De La Salle University- Manila
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LBYCPEI
Object Oriented Programming Laboratory

Final Project Proposal

Serpent Sweeper

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I. Introduction

In an era marked by pressing environmental challenges, the need to foster a sense of responsibility towards our surroundings has never been more critical. Traditional methods of education and awareness often fall short in engaging individuals effectively. This research endeavors to bridge this gap by leveraging the power of gaming to captivate and motivate players to embrace sustainable practices. Serpent Sweeper is an engaging Java-based 2D game that takes players on a thrilling adventure focused on cleanliness and environmental responsibility. Inspired by the United Nations' Sustainable Development Goal 11, "Sustainable Cities and Communities," the game offers an innovative solution to raise awareness and inspire action.

The primary objective of this program is to strengthen the effectiveness of gamification in promoting environmental responsibility. To achieve this goal, several specific objectives have been outlined. Firstly, the students aim to develop an engaging Java-based 2D game called Serpent Sweeper, which combines the addictive gameplay mechanics of the classic "Snake Game" with a unique eco-conscious twist. Secondly, the game's ability to educate players about the significance of environmental cleanliness and sustainable practices will be assessed. The project also seeks to evaluate the impact of gamification on players' attitudes and behaviors towards environmental responsibility. Additionally, the effectiveness of various game elements, including progression systems, power-ups, and achievement systems, in motivating players to adopt sustainable practices will be identified. Lastly, the students are aiming to explore the potential of virtual reward systems to further enhance players' engagement and incentivize sustainable actions beyond the confines of the game. By accomplishing these objectives, the students' program will contribute valuable insights into the efficacy of gamification as a tool for promoting environmental consciousness and fostering sustainable behaviors.

The scope of the project encompasses the development and implementation of "Serpent Sweeper." The game will incorporate the addictive gameplay mechanics of the classic "Snake Game" while integrating an eco-conscious twist. The features of the game will include three distinct stages: Garden, Park, and City, each presenting unique environments and challenges for players to navigate. Players will progress through these stages by consuming various types of environmental debris, starting with "Litters" and eventually advancing to "Trash Heaps" and "Waste Mountains." The game will also incorporate different game elements such as progression systems, power-ups, achievement systems, and virtual reward systems. These features will enhance the gameplay experience, motivate players to embrace sustainable practices, and provide incentives for their engagement and progression within the game.

The project's constraints include the utilization of Java programming language for game development, necessitating the adherence to its associated limitations and conventions. The game will be developed as a 2D platform, requiring careful attention to

graphics, animations, and user interface design. Additionally, the project will need to consider compatibility with various operating systems and ensure optimal performance on different devices. Time and resource constraints will also be factors to consider in the development process. Moreover, the game's focus on environmental responsibility may pose challenges in striking a balance between educational elements and enjoyable gameplay to ensure the game remains engaging without being overly didactic. However, by carefully managing these constraints, the project aims to deliver a high-quality game that effectively promotes environmental responsibility and offers an enjoyable gaming experience for players.

II. Methodology

To address the problem of promoting environmental responsibility and implement the desired functionality in "Serpent Sweeper," a systematic approach will be followed, leveraging the fundamental pillars of Java programming. The project will employ an object-oriented programming (OOP) approach, utilizing Java's class and object concepts to encapsulate data and behavior within modular units. The game's entities, such as the serpent avatar, debris objects, and obstacles, will be represented as classes with defined attributes and methods. This approach will enable code reusability, maintainability, and efficient organization of the game's components.

In terms of functionality, the project will utilize the inheritance pillar of Java. Different serpent classes will be created, representing the three stages of the game: baby serpent, medium-sized serpent, and super serpent. Each class will inherit properties and behaviors from the preceding class while introducing new features and capabilities. This hierarchical structure will allow for progressive gameplay and the evolution of the player's serpent avatar throughout the stages.

Java's polymorphism pillar will be employed to implement various game elements and interactions. Debris objects, obstacles, and power-ups will be represented as different subclasses of a common parent class, allowing for dynamic behavior and interchangeable usage. This flexibility will enhance the game's variety and challenge, as players encounter different types of debris and obstacles with distinct properties and effects. Furthermore, the project will make use of Java's abstraction pillar to simplify complex operations and enhance code modularity. Abstract classes and interfaces will be employed to define common functionalities and ensure consistency across different game entities. For example, a base "GameEntity" abstract class can be created to encapsulate shared properties and methods for all game objects, reducing code duplication and improving maintainability.

Java's final pillar, exception handling, will be utilized to handle runtime errors and ensure the game's stability and reliability. By implementing proper exception handling

mechanisms, the project will anticipate and gracefully recover from unexpected situations, such as invalid user inputs or file loading errors. Throughout the development process, adherence to coding best practices and design patterns specific to Java, such as the Model-View-Controller (MVC) architecture, will be emphasized. This approach separates the game's logic (model), user interface (view), and user input handling (controller) to improve code organization, maintainability, and scalability.

By leveraging the pillars of Java programming, employing OOP principles, and following established design patterns, the project will adopt a structured and efficient approach to address the problem of promoting environmental responsibility and successfully implement the desired functionality in "Serpent Sweeper."

III. Project Description

The ‘Serpent Sweeper’ project is a JAVA program based on the popular computer game ‘Snake’. The program will follow a modular and object-oriented approach for its design. At its core the architecture is the Game Engine, which handles the game’s logic, rendering, and user-input. It takes care of the game loop, updating the game state, and rendering the visuals on the screen.

The ‘Snake’ would represent the player in the game. It is composed of segments that would form the body, the ‘Snake’ module handles the movement of the snake, collision detection with the trash objects, and the interaction.

The ‘Trash’ items are randomly placed on each of the game boards. They would serve as the collectible items in which the snake feeds upon. These items have a position on the board and may possess different properties. They also can be of differing sizes, requiring the snake to grow larger in order to consume the trash. These are separated by categories.

The ‘Game Board’ is the grid or playing area where the snake and trash items are positioned, the game board will be multiple and contain different themes and level design. It keeps track of the positions and provides methods for collision detection.

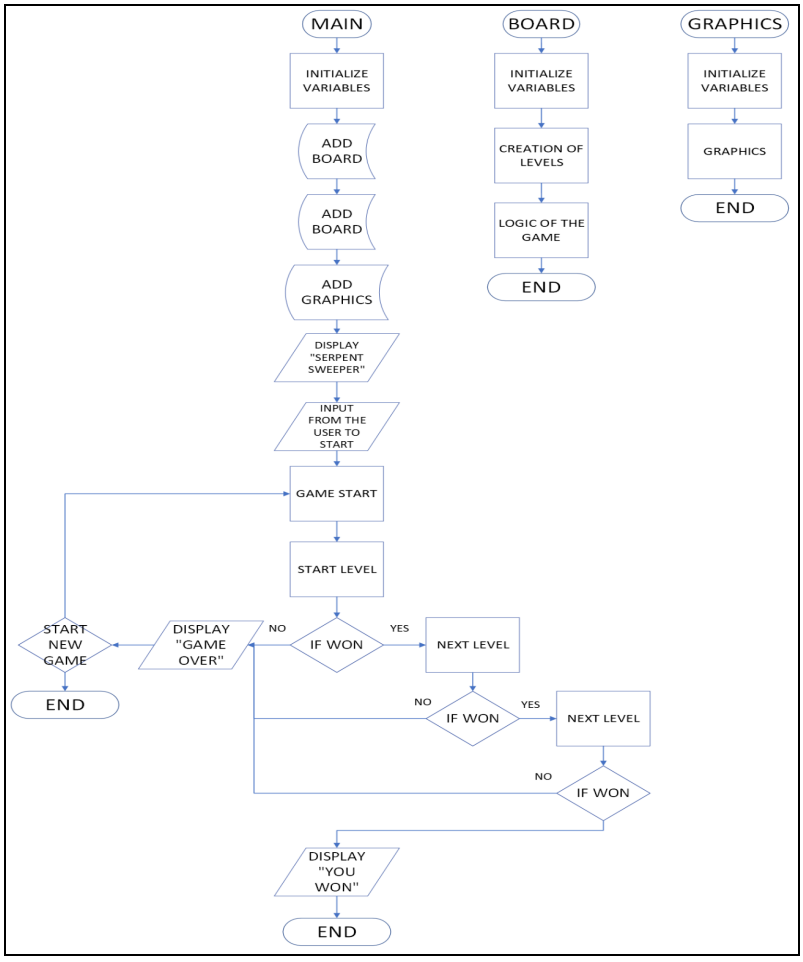
The user interface component handles the display of the game. This includes the scores, level, and any additional information. The ’Collision Detection’ module handles the detection of collisions between the snake and trash items, including the other potential game objects such as obstacles.

IPO

Input	Process	Output
- Player starts the game - Player chooses to start a new game or continue a saved game	- Game initializes and loads appropriate resources - Load the saved game data or start a new game session	- A new game session begins or a previously saved game session continues
- Player moves the snake in the game environment	- Game detects player input and changes the direction of the snake accordingly	- The snake moves in the chosen direction on the game screen
- Player guides snake to consume "Litters", "Trash Heaps", or "Waste Mountains" depending on snake's size	- Game detects collision between snake and environmental debris - Game updates snake size and score based on debris consumed	- Snake size increases, debris is removed, and player score is updated
- Player's snake encounters obstacles	- Game detects collision between snake and obstacle - Determine game over condition	- Game over screen is shown and player is prompted to restart or quit
- Player progresses through stages (Garden, Park, City)	- Game tracks player's score and snake size - Load next stage when progression criteria are met	- Next stage is loaded with new environment, obstacles, and debris
- Player collects power-ups	- Game detects collision between snake and power-up - Activates power-up effects for a specified duration	- Effects of the power-up are visible and applicable to the gameplay
- Player accomplishes achievements	- Game monitors player's progress against predefined achievement criteria - Update achievement status when criteria are met	- Achievements unlocked are displayed and stored in the player's achievement list

- Player chooses to save and exit the game	- Game saves the current state including the player's score, stage, snake size, achievements, etc. - Exit the game	- Game session is saved and game exits
- Player participates in a time-trial challenge	- Game sets a countdown timer - Monitor player's performance against time	- Results of the time-trial are shown, including whether the player successfully completed the challenge or not
- Player accumulates virtual rewards	- Game tracks and updates the player's virtual rewards based on their performance and achievements	- Display of the player's total virtual rewards

Flowchart



UML Diagram

GDrive Link (The image/diagram is too large for this document):
https://drive.google.com/file/d/1W_WHevD-6SntrJ6TQ1_CZqJ5tO4e9yGt/view?usp=sharing

IV. Deliverables

**Note: The Deliverables and Tasks are still tentative and up for changes.*

Gantt Chart

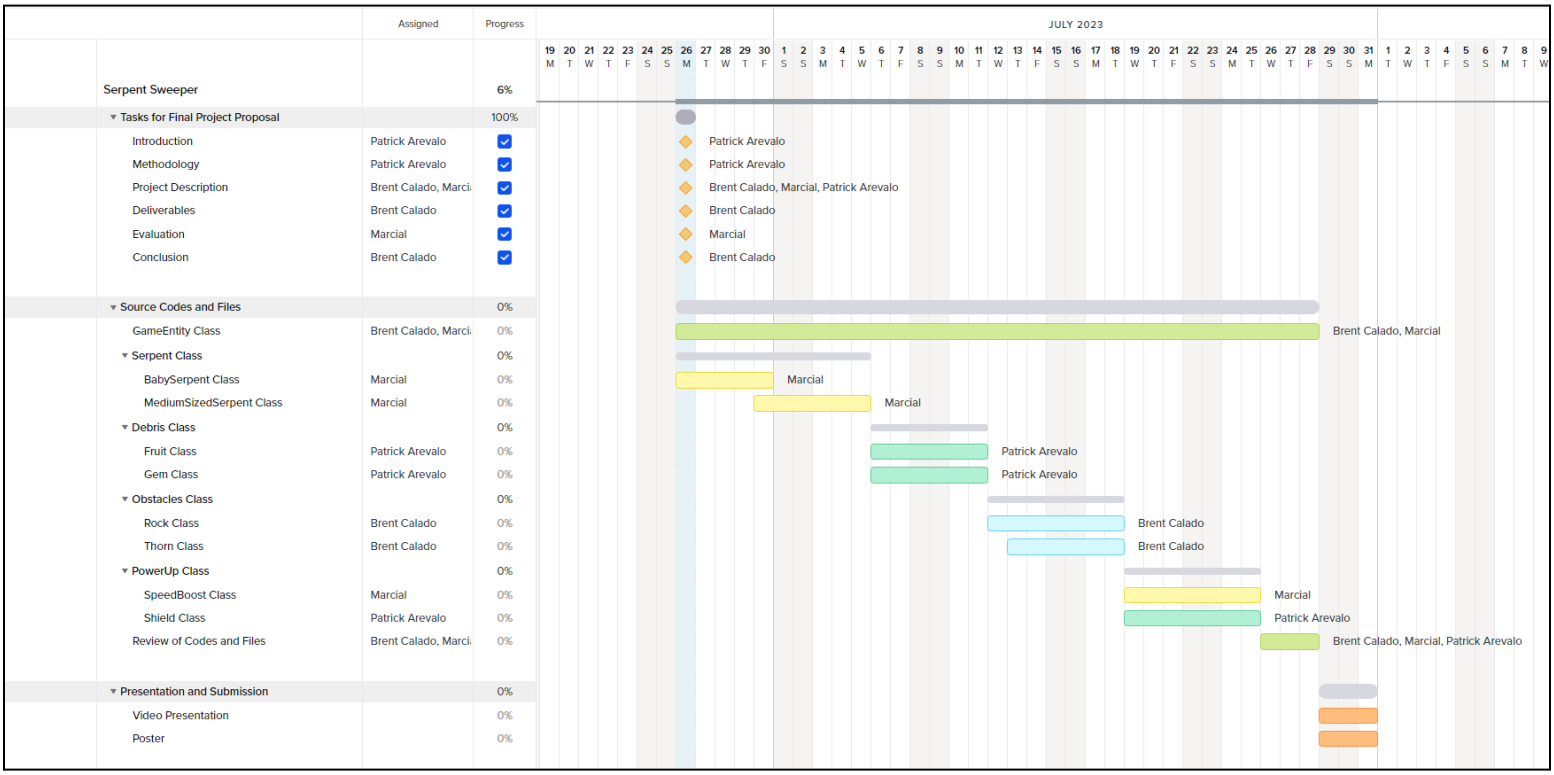


Image Link:
https://drive.google.com/file/d/1VZo3DQjbnqnA_77CaMyVIG2PVdXthaHm/view?usp=sharing

Other documents, such as the User Manual, may also be provided to further aid users into playing the game.

The Serpent Sweeper User Manual is an informative and comprehensive guide designed to assist players in navigating the game. Initially, the manual is subdivided into

6 parts: *Getting Started, Game Controls, Gameplay, Achievements & Rewards, Saving & Loading Games, and Troubleshooting.*

In the "Getting Started" section, the manual instructs users on how to initiate the game, offering a brief overview of the main menu and game settings.

The "Game Controls" section details the controls for maneuvering the snake in various directions, providing the core interaction method for players.

In the "Gameplay" section, the manual explains the game's core mechanics. It provides an overview of the game levels - Garden, Park, and City, and the process of progressing through these stages. The manual explains how players guide their snake avatar to consume environmental debris to grow and score points, and the consequences of colliding with obstacles.

The "Achievements & Rewards" section lists various tasks that, when completed, unlock achievements for players and provide virtual rewards. The use of these rewards to enhance gameplay, such as purchasing power-ups, is also detailed here.

The manual also guides players on saving and loading their game progress in the "Saving & Loading Games" section, ensuring that they can continue their journey at their convenience.

Finally, the "Troubleshooting" section provides initial troubleshooting steps for common issues that players may encounter during the game.

Finally, the "Contact Information" section provides the necessary details for users to get further support if needed. This includes the support email and the official game website link.

The Serpent Sweeper User Manual, with its easy-to-understand instructions and comprehensive coverage of all aspects of the game, ensures a smooth and enjoyable gaming experience for all players.

V. Evaluation

METRIC	DESCRIPTION	ASSESSMENT
Gameplay Experience	Analyzes the gameplay experience	This assesses smoothness of the game, such as the controls and the

		intuitiveness of the game.
Graphics and Visuals	Visuals presented in the game	Evaluates the quality of the graphics presented in the game.
Game Mechanics	The rules and mechanics concerning the game.	Gauges the core mechanics of the game, such as the movement of the snake, and the progression.
Performance	Optimization and organization of code.	This evaluates the optimization of the program, testing whether or not the game is polished or not.
Level Design	Concerning the design of each level is suitable and appropriate to the user's experience.	This rates the design and variety of the level design in game,
Bug-Free Operation	Tests the game if it is without any major game-breaking bugs or noticeable glitches.	Ensures that the game is free from any game-breaking bugs or noticeable glitches when running.
Player-Feedback	Feedback given by players	This is the feedback gained from other players' rating and review.

VI. Conclusion

To conclude, the game addresses the need for promoting environmental responsibility and cleanliness in a fun and engaging manner.

The significance of the project lies in its ability to educate players about the importance of cleaning up the environment and taking care of their surroundings. By assuming the role of a serpent, players progress through different stages and evolve into more powerful snakes by consuming various types of environmental debris. Starting with "Litters," they level up to medium-sized snakes, and ultimately become super snakes capable of consuming "Waste Mountain." This progression represents the players'

commitment to cleaning up and showcases the positive impact an individual can have on their environment.

The game's three stages, Garden, Park, and City, offer increasingly expansive maps, providing a sense of growth and accomplishment for players. However, they must also navigate carefully to avoid obstacles scattered throughout the environment. This challenges players to demonstrate agility and strategic thinking, enhancing their problem-solving skills while reinforcing the message that environmental cleanup is not without its challenges.

Basically, the Serpent Sweeper project addresses the need for promoting sustainable cities and communities by combining entertainment and education. By immersing players in a fun game environment, it raises awareness about environmental responsibility and encourages individuals to take action in cleaning up their surroundings.

VII. Tentative References

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