

Project
Tower Defense Protect our world Game

Submitted by
Patanin Thongsongsom 6404062660011

Present
Asst.Prof. Sathit Prasomphan
040613204 Object-Oriented Programming
KING MONGKUT'S UNIVERSITY OF TECHNOLOGY NORTH BANGKOK

Table of content

Origin and importance	3
Benefit of Project	3
Development	4
ClassDiagram	4
The Main Algorithm	13
Summary	14

Introduction

Origin and importance: from the begin I like to play tower defense game and then I think is good to have tower defense game in my life by using java code then It is origin in my project.

Project Type: Game.

Benefit of Project: it can improve planning skill and practice problem solving and have some fun with this game project

projectscope:

Detail:

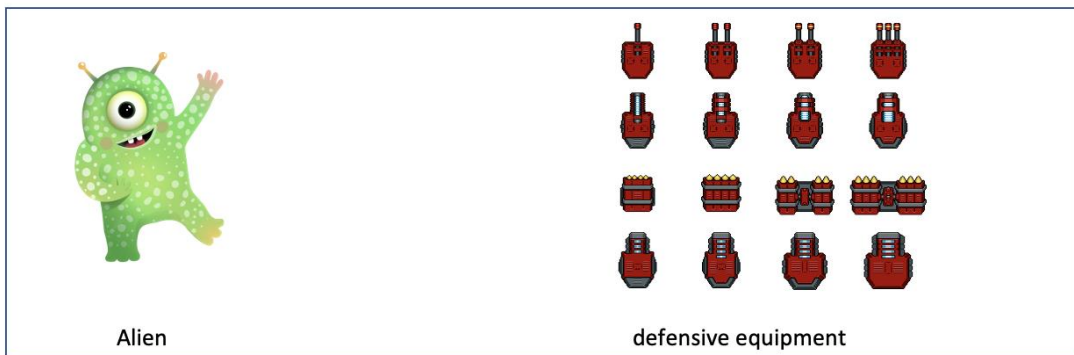
This game is about Human Town is attack by Alien than Human will build the Defensive equipment for kill all Alien offend the human.

How to Play this Game:

Use mouse to control the cursor and select the defensive equipment and paste to the path where the alien will walk.

Storyboard:

Character



Scene

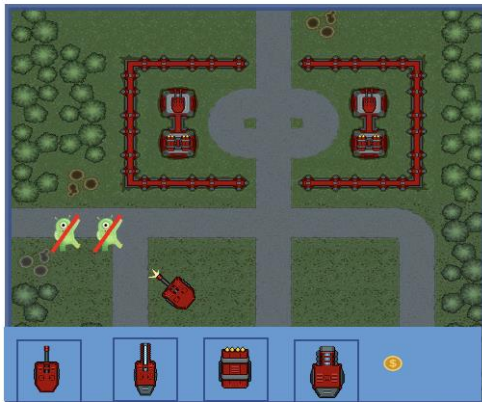
-Start Game



When the alien move passes the wall, the game will over.



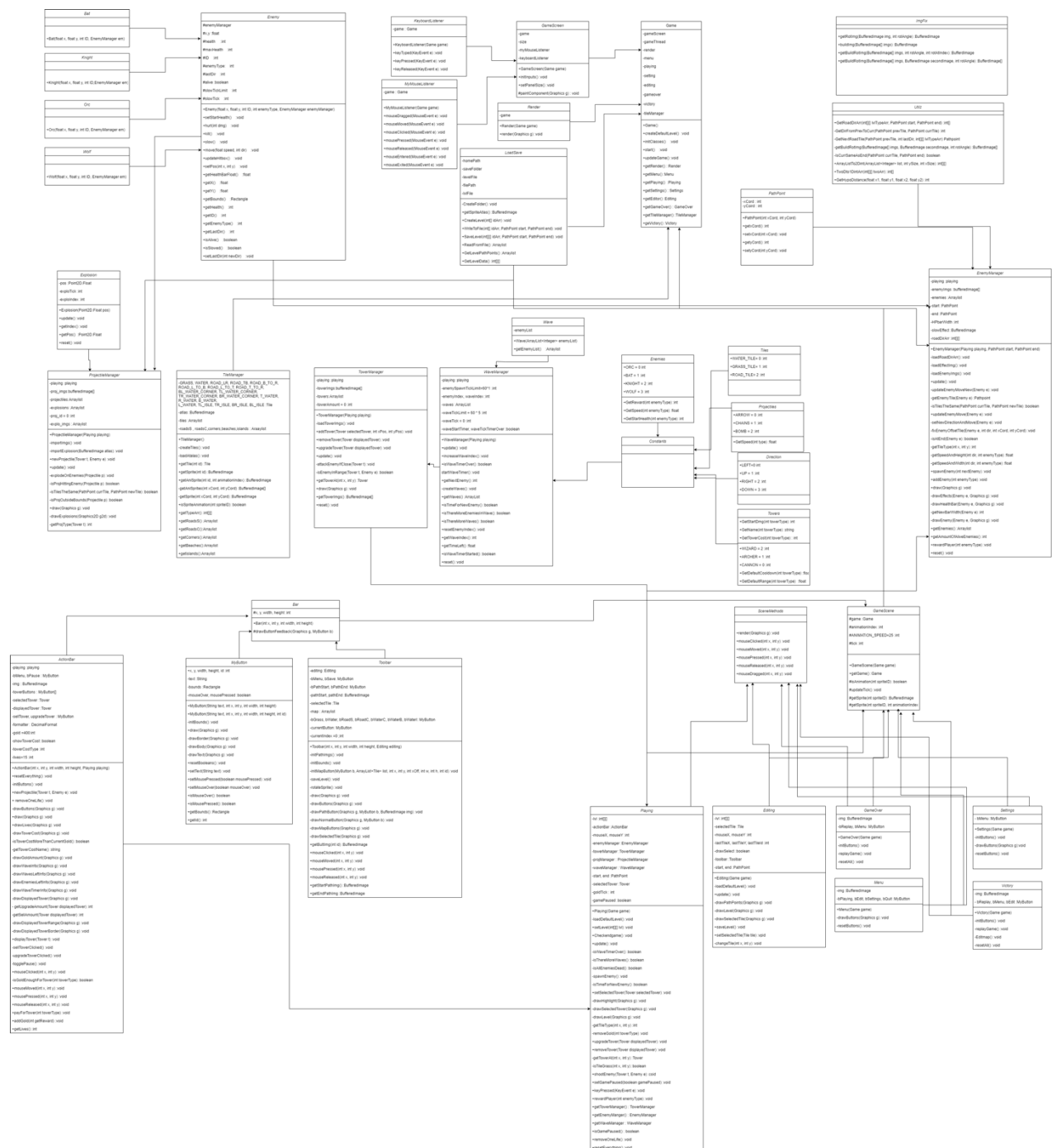
If Human kill all alien and no alien passes the wall, The human will Win.



Development

How to play this game: First you will create your map by click edit map and then press save button and relaunching game for save file to your computer then click play button then chose the tower you want than put it down on the map by enemy will walk pass the road don't forget if enemy get in the tent you will lose your heart point if heart point going to zero you will lose this game if you kill all enemy you will win this game.

Class Diagram



This class Diagram it represent about relation in my project int mainclass is Game class it will have a Loadsave class GameScreen class and Render is subclass. Then Gamescreen have 2 subclass is KeyboadListener it will check if keyboard has press and MyMouseListener it will check if mouse has click or move around a game. Then game will have Enemy in enemy class have a all enemy in game is subclass. Then enemy class is Abstract class and it will Override in Enemy manager and Enemy Manager is the superclass in this game it have TowerManager WaveManager TileManager ProjectileManager to control a ammo of tower and it have GameScene to control a scene in game then in Wavemanager is a class it will control a wave of enemy in game and control a Path to guide a enemy TileManager is control about entity in game ex. Road River or Tree etc. then this class will check the enemy will on the road only can not pass if it not have a road next GameScene Class it have 6 subclass it have Playing scene Editing scene GameOver scene Menu scene Victory scene.and it have SceneMethods is Abstract class all scene have all Methods inSceneMethods class. Next the UI in game it will control by Bar class it have 3 subclass is ActionBar this class have a heath gold tower image and wave round in this class next Mybutton class this class have all button in game it will control size or color in this class next ToolBar class it only use in Edting map it will have the entity in game must have to create your own map Ex. Road , Safepoint ,Spawn enemy etc. Then all class it will call imgFix if class want a image and it have a utily class it have Enemies to tell how many enemy in game and how much heath speed and Reward and have Towers it have name of tower and damage in towers.

development model: Application

```

Oop project > src > managers > J EnemyManager.java > {} managers
16 import static helpz.Constants.Direction.*;
17 import static helpz.Constants.Tiles.*;
18 import static helpz.Constants.Enemies.*;
19
20 public class EnemyManager {
21
22     private Playing playing;
23     private BufferedImage[] enemyImgs;
24     private ArrayList<Enemy> enemies = new ArrayList<>();
25     private PathPoint start, end;
26     private int HPbarWidth = 20;
27     private BufferedImage slowEffect;
28     private int[][] roadDirArr;
29
30     public EnemyManager(Playing playing, PathPoint start, PathPoint end) {
31         this.playing = playing;
32         enemyImgs = new BufferedImage[4];
33         this.start = start;
34         this.end = end;
35
36         loadEffectImg();
37         loadEnemyImgs();
38         loadRoadDirArr();
39     }
40
41     private void loadRoadDirArr() {
42         roadDirArr = Utilz.GetRoadDirArr(playing.getGame().getTileManager().getTypeArr(), start, end);
43     }
44
45     // private void tempMethod() {
46     //     int[][] arr = Utilz.GetRoadDirArr(playing.getGame().getTileManager().getTypeArr(), start, end);
47     //     for (int j = 0; j < arr.length; j++) {
48     //         for (int i = 0; i < arr[j].length; i++) {
49     //             System.out.print(arr[j][i] + "|");
50     //         }
51     //     }
52 }

```

Constructor: in this line 32 have a constructor to define a value in class it have Playing ,start, end to implement and call a function to start a load every thing in class want to use for run a game

```

Oop project > src > objects > J Projectile.java > {} objects
1 package objects;
2
3 import java.awt.geom.Point2D;
4
5 public class Projectile {
6
7     private Point2D.Float pos;
8     private int id, projectileType, dmg;
9     private float xSpeed, ySpeed, rotation;
10    private boolean active = true;
11
12    public Projectile(float x, float y, float xSpeed, float ySpeed, int dmg, float rotation, int id, int projectileType) {
13        pos = new Point2D.Float(x, y);
14        this.xSpeed = xSpeed;
15        this.ySpeed = ySpeed;
16        this.dmg = dmg;
17        this.rotation = rotation;
18        this.id = id;
19        this.projectileType = projectileType;
20    }
21
22    public void reuse(int x, int y, float xSpeed, float ySpeed, int dmg, float rotate) {
23        pos = new Point2D.Float(x, y);
24        this.xSpeed = xSpeed;
25        this.ySpeed = ySpeed;
26        this.dmg = dmg;
27        this.rotation = rotate;
28        active = true;
29    }
30
31    public void move() {
32        pos.x += xSpeed;
33        pos.y += ySpeed;
34    }
35
36    public Point2D.Float getPos() {
37        return pos;
38    }
39
40    public void setPos(Point2D.Float pos) {

```

Another Constructor: in line 12 it have Projectile like a class name it will implement a 7 variable pos it will create by use float x and float y and it will go to function but it other variable it will copy value to this class

In this class have Encapsulation in line 7-10 is a private variable than other class can't call them. It call private.

```
Oop project > src > enemies > J Enemy.java > Enemy > slowTick
/
import static helpz.Constants.Direction.*;
8
9 public abstract class Enemy {
10     protected EnemyManager enemyManager;
11     protected float x, y;
12     protected Rectangle bounds;
13     protected int health;
14     protected int maxHealth;
15     protected int ID;
16     protected int enemyType;
17     protected int lastDir;
18     protected boolean alive = true;
19     protected int slowTickLimit = 120;
20     protected int slowTick = slowTickLimit;
21
22     public Enemy(float x, float y, int ID, int enemyType, EnemyManager enemyManager) {
23         this.x = x;
24         this.y = y;
25         this.ID = ID;
26         this.enemyType = enemyType;
27         this.enemyManager = enemyManager;
28         bounds = new Rectangle((int) x, (int) y, width: 32, height: 32);
29         lastDir = -1;
30         setStartHealth();
31     }
32
33     private void setStartHealth() {
34         health = helpz.Constants.Enemies.GetStartHealth(enemyType);
35         maxHealth = health;
36     }
37
38     public void hurt(int dmg) {
39         this.health -= dmg;
40         if (health <= 0) {
41             alive = false;
42             enemyManager.rewardPlayer(enemyType);
43         }
44     }
45
46     public void kill() {
47         // Is for killing enemy, when it reaches the end.
48         alive = false;
49         health = 0;
50     }
51 }
```

In this class have Constructor for implement a value in class variable and all variable is Protected it mean it can access by subclass and superclass only but other class can not access this variable and this class is Composition too because all enemy in game need to extend this class for implement all enemies in game need to have then this class will be an Abstract class

```
Oop project > src > enemies > J Orc.java > ...
1 package enemies;
2
3 import static helpz.Constants.Enemies.ORB;
4
5 import managers.EnemyManager;
6
7 public class Orc extends Enemy {
8
9     public Orc(float x, float y, int ID, EnemyManager em) {
10         super(x, y, ID, ORB, em);
11     }
12
13 }
14
```


In this class have extends an enemy class because this class is sub enemy in game then this class can use all function in Enemy class too.

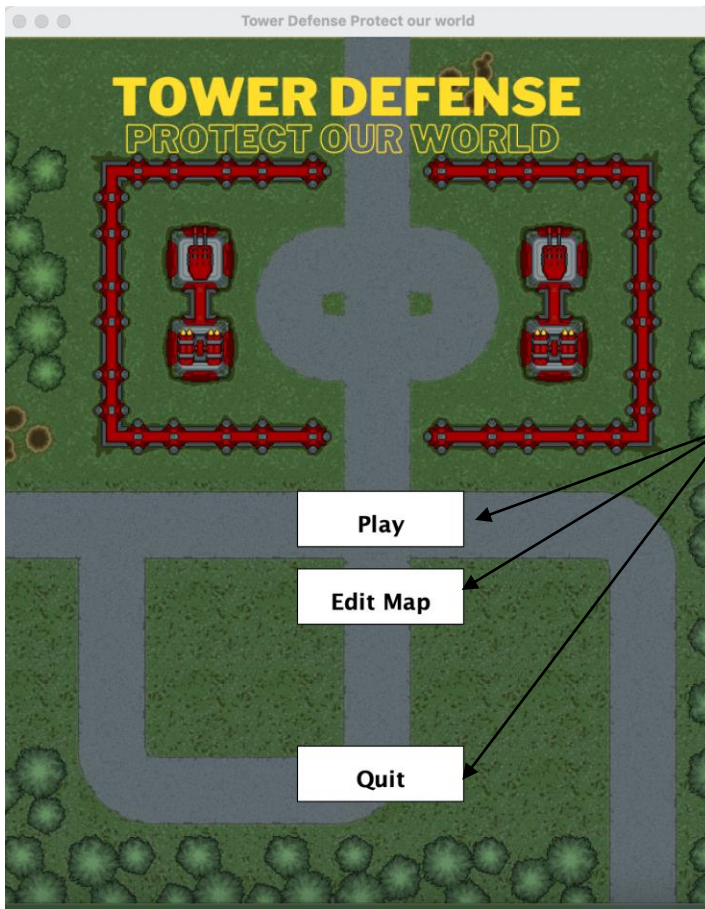
```
Oop project > src > scenes > J SceneMethods.java > {} scenes
1  package scenes;
2
3  import java.awt.Graphics;
4
5  public interface SceneMethods {
6
7      public void render(Graphics g);
8
9      public void mouseClicked(int x, int y);
10
11     public void mouseMoved(int x, int y);
12
13     public void mousePressed(int x, int y);
14
15     public void mouseReleased(int x, int y);
16
17     public void mouseDragged(int x, int y);
18
19 }
20
```

In this class it is Interface class it need to implement a methods to use this class then other class will use this it will use Implement this class and Override the methods

```
Oop project > src > scenes > J GameOver.java > {} scenes
15
16 public class GameOver extends GameScene implements SceneMethods {
17     private BufferedImage img;
18     private MyButton bReplay, bMenu;
19
20     public GameOver(Game game) {
21         super(game);
22         initButtons();
23     }
24
25     private void initButtons() {
26
27         int w = 150;
28         int h = w / 3;
29         int x = 690 / 2 - w / 2;
30         int y = 350;
31         int yOffset = 100;
32
33         bMenu = new MyButton(text: "Menu", x, y + yOffset, w, h);
34         bReplay = new MyButton(text: "Play Again", x, y, w, h);
35
36     }
37
38     @Override
39     public void render(Graphics g) {
40
41         InputStream is = getClass().getResourceAsStream(name: "/res/GameOverpic.png");
42         try {
43             img = ImageIO.read(is);
44         } catch (IOException e) {
45             e.printStackTrace();
46         }
47         g.drawImage(img, x: 0, y: 0, observer: null);
48         // game over text
49         g.setFont(new Font(name: "LucidaSans", Font.BOLD, size: 50));
50         g.setColor(Color.red);
51         g.drawString(str: "Game Over!", x: 250, y: 250);
52         // buttons
53         g.setFont(new Font(name: "LucidaSans", Font.BOLD, size: 20));
54         bMenu.draw(g);
55         bReplay.draw(g);
56     }

```

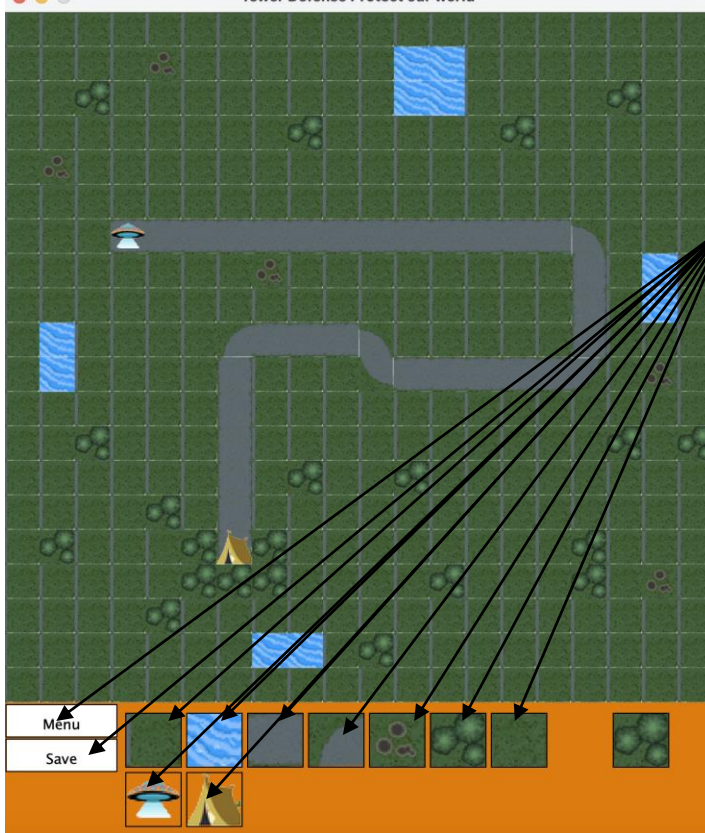
Example this class has extends Gamescene class and implements SceneMethods class then this class have a methods in Gamescene and need to override a methods in SceneMethods class and it can use all of methods.



-In Menu My project have

3 Component are 3 buttons

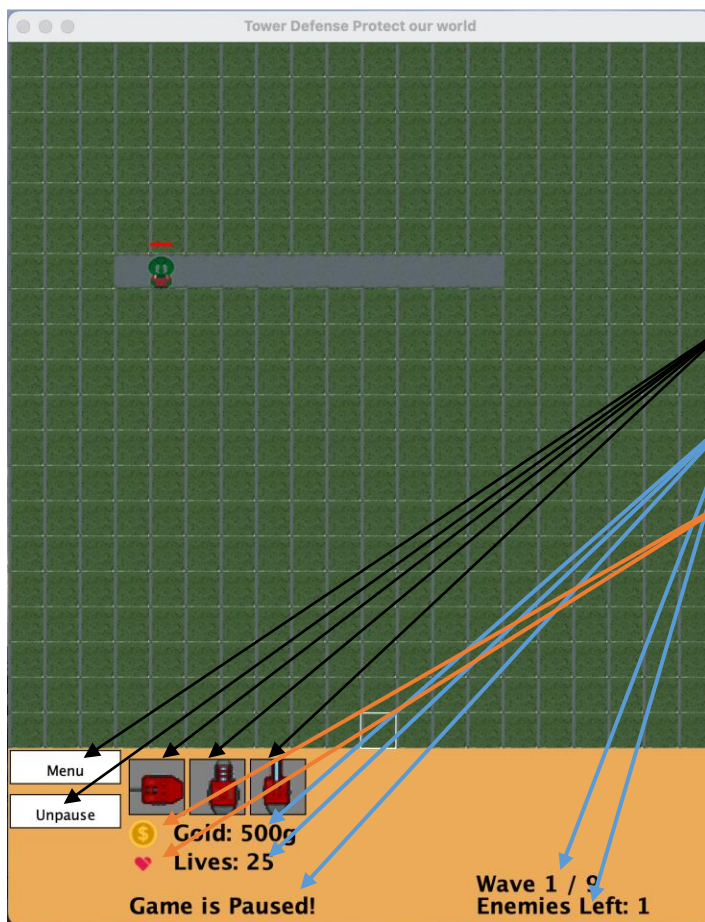
Event handling: is check mouse click on buttons or not



In Editing map it have

11 Component are 11 buttons

Event handling: is check mouse click on buttons or not



In Playing scene it have

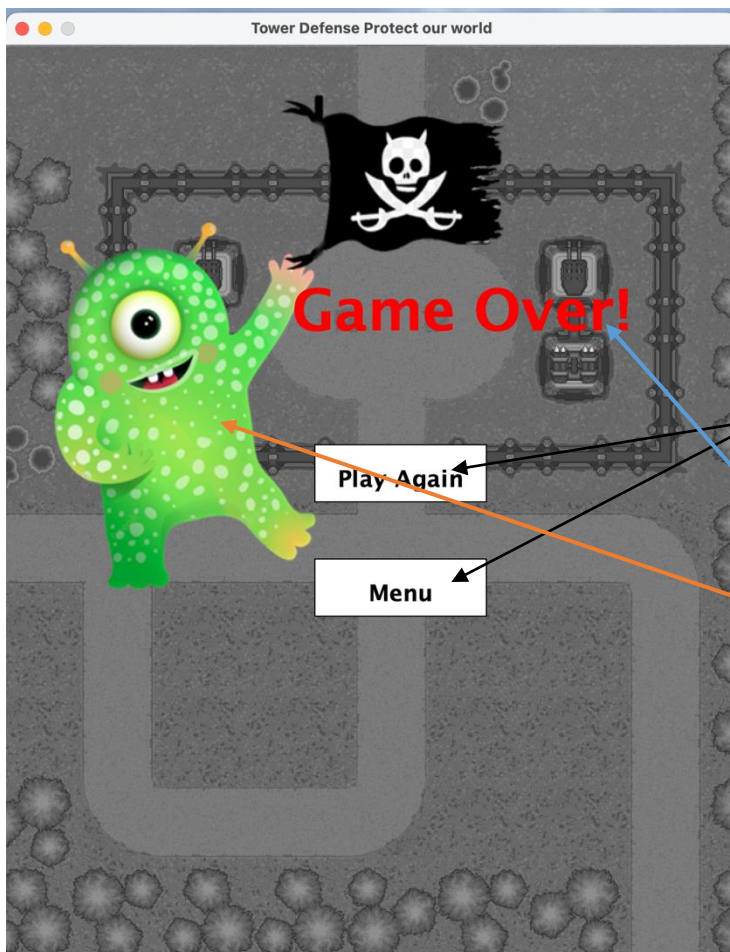
12 Component are :

5 buttons

5 String

2 Image

Event handling: is check mouse click on buttons and have more gold or not and check wave is not end it will spawn enemy and lives not <0 and enemies >0



In GameOver scene it have

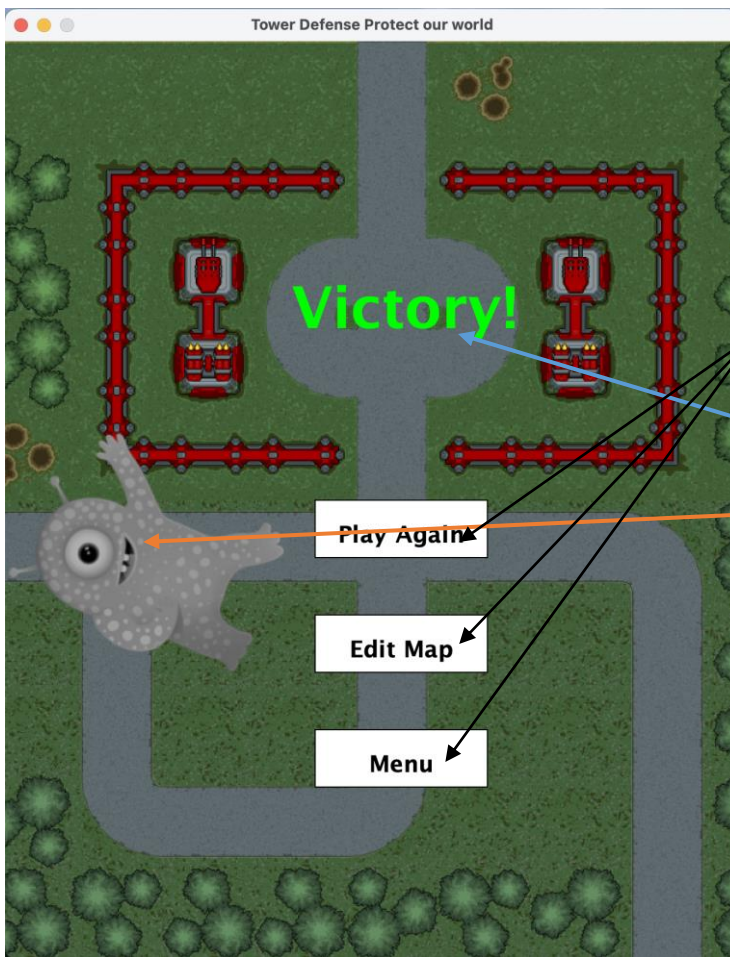
4 Component are :

2 Buttons

1 String

1 Image

Event handling: is check mouse click on buttons or not



In Victory scene it have

5 Component are:

3 Buttons

1 String

1 Image

Event handling: is check mouse click on buttons or not

The Main Algorithm in this game is check default wave if current wave is not end it will spawn enemies to the map and enemies will walk though on the road path if the enemies pass to a tent it will reduce lives point or heart point in game and if the heart point is going down to zero and the game is over but if we place the tower on the map tower will shoot the enemies and the enemies will dead if wave not end it will spawn a new wave of enemies until the wave is end if it end and heart point is more than zero you will win this game.

Summary

Problems encountered during development: it is checking filed and check if how can enemies walk only on the road in first time enemies will walk around the map and go to tent and check how many wave left to spawn a new lot of enemies and problems with JFrame in beginning it can't import the image by lot of image then I use arraylist to cut image to small rectangle and then put it on the map by the way may problems is fix by continues coding and find some answer form github or stackoverflow but not all the problems.

Program highlights : it have upgrade a tower by increase a firerate range or damage etc. and have a tower for slow the enemy.

Advice to Prof. : should add on the Polymorphism and Inheritance it will must confused to study in last unit but now it pretty good.