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MALAYA**



WIA3003 ACADEMIC PROJECT II

Semester 1 Session 2022/2023

Dyscalculia Screening Web Apps For Primary School Students

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TABLE OF CONTENTS

TABLE OF CONTENTS.....	2
LIST OF TABLES	5
LIST OF FIGURES	6
LIST OF ABBREVIATIONS	8
ACKNOWLEDGEMENTS	9
ABSTRACT.....	10
Chapter 1: Introduction	11
1.1 Overview	11
1.2 Problem Statement	11
1.3 Project Objectives	12
1.4 Project Scope.....	12
1.4.1 System Overview.....	12
1.4.2 Target Users.....	13
1.5 Project Schedule.....	14
1.6 Report Organisation	15
Chapter 2: Literature Review.....	17
2.1 Introduction	17
2.2 Types of Dyscalculia.....	18
2.3 Issues Faced by Dyscalculia Students and Educators	19
2.4 Existing System.....	21
2.4.1 Learning Success System	21
2.4.2 IXL Learning	22
2.4.3 Dyscalculia Screener	23
2.4.4 Comparison between the Existing Systems.....	24
2.5 Study on Applicable Framework.....	25
Chapter 3: Research Methodology.....	26
3.1 Software Development Methodology	26
3.1.1 Waterfall Model.....	26
3.1.2 Characteristics of Waterfall	27

3.2 Stakeholder Collaboration Initiative	28
3.2.1 E-mail	28
3.3 Data Gathering Methodologies	29
3.3.1 Online Interview with Professional Special Need Educator	29
3.3.2 Stakeholder Online Meeting	30
Chapter 4: Requirement and System Analysis.....	33
4.1 Requirement Elicitation.....	33
4.2 System Requirements	33
4.2.1 Functional Requirements	33
4.2.2 Non-Functional Requirements.....	36
4.3 Use Case Modelling	36
4.3.1 Use Case Diagram	36
4.3.2 Use Case Descriptions	37
4.4 Activity Diagram.....	43
4.5 Entity-Relationship Diagram.....	53
4.6 Architecture Diagram.....	53
4.7 User Interface Mock-up	54
Chapter 5: System Development	55
5.1 Technical Implementation.....	55
5.1.1 Preparation.....	55
5.1.2 System Development Tools Specification.....	55
5.1.3 System Development Process and Experience	56
5.2 User Interface and/or User Experience	59
5.2.1 Usability.....	73
5.2.2 Accessibility	75
5.2.3 Quality of Interaction.....	77
5.3 System Complexity	79
Chapter 6: System Evaluation.....	81
6.1 Introduction	81
6.2 Unit Testing.....	81
6.2.1 Unit Testing (Authentication).....	81

6.2.2 Unit Testing (User Record)	82
6.2.3 Unit Testing (Profile).....	84
6.2.4 Unit Testing (Screening Management).....	85
6.2.5 Unit Testing (Intervention Management)	86
6.2.6 Unit Testing (Report).....	87
6.2.7 Unit Testing (Screening Test).....	88
6.2.8 Unit Testing (Intervention Lesson).....	88
6.2.9 Unit Testing (Chat).....	89
6.3 Integration Testing	89
6.3.1 Integration Testing (Screening)	90
6.3.2 Integration Testing (Intervention)	91
6.3.3 Integration Testing (Report)	91
6.4 System Testing	91
6.5 User Acceptance Testing.....	93
6.6 Error-Free and Error Handling.....	94
Chapter 7: Conclusion.....	97
References	99
Appendix.....	101

LIST OF TABLES

Table 1 The Comparison between the Existing Systems.....	24
Table 2 System Tools to be Used	25
Table 3 Comparison of Existing Dyscalculia Assessments	31
Table 4 The Functional Requirements of the System	33
Table 5 The Non-Functional Requirement of the System	36
Table 6 Use Case ID of the System Requirement.....	37
Table 7 Resources Required for System Development	55
Table 8 Hardware Specification.....	55
Table 9 Software Development Tools	56
Table 10 Usability Testing (Authentication)	74
Table 11 Usability Testing (Profile)	74
Table 12 Accessibility Testing of the Forms	76
Table 13 The Test Cases for Quality of Interaction.....	77
Table 14 Unit Testing (Authentication).....	81
Table 15 Unit Testing (User Record).....	82
Table 16 Unit Testing (Profile).....	84
Table 17 Unit Testing (Screening Management).....	85
Table 18 Unit Testing (Intervention Management)	86
Table 19 Unit Testing (Report).....	88
Table 20 Unit Testing (Screening Test).....	88
Table 21 Unit Testing (Screening Test).....	88
Table 22 Unit Testing (Chat)	89
Table 23 Integration Testing (Screening)	90
Table 24 Integration Testing (Intervention).....	91
Table 25 Integration Testing (Report)	91
Table 26 System Testing.....	92
Table 27 User Acceptance Checklist	93

LIST OF FIGURES

Figure 1 Gantt Chart for FYP I (Semester II Session 2021/2022).....	14
Figure 2 Gantt Chart for FYP II (Semester I Session 2022/2023).....	15
Figure 3 The Screening Test provided by Learning Success System.....	22
Figure 4 Math Skills learning provided by IXL Learning	23
Figure 5 Dyscalculia Screening Checklist	24
Figure 6 Dyscalculia Screener per Grade in Dyscalculia Screener	24
Figure 7 Waterfall Model.....	26
Figure 8 Stakeholder Collaboration Invitation Email	28
Figure 9 Approval on Stakeholder Collaboration	29
Figure 10 The setup situation for in-person digital administration with e-stimulus book and e-manual using FAM assessment tool	31
Figure 11 Use Case Diagram	36
Figure 12 Activity Diagram for UC-01 Register new account	44
Figure 13 Activity Diagram for UC-02 Login.....	45
Figure 14 Activity Diagram for UC-03 Manage profile.....	46
Figure 15 Activity Diagram for UC-04 Manage screening	47
Figure 16 Activity Diagram for UC-05 Manage student record.....	48
Figure 17 Activity Diagram for UC-06 Manage intervention	49
Figure 18 Activity Diagram for UC-07 Conduct screening.....	50
Figure 19 Activity Diagram for UC-08 Conduct intervention.....	50
Figure 20 Activity Diagram for UC-09 View screening result.....	51
Figure 21 Activity Diagram for UC-10 Generate report	51
Figure 22 Activity diagram for UC-11 Send chat message	52
Figure 23 Entity-Relationship Diagram.....	53
Figure 24 Architecture Diagram	53
Figure 25 The Laravel Server is launched	58
Figure 26 The Dyscalculia Screening Web App is added and created from the Laravel Server..	58
Figure 27 The Access Details for the App.....	58
Figure 28 The GitHub Repository for Deployment.....	59
Figure 29 The UI for Admin Dashboard.....	59
Figure 30 The UI of Test Category List.....	60
Figure 31 The UI for the List of Screening Questions.....	60
Figure 32 The UI of Create Screening Question	61
Figure 33 The UI of Edit Screening Question	61
Figure 34 The UI for the List of User Record	62
Figure 35 The UI for the Search Result of User Record by Admin with Username	62
Figure 36 The UI of Create User Record.....	63
Figure 37 The UI of Edit User Record.....	63

Figure 38 The UI of Report	64
Figure 39 The UI of Teacher Dashboard	65
Figure 40 The User Profile Page.....	65
Figure 41 The UI for Intervention	66
Figure 42 The UI of Create Intervention Lesson	66
Figure 43 The UI of Show Intervention Lesson	67
Figure 44 The UI of Edit Intervention Lesson.....	68
Figure 45 The UI of Delete Intervention Lesson	68
Figure 46 The UI of Student Record List	69
Figure 47 The Show Student Record Page Including Screening Result to be viewed by Teacher	69
Figure 48 The UI of Student Dashboard.....	70
Figure 49 The Student Screening Result Page.....	70
Figure 50 The UI of the List of Intervention Lesson for Student	71
Figure 51 The Show Intervention Lesson Page for Student	72
Figure 52 The UI of Send Chat Message.....	72
Figure 53 The UI of Chat Customization Setting	73
Figure 54 The UI of Sending Attachment Successfully via Chat	73
Figure 55 The Test Result of Usability Test (Authentication)	74
Figure 56 The Test Result of Usability Testing (Profile)	75
Figure 57 The Error Message in Profile form.....	77
Figure 58 The Success Message after Success Profile Form Submission	79
Figure 59 The Pagination Links in User Record Module	79
Figure 60 Code for Form Validation	95
Figure 61 Code for Displaying Error Message	95
Figure 62 Validation Exception is Thrown.....	96
Figure 63 Screenshot of meeting with stakeholder.....	102
Figure 64 Screenshot of meeting with stakeholder.....	102

LIST OF ABBREVIATIONS

ERD: Entity-Relationship Diagram

FAM: Feifer Assessment of Mathematics

IDE: Integrated Development Environment

Math: Mathematics

PAL: Process Assessment of the Learner

UAT: User Acceptance Test

WJ IV: Woodcock-Johnson IV

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ABSTRACT

Dyscalculia is a neurodevelopmental disorder that affects the ability of a child to learn arithmetic. The dyscalculia screening web application aims to provide the convenience to the special needs educators with the ability to determine dyscalculia and monitor their performance. This document will document each phase that is carried out for the system.

Obviously, the target users of the web application are the educators from the special educational centre, or we could call it in general as admin and the existing or potential dyscalculia students. The admin would be able to interact with the system to manage the data for student management module and screening module.

The techniques used to elicit the requirements for this project is interview. The interview is conducted using the online platform with the selected special needs educator to gather the data. From the interview, data is then analysed to gather the requirements. Besides, meetings are carried out with the stakeholders to understand the project background and also to define the requirements for the system. The results for both interview and meeting details would be documented in this document.

The software development methodology used in this project is the Waterfall Process Model. It is an example of sequential model. In this model, there are different phases involved in the software development process. The model is simple and easy to use. It is suitable for smaller project and come out with the good results by having well-defined requirements.

There are some modules in the web application which are authentication module, profile module, report module, user record module, intervention module, screening module and chat module. The design of the application includes UML design and mock-up. Some development tools are used during the implementation process such as Visual Studio Code, GitHub and PHP programming language. There are several testing techniques conducted before the production to ensure that the application is error-free and can run smoothly.

In conclusion, the application is crucial in solving the identified problems and provides the optimal solution for the stakeholders.

Chapter 1: Introduction

1.1 Overview

This report is the documentation of the Dyscalculia Screening Web Application for primary school students. The purpose of dyscalculia screening web application is to give the convenience to the special needs educators with the ability to determine dyscalculia students and monitor their performance. The application will be able to evaluate students' arithmetic ability by providing the calculation tasks for them to complete. Therefore, the educators can recognise the condition of each student via the application. The dyscalculia screening web application is not a diagnostic test because the screening results will not indicate whether the student has dyscalculia or not. Rather, the results can indicate that further investigation is warranted to determine if the student has dyscalculia. The scoring from the application will help to determine whether to refer the student to a special needs educators or psychologist to ascertain if further investigation is needed.

1.2 Problem Statement

According to Jeewan jyoti and Gautam (September 2017), the students with learning disabilities such as dyscalculia experience unique learning challenges in classroom environment. They are weak in mathematics and rely heavily on educator support to solve mathematical task. They may appear passive and become frustrated learning in classroom when they fail to solve mathematical problem. According to Kunwar (26 August 2021) , many negative feelings were expressed such as unhappy and unenthusiastic due to the children's continuous failure in mathematics. Hence it is very challenging for both educators and parents to give guidance to the dyscalculia children.

According to May and Ahmad (2020), there is around 4-6% among the primary students are having dyscalculia. They are hardly detected and identified because the adults are unaware of dyscalculia as one of the learning disabilities and have no idea on helping their children. It might affect the dyscalculia students in future if there is no early intervention or screening that helps them to overcome it since their brain is developing during childhood. Therefore, the children that are weak in mathematics should get a proper diagnosis although it is hard to get dyscalculia screening test as they need to go to meet with the professional face-to-face on the spot.

The next problem is lack of automation in screening process. The manual process is conducted by the professional either children paediatrician or educational psychologist. It is conducted by human power instead of the use of automation by technology. Hence, automating the screening process is necessary to identify the dyscalculia students so that it will simplify the screening process without affecting the quality of screening results.

Besides, the paper-based screening test brings a lot of inconvenience to educators. It is hard to keep as a record. It is easily missing at somewhere due to human mistake. It will be worn out after some years. The data management in the paper-based screening test is poor and has to be improved during the era of technology.

In conclusion, dyscalculia screening web application is the appropriate solution to overcome the problems mentioned above.

1.3 Project Objectives

In order to address the problem stated in [Chapter 1.2](#), here come to the objectives of our project which are: -

- To gather requirements of Dyscalculia Screening Web Application from the stakeholder.
- To develop a systematic Dyscalculia Screening Web Application for dyscalculia students.
- To perform user acceptance testing and evaluation.

1.4 Project Scope

1.4.1 System Overview

The web application consists of these modules as listed below:

1. Authentication Module

This module provides the user with the ability to register new account and login to the web application. When they forget their password, they can reset their passwords using e-mail.

2. Profile Module

This module will display the simple profile of the user such as e-mail, age and name. It also provides the user with the ability to edit profile and change password. This module will allow the user to delete account.

3. Screening Management Module

The screening management module allows the admin to create, edit, delete and view the question for screening test.

4. Intervention Management Module

The intervention management module allows the admin to create, edit, delete and view the intervention lesson.

5. User Record Module

This module will allow the admin to create, view, edit, delete the user record and search for user data by username.

6. Report Module

This module allows the admin and teacher to generate and view the report based on the registered users and screening result of the students.

7. Screening Test Module

It allows the student to access and answer the screening questions. After the test is completed, the module will display the result of screening test.

8. Intervention Lesson Module

This module allows the students to do intervention lesson by viewing the contents of lesson.

9. Chat module

This module allows the user to send chat messages and upload attachments in real-time to other users. The module also allows the user to change chat customization such as chat color and dark mode.

1.4.2 Target Users

This system will involve two target users:

1. Management/Admin

Only admin can login and access admin module to manage students' record They can manage the screening and generate report.

2. Teacher

The teacher can login and view the result of screening test that is done by student. The teacher can manage the intervention module and generate report.

3. Student

They are allowed to login and access the screening module to complete the screening test. They can also view their result after the test. They can do some intervention activity after the screening test.

1.5 Project Schedule

The duration of entire project is two semesters (about 10 months). Figure 1 and Figure 2 show the Gantt chart for the duration of 10 months (which represents Semester II session 2021/2022 and Semester I Session 2022/2023).

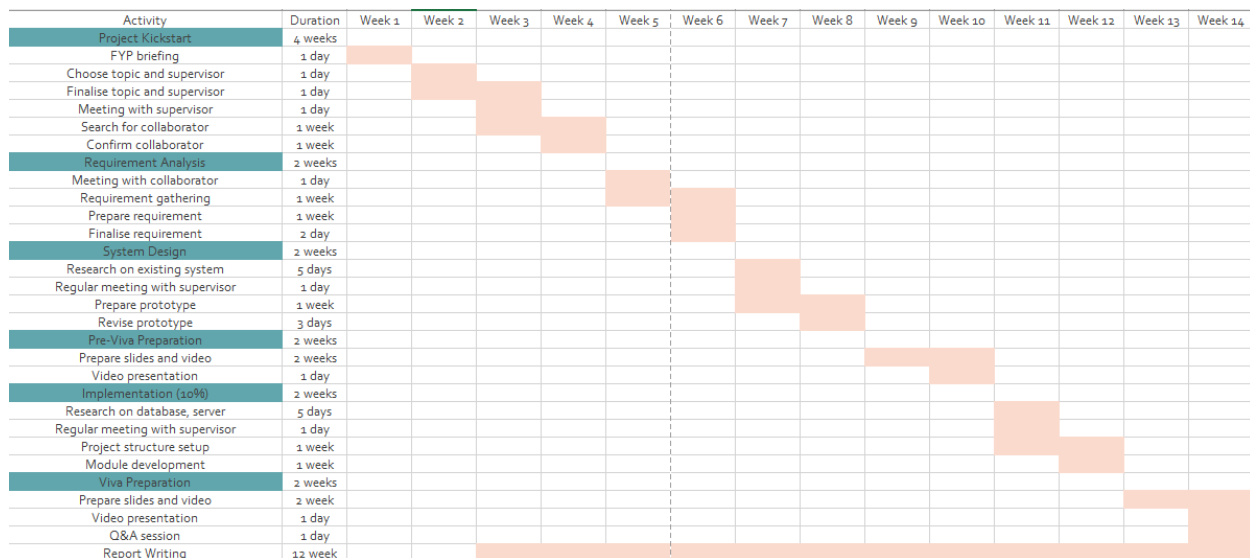


Figure 1 Gantt Chart for FYP I (Semester II Session 2021/2022)

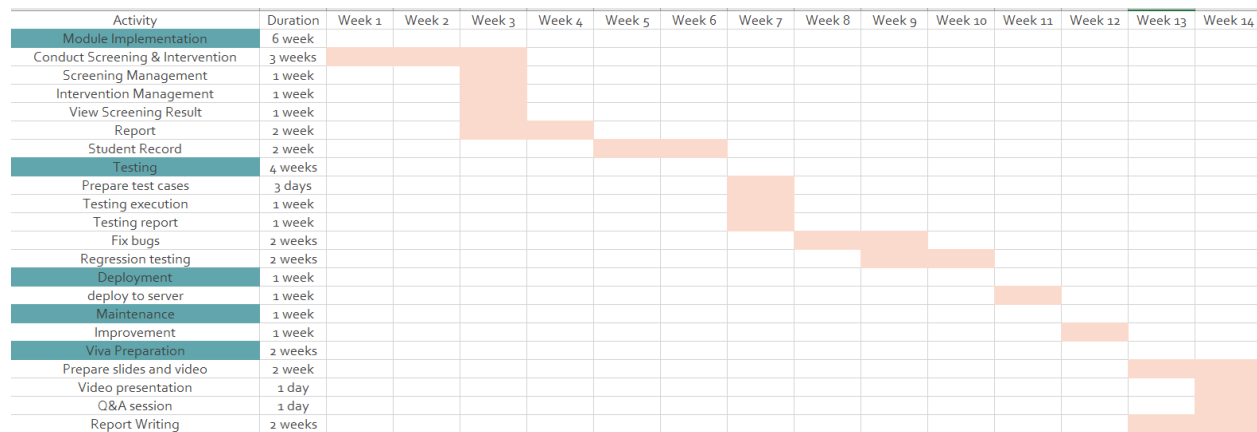


Figure 2 Gantt Chart for FYP II (Semester I Session 2022/2023)

1.6 Report Organisation

The report is organized as below: -

i. Chapter 1 Introduction

This chapter will provide the overview of the project, problem statement and the objective of the project. Besides, the project scope is explained in the chapter. Gantt chart is used to show the overall project schedule within the 10 months of the project duration.

ii. Chapter 2 Literature Review

This chapter will give a brief explanation on the introduction of dyscalculia. Then, the type of dyscalculia and the issues faced by dyscalculia students and educators will be explained in this chapter. There are also some existing systems for screening web application and comparison between the existing system included in this chapter.

iii. Chapter 3 Research Methodology

This chapter will provide the overview on the software development model that has been chosen. Besides, the data gathering methodology used will be discussed in this chapter together with their respective results.

iv. Chapter 4 Requirement Analysis and Design

This chapter will provide the functional requirement and non-functional requirement of the system. Besides, some diagrams such as use case diagram, activity diagram and ERD are shown in this chapter. In addition, the system mock-up interfaces are shown in this chapter too.

v. Chapter 5 System Development

This chapter will cover the topic about the technical implementation of the system, user interface and/or user experience as well as system complexity.

vi. Chapter 6 System Evaluation

This chapter will cover all the test cases in unit testing, integration testing, system testing, and user acceptance testing for the purpose of system evaluation.

vii. Chapter 7 Conclusion

This chapter will show the summary of the project.

Chapter 2: Literature Review

2.1 Introduction

According to Geary (February 2017), dyscalculia is a term that describe a chronic problem in learning and understanding mathematics. For children, these challenges express as a slow learning of number concepts and basic arithmetic. Dyscalculic children can be re-educated and reduce the severity of the learning disability, however they will never completely recovered (Ferraz & Neves, 2015). They should be detected and given proper intervention as early as possible.

According to Soares and Patel (2015), there is around 11% of children with attention deficit hyperactivity disorder (ADHD or ADD) have dyscalculia. The learning disorder complicates and derails aspects of daily life, including mathematical concepts such as time announcements, money counting, and mental arithmetic.

The dyscalculic children struggle with mathematical problem in a variety of ways. Signs vary from person to person and the signs are different at different ages. The signs of dyscalculia include difficulty in processing numbers, weak mental arithmetic skills, difficulty in recognising patterns and sequencing numbers and so on. It is also hard for children with dyscalculia to sort out the direction from right to left immediately. However, miscalculation does not indicate dyscalculia. Diversity, persistence, and frequency are important in determining the existence of dyscalculia.

According to Watson (19 December 2019), dyscalculia can be managed with treatment strategies. If left untreated, the dyscalculic individual lead to work difficulties and financial management problems. Fortunately, there are strategies available to reduce the symptoms of dyscalculia. These may include repeated practice of basic mathematics concepts such as counting and addition, tangible demonstrations of mathematics calculation and so on.

In conclusion, dyscalculia is treatable and early diagnosis can make a big difference in how the individual experiences learning mathematics. It might be more challenging for dyscalculic people to learn mathematics, but it does not mean impossible.

2.2 Types of Dyscalculia

According to Kosc (1974), he discovered six types of dyscalculia based on the students' mathematical abilities. These types of dyscalculia may occur individually or together. (Khing December 2016)

1. Verbal Dyscalculia

This type of dyscalculia is characterized by a difficulty naming and understanding the mathematical concepts presented verbally. For example, a person with verbal dyscalculia can read and write numbers, but cannot talk, remember, or recognize numbers when others instruct him verbally. The results do not come out as expected. The person also cannot name the operational signs or numbers.

2. Ideognostical Dyscalculia

A person with ideognostical dyscalculia feels challenging with the tasks that require understanding of mathematical ideas and relationships, such as identifying which sequence of numbers is larger or smaller. This type of dyscalculia is not limited to oral or written understanding. It is a generalized difficulty with understanding math and numbers as a whole. It can also describe a difficulty in recalling mathematical ideas after learning them.

3. Lexical Dyscalculia

A person with lexical dyscalculia can understand mathematical concepts when talking about them, but has difficulty in reading and writing symbols such as numerical, and cannot understand them when they appear in number sentences or equations. The person suffering from lexical dyscalculia may be able to read individual digits, but unable to recall their places in a larger number. This form of dyscalculia is contrary to verbal dyscalculia because he is capable of doing the mathematical operations instructed orally to him.

4. Operational Dyscalculia

Operational dyscalculia is a difficulty with performing mathematical operations or calculations. A person with operational dyscalculia can understand numbers and their relationship to one another, but finds it hard to do any kind of calculation that requires

manipulating numbers and mathematical symbols. The operationally dyscalculic person can differentiate between bigger and smaller numbers, but he cannot manipulate and carry out mathematical operations like addition, subtraction, multiplication and division.

5. Graphical Dyscalculia

Graphical dyscalculia causes difficulties in writing mathematical symbols, including but not limited to numbers. A person with this disability can understand mathematical ideas but has trouble to read, write, or use the correct corresponding symbols to convey the mathematical understanding in written form. It has the possibility for the graphically dyscalculic person to do calculations mentally.

6. Practognostic Dyscalculia

This dyscalculia refers to inability to differentiate between quantity and values of things that are encountered in daily life. A person with practognostic dyscalculia has difficulty translating the abstract mathematical knowledge into real-world actions or procedures.

For example, the person is able to understand mathematical concepts but faces problem in listing, comparing objects to determine which is larger, and manipulating mathematical equations.

2.3 Issues Faced by Dyscalculia Students and Educators

Mathematical skills and concepts are used everywhere from the kitchen to the playground to the workplace. Hence, it is challenging for the dyscalculic students in learning mathematics, causing them hard to enjoy learning in school. Meanwhile, the educators also have a hard time in teaching them.

Here are some skills and activities that the dyscalculic students may feel challenging:

- **Time management**

Some dyscalculic students may have difficulty with abstract concepts of time. They are chronically early or late in daily life as the ability of reading clock relies on understanding numbers. They may have trouble estimating how long a minute is or

keeping track of how much time has passed. It is difficult for them to stick to a schedule or a plan.

- **Sense of direction**

The students with dyscalculia face problem in reading maps or following directions to reach the places as they have difficulty in learning from left to right. They are unable to imagine things. They may have difficulty imagining what a building or other three-dimensional object would look like if viewed from a different perspective. This will cause them difficulties with the direction. At an older age, this will lead to driving problems.

- **Social skills**

Repeated failures in math lessons can lead the students to assume that failures are inevitable in other areas as well. Low self-esteem can affect their willingness to make new friends and participate in extracurricular activities. They may also avoid playing games and sports that involve mathematics and scoring.

- **Physical coordination**

Dyscalculia affects how the brain and eyes work together. Hence, the dyscalculic students may have trouble judging distances among objects.

In addition, the educators also encounter challenges in teaching mathematics to dyscalculic students. According to Nasir and Efendi (2016), here are some issues that the research participants faced:

- **Limited resources**

Resources is also among the main issues faced by the special needs educators in Malaysia. Those resources issues include financial constraint, lack of standardised screening tool and lack of educators that have skill in providing guidance for dyscalculic students.

- **Lack of assistive technology**

Assistive Technology for students with dyscalculia can be few and far between, but there is definitely helpful for someone with this learning disability(Rajkumar and Hema April 2018). It ranges from as simple as using graphing tools or drawing tools

to solve math equations to talking calculators. This issue is interrelated with the limited resources problem. Thus, inadequate information and insufficient educational strategies on how to integrate the assistive technology into the curriculum still remains as an anxiety among teachers. To illustrate this, the research study (Alkahtani 2013), demonstrated teacher concerns about their training programs that do not provide sufficient coursework and field experience to enable them to support students with special educational needs. Similarly, they reported the lack of accessibility of technology, for example, not enough computers, expense of software and lack of IT technicians (Chiang and Jacobs 2010).

- **Unstructured early intervention programme**

The need for a structured early intervention program should be emphasised in Malaysia to reduce the impacts of dyscalculia on the students, raise their self-esteem and develop positive attitude in learning mathematics. A systematic and holistic early intervention programme is important to people with learning disabilities, especially for the dyscalculic children, to make sure they get the personalised coaching in skills related to basic arithmetic and mathematics. Early intervention can greatly improve one's academic achievement as well as overall human development. Therefore, a systematic and holistic early intervention programme that include all categories of dyscalculia treatment should be implemented.

2.4 Existing System

2.4.1 Learning Success System

The Learning Success System is a simple research-based method that parents can use to assist children overcome learning difficulties. It simplifies the process and enables a parent to work at home with their child. It is convenient to both parents and child, reduces the cost of learning centres and uses cutting-edge neuroscience research. This system consists of screening test for parents to determine the dyscalculic condition of the child.

This system works because it overcomes the learning struggles by the child. The child easily loses his focus after some time of learning and the parents feels frustrated when teaching. With this system, the child can develop the love of learning, overcome learning challenges and

improve confidence in reading, math, logical thinking, and writing by making the learning process fun.

The URL link: <https://www.learningsuccesssystem.com/dyscalculia-test>

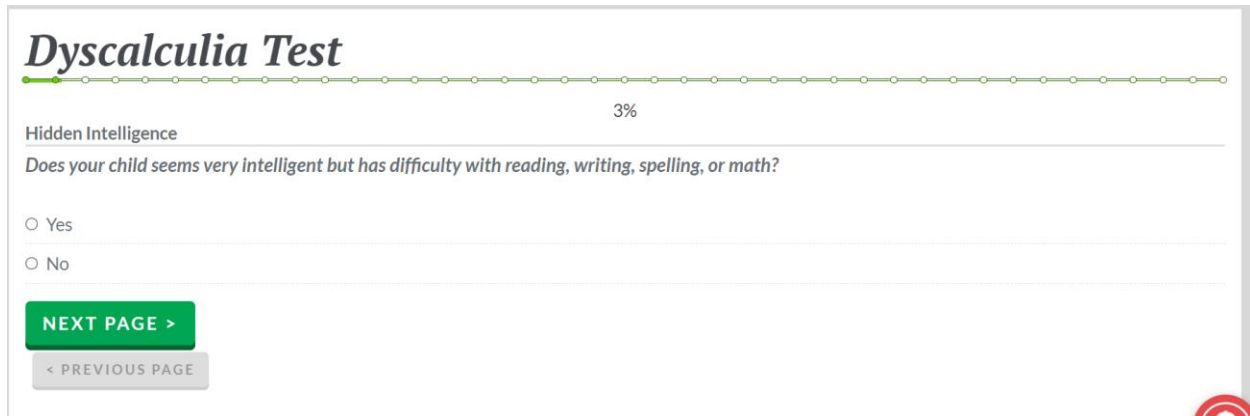
The screenshot shows a web interface for a 'Dyscalculia Test'. At the top, the title 'Dyscalculia Test' is displayed in a large, bold, black font. Below the title is a progress bar consisting of a horizontal line with small circles; the first few circles are filled green, and the text '3%' is centered above the bar. Underneath the progress bar, the text 'Hidden Intelligence' is followed by a question: 'Does your child seems very intelligent but has difficulty with reading, writing, spelling, or math?'. Below the question are two radio button options: 'Yes' and 'No'. At the bottom left of the form area, there is a green button labeled 'NEXT PAGE >' and a grey button labeled '< PREVIOUS PAGE'. A small red circular logo is visible in the bottom right corner of the interface.

Figure 3 The Screening Test provided by Learning Success System

2.4.2 IXL Learning

The IXL Learning is personalised learning platform that consists of comprehensive curriculum, personalised guidance and real-time diagnostic and analytic.

IXL offers personalized skill recommendations based on what each student has been practicing, so they can grow from where they are. The curriculum in IXL covers 5 subjects which are mathematics, language arts, Spanish, science and social science. The student also will get the certificate as an award when reaching a learning milestone.

The parents can set up account for the child to master the skills provided in IXL. In the meantime, the educators can do lesson planning and provide meaningful learning in a fun way to the students. In addition, the real-time diagnostic evaluates the students to identify their learning level and creates a personalized action plan to maximize their growth.

The URL link: <https://www.ixl.com/math>

The screenshot shows the IXL Learning website interface. At the top, there is a navigation bar with the IXL logo, a search bar, and login options (Username, Password, Sign in, Remember). Below this is a green navigation bar with tabs for Learning, Diagnostic, Analytics, Inspiration, and MEMBERSHIP. Under the Learning tab, there are icons for Recommendations, Skill plans, Math (selected), Language arts, Science, Social studies, Spanish, Standards, and Awards. The main content area shows the path: IXL Spotlight - 7th grade > C.4 Add integers QFU. There are links for 'Learn with an example' and 'Watch a tutorial'. The math problem is 'Add: -4 + 4 = ' with an input box and a 'Submit' button. On the right, a sidebar displays performance metrics: 'Questions answered' (0), 'Time elapsed' (00:00:07), and 'SmartScore out of 100' (0).

Figure 4 Math Skills learning provided by IXL Learning

2.4.3 Dyscalculia Screener

The Dyscalculia Screener is a site that offers screening service to detect dyscalculia. It involves four steps for the screening which are dyscalculia checklist as seen in Figure 5, dyscalculia screeners per grade, math and dyscalculia screening test and in person testing.

For the checklist, if the score of the result is higher than 8, it indicates that the individual has the symptom of dyscalculia. Besides, the dyscalculia screeners per grade aim to give the indication to the individual based on the education level. The individual is encouraged to do further screening or diagnostic from the formal institute if the score of the test is high.

The URL link: <https://dyscalculiascreener.org/>

Dyscalculia Screening Checklist

1. Counting and skip counting backwards is more difficult for me than counting forward

- ☐ Yes
☐ No


2. Memorizing addition and subtraction facts is hard

- ☐ Yes
☐ No

3. Memorizing multiplication tables is hard, in particular the 7 and 8 times table

- ☐ Yes
☐ No





Figure 5 Dyscalculia Screening Checklist

 **Dyscalculia Screener**

Home Screening process Information Become a Dyscalculia Tutor

KG FALL SEASON DYSCALCULIA SCREENER

When I do calculations I use my fingers to count
Click the smiley to show how much YOU agree with this.

☐  ☐  ☐  ☐ 

When I do calculations I use tally marks
Click the smiley to show how much YOU agree with this.





   

Figure 6 Dyscalculia Screener per Grade in Dyscalculia Screener

2.4.4 Comparison between the Existing Systems

The existing systems have been explained in the above sections. Table 1 shows the comparison between the existing systems.

Table 1 The Comparison between the Existing Systems.

Existing System	Learning Success System	IXL Learning	Dyscalculia Screener
Main feature	<ul style="list-style-type: none"> Dyslexia & Dyscalculia Screener Self-paced educational therapy 	<ul style="list-style-type: none"> IXL Skills IXL Real-Time Diagnostic IXL Analytics 	4 step process <ul style="list-style-type: none"> Free dyscalculia checklist Free dyscalculia screeners per grade Math and dyscalculia screening test In person testing
Target user	Parents, schools	Families, classrooms, schools	Children, parents
Paid membership	For provided lessons	For certain feature (IXL Real-Time Diagnostic & Analytics)	For further screening and result

2.5 Study on Applicable Framework

Table 2 below shows the frameworks or libraries that are applicable to be used in our project. It involves frontend, backend, database and IDE.

Table 2 System Tools to be Used

Stack Development	Framework / Library
Front-End	Tailwind CSS Alpine.js Bootstrap
Back-End	Laravel
Database	MySQL
Web Server	XAMPP
Code Editor	Visual Studio Code
Version Control System (VCS)	GitHub

Chapter 3: Research Methodology

3.1 Software Development Methodology

According to (Nikolaieva), software development methodology refers to structured processes involved when working on a project. The purpose is to provide a systematic approach to software development according to software requirements. Software development process does not involve any technical aspect but demands proper planning for the software development lifecycle by the development organization.

Throughout the years, various software development methodologies were introduced to capitalize the available technologies and resources as well as provide a platform for developers to cooperate more efficiently as a team. It formalizes communication and determines how information is shared within the team.

It is crucial to choose the best, suitable methodology for software that is going to develop. The software development methodology chosen for this project is waterfall model.

3.1.1 Waterfall Model

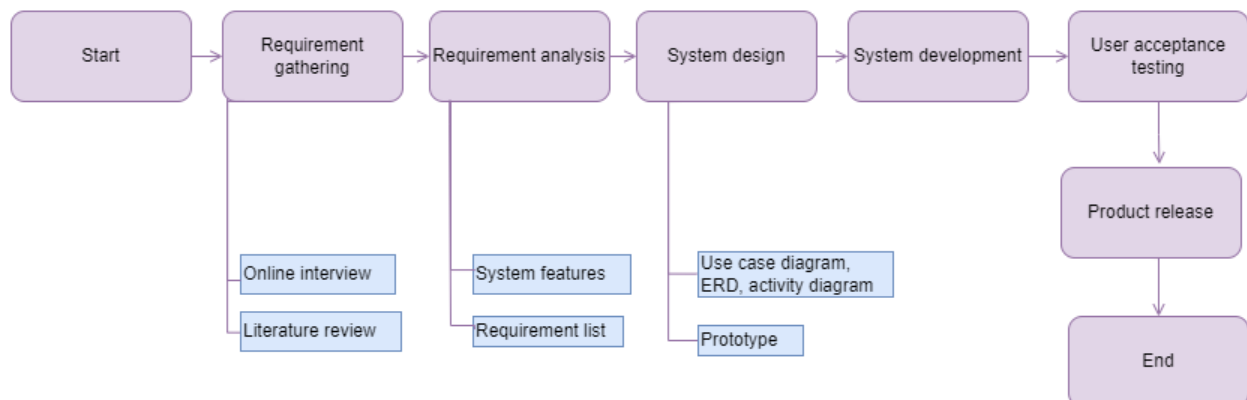


Figure 7 Waterfall Model

Figure above shows the overview of waterfall model which is implemented for this system. It is a software development life cycle model that was originally defined by Royce around 1970. The waterfall model is a linear-sequential life cycle model that breaks down the project activities into phases, where each phase depends on the deliverable of the previous phase and corresponds to a specialization of tasks. The waterfall model for this project consists of six phases which are: -

1. Requirement Gathering Phase

It is the phase that involves stakeholder communication and planning activities. The purpose of this phase is to prepare the basis of the project, including the project scope and project requirement. It is conducted via an online interview with the stakeholder and via the literature review about dyscalculia.

2. Requirement Analysis Phase

In this phase, the requirements of the system are analyzed after meeting with the stakeholder. The system features and the requirement list are drafted based on the result of the requirement gathering phase.

3. System Design Phase

Common design processes undertaken in this phase include the creation of use case diagram, activity diagram and entity-relationship diagram (ERD). The design of the system is finalized and refined using prototyping to display the user interface.

4. System Development Phase

The system is developed under this phase based on the deliverables from the system design phase.

5. User Acceptance Testing (UAT)

UAT is conducted by the end users or stakeholders to verify or accept the software application before being released to the market.

6. Product Release Phase

This is the final phase of the project. Once the user acceptance testing has been passed, the system will be delivered to the target end-users and stakeholders. It also involves the process of data migration, user documentation and user training if applicable.

3.1.2 Characteristics of Waterfall

The waterfall model shows some characteristics that are suitable to implement throughout this project.

1. Requirements are well-defined

The requirements of the project are clearly defined by the stakeholders and are not supposed to change in future.

2. Project is small

The project involves small amount of workload, roles and responsibilities. There is only a small team with a few members such as supervisor, developer, and tester.

3. Timeline of project is short

The project is expected to complete within a year.

3.2 Stakeholder Collaboration Initiative

Stakeholder plays an important role in this project because the stakeholder can help to define the system requirements. The initiative is taken to approach and collaborate with the stakeholder which is HappyLand Psychology Sdn. Bhd. through e-mail.

3.2.1 E-mail

After defining and identifying the potential collaborator from the supervisor, an e-mail had been sent to HappyLand Psychology Sdn. Bhd. to ask for permission and approval to become the system collaborator as seen in Figure 8. After one week, HappyLand agreed to become the stakeholder as shown in Figure 9.



Figure 8 Stakeholder Collaboration Invitation Email

DOKUMEN PERSETUJUAN

Saya ~~bersetuju/tidak bersetuju~~ (sila potong mana yang tidak berkaitan) untuk bekerjasama bagi menjayakan projek Aplikasi Web Saringan Dyscalculia untuk Murid Sekolah Rendah.

Yang benar,



(Tandatangan Guru Besar)

Figure 9 Approval on Stakeholder Collaboration

3.3 Data Gathering Methodologies

3.3.1 Online Interview with Professional Special Need Educator

The data gathering methodologies used in this project is an online interview with the professional that have background in special education for a few years, who is Miss Tan Hui Wen. She has graduated from Bachelor of Social Science Psychology, and she works as the personal assistant of the principal in HappyLand. The purpose of data gathering is to collect insights about dyscalculia and understand the demographic profile of the interviewee.

From the interview, HappyLand is a committed organization to provide professional, psycho-educational therapy and special education services to the children with exceptional needs. There are around 150-200 students in HappyLand. There is a total 50 of them having learning disabilities, including dysgraphia, dyslexia and dyscalculia. There are 20 of them are dyscalculia students only. There are around 3 teachers that are involved in teaching dyscalculia students.

From the interview, we know that the dyscalculia is a learning difficulty in mathematics. The dyscalculia people have a hard time in understanding mathematics concept. They struggle in solving basic mathematics problems. Dyscalculia is a neurological disorder that prohibits the brain from understanding basic numerical and arithmetic concepts. The signs of dyscalculia include difficulty counting backwards, slow to perform calculations and weak mental arithmetic skills. In addition, the diagnosis of dyscalculia can be conducted via initial screenings of dyscalculia carried out by a specialist teacher and then they will usually make a referral to an educational psychologist who is able to do a full, complete assessment.

Based on the interview, the dyscalculia cannot be cured but can be managed with some treatment such as repeated practice of basic Math concepts. The dyscalculia affects daily life of an individual through money calculation and time announcement. There is some ways to improve the performance of students with dyscalculia. For example, use real-life situation or physical object to represent the Math calculation and draw the math problem on the paper to help them to visualise and understand the problem well.

3.3.2 Stakeholder Online Meeting

Table 2 shows the meeting details with the stakeholder that have been conducted via online meeting.

Table 2 The Meeting Details with the Stakeholder via Online Meeting.

Interview	Information
Participants	1. Sim Ying Ying 2. Miss Tan Hui Wen
Date and Time	10 May 2022 10:45 – 11:15 am
Platform	Zoom Meeting
Meeting Details	<ul style="list-style-type: none"> • Discuss on the project background • Identify the target user • Discuss on the project requirements

The findings of the meeting are listed as below: -

Before providing services to the children, the founder of HappyLand, Dr. Eva Wong, PhD in Educational Psychology, will conduct the assessments for the children to be completed. If the children have been completed the assessment from other authorities and received the result or report, then the educators will study the report provided.

Based on the interview, Miss Tan shared about Process Assessment of the Learner (PAL) that is used as diagnostics tool for dyscalculia that measures the development of cognitive processes critical to learning math skills and actual math performance. It can be conducted using paper-and-pencil and give the scoring manually. The assessment usually covers Math fluency,

Math computation and Math concept. She also shared about some existing dyscalculia assessments that are used widely all around the world such as Woodcock-Johnson IV (WJ IV) Math and Feifer Assessment of Mathematics (FAM). The table 3 shows the summary of the 3 assessments mentioned by Miss Tan. The Figure 10 also shows an example of the situation using FAM.

Table 3 Comparison of Existing Dyscalculia Assessments

Existing Assessment	PAL-II Math	WJ IV Math	FAM
Administration:	Paper-and-pencil	Paper-and-pencil	In-person digital administration
Scoring options:	Manual scoring	Manual Scoring table	Online scoring via PARiConnect
Package included:	Printed booklets, Scoring manual, Record form	Math subtests, Scoring guide, Test Record Booklet & Scoring Report	e-stimulus book (child) e-manual (admin) Record form

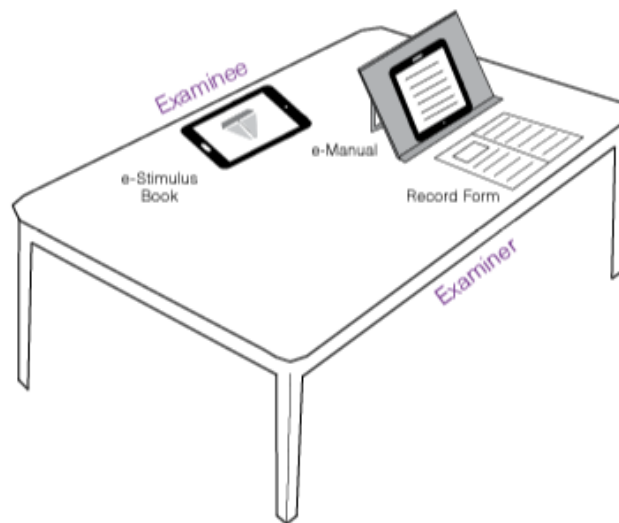


Figure 10 The setup situation for in-person digital administration with e-stimulus book and e-manual using FAM assessment tool

From the opinion of the interviewee, she suggests that the system need authentication for the target users, which are admin, teacher and students. The user manual can be prepared as the reference of student and admin after system is fully completed. During the interview, we have

discussed about the system requirements. Based on the discussion, the system shall have the following features:

- Authentication
- Profile
- Screening management
- Intervention management
- User record
- Screening test or assessment
- Intervention lesson
- Generate report
- Real-time chat message

Chapter 4: Requirement and System Analysis

4.1 Requirement Elicitation

To obtain the requirement of the system, there are two methods used during the requirement elicitation process. The methods are listed as below: -

i. Literature Review

Literature review is the most effective method in the requirement elicitation process. Similar existing systems can be studied, and their features or modules are extracted for reference. After reviewing the system, a comparison table is made to list the features of the existing system and benchmark this proposed system.

ii. Stakeholder Requirement

Stakeholder requirement is another effective method to gather the requirements of a system. A meeting with the stakeholder is conducted to discuss the project background and the project requirements. After that, the requirements of the stakeholder for this system are added.

4.2 System Requirements

4.2.1 Functional Requirements

Table 4 below shows the functional requirements of each of the modules in the web application.

Table 4 The Functional Requirements of the System

Module	ID	Functional Requirements	Priority
Authentication	FR-01	The system shall allow the user to register new account.	High
	FR-02	The system shall allow the user to login to the account.	High
	FR-03	The system shall allow the user to reset password.	Medium
	FR-04	The system shall allow the user to logout from the system.	Medium

Profile	FR-05	The system shall allow the user to view profile.	Medium
	FR-06	The system shall allow the user to change password.	Low
	FR-07	The system shall allow the user to edit profile such as name and e-mail.	Low
Screening Test	FR-08	The system shall allow the registered student to do dyscalculia screening test.	High
	FR-09	The system shall allow the student to view the result of dyscalculia screening test after completing the test.	Medium
Screening Management	FR-10	The system shall allow the admin to edit the screening test category and question.	Medium
	FR-11	The system shall allow the admin to create the screening test category and question.	Medium
	FR-12	The system shall allow the admin to delete the screening test category and question.	Medium
	FR-13	The system shall allow the admin to view the screening test category and question.	Medium
Intervention Lesson	FR-14	The system shall allow the student to access intervention lesson.	Low
Intervention Management	FR-15	The system shall allow the teacher to create intervention lesson.	Low

	FR-16	The system shall allow the teacher to view intervention lesson.	Low
	FR-17	The system shall allow the teacher to edit intervention lesson.	Low
	FR-18	The system shall allow the teacher to delete intervention lesson.	Low
User Record	FR-19	The system shall allow the admin to view user record.	Medium
	FR-20	The system shall allow the admin to edit user record.	Medium
	FR-21	The system shall allow the admin to search for user record by name.	Medium
	FR-22	The system shall allow the admin to create user record.	Medium
	FR-23	The system shall allow the admin to delete user record.	Medium
	FR-24	The system shall allow the teacher to view the student record, including the student screening result if the test is completed by the student.	Medium
Report	FR-25	The system shall allow the admin and teacher to generate and view report based on the registered users and student screening result.	Medium
Real-time chat message	FR-26	The system shall allow the user to have real-time chat among themselves.	Medium
	FR-27	The system shall allow the user to upload attachments and send to others via chat box.	Medium

	FR-28	The system shall allow the user to change chat customization such as dark mode and chat color.	Medium
--	-------	--	--------

4.2.2 Non-Functional Requirements

Table 5 below shows the non-functional requirements in the web application.

Table 5 The Non-Functional Requirement of the System

ID	Non-Functional Requirements	Quality Requirements	Priority
NFR-01	The system shall allow only registered user to login the system.	Security	High
NFR-02	Different browsers (Mozilla, Chrome) shall be able to use the system.	Portability	High

4.3 Use Case Modelling

4.3.1 Use Case Diagram

Figure 11 shows that use case diagram of the web application. Table 6 shows the use case ID of the functional requirements for the web application that is attached to use case description in Section 4.3.2.

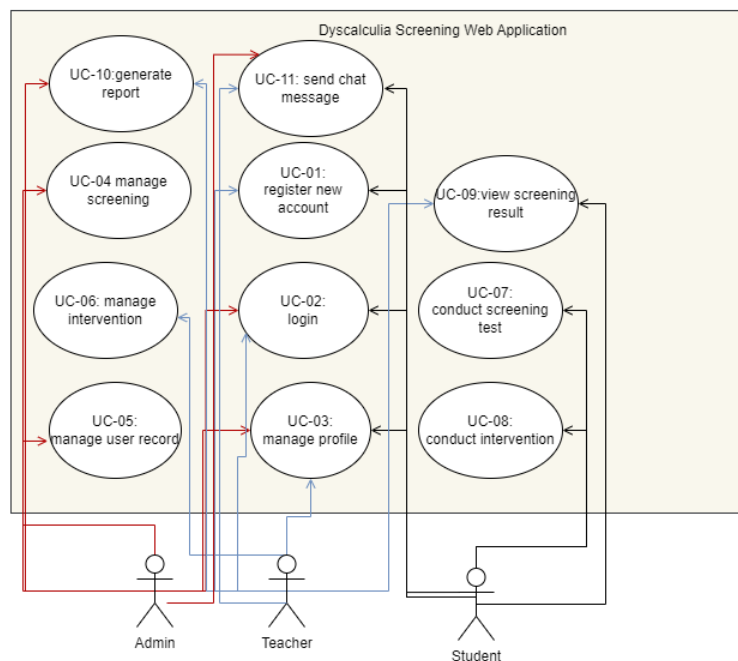


Figure 11 Use Case Diagram

Table 6 Use Case ID of the System Requirement

Use Case ID	Use Case Name	Functional Requirement ID
UC-01	Register new account	FR-01
UC-02	Login	FR-02
UC-03	Manage profile	FR-05, FR-06, FR-07
UC-04	Manage screening	FR-11, FR-12, FR-13, FR-10
UC-05	Manage user record	FR-19, FR-20, FR-21, FR-22, FR-23, FR-24
UC-06	Manage intervention	FR-16, FR-17, FR-18, FR-15
UC-07	Conduct screening	FR-08, FR-09
UC-08	Conduct intervention	FR-14
UC-09	View screening result	FR-24
UC-10	Generate report	FR-25
UC-11	Send chat message	FR-26, FR-27, FR-28

4.3.2 Use Case Descriptions

This section will cover the use case descriptions of all the use cases in Table 5.

1. UC-01 Register new account

Use Case ID	UC-01
Use Case Name	Register new account
Trigger	The user clicks the register button in the index page.
Actors	Teacher/ Student
Pre-condition	The user has not been registered an account.
Post-condition	The user has registered an account.
Main Flow	<ol style="list-style-type: none"> 1. User enters name, email, age, and password and select gender and roles either teacher or student. 2. User clicks register button.

2. UC-02 Login

Use Case ID	UC-02
--------------------	-------

Use Case Name	Login
Trigger	The user clicks the login button in the index page.
Actors	Registered user
Pre-condition	The user has registered an account.
Post-condition	The user can login successfully.
Main Flow	<ol style="list-style-type: none"> 1. User enters email and password. 2. User clicks login button.
Alternative Flow – User forgot password	<ol style="list-style-type: none"> 1. User clicks forgot password. 2. The system redirects to the reset password page. 3. User enters email address and click reset button. 4. The system sends the new password to the user via e-mail.

3. UC-03 Manage profile

Use Case ID	UC-05
Use Case Name	Manage profile
Trigger	The user clicks the profile button.
Actors	Registered user
Pre-condition	The user has been logged into an account.
Post-condition	The user can manage profile successfully.
Main Flow	<ol style="list-style-type: none"> 1. User inputs details to edit profile includes name, age, email and password. 2. User clicks update button. 3. The system displays success message “Profile updated successfully”.

4. UC-04 Manage screening

Use Case ID	UC-04
Use Case Name	Manage screening
Trigger	The admin clicks the screening button from the dashboard.

Actors	Admin
Pre-condition	The admin has logged in an account.
Post-condition	The admin can manage screening successfully.
Main Flow	<ol style="list-style-type: none"> 1. The admin views the test category list. 2. The admin clicks the create button to create a test category. The admin inputs all the input fields and clicks the Create button. The application shows the success message. 3. The admin clicks edit icon to edit the category. The admin updates the category details such as name and description by entering the details in the input field. The application displays a success message. 4. The admin clicks delete icon to delete category. The system displays pop up message “Are you sure to delete?” for confirmation. 5. The admin clicks the show icon to view the category details. 6. The admin clicks on the Test Question navigation tab to navigate to screening page. 7. The admin clicks the Create button to create a question. The admin inputs all the input fields and clicks the Create button. The application shows the success message. 8. The admin clicks edit icon to edit the question. The admin inputs all the input fields and clicks the Update button. The application displays a success message. 9. The admin clicks delete icon to delete category. The system displays pop up message “Are you sure to delete?” for confirmation. 10. The admin clicks the show icon to view the category details.

11. UC-05 Manage user record

Use Case ID	UC-05
Use Case Name	Manage user record

Trigger	The admin clicks the user record button.
Actors	Admin
Pre-condition	The user has logged into an account.
Post-condition	The user can manage profile successfully.
Main Flow	<ol style="list-style-type: none"> 1. The admin views the user record list. 2. The admin clicks the create button to create a new record for the user. 3. The admin clicks the edit icon to edit the user record. The admin updates the user record by entering the details in the input field. 4. The admin clicks the delete icon to delete user record. The system displays pop up message “Are you sure to delete?” for confirmation. 5. The admin clicks show icon to view the user record in detail.

12. UC-06 Manage intervention

Use Case ID	UC-06
Use Case Name	Manage intervention
Trigger	The teacher clicks the intervention button.
Actors	Teacher
Pre-condition	The teacher has logged into an account.
Post-condition	The teacher can manage the intervention successfully.
Main Flow	<ol style="list-style-type: none"> 1. The teacher views the intervention list. 2. The teacher clicks the create button to create a new intervention topic for the student. 3. The teacher clicks the edit icon to edit the intervention content. The teacher updates the intervention by entering the details in the input field.

	<ol style="list-style-type: none"> 4. The teacher clicks the delete icon to delete intervention topic. The system displays pop up message “Are you sure to delete?” for confirmation. 5. The teacher clicks show icon to view the intervention lesson that had been created.
--	--

13. UC-07 Conduct screening

Use Case ID	UC-07
Use Case Name	Conduct screening
Trigger	The student clicks the screening button.
Actors	Student
Pre-condition	The student has logged into an account.
Post-condition	The student can conduct the screening successfully.
Main Flow	<ol style="list-style-type: none"> 1. The application displays the screening test categories and questions. 2. The student starts doing and answering screening test. 3. The student completes the test and clicks the submit button. 4. The application displays the page, saying the test has been taken. 5. The student clicks view t=result button to view the screening result.

14. UC-08 Conduct intervention

Use Case ID	UC-08
Use Case Name	Conduct intervention
Trigger	The student clicks the intervention button.
Actors	Student
Pre-condition	The student has logged into an account.
Post-condition	The student can do the intervention successfully.

Main Flow	<ol style="list-style-type: none"> 1. The student views the intervention lesson topic list from the application. 2. The student clicks one of the show icons to view the selected intervention topic. 3. The student can read, download and print the PDF file uploaded by the teacher.
------------------	--

15. UC-09 View screening result

Use Case ID	UC-09
Use Case Name	View screening result
Trigger	<p>The student clicks the screening button.</p> <p>The teacher clicks the student record button.</p>
Actors	Student / Teacher
Pre-condition	The actor has logged into an account.
Post-condition	The actor can view the screening result successfully.
Main Flow	<ol style="list-style-type: none"> 1. The student clicks view result button from screening page. 2. The teacher selects one student record from the record page to view the student details and the screening result. 3. The application displays the result.

16. UC-10 Generate report

Use Case ID	UC-10
Use Case Name	Generate report
Trigger	The actor clicks the report button
Actors	Admin/Teacher
Pre-condition	The actor has logged into an account.
Post-condition	The actor can view report successfully.
Main Flow	<ol style="list-style-type: none"> 1. The system redirects to report page.

	2. The system displays the report in the form of charts and table based on the registered users and student screening result.
--	---

17. UC-11 Send chat message

Use Case ID	UC-11
Use Case Name	Send chat message
Trigger	The actor clicks chat button
Actors	User
Pre-condition	The user has logged into an account.
Post-condition	The user can generate report successfully.
Main Flow	<ol style="list-style-type: none"> 1. The actor inputs the message and clicks the send button. 2. The actor uploads attachments and clicks the send button. 3. The actor clicks the setting icon to make chat customization. The actor chooses the chat color and clicks save changes button. 4. The application displays the chat page with selected chat color. 5. The actor clicks delete conversation to clear the conversation history.

4.4 Activity Diagram

This section will show the activity diagram of the use case listed in the Table 6 in Section 4.3.1.

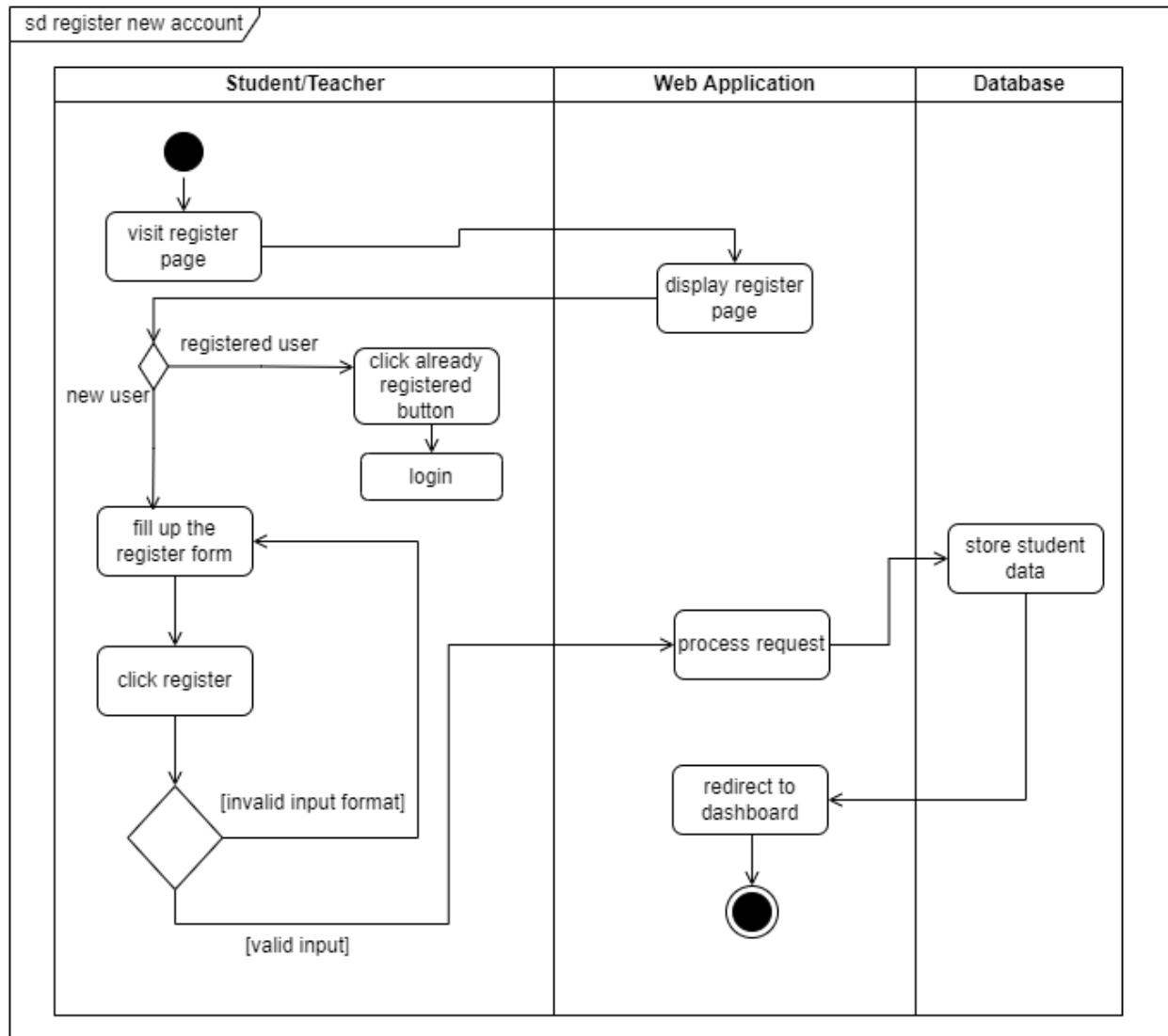


Figure 12 Activity Diagram for UC-01 Register new account

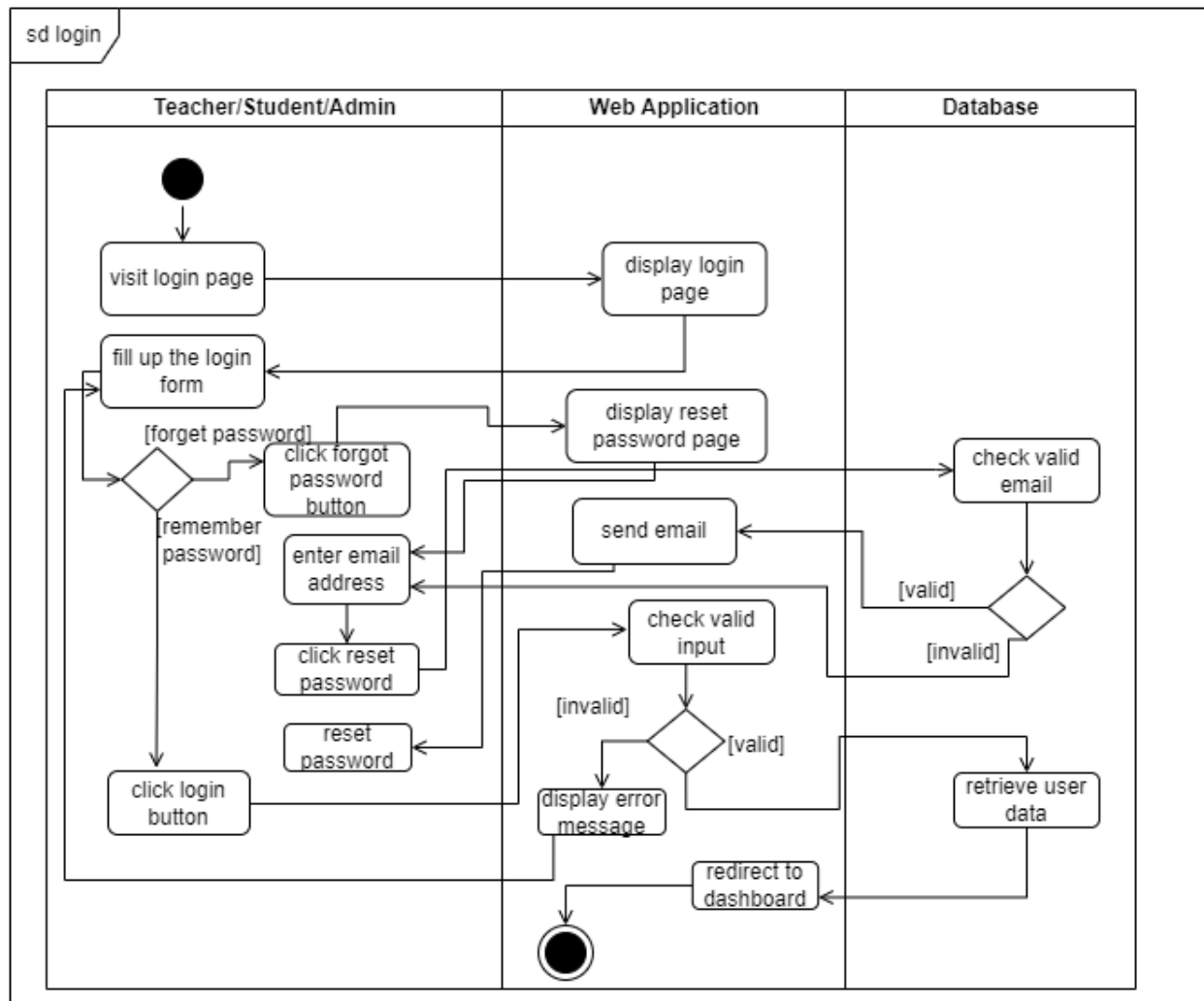


Figure 13 Activity Diagram for UC-02 Login

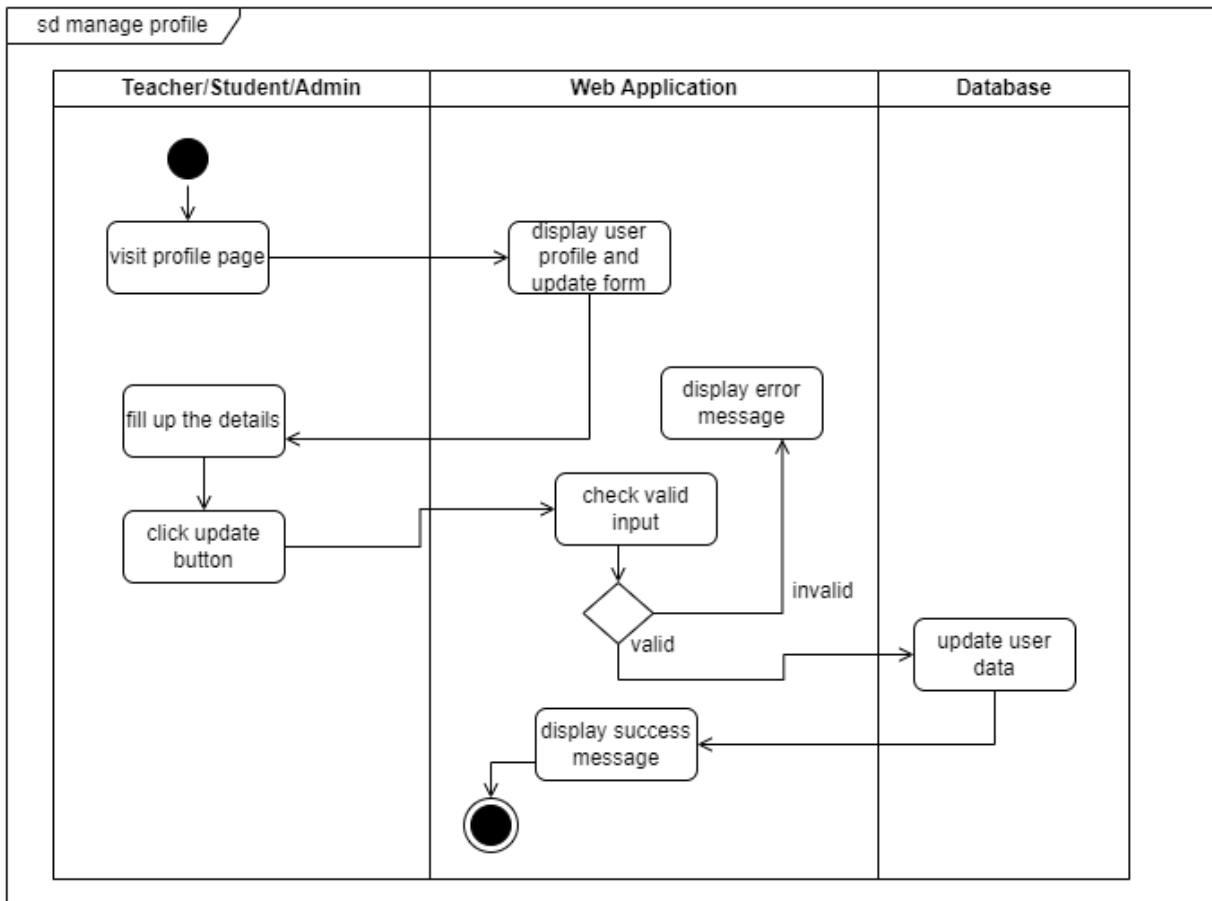


Figure 14 Activity Diagram for UC-03 Manage profile

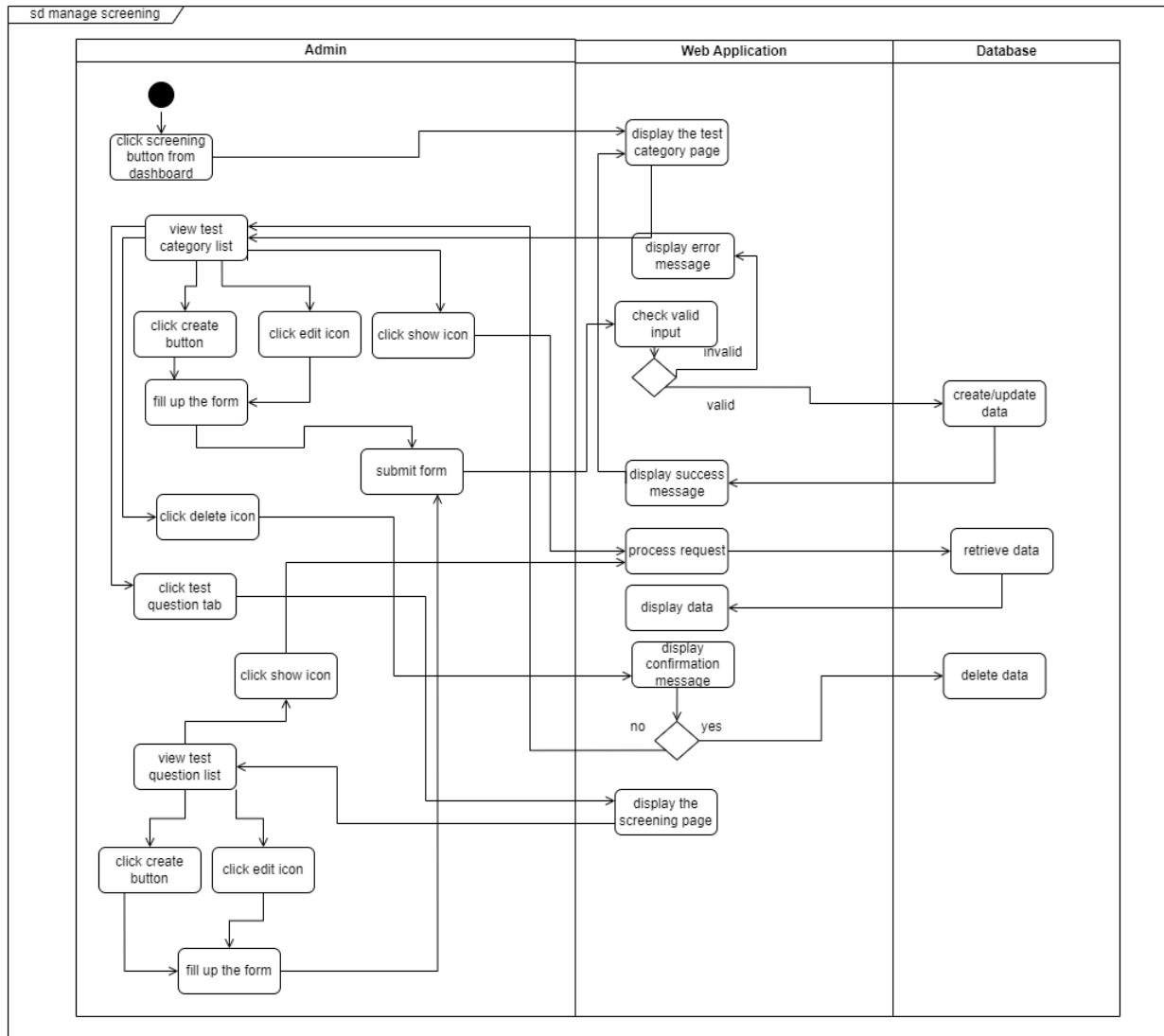


Figure 15 Activity Diagram for UC-04 Manage screening

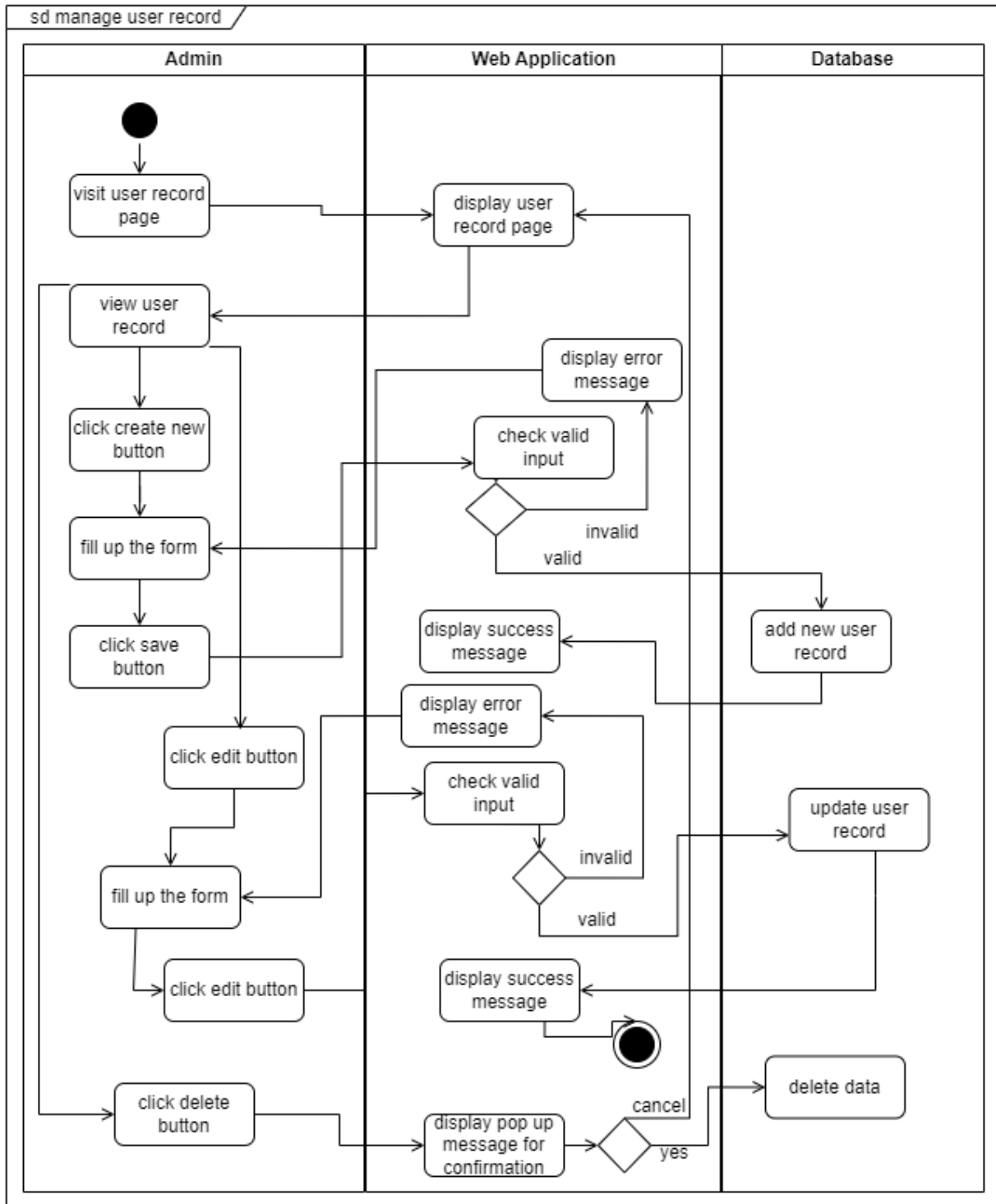


Figure 16 Activity Diagram for UC-05 Manage user record

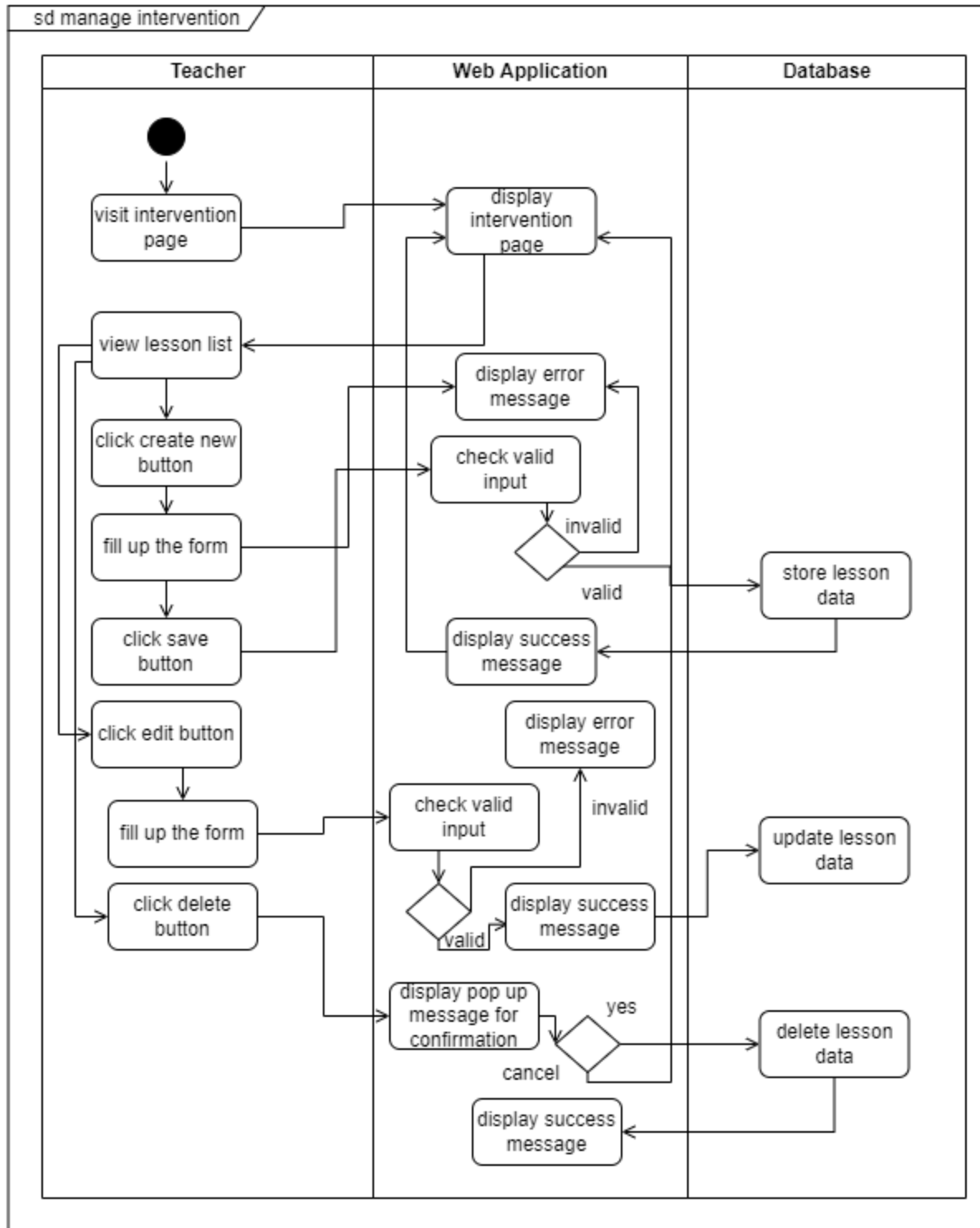


Figure 17 Activity Diagram for UC-06 Manage intervention

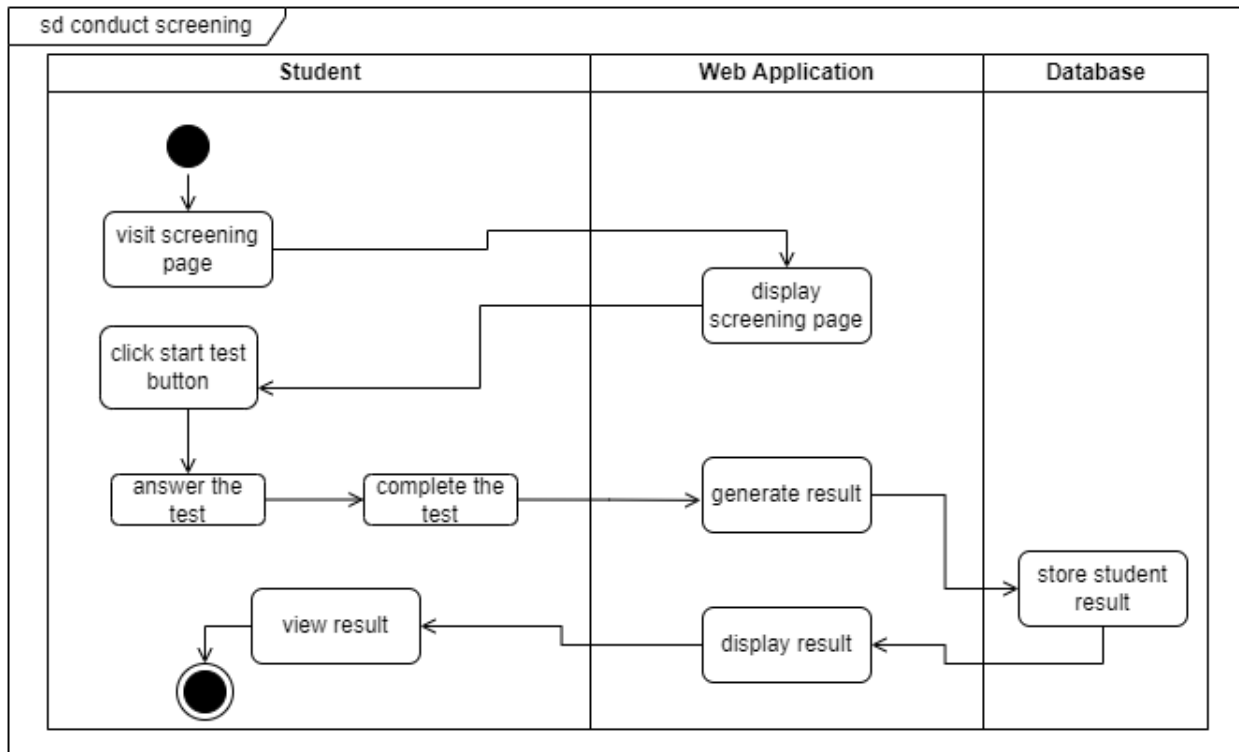


Figure 18 Activity Diagram for UC-07 Conduct screening

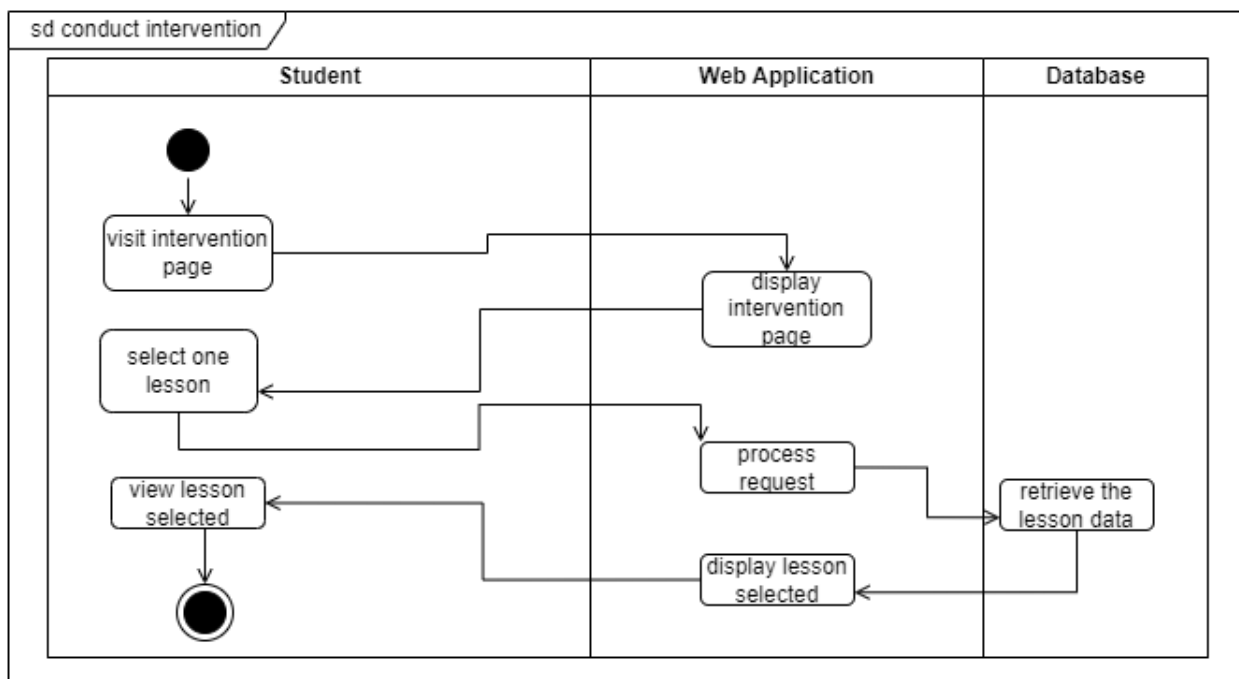


Figure 19 Activity Diagram for UC-08 Conduct intervention

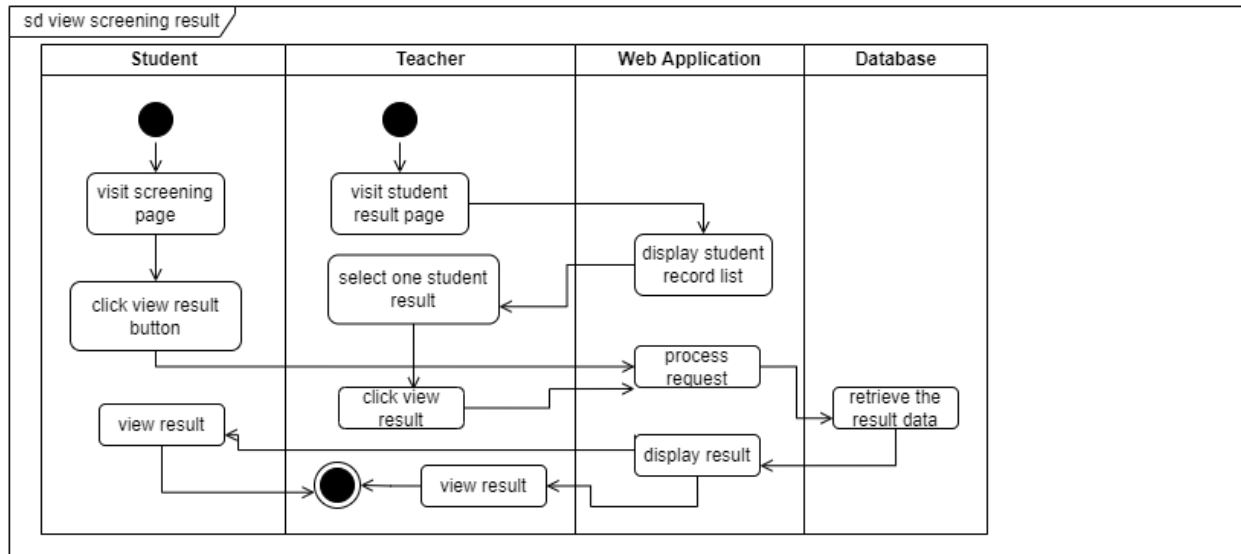


Figure 20 Activity Diagram for UC-09 View screening result

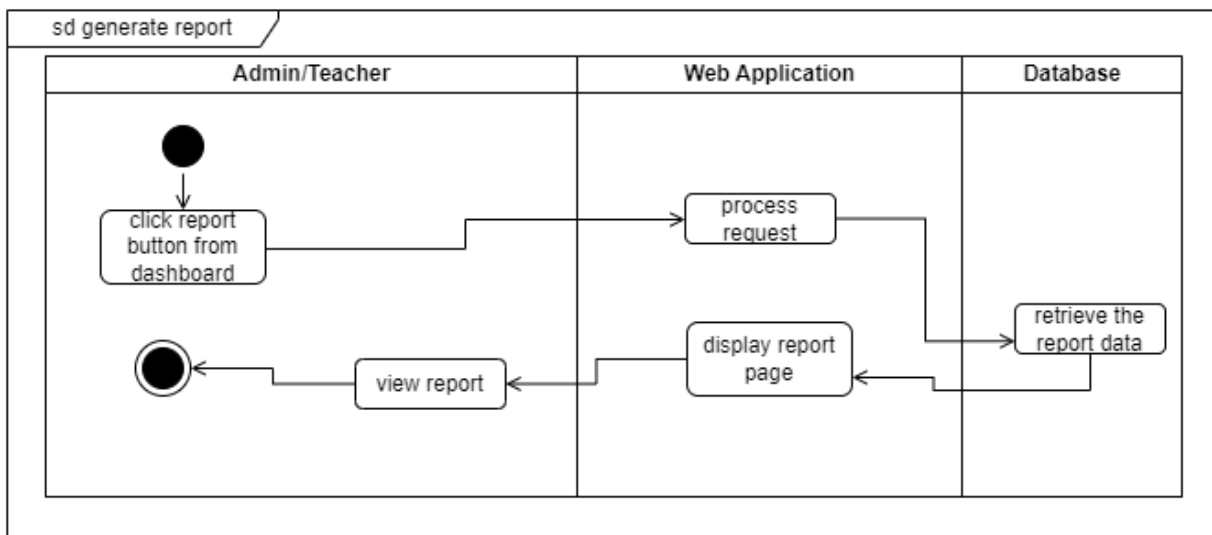


Figure 21 Activity Diagram for UC-10 Generate report

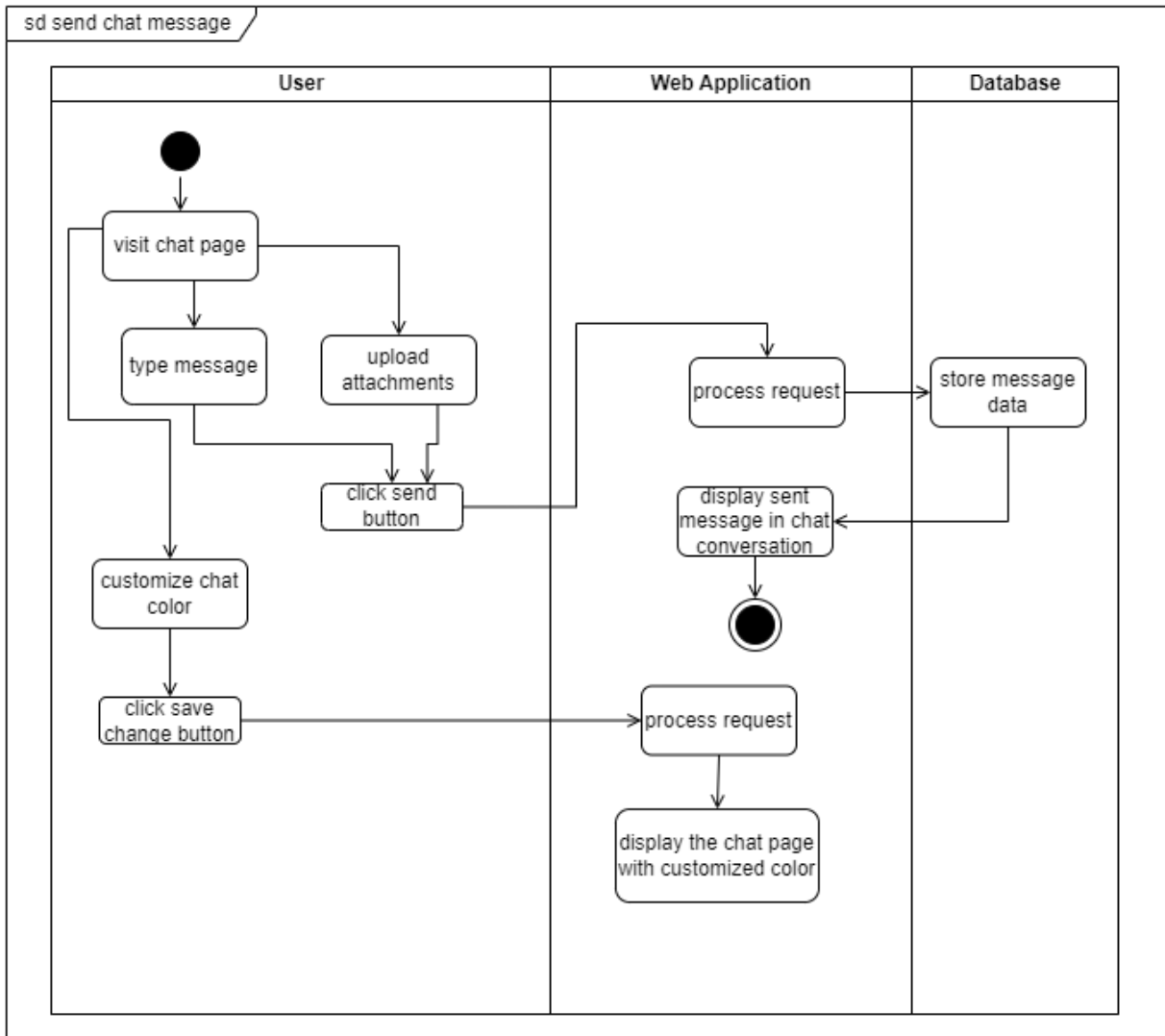


Figure 22 Activity diagram for UC-11 Send chat message

4.5 Entity-Relationship Diagram

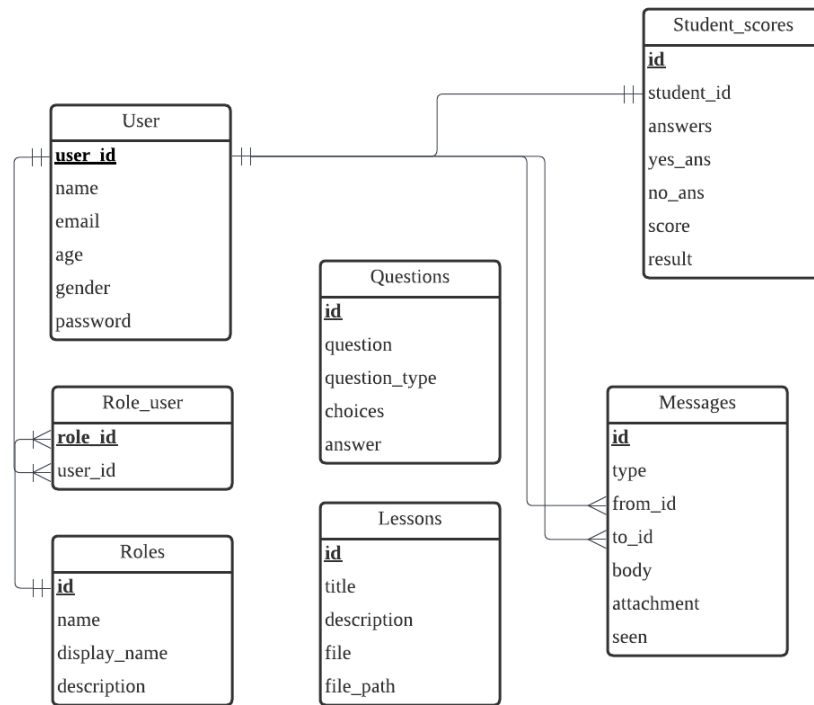


Figure 23 Entity-Relationship Diagram

4.6 Architecture Diagram

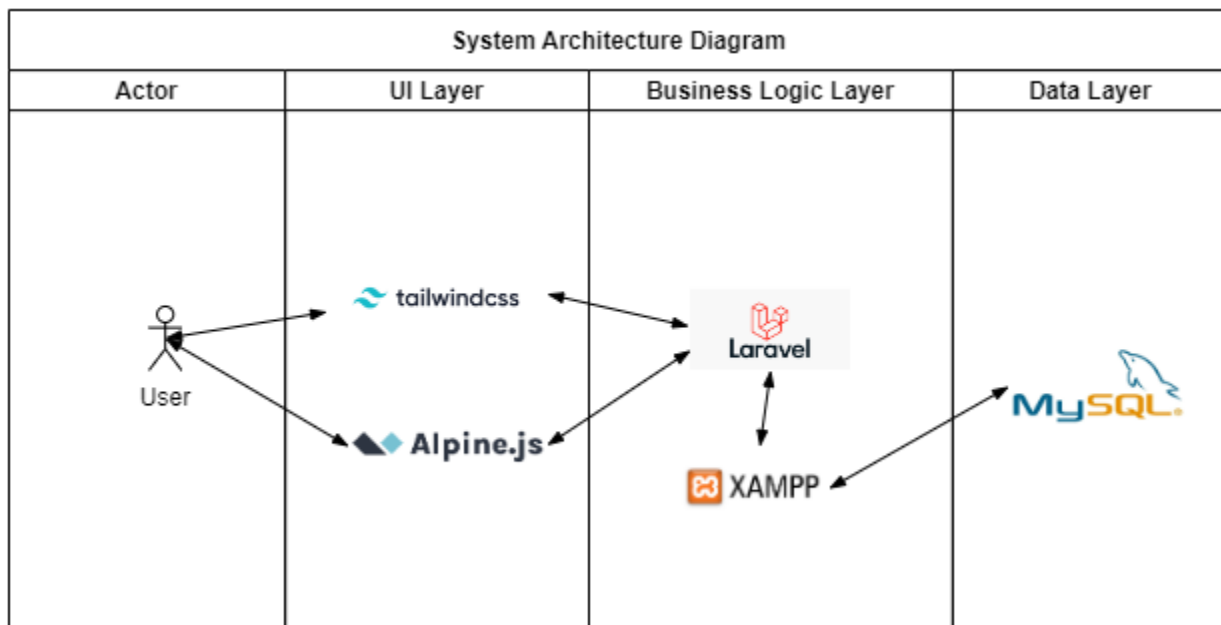


Figure 24 Architecture Diagram

4.7 User Interface Mock-up

The mock up is designed using Figma. The following are the links of the mock up:

1. Admin

<https://www.figma.com/proto/A28ORdgH7j1DXPLDCaw8LH/fyp?node-id=694%3A707&scaling=scale-down&page-id=578%3A284&starting-point-node-id=694%3A707&show-proto-sidebar=1>

2. Teacher

<https://www.figma.com/proto/A28ORdgH7j1DXPLDCaw8LH/fyp?node-id=810%3A175&scaling=scale-down&page-id=810%3A62&starting-point-node-id=810%3A175&show-proto-sidebar=1>

3. Student

<https://www.figma.com/proto/A28ORdgH7j1DXPLDCaw8LH/fyp?node-id=714%3A280&scaling=scale-down&page-id=714%3A266&starting-point-node-id=714%3A280&show-proto-sidebar=1>

Chapter 5: System Development

5.1 Technical Implementation

5.1.1 Preparation

A checklist is used to list down all required resources to make sure the implementation process can be conducted smoothly.

Table 7 Resources Required for System Development

Resources	Result
Development Hardware	
Laptop	/
Development Machine - Laptop	
CPU Performance	/
Memory Capacity	/
Storage Capacity	/
Graphic Card Performance	/
Development Software / Platform	
Visual Studio Code	/
Github	/
Xampp	/
Cloudways	/

5.1.2 System Development Tools Specification

The table below shows the hardware specification of the laptop that is used in the system implementation.

Table 8 Hardware Specification

Component	Description
Processor	1.6GHz quad-core Intel Core i5
Memory (RAM)	4GB
Graphic Card	Intel UHD Graphics 620
Storage Space	256GB SSD

The table below shows the software development tools used in the system implementation.

Table 9 Software Development Tools

Component	Description
Operating System	Window
Code Editor	Visual Studio Code
Version Control	GitHub
Web Server	XAMPP
Internet Browser	Google Chrome
Deployment Tool	Cloudways
UML Diagram	Lucichart, draw.io
Mock Up	Figma

5.1.3 System Development Process and Experience

Environment setup

To set up a Laravel environment, I need to have a web server, PHP, and a relational database management system (RDBMS) installed on my machine. The most common RDBMS used with Laravel is MySQL.

Here is a step-by-step guide to setting up a Laravel environment on local machine for development purposes:

1. Install a web server: Apache is included in the XAMPP package, which is a simple way to install and run a complete web server environment on the local machine.
2. Install PHP: PHP version 8.1.5 is installed on my machine and downloaded from the official website (<https://windows.php.net/download/>).
3. Install a relational database management system: MySQL is installed and downloaded from the official website (<https://dev.mysql.com/downloads/mysql/>). A graphical user interface (GUI) tool such as phpMyAdmin is used to create database.

4. Install Composer: Composer is a package manager for PHP and is used to install Laravel and its dependencies. Composer is installed and downloaded from the official website (<https://getcomposer.org/download/>).
5. Install Laravel: After installing Composer, Laravel is installed using the following command: `composer create-project --prefer-dist laravel/laravel dyscalculia`.
6. Configure the environment: The environment is configured by setting the database credentials and other environment variables in the .env file.
7. Run the application: The Laravel application can be run by the following command to start the Laravel development server: `php artisan serve`. Then, open the web browser and access the Laravel application by visiting <http://localhost:8000>.

Development process

Laravel is a PHP web framework for building web applications. The code in Laravel is written in PHP and follows the Model-View-Controller (MVC) architectural pattern. During the development process, the database is created using migrations in Laravel which includes creating tables, relationships, and indexes. The Eloquent ORM is used to interact with the database while blade templating engine is used to create views. The routing is used to define the URLs for the Laravel application. In Laravel, the controller is a PHP class that handles HTTP requests and performs actions on the data. Controllers are responsible for processing user input, making decisions based on that input, and returning appropriate responses.

Deployment

The Dyscalculia Screening Web Application is deployed using the Cloudways. After signing up and logging in to the Cloudways platform. A new server is launched and accessed. Next, a new Laravel application is created according to the Laravel version used. The application is uploaded using the GitHub. The code is pushed to the Git repository to be deployed via Cloudways. The environment is also configured by setting the environment variables required by the application, such as the database connection details. The database is created and migrations are run. Once the deployment is completed, the application is launched by going to the URL provided by Cloudways.

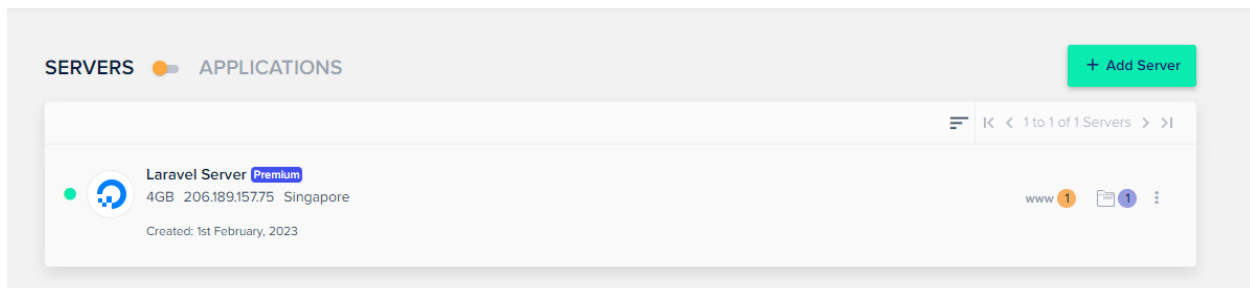


Figure 25 The Laravel Server is launched

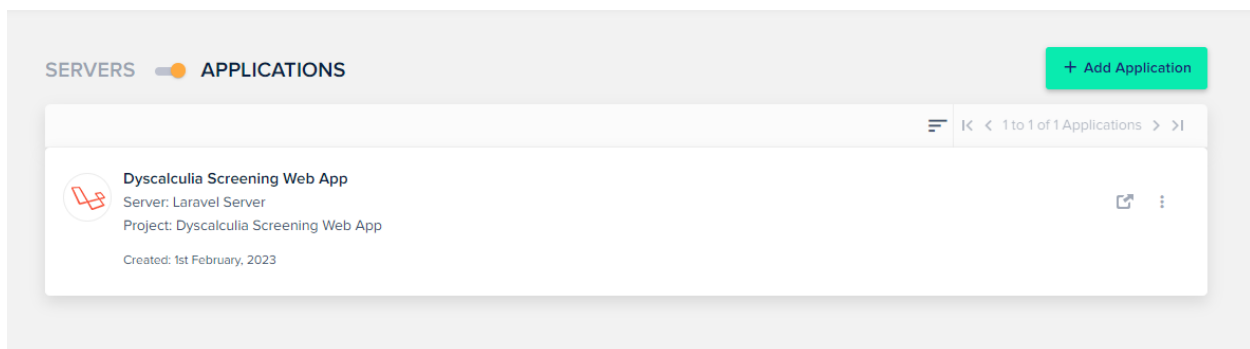


Figure 26 The Dyscalculia Screening Web App is added and created from the Laravel Server

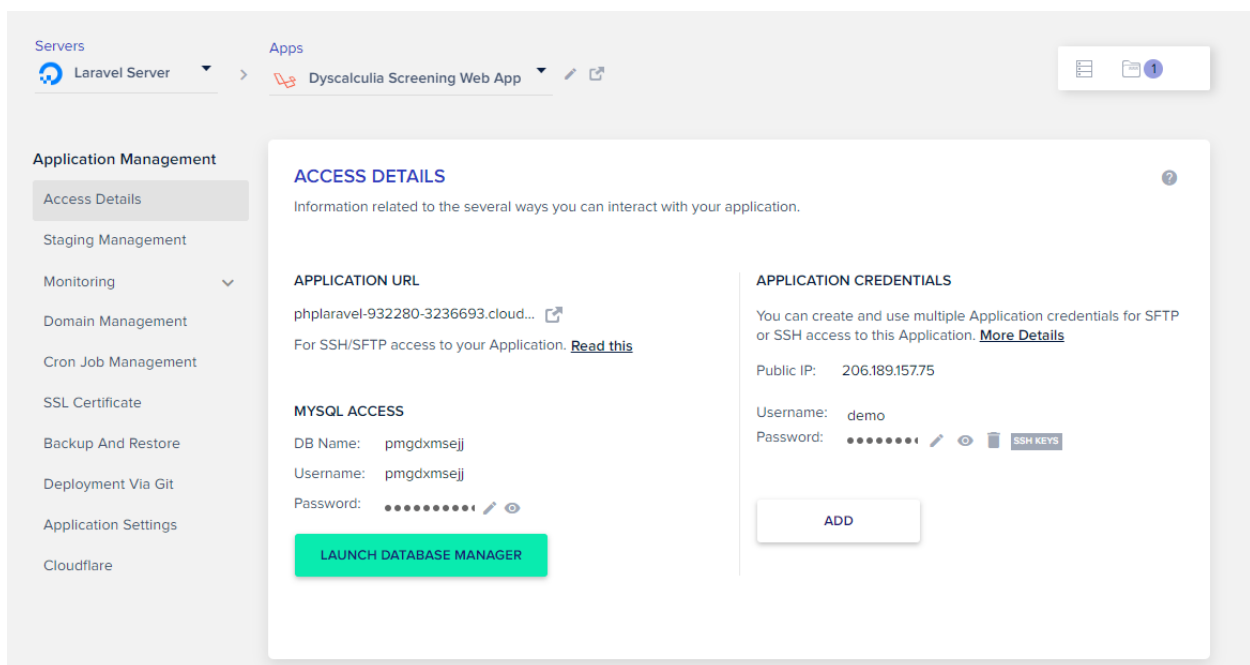


Figure 27 The Access Details for the App

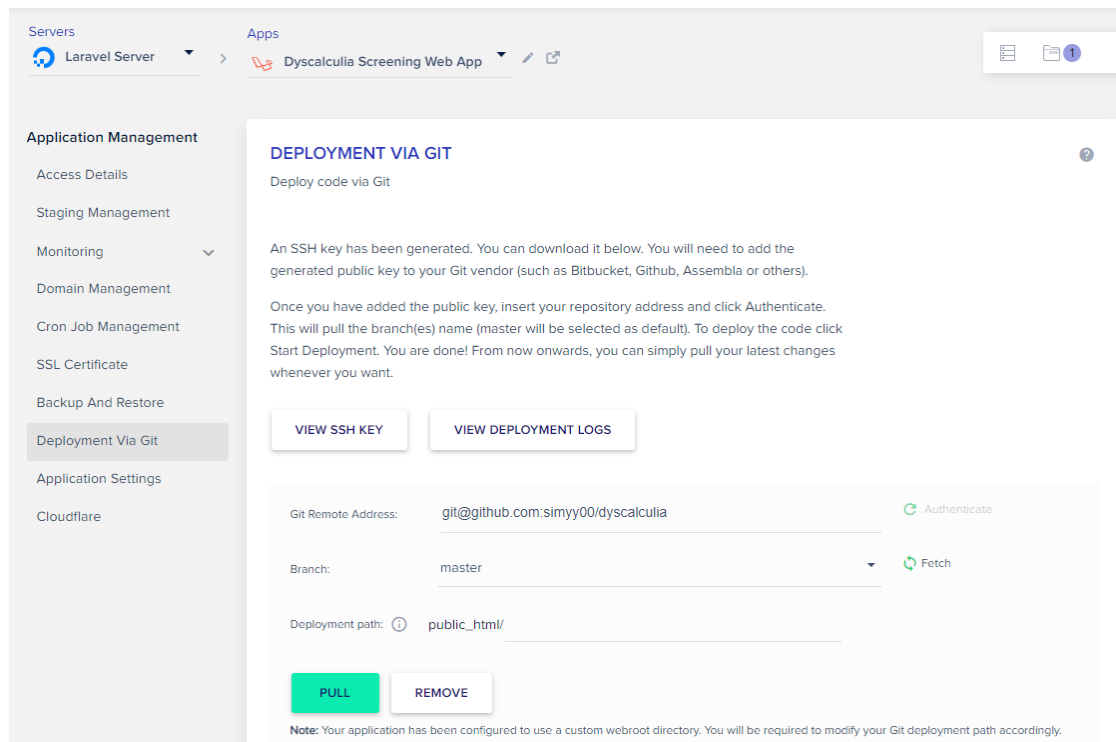


Figure 28 The GitHub Repository for Deployment

5.2 User Interface and/or User Experience

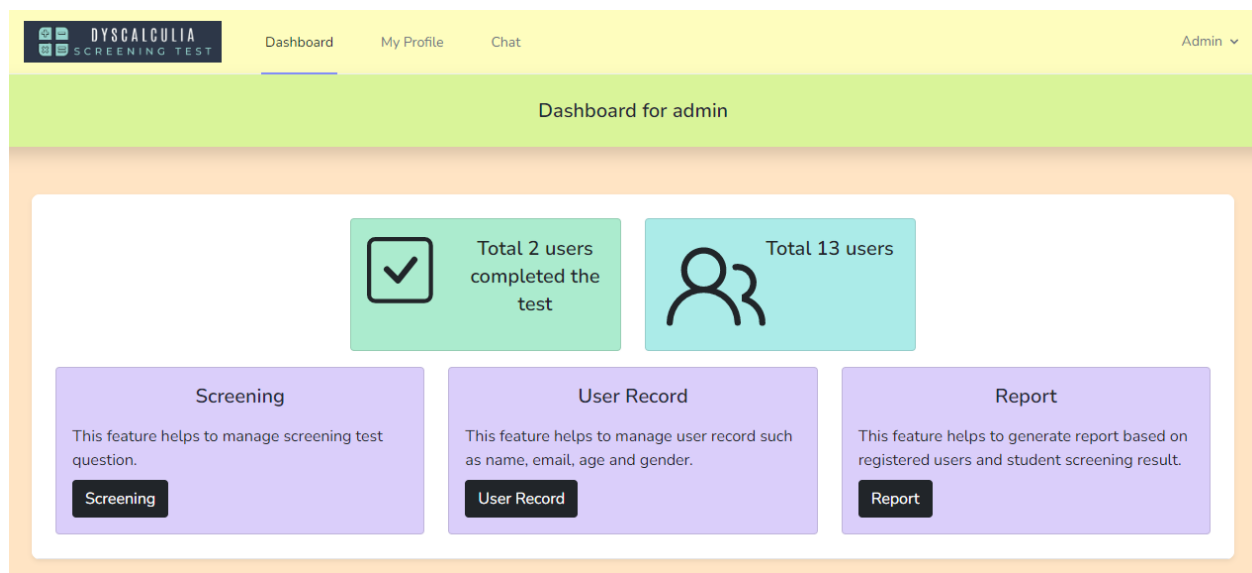


Figure 29 The UI for Admin Dashboard

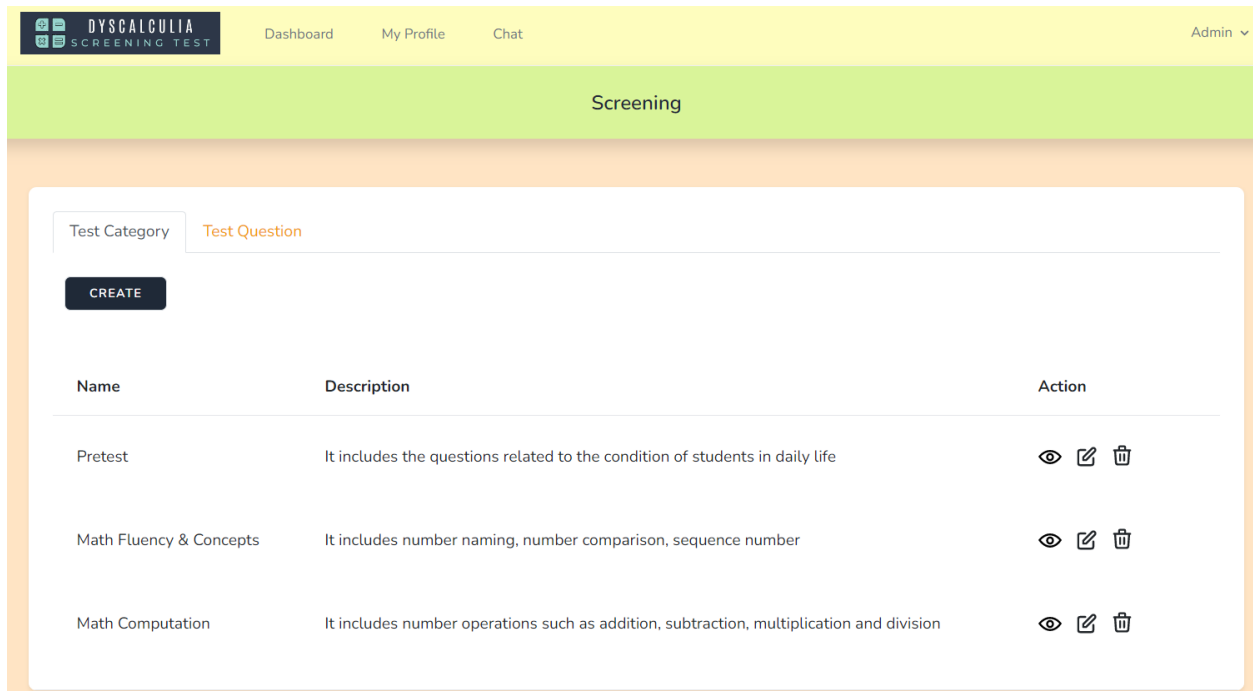


Figure 30 The UI of Test Category List

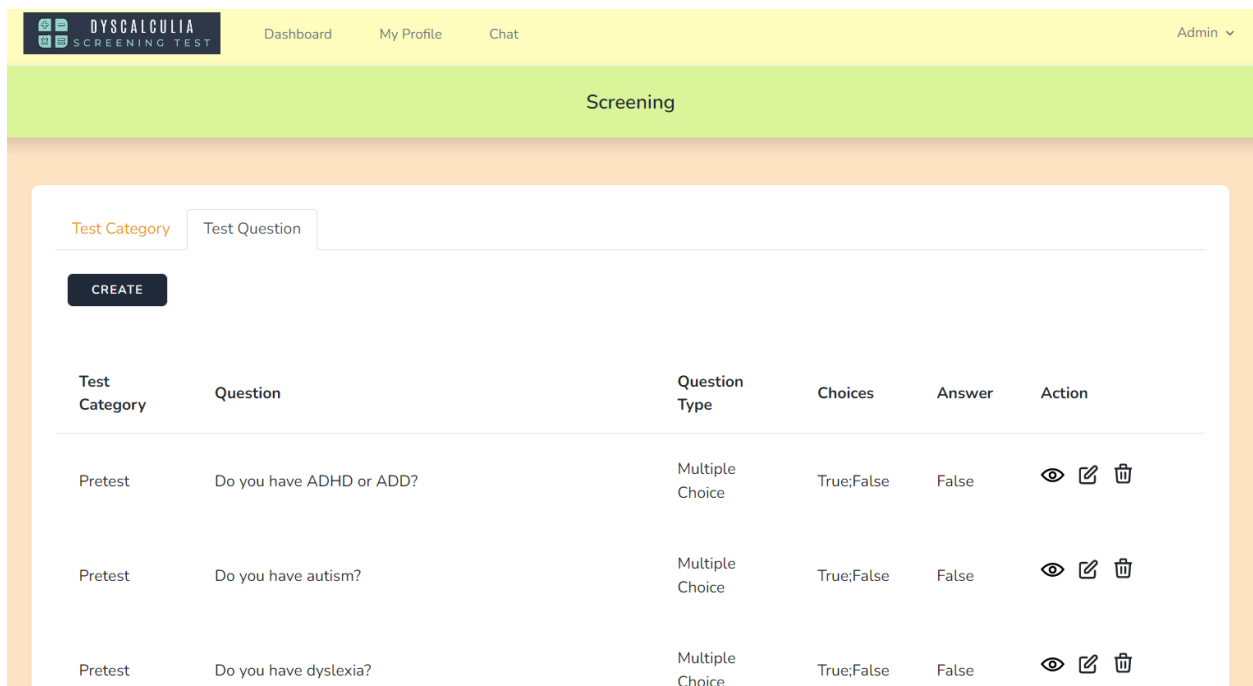


Figure 31 The UI for the List of Screening Questions

DYS CALCULIA
SCREENING TEST

DashboardMy ProfileChatAdmin

Screening

Create Screening

Question

Question Type

-Select a question type-

Choices

Answer

BACKCREATE

Figure 32 The UI of Create Screening Question

DYS CALCULIA
SCREENING TEST

DashboardMy ProfileChatAdmin

Screening

Edit Screening

Question

3+6 =?

Question Type

Multiple Choice

Choices (input format eg: 1;2;2;4)

6;7;8;9

Answer

9

UPDATE

RETURN

Figure 33 The UI of Edit Screening Question

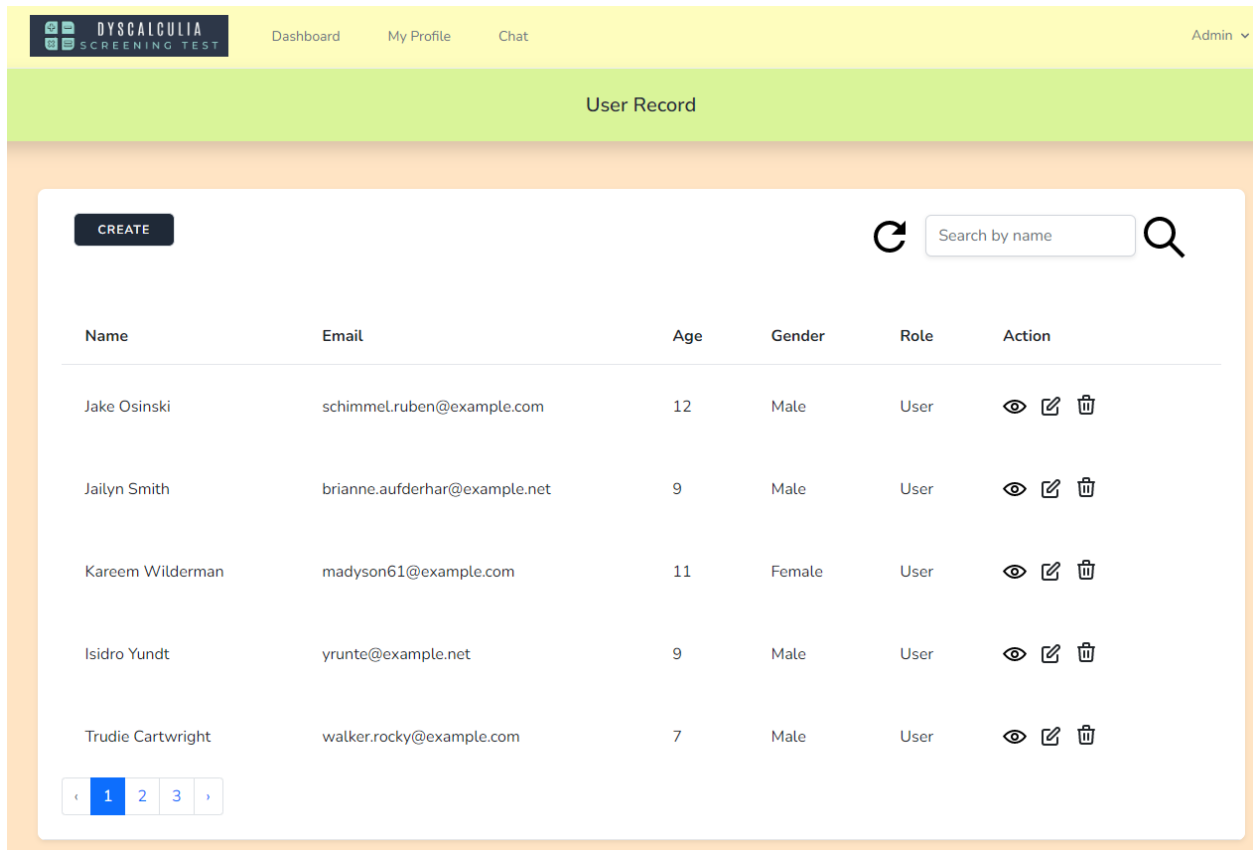


Figure 34 The UI for the List of User Record

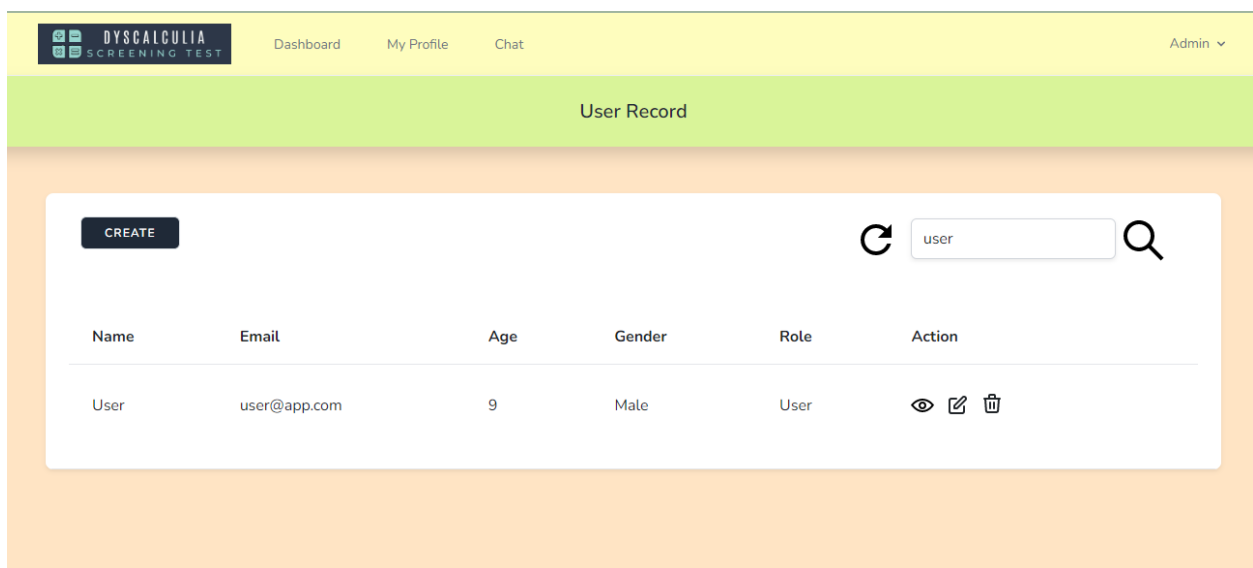


Figure 35 The UI for the Search Result of User Record by Admin with Username

The screenshot shows the 'Create User Record' form within the 'User Record' section of the 'DYS CALCULIA SCREENING TEST' application. The form is centered on a light orange background. It includes input fields for Name, Email, Age, Password, and a dropdown for Gender (set to 'Female'). There is also a dropdown for 'Register as:' (set to 'Student') and a 'CREATE' button at the bottom.

Header: DYS CALCULIA SCREENING TEST | Dashboard | My Profile | Chat | Admin ▾

Section: User Record

Create User Record

Name:

Email:

Age:

Gender: ▾

Password:

Register as: ▾

Figure 36 The UI of Create User Record

The screenshot shows the 'Edit User Record' form within the 'User Record' section of the 'DYS CALCULIA SCREENING TEST' application. The form is centered on a light orange background. It includes input fields for Name (pre-filled with 'Jake Osinski'), Email (pre-filled with 'schimmelLruben@example.com'), Age (pre-filled with '12'), and a dropdown for Gender (set to 'Male'). There are 'UPDATE' and 'RETURN' buttons at the bottom.

Header: DYS CALCULIA SCREENING TEST | Dashboard | My Profile | Chat | Admin ▾

Section: User Record

Edit User Record

Name:

Email:

Age:

Gender: ▾

Figure 37 The UI of Edit User Record

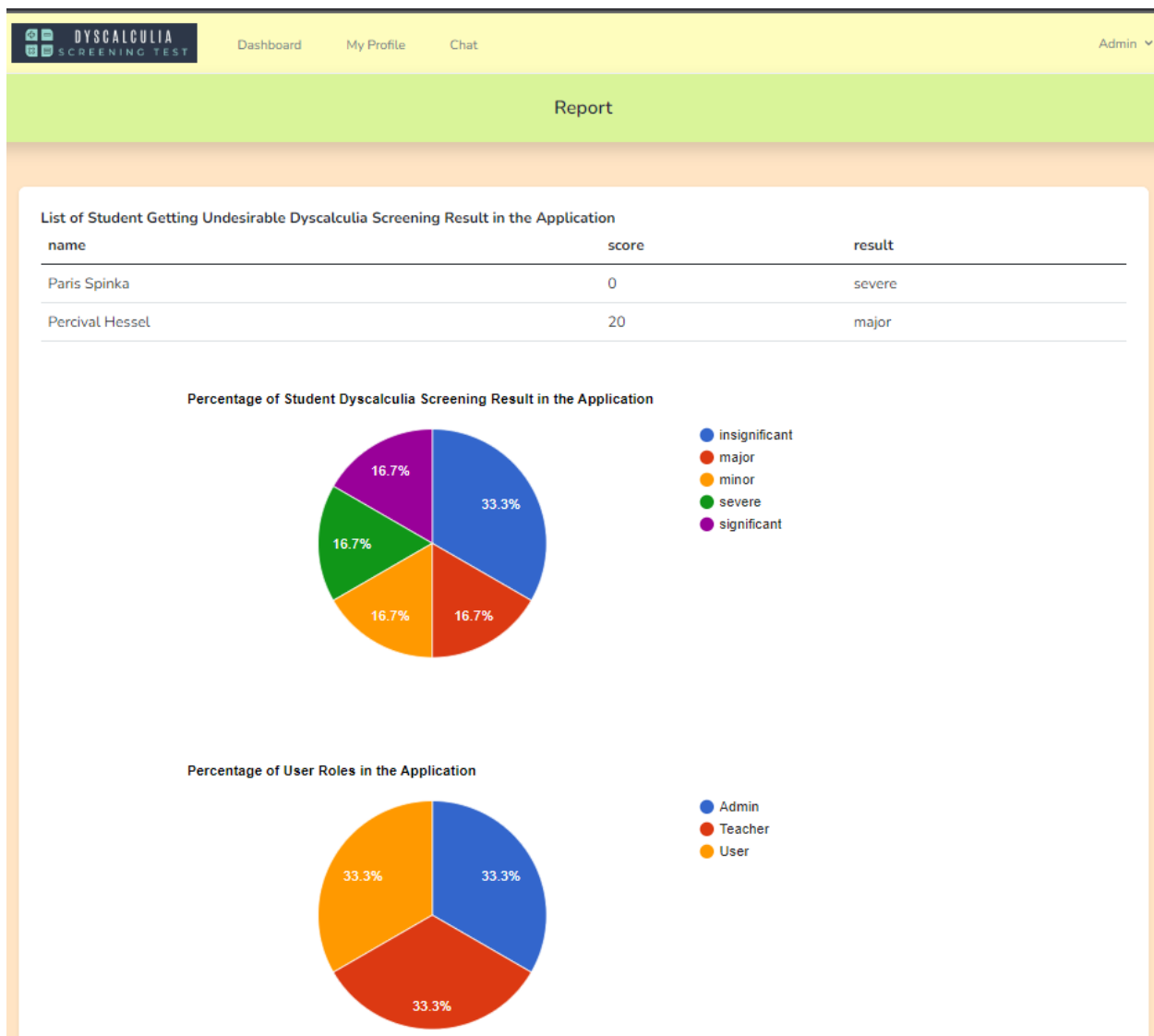


Figure 38 The UI of Report

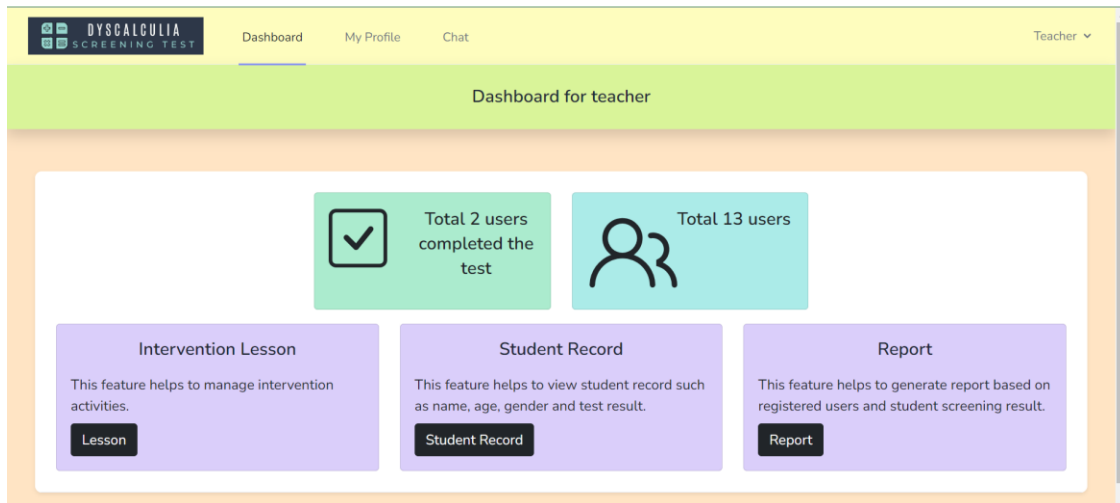


Figure 39 The UI of Teacher Dashboard

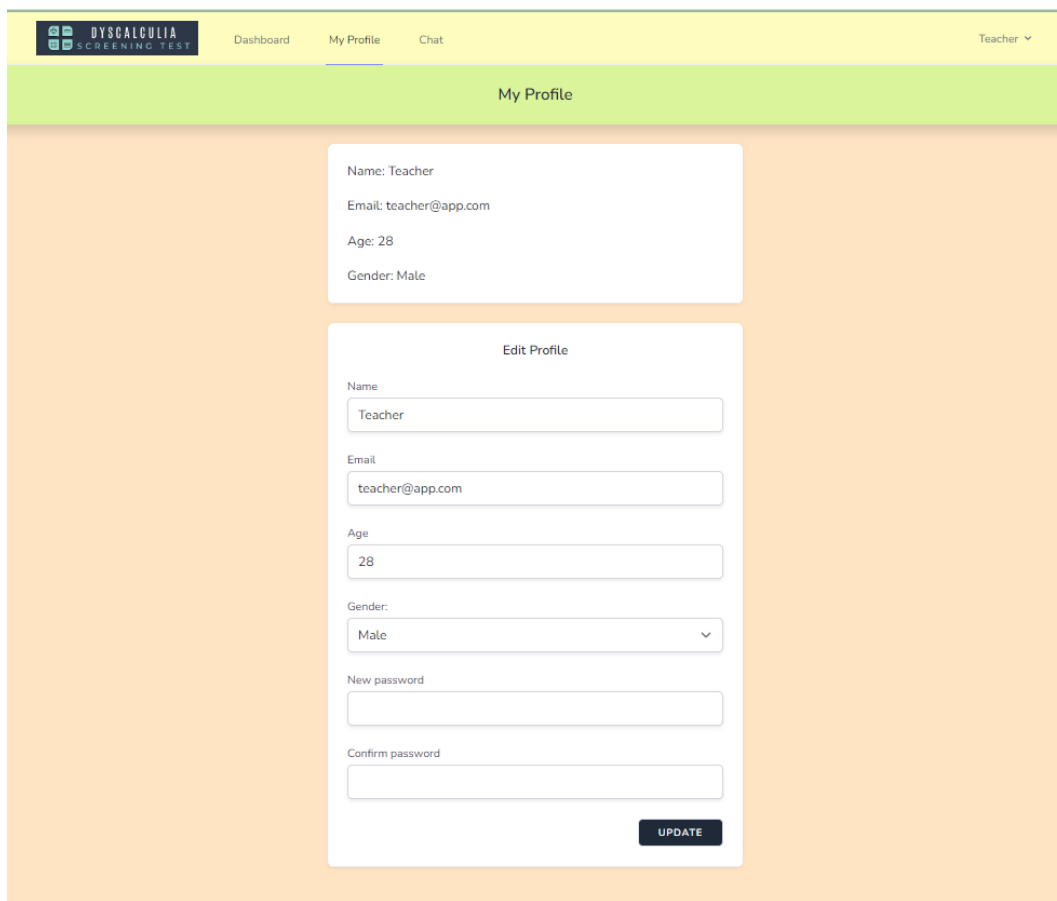


Figure 40 The User Profile Page

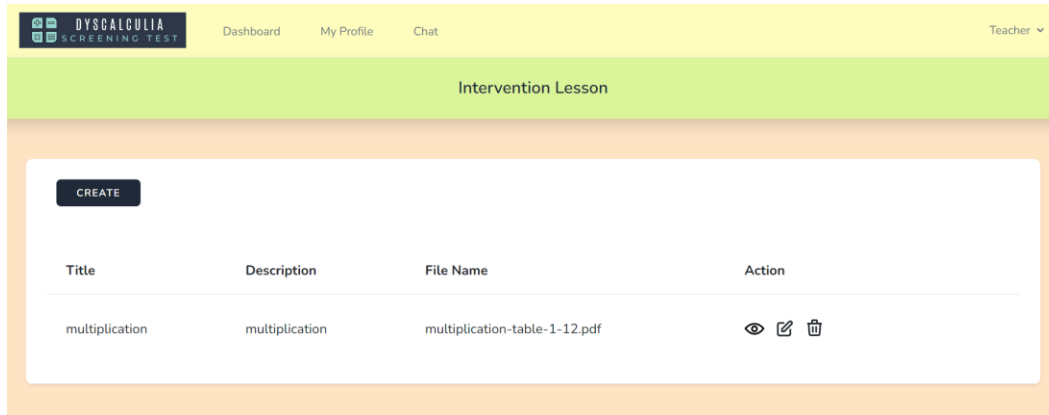


Figure 41 The UI for Intervention

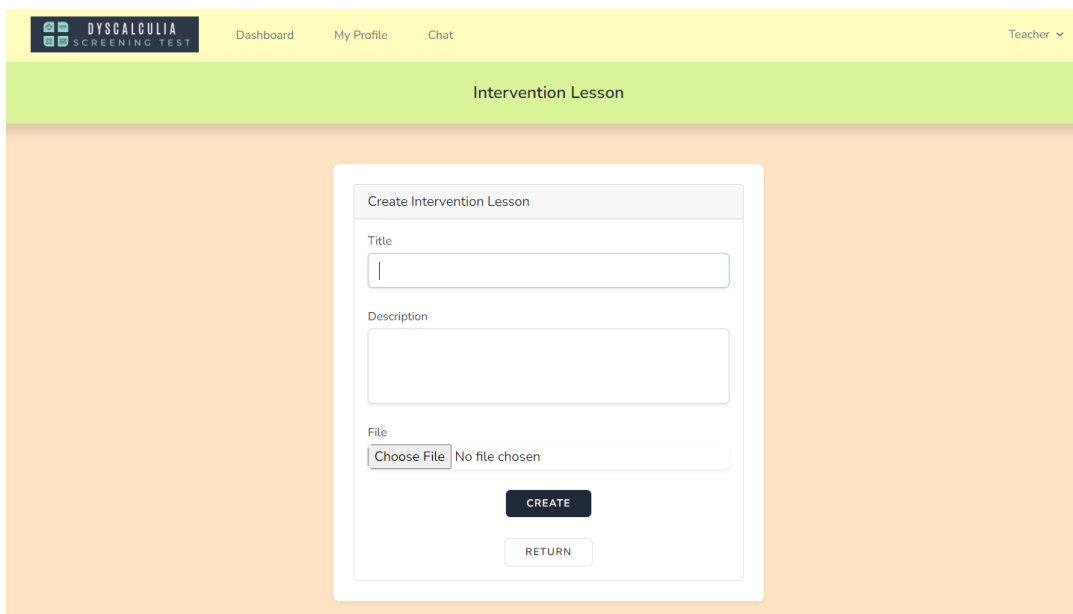


Figure 42 The UI of Create Intervention Lesson

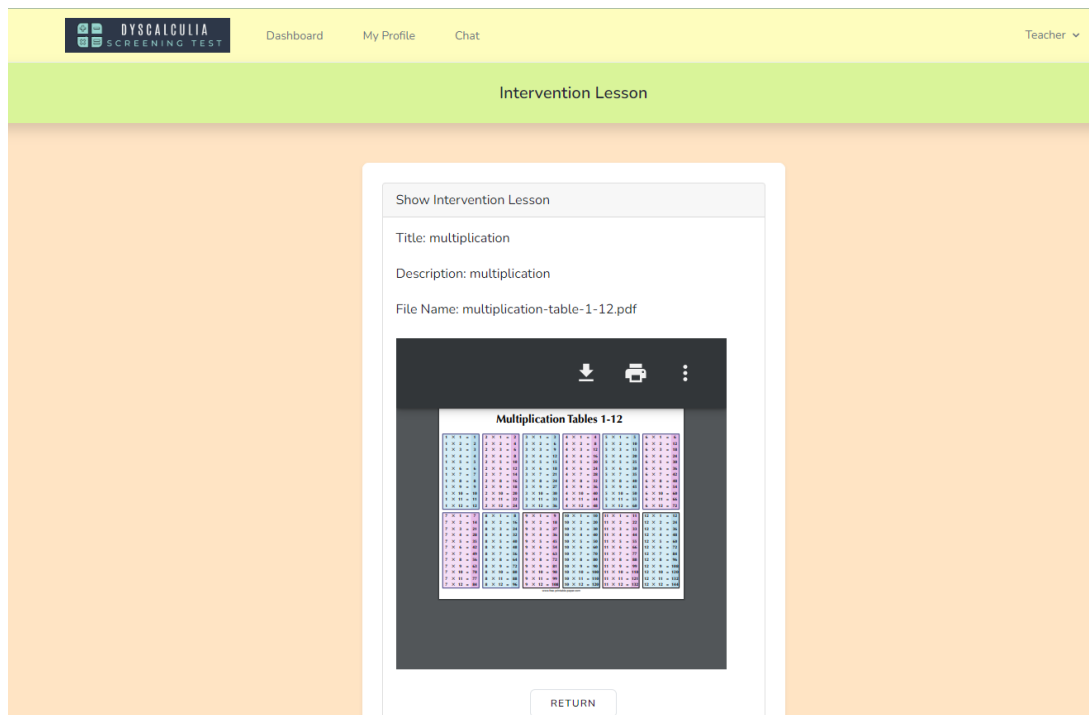


Figure 43 The UI of Show Intervention Lesson

DYSCALCULIA

SCREENING TEST

Dashboard

My Profile

Chat

Teacher

Intervention Lesson

Edit Intervention Lesson

Title

multiplication

Description

multiplication

File

Multiplication Tables 1-12

Choose File

No file chosen

UPDATE

RETURN

Figure 44 The UI of Edit Intervention Lesson

phplaravel-932280-3236693.cloudwaysapps.com/lesson

TRUM V3 03

FSKTM-Ilmiah

Welcome to Univer...

YouCode

New chat

DYSCALCULIA

SCREENING TEST

Dashboard

My P

phplaravel-932280-3236693.cloudwaysapps.com says

Are you sure to delete this item?

OK

Cancel

Intervention Lesson

CREATE

Title	Description	File Name	Action
multiplication	multiplication	multiplication-table-1-12.pdf	

Figure 45 The UI of Delete Intervention Lesson

Name	Email	Age	Gender	Role	Action
User	user@app.com	9	Male	Student	
Jake Osinski	schimmelRuben@example.com	12	Male	Student	
Jailyn Smith	brianne.aufderhar@example.net	9	Male	Student	
Kareem Wilderman	madyson61@example.com	11	Female	Student	
Isidro Yundt	yrunte@example.net	9	Male	Student	

Page 1 of 3

Figure 46 The UI of Student Record List

Show User Record

Name: User

Email: user@app.com

Age: 9

Gender: Male

Result of screening test:

Date completed	2023-02-01 20:34:38
Correct answer	9
Wrong answer	1
Score	90

The result of the student indicates that the student is highly possible of having **insignificant** dyscalculia level.

RETURN

Figure 47 The Show Student Record Page Including Screening Result to be viewed by Teacher

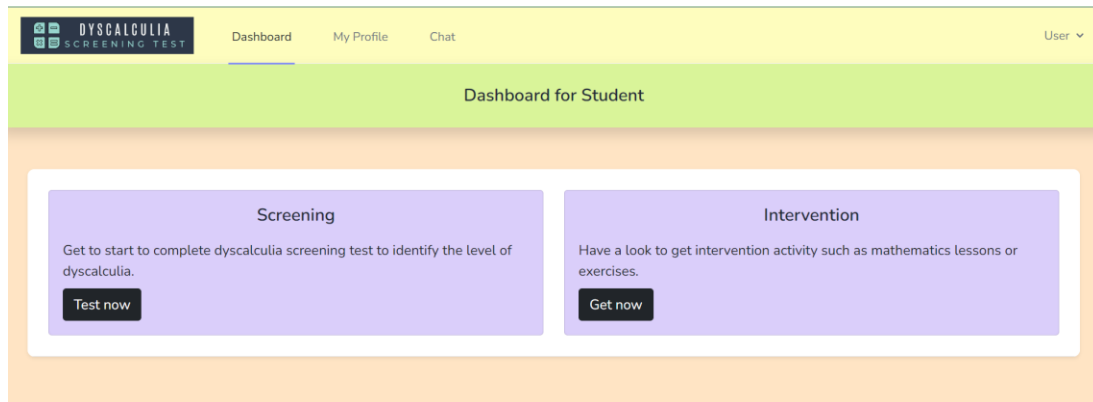


Figure 48 The UI of Student Dashboard

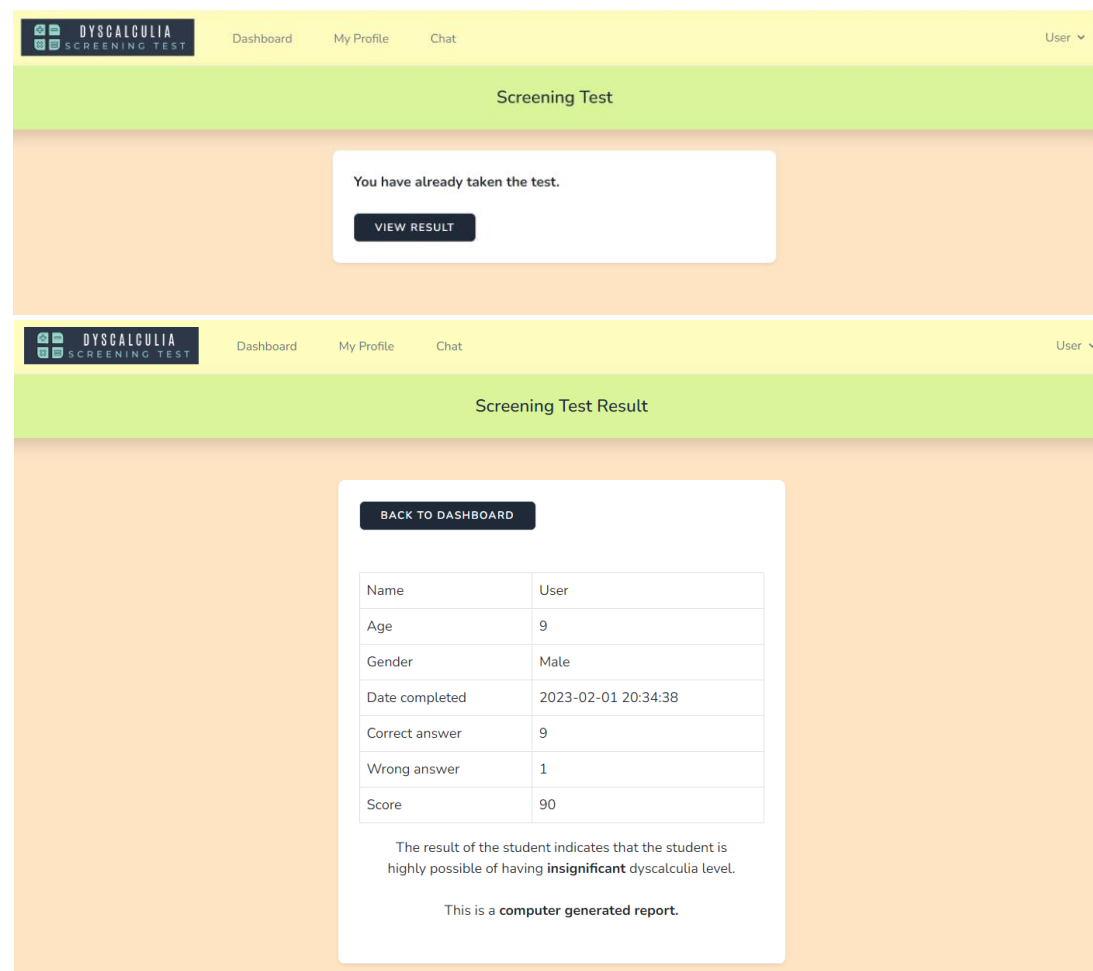


Figure 49 The Student Screening Result Page

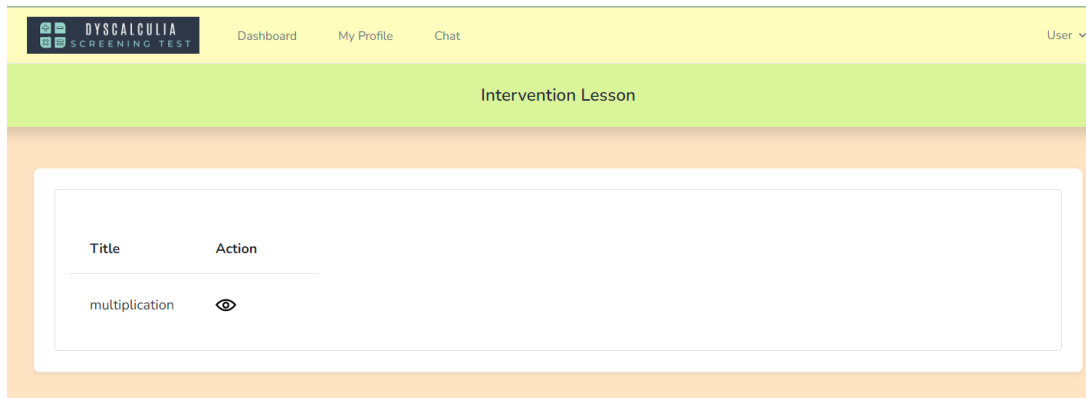


Figure 50 The UI of the List of Intervention Lesson for Student

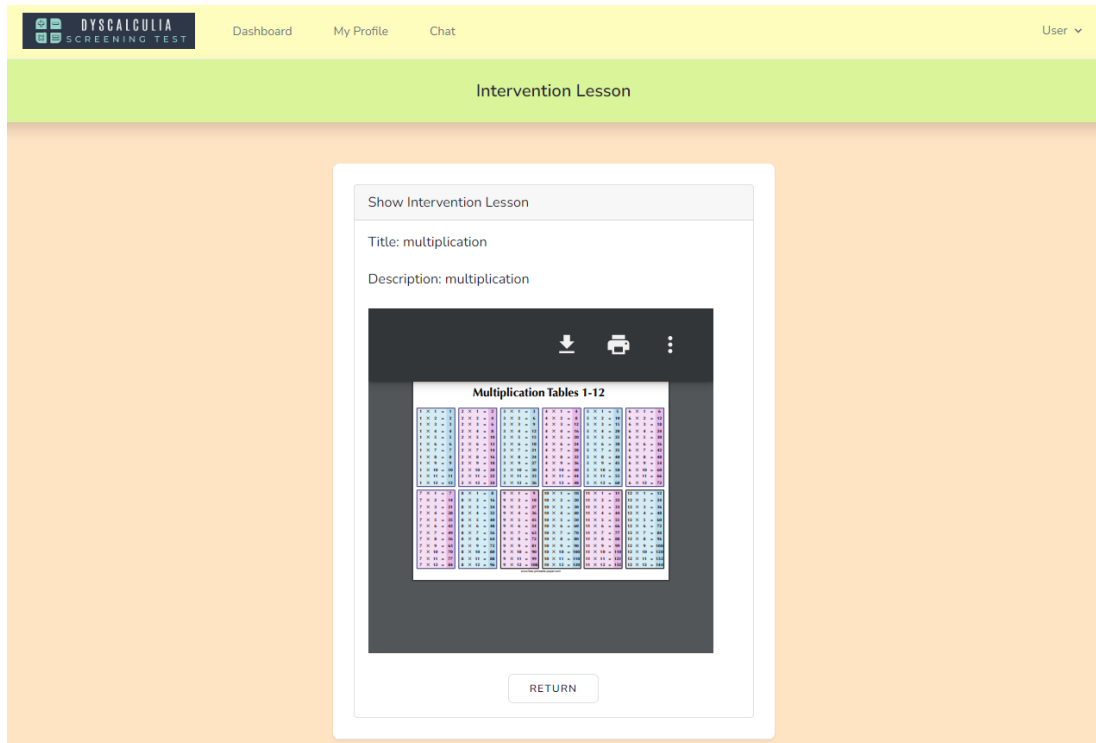


Figure 51 The Show Intervention Lesson Page for Student

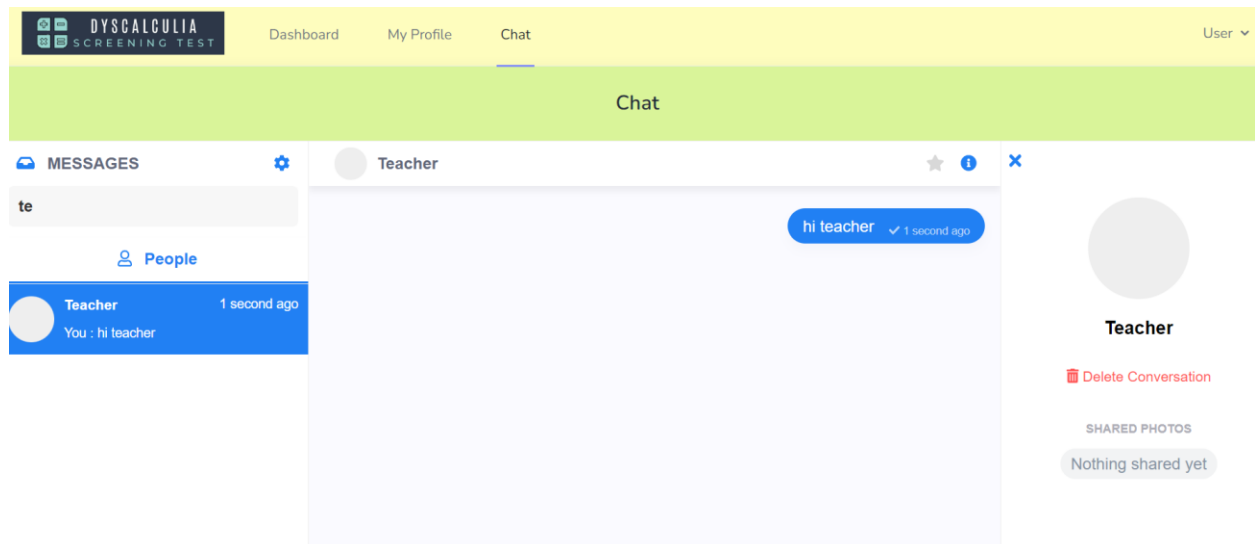


Figure 52 The UI of Send Chat Message

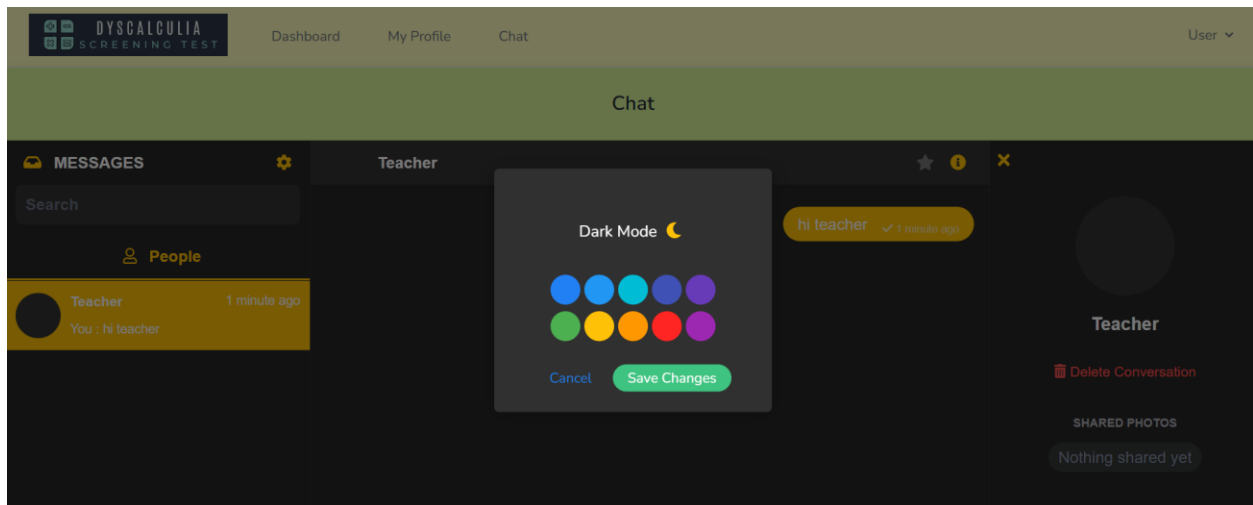


Figure 53 The UI of Chat Customization Setting

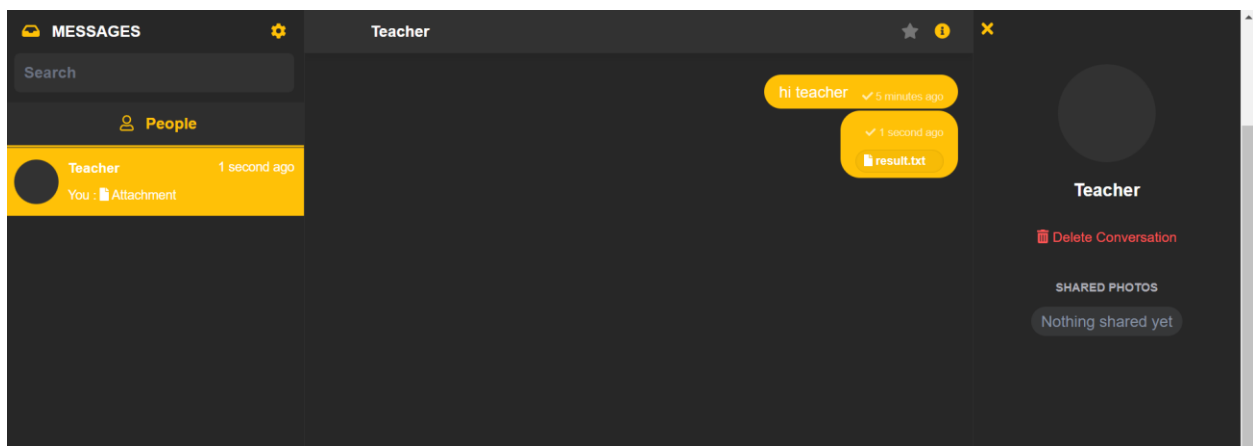


Figure 54 The UI of Sending Attachment Successfully via Chat

5.2.1 Usability

Usability is the measure of how easy it is for users to accomplish their goals when using a product or system, such as a website or software application. It refers to the effectiveness, efficiency, and satisfaction with which users can achieve their objectives. A system that is usable is easy to learn, efficient to use, and satisfying for the user.

Usability is important for a wide range of products, including websites, software applications, mobile apps, and even physical products. It is a key factor in determining the success and popularity of a product, as well as its ability to meet the needs of its users. By making a product more usable, designers and developers can help to improve user satisfaction, reduce errors and support tasks, and increase productivity.

To evaluate the usability of the Dyscalculia Screening Web Application, Laravel Dusk is used as a browser automation tool can perform automated browser testing in Laravel. It can be used for usability testing by simulating user interactions with the website or application and checking that the system behaves as expected.

The following test cases have been written for the usability testing of the web application.

Test Scenario 1: Check the usability of authentication

Table 10 Usability Testing (Authentication)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
AUT-001	Check that a user can successfully login to the website	Email=user@app.com Password=password	The user should be successfully logged in and able to navigate to the dashboard.	The user can login successfully and navigate to the dashboard.	Pass
AUT-002	Check that a user can successfully logout from the website	-	The user should logout successfully	The user can logout successfully	Pass

```
Time: 00:11.748, Memory: 24.00 MB
OK (2 tests, 3 assertions)
* Terminal will be reused by tasks, press any key to close it.
```

Figure 55 The Test Result of Usability Test (Authentication)

Test Scenario 2: Check the usability of profile

Table 11 Usability Testing (Profile)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
PUT-001	Check that a user can successfully visit the profile page and view the content of the page.	-	The user should visit the profile page and view the content of the page successfully.	The user can visit the profile page and view the content of the page successfully.	Pass

```
Time: 00:06.956, Memory: 24.00 MB
OK (1 test, 3 assertions)
* Terminal will be reused by tasks, press any key to close it.
```

Figure 56 The Test Result of Usability Testing (Profile)

5.2.2 Accessibility

Accessibility refers to the design of a product or system to be usable by people with a wide range of abilities, including those with disabilities.

The Dyscalculia Screening Web Application supports accessibility in several ways including keyboard navigation and semantic HTML. The application also provides support for keyboard navigation, which is essential for users who can't use a mouse. Error messages are another important aspect of accessibility because they provide users with feedback on what they did wrong and what they need to do to correct it. Error messages should be clear, concise, and easy to understand. Besides, the application uses semantic HTML elements, such as headings, lists, and links, to convey the structure and purpose of a web page, making it easier for screen readers to interpret.

It is important to provide accessible web applications by understanding accessibility principles and best practices. To ensure the Dyscalculia Screening Web Application is accessible to all users, the test cases are written to test its accessibility.

Test Scenario 1: Check the accessibility of the forms

Table 12 Accessibility Testing of the Forms

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
AT-001	Check the navigation of register form using only keyboard	-	The user should be navigated all fields in form using keyboard	The user should be navigated all fields in form using keyboard	Pass
AT-002	Check that the update profile form displays error message	Password=p	The system should display error message “the password must be at least 8 character”	The system displays error message “the password must be at least 8 character”	Pass
AT-003	Check the use of semantic HTML elements in profile form	form fields = <input>, <select> submit button = <button>	The semantic HTML elements such as <input> and <select> should be used to mark up each form field. and <select>. The form should use semantic HTML elements, such as <button>, to submit the form.	The semantic HTML elements such as <input> and <select> are used to mark up each form field. The form uses semantic HTML elements, such as <button>, to submit the form	Pass

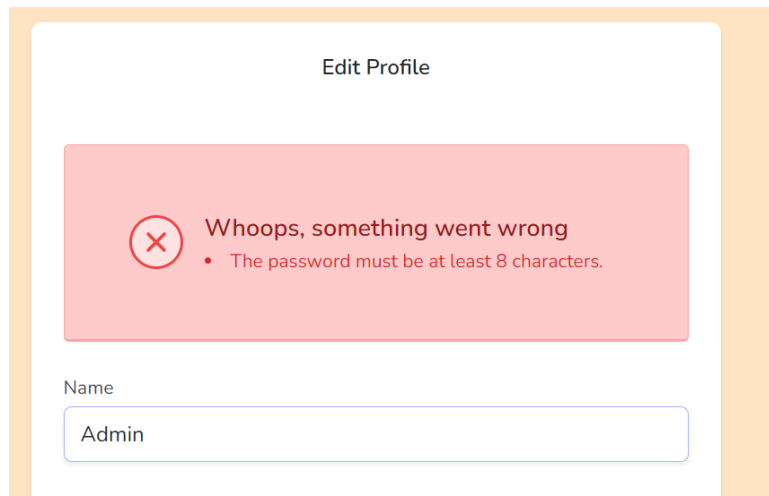


Figure 57 The Error Message in Profile form

5.2.3 Quality of Interaction

The quality of interaction refers to the ease and effectiveness of communication between the user, the application, and any connected systems. A high-quality interaction in the application can be characterized by:

- Easy and intuitive navigation: The application provides a clear and well-organized structure that enables users to easily find the information they need.
- Efficient data retrieval and processing: The application can efficiently retrieve and process data from databases.
- User-friendly error handling: The application provides clear and concise error messages that help users quickly identify and resolve issues.

Overall, the quality of interaction in the application is driven by its focus on providing a positive user experience and enabling efficient and effective communication between the various components of the application. To ensure the quality of interaction in the Dyscalculia Screening Web App, the test cases are written for testing the quality of interaction.

Table 13 The Test Cases for Quality of Interaction

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
--------------	-----------	-----------	-----------------	---------------	-----------

QIT-001	Check the search function in User Record Module	Enter username in search field	The application should display the expected results for the search query	The application displays the expected results for the search query.	Pass
QIT-002	Check success message is displayed after a success update profile form submission	Click submit button with valid data inputs	The application should display success message	The application displays success message	Pass
QIT-003	Check the number of records per page in User Record Module	Number of records per page=5	The application should display the number of records per page accurately	The application displays the number of records per page accurately	Pass
QIT-004	Check correct pages are loaded when clicking the pagination links in User Record Module	Click page 2, previous page, next page	The application should display the correct pages when clicking the pagination links	The application displays the correct pages when clicking the pagination links	Pass

Edit Profile

Success

Profile saved successfully

Name

Admin

Email

admin@app.com

Age

30

Gender:

Figure 58 The Success Message after Success Profile Form Submission

Name	Email	Age	Gender	Role	Action
user3	user3@app.com	12	Female	User	
User	user@app.com	10	male	User	
Koby Bergnaum	ludwig71@example.net	11	Male	User	
Dominique Bechtelar	green.vergie@example.net	8	Male	User	
Avery Kunde	dwright38@example.org	8	Male	User	

1

2

3

Figure 59 The Pagination Links in User Record Module

5.3 System Complexity

System complexity refers to the level of difficulty in understanding, designing, implementing, and maintaining a system. It is a measure of how many components and relationships are involved in the system, and how difficult it is to understand how they interact and function.

The Screening Management Module is considered complex because it needs to retrieve multiple tables that are connected using the foreign key. For example, in the database, the categories table is used to categorize all the test questions in the questions table that is managed by the admin. In the questions table, there are correct answers for each question. The application is required to compare both answers from the student and the correct answers in the database. Once the application checks the screening test that is completed by the student, the application will then store the result in the database and display the screening result.

On the other hand, the Screening Test Module is used by the student to answer the screening test. The screening test questions are displayed on the screen according to the test categories. There is a list of test categories displayed at the sidebar that helps to navigate to the respective questions easily.

Report Module is also complex because it is used to monitor the total registered users and the student screening result in the application. It generates the charts based on the total registered user and screening result of students in the database. Besides, there is a table that consists of the list of students getting undesirable dyscalculia screening result in the report module of the application.

In addition, Chat Module is also complex because it is used to ease communication between the users. It stores the messages from whom to whom in the database and has the function of searching for the users from the contact list when willing to ask someone for inquiry. The user can also customize chat settings such as dark mode and chat color. Other than message, the user is able to upload photos and attachments to be sent to the others.

Chapter 6: System Evaluation

6.1 Introduction

System evaluation is an important process to measure the performance and effectiveness of a system, such as a computer program, product, or service. The goal of system evaluation is to determine how well the system meets its intended purpose and to identify areas where improvements can be made. This process typically involves the collection and analysis of data, and may include user testing, benchmarking, and other methods of measurement. The results of system evaluation can be used to make decisions about future development, maintenance, and deployment of the system. There are several types of testing carried out which are Unit Testing, Integration Testing, System Testing and User Acceptance Testing.

6.2 Unit Testing

Unit testing is a software testing method where individual units or components of a software application are tested in isolation from the rest of the system. The goal of unit testing is to validate that each unit of the software performs as designed. A unit is the smallest testable part of an application, such as a function or a class.

Unit tests are typically automated and are run every time the code is changed to ensure that new changes do not break existing functionality. By writing unit tests, we can quickly and easily identify and fix bugs in their code, as well as ensure that changes to the code do not break existing functionality.

Unit tests are written using a unit testing framework, such as JUnit for Java, NUnit for .NET, or PHPUnit for PHP. The frameworks provide methods for defining and running test cases, as well as for asserting that the output of the code being tested matches the expected results. For the Dyscalculia Screening Web Application, PHPUnit is used to conduct the whole testing process.

6.2.1 Unit Testing (Authentication)

Testing is carried out to check the authentication module which includes register new account, login and logout.

Table 14 Unit Testing (Authentication)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTA-001	Verify the new user register account with valid input	Name=user Email=user@app.com Age=10 Password=password	The new user should register account successfully.	The new user account can be registered.	Pass
UTA-002	Verify the new user register account with one empty input	Name=user Email= Age=10 Password=password	The system should display error message “Please fill out the field”.	The system displays error message “Please fill out the field”.	Pass
UTA-003	Verify the user login with valid input	Email=user@app.com Password=password	The user should login successfully.	The user can login successfully.	Pass
UTA-004	Verify the user logout	Click logout	The user should logout successfully.	The user can logout successfully.	Pass

6.2.2 Unit Testing (User Record)

Testing is carried out to check the search function by username, CRUD function and the existence of user in the database from the user record module.

Table 15 Unit Testing (User Record)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTUR-001	Verify the search	Name=user	The user record should	The user record can be	Pass

	function with valid registered username		be searchable by admin with name input.	searchable by admin with name input.	
UTUR-002	Verify the user record can be created	Name=user Email=user@app.com Age=10 Password=password	The user should be created successfully.	The user can be created successfully.	Pass
UTUR-003	Verify the user record can be updated	Name=user Email=user@app.com Age=12 Password=password	The user record should be updated successfully.	The user record can be updated successfully.	Pass
UTUR-004	Verify the selected user record can be shown	Click show icon	The system should display the user record after the show icon is clicked.	The system displays the user record.	Pass
UTUR-005	Verify the delete button to delete user record	Click delete icon	The system should display pop up message “Are you sure to delete this item”.	The system displays pop up message “Are you sure to delete this item”.	Pass
UTUR-006	Verify the refresh button	Click refresh icon	The system should refresh the page after the refresh button is clicked.	The system refreshes the page.	Pass

6.2.3 Unit Testing (Profile)

Testing is carried out to check the user profile module which includes display user profile and update user profile.

Table 16 Unit Testing (Profile)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTP-001	Verify the update user profile function	Name=update Email=update@gmail.com Age=12 Gender=male	The profile should be updated successfully.	The user profile can be updated successfully in the database and the system displays success message “Profile saved successfully”.	Pass
UTP-002	Verify the update password function	Password=password	The user password should be updated successfully.	The user password should be updated successfully in the database and the system displays success message	Pass

				"Profile saved successfully".	
--	--	--	--	-------------------------------	--

6.2.4 Unit Testing (Screening Management)

Testing is carried out to check the screening management module that includes CRUD operations for the test categories and screening questions.

Table 17 Unit Testing (Screening Management)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTSM-001	Verify the screening question can be created	Test category=pretest Question=test Question type=True or False Choice=True;False Answer=False	The question should be created successfully and the application should display success message "New question has been created".	The question can be created successfully and the application displays success message "New question has been created".	Pass
UTSM-002	Verify the screening question can be edited	Question=updatetest Question type=True or False Choice=True;False Answer=False	The application should display success message "Question updated successfully" after success edit form submission	The application should display success message "Question updated successfully" after success edit form submission	Pass

UTSM-003	Verify the screening question can be deleted	Click delete icon and confirm the action	The question should be deleted successfully with success message “Question deleted successfully”.	The question can be deleted successfully with success message “Question deleted successfully”.	Pass
UTSM-004	Verify the selected screening question can be shown	Click show icon	The question should be displayed successfully.	The question can be displayed successfully.	Pass
UTSM-005	Verify the CRUD operations of manage test categories	Complete success submissions in each form, click delete icon and show icon	The test category can be created, edited, deleted and viewed successfully.	The test category can be created, edited, deleted and viewed successfully.	Pass

6.2.5 Unit Testing (Intervention Management)

Testing is carried out to check the manage intervention lessons function that includes CRUD operations for the lessons.

Table 18 Unit Testing (Intervention Management)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTIM-001	Verify the intervention	Title=test Description=test File=pdf file	The application should display a success message	The application displays success message ‘New	Pass

	lesson can be created		'New lesson has been created' after a success form submission.	lesson has been created' after a success form submission.	
UTIM-002	Verify the intervention lesson can be edited	Title=update test Description=update test File=update pdf file	The application should display a success message 'Lesson updated successfully' after a success form submission.	The application displays a success message 'Lesson updated successfully' after a success form submission.	Pass
UTIM-003	Verify the intervention lesson can be deleted	Click delete icon and confirm the action	The lesson should be deleted successfully with success message "Lesson deleted successfully".	The lesson can be deleted successfully with success message "Lesson deleted successfully".	Pass
UTIM-004	Verify the selected intervention lesson can be shown	Click show icon	The lesson should be displayed after clicking show icon.	The lesson can be displayed after clicking show icon.	Pass

6.2.6 Unit Testing (Report)

Testing is carried out to check the functionality of the Report Module in providing the related charts and table.

Table 19 Unit Testing (Report)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTR-001	Verify the report can be generated and displayed	Click report button	The application should display the report including charts and table.	The application should display the report including charts and table.	Pass

6.2.7 Unit Testing (Screening Test)

Testing is conducted to check the functionality of the Screening Test Module to be completed by the students.

Table 20 Unit Testing (Screening Test)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTST-001	Verify the student can provide the answer for each question	Input all the answer in the form	The student should answer all questions.	The student can answer all questions.	Pass
UTST-002	Verify the student can submit the test form	Click submit button	The application should navigate to the result page.	The application can navigate to the result page.	Pass

6.2.8 Unit Testing (Intervention Lesson)

Testing is conducted to check the functionality of the Screening Test Module to be completed by the students.

Table 21 Unit Testing (Screening Test)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTIL-001	Verify the student can view the selected lesson	Click show icon	The application should display the lesson successfully.	The application should display the lesson successfully.	Pass

6.2.9 Unit Testing (Chat)

Testing is conducted to check the functionality of the Screening Test Module to be completed by the students.

Table 22 Unit Testing (Chat)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
UTC-001	Verify message can be sent	Message=hi	The message should be sent successfully	The message can be sent successfully	Pass
UTC-002	Verify chat background switch to dark mode	Click moon icon and click save changes	The chat background should be switched to dark mode.	The chat background can be switched to dark mode.	Pass
UTC-003	Verify chat color switch to selected color	Click orange color and click save changes	The chat color should be switched to orange color.	The chat color can be switched to orange color.	Pass

6.3 Integration Testing

Integration testing is a type of software testing that checks how different components or modules of a system work together. The purpose of integration testing is to identify the problems that may arise when different components are combined, such as compatibility issues, data loss,

incorrect functionality, and more. Integration testing verifies the interaction between different components and ensures that the system as a whole works as expected.

During integration testing, individual components are combined and tested as a group. This helps to identify any issues that may not have been apparent during unit testing and to catch them early in the development process.

In general, integration testing is an important part of the software development process, as it helps to ensure that the system works as expected and is ready for deployment.

6.3.1 Integration Testing (Screening)

The testing is conducted to test the combination of Screening Management Module and Screening Test Module.

Table 23 Integration Testing (Screening)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
ITS-001	Check the screening questions with answer choices that are managed by the admin can be viewed by the student.	-	The system should display the list of screening questions to be viewed by the student.	The system can display the list of screening questions to be viewed by the student.	Pass
ITS-002	Check the screening test can be completed by students.	Input all answers and click submit button	The application should display the result after completion of the test	The application displays the result after completion of the test	Pass

6.3.2 Integration Testing (Intervention)

The testing is conducted to test the combination of Intervention Management Module and Intervention Lesson Module.

Table 24 Integration Testing (Intervention)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
ITI-001	Check the intervention lesson can be viewed by students after the teacher uploads it.	-	The intervention lesson should be viewed by students after the teacher uploads it.	The intervention lesson can be viewed by students after the teacher uploads it.	Pass

6.3.3 Integration Testing (Report)

The testing is conducted to test the combination of User Record and Screening Test Module to be used in Report Module.

Table 25 Integration Testing (Report)

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
ITR-001	Check the report generation	-	The report should be displayed as the charts and table.	The report can be displayed as the charts and table.	Pass

6.4 System Testing

System testing is a type of software testing that evaluates the overall functionality and performance of a system to ensure that it meets the specified requirements and expectations.

System testing focuses on verifying the system as a whole, including its components, interfaces, and interactions with external systems. The purpose of system testing is to validate that the system works as expected under real-world conditions and to identify any issues that may arise in the deployment environment.

During system testing, various test cases are executed to simulate different use cases, scenarios, and environments. The test cases cover various functional and non-functional requirements, such as performance, security, usability, compatibility, and more. The results of the tests are analyzed, and any defects or issues are reported and fixed.

System testing is important because it provides a comprehensive assessment of the system and helps to identify any problems that may impact the quality of the product. It also provides stakeholders with confidence in the system and helps to ensure that the system is ready for deployment.

Table 26 System Testing

Test Case ID	Test Case	Test Data	Expected Result	Actual Result	Pass/Fail
ST-001	Check the navigation bar which can navigate the user to correct pages	-	User should be navigated to correct pages through navigation bar	User can navigate to correct page through navigation bar	Pass
ST-002	Check all the links and buttons are functional after clicking by the user	-	The links and buttons should be functional after clicking by the user	The links and buttons can be functional after clicking by the user	Pass
ST-003	Check authentication by logging in with invalid data for security purpose	Email=test@app.com Password=pw	Error message should be displayed 'These credentials do not match our records.'	The application display error message 'These credentials do	Pass

				not match our records.'	
--	--	--	--	-------------------------	--

6.5 User Acceptance Testing

User Acceptance Testing (UAT) is a process of testing a system or software by the end users or customers before it is implemented in a production environment. The main purpose of UAT is to ensure that the system meets the business and technical requirements that guided its design and development.

During UAT, actual users of the system will test it in a simulated production environment. They will test the system's functionality, usability, and performance, and provide feedback on any issues or defects they find. UAT also includes testing the system's ability to handle and recover from any errors or exceptional conditions.

UAT is typically the last phase of the software development life cycle and is performed after all other testing has been completed. The results of UAT are used to ensure that the system is ready for deployment, and that it will meet the needs of the users.

Table 27 User Acceptance Checklist

Testing Description	Meeting Requirement
Authentication	
User can register new account.	/
User can login using e-mail and password.	/
User can logout.	/
User can reset password	/
Profile	
User can update profile such as name, email, age, gender and password.	/
User Record	
Admin can create, edit, delete and view user details.	/

Screening Management	
Admin can create, edit, delete and view dyscalculia screening questions.	/
Admin can create, edit, delete and view dyscalculia screening test categories.	/
Teacher can view student record including student dyscalculia screening result.	/
Report	
Admin and teacher can obtain, and view report based on the registered users and student dyscalculia screening result.	/
Intervention Management	
Teacher can create, edit, delete and view intervention lesson.	/
Screening Test	
Student can conduct dyscalculia screening test successfully.	/
Student can view the dyscalculia screening result after the test is completed.	/
Intervention Lesson	
Student can view the contents of intervention lesson and download intervention lesson.	/
Real-time Chat Message	
User can send chat message among themselves.	/
User can upload attachments such as file and photo and send to other users via chat box.	/
User can change chat customization such as dark mode and chat color.	/

6.6 Error-Free and Error Handling

Error-free refers to an application that runs without any errors, exceptions, or unexpected behavior. This means that the application should run smoothly and provide the desired output for all inputs. Error handling refers to the process of detecting and responding to errors that occur in

an application. It involves identifying the cause of the error and taking appropriate action to resolve it. This might involve logging the error and displaying an error message to the user,

There are several ways to make the Dyscalculia Screening Web Application error-free and handle errors properly. Some of the ways include validation, exception, error logging and the use of version control system. The form validation helps to check the input data by the user to ensure that it meets the expected format and constraints. It helps to prevent errors and ensure that the data entered into a form is accurate and usable. The figure below shows an example of form validation by defining the validation rules.

```
public function rules()
{
    return [
        'email' => ['required', 'string', 'email'],
        'password' => ['required', 'string'],
    ];
}
```

Figure 60 Code for Form Validation

```
@if ($errors->any())
<div class="alert flex flex-row items-center bg-red-200 p-5 rounded bor
<div class="alert-icon flex items-center bg-red-100 border-2 border
    <span class="text-red-500">
        <svg fill="currentColor"
            viewBox="0 0 20 20"
            class="h-6 w-6">
            <path fill-rule="evenodd"
                d="M4.293 4.293a1 1 0 011.414 0L10 8.586L14.293 4.293a1 1 0 010 1.414L10 14.293L4.293 10a1 1 0 010 -1.414L10 4.293a1 1 0 011.414 0Z" clip-rule="evenodd"></path>
            </svg>
        </span>
    </div>
<div class="alert-content ml-4">
    <div class="alert-title font-semibold text-lg text-red-800">
        {{ __('Whoops, something went wrong') }}
    </div>
    <div class="alert-description text-sm text-red-600">
        @foreach ($errors->all() as $error)
            <li>{{ $error }}</li>
        @endforeach
    </div>
</div>
</div>
@endif
```

Figure 61 Code for Displaying Error Message

The exception handling is another way of dealing with errors and unexpected behaviour that occurs in the application. It involves detecting and responding to exceptions in a controlled manner, so that the application can continue running smoothly even in the face of errors. The figure below is an example of throwing a validation exception when logging into the application failed.

```

* Attempt to authenticate the request's credentials.
*
* @return void
*
* @throws \Illuminate\Validation\ValidationException
*/
public function authenticate()
{
    $this->ensureIsNotRateLimited();

    if (! Auth::attempt($this->only('email', 'password'), $this->boolean('remember'))) {
        RateLimiter::hit($this->throttleKey());

        throw ValidationException::withMessages([
            'email' => trans('auth.failed'),
        ]);
    }

    RateLimiter::clear($this->throttleKey());
}

```

Figure 62 Validation Exception is Thrown

In addition, writing tests can also catch errors early and prevent them from happening in production. The tests may include unit testing, integration testing, system testing and user acceptance testing.

Ultimately, error handling is an essential part of software development, and a well-designed error handling strategy can help to ensure that applications continue running smoothly even in the face of errors.

Chapter 7: Conclusion

The report is the documentation of the implementation for the Final Year Project in Phase II. Firstly, the report covers the background of the project and the problem statements which are addressed to come out the solution plan that is the proposed web application. The objectives have been identified and the project timeline has been planned to be completed within a year. The proposed system has been described briefly in this report.

Next, I have written about literature review, including the type of dyscalculia, the issues faced by educator and student as well as the existing systems to benchmark with our proposed system. Some of the applicable frameworks such as alpine.js, Tailwind CSS, and Laravel are chosen to be implemented in the proposed system.

In addition, I have chosen the suitable software development model which is the Waterfall Model. I manage to gather the data using the data gathering methodologies such as online interview with the professional in educational psychology field and meetings with the stakeholder.

Besides, I have gathered the requirements from the stakeholder via online meeting and the web application features have been figured out. Then, the UML diagram such as use case diagram, activity diagram, entity relationship diagram, and architecture diagram, have been drawn based on the functional requirements of the system for documentation purposes. On the other hand, the prototyping of the web application is developed to ease the technical implementation in Final Year Project, Phase II. The system development and the testing techniques used also have been included in the report.

In conclusion, the completed system development process marks the end of the project. The development of the system has been a challenging but rewarding experience. All the objectives of the project had been fulfilled. I had successfully designed, developed and tested a system that meets the needs of the stakeholders, and the identified problem is solved. The system has been designed with user-friendly interfaces, robust security features and scalability in mind. The system development process has become one of the best achievements that I have gained. I have learned a lot from this project. I am very delighted with the output as I have managed to cover all the objectives of the project.

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Appendix

Interview question

Section 1: Demographic profile

1. What is the nature of business?
2. What is the total number of students in your organization?
3. How many students are having dyscalculia in your organization?
4. How many teachers are involved in teaching dyscalculia students?

Section 2: Understanding the dyscalculia

1. Do you know about dyscalculia?
2. Is dyscalculia a neurological disorder?
3. What are the signs of dyscalculia?
4. What are the accurate ways diagnosing dyscalculia?
5. Can dyscalculia be cured?
6. How does dyscalculia affect daily life?
7. How can we improve the learning and performance of students with dyscalculia?

Section 3: System development

Introduction of the system:

The system will perform authentication, screening, show results of screening and performance of the students after some intervention activities.

Question:

1. Do you need authentication for the system?
2. (Authentication is the process of verifying the identity of an individual. Example: login using a username and password.)
3. If yes, who is the administrator?
4. Do you conduct any screening test before the student attends the class?
5. If yes, can you provide the test as an example?
6. Do you need report generation for the system?
7. (Report for result of screening/performance after intervention activity)
8. If yes, what kind of report do you prefer to generate?

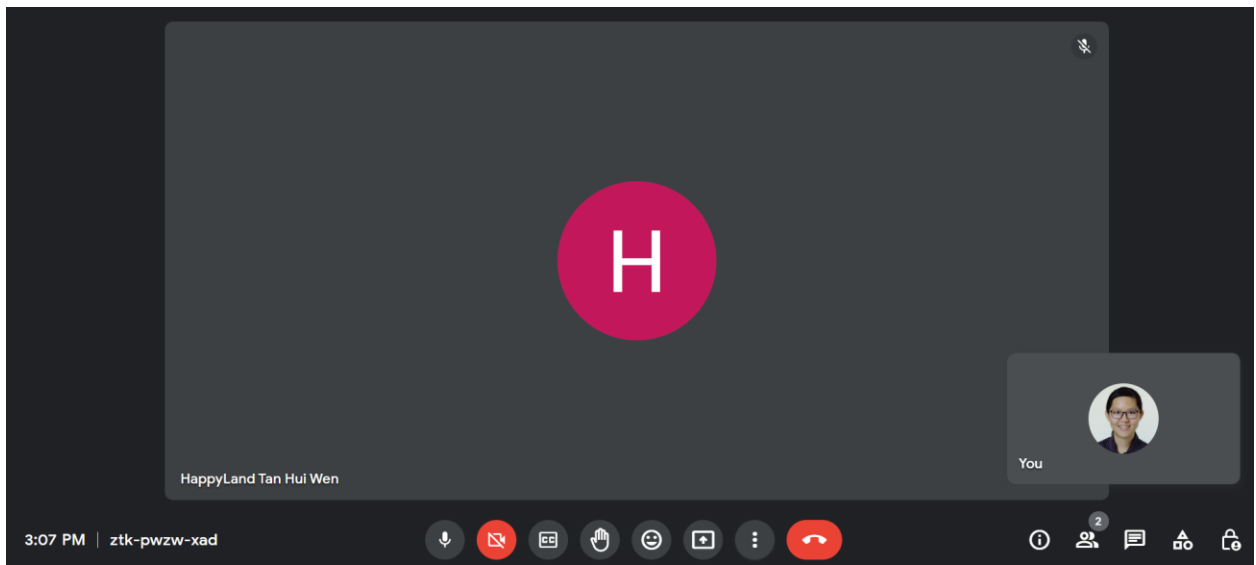


Figure 63 Screenshot of meeting with stakeholder

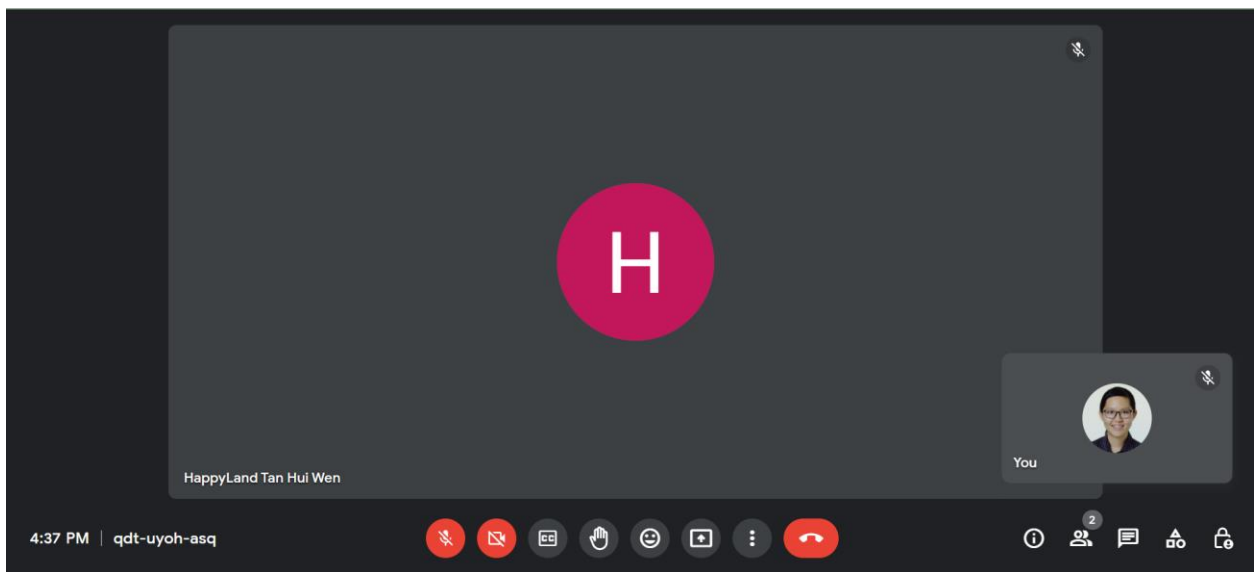


Figure 64 Screenshot of meeting with stakeholder

The GitHub link for source code: <https://github.com/simyy00/dyscalculia>