence diagram is a diagram created in the Unified Modeling Language (UML) and shows the flow of communications sent between entities inside an operation.

The following sequence diagrams are referred to the Table 3. 1 "Detailed Use Cases for user registration" use case narrative.
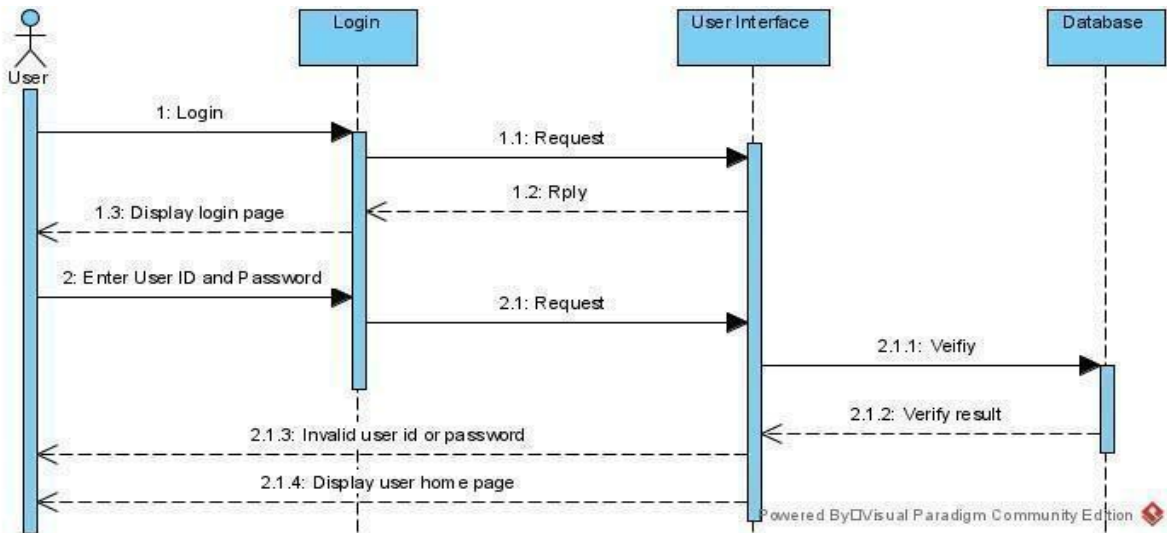
1. Sequence diagram for user login

Figure 3. 6 Sequence diagram for user login

2. Sequence diagram for user registration
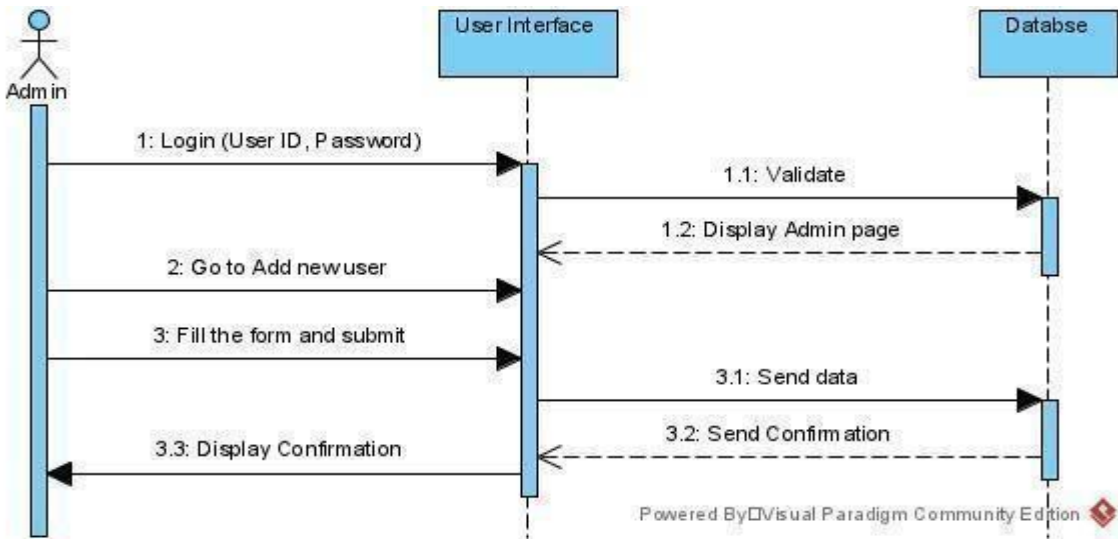
Figure 3. 7 Sequence diagram for user registration

3.5.5 Activity diagram

According to Guru99.com, the Activity Diagram is a flowchart that illustrates the transition from one stage to the other. The action can be defined as a system operation. The main objective of activity diagrams would be to illustrate the system's dynamic behavior.

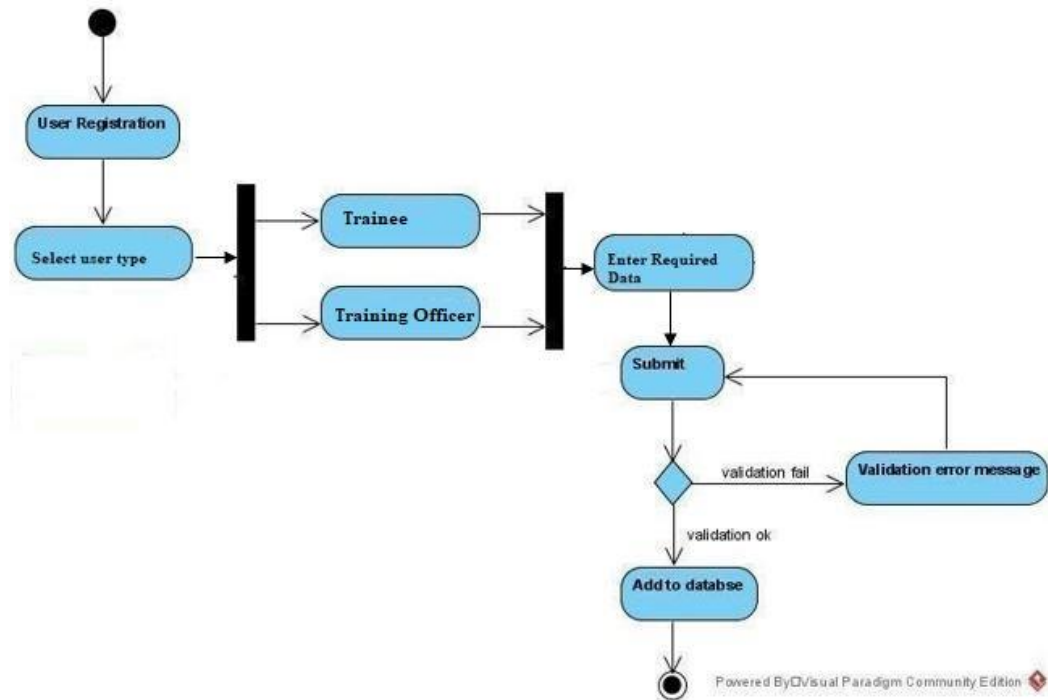**1. Activity diagram for user registration**

Figure 3. 8 Activity diagram for user registration

3.5.6 Database Design

The database for this system was designed using relational database techniques. Database normalization has been used to prevent redundancy and data abnormalities, and to increase performance.

According to Guru99.com, an entity relationship diagram illustrates a system's database schema including entities and it describes data type & relations based on their interconnections among entities.

ER/EER diagrams have been used to develop database schemas including entities, primary keys, and foreign keys. Figure 3.9 is an illustrated database diagram to represent the projected ITM system's entities & characteristics, as well as the links between them.
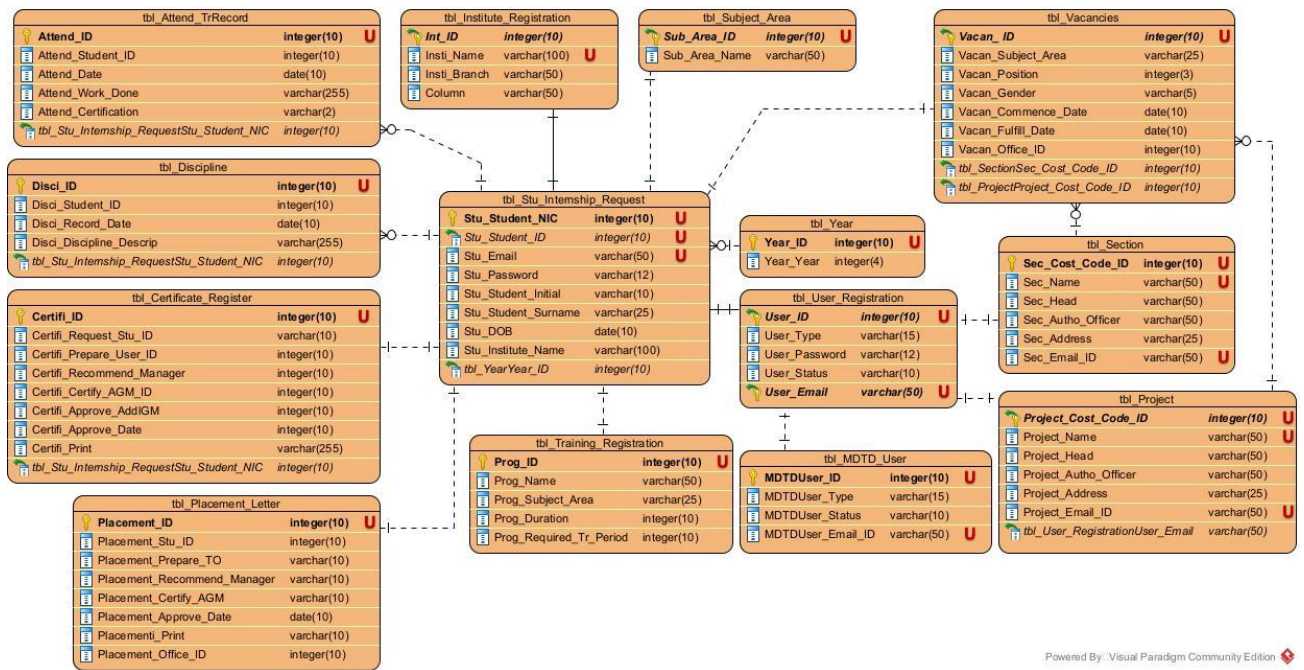
Figure 3. 9 ER/EER Diagram for the projected ITMS.

3.6 User Interface Design

The user interface must be carefully designed since it will be important to the application's productivity & better success. The system user interface should be simple. But it should be direct to keep customers guided across the web application. The system user interface implementation for this web-based project took a long time since it had to suit the different users' requests as mentioned previously.

The majority of users were of the opinion that the basic functionality of the system should be displayed from the very beginning of the site. Therefore, opportunities for access to those activities were placed at the top of the home page for this system.
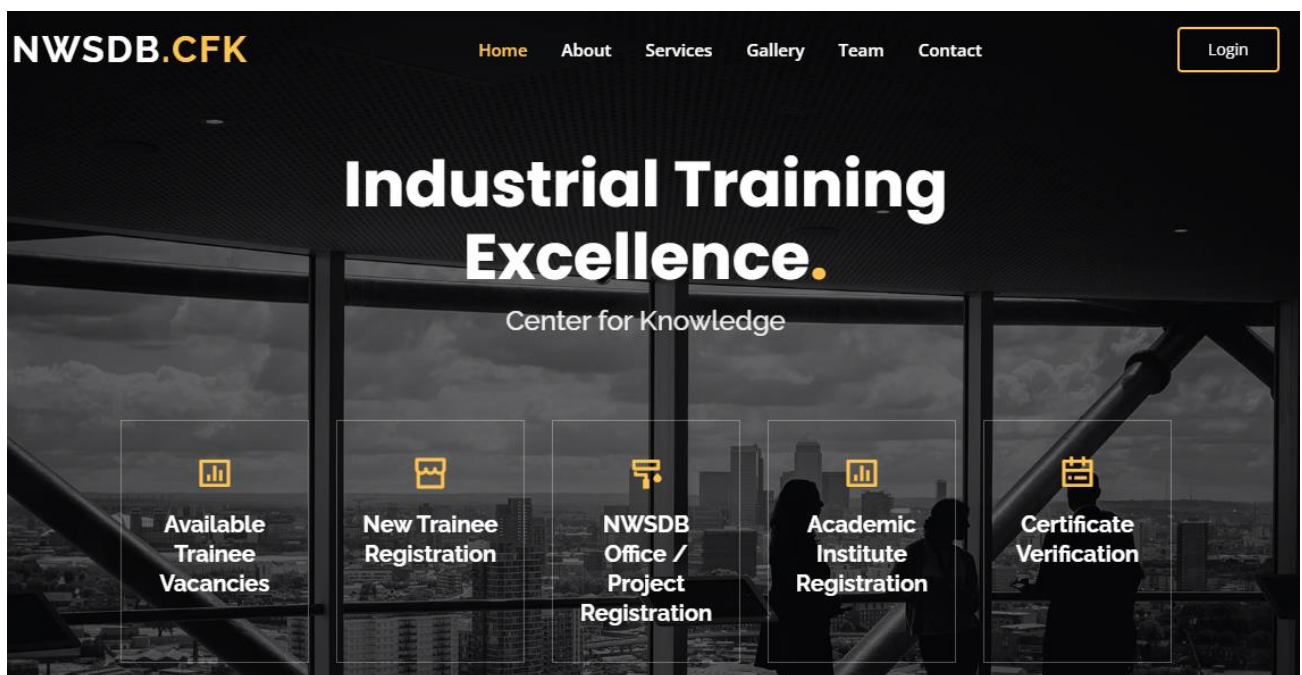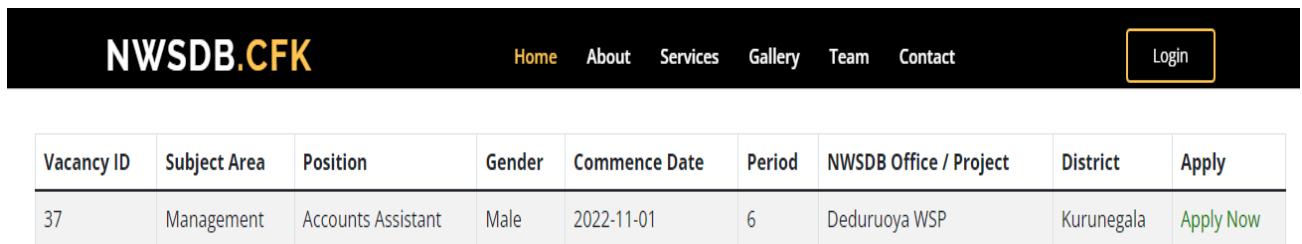
    a) **Home Page**

Figure 3. 10 Home page of the ITMS

b) New Trainee Registration

The main users of this system are the trainees who are seeking industrial training. It was my opinion that they should have a very clear non-complicated registration interface. Therefore, a very simple new trainee registration form was created.

c) Directly applying for existing vacancies.

It was decided to give trainee the opportunity to apply directly for the existing vacancies. Therefore, students were given the opportunity to inquire about the current vacancies and apply for them directly.

Vacancy ID	Subject Area	Position	Gender	Commence Date	Period	NWSDB Office / Project	District	Apply
37	Management	Accounts Assistant	Male	2022-11-01	6	Deduruoya WSP	Kurunegala	Apply Now

Figure 3. 11 Directly applying for existing vacancies

d) Drop-down menus

Drop-down menus are provided to make it easier for users to browse data while filling a form and to get uniform data.

3.7 ITMS overall accessibility diagram

The ITMS platform is built to be completely web-based & controlled by a web server in the IT department of NWSDB. Users from the NWSDB office, MDTD, trainees, and other regional offices of Sri Lanka are using web browsers to connect to the main server computer over the internet. The web-based system's overall accessibility diagram for the suggested ITMS is shown in Figure 3.14.
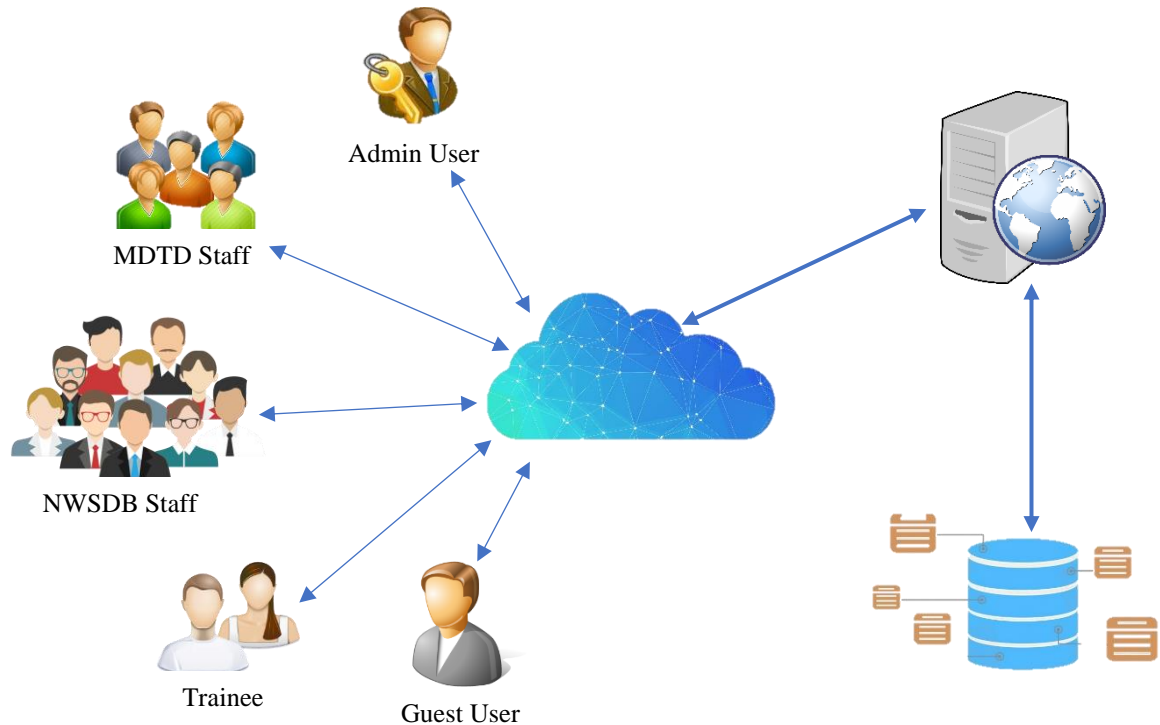

Figure 3.12 System access overview

Based on a central database, the suggested web-based ITMS will be established. Using their user identities, all users get permission to this web-based application over the Internet. Functions will be activated based on the user's credential level.

3.8 System Security

"Web application security (also known as Web AppSec) is the idea of building websites to function as expected, even when they are under attack. The concept involves a collection of security controls engineered into a Web application to protect its assets from potentially malicious agents." (Synopsys.com, n.d).

When it comes to security, there are three key roles as follows,

- Physical security.

  The system or server computer must be located inside a protected location. That place avoids illegal access.

- Logical security.

  This defines a unique user ID, Passwords & Firewall. The password must be encrypted prior to entering the system's database. Firewalls should be updated regularly.

- Behavioral security.

  Specific rules or practices must be introduced to avoid internal threats to web-based systems. User behavior should limit restrictions on system security.

If the system's level of security is to stay optimum level, these three roles must collaborate together.

3.9 Summary

The chapter 3 tried to explain the suggested web-based ITM system's process model, system architecture, schema & essential security. Different kinds of diagrams like Class, Activity, Sequence & ER/EER diagrams were also performed to explore the proposed system. On the other hand, the core of the development of a web-based project has been completely discussed in this chapter, with supported diagrams, user interface layout & structural blueprints.

Chapter 4: Implementation

4.1 Introduction

The section describes the significant actions taken during the project implementation stage of the ITM system. This describes the software tools & hardware equipment necessary to implement the suggested web-based system, which includes programming language, layout, platforms, architectures, and DBMS. Will further, the section covers a few of the source codes that have been utilized in this system implementation.

4.2 Implementation Methodology

The RAD model was primarily applied as the implementation approach, and that was shown to just be highly effective with this web-based ITMS since it is used to produce the operational prototype for which users may be engaged first from starting. The ITMS developed component by component & verified for faults & problems. Users may accept release depending on the test outcomes, and additional innovations could be obtained to end users.

4.3 Implementation Environment

This suggested time is totally web-based and Windows OS based, with the system developed using open-source free software applications. Apache web server installed on the XAMPP cross-platform. The MYSQL database system & PHP have been the core essential software to develop the ITMS. The project platform was created based on the MVC model & PHP framework.

The subchapters cover what are the database system, programming language & other essential software that will be utilized to successfully create this ITMS. The software and technologies mentioned above were used because they are freely available and easy to understand and handle for a first-time developer of web software application. MYSQL database system and PHP programming were studied as subjects in our post-graduation. So, I decided to use it to develop this web-based system.

4.3.1 Software requirements & Environment

Software requirements and environment mainly consist of three-component. The requirements of those components are given below in table 4.1.

System Development	Webserver	Client computer
XAMPP cross-platform	Apache web-server	Web browser application
Apache web-server	PHP My-Admin	PDF Reader
PHP language	MYSQL	Internet connection
MYSQL	Internet connection	
Visual Paradigm & draw.io		
Apache NetBeans IDE		
MS Paint		

Table 4.1 - Minimum software requirement for the system development & use environment.

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4.3.2 Hardware requirements & Environment

Hardware requirements and environment also mainly consist of three-component. The minimum requirements of those components are given below in table 4.2.

Hardware Component	System Development	Webserver	Client computer
Processor	Core i5 2.1 GHz	Core i7 2.4 GHz	Core i3 1.8 GHz
Cache	4 MB	8 MB	3 MB
Ram	8 GB	16 GB	4 GB
Hard Disk	500 GB	1 TB	380 GB
Network Adapter	100 Mbps Ethernet	1000 Mbps Ethernet	100 Mbps Ethernet / Wi-Fi
Input Devices	Keyboard / Mouse	Keyboard / Mouse	Keyboard / Mouse
Display Resolution	1024 x 786 Pixels	1024 x 786 Pixels	1024 x 786 Pixels

Table 4.2 - Minimum hardware configurations for the system development & use environment.

4.4 Implementation of Database

Database services should be used to find, sort, organize, and show data in response to user online queries. Databases could include coding that executes calculations & operations in order to serve internet browser requests.

The database was developed using the XAMPP cross-platform. My SQL queries have been provided to administer database operations.

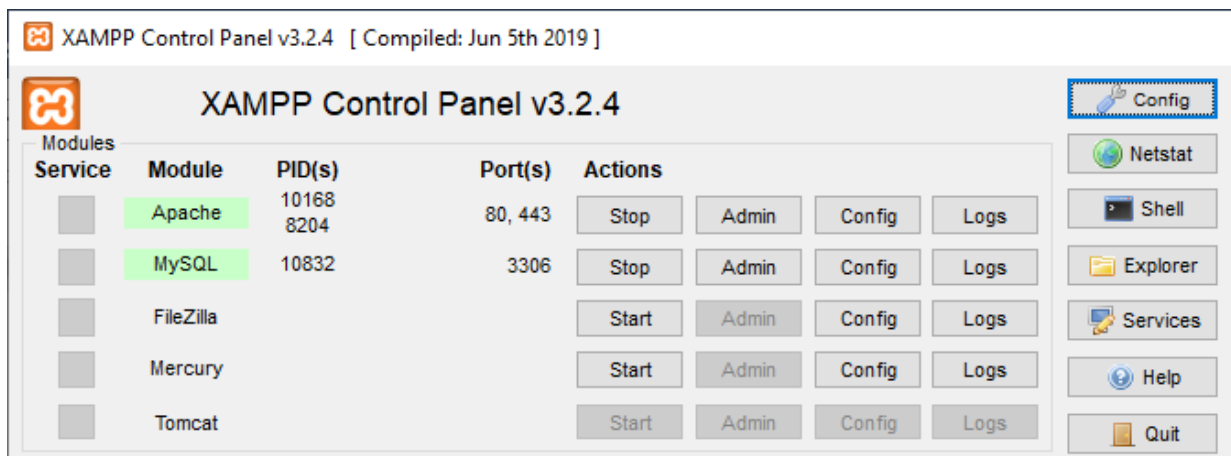The SQL query to set up the database is shown in Figure 4.1. The database is named "itms_db".

Figure 4.1 - XAMPP control panel.

The SQL query to set up the database is shown in Figure 4.2. The database is named "itms_db".
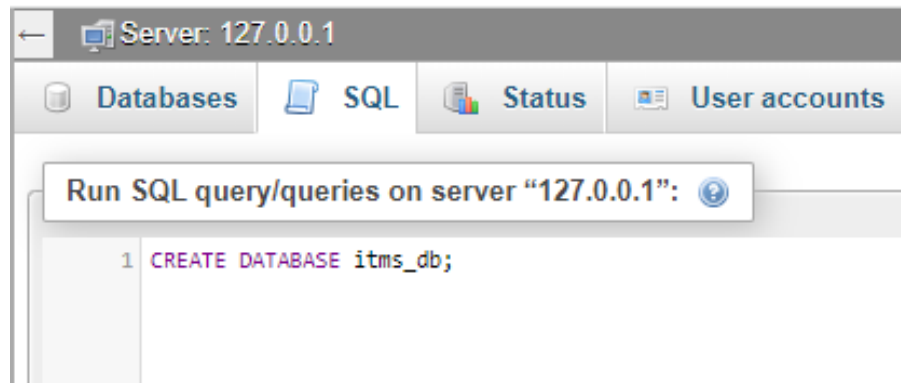
Figure 4.2 – SQL query to set up the database.

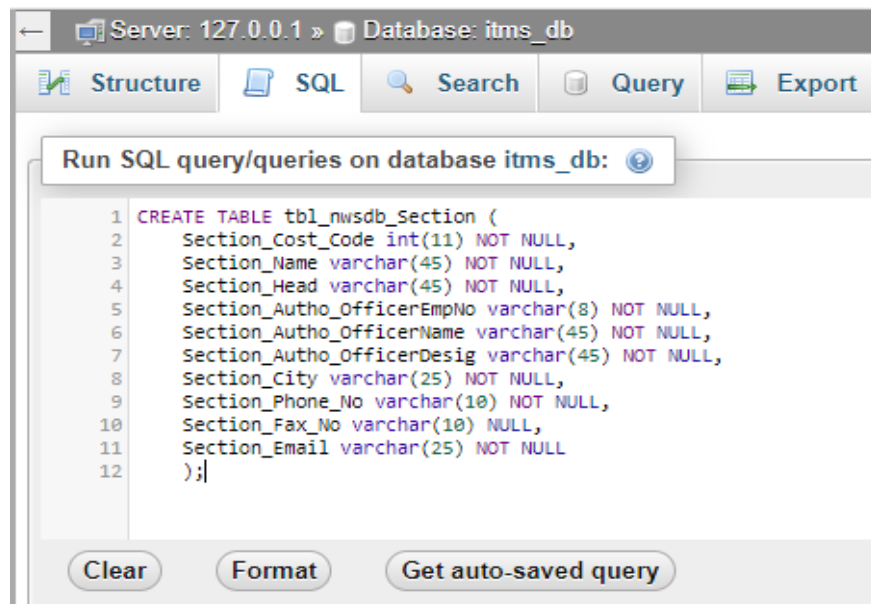The SQL query to set up the table is shown in Figure 4.3. The table is named "tbl_nwsdb_Section".

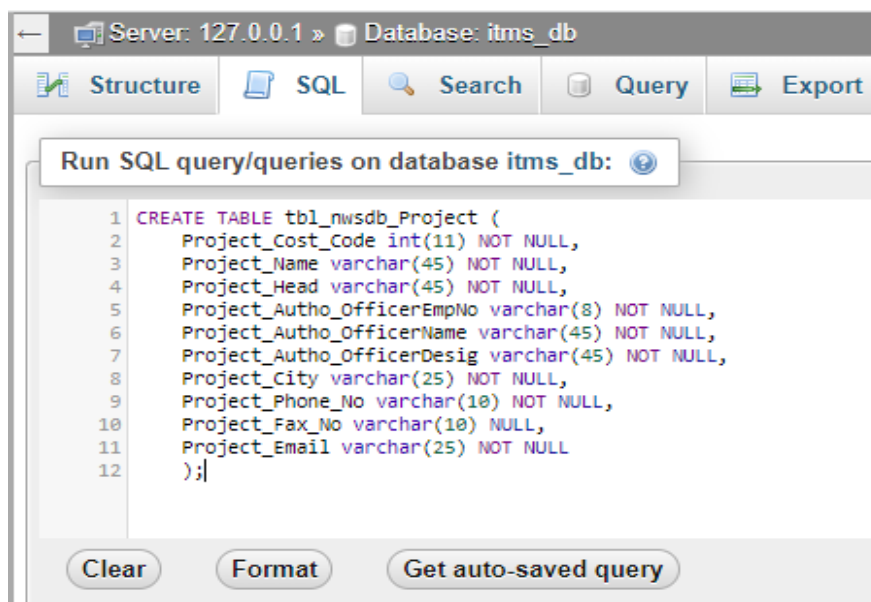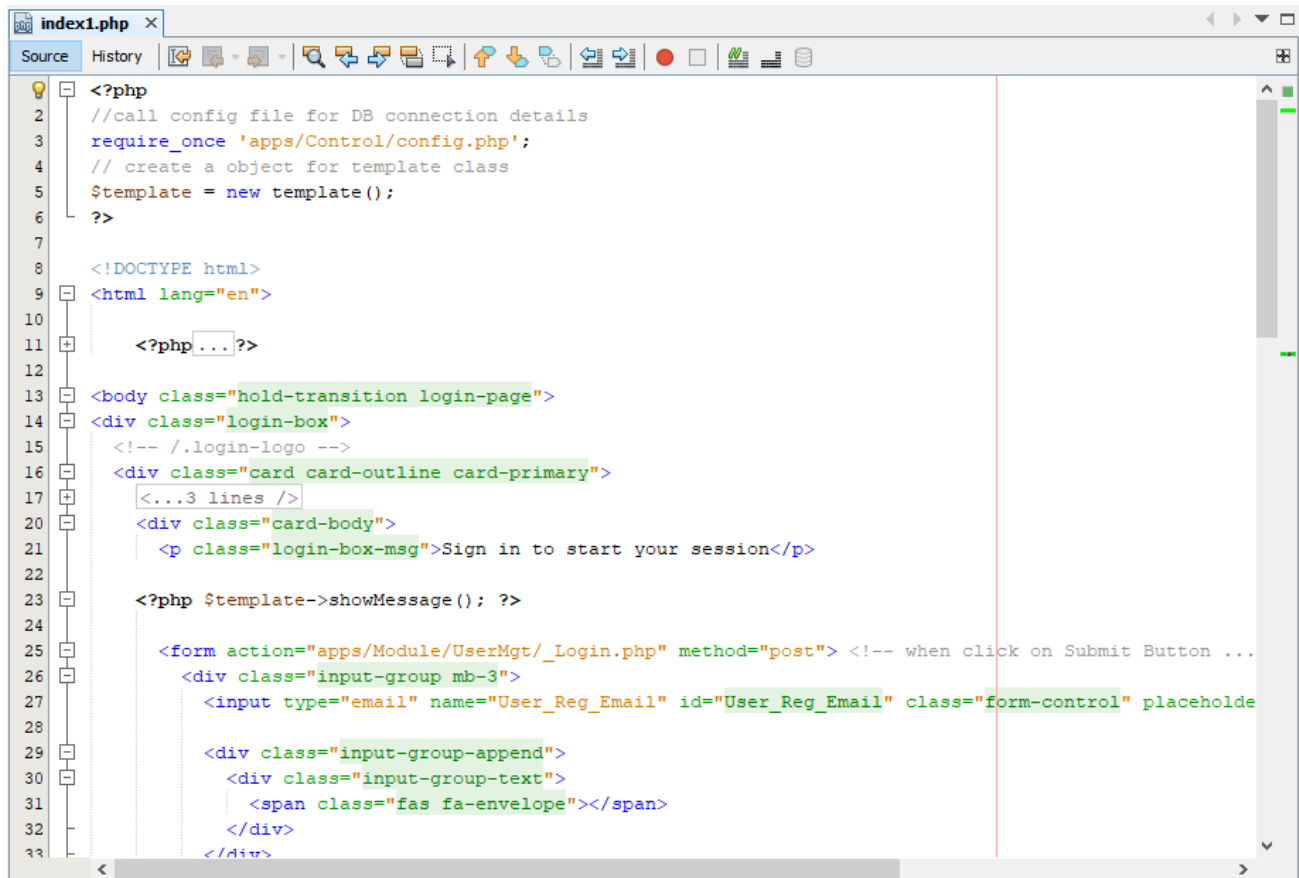```
1   CREATE TABLE tbl_nwsdb_Section (
2   Section_Cost_Code int(11) NOT NULL,
3   Section_Name varchar(45) NOT NULL,
4   Section_Head varchar(45) NOT NULL,
5   Section_Autho_OfficerEmpNo varchar(8) NOT NULL,
6   Section_Autho_OfficerName varchar(45) NOT NULL,
7   Section_Autho_OfficerDesig varchar(45) NOT NULL,
8   Section_City varchar(25) NOT NULL,
9   Section_Phone_No varchar(10) NOT NULL,
10   Section_Fax_No varchar(10) NULL,
11   Section_Email varchar(25) NOT NULL
12);
```

**Figure 4.3 – SQL query to set up the section table.**

The SQL query to set up the table is shown in Figure 4.4. The table is named "tbl_nwsdb_Project".



```
1   CREATE TABLE tbl_nwsdb_Project (
2       Project_Cost_Code int(11) NOT NULL,
3       Project_Name varchar(45) NOT NULL,
4       Project_Head varchar(45) NOT NULL,
5       Project_Autho_OfficerEmpNo varchar(8) NOT NULL,
6       Project_Autho_OfficerName varchar(45) NOT NULL,
7       Project_Autho_OfficerDesig varchar(45) NOT NULL,
8       Project_City varchar(25) NOT NULL,
9       Project_Phone_No varchar(10) NOT NULL,
10      Project_Fax_No varchar(10) NULL,
11      Project_Email varchar(25) NOT NULL
12  );
```

Figure 4.4 – SQL query to set up the project table.

4.5 Implementation of Coding

Coding plays a very important role in completing a program. This provides instructions on what to do and how to do on run the program. The code was developed using PHP. Apache NetBeans IDE was used as an editor. The editor helps to easily refactor codes.
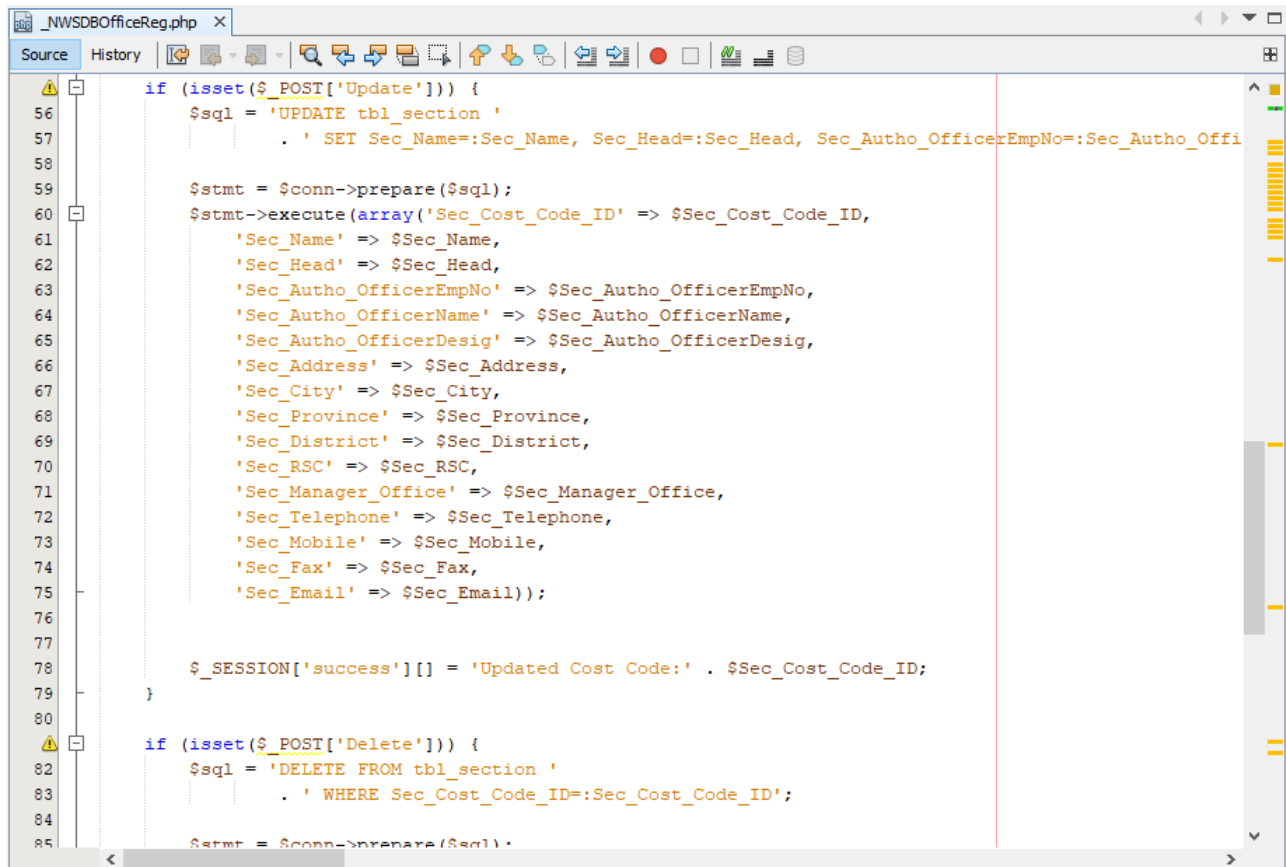
The code to implement the user login is shown in Figure 4.5. The login page is named "index1".


```php
<?php
//call config file for DB connection details
require_once 'apps/Control/config.php';
// create a object for template class
$template = new template();
?>

<!DOCTYPE html>
<html lang="en">

    <?php ... ?>

<body class="hold-transition login-page">
<div class="login-box">
    <!-- /.login-logo -->
    <div class="card card-outline card-primary">
        <...3 lines />
        <div class="card-body">
            <p class="login-box-msg">Sign in to start your session</p>

        <?php $template->showMessage(); ?>

            <form action="apps/Module/UserMgt/_Login.php" method="post"> <!-- when click on Submit Button ...
                <div class="input-group mb-3">
                    <input type="email" name="User_Reg_Email" id="User_Reg_Email" class="form-control" placeholde

                    <div class="input-group-append">
                        <div class="input-group-text">
                            <span class="fas fa-envelope"></span>
                        </div>
                    </div>
```

Figure 4.5 - Code of the User-Login page

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The code to implement the Update & Delete is shown in Figure 4.6. The page is named as "_NWSDBOfficeReg".

Figure 4.6 - Code of the Update & Delete

4.6 Implementation of Security

Security is a very important aspect of a system. In a web base system, it is an area that needs further special attention. To prevent unauthorized access to the login password, each complete password is stored in the data table using the SHA 1 encrypted hash algorithm.

Figure 4.7 represents the encryption codes of the security implementation.

```
// Get the values from view page and assign to variables
$User_Reg_ID = $_POST['User_Reg_ID'];
$User_Reg_Emp_Cost_No = $_POST['User_Reg_Emp_Cost_No'];
$User_Reg_No_Type = $_POST['User_Reg_No_Type'];
$User_Reg_Name_Initial = $_POST['User_Reg_Name_Initial'];
$User_Reg_Name_Surname = $_POST['User_Reg_Name_Surname'];
$User_Reg_Signature = $_POST['User_Reg_Signature'];
$User_Reg_Password = sha1($_POST['User_Reg_Password']);
$User_Reg_Photo = $_POST['User_Reg_Photo'];
$User_Reg_Role = $_POST['User_Reg_Role'];
$User_Reg_Is_Active = $_POST['User_Reg_Is_Active'];
$User_Reg_Designation = $_POST['User_Reg_Designation'];
$User_Reg_Email = $_POST['User_Reg_Email'];
// Find the errors while insert/update/delete
```

Figure 4.7 - Code of the SHA 1 encryption

4.7 Implementation of User interface

The user interfaces are very important to the success of an application. The web application interface enables a user can interact with applications running on a web server via an internet browser. Figure 4.8 shows the modules of the system that interact with different user categories.
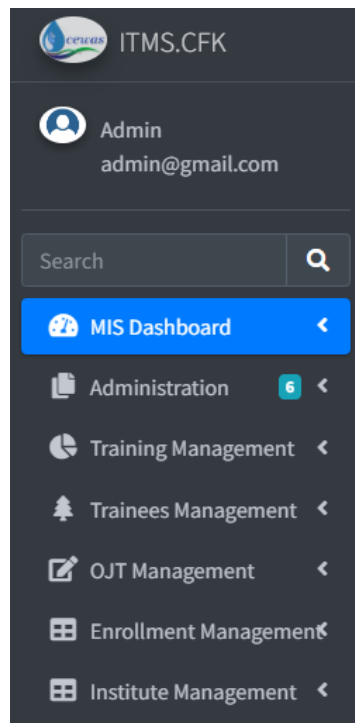

Figure 4.8 - Modules of the system

Figure 4.9 shows the current registered users on the system.

Figure 4.9 - Registered users on the system

Figure 4.9 shows the user edit, view & delete interface.

Figure 4. 10 - User edit, view & delete interface

4.8 Implementation Chapter Summary

The RAD model was primarily applied as the implementation approach & the project platform was created based on the MVC model. The chapter fully described the project implementation workflow, in a very well systematic way, considering all of the hardware & software specifications, Database, Coding, Security & Interface implementation.

The minimum software equipment and hardware requirements for the development and implementation of this project are specified. XAMPP was used as a cross-platform facility for system development. PHP platform was primarily used as an implementation programming language and the MYSQL platform was used as a database system.

Chapter 5: Testing and Evaluation

5.1 Introduction

Once the successful completion of the program, that is essential to evaluate the system using different types of testing & assessment approaches. This will aid in identifying software development challenges relating to both functional and nonfunctional constraints. Additional testing & assessment show system faults including validating, programming mistakes, error data inputs, security failures, and so on. This chapter will go through all of the cases and approaches utilized to create a fully accurate software package to substitute the traditional industrial training management system.

"Software Testing is a method to check whether the actual software product matches expected requirements and to ensure that software product is defect free. It involves execution of software/system components using manual or automated tools to evaluate one or more properties of interest. The purpose of software testing is to identify errors, gaps or missing requirements in contrast to actual requirements." (Thomas Hamilton, 2022)

5.2 Software Testing Types

The proposed system was examined in two categories throughout this testing procedure as follows. (Guru99.com. 2022)

> **Type 1 -** Functional testing approach
>
> **Type 2 -** Non-functional testing approach
>
> > (Performance Testing approach)

5.2.1 Functional testing approach

> Following tests are covered under functional testing approach. (Guru99.com. 2022)
> - Unit Testing
> - Integrating Testing
> - System Testing

5.2.1.1 Unit Testing

The suggested ITMS system was constructed in units, and each unit was tested independently. The sign-in and sign-out units were tested in the first stage. The "Industrial Training Request" unit was then tested for its functionality in the next stage. Following this, the authorized NWSDB office and Project office were checked for their functionality. When such modules were designed, they were checked on a one-by-one basis.

5.2.1.2 Integrating Testing

After the successful completion of unit testing, integrated testing occurred by combining multiple units. This industrial trainee registration module is being tested in this system with training request registration and training subject area registration. Students are unable to register with the system if the training request and training subject areas are not added.

5.2.1.3 System Testing

Just after that, the ITMS system was completed, it became evaluated using actual data to discover any issues in the functionalities & its capabilities. The primary goal is to ensure that single units are compatible. As an outcome of this, it discovered certain instances where modules were constructed with varying specifications, such as input size, data type & name of attributes. System security was validated during system testing by logging in with multiple user access authentication. Also, more data was entered into the inputs & the system examined any validity issues.

5.2.2 Non-Functional testing approach

Following tests are covered under functional testing approach. (Guru99.com. 2022)
- Usability Testing
- Acceptance Testing

This testing had been done to discover any faults here on the user's end.

5.2.2.1 Usability Testing

A usability test is a method in the user centered design process that tries to determine the web-based ITMS with real human beings. This is an essential usability approach as it provides instant feedback according to how users interact with this system.

The purpose of this test will be to satisfy users, and so it focuses on the below key system components.

- System Effectiveness
- System Efficiency
- System Accuracy
- User Friendliness

5.2.2.2 User Acceptance Testing

Prior to delivering any applications in real operation, the user should perform a quality check to ensure that the system meets the client's criteria as defined. The training officer & Manager (Training) evaluated the trainee registration & NWSDB office / Project registration process and discovered that the field size of the trainee's name & cost code of NWSDB office / Project in the back-end of the table field was insufficient, which was fixed.

5.3 Plan of the system testing

The testing was designed to examine the essential functions of the web-based ITMS. This testing was designed to accomplish the below goals.

- It is being validated the programme, hardware, & essential functions in compliance with the client's requirements.
- It provides the outline of how the testing will be carried out.
- It specifies the testing methodologies, approaches & suitable strategies that should be applied.

The test plan for the ITMS sign-in process is mentioned in the table 5.1

No	Assigning Task	Testing Approach	Expecting Result	Level
1	Trying to authenticate without inputting their usernames & passwords.	Input username & password, that does not exist in the ITMS database.	Showing a warning message. "User Name or Password does not exist."	High
2	Attempting to login without a username and password.	There was no username or password input.	Showing a warning message, "User name & Password is required"	Medium
3	Attempting to login without a password.	Inputting only username	Showing a warning message, "Password is required"	Medium
4	Attempting to login without a username.	Inputting only password	Showing a warning message, "Username is required"	Medium
5	Attempting to login with correct username and password.	Inputting existing Username & Password	Directing to ITMS main page as per the authentication privileges.	High

Table 5. 1 Test plan for the sign-in process

The test plan for the NWSDB office registration process is mentioned in the table 5.2

No	Assigning Task	Testing Approach	Expecting Result	Level
1	Attempting to create a NWSDB office without no data.	Don't enter any data about the NWSDB office.	Displaying warning messages near required data fields.	High
2	Validating NWSDB office cost code.	Entering an existing registered NWSDB office cost code.	Displaying warning message, "Cost code is already existing".	High
3	Validating Email ID	Entering an email ID without the standard format.	Displaying warning message	Medium
4	Validating phone number	Entering phone numbers varied number length sizes.	Displaying warning messages about the phone number length.	High

| 5 | Attempting to create a NWSDB office with all required data. | Entering all required data into the new NWSDB office registration form. | Creating the NWSDB office properly in the ITMS & Displaying successful message, "xxxx Cost code is Successfully Created". | High |

Table 5. 2 The test plan for the NWSDB office registration process

The test plan for the Trainee registration process is mentioned in the table 5.3

No	Assigning Task	Testing Approach	Expecting Result	Level
1	Attempting to create a new trainee without no data.	Don't enter any data about the new trainee.	Displaying warning messages near required data fields.	High
2	Validating NIC No of the trainee.	Entering NIC No varied length sizes.	Display error on NIC number.	High
3	Validating NIC No of the trainee.	Entering an existing registered NIC number.	Displaying warning message, "NIC number is already existing".	High
3	Validating Email ID	Entering an email ID without the standard format.	Displaying warning message	Medium
4	Validating phone number	Entering phone numbers varied number length sizes.	Displaying warning messages about the phone number length.	High
5	Attempting to create a new trainee with all required data.	Entering all required data into the new trainee registration form.	Creating the trainee properly in the ITMS & Displaying successful message, "xxxx NIC No is Successfully Created".	High

Table 5. 3 The test plan for the Trainee registration process

5.4 Implementation of Test cases

When finishing the testing plan, the system testing plan should proceed in compliance with the test plan. Each function in the testing plan could represent a separate test case.

Each of the testing designs described in the previous section (5.3) created testing cases.

The following table 5.4 represents the test case under table 5.1 "Test plan for the sign-in process."

The testing case of trying to authenticate without inputting their usernames and passwords is shown in table 5.4 below.
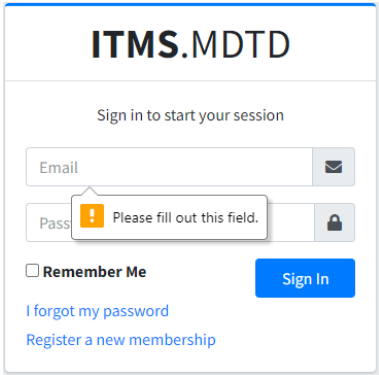
Testing case no	ITMS_TC01	
Testing case name	User sign-in	
Description of the testing case	The system accepts only valid sign-in authentication.	
Preconditions for the testing case	The user should have the ability to access the sign-in web page.	
Assumption of the testing case	The user should have a stable internet connection. The web browser properly opens the sign-in page.	

Steps of the Testing Case
   a. Load the ITMS home page
   b. Navigate to the sign-in user interface.
   c. Click on Sign-in without inputting any usernames and passwords.		

Expected Testing Outcome	Showing a warning message, "User name & Password is required"	
Testing Result		**Testing Status** Success

Table 5. 4 The testing case sign-in authentication

The following table 5.5 represents the test case under table 5.2 " NWSDB office registration process."

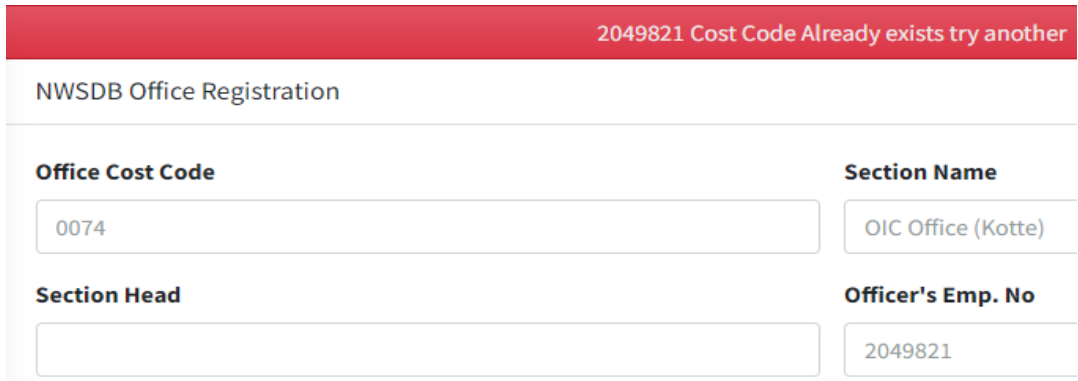The testing case of trying to validating NWSDB office cost code is shown in table 5.5 below.

Testing case no	ITMS_TC02	
Testing case name	Validating NWSDB office cost code	
Description of the testing case	The ITMS should authorize to register NWSDB office with unique office cost code.	
Preconditions for the testing case	The user should have the ability to access the NWSDB office registration web page.	
Assumption of the testing case	The user should have a stable internet connection. The web browser properly opens the NWSDB office registration web page.	

Steps of the Testing Case
  a. Load the ITMS home page
  b. Navigate to the NWSDB office registration user interface.
  c. Input NWSDB office registration details & office cost code that is utilized for another cost center.
  d. Click on Register button.		

Expected Testing Outcome	Showing a warning message, "Cost code already exists"	
Testing Result		**Testing Status**
		Success

Table 5. 5 The testing case of validating NWSDB office cost code

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The following table 5.6 represents the test case under table 5.3 " Trainee registration process."

The testing case of trying to validating trainee National ID number is shown in table 5.6 below.
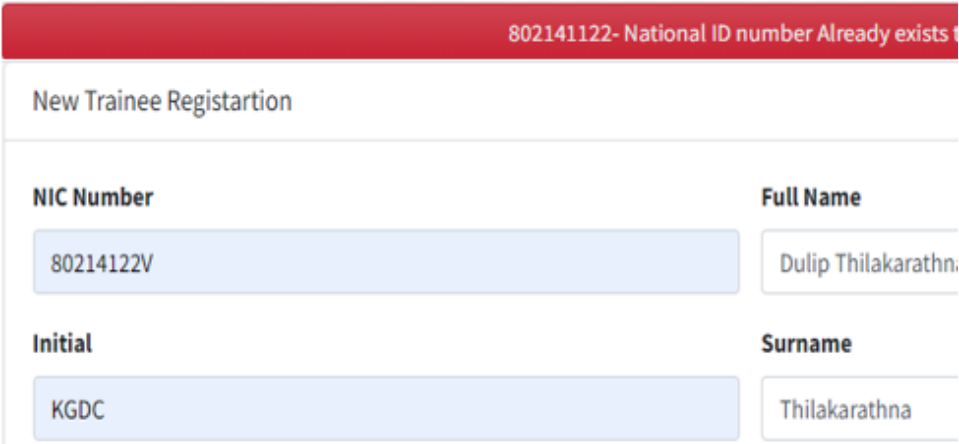
Testing case no	ITMS_TC03	
Testing case name	Validating trainee National ID number.	
Description of the testing case	The ITMS should authorize to register new trainee with unique National ID number.	
Preconditions for the testing case	The user should have the ability to access the new trainee registration web page.	
Assumption of the testing case	The user should have a stable internet connection. The web browser properly opens the new trainee registration web page.	

Steps of the Testing Case
  a. Load the ITMS home page
  b. Navigate to the new trainee registration user interface.
  c. Input new trainee registration details & National ID number that is utilized for another trainee.
  d. Click on Register button.		

Expected Testing Outcome	Showing a warning message, "National ID number already exists"	
Testing Result		**Testing Status**
		Success

Table 5.6 The testing case of validating trainee National ID number.
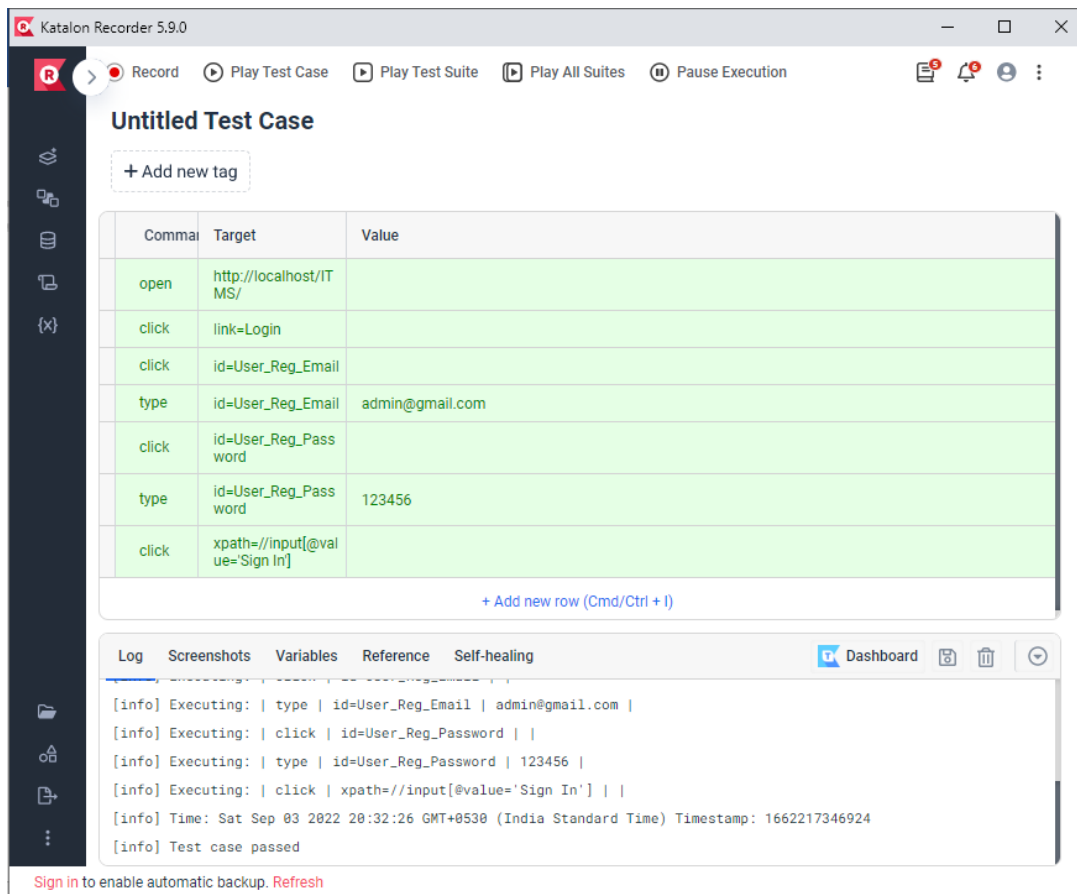
5.4 Implementation of Automation Testing

An automated test is an important approach that executes a test case set through particular unit testing software applications. Testing scripts or testing platforms are used in automation testing with pre-defined sets of data without requiring manually entering data.

This makes it simple to execute continuously till the application defects are fixed. This assists in increasing software quality in a very short amount of time.

5.4.1 Automatic unit testing

Figure 5.1 represents the outcomes of the unit relevant to the sign-in operation. For this automated testing case, the Katalon Recorder had been utilized. The result of the test case showed success. The code base was attached in Appendix A for reference.

```
[info] Playing test case ITMS Sign-in Test Suite / Untitled Test Case

[info] Time: Sat Sep 03 2022 20:32:18 GMT+0530 (India Standard Time) Timestamp: 1662217338801

[info] OS: Windows Version: 10

[info] Browser: Chrome Version: 104.0

[info] If the test cannot start, please refresh the active browser tab

[info] Executing: | open | http://localhost/ITMS/ | |

[info] Executing: | click | link=Login | |

[info] Executing: | click | id=User_Reg_Email | |

[info] Executing: | type | id=User_Reg_Email | admin@gmail.com |

[info] Executing: | click | id=User_Reg_Password | |

[info] Executing: | type | id=User_Reg_Password | 123456 |

[info] Executing: | click | xpath=//input[@value='Sign In'] | |

[info] Time: Sat Sep 03 2022 20:32:26 GMT+0530 (India Standard Time) Timestamp: 1662217346924

[info] Test case passed
```

Figure 5. 1 Automated test result of Sign-in operation

5.4.2 Automated UI testing

User interface of the training center registration form of the system was tested by using automation testing. For this automation testing, TestNG, Selenium web driver and Chrome web browser with Java class were used. Following figure 5.2 shows the result of the automated testing.

```
🔲 Problems  📖 Javadoc  🔍 Declaration  🖥 Console ⌗  �ⓣ Results of running class autoTestInsRegistration        ▣ ✖ ✖ | 🔊 🔋 🖲 🗐 🗐
<terminated> autoTestInsRegistration [TestNG] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Sep 9, 2022 10:29:54 PM – 10:30:22 PM)
[RemoteTestNG] detected TestNG version 7.4.0
Starting ChromeDriver 93.0.4577.15 (660fc11082ba57405eca2e8c49c3e1af756fbfae-refs/branch-heads/4577@{#203}) on port 24537
Only local connections are allowed.
Please see https://chromedriver.chromium.org/security-considerations for suggestions on keeping ChromeDriver safe.
ChromeDriver was started successfully.
Sep 09, 2022 10:30:00 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Detected dialect: W3C
PASSED: AutoTestInsReg


===============================================
    Default test
    Tests run: 1, Failures: 0, Skips: 0
===============================================


===============================================
Default suite
Total tests run: 1, Passes: 1, Failures: 0, Skips: 0
===============================================
```

Figure 5. 2 Automated test result of the training center registration UI

5.5 Feedback on User Evaluation

Usability testing is an important part of determining the most optimal user experience. The user's feedback in this case confirms the software package's long-term sustainability. From start to finish, user feedback & suggestions are the major of all system development processes. So, it is an important role to analyze what are the user's feedback about the system.

A predefined questionnaire was created to obtain end user comments & feedback for the suggested ITMS system's usability testing. In this task, a google form was used to collect data very easily. It is also very easy to analyze the data obtained through Google Forms. A special feature in Google Forms is the automatic creation of graphs and tables required for data analysis.

All users using the system are given the opportunity to interact with the system and after that give their feedback through the Google Form. This user evaluation is primarily aimed at the five (5) main categories listed below.

- Usability
- Functionality
- Productivity
- Security
- Appearance

The user's responses to the questionnaire were evaluated using a Likert scale. The Google form used for user feedback is given in Appendix A.

The considered values for the Likert scale are as follows.

1   -   Strongly Disagree

2   -   Disagree

3   -   Neutral

4   -   Agree

5   -   Strongly Agree

5.6 Results of user's feedback evaluation

User answers had been gathered via a Google form, and the answers were organized into five major categories mentioned above (Usability, Functionality, Productivity, Security, Appearance)

These feedback results & findings are represented numerically & graphically in the next subsection.

5.6.1 Feedback results of usability

The system's usability has been tested using four key questions. The summarized answers are shown in Table 5.7. The figure 5.3 provides an illustration of the answer for just a clearer understanding.

	Q1	Q2	Q3	Q4	Total	%
Strongly Agree	5	4	4	7	20	33.33
Agree	9	11	9	8	37	61.67
Undecided	1	0	2	0	3	5.00
Disagree	0	0	0	0	0	-
Strongly Disagree	0	0	0	0	0	-
Total	15	15	15	15	60	100

Table 5. 7 Summarized answers of usability (Numerically)
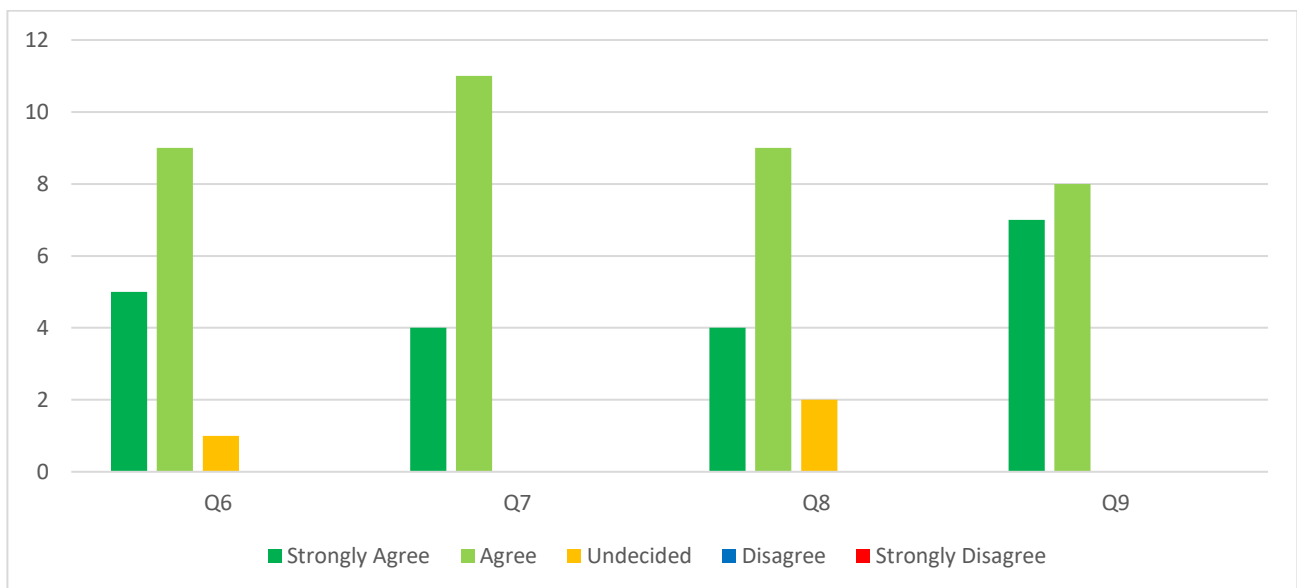

Figure 5. 3 Summarized answers of usability (Graphically)

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Based on the summary results, the majority of users are satisfied with the usability of the ITMS.

5.5.2 Feedback results of appearance

The system's appearance has been tested using five key questions. The summarized answers are shown in Table 5.8. The figure 5.4 provides an illustration of the answer for just a clearer understanding.

	Q5	Q6	Q7	Q8	Q9	Total	%
Strongly Agree	4	5	4	8	3	24	32.00
Agree	10	9	9	7	11	46	61.33
Undecided	1	1	2	0	1	5	6.67
Disagree	0	0	0	0	0	0	-
Strongly Disagree	0	0	0	0	0	0	-
Total	15	15	15	15	15	75	100

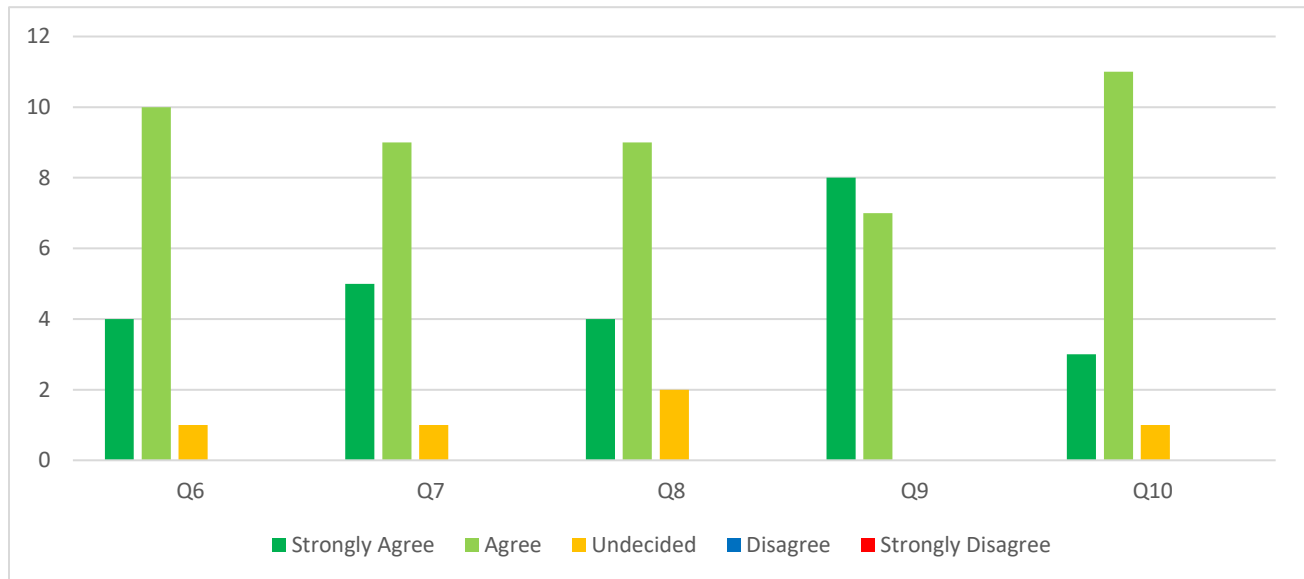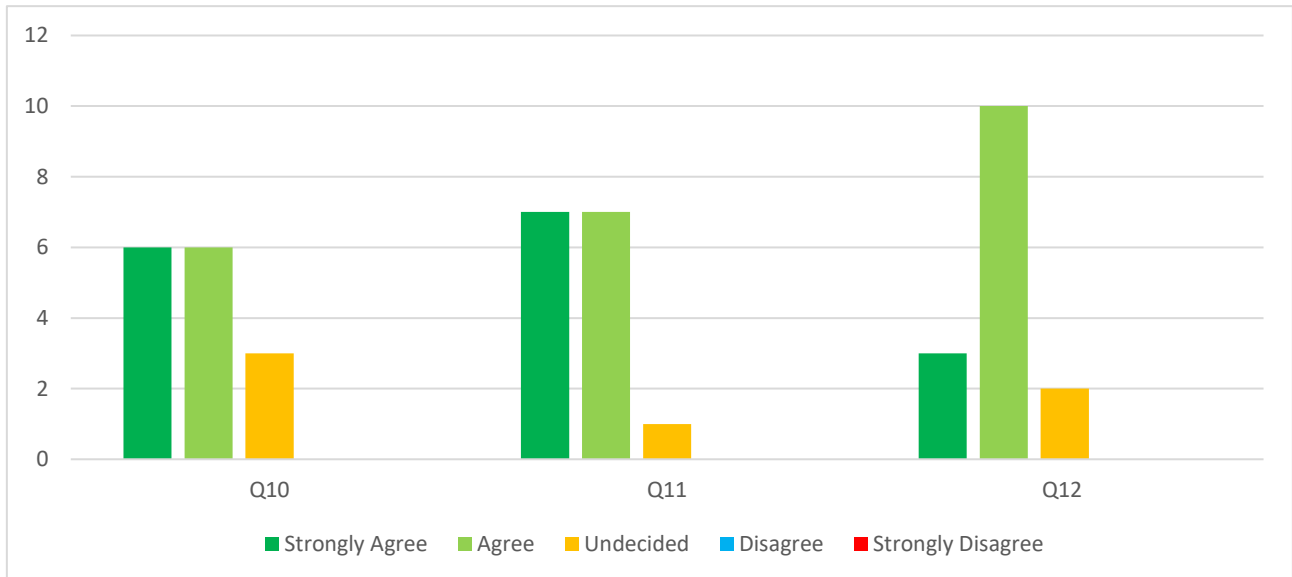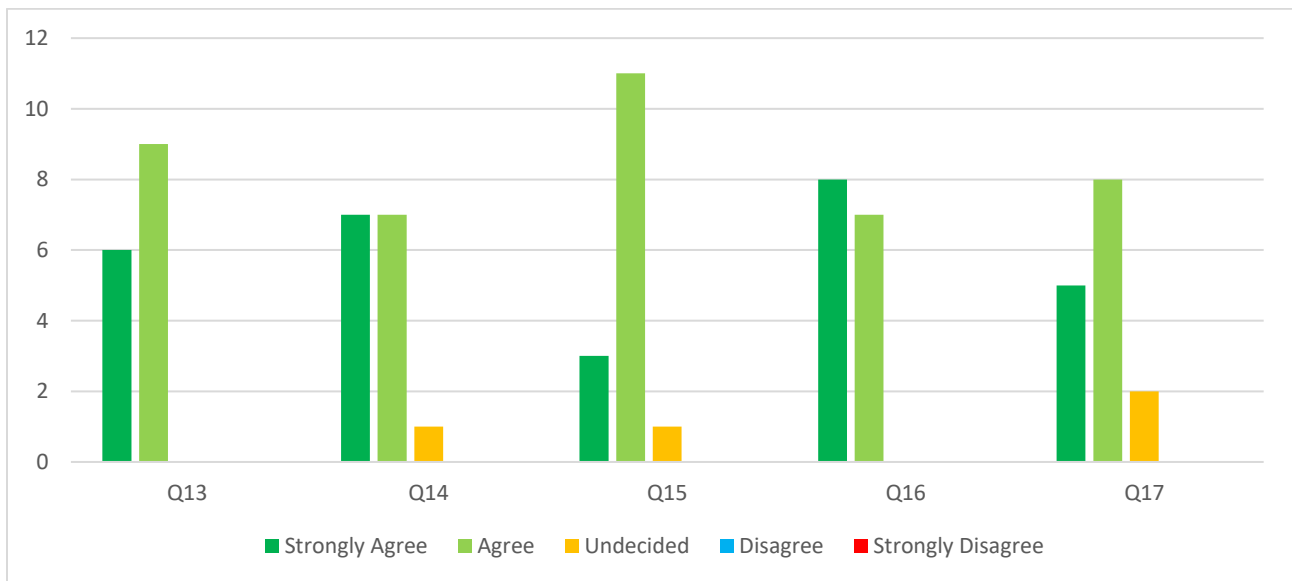**Table 5.8 Summarized answers of appearance (Numerically)**

Figure 5. 4 Summarized answers of appearance (Graphically)

Based on the summary results, the majority of users are satisfied with the appearance of the ITMS.

5.5.3 Feedback results of functionality

The system's functionality has been tested using three key questions. The summarized answers are shown in Table 5.9. The figure 5.5 provides an illustration of the answer for just a clearer understanding.

	Q10	Q11	Q12	Total	%
Strongly Agree	6	7	3	16	35.56
Agree	6	7	10	23	51.11
Undecided	3	1	2	6	13.33
Disagree	0	0	0	0	-
Strongly Disagree	0	0	0	0	-
Total	15	15	15	45	100

Table 5.9 Summarized answers of functionality (Numerically)

Figure 5. 5 Summarized answers of functionality (Graphically)

Based on the summary results, the majority of users are satisfied with the functionality of the ITMS.

5.5.4 Feedback results of performance

The system's performance has been tested using five key questions. The summarized answers are shown in Table 5.10. The figure 5.6 provides an illustration of the answer for just a clearer understanding.

	Q13	Q14	Q15	Q16	Q17	Total	%
Strongly Agree	6	7	3	8	5	29	38.67
Agree	9	7	11	7	8	42	56.00
Undecided	0	1	1	0	2	4	5.33
Disagree	0	0	0	0	0	0	-
Strongly Disagree	0	0	0	0	0	0	-
Total	**15**	**15**	**15**	**15**	**15**	**75**	**100**

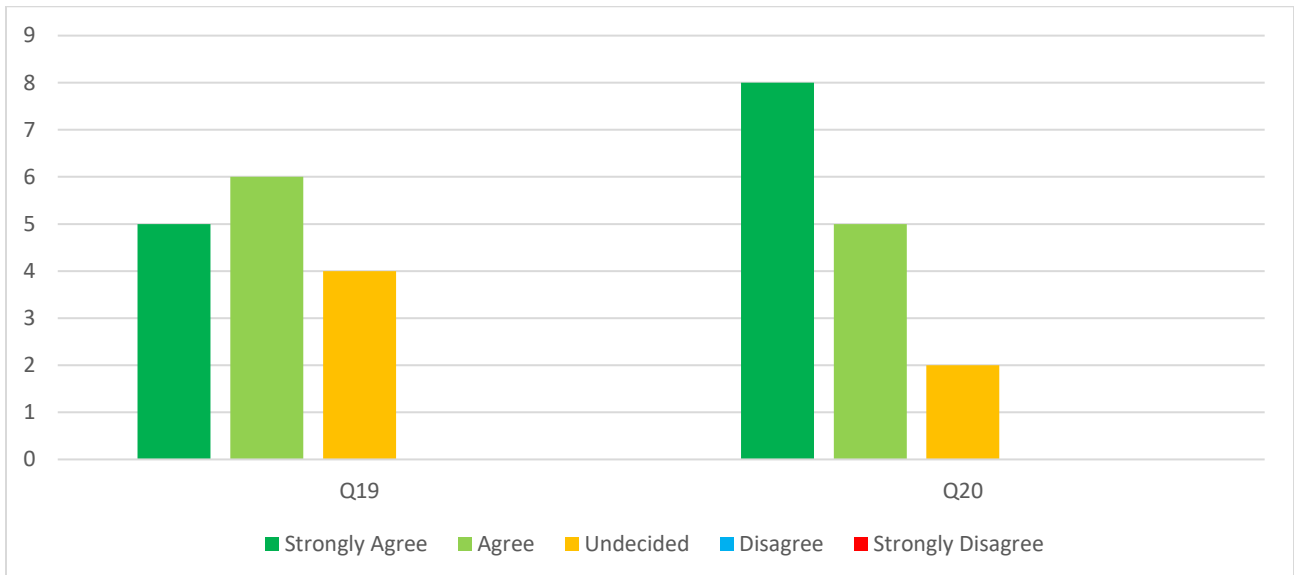**Table 5.10 Summarized answers of performance (Numerically)**

Figure 5. 6 Summarized answers of performance (Graphically)

Based on the summary results, the majority of users are satisfied with the performance of the ITMS.
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5.5.5 Feedback results of security

The system's security has been tested using five key questions. The summarized answers are shown in Table 5.11. The figure 5.7 provides an illustration of the answer for just a clearer understanding.

	Q18	Q19	Total	%
Strongly Agree	5	8	13	43.33
Agree	6	5	11	36.67
Undecided	4	2	6	20.00
Disagree	0	0	0	-
Strongly Disagree	0	0	0	-
Total	15	15	30	100

Table 5.11 Summarized answers of security (Numerically)

Figure 5. 7 Summarized answers of security (Graphically)

Based on the summary results, the majority of users are satisfied with the security of the ITMS.

5.5.6 Summary of Feedback results of the Usability Evaluation

The system's usability has been tested using five major categories. The summarized answers are shown in Table 5.14. The figure 5.8 provides an illustration of the answer for just a clearer understanding.

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Usability	20	37	3	0	0
Appearance	24	46	5	0	0
Functionality	16	23	6	0	0
Performance	29	42	4	0	0
Security	13	11	6	0	0

Table 5.12 Overall results of usability feedback (Numerically)
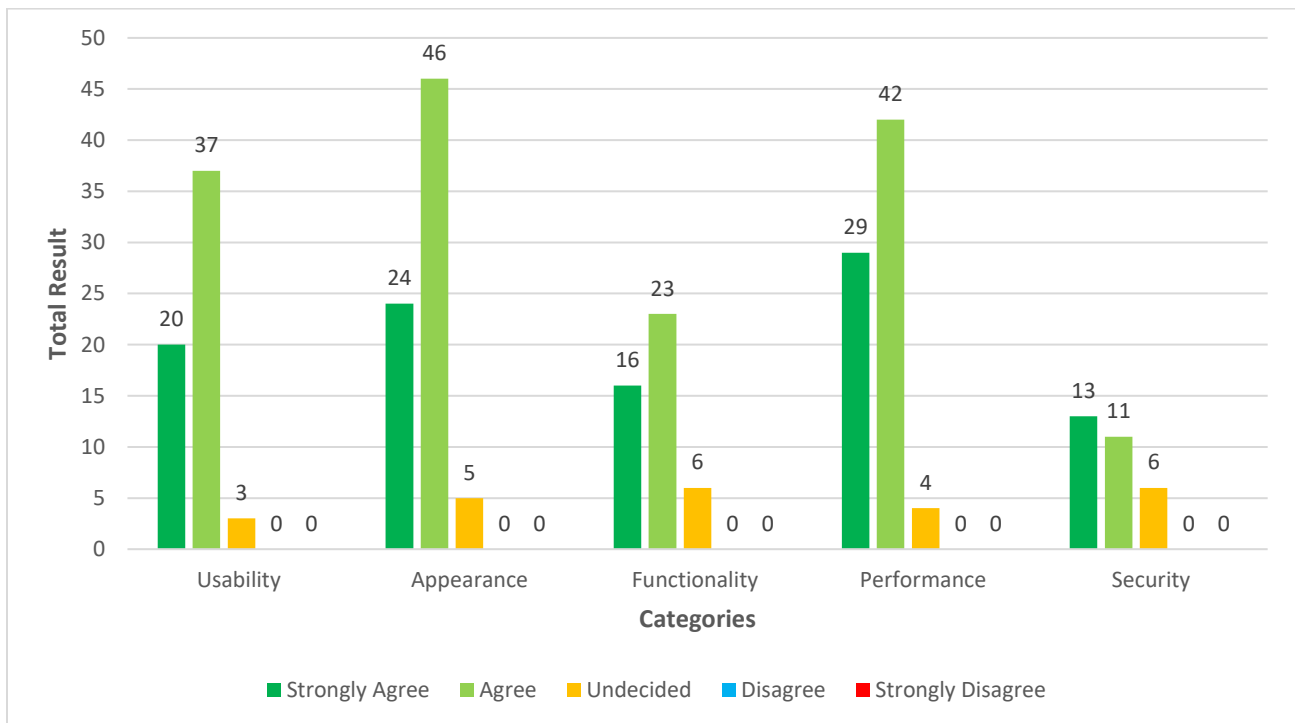
Figure 5. 8 Overall results of usability feedback (Graphically)

5.7 Chapter Summary

The various testing approaches applied to find system defects and user feedback with the ITMS were addressed in this chapter. The system was checked by signing in and reviewing relevant outcomes. Also, the feedback received from users using this system has been analyzed.

This can be capable of producing stable web-based applications after performing those testing and evaluating user answers & feedback.

Chapter 6: Conclusion

6.1 Introduction

The conclusion chapter concentrates upon the fulfillment of goals, and lessons that have been learned, as well as providing recommendations & direction for future improvements that will be focused on the implementation of a new industrial training management system.

Various challenges and problems were encountered in the development of this web based ITM system. The chapter will also go through some of the system's limitations, issues, and solutions to transcend those challenges.

6.2 Fulfillment of the system goals

The web-based Industrial Training Management system was designed for National Water Supply & Drainage Board's Manpower Development & Training Division (Center for Knowledge). The new system basically answers various problems arising inside the traditional industrial training management process, that has been shown to be both time-consuming & mistakes, particularly when dealing with a significant number of OJT/Internship applicants in various courses and programs.

This system will be much more beneficial to both OJT/Internship students and the MDTD training executive officers in terms of making their OJT / Industrial training process more effective.

The system makes it easier to register training centers and their students, seek industrial training, request trainees, assign training, recode training activities, issue final certificates, and print MIS reports.

Furthermore, it reduced overall stress & optimized the effectiveness of OJT / Industrial training management process through minimizing time, work, materials, budget, and other resources. Also, it satisfies the MDTD of the NWSDB's need to handle the OJT / Industrial training. The freshly created system assists staff members (NWSDB Offices and Projects) in registering students while

also providing OJT / Industrial training. Because this system is internet-based, MDTD training and management personnel may also operate from home. The system users will then have a very adaptable working environment.

Finally, after completing the industrial training, they can verify the correctness of the certificate online by entering their NIC number into the system. And anyone else who knows the NIC number can verify the correctness of the certificate through this service.

6.3 Learning experiences

This entire operation assisted in obtaining additional technical understanding & application development skills. It is critical to deal with various kinds of potential people while collecting data & analyzing real requirements. To get the most out of it, excellent contact between the target people was important, as is collaborating with them perspective of view through their point of view. The most difficult & talented able aspect of this task was the application implementation level.

Furthermore, that encouraged myself to perform the trial-and-error approach while using classroom learning of coding like as PHP, Bootstrap, MYSQL, CSS, & various other web-based developing methods & tools. That project assisted in learning about several approaches in use for application designing, web-based programming, & testing with various patterns to discover the required answers.

Some other essential key learning had been that building that type of fresh program with very little skill must begin with a very simple version. The product should then be improved one by one until it fulfills the client's actual needs. Whenever the tests failed or even a service quit functioning during the system testing, it became significantly simpler to identify the fault by only altering one component at a time.

6.4 Difficulties & Challenges

The project proposal preparation level included a clear & strong knowledge of the industrial training manual system as well as a solution for the manual system. Because of my lack of web-based application development knowledge & skill, researching various web applications for the best and most suitable web development language, technology, and methodology for this web-based project necessitates additional effort. Doing this preliminary project proposal preparation level study took longer time than the planned time frame.

While researching similar & comparable systems, the majority of them are business solutions, therefore they were not authorized to enter the web application. It can only read the system's features without even being able to test or use it.

After studying web development technologies, the PHP web application development language is selected for this web development, & MYSQL is applied as the database management & query language. Learning MYSQL & PHP required more time and it impacted the project delivery date. As I have not done this kind of project before, I had to put in a lot of effort to complete these tasks and I had to devote a long time & money to it. Also had to attend additional classes related to these subjects such as PHP & Web development.

Furthermore, a few employees in the NWSDB - MDTD was unfamiliar with the current web-based system. Their attitude was that the old manual industrial training management systems of Vedas were easy and correct. To eliminate this problem, it is necessary to have the appropriate training in web-based ITMS.

6.5 Upcoming & Future Improvements

In near future, when web-based technology advances, the ITMS system must be upgraded to embrace modern web-based technologies and think more attention to online security threats.

Furthermore, if a trainee does not finish the industrial training plan, the trainee should be able to request a letter of service. The ITMS should be designed to generate that training letter based on his work done.

As another aspect of development, trainees should be given the opportunity to modify their own profile data. This allows them to update their information on occasion. Currently there is no SMS notification system in the current system. Adding that facility to the system can create a more efficient notification system in the future.

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Appendix A – User Feedback Questionnaire

Industrial Training Excellence.
Center for Knowledge

Section 1 of 6

Web Based Industrial Training Management System (ITMS)

Thank you for using ITMS.
We want to hear your feedback so we can keep improving ITMS.
Please fill this quick survey and let us know your thoughts .

Feedback of usability

Description (optional)

1. Interface are user frienndly *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

2. This system (ITMS) easy to learn *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

3. I am able to find links easily *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

4. Display the error message *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Feedback of Appearance

Description (optional)

5. Interface of the ITMS pleasant for me *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

6. It is easy to find the information *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

7. I like colour combination *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

8. Font size, face & colour are readable *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

9. It is easy to navigate the manu bar *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Feedback of Functionality

Description (optional)

10. It is easy to register trainee *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

11. It is easy to register NWSDB Section / Project *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

12. It is easy to assign trainees to the training in subject field wise *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Feedback of Performance

Description (optional)

---

13. Main application interface load with the very short time *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

---

14. It is fetch the details quickly on the website *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

---

15. Save data with in short time *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

---

16. Validate of data accurate *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

---

17. Always display accurate information *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Figure 5.9 User Feedback Questionnaire

Appendix B - System Manual

The Web Based Industrial Training Management System (ITMS) has been constructed using web technologies and a PHP framework. As a result, it is important to set up the web server together with the other prerequisite tools kit.

Requirements of Web service

The web service environment is set up using the software and versions listed below.

- Apache 2.4.39
- MySQL 5.7
- PHP Version 7.3.28

XAMPP Version: 3.2.4 may be used to set up the web platform for all essential supporting applications on Microsoft Windows.

Figure B.1, illustrates the primary controlling interface of the active XAMPP program.
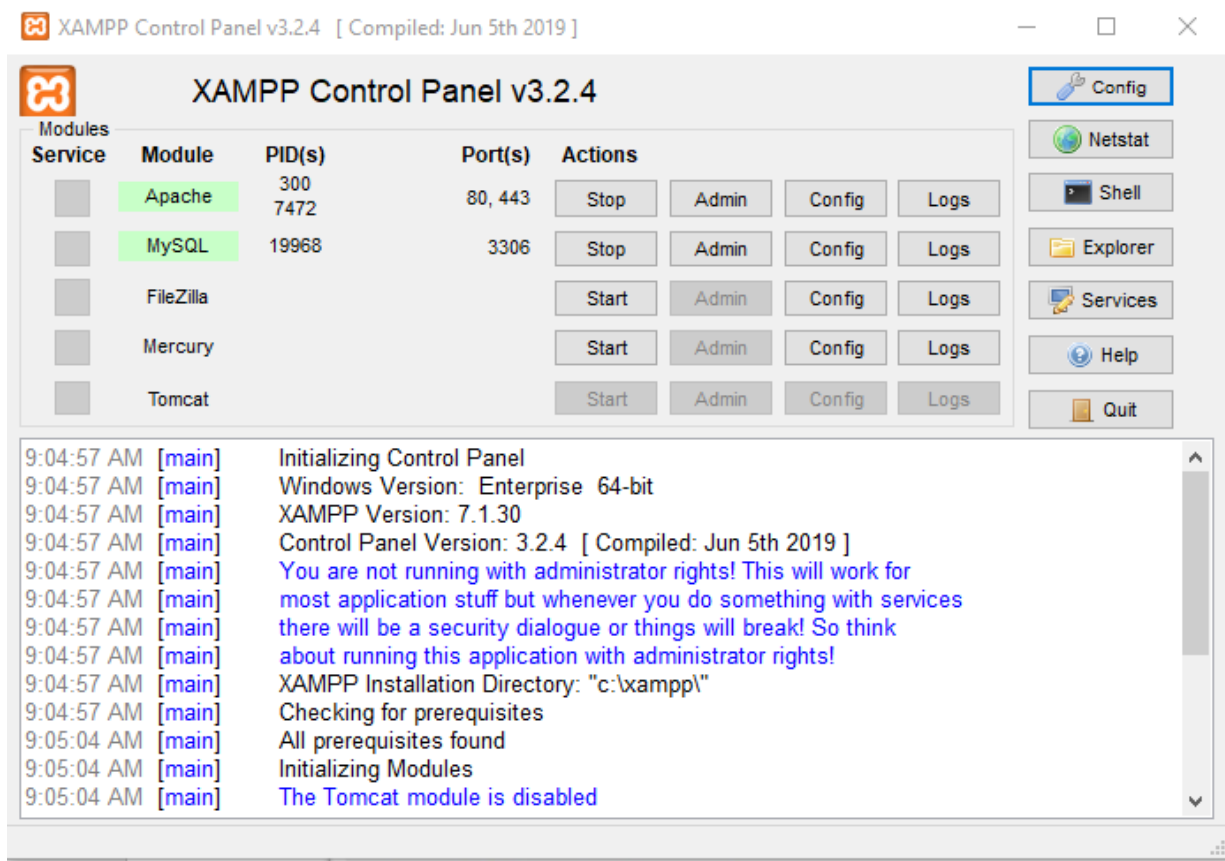
Figure: B.1

Steps of proper installation

1. When finishing your web server configuration, ensure that all essential services are available. Then after, build a database called "diets" and import the database backup.

2. Make a folder called "ITM" under "C:\xampp\htdocs" Import the entire files and folders to the ITM folder. The folder structure is illustrated in Figure B.2.
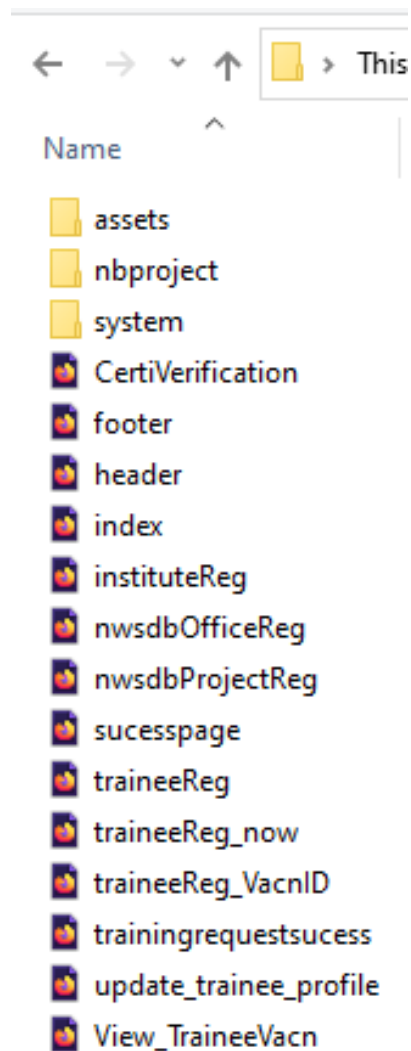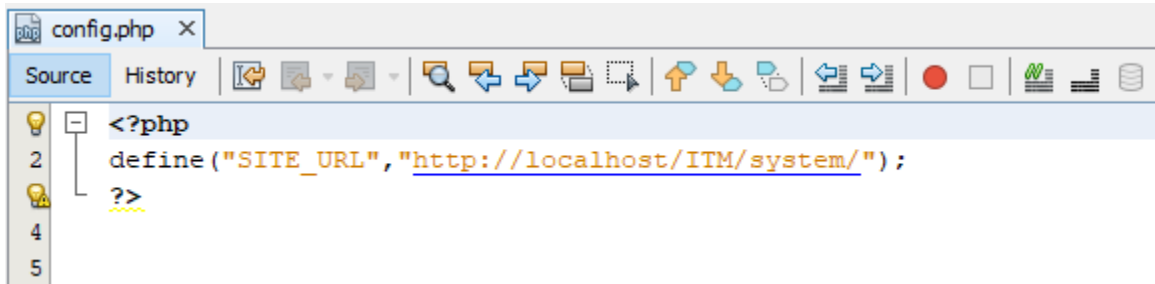
Figure B2 The folder structure

3. For modify the main URL, edit the "config.php" file located at " C:\xampp\htdocs\ITM\system\config.php." Figure B.3 illustrates the code.

Figure B3: "config.php" file

4. When the entire process has been completed successfully, the system may be accessed through any web browser by entering http://localhost/ITM/ in the address bar.

Appendix C - User Documentation

Industrial Training Management System (ITMS)

National Water Supply & Drainage Board

1. To access the ITEMS, by entering http://localhost/ITM/ in the address bar in any web browser. and, the user will find the following home page in figure C.1.
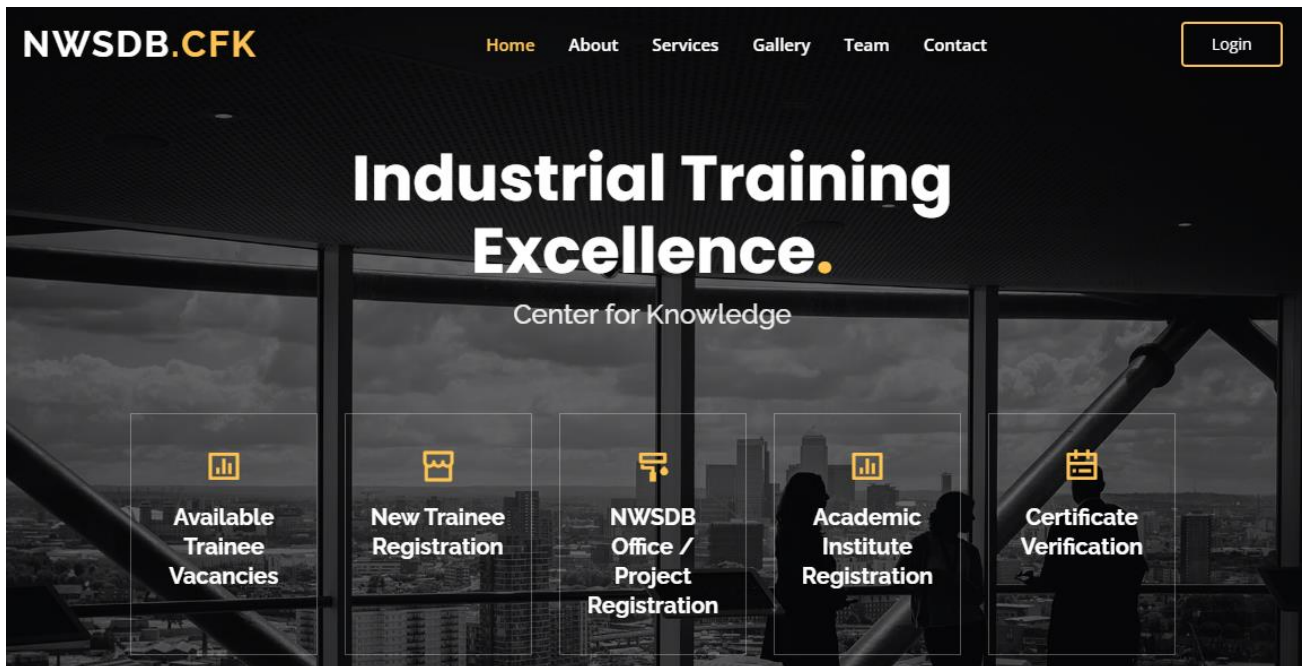
Figure C.1: Home page of ITMS

This system works in two ways,

1. **NWSDB.CFK information page**

    General data about the organization is included and users have the opportunity to make inquiries. Also, the following users who are not currently registered with this system are given the opportunity to register.

    - As a Trainee
    - As a NWSDB Office
    - As a NWSDB Project
    - As an Academic Institute

There is also an opportunity to know about the current training opportunities. (By clicking on the Available Trainee Vacancies icon.)
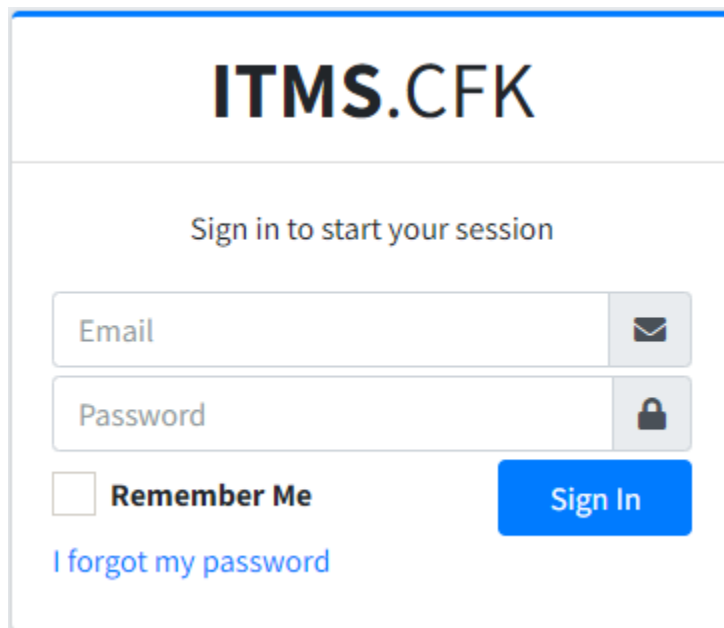
In addition to this, anyone has been given the opportunity to enter the number of the certificate and confirm its true and correct fear. (By clicking on the Certificate Verification icon.)

2. **ITMS Web Application**

If you are a registered user of this system, you can login to this web application as a user role listed below.

- Administrator
- Trainee
- Training Officer
- Manager (Training)
- AGM (MD&T)
- NWSDB Office / Project
- Academic Institute

To access the ITMS web application, click on the Login button in the upper right corner. The login page appears, prompting you to input your usernames and passwords.

Figure C.2: Login interface

After successfully logging in, you will see the dashboard with the side menu bar. The primary functionalities are accessible via the left menu bar. Depending on the user role, the main dashboard changes, and the left menu bar also change.
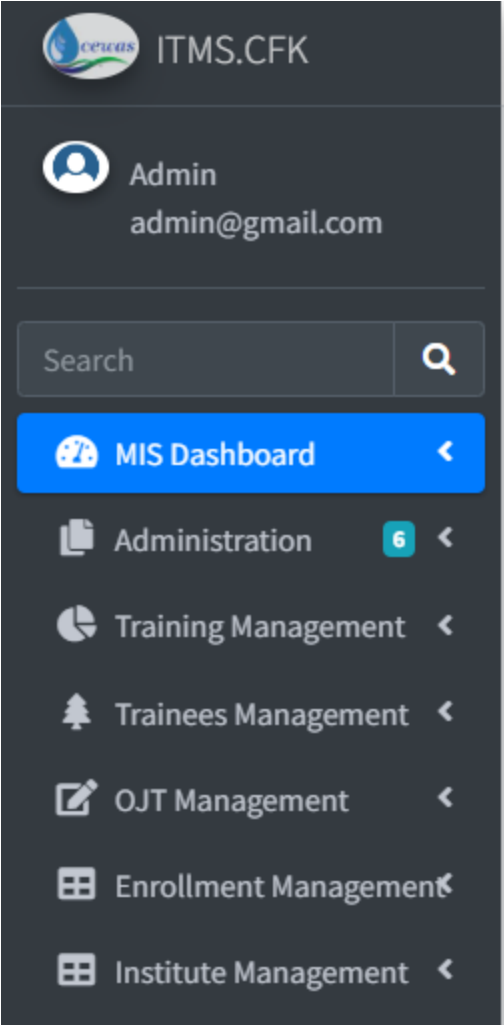
Figure C.3: Main left menu bar

The functionalities provided by this system from user to user can be as follows.

User Role - Administrator

The system facilitates the following function / activity when login as an Administrator.

No	Module	Function / Activity
1	MIS Reports	• All User Count • MDTD Staff Users
2	Administrator Module	• Manage User Accounts • Change Password • Staff Registration • View Pending Staff Reg • Manage User Role
3	Trainees Management	• Trainees Designation
4	OJT Management	• Subject Area Registration • Programme Registration • Discipline Category
5	Institute Management Module	• Pending Institute Registration • View Institute • Pending NWSDB Office Registration • View NWSDB Office

Below are some of the main interfaces provided by the system to perform the main functions related to the user.

- **Manage User Accounts**

Existing user accounts can be controlled through this interface.

1. Admin User is given the opportunity to find users under various categories and he has to make the required selection and click the search button.
2. Pressing the action button allows users to change their status.

- **Staff Registration**

A new staff account can be created through this interface.

Entering the NIC number, name, sign pic, photo, email & user role and pressing the register button give the opportunity to enter a new staff member.

- **Manage User Role**

User role can be created through this interface.

A user role can be added by entering the name and description of user roles and pressing the register button.
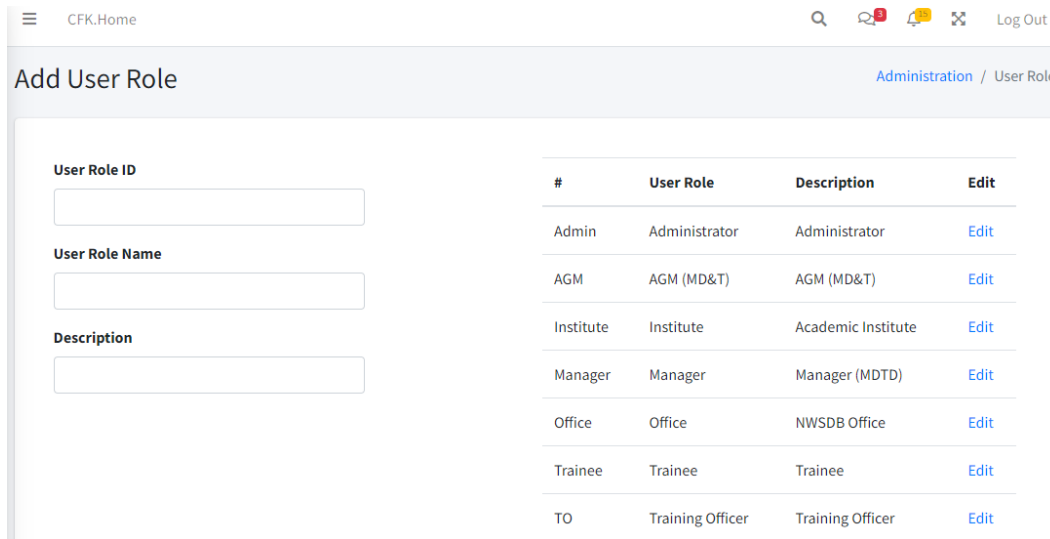
User Role – Trainees

The system facilitates the following function / activity when login as a trainee.

No	Module	Function / Activity
1	MIS Reports	• Training Summary • Training Days & Work done • Discipline Variolations
2	Administrator Module	• Update Profile • Change Password
3	Training Management Module	• Record Attendance • View Training Assign Letter • Certificate Request

- **Update Profile**

Pressing the Action button will show the current data and allow changing only the contact information. (Only contacts in user accounts are allowed to be updated here.)

Current User Account

User ID	Surname	User Role	Email	Statues	Edit
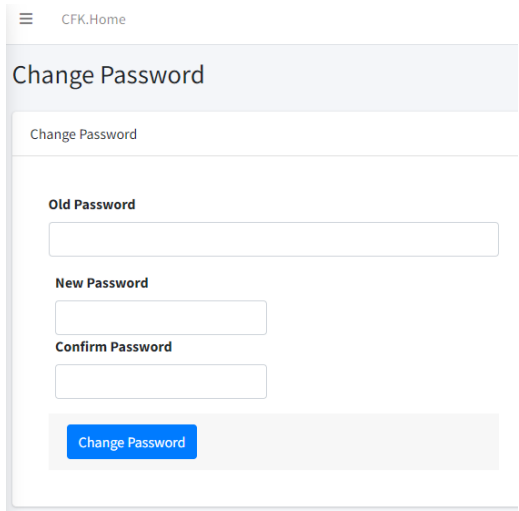
Update Profile

NIC Number

802141122V

Full Name

Kehelwala Gamaralalage Dulip Thinthaka

Initial

K.G.D.C.

Surname

Thilakarathna

Date of Birth

01/08/1980

Gender

Male

Academic Year

2022

Programme Name

ArcGIS Pro

Internship Period (Months)

6

Permanent Address

No. D82/1, Thimbiripola Road, Dehiowota.

Email Address

kgdulip@gmail.com

District

Colombo

Mobile Number

0772962658

Fixed Telephone No

0342244708

Copy of NIC;

Copy of Institute Recommendation Letter;
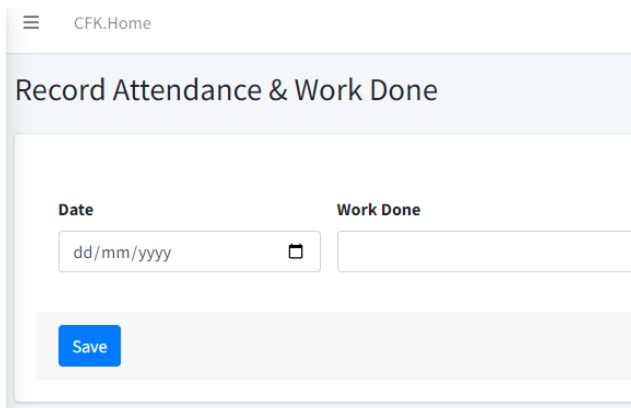
Update

- **Change Password**

After entering the old password and entering the new password and re-confirming the password, it gives the opportunity to change the password clicking "Change Password".

- **Record Attendance**

After entering the date of arrival at work and the work performed, it gives the opportunity to enter the relevant information on a daily basis by clicking on the "Save" button.

- **Certificate Request**

The number of days completed will be displayed and the number of disciplinary offenses committed will also be displayed.

A medical certificate must be submitted if the number of days completed is less than 96 days.

After completing the requirements, you will be given the opportunity to request a certificate by clicking on the "Submit" button.

Introducing the ITM system to MDTD staff.

It is expected to provide practical training on this system for the MDTD staff. According to their user role, practical hand-on training will be provided on the following tasks to be done there.

User Role – Training Officer

The system facilitates the following function / activity when login as a training officer.

No	Module	Function / Activity
1	MIS Reports	• Current Trainee – Subject • Current Students – Institute • Current Trainees – Office • Completed Students – Year • Dropped out Students – Year • Disciplinary Violation Summary

2	Administrator Module	• Change Password
3	Training Management	• Pending Trainee Requests
4	Trainees Management	• Pending Training Request • Pending Certificate Request • Prepare Certificate • View Active Trainees
5	OJT Management	• Programme Registration • Subject Registration • Disciplinary Category
6	Enrollment Management	• Pending Enrollment • Select Trainees (Tr) • Assign Trainees (System) • Assign Trainees (TO) • Assign Trainees
7	Institute Management Module	• View Institute • View NWSDB Office / Project

User Role – NWSDB Office / Project

The system facilitates the following function / activity when login as a training officer.

No	Module	Function / Activity
1	MIS Reports	• Current Trainees • Pending Request
2	Administrator Module	• Change Password • Update Profile
3	Training Management	• Pending Trainees Request
4	Trainees Management	• Trainees Request
5	Enrollment Management	• Current Enrollment
6	OJT Management	• Record Dripline Violation • Approve Attendance / Work Done

User Role – Manager (Training)

The system facilitates the following function / activity when login as a Manager (Training).

No	Module	Function / Activity
1	MIS Reports	• Current Trainee – Subject • Current Students – Institute • Current Trainees – Office • Completed Students – Year • Dropped out Students – Year • Disciplinary Violation Summary
2	Administrator Module	• Change Password
3	Trainees Management	• Certify Certificate
4	Enrollment Management	• Certify Trainee's Assign
5	Institute Management Module	• View Institute • View NWSDB Office / Project

User Role – AGM (MD&T)

The system facilitates the following function / activity when login as a AGM (MD&T).

No	Module	Function / Activity
1	MIS Reports	• Current Trainee – Subject • Current Students – Institute • Current Trainees – Office • Completed Students – Year • Dropped out Students – Year • Disciplinary Violation Summary
2	Administrator Module	• Change Password
3	Trainees Management	• Approve Certificate
4	Enrollment Management	• Approve Trainee's Assign
5	Institute Management Module	• View Institute • View NWSDB Office / Project

User Role – Institute

The system facilitates the following function / activity when login as an institute.

No	Module	Function / Activity
1	MIS Reports	• Current Trainees • Institute List
2	Administrator Module	• Change Password • Edit Institute Profile
3	Enrollment Management	• View Current Trainees

User Role – Guest

The system facilitates the following function / activity when login as a guest.

No	Page	Function / Activity
1	Home Page	• Verify Certificate

Appendix D - MI Reports

Figure D.1 depicts the total number of trainees depending on subject areas.

Figure D.1: Total number of trainees depending on subject areas

Figure D.2 depicts the total number of trainees distributed among NWSDB office/project.

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மனிதவலு அபிவிருத்தி மற்றும் பயிற்சி பிரிவு

MANPOWER DEVELOPMENT & TRAINING DIVISION

National Water Supply & Drainage Board

Thelawala Road, Ratmalana

Tel: 011-2632355
Fax: 011-2626176

E-mail: agmmpdt@waterboard.lk
mdtdnwsdb@gmail.com
nwsdbtraining@gmail.com

Industrial Training Management System (ITMS)

Current Trainees Report based on NWSDB Office / Project
12-11-2022

NWSDB Office / Project	Student Count
Manager Office (Kotte)	12
DGM Office (Uva)	29
Dumbara Water Supply Project	18
Manager Office Kandy (East)	20

Figure D.2: Total number of trainees distributed among NWSDB office/project.

Figure D.3 depicts the summary report of disciplinary violation category.

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Fax: 011-2626176	mdtdnwsdb@gmail.com
	nwsdbtraining@gmail.com

Industrial Training Management System (ITMS)

Disciplinary Violation Summary based on Type of Category
12-11-2022

Disciplinary Violation Category	No of Times
Late Arrival	14
Early Departure	9
Failure to comply with supervisor's instructions	6
Creating employee conflicts	3

Figure D.3: Summary report of disciplinary violation category

Figure D.4 depicts the total number of trainees relevant to the education institution.

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nwsdbtraining@gmail.com

Industrial Training Management System (ITMS)

Current Trainees Report based on Education Institute
12-11-2022

Education Institute	No of Trainees
National Youth Council	16
Vocational Training Authority	34
University of Moratuwa	10
National Apprentice and Industrial Training Authority	19

Figure D.4: Total number of trainees relevant to the education institution.

Appendix E – Automated Testing

Source code of unit testing (User Sign in testing)

```
[info] Playing test case ITMS Sign-in Test Suite / Untitled Test Case

[info] Time: Sat Sep 03 2022 20:32:18 GMT+0530 (India Standard Time) Timestamp: 1662217338801

[info] OS: Windows Version: 10

[info] Browser: Chrome Version: 104.0

[info] If the test cannot start, please refresh the active browser tab

[info] Executing: | open | http://localhost/ITMS/ | |

[info] Executing: | click | link=Login | |

[info] Executing: | click | id=User_Reg_Email | |

[info] Executing: | type | id=User_Reg_Email | admin@gmail.com |

[info] Executing: | click | id=User_Reg_Password | |

[info] Executing: | type | id=User_Reg_Password | 123456 |

[info] Executing: | click | xpath=//input[@value='Sign In'] | |

[info] Time: Sat Sep 03 2022 20:32:26 GMT+0530 (India Standard Time) Timestamp: 1662217346924

[info] Test case passed
```

Figure E.1: Source code of unit testing (User Sign in testing)