Project Report

Guillaume St-Pierre – 101066038

Description

In this game, you are a diver trying to find the great underwater treasure buried deep into the ruins. With your limited set of tools, you must dive deeper and deeper into the ruins, collect treasure, fend of monsters and buy new tools to hopefully find the great treasure at the end of the ruins.

This is the final build of the game, submitted for grading. This report explains what the feature are, what was cut and how much was successfully implemented. It also describes the controls and objectives of the game.

Playing

When you start the game, you will be presented with the main menu when you can buy upgrades and attempt a run. Click on the "start game" button to start a run. Each run only last as long as your reserve of air, which slowly depletes during the course of the game.

When your air runs out, you will be brought back to the main menu where you may buy upgrades with the treasure found in the ruins and attempt a new dive. Treasure does not respawn between runs, but monsters do!

When hit by a monster, you will lose a small part of your treasure and some air. Treasure stays in the world until you pick it up again, so don't worry about losing your run.

Controls

- All menu controls are done with the mouse.
- Moving is done with the A and D keys. As you are an underwater diver, water will apply resistance to your movements, and you will slow down if you don't hold the keys.
- You can move up in the water using Spacebar. Gravity is still applied when moving up and you will slowly sink back down if not holding it.
- You can move your current weapon's aim using the mouse and attack with a mouse click.
- You can select your weapon with the 1, 2 or 3 keys. The Harpoon is weapon 1, the pistol is weapon 2 and the laser is weapon 3. Weapon 2 and 3 are locked at the start of the game and must be bought using the game's currency.
- You can pause the game and quit your current run with the Escape key.

To play the game, try moving around and attacking the monsters. You may collect treasure by moving next to them and leave the level by moving to the arch-like structure at the end of a level.

Upgrades

Upgrades are divided into two parts: three upgrade trees and three infinite upgrades.

The first tree is the harpoon tree. You may upgrade the harpoon by buying the next upgrade in the chain, up to a maximum level of 3. The harpoon is unlocked from the start and thus the first box is set as completed.

The second tree is the pistol tree. The pistol is a quick, but weak and short ranged weapon which can be unlocked and then upgraded three times.

The third upgrade is the laser. The laser is a slow but powerful ranged weapon which blasts a powerful ray through most of the screen. The laser can be unlocked and upgraded three times.

The infinites upgrades allow you to upgrade, in order, your total amount of air per run, your ability to keep air and treasure when getting hit, and your movement speed. You can select each of these upgrades indefinitely, with an increasing cost every time it is bought.

Upgrades

During the course of the game, you may see a monster dropping something else than treasure. These are powerups and they act as follows:


Air adds 30 seconds of air to your current air counter, allowing you to go deeper in the ruins without having to upgrade your air tank.


The armor allows you to gain temporary invincibility to damage and ignore monsters completely for 5 seconds.


The pepper allows you to gain a 50% boost to damage for 15 seconds, useful for dealing with the pesky smokers.

Enemies

You will face a few monsters during the course of the game, which are described here:


The fish is a weak enemy that will charge at you when you enter their line of sight. It can be dispatched with a few harpoon hits but can also be dangerous in groups.


The big fish is a patrolling enemy which will shoot at you when you enter their line of sight. They are very strong and tend to run away when you get near them, making them more difficult to deal with.


The smoker looks like a plant, but it is actually a very annoying enemy. The smoker, as its name implies, will create a column of smoke up to the ceiling above it, blocking your progression. The smoke can be easily avoided, but the smoker is very resistant and will take precious time to take out. Smokers like to dwell near treasure for strange reasons, so follow their smoke to find some goodies.

Requirements

Technical requirements.

1. Written in C++ using OpenGL to render; readable code with no fatal bugs.
    a. The game is indeed written in C++, most of the code is documented. The code is properly formatted, and I hit no major bugs when testing the game.

2. All movement handled through transformations.
    a. This is indeed the case as all movement is handled using the transformations in the render methods of each entity. A lot of inheritance is used to render the entities and transformation are used throughout.
3. At least one use of physically-based motion (with gravity and momentum-based collisions).
    a. The player, treasures and powerups are all affected by gravity through their parent object. The player can fight against gravity through the controls or by using their ability to stick to walls.
4. Collision detection between game entities and the walls and platforms of the level.
    a. Collision detection works and bounding boxes can easily be tweaked. The player will stop when trying to move against walls, the floor or the ceiling. Similarly, enemies will collide with walls and not see the player through any terrain.
5. At least one instance of hierarchical transformations for a compound object (e.g., a cannon with swiveling barrel).
    a. The player has weapons which are hierarchical transformations. The player can both move around and flip and the weapons will stay attached to the arm of the player sprite. Attacking also triggers the weapon's attack animation using these transforms.
6. A gameworld larger than the screen, with ability to scroll around and see different parts.
    a. The camera is centered on the player at all time. When moving, the world will be moved accordingly so the player is always centered.
7. At least one enemy that navigates using path planning.
    a. Both the fish and the big fish patrol the world using path planning. This is beyond overkill for a wander mechanic, but it allows me to complete this requirement.
8. At least one game entity that moves using chase, pursuit, flee, or escape behaviours.
    a. The small fish currently charges the player using chase. The bug fish will flee when the player approaches.
9. Finite state machine controlling overall game (e.g., loading screen, pause, break from action between levels).
    a. The state machine exists and currently powers everything in the game. States can be transitioned and loaded in very easily.
10. At least two instances of particle systems used.
    a. We have three instances of the particles system, with two reusing the same base system. The laser beam is a particle that spawns near the tip of the laser and which animates into a nice folding laser beam. The smoker and player uses the same particles system for the smoke and the bubbles spawning above them. This system is very generic and could be used for spawning blood from enemies or other things.

Gameplay requirements.

1. At least three different enemy types with distinct behaviours.
    - All three enemies are implemented and distinct.
2. At least three levels with different layouts.

        - We have all three levels implemented with difficulty ramping up between levels. Their themes are distinct, and they are designed to be completable within five minutes. We only have one completion condition unfortunately with the player having to reach the exit at the end of a level.
3. At least two distinct weapons the player can use.
    - We have three weapons. The harpoon does good damage but is only used in close quarters. The pistol has low range and low damage but shoots fast. The laser has a huge range and size and does a massive amount of damage but is slow to recharge.
4. Use of currency for player to buy upgrades. (Or, some clever way to otherwise get the player to make long-term decisions.)
    - Upgrades are bought with treasure using the upgrade interface on the main menu.
    - 4a. optionally, RPG-style upgrade paths for the player: additional weapons, shields, speed boosters, and more.
        - The player can unlock two new weapons throughout the game and both weapons are upgraded individually. Infinite upgrades for the player's suit also exists.
5. A HUD showing useful information: current cash, health, other game elements of interest.
    - The HUD shows the current air from the player and the current amount of treasure. A powerup time was planned but has been cut to make the deadlines.
    - The enemy's health bar has been voluntarily omitted to add tension and unknown elements to the game.
6. At least one interesting powerup with a timer.
    - Powerups are implemented and can be dropped by enemies on a 65% chance. Otherwise, the enemy drops treasure. Powerups act on a time and have distinct effects, they are described in the previous section.
7. Challenges that reward planning as well as reflexes.
    - Level design require the player to learn and chose their paths throughout the game. Smokers are also a big element for planning paths as they block progression and take some time to defeat. Players can evade some smokers, but they can also choose to defeat a smoker and get more treasure at the cost of air.

Planned and completed features

Water physics-based movement	COMPLETED
Camera controls	COMPLETED
Collision detection on walls	COMPLETED
Can stick to walls and floor	COMPLETED
HUD	COMPLETED
Powerup timers on the HUD	DROPPED
State machine for levels and menus	COMPLETED
Menu for starting the game	COMPLETED
Pause menu	COMPLETED
Player loses air as time goes one	COMPLETED
Player loses air and treasure when hit	COMPLETED
Harpoon weapon	COMPLETED
Pistol weapon	COMPLETED
Laser weapon	COMPLETED
Weapons are represented on the player	COMPLETED
Collectable treasure that do not respawn	COMPLETED
Unlockable weapons	COMPLETED
Upgradable weapons	COMPLETED
Upgradable suit, flippers and armor	COMPLETED
Upgrade and unlock menu	COMPLETED
Fish Enemy that charges at the player	COMPLETED
Smoker enemy that create a wall of smoke	COMPLETED
Jellyfish enemy that shoots electricity	COMPLETED
Enemies can drop treasure or powerups	COMPLETED
Enemies use path planning	COMPLETED
Powerups that can be picked up	COMPLETED
Level can be exited	COMPLETED
Levels have breakable walls for shortcuts	DROPPED
Interesting levels with varied challenges	COMPLETED

Dropped features

Some features were cut from the final build for time reason. I decided to freeze the code on April 8th and focused on fixing bugs and improving the current game. Performance was somewhat bad on big levels and the time gained by cutting features allowed me to improve the performance of the game significantly. I will describe the few cut features here:

Powerup timers on the HUD

I had planned to have some kind of timer for how long each powerup would last for on the HUD as well as an effect on the player through the colour attribute on the shader (Like how the enemies flash red when hurt). Unfortunately, while my HUD system is pretty nice to work with, creating a HUD can be very time consuming. I decided not to have this time in the final build as it was possible to work without it and still enjoy the game.

Levels have breakable walls for shortcuts

This was planned from the start. Players would have been able to break walls in later levels and go back to previous levels to make further runs easier. Sadly, the spaghetti nature of the collision resolution code as well as the state transition code made this very difficult to implement in practice. As it added very little quality to the game after having designed the levels, I decided to drop it.