CCT College Dublin
Computing • IT • Business

Applied Technology Group Project:

Galaxy Chronicles: Zenith, the Invisible Enemy (The invincible Enemy)

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To all anonymous gamers.

Who have lives so many lives, loves, challenges and wonders.

Never stop exploring!

Contents

Introduction

Ever since the electronics engineer Nolan Bushnell started the era of studios game development with Atari from the early 70s to the present day, we see a growing evolution of digital games in various categories, whether in the technological part or stimulate the user ratiocination and acquire skills. (“ADAMS IN BATEMAN AND BOON, 2006”).

However, developing a game has always been a challenge, concluding it is a considerable challenge, either by lack of knowledge or for not knowing the stages of development. This project aims to make specific documentation for developing a 2D platform game.

According to Yu (2010), one of the biggest problems in game development is finishing it, knowing when it is complete. A very high number of game developers simply discard the project or fail to finish it. This fact is usual; as such developers do not know which the next part of the development is and also don't know how the game will be in the end. Therefore, they can miss essential elements for the game. This is because there was no early concern with project planning.

Along with the market growth and the need for an industry with interdisciplinary, some methodologies were brought from other areas, as in the attempt to apply product design methodology in games, as in the case of the study by Eric Zimmerman (Zimmerman, 2003).

To minimize the problems mentioned above, the main idea is to develop a game design document, which is extremely critical for its development, which is usually ignored by some company’s developers. With this document complete, the entire implementation phase will be

Straight forward and more relaxed, as the concepts and steps for development will already be described and detailed, with no room for faults.

Object of Study

This project has as objective the design and implementation of a 2D digital game, more specifically in its conception phase, initial planning phase, survey of which elements and rules will compose the game and finally implementation.

Project Background

As a team we started doing a brainstorm to decide the objective of our final project, initially we were thinking in a project to solve a problem and make it profitable but in the middle time we found out that games are a passion we all share, even if it is a casual game that you play during the bus travel or a more complex game as a Role-playing game (RPG).

We decided to change the path and do a game as a final project, the main cause that made us change our minds is that a game is something that the whole process would be fun to do. The team will have to use the creativity and the whole games background to create a good game with a story and puzzles that challenges the user.

After agreeing that we are going to make a game, we had to do a next step that is answering two questions: What type of game? And what is the game’s story? We decided to create a 2D platform game with some RPG features, mixing the both type of games that we like the most. The main idea was an RPG but the complexity of this type of game is really high and we think we won’t be able to deliver a high-level game so we choose to combine business with pleasure, RPG features in a 2d platform game.

The first step of any project is found out the problem, requirements, market study and user expectations and needs. In this process we gather together essential information that gives direction of the project.

A market analysis is a costly and time-consuming process, this factor that prevent game companies from carrying out such a survey and what happens is that at least an analysis of trends and a survey of what has been done over time must be done, for example, which games are most played in a certain region of the world and on which platform, or which games that have same characteristics as the one being developed.

Roles

Art, Animation & Sound: No copyright sounds, Background (parallax), characters, illustrations and sprites.

Programming & Simulation: Create the classes, set actions and use the engine.

Development & Direction: Manage the tasks and check if the project is in the right track.

Responsibilities

Art, Animation & Sound - Valter and Leandro.

Programming & Simulation - Diego (Manager), Alisson, Valter, Leandro and Marcos

Development and Direction: Alisson and Marcos

Structure of the work

The present work is divided into five chapters. Chapter 1 presents the introduction of the work, the object of study, project background and rationale, roles and responsibilities, literature review, methodology and project plan.

The introduction provides a brief explanation of the problem and the justification for the work and the relevance of it.

Chapter 2, entitled System Analysis and Design, provides an overview, how games are developed, what are their constituent elements

Chapter 3, the implementation of de system and how we planned to get to the final piece.

Chapter 4 Tests and evaluations are presented, the limitations and problems during implementations.

Chapter 5 and last chapter presents the study's conclusions and recommendations for future

Evolution of the Games and Platform

The world's first game officially appeared in 1958, created by Willy Higginbotham. The game, called Tennis Programming, later known as Tennis for Two, was simply software that simulated a tennis match using an oscilloscope.

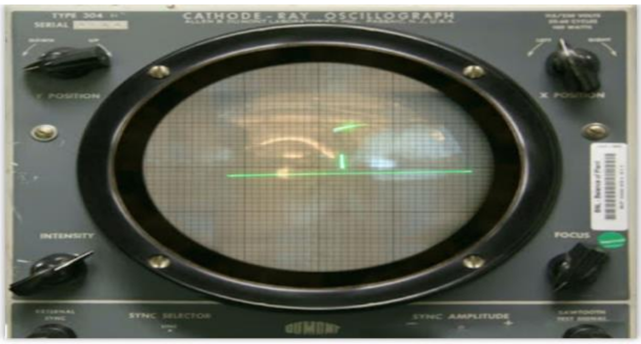


Figure 2: Tennis for two.

Later, with the small evolution of technology, the famous Pong appeared, in 1972. Created by Atari. The main factors in its success were its "playability" and its simplicity: nothing more than a scoreboard, two dashes and a ball.

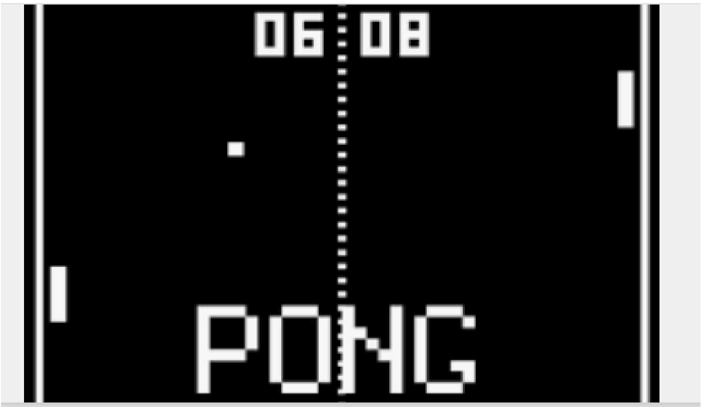


Figure 3: Pong.

The first platform game was developed by Universal Entertainment Corporation, formerly known as Aruze Corporation, released in 1980 SupesuPanikku (Space Panic in English) was the first game involving climbing ladders between walkable platforms.

The genre was inspired in a game called Heiankyo Alien (also known as "Digger" in North America) the game was released in 1979 and it was a top-down view maze game with digging and trapping mechanics. Space Panic changed it to a side-view gameplay format while adding platforms and ladders.

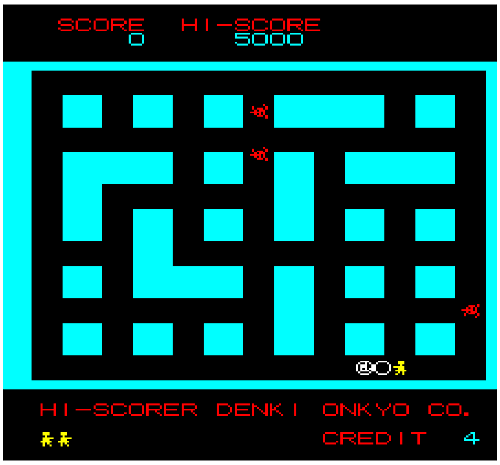


Figure 4: Heinkyo Alien 1979

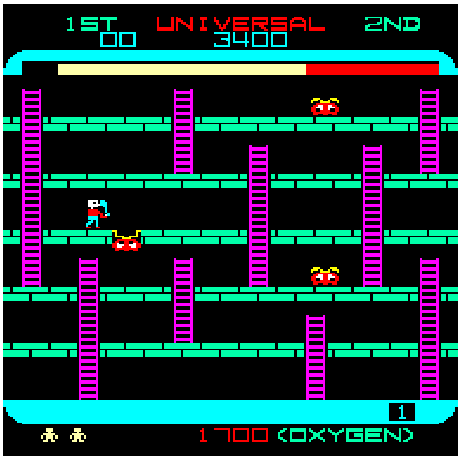


Figure 5: SupesuPanikku 1980

In 1981 Nintendo released Donkey Kong, its game play consists of the main character Mario, jumping and avoiding obstacles to ascend a construction site and rescue Pauline from the giant gorilla named Donkey Kong. The game uses the same Silicon Graphics (SGI) technology as the original, which features the use of pre-rendered 3D images. Diddy's Kong Quest received critical acclaim and is widely considered to be one of the greatest 2D platform game ever made.

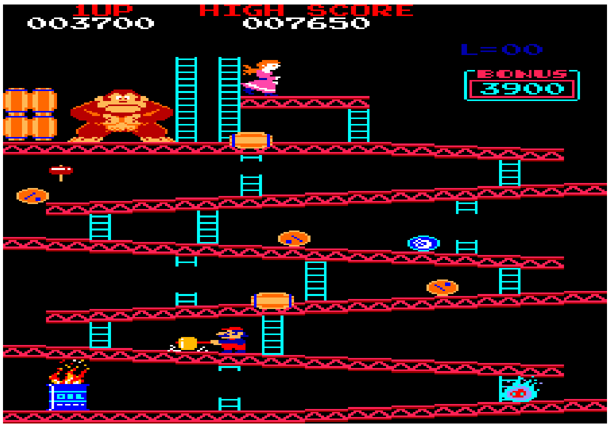


Figure 6 – Donkey Kong 1981

In 1985, Super Mario Bros finally came to life on the NES. It brought us side-scrolling levels, memorable foes, boss battles, secret paths, power-ups and so on. The limited power of the NES only allowed for horizontal scrolling (as evidenced by going out of bounds causing Mario to disappear from the screen) but for that time, it was more than enough.

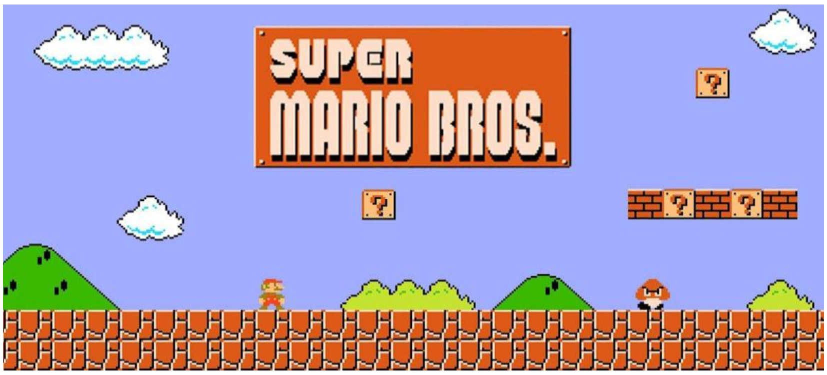


Figure 7 – Super Mario Bros. 1985

Other titles like Mega Man and Metroid also rose to prominence; the former mixing shooting with platforming and the latter emphasizing exploration and adventure. Capcom's Bionic Commando introduced us to the grappling hook and multi-directional scrolling, both of which became staples in their own right.

After the creation of these games, it was a boom in the market with several game options such as:

The 16-bit Era

Sega's Genesis console was out in 1989, two years ahead of Nintendo's Super NES, and had titles like Capcom's Strider to showcase its power. However, it was Nintendo's Super Mario World which caught the industry's attention. This new 16-bit era of platforming allowed for all kinds of innovations, not the least of which included enhanced parallax scrolling, large spanning levels and more detailed pixel sprites. While Nintendo was basking in the Mario acclaim, Sega realized it needed something more. It needed a mascot.

Thus, Sonic the Hedgehog was born. Sonic introduced a much faster style of platforming, an attitude that was “cooler” than Mario and a look that distinguished him from the pack. Naturally, he had his own set of rip-offs like Bubsy, Aero the Acro-Bat and whatnot but the series continued towards greater success with Sonic the Hedgehog 2 and 3.

Figure 8 - Sonic the Hedgehog 1991

This generation is interesting because it featured some of the best platforms of all time. Capcom's platforming shooter Mega Man had discovered new horizons with the more mature Mega Man X series on the Super NES. Nintendo further expanded its console's range of platform games by purchasing Rare Studios. Rare took a big risk at the time by producing expensive pre-rendered graphics for Donkey Kong Country. Sega was still riding high on the Hedgehog wave with Sonic and Knuckles. Castlevania took cues from the Metroid franchise in Symphony of the Night and became an instant hit. Let's not forget Super Metroid, Rayman, and Super Mario World 2: Yoshi's Island and other classics.

Honourable Mentions

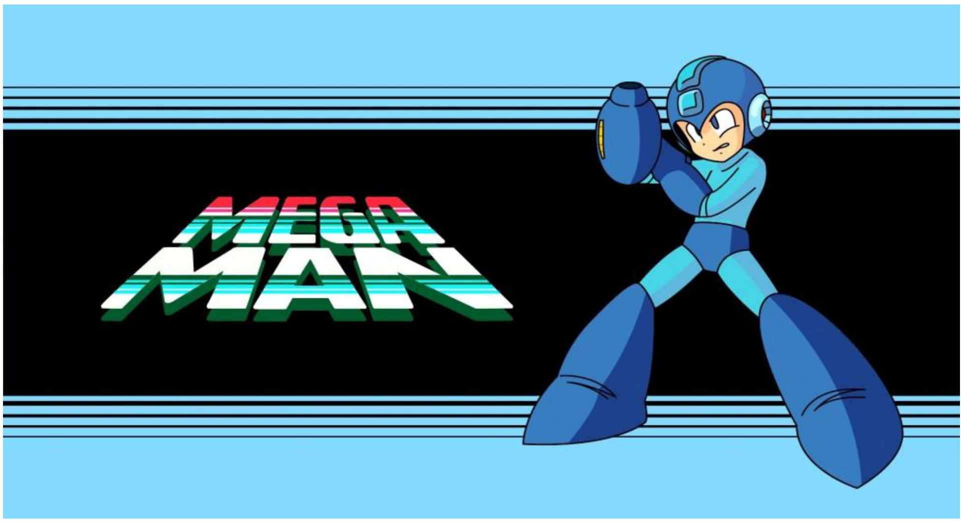


Figure 9 - Mega Man Series

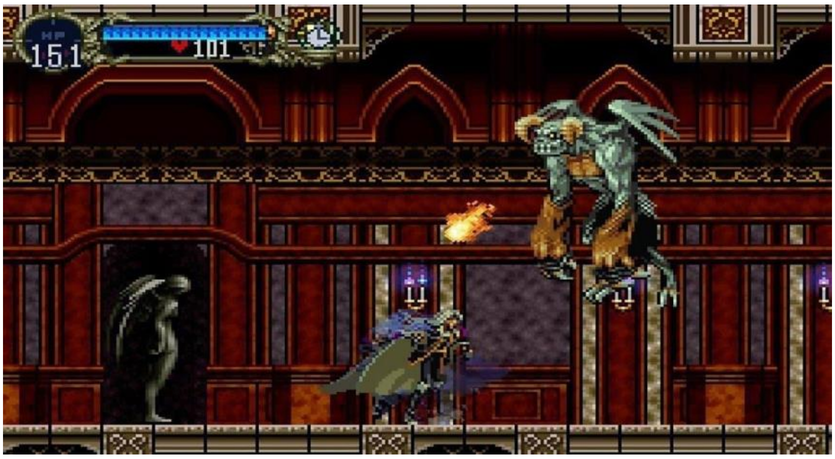


Figure 10 - Castlevania Series

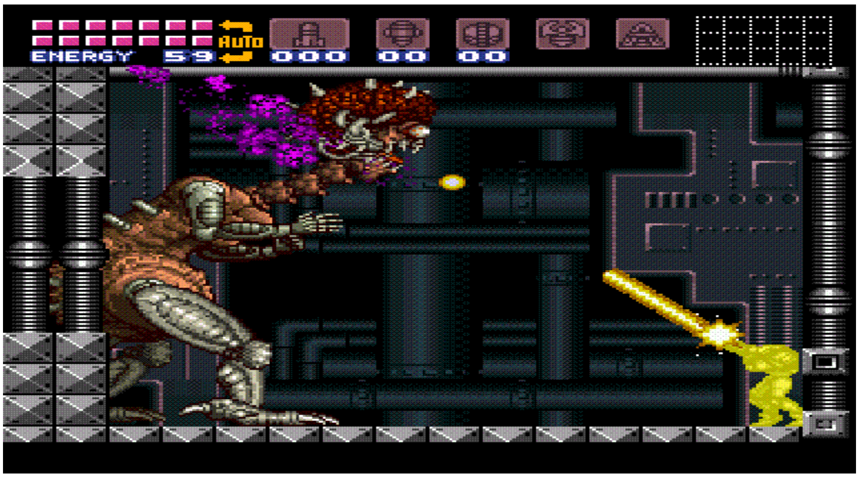


Figure 11 - Super Metroid

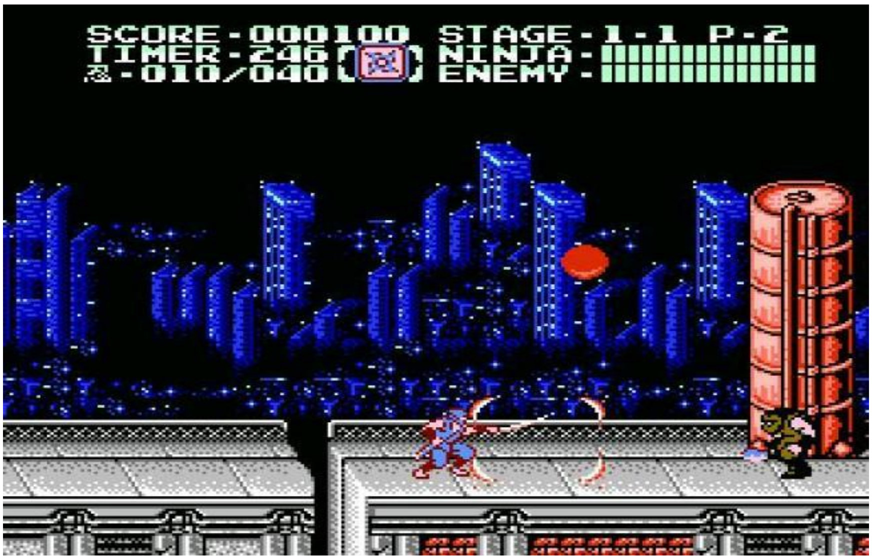


Figure 12 - Ninja Gaiden

Figure 13 - Contra Series

The New Generation of Games

There was a decline in popularity of the genre after 2006 with the ascension of the new modern first-person shooter games; however, the genre still exists in the commercial environment, with several games selling in the millions of units.

Nowadays platform games are developed mostly by indie teams; there are some very good titles out there, like Hollow Knight, selling over 3 million copies. These games come with new recipes, new mechanics, modern graphics, retro style, the genre has expanded significantly. New tools are available for the developers, making the game development easier and possible for smaller teams, consoles and PCs are much more powerful now, expanding, even more, the possibilities as we do not have the same limitations we had back in the ’90s.

Hollow knight is a very good example of how technology is helping small teams. The game was developed and published by Team Cherry, a small team having only 2 members Ari Gibson and William Pellen which started a kick-starter campaign in 2014 seeking a modest sum of $ 35,000. The game passed this goal, raising more than $ 57,000, allowing its scope to be expanded and another developer to be hired, technical director David Kazi as well as composer Christopher Larkin.

Influences for the game include *Faxanadu*, *Metroid*, *Zelda II*, and *Mega Man X*. Team Cherry noted that Hallow nest was in some ways the inverse of the world tree setting in *Faxanadu.* The team also noted that they wanted to replicate the sense of wonder and discovery of games from their childhood from such games, in which "there could be any crazy secret or weird creature."

Believing that control of the character was most important for the player's enjoyment of the game, the developers based the Knight's movement on *Mega Man X*. They gave the character no acceleration or deceleration when moving horizontally, as well as a large amount of aerial control and the ability to interrupt one's jump with a dash. This was meant to make the player feel that any hit they took could have been avoided right up until the last second.

To create the game's art, Gibson's hand-drawn sketches were scanned directly into the game engine, creating a "vivid sense of place". The developers decided to "keep it simple" to prevent the development time from becoming extremely protracted. The complexity of the world was based on *Metroid*, which allows players to become disoriented and lost, focusing on the enjoyment of finding one's way. Only basic signs are placed throughout the world to direct players to important locations. The largest design challenge for the game was creating the mapping system and finding a balance between not divulging the world's secrets while not being too player-unfriendly.

The technology used to develop this game was Unity and the game was released on diverse platforms, in 2017 it was released for Windows, MAC and Linux, and later on, in 2018 it was released for Nintendo Switch, PlayStation 4 and X-box One.

Figure 14: Hollow Knight 2017

Main References

Chrono Trigger

Chrono Trigger features a standard RPG video game. The player controls the protagonist and his companions in the game's two-dimensional world, which consists of various forests, cities and dungeons. Navigation takes place through a world map, representing the landscape from a reduced aerial view. Areas such as forests, cities, and similar places are described as more realistic scaled-down maps, where players can chat with locals to buy items and services, solve puzzles and challenges, or encounter enemies. Chrono Trigger's game play differs from traditional Japanese RPGs; instead of appearing in random encounters, many enemies are openly visible on field maps or lie in wait to ambush the party. Contacting enemies on a field map initiates a battle that takes place directly on the map, not on a separate battle screen.

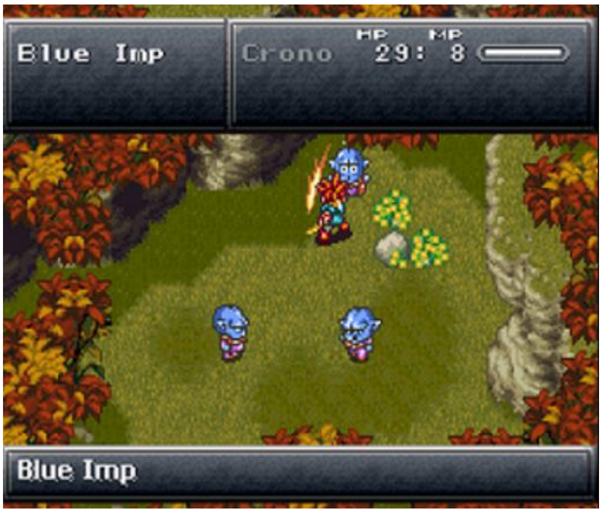


Figure 15: Chrono Trigger image

Metal Slug

Metal Slug (Japanese:メタルスラッグ, Hepburn: MetaruSuraggu) is a Japanese gun and racing video game series created by Nazca Corporation before merging with SNK in 1996 following the completion of the first game in the series. Derivative games include a third-person shooter to commemorate the 10th anniversary of the series and a defence game for the mobile platform. Created for Neo-Geo arcade machine hardware (MVS) and Neo-Geo home game console (AES) hardware, the original games have also been ported to other consoles and mobile platforms over the years, with several later games created for many more Platforms. The games focus on the Peregrine Falcon Squad, a small group of soldiers who fight a rebel army, aliens, zombies, mummies and various other forces intending to take over the world.

Figure 16: Metal Slug.

Literature Review

After defining the main idea, we used a questionnaire to make the directions of the project clear, as you can see below.

Questions	Answers
What is the purpose of the game?	Casual gaming for all ages.
Who would be interested in playing such a game?	Commuters, People waiting in queues, Before bed-Time, Leisure time, Casual.
What style of game to adopt?	Adventure 2-D, Sci-Fi/Fiction.
Is there something similar already developed?	Yes, with different mechanic/plot combinations
Is the existing game well accepted?	Many are world-wide famous franchises.
What are the reasons for the success or failure of the game existing?	Uncertain to point a main reason for all, we believe one important reason is how well the player understands the mechanics and the objectives to have fun with little screen time.
What are the trends?	Hollow Knight, Blasphemous, Katana zero, etc.
What visual features are required?	Parallax, pixel-art animation.
What technologies are involved in the game?	AI, Possibly OpenGL, DirectX, etc.
What are the requirements for the use of trademarks and rights to image use?	Avoid using non-authorised images, focusing on create own or free-to public pixel art.

The next step was to find out which would be the best tools to develop the game, after thorough research we get involved in a dilemma to decide between the two most popular game development tools **Unreal Engine** and **Unity**.

Unreal Engine

Why choose Unreal engine?

Our first option was Unity but we decided to migrate to unreal first of all because our team member Diego has knowledge and experience with unreal engine, secondly developing in Unreal Engine 4 is very simple for beginners. Using the Blueprints Visual Scripting system, you can create entire games without writing a single line of code! Combined with an easy-to-use interface, you can quickly get a prototype up and running.

Unreal Engine is a complete suite of creation tools for game development, architectural and automotive visualization, linear film and television content creation, broadcast and live event production, training and simulation, and other real-time applications.

How much does it cost?

Unreal Engine End User License Agreement for Publishing: This license is free to use and incurs 5% royalties when you monetize your game or other interactive off-the-shelf product and your lifetime gross revenues from that product exceed $1,000,000 USD.

Unreal Engine End User License Agreement for Creators: This license is free to use and 100% royalty-free; you can use it to create internal or free projects, or to develop linear content or custom projects for clients, but not for publishing off-the-shelf offerings.

What coding language does Unreal Engine use?

Unreal Engine uses the text-based programming language, C++. In addition, Unreal Engine also uses visual scripting called Blueprints which utilizes a faster programming option via drag-and-drop.

Games that use Unreal

- Batman: Arkham City (Return to Arkham);
- Ark: Survival Evolved;
- Conan Exiles;
- Kingdom Hearts 3;
- Final Fantasy 7 Remake;
- Dragon Ball Fighter Z;

Sprites

We cannot forget one of the main parts of our process the graphics, to illustrate how the graphics part of a game works we need to start with the Sprint concept.

A sprite which is also known as an icon is defined as a two-dimensional image or animated image that plays a specific role in a scene. They are the non-static elements within a 2D game, moving independently of the background.

Often used to represent player-controlled characters, props, enemy units, etc., sprites can be composed of multiple tiles or smaller sprites. The term sprite can be applied more loosely to mean any 2D graphic drawn on a computer, also known a Pixel Art.

The idea of a sprite dates back to the mid-1970s where relatively primitive sprite images first started to be manipulated within a greater visual image, assets of bitmaps.

As computer graphics developed throughout the decades, sprites changed from a simple bitmap or block images to more sophisticated animated GIFs, and then to three-dimensional or more fully animated characters

The use of sprites originated with arcade games. The first video game to represent player characters as human sprite player images was Taito' Basketball, which was licensed in February 1974 to Midway, releasing it as TV Basketball in North America.

The first video game with colour sprites was 1973 arcade game Playtron, developed by Japanese company Kasco, which only manufactured two cabinets of the game.

Billboarding

Billboarding is one term used to describe the use of sprites in a 3D environment. In the same way that a billboard is positioned to face drivers on a highway, the 3D sprite always faces the camera.

Alternative terms

- 3D Sprite is a term often used to refer to sprites that are essentially texture-mapped 3D facets that always have their surface normal facing into the camera.
- Z-Sprite is a term often used for 3D environments that contain only sprites. The Z-parameter provides a scaling effect that creates an illusion of depth. For example, in adventure a game such as Kings Quest VI the camera never moves, normal 2D sprites might suffice, but Z-sprites provide an extra touch.
- Impostor is a term used instead of billboard if the billboard is meant to subtly replace a real 3D object.

They're all free to download or use online and can help you to create the pixel art for your sprite sheet.

- PiskelApp.
- Pixie.
- Pixlr.
- GrafX2.
- GIMP.
- PyxleOS.
- LunaPic.
- GraphicsGale.

Sprites are an indispensable tool when it comes to designing 2D indie games and retro games. They can be implemented in various game genres such as sidescrollers, platform games, 2D RPGs, and fighting games. A lot of web games that you play in the browser use sprites.

Learning how to create and use them will help you significantly on the path to becoming a professional game developer. There are plenty of online resources to help you along.

Methodology

To realize a game project, you must go beyond programming. Achieving a good game balance combined with a good user experience is one of the big challenges of each new project game.

For this, we can use methods that help this assessment in each of the steps from the game design, from its conception to the finalization. After some exploration we found three options of methodologies that can fit in our project: Kanban, Double diamond and Scrum.

The Kanban methodology is a visual system for managing work as it moves through a process. It visualizes both the process (the workflow) and the actual work passing through that process. The goal of Kanban is to identify potential bottlenecks in your process and fix them so work can flow through it cost-effectively at an optimal speed or throughput.

The Double Diamond design model is a framework that can be used in a variety of industries but mostly by designers. The Double diamond has four stages: Discovery, Definition, Development and Delivery and together these stages work as a map and the designers can use it to organize their thoughts in order to improve the creative process.

Finally, the Scrum methodology, this method is one of the most popular agile frameworks in use today and rightly so it is used to develop complex products and systems. In the field of project management, "scrum" refers to the brief meetings where team members come together to talk about their successes relating to a project, how far they've come, what the next steps are and any future challenges they anticipate.

The whole idea behind agile project management with Scrum is to give the end users exactly what they want. This can be achieved through "Sprints" or continuous feedback and iterations. Sprints are meant to be short, but regular, cycles of no more than four weeks for which a significant product increment is expected to be presented.

Those three methodologies are really used in the project management field and in a variety of projects and our team need a reduction of risks, flexible to changes and time reduction methodology as in the approach of games design by author Eric Zimmerman.

The author proposes that the development of a game as a whole must follow an iterative cycle, believing that its creation process can be used as design research and that design theories can help to develop processes used to design new games.

Along the development process based on the iteration design, the game is deconstructed and built several times throughout its process until reaching its ideal stage. During the development of a game, some questions may arise followed by answers to such questions, in a process cyclical of questions and answers. Zimmerman (2003), states:

"Iterative design is a methodology based on the cyclical process of

Prototype, analyse and refine a product throughout the process."

At each stage of game development, through iterative design (figure 1.1), we have succession of interventions that are made in the products, generating several versions of the product, in a spiral that tends to the best final finish. In that process, each design decision is made from the observation and experimentation of the prototypes that are generated.

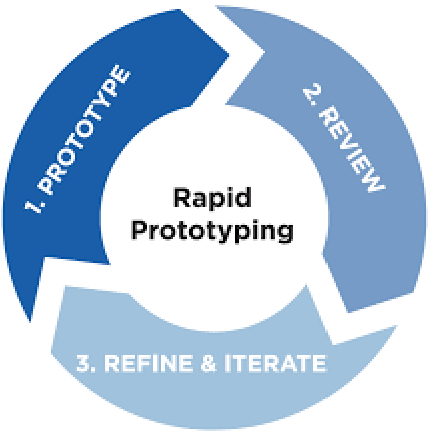


Figure 17: Rapid Prototyping proposed by Zimmerman.

In this case, iterative design can mean testing a game from a low-fidelity prototype to alpha and beta versions of the game.

After our team meeting and analysing the methodologies listed above, we decided to use the Scrum methodology with the sprint meetings to keep the whole team updated and check the next steps and also use the iterative cycle to achieve our goal that is the best final game.

Game History

The history telling in vital for an adventure game as much as exploration, the plot was developed for the player go back and forward in all game scenario to discover and explore, whilst fighting a threat.

The Plot can be divided in two: The main history and the Character's Past.
The past will be an attachment to this document, and the history will be told in this document as sub-chapters;

Chapter one: the Invasion of an Invisible Terror

Berg is a peaceful citizen of Planet Earth.
Whilst sipping his favourite drink on his favourite day of the week, a Tuesday. Something happened.

Does he realize he saw something or was it, someone? Some blue creature? It cannot be.
--Maybe it's my drink. -- Berg said as he rubbed his eyes.

A beautiful waitress offers to refill his cup with her lemon coffee liqueur while asking if he is okay.
--I'm great my dear -- says Berg as he saw some more little creatures entering the cafe.
--I just don't remember seeing this kind of bug before around here... -- says Berg as he points to the door.
The waitress calmly looks at the door with a worried face -- are you talking about the teenagers? -- She said lowering her eyebrows.

--No, forget maybe this should be my last dose of Lemon coffee...-- Berg said while taking a long sip from his mug. This was when Berg saw one of the little creatures climbing by the waitress's hand.
-- Hey, what's that in your hand? Don't you see it? -- Berg said alarmed as the creature slowly climbed the waitress's arm towards her head.
--I don't know what you're talking about dear, but I think I agree with you, I don't think you should drink anymore"- Said the waitress clearly emotionally affected by Berg's comment.

Berg, Alarmed, watched the waitress walk away with light steps as he watched the creature finish climbing up to her head. The waitress stopped abruptly, looking lost, knocking her tray of coffee to the floor. Some employees and customers ask if everything is ok.
Berg notes that her colour has turned slightly bluish and her eyes have changed colour to white. This didn't seem to be noticed by the others around who helped her clean the floor and put some glasses back on the tray. She was smiling, but not as before, the smile was malevolent and Berg saw

for a moment her eyes waver between blue pleadings for help and white and implacable until at last her eyes fixed on white.

She coughs in her hands and new creatures appear in her hands after a blue cloud dissipates. She thanks everyone with handshakes and leaves. Everyone around has taken a creature from her hands. Creatures go up their arms and goes towards the heads.
Berg saw enough, in a hush; he filled his canteen with drink, got his backpack, and sped off towards the street to get away from these white-eyed green people.

Just by reflex Berg knows the little device he always carries with him is exactly what he needs to survive, the blue gun.

Berg runs lost in the street, blue infected humans attack him and he shots at them, these shots are different, this gun was useless until today He used to think this gun was important but not useful until now.
People who get shot turns back to normal, like their body just kills the creatures instantly form inside. Berg goes in direction to the biggest hospital shooting people to save them. He progresses in direction to the hospital.

At the hospital which seems to be the only place around where he can get protection and a place where he hopefully won't be attacked. The blue gun he always carried with him proved crucial for his survival. But something is strange, for some reason just Berg can see the little creatures and how infection happens.

Berg goes to speak with the hospital's chief doctor.

--Sir, I have this gun that saves people, please let me talk to someone for we need more people with this to solve this problem-- Said berg to the doctor in front of the hospital office.

--Thank you, sir, for your service to the community! I see you are one of them... FANTASTIC! Now please follow me we certainly have much to talk about-- said the doctor.

-- Thank you, doctor, I believe they are testing cures in the hospital and I would like to help -- Berg said with an adventurous air whilst followed the doctor in direction to the big office.

--Oh, my dear, thank you very much but your help will not be needed. – Said the doctor after closing the door behind Berg -- Our research has already ended, we did the study of patients and concluded that everyone just needs to wait for this flu to pass-- Said the doctor as his teeth grow sharp and his face pales.

Berg notices new figures, and now he can see little red creatures dancing revolving around the doctor's head.

--Doctor, I think you're bad too, let me help you-- berg said while taking the gun out to help. Quick as lightning, the doctor pushes the berg to the back of the room and presses a button that closes all exits from the room and a red light fills the room.

-- It seems that we have an enemy that we can't neglect, if it wasn't for you this continent wouldn't have an only soul without me inside it! We'll never let you win this time we have the Victory! -- Said the doctor as he turned into a red creature and attacks.

--BOSS FIGHT--

At the end of the battle, Berg finds that the slime that dissolves after the creature dies has a piece of paper written between unrecognizable bits of cipher that he didn't understand, managed to find a piece of text he could understand:

“The key to kill this disease is not found so easy; Cross the ocean towards the south, the next piece is about the Mouth!"

-- Would it be possible? If it is a disease that means the doctor was hiding the cure, I need to know more. There is no time to waste; I need to travel to the South-- Said Berg worriedly. Berg acclaimed by the hospital people tells them about his adventure to save people from the disease caused by the creatures they can't see and where his adventure will take them.

Motta; A Pilot hiding among the crowd informs Berg that he has an aircraft at the helipad on the hospital from where he can take him to the airport and from there, take him to South America on a plane.
-- Sir, please, come with me! I will help you! I have an airplane to bring you anywhere you need! – Motta said.
-- Thank you! Please let’s go to South America! -- Said Berg.

Comment of the author:

During the first chapter, the idea was to create ambience for the player to feel slightly lost, as much as the main character is. Berg at this point doesn’t remember his past and find himself in an invasion moment where he is the only who can fight and see the creatures, he discovers himself as the chosen one and decide to do something about it without little clue.

There is introduction on how the main mechanic of the game will work. A 2d third person platform game, with a character that can shoot infected people. People aren't the enemy; therefore, they don't die when shot at, they just get disinfected and can be infected again by other creatures in the scenario

Creatures bounce in the screen edges and whenever touches a not-infected person, it disappears and changes the person who can now damage the main character. This mechanic will apply during the whole game with exception for Boss Fights. Boss fight mechanics vary from boss to boss and will be described further.

Chapter two: This is bigger than me.

Berg has a restless sleep as he flies towards South America. In his dream he sees a boy on boat fishing with his father, blue creatures, a strong light, a strange planet, His mother...

-- WAKE UP BERG! -- shouts Motta.

-- Uh, What? Sorry have we arrived? -- Said berg a little confused from his abrupt awake.
-- Mr Berg, you scared me! I thought you've turn in one of them! Oh My God Thank God you are ok!" said Motta.

-- I'm sorry I got you concerned I think I was very tired; there is no time for resting I need to investigate the next Clue! -- Berg says while running through the door.

-WAIT, you cannot walk now without this!" -- Said Motta holding a blue face mask -- They said on the radio this is important not to get infected, please use it! -- Said Motta.

-- Thank you, Friend! I should be back soon -- Said berg Storming out of the door.

Going from the terminal Berg sees that people who has blue masks don't get blue creatures to climb their faces, they slip and fall. Not everyone is using masks and berg progresses shooting blue infected people to turn them back to normal. Berg notices that blue infected people don't harm berg when he is using blue masks. At the exit of the terminal after a small sprint and a few foes, Berg Fights his first red-infected person.

-- There is more? It mutates! And they are stronger after that, I don't know where to look for this Mouth, I shall travel around this country and see if I find any clue about it-- Berg runs through scenarios from the airport to Rio de Janeiro, gets a bus to different scenarios where he sees signs and posters that refer to leads that makes him travel to different places and look further more.
In Rio, berg sees that the biggest city is Sao Paulo. – The biggest might have a good clue—Berg goes onto a bus towards Sao Paulo.

Berg travels to Sao Paulo, and finds that has a clue that refers to the biggest state on south east is actually Minas Gerais. Progressing from Minas Gerais Berg finally see an important clue – The Mouth Museum in Bahia was recently refurbished –Berg reads from a billboard; Berg progresses to a bus that brings him to Bahia where he finds the museum. The museum is saturated with new purple creatures bouncing around and Berg suspects this is the right place at last. By the reception he asks the lizard receptionist

--Excuse-me dear sir, I wonder if you can see the purple cloud inside? -- The receptionist answers -- Oh my! Fantastic you have arrived finally, please come with me... – Said the lizard wrapping him with the tail and dragging him into a huge office. Berg follows struggles to lose himself from the receptionist whilst they arrive to a big dome room where at the end of it there is a triple headed lizard dressed in a smoking at its oak desk. The head on the left looks female and have round teeth, the head on the right looks male and have squared teeth, the head centred looks very lizard-ish and its huge mouth shows all its sharp teeth. The Receptionist leaves fast and closes the door behind them.

-- Ah, you are Mr Berg? It is so nice to meet you sir, please take a seat -- the Hydra says with its female head. -- My good sir, your efforts have been noticed and I would like to help you fighting this good fight and free humanity from the invasion of This Disease, I've been researching ways to kill it and I have much to learn from your past in Keppler. But before I ask you some questions, please have this piece of paper" -- says the male head.

-- The next clue resides outside the oldest dungeon in Europe -- Berg reads from the piece of paper. Looking at the centred head which was gazing at him since the beginning Berg made a ball with the piece of paper and throw it at the Hydra.

-- Hmm suspicious! Are you? I understand I've been like you for so long. I'll show you a good reason not to be suspicious.... MWAHAHAHAHAH!"—The middle-headed Lizard says whilst the purple cloud invades the room and each head swallows it and the hydra get bigger and purple and attacks.

Berg is confused; this word the Hydra said was not strange and gives him a good sensation... Keppler, if I stop to think about it and remember what happened whilst I was fighting these creatures, I shall remember something more. Berg sees at the desk a piece of paper hidden under some folders -- Clue from the rounded mouth, find the Eye of the East dragon, underneath the meat wagon—Berg Reads and knows where to go immediately. Berg runs back to the airport where he finds the Motta who is ready to fly to Asia.

Comment of the author

In this Chapter, the player will be firstly introduced to the flashback concept. Here berg has visions whilst sleeping on the plane of images he doesn't understand but he recognizes his family from flashback, this alone gives the important Idea that this was his past.

A new mechanic feature is implemented, the Mask. The mechanic will be explained further. But the first interaction will be noticed when the player can't be harmed by people infected by blue creatures. And soon enough there will be the first encounter with an upgraded enemy.

The enemies' mechanic will be explained further, and at this chapter we notice a trend in the game. Enemies will improve damage and hit points increasing the challenge the player will face during the game play.

During this chapter, the hero has very little clue, and for this explore various different scenarios until he finds something that matches with his clue, finding a BOSS that tries to deceive him, Here the player will have the option in the dialog to accept the proposal or refuse.

The concept of non-human bosses will be important for the plot; the objective is to keep the player interested on what is the real enemy and get curious to understand the flashbacks and gather more information in the game keeping a certain urge to continue the history and overcome challenges to learn more.

Chapter three: Abrupt Learning

Motta brings Berg to China, The Dragon of the west. This is the only moment he has to get some sleep, but now they are restless and have some confused images and scenarios he doesn't understand.

-- A white mountain in a warm place..., A Laboratory? City...? This is Huge! ...—Berg was talking whilst sleeping.

--**! HOOOONK! ** -- Bergs wakes up abruptly with Motta using an air horn to wake him up.
-- I'm Sorry Berg, but this is the only way I could think on how to wake you up-- said Motta, slightly repented.
-- Oh My God! You could have used water! -- Said berg with a huge headache pinching he's brain.
-- In fact I have, but for some reason the water never touched you, I think you should see a doctor, this doesn't look normal... -- Said Motta offering him a Coffee mug -- We have arrived, this is the capital of China, Probably the eye as the clue says? -- said Motta with a friendly face.
-- Thank you friend, it's time to go! – Berg storms out of the airplane and runs into the big city.

The country is huge and he decides to start looking from the Capital, Beijing. -- My clue is some place called the meat wagon... or is this some car? Oh my God! People are infected here as well! --The city centre has many people and now all three colours of little creatures' flies around the air of the city. Some of them fluctuates too high to touch people, others fly towards the population. Berg uses his gun to fight against a big horde of infected people, trying to save them from the creatures, but there is too many for him to be able to fight.

The new purple infected humans can jump high, avoiding most of his shots, and they are more resistant to the Cure-gun, eventually berg is overwhelmed by the crowd when a big Flash occurs. Silence

...

...

-Berg? ... Baby, wake up Sleepy head! – A voice was coming from the void.
-- My Mom's voice? Am I dead? All my efforts were in vain? I really thought I could make it – Berg was confused and scared.

-- Stop thinking like that darling – The voice was calming and distant, but still loud enough.
-- Can she hear my thoughts? Why I'm in pain? UHHHG! – Berg feels immobilized, he manages to open his eyes, he is in a white room with a bed, and he is Young again.

-- Son, we don't have much time, please listen to Me.—the voice was austere and kind at the same time.
-- I'm not dead, and I'm sorry we had to erase your memory but this was necessary to make you the perfect weapon against the invasion. I've being trying to contact you since the Invasion started, but your mind training was too good for me to penetrate your brain waves and explain you much. Your moment of weakness permitted me to finally contact you. -- Said Mom's voice.
-- Wh... What are you talking about? Is this another trick from the creatures? YOU WON'T GET ME! UHHHGH! *pain*-- Said berg struggling to move and feeling immobilized.

-- Son, it's me, You Mom Clara. I should have started with the safe word: Eubiose.
-- No one knows the meaning or the existence of this word... someone told me and my family only.... Mom??!. .... MOM!? -- Said berg crying. -- How do I know it? I can't remember! -- Berg cries.
-- I'm sorry Son; I don't have time to remind you of everything. Please listen carefully! You know you had to carry this gun with you all the time and the reason of this is because we had you trained to contain the invasion and eradicate the invaders.

We had several layers of protection incorporated in you and your mind and that is the reason for you not to remember everything. The invaders are able to read the mind of those who it infects and it has infected all people and stayed dormant until now.

We could not risk getting our plans to leak, I'm Sorry!

All I can say is, everything you need to know and learn is already on you, and you just have to remember! At the moment I can only help you with the first step. -- A flare of light touches Bergs Head. -- It's time to get back to fight son, you can do it! —Said the voice, almost crying. A big Flash occurs. And silence.

...

...

Berg is back in Beijing, He adult again and is inside a rainbow-bubble, he is not hurt anymore. The bubble explodes, destroying all Creatures flying on the air and cures all infected foe. Berg see's that his equipment was upgraded and now he has more protection and better fire power. He progresses his journey passing through a sign pointing forward -- Forbidden City, Hearth Of China -- There is a great amount of foes to be cured during the way, but the new upgrades on his equipment makes it easy to progress towards the Palace.

At the Palace he founds a crowd infected by yellow that speaks in one voice to him. -- You are not allowed here, Mr Wagon won't tolerate intruders, LEAVE or be crushed! -- says the mob in a calm voice.

-- Please folk, let me talk to this Wagon person, I mean no harm to you. Please let me help you guys! -- Said Berg noticing some people were crying in suffering among the crowd. -- I don't need any help. I'm feeling better every second! -- even though the voices sound calm, Berg sees that people are suffering and suddenly understands, this is a new variant! Berg Attacks the Crowd. After the crowd is finished the yellow cloud speaks -- You really did it, you woke me up, you are going to regret it. I can infect you instead; I can be immune for some time! MWAHAHAHAH!-- The cloud flies towards Berg and it gets absorbed by his mask

The palace is visible now, it's not crowded anymore, and berg sees a chest over the throne. -- Clue from The Meat Wagon Its written: Z3r0 located, undergrounded in magic chamber, 4us7r4l14, the best hideout that ever existed—This is very complicated, I wonder if Motta can help me decipher it.

Back to the airport, Motta is ready to bring Berg to Oceania.

Comment of the Author:

This Chapter is located exactly in the middle of the history, a new objective is presented and some important information is given to Berg when he succumbs overwhelmed by infected people.

This piece of the history was made for the player fail, so the flashback can occur. By Utilizing a Deus-Ex machine concept to bring salvation and introduce a bigger plot to give a clear objective to the player that at the end of the chapter will be given the ability to meditate after re-matching boss fights to unlock features such as weapon upgrade, defence upgrades and so on.

The flashbacks will give the player the idea of what is really happening and explain what is happening to the planet giving a sense of adventure to replay chapters with new perspective every time.

Chapter four: All begins from zero and turns back to it.

On his sleep on the plane, Berg now pays attention to the images he sees. These were hints they imprinted on him long ago, and now being able to concentrate on them, he can search for the answers he has been looking for. Motta leaves Berg at The Pinnacles.
-- Err... Motta, why are we in a desert? I understand this is a huge continent, but...-- Asked Berg confused.
--Ah, sorry I didn't want to bother you with details, but I noticed the numbers and characters positions is rearranged like this – Motta writes the message in a piece of paper and make arrows rearranging the letters -- You will have this term that in Maori: “Keokeonga”, that means Pinnacles, so I thought this was a good lead...- Said Motta no very confident with his idea.
--Are you kidding me? THIS IS GENIOUS! Brilliant my friend! I'll go now thank you! -- Said Berg, getting his gun, mask and running towards the desert.

He sees from afar a small lump that differs from the pinnacles in the desert and goes in that direction, there are infected popping from the ground to attack him as he progresses to the construction that grows bigger as he approaches, when he is closer Berg sees a Bunker and its entrance.
Inside the bunker is a big laboratory filled with infected of all colours and the air is saturated with small creatures, he gets attacked by hundreds of scientist and soldiers on his progression to a big hangar at the very centre of the installation. Berg progresses to a hangar where he sees a space ship written “Vikka”. From the ship it a pink creature with tentacles merges from the door and drops on the floor with a wet splash sound.

... Flop, plip, plop ... The creature falls from the ship and slides close to Berg. -- Tell me where she IS! You have no escape against my Semi-last variant, you are weak! -- Said the pink Creature. -- I don't know who you are talking about, but I'm here to learn from you! so YOU TELL ME WHAT IS GOIN.... * -- Berg is held by the tentacles and squeezed. In just a fraction of a second, a rainbow bubble appears and loses him out of the grip and fades out. --I tried the nice way, let's fight-- Said Berg getting his weapon.

After the fight against the pink creature, Berg sees now a chest underneath the space ship. -- Kepplerlian technology detected at the famous angry market animal in North America, Keep the Earthling away from it. – The piece of paper inside the chest wasn't encrypted very well this time; Berg knew he was getting closer to something finally.

Motta as usual is ready to Fly Berg to the next destination

-- Wow Berg, that was awesome I love the colours of that bubble you have; can you show me again? -- I believe I don't even know how to activate it... maybe one day... Let's go to North America my Friend! -- said Berg. -- Right 'O Way! The engine is running, let's go! —Motta said operating the command panel in the airplane.

Comment of the Author:

Chapter four creates the sense of partnership between Berg and Motta; Motta is now an important ally to Berg also for investigation and provides Berg the Support that only a side-kick can provide.

This chapter shows another non-human as a BOSS fight, and has another clue that links to the flashback past. Until now it's not mandatory for the player to revive their past on flashbacks, even though the game difficulty increased by much at this point.

Important to mention that every new variant will be produced in every scenario, including the old ones, making the game difficulty not the stage level, but the conclusion level, being the last moment the most difficult in the game.

This idea for difficulty progression was created to complement the urgency idea the flashbacks will give about the invasions and the problem Berg is facing.

The title has much more to do with the flashback that matches the last stage, so it will give the player a hint of what to do at the end of the game in case they didn't went through the flashbacks As the Problem Started with Zenith and Finishes with itself, in another form.

Chapter five: The real enemy is ignorance.

Berg still have his dreams with flashes of his past, but know he understands where it comes from after he learn how to access his memories on meditations.

There is so much more to learn and the time urges. But at least now He has a proper lead, some technology from Keppler found in North America. He can't help but think this is what he has to find to know at last what is happening. Motta didn't have to wake him up this time, he as peacefully studying his weapon and armour when Motta arrived after landing the plane.

--Hello Berg, Is everything all right? Did you sleep? -- Asked Motta worried. Berg looked at Motta, distracted for a second.

-- Yeah, sure, I... I've been learning too much recently, and have lots to think about. I actually have slept a lot, this was a long flight... -- Said Berg, trying not to look tired or confused to Motta.

-- So, I studied about animal’s statues in America, and from all these statues photos I've found, the most promising is this one here -- Motta points to a ferocious Bull statue. -- As this is close to a market, and looks angrier than almost all the others. These people aren't talking much in code anymore; I think they don't have much time to encode their hints anymore. – Motta was concentrated on his explanation, yet sounding a little insecure.

--I'm impressed Motta, it will be interesting if you follow me from close this time I could use your help there, but keep yourself safe, will you? you're so Smart than I think you can help me find whatever we are looking for there-- Said Berg, He was a little concerned the entrance to whatever hidden passage couldn't be found by him as he was so mentally exhausted from the abrupt learning he has been having lately.

-- Sir, I'll be honoured! Let's take a cab to the city! -- Said Motta signalling the next cab at the airport of New York. From the city centre of New York, the number of enemies is much bigger as they progress to their destination. The type of enemies also progresses in number and more variants. They arrive at the bull statue where Motta has to decipher the words written on the bull. There are hordes coming and he has to be protected whilst reading the statue. After some time and many foes Berg fought to protect Motta from being disturbed, Motta finally talks.
-- That's it, I managed to decipher something but there is a missing word I don't know-- Motta finishes the reading a little disappointed -- It indicates the translation was attempted by the headquarter master of the market, should we pay him a visit? —Suggested Motta.

At the entrance of the Market, they progress in a crowded place with all variants and hundreds of people who get infected. The last room is the office where a suit man is at his desk.
-- Oh, isn't it Mr. Hero? I have the best security the money can buy, and here you stand before me ha ha-ha-- Said the man, standing up from the table and walking to the centre of the room.
-- Perhaps your investment is just not smart enough, I need answers! -- Said berg, confident.

-- Oh My! A human is a Human after all... I Do HAVE the best security the money can buy; I just didn't mention the ones you defeated were them... ZENITH! COME TO ME! -- Said the man on suit and a cloud full of black creatures' storm in the room, The man also turned black and turned into dust being absorbed by the cloud. Turning it's into a black sphere body.

--AAAAAHHHH! -- Motta runs back and closes the door. Berg battles against the Sphere and after defeating it the battle, Motta enters the room again. --Are you ok Berg? How can you do all these things? -- Motta asks painting on excitement.

-- Not time now Motta Lets find the clue, He has to have something here -- Said Berg.
-- Ah, He dropped this envelope when he turned into dust before fighting you, It says: The statue has it's material programmed to activate with a secret word to open some type of patch we cannot access from any other side, It's like a worm-hole even though there is no knowledge on how to make it portable, in Kepplerlian it means "Says the secret word Friend, And Zenith shall find peace". We must absorb a Kepplerlian or the "hero" to be able to do so. -- Motta Finished to read the letter and put it back into the envelope, he was shaking and looking at Berg with gravity and fear.

-- I'm sorry Motta, I don't know what word is this, even though I actually met a few Kepplerlians... unless... This is now a safe place; I can do a last mediation and remember it—Berg Rematches his fight against the last boss and remembers the Special word. Berg has now to go back to the statue and now he can activate it after defeating the horde that protects it.

The statue turns into stairs that goes two meters down and has a door they enter.
Now the scenario is completely different, they are in the middle of the sea in a lump of sand that they stand alone. The door isn't there anymore.

They notice that the island is coming up as more dry sand comes from the water, trees, and a bunker entrance. They notice that a rainbow bubble is surrounding the little island and keeps water or anything to contaminate the land. Inside the bunker there is something similar to Snow's white glass coffin, but built with something similar to some other technology thank Kepplerlian, a woman lies on it.

Berg and Motta approach the chamber to interact with it and he hears a weird loud noise. Both look back; trying to see where it came from, when they look back the lovely lady is standing in front of them.

-- Greetings friends, I'm afraid I don't have much time as our bubble has just dissipated with the abrupt exposure. I'm Jakeline -- Jakeline was wearing very ancient clothes, but had perfect English, and looked to be in peace.

-- WHAT IS HAPPENING? OH MY GOD, WAS IT YOU? -- Motta was completely surprised, looked at Jakeline and to Berg, confused.

-- Berg? She just spoke without moving her lips! WHAAAT? I'm going crazy!!! – Motta was with hands on his head and falling on his knees. Berg didn't notice before but she was using telepathy, He was familiar to it since he was a boy and it was so natural, he didn't even notice, what explains Motta’s Shock.

--Yes, she cannot speak our language Motta, so she will have to use telepathy -- Berg tried to explain the situation to Motta so he could stop freaking out.

-- Gentlemen, I'm Maharatanga, I'm co-hosting Jakeline, and I’m the variant Zenith is looking for as the final variant to succeed his mission to be invincible. All I need to ask you is to let me handle the situation and... Listen... He shall be here soon. FAST, come closer Berg. -- Jakeline was abruptly worried, dashed in Berg's direction and a tablet materialized on her hands. That she transformed into the gadget similar to the one Pedro used in him just before the earth mission.

-- Wait, don’t erase my memory again! What you want to do? -- Berg went back and assumed fight position.

-- This is a dream, that's it, just a silly dream... I just have to not think much about it...--Motta was in fetal position, crying.

-- I just want to give it to you, no much time to explain he is here already I feel him! Please. -- Jakeline was abrupt interrupted when a rainbow cloud of creatures stormed the dome, every time more and more creatures entered mixing and revolving over their heads.

-- Just attach it to your gun Berg, and fight him, I finish It When you are done! -- Berg couldn't think straight as the sound of all creatures was getting loud and distracting, even microscopic, where was so many that the shock against the walls were making a loud sound. Berg held the gadget close to his gun which started to glow in a rainbow colour, he never seen before.

-- SHE IS MINE, JUST GIVE UP! WE ARE TOO MANY FOR YOU-- the sound was coming from everywhere as all creatures were speaking, maybe the sound came from the bumps on the walls or telepathy, Berg couldn't tell. Jakeline Evolved herself in a rainbow bubble whilst a torrent of creatures went in her direction, her bubble was impenetrable and she assumed meditation position.
-- IT'S JUST A MATTER OF TIME, I BREAK YOUR PUNY BUBBLE AS SOON AS I KILL THIS "HERO" HERE. -- The cloud Mixed in a rainbow colour and assumed all bosses' forms and fight Berg.

Zenith doesn't die after the battle, it stops attacking, get back in a rounded shape.
--This is temporary, you cannot kill me, nothing can. If you don't surrender, we will fight until the end of times! -- Zenith sounded extremely tired. Before anyone could notice, Jakeline was running inside the cloud and entered inside Zenith.

-NOOOOOOOOOOOO -- Said berg, it was too late she was already inside.
--MWAHAHAHA can't believe! It's My Ultimate form, I'll assimilate. Run for your Life Mortal! -- Zenith was changing colour back to rainbow and achieving a final white colour. Berg and Motta Runs towards the shore out of the bunker

-- We are lost! What have happened Berg?!—Motta was running behind Berg whilst a white glow was increasing intensity behind them.

-- She... She got herself Killed I was meant to protect her from him, what was she thinking -- Berg answered his friend. -- I don't know what to do! -- Berg couldn't be more lost.
In a great boom, quadrillions of small shiny small particles light beams were scattered all the directions over the planet.

-- WHOAAAAAAAAAAAAHH-- A sound that could be heard all over the planet, as a strong telepathy it was coming from Zenith, which exploded and was scattered all around the planet.
-- I thought I was, oh, what I've done? I'm so, so very sorry earthlings, Kepplerlians, Oh! So many people!
I didn't realized, I'm devastated now that I realized what I've been doing.
I don't know what to do to repair it; I could hear your thoughts and I can see...
I humbly offer to be this galaxy's shield for its duration to compensate my bad doing.
Please accept my humble service, fellow living beings.

Earthlings where one of the hundreds sentient races that couldn't understand what this was about.
This huge telepathy reached the whole galaxy with particle spin.

At the centre of the galaxy, All population of Keppler Gasped and awed from surprise and relief as Zenith fused with Maharatanga and was turned from foe to friend.

Comment of the Author

This chapter will have two bosses and a few plot twists to conclude the history of the Invisible and invincible enemy. Berg will be forced to learn about his past to learn how to access the last Boss.

Accessing the last boss triggers a fight full of challenges with the semi-ready Zenith form, where it can transform into all other creature and bosses, and makes the hero fight simultaneously with two boss versions, an interesting challenge for a final boss fight.

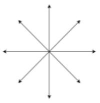
As the player will have to unlock all the flashbacks and therefore all features for enhancement of weapon, armour and powers; this fight's objective is to be overwhelming and breath-taking.

The ending scene was developed to give the history a possible continuation, as there are some points in the history that wasn't explained, such as how Zenith's planet was destroyed in first place, Why Berg's mom was abducted, why time in Keppler is so different, why just berg sees the creatures, and so on.

The purpose of this ending is to give the player expectation for a continuation, and a great fight experience to finish the game with a good sensation of relief and wanting more.

Mechanics Tables

Character and NPC's table.

Characters and NPC's		
Name	***Description***	***Actions***
Berg	The main playable character. The hero trained by the Kepplerlians to counter-attack Zenith's invasion in Planet Earth. Original Hit points: 100 Shooting speed: 2 shots/sec.	Movements: Jump, moves left and right, double jumps towards any direction:  Also able to shot projectiles to all described directions accordingly to his Gun mode.
People	Citizens of the world, People living their lives, and other Zenith victims. People might be using masks of random colours, which makes them invulnerable to the creature that matches the mask colour. People won't use masks of creatures that don't exist yet in the game.	People can be infected by Zenith particles. When a particle touches someone who is not infected, this person becomes infected and tries to infect others and kill the Hero. The infection has a sum of hit points and when reaches to zero, the person turns back to normal.
Zenith particles: Blue	The first variant of Zenith particles, this infects people and make them slowly move towards their victim to attack.	People infected by Zenith blue particles turns into zombies who walks towards a victim to attack slowly. People infected by this variant have 1 hit point to turn back to normal.

Zenith particles: Red	The second variant of Zenith particles. This infects people and makes them slowly move towards their victim and attacks shooting red particles to the direction they're facing.	People infected by Zenith red particles turns into zombies who walks towards a victim and shooting red particles that can cause 2 hit points damage to the hero or infect and not-infected human. People infected by this variant have 2 hit points to turn back to normal.
Zenith particles: Purple	The third variant of Zenith Particles. This infects people and makes them move fast towards their victim and attack directly, infected can jump high and move fast	People infected by Zenith purple particles turns into zombies who runs towards a victim to cause 4 hit points of damage or infect a not-infected human with the same variant. People infected by this variant have 4 hit points to turn back to normal.
Zenith Particles: Yellow	The fourth variant of Zenith particles. This infects people and makes them move in medium speed towards their victim to attack directly; They can become invulnerable for two seconds and have 10 seconds of cool down to do it again.	People infected by Zenith yellow particles turns into zombies who walk fast towards a victim to cause 8 hit points of damage or infect a not-infected human with the same variant. People infected by this variant have 8 hit points to turn back to normal.
Zenith Particles: Pink	The fifth Variant of Zenith Particles. This infects people and makes them move in	People infected by Zenith Pink particles turns into zombies who walk in medium speed

	medium speed, can jump randomly and have a mid-range attack with a tentacle that will hold the hero for a second or until he takes damage. Tentacles attacks are random and have a cool down time of three seconds.	with random jumps towards their victims to hold or cause damage of 16 hit points of damage or infect a not-infected human with the same variant. People infected by this variant have 16 hit-points to turn back to normal.
Zenith Particles: Black	The Sixth Variant of Zenith Particles. This infects people and makes them have all abilities of the other variants all together.	People infected by Zenith Black particles turns into zombies who run with random jumps, shoots black particles, can be invulnerable for two seconds, and hold enemies with a tentacle. All damages are 32 hit points of infects a not-infected person with this variant.
Doctor??? (BOSS)	An important person in medicine who was being controlled by Zenith to ensure contamination in the continent. Human form for teleport and normal movement. Big red fists when punching	Boss Abilities: Red Shot (projectile): 2 damage Teleport: Change to the other side of Berg in the arena in random distance. Red Punch (melee): deals 4 hit points of damage and pushes berg to the punch direction

	forward, shooting or punching the floor. Total Hit points: 200 First-Time loot: Clue for next chapter, blue mask upgrade, 1 upgrading point. Rematch loot: 1 Upgrading points, Unlock Past Memory 1.	until the next wall in the scenario. Red punch to the ground: Charges for two seconds and punches the floor, damage taken if berg is standing on the floor is 10 hit points. 30 seconds of cool down.
Hydra (BOSS)	A mythological lizard creature captured by Zenith in an unknown planet, controlled with the purpose of helping Zenith to conquer the galaxy. Three heads as described in the history, originally green but turns into purple for the fight with Zenith's saturation. Total Hit-points: 300 First-Time loot: Clue for next chapter, red mask upgrade, 2 Upgrading points. Rematch loot: 2 Upgrading points, Unlock past memory 2.	Boss Abilities: Dash Slam: 6 damage, jumps towards the enemy for a body slam. Purple mine-cloud: any head spits a mine on the floor that activates with proximity, and explodes after one second. Deals 4 damage (mines can be destroyed if shot at, one hit point). Head Combo: Teleports behind Berg, and charges for two seconds to slam their heads on the floor, random timing and floor damage of 10hp each slam) 30 seconds of cool down.

Angry crowd (BOSS)	A Human army controlled by Zenith, contains genetically modified humans that act as a hive to attack a threat. The Mob is made of healthy-looking people with angry faces. And yellow infected colour. The mob is abstract and a number between 150 and 200 individuals will be generated to spawn at the location. They appear at the background in three sprites for percentage of individuals left. Individual total hit points: 7. First-Time Loot: Clue for next chapter, purple mask upgrade, 4 Upgrade points. Rematch loot: 4 Upgrade points, Unlock past memory 3.	Boss Abilities: Spawn randomly 3 – 10 individuals simultaneously every 10 seconds. Every individual deal melee damage of 4hp. 10% of the individuals will have the power to jump. 10% of the individuals will be able to shoot red shots: 5hp damage. 20% of the individuals can become invulnerable for a second standing idle, not moving. Crowd Tactical attack: an organised attack with an invulnerable agent that remains invulnerable until reached the middle of the scenario and behind it five shooters shooting red shots one per second. This happens from both sides, once at any time of the fight.
Pink Kappa (BOSS)	A mythological octopus-humanoid creature captured by Zenith in an unknown planet, controlled with the purpose of Helping Zenith to conquer the Galaxy.	Boss Abilities. Lurking: The boss keeps lurking in the scenario and do not expose itself unless it does the Body Slam ability. Living tentacles: makes eight

	A hybrid of humanoid and octopus, body colour pink/purple pallet. Total Hit points: 1200 First time loot: Clue for next Chapter, Yellow mask upgrade, 8 upgrade points. Rematch loot: 12 upgrade points, unlock past memory 4.	tentacles on the floor that advance towards berg to Hold it in grip, until he fights to release himself of it. (Tentacles have 10hp each, deducted from the Boss) The boss creates new tentacles just after dropping its own tentacles, loosing Hp in the process. Mega Slam: Activates if a tentacle manages to hold berg. Pink kappa appears over berg, starts spinning and in three seconds drops in a spiral attack that deals 30hp of damage. Remains exposed for ten seconds if missed the attack.
Black Sphere (BOSS)	A mythological sphere creature captured by Zenith in an unknown planet, controlled with the purpose of helping Zenith to conquer the galaxy. A black sphere that can change shape made of an organic mutant metal alloy that changes properties accordingly to the creature objective. Total Hit points: 3000 First time loot: 20 upgrade points, pink mask upgrade.	Boss abilities: Cool down phase: Sits on the floor for five seconds to rest from its last transformation. Gun Form: Shots 10 random colour shot that saturates the mask that is not the colour equipped. If hit Berg with a fully saturated mask, it deals one hp damage, killing him. Shield: reflect any shots back to Berg with black colour. 12hp Damage. Blade Form: Slashes three times through the scenario

	Rematch loot: 40 Upgrade points, Black mask, unlock past memory 5.	randomly on floor level, jump level or double jump level. Each slash deals 30hp damage.
Zenith Semi-complete	A cloud of super-charged Zenith particles, it contains all the colours simultaneously attached to each other, giving it a rainbow-looking cloud appearance. The particles can now move individually and act as a hive, part of the same being: Zenith. The cloud has a total of 5000HP; It shines less brightly when the HP drops 70%, half and 30%. No loot. Defeating it results in Game-Over with ending scene.	Boss abilities: Creation Attack: spawn two bosses randomly (all but not the sphere). The bosses spawned have 1000HP each (if crowd, 100 infected with 10hp each). The damages for simple attack are flat regulated to 20hp, and special attacks to 50hp. The last 1000HP will be two spheres of 500HP each. Every boss sprite will have rainbow pallet colours.
Motta (Pilot)	Motta is a Pilot human being who volunteered to assist the hero on his journey originally helping with transportation around the world and later on helping to solve the Clues mysteries.	Dialog to change map/scenario.

Items

Items		
Item name	***Description***	***Actions***
Kepplerlian gun	Gun with DNA-based technology that revert the host DNA to absorb Zenith's particles. (Written in Kepplerlian). Shoots projectiles of cure: Level 1: Blue shots, 1hp damage. Level 2: Red shots, 2hp damage. Level 3: Purple shots, 4hp damage. Level 4: Yellow shots, 8hp damage. Level 5: Pink shots, 16hp damage. Level 6: Black shots, 28hp damage. Level 7: Rainbow shots, 40hp damage. Piercing shot: all projectiles deduct the hit points from the enemy until the damage value reaches zero or hit a neutral surface.	The gun can be switched to different Shooting modes conforming being upgraded: Level 1: gun mode, three shots per second. Level 3: Shot-gun, one shot per second, shots three projectiles to the direction berg is facing, one up front, front upwards and front downwards. Level 5: Machine gun, shots five projectiles per second, with damage reduction of 20% each. Level 7: Bubble-charge mode, like level one, with 50% damage reduction, but shots recharge special ability by 10%.
Blue mask	Simple blue mask. Offers good earth-technology protection against small particles. (Do not regenerate life) Protection against blue-type attacks Not upgradable Saturation: 100	Damage invulnerability against Blue-type attacks, once you get the item you will be protected from the colour particle. Protection cost: 10-saturation/per attack.

Rainbow Mask	Kepplerlian DNA-based technology mask mutates accordingly to Zeniths mutation information received.
	(Written in Kepplerlian);
	(Do not regenerate life)
	
	Protects against Colour-based attacks.
	Level 1: Blue mode + 100 Saturation.
	Level 2: + 20 Saturation, Red mode;
	Level 3: + 20 Saturation, Purple Mode;
	Level 4: + 20 Saturation, Yellow Mode;
	Level 5: + 20 Saturation, Pink Mode;
	Level 6: + 20 Saturation, Black Mode.
		This item can be switched to protect against colour damage types, once you get the item you will be protected from the colour particle.
		No cool down for changes, as it changes accordingly to Telepathic commands.

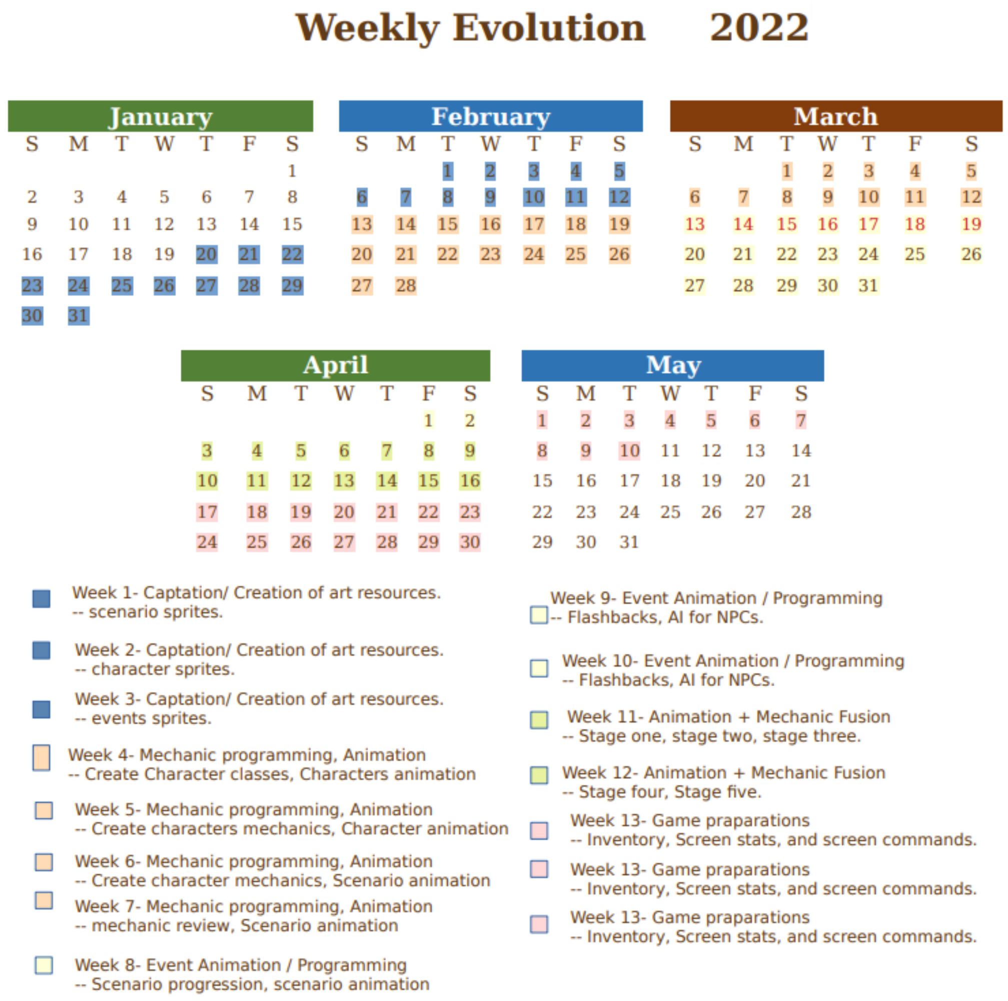
Kepplerlian Rainbow Discharge Node	Ending game item, discharges unknown rainbow energy in form of an expanding explosion, deals 100 damage to all foes and wipe the scenario of zenith normal floating particles, restores Berg Hp and Saturation.	This item can be recharged by using the Kepplerlian gun and discharged at any time once the energy is filled up again. It needs 100 energy points to be activated.
Logbook	Berg's logbook contains all information about stats, the clues found; last dialogs, memories, and information the player might want to check and read to continue the game play. Logbook can be accessed anytime pressing "L", It won't pause the game, and it opens a window as described at this item description.	Interaction with it opens a menu with tabs for inventory, dialogs, Memories, characters description, save game and Open Map. It opens and closes by pressing "L". Any sub interactions with it won't stop the game progression as well.

Mechanic and screen features table.

Mechanic and screen features		
Item	Description	Actions
Screen	The screen is what is shown to the player at all moments of the game play. It will be used to show basic information and instructions on how to access more information. Also, as the character and NPC's actions and progression over time.	The screen shows all the events that happen in the game by using graphic-translated information to the user. All interactions in and out the game will be shown as an output on the screen. Actions can be described but not limited to: show Game menu, pause game, resume game, leave game, save game, open inventory, interact with inventory, close inventory, all character actions, all NPC actions, and all scenario actions.
Inventory	The inventory is described with all items the character has from the beginning and/or found during the game play. Inventory holds items and provide the ability to open items and see their descriptions	Show item details, equip items, remove items, switch item mode.
Character Stats	Character stats will show	Original features:

	features Berg has and can be upgraded to improve game play. Upgrade points can be used to improve any feature in the three and there is no maximum for it.	Hit points: 100 Speed: 50 Jump: 50 Shot Speed: 150 Saturation: 0 Each feature can be increased with upgrading points.
Help	Help menu with information about items found or where to access anything.	Has the option to type what the user needs help for, or the option to pause the game to click over an item the player wants information of.

Project Plan



Weekly Evolution 2022

January

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

February

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

March

S	M	T	W	T	F	S
		1	2	3	4	5
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13	14	15	16	17	18	19
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27	28	29	30	31		

April

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
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24	25	26	27	28	29	30

May

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

🟦 Week 1- Captation/ Creation of art resources.
-- scenario sprites.

🟦 Week 2- Captation/ Creation of art resources.
-- character sprites.

🟦 Week 3- Captation/ Creation of art resources.
-- events sprites.

🟧 Week 4- Mechanic programming, Animation
-- Create Character classes, Characters animation

🟧 Week 5- Mechanic programming, Animation
-- Create characters mechanics, Character animation

🟧 Week 6- Mechanic programming, Animation
-- Create character mechanics, Scenario animation

🟧 Week 7- Mechanic programming, Animation
-- mechanic review, Scenario animation

🟨 Week 8- Event Animation / Programming
-- Scenario progression, scenario animation

🟨 Week 9- Event Animation / Programming
-- Flashbacks, AI for NPCs.

🟨 Week 10- Event Animation / Programming
-- Flashbacks, AI for NPCs.

🟩 Week 11- Animation + Mechanic Fusion
-- Stage one, stage two, stage three.

🟩 Week 12- Animation + Mechanic Fusion
-- Stage four, Stage five.

🟥 Week 13- Game praparations
-- Inventory, Screen stats, and screen commands.

🟥 Week 13- Game praparations
-- Inventory, Screen stats, and screen commands.

🟥 Week 13- Game praparations
-- Inventory, Screen stats, and screen commands.

Figure 18: Work Schedule

Chapter 2: System Analysis and Design

After deciding on the game's story, items and mechanics, we were able to move on to the next step which is the Analysis and Design. We had a meeting with the orientator David McQuaid about the game engines, he advised us not to use either Unreal or Unity, as we have been learning and improving our knowledge in JAVA for 3 years, He recommended us to create our own "engine " and do it from scratch, even if the JAVA language is not the most suitable for game development because JAVA needs more memory and more focused on code maintenance than optimization, so the game may suffer a little with GPU and memory expenses, according to Alex Yelenevych on his website. Even with these difficulties of the Java language we decided to do the entire project in JAVA showing the evolution and knowledge that we have obtained in the last 3 years of bachelor's; we used some optimizations during the process to try to improve memory consumption and the game to run smooth.

During this chapter, we will explain the design patterns and choices we will do to accomplish the project.

The first step after setting all the mechanics and items was to dive into the programming patterns, the programming patters are general solutions to recurring problems during software development. It is not a framework or an already made code, but a high-level definition of how a common problem can be solved and after research we decided that the following patterns can be helpful in our project.

Strategy design pattern:

Behavioural patterns are used to eliminate duplicate code and add methods that might be included in many different classes but not enough to be in a parent class, it is used as an interface or abstract class to implement new abstract features whenever necessary to many different classes. Also, can be implemented as an instantiation of a class or even an Enum to modify the capabilities of a given feature.

A strategy can be used accordingly to the circumstances given and when applied will run commands to modify whatever has to be modified to make the object accomplish its task whenever Necessary; The Structure is composed of the Context, the Strategy, and the Client.

Context: it Maintains a reference to one concrete strategy, then it communicates with a given object via the strategy interface, with a given strategy it set a strategy and does something by communicating changes to the object; then it calls the execution of a method each time it needs to on the linked strategy object.

Strategy: It will implement variations of an algorithm the context will use; the interface will declare a method the context will use to execute a given strategy.

Client: It creates a specific strategy Object and forwards it to the context; which will expose the setters allowing the client to replace a given strategy at runtime.

Observer design pattern:

Usually used When it's necessary for multiple objects to receive an update when another object changes.

It maintains a list of its dependents, called observers and notifies automatically of any state changes. Usually Used or implemented on threads.

The client instantiates the environment for the agents where The Publisher will update the subscribed object of updates.

Client: Creates Publisher, objects and subscribers and registers subscribers for publisher's events.

Publisher: collects and communicates the subscribers of other objects. These events occur when the publisher changes its state or executes some behaviours. Publishers contain a subscription infrastructure that lets new subscribers join and current subscribers leave the list. Publishers will often also pass themselves an argument for contextual data so the right argument will be accessed when updated to its subscribers.

Subscriber: the interface declares the update method that can have many parameters that will allow the publisher to pass details along with the updates; It will perform actions in response to the updated information given by the publisher

Prototype Design:

Copy (override) the same object and pass it as a new object with some modification if necessary.

It is used to avoid creating multiple subclasses when its needed numerous potential different objects that share the same features or code.

The basic implementation of this pattern Utilizes a prototype, the Client.

Prototype: the interface declares the cloning methods, usually a cloning method unless its standard values are already declared so the same code can be instantiated multiple times with new values, like using a constructor to pass the data the prototype has.

Client: Will produce a copy of any object that follows the prototype blueprint

Command Design Pattern

The behavioural pattern where an object is used to represent and encapsulate all the information to call a method at a later time.

In command pattern, the terms associated are command, receiver invoker and client.

Command: declare a single method, forcing its execution by an object acting as a receiver; implement different requests. A concrete command doesn't perform the work on its own, it will most likely have to pass the call to one of the logic objects. Parameters required to execute a method can be declared as arguments in the concrete command. Command objects can be immutable by only allowing the initialization of these fields via the constructor.

Receiver: contains logic, usually objects act as a receiver; most methods or commands only handle the details of how a request is passed to the receiver, and the receiver performs the actual actions.

Invoker: Responsible for sending requests. This class must store a reference to a command object. The invoker triggers the command instead of sending the request directly to the receiver. Usually, it gets a pre-created command from the client via the constructor.

Client: creates and configures concrete command objects. It must pass request parameters and a receiver instance into the command's constructor. By doing it, the resulting command can be associated with one or multiple senders.

State Machine:

A state machine also known as a finite-state machine (FSM) is a behaviour model. It must have a finite number of states and each unique state will make the program behave differently. The main characteristics of a state machine are states and transitions, the idea is that the program should be able to be switched from one state to another and the transition between states is defined by a set of predetermined rules. The main idea is that, at any given moment, there is a finite number of states that a program can be in. Within any unique state, the program behaves differently and the program can be switched from one state to another instantaneously. However, depending on the current state, the program may or may not switch to certain other states. These switching rules, called transitions, are also finite and predetermined. When the software is initialized, there is an initial state which is where the machine starts. The following input will determine to which state the machine will change, depending on the state it may or may not produce an output. The problem with using a state machine is that as the project evolves, it becomes harder and harder to adapt the existing states to the new states, the solution would be implementing a State pattern.

State Pattern:

The State pattern suggests that you create new classes for all possible states of an object and extract all state-specific behaviours into these classes. Instead of implementing all behaviours on its own, the original object, called context, stores a reference to one of the state objects that represents its current state, and delegates all the state-related work to that object. To transition the context into another state, replace the active state object with another object that represents that new state. This is possible only if all state classes follow the same interface and the context itself works with these objects through that interface.

Flyweight Pattern:

The flyweight pattern is used when a large number of similar objects needs to be created, it reduces memory usage by sharing some of its data with other similar objects. Flyweight is a shared object that can be used in multiple contexts simultaneously. The flyweight acts as an independent object in each context. This pattern would be very useful for game development and could apply while developing particle effects or a tiled level with a large number of tiles.

The second step after deciding all the main points of the project is to create a UML Class Diagram, the class diagram is how we illustrate the software structure, at a micro or macro level and how each of the components of its structure will be interconnected. The Diagram is very versatile and the important point is to understand the context in which the diagram will be applied, defining a model to follow for software that does not yet exist. Specifying a model before actually building executable software, in order to decrease the waste of time and work.

In the UML class diagram, we have three necessary concepts to understand: diagram, elements and relationships. Basically, the elements make up the diagram and the relationships are how these elements interact with each other, we have the association which is a type of relationship used between classes when they are independent (without dependence on each other) and we also have the Generalization that is a relationship where the class provides resources for the specialized class (inherited), whatever the parent (generalized) class has, the siblings (specialized) will have.

Right after understanding the UML class diagram, we created our diagram to ease the implementation and as we said in the methodology, we need to reduce the risks, be flexible to changes and have good time management.

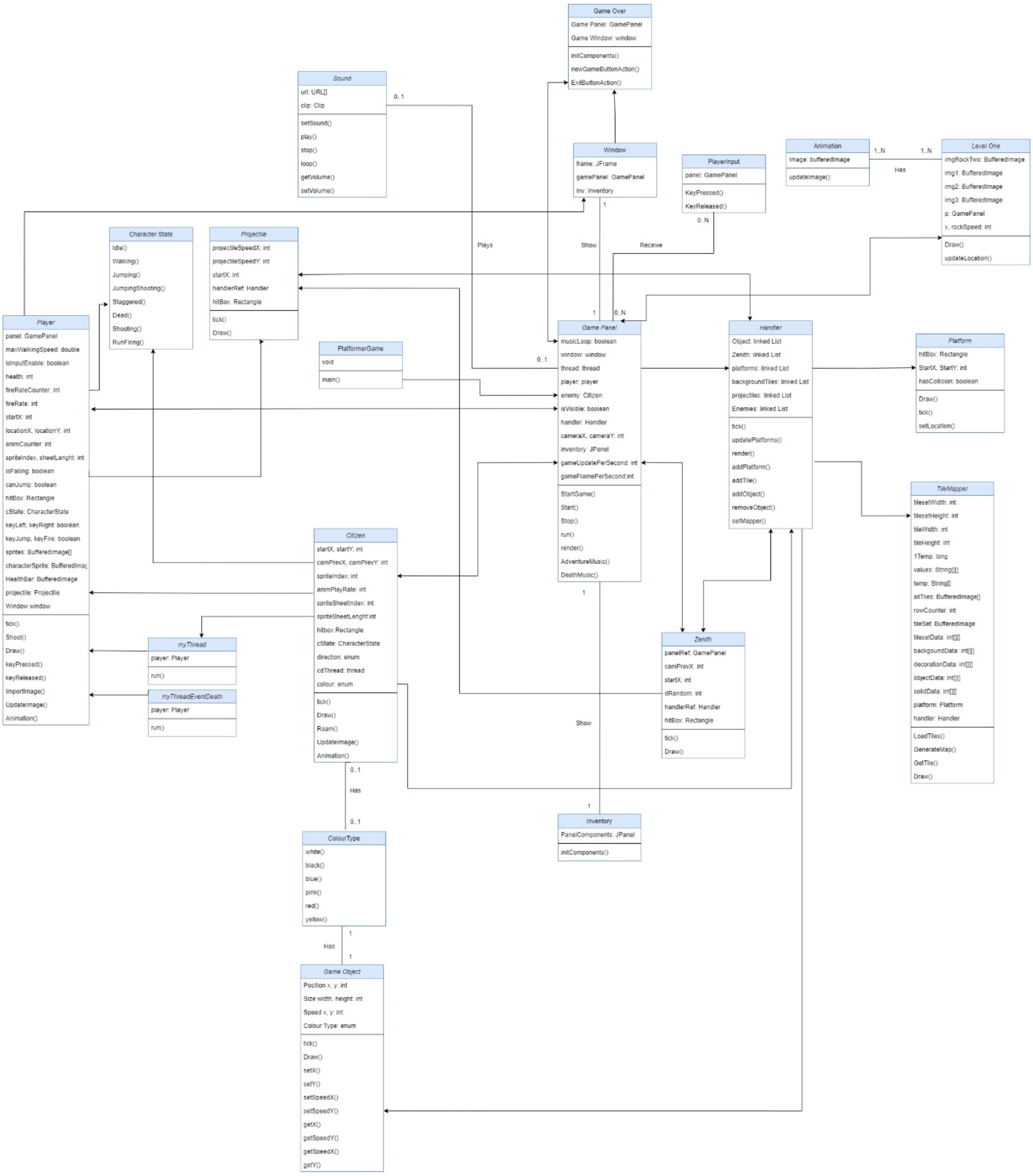


Figure 19 : Class Diagram

Also, to help with the implementation we made a process flowchart. The flowchart is a graphical representation that describes the sequential steps of a given process using geometric figures and other similar elements, simplifying the flow of information and improving understanding of processes and how they are interconnected, it is also useful to identify problems and bottlenecks that can generate rework.

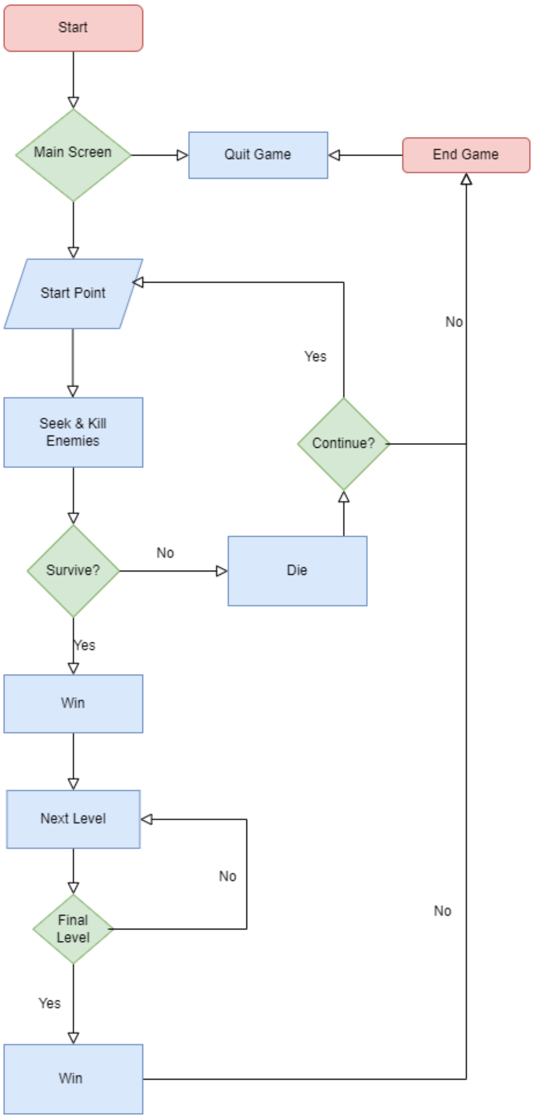


Figure 19: Process flowchart

The last diagram we created was the Use case diagram, this diagram documents what the system does from the user's point of view. We don't dive into technical details in this diagram. In other words, it describes the main functionalities of the system and the interaction of these functionalities with the users. The Use Case diagram is basically made up of four parts: Scenario which is a sequence of events that happen when a user interacts with the system, Actor that is the system user, the use case which is a task or functionality performed by the actor(user) and communication that is what links an actor with a use case.

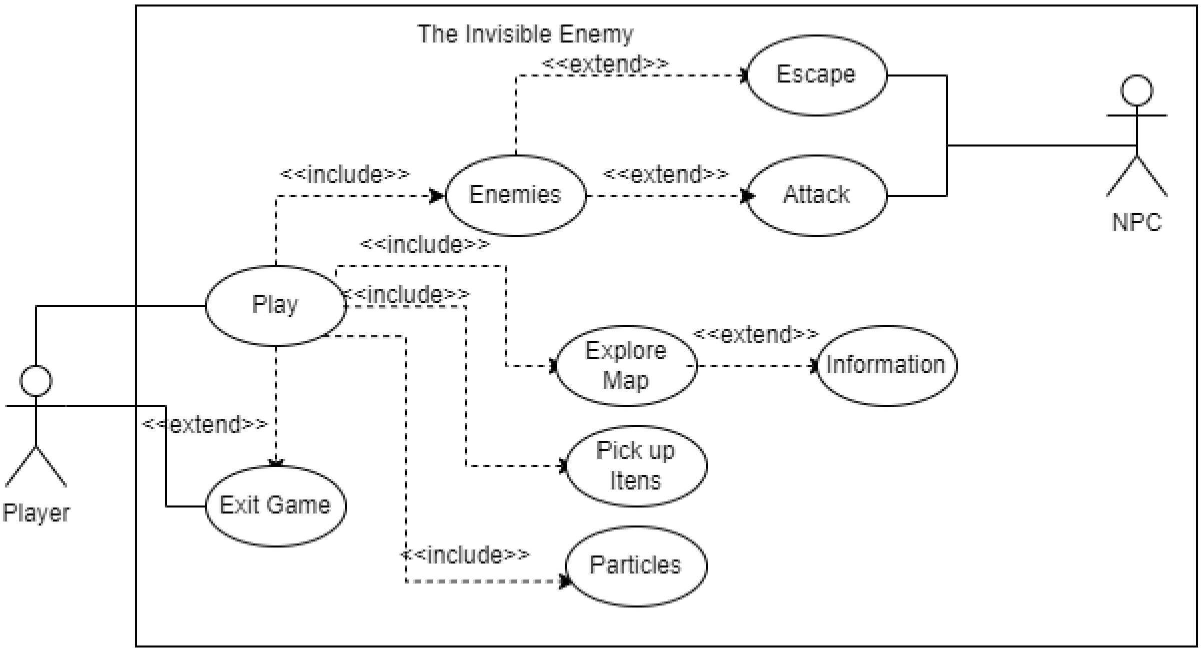


Figure 20: Use Case Diagram.

The user input is something that we decided on just at the beginning of the project because it has a pattern in computer games of using W, A, S, D and space bar. The User input is the operation through which data is entered into a computer, they are a collection of these data entered and which, when processed, are transformed into output (information). Character movement is a crucial part of any game. A game is an interactive experience, so one of the most important tasks is to gather player inputs (data inputs) and react accordingly.

Following the market pattern, we decided to use A = Left, D = Right, F= Shot and Spacebar = Jump.

Figure21: Keyboard

Finally, in the graphical design part, which is the area that the player has more contact with, only sees the mechanics working and the graphics, so this is the area that makes the player immersed in the game. We took this question to the orientator and he gave us the advice not to waste much time and not to worry about the graphics because the most important thing would be our game mechanics and implementation. We decided as a group that we would do a good game with nice graphics.

We decided to create a map with 16x16 tiles, all blocks would be tiles, creating a platform (where the character walks) and also creating all the screen elements and the map background, that was our first plan but you will see in the next chapter that we could find some better implementations.

Chapter 3: Implementation of the System

In Chapter 3 we will see the implementation of the system and some overview of what we changed from the first plan and what we could get a more efficient way to do.

In the last chapter, you could see the design patterns that we planned to use during the implementation of the project but you will see below the real implementation of the patterns.

Strategy design pattern implementation

The strategy pattern was partially applied to the project on classes with the mission of adapting objects to new circumstances and events, changing the object states to the desired state dynamically during the interactions between different objects that demand action or change in the behaviour of one or more objects.

The implementation was done using the same class instead of an abstract class or an interface which is not ideal, for this was used an Enum used by both classes Zenith and Citizen, to ease the implementation of similar features whenever necessary to multiple objects; whether changing objects or creating new objects entirely.

As the game is dynamic and its context can be dynamically changed accordingly to the game state and player actions this adaptation was reached as the desired solution for this demo.

It is possible to see this characteristic in objects such as Zenith particles and Citizens, that has their strategy changed accordingly to circumstances such as event of infection and event of Citizen damage.

Observer design pattern

In a dynamic slightly chaotic environment, a Video-Game creates, where it is necessary to maintain many objects informed of different information about themselves and other surrounding objects, the Observer pattern was overlooked and adapted to this game environment.

Usually, this pattern uses one single observer to update a subscribed list of objects that will be updated in a centralized way; The solution of centralizing all the updates in one single class/Object showed to consume too much processing power as a huge number of updates would be necessary in a ever-growing exponential way as new objects are implemented into the environment and also new events for their interactions.

Another problem this pattern would create if fully implemented would be the constant updates following an order that does not necessarily have to be followed; the game being dynamic and chaotic, the order of events is not to be precisely updated in order, this would consume unnecessary computational power.

For this the Handler class was created to handle objects displayed in the game window, most of these objects are not very dynamic and can be managed in an Observer pattern manner; other objects need different update times and frequencies and therefore communicate directly with the object it interacts with, even being inside the handler they would run some aspects outside it and the Handler wouldn't show every update unless called for this specific reason.

Another class that utilizes the concept is the TileMap class, responsible to read and construct the map instantiation in the game Window; It will communicate and work along with the Game panel and the Handler to dynamically update the map elements correctly as the player moves through the scenario moving the relative position between the player character, the map object and the camera position.

The constant information update for the map objects real-time positioning was achieved by this interaction.

Prototype Design.

During the instantiation of the zenith particles, instead of using the factory design method, it was more interesting to create all necessary objects in the Game Panel class by using the same variable and adding it into an array; the objective was only to change the instantiation of each different colour for the purpose of showing it dynamic colour variance;

This was reached by using always the same variable to store a new object which was used as the prototype and then modifying it accordingly to the number of different colours we like to implement.

this approach was chosen to make it easy to instance level difficulty faster by just changing the variables responsible for the number of colours created and the number of particles to be the right amount of the right colour accordingly to the stage and game progression.

as the standard values are already given in Zenith class, all clones in the array will have its colour feature changed accordingly to the stage level in a random quantity until reaches the total number of objects in a given stage.

Command Design Pattern

During the construction of the project, the command pattern was utilized by many classes that receive as their constructor an instance of the game panel that would instantiate all objects and their methods to be used whenever necessary.

as the communication dynamic between the objects in-game was done in an adapted observer pattern as explained above, the implementation of different requests would be called on different occasions, sometimes outside the commander class which is understood to be the Game Panel; many receivers would have an instantiation of the commander and act accordingly to call a given method or function when necessary. The invoker would act towards a third object to call the game panel which would be shared between all objects.

this adapted implementation was necessary also as the command Pattern centralizes and this game environment needed decentralized objects to optimize the thread update time in-game loop.

State machine

This was achieved along with the above patterns altogether to obtain a dynamic game environment where states and transitions are computed smoothly during the chaotic random events happening simultaneously in the game. Objects were able to be switched from one state to another and the transition between states within the game loop and multiple threads.

As the number of states, the program will constantly change at every moment due to the randomness aspect of the Zenith particle and Player behaviour, the artefact behaviour will encapsulate the states to recreate similar states in different positions, making the computational power-optimized by the repetition of tasks in different micro-scenarios that follow a basic set of rules and therefore repeat constantly, therefore reutilizing code and variables.

The problem of using a state machine is that as the project evolves, it becomes even harder to adapt the existing states to the new states, that's how the solution found for this was temporary focused on creating similar interactions within these micro-scenarios to the same objects which could be escalated to a certain number of events but not ideal for a full game with thousands of dynamic object processes running at the same time but better than centralizing events.

State pattern

This pattern would be ideal and the next step to fulfil the scalability the game would demand in the future would extract all state-specific behaviours into multiple classes, accessing object functions separately only triggering events when they are actually necessary for the opposition to the actual state where many objects check unnecessarily many other non-interacting objects.

Flyweight pattern

The implementation of this pattern was useful to apply the scalability for the application of Maps and other multiple objects that are positioned in relation to each other. And connected in a degree to every game object that will eventually interact with in one or more ways. Many objects in this artefact were used in multiple contexts simultaneously.

As mentioned in the last chapter about the diagrams, you can see below the diagrams of the implemented system.

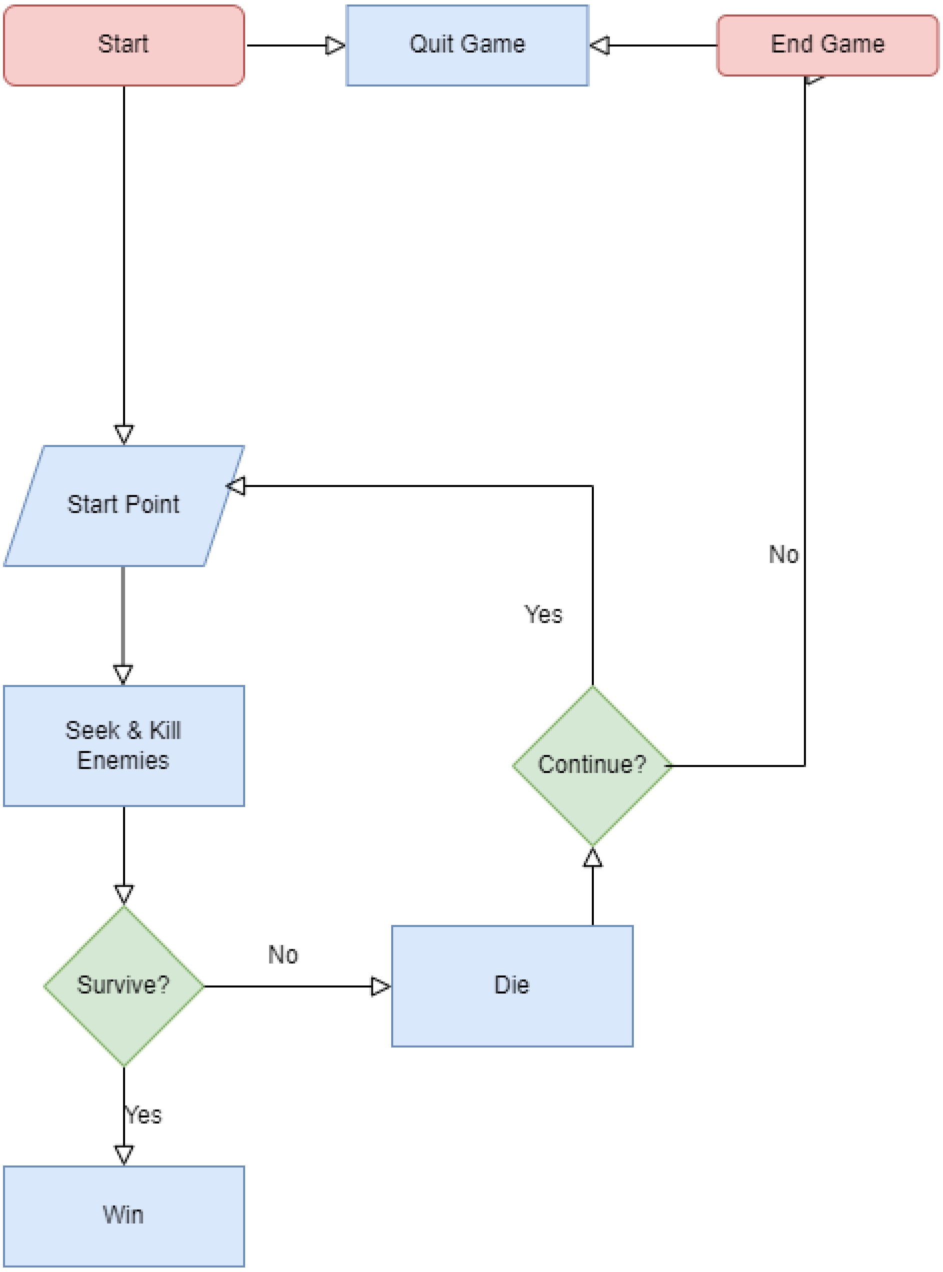


Figure 22: Flow Chart Diagram 2

The flow chart diagram above is similar to the last chapter, as the game's story was really big we decided to create a functional first phase with some elements and better mechanics than a long game with poor elements and mechanics.

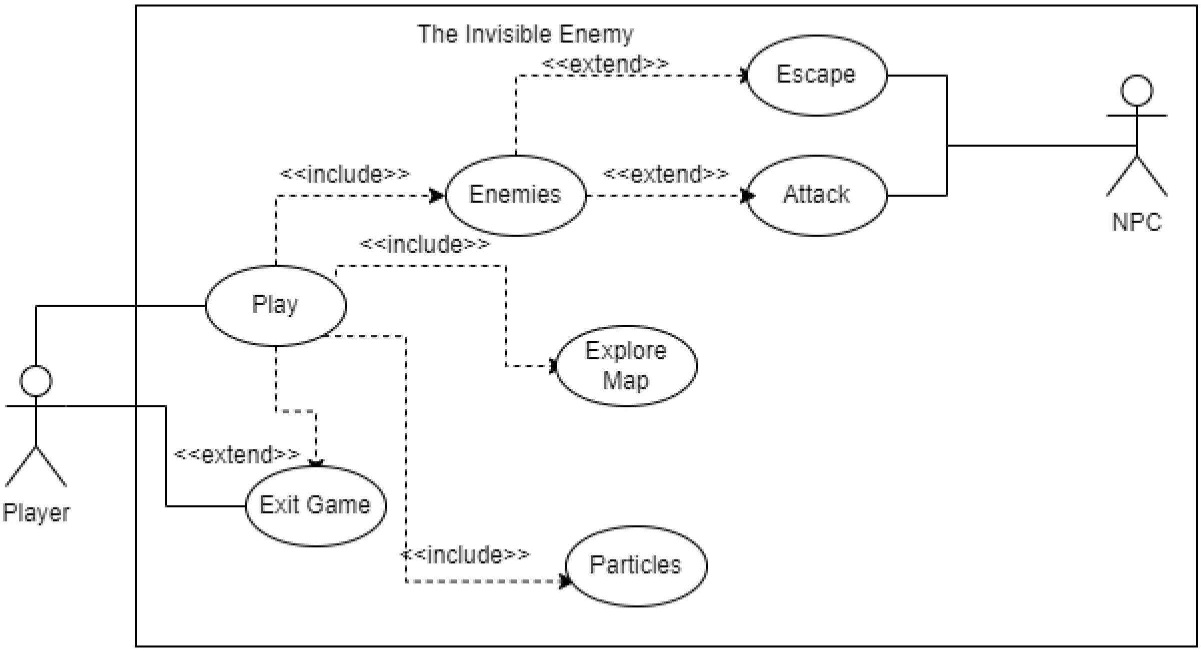


Figure 23: use case diagram 2

As we also could see in the last chapter, this diagram is a bit different from the one we planned for the same reason above.

We finished the last chapter talking about the graphics of the game, we were implementing a tile's structure using a Map in a txt file, and we were generating background in tiles through a 2D Array list. We were using the txt file position to load each image on the map, rendering in a big window but we started facing some problems. As we mentioned at the beginning of the last chapter, as we are using JAVA, the focus of the JAVA is code maintenance and not optimization, so JAVA systems can get heavy and it takes too much memory and processing to run and if we use a 1280x720px window using 16x16px tiles it requires too much process to render all the blocks (platform, background and elements).

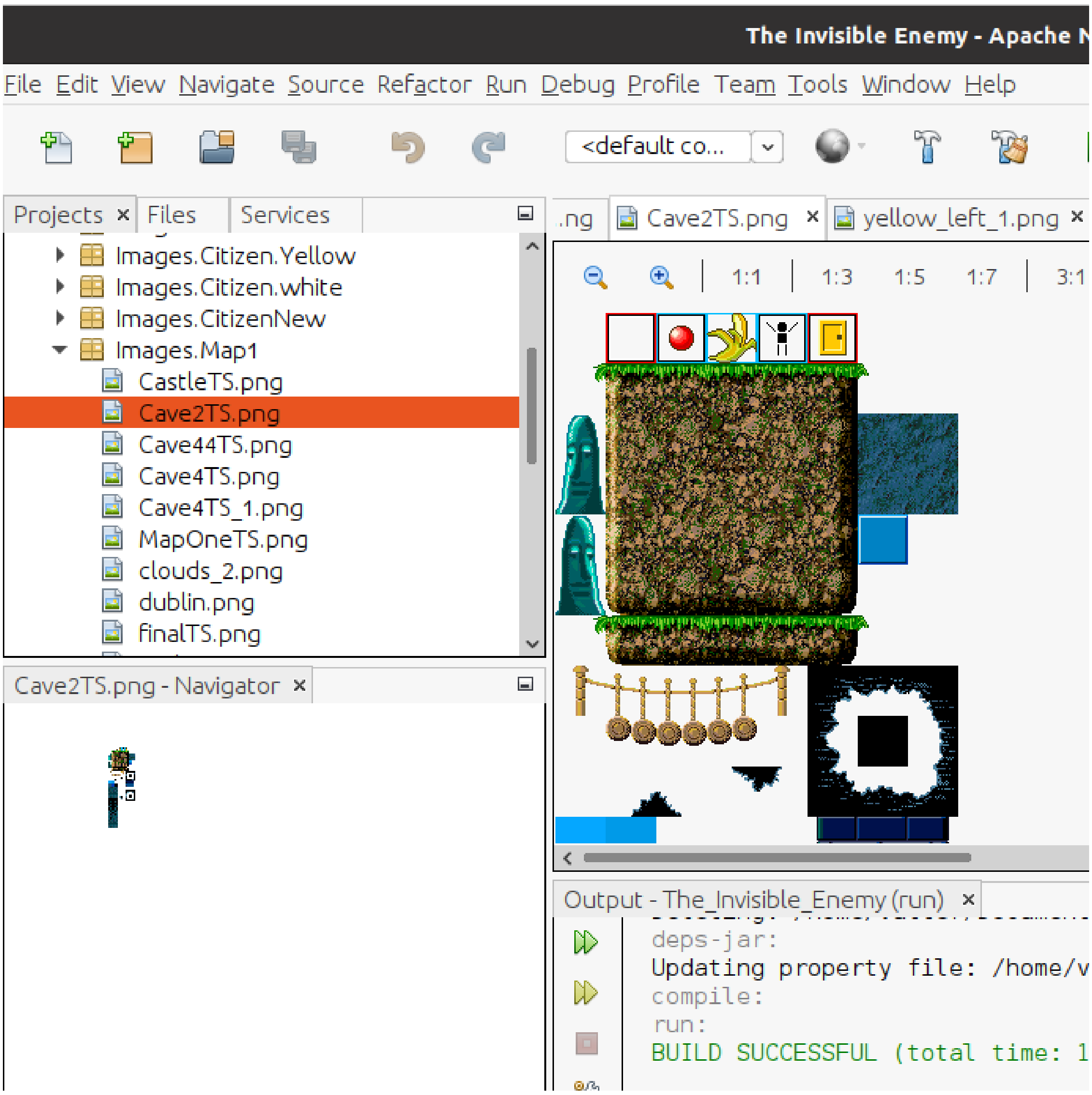
We had to find a better and optimized way of doing it without using too much processing and RAM memory, we will explain how we found a better solution during the next chapter.

Chapter 4: Testing, Evaluation and Adaptation

First of all, we will talk about the first and biggest issue that we found. As we talked about at the end of the last chapter, the graphic part was supposed to be not relevant but, in the end, it became a real issue, it was consuming our processing and memory so hard that sometimes we couldn't run the project as it should.

We started looking for some other way of doing it and we found this method of using a parallax background and reading the Map from a JSON file. In order to create the Map, we started using the software called Tiled Map Editor, which is an open-source tool that allows creating map layouts in a better way and saving in JSON format.

The Tiled work as an empty window and we can Choose your map size and base tile size, in our case we used 400 tiles x 50 tiles and a TileSet base of 32x32px.


The Invisible Enemy - Apache N
File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help
<default co...
Projects × Files Services
Images.Citizen.Yellow
Images.Citizen.white
Images.CitizenNew
Images.Map1
CastleTS.png
Cave2TS.png
Cave44TS.png
Cave4TS.png
Cave4TS_1.png
MapOneTS.png
clouds_2.png
dublin.png
finalTS.png
Cave2TS.png - Navigator ×
.ng Cave2TS.png × yellow_left_1.png ×
1:1 1:3 1:5 1:7 3:1
Output - The_Invisible_Enemy (run) ×

```
deps-jar:
Updating property file: /home/v
compile:
run:
BUILD SUCCESSFUL (total time: 1
```

Figure24: TileSet example

As you can see above, that is a Tile Set already saved in png format and there is also a JSON file that specifies where each tile will be placed while rendering. We have a class that reads the JSON file that gives the coordinates and another one that set the tiles in the correct positions and imports the map in a 2d array variable so we can show it to the user.

Solving that problem, we still had the background problem, using Tiled we can just set the surfaces and create collision areas but the background is still blank. We started looking for a better way than using before (a big set of tiles) and we found the parallax background.

The parallax is a scrolling background effect that it has different layers of backgrounds that move at different speeds to achieve the effect of motion. By moving the front layer(s) faster than the back, the distance/depth effect is achieved.

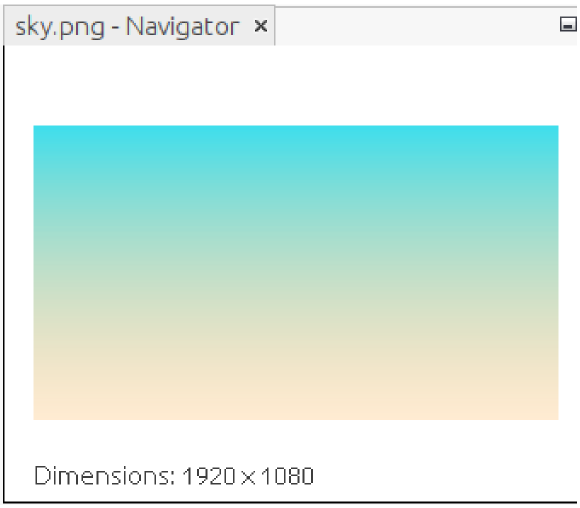
To be clear, the back layer is the background, and the front layer is all the platforms and other game objects.

This technique wasn't created for games ending the first use of the parallax effect dates to early cinema. The famous Disney used it in some of their production.

In our application we are using 3 background images different the camera Moves based on the offset in the X vector in this case 200 to the left and 400 to the right if the player X position is not within this offset the camera will move or else, we move the player instead of the camera.

The background image is imported in the Level one Class and the motion is done in the render method in the handler class.

First background is image is the sky.


sky.png - Navigator

Dimensions: 1920 × 1080

Figure25 : Sky layer

Second background is the Clouds.

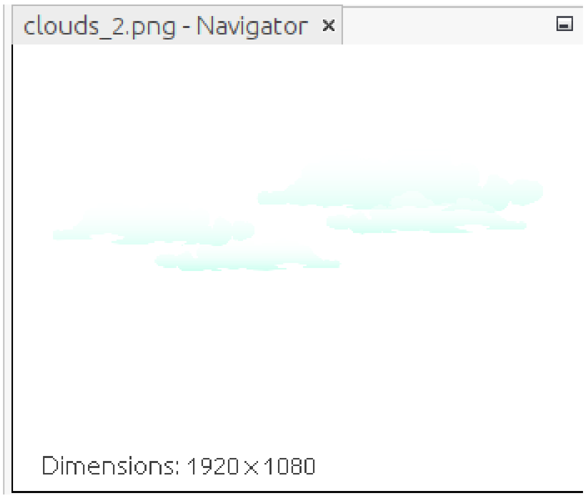


Figure26: Cloud Layer

The Last background image is Dublin City Background.

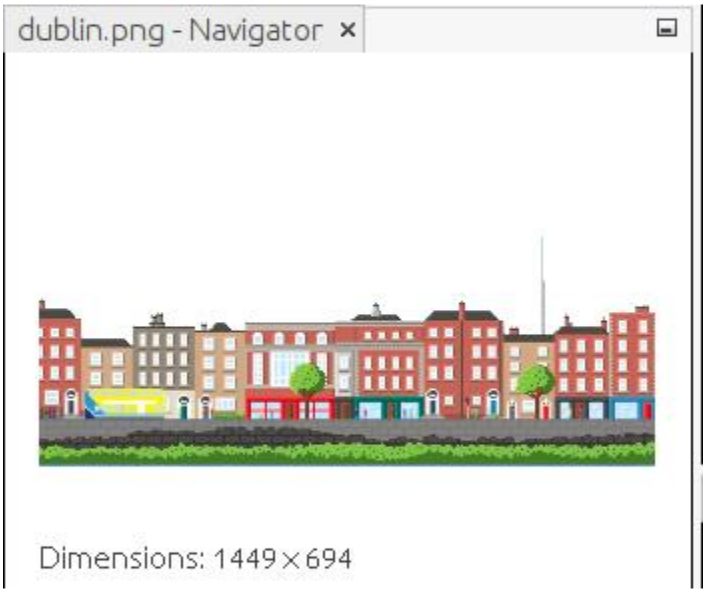


Figure 27: Dublin Layer

Final Result:

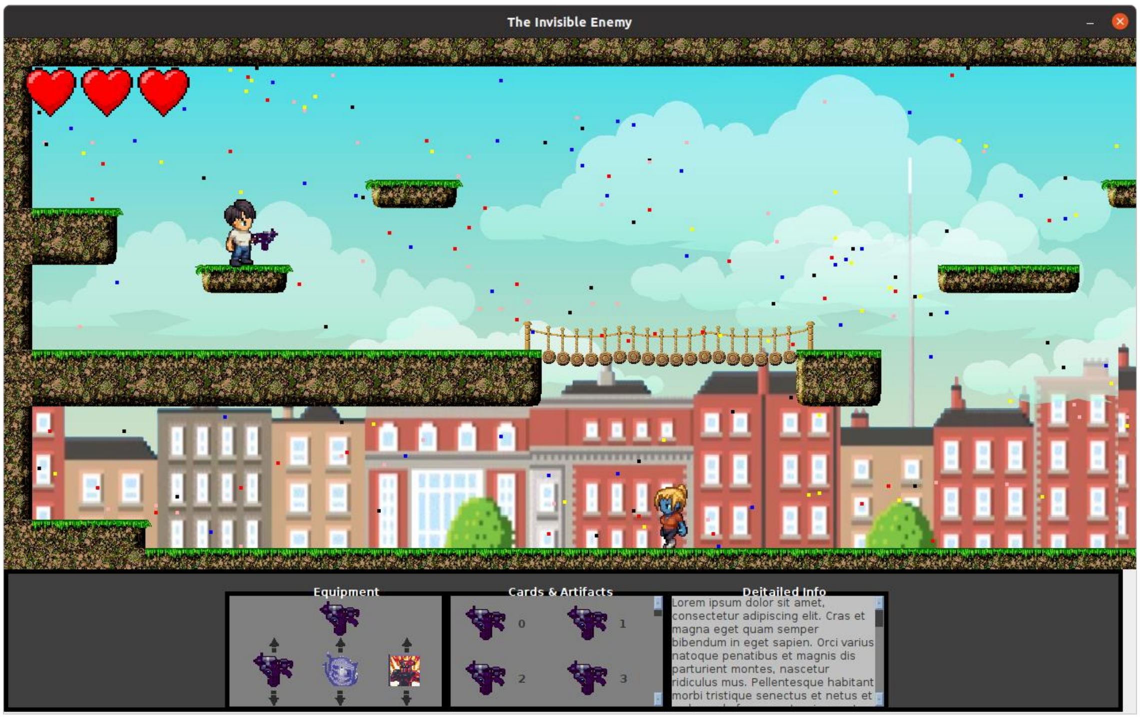


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Figure 28: Final result Layers

Camera

The camera system in this project works by collecting information relative to the player and other moving objects (scrolling) towards a given direction.

The camera has two states and activates once the player sprite reaches a point on screen; when the camera is stopped and the player moves outside the moving zone, the camera stands still; when the player moves inside the move zone the camera follows it by leaving the player stationary on screen and moving all other objects.

The static mode only updates the position of movable objects such as players, citizens and Zeniths;

The moving mode leaves the player sprite still whilst updating the scenario moving at player speed and the movement of the moving object is incremented with the value of player speed.
this gives the impression of a camera following the player inside the scenario.

Zenith Particles

The zenith particle approach was elegant, instead of reading images the rectangle function would have the features we need to implement movement without making it necessary for the update to draw a whole 32x32 sprite, this added to the pong ball movement style and also a random direction setter activated by collision with the scenario made it possible to create the desired effect on zenith particles which will move through the scenario randomly creating a sensation of saturation.

Zenith particles have different colour instantiation and when a collision with a clear citizen happens, the Zenith particle is deleted from the game and changes the citizen's state to the same colour the particle carries; creating the desired behaviour of acting like a virus.

Projectiles

Projectiles utilize the same rectangle object features, alike the Zenith, the projectile has a simple trajectory and an event for impact.

The projectile doesn't read its own impact, instead, every object in the game reads if is there a projectile intersecting with its own hitbox.

When a projectile hits a map surface with collision it just disappears; if hits an infected citizen, it removes the colour state back to white and disappears.

in a way, projectiles and zeniths are opposites and one compliments the other's job when an event is triggered in a Citizen.

Citizen

The citizen moves through the scenario and is susceptible to be hit by a Zenith particle. Its natural state is "white" and in case it is hit by a Zenith's particle it changes its state to infected by a Zenith's colour.

an infected citizen can inflict health damage to the player when infected; if shot with a projectile its state changes back to white.

Conclusion and Further Work

The challenge of showing skills learned in a Java 2d Game project is desirable to many IT students as it initiates the student in advanced concepts and in such an environment even an abstract concept can be easily defined and demonstrated;

as the history was complete and well planned, this project has all features necessary to expand towards its completion in a short time as per the consistency of the code, the expandable mechanics and the low performance it demands; all the main challenges the project presented until this point were met at the time of submission.

many abstract patterns and concepts can be easily identified by verifying the behaviour of the graphic object which is one of the biggest challenges for students to overcome when dealing with logic coding.

this project has many interesting known features adapted to a brand-new concept of non-violent games and could be improved further in the future to achieve the final completion goal; Also, the adaptation of a few patterns to achieve decentralized object behaviour is a point that raises questions to be answered in the future such as: Is it a scalable concept or is this approach limited? If so to what aspects?

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Figure 18-28: Screen Shots from our Project

Appendices

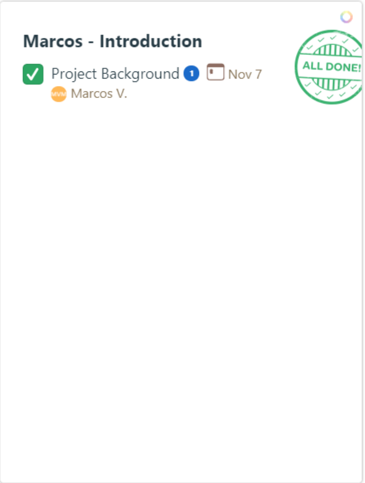
Appendix A: Group Communication and Activity

A WhatsApp group was created to keep the good and fast communication in our team. Using this App is possible to keep the track of the project and ask the team members with we have questions.

Final Project ATG-21-009

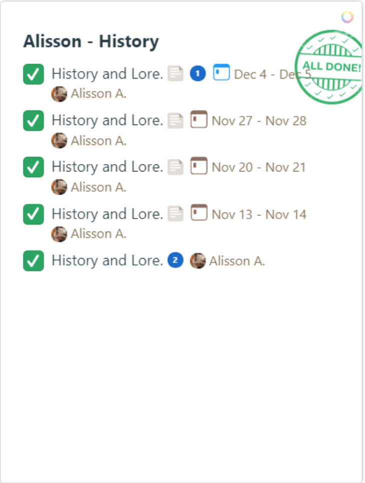
Group · 5 participants

We also used a to-do list in Basecamp to split the tasks and give deadlines to complete what we planned.



Marcos - Introduction

☑ Project Background 1 Nov 7 Marcos V.



Alisson - History

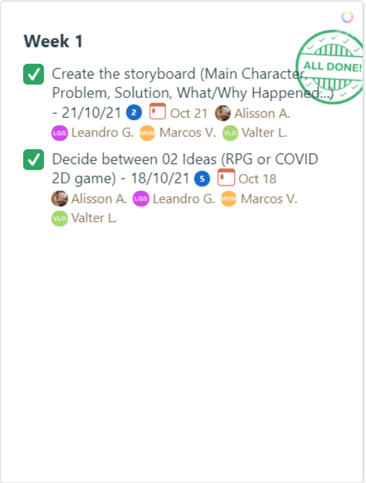
☑ History and Lore. 1 Dec 4 - Dec 5 Alisson A.

☑ History and Lore. Nov 27 - Nov 28 Alisson A.

☑ History and Lore. Nov 20 - Nov 21 Alisson A.

☑ History and Lore. Nov 13 - Nov 14 Alisson A.

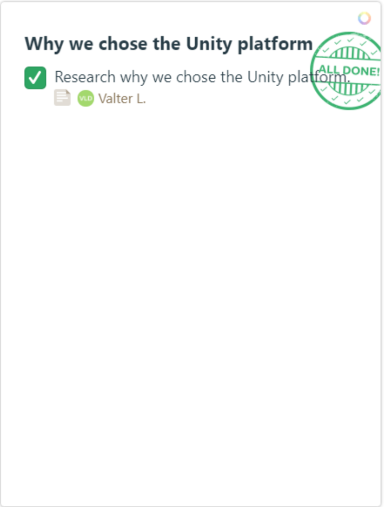
☑ History and Lore. 2 Alisson A.



Week 1

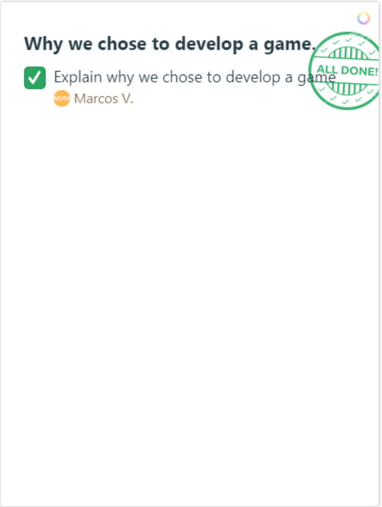
☑ Create the storyboard (Main Character, Problem, Solution, What/Why Happened...) - 21/10/21 2 Oct 21 Alisson A. Leandro G. Marcos V. Valter L.

☑ Decide between 02 Ideas (RPG or COVID 2D game) - 18/10/21 5 Oct 18 Alisson A. Leandro G. Marcos V. Valter L.



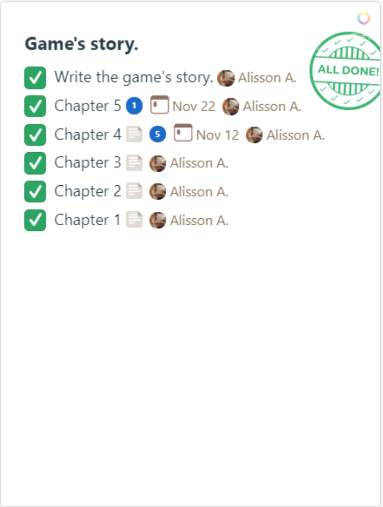
Why we chose the Unity platform

☑ Research why we chose the Unity platform. Valter L.



Why we chose to develop a game.

☑ Explain why we chose to develop a game Marcos V.



Game's story.

☑ Write the game's story. Alisson A.

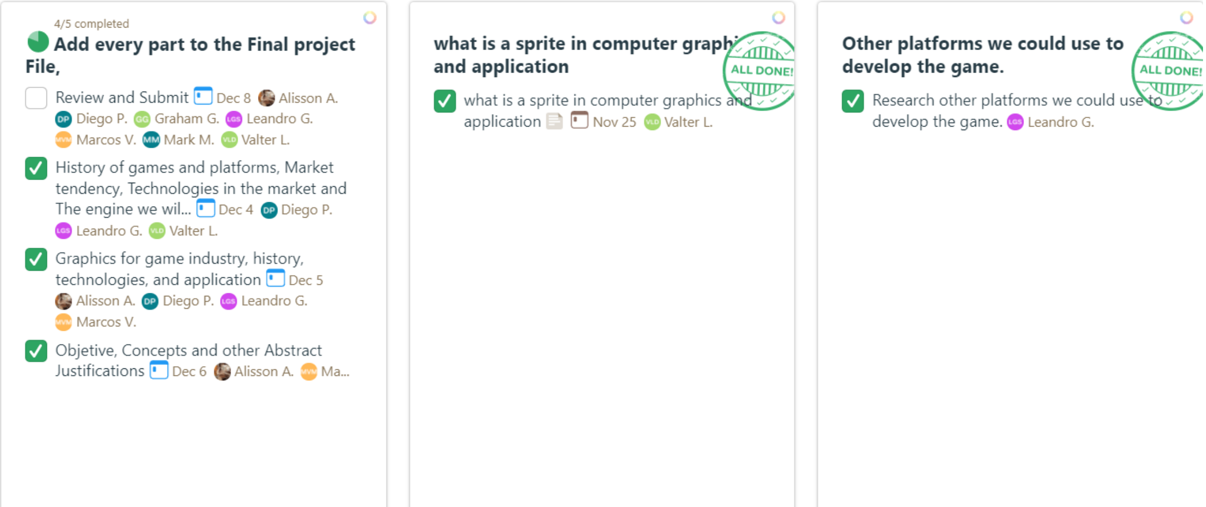
☑ Chapter 5 1 Nov 22 Alisson A.

☑ Chapter 4 5 Nov 12 Alisson A.

☑ Chapter 3 Alisson A.

☑ Chapter 2 Alisson A.

☑ Chapter 1 Alisson A.



4/5 completed

Add every part to the Final project File,

- □ Review and Submit Dec 8 Alisson A. Diego P. Graham G. Leandro G. Marcos V. Mark M. Valter L.
- ☑ History of games and platforms, Market tendency, Technologies in the market and The engine we wil... Dec 4 Diego P. Leandro G. Valter L.
- ☑ Graphics for game industry, history, technologies, and application Dec 5 Alisson A. Diego P. Leandro G. Marcos V.
- ☑ Objetive, Concepts and other Abstract Justifications Dec 6 Alisson A. Ma...

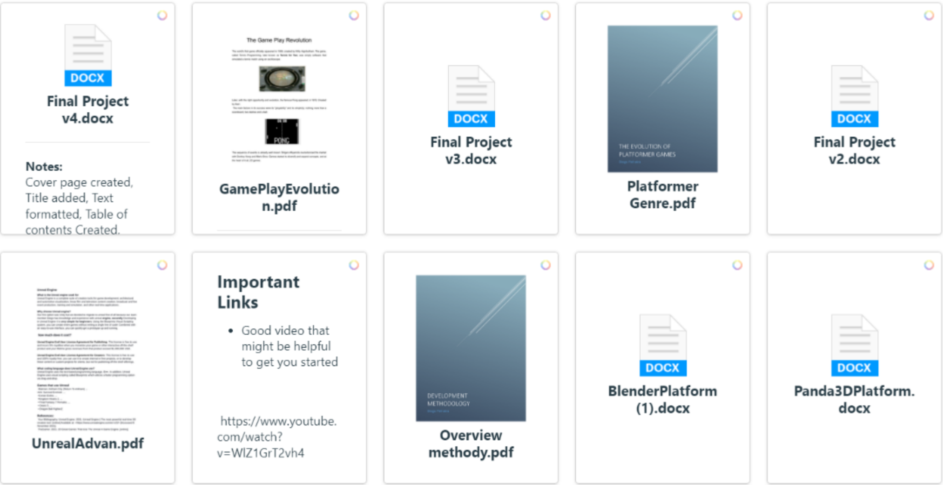
what is a sprite in computer graphi and application

- ☑ what is a sprite in computer graphics and application Nov 25 Valter L.

Other platforms we could use to develop the game.

- ☑ Research other platforms we could use to develop the game. Leandro G.

Along with that we uploaded useful links for the project and versions of the Final Project to keep it safe in case something happens with the document.



Final Project v4.docx

Notes:
Cover page created, Title added, Text formatted, Table of contents Created.

GamePlayEvolution.pdf

Final Project v3.docx

Platformer Genre.pdf

Final Project v2.docx

UnrealAdvan.pdf

Important Links

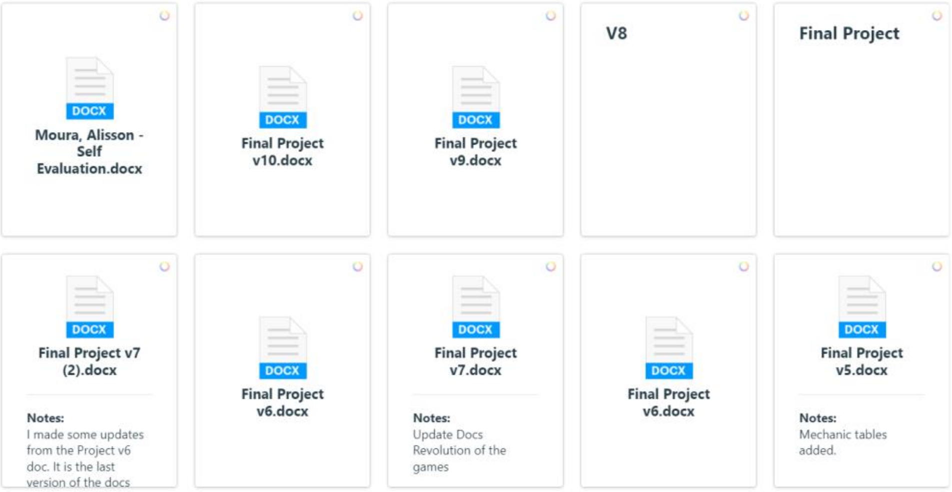
- Good video that might be helpful to get you started

https://www.youtube.com/watch?v=WlZ1GrT2vh4

Overview methody.pdf

BlenderPlatform (1).docx

Panda3DPlatform.docx



Moura, Alisson - Self Evaluation.docx

Final Project v10.docx

Final Project v9.docx

V8

Final Project

Final Project v7 (2).docx

Notes:
I made some updates from the Project v6 doc. It is the last version of the docs

Final Project v6.docx

Final Project v7.docx

Notes:
Update Docs Revolution of the games

Final Project v6.docx

Final Project v5.docx

Notes:
Mechanic tables added.

Appendix B: Individual Self Evaluation Report 1

Criteria:

4- Consistently: This means you were dependable in each task.

3- Most of the time: This means more often than not.

2- Occasionally: This means you sometimes did this.

1-Seldom: This means rarely or not often.

<table>
<tr><td colspan="2">Student: Alisson Moura
Student Number: 2019142</td></tr>
<tr><td colspan="2">During this semester I've studied a few techniques for writing what is known as "journey of the Hero"; the progression of a character in a way to discover himself and save their world. Applying the Journey to the history of Zenith was very challenging as time was in essence for accomplishment.
I have satisfaction with the result, but I see much space for improvement of the plot, adding more events and characters during the adventure. The creation of the mechanics happened along with the history. The objective to rematch stages in the game to reuse programming and extend the playable hours worked well in my point of view.

I expect the Mechanics to be revisited in the future as of tests might show if it's not challenging or too difficult to play until the end. Understanding the progression of this project was especially hard for me, and I'm happy that team work helped us to accomplish that not at perfection but good enough to make us proud of it. I would like to revisit the history line in the future to improve details and descriptions, work better in characters and scenarios, but I believe that what we have won't make a bad result already.

As the creation of mechanics and plot was assigned to me, and many of my colleague’s work would be possible once the story and mechanics are complete; I saw myself under pressure to deliver something complete and yet in a short period of time, managing time with work and other college subjects. I believe the time management could be improved, but I’m also happy with the result; But I imagine I might have made my colleagues time shorter than it could be if I had made a better time management and ensure my colleagues have more time to work on their tasks.</td></tr>
<tr><td></td><td>1 to 4 based on the criteria above</td></tr>
<tr><td>Worked collaboratively on all parts of the assignment.</td><td>2</td></tr>
</table>

Respectful and polite to all group members.	3
Addressed any problems in the group positively.	4
Offered suggestions for improvement of other group members.	3

Student: Diego Pinheiro

Student Number: 2019466

This semester was very challenging, working as a team is not simple as it looks, but it was a great experience for me, I learnt a lot about why good communication is so important for a successful team. The beginning was very hard, I was working on a project and I had some problems with one of the team members which made me leave the team and abandon the project, it was a shocking experience but I was lucky enough to be accepted in my current team. Joining a new team was a bit challenging as I had to learn how to adapt to their workflow, fortunately we have good communication and it made things easier for us, I did the best I could to catch up to their pace and deliver as much as I could. Since I joined the team, we had some meetings where we could discuss how we would be putting up the project together, for this "first stage" I was part of the research team, my main role was focused on researching some aspects of the game we are developing. Throughout the research I have learnt a lot more than I was expecting about this game genre and I was really excited to learn more about it, I felt that I was expanding skills that I don't even know I had before. We faced a lot of challenges that were new to me, and I believe that was a really important part of this semester, learning how to work as a team and solve problems as a team. After all the hard work I feel the improvement on my communication skills and I am really enjoying working in a team, everyone is doing their best and I see how much we can achieve now, it is really being great experience. Overall, I am really happy with the direction that this project is going, I trust my team and I believe that we are going to deliver a really good product at the end.

	1 to 4 based on the criteria above
Worked collaboratively on all parts of the assignment.	2
Respectful and polite to all group members.	4
Addressed any problems in the group positively.	3
Offered suggestions for improvement of other group members.	2

Student: Leandro Guimarães

Student Number: 2019384

This semester professors Mark Morrissey and Graham Glanville presented us with our latest work. Our group chose to make a 2D game. I was thrilled with the idea. During our research, I noticed that it will not be easy as we are going to use several tools that I have never used, such as Unreal Plataforma and graphic designs.

Over the semester, we met several times to share tasks and talk about the project. Sometimes we meet with the professors via Zoom to clear up doubts and explain what is being done so that they can help us.

We discussed how the timetable would be, which tools to use and work together, we interact a lot in Basecamp and it has helped us a lot.

My part in the group so far has been researching about the games, how they were made, their development, researching the positive and negative points of using certain platforms to create the game and giving some ideas for the game's history.

	1 to 4 based on the criteria above
Worked collaboratively on all parts of the assignment.	4
Respectful and polite to all group members.	4
Addressed any problems in the group positively.	3
Offered suggestions for improvement of other group members.	4

Student: Marcos Rodrigues

Student Number: 2019146

Creating a game is not an easy task but I think it is a fun project to do and I rather do something that I like than a project that I find it boring. That’s why I am trying to do my best and learn as much as I can from all aspects of the project: planning, methodologies, breaking down the problems in small pieces and understanding the technologies and how important is to do deep research about the subjects. In general, I think I’m learning a lot with this project and I think I’ll learn more through the process.

The group overall is really good, which team member with the own ease on the tasks and together we can get close to the main goal.

In my point of view, I wasn’t that excited this semester because of the whole world situation and I don’t like the online classes. I was struggling a little bit to focus on the other classes assignments and this situation has as a consequence on this project. Some days I wasn’t feeling good and

creative to do the tasks but like a strong man I never give up and I think I did my best. I could help my team because I like to break down things into small pieces making them easier to finish. I honestly think that my good points are: Communication, planning and breaking down problems and the thing that I want to improve for the next semester is time management, which is something I need to work on.	
	1 to 4 based on the criteria above
Worked collaboratively on all parts of the assignment.	3
Respectful and polite to all group members.	4
Addressed any problems in the group positively.	3
Offered suggestions for improvement of other group members.	3

Student: Valter Brito Student Number: 2019308	
I Valter Lopes de Brito believe that I had a Positive Participation during this period that we were elaborating on this project. I had a significant Collaboration and teamwork attitude, respecting the deadlines and Participation of meetings, collaborating on Basecamp and WhatsApp Group even when we were under pressure working on someone else assessments, we kept engaged with our task and having great communication.	
	1 to 4 based on the criteria above
Worked collaboratively on all parts of the assignment.	4
Respectful and polite to all group members.	4
Addressed any problems in the group positively.	4
Offered suggestions for improvement of other group members.	4