Univerza v Ljubljani
Fakulteta
za računalništvo
in informatiko

Wardens of Steel

Seminar work for Computer Graphics

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Introduction

The game “Wardens of Steel” was made using Java. I used the Light Weight Java Game Library (LWJGL) version 2.9.3, as I have tinkered around with it before and was familiar with a few of the basic concepts before I started making the game. "Wardens of Steel” is a simple tower defense game where you’re supposed to thwart waves of enemies from reaching their goal (if they arrive at this goal, which is a position at the end of their path, you lose the game).

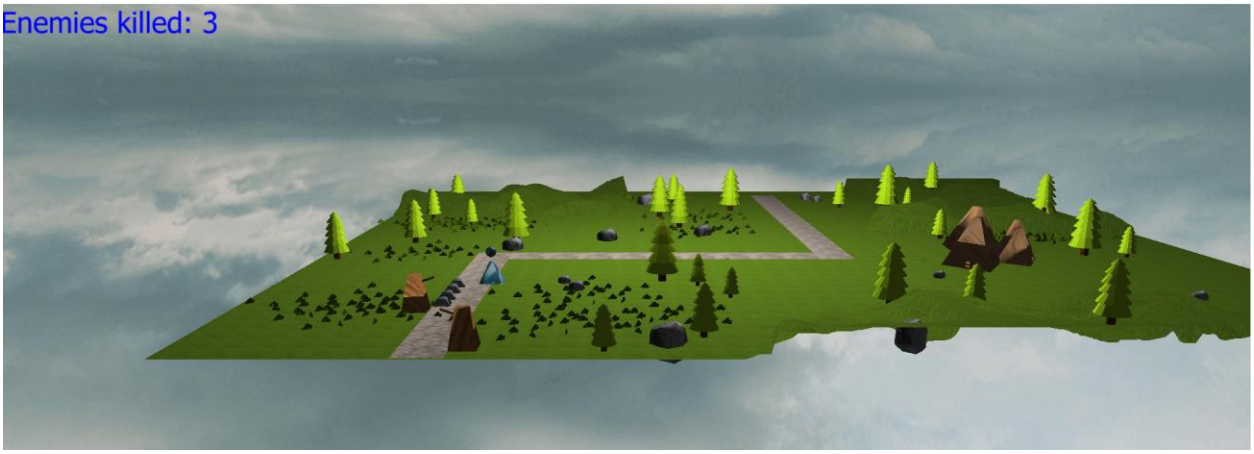
Components of the game

The main game components are:

- Camera movement
- The 3D environment and terrain
- Tower attack mechanic and particle effects
- Enemy movement and enemy wave mechanic
- Ray Casting
- Skybox and GUI

Camera

The camera can be moved using W, A, S, D to move forward, left, back and right respectively. Moving the scrollbar up and down moves the camera up and down. While holding down the scroll button you can change the left and right angle of your camera, and while holding down the right mouse button you can change the up and down angle of the camera. Here are some pictures showcasing the game world in different angles:

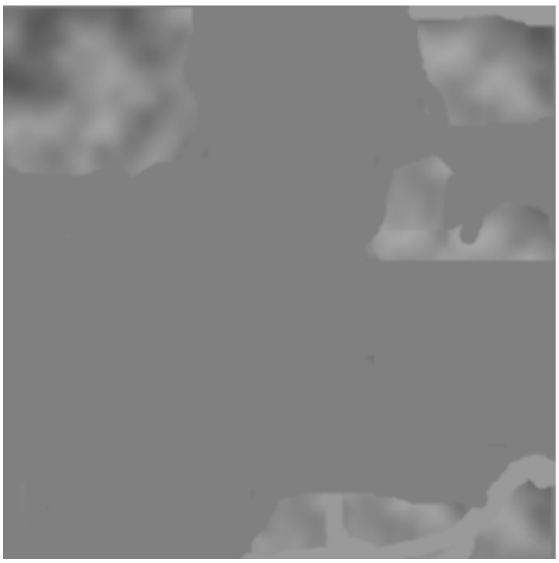

Enemies killed: 3


Enemies killed: 15

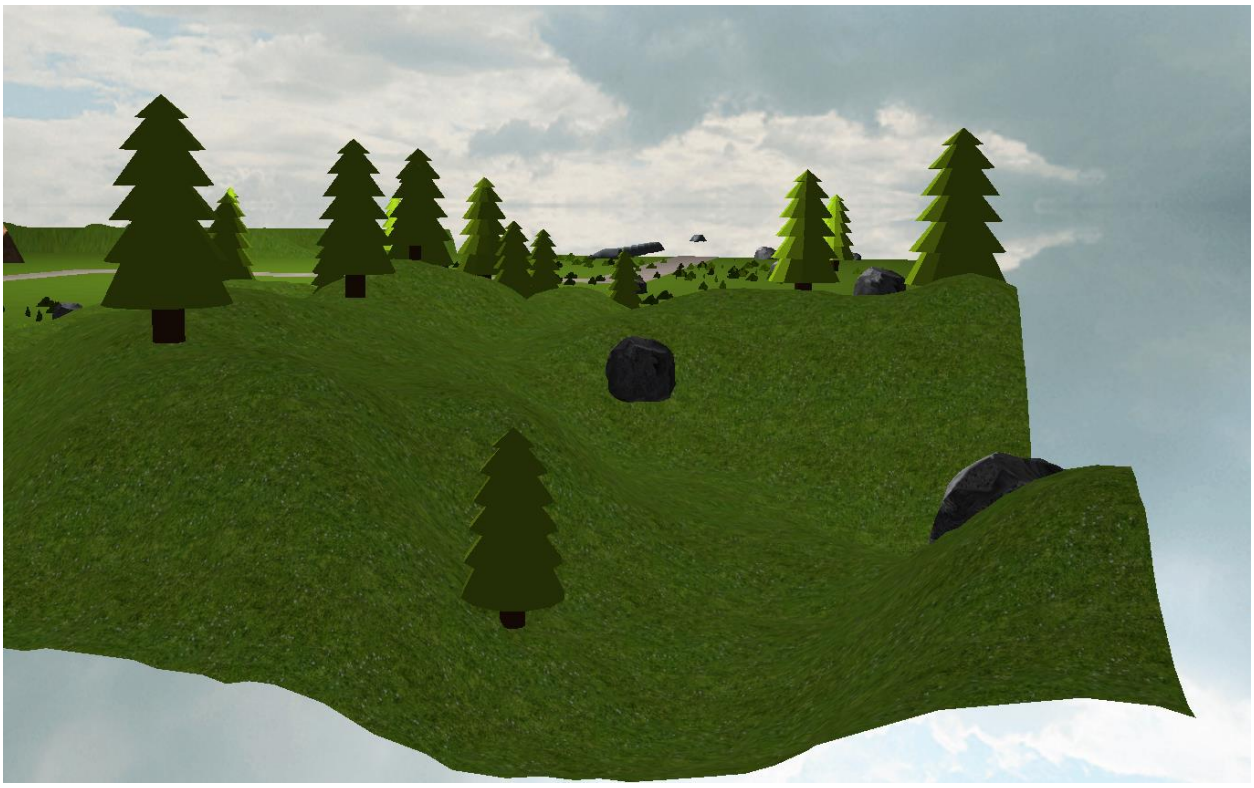

Enemies killed: 20

3D Environment and terrain

The terrain of the map is generated using a grayscale heightmap using an algorithm that reads the image and changes the altitude of the terrain based on the coloration of the image. In order to make the world feel more alive, I added patches of grass, trees, rocks (which are put at random position around the map, excluding the tiles where the enemies walk). I also added a small town (as seen in the images above). Shown below is the view of the game map and the height map:

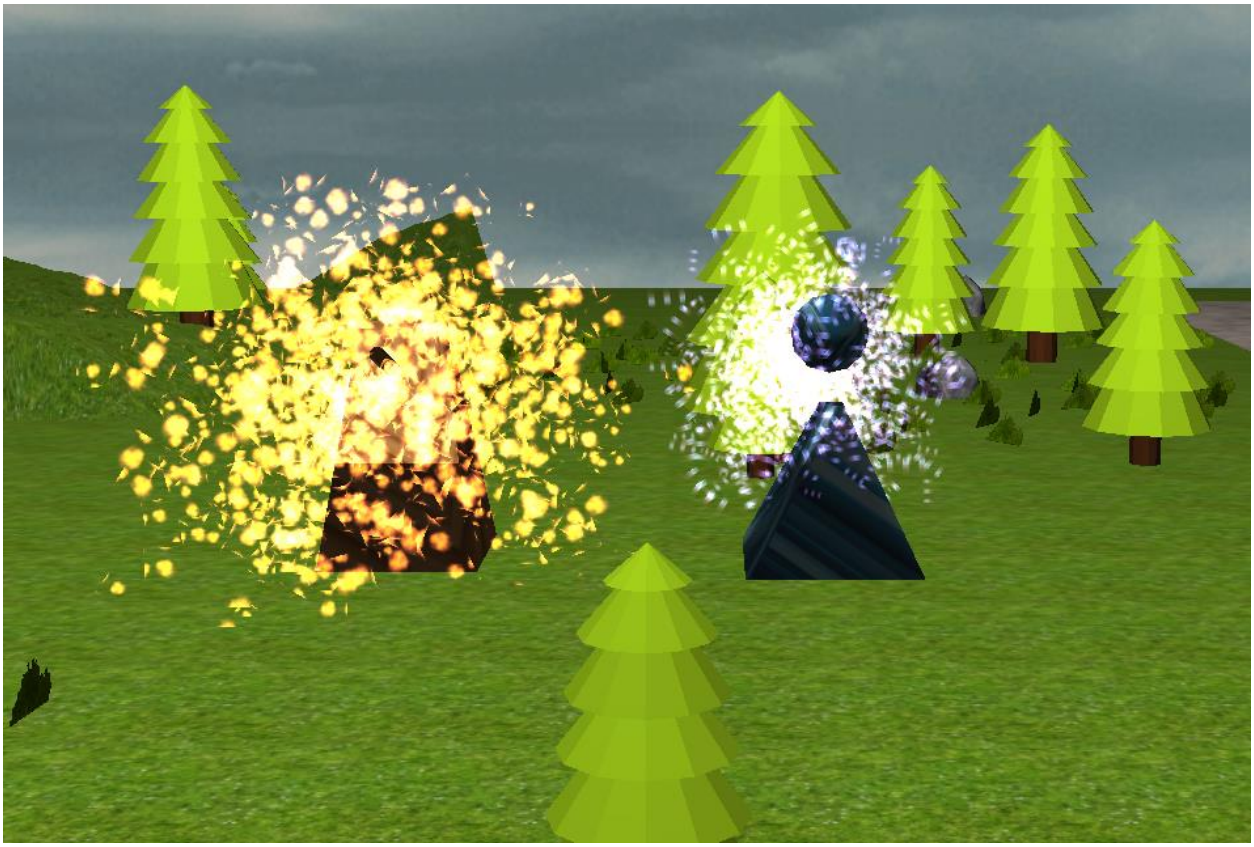


I also added terrain collision detection as shown here:



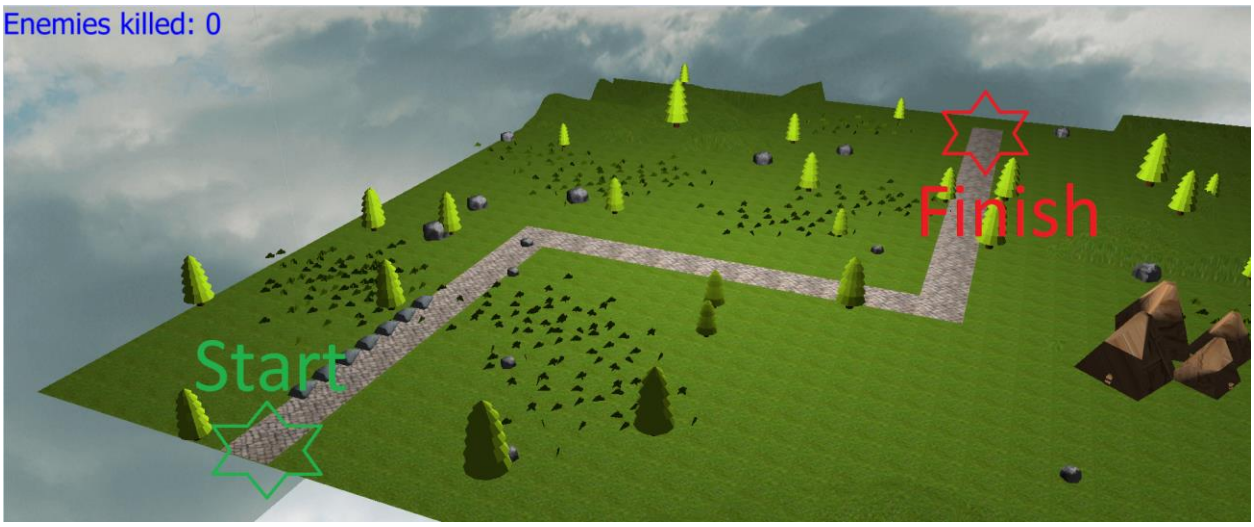
Tower attack mechanic and particle effects

The towers will damage any enemy within their radius of attack. There is a cooldown present to prevent towers from instantly killing the enemies. There are 2 kinds of towers with different attack values, cooldowns and attack effects. To build the first tower you need to click one on the keyboard and then click on the map. To build tower 2, you press 2 on the keyboard and then click on the map. (NOTE: you don't have to keep clicking 1 and 2 all the time, you should click only when you want to switch as the game keeps track of your previously select tower and builds it; the default tower number is 1). Tower 1 (left), Tower 2 (right) and their effects:

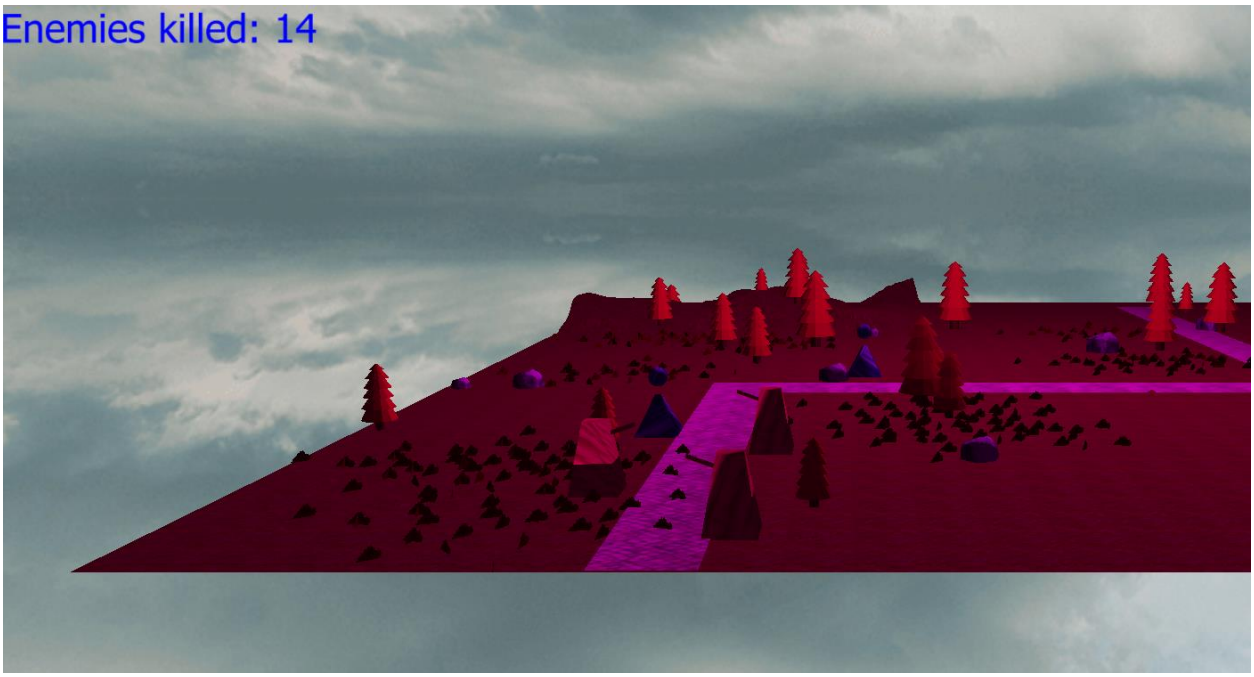


Enemy movement and wave mechanic

Enemies are metallic spaceships that fly along a path and try to reach the end of the road. If they do this, you will have lost the game. When an enemy dies, an explosion audio recording is played.



There are a certain number of enemies that appear one after another and after the final enemy of that group appears there is a small pause before the next batch of enemies appear. This constitutes for a wave. Every 3rd wave, the night falls upon the world and enemies become stronger. The light source changes its color during this time to notify you that the subsequent waves will have +1 enemy and the health of all enemies in the following waves will increase.

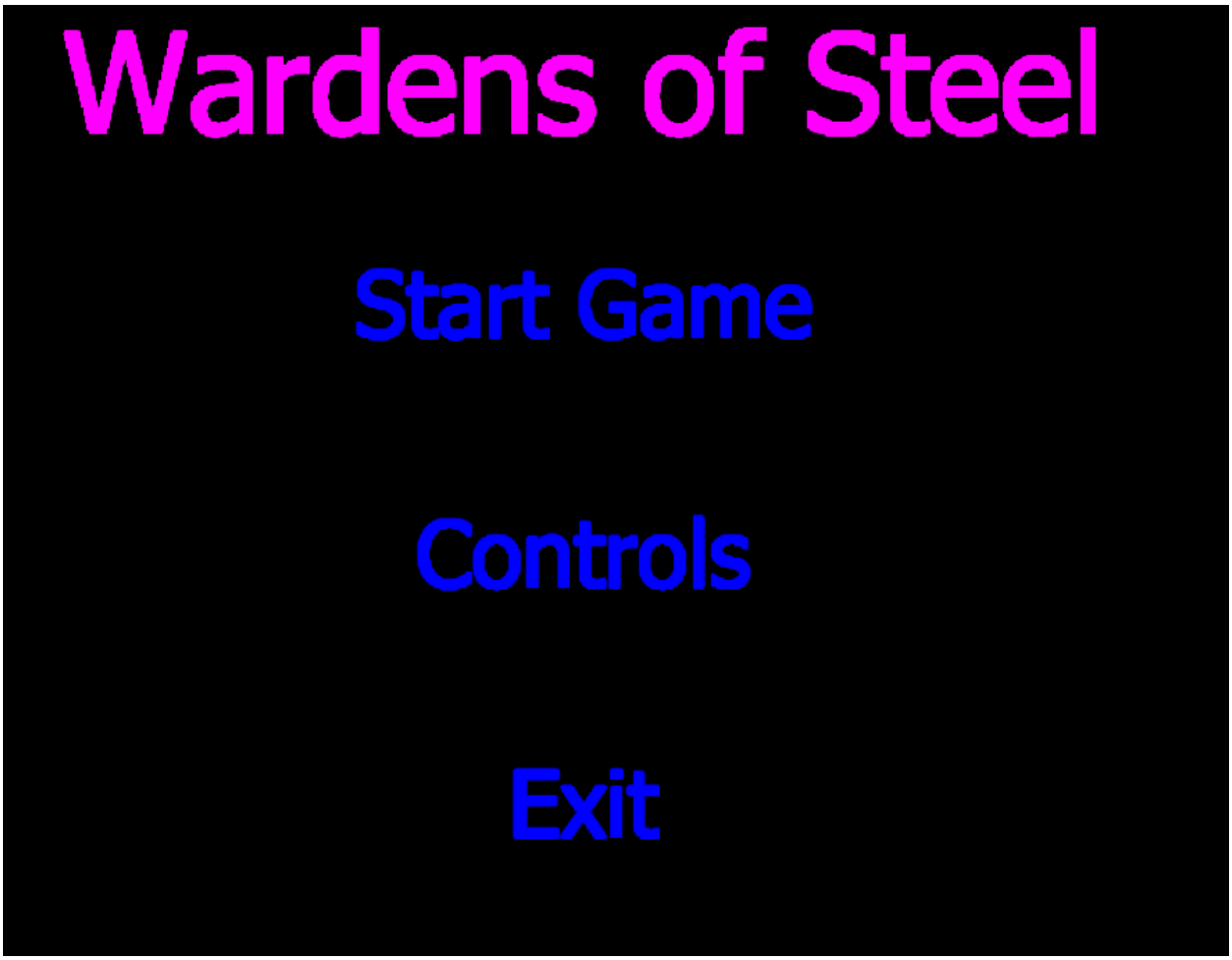

Enemies killed: 14

Ray Casting

Ray casting needed to be implemented so that the game knows where on the terrain you just clicked. It needs to do this in order to know where to build the tower. Towers cannot be stacked together, they cannot be built outside the bounds of the map, they can't be built on the path that the enemies traverse. Ray casting is required for all of this. I used this tutorial to implement this feature.

Skybox and GUI

In order to make the world look more realistic, I added a skybox which I downloaded from here. I used a version of Matthias Mann's PNGDecoder so that I could work with a cubemap. I have some very basic GUI, like a basic Menu, a kill counter and a game over Screen.


Wardens of Steel
Start Game
Controls
Exit


Enemies killed: 39
GAME OVER