

# Software Requirement Specification Document for Adaptive Learning System

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Table 1: Document version history

Version	Date	Reason for Change
1.0	18-Jan-2024	SRS First version's specifications are defined.

**GitHub:** <https://github.com/RedX1500/Adaptive-learning.git>

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## **Abstract**

Learning methods have been upgrading since the years. E-learning models have been a huge help for teachers and students. Though e-learning systems has been a base on the learning era. E-learning systems does not have the ability to adapt on each student's learning way. Adaptive Learning is a way of adapting the way of teaching on each student for better outcome

# **1 Introduction**

## **1.1 Purpose of this document**

The purpose of this document is to discuss the details and algorithms used in the Adaptive Learning System. The adaptation on students is hard for so many teachers since they have only one or two ways to provide their students to learn. Adaptive Learning is a way of teaching by adapting on each student by using algorithms and methods such as Q-learning, Reinforcement Learning and many more listed in this document.

## **1.2 Scope of this document**

The scope of this document is to show case of how important adaptive learning is for the academic community. Students have been struggling for the past years with academic problems such as not understanding the teacher, not having many methods of teaching suitable for each student. Adaptive learning covering all those problems, providing the student methods based on the student's performance during the course

## **1.3 Business Context**

Moving forward with technology is hard specially in the E-learning world. Getting to know each way to be up to date with all of the updates is a big bonus for any industry. E-learning has been consistent in the content that is represented by it. Not having AI, which many industries are getting it to be involved in, is a very huge cutback in the learning industry since it is very reliable, accurate, and easy to use.

# **2 Similar Systems**

## **2.1 Academic**

First of, and one of the most used systems for e-learning environments is Moodle. A moodle is an e-learning platform which many universities and schools. [1] A research project at Tomsk Polytechnic University in Russia involved 137 first- and second-year engineering students pursuing Bachelor's and Specialist's degrees, along with twenty lecturers. The objective was to investigate the factors impacting motivation and demotivation among students and educators using the university's online learning platform. The study utilized four surveys with a mix of multiple-choice and open-ended questions, centered on participants' in-class and out-of-class experiences with the

Moodle learning management system. The results provide insights into how respondents perceive e-learning and the hurdles they faced during the learning process. It became a world wide used platform for e-learning purposes.

Also, Udemyl have been a perfect platform lately [2] for new students to discover. Udemyl is a self learning platform for all faculties and courses. Furthermore, Udemyl has the ability to provide your needs and without any outside help or rely on any teacher live. Its a simple platform with millions of users that care about self-learning outside the zone of having assignments, exams and teachers.

Coursera is an online platform for distance education that provides courses to individuals eager to learn. Collaborating with top universities and organizations worldwide, its mission is to establish collaborative programs with the goal of making education a fundamental right for everyone. Founded in 2012 by Stanford University Computer Science Professors Daphne Koller and Andrew Ng, Coursera was officially launched in April of the same year. [3]. Coursesa is one of the best if not the best platform for e-learning systems due to is uniqueness and the ability of having a platform to provide a certificates for users that can be used in a job interview.

## **2.2 Business Applications**

Many businesses are based on relying on the user themselves to have the profit out of them. Such as Thinkfic, is an online platform that enables individuals and businesses to create, market, and sell online courses. It provides tools for course creation, customization, and management, allowing instructors to design and deliver their content in various formats. Thinkific also offers features for marketing, student engagement, and analytics to help course creators build and grow their online education businesses. [4].

Also, as mentioned before, Coursera is one of the biggest business methods for e-learning since it is used by many people across the world [5]. Coursera's mission is to empower people with education that can transform their lives and careers. The platform aims to break down barriers to learning by offering courses on a variety of subjects, from technology and business to arts and humanities.

## 3 System Description

### 3.1 Problem Statement

With the appearance of the internet and the development of Artificial Intelligence, people started to try and use them to make E-Learning a viable option to learn at home. However with it comes a lot of problems and the biggest being that not everyone learn the same way, people have different learning abilities, speeds and ways to understand something. Here comes Adaptive Learning Methods, its a way to make the learning system adapts to whom ever is using it. Our objective is to improve upon the current learning systems and make them adapt to the user's ways of learning and automatically gets the users materials based on the topic and they way that best suits the current user with the oversight of the course instructor.

### 3.2 System Overview

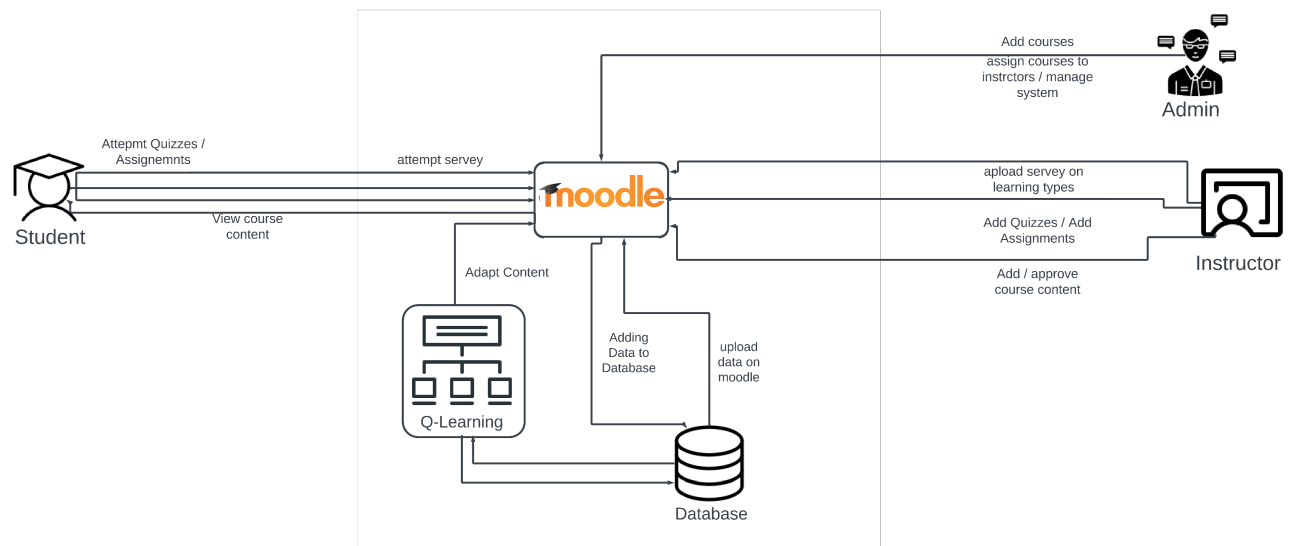


Figure 1: System Context Diagram

Our system is designed to learn and adapt to each student and provide them with their best suited learning style from the 4 main learning styles that humans use which are (Visual, Auditory, Read/Write and Kinaesthetic). The system will start with a basic survey for the student to know how they prefer to learn, be it by solving problems or watching videos or something else, then the system will provide the student with studying materials for each of the 4 learning styles and after each lesson there will be a quiz on that lesson, after testing each of the 4 learning styles the system will compare the marks they got to see which style suits them. The system will then provide the student in all future lessons with materials for all 4 styles while having the majority of the studying material be on the style that produced the highest grade. After that the system will use Q-Learning to check its current states and all possible actions and the set goal (which will be that the student get 10/10 in the quizzes) to alter and adapt the course's materials based on the student's performance.

### 3.3 System Scope

The Final shape of the project will be a plugin for the MOODLE website that will adapt to students learning styles and alter their course material for each course to make them better themselves. It will be using Q-learning model as its adaptive algorithm to adapt each course's contents to suit each user based on whats more effective with each user.

### 3.4 System Context

Our system will consist of students, instructors and admins. Admins add the courses and instructors then assign instructors to their courses, they will also maintain and manage the system from any future failures. Instructors divide the course into lessons and add questions to their courses and basic studying materials, they will also approve or disapprove of materials brought by web search API. Students will take a one time survey then use the studying materials and take quizzes after each lesson they take.

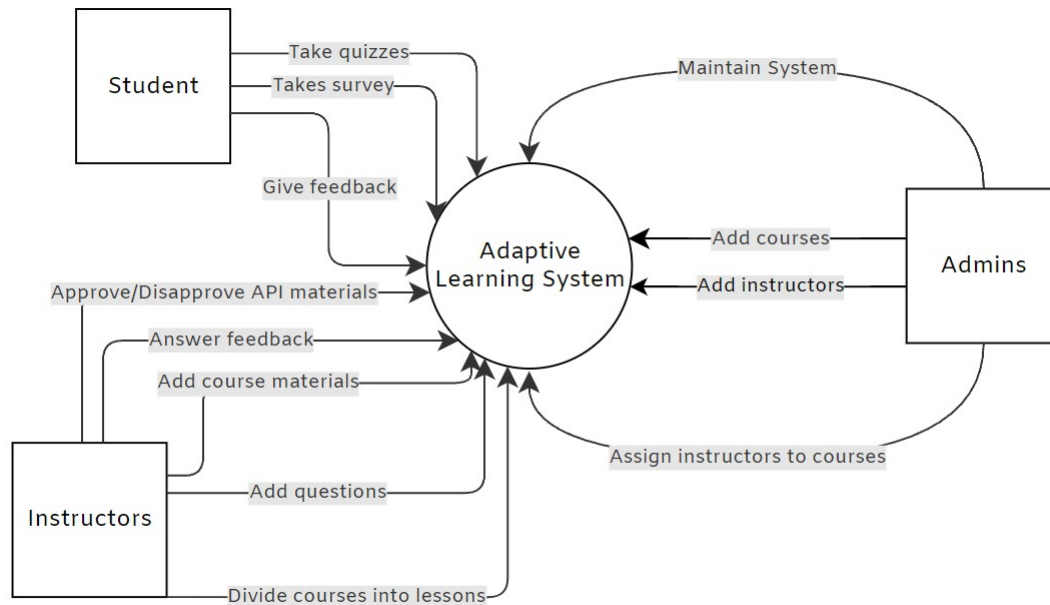


Figure 2: System Context Diagram

### 3.5 Objectives

Our systems objectives are to lower the load of teaching and creating materials and helping each student in their own way for Teachers. Also, to help students understand to their best abilities without the hep of teachers.

- The system will observe the users and test them to learn their preferred learning method.
- The system will extract the main topic of the course and find studying materials from the internet, and after the course instructors approve of the materials.

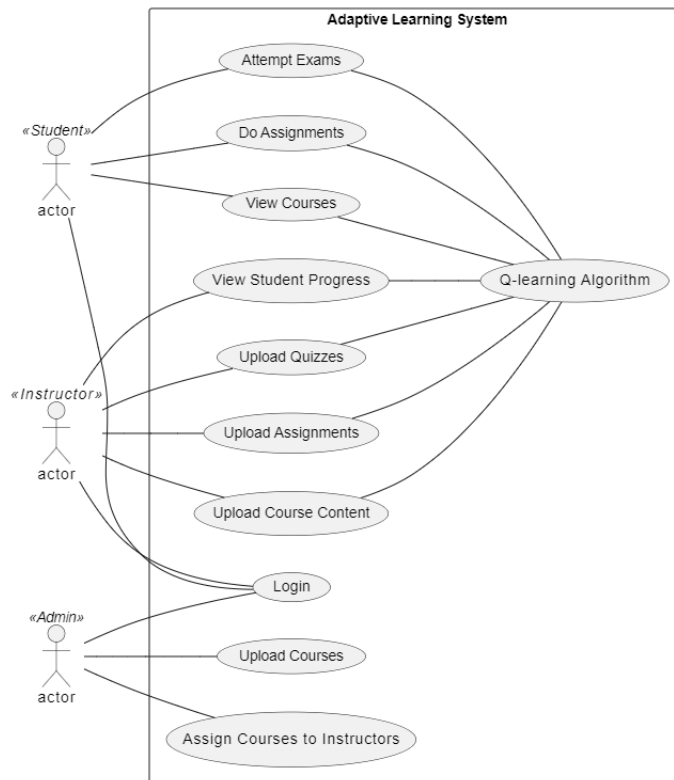
- while the student is studying the system will be observing and further adapting the course to benefit the user more.

### 3.6 User Characteristics

Expected users consist of Admins who will manage and maintain the system by adding courses and instructors while assigning them to their courses. Students who will use the system to learn and take quizzes to test their progress. Instructors who will monitor the student's progress and add basic studying material to courses and question back to each of their courses.

## 4 Functional Requirements

### 4.1 System Functions



## 4.2 Detailed Functional Specification

Name	Login
Code	F1
Priority	Crucial
Input	Username, password
Output	access to the system
Pre-condition	N/A
Post-Condition	sign in as student, admin or instructor
Dependency	N/A
Risk	if function failed cant access system

Name	View Courses
Code	F2
Priority	crucial
Input	student ID
Output	courses student with that ID assigned to
Pre-condition	logged in
Post-Condition	N/A
Dependency	Login
Risk	student wont be able to see their courses

Name	Attempt Exam
Code	F3
Priority	Crucial
Input	student ID
Output	access to exam
Pre-condition	logged in and assign to the course
Post-Condition	take exam
Dependency	view course
Risk	wont be able to take exam



Name	Upload courses
Code	F4
Priority	crucial
Input	Course name
Output	create course
Pre-condition	Admin account
Post-Condition	N/A
Dependency	Login: type admin
Risk	there wouldn't be any courses on the system

Name	Assign Instructor
Code	F5
Priority	Crucial
Input	instructor ID
Output	N/A
Pre-condition	Admin login
Post-Condition	course will have instructor
Dependency	Upload Course
Risk	course will not have an assigned instructor

## 5 Design Constraints

### Add Content

Content Title:

Content Type:

Select Content Type ▼

Add File:

Choose File

No file chosen

Add Content

Figure 4: Instructor UseCase Diagram

## Add Question

Question Text:

Question Type:

Multiple Choice Question (MCQ) ▼

Difficulty:

A horizontal slider bar with a blue segment on the left and a grey segment on the right. A blue dot is positioned at the end of the blue segment.

**3**

Choice 1:

☐ Correct

Choice 2:

☐ Correct

Choice 3:

☐ Correct

Choice 4:

☐ Correct

Figure 5: Add Question

MIU Moodle

localhost / Moodle/Teacher/add\_question\_course.php?course\_id=28

Home Courses Login Profile

## Add Questions to the Course

### Multiple Choice Questions (MCQ)

Question:

### Text Questions

Text Question:

### Video

Video Title:

Video URL:

Add Questions

Figure 6: Add Question Teacher

MIU Moodle

Home Courses Login Profile

## Create or Select a Course

Course Title:

Course Description:

Create New Course

Figure 7: Add Course

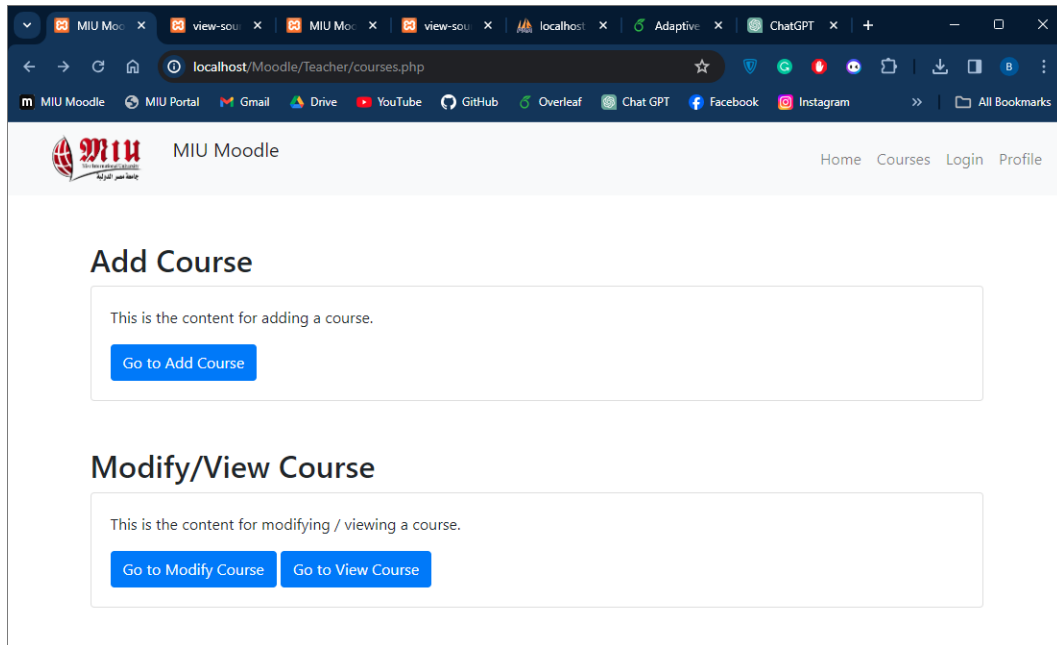


Figure 8: Courses

# Course Management

Add Lecture

Lecture Name	Actions
Lecture 1	<a>Delete</a> <a>Details</a>
lecx	<a>Delete</a> <a>Details</a>

Figure 9: Student Course



## Login

Username

Password

Login

Figure 10: Login

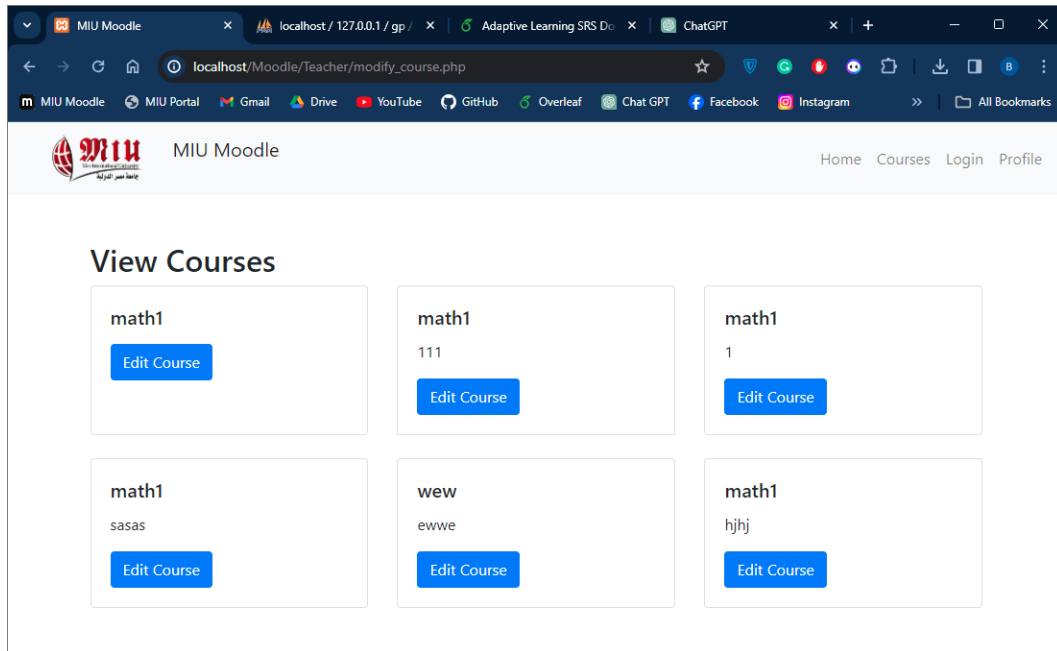


Figure 11: View Teacher Courses



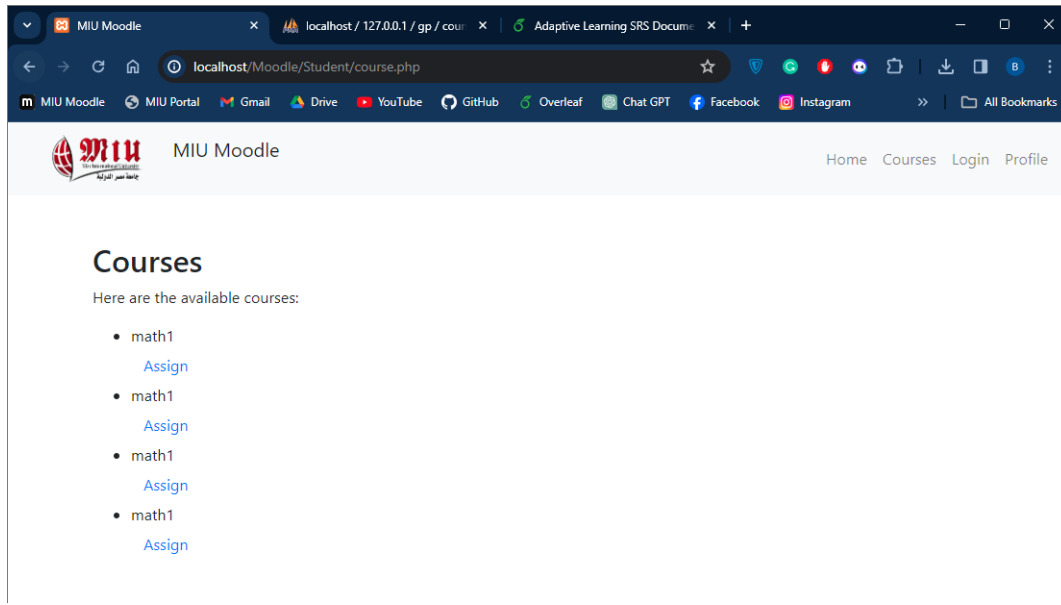


Figure 12: Course Details

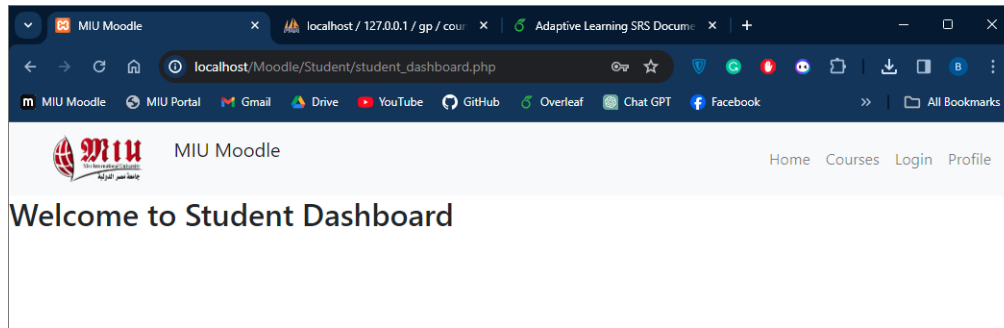


Figure 13: Dashboard

# Topic Management

Add Topic

Topic Name	Actions
top1	<div>Add QuestionAdd ContentDelete</div>
topic2	<div>Add QuestionAdd ContentDelete</div>
topic3	<div>Add QuestionAdd ContentDelete</div>

Figure 14: Topics

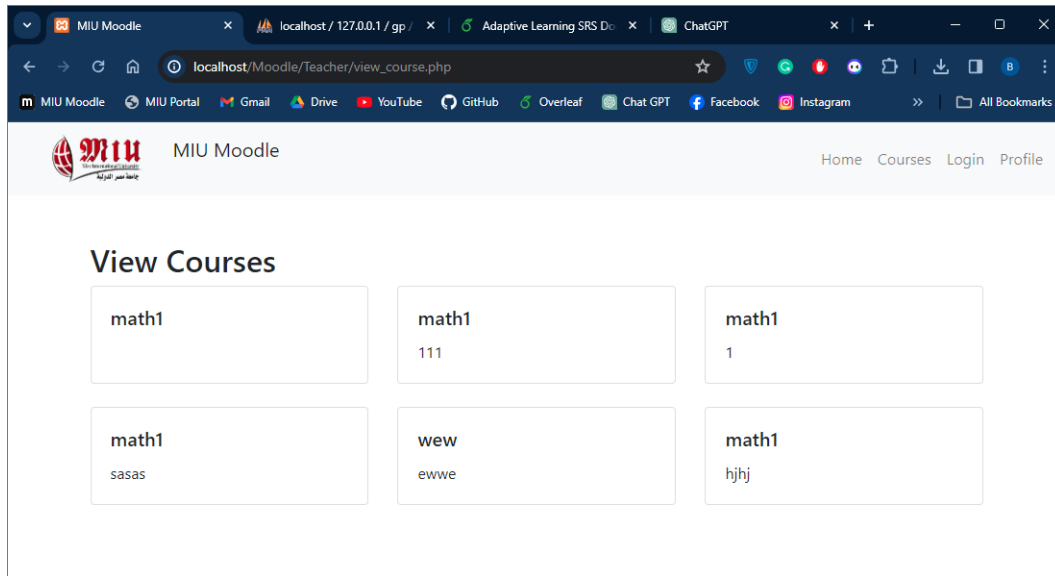


Figure 15: View Student Courses

## 5.1 Standards Compliance

The student must work on a laptop or a PC or a phone to access our intended application

## 6 Non-functional Requirements

### 1. Performance

Our application will be in a high performance type

### 2. Reliability

The adaptation is based on Q-learning algorithm which is one of the most accurate algorithms in Reinforcement Learning

### 3. Usability

The application will provide a user-friendly, simple interface

### 4. Scalability

More input options and performance enhancement could be done in the future.

## 7 Data Design

1. Users: Represents both students and teachers with common attributes such as username, password, role (student or teacher), first name, last name, and email.

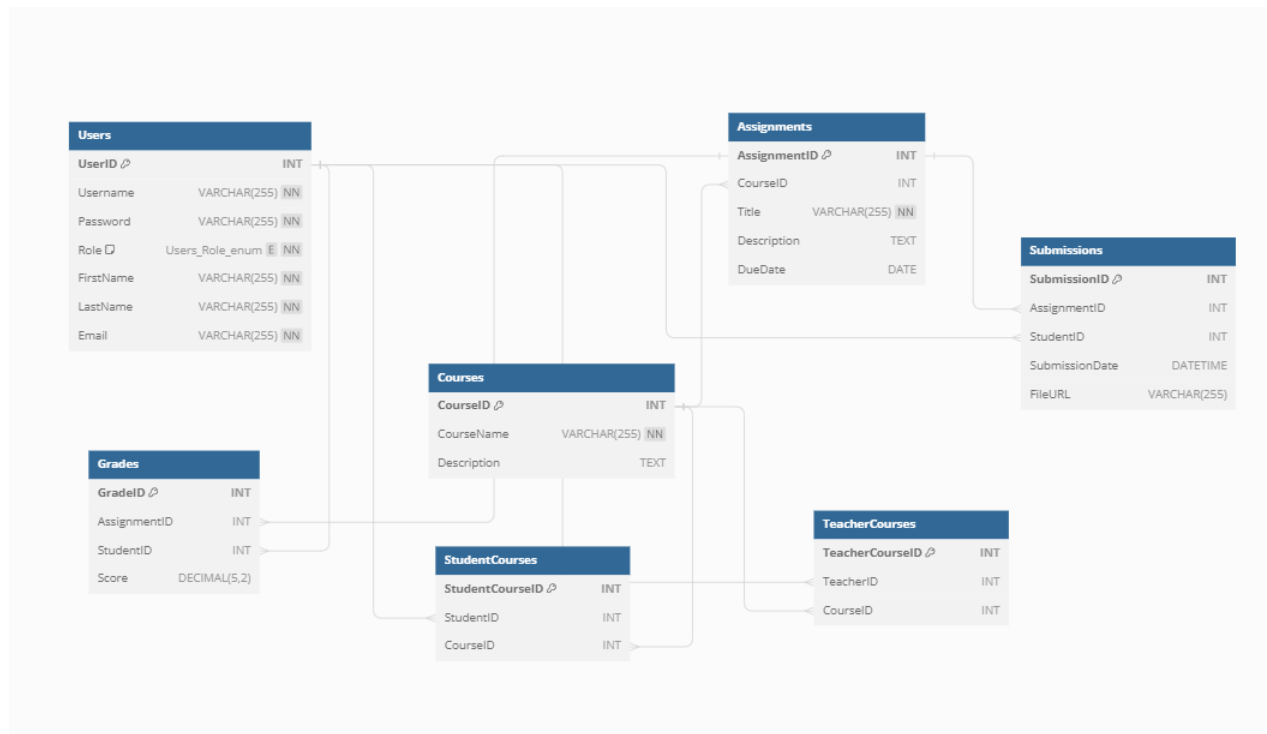


Figure 16: Database Diagram

2. **Courses**: Contains information about various courses, including a unique course ID, course name, and a description.
3. **Assignments**: Tracks assignments associated with specific courses, including details like assignment title, description, due date, and a reference to the course it belongs to.
4. **Submissions**: Captures submissions made by students for specific assignments, linking them to the assignment and student. Includes submission date and an optional file URL.
5. **Grades**: Records grades assigned to students for their submissions, associating them with the corresponding assignment and student. Includes a numeric score.
6. **TeacherCourses**: Establishes the relationship between teachers and the courses they are assigned to teach.
7. **StudentCourses**: Represents the enrollment of students in specific courses, establishing a many-to-many relationship between students and courses.

## 8 Preliminary Object-Oriented Domain Analysis

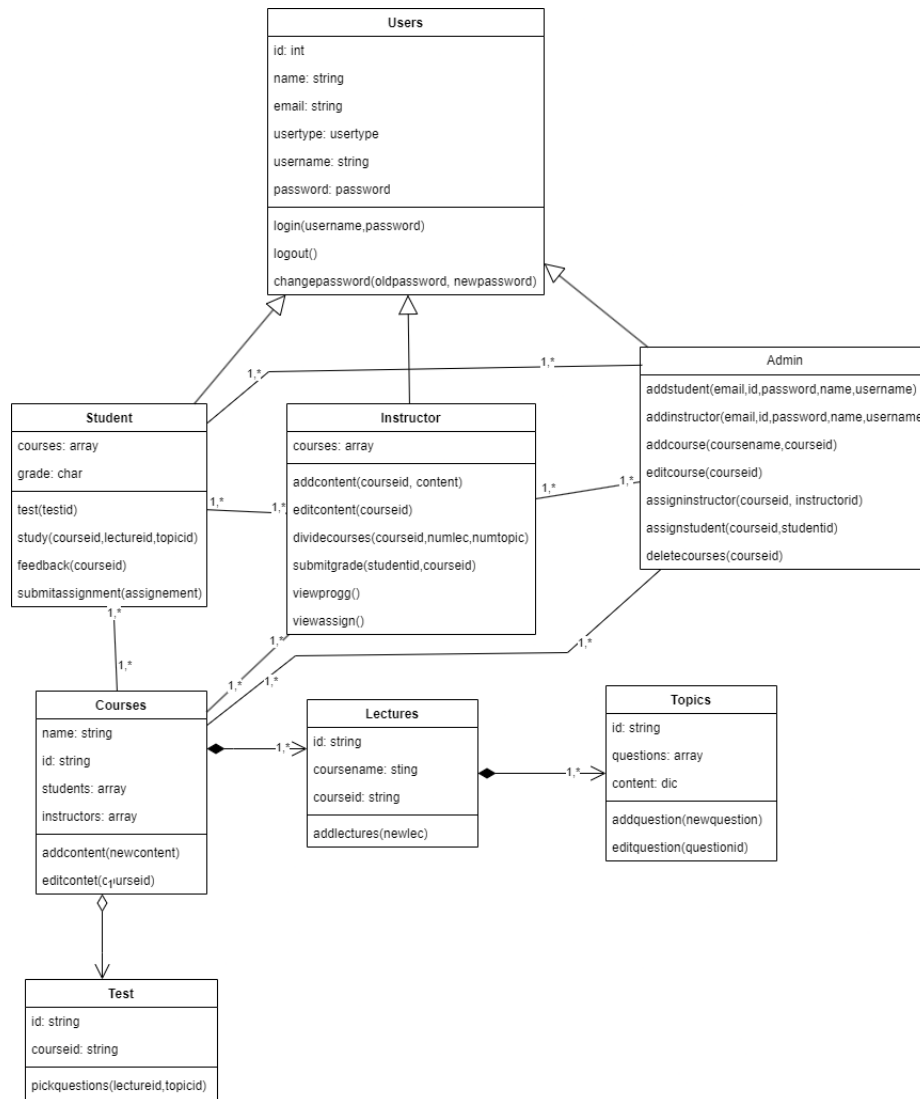


Figure 17: Class Diagram

## 9 Operational Scenarios

### 9.1 Scenario 1: Instructor adds/approves materials

The instructor will add basic materials for each lesson for the student to start with then depending on how the student interacts with the system, it will search online for more studying materials and ask the instructor for their approval on the materials and if they do so the materials will be available to students.

## **9.2 Scenario 2: System adapts to student**

After studying using mainly the Visual style of learning, watching videos and lectures the student took a quiz and got 6/10 so the system lowered the percentage of visual materials and increased of the other 3 styles based on the data collected at the beginning of the course.

## **9.3 Scenario 3: Admin adds new course**

The admin added a new course to the system and then assigned it to its instructor.

## 10 Project Plan

	A	B	C
1		A	B
2	1	Task	Expected due date
3	2	research for SDD	last week of Jan 2024
4	3	start writting in SDD paper	first week of Feb 2024
5	4	start working on diagrams	second week of Feb 2024
6	5	start on code	second week of Feb 2024
7	6	start working on Moodle	third week of Feb 2024
8	7	finish research	fourth week of Feb 2024
9	8	finish SDD paper	second week of Mar 2024
10	9	finish code	fourth week of FMar 2024

Figure 18: Project Plan

## 11 Appendices

### 11.1 Supportive Documents

#### References

- [1] Tatiana Aikina and Liudmila Bolsunovskaya. “Moodle-based learning: Motivating and demotivating factors”. In: *international journal of emerging technologies in learning (iJET)* 15.2 (2020), pp. 239–248.
- [2] Richard Qiu. “Udemy: blended and e-learning for transforming teaching and learning”. In: *Anticipating and Preparing for Emerging Skills and Jobs: Key Issues, Concerns, and Prospects*. Springer Singapore Singapore, 2020, pp. 215–220.
- [3] Huma Shafiq, Zahid Ashraf Wani, Iram Mukhtar Mahajan, et al. “Courses beyond borders: A case study of MOOC platform Coursera”. In: *Library Philosophy and Practice* (2017), pp. 1–15.
- [4] M Firman Akhsanu Ridho, I Nyoman Sudana Degeng, and Nurmida Catherine Sitompul. “The Development of Graphic Design Online Class Using Thinkific Platform to Improve Commercial Graphic Design Skill”. In: *International Journal of Social Science And Human Research* 4.1 (2021), pp. 550–556.



- [5] Jeffry R Young. “Inside the Coursera contract: How an upstart company might profit from free courses”. In: *The chronicle of higher education* 19.07 (2012), p. 2012.