



DE LA SALLE UNIVERSITY - MANILA

Serpent Sweeper

A Term Project

Presented to Mr. Ramon Stephen L. Ruiz

In Partial Fulfillment of the

Requirements for the Course Object Oriented Programming Laboratory (LBYCPEI)

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I. Introduction

In the rapidly urbanizing world, cities and communities face a myriad of challenges, ranging from population growth and inadequate infrastructure to environmental degradation and social inequalities. As urban centers continue to expand, there is an urgent need to address these issues to ensure the well-being and sustainable development of present and future generations. Currently, over 50% of the global population resides in urban regions. However, projections indicate that by the year 2050, this number will escalate to 6.5 billion individuals, encompassing approximately two-thirds of the world's population (Joint SDG Fund, n.d.). Unplanned urbanization can lead to overburdened resources, pollution, slums, and insufficient access to essential services. Without effective measures, these problems could exacerbate, jeopardizing the quality of life for billions of people living in urban areas worldwide.

Sustainable Development Goal 11 (SDG 11) seeks to tackle the complex challenges arising from urbanization by promoting sustainable cities and communities. Adopted by the United Nations as part of the 2030 Agenda for Sustainable Development, this goal aims to make cities and human settlements inclusive, safe, resilient, and environmentally sustainable. SDG 11 encompasses various key aspects, such as affordable housing, efficient public transportation, waste management, access to green spaces, and measures to mitigate the impact of climate change in urban areas (United Nations Development Programme, n.d.).

To achieve SDG 11, governments, urban planners, communities, and individuals must collaborate to implement policies and practices that balance economic growth, social inclusion, and environmental protection. This includes investing in smart infrastructure, upgrading slums, enhancing public transportation, promoting sustainable urban planning, and ensuring equal access to basic services for all residents. The global population is steadily rising, necessitating the development of contemporary, eco-friendly urban centers to cater to everyone's needs. To ensure the well-being and success of all individuals, we require innovative urban planning that fosters the creation of secure, cost-effective, and adaptable cities, enriched with environmentally friendly and culturally stimulating living environments (UNICEF, n.d.). Additionally, fostering

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community participation, promoting cultural heritage, and safeguarding natural resources are integral components of SDG 11's vision.

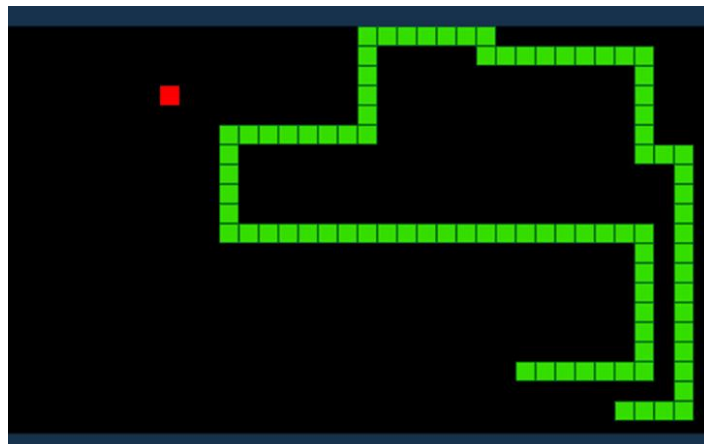
In line with the spirit of SDG 11, allow us to introduce "Serpent Sweeper," a captivating Java-based 2D game that ingeniously merges the addictive gameplay of the classic "Snake Game" with an eco-conscious twist, aligning perfectly with the inspiring theme of 'Goal 11: Sustainable Cities and Communities'. In Serpent Sweeper, players embark on a thrilling adventure centered around cleanliness and environmental responsibility. Starting as a humble baby serpent, they progress through the game, evolving into a medium-sized serpent, and ultimately transforming into a formidable super serpent. The objective of the game is to advance through various stages and become the heroic savior of the city by consuming different types of environmental debris, symbolizing the player's unwavering commitment to cleaning up their surroundings. Beginning with "Litters," the baby snake must gather a specified amount to level up into a medium-sized snake. This progression unlocks the ability to devour "Trash Heaps," continuing the cycle until the coveted status of a super snake is achieved, granting the power to consume the grand "Waste Mountain". The game encompasses three captivating stages: Garden, Park, and City. As players ascend through these stages, they unlock increasingly expansive maps, mirroring the growth of their snake avatar. However, they must tread carefully amidst the obstacles scattered throughout the environment. Colliding with these obstacles, regardless of the snake's size, results in an immediate game over, challenging players to demonstrate both agility and strategic thinking. With its engaging gameplay and environmentally conscious theme, Serpent Sweeper not only provides hours of entertainment but also promotes awareness of the importance of sustainable practices in our communities.

II. Related Work

The ‘Related Works’ section of this paper provides a glimpse into other games that share similar themes or objectives with Serpent Sweeper. These games, each in their own unique way, encourage players to consider environmental responsibility, sustainability, and cultural awareness. Serpent Sweeper's eco-conscious twist and focus on sustainable cities and communities make it a meaningful addition to the realm of games with social and environmental messages.

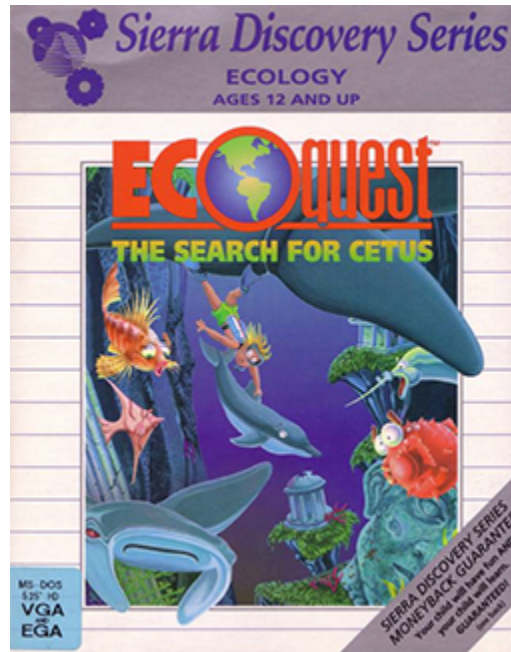
The following are some games/applications that incorporate the same theme and essence of the “Serpent Sweeper” project:

1. **“The Snake Game”** - Developed in the late 1970s and early 1980s, The Snake Game is a classic video game that became popular on mobile phones and personal computers. Also known as simply ‘Snake’ or ‘Snakey’, the game's objective is straightforward: control a snake on a bordered plane or grid, guiding it to eat food items (usually depicted as dots or pellets) that appear on the screen. As the snake consumes food, it grows longer, making the game progressively challenging. The game is also the one in which the “Serpent Sweeper” application is inspired from.



The Snake Game

2. **"EcoQuest: The Search for Cetus"** - Developed by Sierra On-Line in 1991, EcoQuest is an adventure game that focuses on environmental themes. Players embark on a journey to save the ocean from pollution and harm caused by humans. The game raises awareness about marine conservation and ecological responsibility.



Ecoquest: The Search for Cetus

3. **"SimCity" Series** - Created by Maxis and first released in 1989, the SimCity series allows players to design and manage their virtual cities. By balancing factors like infrastructure, pollution, and resources, players learn about urban planning and sustainable city development.



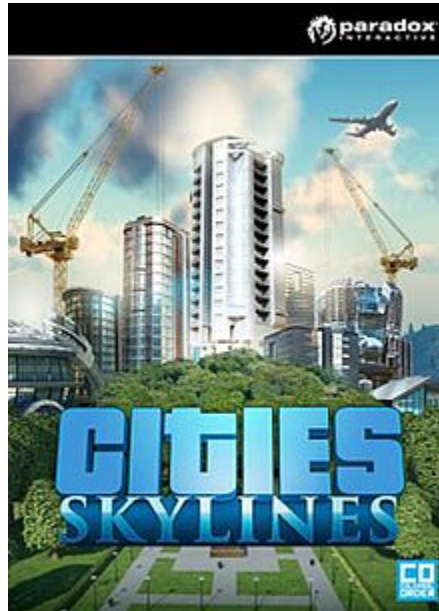
SimCity (2013 video game)

4. **"Grow Home"** - Developed by Ubisoft Reflections in 2015, Grow Home is an exploration game where players control a robot named B.U.D. tasked with growing a giant plant to save its home planet. The game promotes the value of ecological balance and environmental preservation.



Grow Home

5. **"Cities: Skylines"** - Developed by Colossal Order and released in 2015, Cities: Skylines is a city-building simulation game that challenges players to create efficient and sustainable cities. Players must manage resources, plan transportation networks, and maintain a balance between economic growth and environmental well-being.



Cities: Skylines

Incorporating elements inspired by these renowned games, Serpent Sweeper emerges as a fresh and innovative addition to the gaming landscape. By combining the classic allure of "The Snake Game" with a thought-provoking twist of eco-consciousness and sustainable urban development, Serpent Sweeper beckons players to embark on a thrilling journey of environmental stewardship and social impact.

With the use of Java, Serpent Sweeper will now try to incorporate the themes of the aforementioned games and applications into its own, contributing to the goals of SDG 11.

III. Proposed Application

The team's proposed application is a Java-based application titled "Serpent Sweeper". "Serpent Sweeper" project is a modular and object-oriented Java program inspired by the classic 'Snake' game. This project employs a well-structured architecture, including a Game Engine, Snake module, Trash module, Game Board, User Interface, and Collision Detection, to ensure efficient game logic, rendering, and user interaction.

Game Engine:

The core of the application is the Game Engine. It orchestrates the game loop, updates the game state, and renders visuals. It interfaces with the Snake module, Trash module, Game Board, User Interface, and Collision Detection components.

Snake Module:

The Snake module represents the player's character. It consists of segments forming the snake's body. This module manages movement, collision detection with trash items, growth upon consuming trash, and user interaction.

Trash Module:

Trash items are collectible objects placed randomly on game boards. These items provide sustenance for the snake. Different types of trash items may have varying properties, sizes, and effects. They are categorized based on their properties.

Game Board:

The Game Board serves as the play area, comprising a grid where the snake and trash items are positioned. Multiple game boards offer diverse themes and level designs. This module manages position tracking and provides collision detection methods for various game objects.

Collision Detection:

The Collision Detection module specializes in identifying collisions between different game objects. It ensures accurate detection between the snake, trash items, and any other

potential elements like obstacles. This module plays a pivotal role in maintaining game integrity.

User Interface:

The User Interface component handles the visual display of game-related information, including scores, levels, and additional details. It interfaces with the Game Engine to provide real-time updates to the player.

By following this modular and object-oriented design, the 'Serpent Sweeper' project achieves a robust and organized structure. This approach enhances code readability, maintainability, and scalability, making it easier to add new features, levels, or components in the future. The careful separation of responsibilities across modules ensures that each component can be developed and tested independently, contributing to an overall smoother development process.

IV. Implementation / OOP Aspects

The “Serpent Sweeper” project represents a dynamic and immersive Java application that draws inspiration from the timeless classic 'Snake' game while embodying the foundational principles of Object-Oriented Programming (OOP). This meticulously designed application embraces abstraction, polymorphism, encapsulation, and inheritance – the four cornerstones of OOP – to deliver a robust and modular gaming experience.

Abstraction:

Abstraction is evident in the program through the modular design and separation of concerns. Each component, such as the Game Engine, Snake module, Trash module, and more, abstracts complex functionality into manageable and reusable units. These modules expose only essential methods and attributes, hiding internal implementation details and promoting a clear interface for interaction.

Polymorphism:

Polymorphism is exemplified in the Snake module, where different types of snakes (T1Snake, T2Snake, T3Snake) exhibit unique behaviors while adhering to a common interface. This enables the Game Engine to treat various snake instances uniformly, invoking their specific methods based on their individual characteristics. Similarly, the Trash module could utilize polymorphism to handle different types of trash items with shared methods.

Encapsulation:

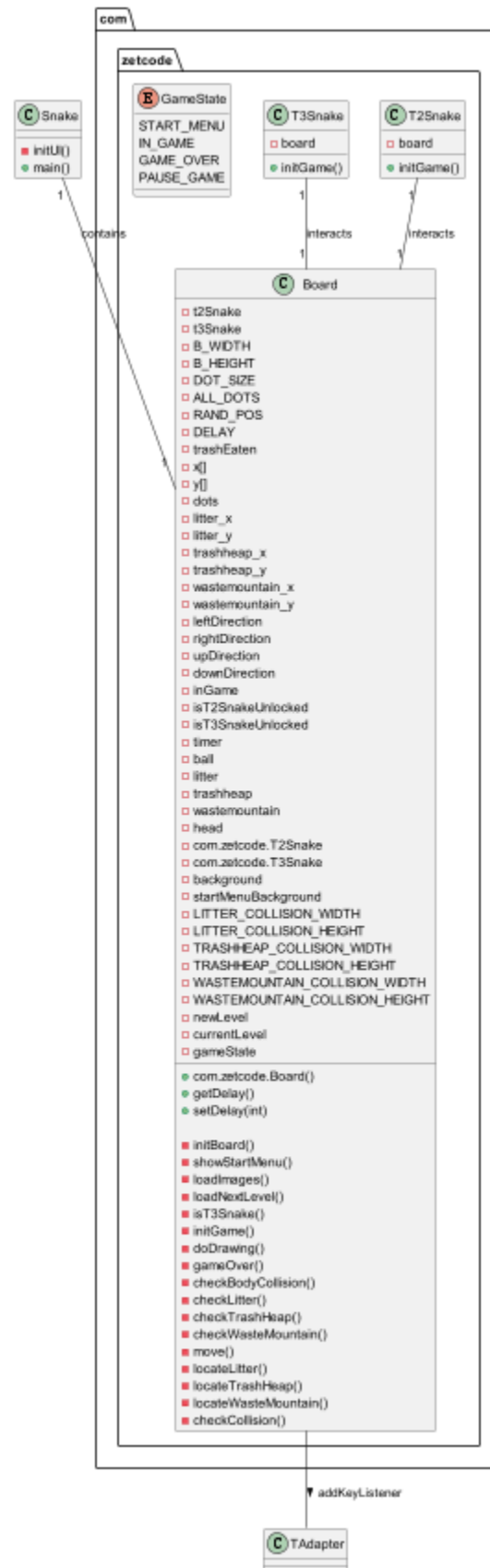
Encapsulation is a central principle of the program, ensuring that data and behavior are encapsulated within their respective modules. For instance, the Snake module encapsulates movement logic, collision detection, and growth mechanisms, shielding internal details from external manipulation. This promotes data integrity, prevents unauthorized access, and supports maintenance and updates.

Inheritance:

Inheritance is prominently employed in the extension of the Snake class. T2Snake and T3Snake classes inherit from the base Snake class, inheriting its core properties and behaviors while adding their distinct features. This simplifies code reuse, minimizes redundancy, and allows for tailored variations of snakes. Inheritance can also be applied to create different types of trash items, deriving from a common Trash base class.

Overall, our program effectively leverages these four pillars of OOP to create a well-structured, modular, and extensible application, contributing to code organization, flexibility, and scalability.

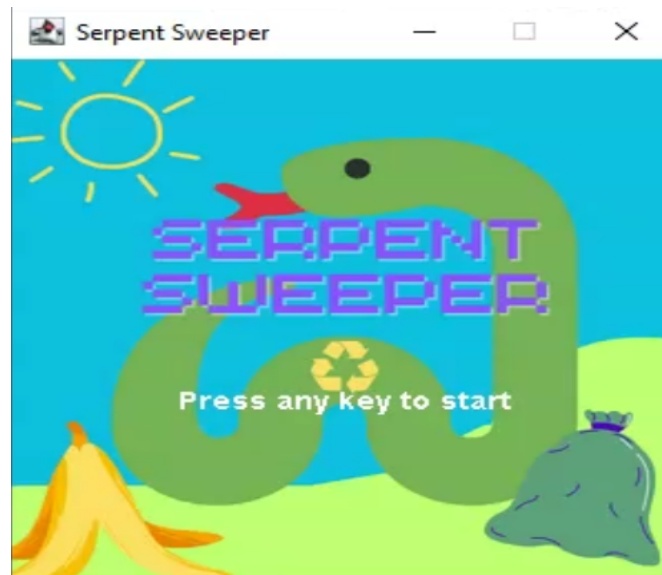
UML Diagram:



V. Walkthrough / Data / Results / Evaluation

The game revolves around controlling a snake-like creature to eat trash and progress through the different levels. There are three types of snakes (T1, T2, and T3) with varying abilities but T2 and T3 snakes are unlocked as the player progresses in the game.

---- Start Menu ----



When the game is launched, the user is greeted with the start menu. The start menu contains the title, the background image, and text detailing the user to press any key to continue.

---- Garden Level ----

Serpent Sweeper



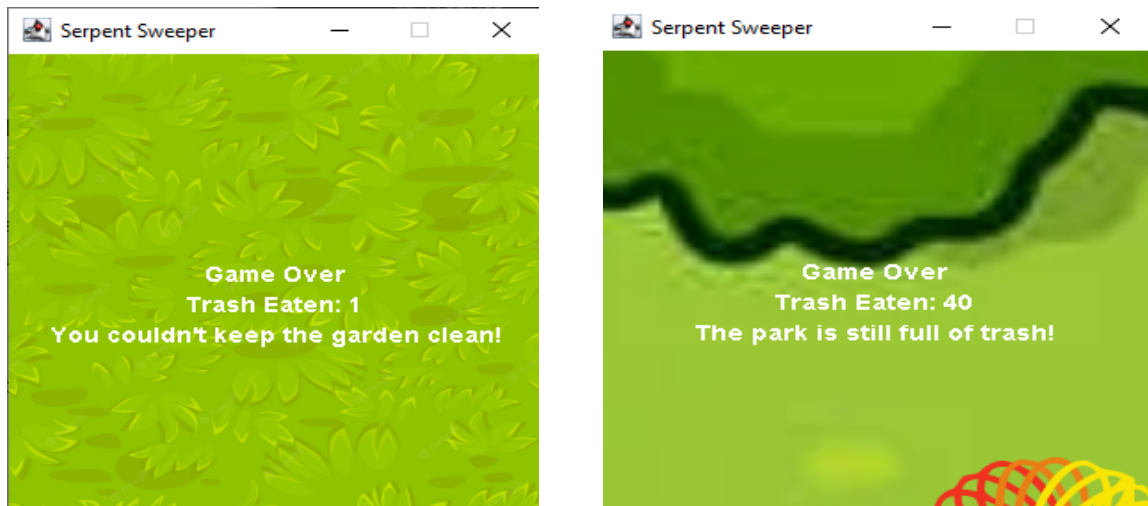
Once the user has pressed a key, they are then moved to the Garden level. In game, the game is now playable where you can move the snake with the use of the arrow keys. The goal of the game is to control the snake and eat the trash items to increase the snake's length. The snake is represented through a series of green dots with the snake's head being the main indicator of a tier. In the first level, the snake is currently in it's beginning tier; this means that it is not capable of eating higher garbage such as 'WasteMountain'.

The background features a grassy playing area to simulate one's own garden and the garbage that pollutes it.

On the upper left of the screen, you can see the counter for the trash. This will keep track of the trash or points gathered by the player.

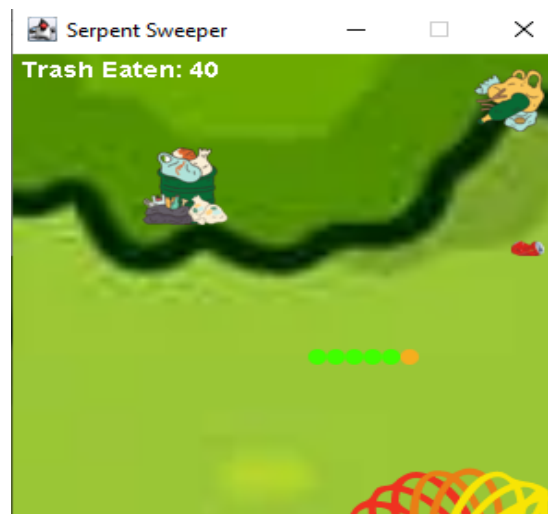
When the snake finally reaches 20 points, he is then transferred to the next level. Which is the Park level.

---Game Over Screen---



Once the player fails a level he would be greeted by a message indicating that the Park, Garden, or the city is still not clean. And that the user is unsuccessful in cleaning those areas. The screen would also show the score of the player.

---Park Level---



Much like the previous level, the gameplay is still the same. However this time, the snake now has moved up to the second level, thus changing it's head to yellow indicating that the snake is now capable of eating 'WasteMountain'. The snake is now tasked of eating 45 trash total in order to move on the level 'City'.

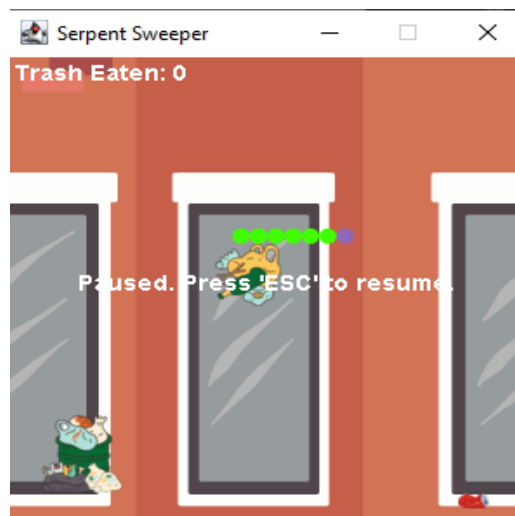
---City Level---



This is the third and final level of the game, in this level it plays much like before only faster and the head of the snake changes once again into its last form. Turning the head into purple. This time the number of trash needed to be gathered is 60 and around this level the snake is expected to be larger thus granting the task of getting 60 trash more difficult than it looks.

After the player has done all of the requirements to win, the game will end.

---Pause Screen---



During the game, you can pause it by pressing the “ESC” key. This will display “Paused. Press ‘ESC’ to resume.” message on the screen, and the game will be temporarily halted. To resume playing, press the “ESC” key again.

Essentially, the following are the key aspects of the game:

1. Start Menu:

The start menu is straightforward and visually appealing, with a clear message prompting the user to press any key to continue. It effectively sets the tone for the game and prepares the player for the upcoming challenges.

2. Points Counter:

The inclusion of a trash counter in the upper left of the screen serves as a valuable gameplay element, allowing players to track their progress and strive for higher scores. This feature adds a competitive aspect to the game, encouraging players to improve their skills and strategize their moves.

3. Game Over Screen:

The Game Over screen effectively conveys the player's performance, displaying a message indicating the area's cleanliness status and the player's score. This feature motivates players to replay and improve their performance in subsequent attempts.

4. Garden Level:

The Garden level introduces players to the gameplay mechanics, allowing them to control the snake using arrow keys to eat trash items and increase the snake's length. The tier-based progression system, represented by different snake heads, adds a sense of achievement and motivation to move forward. The garden-themed background complements the narrative and immerses the player in the game world.

5. Park Level:

The Park level introduces additional challenges with an increased trash requirement and a new snake tier. This progression adds depth to the game, keeping players engaged and eager to unlock new levels and abilities.

6. City Level:

The City level offers a final and more challenging stage with a higher trash requirement and faster gameplay. The change in snake appearance adds visual progression and rewards the player's efforts in mastering the previous levels.

7. Pause Screen:

The inclusion of a pause feature provides convenience for players who may need to temporarily halt the game. The "Paused. Press 'ESC' to resume." message ensures players understand how to resume the game seamlessly.

To evaluate, "Serpent Sweeper" showcases a well-designed and thoughtfully executed game that combines entertainment with an eco-conscious message. The gradual introduction of new challenges, tier-based progression, and engaging visuals contribute to a compelling gaming experience. Future work could involve expanding the game's content, incorporating additional levels, and further refining gameplay mechanics to provide players with even more immersive and rewarding gameplay. Additionally, fostering a community for players to share their experiences and feedback would enhance the game's potential for continual improvement and lasting impact.

VI. Conclusion and Future Work

Conclusion

All in all, our “Serpent Sweeper” project stands as a remarkable fusion of entertainment and environmental consciousness within the realm of gaming. By creatively integrating the addictive gameplay of the classic “Snake Game” with an eco-conscious twist, this project not only offers players an engaging and enjoyable experience but also promotes awareness and responsibility towards sustainable cities and communities.

The modular and object-oriented design of the application, incorporating a well-structured game engine, snake module, trash module, game board, collision detection, and user interface, showcases the application of fundamental object-oriented programming principles. Abstraction, polymorphism, encapsulation, and inheritance are seamlessly integrated into the structure of the program, enabling a robust and organized architecture that facilitates code readability, maintainability, and scalability.

Looking back on our journey of creating this project, it is evident that this endeavor is more than just a game or a project completion, but it’s a catalyst for change and improvement. The intersection of entertainment and environmental consciousness has the potential to spark conversations, ignite passion, and drive real-world action. By immersing its players in a virtual world, where their choices directly impact the health of the in-game environment, “Serpent Sweeper” fosters a sense of responsibility and agency that transcends what’s happening in front of the screen. This unique blend of entertainment and education opens the door to a future where gaming is not only an escape, but also a powerful tool for raising awareness and fostering societal transformation and innovation.

Future Work

As we move forward with the "Serpent Sweeper" project, there are several exciting avenues for future development and expansion. Firstly, we envision enhancing the game's educational aspect by integrating more comprehensive information and facts

about sustainable cities, environmental conservation, and the importance of community involvement in real-world initiatives. This will deepen players' understanding of the issues at hand, fostering a more meaningful connection between the virtual world and the real world.

Additionally, we plan to introduce more diverse and challenging levels that reflect the intricacies of sustainable urban planning. These levels will present players with unique environmental scenarios, requiring them to think critically and strategize in order to overcome obstacles and achieve their eco-conscious objectives.

Moreover, we aim to incorporate multiplayer functionality, allowing players to collaborate with friends or team up with individuals worldwide. This cooperative aspect will promote community engagement and collective problem-solving, empowering players to work together towards the common goal of creating sustainable cities and communities.

To reach a broader audience and raise awareness on a larger scale, we aspire to develop mobile versions of "Serpent Sweeper" for both Android and iOS platforms. Making the game accessible on mobile devices will enable players to enjoy the experience on the go and encourage a more widespread adoption of the eco-conscious message. Incorporating user feedback and suggestions will be paramount in the future development of the game. We plan to actively engage with the gaming community and environmental enthusiasts to gather insights and perspectives that can shape the evolution of "Serpent Sweeper." By staying responsive to the needs and desires of our players, we can continuously refine the game to offer an increasingly immersive and impactful experience.

VII. Contributions

Student Name	Tasks Assigned	Percentage of the Work Contribution
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AREVALO, John Patrick J.	<ul style="list-style-type: none"> • T2Snake.java • T3Snake.java • Video Editor • Proposed Application • Implementation/OOP Concepts • Conclusion 	33%
CALADO, Brent Mitchel R.	<ul style="list-style-type: none"> • Snake.java • Board.java • Poster Editor • Introduction • Related Works • Future Work 	33%
CELLO, Jose Marcial S.	<ul style="list-style-type: none"> • Board.java • GameState.java • Created images for assets in the program • UML Diagram • Walkthrough/Data/Results/Evaluation 	34%

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