



King Abdulaziz University

Faculty of Computing & Information Technology
Computer Science Department

CPCS-391 Computer Graphics I Spring 2020 second term - 2020 Final Project Report

[CUBOID CREEP]



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1. Phase1: Project Proposal

To: Dr. Mohammed Yahya Zahab

From: Omar Al-Qurashi

Date: 2020/2/25

Subject: Cuboid Creep Project

1.1- PROBLEM DEFINITION

Developing an interactive 2.5D game which consists of:

- 2D and 3D Polygons and other shapes
- Animations for all characters and maps
- Enemies that chase the player
- Pathfinding for enemies in the game (Shortest-Path Algorithm)

These points should be implemented using the Java OpenGL Library. The target users for this game are going to be **14+ (14 years old or above)** because the game will have a horror factor. This game will help users to develop his/her decision-making skills.

1.2- TEAM MEMBERS

The following is a list of team members from section **GT** that will work on this project:

- Omar Abdul-Aziz Al-Qurashi (ID: 1742589, Team Leader)
- Hussam Adnan Shawly (ID: 1742403)
- Mohammed Saleh Al-Harbi (ID: 1740373)
- Mohammed Alzahrani (ID: 1740166)

1.3- PROJECT SUMMARY

The project will be an interactive game where a player controls a 2D character to collect points while avoiding the enemies. It has multiple maps with different stages, which are connected as a 3D cube object. When the player wins, he/she can go to the end of the current stage, which makes the cube flip itself to the next stage.

1.4- PROJECT OBJECTIVE

Applying theoretical aspects of computer graphics in developing an interactive game using Java OpenGL Library.

1.5- PROJECT RESPONSIBILITIES

Omar Abdul-Aziz Al-Qurashi	World & Characters Designer, Animator, Presentation Designer
Hussam Adnan Shawly	Testing, Gameplay Mechanics, GUI Designer
Mohammed Saleh Al-Harbi	AI, Game Logics and Levels Designer
Mohammed Alzahrani	World Designer, Testing, Writing the Report

2. Phase2: Project Abstraction

2.1- PROJECT DESCRIPTION

The project will be about an interactive game called **Cuboid Creep**; it's based on the 1980 Pacman game. The objective of this game is to reach the final stage and defeat the boss. There are multiple stages to complete. The stages are squares that will be connected as a 3D cube object. When the player reaches the end of any stage, he/she will go to the next stage. Each stage has obstacles, such as enemies and traps to avoid, torches that alert enemies and reduced field of vision.

2.2- OBJECTIVE & GOAL

The following table describes the **goal and objective** of this project:

Objective	Applying theoretical aspects of computer graphics in developing an interactive game using Java OpenGL Library.
Goal	Helping people to develop their decision-making skills.

2.3- SCOPE

2.3.1- Included

The features that the game will have includes the following:

- The player has full control of one character
- The game is 2D with some 3D elements
- The game will have enemies / other characters that will interact with the player, and the player's actions will directly affect them.
- The game will have obstacles that will block and obscure the player's way and possibly end his journey.
- The game map will be covered in shadows that the player must lit to see his/her way.
- The game will offer scripted character animation such as dash/jump animations.

2.3.2- Excluded

The features that will not be part of the game are:

- The support of multi-player.
- The support of online gameplay.
- Availability of this game in other platforms other than PC.
- Playing the game with other controllers other than Keyboards.

2.4- UML USE CASE DIAGRAM

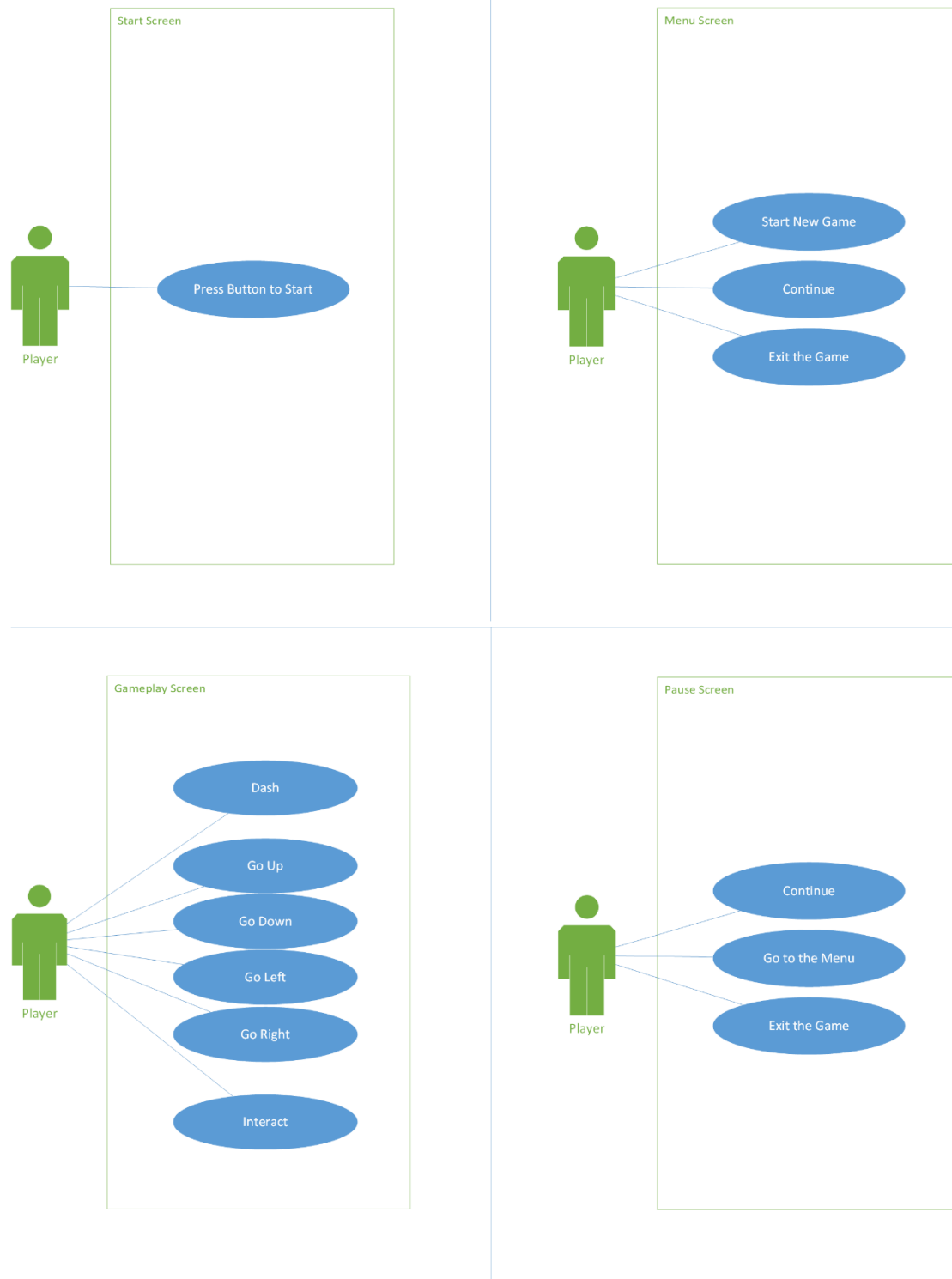


Figure: 1

Figure: 2

2.5- USE CASES:

Use Case Documentation	
Use Case ID:	SS01
Use Case Name:	Press Button to Start.
Actors:	
Player	
Preconditions:	
Launch the Game file.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none">• Press on the space or enter key.	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
<ul style="list-style-type: none">• The game doesn't start.• A message that contains the error will appear, alongside a potential solution.	
Extension Points:	
Postconditions:	
The player will move from the start screen to the menu screen.	

Use Case Documentation	
Use Case ID:	MS01
Use Case Name:	New game on Main Screen.
Actors:	
Player	
Preconditions:	
The player is currently is in the main screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none">• Highlight the option "New Game"• Press the option "New game".	
Flow of Events of the Alternative Scenarios:	
<ul style="list-style-type: none">• Highlight the option "New Game"	
Flow of Events of the Exception Scenarios:	
Extension Points:	
Postconditions:	
The player will start a new game save overwriting any old save.	

Use Case Documentation	
Use Case ID:	MS02
Use Case Name:	Continue the game.
Actors:	
Player	
Preconditions:	
The player is currently is in the main screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> Highlight the option “Continue” with the mouse. Click on the option “Continue”. 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
<ul style="list-style-type: none"> The save file could not be loaded. <ul style="list-style-type: none"> The save file is corrupted. The save file doesn't exist. 	
Extension Points:	
Postconditions:	
The player will start the game from the latest checkpoint.	

Use Case Documentation	
Use Case ID:	MS03
Use Case Name:	Exit Menu Screen.
Actors:	
Player	
Preconditions:	
The player is currently in the main screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> Highlight the option “Exit Game” with the mouse. Click on the option "Exit Game". 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
Extension Points:	
Postconditions:	
The player will go back to Start Screen.	

Use Case Documentation	
Use Case ID:	PS01
Use Case Name:	Continue the game.
Actors:	
Player.	
Preconditions:	
The player is in the pause screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> Highlight the option "Continue" with the mouse. Click on the option "Continue". 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
Extension Points:	
Postconditions:	
The player will continue playing the game.	

Use Case Documentation	
Use Case ID:	PS02
Use Case Name:	Go to Menu Screen.
Actors:	
Player	
Preconditions:	
The player is currently is in the pause screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> Highlight the option "Go to the Menu Screen" with the mouse. Click on the option "Go to the Menu Screen". 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
Extension Points:	
Postconditions:	
The player will be moved to the Menu Screen.	

Use Case Documentation	
Use Case ID:	PS03
Use Case Name:	Exit the Game.
Actors:	
Player	
Preconditions:	
The player is currently is in the pause screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> Highlight the option "Exit the Game" with the mouse. Click on the option "Exit the Game". 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
Extension Points:	
Postconditions:	
The player will be moved to the Menu Screen.	

Use Case Documentation	
Use Case ID:	GS01
Use Case Name:	Go Up.
Actors:	
Player	
Preconditions:	
The player is currently is in the Gameplay Screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> The player will press Up arrow. 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
<ul style="list-style-type: none"> The player reached an obstacle. 	
Extension Points:	
Postconditions:	
The character will move up.	

Use Case Documentation	
Use Case ID:	GS02
Use Case Name:	Go down.
Actors:	
Player	
Preconditions:	
The player is currently is in the Gameplay Screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> The player will press Down arrow. 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
<ul style="list-style-type: none"> The player reached an obstacle. 	
Extension Points:	
Postconditions:	
The character will move down.	

Use Case Documentation	
Use Case ID:	GS03
Use Case Name:	Go right.
Actors:	
Player	
Preconditions:	
The player is currently is in the Gameplay Screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> The player will press Right arrow. 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
<ul style="list-style-type: none"> The player reached an obstacle. 	
Extension Points:	
Postconditions:	
The character will move right.	

Use Case Documentation	
Use Case ID:	GS04
Use Case Name:	Go Left
Actors:	
Player	
Preconditions:	
The player is currently is in the Gameplay Screen.	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> The player will press left arrow. 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
<ul style="list-style-type: none"> The player reached an obstacle. 	
Extension Points:	
Postconditions:	
The character will move left.	

Use Case Documentation	
Use Case ID:	GS05
Use Case Name:	Dash.
Actors:	
Player	
Preconditions:	
<ul style="list-style-type: none"> The player is currently is in the Gameplay Screen. 	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> The player will press Space. 	
Flow of Events of the Alternative Scenarios:	
Flow of Events of the Exception Scenarios:	
<ul style="list-style-type: none"> The player reached an obstacle. 	
Extension Points:	
Postconditions:	
The character will Dash.	

Use Case Documentation	
Use Case ID:	GS06
Use Case Name:	Interact.
Actors:	
Player	
Preconditions:	
<ul style="list-style-type: none"> The player is currently is in the Gameplay Screen. The player is near an interaction point. 	
Flow of Events of the Primary Scenario:	
<ul style="list-style-type: none"> The player will press E. 	
Flow of Events of the Alternative Scenarios:	
<ul style="list-style-type: none"> The player will press the Enter key. 	
Flow of Events of the Exception Scenarios:	
<ul style="list-style-type: none"> The is nothing to interact with. 	
Extension Points:	
Postconditions:	
The Player will start the interaction.	

3. Phase3: Implementation

3.1. Sketches:

The Player Character:

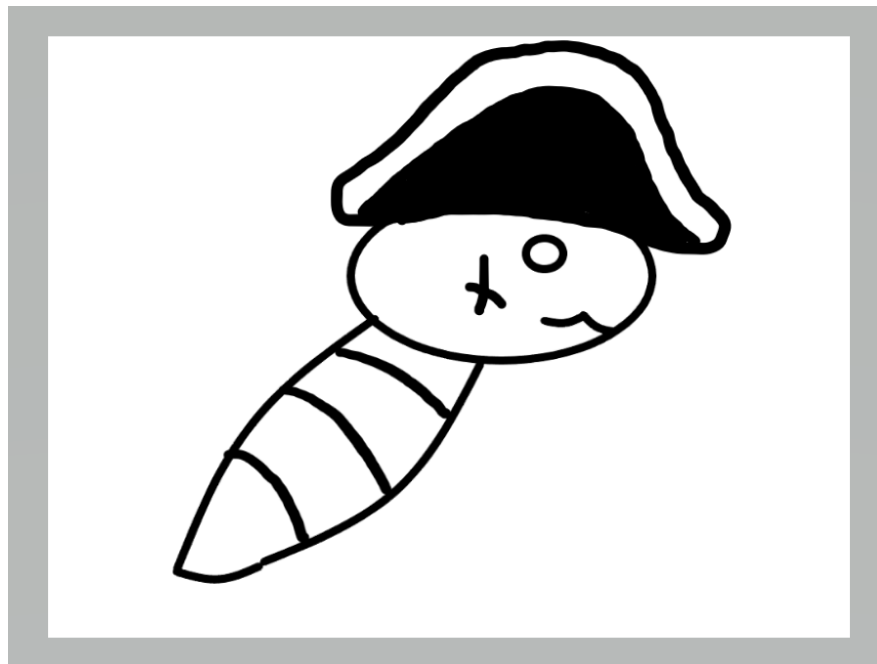


Figure: 3

The Last Boss:

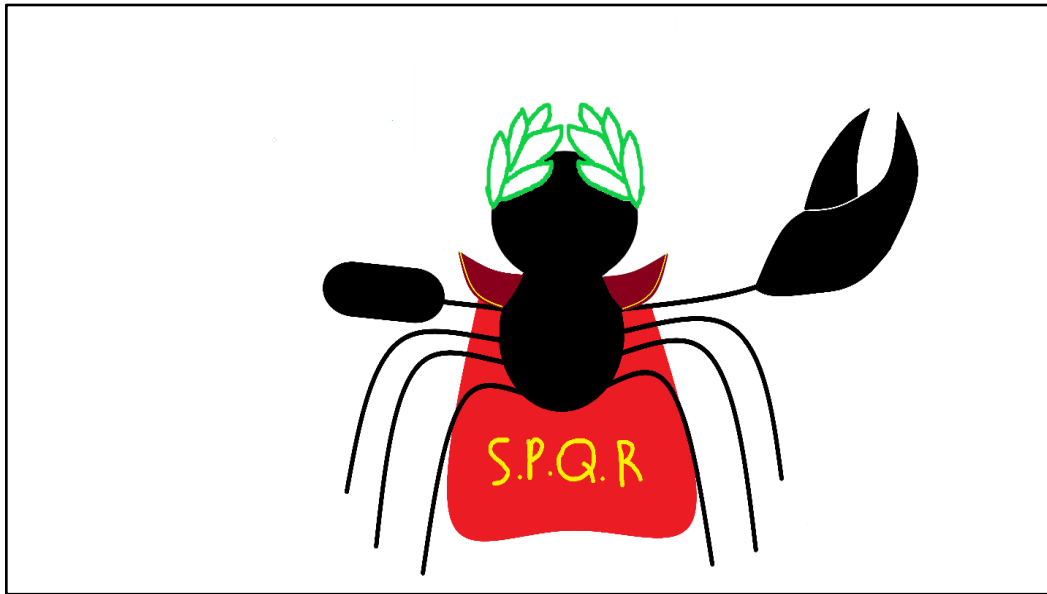


Figure: 4

Enemies:

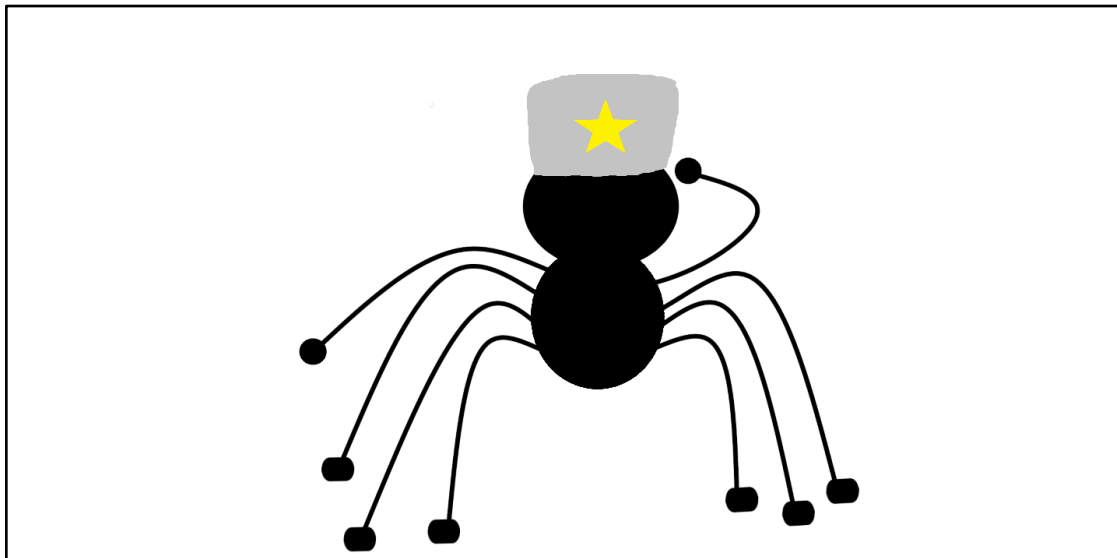


Figure: 5

Map 1:

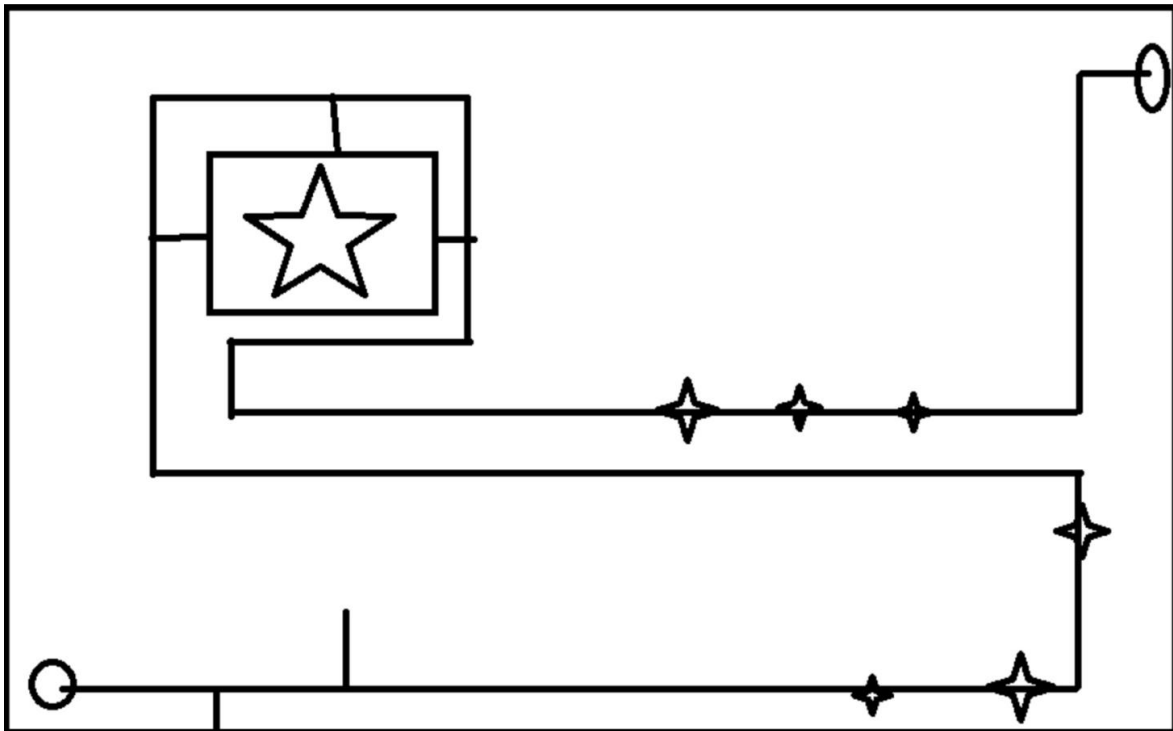


Figure: 6

Map 2:

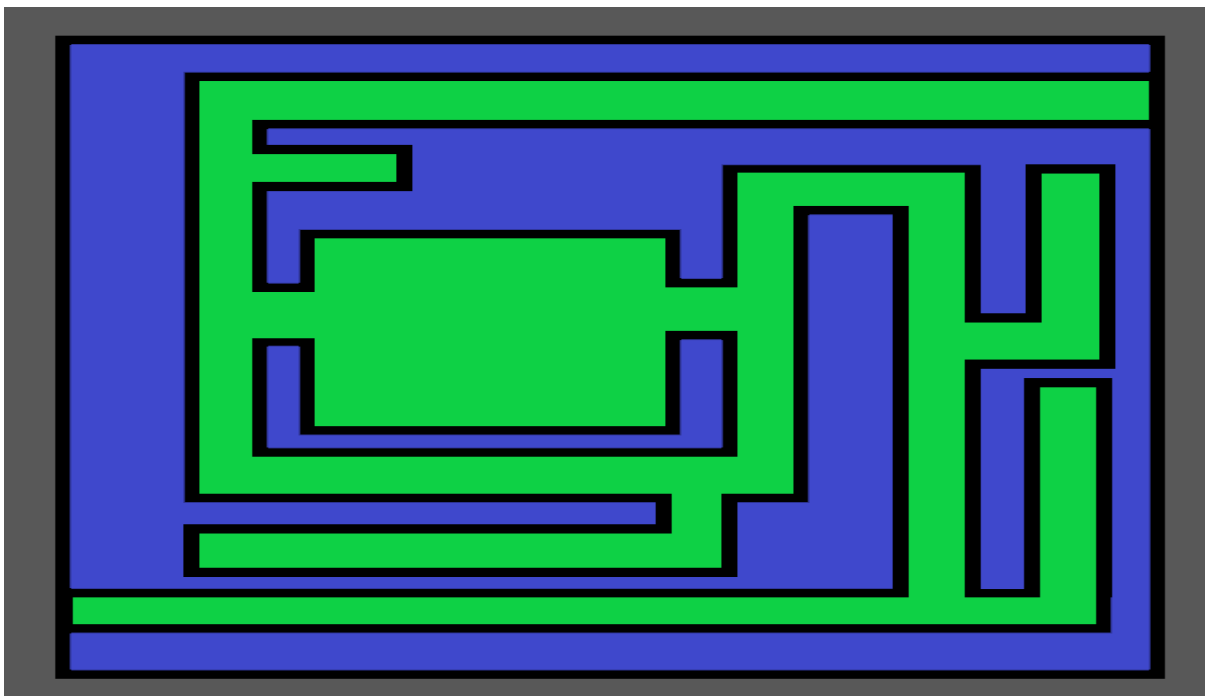


Figure: 7

Map 3:

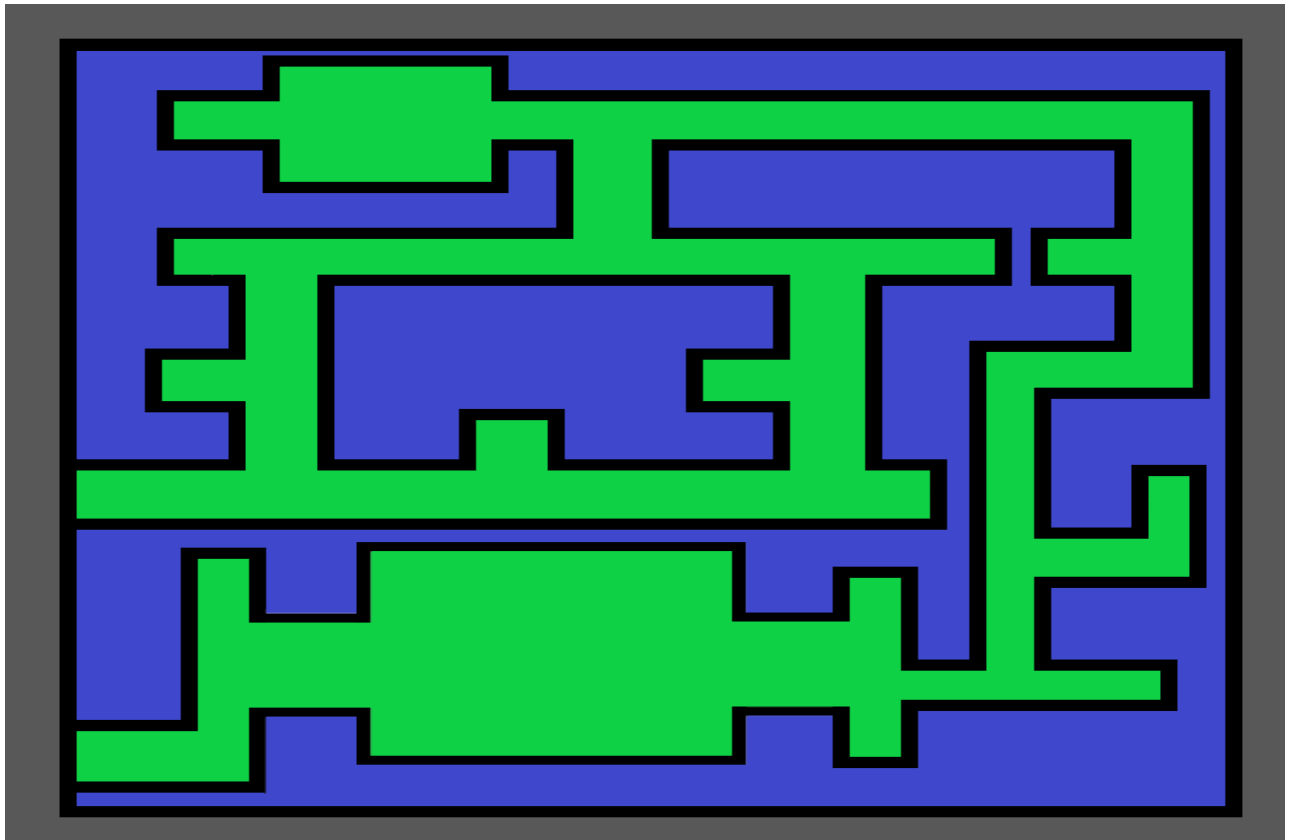


Figure: 8

3.2. Sketch for Simplifying the Model:

To simplify the sketching, we drew boxes on the whole map, and we used those boxes to determine the coordinates of each object.

0,11	1,11	2,11	3,11	4,11	6,11	6,11	7,11	8,11	9,11	10,11	11,11
0,10	1,10	2,10	3,10	4,10	5,10	6,10	7,10	8,10	9,10	10,10	11,10
0,9	1,9	2,9	3,9	4,9	5,9	6,9	7,9	8,9	9,9	10,9	11,9
0,8	1,8	2,8	3,8	4,8	5,8	6,8	7,8	8,8	9,8	10,8	11,8
0,7	1,7	2,7	3,7	4,7	5,7	6,7	7,7	8,7	9,7	10,7	11,7
0,6	1,6	2,6	3,6	4,6	5,6	6,6	7,6	8,6	9,6	10,6	11,6
0,5	1,5	2,5	3,5	4,5	5,5	6,5	7,5	8,5	9,5	10,5	11,5
0,4	1,4	2,4	3,4	4,4	5,4	6,4	7,4	8,4	9,4	10,4	11,4
0,3	1,3	2,3	3,3	4,3	5,3	6,3	7,3	8,3	9,3	10,3	11,3
0,2	1,2	2,2	3,2	4,2	5,2	6,2	7,2	8,2	9,2	10,2	11,2
0,1	1,1	2,1	3,1	4,1	5,1	6,1	7,1	8,1	9,1	10,1	11,1
0,0	1,0	2,0	3,0	4,0	5,0	6,0	7,0	8,0	9,0	10,0	11,0

Figure: 9

3.3. UML Domain Model:

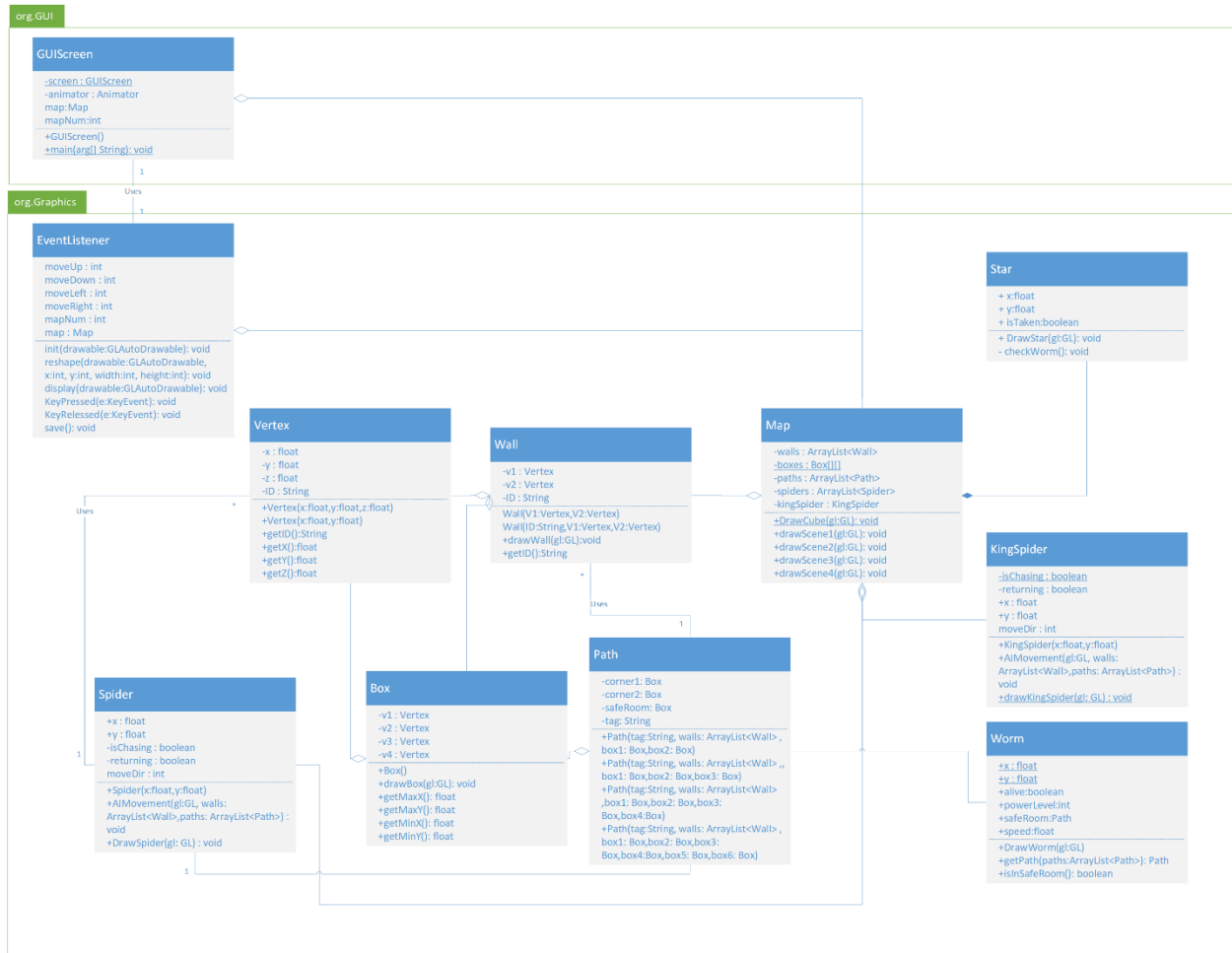


Figure: 10

3.4. Scenario:

This scenario is going to explain how a stage in the game works.

Legend:

Blue Circle : player.

Red Circles : enemies.

Yellow Circle : Coin.

White cross mark : safe point.

Gold star : Goal.

In figure11 , we can see that the player he starts at the bottom left of the map, the player can only walk in the green corridors.

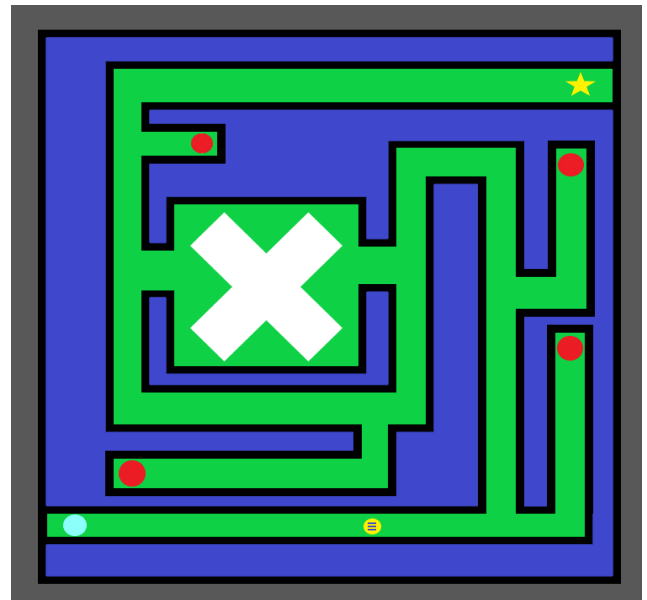


Figure: 11

In figure12 the player came into contact with the coin, when the player makes contact with the coin, the coin disappears, however the coin is just aesthetic.

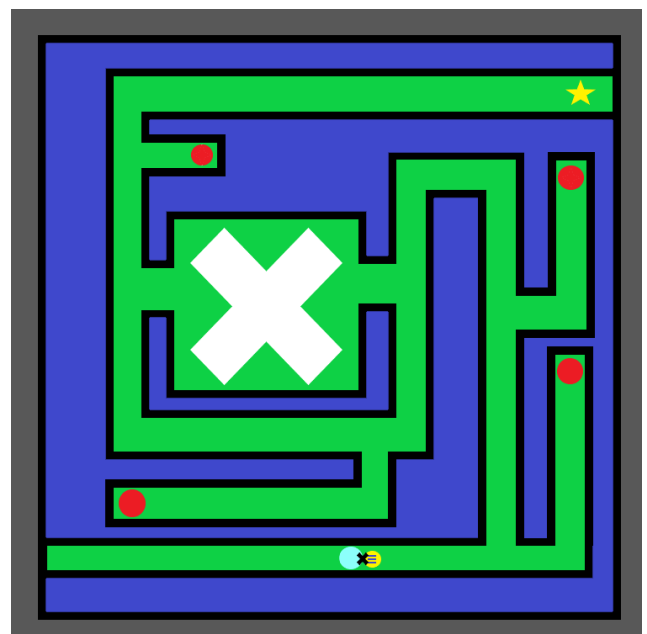


Figure: 12

In figure 13 we can see that when the player moved forward, and when he goes near the enemies, the enemies will try go to the player's position.

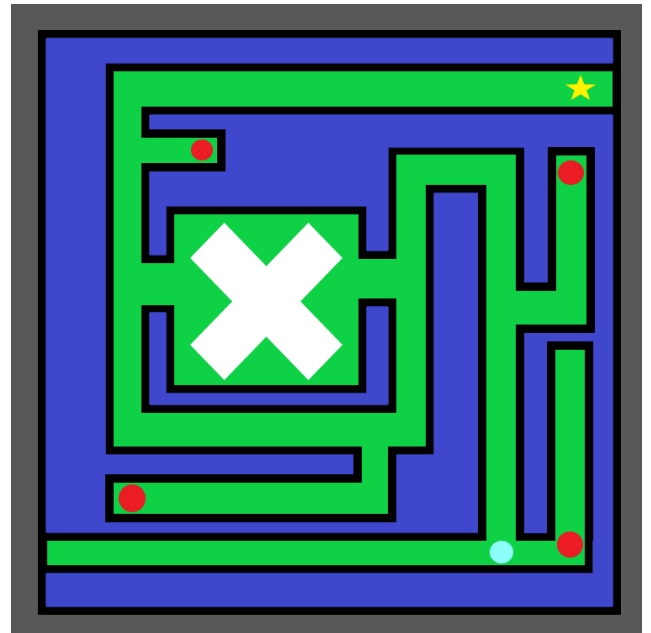


Figure: 13

In figure 14 we can see that the player didn't avoid the enemy and got caught, when the player gets caught, he dies.

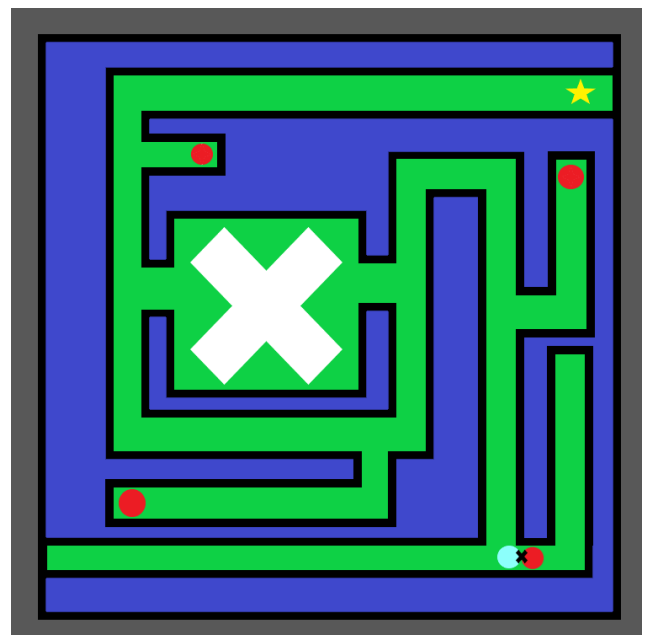


Figure: 14

Here in figure 15 we can see that the player got resurrected in the beginning of the map.

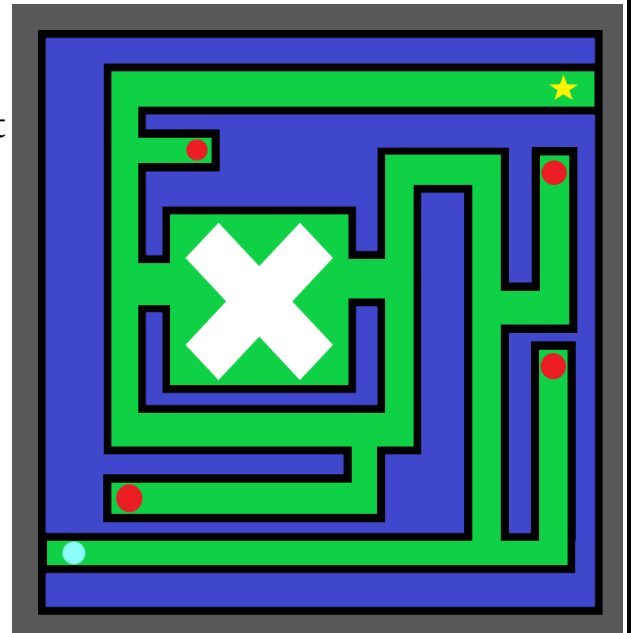


Figure: 15

In figure 16 we can see that the player avoided the enemy this time.

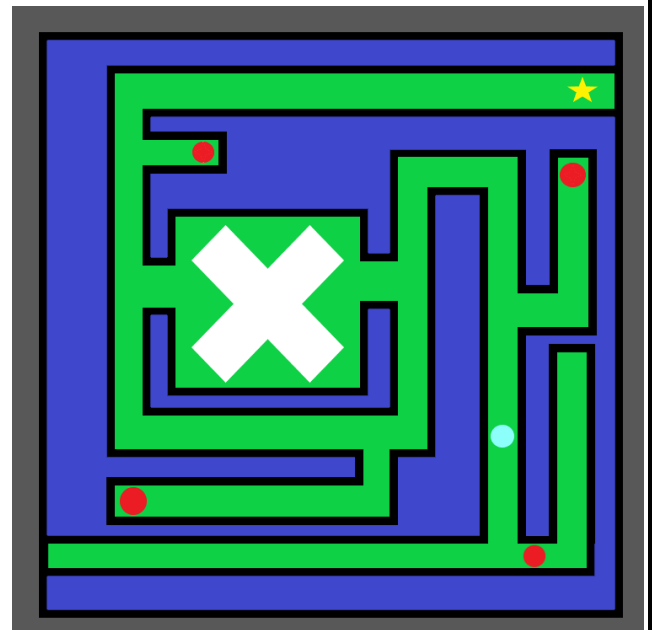


Figure: 16

In figure 17 we can see that the player reached the safe point, when the player reaches this point all enemies return to their respective positions.

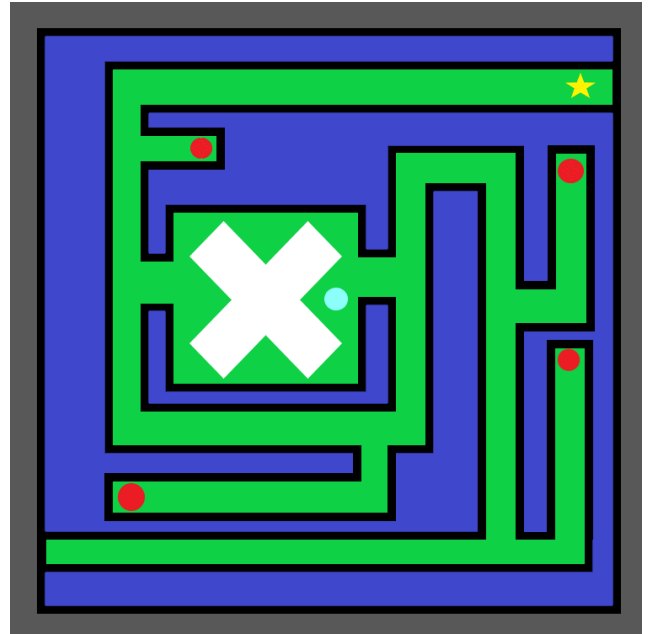


Figure: 17

In figure 18 the player got caught by the enemy again, so he dies.

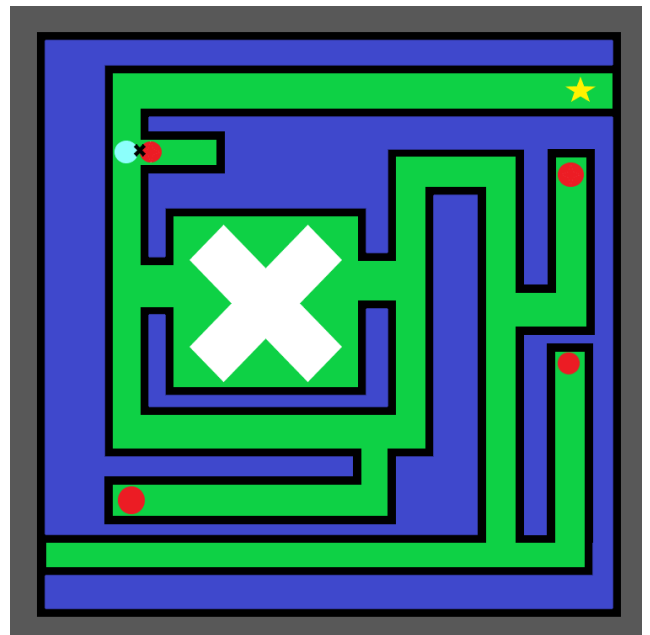


Figure: 18

Here we can see in figure 19 that the player got resurrected in the beginning of the map, because he died again.

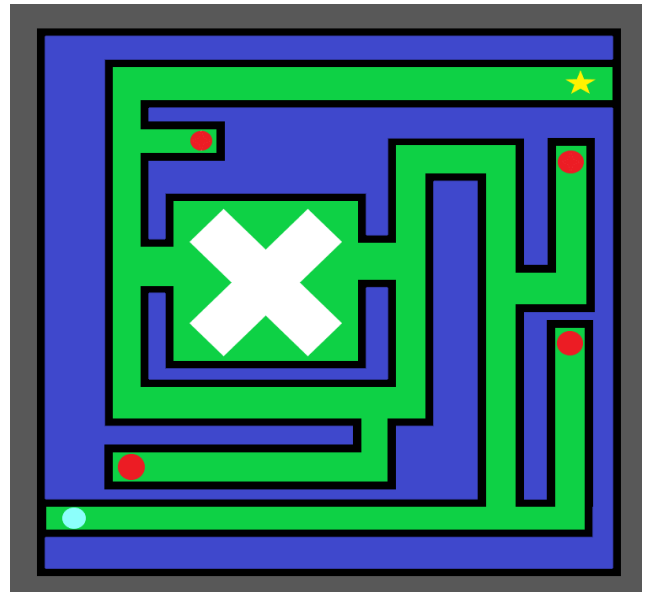


Figure: 19

In figure 20 the player used his dash to evade the enemy.

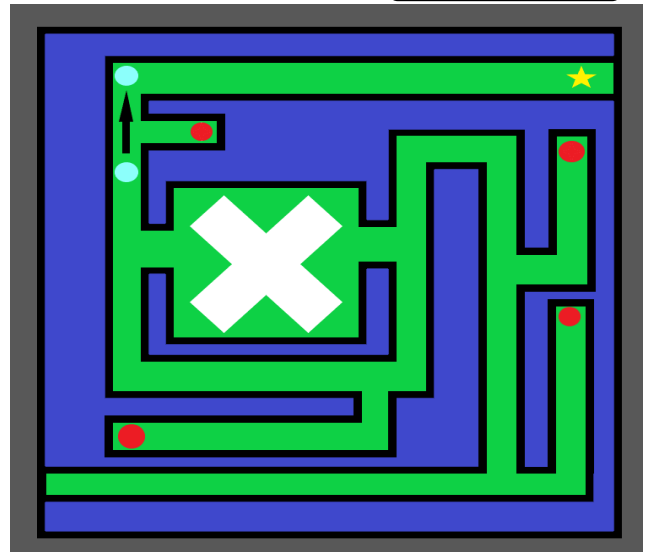


Figure: 20

In figure 21 when the player reaches the goal, he moves to the next map.

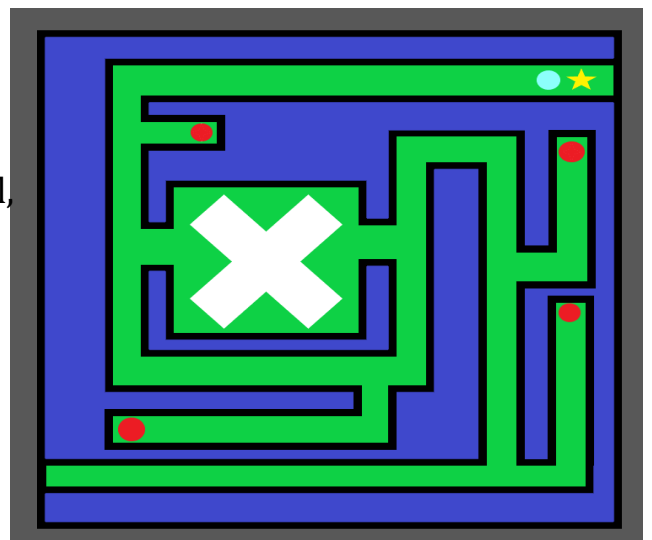


Figure: 21

3.5. Project Idea:

Our project Idea Is based of the 1980s classic PAC-MAN, it has a similar concept of trying to evade the enemies while collecting coins, however we have changed the winning condition to reaching the end of the map, instead of collecting all the coins, we have also added a dash that allows the player to evade the enemies, also added unique multiple stages that the user has to beat and a final stage with a boss.

1980s PAC-MAN:

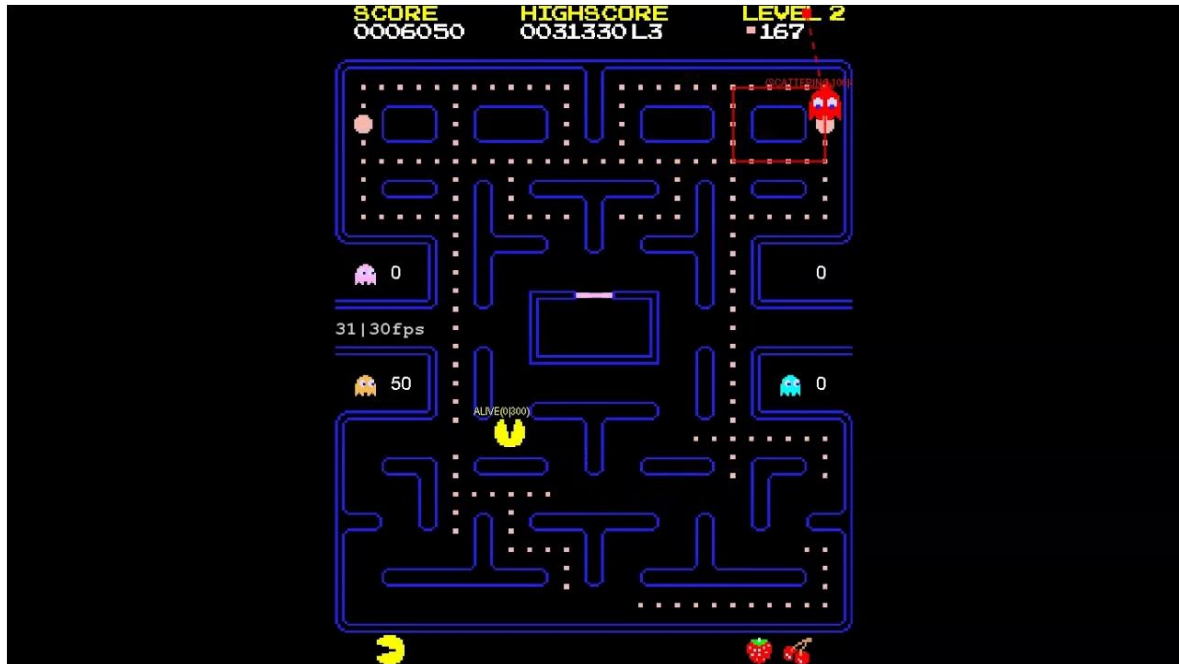


Figure: 22

3.6. Missing Items:

In the abstraction we have mentioned the functionalities that we would like to cover in our game, however due to the shortness of the semester, and the coronavirus pandemic our time to develop this game was cut short, so this is the list of things that we would have liked to include in our game:

- The 6 stages were reduced to 3 stages.
- Traps that the player would need to avoid.
- Interactable objects in the game.
- Reduced vision for the player.
- Images of the enemies were scrapped because of compatibility issues.
- A better UI design.
- Start screen

3.7. The Libraries:

3.7.1. The first Library:

- Java OpenGL.
- The target of the library is to draw object and display them on the screen.
- This library helped us draw the stage, main character, and enemies, also it helped us manipulate them around the map.
- <https://jogamp.org/>.
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3.7.2. The Second Library:

- Java Swing.
- The target of the library is design GUIs for the application.
- This library helped us design the Start Screen and the Pause Screen for the application.
- <https://netbeans.org/features/java-on-client/swing.html>.
- The Licenses is as follows:
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