AGT Milestone 2 report

Overview

The game is called Psychedelic Invaders due to its use of odd and strange assets used, inspired by psychedelic art, and invaders because its a game set in space so that part of the name is inspired by space invaders. The theme is that you're a cosmic bounty hunter paid by a galactic federation to explore the rogue planet of Zyrion 37-G where the federation has detected strange activity. As you land on the mostly desolate planet you are attacked by strange aircrafts, and turrets. Your mission is to defeat their leader and escape alive. The genre of the game is an on rails type of flying/ first person shooter game with some features which would be appealing for speedrunners to play. The aim of the game is to beat the game as fast as possible and get a high score. You get points for shooting at enemies and you lose points for losing lives. To win you have to defeat the boss of the game who is an ancient deity on this planet. WASD controls are used to move the camera up, down, left and right. Since this is a rail based game the camera moves forward at a constant speed. Mouse is used to move the camera in 360 view. The spacebar is used to shoot ballistics at enemies.

List of assets used

skybox - https://wwwtyro.github.io/space-3d/ Randomised Seed was : x637rdnuxr4
Date: 4/11/2020
License - personal use

terrain - https://texturehaven.com/tex/?c=terrain&t=forrest_ground_01
Date: 4/11/2020
License - https://texturehaven.com/p/license.php

boss model - https://free3d.com/3d-model/sequin-jester-mask-v1--494203.html
boss texture - https://free3d.com/3d-model/star-wars-imperial-turret-58616.html this model had no texture so i decided to add one using blender by just putting an image on it. I used an image from the turret model zip.
Date: 29/11/2020
License - personal use license

powerup model - https://free3d.com/3d-model/laurel-wreath-with-lightning-bolt-v2--164822.html
powerup texture - https://www.freepik.com/free-vector/overlapping-forms-background_10073459.htm#page=1&query=yellow&position=15
this model had no texture so i decided to add one using blender by just putting an image on it
Date: 3/12/2020
License - personal use license

enemy texture - https://3dtextures.me/2020/10/07/sci-fi-wall-007/
Date: 4/11/2020
License - personal use license

enemy2 texture - https://www.freepik.com/free-vector/psychedelic-optical-illusion-wallpaper_8622320.htm#page=1&query=psychedelic%20texture&position=24
Date: 27/11/2020
License - personal use license

enemy_bullet texture - https://www.freepik.com/free-photo/abstract-saturated-psychedelic-vivid-background_5133846.htm#page=1&query=psychedelic&position=5
Date: 28/11/202
License - personal use license

player model - https://free3d.com/3d-model/star-fighter-657163.html
Date: 3/12/2020
License - personal use license

turret model- https://free3d.com/3d-model/star-wars-imperial-turret-58616.html
Date: 6/11/2020
License - personal use license

risen audio - https://visceracannon.bandcamp.com/album/hymns by Terry A. Davis
The audio was too loud so i used an online converter to reduce the volume by 80% so you can hear other sounds. The name of the file on the website is Risen track 90. The tool used for this is - https://www.onlineconverter.com/increase-mp3-volume

RIP King Terry
1969 - 2018

Date: 4/12/2020
License - https://creativecommons.org/licenses/by/3.0/

intro audio - https://samplefocus.com/samples/sci-fi-ambience-panned-loop
Date: 4/12/2020
License - https://samplefocus.com/license

powerup audio - https://samplefocus.com/samples/8-bit-coin-fx
Date: 4/12/2020
License - https://samplefocus.com/license

explosion audio-
https://www.freesoundeffects.com/free-sounds/war-and-battle-sound-effects-10042/
name of file on website is Explosion 3
Date: 4/12/2020
License - personal use license

electric audio - https://www.freesoundeffects.com/free-sounds/electric-sounds-10032/
name of file on website is arc 1
Date: 4/12/2020
License - personal use license

bullet audio - https://www.zapsplat.com/music/laser-gun-single-shot-2/
Date: 4/12/2020
License - https://www.zapsplat.com/license-type/standard-license/

No additional libraries were used.

Part 1- Basic Game Modelling

Intro screen- For the intro screen i used the m_2d_camera and set its position behind where the game actually starts. I did this by using a bool to switch between the cameras. This allowed me to render objects for the intro screen to make it look more appealing and give the effect of being on a strange planet. I have objects rotating and moving on the intro screen so that it looks more lively. I also created a flicker and colour changing effect for the text of the intro screen to give it a more strange feeling and obscure aesthetic. I also allowed the player to change between easy and hard modes by pressing “E” and “H” respectively. This is set to easy mode by default and I also displayed the current mode.

```
bool easy = true;
int lives = 3;

If (startscreen)
        if(e pressed)
           easy = true;
           lives = 3;
        if(h pressed)
           easy = fasle;
           lives = 1;
if(easy)
   render “current mode: easy”
else
   render “current mode: hard”
```

Primitives- The first primitive is the same one I used for milestone one which is the first enemy of the game. I have created a vector of this primitive and made it rotate constantly. I used a texture that matches the theme of my game. For this primitive I used the tetrahedron files given to us as a starting point and modified it so that it would resemble an aircraft i did

this by flattening the shape and extending it at one of the points it sort of looks like a paper aeroplane which is the look i was going for. The second primitive is enemy 2 which is an extremely flat primitive so that it will be harder to shoot as the hit box will be thinner. For the texture I used some abstract art which matches the theme of my game. The third primitive is the enemy bullet which is a 2d irregular triangle. I used this primitive to be the bullets that the boss will shoot in the game. I decided to make this primitive 2d because it constantly rotates on all axis at different rotation amounts meaning that it can catch the player of the game by surprise since it will move around as it is being fired towards you and since its 2d at a certain rotational point it will be more difficult to see adding difficulty to the game. For the texture I used another piece of abstract art that looks great with light shining on it.

```
//creating vector of enemies and of boxes
for (int i = 0; i <= 10; i++) {
auto tmp_m_enemy = engine::game_object::create(enemy_props);
		m_enemies.push_back(tmp_m_enemy);
	}
	for (int i = 0; i <= 10; i++) {
		engine::bounding_box tmp_enemy_box;
		tmp_enemy_box.set_box(10, 2, 10, glm::vec3(0,0,0));
		m_enemy_boxes.push_back(tmp_enemy_box);
	}

//updating enemies and boxes
for (int i = 0; i < m_enemies.size(); i++) {
			m_enemy_boxes[i].on_update(m_enemies[i]->position());
		}

//rendering vector of enemies and the collision boxes
			for (auto e : m_enemies) {
				engine::renderer::submit(textured_lighting_shader, e);
			}

			for (auto b : m_enemy_boxes) {
				b.on_render(2.5f, 0.f, 0.f, textured_lighting_shader);
			}
```

Audio- I changed the background audio of the game and added a different one for the intro screen and when the player starts the game. I did this by playing the intro audio when you run the game and when you press “Enter” to start the game it stops all audio and then plays the audio for the in game background music. I have very limited musical knowledge so I was unsure if the intro screen and in game music matches the theme but my thinking was to have a form of dark “glitchy” music for the intro screen and have a more technologically limited music for the in game music. For the first game event sound I used some electrical audio for when the alpha sphere spawns when the enemy is destroyed. The second game event sound I used an explosion sound for when the billboard explosion spawns when the enemy is destroyed. The third game event sound I used was when the player picks up the

power up which is an indication that the powerup is active. These sounds match what's happening in the game as they occur.

Heads up display (HUD)- For the HUD i added a crosshair to show the center of the camera more clearly allowing the player to line up their shots more accurately. I did this by rendering text “[x]” to the center of the screen. I also added a score to the game that updates when enemies are destroyed and when the player takes damage. I added a timer to count how long it takes the player to finish the level. I did this by incrementing a float variable with time_step once the player starts the game. I added lives to the HUD that changes depending whether or not the game is in easy or hard mode that is decided by the player in the intro screen. Easy mode = 3 lives, Hard mode = 1 life. I did this by creating a bool for which mode it is and then changing the value of the lives depending on the mode and it is set to 3 lives, easy mode by default. The lives also update when the player takes damage. To render the score, timer and lives i casted the variables as strings and added them as text to render on the in-game screen.

```
//casting variables as strings to render as text
std::string timer = std::to_string(seconds);
std::string current_score = std::to_string(score);
std::string lives_left = std::to_string(lives);
```

Part 2- Camera, Meshes, Lighting and FX

Camera technique- for the camera technique I have decided to implement a on the rails camera constraint so the camera will move forward at a constant speed as well as a limit on how much the player is able to move in the left, right, up and down direction. I have also allowed the camera to be rotated in 360 degrees view using the mouse to turn in any direction so the player is able to shoot at enemies they have moved passed due to the on rails nature of the game. A hidden mechanic of this technique allows the player to move faster in the forward direction by using the mouse to turn left or right and then using “D” or “A” respectively to complete the level faster as well as being able to remain in position to go against the forward movement by turning left or right and holding the left or right movement keys respectively i think my take of on rails type game will be an excellent game for speedrunners to attempt because of this hidden mechanic.. Another technique I used for the camera is the switching between the intro screen camera and the game screen camera. I did this with a bool for the intro screen being active and setting it to false once the player starts the game with “Enter” switching the camera.

Meshes- The first mesh used is the same one from milestone one. The turret i have implemented with a loop and using the code on moodle to make the turret turn towards the player as it moves past the turret. This is so the mesh looks more realistic when it shoots towards the player. The second mesh I used was for the powerup which is a medallion with a lightning bolt and a wreath on it to symbolise speed. This mesh was not textured so I used Blender in order to add an image texture to the model and export it back to my project which generated an MTL file. The third mesh I used was a mask which is the boss of the level. This model was also untextured so I used Blender to add one the same way I did for the power up model. I decided to only render the boss after a certain score was reached and rendered

it in front of the player forward movement; this was done by getting the camera's current Z axis position and subtracting a certain distance. To make the boss move backwards I used a variable i incremented with time_step. For the textures i added to the boss and the power up it seemed to only work if i had the textures in the same folder as the model i think i had to edit the MTL file to change this but i didn't want to risk it so just left the textures in the models folder. The idea for using a mask as a boss was inspired by the boss Andross from the original Starfox on the SNES.

Lighting- The first lights I used were two spotlights which I used for the eyes of the boss model since I thought it would be a good look as it should render when the boss renders to signify to the player that something major is happening. The sphere for the lights work well with this but the glow for the light doesn't seem to follow the sphere for a reason i was unsure about and if i wanted to render it when the score reached a certain number then it wouldn't render at all. It would also not be at the position of the boss either so I decided to just have its position further back and have the boss back into it. For the second light I used a point light and updated its position with the ballistic meaning that the light would follow the ballistic at all times creating a moving light source.

Special effects- The first special effect I used was an explosion with code taken from moodle. I also used the same explosion animation from the FX sample code. I then added this explosion effect for when the enemy is destroyed by the ballistic or by collision with the player. The second special effect I used was the alpha sphere taken from moodle. The effect was taken from moodle with some slight alteration to the colour to match my game. I added this effect for when the enemy is destroyed by the ballistic only. The alpha sphere is meant to be the effect of the ballistic exploding in an electrical surge on impact with the enemy and the explosion signifies the death of the enemy. When the player collides with the enemy only the explosion effect plays while when the ballistic collides with the enemy it plays both the alpha sphere as well as the explosion. I also attempted to create a third effect with a crossfade for when the player picks up the power up but was unsuccessful with implementing it.

```
for (int i = 0; i < 10; i++) {
                        if (m_camera_box.collision(m_enemy_boxes[i])) {
                                //reduce score and lives
                                score -= 100;
                                lives -= 1;
                                //explosion at position of enemy
                                m_billboard->activate(m_enemies[i]->position(), 20.f, 20.f);

                                // play explosion audio
                                m_audio_manager->play("explosion");

                                //"despawning" enemies at collision with ballistic
                                m_enemies[i]->set_position(glm::vec3(-100, -100, -100));
                        }
}
```

Part 3- Physics, AI, and Gameplay

Physics- The first game physics I implemented was the hidden mechanic implemented with the camera as I allowed the player to increase or decrease their forward momentum by turning with the mouse left and moving the camera right for increased momentum or left with decreased momentum to a halt. This mechanic can also be executed if the player turns right with the mouse and moves the camera left for increased momentum and right for decreased momentum to a halt. The second game physics I implemented was the shooting of the ballistic which I had taken the code from moodle. Using this sample code I increased the velocity of the ballistic once the player had picked up the powerup since only one ballistic is able to be shot at a time. I figured this power up would be helpful for the player to finish the game faster. I did this by incrementing the ballistics update with a time_step multiplier. The third game physics I implemented is the collision boxes for the ballistic, player and power up. I did this with the help of the moodle code, however the bottom of the boxes were set to the centre of the object rather than its bottom. I was unable to fix this issue with the collision boxes. I also attempted to add boxes for the boss, enemy2, turrets and enemy bullets but the boxes seemed to not work for these objects and was unable to get them to work in time. To create the collision boxes for the enemy I created a vector of enemies and then created a vector of boxes matching with the enemies and then to check whether the player of the ballistic was colliding with any of the enemies i used a loop to go through the vector of boxes and then change the position of that box and its corresponding enemy as well as the ballistic to somewhere far away from the explorable part of the game level.

```
for (int i = 0; i < 10; i++) {
                        if (m_ball_box.collision(m_enemy_boxes[i])) {
                                score += 200;

                                //"despawning" ball at collision
                                m_ballistic.object()->set_position(glm::vec3(-100, -400, 0));

                                //explosion at position of enemy
                                m_billboard->activate(m_enemies[i]->position(), 20.f, 20.f);

                                //alpha sphere at enemy position
                                m_alpha_sphere->activate(5.f, (m_enemies[i]->position()));

                                m_audio_manager->play("electric");


                                m_audio_manager->play("explosion");

                                //"despawning" enemies at collision with ballistic
                                m_enemies[i]->set_position(glm::vec3(-100,-100,-100));
                        }
}
```

NPC and AI(very partially implemented)- I have implemented 4 NPCs into the game which are enemy, enemy2, turret and the boss. They do not have any significant intelligence, just some very basic movements. I didn't have enough time to implement the AI part of this requirement but I did have some ideas for implementing AI onto these NPCs. For the turret I wanted it to shoot some sort of projectile towards the player with two states aiming and shooting with a limit on its range of shooting. For the enemy I wanted to use pathfinding to create kamikaze aircrafts that would attempt to crash into the player. For enemy2 i wanted to create vectors of these enemies in order to create shapes using multiple enemy2's and use those as obstacles the player must navigate past since i also wanted to increase the amount of ballistics it would take to destroy enemy2 NPCs making it more difficult to kill. For example I would create one vector for a shape made up of 5 enemy2's and they would move towards completing this shape with overlapping collision boxes while also leaving some gaps for the player to go through. For the boss I thought about implementing some intelligent movements it would use to evade attacks as well as go above, behind, left and right of the player while also shooting enemy bullets towards the player from different directions forcing the player to be more active with the mouse as they attempt to defeat the boss.

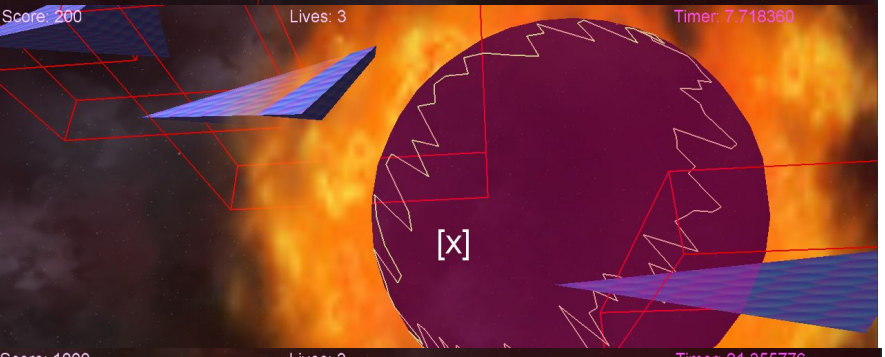
Gameplay- The first gameplay element I implemented was the power up which is in line with my games theme since you can only shoot one ballistic at a time. The powerup increases the velocity of the ballistic meaning you can defeat enemies much more quickly and you wont need to have as much patience with the ballistic approaching enemies before attempting to shoot at other enemies. The seconds gameplay element I implemented was a timer to count the time it takes the player to complete the level. This was done by creating a float variable and then incrementing that variable with time_step when the player presses "Enter" on the intro screen. I then casted this float as a string and rendered it as text on the HUD.

Reflecting on the project- For me personally it was an enjoyable experience creating this game level and I feel i have learned a lot about the skills needed to create games. That is the biggest strength in my opinion. The strengths of the game itself are the thematic choices I have decided to implement. I think the game looks great and has a unique style to it as well as some interesting mechanics especially with the modified on rails camera technique. A weakness of my game is that I felt some of my code will need some improvements as the game takes a while to run from pressing F5 to get to the intro screen and I think that my code could be more optimised so that it does not take ages to play the game. The biggest weakness of my game is the lack of AI and significant NPCs as that part is what makes a game playable and enjoyable but due to time constraints I was unable to implement it as much as would have liked. To expand the project into a complete game more levels will be required one idea I had was a boss for every level and each level the boss would be a body part of a singular boss and at the final level you would have to defeat the boss as a full entity. More refined collision detection would also be required as nothing is more frustrating in a shooting game than collision detection that is off in some areas. Most importantly the AI will need to be added to complete the game since that will make the game a challenge in order to beat as well as progress which is something I'm hoping to add in my spare time at some point.

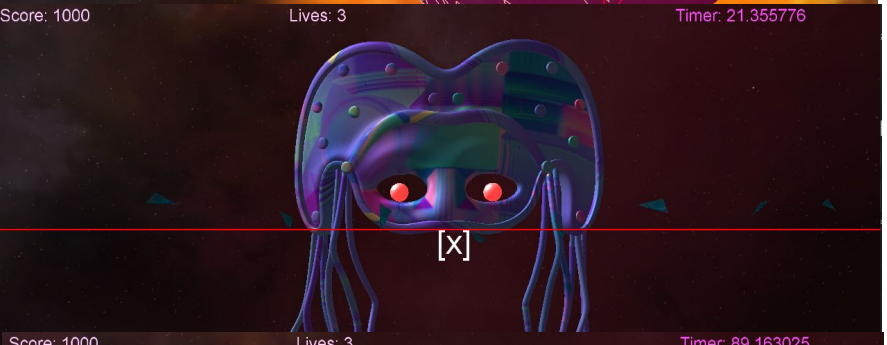
Screenshots-

Intro screen also shows powerup, enemy2 and enemy bullets

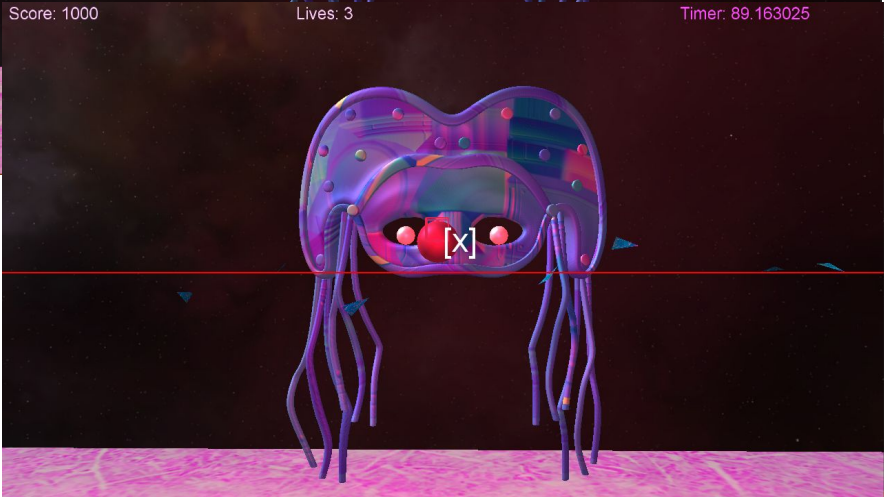
enemies with collision boxes as well as in game hud and player collision



Special effects explosion and alpha sphere and score updated



Boss model



Boss model with light from ballistic