DEVELOPING A PERSONALIZED INTERACTIVE E-LEARNING SYSTEM TO SUPPORT PRIMARY SCHOOLS

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A thesis submitted in fulfilment of the
requirements for the award of the degree of
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DEDICATION

This thesis is dedicated to my mother and sisters, who taught me that education is the key to the future, it is the foundation for a modern society. Also, thanks to my supervisor, for being supportive and a great mentor.

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ABSTRACT

The purpose of the project is to develop a personalized interactive E-Learning System to support Primary Schools. The system is proposed due to the lack of an existing system to facilitate online learning for primary students. Most Educational institutions such as schools, colleges, and universities across the Kurdistan Regional Government (KRG) depend on a face-to-face approach to teaching and learning. Most of the educational institutes follow the traditional education methods. The crisis of the COVID-19 pandemic forced the Ministry of education to shift to online education. Nevertheless, schools were not prepared as an E-learning platform called eWane was used. Unfortunately, it had bad quality and was inefficient in managing the education process. Therefore, developing a personalized E-Learning is needed especially for primary schools as children of that age are most valuable and need to experience adaptive learning and a system that is easy to use. The contents would be customizable and attractive visualized aspects to suit primary students. Finally, the methodology that has been chosen is the Agile methodology and follows Kanban Framework. As it will enable to deliver a high-quality product and cost-efficiently. Finally, all problems have been identified of the E-learning system in KRG for primary schools. though analysing requirements and understanding stakeholders needs. As result proposed system will be able to support online education for primary schools. Later on, the system will be executed successfully during implementation that meets the requirement.

ABSTRACT

Tujuan projek ini adalah untuk membangunkan Sistem E-Pembelajaran interaktif yang diperibadikan untuk menyokong Sekolah Rendah. Sistem ini dicadangkan berikutan ketiadaan sistem sedia ada untuk memudahkan pembelajaran dalam talian untuk pelajar sekolah rendah. Kebanyakan institusi Pendidikan seperti sekolah, kolej dan universiti di seluruh Kerajaan Wilayah Kurdistan (KRG) bergantung pada pendekatan pengajaran dan pembelajaran secara bersemuka. Kebanyakan institut pendidikan mengikuti kaedah pendidikan tradisional. Krisis pandemik COVID-19 memaksa Kementerian Pendidikan beralih kepada pendidikan dalam talian. Namun begitu, sekolah tidak disediakan kerana platform E-pembelajaran yang dipanggil eWane digunakan. Malangnya, ia mempunyai kualiti yang tidak baik dan tidak cekap dalam menguruskan proses pendidikan. Oleh itu, membangunkan E-Pembelajaran yang diperibadikan amat diperlukan terutamanya untuk sekolah rendah kerana kanak-kanak pada usia tersebut adalah paling berharga dan perlu mengalami pembelajaran adaptif dan sistem yang mudah digunakan. Kandungannya adalah aspek visual yang boleh disesuaikan dan menarik untuk disesuaikan dengan pelajar sekolah rendah. Akhir sekali, metodologi yang telah dipilih ialah metodologi Agile dan mengikut Kanban Framework. Kerana ia akan membolehkan untuk menyampaikan produk berkualiti tinggi dan menjimatkan kos. Akhirnya, semua masalah telah dikenal pasti mengenai sistem E-pembelajaran di KRG untuk sekolah rendah. walaupun menganalisis keperluan dan memahami keperluan pihak berkepentingan. Hasilnya sistem yang dicadangkan akan dapat menyokong pendidikan dalam talian untuk sekolah rendah. Kemudian, sistem akan dilaksanakan dengan jayanya semasa pelaksanaan yang memenuhi keperluan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

E-Learning	-	Electronic Learning
KRG	-	Kurdistan Regional Government
MERN	-	MongoDB, Express, React, Node
UML	-	Unified Modeling Language
UI	-	User Interface
JS	-	JavaScript
UTM	-	Universiti Teknologi Malaysia
MVC	-	Model View Controller
RAM	-	Random Access Memory

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

Educational institutions such as schools, colleges, and universities across the Kurdistan Regional Government (KRG) depend on a face-to-face approach in teaching and learning. Most educational institutes follow the traditional education methods. The process starts when the teacher gives lectures while students take notes and memorize contents then later, they will be tested as all of this happens face to face in class. One of the most innovative learning techniques that are implemented in most countries is E-Learning. It is a method of learning and offers a flexible approach to teaching and learning than the traditional classroom school system. E-learning system is integrated part in the private university while the public universities and some secondary and higher secondary schools depend on an online platform such as Google Meet, Gmail, Google Drive, etc. While primary schools are cast aside as they depend fully on real-life classrooms to teach and learn.

The current crisis of the COVID-19 pandemic forced the Ministry of education of KRG to shift to online education. However, schools were not prepared as E-Learning is underutilized. Though eWane platform was used for students of Grade 1 to Grade 12. Unfortunately, the platform was inefficient as it had usability and technical problems which affect the education process as students fell behind in education. Therefore, a personalized E-Learning is needed especially for primary schools as children of that age are most valuable and need to experience interactive learning, and easy to use. The contents would be customizable and attractive visualized aspects to suit primary students.

This project will focus on the development of an E-Learning system for primary schools in KRG. It will offer efficient usability in terms of navigation and

interaction, following design principles to analyse interactivity and user experiences to create the personalized system that will suit primary students. It will take all aspects of usability and the online learning process. These objectives play an important to create an effective system that will facilitate education procedures as well impact primary school's online education in KRG. The project focus to apply successful methods to develop E-Learning by approaching well-founded practices that cover usability and interactive aspects.

1.2 Problem Background

With the covid-19 pandemic, educational institutions decided to shift to online learning to support academic progress. It has been possible with technology to deliver educational content through connecting teachers and students by using an online platform. The public schools and universities in KRG did not offer E-Learning platforms. Therefore, public universities used Google meet and Google drive to implement online learning. While public schools had to use one platform that has been developed by the KRG ministry of education. However, it was ineffective in facilities the education process for students.

Primary schools were the most vulnerable as students had troubles interacting with the system and lacked important key features from usability, as it was difficult for primary students to access and navigate through the website to find their online lessons. Students could not know their progress on their courses and learning stages. In addition, it did not offer a constructive way for students to communicate with their teachers. The system neglected primary students' needs and level of understanding as it completely relied on online videos and self-progress. Therefore, eWane failed to deliver a way for the primary students to perform online learning and shift from the traditional education process that is being used in KRG.

Though this an E-Learning system will be developed that resolve problems related to usability as primary students to find their course contents and navigate through the application that ease of access so students can learn about their progress

and important tasks that need to be achieved such uploading assigned. It will offer an effective way to interact with their teachers as they will help to teach their students. Primary students tend to be imaginative and attracted to visual elements therefore interactive aspects of design and creative interface design will be implanted for the system.

1.3 Problem Statement

The main challenge of this project is to develop an E-learning system that will support primary schools. As primary students have problems using the current E-Learning system in KRG which is called eWane, it is an online platform that is offered through android app and web application, they are suffering to provide usability for primary school students as students have a problem navigating the website and finding their course contents. Also following their courses progress and limited interaction with their teachers. In addition, students experience technical glitches as the website become unresponsive and videos are unable to be played frequently. Moreover, the platform has poor elements of design that are too distracting and confusing to its' users as results users felt frustrated and unable to complete their tasks.

1.4 Project Aim

The aim of this project is to develop an interactive personalized E-learning system for primary schools to increase usability through providing customizable learning content.

1.5 Project Objectives

The objectives of this project are as follows:

(a) To Analysis usability and user interaction for current systems of primary schools in KRG.

(b) To Design and develop an interactive eLearning system for primary schools to deliver personalized interactive education content.

(c) To Evaluate the proposed system based on user-based testing for better usability and enhanced functionality.

1.6 Project Scope

The scopes of the project are:

(a) The System will focus on the development of an E-Learning System in KRG to support primary schools.

(b) The System will focus on online learning as it will adapt primary schools in KRG to integrate into blended learning.

(c) The proposed system will be developed through Interactive web-based technology that enables support cross-platform.

(d) The result of the research will be validated based on a real case study and the developed system will be tested in two primary schools in KGR/Sulaymaniyah.

1.7 Project Importance

Academic and Education are formidable that can determine the environment and mindset of people. It will help address Education in Kurdistan Region Iraq (KRG). Since It is underdeveloped and does not prepare students for the next stage of their life. The crisis of the COVID-19 pandemic forced the Ministry of education to shift to online education. Nevertheless, schools were not prepared as the eWane platform was used but unfortunately, it had bad quality and was inefficient.

Therefore, through this project, a personalized E-Learning will be developed for primary schools as children of that age are most valuable and most neglected. The Project will enable further development strategies to promote enforcement of necessary training for students and educators focused on blended learning. By integrating the E-Learning system will play a valuable role in providing support and prioritizes for the long-term growth of education.

1.8 Report Organization

The report will outline the next chapters and activities are organized to present the project in an effective structure which will support the purpose of the report.

Chapter 2 Literature Review: It identified the main problems of the previous and current system that is used in KRG. It will be focused on analyzing the usability and user interaction of the eWane application.

Chapter 3 Methodology: The main focus is on the methodology that will be conducted. It will outline System Development Methodology that will be followed from the approach, as well as hardware and software requirements.

Chapter 4 Proposed System Design: It is then followed by showing the design of the completed system. The report will include system architecture, interface design, database design, and the related/appropriate techniques algorithms.

Chapter 5 Conclusion: The main objectives that have been accomplished. It will be attained through all the successful results from project coding, analysis, and testing. The report would be conducted by summarizing important points, achievements, and plan for project implantation.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents an extensive review of the literature conducted to analyse the existing system being implemented for online learning in primary schools of KRG. It will identify the relevant studies and support. The review is carried out based on the conducting research, analysing and observation on the existing system. The current existing system is called eWane that is currently used for online learning (*ewane*, 2020). Then, eWane will be compared with the proposed system for analysis. Finally, there would be literature review on the tools and technologies used for development and implementation of project.

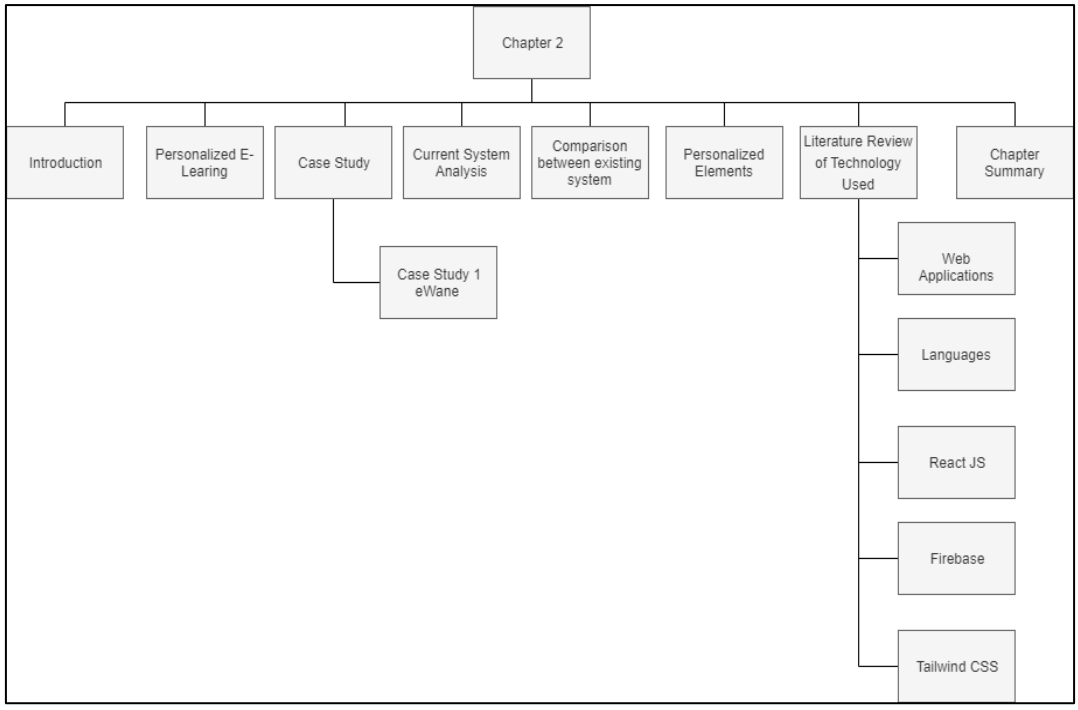

Figure 2.1 Chapter 2 Structure

2.2 Personalized E-Learning

Personalized E-Learning customization of the core courses so that it can now address the specific learning needs based on the students and learning progress. Online education process will allow students to customize a variety of the elements. Most important features will be focus on setting goals, progress, and communicate with teachers and students to personalize the learning process. The key elements that are customized in personalized eLearning are learning paces, the teachers' approach, and lessons and activities that draw upon the student's experience and interests. It is creating learning environment that allows students interests and needs so it can lead to improved comfortable and learning results (*How Personalization in ELearning Works*, 2018).

Students have different needs and online learning environment needs to meet up with the students' tendencies and evolving characteristics students, E-learning should provide personalization features for course content, adaptive learning materials, and navigational designs to support learning styles of students. It main purpose is to provide a flexible learning environment to allow students to interact with the learning materials that is suited with their needs (Racelis, 2020). Finally, the teachers need to follow a personalized learning approach that can focus on where students progress at their own pace mastering key concepts and integrating assessments with the purpose of developing critical thinking and collaboration.

2.3 Case Study

In these parts, it will illustrate the case study for the existing system that has been used by the Education Ministry of Kurdistan for implementing online learning in primary schools. There is solely dependent on eWane system to manage and follow online learning. The depth explanation of the system is discussed below. Company Organization Structure

2.3.1 Case Study 1 eWane

After eWane System is a web-based system developed by the SoftMax company. The objective of this system is to provide a E-Learning platform that can take place online where schools conducted their activities. This system used by Students, Teacher and principle. As the system have limited features. Furthermore, it has been developed for students' perspective to view their course video and books. However, the proposed system takes different approach where it will be primary based on Students engagement with teachers to integrate interactive elements so system offer collaboration and communication across the platform. Although, system will have personalized as to accommodates needs for different primary schools and users. Figure 2.2 shows the user interface of eWane for user to login into the system.

Figure 2.2 eWane Login Page (*ewane*, 2020)

2.4 Current System Analysis

Study of eWane is an E-Learning system that was developed to manage learning activities to deliver students' course contents and learning outcomes in KRG. Generally, the system has been developed to fulfil the requirements of students'

viewing their course videos. Therefore, there is a lot lacking aspects that have been disregarded. The eWane system offers these features:

(a) Students view their Course Videos for each lesson.

(b) Students download or view their course Books.

(c) Students can view their course videos based on their study language. It offers (Sorani Kurdish, Badani Kurdish, Arabic, English, French, Syriac, Turkmen).

(d) Teachers view students reports of their course about videos they have completed watching.

(e) Principle view a variety of reports of their schools about the students and teachers' performance.

(f) eWane system support 3 languages (Kurdish, Arabic, English).

User Login is the first interface in which users' login into the system by entering their username and password. The has been provided by the school. The system will authenticate users' types. After the student's login, the home page will be displayed as shown in figure 2.3.

Figure 2.3 Home Page (*ewane*, 2020)

The system is general because every student views the same courses and videos. The videos are not from their school teacher. The Ministry of education has selected a few teachers in which they have been recorded videos of the lesson and uploaded to the system. It has been disregarded that each school have a different style to followthe course material, as well as students, have been accustomedto their school teachers therefore they were not familiar with teachers as result it has hard for students to adjust from traditional classroom to online classroom.

After that, Students will choose a course then they will redirect to the course Videos and they can also view or download the course books as shown in figure 2.4. Students will have selected the lesson then they can view the video.

Figure 2.4 English Course Videos (*ewane*, 2020)

They are cannot skip the videos and turn back 10 seconds. The flow of navigation is not smooth as students find it difficult to navigate the website, especially the course videos. In addition, students find the videos that cannot skip or turn back confusing as well sometimes the system will be freeze, videos are not loading or they lose the progress of their videos therefore they have to watch the video from the start.

After Teachers log in, it will display a table that contains reports on students' who watched videos. The system does not offer any way of communication for students and teachers. The teachers could not upload assignments or hold an online

meeting with their students. Hence, they could not monitor their students well beings and progress.

Further, Principle login can view multiple reports related to the students' performance. For example, report on how many videos they have completed for all lessons as well teachers who visited the website. They will select the type of report they want, then select the school after that it will be shown in a table form. Where they can download or print the report.

Students have to completely rely on themselves and they have to be tech-savvy. In addition, parents needed to monitor their children progress. unfortunately, primary schools' students are not at that level of understanding which they can follow all instructions, as guidance and constant communication are needed to keep these students on track. The biggest issue was the system was not personalized as each school have its' own requirements and specification from courses, styles and languages of schools.

2.4.1 Stakeholder Interview

To Analysis the current system further, I conducted two interviews which focus on the strength and weaknesses of the system, at the same time all the issues that will be facing students and teachers during using this system. Most importantly, I focused how interactions and personalization aspects. The main purpose of this interview to gather information and discuss current system problems.

The interviews were conducted at Rebar Primary School. First interview was Miss Shilan Xwamrad. She is a math teacher who has over 10-year experience. According to Miss Shilan, during pandemic, most students were struggling with using the system because students' parents were informing the school about their children progress and how the system is not adequate to carry out teaching activities. While teachers could only access a report in which show how many students have watched videos and there was not anything else the system did offer for them.

Miss Shilan admitted that the current system in inefficient and it is not suitable for primary students since they need more attention. In addition, these students are children who are at the first stages of their education and just started learning to write and read. Therefore, parents need to become teacher at home, unfortunately not a lot parents are tech savvy or have abilities to teach their students on their own. Finally, the most important thing that needs to be address for teachers are having control their own course and upload their own videos since students are already familiar with own teachers' style. Nerveless, it is important to have a way to communicate with students.

The second interview was conducted with grade 5 student named Savo Jaza. According to Savo, she struggled to use the system at the start but with her mom she could finally understand the system. The biggest problem she faced during using the system was watching the videos. where it was a little difficult to find the videos but the main issue was you cannot rewind the videos as you like where you could only rewind 10 seconds so there would be times where you want to go back and repeat the section of the video, where you did not understand. Another problem was the website would crash and you need to watch the video from the beginning because you would lose your progress. She admitted to using the eWane only 3 times a week because the design was not that attractive and terrible for watching videos. She also found the videos that has been upload were not good since she did not like their teaching style and was not familiar with teachers.

She found out that her progress was affected since she could not follow her curriculum and learn with her best capability with the current system. She missed her teacher and friends during online learning and the familiar environment. Finally, she did not feel the current system satisfy her needs and suitable to use (See Appendix A for interview questions).

2.5 Comparison between existing systems

A comparison with the existing system is essential because it can help to identify important characteristics which developers to focus on they develop a successful system. The details of the differences between the existing system, eWane System that has been used in public primary schools while Google classroom has been used in some private schools in KRG along with the proposed system are shown in Table 2.1.

Table 2.1 Comparison between existing tables

Description	eWane system	Google Classroom	Proposed System (Khwendnga System)
User Group	Student, Teachers, Principle	Teachers, Student, Guardian	Student, Teachers, Admin
Online Technology	Yes	Yes	Yes
Database	Yes	Yes	Yes
Understanding Level for User Toward System	1. First time users find it difficult to understand system 2. Users have difficulty to navigate and find their course contents.	1. Generally, users have difficulty to get used to the system. 2. Users find it confused to use communicate, course and assignment feature.	1. First time users find easy to understand the system. 2. Users find navigating and find their course contents easy through a smooth flow. 3. Users have clear understanding on communicate, course and assignment feature.
Uploading Assignment	No	Yes (excessive steps to turn on assignment)	Yes (turn on assignment through necessary and simple steps)
Communication with Teacher	No	Yes (Limited to replying to posted share in the virtual class)	Yes (direct communication with teachers)
Online Meeting	No	No	Yes

Criteria:			
• **Login**	Yes	Yes	Yes
• **Manage Student Information**	No	Yes (Limited to inviting and accessing posts)	Yes (Reports, accounts and accessing to courses)
• **Manage Course Contents**	Yes (Limited to only course videos)	Yes (Limited to uploading videos and course material)	Yes (expanding more flexible options for personalized course material)
• **Performance**	No (Slow Responding and glitches)	Yes (Excessive steps and students must be familiar to google platform to comfortably use the system)	Yes
• **High Data**	Yes	Yes	Yes
• **Security**	Yes	Yes	Yes
• **User-Friendly Interface**	No	No	Yes
• **Interactive System**	No	Yes	Yes
• **Usability**	No	Yes	Yes
• **Personalized**	No	No	Yes

Overall, Table 2.1 indicates the proposed system will precisely extend the scope and the functionality of the existing systems. Because eWane does not offer to chat and is limited to what users can do. eWane has been developed in a general way that can satisfy all schools, therefore, neglecting that each school have different requirements, needs and style for handling their class and schools. eWane navigation is confusing for users as they find it difficult they turn back to the place they want. Google classroom offer better options and provide uploading course material, video and turning on assignments. Unfortunately, most schools do not use it since teachers and primary students were not adequate to use the platform since it was confusing users especially in creating classes and managing their courses. Finally, Khwendnga System will be developed that will offer a personalized system for each school since every school have different needs and follow their style and progress for their students. It offers customized content and courses with interactive elements as well communication ways for students and teachers. Along with simple, clear navigation and usability for students.

2.6 Personalized Elements

The E-Learning system will be able to integrate personalized learning process. Most important features are communication between teacher and students. Since it will need to know the progress of students and getting feedback from them for future lessons. It was possible with chatting features. Where they can chat, send attachments and photos which is shown to be effective for learning. There different language based schools, each of them has different teachers and different course material. Therefore, teachers can create their own course and upload their own material which altered to be suited for their styles.

Teachers can alter teaching approach from offering different assessments and activates that draw upon the student's interest and needs. They system is designed for primary students therefore it personalized for them from colors and interactive elements that allows them to focus and be interest in using the application. Primary students are children so there are personalized messages that pop up in the system for

example taking a rest and drink water and remind them of doing their course activities and assessments.

2.7 Literature Review of Technology Used

In this section, information about suitable technologies will be used to will be used in developing the proposed system.

2.7.1 Web Application

The proposed system will be introduced as a web application because it will have an admin board therefore it will be easier for managing accounts and course contents. As a result, data centralization is needed so a database is used for storing all the data, videos and documents. The web-based application provides a simple and easier way to monitor or update information about the students as well course management.

2.7.2 Languages

The system will be built based on JavaScript and Firebase along with Redux technologies. It is used for developing dynamic websites and web applications. Another great aspect is that it is React JS will make development much faster and flexible. As well as other HTML5, CSS, Tailwind CSS and Font-End frameworks for styling and designing the application. It enables the development process smoother, easier and faster deployment for web applications.

2.7.3 React JS

The web application Front-End will most be built on ReactJS front-end JavaScript library. Because it is one of the most modern technologies as well it is free and open-source. It is maintained by Meta (formerly known as Facebook). It is very

useful for the rapid project. The greatest aspect would be reusable UI components as it is one of the biggest attractive point for React (Suraj Surve, 2021). Simplicity and scalability enable fast development and smooth development for the project.

2.7.4 Firebase

The Database that will be used is Firestore cloud. It has aboard aspects that can support a cross-platform document-oriented database program. It was used in the backend which will be Cloud Functions, Authentication, Real-time Database, Cloud Firestore, and Cloud Messaging. Therefore, it is the best choice for developing and supporting complex software solutions (Stevenson, 2018).

2.7.5 Tailwind CSS

Tailwind CSS is utility CSS library is used for design and beautiful layout. It offers customize style through shorter codes. It enables full control on how to customize your style through utilities classes. It has great design support for responsive design interface. It allows development process for the front end much smoother (Dillion Megida, 2020).

2.8 Chapter Summary

The overall chapter covered analyzing existing systems, which all problems have been identified of E-learning system in KRG for primary schools. Therefore, a comparison between the existing system and the technology tools suitable for this project development have been established. The advantages and disadvantages of the current system have been examined therefore determining the best approval for developing the system and technology that will be used. As result proposed system will be able to support online education for primary schools.

CHAPTER 3

SYSTEM DEVELOPMENT METHODOLOGY

3.1 Introduction

The system development methodology is composed of multiple processes or phases used in software development. It has been used to manage and plan activities as result it will ensure an advantageous development process. It provides a clear understanding for developers on their tasks and roles hence the project would be cost-efficient thus enabling to build a secure and excellent product.

This chapter discusses a system development methodology that represents a guideline to complete the system. Thus, developers must choose a suitable methodology to implement the system to ensure a smooth development process and produce high-quality software.

Furthermore, this chapter presents detailed descriptions and justification of the methodology that has been chosen in system development. Besides, the project phase will be elaborated through analysing the system requirements and Identifying all tools and technologies used in the project. Finally, this chapter also will include the system requirement based on hardware and software.

3.2 Methodology Choice and Justification

There are many various development methodologies used by software companies and developers for a different project. It is crucial to choose the methodology that would be appropriate for project requirements. The methodology purpose is to ensure a smooth development process and implement the system

requirements. Every methodology has its advantages and disadvantages but the right methodology will play a vital role in implementing the software project.

The proper methodology selected for this project is Agile methodology and following Kanban Framework. As it will enable to deliver a high-quality product and cost-efficiently. It will enable smooth flexibility and managing tasks as a result productivity will be increased.

3.2.1 Agile Kanban Methodology

Kanban is a framework, which is recognized simplest by the Agile methodology. Taiichi Ohno was a Japanese engineer who developed Kanban (Harris IV, 2014). Agile Kanban Framework provides project transparency and provides a board that enables us to visualize the whole project. Through, Kanban managed and kept the progress of the project. The appealing aspect of Kanban is the clear and simple methodology. This is due to the flexibility and enhanced workflow to deliver the product on time. Kanban is suitable for Khwendnga System, hence the development process can be tracked and the whole project structure will be managed in order to deliver a prime quality system within schedule and budget.

Furthermore, following Kanban is to maintain a consistent standard of release throughout the project. It will provide a Kanban board visualizing and keeping track of tasks would be much easier. It will be more efficient and reduce paperwork. The process will emphasize the versatility and simplicity where you can add new changes or tasks at any work stage and prioritize based on your needs. Also, it can still be implemented when there are no iterations. While Scrum is another popular agile methodology but it has shown it is not suitable for this project as it is mostly used by multiple teams. Also, it needs continuous feedback from stakeholders and all iterations need to be implemented. Therefore, Kanban is chosen as the methodology method of the Khwendnga System for primary schools in KRG.

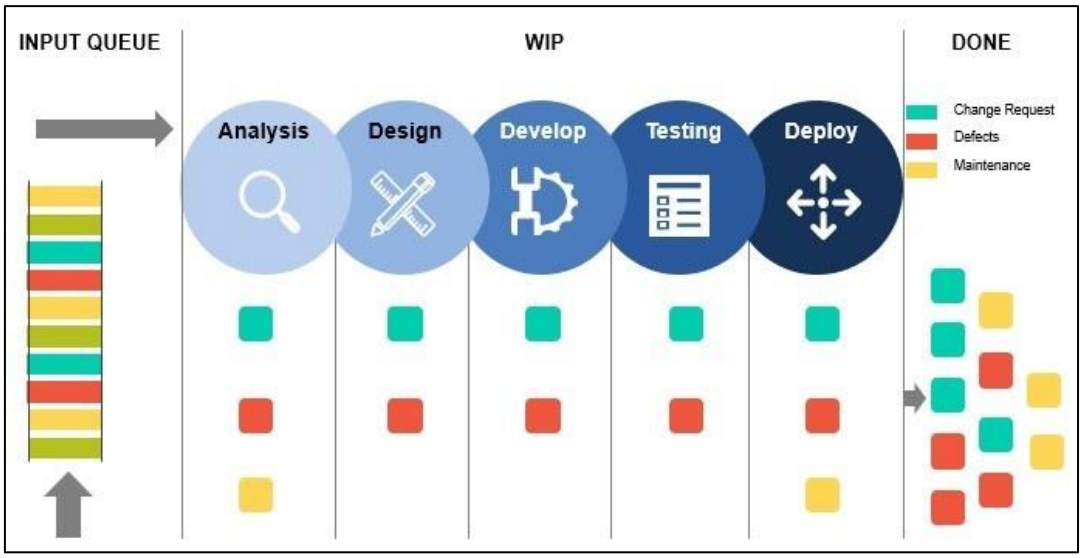

Figure 3.1 Stages of Kanban Framework (Dileep, 2018)

3.2.2 Advantages and Disadvantages of Kanban

Table 3.1 shows the advantages and disadvantages of Kanban in developing Khwendnga System for primary schools in KRG.

Table 3.1 Advantages and Disadvantages of Kanban ("What's the Difference? Agile vs Scrum vs Waterfall vs Kanban," 2017).

Advantages	**Disadvantages**
Increase Process Flexibility for the project as it can add new changes or tasks at any time.	Kanban can become complicated when there are multiple teams or excessive tasks.
Simple and Easy to follow as result provide continuous delivery.	Kanban board needs to be kept updated as to not encounter issues in the development process.
Reduce time for development process.	Keeping track can be overwhelming if there too many team working on it.
Kanban visual board enable accomplish goals and easier.	
Provide systematic approach to improving managing work in a more productive and efficient way by tracking progress.	

3.3 Phases of the Chosen Methodology

Kanban can determine to development stages for different tasks. The project is composed of three parts: To Do, In Progress and Done. The basic principle for Kanban is cost-effective and minimizing work progress in which the current task is called (Work In Progress or WIP). This framework is used to implement agile software development by placing the task in Kanban board. It will be visually represented as easier to follow and track the project progress. While software development process can be divided into these stages: Analysis, Design, Development, Testing, Deployment (Nitish Khagwal, 2019).

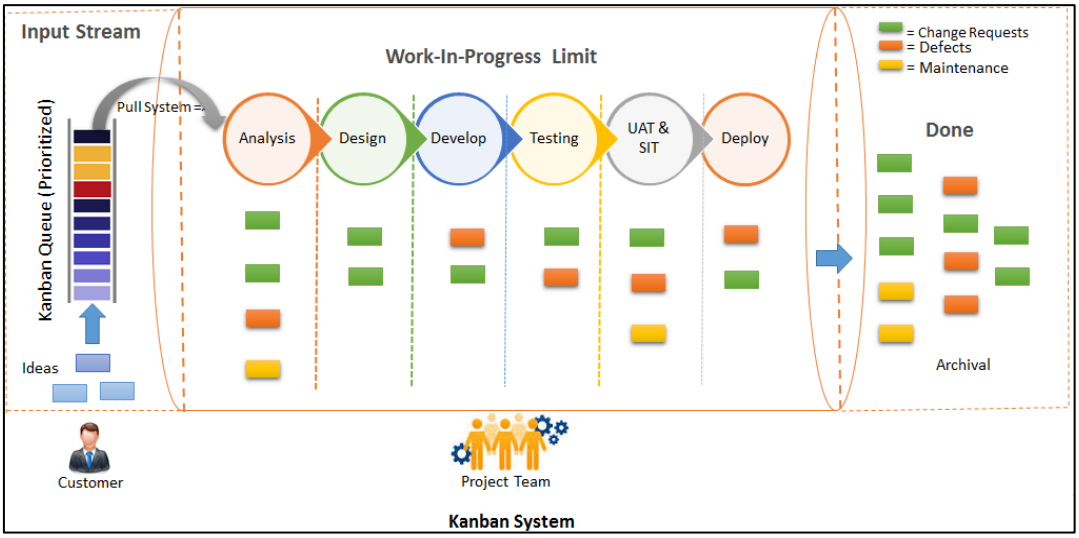

Figure 3.2 Kanban Lifecycle (Vikash Karuna, 2015)

During the first phase Analysis, the requirements needs and analysis for activities for the proposed system will be gathered. It contains records and tasks for the product backlog. The requirements have been established through market researching and stakeholder needs by conducting interviews and learning more about education accessibility through the community. This process enabled to development of a solution for the system. As all tasks have been presented visually on a Kanban Board. This phase focused more on analysing and understating the requirements of stakeholders. Therefore, it will enable to determine Product Backlog to deliver during each release. The requirement will be verified and reviewed by the supervisor.

The second phase Design defines system design and structure as it will provide the basis for the development phase. hence, a porotype will be created that will stateside the user's requirements. In addition, the architecture has been determined based on the layer and interaction of class and component between users for the application. As it supplies a comprehensive architectural overview of the proposed system. Which is responsible for presenting several different architectural views to show the different aspects of the system. During this phase, All the use cases and actors also have determined. The actors for this proposed system are the admin, teacher and students, principal. All the use cases have been grouped into six modules which are Module Administration, Module Students, Module Assignment, Module Online Meeting, Module Chat and Module Course.

Next, the third phase Develop include the implementation and presents the technical specifications. It will provide methods to check the requirements and criteria consistently by improving the conformance of implementation. It focuses on programming aspects and implementing the important functionalities for the system. The requirements were emphasized during this phase work release. Because it enables changes and preparing for bugs where it allows to manage the project with ease. The team worked through GitHub which enables implementation and various testing to be performed. It has will enable us to present a faster and more efficient workflow. By developing a flexible project plan based on important features and integrated to be tested. It enables continuous changes to the plan based on current requirements. The progress would be checked by the Kanban board.

Then, the fourth phase Testing showcase testing methods with appropriate procedures will be implemented. Testing was essential and it is done incrementally and interactively. Based on changing and satisfaction stakeholders' requirements. Finally, by following enable testing unit, functional, and performance tests. The component would be tested through user acceptance testing and check the comparability and functionality of the system.

Finally, the fifth phase presents the technical specifications and quality that have been used to check for deployment process and maintenance. It will provide

methods to check the requirements and criteria consistently by the system during future releases. The Module of the deployment phase along with the maintenance with appropriate procedures. It keeps track of the dependencies and implementations added or discarded for the remaining tasks that were left in the previous phase. The system has been developed and delivered therefore phases of operations start.

The previous phase enabled system transitions from development and testing to operations and maintenance. Since the system passes its tests and is operational. Further, new functionality can be implemented in response to new requirements. As testing for the new codes since changes are bundled and deployed as a new release. The phase will continue and repeat itself until the application is retired. Therefore, the migration and implementation of new releases of applications throughout the Sector have been followed to deliver products under an efficient application delivery model. The application delivery leads the planning process and prioritizes resources based on project capacity to create application delivery solutions for the system. As these stages have been planned through Gantt chart which can be shown in appendix B. Figure 3.3 show Kanban Board has been used to develop this project by following agile methodology.

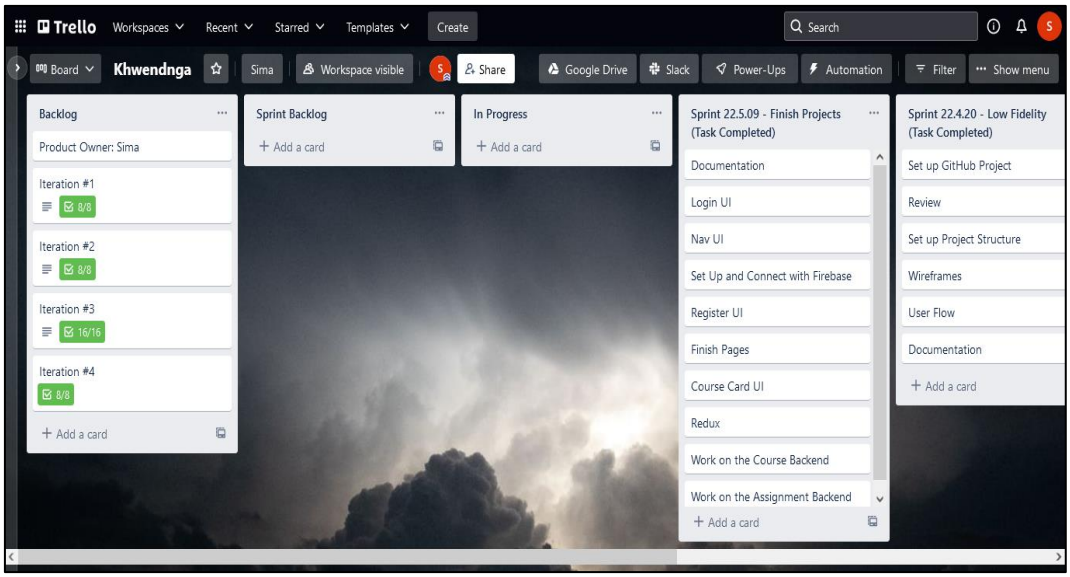

Figure 3.3 Kanban Board

3.4 Technology Used Description

A web-based system technology will be used to develop the Proposed system. This system has involved three users which are admin, teachers, and students. Admin will use this system to manage registering the student account and adding information. Admin also can record and update the course easily. While the teachers can view the students' progress. Also, upload assignments and their course material. Besides, the students will be able to communicate with their teachers as well as view and upload their assignments. In addition, Users can use personal computers or mobile phones to open and access this system though browser.

3.5 System Requirement Analysis

The section will elaborate on the system requirement analysis to implement the proposed system. The section address suitable hardware and software are chosen for the project as it can fulfil user requirements and specification.

3.5.1 Hardware Requirement

Table 3.2 shows the hardware requirement specification which will be used by the Khwendnga System for primary schools in KRG.

Table 3.2 Hardware Requirements

No	Hardware	Specification
1	Computer (Desktop/Laptop)	Personal laptop or desktop
2	Mobile Phone	Android or iOS
3	WLAN	Wi-Fi 802.11 b/g/n
4	Random Access Memory (RAM)	8GB
5	Hard Disk Storage	120GB and above
6	Operating System	Window 8 or higher, macOS
7	Processor	Intel Core i5 and above

3.5.2 Software Requirements

Table 3.3 illustrates the functionality of software requirements that will be used for the Khwendnga System for primary schools in KRG. The functionality for the software requirement is as follows.

Table 3.3 Software Requirements

No	Software	Functionality
1	Enterprise Architect (EA)	To draw a UML diagram
2	Web Browser	For output result
3	Adobe XD	For designing the wireframe and porotype.
4	Visual Studio Code	For system development software.
5	MangoDB	For database management system
6	ReactJS	For Front end development of web.
7	React Native	For Front end development for mobile.
8	Express	For backend development for the system.
9	NodeJs	For further support in backend development.

3.6 Chapter Summary

This chapter has elaborated on the suitable system development methodology that has been implemented in the project. This chapter also addresses the advantages and disadvantages of the chosen methodology. Every phase of the chosen methodology has been identified and discussed. further analyzed the tools and technologies that have been used for the project. Finally, explained the system requirements that consists of hardware and software.

CHAPTER 4

REQUIREMENT ANALYSIS AND DESIGN

4.1 Introduction

Chapter 4 will present the analysis requirements result based on the workflow and design phase. Through UML behavioural diagrams such as use case model, activity diagram, and sequence diagrams based on the indicated results. As well include the database design and interface design for the Khewndnga system have been described in this chapter.

4.2 Requirement Analysis

The existing system has been evaluated to identify plans and goals for requirement analysis. The following sections show different requirements that have been collected, database design, the definition of systems and the user requirements analysis. Through illustrated diagrams such as the use case model, and domain model where these diagrams demonstrate the developer's interpretation of the user's requirements and system functionality.

4.2.1 Use Case Model

The use case model contains use cases and actors that showcases all the important functions and relationships. Giving more scoop on different stakeholders and features of the Khwendga System. It demonstrates the functional requirement from different users' perspectives of the system. The use case represents functions while the actor is someone that interact with the system. Figure 4.1 shows the use case model of the Khwendga System.

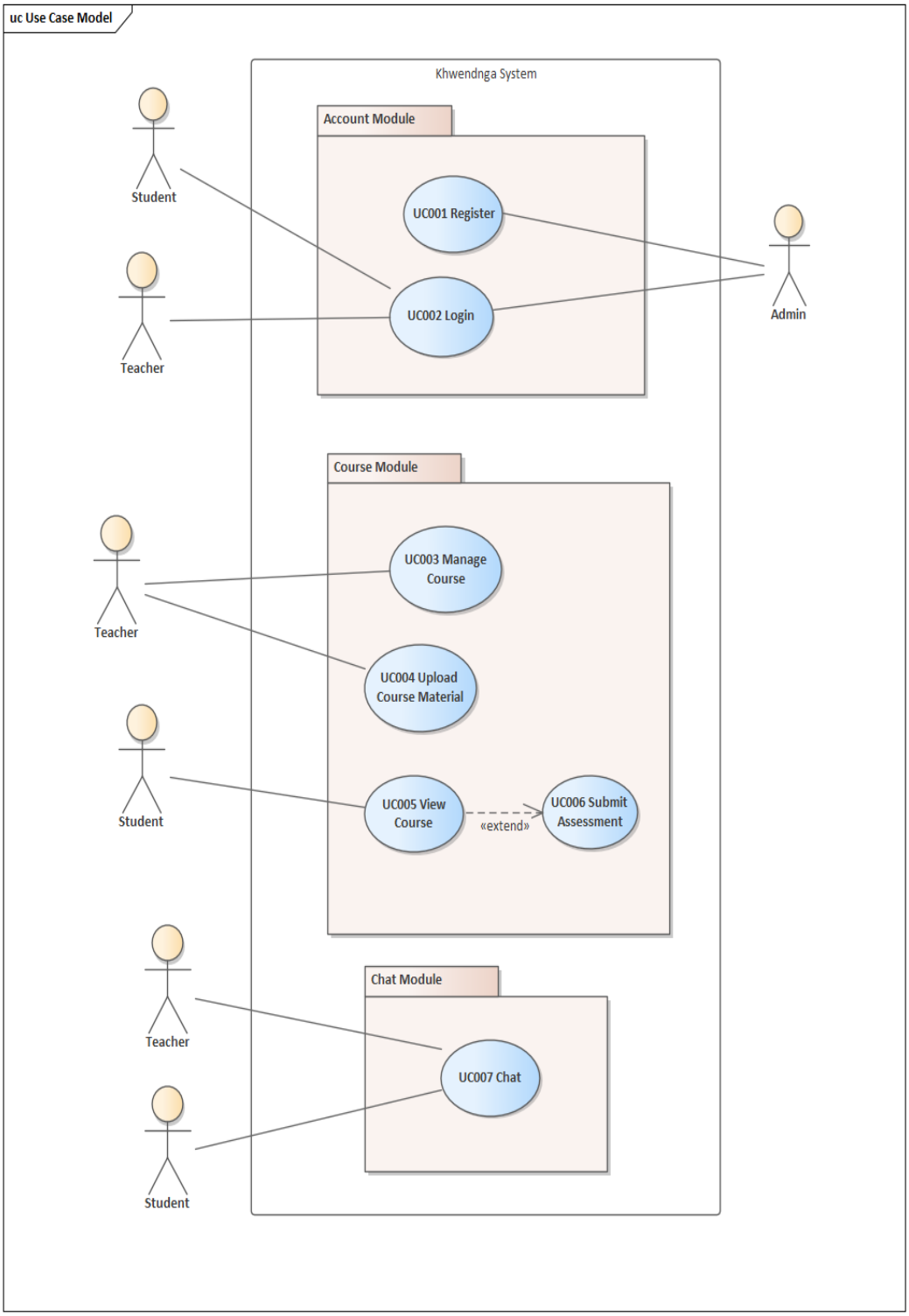

Figure 4.1 Use Case Model

4.2.2 Use Case Description

Below Table 4.1 offer explanation for each use case and features that are provided by the system.

Table 4.1 Use Case Model Description.

Use Case	Description
UC001: Register	The event enables the admin to register a new user to the system.
UC002: Login	The event enables users to login into the system.
UC003: Manage Course	The event enables the teachers to view, edit or delete courses.
UC004: Upload Course Material	The event enable the teacher to upload course martial for their lesson.
UC005: View Course	The event enable the students to view the course that their teacher created.
UC006: Submit Assignment	The event enables the student to submit assignment of their assessment.
UC007: Chat	The event enables the teacher and students to chat.

4.2.3 Sequence Diagrams

This project has used sequence diagram to model interactions between objects in single use situations. It highlights messages flow action for each event of objects. Further details and explanation can be referring to the SRS document at Appendix C.

4.2.4 Activity Diagram

This project has used activity diagram to show the flow of process from one state to another. Where every state represents an activity. Further details and explanation can be referring to the SRS document at Appendix C.

4.2.5 Domain Model

The domain model highlights the interaction on the function and class with relationship between them. It also shows attributes class and main class components that is required to facilities the system. It indicates conceptual domain model that incorporates both behaviour and data.

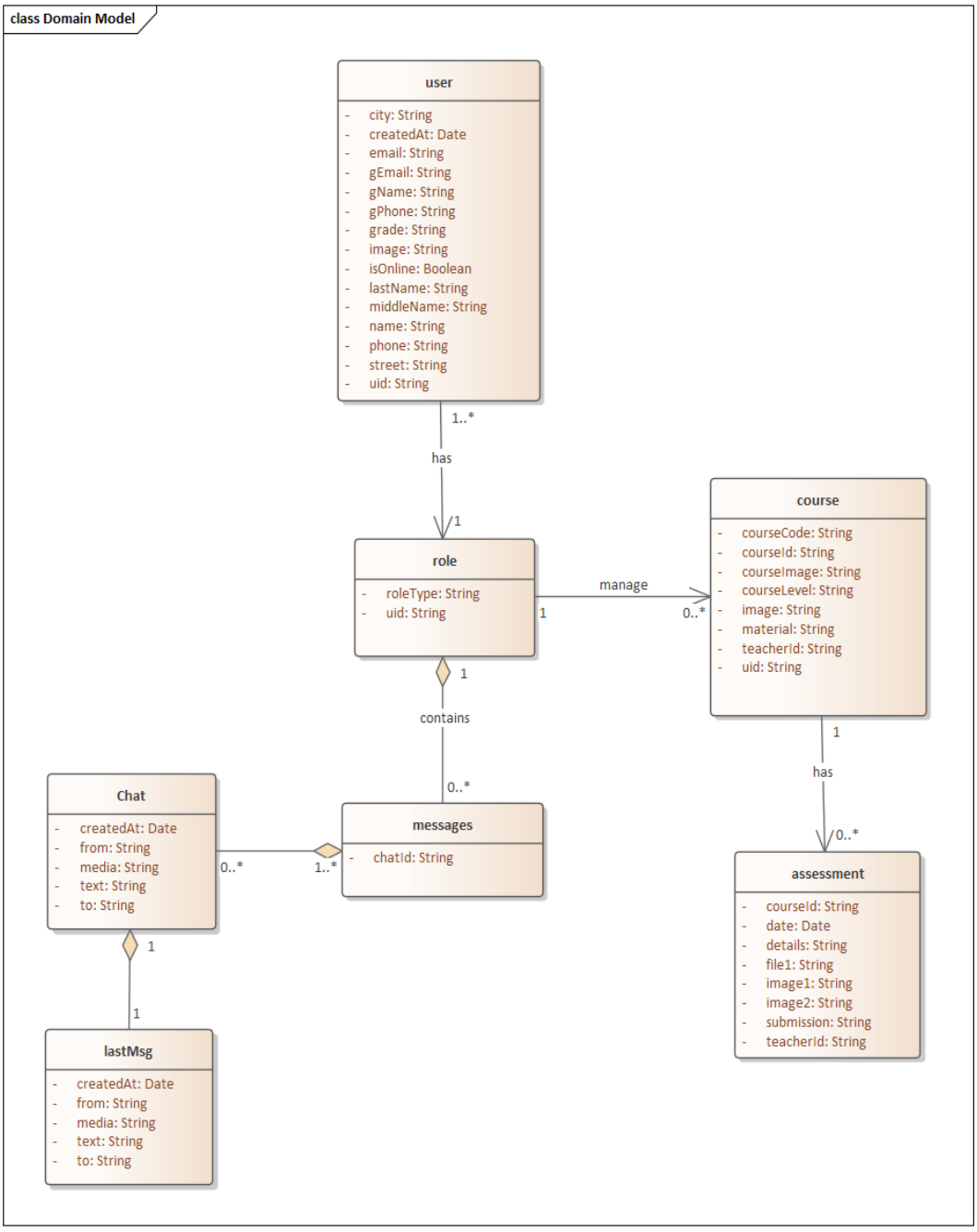

Figure 4.2 Domain Model

4.2.6 Architecture Design

The chosen architectural style is Model-View-Controller (MVC) pattern. MVC is a design pattern that interacts within a system by three separated layers. The Model component control data of the system as well as manage associated operations on that data. While the View component manages the presentation of data to the user. whereas the Controller component handles the interaction of the user and move these interactions to the Model and the View components. Therefore, the main reason for choosing this style is because MVC allows changing data independently of its representations and vice versa. In addition, it controls how it displays the data and how users interact with the system. Since MVC architecture pattern's main advantage is to provide high reusability and integrability of the code. Figure 4.3 shows the Khwendga system MVC architecture pattern that has been implemented.

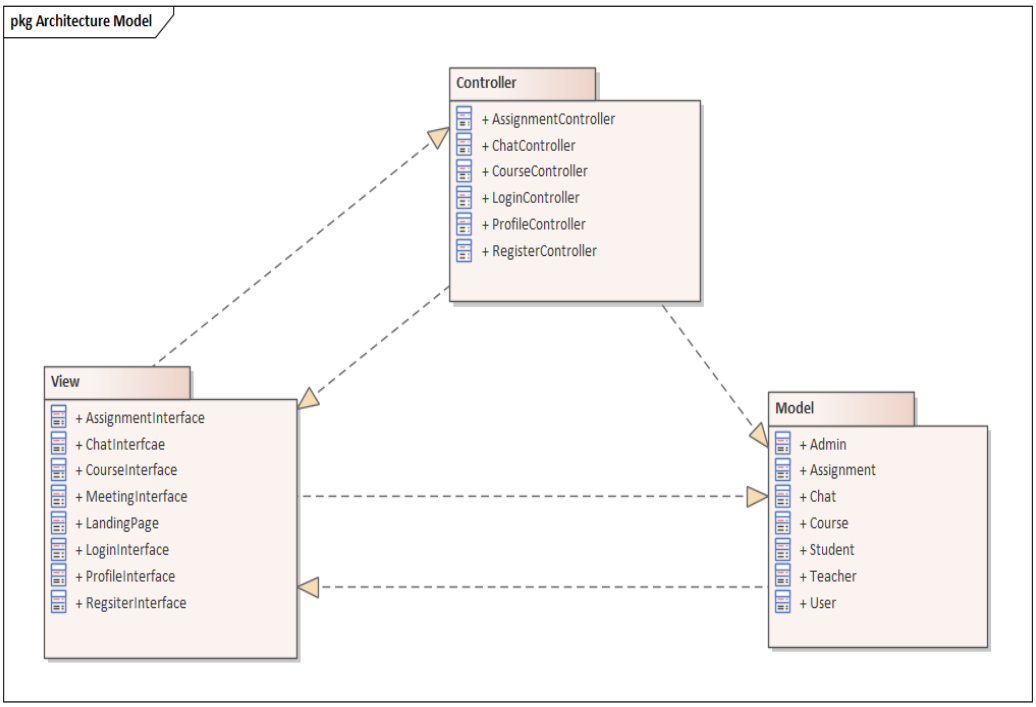

Figure 4.3 Architecture Design

4.3 Database Design

This section describes the data attributes involved in the system that are stored in the database of the system. The database for this project consists of seven tables which are the user table, roles table, messages table, lastMsg table, grades table, courses table and assignments table. While more details in designing the database tables for the system can be referred to SDD documentation in Appendix D.

4.4 Interface Design

The user interface is the visual that will be presented to the end-users. Depend on the requirements analysis and needs for the system a good user interface has been created that provide users with quick, easy access and a convenient interface to use the system. Further details and design can be referring to the SDD document at Appendix D.

4.5 Chapter Summary

This chapter describe and explain illustrated diagram that showcases the process of how components interact as well the database and interface design that model the navigation of the proposed system. Finally, in this chapter, the system requirement and the design architecture are determined. It is important to execute the proposed system successfully during implementation that meets the user requirement. From the analysis, every detail has been documented and used to continue with the system design.

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Introduction

This chapter will showcase the development and testing stages. The development processes of system main functions that include the user interface (UI) and coding. In addition, the testing process that has been implemented after the completing development. The testing includes User Acceptance Testing and Black Box testing for the developed system. Because testing is essential as it ensure quality and whether the system meets user requirements.

5.2 Coding of System Main Functions

The system has developed using Model-View-Controller (MVC) pattern. There are three separated layers. The Model component control data of the system as well as manage associated operations on that data. While the View component manages the presentation of data to the user. whereas the Controller component handles the interaction of the user and move these interactions to the Model and the View components

5.2.1 Model Layer

The Model layer deal with data of application and business logic. The main purpose is to manage data from validating, processing and store them. It manages all related operation of the data. From Figure 5.1, section of code Profile.jsx is a Model layer that is used to connect to the firestore cloud database for users data and retrieve their information.

```
const fetchInfo = async () => {
  try {
    const q = query(collection(db, 'users'), where('uid', '==', user?.uid));
    const doc = await getDocs(q);
    const data = doc.docs[0].data();
    setName(data.name);
    setMiddleName(data.middleName);
    setLastName(data.lastName);
    setImage(data.image);
    setEmail(data.email);
    setGrade(data.grade);
    setCity(data.city);
    setStreet(data.street);
    setPhone(data.phone);
    const q1 = query(collection(db, 'roles'), where('uid', '==', user?.uid));
    const doc1 = await getDocs(q1);
    const data1 = doc1.docs[0].data();
    setRoleType(data1.roleType);
    const q2 = query(
      collection(db, 'courses'),
      where('teacherId', '==', user?.uid)
    );
    const doc2 = await getDocs(q2);
    const data2 = doc2.size;
    setTotalCourses(data2);

    const q3 = query(
      collection(db, 'assignments'),
      where('submission', '==', 'yes')
    );
    const doc3 = await getDocs(q3);
    const data3 = doc3.size;
    setTotalAssignments(data3);
  } catch (err) {
    console.error(err);
    alert('An error occured while fetching user data');
  }
};
```

Figure 5.1 Fragments of Code in Profile.jsx

5.2.2 View Layer

The View component manages the presentation of data to the user. The user can view the interface rendered from the coding. Below Figure 5.2 shows the footer view.

```
export default function Footer() {
  return (
    <footer class="footer">
      <div class="footer-header">
        <div class="footer-title mt-2">© 2022- SJM</div>
      </div>
    </footer>
  );
}
```

Figure 5.2 Codes of Footer.jsx

5.2.3 Controller layer

The Controller component handles the interaction of the user and move these interactions to the Model and the View components. From Figure 5.3, section of code CourseAction.jsx of redux technology has been used in order to retrieve and manipulate action for course in the view and model layer.

```
export const FetchCoursesRequest = () => {
  return {
    type: FETCH_COURSES_REQUEST,
  };
};

export const FetchCoursesSuccess = (data) => {
  return {
    type: FETCH_COURSES_SUCCESS,
    payload: data,      Sima Jazaa, 4 days ago • Feat: Add
  };
};

export const FetchCoursesFailure = (error) => {
  return {
    type: FETCH_COURSES_FAILURE,
    payload: error,
  };
};

export const FetchCourses = () => {
  const [user] = useAuthState(auth);

  return async (dispatch) => {
    dispatch(FetchCoursesRequest());
    console.error('fetch');

    try {
      const q = query(collection(db, 'users'), where('uid', '==', user?.uid));
      const docm = await getDocs(q);
      const data1 = docm.docs[0].data();

      const q1 = query(collection(db, 'roles'), where('uid', '==', user?.uid));
      const docm1 = await getDocs(q1);
      const data11 = docm1.docs[0].data();

      let querySnapshot;
      if (data11.roleType === 'teacher') {
        querySnapshot = await getDocs(
          query(collection(db, 'courses'), where('teacherId', '==', data11.uid))
        );
      } else {
        querySnapshot = await getDocs(
          query(
            collection(db, 'courses'),
```

Figure 5.3 Fragments of Code in CourseAction.jsx

5.3 Interfaces of the Main Functions

The web based system user interface offers interactive visual that will be presented to the end-users. Depending on the requirements analysis and needs for the system a good user interface has been created that provide users with quick, easy access and a convenient interface to use the system. The interface includes various elements, videos, animation along with attractive colors that draw attention of users especially primary students.

There are three main modules for the system. Figure 5.4 and Figure 5.5 show the Login and Profile of student Interface for Account Module. As all of important functional and feature has been shown in the interface. Teachers can view their students who have been registered into their class and it can be access in their profile dashboard where they click on the icon of students of the course. It will show the students in a table.

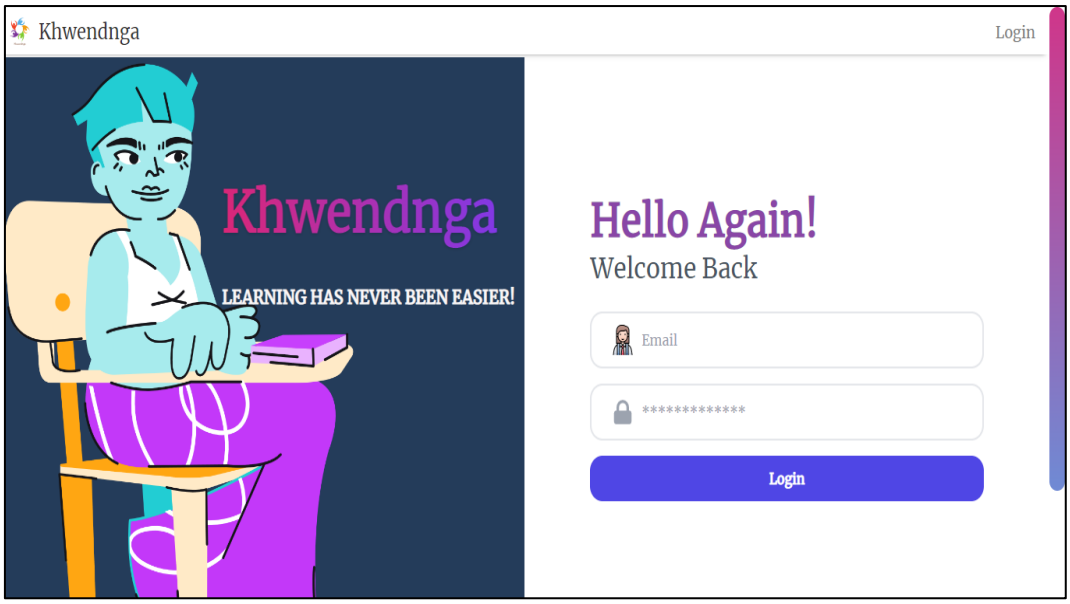

Figure 5.4 Login Interface

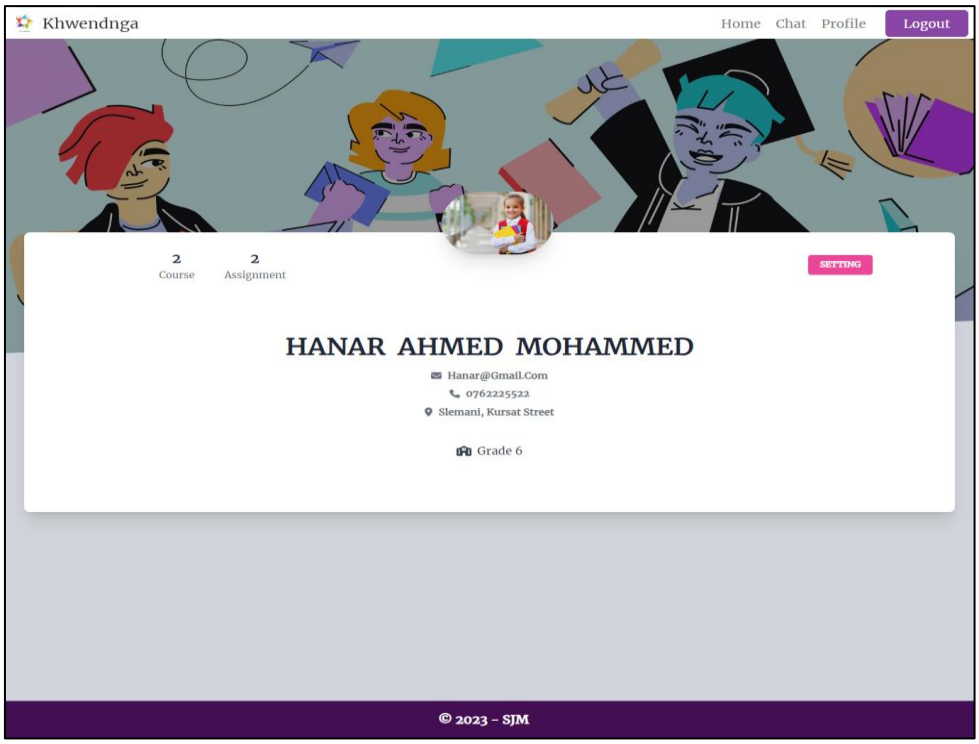

Figure 5.5 Student Profile Interface

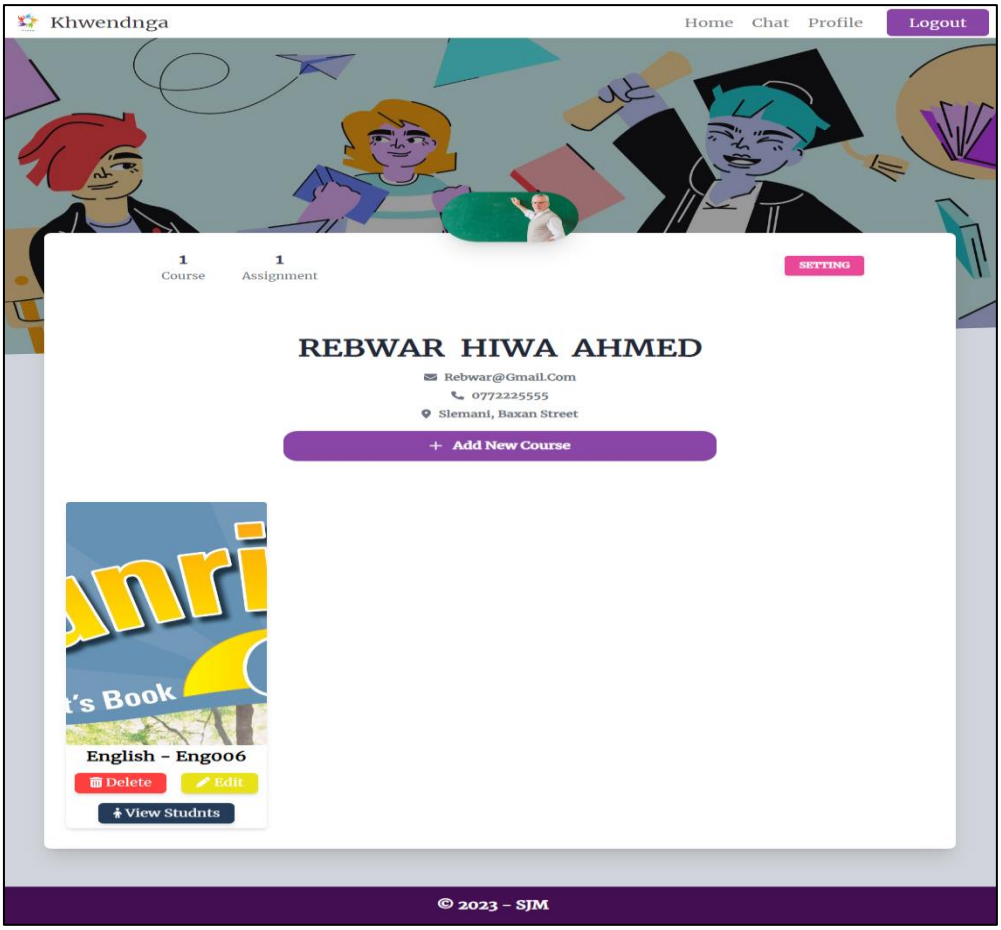

Figure 5.6 Teacher Profile

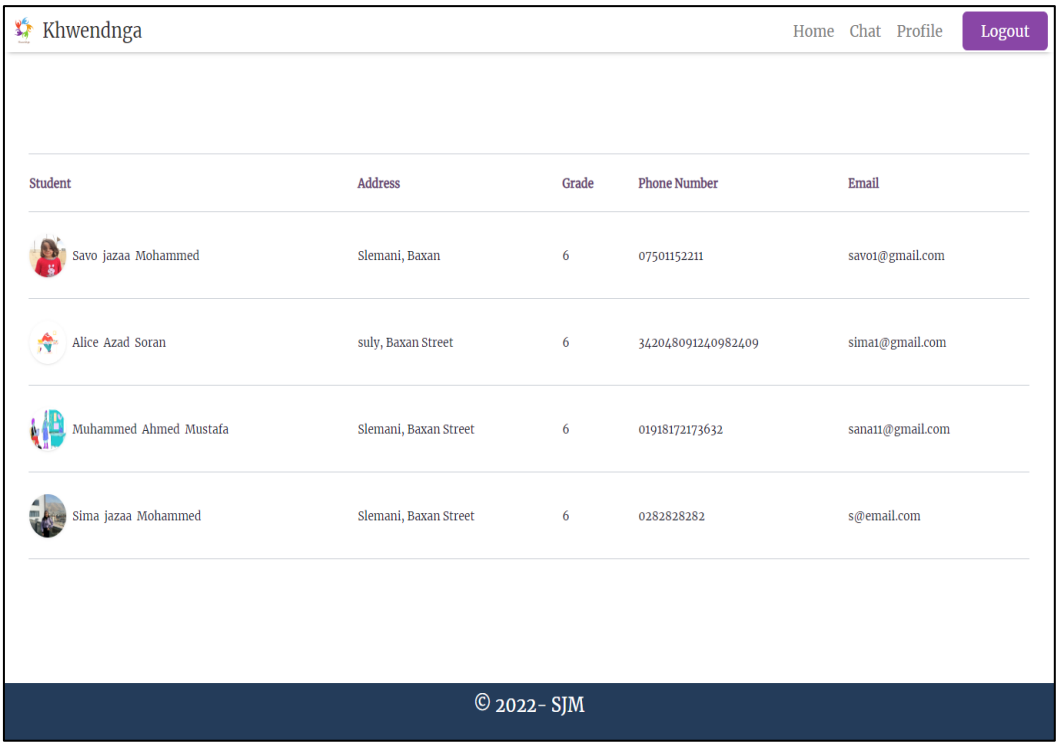

Figure 5.7 Students List Interface for English - EN00017

While the course Module focus delivering the course and interactive elements for students. It would show the course cards for students in which they click it and show all the details. As well there personalized messaged through system which this can be shown to students reminding to take a break.

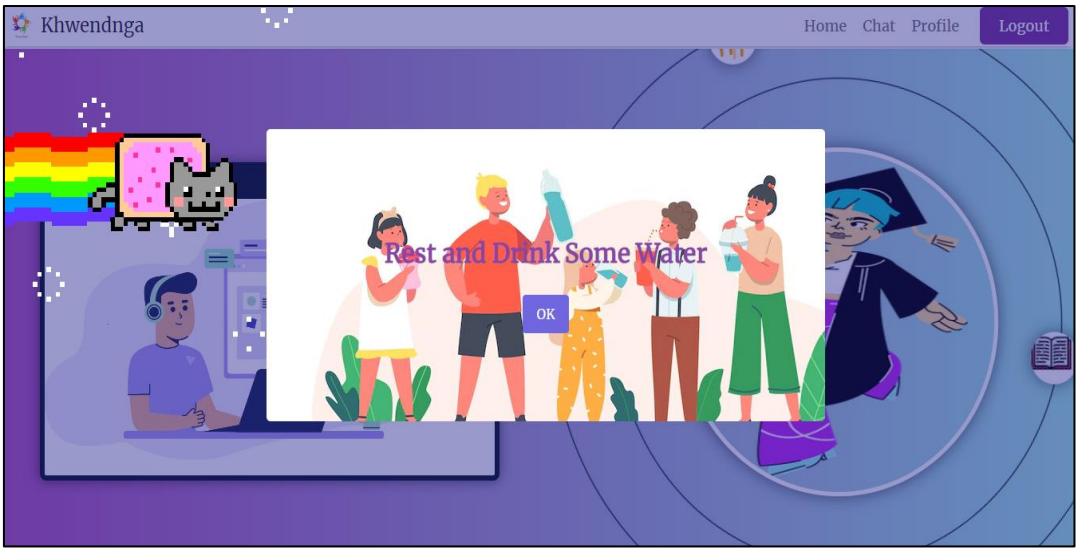

Figure 5.8 Personalized Message

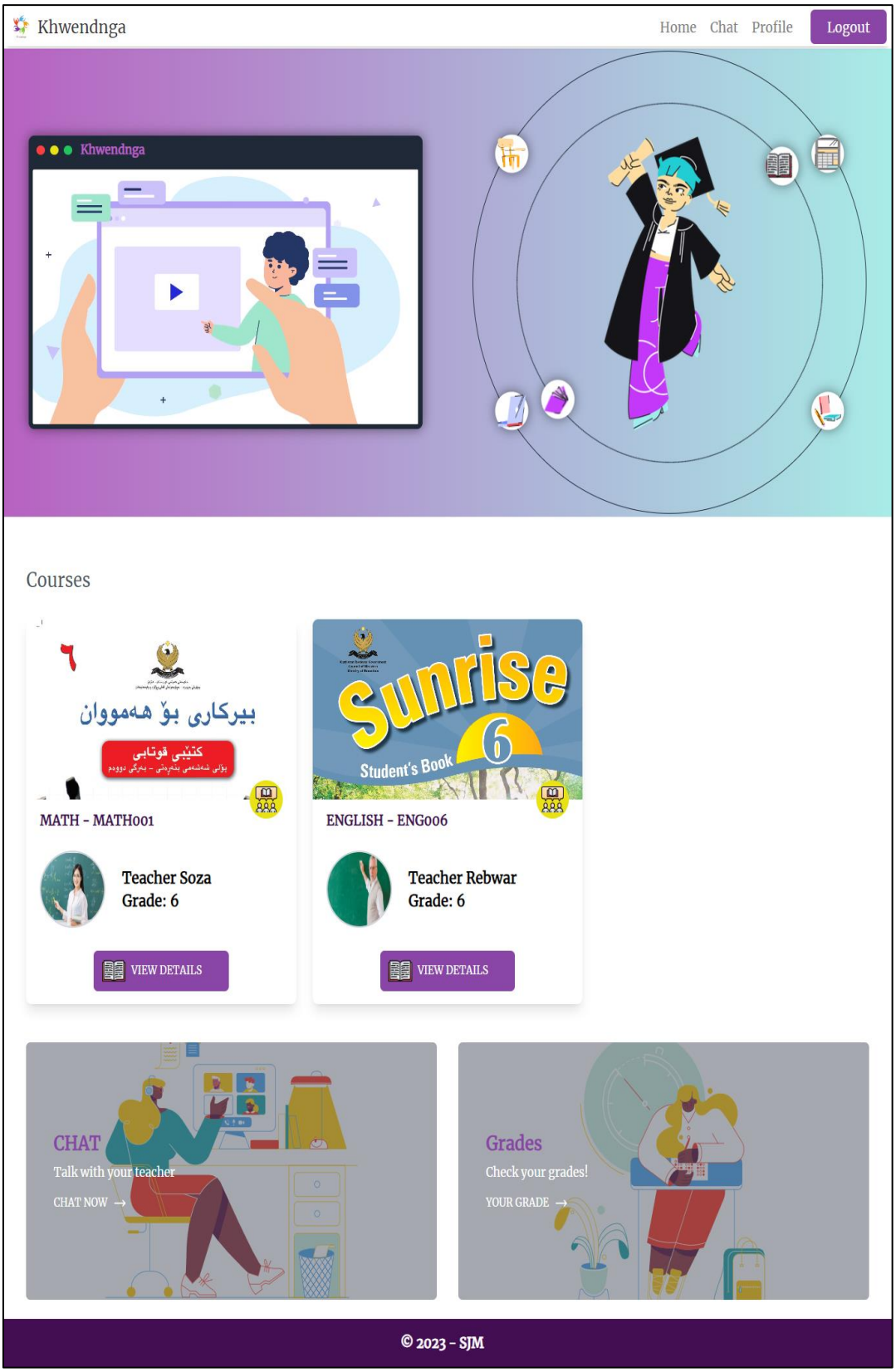

Figure 5.9 Home Interface which shows the courses.

The Final Module is the Chat where it has a simple and easy interface which all users are familiar with.

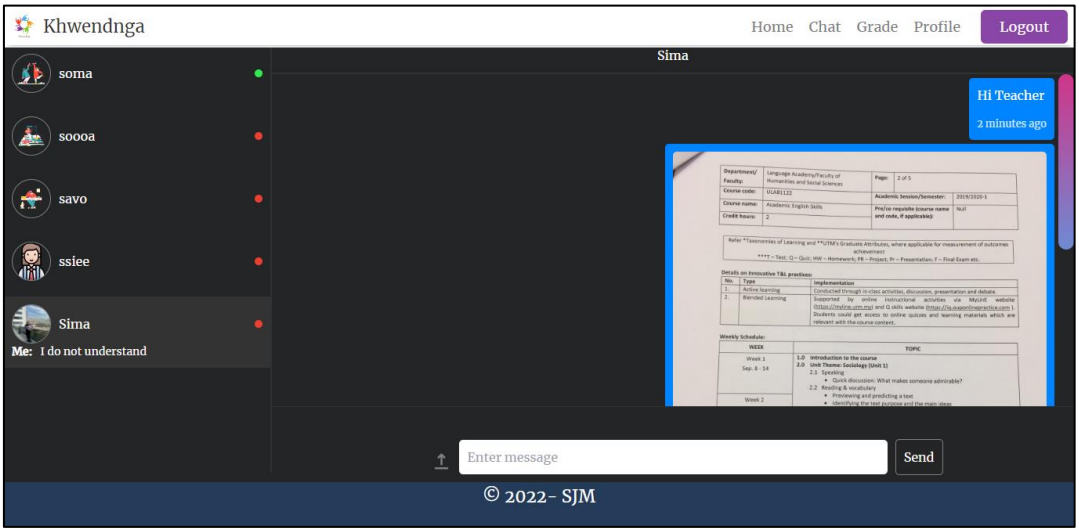

Figure 5.10 Chat Interface

5.4 Testing

This part shows the testing implementation of the Khwendnga System. The testing process will be done into two. The testing will black-box testing and user acceptance testing.

5.4.1 Black-Box Testing

Black box is a testing technique to validate input and output of the system. It ensures the quality by focusing on the user requirement. Therefore, black-box testing is required to ensure that all requirements from functional and needs are met. As the interface will be tested along any input errors. Table 5.1 show the black box testing for the system.

Table 5.1 Black Box Testing

No	Test Case	Expected Output	Real Output	Discussion
1	Register New User	New User Information can be registered by the admin.	Tested and success.	New User has been added to the system.
2	Add Course	New Course can be added by the teacher.	Tested and Success.	New Course has been added to the system.
3.	Upload Course Material	New Course Material has been added by the teacher.	Tested and Success.	New Course Material has been added for the teacher course.
4.	Submit Assignment	Assignment has been submitted by the student.	Tested and Success.	Students has submitted their assignment to the teacher.

5.4.2 User Acceptance Testing

The User Acceptance Testing (UAT) was executed for determining users' satisfaction for the proposed system. It is main purpose for getting feedback from the users of the system so later can be improved. It also performed to ensure that system's user requirements and specifications have been met. The testing process for UAT showed every use cases of the Khwendnga system are passed. Also, the sytem got positive feedback from users. UAT was conducted with target user s by filling up the UAT document after testing the system. Further details for UAT testing can be referred in Appendix D in the STD.

5.5 Chapter Summary

This chapter summarize all the main function of the Khwendnga System for primary school. It covers important interface and coding development that has been used for developing this project. In addition, it showcases different testing has been conducted with the users to ensure quality of the system.

CHAPTER 6

CONCLUSION

6.1 Introduction

This chapter elaborates importance of developing an E-Learning system to support primary school. Through the works that have done during the previous documentation of this project. In addition, this chapter will restate the objectives of the project and illustrates how the significant this project for Education in KRG since It is underdeveloped and does not prepare students for the next stage of their life. Most importantly, there will be suggestions for improvement are also discussed to enhance the capacity of the system in the future. Therefore, this project will be interactive eLearning system that can to deliver personalized interactive education content depend on primary school. In order students to be engaged and fully focus, it needs to good usability and interaction based analysis of current system of primary schools in KRG. Finally, the system was evaluated based on user-based testing for better usability and enhanced functionality in the future.

6.2 Achievements

The plan to develop the Khwendga System for Primary School in KRG is best solution for providing support for long term growth of education sector in KRG. It resolves online learning problem by eWane regarding the personalized and interactive system foe schools. In addition, there deadlines and time limited project therefore it controls progress projects, it still gained the achievement from the reviewing current system and analyse based on required aspect to determine plan and development methodology to implement the system from design and important functionalities. Khwendga system will be primary based on Students engagement with teachers to

integrate interactive elements so system offer collaboration and communication across the platform. The following discussed the objectives that have been achieved:

(a) The existing system have been analysed and discussed in chapter 2. Also it has shown list of the functionality from other systems as well.

(b) The project has matched the main objectives by gathering the requirement via interviewing and analysing documentation of the current system.

(c) The project functionalities that have been proposed are planned to be implemented and have fully explained in details.

(d) The system is prepared to go to development stages through planning and prepared documentation. The proposed system will offer efficient way of delivering personalized educations contents from anywhere and at any time

6.3 Suggested plan for Improvements

This project approach was to satisfy requirements and be implemented successfully without any cost in development or efficiency. There are still many changes that may be made to improve the project's requirements and performance. It will be mainly focused on completing important functionality by following Kanban agile methodology. The Khwendga system needs to be implemented based on personalized aspects that primary schools need as its system will offer interactivity and communication for teachers and students so adding online meeting feature would be perfect improvement in the future. Supporting Kurdish and Arabic languages for Kurdish and Arabic based schools as result It will be a great way for technology accessibility. Through, developing a personalized E-Learning is needed especially for primary schools as children of that age are most valuable and need to experience adaptive learning, and easy to use. The contents would be customizable and attractive visualized aspects to suit primary students. Finally, keeping documentation and adept any changes or improvement for the project in later stages.

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Appendix A Interview Questions

Teacher:
Name and Details and Grade they teach?
1. What are the problems you have faced with your current system?
2. If we propose a new system for E-Learning Primary school, how do you expect the system to be?
3. What should we add to new system to support primary schools?
4. What is the average rate for using the eWane?
5. Did you think the students could follow eWane application?
6. Do you think students learning has been effected? Explain why.
7. Do you think the eWane support teacher teaching activates?
8. Do you think this program system is satisfying and totally reliable***?***
Student:
Name and Details and Grade they are?
1. What are the problems you have faced with your current system?
2. What should we add to new system to support you as a student?
3. What is the average rate for using the eWane as a student?
4. Did you think you could follow eWane application?
5. Do you think your learning has been effected? Explain why.
6. Do you think the eWane support effective teaching?
7. What did you miss during online learning?
8. Do you think the current program system is satisfying and totally reliable?

Figure A.1 Interview Questions

Appendix B Gantt Chart

MONTH/WEEK	NOVERMBER		DECEMBER				January				FEBRUARY			
	3	4	1	2	3	4	1	2	3	4	1	2	3	4
PSM1 Topic Propsal														
Choosing PSM1 Title														
Proposal														
Chapter 1: Proposal														
Project Proposal														
Refine Proposal														
Chapter 1 Report														
Chapter 2: Literature Review														
Study on Existing System														
Study on Technologies Used														
Chapter 2 Report														
Chapter 3: Methodology														
Compare Related Methodologies														
Choosing Methodology														
Chapter 3 Report														
Chapter 4: Design														
SRS														
SDD														
STD														
Chapter 4 Report														
Chapter 5: Conclusion														
Chapter 5 Report														
Draft Full Report														
Report first Correction														
PSM1 Presentation														
Report Second Correction														
Report Submission														

Figure B.1 Gantt Chart for PSM1

MONTH/WEEK	March				April				May				June				July			
Khwendnga	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Analysis Phase																				
Requirements Gathering																				
Analyse Requirements																				
Define existing system problem																				
Supervisor review																				
Design Phase																				
Use case specification																				
Activity and sequence diagram																				
Wireframe																				
Interface design																				
Supervisor reviewed all iteration																				
Development Phase																				
Front Development																				
Manage Course (add, view, delete, update)																				
Manage Admin																				
Manage Teachers																				
Manage Students																				
Demo to SV and comments																				
Testing Phase																				
User acceptance test																				
Demo to SV and comments																				
Deploy Phase																				
Optimize project performance																				
Deploy System																				
Documentation Phase																				
Documentation FYP 2																				
Presentation FYP 2																				
Submission report																				

Figure B.2 Gantt Chart for PSM2

Appendix C Software Requirements Specification

Software Requirements Specification

DEVELOPING A PERSONALIZED INTERACTIVE E-LEARNING SYSTEM TO SUPPORT PRIMARY SCHOOLS

Version 1.0

23 June 2022

Department Software Engineering

School of Computing

Faculty of Engineering

Revision Page

a. Overview

The Software Requirement Specification (SRS) contains overall description and functionality for Khwendnga System. It has developed to support primary schools. It includes requirements from stakeholders and showcase features of the system.

b. Target Audience

- Primary Students.
- Teachers.
- Parents and Guardian of students.
- Primary School.

c. Project Member

This is an individual project is developed by Sima Jazaa Mohammed.

d. Version Control History

Version	Primary Author(s)	Description of Version	Date Completed
Version 1.0	Sima Jazaa Mohammed	SRS 1.0 of Khwendnga System.	23/6/2022

Table of Contents

1. Introduction

1.1 Purpose

The System Requirements Specification (SRS) document describe the detailed description of the Khwendnga (KS). It includes instructions about functional and non-functional requirements related learning process. The main purpose is for managing online learning activities. It shows stakeholders' requirements and features of the system. Finally, it clarifiers the interaction of system and specific requirements. Therefore, this document provides complete, clear and concise details for stakeholders to ensure a smooth managing of online learning without any issues or conflicts.

1.2 Scope

The web application will be personalized and interactive. Admin can register accounts for teachers and students. Students can login into the system and then view their course. Along they can view their course assessments and submit their solution for their assignments. Most importantly chat with their teachers. Teacher can view their course and add new course along with assessments for their students.

1.3 Definitions, Acronyms and Abbreviation

Table 1.1 Definition, Acronyms and Abbreviations used in the system

Acronyms	Definitions
SRS	Software Requirements Specification
UML	Unified Modeling Language
UI	User Interface
JS	JavaScript

MVC	Model View Controller
RAM	Random Access Memory
KS	Khwendnga System

1.4 References

Milićević, V., Denić, N., Milićević, Z., Arsić, L., Spasić-Stojković, M., Petković, D., . . . Jovanović, A. (2021). E-learning perspectives in higher education institutions. *Technological Forecasting and Social Change, 166*, 120618.

1.5 Overview

The SRD incorporates the following Sections where it contains an overall description for Khewndnga (KS) which will provide the product perspective and related interface for the system. In addition, it also includes the requirements, user characteristics constraints, functionalities, assumption and dependencies of the system. Specific Requirements is the next section in the document which it will describe the external interface requirements, the system features, performance requirements, design constraints, software system and other requirements of the system.

2. Overall Description

This section provides description of Web based application of KS. It is a complete web based application for online learning activity that provides managing course, chatting and account. Where users will be able to login and redirected to the home page, then it shows the courses belong to users. The Teacher and Student their accounts will be registered by Admin. Also, Teacher can add, edit and delete their courses in the system while students can view their courses and submit their solution for their assessments though the system.

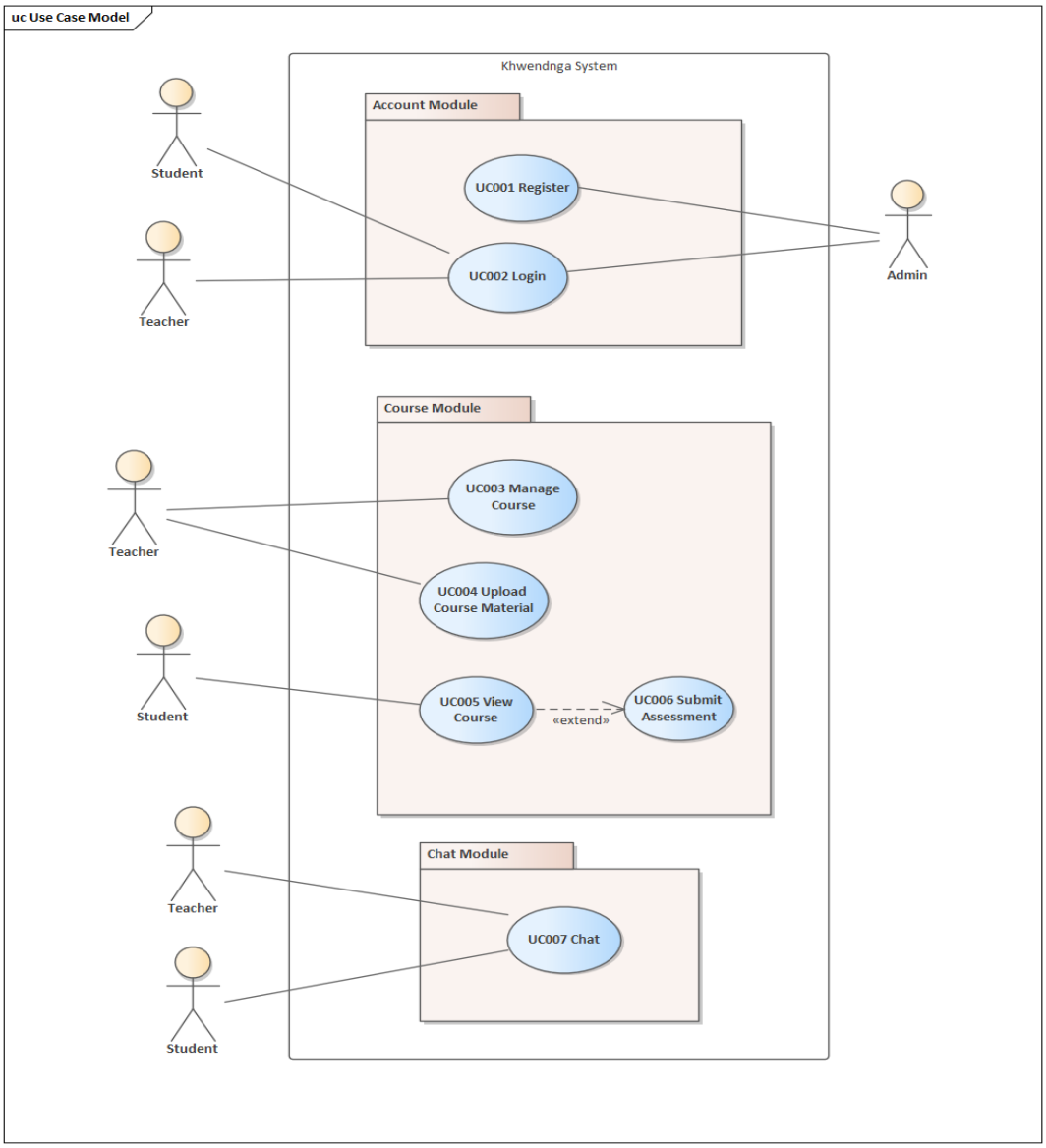


Figure 2.1 Use Case Model

2.1 Product Perspective

KS is a product that would provide online learning for primary schools and make more activities more efficient. KS is web-based application system. For security purposes only the Admin can register new teacher and student accounts. It can be support a large number of users and in the future expand. The system will enhance online learning process. Therefore, increase efficiency through personalization and interactivity. The data during the courses and chat along user information will be stored in firestore of firebase. The data will be retrieved from database using web-based system. Where it presents a new system that will be access through mobile phone and PCs since it is more convenient for users.

2.1.1 System Interfaces

The System consist of these interface below:

(a) Login

(b) Register

(c) Home

(d) Profile Students

(e) Profile Teacher

(f) Profile Admin

(g) Course

(h) Add Course

(i) Add Course Material

(j) Chat

2.1.2 User Interfaces

There will be a Login page where users need to login and if they do not have an account, then admin will register their account in the Register Page. After user Login, they will be redirected to the Home page will show case the courses and users can navigate through the navbar to the profile and chat pages. User can click on the course card and they will be redirect the course details which will show assignments and videos that teacher has upload in the Add Assignment. The Khwendnga system has been developed based on interactivities and visual appeal for children along personalization. The main users are student, teacher and admin. Besides, there are different interface and functionality based on their role.

2.1.3 Hardware Interfaces

KS is web app where it supports cross platforms and accessed through mobiles and Pcs. It only needs to connect internet like by Modem, WAN – LAN, Ethernet Cross-Cable.

2.1.4 Software Interfaces

The Firebase will be used to organize and store data of the course, chat and users. ReactJS has been used for the system functionality and interface design.

2.1.5 Communication Interfaces

The system communication with other system has been implemented through internet network and database server.

2.2 Memory

The system has firebase cloud data storage since it has a huge capacity of memory to back up and save large amount of data. Therefore, it has fast performance and effective loading along it has 35 megabytes of memory there will be not for the system operation.

2.3 Operations

See Section 2.1.2 User Interfaces

2.4 Site Adaptation Requirements

The system is a new web app that has been developed for KS. The new system enables chatting and managing courses from online.

2.5 Product Functions

There are 7 use cases that show the main functions performed by the proposed system:

Table 2.1 Use Case Description

Use Case	**Description**
UC001: Register	The event enables the admin to register a new user to the system.
UC002: Login	The event enables users to login into the system.
UC003: Manage Course	The event enables the admin to view, edit or delete courses.
UC004: Upload Course Material	The event enable the teacher to upload course martial for their lesson.

UC005: View Course	The event enable the students to view the course that their teacher created.
UC006: Submit Assignment	The event enables the student to submit assignment of their assessment.
UC007: Chat	The event enables the teacher and students to chat.

2.6 User Characteristics

Based on Table 2.2, there are 3 main actors in the system which are students, teacher and admin.

Table 2.2 Actors and Roles

Actor	**Role**
Student	The student can login into the system. Where they can view their courses and assessments then they will be able to submit their assignment. Along they can chat with their teacher.
Teacher	The teacher can login into the system. They are responsible for managing their course where they can add, edit or add new courses. Also, they can upload course material for their course. Finally, they will be able to chat with their students,.
Admin	Admin main responsibly is registering new accounts for students and teachers.

2.7 Constraints

Below are the system constraints:

(a) The system should be available 24 hours a day.

(b) Every user needs to have their own account in order to access the website.

(c) The data needs to be stored where they can be accessed by the Khwendnga website.

(d) They system must works in different browsers like Mozilla Firefox, Safari, Google Chrome, Brave, etc.

2.8 Assumption and Dependencies

Below are the main factors for assumption and dependencies:

(a) The system cannot be accessed where there is no internet connection.

(b) Registered Users who have their own email and password can access the website only.

3. Specific Requirements

The Domain diagram, it showcases the attributes that have been used and their class relationship with each other. It identifies the interaction between the classes. Finally, it highlights the main class components that are required to facilitate the system.

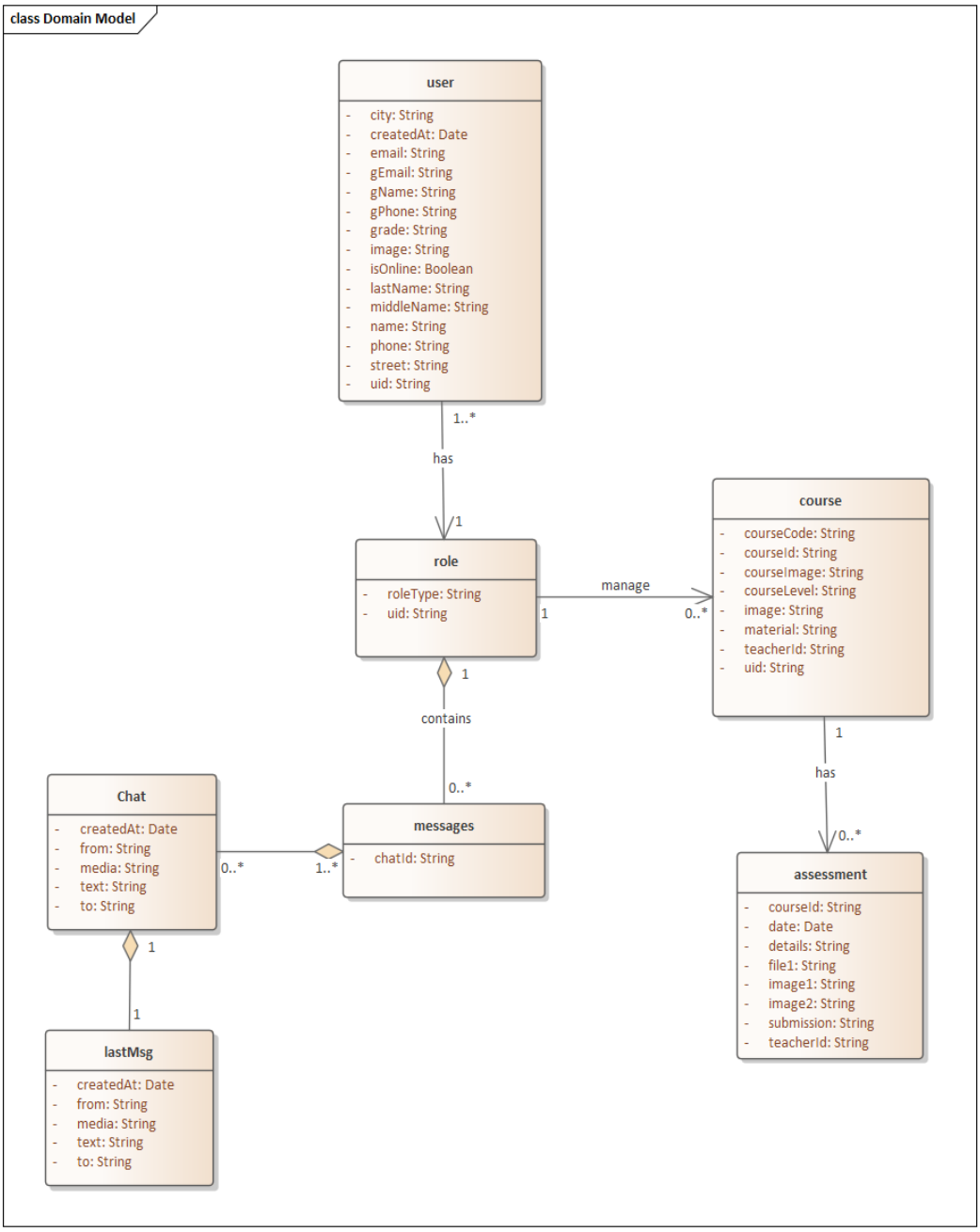


Figure 3.1 Domain Model of Khwendnga System

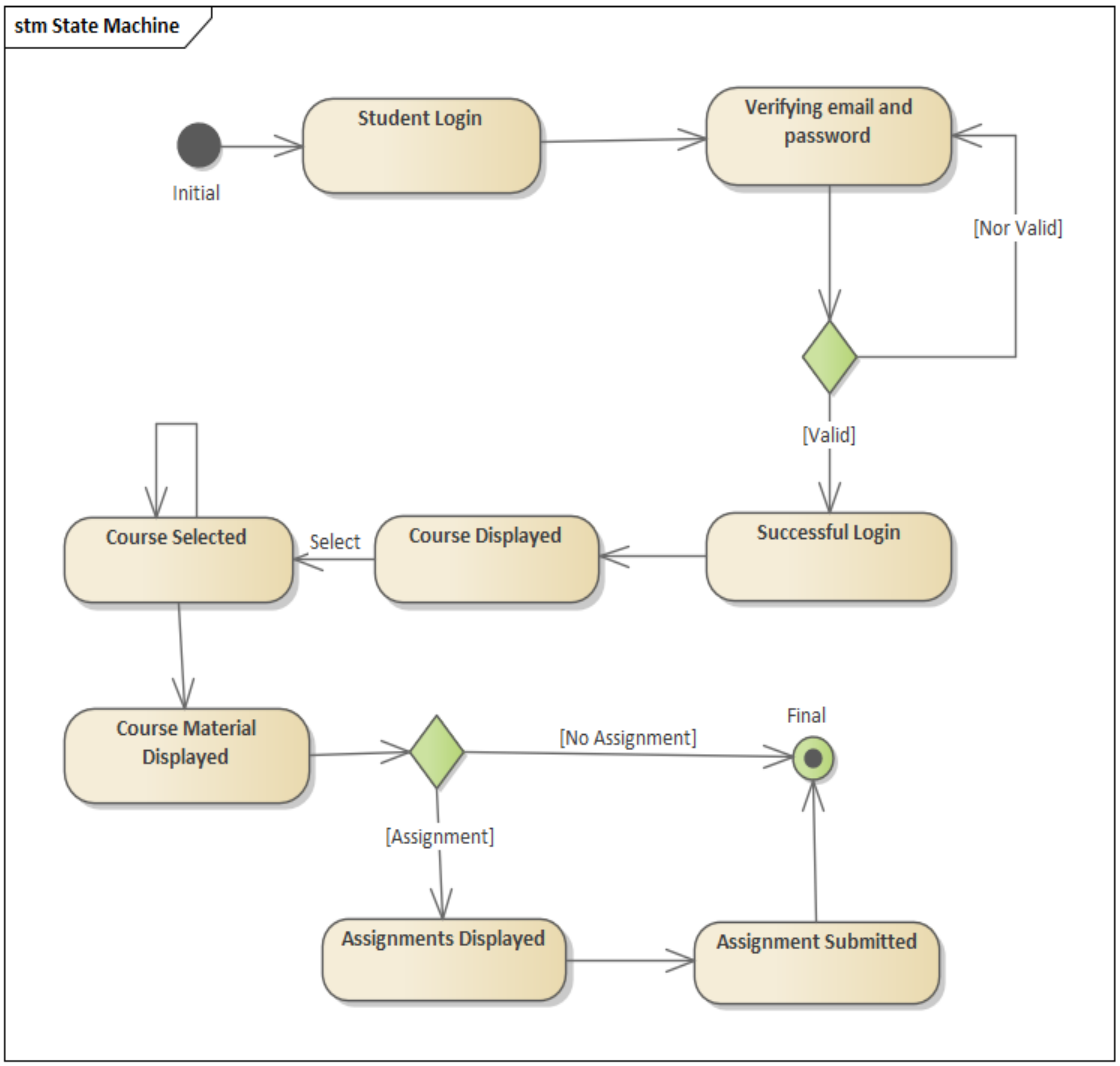


Figure 3.2 State Machine for Khwendnga System

3.1 External Interface Requirements

3.1.1 User Interfaces

The web based system user interface offers interactive visual that will be presented to the end-users. Depending on the requirements analysis and needs for the system a good user interface has been created that provide users with quick, easy access and a convenient interface to use the system. The interface includes various elements, videos, animation along with attractive colors that draw attention of users especially primary students.

3.1.2 Hardware Interfaces

KS is web app where it supports cross platforms and is accessed through mobiles and Pcs. It can be accessed from Mozilla Firefox, Google Chrome, Safari, Brave, and Microsoft Edge Browsers. It available for smartphones with Android or iOS operating systems and Windows and macOS operating systems. There will need a processor speed of 1.5 GHz , Memory of 4GB and storage of 15 GB to run the system efficiently without any problems. Furthermore, for the internet connectivity, there will need 3G for effective performance.

3.1.3 Software Interfaces

Client and server will have asynchronous communication. The main advantage is to manage a large number of users at the same time. Also, this system supports web browsers since it is the most convenient for the users. KS use a Cloud Firestore to store and organize data from the system. The system functionality has been implemented using ReactJS and Redux because it is the most flexible library to develop. Microsoft. Furthermore, tailwind CSS and CSS were used for styling and the front end of the system.

3.1.4 Communication Interfaces

This web application will be secure since it used firebase authentication and internet communication channels.

3.2 System Features

3.2.1 Module Account

3.2.1.1 UC001: Use Case Register

Table 3.1 Register Use Case Specification

ID	UC001
Description	The event enables the admin to register a new user to the system.
Actor	User (Admin)
Precondition	Admin needs to login into the system. Admin is the only one who registers accounts.
Normal Flow	1. Register page will be displayed 2. Admin fill in user information. 3. System validates user authentication. 4. If authentication fails, go to Exception 1. 5. Successful Message will be shown for Successful Registration. 6. The use case will end.
Exception	1. User authentication fails. 1.1. Error message will be displayed 1.2. Return to Normal Flow 2.
Postconditions	New users will be registered into the system.

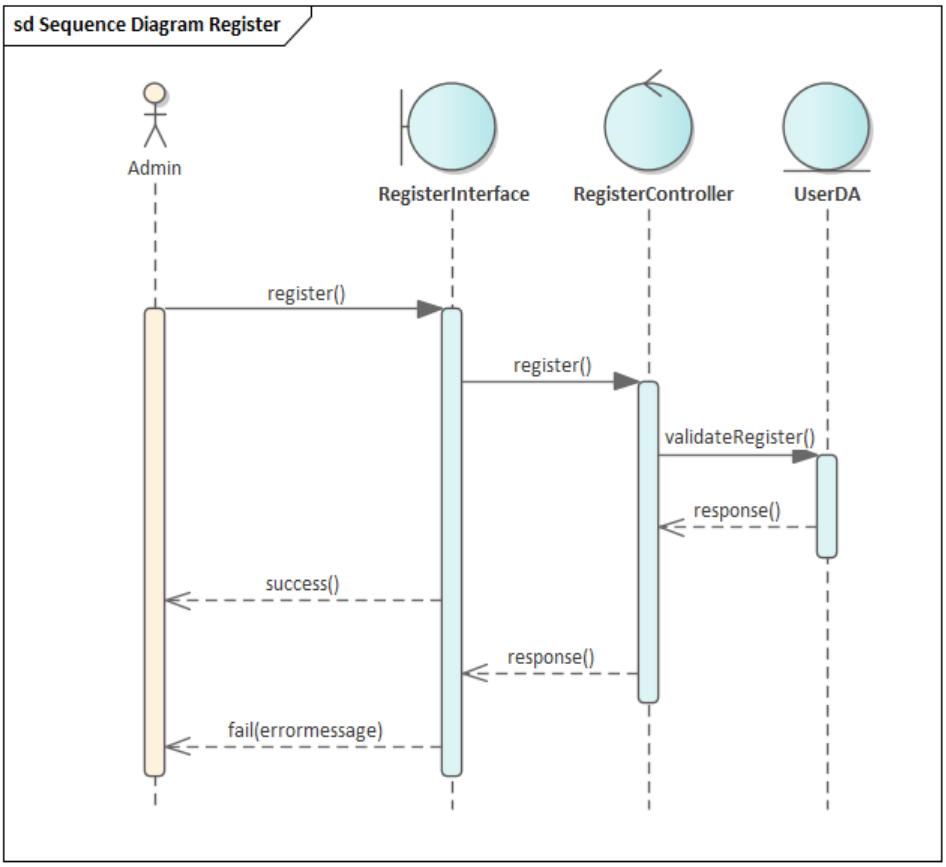


Figure 3.3 Register Sequence Diagram

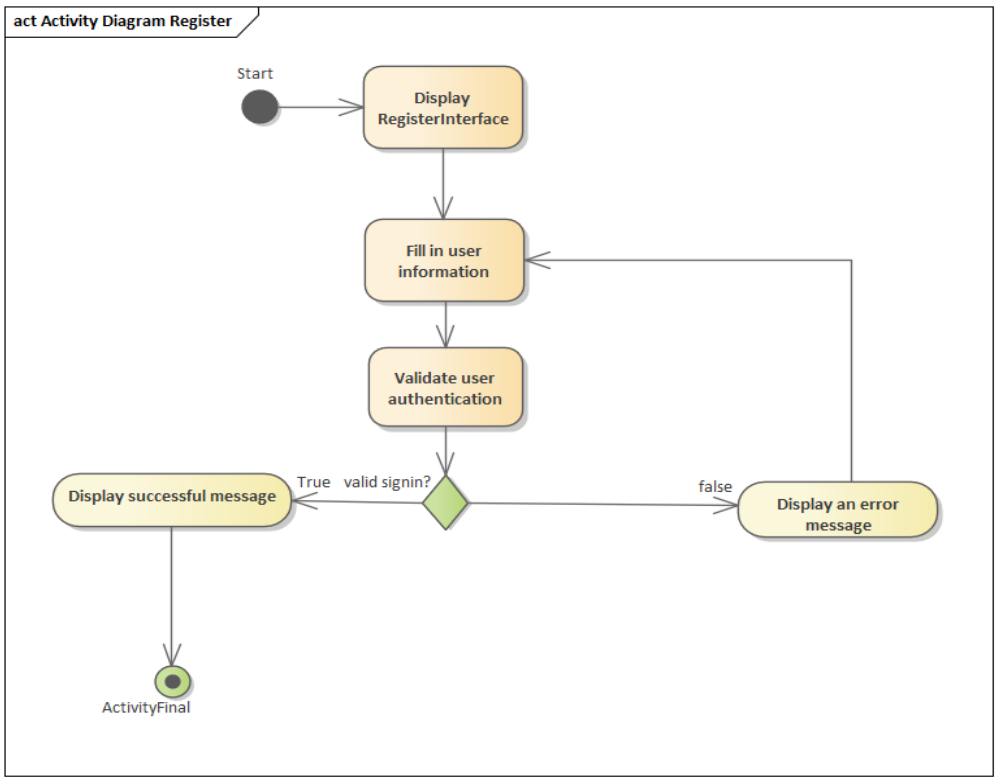


Figure 3.4 Register Activity Diagram

3.2.1.2 UC002: Use Case Login

Table 3.2 Login Use Case Specification

ID	UC002
Description	The event enables the user to login into the system.
Actor	User (Admin, Teacher, Student)
Precondition	Registered users can only login into the system.
Normal Flow	1. Login page will be displayed 2. User fill in email and password. 3. System validates user authentication. 4. If authentication fails, go to Exception 1. 5. Successful Login will be redirected to the Login page. 6. The use case will end.
Exception	2. User authentication fails. 2.1. Error message will be displayed 2.2. Return to Normal Flow 2.
Postconditions	User will be able to login into the system.

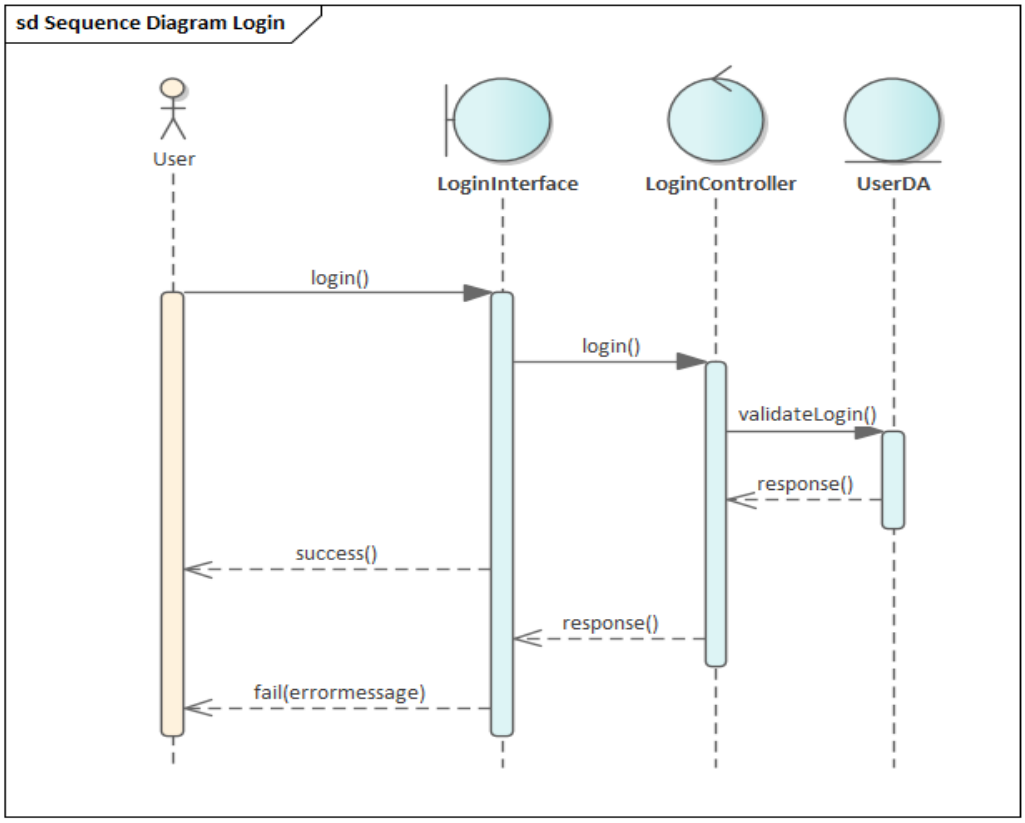


Figure 3.5 Login Sequence Diagram

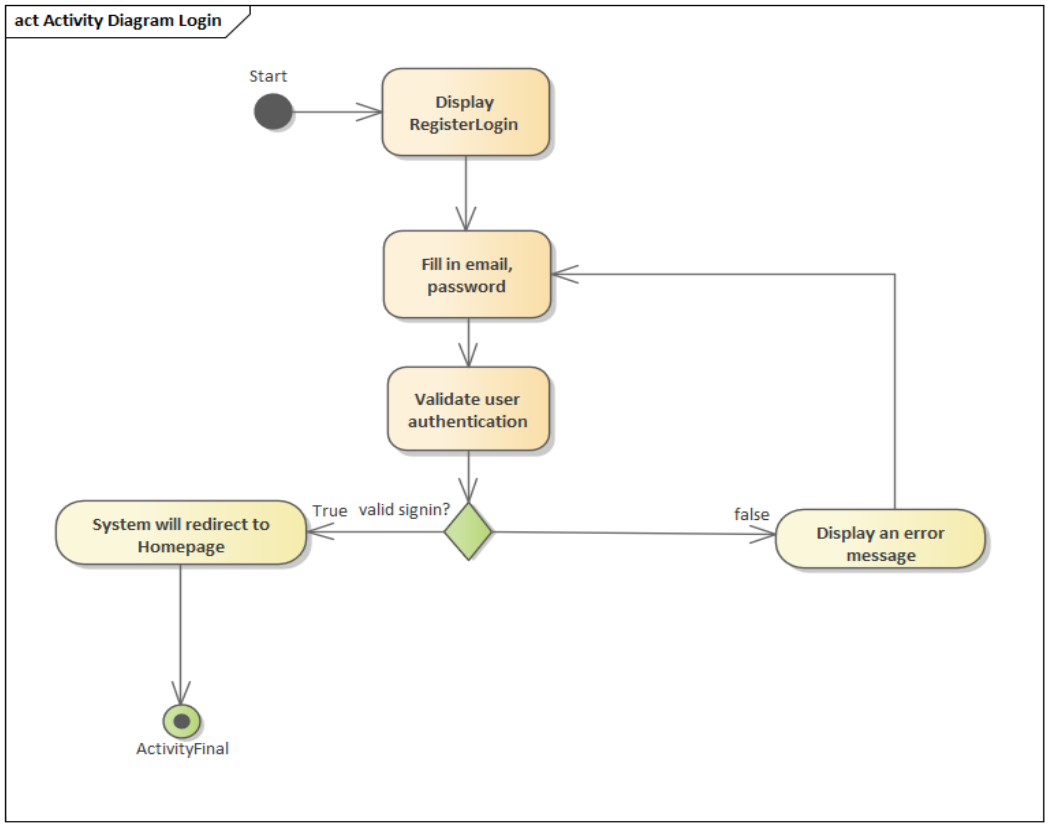


Figure 3.6 Login Activity Diagram

3.2.2 Module Course

3.2.2.1 UC003: Use Case Manage Course

Table 3.3 Upload Course Use Case Specification

ID	UC003
Description	The event enables the teacher managing their course.
Actor	User (Teacher)
Precondition	Teachers are the only one who can manage their course. They needs to login into the system.
Normal Flow	1. Add 1.1. Teacher click "Add New Course". 1.2. System will display add course form. 1.3. Teacher adds new course information. 1.4. Teacher click submit. 1.5. System validates course data. See Exception 1. 1.6. Return normal Flow 4. 2. Edit 2.1. Teacher select course. 2.2. Teacher click "Edit Course". 2.3. System will display the edit course form. 2.4. Teacher edits course information. 2.5. Teacher click submit. 2.6. System validates course data. See Exception 1. 2.7. Return normal Flow 4. 3. Delete. 3.1. Teacher select course. 3.2. Teacher click "Delete Course". 3.3. System will display confirmation message. 3.4. Teacher click 'Ok'. 3.5. System will delete course data from database. 4. The use case will end.
Exception	1. Fail to add the course.

	1.1. Error message will be displayed 1.2. Return to Normal Flow 4. 2. Fail to edit the course. 2.1. Error message will be displayed 2.2. Return to Normal Flow 4.
Postconditions	Teachers will be able to manage courses.

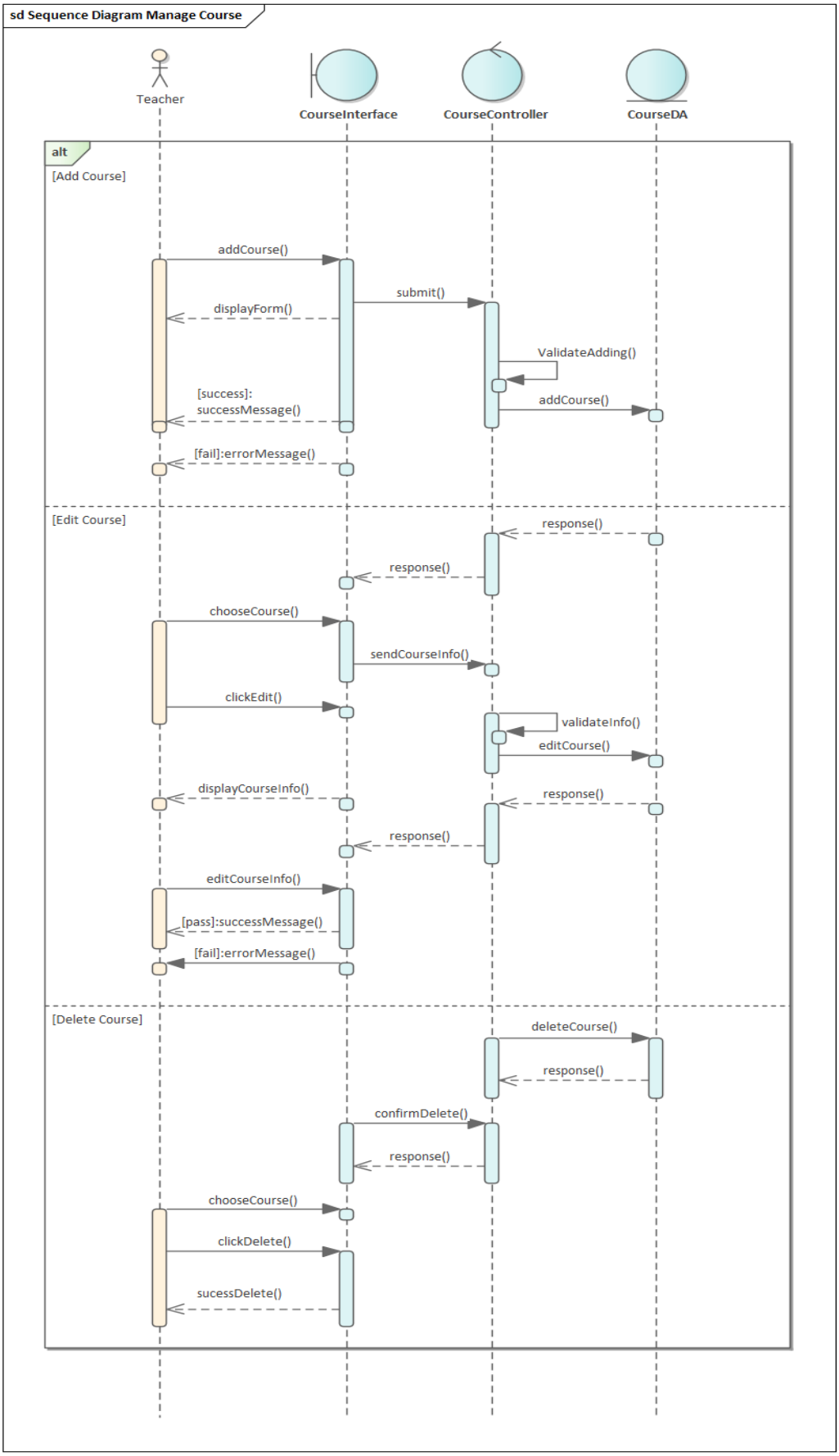


Figure 3.7 Sequence Diagram Manage Course

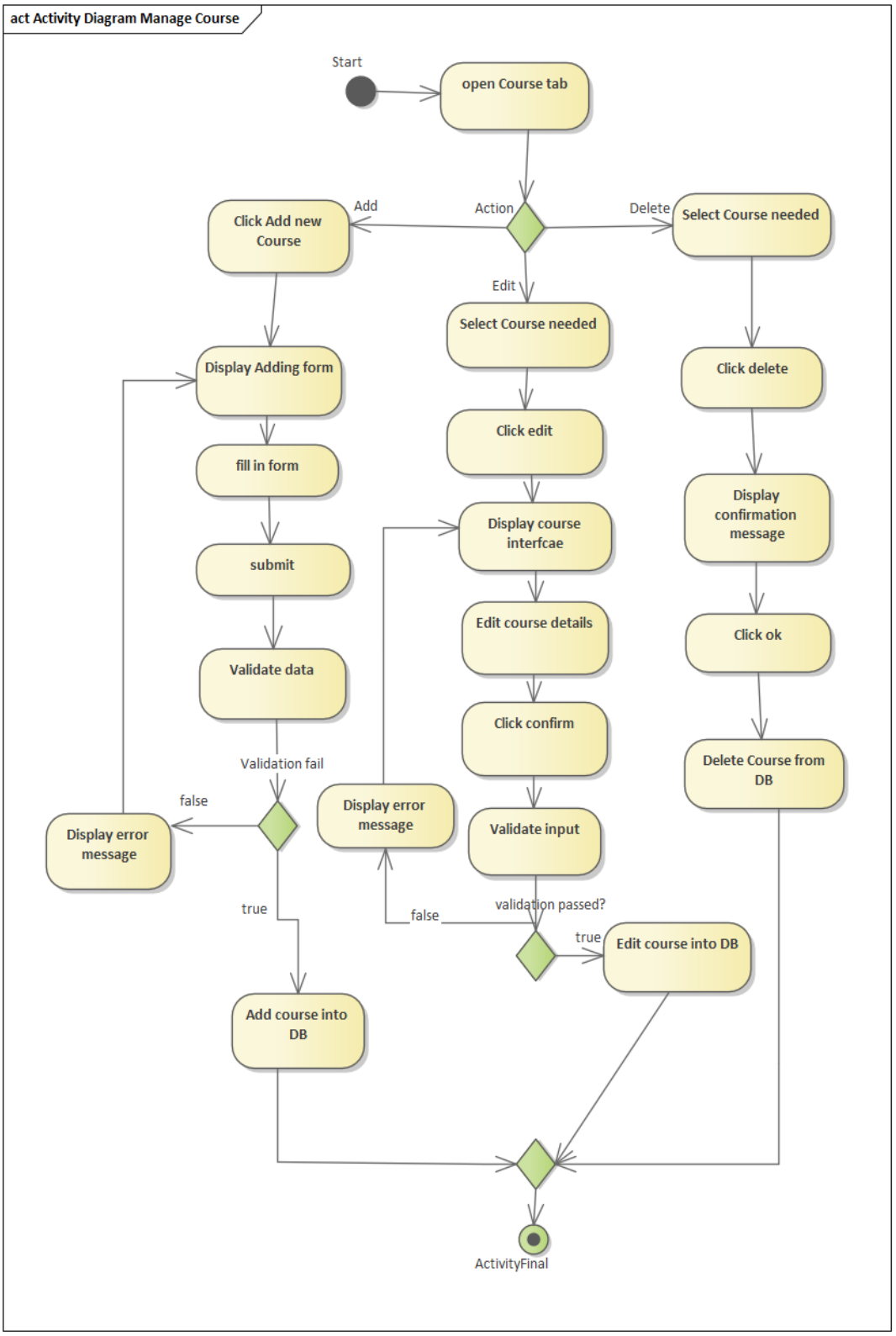


Figure 3.8 Activity Diagram Manage Course

3.2.2.2 UC004: Use Case Upload Course Material

Table 3.4 Upload Course Material Use Case Specification

ID	UC004
Description	The event enables the teacher to upload their course material.
Actor	User (Teacher)
Precondition	Teachers are the only one who can upload their course material. They need to login into the system
Normal Flow	1. Teacher Select Course 2. Teacher click "Upload New Course Material". 3. System will display add material form. 4. Teacher adds new course material information. 5. Teacher click submit. 6. System validates course material data. See Exception 1. 7. The use case will end.
Exception	1. Fail to add the course material. 1.1. Error message will be displayed 1.2. Return to Normal Flow 4.
Postconditions	Teachers will be able to add new course material.

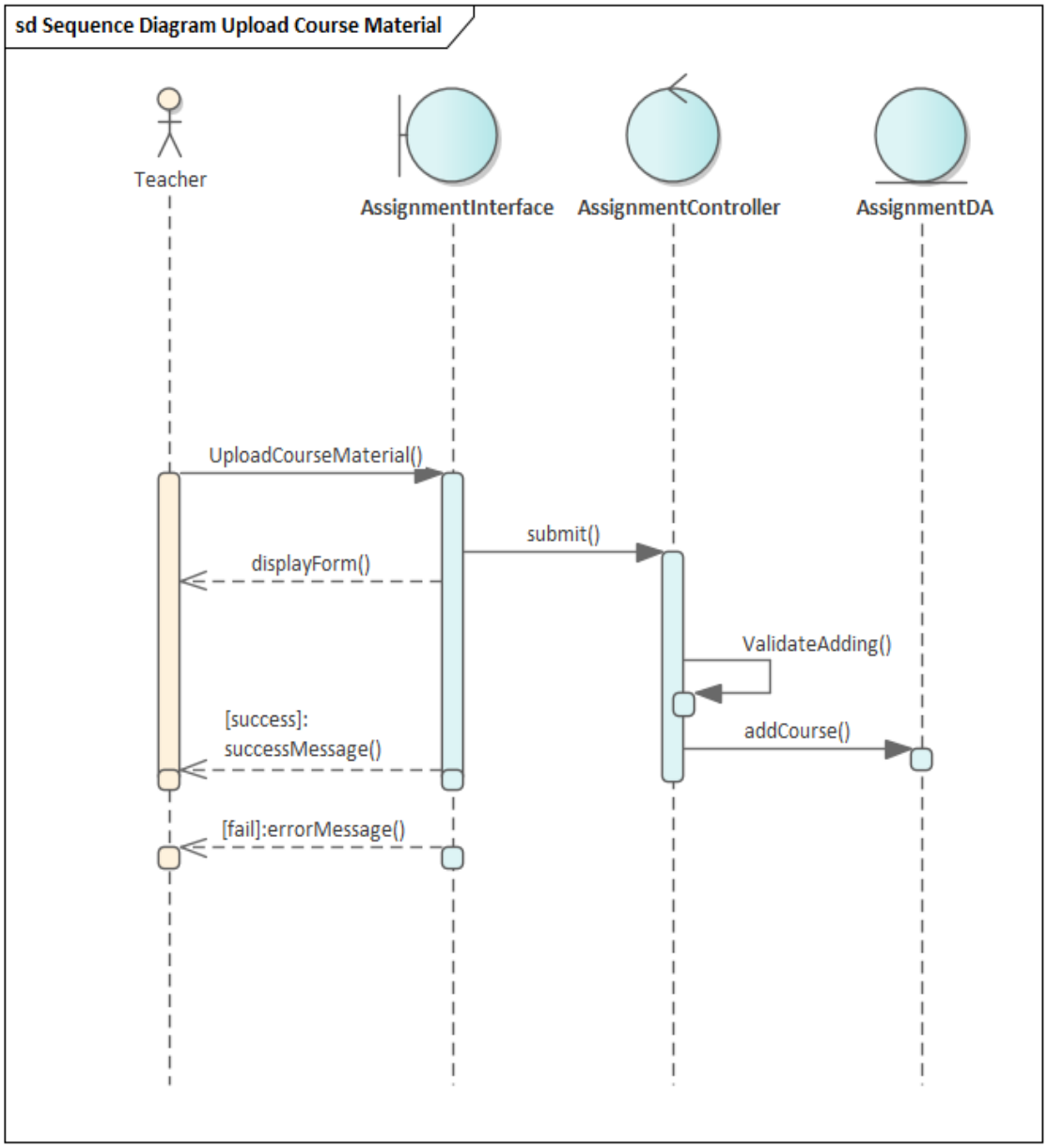


Figure 3.9 Sequence Diagram Upload Course Material

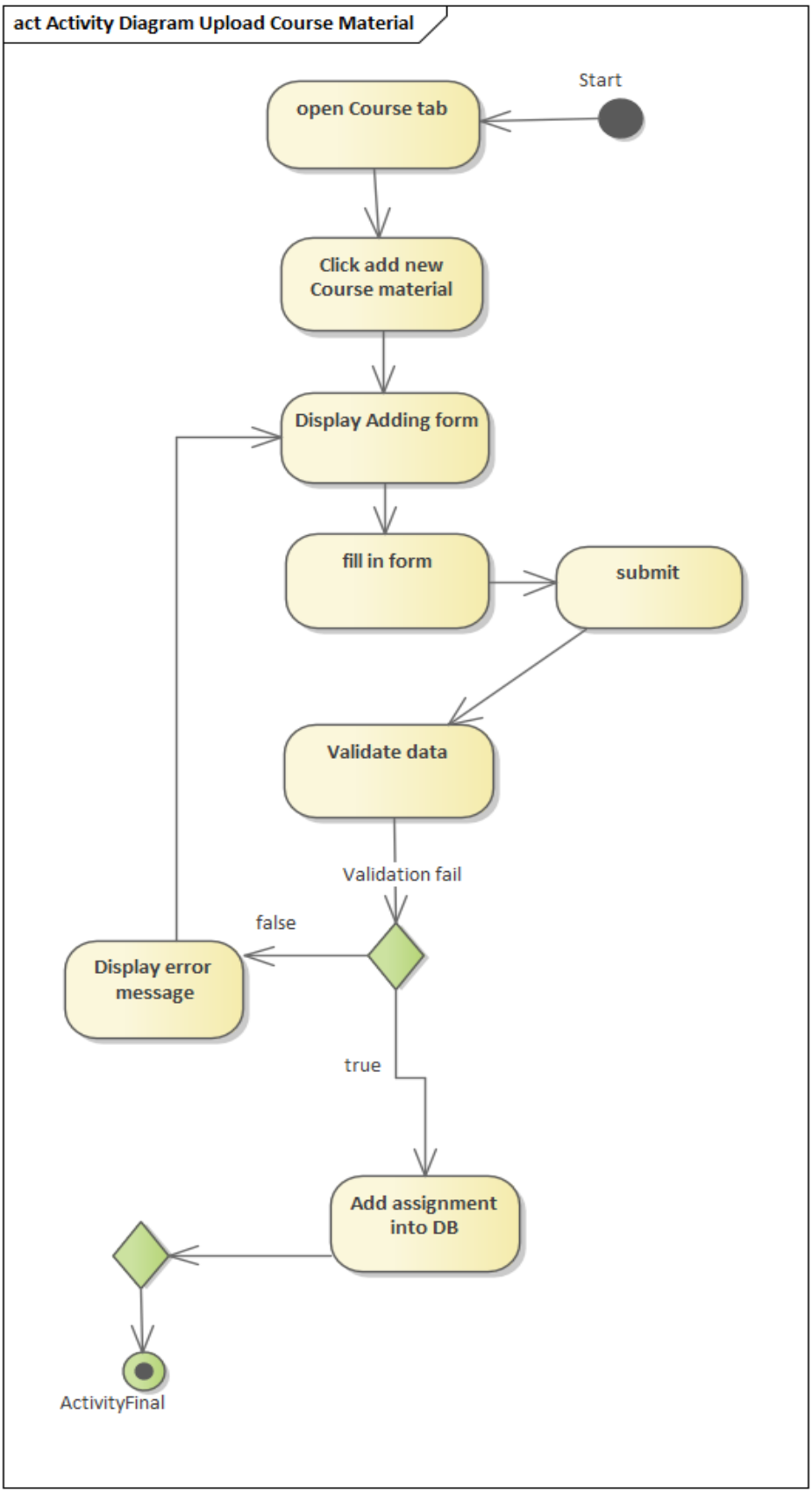


Figure 3.10 Activity Diagram Upload Course Material

3.2.2.3 UC005: Use Case View Course

Table 3.5 View Course Use Case Specification

ID	UC005
Description	The event enables the teacher to managing their course.
Actor	User (Teacher, Admin, Student)
Precondition	Users' needs to login into the system.
Normal Flow	1. Home Page display available courses. 2. User select course card. 3. System will display course details. 4. The use case will end.
Postconditions	User will be able to view their selected course details.

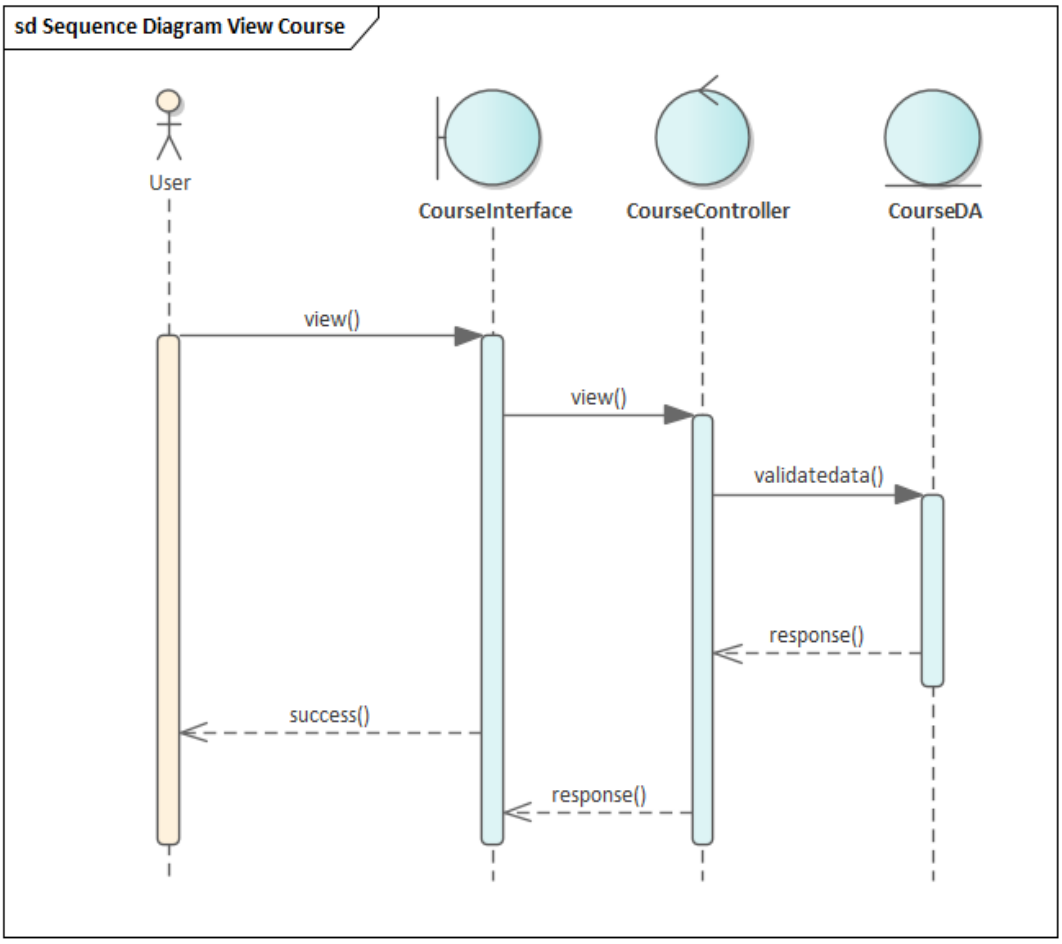


Figure 3.11 Sequence Diagram View Course

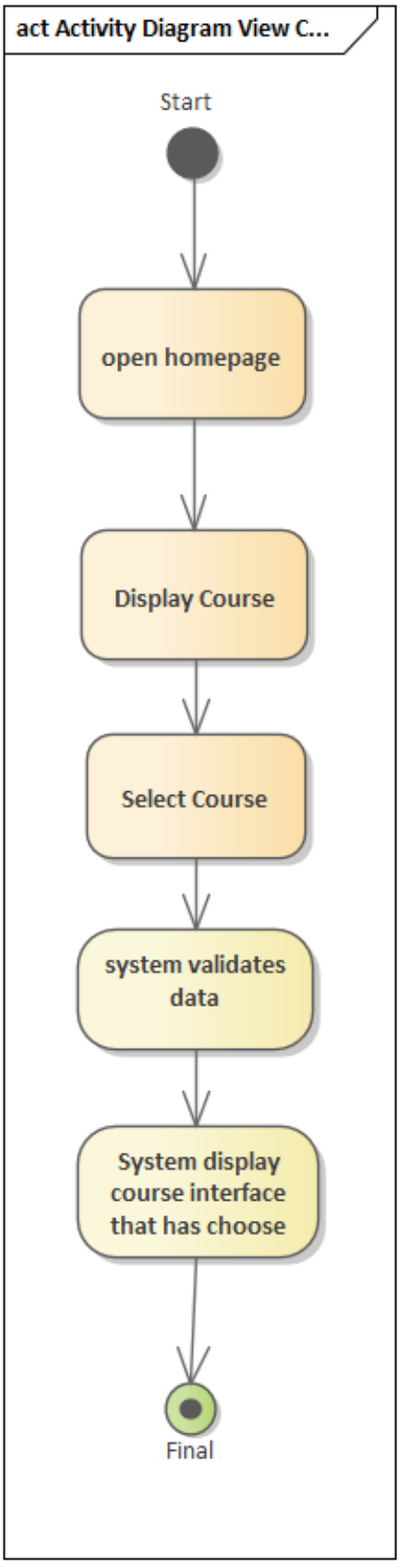


Figure 3.12 View Course Activity Diagram

3.2.2.4 UC006: Use Case Submit Assignment

Table 3.6 Submit Assignment Use Case Specification

ID	UC006
Description	The event enables the student to submit their course assignment.
Actor	User (Student)
Precondition	Student need to login into the system
Normal Flow	1. Student Select Course 2. Student click "submit assignment". 3. System will display submit form. 4. Student fill the form. 5. Student click submit. 6. System validates assignment data. See Exception 1. 7. The use case will end.
Exception	1. Fail to submit the assignment. 1.1. Error message will be displayed 1.2. Return to Normal Flow 4.
Postconditions	Student will be able to submit their assignment.

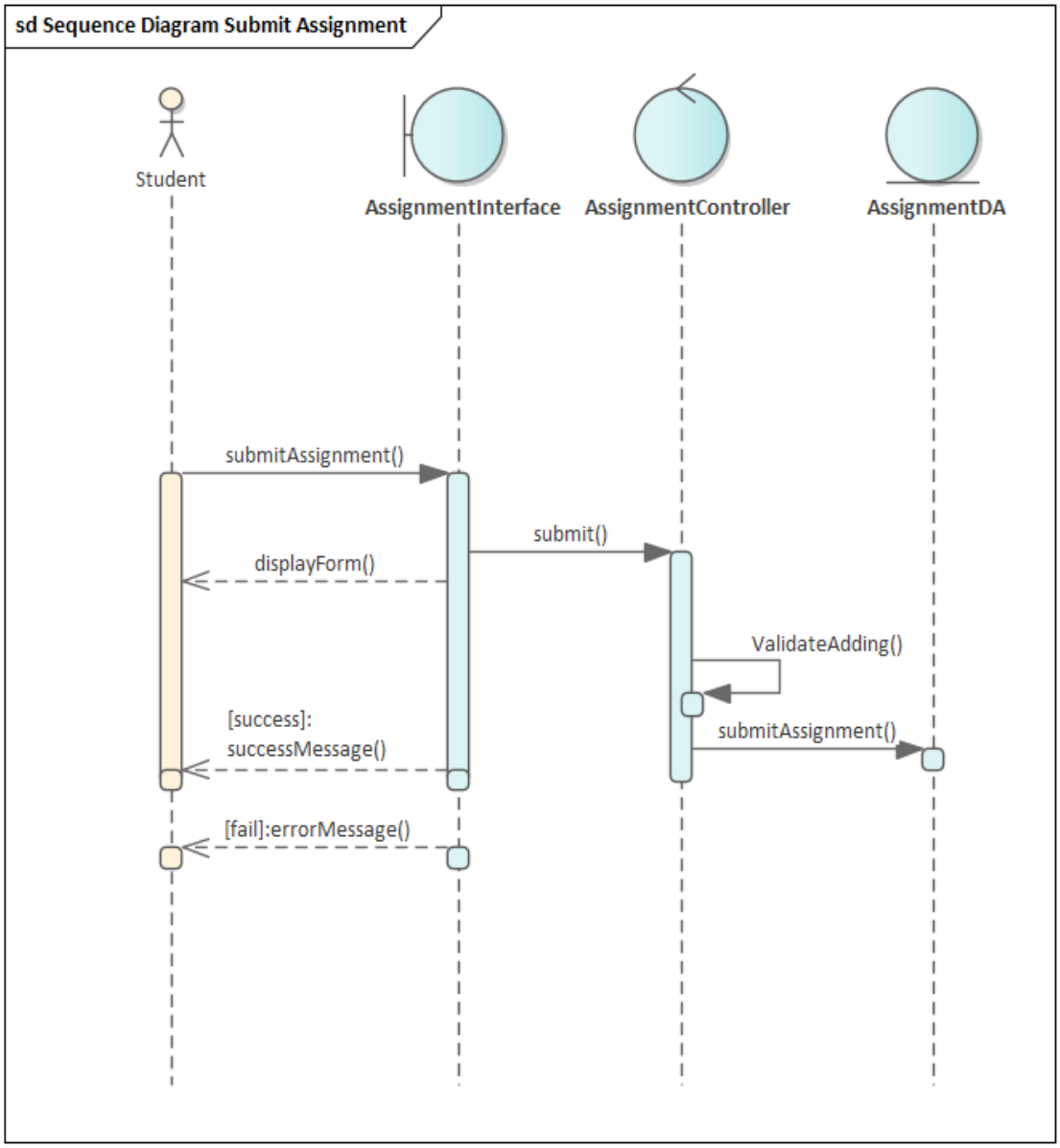


Figure 3.13 Submit Assignment Sequence Diagram

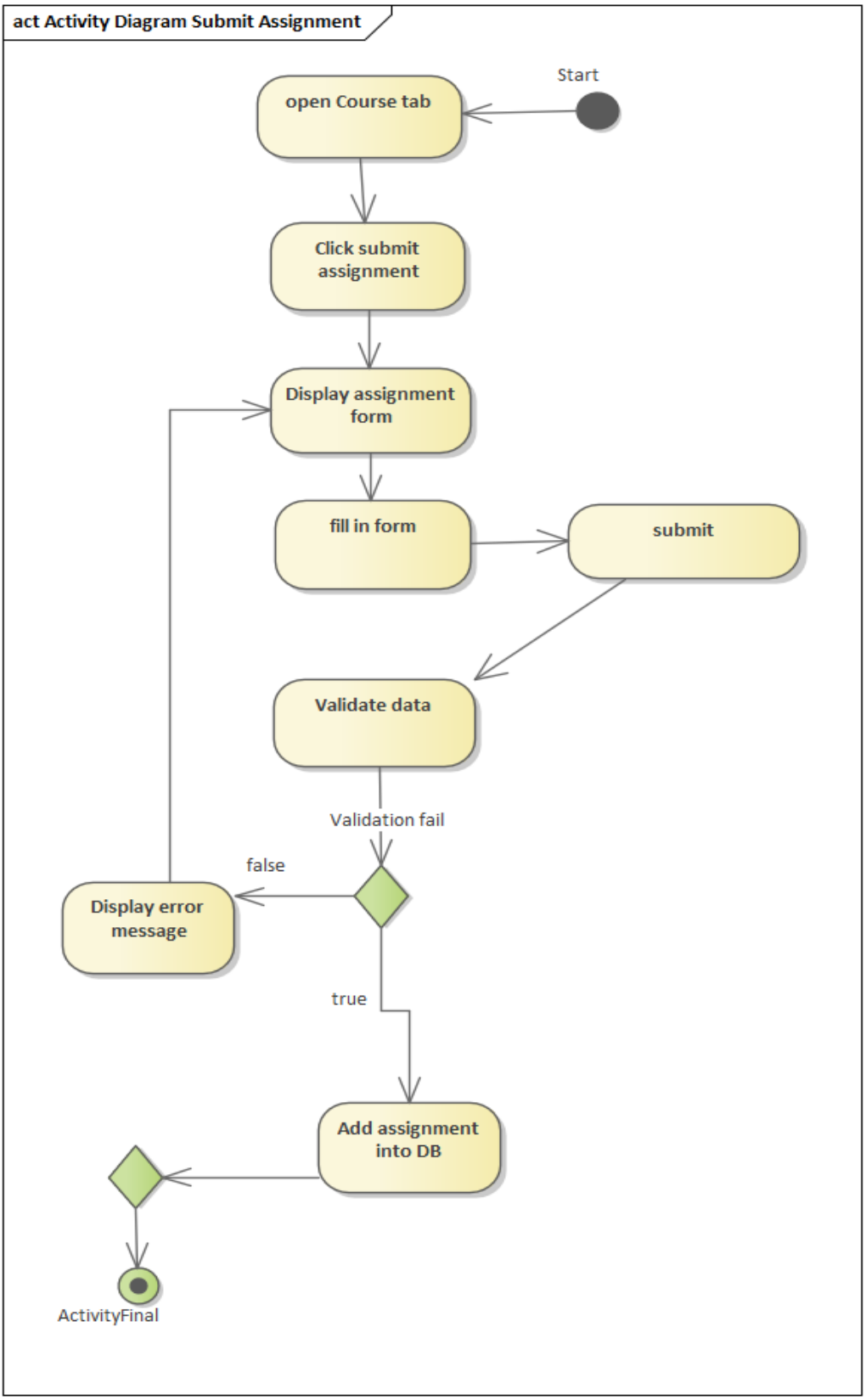


Figure 3.14 Submit Assignment Activity Diagram

3.2.3 Module Chat

3.2.3.1 UC007: Use Case 007: Chat

Table 3.7 Chat Use Case Specification

ID	UC007
Description	The event enables the user to chat and communicate with each other.
Actor	User (Student, Teacher)
Precondition	User need to login into the system
Normal Flow	1. User Select Chat 2. User click user to chat with. 3. System will display chat form. 4. User enter a message. 5. User click send. 6. System validates data. See Exception 1. 7. The use case will end.
Exception	1. Fail to sending the chat messages. 1.1. Error message will be displayed 1.2. Return to Normal Flow 4.
Postconditions	User will be able to see messages.

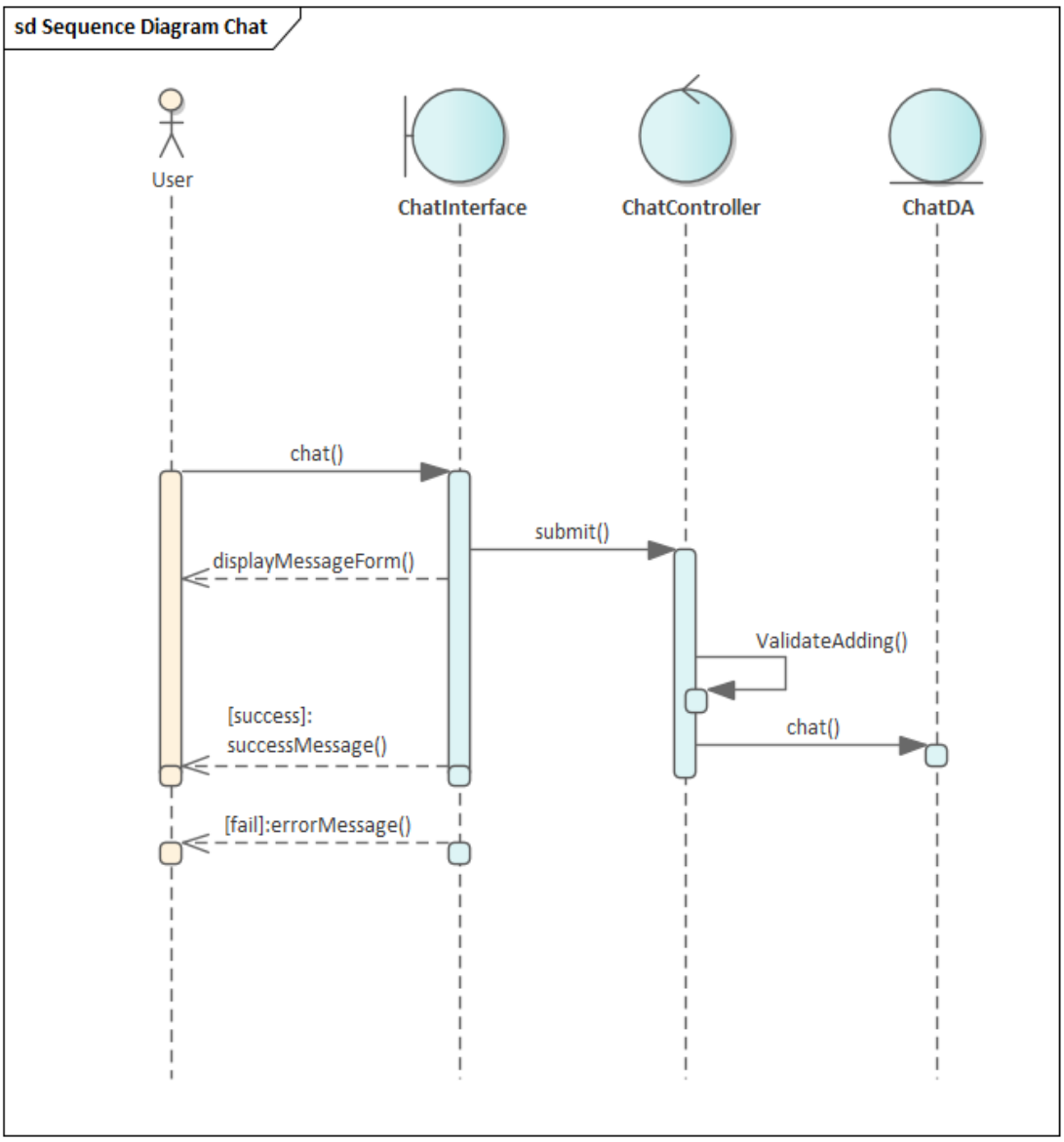


Figure 3.15 Sequence Diagram Chat

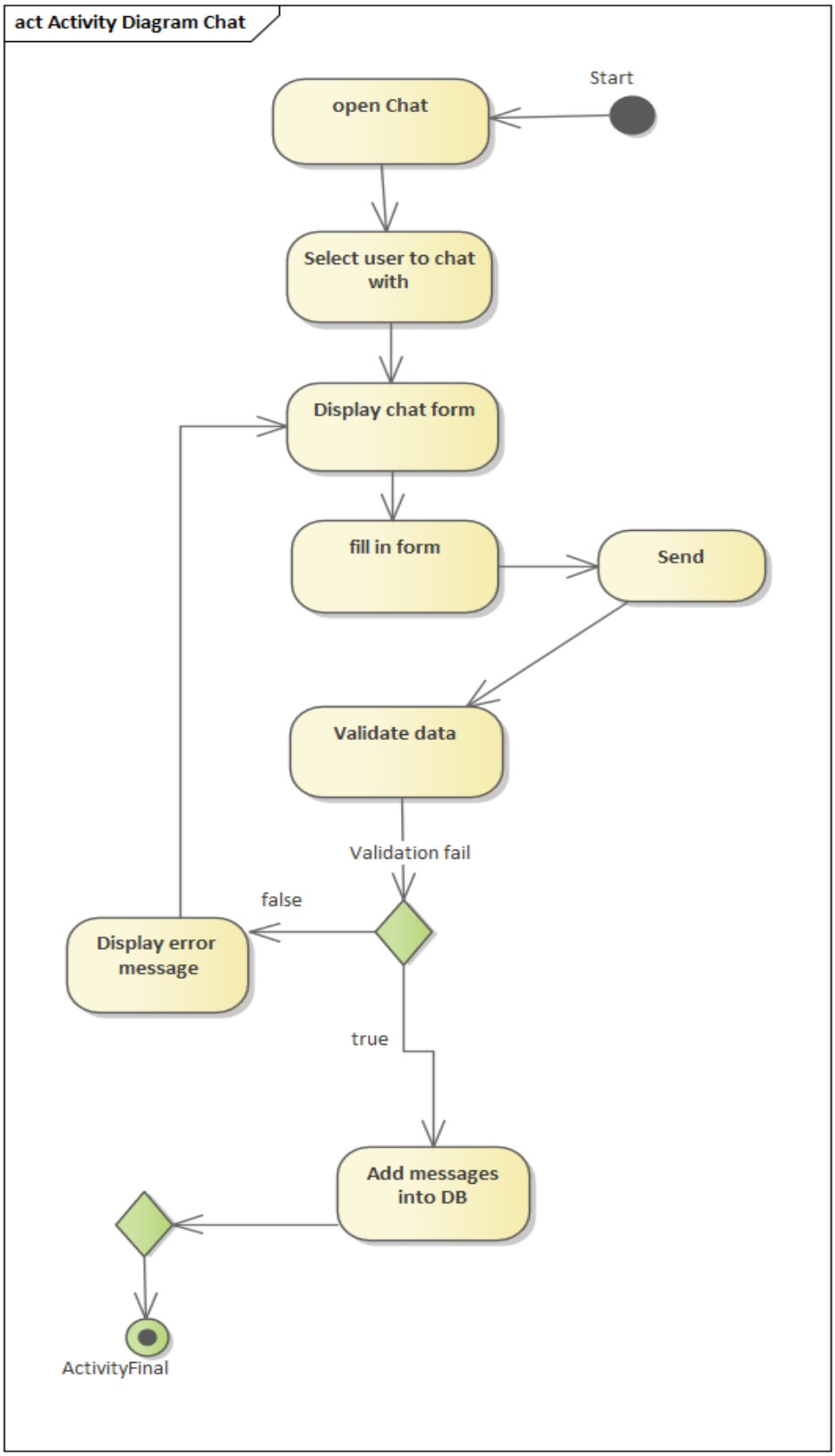


Figure 3.16 Chat Activity Diagram

3.3 Performance Requirements

Table 3.8 Performance Requirements

Account Module	The system shall allow admin to register new users only. The system Shall allow user to login into the system using email and password. The system will not allow registration and login if there the submission are incomplete or incorrect
Course Module	The system shall allow teacher to manage (add, edit, delete) course. The system shall allow teacher to upload their course material. The system shall allow users to view course. The system shall allow students to submit their assignments. The system shall display verification for the submitted forms.
Chat Module	The system shall allow students and teachers to chat with each other.

3.4 Design Constraints

The IEEE Std 830-1998 IEEE is used for requirement elicitation since it is the best standard Software for recommended Practice for Software Requirements Specifications. As it is in response to this SRS shall be documented using IEEE Std 1016-1998.

3.5 Software System Attributes

The system need to be connected to the internet in order to work, otherwise they cannot access the web application or view any data. The system design is simple and flexible user interface to help the users to access and understand the system easily.

3.6 Other Requirements

Table 3.9 Non-Functional Requirements

Performance	The Login should be validated within 6 second. Database needed be updated with latest data that has been added.
Availability	The system should be access everywhere without any error. Only registered users who already have account can use the system.
Security	Communication between server and user should be secure.
Usability	The system should able to easy learn as 95% of users to perform task effectively.
Scalability	The system should be scalable so it can be extended or integrated into another system.

Appendix D Software Design Document

Software Design Document

DEVELOPING A PERSONALIZED INTERACTIVE E-LEARNING SYSTEM TO SUPPORT PRIMARY SCHOOLS

Version 1.0

23 June 2022

Department Software Engineering

School of Computing

Faculty of Engineering

Revision Page

a. Overview

The Software Design Document (SDD) contains details about the functionality for Khwendnga System. It has developed to support primary schools. It includes important diagram from the system and showcases features of the system.

b. Target Audience

- Primary Students.
- Teachers.
- Parents and guardians of students.
- Primary School.

c. Project Team Members

This is an individual project is developed by Sima Jazaa Mohammed.

d. Version Control History

Version	Primary Author(s)	Description of Version	Date Completed
Version 1.0	Sima Jazaa Mohammed	SDD 1.0 of Khwendnga System.	23/6/2022

Table of Contents

1. Introduction

1.1 Purpose

The Software Design Description (SDD) show a detailed description for developing a personalized and interactive E-Learning system to support primary school. It contains instructions on functional and non-functional requirements and processes. The main purpose is to organize online learning activities. The document contains requirements from stakeholders and showcases features of the system. Finally, it clarifies the interaction of the system and specific requirements. This document provides complete, clear and concise details for Khwendnga system and provides the stakeholders to ensure smooth management of the system also avoid any issues and conflicts.

1.2 Scope

The document for Kwendnga system will elaborate on system design and architecture. It will also explain database design and user interface. It will offer related documentation for all processes for courses, accounts and chats. The system is designed for Admin to register accounts for teachers and students. Also, explain the login process for and viewing their course. Along, with course assessments and submitting solutions for assignments. Most importantly, describing communication with teachers and managing courses.

1.3 Definitions, Acronyms and Abbreviation

Table 1.1 Definition, Acronyms and Abbreviations used in the system

Acronyms	Definitions
SDD	Software Design Description
UML	Unified Modeling Language

UI	User Interface
JS	JavaScript
MVC	Model View Controller
KS	Khwendnga System

1.4 References

IEEE Computer Society. (2009). *IEEE Standard for Information Technology Systems Design--Software Design Descriptions, Middle East*. doi: https://doi.org/10.1109/ieeestd.2009.5167255

1.5 Overview

The SDD incorporates the following Sections where it contains an overall description for KS which will provide the system background and project purpose. Also, this document describes the system architecture in full detail through analysis by using diagrams. In addition, this document defines the designed database. It contains the data dictionary that describes the data attributes. Finally, there will be the design interface which defines the view of the system.

2. System Architectural Design

2.1 Architecture Style and Rationale

The chosen architectural style is Model-View-Controller (MVC) pattern. MVC is a design pattern that interacts within a system by three separated layers. The Model component control data of the system as well as manage associated operations on that data. While the View component manages the presentation of data to the user. whereas the Controller component handles the interaction of the user and move these interactions to the Model and the View components. Therefore, the main reason for choosing this style is because MVC allows changing data independently of its representations and vice versa. In addition, it controls how it displays the data and how users interact with the system. Since MVC architecture pattern's main advantage is to provide high reusability and integrability of the code. Figure 4.3 shows the Khwendga system MVC architecture pattern that has been implemented.

2.2 Architecture Model

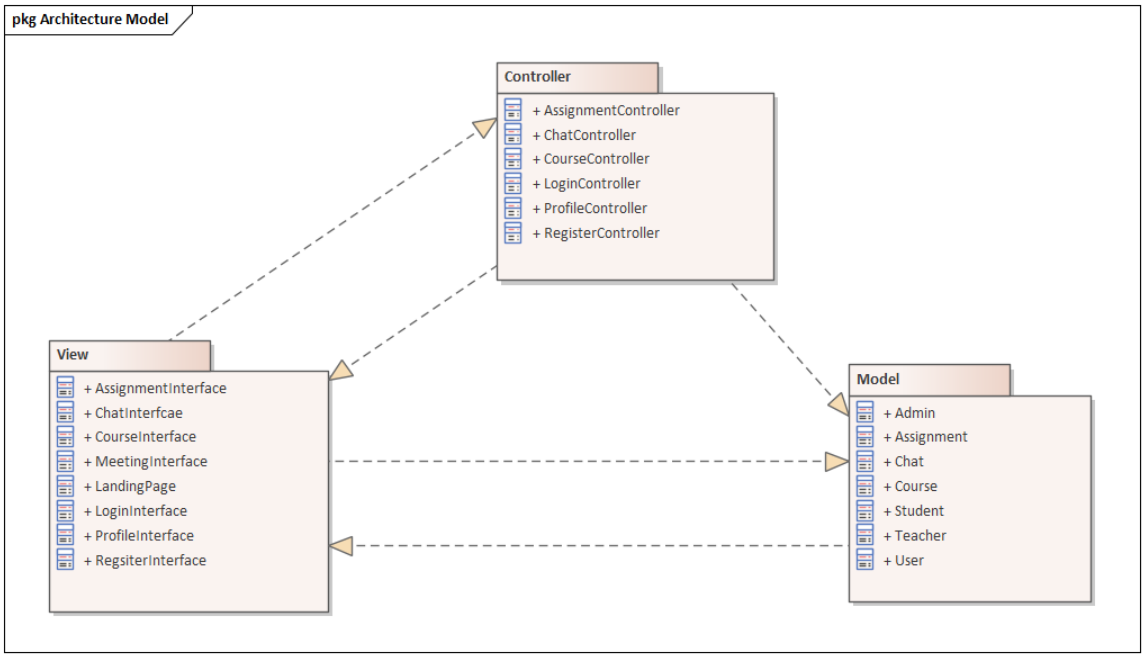


Figure 2.1 Architecture Model

2.3 Use Case Diagram

The use case model contains use cases and actors that showcases all the important functions and relationships. Giving more scoop on different stakeholders and features of the Khwendga System. It demonstrates the functional requirement from different users' perspectives of the system.

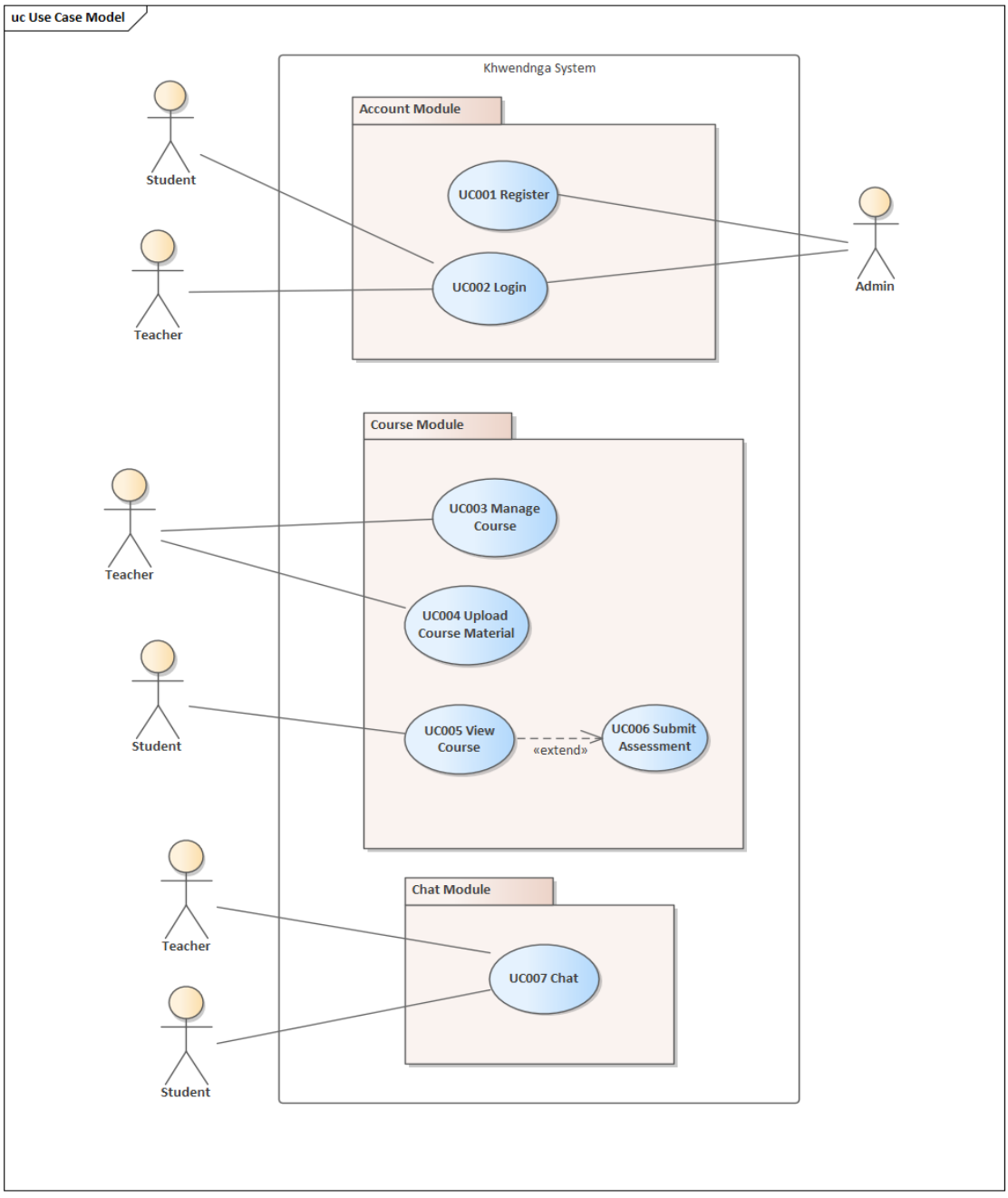


Figure 2.2 The Use Diagram of Khwendnga System

3. Detailed Description of Components

3.1 Complete Package Diagram

The package diagram displays organizations and arrangement of various model elements. It functionalities and orders for the system. Figure 3.1 shows the model package implemented in the system platform.

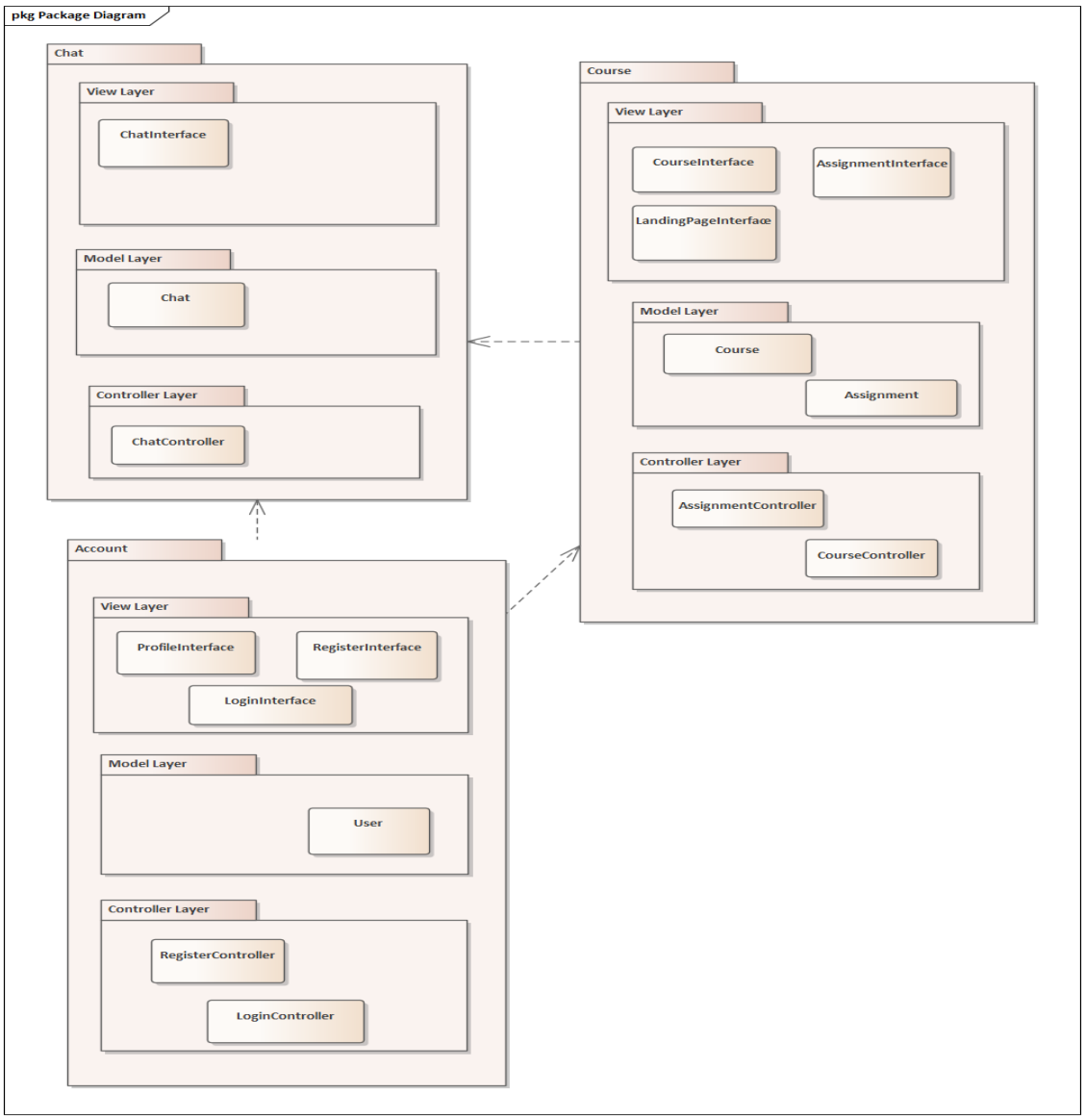


Figure 3.1 Complete Package Diagram

4. Data Design.

4.1 Data Dictionary

This section shows the data attributes that are stored in the database of the system in the firestore.

Table 4.1 User Database

Attribute	Data Type	Description
uid	String	The primary key which is unique Id of user
name	String	The first name of the user.
middleName	String	The middle name of the user.
lastName	String	The last name of the user.
email	String	The email of the user.
phone	String	The phone number of the user.
isOnline	boolean	The status of the user whether they are online or not.
image	String	The image of the user.
city	String	The city which user live there.
street	String	The street which user there.
grade	String	The grade of student.
gName	String	The full name of student's guardians.
gEmail	String	The email of the student's guardians.
gPhone	String	The phone number of student's guardians

Table 4.2 Roles Database

Attribute	Data Type	Description
uid	String	The foreign key which is the unique Id of user
roleType	String	The role of the user.
id	String	The primary key for role of each user.

Table 4.3 messages Database

Attribute	Data Type	Description
id	String	The primary key is unique Id of messages.
chatId	String	The unique key for each of the chat id between two users..
createdAt	timeStamp	date and time in which the message were send.
media	String	The images which the user send.
to	String	The unique key of the user to which message send it to.

Table 4.4 lastMsg Database

Attribute	Data Type	Description
id	String	The primary key is unique Id of last messages.
createdAt	timeStamp	date and time in which the message were send.
media	String	The images which the user send.
to	String	The unique key of the user to which message send it to.
unread	boolean	The last messages whether user received.

Table 4.5 courses Database

Attribute	Data Type	Description
id	String	The primary key is unique Id of course.
courseCode	String	The code of course.
courseImage	String	The image for the cover of the course.
courseLevel	String	The level or grade of the course.
courseName	String	The name of the course.
image	String	The image of teacher.
name	String	The name of the teacher.
uid	String	The unique key of the teacher.

Table 4.6 Assignment Database

Attribute	Data Type	Description
id	String	The primary key is unique Id of assignment.
courseId	String	The unique key of course id.
assignmentImage1	String	The first image for the cover of the course details.
assignmentImage2	String	The second image for the cover of the course details.
date	timeStamp	The deadline of the assignment.
file1	String	The media file which teacher upload.
video.	String	The video for their lesson.
teacherId	String	The unique key of the teacher.
title	String	The title of the section.

5. User Interface Design

5.1 Overview of User Interface

The user interface is the visual way to present the system to the users. The interface is needs to have easy access and a friendly interface. This section presents the user interface of the Kwendnga system based on the user's perspective.

5.2 Screen Images

The screen images are shown based on the use cases for every module.

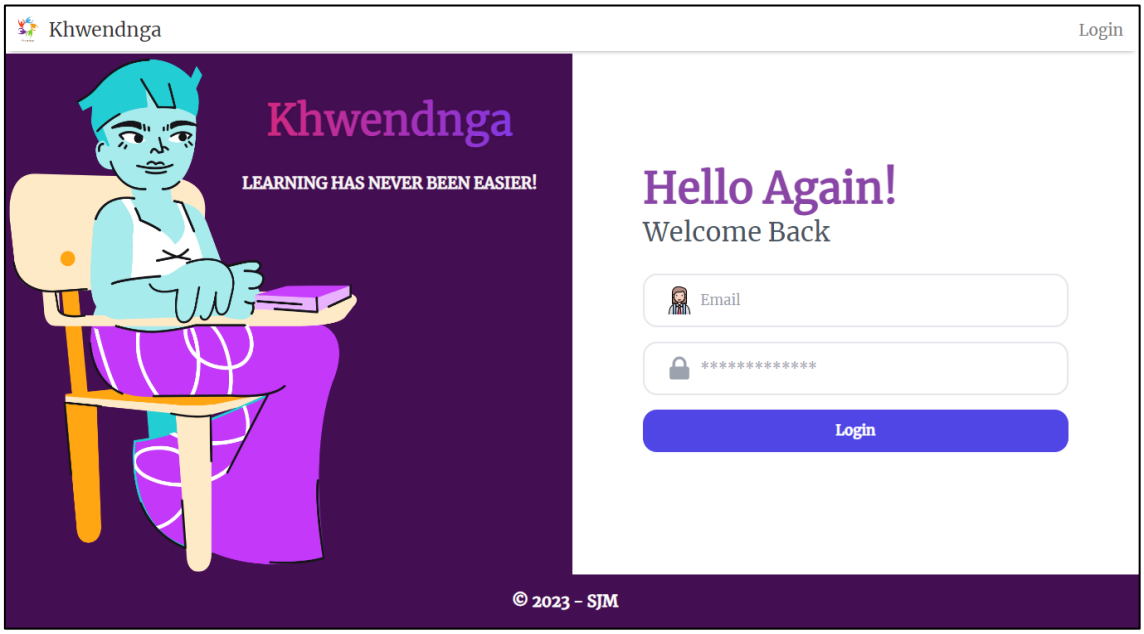


Figure 5.1 Login Page

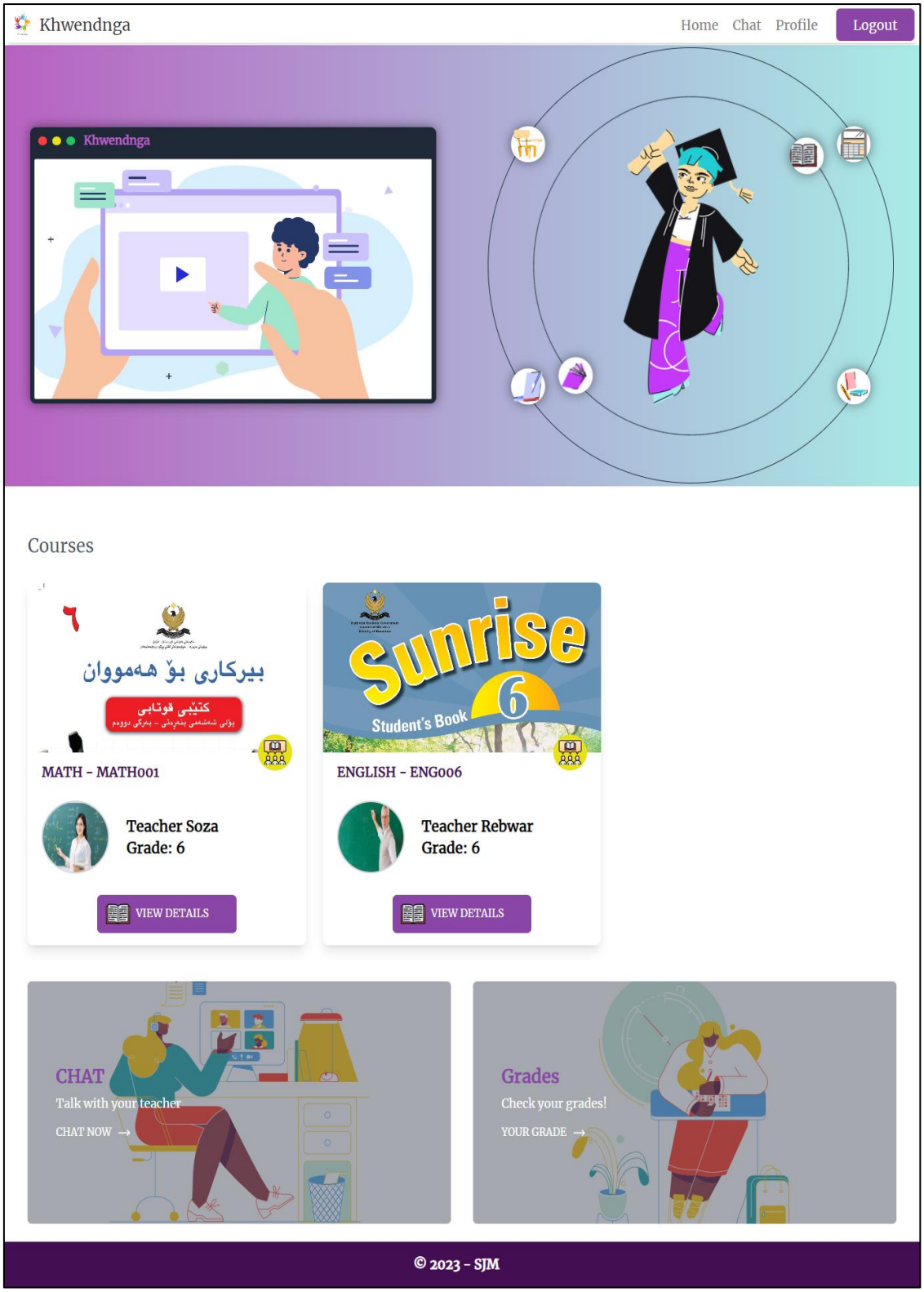


Figure 5.2 Home Page

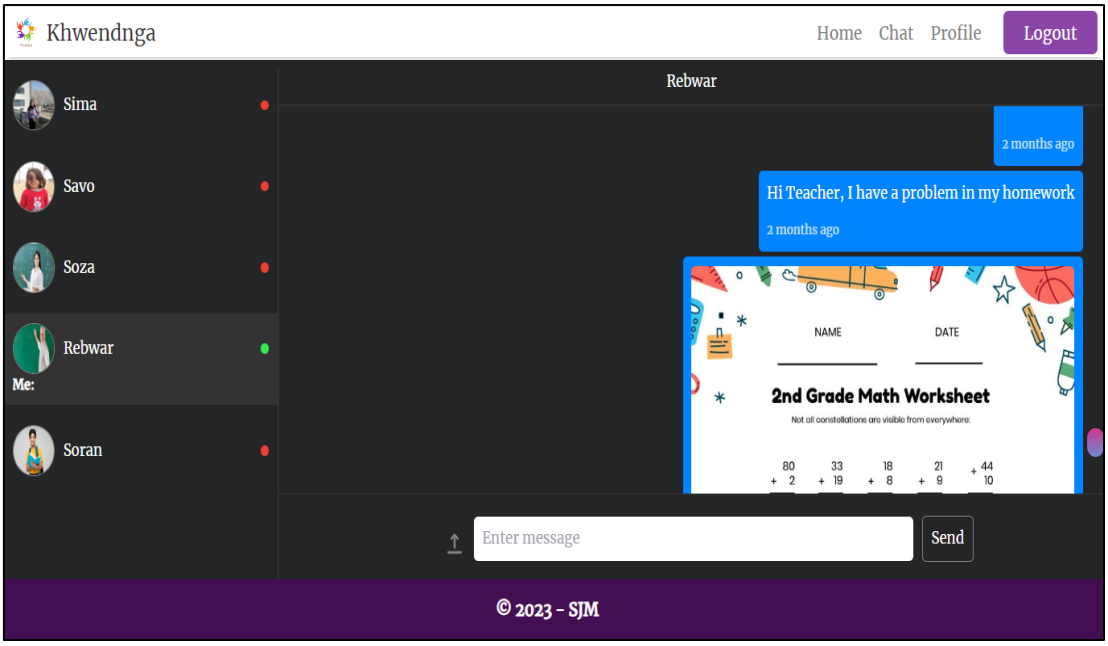


Figure 5.3 Chat Page

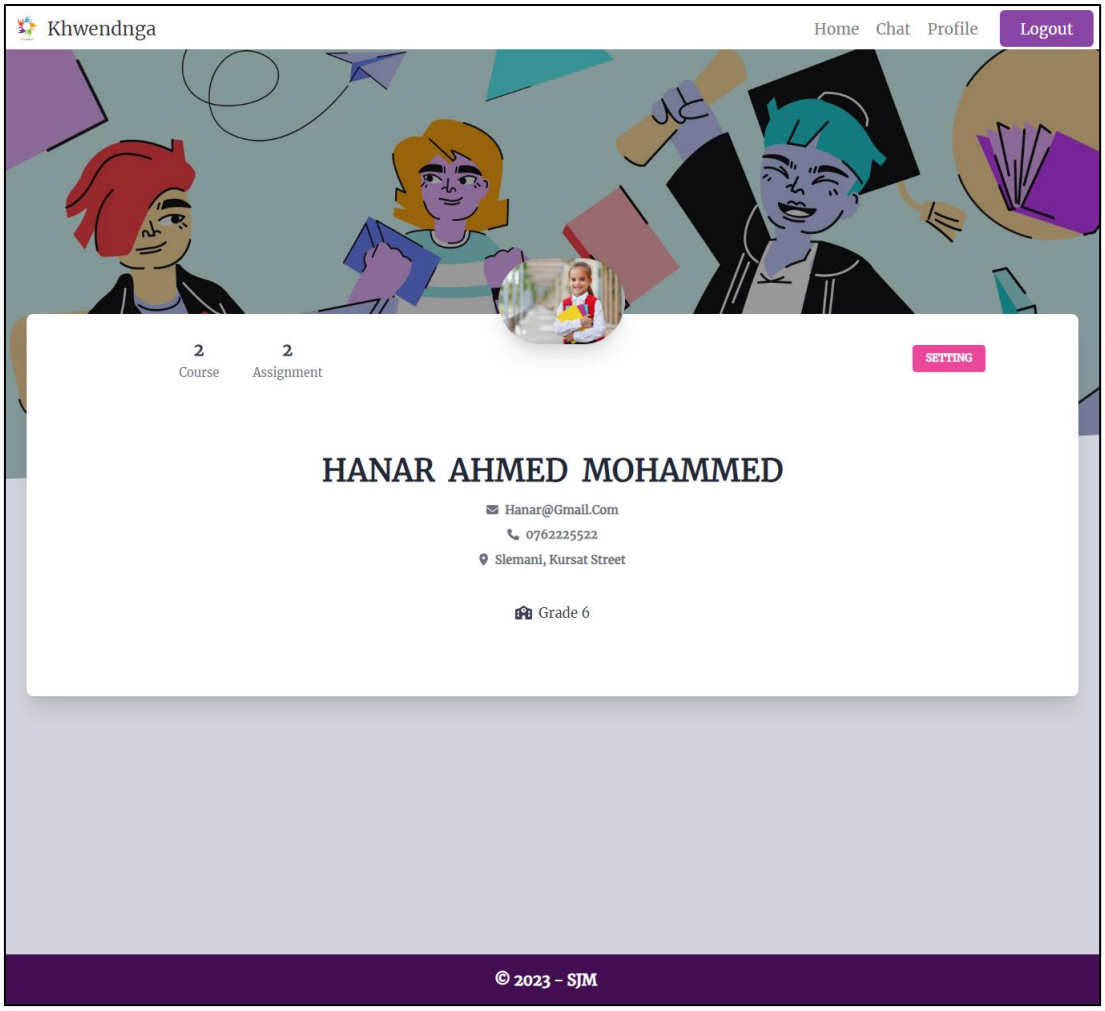


Figure 5.4 Profile Page

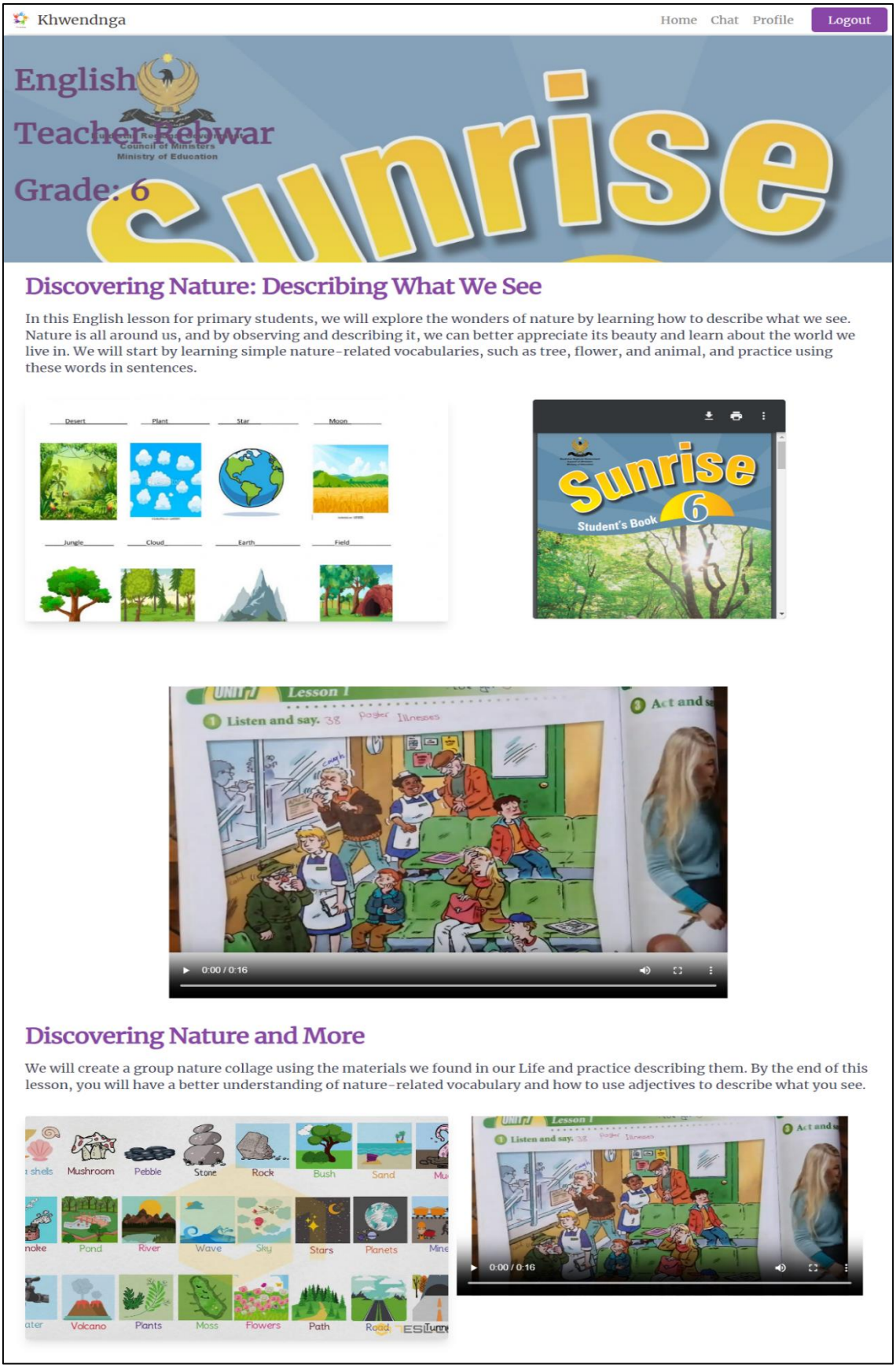


Figure 5.5 Course Details Page

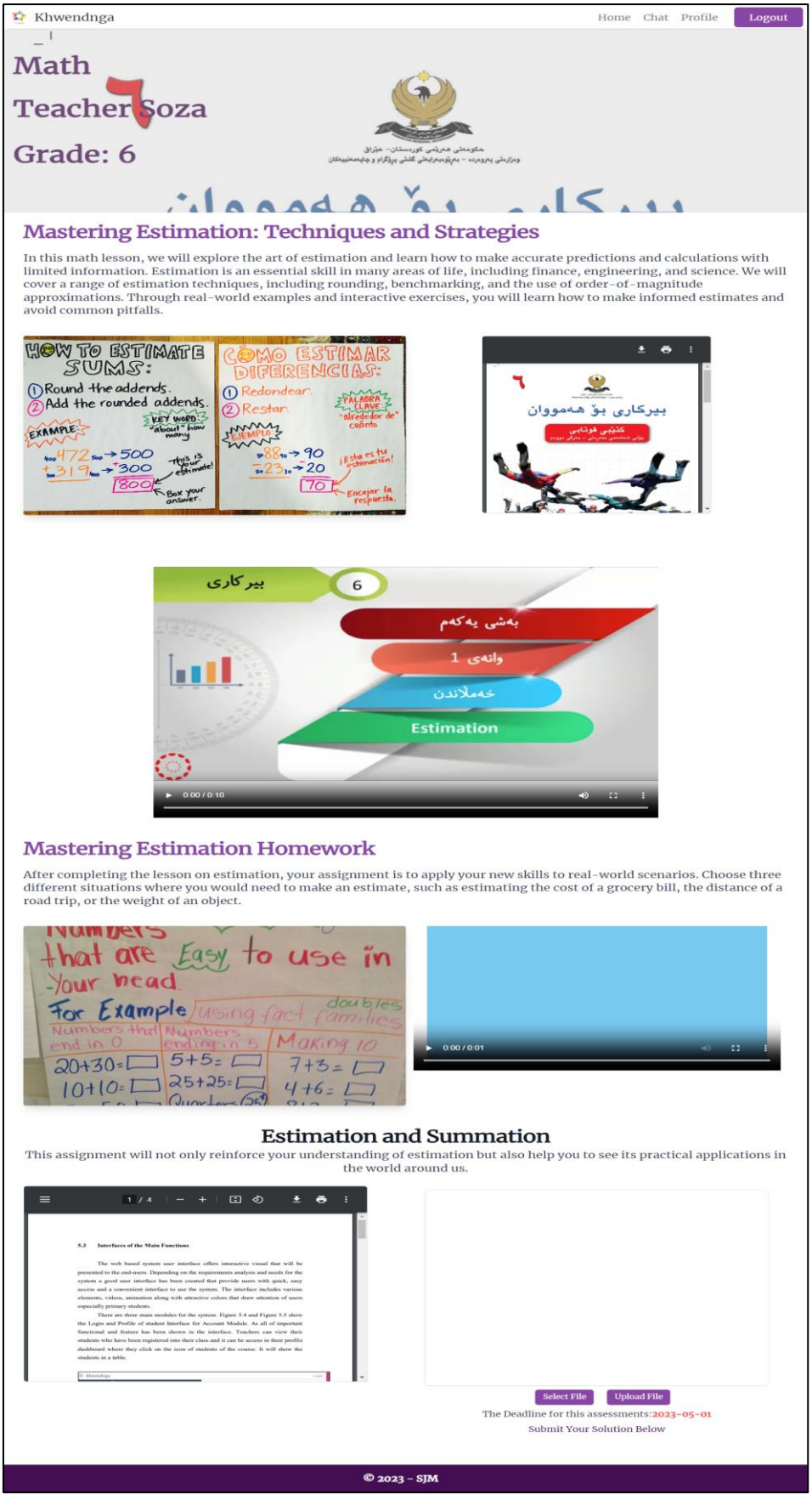


Figure 5.6 Assignment Section at Course Details Page.

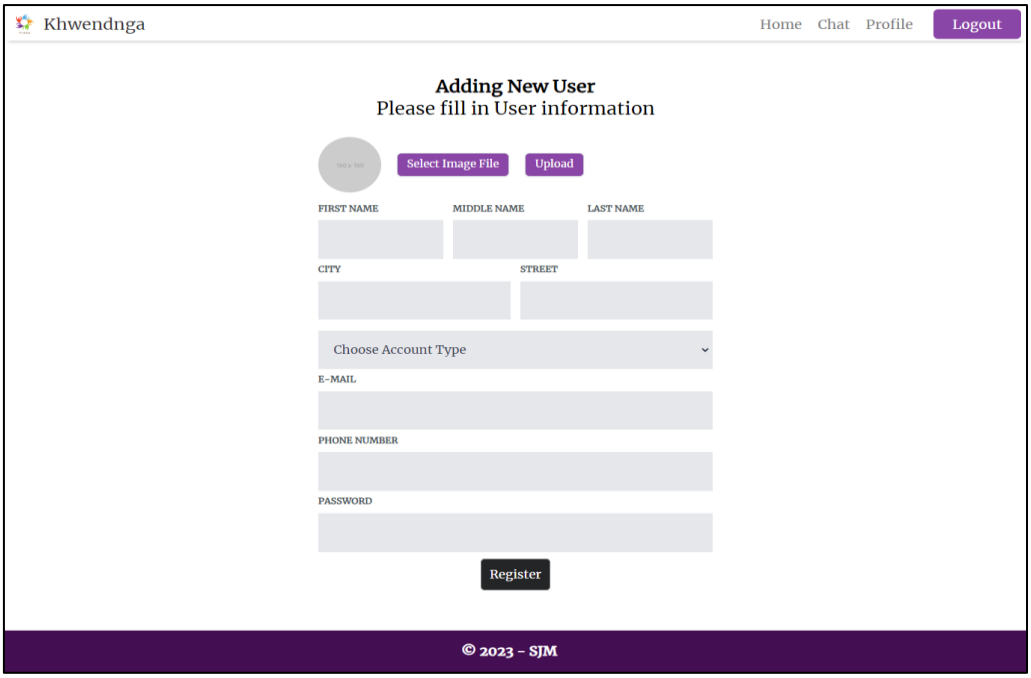


Figure 5.7 Register Page

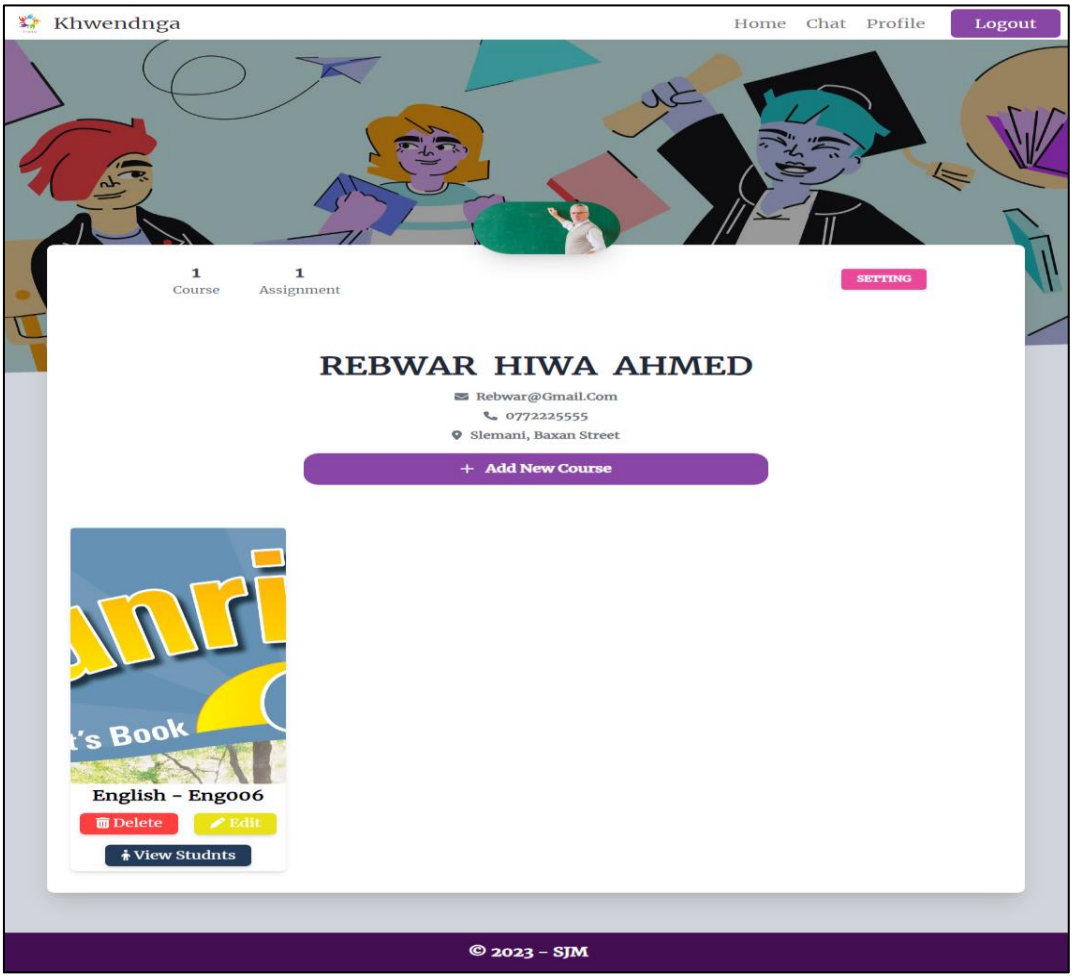


Figure 5.8 Profile Page for Teacher

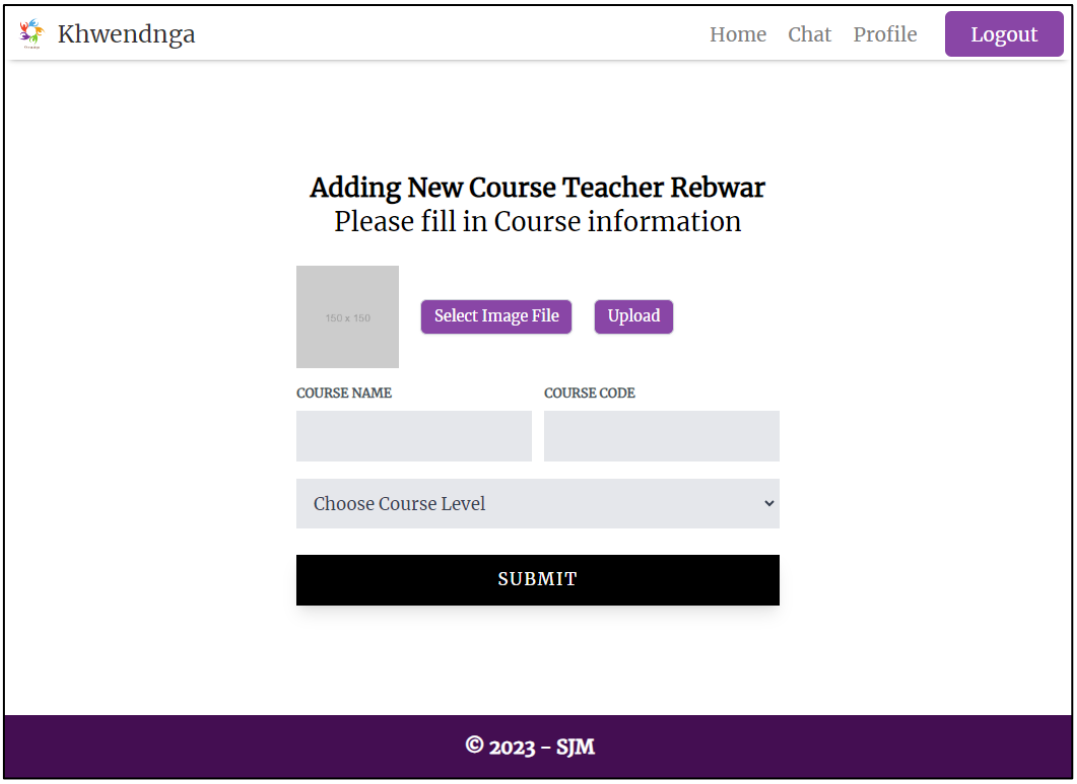


Figure 5.9 Add New Course Page

Figure 5.10 Course Page for Teacher

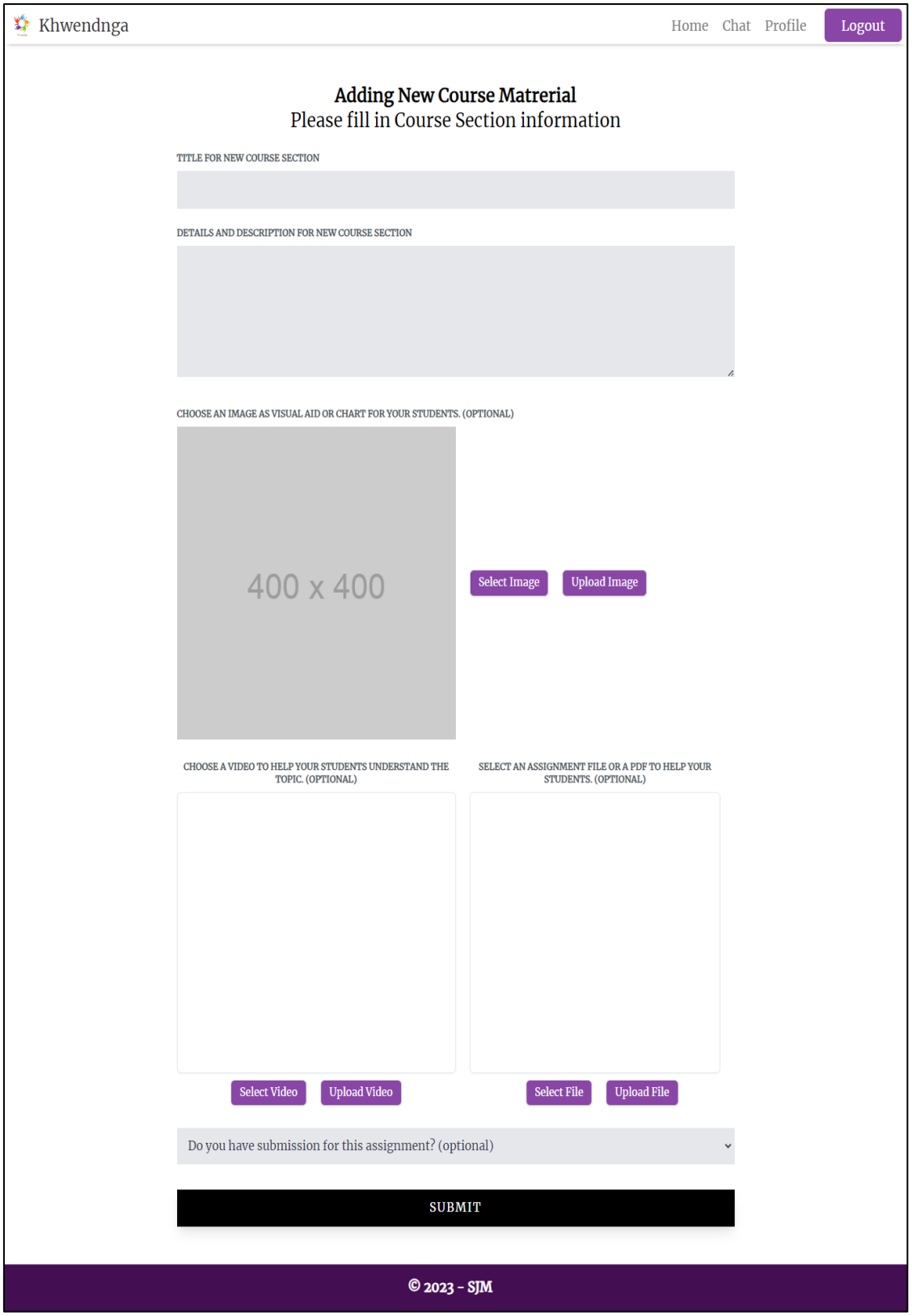


Figure 5.11 Upload Course Material Page

Appendix E Software Testing Documentation

Software Testing Documentation

DEVELOPING A PERSONALIZED INTERACTIVE E-LEARNING SYSTEM TO SUPPORT PRIMARY SCHOOLS

Version 1.0

23 June 2022

Department Software Engineering

School of Computing

Faculty of Engineering

Revision Page

a. Overview

This Version of the Software Testing Documentation (STD) include the results and analysis for the developed Khwendnga System (KS).

b. Target Audience

- Primary Students.
- Teachers.
- Parents and guardians of students.
- Primary School.

c. Project Team Members

This is an individual project is developed by Sima Jazaa Mohammed.

d. Version Control History

Version	Primary Author(s)	Description of Version	Date Completed
Version 1.0	Sima Jazaa Mohammed	STD 1.0 of Khwendnga System.	23/6/2022

Table of Contents

1. Introduction

1.1 Purpose

This STD provides the testing activities as well as the results and discussions for the testing of the developed system. In addition, performing User Acceptance Testing for the targeted users to ensure quality and satisfaction of users.

1.2 Scope

The system product went through several stages of testing to ensure the high quality the of product. It showcases It allows developers to find issues and flaws, errors, and weaknesses so later address them and resolve them. Testing has been conducted through proper procedures.

1.3 Definitions, Acronyms and Abbreviation

Table 1.1 Definitions, Acronyms and Abbreviation Table

Acronyms	Definitions
STD	Software Testing Document
KS	Khwendnga System
UAT	User Acceptance Testing (UAT)

1.4 System Overview

This STD showcases full details about the results and process for the Test Cases, Data, and Expected Results validating data through black-box testing. Finally, User Acceptance Testing (UAT) for determining users' satisfaction.

2. Test Cases, Data and Expected Results

2.1 Test TC001 for Account Registration: Register UC001

This section consist of login attempts tests for the developed system

Test Case ID	**TC001_01_01**	**TC001_01_02**	**TC001_01_03**	**TC001_01_04**
Action/Input				
Used Email	Rebaz415@gmail.com	Daro.21@hotmail.com	Renwar33@gmail.com	Sana366@yahoo.com
Used Password	Re57baz	Daro21	Sima@76	Sana2
Password Sufficient	Yes	yes	yes	no
Output				
Login Successful	Yes	Yes	Yes	
Login Failed				No
Expected Result				
Redirect to	Yes	Yes	Yes	No

Landing Page				
Testing Result	Pass	Pass	Pass	Pass

2.2 Test TC002 for Account Login: Login UC02

This section consists of login attempts tests for the developed system

Test Case ID	**TC002_01_01**	**TC002_01_02**	**TC002_01_03**	**TC002_01_04**
Action/Input				
Used Existing User Email	Yes	Yes	No	Yes
Used Correct Password	Yes	No	No	No
Expected Result				
Redirect to main page	Yes	No	No	No
Testing Result	Pass	Pass	Pass	Pass

2.3 Test TC003 for Manage Course: Manage Course UC003

This section consists of Manage Course tests for the developed system

Test Case ID	TC003_01_01	TC003_01_02	TC003_01_03	TC003_01_04
Action/Input				
User has account type of teacher	Yes	Yes	No	Yes
User adds new course information	Yes	Yes	No	Yes
User submits new information	Yes	Yes	No	Yes
Output				
New Course Added	Yes	Yes	No	Yes
Expected Result				
New Course Saved	Yes	Yes	No	Yes
Testing Result	Pass	Pass	Pass	Pass

Test Case ID	TC003_02_01	TC003_02_02	TC003_02_03	TC003_02_04
Action/Input				
User has account type of teacher	Yes	Yes	No	Yes
User Edits Course	Yes	Yes	No	Yes
User Submits new information	Yes	Yes	No	No

System Validates new Course Data	Yes	Yes	No	No
Output				
Course Modified	Yes	Yes	No	No
Expected Result				
Testing Result	Pass	Pass	Pass	Pass
Test Case ID	**TC003_03_01**	**TC003_03_02**	**TC003_03_03**	**TC003_03_04**
Action/Input				
User has account type of teacher	Yes	Yes	No	Yes
User selects course to edit	Yes	Yes	No	No
User confirms deletion course	Yes	No	No	No
System Deletes course Data	Yes	No	No	No
Output				
Course Deleted	Yes	No	No	No
Expected Result				
Testing Result	Pass	Pass	Pass	Pass

2.4 Test TC004 for Upload Course Material: Upload Course Material UC004

This section consists of Upload Course Material tests for the developed system

Test Case ID	TC004_01_01	TC004_01_02	TC004_01_03	TC004_01_04
Action/Input				
User Account Type is Teacher	Yes	Yes	No	Yes
User Navigates to upload new Material	Yes	Yes	No	Yes
User adds new course material	Yes	Yes	No	No
Output				
Course Material Saved	Yes	Yes	No	No
Expected Result				
Course Material Saved	Yes	Yes	No	No
Testing Result	Pass	Pass	Fail	Pass

2.5 Test TC005 for View Course: View Course UC005

This section consists of View Course tests for the developed system

Test Case ID	TC005_01_01	TC005_01_02	TC005_01_03	TC005_01_04
Action/Input				
User Account Type is Teacher	Yes	Yes	Yes	No
User Selects Course Card	Yes	Yes	yes	No
System Displays Course Detail	Yes	Yes	Error_Message	No

Output				
User can view course detail	Yes	Yes	No	No
Testing Result	Pass	Pass	Fail	Fail

2.6 Test TC006 for Submit Assignment: Submit Assignment UC06

This section consists of Submit Assignment tests for the developed system

Test Case ID	**TC006_01_01**	**TC006_01_02**	**TC006_01_03**	**TC006_01_04**
Action/Input				
User Account Type is Student	Yes	Yes	Yes	No
User Clicks submit Assignment	Yes	Yes	yes	No
User Fills the form	Yes	Yes	No	No
System Validates Assignment Data	Yes	Yes	No	No
Output				
User Submitted Assignment	Yes	Yes	No	No

Testing Result	Pass	Pass	Fail	Fail

2.7 Test TC007 for Chat: Chat UC007

This section consists of Submit Assignment tests for the developed system

Test Case ID	**TC007_01_01**	**TC007_01_02**	**TC007_01_03**	**TC007_01_04**
Action/Input				
User Account Type is Student, and Teacher	Yes	Yes	Yes	Yes
User Navigates to chat	Yes	Yes	yes	Yes
System Displays chat Form	Yes	Yes	Yes	Yes
User can send enter and send a message	Yes	Yes	Yes	No
Output				
User can communicate using chat function	Yes	Yes	Yes	Show Error Message
Testing Result	Pass	Pass	Pass	Fail

3. User Acceptance Testing

The user acceptance has been conducted with target users of the system. Where over 33 people have participated. 20 students from grade 3-6 students along 13 teachers. First the system was tested through proper steps and later they need to fill a form.

The students found it easy to follow the navigation and find their course contents. Most of them were positive that they can use the system and navigate without any problem because of the simple design. As shown in their response in figure 3.1. Similar Questions have been asked it was the same result.

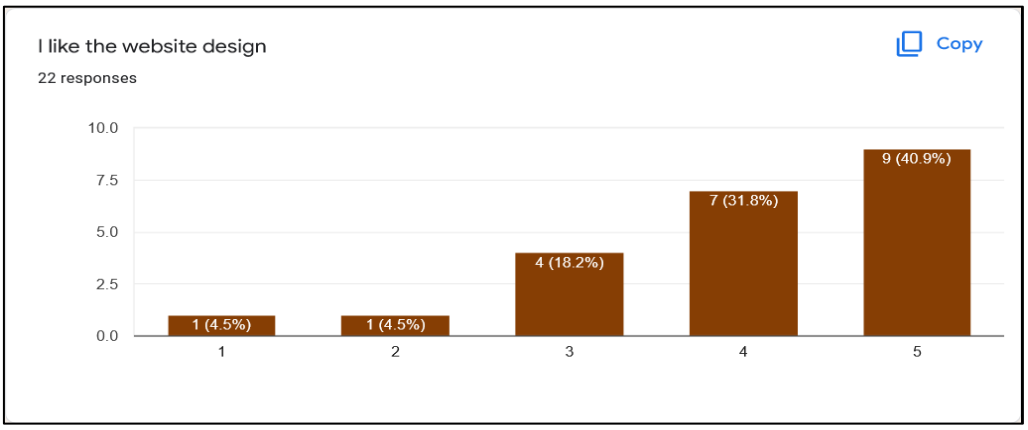


Figure 3.1 Design Question

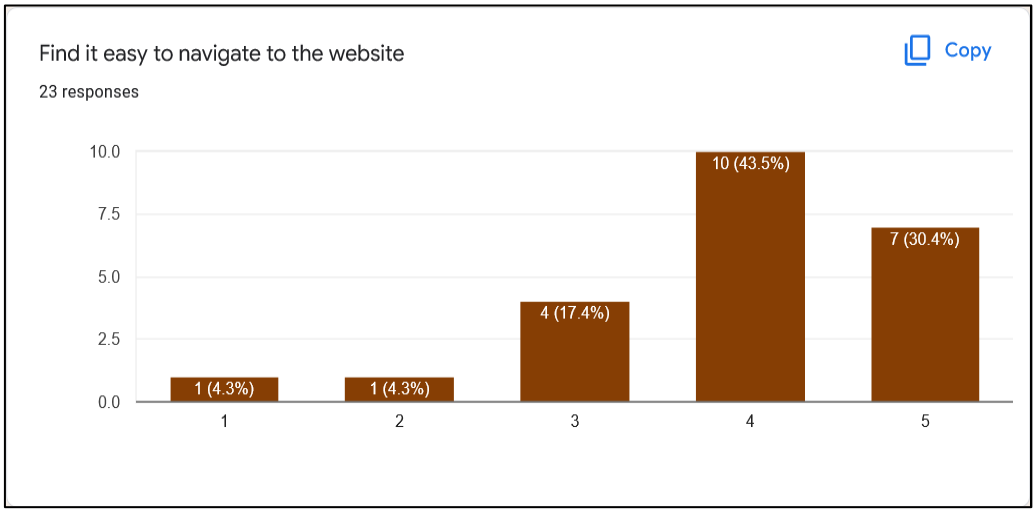


Figure 3.2 Navigation Question

Finally, users loved they could chat and communicate between teachers and students. They found out one greatest aspect for facilitating online learning. Students shown great interest in animation and videos that has been used for the website. It increased their favourability and wanted to frequently use the website. Finally, they were confident since the system was easy to learn and contents display clearly. Below are figure 3.3 which show positive feedback for chat and interactive elements of the website.

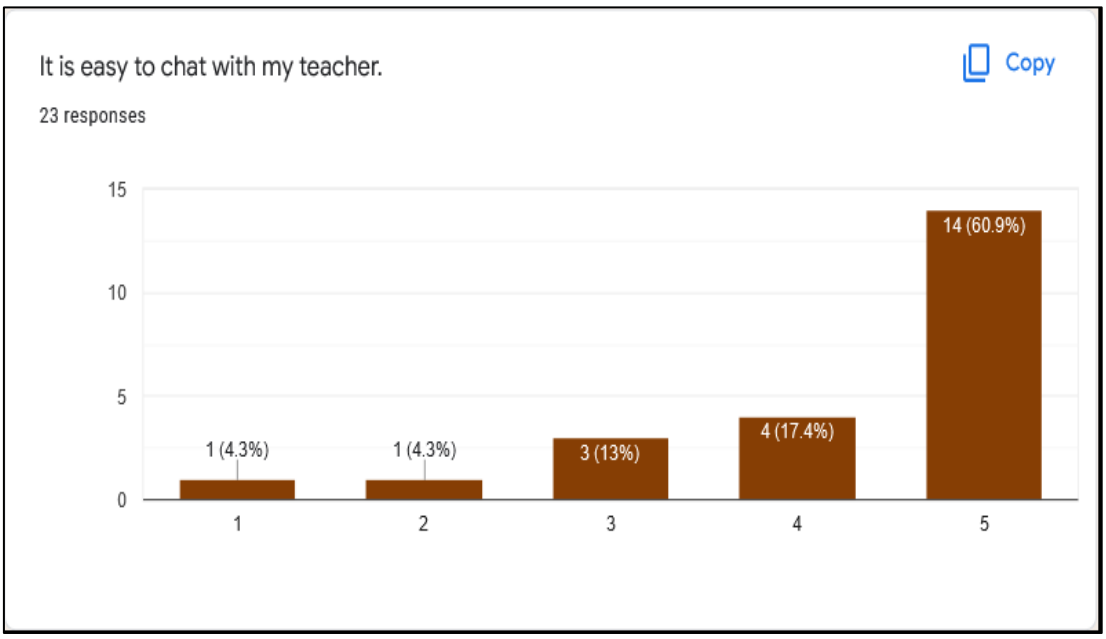


Figure 3.3 Chat Questions

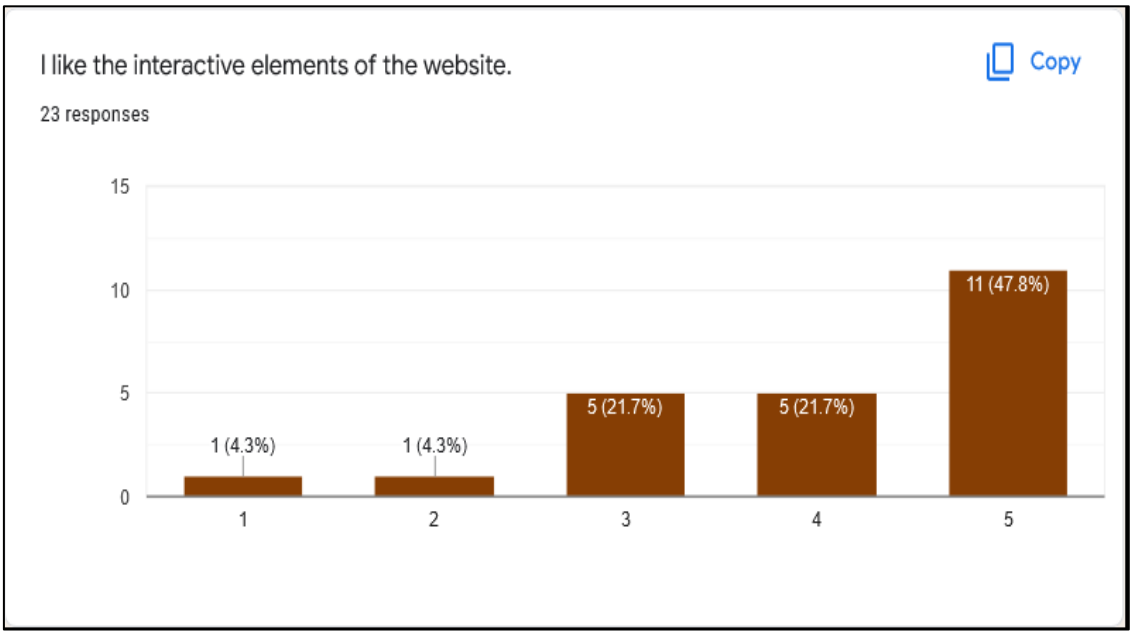


Figure 3.4 Visual Question

Finally, Teachers liked the ability of the system to add their own courses and simple process in order to add new material. They mostly consider it a very helpful tool for their teaching activities and the features the system offer. They consider it a flexible tool to integrate in their teaching style. See Questionnaires in Appendix 4.1 and Appendix 4.2.

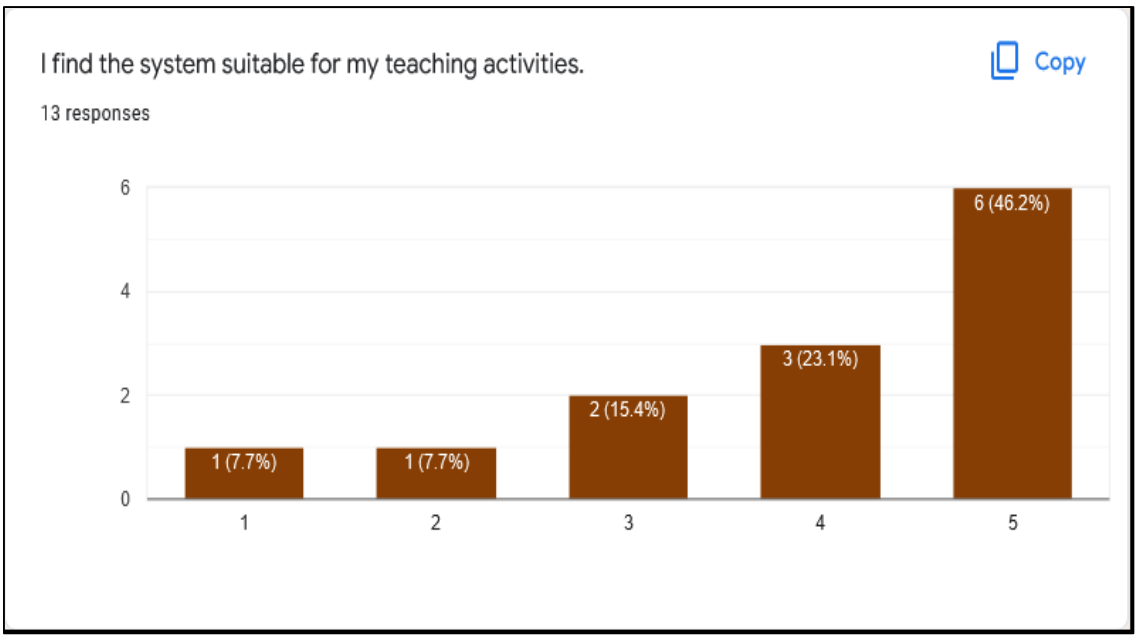


Figure 3.5 Teaching Question

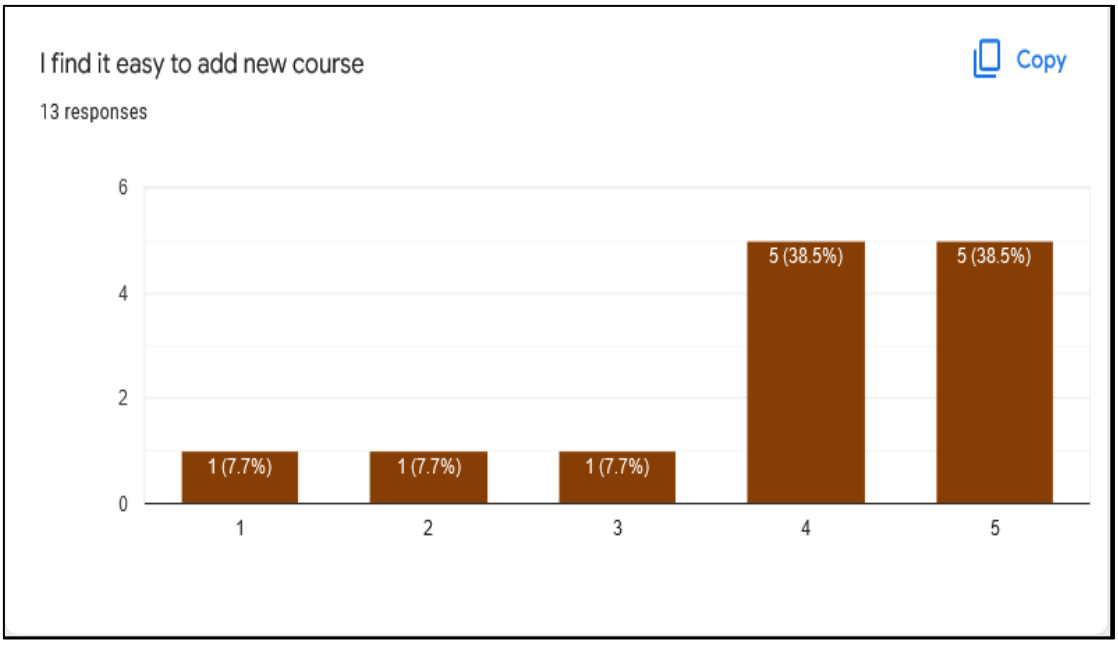
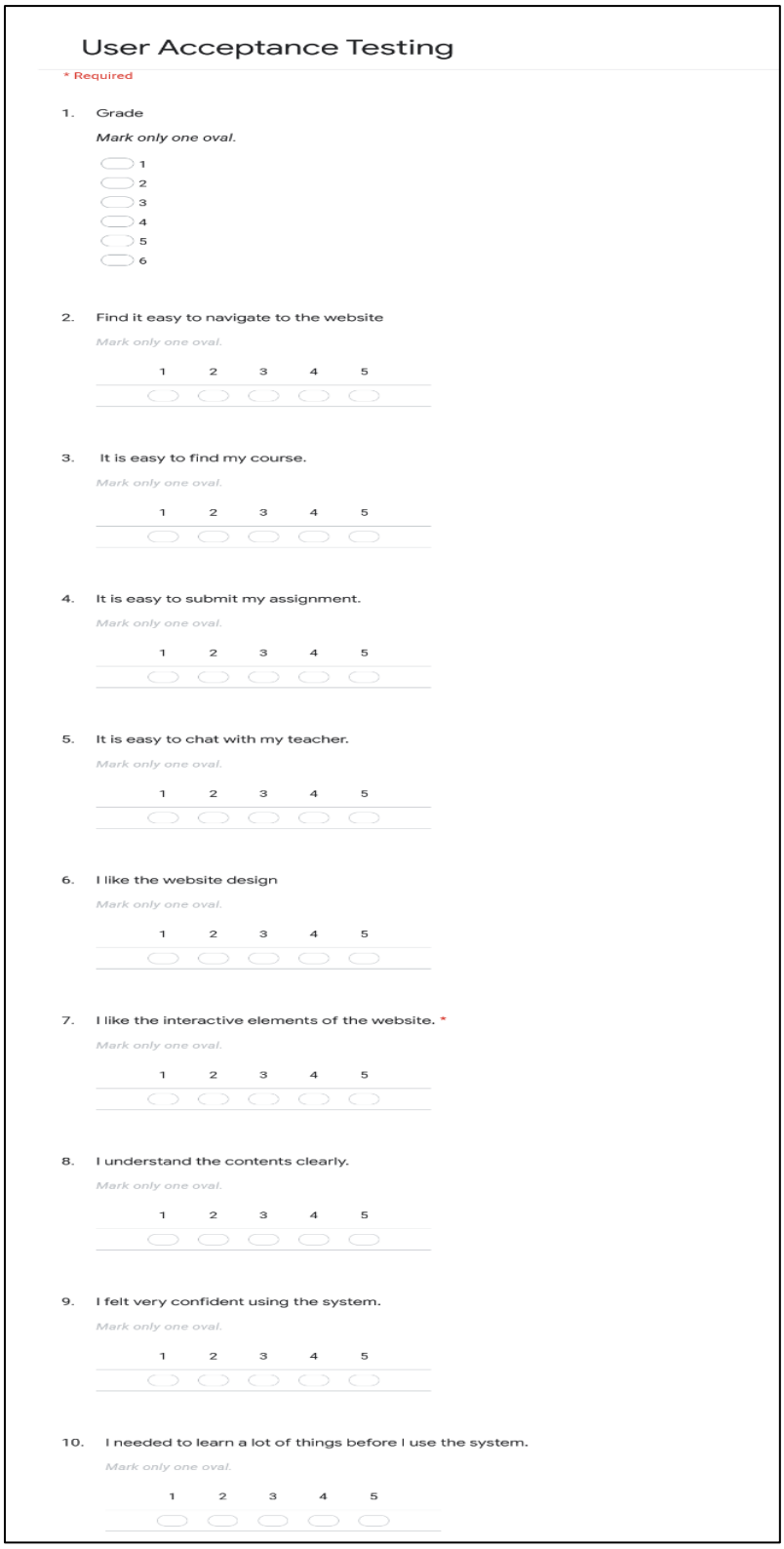


Figure 3.6 Add New Course

4. Appendices



User Acceptance Testing

* Required

1. Grade

Mark only one oval.

- 1
- 2
- 3
- 4
- 5
- 6

2. Find it easy to navigate to the website

Mark only one oval.

1 2 3 4 5

3. It is easy to find my course.

Mark only one oval.

1 2 3 4 5

4. It is easy to submit my assignment.

Mark only one oval.

1 2 3 4 5

5. It is easy to chat with my teacher.

Mark only one oval.

1 2 3 4 5

6. I like the website design

Mark only one oval.

1 2 3 4 5

7. I like the interactive elements of the website. *

Mark only one oval.

1 2 3 4 5

8. I understand the contents clearly.

Mark only one oval.

1 2 3 4 5

9. I felt very confident using the system.

Mark only one oval.

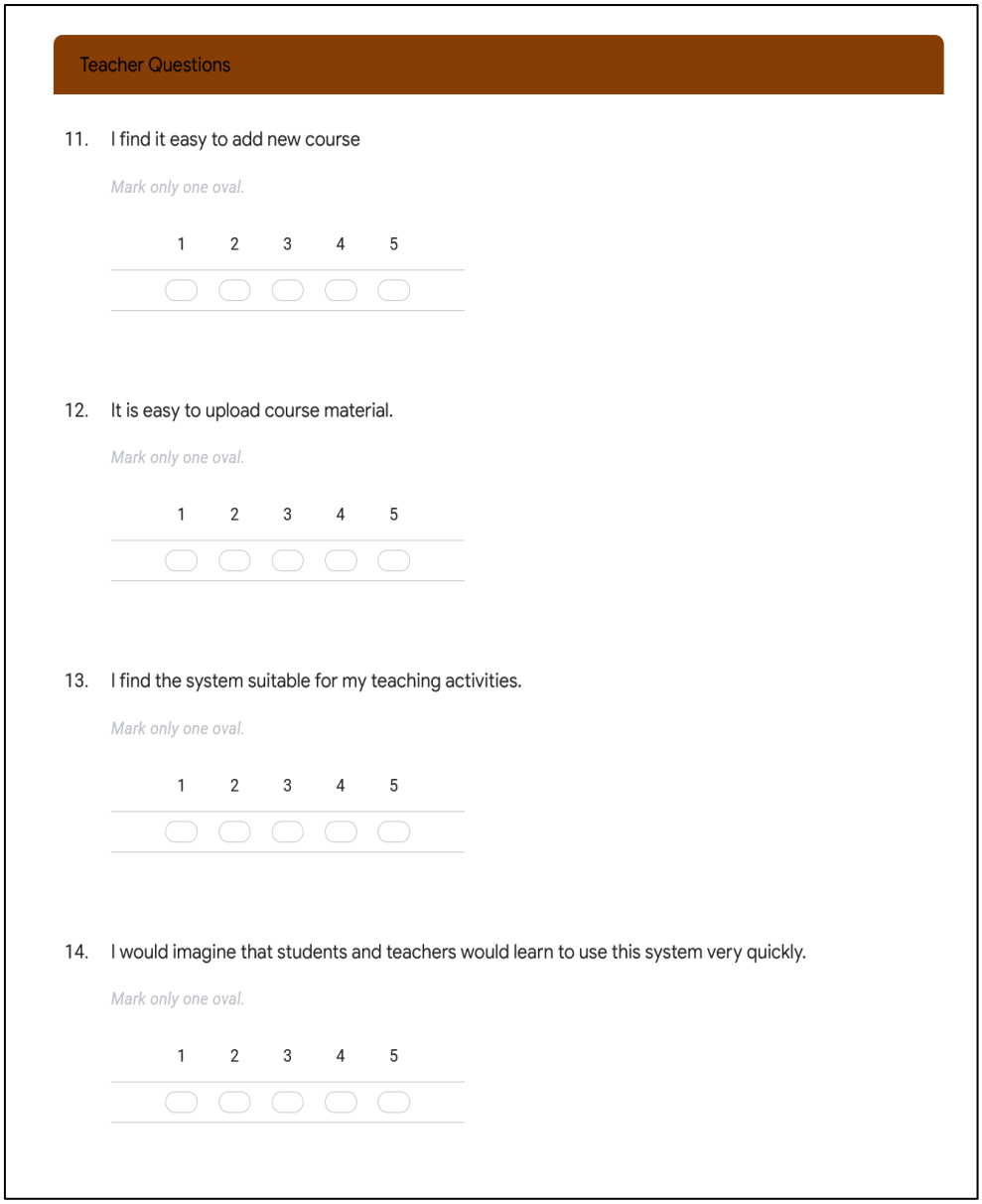
1 2 3 4 5

10. I needed to learn a lot of things before I use the system.

Mark only one oval.

1 2 3 4 5

Appendix 4.1 Students Questions



Teacher Questions

11. I find it easy to add new course

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

12. It is easy to upload course material.

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

13. I find the system suitable for my teaching activities.

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

14. I would imagine that students and teachers would learn to use this system very quickly.

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

Appendix 4.2 Teachers Questions