System Requirement Specification (SRS)

Team 8 - LearnEZ

1 Introduction

1.1 Purpose

The purpose of this document is to present a detailed description of the entire CZ3003 – Software System Analysis & Design Lab Project, that from henceforth will be called LearnEZ. This document will include the functional and non-functional requirements, as well as the features and interfaces of LearnEZ.

Furthermore, this document will also present a detailed description about operating environment, design and implementation of LearnEZ.

1.2 Document Conventions

Boldface font and indention is being used for topic titles. The remainder of the document will be written using the standard font, Arial with font size 12 as well as a line spacing of 2.0.

1.3 Intended Audience & Reading Suggestions

This document is intended for the developers (members of the project), users of LearnEZ (Students and Teachers) and the reviewers (i.e. lecturer, lab assistant or professor).

Developers who review this document can better understand the capabilities of each section of the application, so as to carry out further enhancements such as adding new features or improving existing features.

Users who are interested in LearnEZ can read this document to understand the functionality of the application.

Reviewers who review this document can get a detailed overview of the application including overall description, system features and other nonfunctional requirements for a better understanding of the application.

1.4 Project Scope

LearnEZ is a game developed for Android phones to facilitate the learning of Software Engineering concepts in a fun and interactive way. LearnEZ encourages student interaction using leaderboards as well as giving students the option to create

their own levels after they are done with the game. LearnEZ allow teachers to check the student progress through report generated in the game.

The objective of LearnEZ is to gamify and socialize the teaching and learning of Software Engineering courses in Nanyang Technological University.

1.5 References

LearnEZ is conceptualized and created based on the lab requirements of CZ3003 – Software System Analysis & Design Lab Project, available on NTULearn.

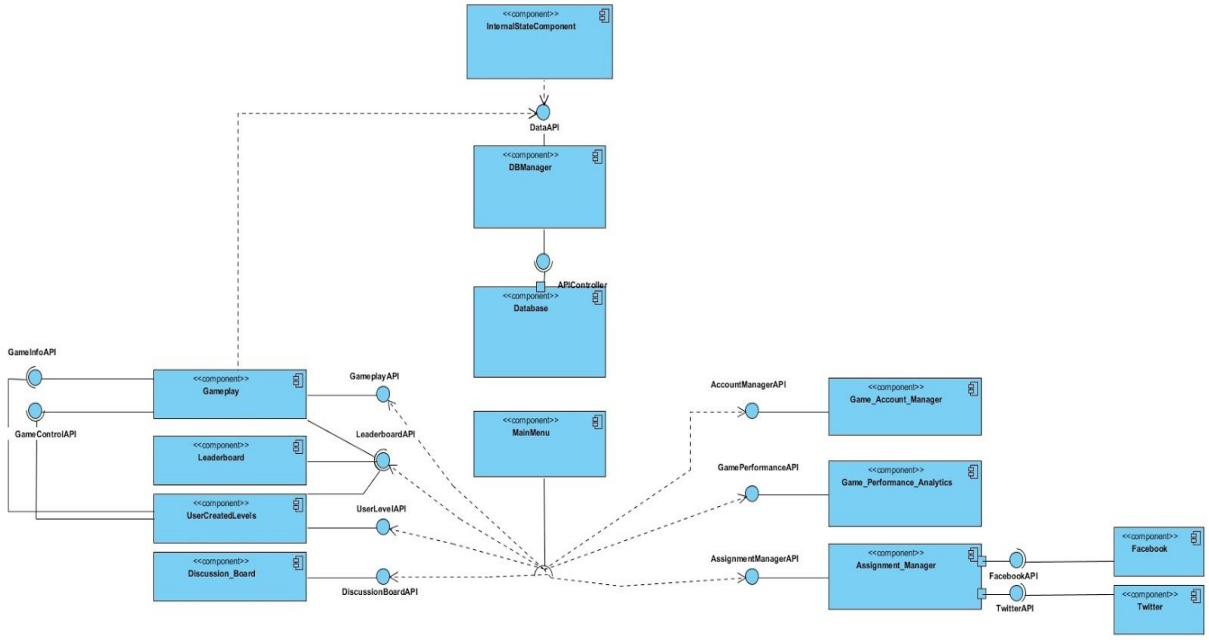
2. Overall Description

2.1 Product Perspective

Software Engineering can be a challenging subject to teach. Moreover, in a university setting it can be hard for teachers to effectively gauge the proficiency of students. As such, designing a game that solves these two problems will greatly improve the learning experiences and outcomes of Software Engineering students.

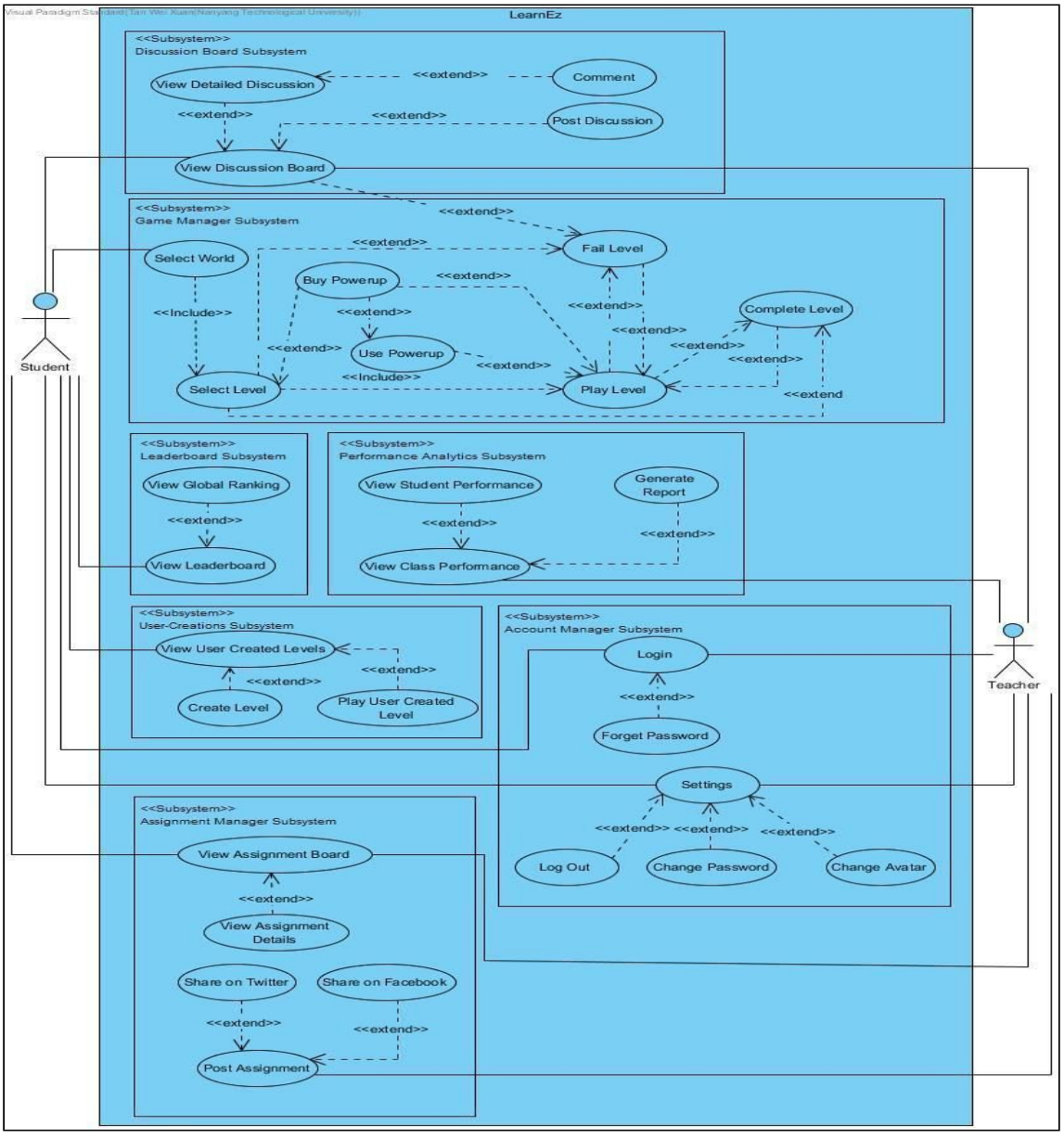
LearnEZ is designed to be supplementary with classroom lessons and should not be considered a substitute for classroom lessons of any sort.

Below is a black box component diagram of the entire LearnEZ system. It shows the main components and the interaction between them.



2.2 Product Functions

These are a list of features included in LearnEZ with details explained in Chapter 4 System Features.



- Account Manager
    - Login

        - Authentication of users.
    - Forget Password
        - Allow user to reset his/her password.
    - Settings
        - User Settings of the LearnEZ Game application.
    - Change Password
        - User can change the password for his/her account.
    - Change Avatar
        - User can change the avatar for his/her account.
    - Log Out
        - User can log out of the application.

- Assignment Manager
    - View Assignment Board
        - Application will display ongoing assignments to the user.
    - View Assignment Details
        - Display details for the selected assignment.
    - Post Assignment
        - Allow a Teacher to post an assignment.
    - Share on Facebook
        - Post the Teacher's assignment to his/her Facebook.
    - Share on Twitter
        - Post the Teacher's assignment to his/her Twitter.

- Leaderboard
    - View Leaderboard
        - Application will display the top five scoring users in the Student's class.
    - View Global Ranking
        - Application will display the top five scoring students in the cohort.

- Performance Analytics
    - View Class Performance
        - Application will display the performance of the Teacher's class.
    - View Student Performance
        - Application will display the performance of the selected student.
    - Generate Report
        - Generate a performance summary report of the Teacher's class.

- User Creations
    - View User Created Levels
        - Application will display User Created Levels.
    - Play User Created Levels
        - Student must be able to play User Created Levels.
    - Create Level
        - Student must be able to create levels.

- Discussion Board
    - View Detailed Discussion
        - Views the entire discussion thread.
    - View Discussion Board
        - Shows ongoing discussions.
    - Post Discussion
        - Posts a new discussion onto the server, other users wil be able to see it upon refreshing the screen.
    - Comment
        - Leave a comment on a discussion.

2.3 User Classes & Characteristics

Student	The term Student refers to anyone playing the game. The student must have an Android smartphone and must be proficient at using a smartphone. The Student will use the game as a learning and challenging platform, completing quizzes that are set within levels that are meant to challenge the understanding of a student's Software Engineering concept.
Teacher	The term Teacher refers to anyone conducting the lessons for the Students. The Teacher is expected to

	understand all Software Engineering related concepts taught in the scope of the module. The Teacher will be given the authority to view his/her class and individual Student's performance reports.
System Administrator (Admin)	The term System Administrator (Admin) refers to a user given administrator functions. This extends to all user-class functionalities on top of including editing of any databases or functions by accessing directly into the source code. In this case, Admin refers to the team working on this project.

2.4 Operating Environment

- Android for Smartphone Application
    - Minimum Version: Android 9.
    - Targeted Version: Android 9 and later.

- Dependencies
    - facebook-android-SDK: 5.4.0.
    - twitter-kit-android: 3.2.

- Database
    - MySQL Workbench 8.0 CE.

- Laravel

2.5 Design & Implementation Constraints

LearnEZ requires several functional API module to function properly.

- Social Media API for Teacher to share assignments such as Facebook API and Twitter API.
- RESTful API to manipulate and retrieve relevant data from the database.

2.6 User Documentation

As per the scope of the project, this document will serve as documentation for the users to understand the functionality of the application.

This document, along with the full user interface and functionality of the application will also be available at MediaWiki for the users to understand the functionality of the application.

The following format are adopted to make the structure of the user documentation readable and easy to understand

- Indentation is made for sub-points.
- A good layout of headings, page numbers and section titles.
- Pictures are included for key steps.

2.7 Assumptions & Dependencies

We assume that the user owns an Android device supporting Android 9 and later versions. The user must be familiar with using an Android device and a smartphone. Also, the user is already connected to the internet.

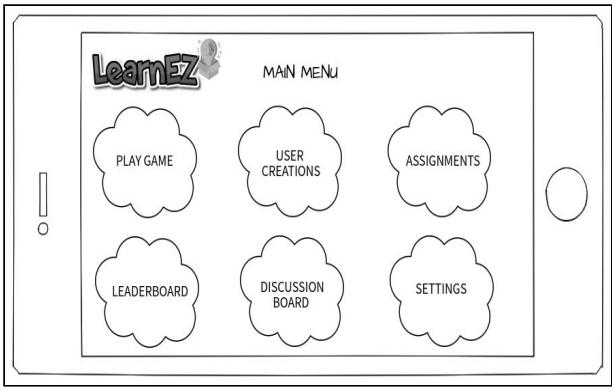
3 External Interfaces Requirements

3.1 User Interfaces

Landing Page – Landing page for users who just launched LearnEZ.

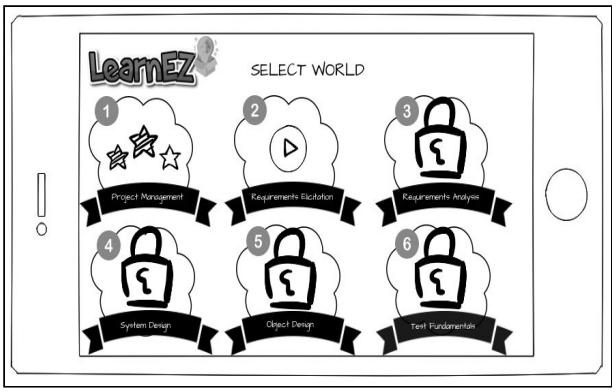
Login Page – User can either login via their Matriculation Number (Student) or Staff ID (Teacher). In the event that user forget their password, they are able to reset their password by clicking on the "Forget Password?" text.

Figure 1: Landing Page (left) and Login Page (right)



Main Menu Page (Student) – Main landing page for Student who successfully logged into LearnEZ. Students will be able to access the different functionalities in the game from the Main Menu Page.

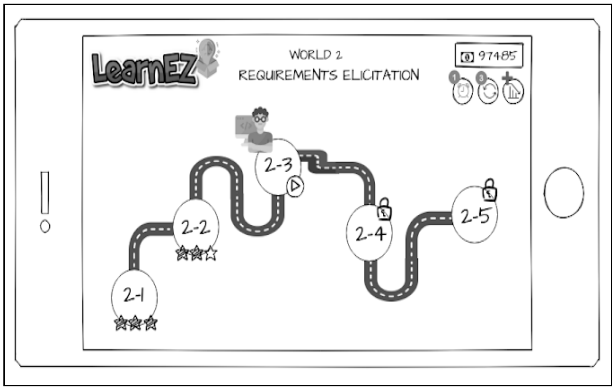
Figure 2: Main Menu Page (Student)



Select World Page (Student) – Student will be able to select from a series of different world to play; each world representing a different aspect of Software Engineering.

Completed world will show the Student's score for that world, ongoing world will show the play button and subsequent world will be locked for the Student to encourage progressive learning.

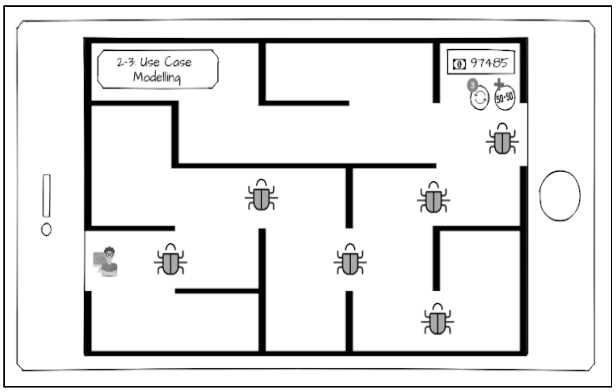
Figure 3: Select World Page (Student)



Select Level Page (Student) – In each world, Student will be able to select from several levels; each level representing specific topics of each world.

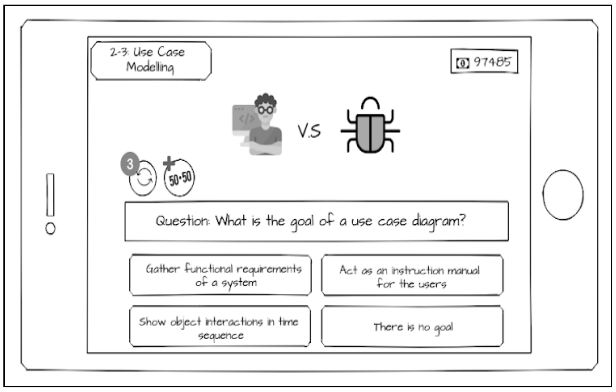
Completed level will show the Student's stars earned for that level, ongoing level will show the play button and subsequent levels will be locked for the Student.

Figure 4: Select Level Page (Student)



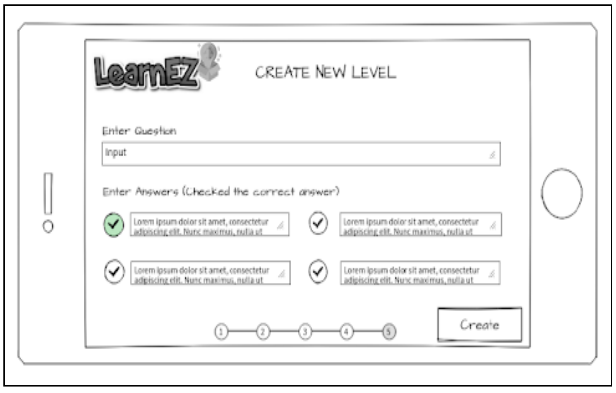
Play Level Page (Student) – In each level, Student will move across a maze with "bugs" representing the questions in that level; question is relevant to specific topics with varying difficulties.

Figure 5: Play Level Page (Student)



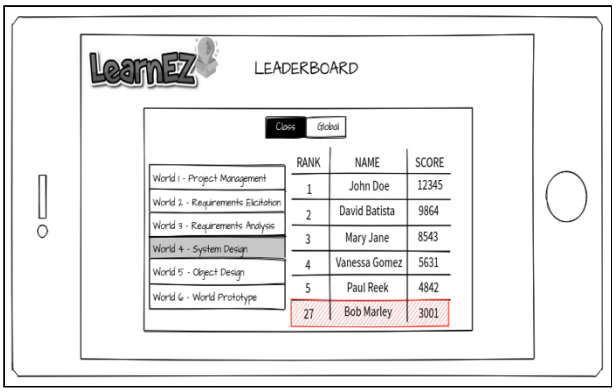
Gameplay Page (Student) – The gameplay format of LearnEZ will be in the form of Multiple Choice Question.

Figure 6: Gameplay Page (Student)



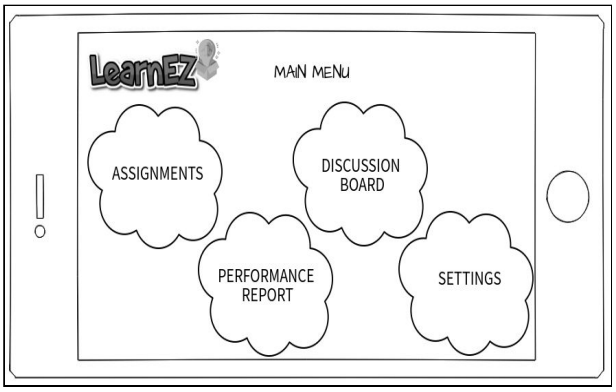
User Created Level Page (Student) – Student will be able to design their own level with custom questions and answers so that students can challenge each other.

Figure 7: User Created Level Page (Student)



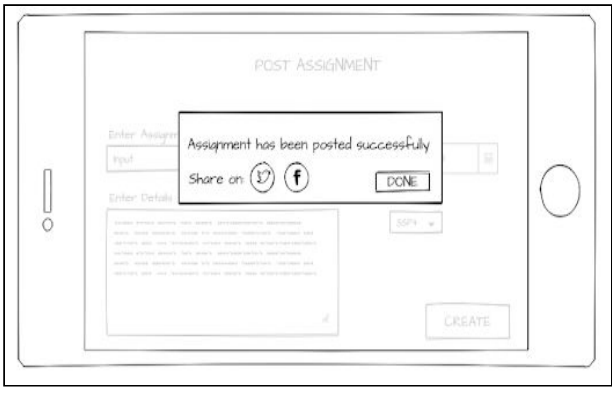
Leaderboard Page (Student) – Student will be able to access the leaderboard and view the top 5 players for each world as well as their own ranking.

Figure 8: Leaderboard Page (Student)



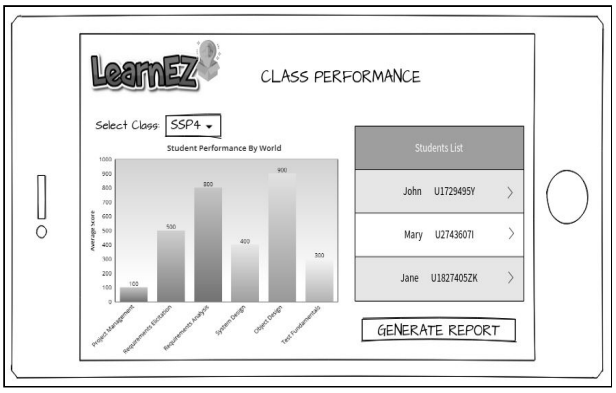
Main Menu Page (Teacher) – Main landing page for Teacher who successfully logged into LearnEZ. Teachers will be able to access the different functionalities in the game from the Main Menu Page.

Figure 9: Main Menu Page (Teacher)



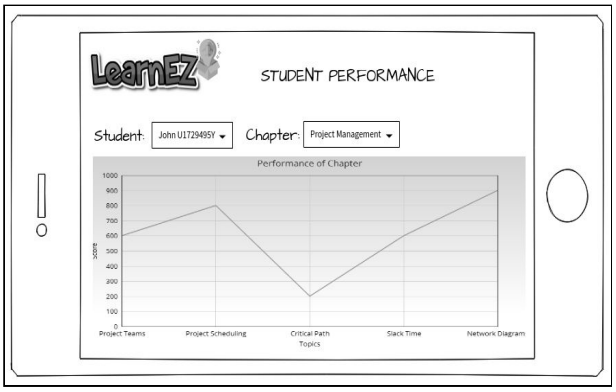
Share Assignment Page (Teacher) – Teacher will be able to give assignment to Student in game and share them via social media (Facebook and Twitter).

Figure 10: Share Assignment Page (Teacher)



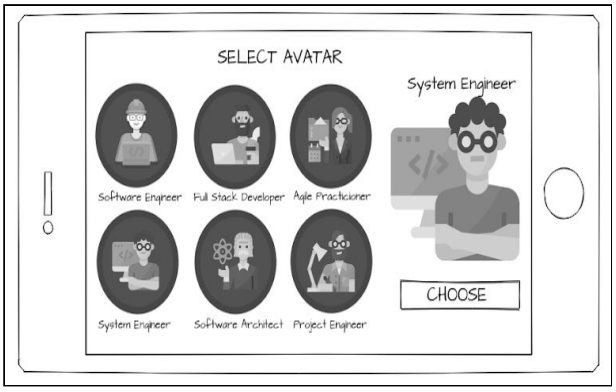
View Class Performance Page (Teacher) – Teacher will be able to view the class performance for each world's level to understand their Student's overall mastery of the course. The Teacher can then adjust the teaching contents and key points during classroom teaching.

Figure 11: View Class Performance Page (Teacher)



View Student Performance Page (Teacher) – Teacher will be able to view the individual Student performance for each world's level to gauge the student's overall mastery of the course. The Teacher can then tailor the teaching contents according to the needs of the Student in his/her class.

Figure 12: View Student Performance Page (Teacher)



Avatar Page – User will be able to choose from different avatar (in-game characters)

Figure 13: Avatar Page

3.2 Hardware Interfaces

- Android Smartphone
    - Touchscreen
- Windows Laptop
    - Arrow Keys

3.3 Software Interfaces

- Android Smartphone
    - Android Facebook SDK for Teacher to share assignment.
    - Android Twitter SDK for Teacher to share assignment.
    - MySQL Workbench 8.0 CE
    - GoDot Open Source Game Engine

- Windows Laptop
    - MySQL Workbench 8.0 CE
    - GoDot Open Source Game Engine
    - Android Studio
    - GoDot Emulator

3.4 Communication Interfaces

- HTTPS Communication between Application and Database (Port: 443)

- Laravel Database (Port: 3306)
    - Protect users against man-in-the-middle attacks that can be launched from a compromised or insecure network.
    - Provide bi-directional encryption of communication between the application and the database. Protect against eavesdropping and tampering with the contents in the communication.
    - POST method will be used by the application to send data to the database in functions like Login and updating of information

4. System Features

4.1 Account Manager

4.1.1 Login

4.1.1.1 Description and Priority

Handles the login procedure to authenticate the user's account with the database. If the account is authenticated, user will be logged into the application.

High Priority as user must be logged into the application to access the functionalities.

4.1.1.2 Stimulus and Response Sequences

User Action: Launch the mobile application.

S**ystem Response:** Mobile application displays the login page.

User Action: Enters correct login information.

System Response: User is authenticated and logged into the application's main page.

User Action: Enters invalid matriculation number / staff id

System Response: User is prompted with an error message "You do not

have an account with LearnEZ. Please contact the System Administrator to create an account for you".

User Action: Enter invalid password.

System Response: User is prompted with an error message "You do not have an account with LearnEZ. Please contact the System Administrator to create an account for you".

4.1.1.3 Functional Requirements

REQ-1: User must be able to enter their matriculation number / staff id and password.

REQ-2: User must be able to login to the system.

REQ-2-1: System must authenticate the user using the user's login credentials

REQ-2-1-1: System must display an error message for unsuccessful login until user closes the message.

REQ-2-1-1-1: If invalid matriculation number / staff id, an error message shall be displayed in a red dialog box: "You do not have an account with LearnEZ. Please contact the System Administrator to create an account for you".

REQ-2-1-1-2: If incorrect password, an error message shall be displayed in a red dialog box "You do not have

an account with LearnEZ. Please contact the System Administrator to create an account for you".

4.1.2 Forget Password

4.1.2.1 Description and Priority

Handles the reset account password procedure in the event that a user forgets his/her login password.

High Priority as user cannot access the application's functionalities if he/she is unable to login to the application.

4.1.2.2 Stimulus and Response Sequences

User Action: Selects "Forget Password".

System Response: User is prompted to enter his/her matriculation number staff id.

User Action: Enters an existing matriculation number / staff id

System Response: System will send an email containing a new password to the user's email address

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User Action: Enters invalid matriculation number / staff id

System Response: Message "No User Found!" is displayed under the text input in red font.

4.1.2.3 Functional Requirements

REQ-1: User must be able to enter their matriculation number / staff id and password.

REQ-1-1: A valid matriculation number / staff id paired with a corresponding valid password must allow the user to log in.

REQ-2: User must be able to reset their password.

REQ-2-1: System must reset the user password using the user's valid matriculation number / staff id

REQ-2-1-1: System must verify the user's matriculation number / staff id

REQ-2-1-1-1: If invalid matriculation number / staff id, an error message shall be displayed in the reset password dialog box as a red font message: "No User Found!".

4.1.3 Settings

4.1.3.1 Description and Priority

Handles the user settings of LearnEZ Game application.

High Priority as user should have control over their account.

4.1.3.2 Stimulus and Response Sequences

User Action: Selects "Settings" in the Main Menu Screen of the application.

System Response: System will retrieve and display the following information of the user from the database – Name, Matriculation Number / Staff ID, Email, Avatar, and if user is a Student - Group, Highest Stage Cleared, Total Score and Currency. System will display the options "Change Password", "Log Out" and "Change Avatar".

4.1.3.3 Functional Requirements

REQ-1: User must be able to change the settings of their accounts

REQ-1-1: User must be able to change their avatar.

REQ-1-2: User must be able to change their password.

REQ-1-3: User must be able to log out.

REQ-2: System must retrieve the following information of the user from the database – Name, Matriculation Number / Staff ID, Email, Avatar, and if user is a Student - Group, Highest Stage Cleared, Total Score and Currency.

REQ-2-1: Name must be displayed in the following format: <LastName> <First Name>.

REQ-2-2: Matriculation Number / Staff ID must be displayed as retrieved from database.

REQ-2-3: Avatar must be displayed in the form of an animated avatar.

REQ-2-4: Class must be displayed in the following four alphanumeric characters: <Lab Group Letters> <Group Number>.

REQ-2-5: Highest Stage Cleared must be displayed in the following format: <World> - <Level><Level Name>.

REQ-2-6: Total Score must be displayed in numerical characters.

REQ-2-7: Currency must be displayed in the following characters: <$>numerical characters.

4.1.4 Change Password

4.1.4.1 Description and Priority

Handles the user changing of password for his/her LearnEZ account.

High Priority as user should be able to change the password of their account.

4.1.4.2 Stimulus and Response Sequences

User Action: Selects “Change Password”.

System Response: System will display two fields for user to enter his/her new password twice.

User Action: Enters matching passwords.

System Response: System will update the password for the user’s account and displays a dialog box with a message “Password has been changed!”

User Action: Enters mismatched passwords.

System Response: User is prompted with an error message “Passwords do not match!”.

4.1.4.3 Functional Requirements

REQ-1: User must be able to change their password.

REQ-1-1: System must ensure the user’s new password and the new re-entered password matches.

REQ-1-1-1: System must display an error message for mismatched passwords

REQ-1-1-1-1: Error message shall be displayed within the change password dialog box as a red font message: “Passwords do not match”.

REQ-1-2: System must update the user's previous password to the user's new password and a message shall be displayed in the form of a dialog box: "Password has been changed!".

4.1.5 Change Avatar

4.1.5.1 Description and Priority

Handles the user changing of avatar for his/her LearnEZ account.

Low Priority as it does not affect the user's learning experience.

4.1.5.2 Stimulus and Response Sequences

User Action: Selects the red button with two intertwining white arrows to change avatar..

System Response: System will display all the available avatars and the user's current avatar.

User Action: Selects an avatar.

System Response: System will display chosen avatar on the settings page.

User Action: User select the same avatar as his current avatar.

System Response: -

User Action: Selects "Choose" on his chosen avatar.

System Response: User is prompted with a confirmation to confirm the

change of avatar.

User Action: Selects “Confirm” when prompted to confirm the change of avatar.

System Response: System will update the avatar for the user’s account.

User Action: Selects “Close” when prompted to confirm the change of avatar.

System Response: System will display all the available avatars and the user’s current avatar.

4.1.5.3 Functional Requirements

REQ-1: User must be able to change their avatar.

REQ-1-1: User must be able to select from six avatars.

REQ-2: System must update the user’s avatar.

4.1.6 Log Out

4.1.6.1 Description and Priority

Handles the logging out of user from his/her LearnEZ account.

High Priority as user should be able to log out from their account when they are done using the application.

4.1.6.2 Stimulus and Response Sequences

User Action: Selects “Log Out”.

System Response: User is prompted with a confirmation to confirm the log out process.

User Action: Selects “Confirm” when prompted to confirm the log out process.

System Response: System will log the user out.

User Action: Selects “Cancel” when prompted to confirm the log out process.

System Response: System will return to “Settings” page (4.1.3).

4.1.5.3 Functional Requirements

REQ-1: User must be able to log out.

4.2 Assignment Manager

4.2.1 View Assignment Board

4.2.1.1 Description and Priority

Handles the viewing of the lists of user’s ongoing assignments.

High Priority as user should be able to view ongoing assignments to facilitate classroom teachings.

4.2.1.2 Stimulus and Response Sequences

User Action: Selects “View Assignment” in the Main Menu Screen of the application.

System Response: System will retrieve and display an assignment board, with the list of ongoing assignments, if any. If user is a Teacher, System will display the option “New Assignments”.

4.2.1.3 Functional Requirements

REQ-1: Student must be able to view ongoing assignments assigned to them.

REQ-2: System must retrieve the list of ongoing assignments of a Student.

REQ-2-1: System must display an error message if there are no ongoing assignment.

REQ-2-1-1: Error message shall be displayed in the form of a text overlay on the screen: “YAY! No Ongoing Assignment”.

REQ-3: Teacher must be able to view assignments he/she has posted.

REQ3-1: Teacher must be able to filter assignments displayed by the tutorial groups.

REQ3-2: If there are no on-going assignments there will be no assignments displayed.

4.2.2 View Assignment Details

4.2.2.1 Description and Priority

Handles the viewing of the details for the selected assignment.

High Priority as user should be able to view the details of a selected assignment to facilitate classroom teachings.

4.2.2.2 Stimulus and Response Sequences

User Action: Selects an assignment in “View Assignment Board” page (4.2.1).

System Response: System will retrieve and display the following information

of the selected assignment from the database – Assignment Title, Assignment Details and Assignment Due Date.

4.2.2.3 Functional Requirements

REQ-1: User must be able to view assignment details.

REQ-2: System must retrieve the following information of the assignment from the database – Assignment Title, Assignment Details, Posted By and Assignment Due Date.

REQ-2-1: Assignment Title must be displayed in alphanumerical character.

REQ-2-2: Assignment Details must be displayed in alphanumerical characters.

REQ-2-3: Posted By must be in the form of <Last Name><First Name>

REQ-2-4: Assignment Due Date must be displayed in the following format:<DD> - <MM> - <YYYY> < HOUR> : <MINUTE> : <SECONDS>

4.2.3 Post Assignment

4.2.3.1 Description and Priority

Handles the posting of a new assignment by a Teacher.

High Priority as Teacher should be able to post new assignments to facilitate classroom teachings.

4.2.3.2 Stimulus and Response Sequences

User Action: Selects “New Assignment”

System Response: System will display the new assignment form with the

following fields – Assignment Title, Assignment Details, Due Date and Time. System will also display a drop down box for the Teacher to select the group and select a .pdf file. System will also display the option “Create”.

User Action: Selects “Create”

System Response: Teacher is prompted with a success message “Assignment has been posted”. System will add the new assignment into the database.

4.2.3.3 Functional Requirements

REQ-1: Teacher must be able to post assignment.

REQ-2: Student must not be able to post assignment.

REQ-3: Teacher must be able to enter Assignment Title, Assignment Details, Due Date and Time.

REQ-3-1: Due Date must be entered in the following format: <DD> - <MM> - <YYYY> <HOUR> : <MINUTE> : <SECONDS>

REQ-3-2: Teacher must be able to select a Class to post the assignment to.

REQ-3-2-1: Teacher must only be able to post assignment for the classes he/she is assigned to.

REQ-3-3: Teacher must select a pdf file to post.

4.2.4 Share on Facebook

4.2.4.1 Description and Priority

Handles the sharing of a new assignment by a Teacher to his/her Facebook. High Priority as Teacher should be able to share new assignments on social media – Facebook, to facilitate classroom teachings.

4.2.4.2 Stimulus and Response Sequences

User Action: Upon pressing “Post”, Teacher selects “SHARE ON FACEBOOK” button in the pop-up dialog box.

System Response: System will invoke the Facebook API and launch the default browser which is then directed to a Facebook post page, with a link to the pdf file.

User Action: Selects “Post”

System Response: Facebook will post the latest status with a url link to the pdf.

4.2.4.3 Functional Requirements

REQ-1: Teachers must be able to share assignments on Facebook.

4.2.5 Share on Twitter

4.2.5.1 Description and Priority

Handles the sharing of a new assignment by a Teacher to his/her Twitter. High Priority as Teacher should be able to share new assignments on social media – Twitter, to facilitate classroom teachings.

4.2.5.2 Stimulus and Response Sequences

User Action: Upon selecting “Post” button, Teacher selects “SHARE ON TWITTER” button.

System Response: System will invoke the Twitter API and launch the default browser with a filled Tweet box “New Assignment Posted “ + url

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User Action: Enter Twitter username and password, then pressing “Log in and Tweet”

System Response: System will invoke the Twitter API and post the tweet to Twitter.

4.2.5.3 Functional Requirements

REQ-1: Teachers must be able to share assignments on Twitter.

4.3 Leaderboard

4.3.1 View Leaderboard

4.3.1.1 Description and Priority

Handles the viewing of leaderboards, which displays the top five scoring Students in the class and the current student logged in .

High Priority as Student should be able to view leaderboards to keep the Students engaged to strive for higher ranks.

4.3.1.2 Stimulus and Response Sequences

User Action: Selects “Leaderboard” in the Main Menu Screen of the application.

System Response: System will retrieve and display a Leaderboard with two buttons – “Class” and “Global”, with the information of the top five Students and the current Student – Rank, Name and Score, in the class.

4.3.1.3 Functional Requirements

REQ-1: Student must be able to view the top five students with the highest score in his/her class.

REQ-1-1: Student must be able to view his/her ranking in his/her class.

REQ-2: System must retrieve the following information of the top five students in the Student’s class with the highest score from the database – Rank, Name and Score.

REQ 2-1: System must retrieve the current student’s information in the Student’s class with his/her score from the database – Rank, Name and Score.

REQ-2-2: Name must be displayed in the following format: <Last Name> <First Name>.

REQ-2-3: Score must be displayed in numerical characters.

REQ-3: System must rank the top five students according to their Score.

REQ-3-1: System must rank the current student according to his/her score with reference to the class leaderboard ranking.

REQ-3-2: Rank must be displayed in numerical characters.

4.3.2 View Global Ranking

4.3.1.1 Description and Priority

Handles the viewing of leaderboards, which display the top five scoring Students within the cohort and the current student logged in.

High Priority as Student should be able to view leaderboards to keep the Students engaged for higher ranks.

4.3.1.2 Stimulus and Response Sequences

User Action: Select “Global” from “View Leaderboard” page (4.3.1).

System Response: System will retrieve and display a Leaderboard with two tabs – “Class” and “Global”, with the information of the top five Students and the current student logged in – Rank, Name and Score, in the cohort.

4.3.1.3 Functional Requirements

REQ-1: Student must be able to view the top five students with the highest score in his/her cohort.

REQ-1-1: Student must be able to view his/her score in his/her cohort.

REQ-2: System must retrieve the following information of the top five students in the Student’s cohort with the highest score from the database – Name and Score.

REQ 2-1: System must retrieve the current student’s information in the Student’s cohort with his/her score from the database – Name and Score.

REQ-2-2: Name must be displayed in the following format: <Last Name> <First Name>.

REQ-2-3: Score must be displayed in numerical characters.

REQ-3: System must rank the top five students according to their Score.

REQ-3-1: System must rank the current student according to his/her score with reference to the global leaderboard ranking.

REQ-3-2: Rank must be displayed in numerical characters.

4.4 Performance Analytics

4.4.1 View Class Performance

4.4.1.1 Description and Priority

Handles the viewing of the selected class's performance.

High Priority as Teacher can logically adjust the teaching contents and key point during classroom teachings according to the performance of his/her class.

4.4.1.2 Stimulus and Response Sequences

User Action: Selects "Performance Report" in the Main Menu Screen of the application.

System Response: System will retrieve and display the class performance in the form of 6 overlapping line graphs. System will display the option "Generate Report" button and also the list of students in the class.

4.4.1.3 Functional Requirements

REQ-1: Teacher must be able to view the performance of his/her class for each world.

REQ-2: System must retrieve the following information from the database –

Average Score, World ID, Student Name and Matriculation Number.

REQ-2-1: Average Score must be displayed in as a point on the line graph corresponding to the score on the y-axis.

REQ-2-2: World ID must be displayed in the form of World<id> where id is an integer ranging from 1 to 6.

REQ-2-3: Student Name must be displayed in the following format: <Last Name> <First Name>.

REQ-2-4: Matriculation Number must be displayed in nine alphanumeric characters.

4.4.2 Generate Report

4.4.2.1 Description and Priority

Handles the generation of performance summary report for a class.

High Priority as Teacher can logically adjust the teaching contents and key point during classroom teachings according to the performance of his/her class.

4.4.2.2 Stimulus and Response Sequences

User Action: Selects “Generate Report” in the “View Class Performance” page (4.4.1)

System Response: System will compile and display the retrieved data from “View Class Performance” (4.4.1) into a CSV file with a title <Lab Group><Group Number>-Performance-Report. The CSV file shall have three columns, “World Name”, “Level Name”, “Total Score”.

User Action: Selects “Download”

System Response: User will download the CSV file into his/her smartphone.

4.4.2.3 Functional Requirements

REQ-1: System must generate the performance summary report in a CSV format.

REQ-1-1: Teacher must be able to download the performance summary report.

4.4.3 View Student Performance

4.4.3.1 Description and Priority

Handles the viewing of the selected Student’s performance.

High Priority as Teacher can logically adjust the teaching contents and key point during classroom teachings according to the performance of his/her student.

4.4.3.2 Stimulus and Response Sequences

User Action: Selects a student in “View Class Performance” page (4.4.1)

System Response: System will retrieve and display the student performance in the form of a line graph, according to the level of each world. System will display the options for Teacher to change the world.

4.4.3.3 Functional Requirements

REQ-1: Teacher must be able to view the performance of his/her student for each world, and each level of the world.

REQ-2: System must retrieve the following information from the database – Score, World Name, Level Name, Student Name and Matriculation Number.

REQ-2-1: Score must be displayed in numerical characters.

REQ-2-2: World Name must be displayed in alphabetical characters.

REQ-2-3: Student Name must be displayed in the following format: <Last Name> <First Name>.

REQ-2-4: Matriculation Number must be displayed in nine alphanumeric characters.

4.5 User Creations

4.5.1 View User Created Levels

4.5.1.1 Description and Priority

Handles the viewing of Student Created Levels.

High Priority as Student can challenge each other and engage in active learning with other Students.

4.5.1.2 Stimulus and Response Sequences

User Action: Selects “User Created Level” in the Main Menu Screen of the application.

System Response: System will display the options the existing User Created Levels and “Create Levels” button

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4.5.1.3 Functional Requirements

REQ-1: Student must be able to play other Students’ Created Levels.

REQ-2: Student must be able to create their own User Created Level.

4.5.2 Play User Created Levels

4.5.2.1 Description and Priority

Handles the playing of existing User Created Levels.

High Priority as Student can challenge with each other and engage in active learning with other Students.

4.5.2.2 Stimulus and Response Sequences

User Action: Selects a user created level.

System Response: System will retrieve and begin playing the selected User Created Level.

User Action: User completes the level.

System Response: System will redirect the user to the UCL View Page (4.5.1)

User Action: User fails the level.

System Response: System will display a failed popup.

4.5.2.3 Functional Requirements

REQ-1: Student must be able to play other Students' Created Levels.

REQ-2: System must not keep track of the Student's score when playing user created levels.

REQ-3: Student must not be able to use powerup in the User Created Level.

REQ-4: Student must not be able to buy powerup in the User Created Level.

4.5.3 New Level

4.5.3.1 Description and Priority

Handles the creation of User Created Levels.

High Priority as Student can create level for other Student to challenge and engage in active learning with other Students.

4.5.3.2 Stimulus and Response Sequences

User Action: Selects “New Level”

System Response: System will display the new level form with the following fields – Level Title, Level Description. Question Title, Question Options and Question Answers.System will require the user to enter five Questions with four Options each. One of the four Options must be selected as the correct option. System will display the button “Create”.

User Action: Selects “Create”

System Response: Student is prompted with a success message “User Created Level has been created”. System will add the new User Created Level into the database.

4.5.3.3 Functional Requirements

REQ-1: Student must be able to create levels.

REQ-2: Created level must have five questions.

REQ-2-1: Each question must have four options.

REQ-2-1-1: Student must choose one of the four options to be the correct option.

REQ-3: Student must choose a world to place the level in.

4.6 Game Manager

4.6.1 Select World

4.6.1.1 Description and Priority

Handles the selection of world to play.

High Priority as Students can view and select worlds in the game, each representing a Software Engineering concept.

4.6.1.2 Stimulus and Response Sequences

User Action: Selects unlocked world

System Response: User enters world and will go to “Select Level” page (4.6.2)

User Action: Selects locked world

System Response:-

4.6.1.3 Functional Requirements

REQ-1: Student must be able to select a world to explore.

REQ-1-1: Student must be able to select any unlocked world.

REQ-1-2: Student must not be able to select a locked world.

REQ-2: System must unlock the successive world in order of chapter number, upon a User's completion of a world (i.e. When world 4 completed, world 5 will then be unlocked).

4.6.2 Select Level

4.6.2.1 Description and Priority

Handles the selection of level to play.

High Priority as Students can view and select levels in the game, each representing an aspect of the selected Software Engineering concept.

4.6.2.2 Stimulus and Response Sequences

User Action: Selects unlocked level

System Response: System must retrieve the following information from the database – World-Level, Topic Name, Leaderboard and Stars Unlocked. System will display the option "Play" button.

User Action: Selects locked level

System Response: -

4.6.2.3 Functional Requirements

REQ-1: Student must be able to select an unlocked level to play.

REQ-1-2: Student must not be able to select a locked level.

REQ-2: System must unlock the successive level in order of topic number, upon a User's completion of a world (i.e. When level 4 completed, level 5 will then be unlocked).

4.6.3 Buy Powerup

4.6.3.1 Description and Priority

Handles the buying of in-game powerup.

Low Priority as powerup is not crucial to the core of the gameplay.

4.6.3.2 Stimulus and Response Sequences

User Action: Selects add button for the individual powerup at the level screen

System Response: System will display the powerup selected

and the cost of the powerup in a dialog box.

User Action: Buy powerups with insufficient currency

System Response: User is prompted with an error message "Not enough coins".

User Action: Buy powerup with sufficient currency

System Response: System will update the user's powerup quantity in the database, and the deducted currency of the user.

4.6.3.3 Functional Requirements

REQ-1: User must be able to purchase powerup

REQ-1-1: User must have sufficient currency to buy powerup

REQ-2: System must update the User's current quantity of each powerup

4.6.4 Use Powerup

4.6.4.1 Description and Priority

Handles the usage of in-game powerups.

Low Priority as powerups are not crucial to the core of the gameplay.

4.6.4.2 Stimulus and Response Sequences

User Action: Selects powerup with sufficient quantity.

System Response: System will decrease the user's selected powerup count by 1. System will active powerup effect.

4.6.4.3 Functional Requirements

REQ-1: User must be able to use powerup.

REQ-1-1: User must have at least 1 powerup in order to use.

REQ-2: System must update the User's current quantity of each powerup upon successful use of powerup.

4.6.5 Play Level

4.6.5.1 Description and Priority

Handles the playing of the selected level.

High Priority as this enables the game to be played.

4.6.5.2 Stimulus and Response Sequences

User Action: Selects "Play" from "Select Level" page (4.6.2)

System Response: System will generate a "maze" for the selected level

4.6.5.3 Functional Requirements

REQ-1: User must be able to play any unlocked level.

REQ-2: User must complete the game in order to unlock the next level.

REQ-3: System must generate six obstacles in the maze

REQ-3-1: Obstacles must represent a question that the user have to solve to continue with the maze.

REQ-4: A timer of 3 minutes and 30 seconds shall begin upon start of the maze.

REQ-4-1: Upon timer hitting 0 seconds, the user will incur a Fail Level (4.6.7)

4.6.6 Complete Level

4.6.6.1 Description and Priority

Handles the user's completion of a level.

High Priority as this enable the user to move on to the next level, to continue with the gameplay.

4.6.6.2 Stimulus and Response Sequences

User Action: User successfully completes the level.

System Response: System will display the score and timing, and then invoke "Select Level" page (4.6.2)

4.6.6.3 Functional Requirements

REQ-1: System must update the user's completion of a level

REQ-2: System must unlock the next immediate subsequent level.

4.6.7 Fail Level

4.6.7.1 Description and Priority

Handles the user's failing of a level.

High Priority as this prevent the user to move on to the next level, to retry the current level.

4.6.7.2 Stimulus and Response Sequences

User Action: User fails the level due to time running out.

System Response: System will invoke "Select Level" page (4.6.2) for the current level

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4.6.7.3 Functional Requirements

REQ-1: System must not unlock the next immediate subsequent level.

4.7 Discussion Board

4.7.1 View Discussion Board

4.7.1.1 Description and Priority

Handles the viewing of the list of discussions.

High Priority as user should be able to view discussions to facilitate learning of Software Engineering concepts.

4.7.1.2 Stimulus and Response Sequences

User Action: Selects "Discussion Board" in the Main Menu Screen of the

application.

System Response: System will retrieve and display a discussion board, with each page showing four discussion thread, if there are any to display. System will display options “NEW DISCUSSION” and the navigating next page and back page arrow buttons for the user to select.

User Action: Selects “New Discussion”

System Response: System will invoke “Post Discussion” page (4.7.2).

User Action: Selects a discussion

System Response: System will invoke “View Detailed Discussion” page (4.7.3).

4.7.1.3 Functional Requirements

REQ-1: Users must be able to view discussions.

REQ-2: System must retrieve the list of discussions.

REQ-2-1: System must display an error message if there are no discussion.

REQ-2-1-1: Error message shall be displayed in the form of a text overlay on the screen: “No Discussion Found”.

REQ-3: Users must be the author of the discussion to delete it.

4.7.2 Post Discussion

4.7.2.1 Description and Priority

Handles the posting of a discussion.

High Priority as user should be able to post discussions to facilitate the learning of a Software Engineering concepts he/she is unsure of.

4.7.2.2 Stimulus and Response Sequences

User Action: Selects “New Discussion”

System Response: System will display the new discussion form with the following fields – Discussion Title and Discussion Details.

System will display the option “Post Discussion”

User Action: Selects “Post Discussion”

System Response: User is prompted with a success message “Your discussion has been posted successfully”. System will add the new discussion into the database.

4.7.2.3 Functional Requirements

REQ-1: Users must be able to post discussion.

REQ-1-1: User must be able to enter Discussion Title and Discussion Details.

4.7.3 View Detailed Discussion

4.7.3.1 Description and Priority

Handle the viewing of a discussion thread posted in the discussion board.

High Priority as user should able to view the detailed information of a discussion including the comment made on the discussion.

4.7.3.2 Stimulus and Response Sequences

User Action: Selects “View More”

System Response: System expands discussion view and retrieve the comments of the discussion thread.

4.7.3.3 Functional Requirements

REQ-1: Detailed discussion must have the comments within the discussion arranged chronologically, with the most recent one at the top.

4.7.4 Comment

4.7.4.1 Description and Priority

Handles commenting on a discussion thread posted in the discussion board.

High Priority as user should be able to post his opinions on a discussion to facilitate learning experience.

4.7.4.2 Stimulus and Response Sequences

User Action: Selects “Comment” button

System Response: System will display a text box for the user to enter his/her comment

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User Action: Selects “Post” button

System Response: User is prompted with a success message “Your comment has been posted successfully”. System will add the new comment into the database.

4.7.4.3 Functional Requirements

REQ-1: User must be able to post a comment

REQ-1-1: Comment must contain less than 280 alphanumeric characters.

5 Other Nonfunctional Requirements

5.1 Performance Requirements

- The application must respond to user's input within 5 seconds.
    - Reduce the waiting time of the user to improve user experience satisfaction.

- The performance report must be generated within 5 seconds when the Teacher request for a report.
    - Reduce the waiting time of the Teacher to improve user experience satisfaction.

- The application system database must be able to store at least 1,000 users' account personal information.
    - Support multiple users using the application.
    - Improves the scalability of the application.

- The application system database must be able to store at least 1,000 questions and answers.
    - Support multiple questions of each level with varying difficulty to improve Student learning experience.
    - Improves the scalability of the application.

- The application system database must be able to store up to a year of student's playing history.
    - Enable Teacher to track their student's playing history and learning experiences.

- The application system database must be able to support up to 5,000 concurrent active query and still respond under 1 minute.
    - Support multiple users using the application.
    - Supports high load, and higher player base.
        - Improves scalability of application.

5.2 Safety Requirements

No safety requirements have been identified.

5.3 Security Requirements

- Account
    - Admin will have to create an account for Student and Teacher in order for them to use the application.
    - Account will be tagged to the user.

- Account Information (Student)
    - Students will only have access to their own personal information.

- Account Information (Teacher)
    - Teacher will only have access to their own personal information and playing information of the Student registered in the Teacher's class, by the Admin.

- Account Password
    - The minimum length for the password will be 8 characters long.
    - Users will only be able to change their own account password.

5.4 Software Quality Attributes

- Usability
    - The application must be able to support English language.
    - The interface of the application must be simple with less than 10 interactive buttons at any screen.

- Reliability
    - The application must be accessible by all users for at least 95% of the time when accessed at any time.
    - The application must not crash at any point in time at all.

- Portability
    - The application system database must be able to migrate information to another Android smartphone easily.
- Maintainability
    - The application functionalities are distinctly separated within each subsystem, any updates and changes made to the subsystems will not affect other subsystems.
- Testability
    - Because of the loose coupling between subsystems, improvements are made to the testing of individual subsystems which results in improving the testability of the whole application.

- Scalability
    - With the non functional requirement for concurrent user accessing database, and the minimum number of user database entries to be stored, this application is scalable beyond just having a small handful of users.

5.5 Business Rules

- Students must be a member of Nanyang Technological University and taking a course related to Software Engineering to access the functionalities of LearnEZ.

- Teacher must be a member of Nanyang Technological University and teaching or facilitating a course related to Software Engineering to access the functionalities of LearnEZ.

Appendix A: Glossary

Term Definition	Term Definition
System Administrators	System Administrator (Admin) refers to a user given administrators functions. This extends to all user-classes functionalities, in addition to editing of any data bases or functions, by accessing directly into the source code. In this case the Admin refers to the team working on this project.
Teachers	Teachers refers to a user class that can access Students analytics, as well as send assignments to Students.
Students	Students refers to users who are playing the game for educational purposes and must not be able to access Admin functions.
Class	A Class refers to a collection of Students. Teachers are assigned Class(es) of Students, and thus the Students in a Class assigned to a Teacher are by extension the Teacher's Student.
Final Level Difficulty Score	This denotes the Difficulty Score a Student achieves at the end of the level.

Score	Score is the only metric displayed to account for the Student's proficiency. It is derived by multiplying "Final Level Difficulty Score" and "Time Taken for Level".
World	A World refers to a collection of five levels. Each World is a different Software Engineering related chapter.
Level	Level is the term used to replace what is called "Sections" in the "Lab Project Basic Requirements" document. Each Level is a topic within a Software Engineering chapter. A level is a playable maze that scrolls from the top of the phone screen to the bottom, with the user requiring to navigate out of the maze lest they lose. Obstacles will be along the maze and each obstacle hit by the user results in a quiz. Each Level will follow the chapter of the World.
Obstacle	Obstacles are quizzes that appear as a bug within a level.
Quiz	Quizzes are a result of the Student's Avatar colliding with an Obstacle. Quizzes have a Multiple Choice Question format with four options. When a Student answers correctly, the Avatar will speed up.
Main Menu	Main Menu is the page that Students will see immediately after login. It shall include the following options:

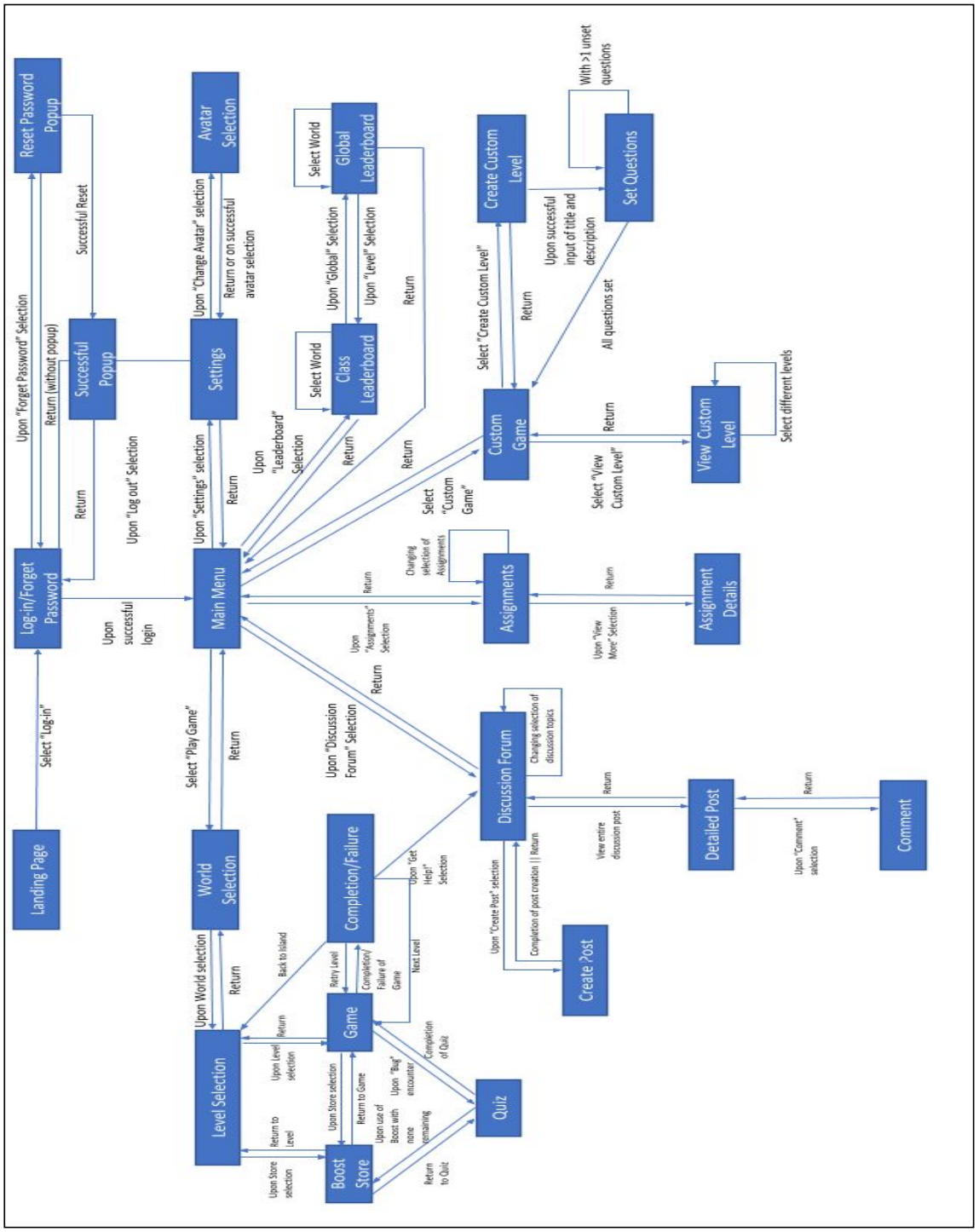
	● Play Game ● User Created Levels ● Assignments ● Leaderboard ● Discussion Board ● • Settings
Leaderboard	The Leaderboard shall show the top five Student's score in the level or world.
Discussion Board	The Discussion Board is a page where users can upload threads for any particular world, and other users can comment and upvote and downvote these threads.
Threads	Threads are a discussion post, where users may reply to a post thus creating a thread.
Settings	The Settings page shall allow users to change their Avatar, change password, and logout. The default Avatar would be the Software Engineer.
Avatar	Avatar refers to the characters that a Student can play as. There are 6 Avatars available: 1. Software Engineer (Default) 2. Fullstack Engineer

	3. Agile Practitioner 4. System Engineer 5. Software Architect 6. 6. Project Engineer
Power-ups	Power-ups refer to abilities that can be used during an encounter to give the Student a boost. The Power-ups in the game are the following: o Change Question o This powerup allows the Student to swap the o current question for another, with the same o difficulty. o 50/50 o Reduces the options in the quiz from four to two. One of the two must be a correct option, and the other will be wrong.
Settings	Settings will display the Student's name, matriculation number, email, tutorial group number, highest stage cleared (in the format of world-levels (i.e. 4-3 means 4th world, 3rd level))
Leaderboards	Leaderboards refers to a scoreboard where the top 5 scoring students are listed in descending order (Highest scoring student should be at the top of the page). There will be a leaderboard for each World.

	Leaderboards must include the Student's name, rank, Avatar and score. There will be a global Leaderboard and a class Leaderboard. Class Leaderboard shows the Leaderboard for the class, and global Leaderboard shows the Leaderboard for the cohort.
Student Report	Student Reports are only accessible to the Teacher, and by extension the Admin. Student Report must include the Student's Name, Matriculation Number, School and Score (Final Level Difficulty Score * Time Taken).
Assignments	Assignment refers to questions that a Teacher poses to a Student, in the game, through social media.
Csv	Csv is an abbreviation for 'Comma-separated values' and a common file used for reading documents. In this project it is used for documents for Teachers to download.
Ongoing Assignments	Ongoing assignments refers to an assigned student's assignment that is not past it's due date.

Appendix B: Analysis Models

Dialog Map



Entity-Relationship Diagram