Functional Requirements

Table of Contents

List of Functional Requirements

1. Graphical User Interface

a. The game has a Graphical User Interface (GUI).
b. All visual elements are 2-dimensional.
c. The GUI is mouse-based so that the user can click on buttons/ text boxes to navigate the different menus and progress through gameplay.
d. There are alternative keyboard shortcuts that allow the user to access different menus/ features directly.
e. The alternative keyboard shortcuts are told to the user through the Instructions screen.
f. The TAB key cycles through the GUI buttons/ text boxes in a logical order. (top to bottom, left to right)
g. The gameplay has a visual display system to show the order of the action blocks.
h. The GUI has a colour-blind mode.
i. The buttons respond to user input. (using sound effects)
j. The game has an audio feedback system activated by the GUI elements and gameplay actions.
k. The game should have the following screens/ menus:
   i. Multi-User Login
   ii. Main Menu
   iii. Gameplay
   iv. High-Score Table
   v. Progression
   vi. Tutorial
   vii. Pause
   viii. Settings

2. Main Menu (Screen)

a. The main menu screen displays the name of the game project.
b. The main menu screen displays the logo/ banner of the game project.
c. The main menu screen displays a wallpaper that is representative of the gameplay.
d. The main menu screen has a button that continues the most recently accessed game save.
e. The main menu screen has a button that creates a new save file.
f. The main menu screen has a button that opens the instructions screen.
g. The main menu screen has a button that opens the high-score table screen.
h. The main menu screen has a button that opens the student or teacher progression screen.
i. The main menu screen has a button that opens the settings menu.
j. The main menu screen has a button that exits the game to the desktop.

k. The credits area contains the full names of all team members.
l. The credits area contains the group ID. (Group 68)
m. The credits area contains the course term. (Winter 2024)
n. The credits area mentions that this game project was created as part of CompSci 2212B at Western University.
o. The build number indicates which version of the compiled game the user is running.

3. Tutorial (Screen)

a. The tutorial screen has a button that returns to the previous screen.
b. The instructions menu lists all mouse inputs.
c. The instructions menu lists all keyboard shortcuts.
d. The instructions menu contains tips on how to interact with the gameplay screen.
e. The instructions menu summarises what the game teaches, what the player can learn, and the major features of the game.

4. Gameplay (Screen)

a. The gameplay screen has at least 3 levels of difficulty (as 3 separate stages).
b. The gameplay screen has a scoring system to reward/ compare player solutions for every stage, using weighted metrics:
    i. The highest score
    ii. The shortest time
    iii. The number of checkpoints reached.
    iv. The completion of the stage.
c. The gameplay screen has a progression system to unlock new stages based on the player's score.
d. The gameplay screen has a per-stage feedback system to comment on the player solution's correctness.
e. The gameplay screen has a game clock to track the fastest time and the total amount of time spent on each stage.
f. The gameplay screen has a button that opens the high-score table screen.
g. The gameplay screen has a pause button that can pause/ unpause/ reset the execution of action blocks.
h. The gameplay screen has a pause menu button that opens the pause menu.
i. Updates the save file automatically when a stage is completed.
j. No score is deducted for incorrect answers, and infinite retries are available.
k. Puzzles are solved by chaining a sequence of action blocks to control a character to complete objectives.
l. Action blocks can be added by mouse (or keyboard, using the debug menu).
m. Each stage teaches concepts of the same theme through puzzle-solving:
    i. Move the character to the finish line in the Cartesian coordinate system. (Forward, Back, Rotate Counter-clockwise, Rotate Clockwise)
    ii. Move the character to avoid obstacles. (Walls, Traps)
    iii. Control the character to grab items and place them on checkpoints.
    iv. Automate character movement using constant loops. (Goto line = X)
    v. Automate character movement using variable loops, based on input variables of the coordinates of the character, the finish line, the obstacles, and the checkpoints. (Loop X - Y times and then Goto line = Z)

5. Save & Load

a. The game has a save system that creates/ accesses independent save files to keep track of each student's progression.
b. The game has a file system that saves/ loads (multiple) game files in CSV format.
c. The game only displays save files that belong to the current user, unless teacher mode/ dev mode is enabled.
d. The game has a folder for storing save files that allows teachers and developers to create or delete any save file manually.
e. Each save file includes these data:
    i. user type
    ii. username
    iii. password
    iv. stage ID
    v. stage completion
    vi. highest score
    vii. shortest steps
    viii. time spent
    ix. number of attempts

6. High-Score Table (Screen)

a. The high-score table is stored and loaded locally on a computer.
b. The high-score table has a button that returns to the previous screen.
c. The high-score table is updated automatically each time the high-score table screen is opened.
d. The high-score table displays the 5 highest-scored entries sorted in descending order in a list format, including empty entries.
e. Each entry contains:
    i. The player's full names.
    ii. The player's score.
f. Each entry is separated with a solid-coloured border.

7. Multi-User Login (Screen)

a. The multi-user login screen is used locally and asynchronously on a computer.
b. The multi-user login screen is opened automatically on game launch.
c. The multi-user login screen auto-selects the user type based on username and (secret) password:
    i. Student
    ii. Teacher
    iii. Developer
d. The multi-user login screen prompts and stores the following login information:
    i. Username
    ii. Password (custom student passwords, or unique secret passwords for teachers/ developers)
e. The username and password are used to enable teacher/ developer mode.
f. The username and password are used to gain permission to load the save files. (students can only load their own save files, while teachers/ developers can load any save files)
g. The username and password are stored in each save file for identification.

8. Teacher Mode

a. The teacher mode can be enabled by logging in with the username "teacher" and a unique secret password.
b. The teacher mode has access to all features in student mode.

    c. The teacher mode has special access to the teacher progression screen.
    d. The teacher mode uses a save file with all stages already completed, thus having direct access to any stages.

9. **Developer Mode**
    a. The developer mode can be enabled by logging in with the username "developer" and a unique secret password.
    b. The developer mode has access to all features in student mode and teacher mode.
    c. The developer mode has access to view detailed crash reports, stored in a crash log in TXT format.
    d. The developer mode has access to a debug button that can print the action chain in an encoded String format (to verify the action chain View and Model classes).

10. **Error Handling**
    a. For incorrect user inputs (e.g. incorrect password), the game displays an error popup message and discards the garbage input.
    b. For critical errors (e.g. input buffer overflow), the game displays an error popup message and resets the current screen. (no unexpected crashes)
    c. The game logs errors to a log file named game_errorlog.txt
    d. The game can unload currently opened screens/ menus and exit to the main menu.
    e. The game can close all windows and exit to the desktop. (no remaining background processes)
    f. The game can correctly save/ load save files, and the saved data remains uncorrupted between restarts.
    g. The game can scale window size correctly. (or lock window size)
    h. The game can minimize windows correctly. (or lock window size)
    i. The game can maximize windows correctly. (or lock window size)

11. **Progression (Screen)**
    a. The teacher progression screen is not accessible in student mode.
    b. The progression screen has a button that returns to the previous screen.
    c. The progression screen displays the following statistics:
        i. Each player's name.
        ii. Each player's score.
        iii. Each player's current incomplete stage.
        iv. Each player's list of all completed stages, with the number of attempts per stage.
        v. Each player's total time spent.
        vi. Aggregated statistics of all players. (average score, frequency distribution of scores, average time spent)

12. **Pause (Menu)**
    a. The pause menu has a button that returns to the previous screen.
    b. The pause menu has a button that manually saves the current progression.
    c. The pause menu has a button that opens the main menu screen.
    d. The pause menu has a button that opens the settings screen.
    e. The pause menu has a button that opens the tutorial screen.

13. **Settings (Menu)**
    a. The settings menu has a button that returns to the previous screen.
    b. The settings menu has a drop-down menu that selects the resolution.
    c. The settings menu has a drop-down menu that selects the colourblind mode.
    d. The settings menu has a slider that adjusts the volume of sound effects.

Scenario model

Actors

Student

Actor	Student
Description	The target audience of the game
Aliases	User, Player
Inherits	None
Actor Type	Person, End-user
Active/ Passive	Active

Teacher

Actor	Teacher
Description	Monitors students' progress, and controls certain settings
Aliases	User, Admin, Instructor
Inherits	Student

Actor Type	Person, End-user
Active/ Passive	Active

Developer

Actor	Developer
Description	Tests and updates the game, and has access to debug mode
Aliases	User, Dev
Inherits	Teacher
Actor Type	Person
Active/ Passive	Active

Use Cases

Student

Name	Launches the game and logs in
Primary Actor	Student
Secondary Actors	None
Goal In Context	The user launches the game. After the game finishes loading, a screen comes up that prompts them to either log in to their account or register a new account.
Preconditions	None
Trigger	A student decides to launch the application.
Scenario	1. The user decides to launch the game 2. The game loads and the screen shows up which prompts the user to either login or register an account. 3. The user inputs their username to log in to their account. 4. There will also be a password field, which students will leave blank. For teachers and developers, there will be a special username and password they can enter to get special permissions when they login into the game. 5. If the entered information is incorrect, the user is prompted to try logging in again or register for an account. 6. Once the user enters the correct login information, the user is brought to the main menu of the game.
Alternatives	The student is logging in for the first time, meaning they have to register an account. If they press the button to register an account they will be brought to a separate screen which will allow them to input a username. This information will be stored in a file for use when they log in the next time. They will then be redirected to the login page once again.
Exceptions	The game fails to launch properly. The student enters incorrect login information.
Priority	Highest

Name	View the high score screen
Primary Actor	Student
Secondary Actors	None
Goal In Context	To view the game leaderboard
Preconditions	Logged in
Trigger	The player wants to view the leaderboard

Scenario	1. The player is logged in and looking at the main menu 2. The player clicks the high score button 3. A new screen is displayed with the leaderboard
Alternatives	None
Exceptions	None
Priority	High

Name	View the instructions
Primary Actor	Student
Secondary Actors	None
Goal In Context	To view the instructions for playing the game
Preconditions	Logged in and is in the main menu
Trigger	The player wants to view the instructions
Scenario	1. The player is logged in and looking at the main menu 2. The player clicks the instructions button 3. A new screen with the instructions is displayed
Alternatives	None
Exceptions	None
Priority	High

Name	Play new game
Primary Actor	Student
Secondary Actors	None
Goal In Context	To play the game
Preconditions	Logged in and is in the main menu
Trigger	The player wants to start playing
Scenario	1. The player is logged in and looking at the main menu 2. The player clicks the play new game button 3. A new screen showing the game levels is displayed 4. The player clicks on one of the levels 5. The game screen is displayed 6. The player completes the stage 7. A feedback screen is displayed with the score and options to continue to the next stage or return to the main menu 8. The player clicks the button to continue 9. Repeats 5-8 until the player completes all stages or exits
Alternatives	1. The player clicks return to main menu button on the feedback screen 2. The game progress is saved 3. The main menu is displayed
Exceptions	None
Priority	Highest

Name	Load saved game
Primary Actor	Student
Secondary Actors	None
Goal In Context	To load a saved game
Preconditions	Logged in and is in the main menu
Trigger	The player wants to continue a saved game
Scenario	1. The player is logged in and looking at the main menu 2. The player clicks the saved game button 3. The saved game menu showing the saved games is displayed 4. The player clicks on one of the games 5. The game screen is displayed at the saved stage/checkpoint
Alternatives	1. The player clicks return to main menu button on the saved game menu 2. The main menu is displayed
Exceptions	None
Priority	Highest

Name	Change settings
Primary Actor	Student
Secondary Actors	None
Goal In Context	To change the game settings
Preconditions	Logged in and is in the main menu
Trigger	The player wants to change the settings
Scenario	1. The player is logged in and looking at the main menu 2. The player clicks the settings button 3. A new screen with the settings is displayed 4. The player selects a new resolution 5. The game screen resolution is adjusted accordingly
Alternatives	1. The player changes the sound volume 2. The sound volume is adjusted accordingly
Exceptions	None
Priority	Lowest

Name	Exit game
Primary Actor	Student
Secondary Actors	None
Goal In Context	To exit the game
Preconditions	Logged in and is in the main menu
Trigger	The player wants to exit the game

Scenario	1. The player is logged in and looking at the main menu 2. The player clicks the exit button 3. The game window is closed and the application is terminated
Alternatives	None
Exceptions	None
Priority	High

Teacher

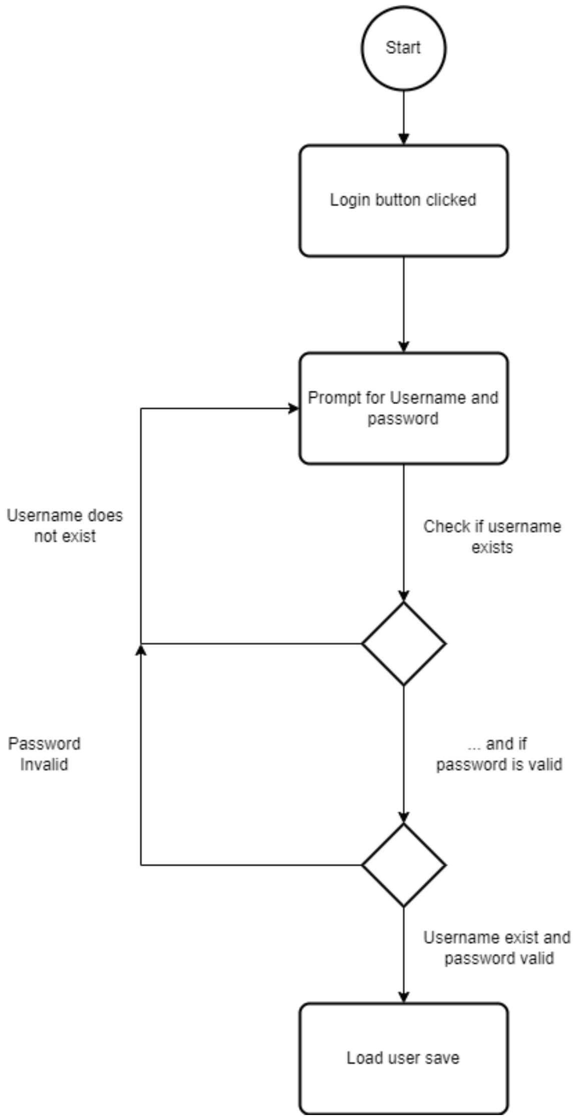
Name	View student progression
Primary Actor	Teacher
Secondary Actors	None
Goal In Context	To check students' progression
Preconditions	Logged in in Teacher Mode
Trigger	Teacher wants to view each of their student's progress
Scenario	1. The teacher is logged in as a teacher 2. The teacher clicks on the progression button 3. The progression screen showing statistics for all students is displayed
Alternatives	None
Exceptions	None
Priority	High

Developer

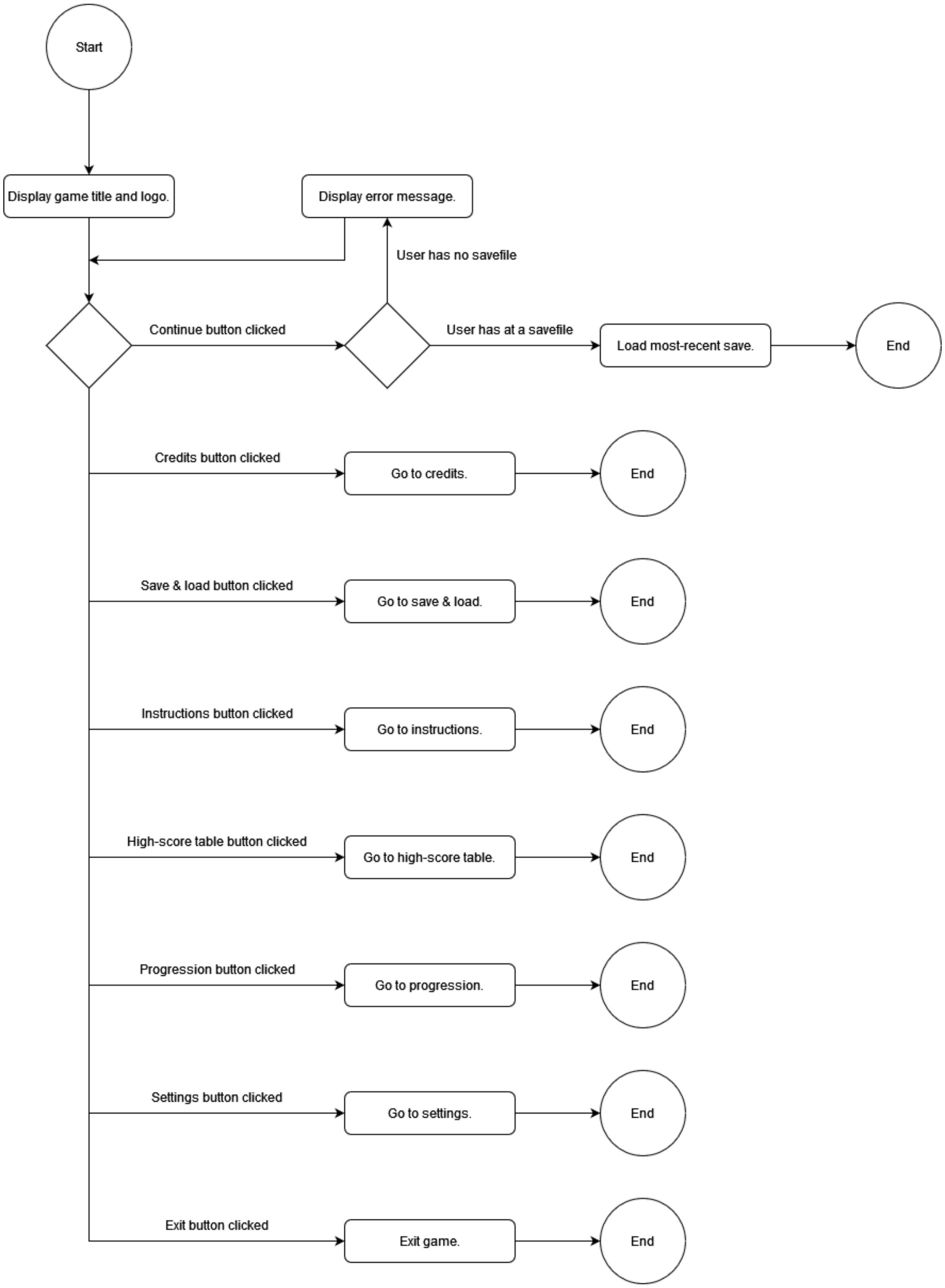
Name	Debug
Primary Actor	Developer
Secondary Actors	None
Goal In Context	To debug the game
Preconditions	Logged in as a developer
Trigger	Developer decides to fix a bug
Scenario	1. The developer clicks the debug mode button from the main menu 2. The debug menu is displayed 3. The developer clicks on a system log or a crash report
Alternatives	None
Exceptions	None
Priority	Medium

Activity Diagrams

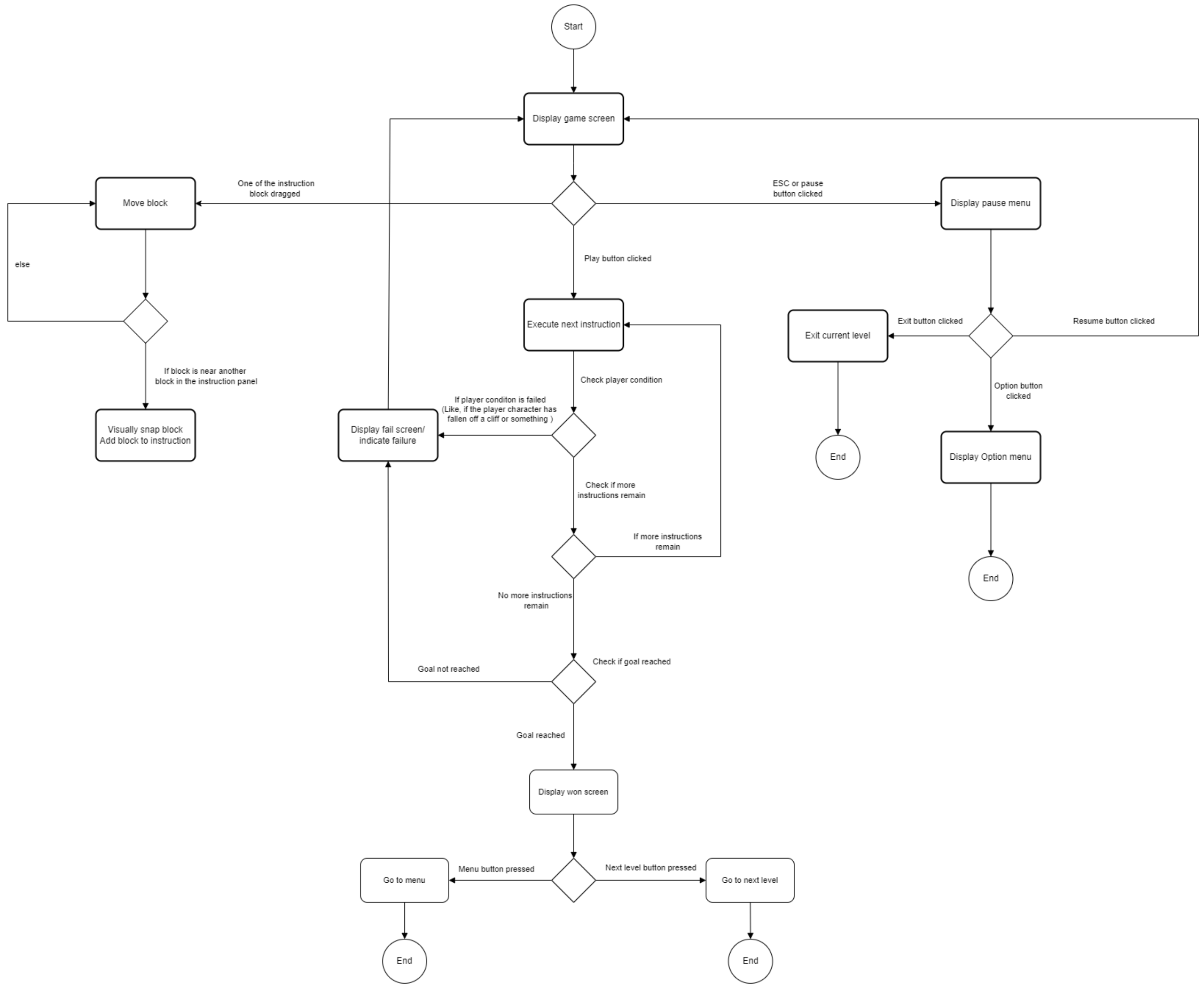
Multi-User Login


Start
Login button clicked
Prompt for Username and password
Check if username exists
Username does not exist
... and if password is valid
Password Invalid
Username exist and password valid
Load user save

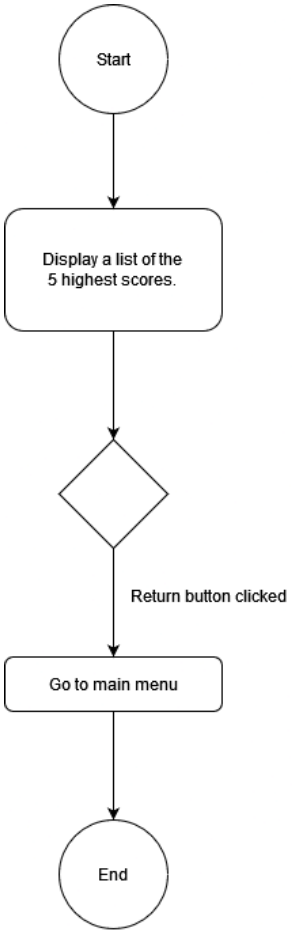
Main Menu


Start
Display game title and logo.
Display error message.
User has no savefile
Continue button clicked
User has at a savefile
Load most-recent save.
End
Credits button clicked
Go to credits.
End
Save & load button clicked
Go to save & load.
End
Instructions button clicked
Go to instructions.
End
High-score table button clicked
Go to high-score table.
End
Progression button clicked
Go to progression.
End
Settings button clicked
Go to settings.
End
Exit button clicked
Exit game.
End

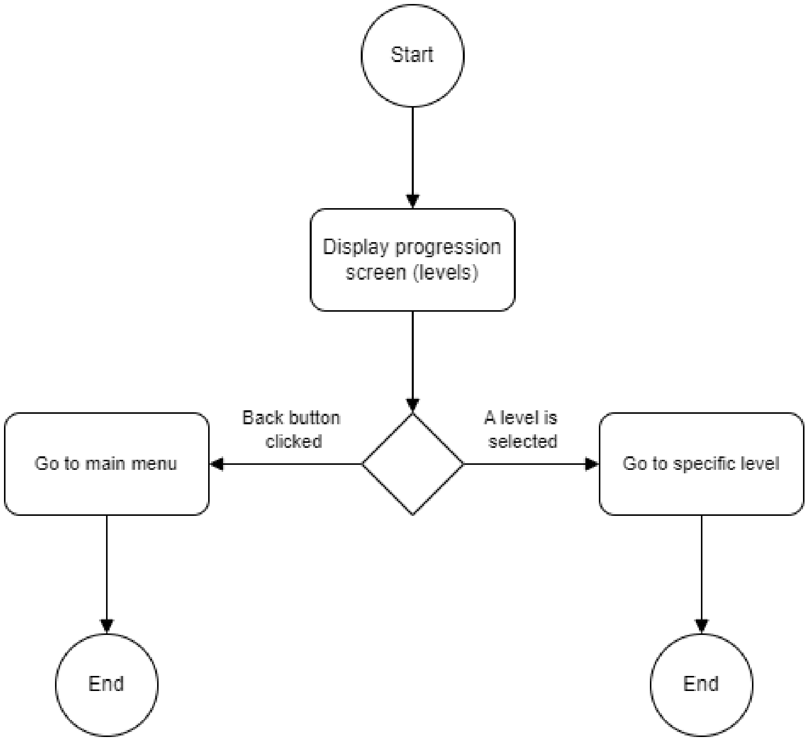
Gameplay


Start
Display game screen
One of the instruction block dragged
ESC or pause button clicked
Move block
Display pause menu
else
Play button clicked
Execute next instruction
Exit button clicked
Resume button clicked
Exit current level
If block is near another block in the instruction panel
Check player condition
If player conditon is failed (Like, if the player character has fallen off a cliff or something)
Option button clicked
Visually snap block Add block to instruction
Display fail screen/ indicate failure
End
Display Option menu
Check if more instructions remain
If more instructions remain
End
No more instructions remain
Goal not reached
Check if goal reached
Goal reached
Display won screen
Menu button pressed
Next level button pressed
Go to menu
Go to next level
End
End

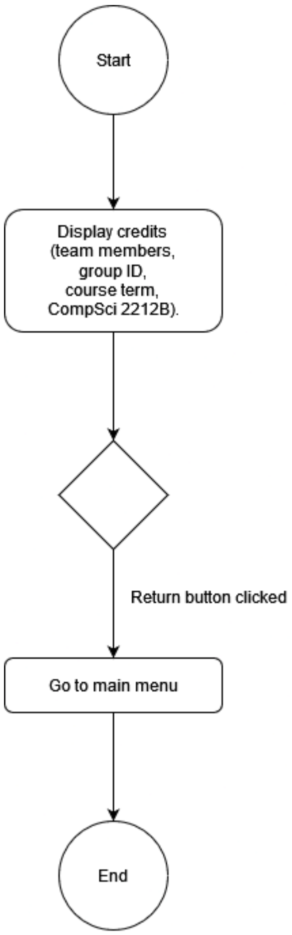
High-Score Table



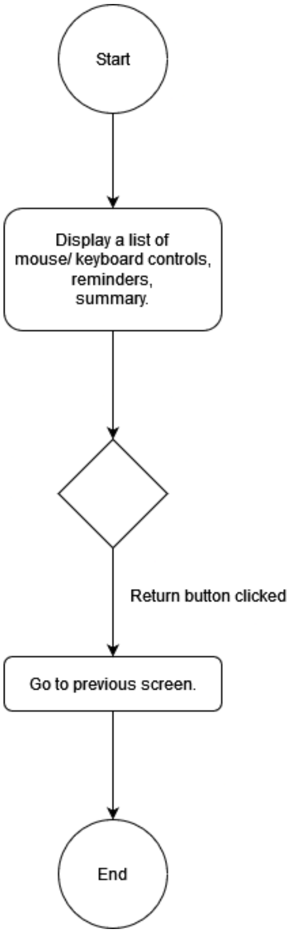
Progression



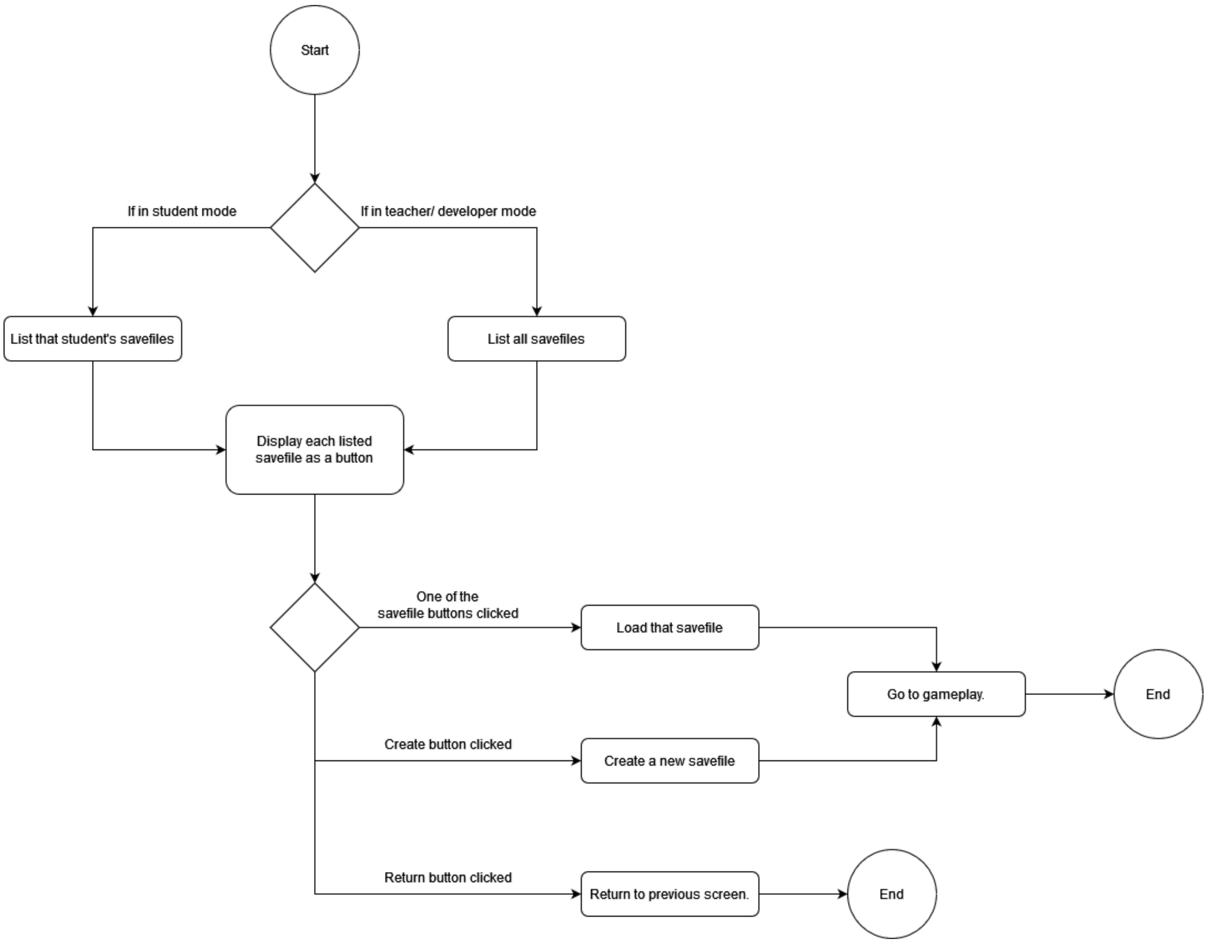
Credits


Start
Display credits (team members, group ID, course term, CompSci 2212B).
Return button clicked
Go to main menu
End

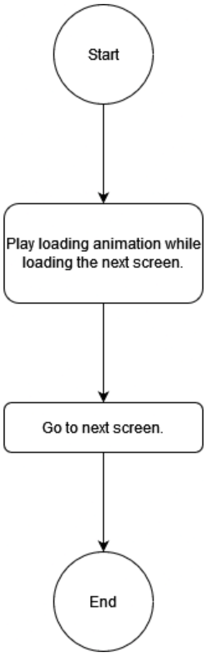
Instructions


Start
Display a list of mouse/ keyboard controls, reminders, summary.
Return button clicked
Go to previous screen.
End

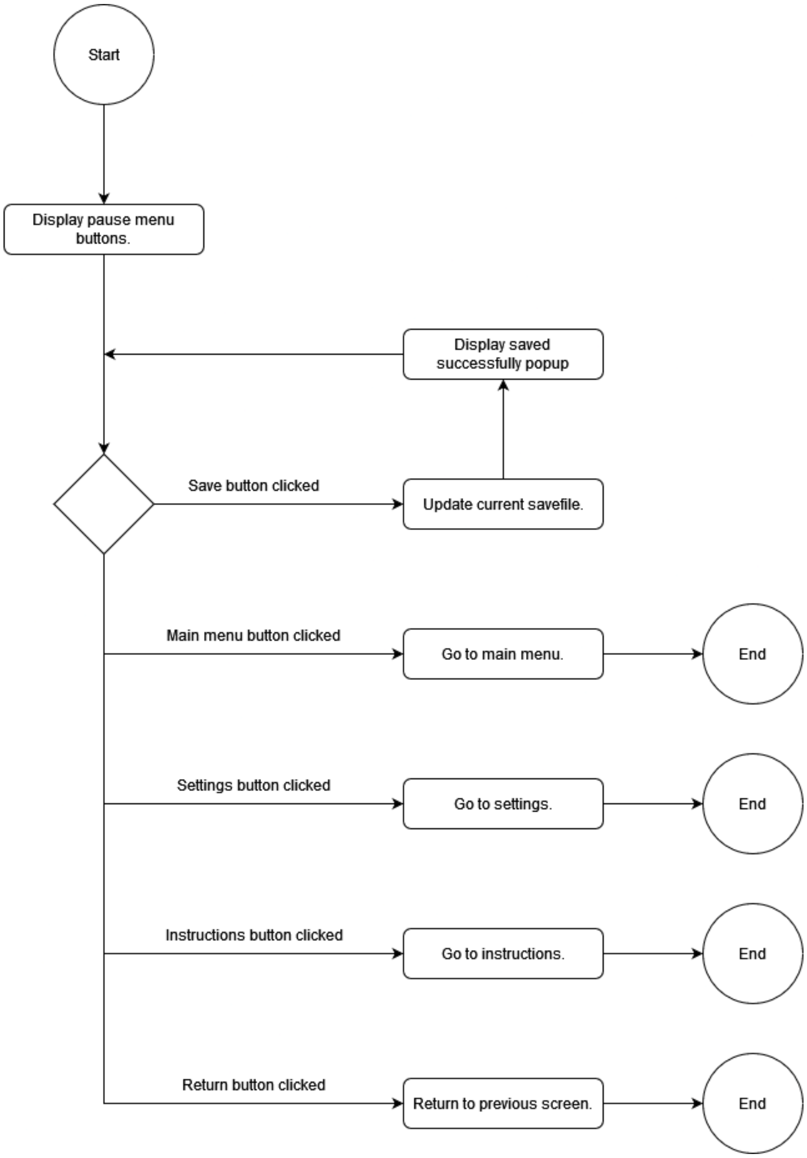
Save & Load


Start
If in student mode
If in teacher/ developer mode
List that student's savefiles
List all savefiles
Display each listed savefile as a button
One of the savefile buttons clicked
Load that savefile
Go to gameplay.
End
Create button clicked
Create a new savefile
Return button clicked
Return to previous screen.
End

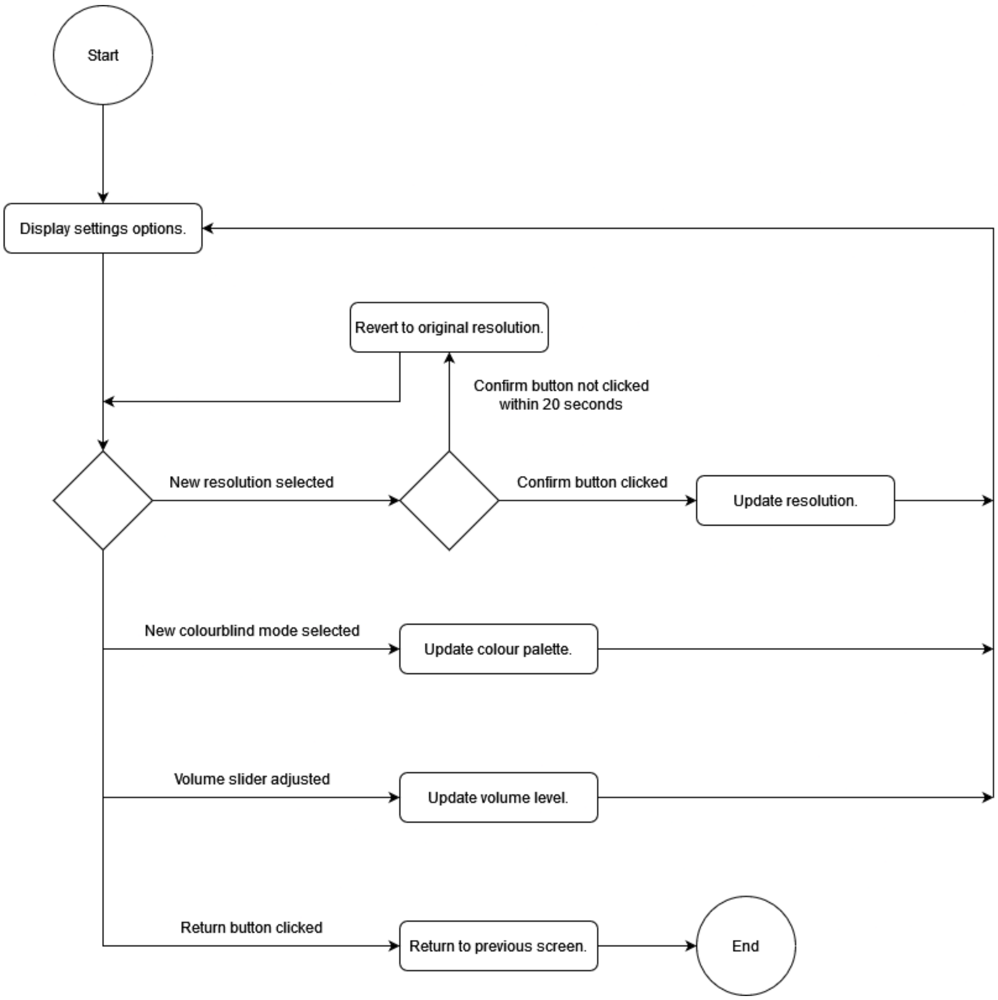
Loading



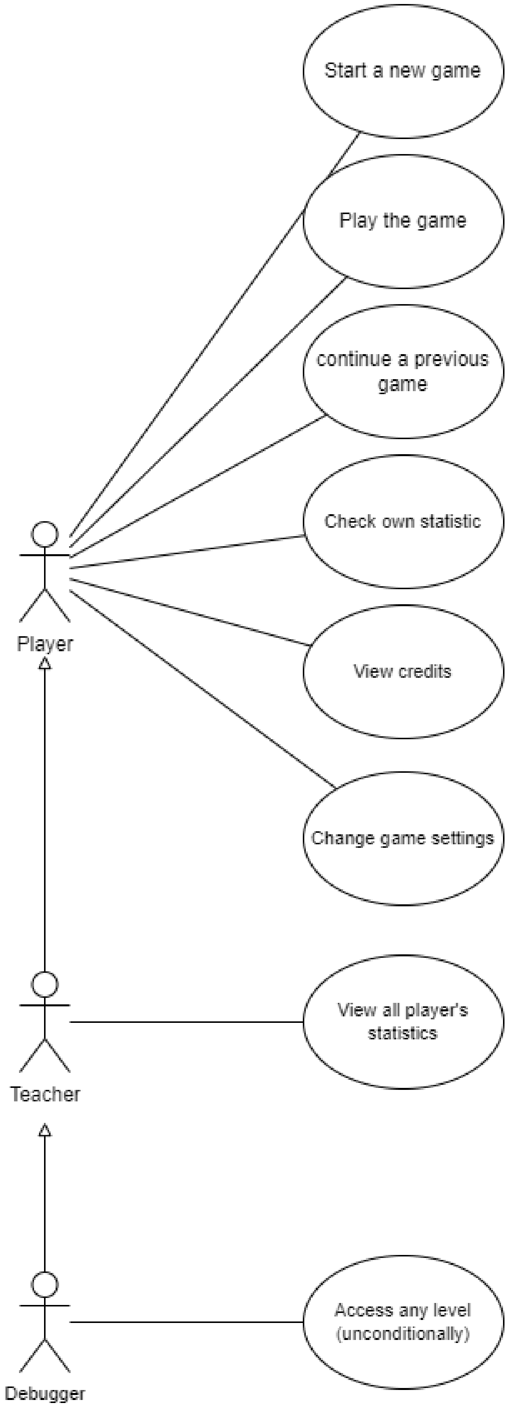
Pause


Start
Display pause menu buttons.
Display saved successfully popup
Save button clicked
Update current savefile.
Main menu button clicked
Go to main menu.
End
Settings button clicked
Go to settings.
End
Instructions button clicked
Go to instructions.
End
Return button clicked
Return to previous screen.
End

Settings



Use Case Diagram(s)


Start a new game
Play the game
continue a previous game
Check own statistic
View credits
Change game settings
Player
View all player's statistics
Teacher
Access any level (unconditionally)
Debugger