VIETNAM NATIONAL UNIVERSITY HCM

INTERNATIONAL UNIVERSITY

School of Computer Science & Engineering

Holly Fish Project

Course: OBJECT - ORIENTED PROGRAMMING

Group Member

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Chapter 1. Abstract

Stardew Valley is an open-ended country-life RPG which was developed by Eric "ConcernedApe" Barone. In this game players take the role of a character who inherits their deceased grandfather's dilapidated farm in a place known as Stardew Valley. And the main gameplay of the game allows players to grow crops, raise livestock, fish, cook, mine, forage, and socialize with the townspeople, including the ability to marry and have children.

And among the many features that the game brings, fishing is one of the most popular features of many players in Stardew Valley. In Stardew Valley fishing gameplay, the player's goal is to catch fish that can be sold for money, and through the money they earn, they can buy food to recover. Restore your stamina or upgrade your fishing rod to be able to catch rare fish species.

In this undertaking, our team created the game Holly Fish to bring players a fishing game which was inspired by the fishing gameplay of Stardew Valley. The theme of the game and the art style were recreated based on our ideas and drawing style to create a game with bright, user-friendly and cute 2D pixel graphics for players. Along with the new idea, the basic rules of Stardew Valley remain the same, but the game rules have been refreshed and added some innovative features. New character, new fishing gameplay mechanics. According to the new game rules, players need to fish to earn money and this money fuels player journey in two exciting ways: upgrading their fishing rods to land even bigger catches, and buying items to take care of a player's cow. This cow provides a vital resource - milk - to restore your energy to avoid running out of energy and leading to gameover. But the fun doesn't stop there! Players can also snag rare fish, transforming their hobby into a collection of aquatic treasures displayed in a stunning fish tank, and we also save the player's fishing achievements through a summary table of the fish they have caught.

This game was created to bring players moments of relaxation and entertainment with lots of engaging content.

Chapter 2. Introduction

In today's rapidly advancing Software Technology industry, a higher level of programming skill is becoming increasingly essential. As a result, the traditional Procedural-Oriented Programming approach is no longer sufficient to meet all requirements. This has led to the development of a new method called "Object-Oriented Programming," following Alan Kay's principles, to address these challenges

This project was specifically designed using the Java language, incorporating Object-Oriented Programming. This approach has effectively resolved several issues that commonly arise when using the traditional Procedural-Oriented Method:

- The code becomes more transparent, easily understandable, and concise.
- The project represents a cohesive logical system, achieved by combining numerous related classes.
- Each class contains multiple methods that perform distinct behaviors unique to that class.

Resources can be efficiently reused, enhancing overall efficiency

The purpose of this project is to design a basic game by using OOP (Object-Oriented Programming) method. Therefore, our team decided to create a game named 'Holly Fish" that followed the four pillars of this measure. This project will go through the game overview and design, describing how the game is implemented and the programming functions and libraries used in the design.

Beyond fulfilling the course requirements, our team aims to undertake this project to learn and practice various techniques of OOP throughout the semester. Additionally, we view it as a valuable opportunity to make a significant mark on our future careers as programmers. Consequently, the final version of this project represents the collective effort and hard work of all team members, with minimal external assistance or reliance on available internet source codes.

Chapter 3. Game description

3.1 Game Description

3.1.1 Character

3.1.1.1. Louis

Fig 3.1.1.1. Louis (1)

Louis is a pleasant youth with a head full of tousled brown hair and bright blue eyes that reflect his serene spirit. He wears a cozy orange sweater that keeps him warm during his early morning fishing trips and a pair of comfortable blue jeans. His sturdy brown shoes are perfect for leisurely walks along the riverbanks. Louis's outfit is practical and endearing, perfectly suited for a day of relaxation by the water.

In the game, the player will guide Louis as he navigates in four directions—left, right, up, and down. As you explore the serene landscapes, you'll find peaceful spots along the river where Louis can fish. When he reaches the riverbank, he transitions seamlessly into his fishing stance, ready to cast his line and enjoy the calming activity.

Fishing State	
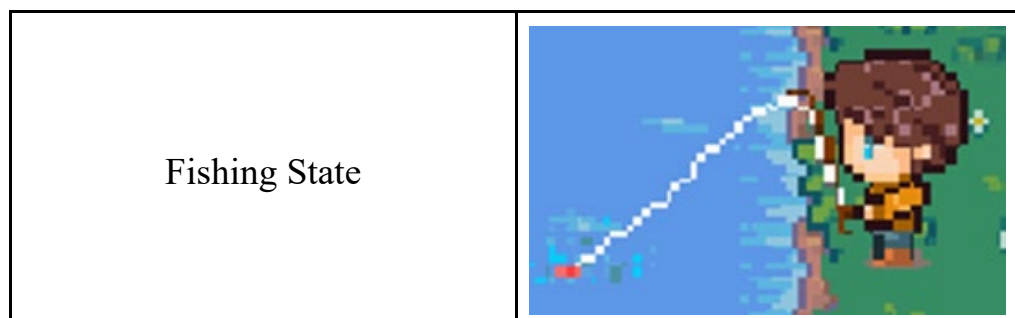
Fig 3.1.1.1. Louis - Fishing (2)

3.1.1.2. Dino

Fig 3.1.1.2. Dino (1)

Dino is an adorable blue dinosaur with big, expressive eyes that reflect his gentle nature. His bright blue scales shimmer in the sunlight, adding a touch of magic to the serene environment. Dino prefers a simple and natural appearance while fishing, allowing his vibrant scales to stand out without any additional adornments. His sturdy feet are perfect for navigating the riverbanks and finding the best fishing spots.

Similar to Louis, in the game, players will control Dino as he moves gracefully through the serene landscapes, with control over four directions: left, right, up, and down. As traversing the tranquil scenery, Dino will uncover peaceful spots along the riverbanks where Dino can engage in his favorite pastime: fishing. Upon reaching these serene fishing spots, Dino seamlessly transitions into his fishing stance, eagerly poised to cast his line into the gentle currents

Fishing State	
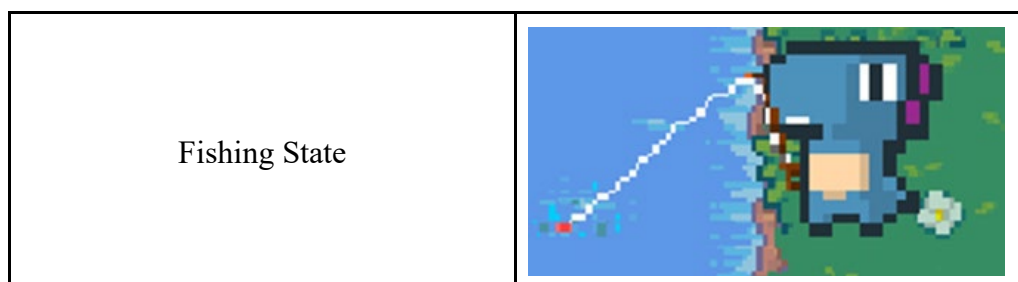
Fig 3.1.1.2. Dino - Fishing (2)
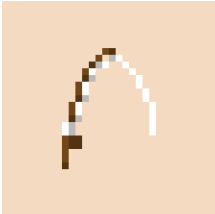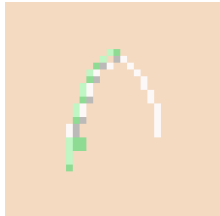
3.1.1.3. Old Man
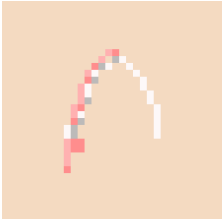
Fig 3.1.1.3. Old Man

A salesman plays a crucial role in facilitating the buying and selling of necessary items in a shop. The salesman serves as the intermediary between the customer and the products available for purchase.

3.1.2 Item

3.1.2.1	There are three types of rods, ranging from level 1 to level 3. Each rod within this classification system is associated with a specific energy (3.1.4.4) consumption requirement. The energy consumption of each rod type is a crucial factor to consider the level of fish(3.1.3.1) that we can catch.
 Rod level 1	
 Rod level 2	

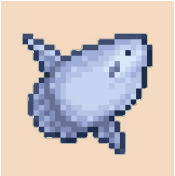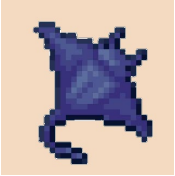|	
Rod level 3	
3.1.2.2 Grass	Grass is a type of plant characterized by narrow leaves, using to feed cow(3.1.3.3)
3.1.2.3 Milk	After eating grass, cow give the player Cow's milk, using to recover
3.1.2.4 Bottle	Trash
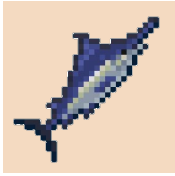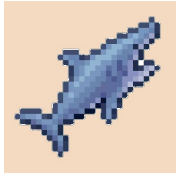
Can

3.1.3 Animal

3.1.3.1	**Common**	**Uncommon**	**Rare**	**Legendary**	In this system, there are three levels of fish, each with four rarities. The rarity of a fish determines how difficult it is to catch. The higher the rarity, the rarer and more valuable the fish is likely to be. The level of the rod used in fishing determines which level of fish can be caught.
Level 1	Bighead Carp Herring	Grass Carp	Silver Carp	Clownfish	
Level 2	Remora Coelacanth	Red Arowana	Pomfret	Koi Carp	

Level 3	Sunfish	Swordfish	Hammerhead	Shark	
	Ray				

3.1.3.2		Duck is a type of waterfowl animal. In this game, they live in a lake and are used for decoration

3.1.3.3		Cow is a cattle animal. When they are fed by the player, they will give the player cow's milk.

3.1.4 Environment

3.1.4.1 Map

Fig 3.1.4.1. Map

The game map is divided into two distinct parts: Lands and Water. Each part has unique features and gameplay mechanics that contribute to the overall relaxing experience of the game.

- Land: Players can freely explore and move around the land area but cannot move into the water. However, they can fish when near the water.
- Water: Players cannot enter the water but can fish from the shoreline and from bridges over the water.

3.1.4.2. Fish tank
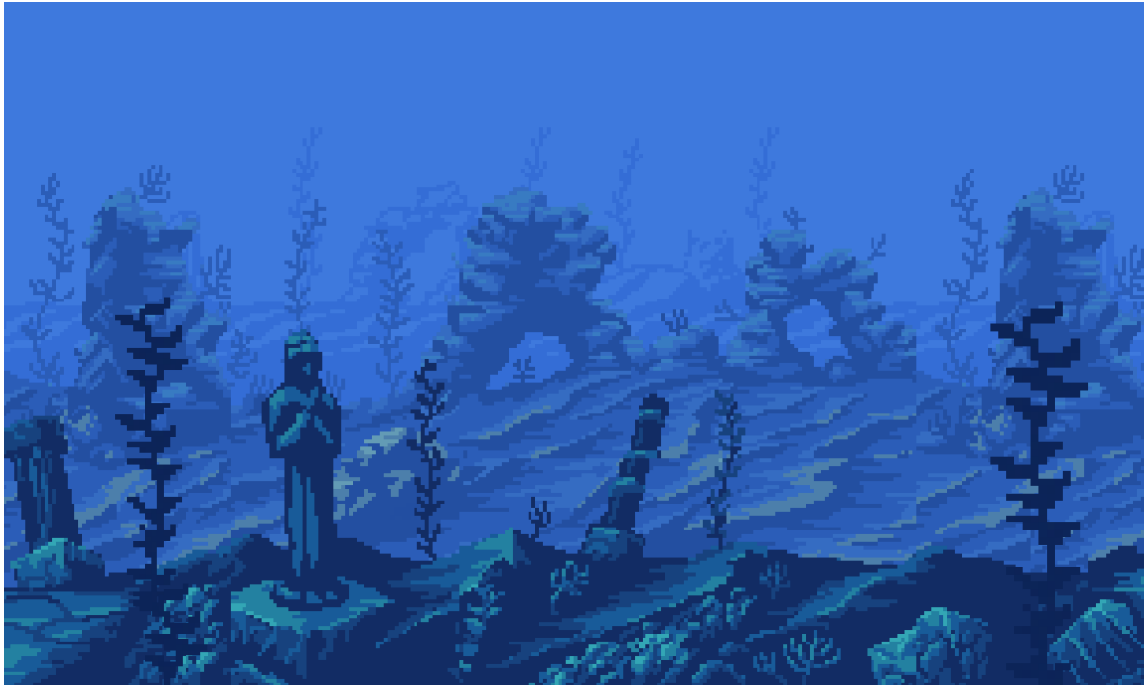
Fig 3.1.4.2. Fish tank - original state (1)

Players can have personal aquariums in their home

Functionality: Any fish caught by the player and added to their inventory is automatically transferred to the fish tank. The aquariums are solely for visual enjoyment. Fish swim around leisurely, and players can take pleasure in watching their movements.

Fig 3.1.4.2. Fish Tank (2)

3.1.4.3. Objects

Chest Shelf Sofa Mat Door	Interior for decoration
Tree Flowers	Exterior for decoration

3.1.4.4 Information

Energy panel	Show the player's energy. If players run out of energy, they can not go fishing. Level 1 rod uses 0.5 energy, level 2 uses 1 energy and level 3 uses 1.5 energy. Recover by drinking cow's milk
Fishing rod panel	Display current fishing rod level
Day and Night panel	Show the present time of the day. There are 4 types of time (Day - Dusk - Night and Dawn)
Coin bag	Display the current player's coin. Using to sell and buy in shop

3.1.5 In-game features

3.1.5.1 Fishing gameplay

When players approach a body of water, they will have the opportunity to go fishing. Upon entering fishing mode, a fishing gauge will appear. This gauge plays a crucial role in determining whether the player successfully catches a fish or not. The fishing gauge consists of an arrow, a vertical bar, and a specific shaded area inside. This gauge comprises an arrow and

a shaded region, both moving independently, with the arrow shifting up and down, and the shaded area also in motion. When the arrow points within the shaded area, the player can catch a fish; otherwise, they risk losing the catch.
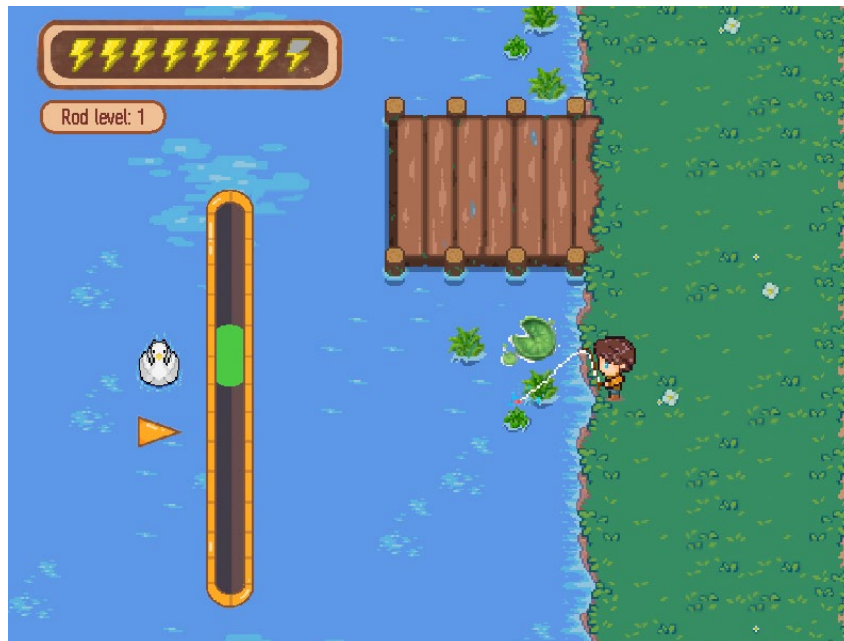
Fig 3.1.5.1.1 Start fishing

Fig 3.1.5.1.2a

Success to catch fish

Fig 3.1.5.1.2b Fail to catch fish

3.1.5.2 Collection

Fig 3.1.5.2 Collection screen

The "Collection" feature experience offers players a concise yet comprehensive overview of their fishing history. Divided into three frames, it includes a list of encountered fish, detailed information about each species, and statistics tracking total fish caught by rarity and overall count. This efficient tool allows players to reflect on their fishing journey and track their progress seamlessly.

3.1.5.3 Inventory
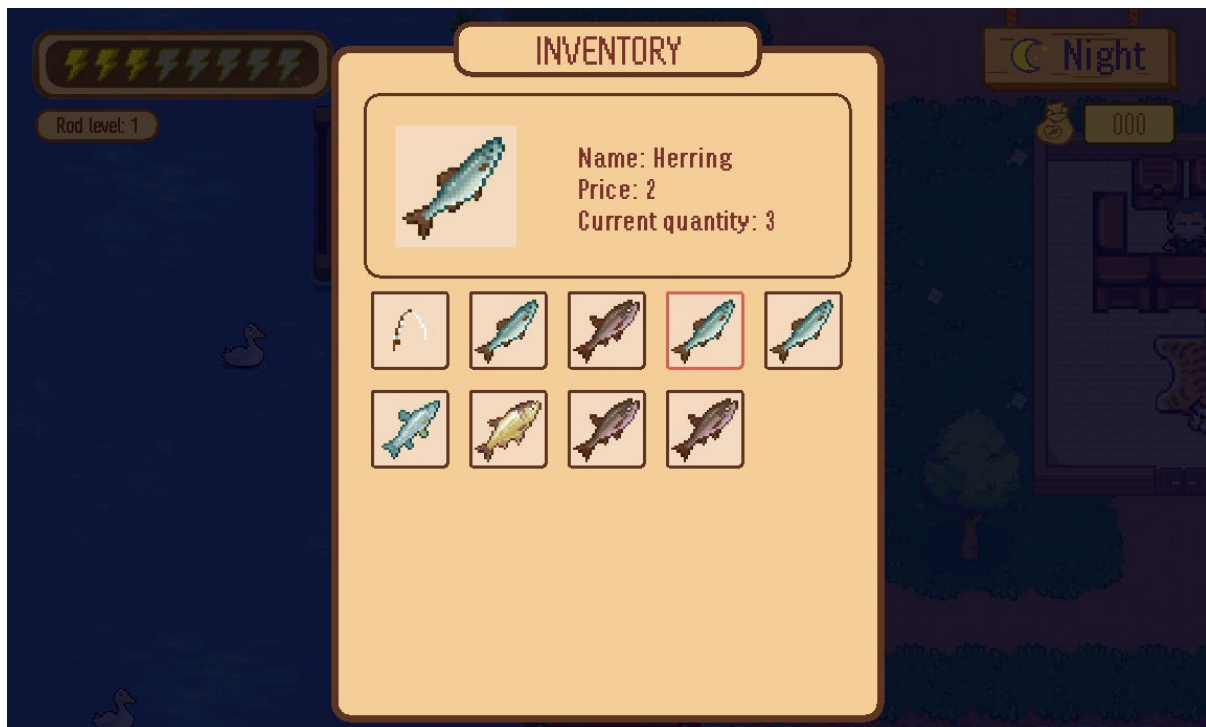
Fig 3.1.5.3 Inventory screen

- The player's inventory in the game consists of two main sections: a list of items and a frame displaying the information of each item.
- The item list contains various items such as fish, grass, milk, and trash. Each item is clearly listed, allowing players to easily review and manage their resources.
- The information section provides details about each item in the inventory, including its name, price for buying or selling, and the current quantity. This helps players gain a better understanding of the resources they possess and manage them efficiently throughout their adventure.

3.1.5.4 Trading
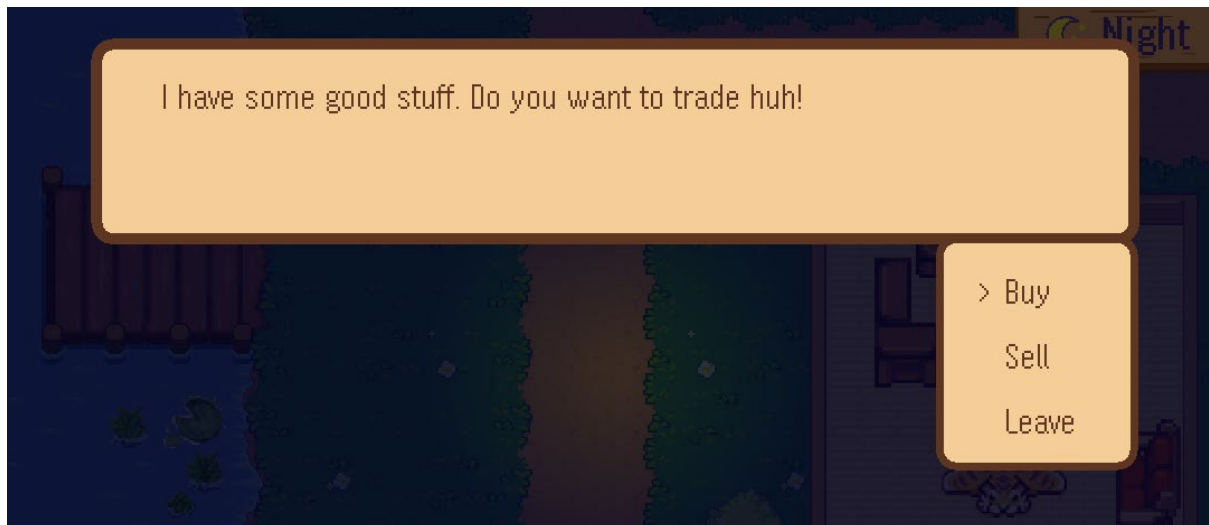
Fig 3.1.5.4.1 Shop selection screen

The interaction with the NPC Old Man is designed for simplicity, enabling players to buy or sell items without any hassle.
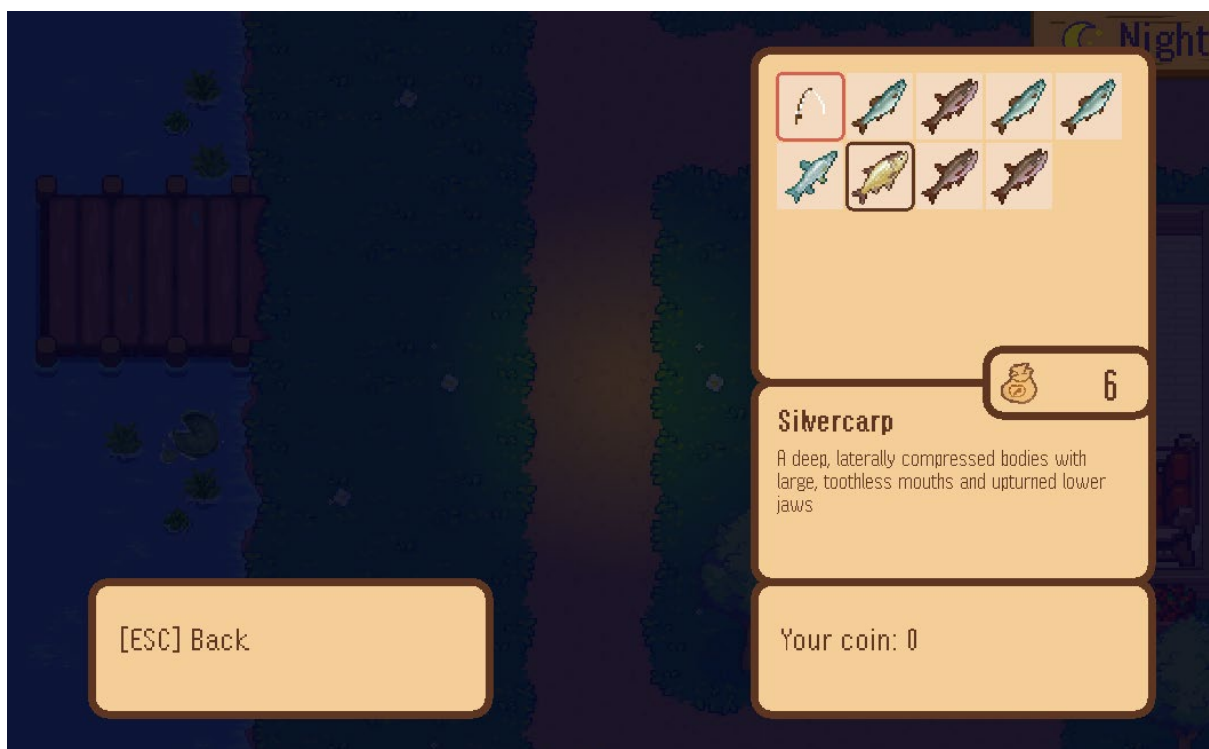
Fig 3.1.5.4.2 Sell screen

In the selling interface, three distinct panels are presented to the players. The first panel exhibits the player's inventory, displaying the items they currently own. The second panel allows players to see the prices of each item they can sell, giving them a clear understanding of their potential income. The third panel provides detailed information about the chosen item, including its name, price, and quantity, enabling players to make well-informed decisions. Lastly, the player's current balance is displayed prominently, ensuring they are always aware of their financial situation.

Fig 3.1.5.4.3 Buy screen

When players switch to the buying interface, they are presented with four panels designed to enhance their purchasing experience. The first panel displays the player's inventory, allowing them to review their current items. The next panel prominently displays the shop's inventory, showing the items that are available for purchase. The third panel provides detailed information about the selected item in the shop, assisting players in their purchasing decisions. Finally, the player's current balance is displayed prominently, ensuring they can effectively manage their spending. These interfaces collectively simplify the interaction with the Old Man NPC, enabling players to conduct transactions with ease while maintaining complete control over their finances.

Fig 3.1.5.4.4 Delete item in buy screen
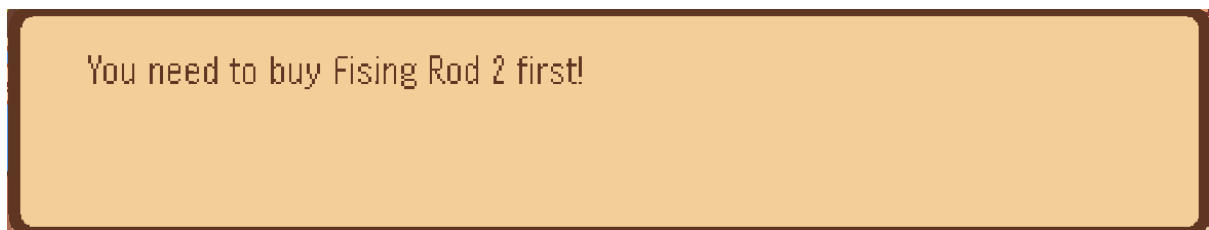
Fig 3.1.5.4.5 Prevent skipping level

Additionally, we have implemented a feature that automatically removes the previous fishing rod from both the shop's inventory and the player's inventory when the player upgrades to a new fishing rod level, and one more feature to prevent player skipping a fishing rod level. Furthermore, the game includes an algorithm that equips the player with the newly purchased fishing rod, enabling them to catch fish appropriate to the rod's level.

3.1.5.5. Options menu
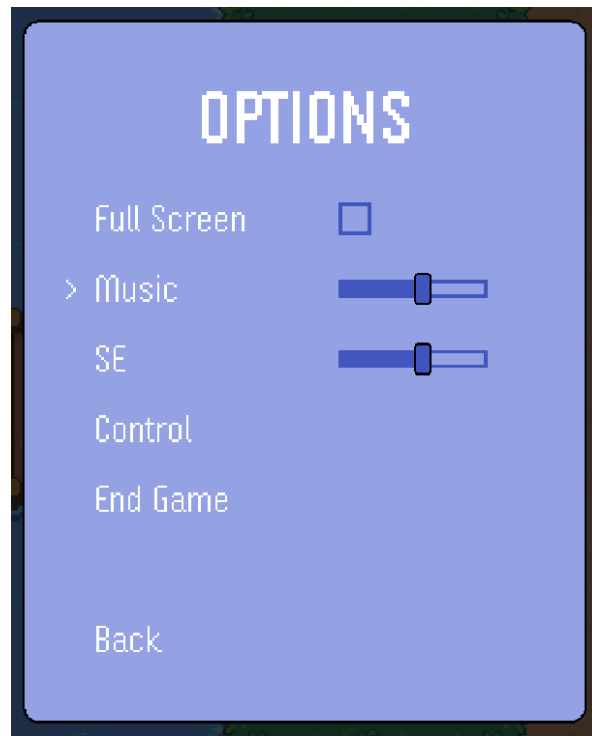
Fig 3.1.5.5 Options menu

The game menu in the fishing game will consist of 5 main sections: Full Screen Toggle, Volume Control for Music and Sound Effects, Controls, and End Game.

- Full screen Toggle:
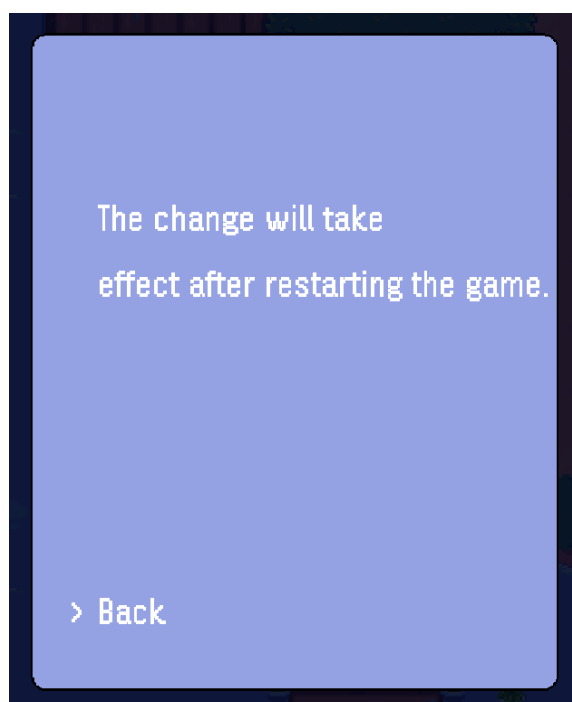
Fig 3.1.5.5a Notification after selected full screen option

This option allows the player to switch to full screen mode. The full screen setting will be saved and applied the next time the player launches the game.

● Volume control:

Fig 3.1.5.5b Music and Sound effect volume

This section includes two separate controls for adjusting the volume of music and sound effects. Each control will have 6 levels of adjustment: 0, 1, 2, 3, 4, 5, ranging from minimum to maximum volume.

● Controls:

Fig 3.1.5.5c Control

In this section, a guide will be displayed to the player, providing instructions on how to play the game and detailing important interaction keys.

- End game
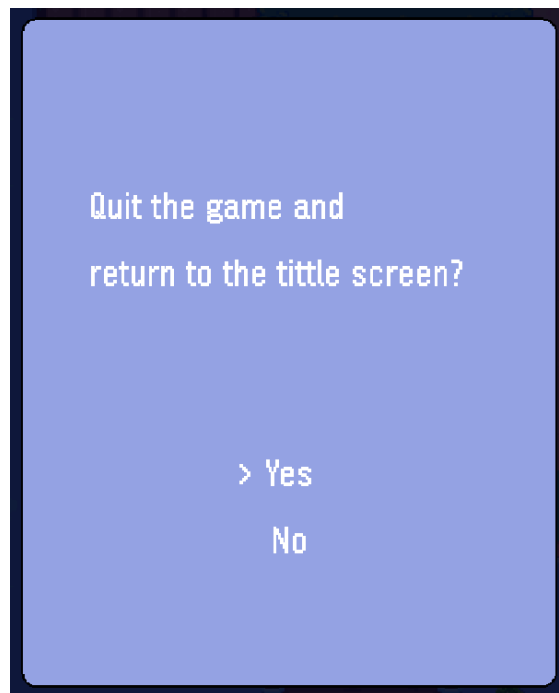
Fig 3.1.5.5d End game option

When the player selects this option, a prompt will appear asking if they want to exit to the title screen. If the player chooses "Yes," they will exit to the title screen. If they choose "No," they will return to the main menu interface.

3.1.5.6. Relationship between cow - milk - energy
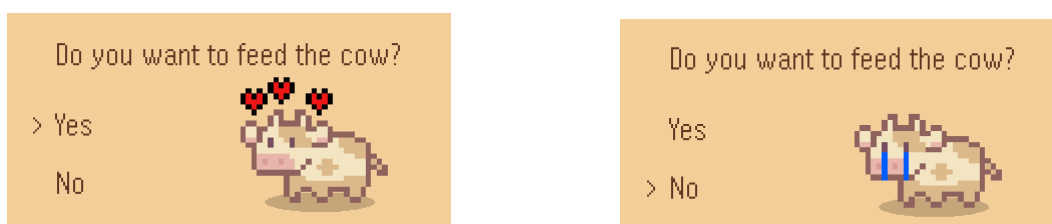
Fig 3.1.5.6.1 Feed Cow screen

When a player approaches the cow, it will suggest they feed it . There are two selection YES or NO along with that is the expression of the cow
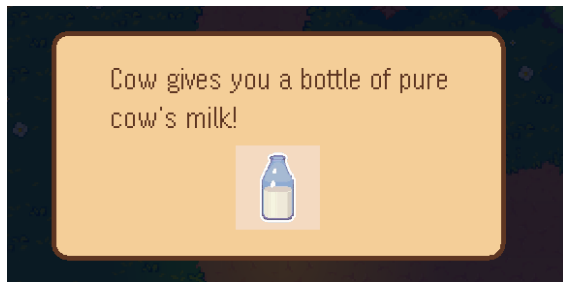
Fig 3.1.5.6.2a Have enough grass   *Fig 3.1.5.6.2b Do not have enough grass*

If a player has enough grass in the inventory, they can feed the cow and receive 1 bottle of cow's milk. Otherwise, a notification will be sent (*Fig 3.1.5.6.2b)*

Fig 3.1.5.5.6a Do not full of energy   *Fig 3.1.5.6.3b Full of energy*
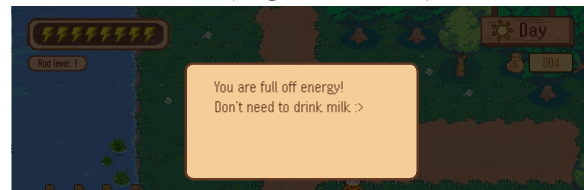
After having milk, the player can use it to recover 4 energy. If the player is full of energy, milk can not be used and will sent a notification (*Fig 3.1.5.6.3b)*

3.1.5.7. GameOver

Fig 3.1.5.7.1 Game Over Screen

To make more use of the player's energy mechanic, we've developed the gameOver feature. This feature will occur when the player run out of their energy and either lacks the funds to purchase grass for the cows or doesn't have a bottle of milk in their inventory to restore energy

3.2 User manual

3.2.1 Key controller

In developing the Holly Fish, our team decided to primarily use keyboard controls, ensuring they were meticulously designed to provide a user-friendly experience. This choice was made to offer players an intuitive and seamless way to navigate and interact with the game, enhancing overall gameplay satisfaction.

Menu

Key	Action
W	Move Up
S	Move Down
D	Volume Up
A	Volume Down
Enter	Interact
ESC	Escape

Player

Key	Action
W	Move Up
A	Move Left
S	Move Down
D	Move Right
Enter	Interact NPC (Cow and Old man)
Space	Fishing
B	Open the bag
ESC	Options Menu
C	Open the collection
L	Open the fish tank

Inventory

Key	Action
W	Move Up
A	Move Left
S	Move Down
D	Move Right
Enter	Consume milk (only for item Milk)
ESC/B	Close

Collection

Key	Action
W	Move Up
A	Move Left
S	Move Down
D	Move Right
Esc/C	Close Collection

Shop

Key	Action
W	Move Up
A	Move Left
S	Move Down
D	Move Right
Enter	• Sell Frame: sell the selected item in the inventory • Buy Frame: buy the selected item in the shop • Back Option: close the current frame

Chapter 4. UML

4.1 Gameplay and GUI Diagram
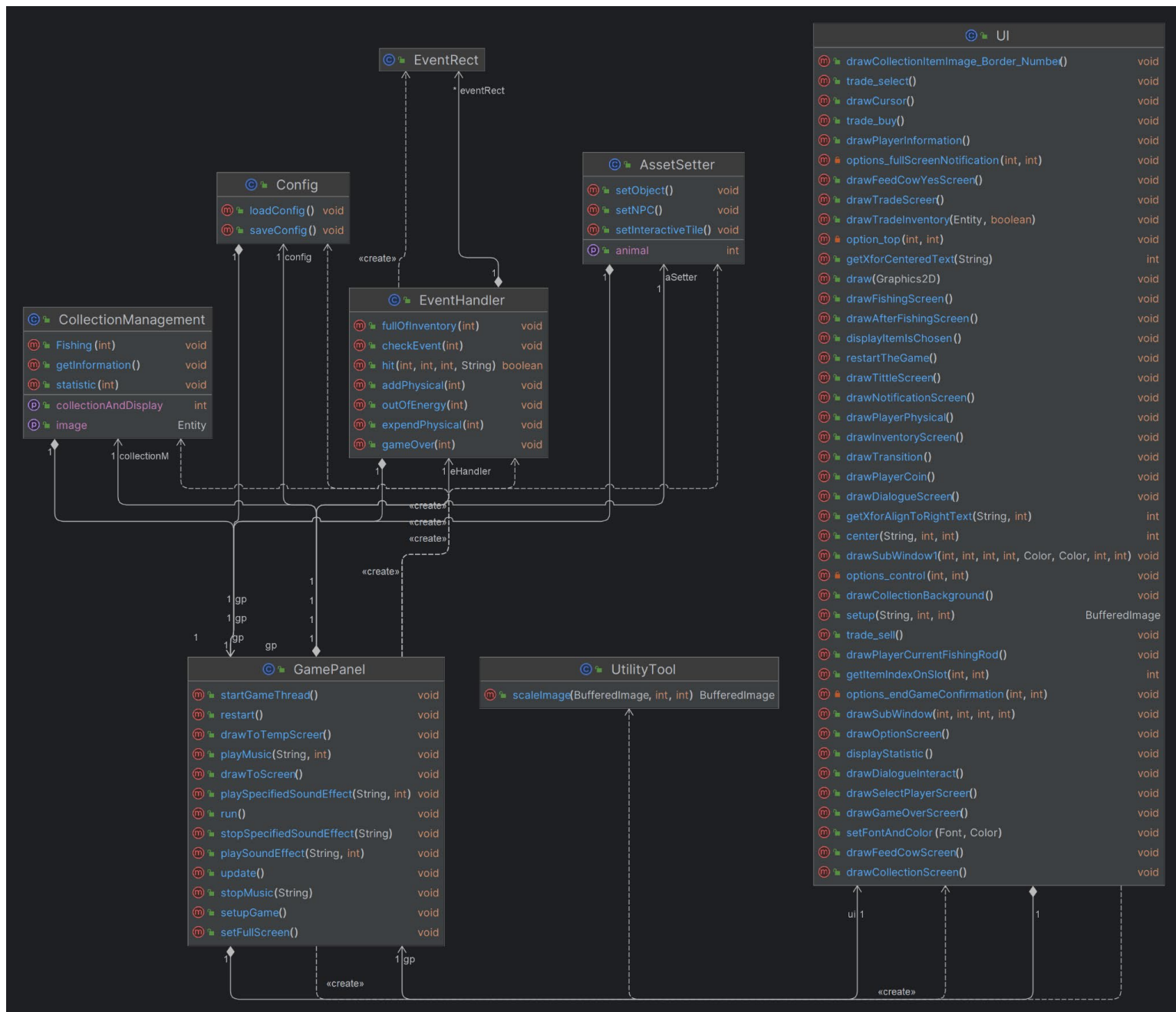
4.2 Control Diagram

Sound

ⓜ setField(int)	void
ⓜ playSpecifiedSE(String)	void
ⓜ loop(String)	void
ⓜ isPlaying(String)	boolean
ⓜ stop(String)	void
ⓜ checkVolume()	void
ⓜ play(String)	void
ⓜ playSE(String)	void

KeyHandler

ⓜ inventoryState(int)	void
ⓜ keyPressed(KeyEvent)	void
ⓜ feedCowYesState(int)	void
ⓜ dialogState(int)	void
ⓜ feedCowState(int)	void
ⓜ keyReleased(KeyEvent)	void
ⓜ gameFishTankState(int)	void
ⓜ gameOverState(int)	void
ⓜ selectPlayerState(int)	void
ⓜ gamePlayerState(int)	void
ⓜ collectionState(int)	void
ⓜ notificationState(int)	void
ⓜ keyTyped(KeyEvent)	void
ⓜ afterFishingState(int)	void
ⓜ optionState(int)	void
ⓜ tradeState(int)	void
ⓜ tradePlayerInventory(int)	void
ⓜ fishingState(int)	void
ⓜ tittleState(int)	void
ⓜ tradeNpcInventory(int)	void

CollisionChecker

ⓜ checkEntity(Entity, ArrayList<T>[])	int
ⓜ checkObj(Entity, boolean)	int
ⓜ checkTile(Entity, boolean)	void
ⓜ checkPlayer(Entity)	void
ⓜ checkAtEdge(Entity)	void

4.3 Entities Diagram
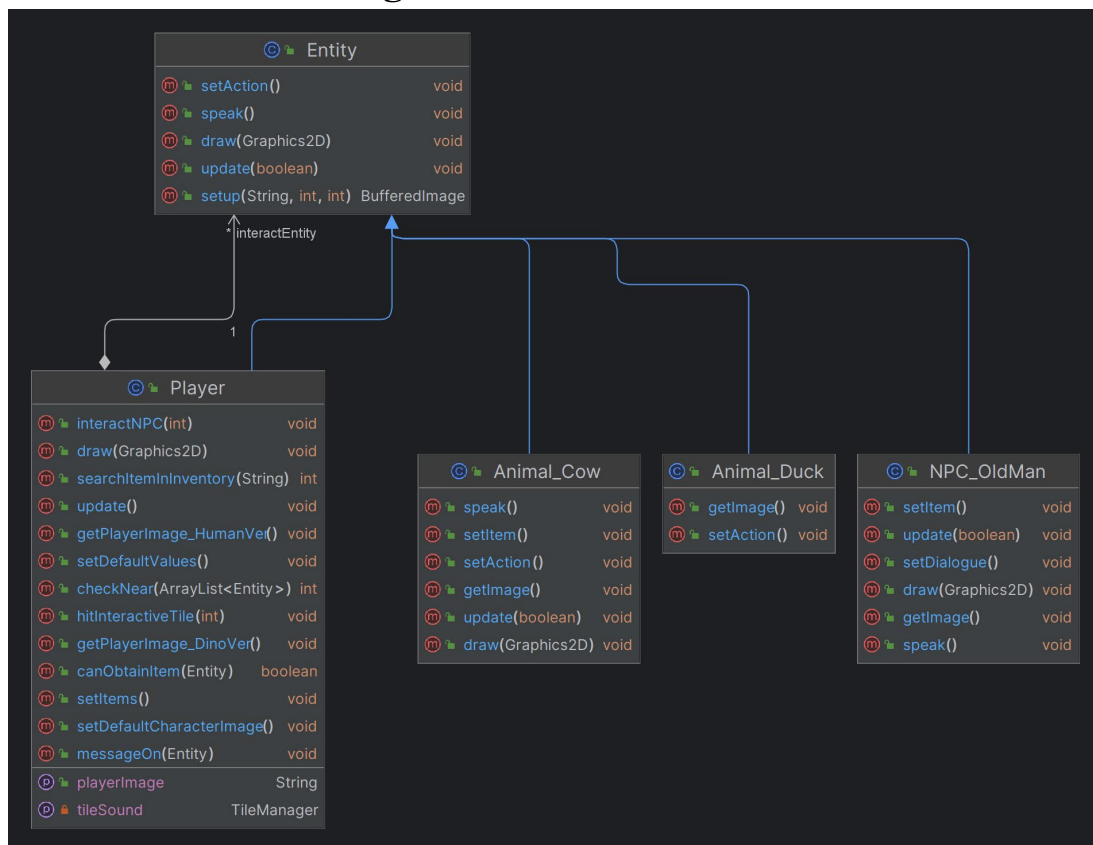
4.4 Objects Diagram
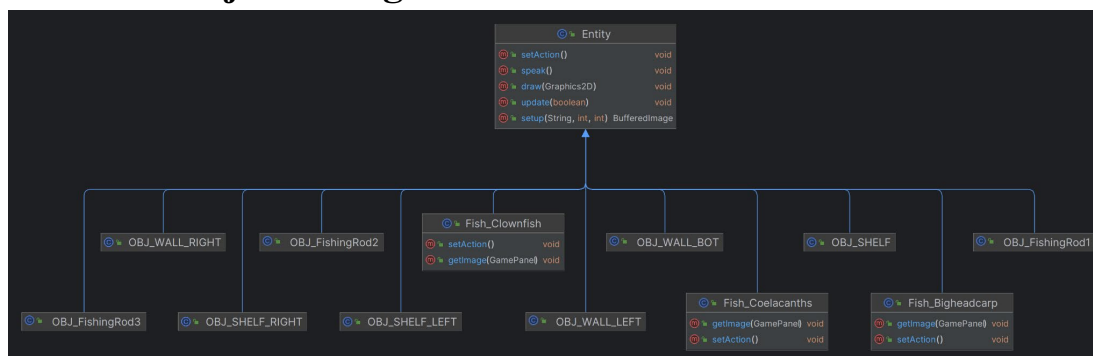
4.5 Environment Diagram

4.6 Tile & Interactive Tile Diagram

Chapter 5. Methodology

Before participating in the recent project, our team conducted research on the Object-Oriented Programming (OOP) methodology and its basic properties. However, we acknowledged that a thorough understanding of OOP alone would not be sufficient.

Our team also needed to address the challenge of collaborative coding. As a solution, we turned to Github, one of the most valuable tools for software developer teams. We primarily coded t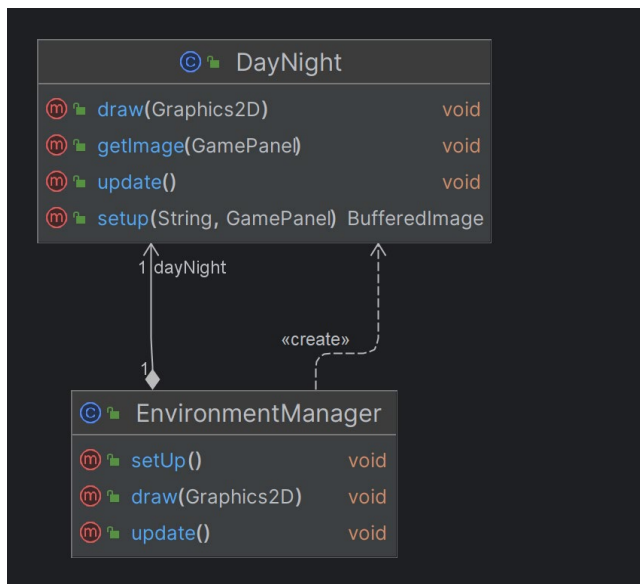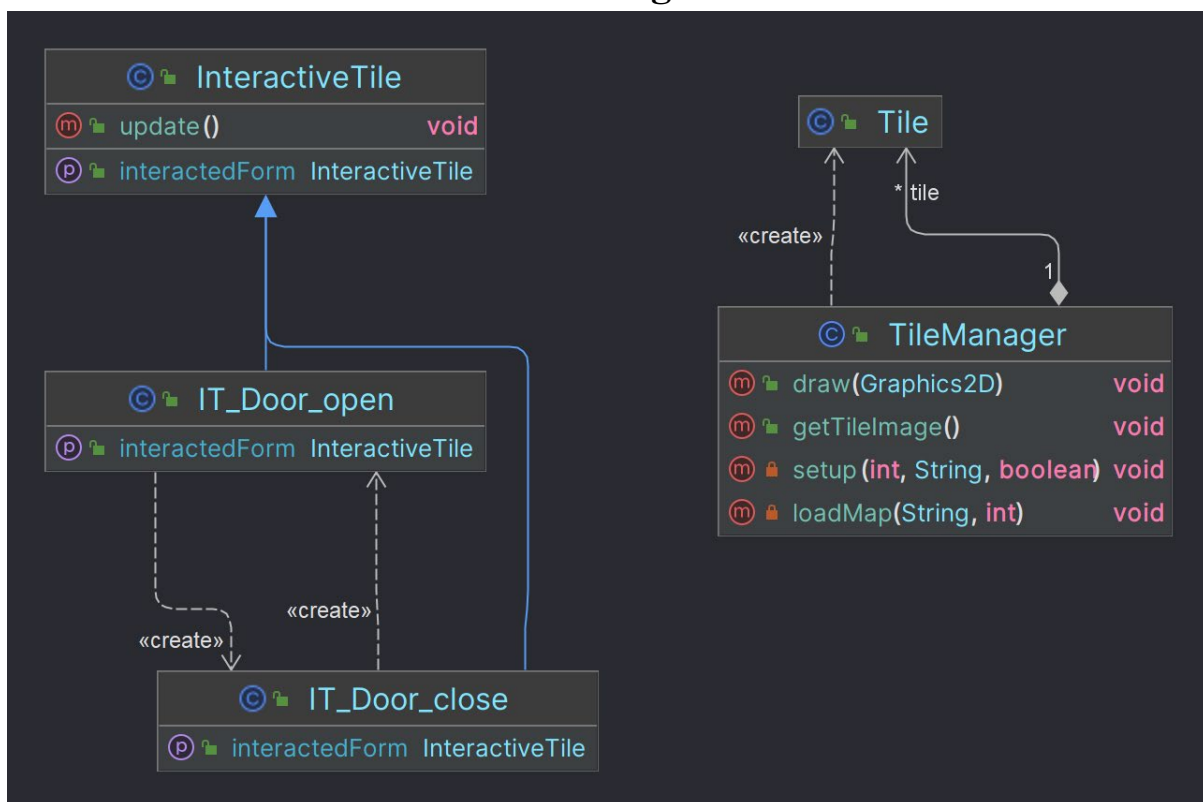he game using Intellij IDEA, Visual Studio Code and utilized Github as a code hosting platform for version control and collaboration. This enabled us to organize and manage the project more efficiently.

One month prior to starting the project, we conducted research on related games and followed how-to tutorials from various sources. Simultaneously, we engaged in practical exercises focused on OOP concepts and applied our knowledge using the Github platform.

Chapter 6. Game design

6.1 Objects

Objects are the heart and soul of this game, bringing it to life. Each type of object has a specific role, contributing uniquely to the gameplay. These objects also form the user interface, making it interactive for players. This interactivity allows players to create characters, game menus, maps, and experiment with different object combinations.

Additionally, many objects can interact with each other, enhancing the game's logical consistency. NPCs, cows, milk, and fishing rods are some typical objects of the game. Each of them has unique interactions with one another and with the players, enriching the gameplay experience:

- Players use the fishing rod to catch fish.

- Players interact with cows to have milk.
- Players use milk to recover energy.
- Players interact with NPCs to buy and sell items or fish.

6.2 Game scenes

Similar to other games, scenes in this game are also very important. They guide players to make informed decisions based on the current setting. Additionally, these scenes enhance the game's environment, making it more vibrant and dynamic.

Scenes also provide a User Interface, allowing players to interact with them. These UI are highly beneficial, enhancing the overall gaming experience. This game has a total of five scenes:

- **Menu:** Initial scene when players turn on the game. It contains 3 buttons that allow players to start a new game, load the game, or quit the game.
- **Choosing character**: Appears right after you start a new game, it allows players to choose their playing character, here are two characters, Louis and Dino.
- **Playing:** The main scenes of the game where players will interact with every main object and content.
- **Game paused:** In this scene in our game, we have implemented both a pause game and a change option of the game can be found when players press the "pause" button. Not only can it temporarily stop the game, but also provides various functions such as Fullscreen, music volume, sound effect volume, control, or end game.
- **GameOver:** This scene will tell players the game has finished. When the player has run out of energy and in this scene you can choose to restart the game or quit to the main menu.

6.3 Animation

At first, when starting to develop a game, the character models can only stand still because they are just plain drawings without any animation, so it makes the game very monotonous and boring. Therefore, in order to fix it, animation has come to life.

Using the definition of animation, the animations in this game are created in one of the most traditional yet effective ways: by rapidly displaying many picture frames of an animation, the objects appear lifelike and dynamic, simulating realistic movement.

Animation in this game was inspired by many sources on the internet but mainly on Pinterest. Then, our team completely redesigned them based on the resources we found to give our games a unique and unified style.

This game has 2 types of objects using animation.

- Louis and Dino: Moving and fishing animation.
- Old Man and Cow: Idling animation.
- Duck: Moving animation.

6.4 Sound

Since the beginning of video games, sound has been essential in crafting a compelling experience. Consequently, sound is a crucial element in our game as well. Our team invested significant time and effort to find the perfect audio to complement our gameplay.

Additionally, to make the game more diverse, we added a feature where the sound of rustling grass is played when the character walks on it, creating a more realistic experience.

Many objects of this game have their own audio, thus each audio will have its own unique properties. These sounds evoke various emotions and feelings in players, such as calmness, happiness, or intensity.
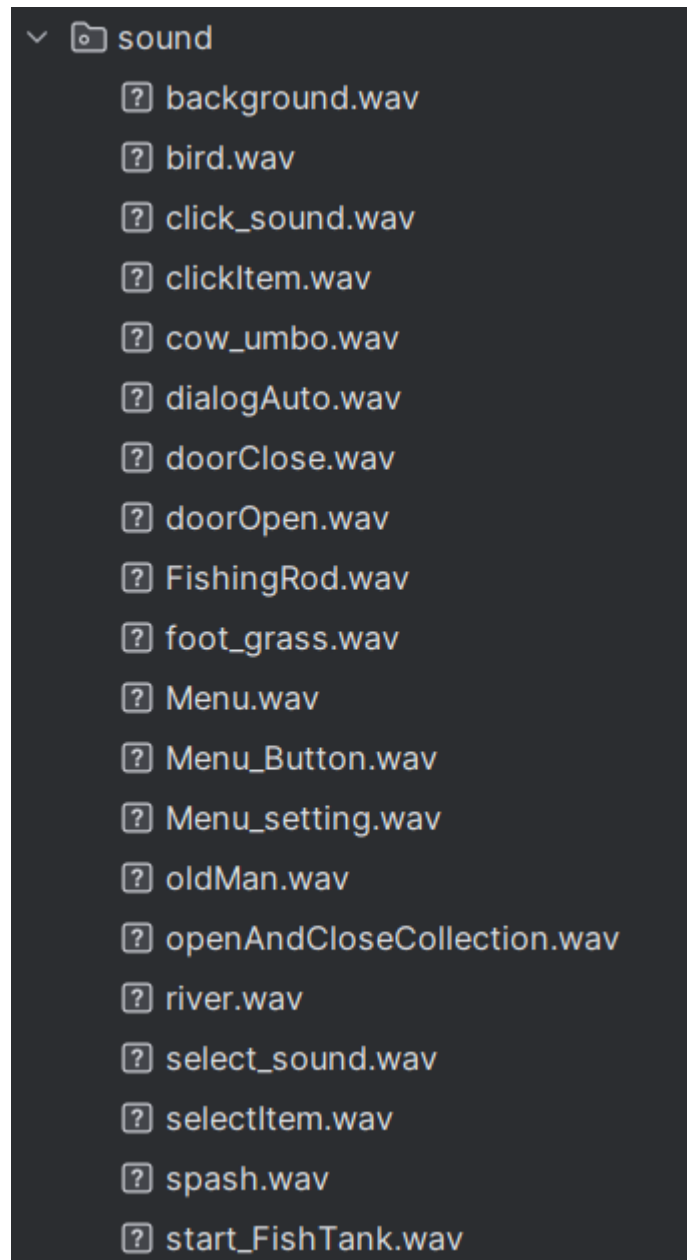
Fig 6.4.1 All sounds used in this game

Chapter 7. Conclusion

The game is still in the development phase. The team's understanding of the four OOP principles, the SOLID framework, and design patterns has deepened after completing a game with new features that were not part of the initial version. This experience has enhanced the team's proficiency in both programming and game development. As a result, the core principles of OOP

were almost strictly adhered to during the development of Holly Fish. The game's code integrates the SOLID principles, a design pattern learned in class, and all four key OOP elements (encapsulation, inheritance, abstraction, and polymorphism).

Chapter 8. Futureworks

Unfortunately, our team had plans to expand the game by adding more levels with a variety of fish species, improving the game's performance for smoother gameplay, and allowing players to fish in any water they encounter. However, due to time constraints and the need to fix existing bugs, the team has not been able to fulfill their initial development goals. Moving forward, our team aim to introduce new levels, incorporate different fish species for day and night cycles, and possibly include a feature where players can grow vegetables within the game.

Chapter 9. Acknowledgement

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Dr. Tran Thanh Tung

MSc. Nguyen Trung Nghia

Our GitHub project:

[Github Project](#)

References:

[How to Make a 2D Game in Java #1 - The Mechanism of 2D Games](#)

[Java GUI](#)