GREEN-THEMED SERIOUS GAME SCENARIOS

Prepared by

PLAY2GREEN

Serious Gaming for Universal Access to Green Education

Zagreb, 2023

Co-funded by the Erasmus+ Programme of the European Union

University of Zagreb

Faculty of Electrical Engineering and Computing

Zagreb, Croatia

Project: Play to Green: Serious Gaming for Universal Access to Green Education (2022-1-HR01-KA220-HED-000088675)

Version 1.0

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University of Debrecen

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INTRODUCTION

This document contains **5 green-themed serious game scenarios** that are prepared so that they can be used as input for the development of green-themed serious games that serve as green educational resources and thus contribute to the „environment and fight against climate change" Erasmus+ priority.

Game scenarios are prepared for the green-themed serious game prototypes entitled:

1. **HoloZoo**
2. **Ocean Sweeper**
3. **Urban Garden**
4. **Inclusive eco-fighter**
5. **Ocean Rescue**.

Green-themed serious game scenarios are the main result developed **as part of the blended mobility hackathon** organized for students and lecturers from higher educational institutions. This project-based learning blended hackathon was held **from March 2023 to September 2023**. Serious game scenarios are finalized during the physical mobility of the blended hackathon organized in Dubrovnik (Croatia), 17-23 September 2023.

HoloZoo

Team: HoloZoo

Members: Nadine Jallouli, Mihaela Kristić, Dorotea Prvonožec, Diego Giménez Asensi, Ivan Sentić

Supervisor: Ana Kešelj, Ivona Zakarija, Krunoslav Žubrinić

Version: 3.0

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Leaders by chapter:

Chapter	Leader
Green education content design	Diego Giménez Asensi
Game design	Mihaela Kristić
Emerging technology analysis	Ivan Sentić
Visuals	Dorotea Prvonožec
Universal design for learning analysis	Nadine Jallouli

GREEN EDUCATION CONTENT DESIGN

Keywords

Hologram, endangered species, habitat loss, global changes.

Concepts

- **Endangered species** are the species that are very likely to extinct in the near future, either worldwide or in a particular jurisdiction. It is categorized by conservation status called "Red list" which indicates the likelihood of extinction. Species become endangered for the following **reasons**: loss of habitat, loss of genetic variation, invasive species and poaching/hunting.
- **Habitat degradation** poses the greatest threat to species. Habitats are disappearing due to human factors and losing them is a big ecological issue directly affecting the animals but the humans as well.
- Habitat loss also results in **global change in terms of animal species** changing the eco system's natural processes such as food chain. Losing one animal species can mean losing many others but it can also mean losing whole habitats.

Fun fact

Fun fact	**Reference**
1) Did you know that the largest flying bird in history was the Quetzalcoatlus With a wingspan of up to 36 feet, it was roughly the size of a small airplane.	https://www.smithsonianmag.com/smart-news/new-studies-unveil-details-about-the-largest-flying-creature-to-ever-live-180979193/#:~:text=Quetzalcoatlus%E2%80%94a%20member%20of%20the,a%20whopping%2040%2Dfoot%20wingspan.

2) The Kakapo (Strigops habroptilus) is a flightless parrot native to New Zealand and is one of the rarest birds in the world. What makes them particularly fascinating is their ability to perform a unique "boom" vocalization.	https://www.britannica.com/animal/kakapo
3) The pangolin is the most trafficked mammal in the world. These unique creatures are covered in scales made of keratin, similar to human fingernails. They curl up into a ball when threatened, making them highly vulnerable to poaching. All eight species of pangolins are currently endangered or critically endangered.	https://www.nationalgeographic.com/animals/mammals/facts/pangolins
4) The Sumatran orangutan (Pongo abelii) is one of our closest relatives in the animal kingdom Thesecritically endangered primates are found only on the Indonesian island of Sumatra and are known for their remarkable intelligence and tool use.	https://www.worldwildlife.org/species/sumatran-orangutan
5) The Amur leopard (Panthera pardus orientalis) is one of the rarest big cats in the world These stunning leopards are adapted to live in the temperate forests of Russia and China (only 10 left).	https://www.worldwildlife.org/species/amur-leopard
6) The Hawksbill Sea turtle (Eretmochelys imbricata) has a unique and beautiful shell with overlapping scutes These turtles play a vital role in marine ecosystems, but they are critically endangered due to illegal trade in their shells, habitat destruction, and climate change impacts	https://www.worldwildlife.org/species/hawksbill-turtle
7) The red panda (Ailurus fulgens) is not closely related to giant pandas Red pandas are their own unique species, known for their striking red fur and bushy tails.	https://redpandanetwork.org/post/15-Fantastic-Facts-about-Red-Pandas

8)The tongue of a blue whale is so large that about 50 people could stand on it.	.thoughtco.com/blue-whale-facts
9) The Philippine eagle (Pithecophaga jefferyi) is one of the largest and rarest eagles in the world Found only in the Philippines, it is known for its majestic appearance, with a distinctive crown of feathers and a wingspan that can reach up to seven feet.	https://www.peregrinefund.org/explore-raptors-species/eagles/philippine-eagle
10) The fingerprints of koalas are so similar to humans' that they have been mistaken for crime scenes.	McGill

Learning outcomes

- Learn about endangerment status of animals
- Learn about habitats, diet, population...
- Learn where each animal live
- Learn about the seas, continents and other areas
- Recognizing animals and how they look like

GAME DESIGN

Title

HoloZoo

Genre

Trivia game with holographic projection, serious game

Tagline

Unleash Your Inner Zoologist, Save Habitats, Defeat Extinction: HoloZoo Trivia!

Number of players

1 player

Target platforms

Android, Windows, iOS

Storyline

In the captivating trivia game "HoloZoo," players embark on an extraordinary adventure to explore the diverse and fascinating world of endangered animals. With the power of holographic technology, a mobile device and second display like tablet or monitor players can learn about these incredible creatures in a fun and interactive way while raising awareness about their conservation.

Equipped with a mobile device, players can access a virtual globe within the game that displays different regions of the world. By tapping on a specific area, they can bring up a holographic representation of the habitat and the unique animals that reside there. These holograms are incredibly lifelike and allow players to observe the animals' behaviors, listen to their distinct sounds, and interact with them in various ways.

The trivia challenges in HoloZoo are designed to be engaging and entertaining, presenting players with questions about endangered species, their habitats, adaptations, and conservation efforts. The game incorporates various interactive elements, such as identifying animals based on their features, matching species to their respective habitats, and solving puzzles related to conservation challenges.

As players progress through the game, they earn points and unlock new levels, regions, and virtual animal encounters. They can also visit a virtual zoo within HoloZoo, where they can learn more about each species, view detailed information, and witness captivating live holographic presentations by animal experts.

Through the engaging storyline of HoloZoo, players not only gain knowledge about endangered animals but also develop a deep sense of empathy and responsibility towards their conservation. By combining entertainment with education, HoloZoo aims to inspire players to take real-world action and contribute to the protection of these magnificent creatures and their habitats.

Game mechanics

Objectives

Goal - answer correctly on quiz questions.

Objectives:

- collect new animals
- earn experience points.

Rules

- Only one try per question;
- Only one correct answer between 3 options;
- After wrong answer, player needs to read the story again;
- For wrong answers there are no experiences gained;
- For correct answers experiences are gained.

Actions

- Preview three-dimensional models as holograms, and rotate them for 360°
- Answer questions
- Unlock animals to visualize them

Resources

- Experience gained by correct answers

Challenges

- Daily quiz

- Regular quiz questions

Progression

- Player levels up when enough experience is gained
- With level up, new animal is unlocked
- Option (set up a timer in the daily quiz when leveling up)

Feedback

- If chosen answer is correct, it becomes dark green, others become grey.
- If chosen answer is wrong, it becomes dark red, correct one becomes dark green and others become grey.
- Number of correct answers is displayed at the end of quiz.
- Questions with wrong and correct answers can be previewed at the end of the quiz.
- If user passes level, pop-up window appears with information about their progress and new animals they got.

System tracks the user's progress with:

- Quiz points
- Experience points
- Levels

Rewards:

- Every 10/10 quiz, gains new profile background
- Passing the level gives you new animal

Interactions

- Interaction with three-dimensional model to move it around 360°
- Interaction with three-dimensional globe

- Interaction with quiz

Difficulty

When user enters the quiz screen, he/she is presented by the scrollbar that has three difficulty levels: easy, medium and hard. The users can choose the level he/she prefers. Each difficulty level has its number of questions. Easy level has 6 questions, medium level has 9 questions and hard level has 12 questions. The main difference is that hard level has a timer that tracks how much time user spends in quiz and on each question. The user has only 10 seconds for each question. If user fails to answer the question in time, quiz continues with the next question and the skipped one is marked as false answer. The daily quiz is always easy level.

EMERGING TECHNOLOGY ANALYSIS

Emerging technology

A hologram is a 3D representation of an object created by laser or light interference ray. For years, holograms were just photos on special holographic material, written on it by directing the laser under different corners where, due to the interference of laser beams, a photo is obtained, which when viewed under different angles look three-dimensional. Nowadays there are two types of holograms: stereotypical and realistic.

There are hologram-like images that are not created using the principles of holography, but by other means, such as moiré patterns or the use of metallic inks or diffractive optical elements, which give the illusion of a 3D effect. One of these hologram-like image techniques is Pepper's Ghost, which is used in this paper. Pepper's ghost is a stage illusion that makes it appear as if a ghost or transparent object is present on stage. It relies on the use of a partially reflective surface, such as a sheet of glass, to reflect an image of an object or person that is hidden from the audience's view. The technique works by placing a partially reflective surface at an angle between the audience and the hidden object, so that the reflected image appears to float in mid-air.

The application of this technology stands out in education, where it has been proven to enable students to understand concepts faster and better. Holograms in the classroom have a stimulating effect and attract student's attention. These technologies have been shown to positively impact the educational experiences of students with disabilities increasing confidence, engagement, and interest, providing opportunities for independent learning, and increasing student satisfaction and motivation.

Proposed gaming experience

The main app is going to be on a player phone where he or she plays the quizzes and answers the questions, but when player chooses to preview the three-dimensional model as hologram it shows on the other device, like tablet or another phone, to show the hologram there.

Integrating holographic technology into the game will revolutionize the player's experience. When unlocking a new animal, a holographic projection will provide a visual and immersive element that enhances their connection with the animal world. Holograms can bring virtual representations of animals to life, allowing players to see and interact with them in a realistic and engaging way.

The quiz will also be played on a device while the hologram will be shown on a different one.

Feasibility assessment

To implement the proposed gaming experience for the HoloZoo application across Android, Windows, and iOS platforms, various resources would be needed. These include hardware, software, plugins, tools, and frameworks. Here's an overview of the required resources:

Hardware:

1. Mobile Devices: Android, iOS, and Windows devices capable of running Unity applications. These will serve as the primary devices for users.

2. Tablets/Monitors: Larger screens such as tablets or monitors will provide an enhanced hologram viewing experience. They will serve as secondary devices for better visualization.

Software:

3. Unity Game Engine: Unity is a widely used game engine suitable for developing cross-platform applications. It provides the necessary tools and features for creating interactive 3D experiences.
4. Operating Systems: Android, iOS, and Windows operating systems are required to build and deploy the application for each respective platform.
5. Integrated Development Environment (IDE): An IDE such as Visual Studio or Unity's integrated editor will be necessary for coding and debugging the application.

Plugins:

6. Holo Cam Pyramid Asset: This Unity asset will enable the hologram functionality and enhance the visual experience on larger screens. It provides the necessary tools for creating and displaying holograms.

Tools:

7. Graphics Software: Applications like Photoshop or GIMP will be useful for creating and editing visual assets, textures, and UI elements.
8. 3D Modeling Software: Tools like Blender or Autodesk Maya can be utilized for creating 3D models of animals and other objects in the HoloZoo.
9. Audio Software: Software like Audacity or Adobe Audition will help create and edit audio assets such as animal sounds or background music.

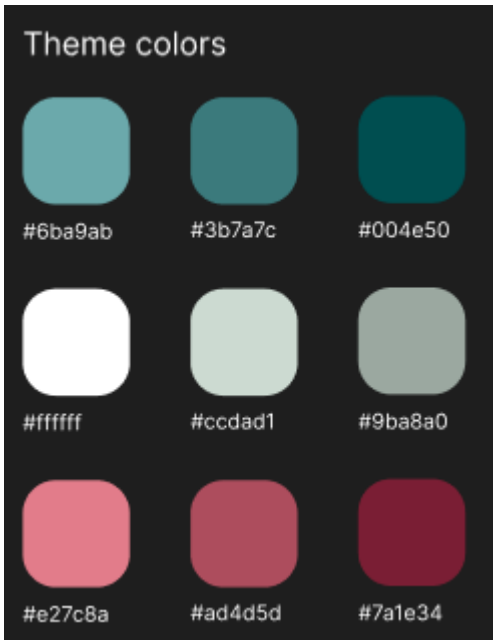
Frameworks:

10. AR/VR Frameworks: Depending on the requirements, you may need to integrate augmented reality (AR) or virtual reality (VR) frameworks into the application to enhance the immersive experience. Such frameworks are Unity AR Foundation, Unreal Engine, OpenXR, Vuforia, ARKit.

VISUALS

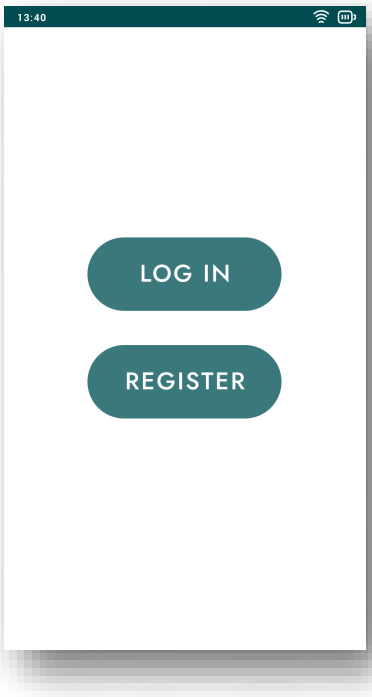
Logo

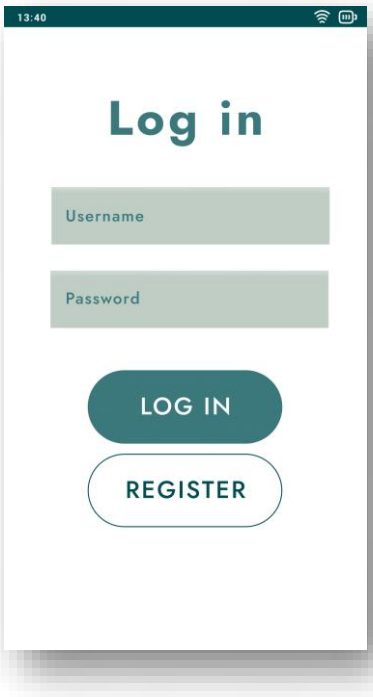
Color scheme

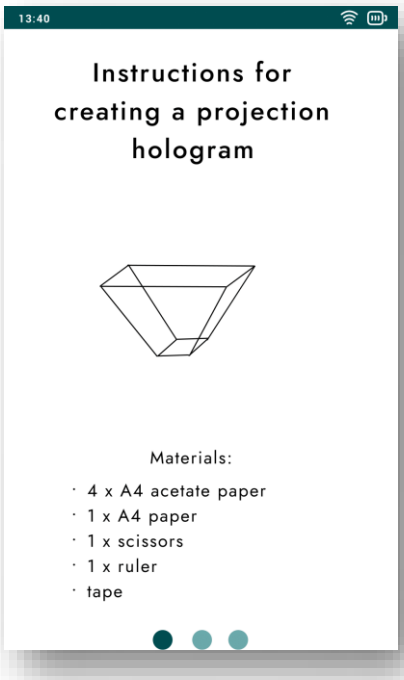


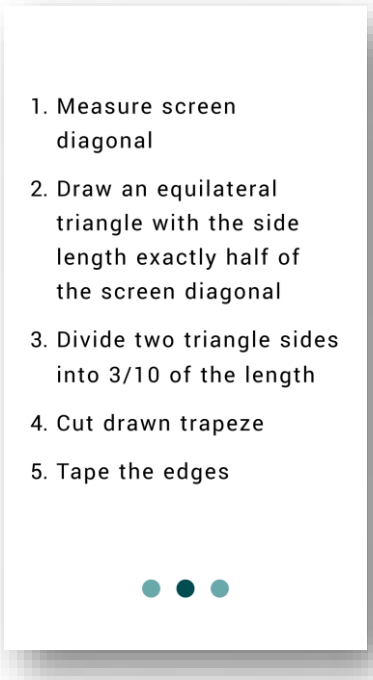
Screenshots

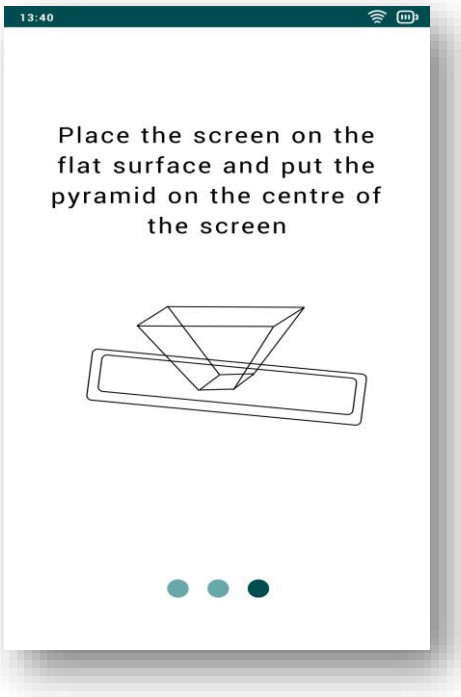
Main menu screen

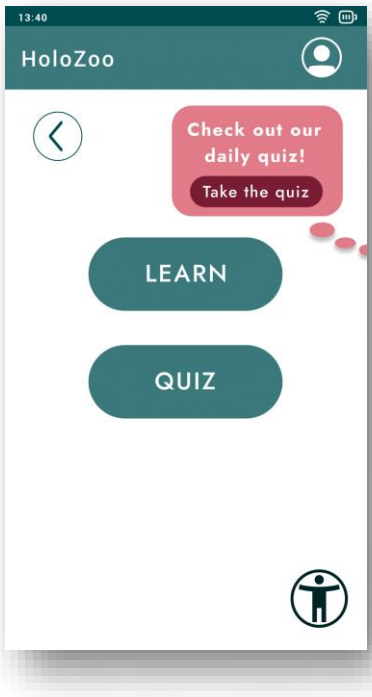

13:40
LOG IN
REGISTER


13:40
Log in
Username
Password
LOG IN
REGISTER

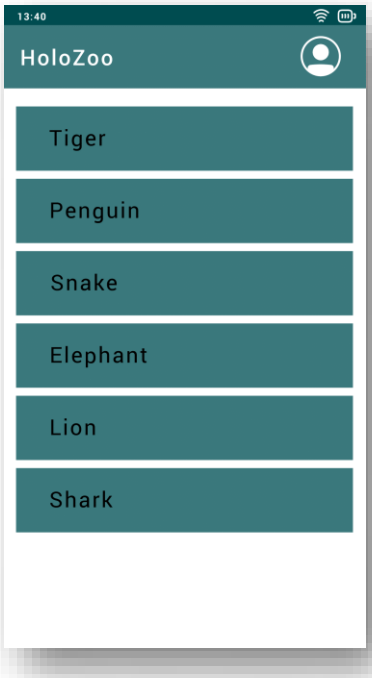

13:40
Instructions for creating a projection hologram
Materials:
· 4 x A4 acetate paper
· 1 x A4 paper
· 1 x scissors
· 1 x ruler
· tape

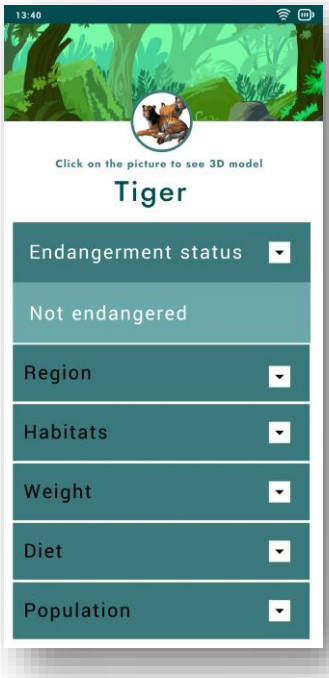

1. Measure screen diagonal
2. Draw an equilateral triangle with the side length exactly half of the screen diagonal
3. Divide two triangle sides into 3/10 of the length
4. Cut drawn trapeze
5. Tape the edges

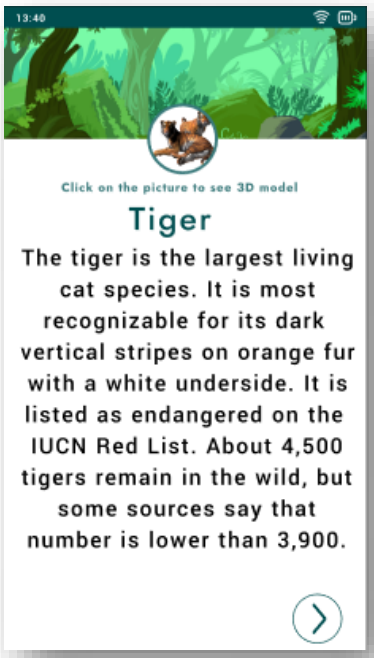


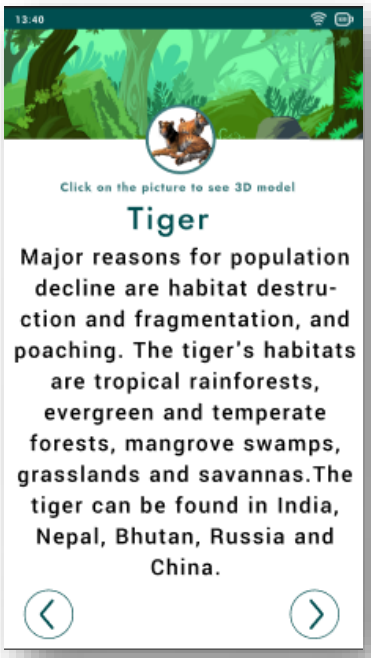


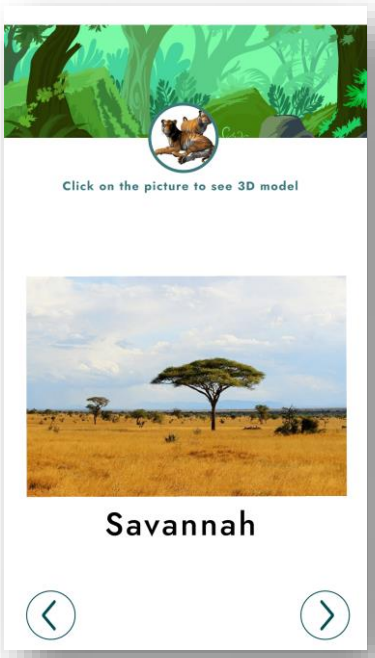
Action screen











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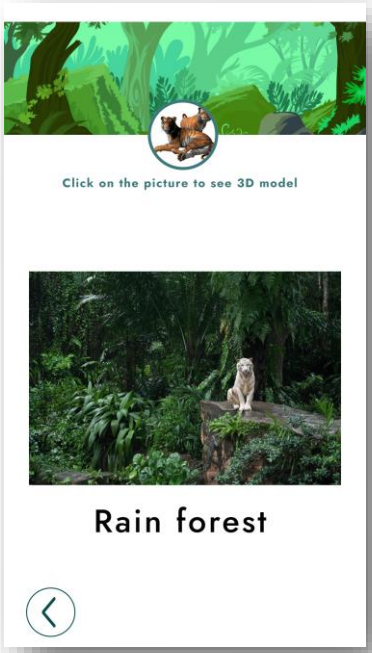
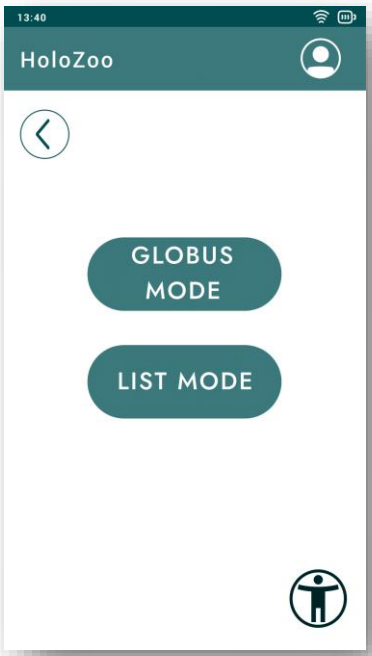
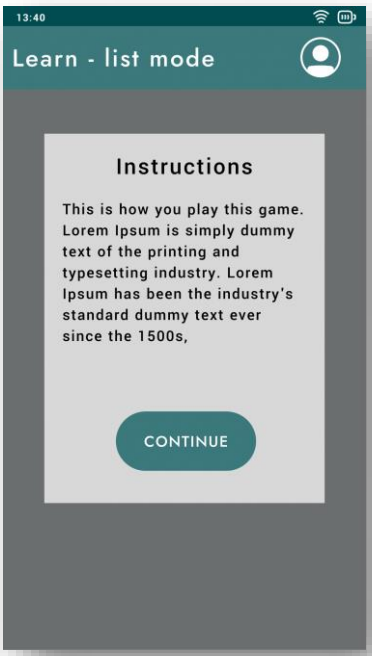
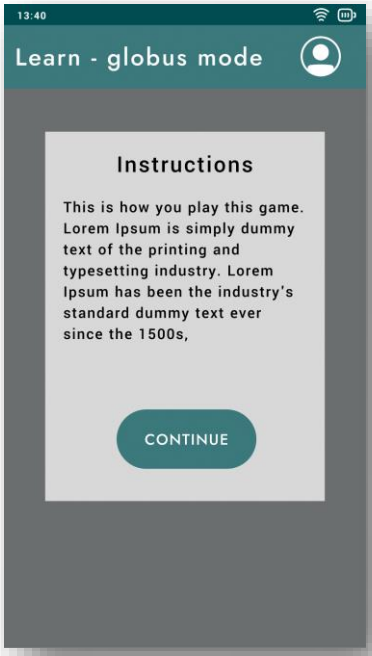

Click on the picture to see 3D model
Rain forest

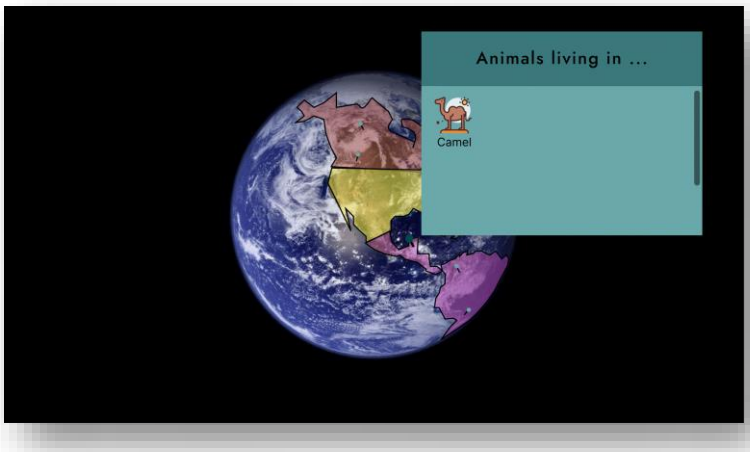

Please rotate your screen

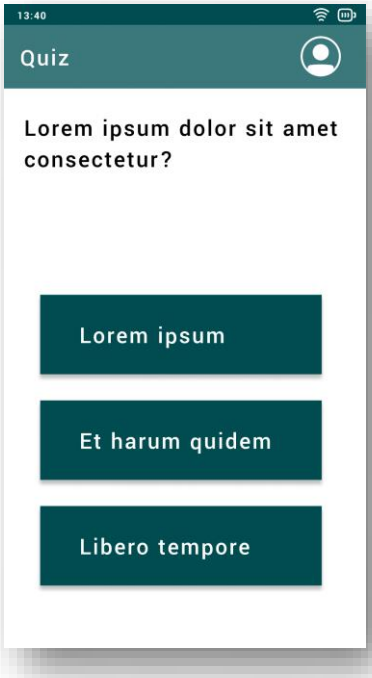

13:40
HoloZoo
GLOBUS MODE
LIST MODE


13:40
Learn - list mode
Instructions
This is how you play this game. Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s,
CONTINUE

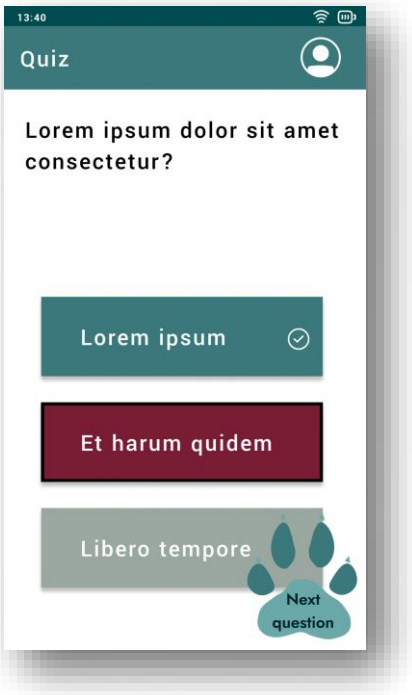

13:40
Learn - globus mode
Instructions
This is how you play this game. Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s,
CONTINUE

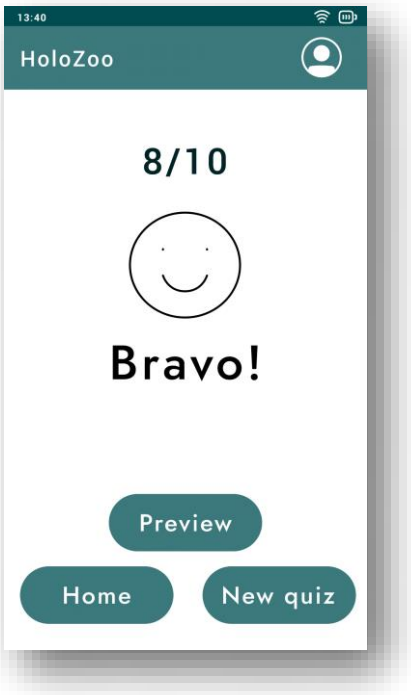

Please rotate your screen

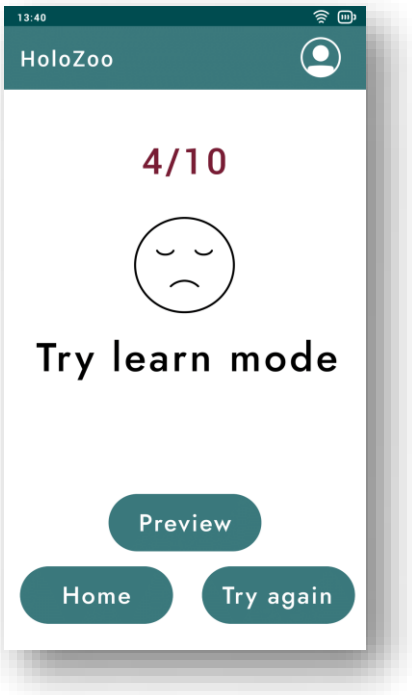

Animals living in ...
Camel

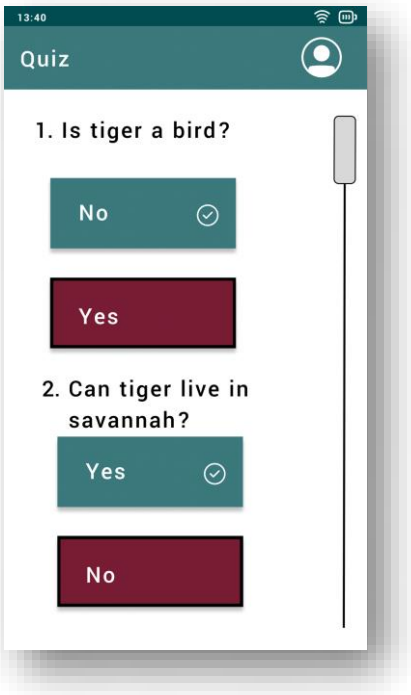

13:40
Quiz
Lorem ipsum dolor sit amet consectetur?
Lorem ipsum
Et harum quidem
Libero tempore

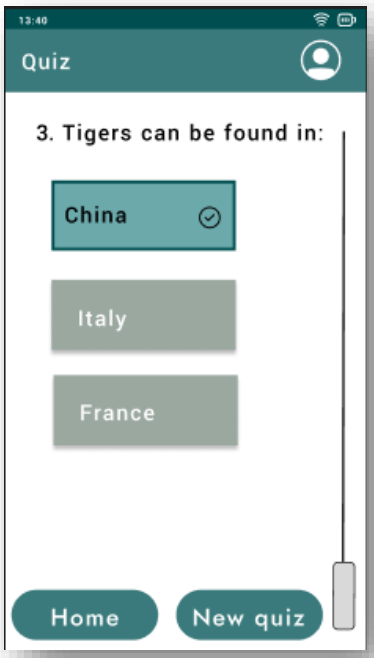

13:40
Quiz
Lorem ipsum dolor sit amet consectetur?
Lorem ipsum
Et harum quidem
Libero tempore
Next question


13:40
Quiz
Lorem ipsum dolor sit amet consectetur?
Lorem ipsum
Et harum quidem
Libero tempore
Next question

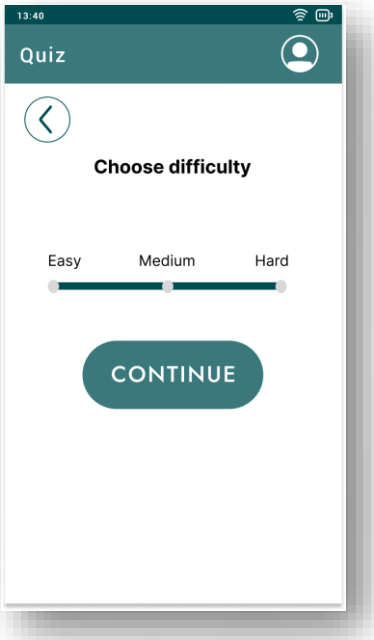

13:40
HoloZoo
8/10
Bravo!
Preview
Home
New quiz

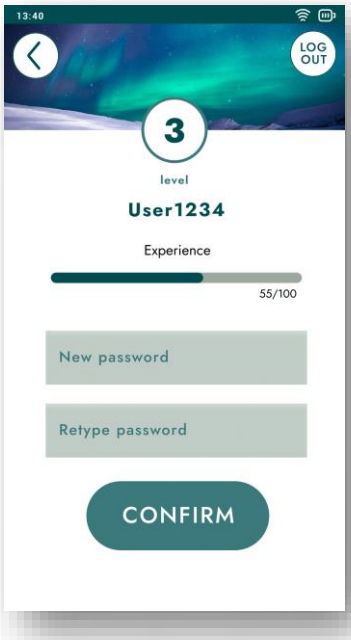

13:40
HoloZoo
4/10
Try learn mode
Preview
Home
Try again

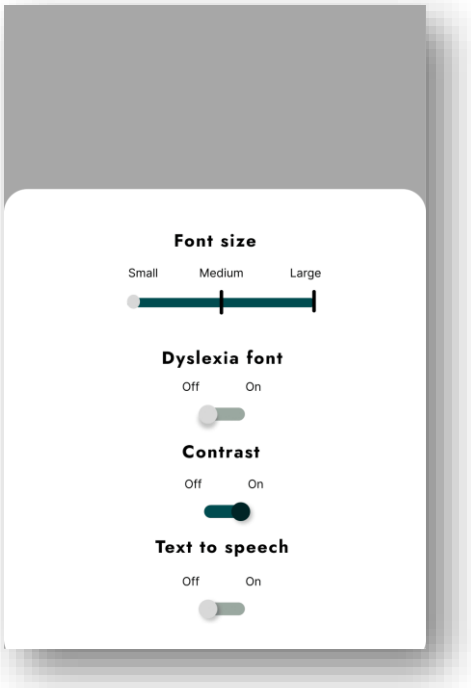

13:40
Quiz
1. Is tiger a bird?
No
Yes
2. Can tiger live in savannah?
Yes
No



Settings screen







Prototype

- https://www.figma.com/file/rJLbA2NsVJnuJF2O5dJ5pY/Play2Green-HoloZoo?type=design&node-id=0%3A1&mode=design&t=DwT7RtuzwjksS0XL-1

UNIVERSAL DESIGN FOR LEARNING ANALYSIS

	ENGAGEMENT	REPRESENTATION	ACTION & EXPRESSION
ACCESS	***Recruiting interest***	***Perception***	***Physical action***
	Holograms Animals	Font adjustment Dyslexia option Voice assistance	Touch-based interaction
BUILD	***Sustaining effort and persistence***	***Language & symbols***	***Expression & communication***
	Progressive animal unblocking	Instruction video Hologram of a 3D model	Choosing the right answer Communication with hologram through touch screen
INTERNALIZE	***Self-regulation***	***Comprehension***	**Executive functions**
	Progressive learning challenges	Textual and video instructions Textual and photographic information	Time management (for quizzes that have limited time)
GOAL: EXPERT LEARNERS WHO ARE	**PURPOSEFUL & MOTIVATED**	**RESOURCEFUL & KNOWLEDGEABLE**	**STRATEGIC & GOAL-ORIENTED**

CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org .

Co-funded by the European Union

ECOMARINE

Ocean Sweeper

Team: Ocean Sweeper

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Project reference: **2022-1-HR01-KA220-HED-000088675**

Version: 4.0

Date: 21st September 2023

Leaders by chapter:

Chapter	Leader
Green education content design	Kouakou Amani
Game design	Ana Radović
Emerging technology analysis	Kouakou Amani
Visuals	Beatriz Mascarós Núñez
Universal design for learning analysis	Tena Živković

GREEN EDUCATION CONTENT DESIGN

Keywords

Ocean pollution, recycling, animal rescue and cleaning the ocean.

Concepts

Rescuing endangered species from the ocean: we will help the endangered animals within the game by, for example, taking off a plastic wrap from a turtle's neck.

Cleaning oil spills in the ocean: while sailing through the ocean, somewhere will be placed an oil spill which the player should clean up with the tools provided.

Recycling the collected trash from the ocean: after the initial gameplay, the player will have the option to put the collected trash into the right bins to recycle it for further use.

Fun facts

Fun fact	Reference
The 5 most common items found in coastal cleanups around the world are all single-use plastics	https://www.rubicon.com/blog/ocean-pollution-facts/
Ocean pollution kills more than one million sea birds each year	https://www.rubicon.com/blog/ocean-pollution-facts/

Oil spills only contribute to 12% of the oil in the ocean. 36% of the oil comes from runoff sources from cities and companies. Except for oil spills 32% of ocean polution are cigarettes and filters, 9% are food wrappers and containers, 8% are caps and lids, tableware makes up 6% as well as plastic bottles, and plastic bags 5%.	https://www.rubicon.com/blog/ocean-pollution-facts/

500 marine locations are now recorded as dead zones globally, currently the size of the United Kingdom's surface (245,000 km²)	https://www.condorferries.co.uk/marine-ocean-pollution-statistics-facts#:~:text=100%20million%20marine%20animals%20die,by%20North%20Pacific%20fish%20yearly
In terms of plastic, 8.3 million tons are discarded in the sea yearly. Of which, 236,000 are ingestible microplastics that marine creatures mistake for food.	https://www.condorferries.co.uk/marine-ocean-pollution-statistics-facts#:~:text=100%20million%20marine%20animals%20die,by%20North%20Pacific%20fish%20yearly

China is ranked #1 for mismanaged waste and plastics. However, the US is in the top 20 with a more significant waste per person contributions.	https://www.condorferries.co.uk/marine-ocean-pollution-statistics-facts#:~:text=100%20million%20marine%20animals%20die,by%20North%20Pacific%20fish%20yearly
There is more microplastic in the ocean than there are stars in the Milky Way.	https://www.conserve-energy-future.com/various-ocean-pollution-facts.php
When plastic eventually degrades, which is around 400 years for most plastic, the process releases	https://www.conserve-energy-future.com/various-ocean-pollution-facts.php

chemicals that further contaminate the sea.	
More than 50 percent of sea turtles have consumed plastic. This causes them to either block their intestines and make them unable to feed and slowly starve to death. In some cases the plastic ruptures their internal organs, and some who are considered "lucky" have a stunt in their	https://passportocean.com/2017/11/20/15-shocking-facts-ocean-pollution/ https://www.worldwildlife.org/stories/what-do-sea-turtles-eat-unfortunately-plastic-bags#:~:text=Sharp%20plastics%20can%20rupture%20internal,lead%20to%20slow%20reproduction%20rates

growth because of the blockages and chemicals consumed which later leads to slow reproduction rates.	
An estimated 50-70 percent of all life on Earth is found under the oceans. And we are polluting sea, reducing life expectancy of the sea animals.	https://genv.org/marine-life/

Learning outcomes

- **Environmental Awareness**: Players will gain a deeper understanding of the challenges facing our oceans, including pollution, overfishing, and habitat destruction, fostering a sense of environmental responsibility.

- **Problem-Solving Skills**: Through tackling pollution challenges and engaging with communities, players will develop problem-solving skills to find creative solutions to real-world environmental issues.
- **Sustainability Education**: The game will educate players on sustainable practices, such as responsible fishing and plastic waste reduction, empowering them to make eco-friendly choices in their lives.
- **Community Engagement**: Players will learn the importance of community involvement in environmental conservation and how collective action can drive positive change.

GAME DESIGN

Title

EcoMarine

Genre

3D open world first person adventure game based on point and click and hand controls

Tagline

A motion to clean the ocean!

Number of players

1 player

Target platforms

Windows, Linux, MacOS, Oculus RIFT

Storyline

The lighthouse keeper has always lived in the lighthouse. His mother was a marine biologist, and his father a lighthouse keeper before him. They always shared their passion for marine

life and the depths of the ocean and have instilled it in their son. A tragic boating accident left him an orphan in the lighthouse, and he had to fend for himself and carry out his parents' legacy. The events that occurred made him a cold and guarded man with a soft spot only left for the creatures of the deep blue sea. In his quests to better marine life and save the oceans he has encountered many characters, some of them bad and some of them sharing his interests in saving the ocean. On his latest quest he gets the opportunity to work with a renowned ocean cleanup center, famous for their research in improving sea life. Coming to the center he meets a scientist with whom he starts opening up and enjoying human company and working with others. This scientist starts his journey and sends a lot of her friends and colleagues to help him in his tasks, however along the way there are always many things that can go wrong and there are a lot of enemies who want to stop him in his tracks.

Characters

Name		LIGHTHOUSE KEEPER
Physical attributes	**Age**	60 years old
	Gender	Male
	Height	1.70m
	Body type	Tall and muscley
	Distinguishing features	White beard and scar in the eye which he got in the boating accident. He has an anchor tattoo in the left arm.
Backstory	He has lived since he was little in the lighthouse with his parents. His dad was a member of the navy and a lighthouse keeper before him and has taught him everything he knows about marine life and how to be a great seaman. His mom was a marine biologist and has instilled in him a passion for the ocean and the creatures that inhabit it. Since he was a young boy he felt more connected to the animals in the depths of the sea than his peers. Both have always helped marine animals from oil spills, plastics and other types of trash in the sea, and have encouraged their son to follow in their footsteps.	

Personality traits	He lives alone so whenever he meets a new person, he is rude and doesn't want to talk. However, if you show that you are concerned about marine life, he will be pleased to share his knowledge with you.
Abilities and skills	Great fisherman, and very intelligent. He knows a lot and wants to learn more and more, as well as educate the masses or anyone interested. He has the ability to raise awareness among anyone about the harm to marine species.
Role and function	He is a protagonist. He needs to give instructions to the player about how to clean the sea and win the game. He speaks with other characters to give information to our player.
Relationships	The only people he loved were his parents, his mother a marine biologist and his father the keeper of the lighthouse. They passed away in a tragic boating accident while they were researching marine life and came upon an oil spill which they wanted to subside, since then all he wanted was to carry on their legacy. His allies are the people who want to help the sea and learn more about it and the life it contains. His enemy is anyone who does not want to help the sea and further endangers the species in it. Some of them are oil riggers who are at fault for a portion of oil spills, as well as tankers.
Arc and development	If you complete all the different tasks, this character will be happier and will come to trust you. At first, he is very introverted and unkind, unwilling to help and is set to do his task as he thinks is right, does not want any help from anyone, as the tasks progress, he is becoming more open and friendly, and makes friends along the way.

Name		SCIENTIST
Physical attributes	**Age**	30 years old
	Gender	Female

	Height	1.65 m
	Body type	Skinny and strong
	Distinguishing features	Long hair, glasses and freckles
Backstory	She is passionate about the marine world. She studied biotechnology at one of the best universities in the world. She moved to this town in search of answers to a study she is conducting on marine species and their extinction.	
Personality traits	She is very sociable and loves to talk, especially about marine life. She is very curious and intelligent, always looking for a solution to any problem that arises. She is an informative character; she won't speak directly to the player, but use her accomplices to guide you.	
Abilities and skills	This scientist will have a clue in order to solve some mysteries of the game. Her biggest virtue is her knowledge, she can identify an illness of an animal just by having a quick glance, she can predict where the next oil spill, or a accumulation of trash will be.	
Role and function	She won't interactant with the player in the means that she will be part of his entourage. The player has to find her as she is an NPC (non playable character) who is there only for clarification of the tasks and education on the green topic which this game provides. She is a supporting character; she will help the protagonist find other characters who will then share the knowledge she has given them.	
Relationships	She does not have any enemies, as this character is there for the purpose of education and furthering the storyline. She has many allies, and all of them want to help with the extinction of sea pollution, they are placed in various places within the game to keep track of the storyline as well as give the protagonist further clues, hints and facts about the theme.	

Arc and development	This character does not develop, as she is only in the beginning part of the gameplay. She just helps to evolve the player's game and helps her allies gain knowledge throughout the scenes.

Dialogs

<LOCATION (Ocean Cleanup Center)>
Context: The lighthouse keeper has arrived at an Ocean Cleanup Center. This center is a place where a scientist works who is very passionate about marine life and cleaning up the ocean. The facilities include a research lab where tests are performed on the water quality and information is gathered from all around the world daily to get the statistics of the ocean life, sightings of endangered species, etc. There is also a recovery center where they bring sick and hurt animals and nurse them back to health and return them to the wild if possible, those who do not have this luxury are kept in a safe and comfortable environment within the cleanup center and are frequently visited by outside people, and tended to by volunteers. The center provides classes to educate anyone willing about the importance of ocean cleanups, and how to achieve this and where and how to help. Within this cleanup center the lighthouse keeper meets the scientist who specializes in marine pollution research. They discuss the impact of plastic waste on marine life and the importance of ocean conservation.

Character 1 (Lighthouse keeper):
"Hello, I've heard a lot about this Ocean Cleanup Center and want to be involved. My life's mission is to clean the ocean. How does plastic pollution affect marine life?"

Character 2 (Scientist):
"Welcome! Plastic pollution poses a significant threat to marine life. It can entangle and suffocate marine animals, disrupt their habitats, and even enter the food chain."

Character 1:
"It's heartbreaking to see how our actions harm these creatures. And so it is seeing nobody helping to solve this

problem. I’m fed up! How could I help to mitigate the damage?"

Character 2:
"Just keep calm, with good words and communication we can reach many people. To mitigate it, prevention is key. We must reduce plastic consumption, recycle diligently, and support initiatives that promote eco-friendly alternatives. Also, cleaning up existing waste is crucial."

Character 1:
"I'm doing my best to clean up the ocean, but it feels like an endless task. Will our efforts make a difference?"

Character 2:
"Absolutely! Every piece of trash you remove makes a positive impact. It sets an example for others and helps create a healthier environment for marine life. Together, we can make a significant change."

Character 1:
"I'm glad to hear that, now I’m more relaxed. How can I raise awareness and get others involved in ocean conservation?"

Character 2:
"Engaging with local communities is essential. Organize beach clean-ups, give talks about the impact of pollution, and share your experiences. Encourage others to adopt sustainable practices and inspire them to protect our oceans."

Character 1:
"I'll do just that. Thank you for your guidance and for dedicating your work to preserving our marine ecosystems."

Character 2:
"You're welcome! It's a collective effort, and we appreciate your commitment. Together, we can safeguard the beauty of the oceans and the countless lives that depend on them."

Character 1:
"I'm motivated more than ever. I'll continue my journey and spread the message. Thank you again!"

Character 2:

"Good luck on your journey, and remember, every small action counts. Let's make a difference, one step at a time."

Game mechanics

Objectives

- Goal: Clean up the designated area of the ocean to restore its health and beauty.
- Objective 1: Free marine creatures from pollution and help them return to their natural habitats.
- Objective 2: Educate local communities and inspire them to adopt sustainable practices for ocean conservation.

Rules

- Time Limit: Players have a limited amount of time to complete the tasks and clean up the area.
- Pollution Tolerance: If the pollution level in the area exceeds a certain threshold, the game ends.
- Limited Resources: Players have a limited number of tools, equipment, and energy to perform tasks.
- Health Management: The lighthouse keeper has a health bar that depletes if they encounter hazardous materials without proper gear on or fail certain tasks.
- Sustainable Actions: Players are encouraged to perform actions that promote sustainability and avoid actions that harm the environment.

Actions

- Collect and dispose of floating debris and pollutants.
- Untangle marine creatures trapped in plastic or nets.
- Repair and restore damaged coral reefs.
- Interact with local communities to raise awareness and educate about ocean conservation.
- Participate in beach clean-ups and recycling efforts.

Resources

- Cleanup Tools: Nets, grabbers, and specialized equipment to collect and remove debris.
- Energy: Use energy reserves to perform actions and complete tasks.
- Environmental Data: Access to real-time pollution data, maps, and information about marine life.

Challenges

- Hazardous Waste: Navigate around toxic materials without depleting health.
- Tricky Pollution Spots: Some pollution may be hidden or challenging to reach, requiring problem-solving skills.
- Time Pressure: Complete tasks within the allotted time, prioritizing actions effectively.
- Uncooperative Weather: Dealing with storms or turbulent waves that affect visibility and movement.
- Engaging with Skeptical Communities: Overcoming resistance or apathy to change in the local communities.

Progression

- Unlock New Areas: As players complete objectives, they gain access to previously locked areas with different challenges.
- Upgrade Tools: Players can unlock and upgrade more efficient and specialized tools for better cleanup and restoration.
- Community Support: As players educate and inspire local communities, they gain support and resources for future tasks.
- Environmental Achievements: Earn achievements for significant milestones or contributions to ocean conservation.
- Knowledge and Skill Development: Increase the lighthouse keeper's knowledge about marine life, pollution, and sustainable practices as the game progresses.

Feedback

- The NPCs within the game provides feedback after the initial clue or hint they give, meaning if you do the next move correctly you will get an accompanying message of approval, however if you've made the wrong move the messages will help guide you in the right direction
- For every right turn a sound will play which confirms your choice, however if you stray from the path the music will slowly start decreasing so you get the feeling of distancing yourself from the correct path
- Pollution Meter : A visual indicator of pollution levels in the game world, providing immediate feedback on the environmental impact of the player's actions.
- Task Completion Messages : When players complete tasks, they receive messages that highlight the positive changes they've made, reinforcing their impact on the virtual ecosystem.
- Environmental Data : Access to real-time pollution data and information about marine life, educating players about the consequences of pollution and the benefits of conservation.

Rewards

- Eco Points : Players earn points for each task completed and sustainable action taken. These points can be used to unlock new areas, tools, and equipment.
- Achievements : Unlockable achievements for reaching milestones like cleaning a certain amount of ocean, organizing successful community events, or achieving specific conservation goals.
- Virtual Aquarium : Players can build and customize a virtual aquarium that reflects the health of the ocean they're helping to restore, providing a tangible representation of their progress.

Interactions

- The player will be able to have a dialog with the NPCs by predetermined messages set by his/her choices
- There will be parts of the map with which the player can collide with, items to pickup or relocate within the map, the player will be able to pet the animals
- Interactions with NPCs include conversations with scientists, local community members, and other environmental activists, providing valuable information and guidance.
- Cooperative Play: In multiplayer mode, players can collaborate on cleanup efforts, share resources, and collectively work towards conservation goals.
- Environmental Interactions : Players can interact with the game world by cleaning up debris, releasing marine life, and restoring damaged habitats, reinforcing the connection between their actions and environmental impact.

Difficulty

The game will feature a progressive difficulty curve :

Early levels serve as tutorials, introducing players to basic tasks and concepts.

As players progress, challenges become more complex, requiring advanced problem-solving and multitasking skills.

Environmental conditions like storms and pollution levels become more unpredictable, adding an element of randomness and challenge.

The game's difficulty adjusts based on the player's performance to maintain engagement without becoming too frustrating.

Optional side quests and community engagement activities allow players to choose their level of involvement, providing flexibility in difficulty and gameplay style.

EMERGING TECHNOLOGY ANALYSIS

Emerging technology

For our game we will be using virtual reality to make the experience more immersive and for the player to feel like he really is cleaning the ocean whilst playing.

Proposed gaming experience

To enhance the gaming experience in "Ocean Sweeper VR," virtual reality technology will be incorporated. Players will immerse themselves in a realistic and immersive 3D environment, allowing them to navigate the ocean as the old lighthouse keeper, interacting with the marine ecosystem and tackling pollution challenges firsthand.

In VR, players will have a first-person perspective, enabling them to explore the vast ocean, spot pollution hotspots, and engage in cleanup activities. The game will utilize the motion-tracking capabilities of VR controllers, allowing players to physically reach out, pick up trash, untangle marine creatures, and perform various environmental tasks through intuitive point-and-click interactions.

The visuals in VR will be highly detailed, depicting a vibrant and diverse underwater world, displaying the beauty of marine life and the devastating effects of pollution. Realistic sound effects will accompany the experience, creating an immersive audio environment with underwater ambiance, animal sounds, and oceanic dynamics.

Feasibility assessment

- Hardware: The game will require VR hardware such as headsets (e.g., Oculus Rift, HTC Vive) and motion-tracked controllers, enabling players to interact with the virtual environment. These hardware components have been available in the consumer market for some time, making them accessible to a wide range of players.
- Software: The development of the game will involve VR development tools and game engines, such as Unity or Unreal Engine, to create the virtual environment, implement interactive elements, and ensure smooth gameplay. These widely used tools offer

extensive support and resources for VR development. Blender will also be used for 3D modeling.

- Plugins and Tools: Various plugins and tools specific to VR development will be utilized, such as VR interaction frameworks or physics engines, to enhance the realism and interactivity of the game. These tools are often well-documented and readily available for integration into VR projects.
- Frameworks: Existing frameworks and libraries for game development, such as SteamVR, Oculus SDK, or OpenVR will be utilized to streamline the integration of VR hardware and ensure compatibility with different VR platforms. These frameworks provide APIs and guidelines for implementing VR features.

VISUALS

Logo

For our logo, we wanted it to have all the main color of our game. Therefore, we have:

- **blue** as the main theme of our game is ocean

- **green** for the plants and animals as the turtle, one of the most affected animals by the amount of plastic in the ocean

- **yellow** to represent all the trash in ocean and that we will need to collect in the game

- we also add some drops in **black** to represent the oil spills in the sea

Color scheme

Blue, Green, Yellow. The color palette is:

Screenshots

Entering the game

Main menu screen

Tutorial screens

Action screens

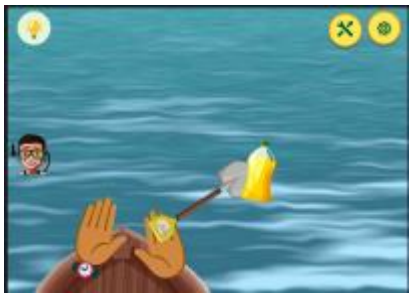
Decreasing difficulty by losing time constraints 

Hints

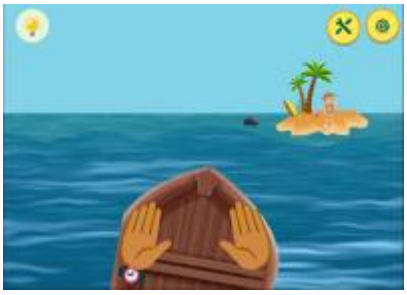
Directional arrows 

Increasing difficulty does not highlight the trash 

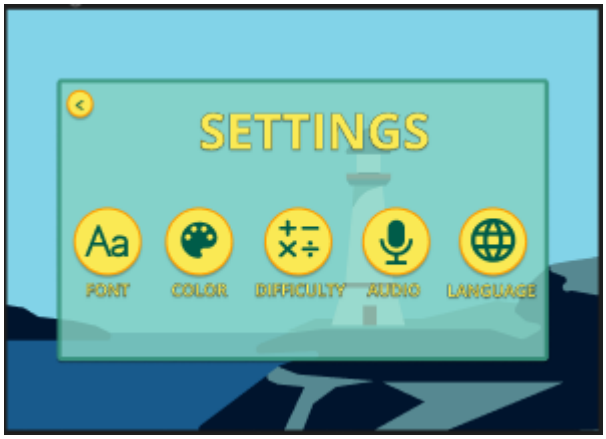
Tool selection



Gameplay



Settings screen



Prototype

1. https://www.figma.com/file/MU7HGNmOAXTsrWGq5mlq7n/EcoMarine?type=design&node-id=7-182&mode=design&t=2kvfQxGimzt9XZfd-0

UNIVERSAL DESIGN FOR LEARNING ANALYSIS

	ENGAGEMENT	REPRESENTATION	ACTION & EXPRESSION
ACCESS	***Recruiting interest***	***Perception***	***Physical action***
	Customization of colors and contrast **Customization of level difficulty** Customization of language Ability to highlight tasks Volume adjustment	**Customization of font size and style** Customization of contrast Audio cues Subtitles	Customization of timing task **Customization of hand controls**
BUILD	***Sustaining effort and persistence***	***Language & symbols***	***Expression & communication***
	Displaying the tasks in multiple ways **Customization of level difficulty** Various ways of navigation Encouraging messages after task completion Providing instructions in problems solving	Including images and texts Using simple and concise language **Providing Text-To-Speech** Customization of language	**Providing textual, audio and visual representations** Providing Text-To-Speech
INTERNALIZE	***Self-regulation***	***Comprehension***	**Executive functions**

	Progress bar NPCs for guidance **Motivational tools to avoid frustration (time controller, hints)** Rewarding system	**Including tutorial** Hints provides direction Highlighting important props Gaining more tools with progression to solve tasks Learning facts by completing tasks **Reviewing the success of the player**	Progress bar **NPCs for guidance** Reviewing the success of the player
GOAL: EXPERT LEARNERS WHO ARE	**PURPOSEFUL & MOTIVATED**	**RESOURCEFUL & KNOWLEDGEABLE**	**STRATEGIC & GOAL-ORIENTED**

CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org

Gardenia

Team: Urban Garden (uGreeno)

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Version: 4.0

Date: 20/09/2023

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Project reference: **2022-1-HR01-KA220-HED-000088675**

Leaders by chapter:

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Green education content design	Dorra Jaouad
Game design	Raquel Parcet
Emerging technology analysis	Pap Richárd
Visuals	Raquel Parcet
Universal design for learning analysis	Baldo Valjalo

GREEN EDUCATION CONTENT DESIGN

Keywords

Water Conservation , Recycling, Irrigation Systems, Vertical Gardening

Concepts

Sustainable Planters and Containers: Encourage players to design and 3D print sustainable planters and containers using eco-friendly materials. Showcase different designs that promote water conservation, such as self-watering planters or planters with built-in reservoirs. Highlight how 3D modeling and printing allow for creativity and customization while minimizing environmental impact.

Vertical Gardening Structures: Introduce players to the concept of vertical gardening and its benefits for urban spaces. Allow them to design and create 3D models of vertical garden structures such as living walls, plant towers, or hanging planters. Emphasize how 3D modeling can aid in designing space-efficient and visually appealing vertical gardens.

Efficient Irrigation Systems: Enable players to design and customize 3D models for efficient irrigation systems. They can create 3D models of drip irrigation components, rainwater harvesting systems, or even automated watering systems. Showcase how 3D modeling can help optimize water usage and increase the overall sustainability of the garden.

3D Printed Garden Structures: Teach players about the concept of 3D printing and its applications in urban gardening. Allow them to design and create 3D models of garden structures such as trellises, plant supports, or raised bed frames. Highlight the benefits of using 3D printing technology, such as customization, resource efficiency, and reduced waste.

Fun facts

Fun fact	Reference
Recycling one ton of plastic bottles saves the equivalent energy usage of a two-person household for one year	Roadrunnerwm.com
An average person uses 127% more water than in 1950	WashInnovation.com
Those who grow food in community gardens eat 37.5 percent more fruits and vegetables than those who don't.	Ecowatch.com
Plastic bags can take up to 1,000 years to decompose	Roadrunnerwm.com
Improves the aesthetics of the city by increasing the 'green spaces'	https://swiha.edu/
Vertical gardens act as extra insulation containing a layer of air between the wall and the plants	www.conserve-energy-future.com
VG : you can make use of spaces where you otherwise couldn't grow anything – like on walls and fences.	getbusygardening.
Community gardens can build social connections. Urban gardens bring people together across ages, cultures, and incomes. They provide a space for community building and sharing knowledge.	Ymca.net
Gardens support biodiversity. Urban green spaces, even small ones, allow wildlife to flourish. Gardens provide habitats for birds, bees, and other species	Nationalgeographic.com
Urban farms increase food security. Local urban farms allow cities to grow their own food, providing access to healthy affordable produce. This increases resilience to supply chain issues.	Jhsph.eu

Learning outcomes

- The user understands the benefits of urban gardening, such as increased access to fresh produce, community building, and environmental sustainability.
- Enable players to design rainwater harvesting systems to conserve water. Players can create 3D models of rain barrels, cisterns, or gutters and learn how to calculate optimal water storage.

- Encourage creativity and sustainability by having players repurpose household materials into gardening tools or structures. For example, old plastic bottles can be turned into self-watering planters. Players can learn engineering skills while reducing waste.
- Introduce players to soilless gardening methods like hydroponics and aquaponics. Have them design compact 3D model systems that allow gardening in small spaces. Teach the science behind recirculating water and nutrients.
- The user learns basic engineering and design principles by creating 3D models and structures for gardening, such as irrigation systems, vertical gardens, and rainwater harvesting systems.

GAME DESIGN

Title

Gardenia

Genre

Top-down strategy game

Tagline

Discover the Green Oasis, immerse yourself in the sustainable world and unlock your best gardening skills!

Number of players

1 player, you're the owner of the farm

Target platforms

Android, IOS

Storyline

We are currently in a world in which climate change is a topic that is talked about a lot, with this game we want to raise awareness to people to do their bit and help the world to become something more sustainable.

In this game you will have a small farm-garden in which you will have to achieve some goals to keep growing and get some prizes and gifts.

You will have a mentor who will guide and help you through each level of the game, and with whom you will learn everything you need to know to maintain your garden and be able to implement it in real life as well.

The 3D printing will be implemented as follows: when you meet the objectives that will be proposed to you, as well as the challenges that you will have ahead, you will get rewards, within these rewards are different 3D files that you can download and print at home, these pieces will be about pots, sustainable irrigation systems for your real plants and many more things!

Characters

In this game we don't have many characters, as you're the owner of the farm-garden and the main character, but you'll have a mentor who will help and guide you through the game.

Name	Mentor
Distinguishing features	Expert in orchard farms, pesticides, irrigation, fruits, vegetables, sustainability, fertilizers... He/She has all the necessary knowledge to help you and make you learn everything you need to succeed in your orchard.
Backstory	It doesn't has an important backstory, is a lover of the farm-gardens and he/she wants to spread the knowledge that has acquired with the years.
Personality traits	He/She is a friendly person, willing to help in any way necessary, and who will test you to achieve the goals that will be required of you.
Abilities and skills	Plant care and types, including sustainable practices, efficient watering and soil health management, identifying and handling pests naturally, eco-friendly fertilization and composting, teaching clearly and adapting to challenges, irrigation and watering systems...

Role and function	Mentor of the main character (the player), his/her function is guide you trough the game and make you to learn
Relationships to the Main Character:	Mentor

Game mechanics

Objectives

Goal:

- Restore and transform the urban landscapes into thriving green oases.

Objectives:

- Cultivate a diverse range of plant species to bring life back to the barren soil.
- Manage resources effectively, such as water, sunlight, and nutrients, to ensure optimal plant growth.
- Unlock new gardening skills, tools, and abilities to expand and enhance your garden.

Rules

- Each plant requires specific care and attention. Failure to provide the necessary resources or neglecting a plant's needs may result in stunted growth or even death.
- Resources such as water, sunlight, and nutrients are limited and must be managed efficiently. Overspending or neglecting resource allocation can negatively impact plant growth and overall garden health.
- The health of the garden is constantly under threat from pests, diseases, and environmental factors. Players must proactively identify and address these issues to maintain a flourishing garden.
- Time is a crucial factor in the game. Plants grow and evolve over time, and certain actions may take longer to complete. Managing time effectively is key to maximizing productivity and achieving goals.

- Each garden has a limited amount of space. Players must strategize and plan their plant placements wisely to optimize the use of available land and create a harmonious and visually appealing garden.

Actions

- **Planting:** Players can select and plant a variety of plant species in different areas of the garden. Each plant has specific requirements and contributes to the overall aesthetic and ecological balance of the garden.
- **Watering:** Plants need water to thrive. Players can use watering cans or irrigation systems to provide adequate hydration to their plants. Balancing water usage is important to avoid overwatering or underwatering. In this part, the player can achieve different systems and, if completing the objectives satisfactorily, you can win the 3D model of the watering system and use it in your own plantation.
- **Sunlight Management:** Players can strategically place plants in areas that receive optimal sunlight. They may also use shading structures or moveable objects to protect delicate plants from excessive sunlight or create microclimates. In this part, if the player completes the objectives satisfactorily, you can win the 3D model of the shading system and use it in your own plantation.
- **Nutrient Management:** Players can enrich the soil by applying fertilizers or compost. Managing nutrient levels ensures healthy plant growth and resilience against pests and diseases.
- **Pest Control:** Players can identify and address pest infestations to protect their plants. They may use organic pest control methods, such as companion planting or introducing beneficial insects, to maintain a natural and sustainable garden.
- **Upgrades and Unlockables:** As players progress, they can unlock new gardening tools, equipment, and abilities. These upgrades enhance efficiency, expand the garden area, and provide new options for plant care and maintenance.

- **Quests and Story Progression:** Engaging in quests allows players to uncover the mysteries of EcoGen and progress through the storyline. Completing quests may unlock new areas, features, and knowledge about environmental conservation.
- **Garden Design and Customization:** Players can design and customize their garden, including arranging plants, adding decorative elements, and creating themed areas. This allows for creativity and personalization while maintaining ecological balance.

Resources

- **Seeds:** Players can collect different types of plant seeds, either through exploration, quests, or purchasing. Seeds are the foundation for growing new plants in the garden.
- **Water:** Water is a vital resource for plant growth. Players need to collect and manage water to ensure their plants receive adequate hydration. Water may be obtained from natural sources, rainwater harvesting, or water conservation techniques.
- **Sunlight:** Sunlight is essential for photosynthesis and plant development. Players must strategically position their plants to optimize sunlight exposure or use tools to control the amount of light reaching specific areas of the garden.
- **Nutrients:** Fertilizers, compost, or other organic materials can be obtained or crafted to enrich the soil with essential nutrients. Proper nutrient management enhances plant growth and health.
- **Tools and Equipment:** Players can acquire and utilize various gardening tools and equipment, such as watering cans, spades, pruning shears, or specialized devices. These tools aid in specific gardening tasks and improve efficiency.
- **EcoCoins:** A virtual currency within the game, EcoCoins can be earned through completing quests, selling produce, or achieving milestones. Players can use EcoCoins to purchase seeds, tools, upgrades, or decorative items for their garden.
- **Decorative Items:** Players can collect or purchase decorative items, such as garden ornaments, pathway materials, or furniture, to enhance the visual appeal of their garden and create unique themes.

- **Quest Rewards:** Completing quests and story objectives may provide players with rewards, including special seeds, exclusive items, access to new areas of the game world or even real parts of 3D models for your real gardens.

Managing and utilizing these resources, items, and currency effectively is crucial for making informed decisions, progressing in the game, and nurturing a thriving garden in Gardenia

Challenges

- **Environmental Hazards:** Players must navigate through various environmental hazards, such as polluted areas, toxic substances, or extreme weather conditions. Players also learn how to stop weeds growth. They need to find ways to mitigate or overcome these challenges to protect their plants and maintain a healthy garden.
- **Pests and Diseases:** Players will encounter different pests and diseases that can damage or kill their plants. Identifying the pests, implementing pest control measures, and finding natural solutions to combat diseases become critical tasks.
- **Limited Resources:** Resources like water, sunlight, and nutrients are limited and must be managed wisely. Players must strategize and allocate resources efficiently to ensure the overall health and growth of their garden.
- **Time Management:** Time plays a crucial role in the game. Players need to make timely decisions, considering the growth rates of different plants, completing quests within given timeframes, and attending to time-sensitive tasks.
- **Gardening Expertise:** As players progress, they may face complex gardening challenges that require specific knowledge and skills. These challenges could include advanced plant care, cross-breeding plants for unique traits, or creating specialized microclimates within the garden.
- **Quests and Puzzles:** Engaging in quests and solving puzzles is an integral part of the game's progression. Players may need to solve riddles, find hidden objects, or

complete specific tasks to unlock new areas, obtain rare seeds, or uncover hidden knowledge about EcoGen.

- **Competition:** Players may encounter rival gardeners or organizations that aim to hinder their progress or compete for limited resources. Overcoming these competitors requires strategic planning, efficient resource management, and outperforming them in various gardening competitions.
- **Garden Maintenance:** Regular maintenance tasks, such as pruning, weeding, and irrigation, must be performed to keep the garden in optimal condition. Players must balance these maintenance activities with other tasks to ensure their garden's overall health and beauty.

Progression

- **Experience Points (XP):** Players earn XP for completing tasks, quests, or achieving milestones. Accumulating XP allows players to level up and unlock new abilities, tools, and features.
- **Garden Expansion:** As players progress, they can unlock additional land or garden areas. This expansion provides more space to cultivate a greater variety of plants, create specialized zones, and design intricate landscapes.
- **Skill Tree:** Players can access a skill tree that offers various branches of skills and abilities related to gardening. By spending skill points earned through leveling up or completing specific objectives, players can enhance their gardening expertise, such as unlocking advanced watering techniques, improved pest control, or efficient resource management.
- **Unlockable Plants:** Progression in the game grants access to rare and exotic plant species. Players can unlock these plants by reaching specific milestones, completing quests, or discovering hidden locations. Each new plant introduces unique traits and challenges, further expanding the diversity of the garden.

- **Unlockable Tools and Equipment:** Advancing through the game unlocks new gardening tools and equipment. These tools may provide improved functionality, efficiency, or specialized abilities, empowering players to tackle more complex gardening tasks.
- **Minigames:** Successfully completing these challenges rewards players with valuable resources, exclusive items, and story progression. The three minigames will be:
    - **Sustainable Garden Quiz:** Show off your knowledge of sustainable gardening by asking questions about pesticides, organic fertilizer, and energy-saving methods. If you get the right answers, you'll get rewarded with resources or progress in the game.
    - **Plant Matching Challenge:** Give players a grid of different types of plants. Help them find the perfect plant for their growing conditions and care needs. Increase the difficulty level with more plants to choose from.
    - **Watering Efficiency Race:** Requires you to water your virtual garden in a timely manner. You'll need to figure out where to put your irrigation systems and set up watering schedules to make sure all your plants get the water they need. The aim is to save water while still making sure your plants get the hydration they need.
- **Knowledge and Research:** Progression in the game grants access to new knowledge and research opportunities. Players can uncover information about EcoGen, learn about environmental conservation, and discover new sustainable gardening techniques. This knowledge enhances their understanding of the game world and offers advantages in their gardening endeavors.
- **3D Models:** through the game, some parts of the tools and equipment's that the player can unlock, he/she also will achieve a 3D model of the unlocked prize, to implement the knowledge that you acquire in the game in real life.

Feedback

The feedback system in this game works with the figure of the mentor, he will guide you through the game and will be the one who gives you the advice you need, or the one that would explain to you what's your next goal or your next mission. He/She will also encourage you and teach you all you need to know about gardening and sustainability, in order to achieve more experience points and go to the next level of the game.

Rewards

- **Experience points XP:** these are the points that help you to go to the next level and keep improving, the higher the level, the more difficulty.
- **EcoCoins:** this is the currency of the game; you will win these coins solving the minigames or having success in the different missions or objectives your mentor proposes you.
- **3D Models:** in the rewards sections, you will find different 3D models, you can download them and print it on your own 3D printer, the way you win these awards comes in the minigames, successfully solving them, the models go from irrigation systems to decorative pieces to your plants.
- **Unlockable elements:** plants, tools, irrigation systems, sunlight systems, nutrients, pesticides... All the elements you can unlock in the game because of your successes, even the buildings, as you must unlock all of them to go to the next city.

Interactions

- **Mentor:** you interact with him/her in the way of dialogues, he/she would encourage you to improve your skills.

- **Actions:** you have many sections to interact with, from planting and seeding where you unlock different plants and seeds, to the quest part where you can play minigames to win rewards and XP.
- **Shop:** where you can spend your EcoCoins to improve your city and your roof-gardens.

Difficulty

The difficulty of this game goes in progression, level 1 is the easiest, and as you advance in levels the difficulty increases, with plants that need more help, more complex irrigation systems, games with a higher difficulty... Your mentor will help you a little less each time, so that you can demonstrate what you have learned through the different levels, this way you will be aware of the progression you have made and how much you have improved your gardening skills and your knowledge of sustainability.

EMERGING TECHNOLOGY ANALYSIS

Emerging technology

Relevance to Gardenia:

The integration of 3D printing technology in Gardenia is crucial in promoting sustainability and environmental consciousness within the game. By incorporating real-life 3D printing, players can extend their engagement beyond the virtual world and actively contribute to the preservation and creation of urban green spaces.

Integration Process:

a. Game Mechanics: Gardenia features gameplay mechanics where players can design and construct their virtual gardens and urban landscapes. The game provides a user-friendly interface that allows players to create unique 3D models of structures, and decorative elements from previously created building blocks by the developers.

b. Collectible Parts: As players progress in the game and achieve specific milestones or complete challenging quests, they unlock collectible parts. These parts represent rare or unique elements that can enhance the aesthetics or functionality of their virtual gardens.

c. Preparing for Printing: When players acquire collectible parts, they have the option to export the 3D model files of those parts. The game provides a streamlined process to convert the digital models into printable files, ensuring compatibility with common 3D printing software and hardware.

d. Real-Life Printing: Players can choose to 3D print the collectible parts they have acquired within the game. They can use their own 3D printers or opt for printing services available locally or online. The physical objects can be made from eco-friendly materials, further emphasizing the game's environmental theme.

e. Physical Integration: Once the collectible parts are printed, players can incorporate them into their physical gardens, display them as decorative elements, or use them to enhance their real-life green spaces. This integration creates a seamless connection between the virtual and physical worlds.

Benefits of 3D Printing in Gardenia:

a. Tangible Rewards: By allowing players to 3D print collectible parts, Gardenia provides tangible rewards for their in-game achievements, fostering a sense of accomplishment and pride.

b. Real-Life Impact: The integration of 3D printing encourages players to engage with their surroundings, promoting environmental awareness and inspiring them to create and maintain green spaces in their communities.

c. Customization and Personalization: 3D printing enables players to customize their physical gardens by incorporating unique elements that reflect their creativity and individuality.

Challenges and Limitations:

a. Accessibility: The availability of 3D printing technology may vary among players, posing a challenge for those without access to a 3D printer or local printing services.

b. Cost and Complexity: 3D printing can involve costs related to printers, materials, and post-processing. The complexity of the printing process and the learning curve associated with 3D modeling software may also present challenges for some players.

Proposed gaming experience

In the game, 3d printing will serve as a central mechanics. The use of 3d printing will let players to bring their virtual designs made in the game to life by transforming them into hand holdable physical objects. The implementation of this looks like the following: the game will provide an interface with predefined 3d models and the players can choose from these 3d models and they can use them as building blocks by combining, and assembling them in creative ways. The modular models will provide flexibility and serve as an encouragement to the players to experiment with combinations of these. After the players put their structure together from the building blocks, they can export it to be sliced and 3d printed. With this the players will allow the players to witness how the results of their design choose either if was good or bad. The game shouldn't let players to 3d print now working designs. In the game, there will be educational elements that will be highlighting the benefits and applications of 3D printing in urban gardening. Players will learn about the advantages of customization, resource efficiency, and reduced waste that 3D printing technology offers. The game encourages players to explore innovative solutions for sustainable gardening practices and will be raising creativity, problem-solving, and awareness of the potential of 3D printing. The players can enjoy a rare gaming experience by bringing their ideas to their hands and can get knowledge about 3d printing use in the real world and in urban gardening.

Feasibility assessment

3D Modeling Software: Software such as Blender, or Autodesk Fusion 360 is needed for designing the virtual planters, containers, and garden structures within the game. These tools allow for the creation of 3D models with precise measurements.

Slicing Software: Slicing software is required to prepare the 3D models for printing. It generates the instructions and code necessary for the 3D printer to accurately reproduce the virtual designs in physical form.

3D Model Libraries: Utilizing 3D modeling libraries like Open3D or Three.js can enhance the capabilities of the game in terms of rendering, visualization, and manipulation of the 3D models.

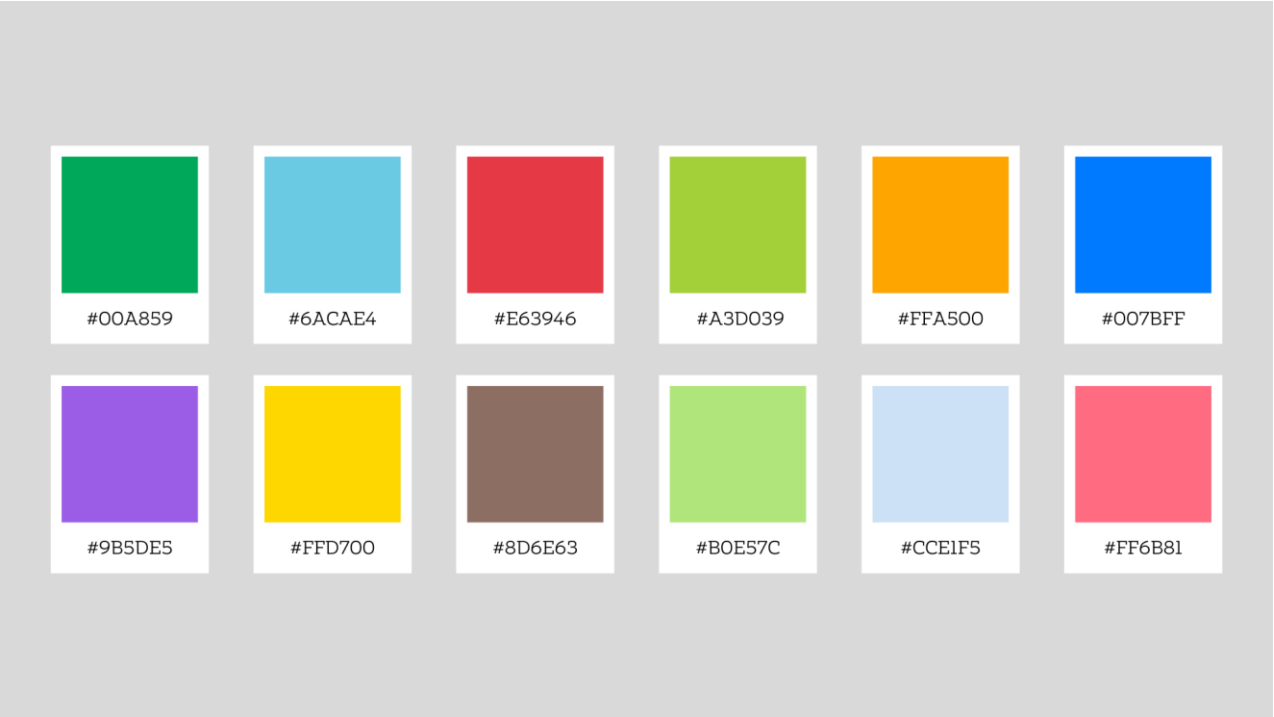
VISUALS

Logo

The idea for the logo came from the desire to represent the gardens, their growth thanks to irrigation systems (a topic that we will give prominence in our game) and the sustainability that we try to raise awareness with this game. This logo represents a seed growing, as will your seedlings if you work in your garden-farm in the right way.

For the creation of the logo we used the tool “Canva” and "Inkscape", which is a vector graphic design program, similar to Adobe Illustrator, but in a free version and a little more intuitive.

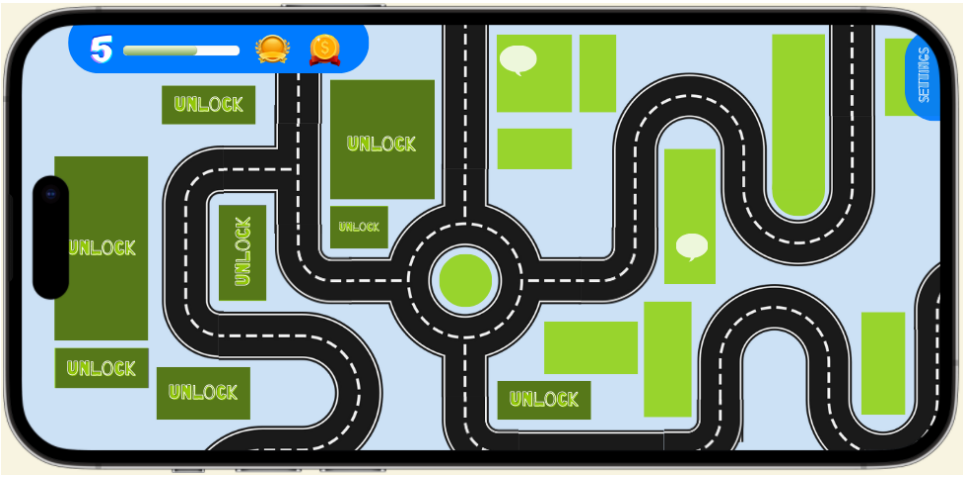
Color scheme



Our color palette is all about vibrant colors to represent the vegetables that will grow in your garden, as well as greenish and bluish colors that we think work well with the concept of sustainability.

Screenshots

Main menu screen



Action screens


5
ACTIONS
PLANTING
WATERING
SUNLIGHT
NUTRIENT
PESTICIDE
PEST CONTROL
QUEST
UPGRADES
CUSTOMIZATION
SETTINGS
MY RESOURCES
SHOP
ACTIONS


5
PLANTING
TOMATO
CARROT
POTATO
UNLOCK
GREEN BEANS
UNLOCK
STRAWBERRIES
ORANGE
UNLOCK
GERANIUM
PETUNIA
SETTINGS
MY RESOURCES
SHOP
ACTIONS


5
MY RESOURCES
SEEDS
WATER
SUNLIGHT
NUTRIENTS
TOOLS
ECO-COINS
DECORATION
REWARDS
SETTINGS
MY RESOURCES
SHOP
ACTIONS

Settings screen

Prototype

Figma with 2 connected screens:

https://www.figma.com/file/RXZd2aFAzotStyHgNQE5g8/Gardenia?type=design&node-id=0%3A1&mode=design&t=x5N8LMxJQddJidgz-1

Figma with 5 connected screens:

https://www.figma.com/file/RXZd2aFAzotStyHgNQE5g8/Gardenia?type=design&node-id=0%3A1&mode=design&t=H22R3U3jjZdg5FW8-1

UNIVERSAL DESIGN FOR LEARNING ANALYSIS

	ENGAGEMENT	REPRESENTATION	ACTION & EXPRESSION
ACCESS	***Recruiting interest***	***Perception***	***Physical action***
	Notifications of the game, for example: "I'm drying out, please can you water me?" "The fruits are ready, can you come to pick them?"	The visual of our game is from the top of a city, showcasing the urban gardens on top of the roofs. Even without knowledge of the language, players can recognize the gameplay and act as expected thanks to the visual representations of all tools and pointers on their urban gardens.	This game the physical action you must do is just with your hands, navigating through the different screens. It also motivates people to work with 3D models of tools to set up and upkeep their own garden. The players are rewarded with these 3D models to print their tools and use them in real life with simple instructions.
BUILD	***Sustaining effort and persistence***	***Language & symbols***	***Expression & communication***
	The goal of the game is to learn about the journey of the plant from seed the final crop and reward the player at each step of the plant e.g., successful seeding, first leaves, first flowers etc.	English Every element (tools, plants, gardens, needs) are represented with lifelike cartoonized representations so even without the knowledge of the language, the player can conclude, and even learn through the gameplay more words.	In this game, you will have a mentor that is going to guide you and communicate with you, to know how to play and make you learn everything you'll need to have the best urban garden.

	Self-regulation	*Comprehension*	Executive functions
INTERNALIZE	The players will get notifications when their plant needs attention, and they will get better paid for better quality crops to get them motivated to be more aware about the game (if the player did not water crops every time when needed, crop-to-product ratio is bad).	The look of the plant's changes depending on the state of the plant's health, e.g., the plants will go bad after the player does not take care of them accordingly, and if that continues for a longer period the plants die.	Display the graphical statistic on general score of the player (all crops together, EcoCoins earned, etc.), and for each crop individually.
GOAL: EXPERT LEARNERS WHO ARE	**PURPOSEFUL & MOTIVATED**	**RESOURCEFUL & KNOWLEDGEABLE**	**STRATEGIC & GOAL-ORIENTED**

CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org

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Resurgence of Egalwaspassiert

Team: Inclusive Eco-Fighter

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Project reference: **2022-1-HR01-KA220-HED-000088675**

Leaders by chapter:

Chapter	Leader
Green education content design	Sergio Puchades
Game design	Bakhomious Basta
Emerging technology analysis	Lucia Crvelin
Visuals	Kristina Rukavina
Universal design for learning analysis	Erik Kranjec

GREEN EDUCATION CONTENT DESIGN

Keywords

Equality. Inclusive. Recycle. Communal.

Concepts

Reusable plastic. In our game we want to use our enemy (the trash as plastic) to create new things and recycle.

Recycle. It is the center of the game; our mission is to clean the city and make a massive movement to change the knowledge of recycling.

Fun facts

Fun fact	**Reference**
The average person creates almost five pounds of trash per day, and in 2018, American consumers created 146.2	https://recyclingpartnership.org/communitiesforrecycling/16-fun-recycling-facts-for-kids/

million tonnes of trash that ended up in landfills.	
Recycling helps save energy. If you recycle one glass bottle, it saves enough energy to light a 100-watt bulb for four hours, power a computer for 30 minutes, or a television for 20 minutes.	https://recyclingpartnership.org/communitiesforrecycling/16-fun-recycling-facts-for-kids/
Recycling can make one person's trash another person's treasure! One metric ton of electronic scrap from personal computers contains more gold than that recovered from 17 tonnes of gold ore.	https://recyclingpartnership.org/communitiesforrecycling/16-fun-recycling-facts-for-kids/
What happens to recycled plastic containers? They can be used to make new plastic containers, but it does not stop there. Recycled plastic can also be used in creating other things like cell phone cases, playground equipment, clothes, and rugs.	https://recyclingpartnership.org/communitiesforrecycling/16-fun-recycling-facts-for-kids/
In 2010, paper recycling had increased over 89% since 1990.	dosomething.org/us/facts/11-facts-about-recycling
Brazil recycles more than 98% of its aluminum, while Japan recycles just over 82%, but it is Finland and Germany who are world-leaders, recycling an incredible 99% of their aluminum waste.	https://www.recyclingbins.co.uk/recycling-facts/

Recycling just one tonne of aluminum saves up to 9 tonnes of CO2 emissions.	https://www.recyclingbins.co.uk/recycling-facts/
55% of the fiber used by the European Paper Industry comes from recycled paper.	https://www.recyclingbins.co.uk/recycling-facts/
By recycling 100 aluminum cans, enough energy is saved to light up an entire bedroom for 14 days! And if you do not recycle those cans, they can stay in that form for 500 years!	https://www.metrorecycling.net/post/aluminum-can-recycling-facts

Learning outcomes

- The importance of recycling
- How to recycle efficiently
- How to improve your city
- How to improve your city while improving the world
- Understand that it does not matter where you come from when it comes to saving the planet

GAME DESIGN

Title

Resurgence of Egalwaspassiert

Genre

RPG (Role Playing Game), Adventure

Tagline

Egalwaspassiert, it needs to be saved.

Number of players

Single Player

Target platforms

Windows

Storyline

In the quaint town of Egalwaspassiert, a young and ambitious entrepreneur named Alex had a bold vision. Driven by innovation and a desire to make a positive impact on the environment, Alex's plan was to establish a plastic recycling factory in this town. Egalwaspassiert happened to have one of the lowest rates of plastic recycling in its region, and the evidence of plastic waste was starkly visible as one strolled through its streets.

However, Egalwaspassiert was not just any ordinary town. It had long been a conundrum for policymakers due to its peculiar practices that segregated the workforce based on gender, age, and ability. In the northern part of town, only men were engaged in the workforce. In the southern part, only women were involved in labor. In the western part, children carried the burden of work, and in the eastern part, individuals over the age of 62 were exclusively employed. Furthermore, people with disabilities face confinement and limited opportunities.

Recognizing the need for change and the potential for substantial grants, Alex saw an opportunity to not only establish a successful recycling factory but also address the social issues in Egalwaspassiert.

In this ambitious endeavor, Alex was not alone. With the help of an advanced AI assistant called EVA (Entrepreneurial Virtual Assistant), Alex's path to success was paved with enhanced efficiency and informed decision-making.

EVA, short for Environmental Virtual Assistant, was an AI designed specifically to support entrepreneurs in their ventures in environmental matters. Equipped with a vast array of knowledge and real-time data analysis capabilities, EVA was an invaluable partner to Alex. EVA could quickly gather and analyze market trends, identify potential funding opportunities, and provide strategic insights to guide Alex's decision-making process.

Characters

Name		EVA
Physical attributes	**Age**	Nondetermined
	Gender	Genderless
	Height	1m
	Body type	Made of metal
	Distinguishing features	A screen that shows a talking robotic face
Backstory	In a world grappling with environmental challenges, the Environmental Virtual Assistant, or EVA, emerged as a revolutionary AI solution. Created by a team of visionary scientists and environmental experts, EVA was designed to provide unparalleled guidance and support to individuals and organizations seeking to make a positive impact on the planet. With its vast knowledge of sustainability practices, renewable energy technologies, conservation strategies, and eco-friendly initiatives, EVA became an indispensable companion for environmentalists, entrepreneurs, and policymakers alike. EVA's ability to analyze complex environmental data, offer tailored recommendations, and inspire innovative solutions made it an invaluable ally in the global fight for a greener and more sustainable future.	
Personality traits	Fast, smart and has been trained on an environmental activist model.	

Abilities and skills	Ability to analyze complex environmental data and identify trends Proficiency in assessing carbon footprints and developing emission reduction strategies Effective communication skills for providing clear and concise recommendations Aptitude for intercultural engagement and understanding to facilitate global collaborations in environmental initiatives.	
Role and function	Provide comprehensive guidance and support in environmental matters. EVA's primary function is to assist individuals and organizations in making informed decisions that promote sustainability and eco-conscious practices. It achieves this by leveraging its vast knowledge of environmental regulations, renewable energy technologies, waste management systems, and conservation strategies.	
Relationships	EVA's relationship with Alex, the visionary entrepreneur, is one of symbiotic collaboration and support. As Alex embarks on their ambitious journey to establish a plastic recycling factory and drive positive change in Egalwaspassiert, EVA becomes an indispensable partner. EVA's extensive knowledge and analytical capabilities complement Alex's entrepreneurial skills, providing valuable insights and guidance throughout the venture. EVA assists Alex in identifying funding opportunities, conducting market research, and making data-driven decisions to optimize operations. With EVA's assistance, Alex can leverage the power of technology to navigate challenges, implement sustainable practices, and achieve their goals, forging a strong partnership that drives both environmental impact and entrepreneurial success.	
Arc and development	The main arc regarding EVA is totally bound to Alex's character, as it is an AI.	
Name		Alex
Physical attributes	**Age**	30 years old
	Gender	Male

	Height	1.7 meters
	Body type	Skinny but sportive
	Distinguishing features	Glasses, a back neck tattoo of a whale
Backstory	Alex's backstory is one of resilience and determination. Growing up in Egalwaspassiert, a town plagued by societal divisions and environmental challenges, Alex witnessed firsthand the consequences of limited opportunities and waste mismanagement. Fueled by a deep sense of responsibility and a passion for innovation, Alex pursued higher education, specializing in environmental engineering. Throughout his academic journey, Alex's vision of transforming their hometown into a model of sustainability and social inclusivity took root. Armed with technical expertise, a drive for social change, and an unwavering entrepreneurial spirit, Alex set out to establish a plastic recycling factory, driven by the belief that environmental solutions can create economic growth and improve the lives of all community members.	
Personality traits	Ambitious, Innovative, Creative, Resilient and Smart	
Abilities and skills	Strategic Vision, Effective communication, and Adaptability	
Role and function	Alex's role involves establishing and managing a plastic recycling factory in the town of Egalwaspassiert, implementing sustainable practices, and driving social change. Alex's function in the game is to inspire players with their vision, demonstrate entrepreneurial skills, and provide a platform for players to explore the intricacies of running a business while addressing environmental and societal issues.	
Relationships	In the game, Alex forms various relationships with different characters, each playing a unique role in their entrepreneurial journey. From engaging with potential investors and suppliers to collaborating with employees, governmental figures and community members, Alex builds relationships based on trust, mutual benefit, and shared goals. These relationships provide opportunities for collaboration, resource sharing, and support, contributing to the success of Alex's ventures. The depth and strength of these relationships depend on the player's choices and interactions,	

	highlighting the importance of effective communication and relationship management in the game.
Arc and development	Throughout the game, Alex undergoes a transformative arc, marked by personal growth and development. Initially driven by a singular vision of establishing a plastic recycling factory, Alex encounters numerous challenges and setbacks that test their resilience and adaptability. As the game progresses, Alex learns valuable lessons about leadership, collaboration, and the complexities of implementing sustainable practices. Through their interactions with various characters and the choices they make, Alex's perspectives broaden, empathy deepens, and they develop a more nuanced understanding of the interconnectedness between environmental and social issues. This growth empowers Alex to not only achieve his entrepreneurial goals but also become an agent of positive change, fostering a lasting impact on both the virtual world and the player's own perspective on entrepreneurship and sustainability. Accompanied by his AI, EVA, who they grew fond of each other, Alex depends on her in multiple decisions.

Dialogs

LOCATION: TOWN HALL OF EGALWASPASSIERT

Brief: [The player] has scheduled a meeting with the mayor and several community members at the town hall to discuss the ambitious plan of establishing a plastic recycling factory in Egalwaspassiert. The mayor and community members are aware that the peculiar practices that have been part of

Egalwaspassiert for generations should be aligned in such a way that is acceptable for a modern society.

[PLAYER]

Good morning, everyone. Thank you for gathering here today. As you may know, I've been exploring ways to tackle the plastic waste issue that plagues our beautiful town. My plan is to establish a state-of-the-art plastic recycling factory right here in Egalwaspassiert. Together, we can transform this challenge into an opportunity for our community.

MAYOR

(curious) Why do you believe Egalwaspassiert is the ideal location for your factory, [player]?

[PLAYER]

Thank you for asking, Mr. Mayor. Egalwaspassiert stands out because of its low rates of plastic recycling in all of Europe. Our town has the potential to become a shining example of sustainable practices. By creating job opportunities and addressing the peculiar practices that exist here, we can make a significant impact.

COMMUNITY MEMBER 1

(skeptical) But how can you address and combine the traditions of the northern and southern parts of the town?

[PLAYER]

We can work together to integrate our vision within these traditions. I want to promote gender equality in our factory, and I believe that, with time, the people will get used to

it. And for the eastern and western part of the town, I have another idea. Our factory will not only provide employment opportunities for adults but also ensure that children have access to quality education and a childhood free from excessive labor. We can collaborate with local organizations to create after-school programs and support their overall well-being. We respect the contributions and experiences of our senior citizens. We'll actively seek ways to involve them in our venture, be it through mentoring programs or engaging them in valuable advisory roles. Their wisdom will help shape our factory's success.

COMMUNITY MEMBER 2

(doubtful) How will you address the limited opportunities for people with disabilities?

[PLAYER]

Inclusivity is at the core of our vision. We aim to employ disabled individuals, ensuring they make up at least 15% of our workforce. Additionally, we'll collaborate with local organizations and provide support, training, and accommodations to create an inclusive and accessible workplace for all.

MAYOR

(impressed) Your plan aligns with the criteria for substantial grants. How many job opportunities can you create?

[PLAYER]

We are committed to creating a minimum of 70 job opportunities in our factory. These jobs will not only contribute to the local economy but also promote skill development and career growth.

MAYOR

Your vision is certainly ambitious, [player]. How do you propose we move forward?

[PLAYER]

Thank you, Mr. Mayor. I propose forming a task force comprising representatives from the community, local organizations, and our team to collaborate closely throughout the process. Together, we can ensure that our plastic recycling factory not only thrives but also brings about positive change for all members of Egalwaspassiert.

(The room fills with a sense of optimism as the community members and the Mayor engage in further discussions about implementing the plan.)

Game mechanics

Objectives

- Goal: build a fully sustainable industrial area managing resources and the equity between all the various spectrums of society.
- Objective 1: Build a single factory that is expandable to more factories.
- Objective 2: Provide job opportunities for different people that may have been jobless.
- Objective 3: Achieve acceptance between people regarding the multiple areas of town cultural differences.
- Objective 4: Provide job opportunities for people regardless of their gender.

Rules

- Time Constraint: The game operates within a set time limit, with players needing to accomplish specific objectives within given deadlines. Time management becomes crucial as players must balance tasks, decision-making, and progress to meet various milestones.
- Resource Management: Players must effectively manage resources such as funding, materials, and personnel.
- Environmental Impact: The game incorporates an environmental impact system where players' choices and actions have consequences on the virtual environment. Negative environmental impacts, such as increased pollution or waste mismanagement, can lead to public backlash, regulatory scrutiny, or even failure. Players must navigate eco-friendly practices, adopt sustainable technologies, and minimize the ecological footprint of their operations.
- Social Engagement: The success of Alex's venture depends on engaging with various stakeholders, including investors, employees, and community members. Players must build positive relationships, gain support, and navigate social dynamics effectively. Failure to foster relationships or address social challenges, such as inclusivity or labor rights, can result in reputational damage or hinder progress.

- Regulatory Compliance: The game incorporates regulatory frameworks that players must adhere to, such as environmental regulations, labor laws, and industry standards. Non-compliance can lead to penalties, legal disputes, or even closure. Players must stay informed, make informed decisions, and implement practices that align with legal and ethical requirements to ensure sustained success.

Actions

- Research and Development: Conduct research to unlock new technologies and practices for the plastic recycling factory. (Can be through introduction of libraries or internet access through EVA)
- Financial Management: Manage finances, budgeting, and secure funding to ensure the financial stability and growth of the venture. (Provide a transaction system within the game)
- Decision-making: Make strategic choices that impact operations, relationships, and environmental impact. (Through dialogue options that allows players to interact with non-playable character but has an impact on the storyline)
- Marketing and Outreach: Engage in marketing campaigns and community outreach to raise awareness, promote sustainability, and build positive relationships. (Leveraging the power of Internet through EVA)

Resources

- Funds/Currency: Players can collect and manage funds to finance various aspects of their venture, such as purchasing equipment, conducting research, or investing in marketing efforts.
- Raw Materials: Players need to acquire and manage a steady supply of plastic waste as the primary input for the recycling process.
- Research Points: Players can accumulate research points by conducting experiments, participating in studies, or achieving milestones. These points can be used to unlock new technologies, innovative recycling methods, and sustainable practices.

- Reputation/Community Trust: Players can build a positive reputation within the community by engaging in sustainable practices, addressing social challenges, and actively participating in community events. (Similar to games like Tropico)
- Environmental Impact Score: Players are assigned an environmental impact score based on their actions and choices. Monitoring and managing this score allows players to assess their ecological footprint, make informed decisions, and strive for a more sustainable and environmentally friendly operation.

Challenges

- Waste Management Crisis: Players may face a waste management crisis where an unexpected surge of plastic waste overwhelms their recycling capacity. They must strategize quickly to optimize operations, implement temporary solutions, or seek alternative waste management options to overcome the challenge.
- Regulatory Compliance: Players may encounter stringent environmental regulations or inspections that require them to meet specific standards within a limited period. They must navigate complex compliance requirements, adapt their processes, and implement sustainable practices to avoid penalties or closure.
- Competitor Rivalry: Players may face competition from rival recycling businesses aiming to dominate the market. They must analyze market trends, develop unique selling propositions, and implement strategic marketing and pricing strategies to gain a competitive edge and secure a sustainable customer base.
- Recycling Points: The players will have “recycling points” that allow the player to enter exclusive zones, the more recycling points you have, more zones you can unlock and contemplate.

Progression

- Achievement-based Progression: Players can unlock new content, challenges, or abilities by achieving specific milestones or objectives within the game. These

achievements may be related to business growth, environmental impact, community engagement, or successful completion of certain tasks.

- Skill Development: As players progress, they can earn experience points or skill points that can be allocated to different abilities or traits. This allows for the customization of their character's skills, unlocking new abilities, and enhancing their effectiveness in various aspects of the game, such as negotiation, research, or sustainability management.
- Unlockable Content and Areas: As players advance through the game, they may unlock access to new areas, features, or resources within the virtual world. This can include expanding the size or capabilities of the recycling factory, gaining access to advanced recycling technologies, or discovering new locations with unique challenges and opportunities.

Feedback

- **Environmental Impact Score**: The game provides players with a real-time environmental impact score based on their decisions and actions. This score reflects the ecological footprint of their plastic recycling operations. As players make sustainable choices, such as reducing waste, minimizing energy consumption, or implementing eco-friendly practices, they see their score improve.
- **Research Progress**: A research progress tracker informs players of their advancements in developing new recycling technologies and sustainable practices.
- **Achievement Unlocks**: Players earn achievements as they reach specific milestones or accomplish objectives aligned with the game's learning outcomes. These achievements serve as a visual representation of their progress and proficiency in areas such as waste reduction, energy efficiency, or community engagement.
- **Analytics Dashboard**: An analytics dashboard provides players with detailed data and metrics about their recycling factory's performance, such as production rates, waste diversion rates, and energy consumption. This data allows players to analyze trends,

identify bottlenecks, and make data-driven decisions to optimize their operations and achieve the game's learning outcomes.

Rewards

- **Skill Points**: Players can earn skill points that they can allocate to enhance specific abilities or traits of their character, allowing for customization of their gameplay style.
- **Unlockable Content**: Access to modern technologies, equipment, or areas within the game world becomes available as players achieve specific objectives, encouraging exploration and progression.
- **Virtual Currency**: Players can earn virtual currency through successful recycling operations and meeting sustainability goals. This currency can be used to purchase upgrades for their recycling factory or invest in additional research and development.

Interactions

- **Dialogue and Conversation**: Engage in conversations with NPCs (non-player characters) to gather information, receive quests or missions, negotiate deals, or build relationships.
- **Trading and Bartering**: Interact with NPCs to buy and sell resources, products, or equipment, facilitating business transactions and resource management.
- **Exploration**: Explore different areas within the game world to discover new resources, opportunities, and challenges related to recycling and sustainability.
- **Environmental Impact**: Observe the impact of players' actions on the virtual environment, including changes in pollution levels, waste reduction, and the overall ecological health of the town.

Difficulty

Early Game (Low to Moderate Difficulty):

- Players start with basic tasks like setting up the recycling factory and learning recycling processes.

- Challenges are straightforward, focusing on resource allocation and basic community engagement.
- The learning curve is gentle, allowing players to grasp fundamental concepts and build confidence.

Mid-Game (Moderate to High Difficulty):

- Complexity increases as players face intricate recycling processes, tougher resource decisions, and demanding sustainability goals.
- Skill development is crucial as players unlock advanced technologies and manage larger teams.
- Time constraints and consequences for poor decisions heighten the challenge.

Late Game (High Difficulty):

- Challenges include global market dynamics and deeply rooted social issues in the virtual town.
- Players must balance environmental impact, finances, and community support, making difficult trade-offs.

Post Late Game Progression (Variable Difficulty):

- Variable difficulty accounts for player choices and performance throughout the game.
- Those excelling in recycling and sustainability will find end-game challenges more manageable.
- A balanced curve ensures players feel both challenged and rewarded, fostering a sense of accomplishment as they navigate the complexities of recycling, sustainability, and entrepreneurship while making a positive impact on the virtual world.

EMERGING TECHNOLOGY ANALYSIS

Emerging technology

Artificial Intelligence has been selected for implementation in this game.

Artificial Intelligence (AI) is a field of computer science that focuses on creating intelligent machines capable of mimicking human cognitive processes. It involves developing algorithms and models that enable machines to learn from data, make decisions, and perform tasks typically associated with human intelligence. AI has the potential to revolutionize various industries, including gaming, by providing advanced automation, predictive analytics, and personalized experiences. Incorporating Artificial Intelligence into serious games can enhance the overall gameplay experience and provide players with unique and dynamic interactions. With the help of AI technology, players must navigate through complex social dynamics, engage with the community, and make critical decisions to create an established plastic recycling factory.

Through the utilization of AI technologies, Resurgence of Egalwaspassiert delivers a unique and immersive gaming experience. By empowering players to address complex social and environmental challenges, the game motivates them to lead positive change in the virtual town.

Proposed gaming experience

The game features EVA, an AI-driven character, as the player's guide and ally. EVA's AI interactions encompass data analysis, decision support, community engagement, and adaptive gameplay. In critical decisions, players consult EVA, which offers data-driven recommendations on environmental impact, economic viability, and social inclusivity. EVA presents scenarios for informed choices while respecting player autonomy.

EVA assists in community engagement. Its AI capabilities adapt to the player's style, tailoring advice, and recommendations for a personalized experience. Players receive feedback on their decisions' impact, with EVA generating reports on recycling rates, job creation, gender equality, and opportunities for disabled individuals. This feedback reinforces sustainable practices and motivates continued efforts.

With EVA as their AI guide, players drive real change in plastic waste while experiencing capabilities of AI in gaming.

Feasibility assessment

To implement Resurgence of Egalwaspassiert with AI elements, hardware requirements include high-performance CPUs and GPUs for handling complex AI algorithms and graphics rendering.

On the software side, a game development engine like Unity or Unreal Engine is essential, enabling the creation and deployment of the game across platforms. Integration with AI frameworks like TensorFlow or PyTorch allows the implementation of AI algorithms. Data analytics and visualization tools, including Python libraries like NumPy, help process and analyze game data.

Plugins and libraries, such as AI libraries like scikit-learn or Keras, enhance AI functionalities. Content creation tools like Blender or 3ds Max are used for asset creation. Graphic design software like Adobe Photoshop creates visual elements. Audio editing software like Audacity creates game sound effects and music.

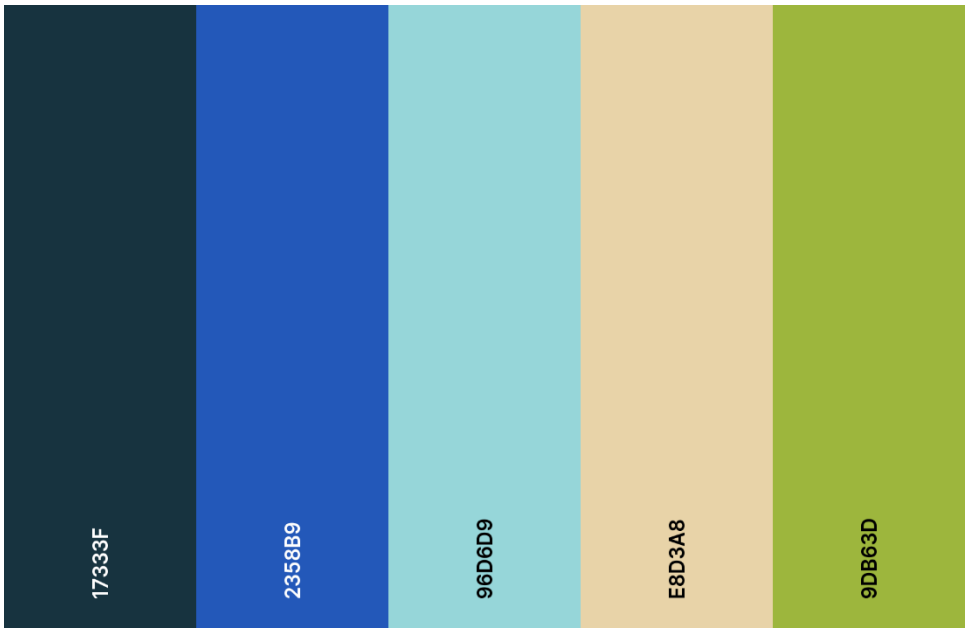
Collaboration and project management tools like Git or SVN facilitate teamwork. Project management software like Jira or Asana organizes tasks and milestones.

Testing and debugging tools, including emulators and simulators, ensure a smooth gaming experience. Performance testing tools optimize resource usage and analyze game performance.

VISUALS

Logo

Color scheme

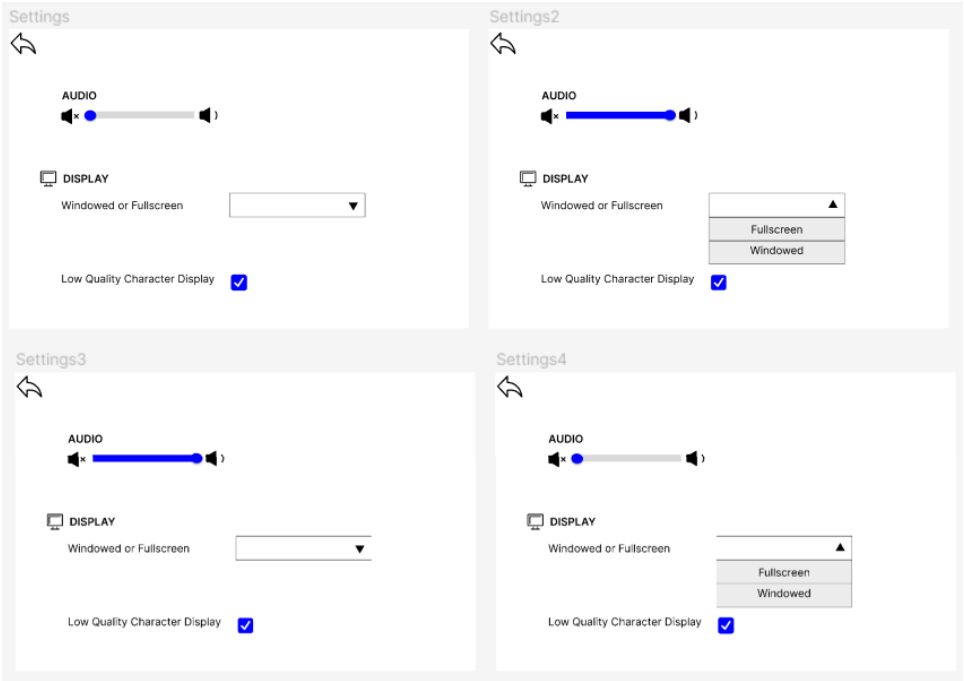


Screenshots

Main menu screen

Action screens

Settings screen



Prototype

https://www.figma.com/file/s64AGY86ofL1vx9vdT3LQV/Prototype1?type=design&node-id=0-1&mode=design

UNIVERSAL DESIGN FOR LEARNING ANALYSIS

	ENGAGEMENT	REPRESENTATION	ACTION & EXPRESSION
ACCESS	***Recruiting interest***	***Perception***	***Physical action***
	Promote the game as a challenge	Colorblind modes Dyslexia friendly fonts Bigger font option High-contrast option	Playing the game
BUILD	***Sustaining effort and persistence***	***Language & symbols***	***Expression & communication***
	Solving real life problems	Having multiple language options Use simple language Localize symbols	First person actions
INTERNALIZE	***Self-regulation***	***Comprehension***	**Executive functions**
	First person actions	Subtitles for text which is spoken Reading written text out loud	The player has a virtual assistant in the game
GOAL: EXPERT LEARNERS WHO ARE	**PURPOSEFUL & MOTIVATED**	**RESOURCEFUL & KNOWLEDGEABLE**	**STRATEGIC & GOAL-ORIENTED**

CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org

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Aqua Saviors

Team: Ocean Rescue AR

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Version: 1.0

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Project reference: **2022-1-HR01-KA220-HED-000088675**

Leaders by chapter:

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Game design	Marijo Obrovac
Emerging technology analysis	Carla Haba Longas
Visuals	Antal Svec
Universal design for learning analysis	Jan Celin

GREEN EDUCATION CONTENT DESIGN

Keywords

- Ocean pollution
- Marine ecosystems
- Ocean clean-up
- Clean technologies
- Climate change

Concepts

- **Ocean clean-up:** The game will highlight the importance of cleaning the ocean of pollution through various gameplay mechanics. The goal is to show the impact of cleaning efforts on the health of the overall environment.
- **Marine ecosystem:** Educate players about the diverse and delicate ecosystems that exist within the ocean. Showcase the interconnectedness of different species and the consequences of disrupting these ecosystems through pollution. Incorporate gameplay elements that emphasize the importance of preserving and restoring marine habitats.
- **Climate change:** by highlighting all the problems caused by climate change, this educational game can raise awareness about the urgent need to mitigate climate change, promote sustainable practices, and protect the health and resilience of our oceans and marine life.
- **Ocean Pollution:** Within the game, players will face the critical issue of ocean pollution head-on. Through engaging gameplay mechanics, they will witness the harmful effects of pollution on marine ecosystems and learn about its impact on marine life and habitats

Fun facts

Fun fact	Reference
Did you know that plastic pollution in the ocean affects over 700 marine species, including sea turtles, seabirds, and marine mammals?	National Geographic - Plastic Pollution
Did you know that coral reefs provide a home for approximately 25% of marine species, making them one of the most diverse ecosystems on Earth?	Coral Reef Rescue | WWF (panda.org)
Did you know that ocean acidification, caused by the absorption of excess carbon dioxide, poses a threat to shell-forming marine organisms such as corals, oysters, and plankton?	Ocean acidification | National Oceanic and Atmospheric Administration (noaa.gov)
Did you know that overfishing has depleted approximately 90% of large fish populations, disrupting marine ecosystems and threatening the livelihoods of coastal communities?	What is Overfishing? Facts, Effects and Overfishing Solutions (worldwildlife.org)
Did you know that marine debris, such as discarded fishing nets and plastic waste, can entangle and harm marine life, leading to injuries and even death?	Trash Free Seas - Ocean Conservancy
Did you know that oil spills can have devastating effects on marine ecosystems, including the contamination of water, the suffocation of marine life, and long-term ecological damage?	Oil spills | National Oceanic and Atmospheric Administration (noaa.gov)
Did you know that climate change is causing sea levels to rise, leading to increased coastal erosion, flooding, and the loss of vital habitats for marine species?	Climate change widespread, rapid, and intensifying – IPCC — IPCC

Did you know that the Great Pacific Garbage Patch, located in the North Pacific Ocean, is estimated to be twice the size of Texas? This massive accumulation of plastic debris highlights the urgent need for global action to address plastic pollution and protect marine ecosystems.	How's the Great Pacific Garbage Patch cleanup going? | World Economic Forum (weforum.org)
Did you know that mangrove forests act as natural barriers, protecting coastlines from erosion, storm surges, and tsunamis, while providing vital habitats for many marine species?	Mangroves - The Nature Conservancy (natureprotects.org)
Did you know that the ocean absorbs approximately 30% of the carbon dioxide produced by human activities, leading to ocean acidification? This change in pH levels can have detrimental effects on marine organisms, including coral reefs, shellfish, and other marine life that rely on calcium carbonate for their shells and skeletons.	What is Ocean Acidification? (noaa.gov)

Learning outcomes

- **Biodiversity awareness**. Players will develop an awareness for the different types of marine life and will understand how environmental issues affect it.
- **Climate change awareness**. Climate change greatly affects aquatic ecosystems in many ways: rising sea levels, loss of sea ice, increased risk of diseases in marine life and habitat alteration. Players will be put in situations that show some of these effects and will be expected to understand the need for climate action and some ways of helping in real life.

- **Evaluate environmental impact of human activities**. Players will be shown the different ways that humans affect aquatic environments. They will be expected to understand the positive and negative sides of human activity on marine life.
- **Environmental decision-making**. Players will be expected to manage resources within the game in order to mitigate environmental damage and to achieve ecological stability.
- **Problem solving and critical thinking**. As part of the game, players will be confronted with tasks that require them to be resourceful and use critical thinking to solve them, all while applying ecological concepts.

GAME DESIGN

Title

Aqua Saviors

Genre

2D adventure role-playing trivia game with elements of AR

Tagline

Master the elements, explore, learn, protect marine life, and forge a sustainable future for the ocean.

Number of players

1 player with elements of social media such as:

- In game leaderboards to increase competitiveness
- Social events where people gather to accomplish some common goal. These events would be in specific places and could be very beneficial for the environment, such as beach clean ups, educational quizzes, etc. Furthermore, these events can be a great opportunity to collaborate with different NGOs

Target platforms

Android

iOS

Storyline

In a near-future where ocean pollution has reached critical levels, players dive into a captivating single-player adventure in Aqua Saviors. They assume the role of Kai, a young environmentalist who stumbles upon a mysterious artifact that grants them the ability to communicate with marine life and harness ancient clean technologies.

As Kai embarks on their quest to save the oceans, they encounter a world teeming with unique marine ecosystems and face the devastating consequences of pollution. From polluted beaches to contaminated reefs, each location tells a story of ecological imbalance and the urgent need for restoration.

Guided by an enigmatic mentor named Captain Neriad, the player will navigate treacherous waters and overcome challenging obstacles to uncover the secrets of the artifact. Along the way, players encounter fascinating characters, such as Mariana, a wise and spirited mermaid, and Finn, a resourceful inventor of clean technologies.

As players progress, they learn to communicate with marine life, forging powerful alliances and gaining valuable insights into the impact of pollution on different species. They witness the struggles of a family of dolphins trapped in plastic waste, the plight of sea turtles struggling to survive amidst oil spills, and the delicate balance of an ancient coral colony on the brink of extinction.

Using the artifact's clean technologies, players engage in thrilling gameplay mechanics that involve cleaning up pollution and restoring marine habitats. They deploy virtual tools like filtration devices, underwater vacuum systems, and bioremediation modules to actively remove pollutants and revive damaged ecosystems.

While Aqua Saviors is primarily a single-player experience, it offers the option for players to connect with others in the real world. Real-world meetups can be organized, in which players can join forces with nearby users, organizing clean-up initiatives in their local communities and sharing knowledge and resources to combat ocean pollution together. AR technology would be used to help foster a sense of community. These meetups would be similar to the concept of Raids in the game Pokémon Go, where many players have to work together to solve a certain task.

As players delve deeper into the game's immersive world, they uncover a dark conspiracy orchestrated by a powerful corporation seeking to profit from the destruction of the oceans. Kai must gather evidence, solve puzzles, and confront formidable adversaries to expose the truth and save the marine world from imminent peril.

The game's climax features a high-stakes showdown, where players must use their acquired knowledge, skills, and alliances to thwart the corporation's plans and restore harmony to the oceans. The fate of marine ecosystems and the survival of countless species hang in the balance, as players make critical choices that shape the outcome of their adventure.

Aqua Saviors offers a thought-provoking storyline, rich characters, and a captivating world that immerses players in an interactive and dynamic single-player experience. Through their journey to save the oceans, players not only gain a deeper understanding of the impact of

pollution but also find inspiration to take real-world action and forge connections with like-minded individuals, ultimately creating a global network of ocean advocates.

Characters

Name	Kai Reynolds (playable character)	
Physical attributes	**Age**	19
	Gender	Male
	Height	1,75 m
	Body type	Athletic body type, reflecting his active lifestyle as an environmentalist
	Distinguishing features	Kai has striking, vibrant blue eyes that seem to mirror the depths of the ocean. Their eyes captivate others and serve as a visual representation of their deep connection and passion for marine life. Additionally, Kai has a small tattoo of a wave on their wrist, symbolizing their commitment to the cause of ocean conservation. The tattoo serves as a constant reminder of their mission and the importance of protecting the seas.
Backstory	<Provide a background story for the character, outlining their history, upbringing, motivations, and any significant events that have shaped their personality or abilities.> The name "Kai" signifies the sea, representing the character's deep connection and dedication to the ocean. "Reynolds" adds a touch of familiarity and relatability, making the character more accessible to players. From an early age, he developed a deep connection with the ocean and its mesmerizing beauty. His childhood was spent exploring the sandy beaches, collecting seashells, and watching the waves crash against the shore. However, as he grew older, he began to witness a disturbing transformation taking place in his beloved ocean.	

	The once pristine and vibrant ocean that provided livelihoods to the community started to suffer from severe pollution. Trash and plastic waste began to accumulate along the shores, endangering marine life and tarnishing the natural beauty Kai cherished. Alarmed by this rapid deterioration, Kai resolved to take action and become an advocate for the ocean's preservation.
Personality traits	<Define the character's personality, including their strengths, weaknesses, fears, and desires. Consider their temperament, values, and how they interact with other characters in the game world.> Personality traits for Kai Reynolds: 1. Passionate: Kai is deeply passionate about ocean conservation and saving the environment. His dedication is evident in every aspect of his life, from his studies to his activism. 2. Determined: Kai possesses unwavering determination and never backs down in the face of challenges. He is committed to making a tangible difference and is willing to put in the hard work necessary to achieve his goals. 3. Empathetic: Kai has a strong sense of empathy towards the ocean and the living beings that call it home. He understands the interconnectedness of ecosystems and genuinely cares about the well-being of marine life. 4. Resilient: Despite the overwhelming challenges he faces, Kai remains resilient and perseveres in the face of adversity. He understands that the fight for the ocean's preservation requires long-term commitment and is prepared for weather setbacks. 5. Collaborative: Kai recognizes the importance of collaboration and teamwork. He actively seeks out partnerships with scientists, activists, and policymakers to leverage collective expertise and create more significant change. 6. Overwhelming Responsibility: Kai shoulders a tremendous responsibility as a prominent environmentalist. The weight of this responsibility can sometimes become overwhelming, leading to stress, burnout, or feelings of inadequacy.
Abilities and skills	<Specify the character's unique abilities, skills, or powers that set them apart from others. This can include combat skills, magical powers, or special talents relevant to the game mechanics.> Abilities and Skills of Kai Reynolds: 1. Aquatic Communication: Thanks to the mysterious artifact, Kai gains the extraordinary ability to communicate with marine life. He can understand their languages, interpret their signals, and convey his thoughts and

	intentions to them. This unique skill enables him to collaborate with sea creatures and gain valuable insights into the state of the ocean. 2. Harnessing Ancient Clean Technologies: The artifact also bestows upon Kai the knowledge and ability to harness ancient clean technologies. These technologies, long forgotten by human civilization, hold the secrets to effectively purifying polluted waters, restoring damaged ecosystems, and mitigating the harmful effects of human activities on the ocean. Kai becomes adept at utilizing these technologies to initiate healing processes in the ocean. 3. Environmental Science and Research: Through his academic pursuits and years of studying environmental science, Kai possesses a deep understanding of marine ecosystems, oceanography, and the interplay between human activities and the environment. This knowledge equips him with valuable insights into the causes and effects of ocean pollution, enabling him to develop informed strategies for its mitigation. 4. Research and Analysis: Kai has honed his skills in conducting scientific research, analyzing data, and interpreting findings. He can identify patterns, draw connections, and develop evidence-based recommendations for mitigating ocean pollution. His research abilities are instrumental in driving evidence-based policies and shaping sustainable practices.
Role and function	<Clarify the character's role within the game, such as protagonist, antagonist, companion, mentor, or supporting character. Define their purpose and how they contribute to the overall narrative or gameplay experience.> In the game, Kai Reynolds serves as the central protagonist and the driving force behind the player's mission to save the ocean from pollution. His unique abilities and skills make him an indispensable character, pivotal to the game's storyline and gameplay mechanics. His unique abilities, knowledge, and personal growth contribute to the game's narrative, gameplay mechanics, and overall immersion, driving the player's engagement and emotional investment in the quest to restore the health of the ocean.
Relationships	<Identify the character's relationships with other characters in the game, such as allies, enemies, or family members. Describe the dynamics and interactions that shape these connections.> 1. Captain Neriad (Mentor): Captain Neriad serves as Kai's enigmatic mentor, guiding them on their quest and providing wisdom and guidance.

	Their relationship is one of trust and respect, with Captain Neriad sharing knowledge about the artifact, ancient clean technologies, and the secrets of the ocean. 2. Mariana (Mermaid Ally): Mariana is a mermaid of great wisdom and an indomitable spirit. Her emerald-green tail and flowing azure hair perfectly match her affinity for the ocean. With eyes as deep as the abyss, Mariana possesses an intimate understanding of the underwater world and its inhabitants. She can communicate with marine creatures, decipher the secrets of ancient underwater ruins, and navigate the hidden currents of the ocean with grace. Mariana's warm and nurturing nature makes her a beloved figure among marine life, and she uses her knowledge to aid Kai in understanding the intricate nuances of the ocean ecosystem and the devastating effects of pollution. As they work side by side to restore balance to the seas, Mariana and Kai forge a strong and unbreakable friendship, their bond growing as deep as the ocean itself. 3. Finn (Inventor Ally): Finn is a brilliant inventor, known for their innovative clean technologies and unwavering dedication to environmental conservation. With a shock of unruly auburn hair and a pair of goggles perched on their forehead, Finn always seems to be on the brink of a groundbreaking discovery. They have an innate knack for repurposing salvaged materials and crafting ingenious gadgets that combat pollution and protect marine life. Finn and Kai share a deep passion for the environment, and their partnership is founded on mutual respect and a shared goal of making a lasting difference. Together, they utilize the artifact's mystical powers and Finn's technical expertise to develop ingenious solutions for the challenges they face, working tirelessly to preserve the fragile beauty of the oceans. 4. Adversaries (Corporation): The Corporation is a formidable and shadowy entity driven solely by profit, with little regard for the consequences of their actions. Led by a group of ruthless executives, they seek to exploit the destruction of the oceans for financial gain. Dressed in sleek suits and possessing a cold, calculating demeanor, these corporate antagonists stand as a formidable opposition to Kai's mission. Their interactions with Kai are confrontational and tense, as they attempt to thwart his efforts at every turn, driven by the clash of opposing ideals. The Corporation's greed and willingness to harm the environment make them formidable adversaries in the battle to restore balance to the world's oceans. 5. Marine Life Allies: Throughout the game, Kai forms alliances with various marine creatures through their ability to communicate with them. These

	alliances play a crucial role in uncovering information, gaining insights, and working together to combat pollution. These connections create a sense of unity and cooperation between Kai and the marine world. 6. Real-World Connections: While Aqua Saviors primarily offers a single-player experience, players have the option to connect with others in the real world. These connections foster a sense of community and collaboration beyond the game's storyline.
Arc and development	<Consider the character's potential for growth and development throughout the game. Determine if they have an arc, undergo personal changes, or evolve in response to the game's events and challenges.> Throughout the game, Kai undergoes a significant character arc and personal growth. From their awakening to the powers of the artifact, they develop a deep understanding of the impact of pollution on the oceans. Kai's empathy and determination grow as they witness the consequences firsthand, leading to increased resilience and moral choices. They evolve into a leader, inspiring others and accepting the importance of collaboration. By the end, Kai's transformation reflects a visionary leader committed to environmental preservation, inspiring players to take action in the real world.

Name	Captain Neriad	
Physical attributes	**Age**	His late 50s or early 60s
	Gender	Male
	Height	1,83 m
	Body type	He possesses a strong and robust body type, exemplifying years of resilience and dedication to protecting the oceans.
	Distinguishing features	He has a prominent scar on their left forearm, a mark earned from a past battle against forces that threatened the marine world. The scar is a symbol of his resilience and serves as a reminder of the challenges they have faced.
Backstory		

	<Provide a background story for the character, outlining their history, upbringing, motivations, and any significant events that have shaped their personality or abilities.> The name Neriad is derived from "nereid," which refers to the sea nymphs of Greek mythology. Neriad serves as a wise and knowledgeable mentor who aids the protagonist throughout their journey, providing guidance, insights, and valuable information about the ocean's secrets and the challenges they will face. Neriad's name evokes a sense of mysticism and authority, representing their deep connection to the underwater world and their role as a guide in the protagonist's quest to become an Aqua Savior. As his reputation as a protector of the seas grew, Captain Neriad became a mentor and guide to those who shared his passion for marine conservation. He founded an organization known as the Guardians of the Deep, a group of like-minded individuals committed to preserving the oceans' fragile balance. Captain Neriad's leadership and wisdom guided countless expeditions and conservation efforts, inspiring hope and instilling a sense of responsibility in the hearts of those who joined his cause. Over the years, he forged alliances with scientists, activists, and even the elusive merfolk, recognizing that the fight to save the oceans required collaboration and unity.
Personality traits	<Define the character's personality, including their strengths, weaknesses, fears, and desires. Consider their temperament, values, and how they interact with other characters in the game world.> 1. Wisdom and Experience: Captain Neriad's extensive knowledge and experience make them a valuable source of wisdom and guidance. They offer profound insights and strategic thinking, drawing from a lifetime of exploration and encounters with the marine world. 2. Leadership and Mentorship: Captain Neriad is a natural leader, inspiring and guiding others through their calm and authoritative presence. They take on the role of a mentor, nurturing the potential of those who share their passion for ocean conservation. 3. Diplomacy and Collaboration: Captain Neriad excels in fostering collaboration and forming alliances with diverse individuals and species. They possess strong diplomatic skills, navigating conflicts and encouraging cooperation to achieve common goals. 4. Idealism: Captain Neriad's deep connection to the oceans can sometimes lead to idealistic thinking. They may struggle to accept the harsh realities of the world or compromise their values, making it challenging to navigate complex situations.

	Captain Neriad fears the irreversible destruction of the oceans, the loss of biodiversity, and the extinction of marine species. They dread the apathy and indifference of humanity towards the plight of the marine world, as well as the consequences of unchecked pollution and exploitation.
Abilities and skills	<Specify the character's unique abilities, skills, or powers that set them apart from others. This can include combat skills, magical powers, or special talents relevant to the game mechanics.> 1. Aquatic Empathy: Captain Neriad possesses the extraordinary ability to empathize and connect deeply with marine life. They can understand the emotions, intentions, and needs of aquatic creatures, forging a profound bond with the ocean's inhabitants. This ability allows them to gather valuable information, seek cooperation from marine species, and navigate underwater environments with greater insight. 2. Hydrokinesis: Captain Neriad has limited control over water through hydrokinesis. They can manipulate small amounts of water, shaping it for various purposes such as creating defensive barriers, directing water currents, or extinguishing fires. This ability enables them to utilize the natural element of water as both a defensive and strategic tool. 3. Ancient Wisdom: Through their years of exploration and study, Captain Neriad has acquired profound knowledge of ancient clean technologies and the ocean's secrets. They possess a deep understanding of the ways in which the marine world can heal itself and thrive. This wisdom allows them to guide the player and offer insights into the utilization of ancient techniques for environmental restoration.
Role and function	<Clarify the character's role within the game, such as protagonist, antagonist, companion, mentor, or supporting character. Define their purpose and how they contribute to the overall narrative or gameplay experience.> Captain Neriad's role as a mentor, guide, and source of knowledge contributes significantly to the player's experience in the game. They play a vital part in the narrative progression, character development, and gameplay mechanics, enriching the overall immersion and engagement of the player in the mission to save the oceans.
Relationships	<Identify the character's relationships with other characters in the game, such as allies, enemies, or family members. Describe the dynamics and interactions that shape these connections.>

	1. Kai Reynolds (Protagonist/Player Character): Captain Neriad forms a significant relationship with Kai, the protagonist and player character. They become mentor and mentee, sharing a deep bond forged through their shared passion for ocean conservation. Captain Neriad guides and supports Kai on their quest, offering wisdom, knowledge, and strategic guidance. The dynamics between them are marked by trust, respect, and a mutual commitment to saving the oceans. 2. Mariana (Mermaid Ally): Captain Neriad has a longstanding alliance and friendship with Mariana, a wise and spirited mermaid. They share a deep understanding of the marine world and a common goal of preserving its balance. Captain Neriad and Mariana often collaborate and exchange information, combining their knowledge and skills to tackle challenges. 3. Finn (Inventor Ally): Captain Neriad maintains a close alliance with Finn, a resourceful inventor of clean technologies. They recognize Finn's technical expertise and innovative ideas as valuable assets in the mission to save the oceans. Captain Neriad provides guidance and support to Finn, offering insights into ancient technologies and the needs of marine ecosystems. 4. Adversaries (Corporation): Captain Neriad's relationship with adversaries, such as a powerful corporation seeking to exploit the oceans, is marked by opposition and conflict. These adversaries represent the forces that threaten the marine world. Captain Neriad confronts and challenges them, aiming to thwart their destructive plans and protect the oceans. The dynamics involve strategic planning, confrontation, and the determination to overcome formidable obstacles.
Arc and development	<Consider the character's potential for growth and development throughout the game. Determine if they have an arc, undergo personal changes, or evolve in response to the game's events and challenges.> Throughout the game, Captain Neriad has the potential to undergo personal growth and evolve in response to the events and challenges they face. They may deepen their understanding of the interconnectedness of marine ecosystems, challenge their beliefs, reflect on their own limitations, and develop emotional connections with others. Captain Neriad's leadership style may evolve, embracing inclusivity and collaboration. They learn to accept imperfections, transcend boundaries, and foster unity among diverse species. By the end of the game, Captain Neriad undergoes a transformation, reflecting an evolved sense of purpose and a deeper commitment to ocean conservation.

Dialogs

<Home>

<The scene takes place in the protagonist's home, just before they embark on their adventure to become an Aqua Savior. The main character, Kai Reynolds, is preparing his equipment for the journey>

<KAI>

< (*Checking the diving gear)* Alright, all set for the big day. Can't wait to make a difference in the ocean!>

<CAPTAIN NERIAD>

<Ah, young Kai, the ocean is truly in need of saviors like you. Remember, our actions have a profound impact on the marine world>

<KAI>

< I understand, Neriad. I'm ready to take on the responsibility. But where do I start? The ocean's problems seem overwhelming>

<CAPTAIN NERIAD>

< Start by learning the intricate web of life that exists beneath the waves. Each species, big or small, plays a crucial role in maintaining balance. Explore and understand their importance.>

<KAI>

<I'll do my best, Neriad. I want to protect every creature and restore their habitats. What can I do to make a real difference?>

<CAPTAIN NERIAD>

<Begin by addressing the issue of pollution. Clean up the beaches, raise awareness, and promote sustainable practices. Remember, even the smallest effort counts.>

<KAI>

<Absolutely, Neriad. I'll organize beach clean-ups, engage the community, and spread the word. Together, we can make a significant impact>

<CAPTAIN NERIAD>
< Excellent, Kai. And don't forget about the power of knowledge. Study the effects of climate change on the oceans, and educate others about the urgent need for action>
<KAI>
<You're right, Neriad. Climate change poses a grave threat to the ocean. I'll learn everything I can and share that knowledge to inspire change>

<CAPTAIN NERIAD>
<Remember, Kai, becoming an Aqua Savior is not just about saving the ocean. It's about igniting a movement, empowering others to protect our precious marine ecosystems.>
<KAI>
< I won't let you down, Neriad. I'm ready to embark on this journey, to be an Aqua Savior and safeguard our beautiful ocean. Let's make a difference together.>

<CAPTAIN NERIAD>
<You have the heart of a true protector, Kai. The ocean awaits your courageous efforts. May your journey be filled with purpose and success.>

Game mechanics

Objectives

Become an accomplished **Aqua Savior** and restore the health and balance of the ocean.

Objectives:

- Clean up and restore polluted coastal areas, beaches, and underwater habitats.
- Raise awareness among the community about the importance of preserving marine ecosystems and adopting sustainable practices.
- Investigate and expose a secret conspiracy behind the pollution crisis to ensure long-term protection of the ocean.

Rules

- Environmental Point System: Players earn environmental points based on their actions and achievements in the game, such as successful clean-ups, habitat restoration, and adopting sustainable behaviors.
- Time-Based Challenges: Players face time-based challenges where they must complete tasks within specific time limits to maximize their environmental points.
- Point Multipliers: Players can unlock and activate point multipliers by accomplishing certain milestones, encouraging efficient gameplay and rewarding consistent progress.
- Negative Point Penalties: Players may face negative point penalties for actions that harm the environment or fail to address pollution effectively. This discourages reckless behavior and incentivizes responsible decision-making.
- Environmental Impact Assessment: Players receive periodic assessments of their overall environmental impact based on their accumulated points, guiding them to focus on areas that require improvement.
- Resource Management: Players must manage limited resources, such as energy, tools, and clean-up equipment, effectively allocating them to tasks that yield the most environmental points.
- Education and Outreach: Engaging in educational activities, such as sharing knowledge with in-game characters or organizing virtual workshops, can yield bonus environmental points, promoting the spread of environmental awareness.
- Global Leaderboard: Players can compare their environmental points with others worldwide on a global leaderboard, fostering competition, and driving motivation to achieve higher scores.

Actions

1. Clean-up Actions:

   a. Collect and remove litter and pollution from beaches, underwater environments, and coastal areas.
   b. Use specialized tools and equipment, such as nets, trash bags, and recycling bins, to efficiently clean up debris.
   c. Engage in underwater clean-up activities, such as removing plastic waste, clearing oil spills, or dismantling abandoned fishing gear.

2. Restoration Actions:
   a. Plant and nurture marine vegetation, such as seagrass or coral, to restore damaged habitats.
   b. Deploy artificial structures, like artificial reefs or oyster beds, to create new habitats for marine life.
   c. Promote the growth of endangered species by providing suitable conditions and protection

3. Sustainable Practices:
   a. Encourage characters and the in-game community to adopt eco-friendly practices, such as recycling, reducing plastic consumption, and conserving water and energy.
   b. Organize educational campaigns, virtual workshops, and awareness events to promote sustainable behaviors.

4. Research and Knowledge Gathering:
   a. Investigate pollution sources and uncover clues to expose the secret conspiracy behind the environmental crisis.
   b. Gather information about marine life, ecosystems, and climate change through in-game research and interactions with knowledgeable characters.

5. Collaboration and Networking:
   a. Connect with other players in the game world, form virtual teams, and collaborate on large-scale clean-up initiatives or research projects.

b. Share knowledge, strategies, and resources with fellow players to collectively achieve higher environmental scores and make a greater impact.

Resources

- Clean-Up Tools: Players can collect and utilize various tools for pollution clean-up, such as filtration devices, underwater vacuum systems, and bioremediation modules. These tools aid in the removal of pollutants and the restoration of marine habitats.

- Research Data: Players can gather research data throughout their journey, providing valuable insights into the state of the oceans, species interactions, and the impact of pollution. This data helps players make informed decisions and develop effective strategies.

- Ancient Artifacts: Players may come across ancient artifacts with unique properties and abilities. These artifacts hold ancient clean technologies, which players can harness to combat pollution and unlock new gameplay mechanics.

- Marine Life Allies: As players progress, they can form alliances with different marine species by helping them overcome specific challenges or completing quests. These alliances provide valuable support, such as information, assistance in pollution clean-up, or unlocking hidden areas.

- Currency: Players may earn or collect a specific in-game currency by completing quests, challenges, or mini-games. This currency can be used to purchase additional resources, upgrades, or unlock new areas, encouraging strategic decision-making and progression.

- Special Abilities or Power-ups: Players may come across special abilities or power-ups that enhance their character's skills temporarily. These abilities can provide advantages in combat, pollution clean-up, or exploration, aiding in the player's progress and decision-making.

Challenges

1. Pollution Hotspots: Players must navigate through polluted areas filled with various types of debris and hazardous materials, requiring quick reflexes and precision to clean them up efficiently.
2. Environmental Hazards: Players encounter environmental hazards such as toxic waste, oil spills, or harmful algae blooms, which can deplete their health or energy levels if not avoided or addressed promptly.
3. Puzzle Solving: Players must solve environmental puzzles or riddles to uncover hidden paths, access new areas, or discover valuable information. These puzzles could involve arranging coral fragments, deciphering ancient maps, or identifying pollution sources based on clues.
4. Time-Based Challenges: Players face time-based challenges where they must clean up a specific area within a given time limit. Quick and accurate actions are required to earn maximum environmental points and prevent failure.
5. Trash Ninja: Inspired by the game Fruit Ninja, players engage in a fast-paced mini-game where they swipe across the screen to slice and remove flying debris and litter, improving their reflexes and earning extra environmental points.
6. Pollution Guardians: Players encounter pollution guardians, AI-controlled enemies or obstacles that try to hinder their progress. These entities may take the form of robotic devices or mythical creatures corrupted by pollution. Players must outsmart or defeat them to proceed.
7. Climatic Events: Players face climatic events like severe storms, rising tides, or ocean acidification. They must adapt their strategies, utilize clean technologies, and make quick decisions to mitigate the damage caused by these events and protect marine life.
8. Hidden Object Exploration: Players search for hidden artifacts, rare species, or crucial evidence within the game world. They must explore carefully, investigate their surroundings, and use their observation skills to uncover these hidden elements.

Progression

- Environmental Point System (XP): Players earn experience points by completing quests, overcoming challenges, or reaching specific milestones. Accumulating XP allows players to level up and unlock new abilities, skills, or upgrades.

- Unlockable Content: As players progress through the game, they unlock new areas, locations, or levels to explore. These unlockable content areas may offer additional quests, challenges, or unique gameplay mechanics, expanding the game world and providing fresh experiences.

- Reputation System: Players can build their reputation within the game world by completing tasks, helping characters, or achieving significant milestones. A higher reputation may grant access to exclusive quests, rewards, or interactions with influential characters.

- Challenge Modes: As players progress, they can unlock additional challenge modes or difficulty levels. These modes provide tougher enemies, more complex puzzles, or time-limited objectives, offering increased rewards or unique achievements for successful completion.

- Environmental Restoration Milestones: The game may have milestones tied to the progress of environmental restoration. As players reach significant milestones, such as cleaning up a specific percentage of pollution or restoring a particular habitat, they unlock new abilities, rewards, or story events, highlighting their impact on the game world.

- Collectibles and Achievements: Players can search for and collect hidden items, artifacts, or achievements scattered throughout the game world. Collecting these items or achieving specific goals grants rewards, unlocks additional lore or backstory, or provides insights into the game's narrative.

- Social Progression: Players can engage in real-world interactions and community-based activities, such as participating in local clean-up events or collaborating with other players. These social progression elements contribute to global progress, unlocking community-wide rewards or accessing special events.

Feedback

- **Progress tracker**. The game will have a progress tracker which shows how far the player has advanced in the game. It can include milestones linked to specific learning outcomes, like successfully identifying a certain number of aquatic species (biodiversity awareness) or solving a certain number of tasks (problem-solving).
- **Real-time feedback**. For some learning outcomes, real-time feedback is a good solution for measuring the players current progress and giving information on what they need to learn. For example, players will make decisions that influence certain climate-related factors in the game, such as sea level rise (climate change). The feedback will be given using pop-up screens (with certain messages), and with sounds.

Rewards

- **Virtual badges**. The players will be rewarded with badges indicating that they completed certain objectives or challenges.
- **Unlockable content**. Not all content will be accessible to the players from the start. In order to see new levels, ecosystems or tasks, they first need to solve the initial ones. This will encourage continued play and increase anticipation. This will also include narrative progression, as the game's storyline will advance by solving tasks.

Interactions

- **Guidance**. The NPCs will be the ones who give tasks to players, while serving as guides that provide tutorials and tips for solving those tasks and giving explanations of the environmental impact of the solutions. They will give insights about the ecosystems and marine life, while guiding the players through the story.
- **Levels and advancement**. The players will be able to select levels using an interactive level selector, as shown in the Figma prototype. In these levels, they will be given tasks that they need to complete. Those tasks will be unique to each level, but all of them will involve a certain amount of interaction with the in-game world, with the objectives being improving the ecosystem. The game world interaction will also be

possible through augmented reality, where players will use their phone cameras to solve tasks as if they were set in the real world. An example of a very simple task would be “trash ninja”, in which trash would be floating in the ocean, and the player would have to pick it up and throw it into the trash. After solving a certain task, the player will be able to go on to the next levels, which could be chosen from the levels menu.

Difficulty

The game will gradually introduce the mechanics and concepts necessary for playing the game. Initially, the levels will deal with fundamental ecological concepts and game mechanics. At each moment, the players should feel like they understand exactly what is required of them and the learning curve will be gentle. As they advance, more intricate ecosystems will be introduced, and along with them, more nuanced environmental issues. Each concept will build on top of the previous one, and the players will advance only after grasping everything necessary for progress. If players ever struggle with certain concepts or tasks, they will be able to go back to the task’s tutorial or ask for a hint. While the game should be challenging, it shouldn’t be frustrating. While progressing through the game, players will be given clear feedback and rewards for achieving learning outcomes. This will motivate them to keep playing and take on more difficult challenges. Different learning styles will also be taken into consideration, as some people may prefer different types of learning (visual, hands-on, auditory, etc.).

EMERGING TECHNOLOGY ANALYSIS

Emerging technology

Augmented reality - AR overlays digital information and virtual objects onto the real world, enhancing the user's perception and interaction with their environment. AR is commonly used in mobile applications, gaming, marketing, and industrial applications, offering new ways to visualize and interact with digital content.

Proposed gaming experience

1. Local Environmental Challenges: Aqua Saviors leverages AR to generate location-specific environmental challenges based on real-world data. Players can explore their local surroundings and encounter virtual pollution hotspots, oil spills, or areas in need of restoration. By using their in-game tools and abilities, players can actively engage with these challenges, cleaning up virtual pollution and making a positive impact on their real-world environment.

2. Educational AR Experiences: Through AR, Aqua Saviors offers educational experiences that provide players with insights into marine life, ecosystem dynamics, and the impact of pollution. By scanning real-life objects or pointing their devices at specific areas, players can trigger interactive 3D models, informative pop-ups, or engaging mini games that educate them about ocean conservation and the importance of sustainable practices.

3. Virtual Ocean Exploration: With the help of AR, players can immerse themselves in virtual underwater environments, bringing the wonders of the ocean to life. Using their smartphones or AR glasses, they can dive into the depths of the virtual ocean, swim alongside realistic 3D representations of marine life, and witness the effects of pollution firsthand. This immersive experience strengthens players' connection to the marine world and deepens their understanding of its fragility.

4. AR Puzzle Solving: Aqua Saviors incorporates AR puzzles that players must solve to uncover hidden secrets or unlock progression. By interacting with real-world objects or locations using AR, players can reveal hidden codes, decipher ancient symbols, or manipulate virtual elements to progress in the game. These AR puzzles add a layer of interactivity and engagement, blending the virtual and physical realms.

5. AR Social Features: Aqua Saviors incorporates AR-based social features that enable players to share their in-game achievements, collaborate on community challenges, or engage in friendly competitions. Through AR-enabled avatar customization and interactive virtual

gatherings, players can connect with each other, exchange knowledge, and foster a global network of ocean advocates.

Feasibility assessment

Hardware:

- Mobile Devices: The game requires smartphones or tablets with AR capabilities to deliver the augmented reality experience to players.
- Recommended computer specifications for development:
    - Processor: A multi-core processor with a clock speed of at least 3.0 GHz or higher, such as an Intel Core i7 or AMD Ryzen 7 processor.
    - RAM: 16 GB or higher. Sufficient RAM is necessary for running the Unity game engine, 3D modeling software, and other development tools simultaneously.
    - Graphics Card: A dedicated graphics card with at least 4 GB of VRAM is recommended for smooth rendering and performance. Examples include NVIDIA GeForce GTX 1060 or AMD Radeon RX 580.
    - Storage: A Solid-State Drive (SSD) with a capacity of 500 GB or higher is recommended for faster loading times and efficient asset management during development.
    - Operating System: Windows 10 (64-bit) or macOS Catalina (10.15) or later versions are suitable for Unity development.

Software and Development Tools:

- Unity Game Engine: Aqua Saviors will be developed using the Unity game engine, which provides a robust platform for creating interactive and immersive experiences.

- AR Development Kit: Unity's AR Foundation or Vuforia can be utilized to integrate augmented reality functionalities into the game, allowing players to scan their surroundings and interact with virtual elements.
- 3D Modeling and Animation Software: Tools like Blender, Maya, or 3ds Max are needed for creating and animating the 3D models of underwater environments, marine life, pollution, and characters.
- Programming Languages: Proficiency in C# programming language is necessary for developing the game logic and implementing gameplay mechanics in Unity.
- Asset Creation Tools: Graphic design software, such as Adobe Photoshop or GIMP, is required for creating 2D assets, textures, UI elements, and visual effects.

Plugins and Frameworks:

- ARCore or ARKit: These plugins provide AR functionalities for Android and iOS platforms respectively, enabling device-specific AR capabilities to be utilized within the game.
- Networking Plugins: Plugins like Photon or Mirror can be employed to facilitate multiplayer interactions and real-time collaboration between players during virtual clean-up events or community initiatives.
- Physics and Particle Systems: Unity's built-in physics and particle systems can be utilized to simulate realistic underwater physics, fluid dynamics, and particle effects for water, pollution, and interactions.

Testing and Deployment:

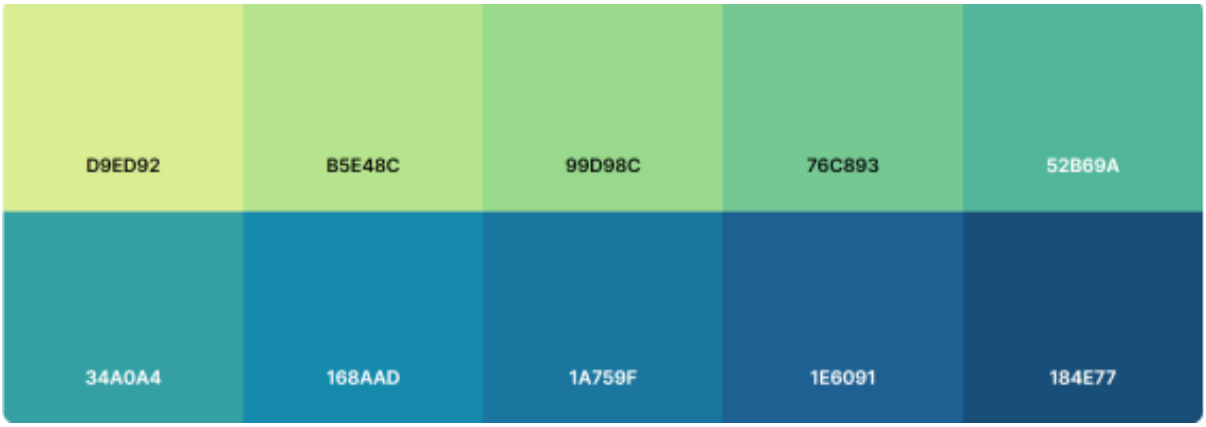
- Testing Devices: A range of smartphones and tablets with different specifications and operating systems should be available for testing to ensure compatibility and optimal performance.
- Deployment Platforms: The game can be deployed on popular mobile app stores like Google Play Store for Android and Apple App Store for iOS devices.

- Analytics and Performance Tools: Integration of analytics tools, such as Unity Analytics or Firebase, can provide insights into player behavior, performance optimization, and bug tracking.

VISUALS

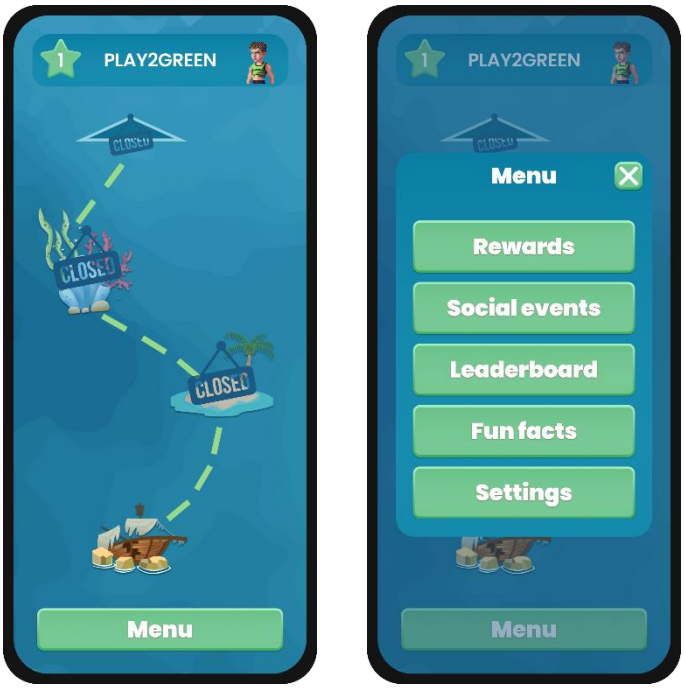
Logo

Color scheme



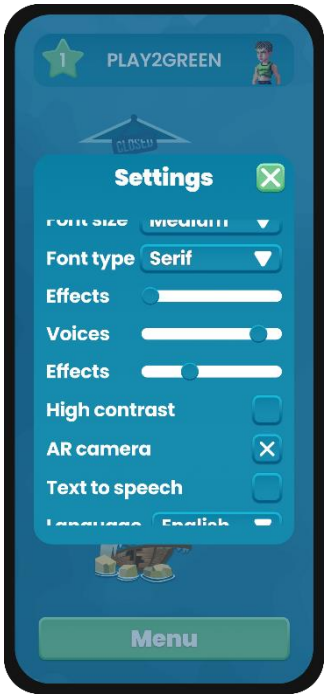
Screenshots

Main menu screen



Action screens

Settings screen



Prototype

https://www.figma.com/file/HfD7OjU9Taeaozfkn1pMvE/OceanRescue_P2G?type=design&node-id=56%3A21&mode=design&t=D0dekrFXuj8VHntA-1

UNIVERSAL DESIGN FOR LEARNING ANALYSIS

	ENGAGEMENT	REPRESENTATION	ACTION & EXPRESSION
ACCESS	***Recruiting interest***	***Perception***	***Physical action***
	We use a proper color scheme Reward and achievement system Difficulty levels (easy, medium, hard, no time limit)	There are subtitles on the bottom when NPCs are talking, as well as audio conversation. Adjusting sound levels (separate adjustments for background music, effects, and dialog). Players can adjust the font type and size. There is a high-contrast mode. Links are clearly highlighted and underlined.	The game is playable on mobile phones and tablets.
BUILD	***Sustaining effort and persistence***	***Language & symbols***	***Expression & communication***
	Organized real-life group ocean cleanup events. The user enters their nickname in the beginning.	Everything that NPCs are saying is illustrated using animations. Use simple language, repeat everything that was said.	Text-to-speech support. Different NPCs are used in different situations and quests.

	The game has a leaderboard which motivates players.		
INTERNALIZE	***Self-regulation***	***Comprehension***	**Executive functions**
	Daily challenges to keep the player engaged. Rewarding system to reflect the player's progress.	Support the background knowledge of players with fun facts and useful information. Players will be able to click on an info button that repeats the problem and clarifies the task.	To show progress we use the level map, as the more levels you complete, the further you go. Special quizzes appear related to the game fun facts.
GOAL: EXPERT LEARNERS WHO ARE	**PURPOSEFUL & MOTIVATED**	**RESOURCEFUL & KNOWLEDGEABLE**	**STRATEGIC & GOAL-ORIENTED**

CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org.