CZ3003 Software System Analysis & Design

2020/2021 Semester 2

Software Requirement Specification

for Physics Lab

Document Version 1.2

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18 February 2021

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Revision History

Version	Date	Author(s)	Comments
1.0	05-02-2021	Krystal Hwang Yan Lin Lee Chun Fei Mindy Hwang Mei Hui	Initial draft of SRS
1.1	10-02-2021	Cai Yu Francis Nai Jian Xiong Huang XiaoYan Mo Naiming Krystal Hwang Yan Lin Tan Wen Jun	Update of SRS
1.2	17-02-2021	Lee Chun Fei Mindy Hwang Mei Hui Tan Wen Jun	Refine of SRS

1.   Introduction

1.1   Purpose

This document contains an overview of the desktop game application, Physics Lab, its functional and non-functional requirements. It also showcases the system features and interfaces, as well as the constraints when developing the software.

1.2   Document Conventions

This document is created based on the IEEE template for System Requirement Specification (SRS) document. The revision history of the document is made available in the section, Revision History.

1.3   Intended Audience and Reading Suggestions

This document is intended for the users of the desktop game application. The users are students and teachers in school. It also serves as a reference for the potential software developers of this game.

The desktop game application aims to achieve the following with its audience:
- Students can form an interest in physics when learning through the social game;
- Students can be engaged and learn with their peers;
- Teachers who are keen to adopt a creative teaching method;

1.4   Product Scope

Physics Lab is a social game on a desktop application that is intended to gamify and socialize the teaching and learning of the physics subjects in school. Students can understand and learn the various physics topics in a game format. The teachers can utilize the application as a guide for the students and access their mastery of the course via data analysis.

The product scope shall cover the following:
- Provide ease of learning physics topics for school students;
- Enable students to master the topics and compete among their peers through games;
- Allow teachers to review the topics and access students' mastery of the course via data analytics;

1.5 References

Github Physics Lab Documentation:

https://github.com/ChunFei96/SSAD-Documentation.git

Godot Game Engine Document:

https://docs.godotengine.org/en/stable/#

Godot Game Engine Asset Library:

https://godotengine.org/asset-library/asset/120

IEEE Template for System Requirement Specification Document:

https://web.cs.dal.ca/~hawkey/3130/srs_template-ieee.doc

Pokemon S.T.A.R. Version Game Review:

https://www.moddb.com/games/pokmon-star-version/images/mode-selection-heroes

Save Your Nuts Game Review:

https://3rd-strike.com/save-your-nuts-review/

SEAB O-Level Science Physics Syllabus Code 5059 Document:

https://www.seab.gov.sg/content/syllabus/olevel/2017Syllabus/5059_2017.pdf

SL Education O Level Science Physics Topical Revision Notes:

      ISBN 978 981 32 4215 1

      Author: Tan Kim Seng

      Publisher: Shinglee Publishers Pte Ltd

      Publication Year: 2016, reprinted in 2020

Use Case Specification Document:

http://agilemodeling.com/shared/UseCaseTemplateFormal.doc

2.   Overall Description

2.1   Product Perspective

Physics Lab is a desktop game application which aims to replace the traditional convention of teaching physics topics in school. Students can interact with the application and learn from the gameplay experience.

The following topics are the physics syllabus used for this game application:
- Physics Quantities, Units and Measurement;
- Kinematics;
- Weight and Density;
- Light

Refer to *Appendix B: Product Skeleton* for more information on the overview of the application skeleton.

2.2   Product Functions

Student

Physics Lab challenges the students to navigate the game through different topics. Each topic simulates a world with multiple levels for the players to explore and complete tasks.

The students can perform the following:
- Choose their game characters which can bring benefit in the gameplay;
- Solve puzzles or questions to learn and score marks;
- Unlock new levels or worlds with enough accumulation of scores;
- Save and retrieve their overall scores;
- Compare the leaderboard ranking with their peers;
- Able to challenge their friends in the same world;

Teacher

Physics Lab provides an intuitive learning guide for the students to learn the topics. It helps to reduce the workload for the teachers as the students can learn the topics before class and revise their learning with the application at their own pace.

The teachers can perform the following:

- Observe the mastery of course via data analysis;
- Assign tasks for students to complete through social media;
- Provide feedback to students on their learning;

2.3   User Classes and Characteristics

The anticipated user classes are student and teacher. The following describes the characteristics of the respective user classes.

Student

- Form the main consumer of the desktop game application;
- Prefer to learn physics knowledge and theory through gameplay;
- Tend to use an application in intervals to complement their school schedules;
- Can play through the game levels alone and challenge their peers;
- Can access the leaderboards;
- Must submit the assignments given from teachers within the deadline;
- Able to self-evaluate their understanding of topics based on topic summary;

Teacher

- Monitor students' progression and mastery of topics;
- Review and adjust difficulties of teaching material based on report statistics result;
- Create assignments for students to complete via social media;

2.4   Operating Environment

The software will run on a standalone desktop application developed by the Godot C# game engine. The game application will store the player's data which includes the leaderboard ranking in database storage in Microsoft SQL Server Management Studio.

The users are to use their keyboard and mouse for input media towards the game interaction. Windows 10 operating system is the preferred use for the software application to ensure the best gameplay experience.

2.5   Design and Implementation Constraints

Time

Limited time is given to the developers to complete the game development. It results in curtailing the number of physics topics to be built in the game. The developers would have to decide the topics that are important and set as a priority. The developer can consider the extensibility of the application to cover more topics in future.

Security

The developers' main focus would be on the completeness of the game. The security requirements to ensure the data is secured or encrypted would be hampered. As there will be a lack of penetration and vulnerability testing.

Database

The Godot game engine and C# framework further limits the suitability of database options available to store the game application datum.

Design

The design conventions will be kept at minimal and simple due to the lack of experience from the developer team to design the game application.

2.6   User Documentation

The following are the user documentation for Physics Lab:
- User Help Document;
- Software Requirement Specifications Document;

The user help document aims to provide quick guidance for users if they face any issue when using the software application. For example, a short tutorial on how the game runs, and frequently answer questions to support the user's questions.

The SRS contains the detailed document of the desktop game application. It includes the functional and non-functional requirements, the structure of the development of the game.

2.7   Assumptions and Dependencies

The following assumptions are applied in Physics Lab:

- The student has not much knowledge on the physics topics;
- All users input are to use keyboard and mouse for interaction;
- All users have an existing account;
- The use of the software application is in English language;
- The software is catered to desktop screen size and has a fixed resolution size;
- The student is not only allowed to change their character after initial selection;
- The developer is responsible for the product development and support;
- The developer has to set the user privilege levels based on their role;

The following dependencies are applied in the application:

- The running of the game depends on the open-source game engine;
- The application runs on Windows Operating System;
- The software only accepts a single input one at a time;

3.   External Interface Requirements

3.1   User Interfaces

The user interface shall follow a minimalist desktop application design. When the user starts the desktop application, the main interface will show and the user has to click on the "Start" button.

The login screen interface will be displayed and the user has to login with their email account. Once logged in, the application will display the character selection and game world selection page for the user to select their game character and game world respectively. If the user has not completed the first game world, he or she would not be able to have the option to select another game world till they meet the minimum score requirement to unlock the other game world.

After every game world is completed, the user's statistics will be shown in the leaderboard of the particular world. When all the four worlds have been completed, an updated overall leaderboard page will be displayed to the user. They can check their scores under the "Overall Leaderboard".

Refer to *Appendix C.3 Dialog Map* for more detailed information on the user interface dialog map.

3.2   Hardware Interfaces

Physics Lab is a desktop game application that is designed specifically for use on the laptop or desktop platforms.

3.3   Software Interfaces

The desktop application is integrated using an open-source game engine, Godot Engine. It has a visual editor that is equipped with all the necessary tools to build an interactive and engaging context-sensitive UI.

Godot engine also contains a wide pool of asset libraries which the developer can utilize from. It can work on multi-platform with different types of operating systems such as Windows, macOS and Linux.

The data of the desktop application would be stored in Microsoft SQL Server Management Studio and shared with related components in the system.

3.4   Communications Interfaces

Email

To register an account for the software application, a school email will have to be used. After the user's first login, they can specify their account name which will be tied to their email.

Electronic Forms

The user with the role of "Teacher" will be able to access the registration form. The "Student" user will not be able to use the application if they are not registered by their teachers.

The login form will be used to authenticate the users.

Social Media

Social media platforms can be connected to the game, such as Facebook. The teachers can upload the assignments and inform their students via the platform. For example, a teacher can share the online assignment by uploading through the class' Facebook group page.

4.   System Features

4.1   Account Creation

Description

This feature describes how the system registers the new student users.

Priority

The account creation feature is a medium priority.

Stimulus/Response Sequences

Stimulus: Teacher clicks on the "Create Student Account" button.

Response: System displays the registration form.

Stimulus: Teacher enters the required information (student name, email, school, password) and clicks on the "Create Account" button.

Response: System will prompt the teacher that the account is successfully created.

Functional Requirements

1. The system must allow the teacher to create the student account(s).

    1.1 After the account is created, the system must allow the student to login using the email and password given by the teacher.

4.2   User Login

Description

This feature describes how users can login to the system.

Priority

The user login feature is a high priority.

Stimulus/Response Sequences

Stimulus: User opens the desktop game application.

Response: System displays the login page.

Stimulus: User enters the username and password.

Response: System directs to the respective user homepage - teacher and student.

<u>Functional Requirements</u>

1. All students must login to the game before playing.

    1.1 The system must allow the student to login to their own account.

    1.2 The system must allow the student to enter username and password.

4.3   Character Selection

<u>Description</u>

This feature describes how the student selects one of the characters after logging into the application. The selected character will be used throughout the game.

<u>Priority</u>

The character selection feature is a high priority.

<u>Stimulus/Response Sequences</u>

Stimulus: Student clicks on the "Login" button.

Response: System will display all the characters for students to choose during the first login.

Stimulus: Student clicks on one of the characters.

Response: System will display a short introduction of the character.

Stimulus: Student clicks on the "Back" button.

Response: System will redirect the student to the character selection page.

Stimulus: Student selects one of the characters and clicks on the "Confirm" button.

Response: System will redirect students to the game world selection page.

<u>Functional Requirements</u>

1. The system must allow students who login for the first time to make a character selection.

    1.1 The character selection page must display four characters.

    1.2 The system must display the character's introduction by clicking on the image of the character.

1.3 The system must allow students to select the character that they chose.

4.4   Mute Background Audio

<u>Description</u>

This feature describes how the system can allow the student to mute the background music.

<u>Priority</u>

The mute background audio feature is a medium priority.

<u>Stimulus/Response Sequences</u>

Stimulus: Student logins to the system successfully and enters the main page.

Response: System will turn on the background audio by default.

Stimulus: Student clicks on the music icon.

Response: System will toggle between the music icon to mute. The icon will show a red strike-off symbol if it is muted.

<u>Functional Requirements</u>

1. The system must allow the student to mute the background audio.

    1.1 The system must display the music icon on the main page.

    1.2 The system must allow the student to switch on/off the background music.

4.5   Leaderboard Score

<u>Description</u>

This feature describes the functionality where it allows players to view their scores.

<u>Priority</u>

The leaderboard score feature is a medium priority.

<u>Stimulus/Response Sequences</u>

Stimulus: Student clicks on the leaderboard icon.

Response: System shows the leaderboard score and displays the score from the highest to the lowest in descending order.

1. Leaderboard score must be updated whenever players tap on the leaderboard icon to refresh.

2. Database connection with the game must be stabilized to ensure data consistency.

4.6   View Account Profile

Description

This feature describes the feature where the users can view their profile such as personal details and email.

Priority

The view account profile feature is a medium priority feature.

Stimulus/Response Sequences

Stimulus: Student clicks on the user profile.

Response: System displays the player's details such as account name and email address.

Functional Requirements

1. The system must allow students to view their details.

      1. 1 The student shall be able to click on the user profile.

      1.2 The system must display and disabled the non-edited fields.

4.7   Monitor Students' Performance

Description

This feature describes how the system allows the teachers to monitor their students' performance.

Priority

The monitoring of students' performance is a high priority.

Stimulus/Response Sequences

Stimulus: Teacher clicks on the "Performance" button.

Response: System displays a drop-down list that contains all the available students.

Stimulus: Teacher selects the student to be reviewed.

Response: System displays the data analysis of the student regarding their performance on each topic.

Functional Requirements

1. The system must be able to retrieve the data from the database correctly.

    1.1 The system will process the student's data and display in an informative summary to the teacher.

5. Other Non-Functional Requirements

5.1 Usability

5.1.1 The application must allow users to accomplish the task with few or no errors;

5.1.2 The application must include help support for users when needed;

5.1.3 The application must be easy for the user to understand, learn and navigate;

5.2 Performance

5.2.1 The application page loading must be less than ten seconds;

5.2.2 The application shall displays relevant error messages;

5.3 Reliability

5.3.1 The information displayed to users must be accurate;

5.3.2 The application must have an uptime of 99.95%;

Appendix

Appendix A: Glossary

Term	Definition
Application	A programme or software designed to perform various specific purposes. In this case, the project defines the application as a desktop application, known as Physics Lab.
Character	A game character person is one of the topics in the game. It acts to trigger the flow of the storyboard when the player selects a character.
Database	A data structure that stores a collection of organized information for easy access, manage and update. In this case, the selected database management system is Microsoft SQL (MSSQL).
Developer	A person who uses his/her technical knowledge to develop a software programme.
GoDot	A free and open-source community-driven 2D and 3D game engine.
Icon	An user interface representative which allows the users to recognise the functionality and triggers the call function. In this application, the below are the listed functions: ● Account - to view user account and edit personal details; ● Replay - to replay the particular game section; ● Sound - to switch on or off the background audio;
IEEE	Institute of Electrical and Electronics Engineers (IEEE). The organisation which sets highly cited global standards and best practises for professional and educational activities.
Leaderboard	A scoreboard which displays the lists of players with the highest score to the lower score.
School	An educational institution designed to provide learning spaces and conducive environments to teach students under the guidance of teachers. In this case, the target scope is secondary school(s) teaching O-level syllabus.
System	An organized collection of parts (or subsystems) that are highly integrated to accomplish an overall goal.
SEAB O-Level	Singapore-Cambridge General Certificate of Education Ordinary Level. It is known as the GCE O-Level.
User	People who use the application or system. The stakeholders of the application are student and teacher. They are persons who are enrolled in an educational institution to acquire or teach knowledge respectively.

Appendix B: Product Skeleton

The diagram shows the product skeleton of Physics Lab. The application consists of the game play, game engine, database, version control and framework.
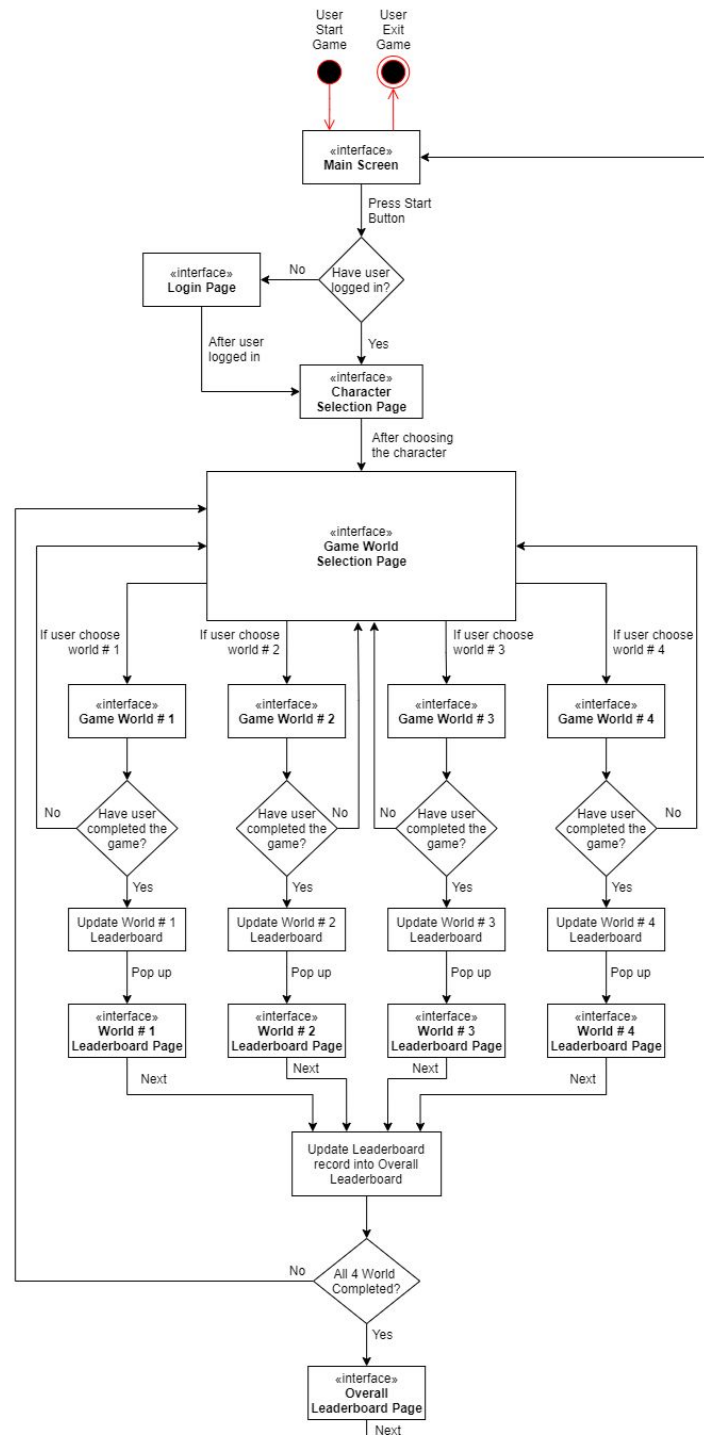
Application Product Skeleton
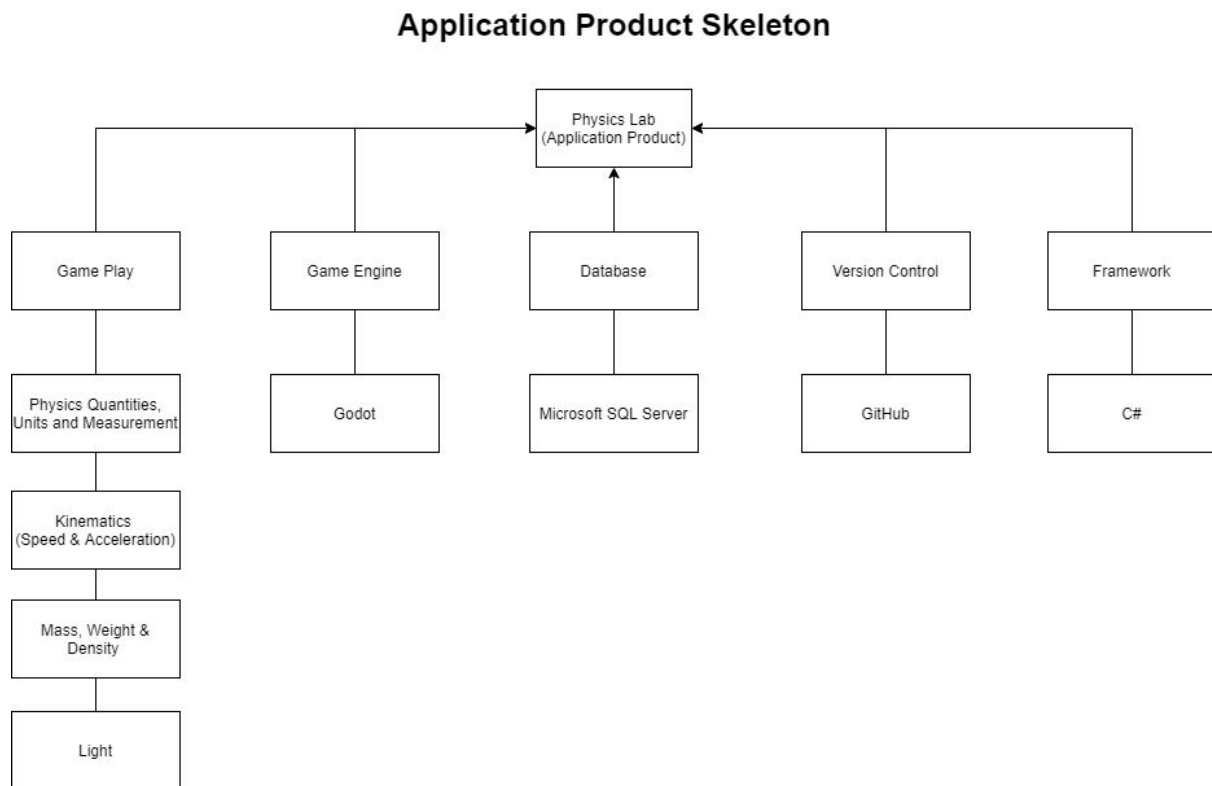
Refer to *ProductSkeleton.pdf* for more detailed information.

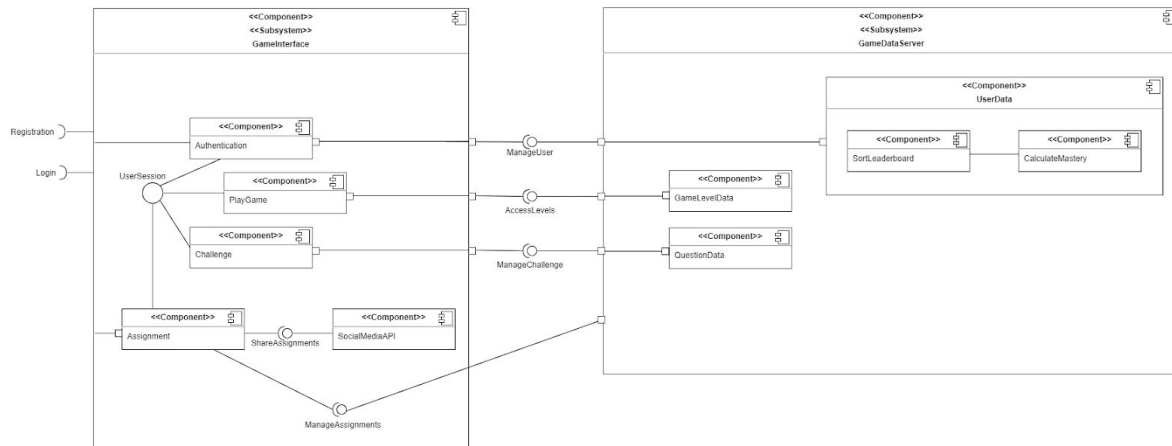# Appendix C: Analysis Models

C.1 Dialog Map

User Interface Dialog Map

Refer to *DialogMap.pdf* for more detailed information.

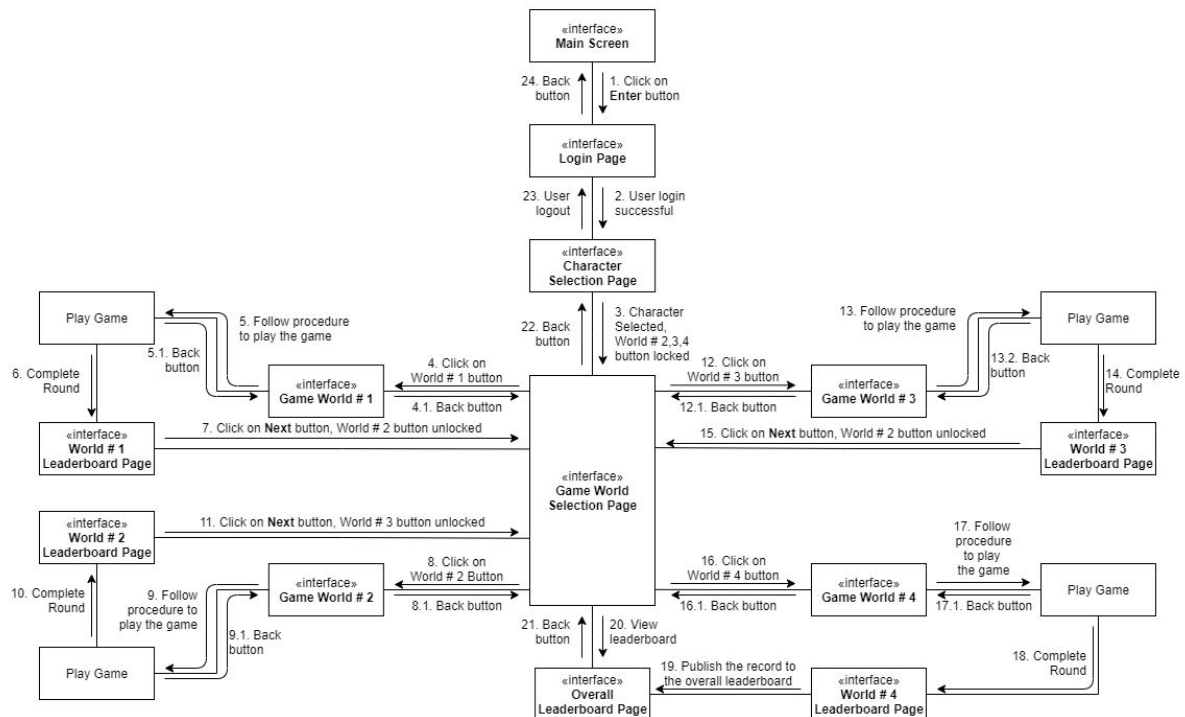## C.2 Static Model - Component Diagram

Component Diagram

Refer to *ComponentDiagram.pdf* for more detailed information.

C.3 Dynamic Model - Communication Diagram

Communication Diagram

Refer to *CommunicationDiagram.pdf* for more detailed information.

Appendix D: To Be Determined List

The following listed are to be tracked and completed.

1. Entity-Relationship Diagram
2. Data Flow Diagram
3. Use Case Model
4. Test Cases