Project Report – SAE J3D

MINOTAUR PROJECT

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1.Introduction

This document is the presentation report of the Minotaur Project, a video game made by the Lolympe team for the SAE J3D project during the first year at EPITA. It explains the progress of the project since the validation of the Technical Specifications Document.

This report describes the main characteristics of the project and provides an overview of its current state of development. Moreover, it includes an individual assessment of each team member’s contributions by highlighting the successes, difficulties, and planned future improvements linked to each task.

2.Project Overview

2.1)Context and objective

Nowadays, Greek mythology still holds strong cultural and educational value.
However, it is less present in the daily activities of younger generations, who do not find much interest in it outside of academic contexts.
That is why the Minotaur Project was created, in order to reintroduce interest in Greek mythology through an immersive and engaging game rather than purely instructional content.

2.2)Game Presentation

The Minotaur Project is a 2D single-player or multiplayer video game.
The project takes inspiration from Greek mythology, especially the myth of Theseus and the Minotaur, but also references from other Greek myths.

A classic game session begins from the main menu, and the game teleports the players directly into a dangerous labyrinth. The player controls a character who must navigate through the maze, and the objective is to survive and find the exit by choosing the right path, while the fear of being chased by the Minotaur creates constant pressure.

3.Team Organization

The Minotaur Project is developed by a team composed of 4 members, each responsible for a specific aspect of the project. In order to manage the different technical and creative tasks efficiently, the work was divided into clear roles at the beginning since the validation of the Technical Specifications Document.

3.1)Team members and roles

Roles' Distribution:				
	Emilie	**Soundhravailou**	**Maravilha**	**Francesco**
Responsible	**Game Design (Items and Graphics) / Artificial Intelligence**	**Network / Multiplayer**	**Sound Design + (User Interface)**	**Website**
Deputy	Sound	Items	Website/ Network/ graphics	Multiplayer/ AI

Emilie was responsible for Game Design and Artificial Intelligence.
This role focused on defining the core gameplay mechanics, player interactions, enemy behavior, and overall game logic. But also about all the design and graphics of the game.

Soundhravailou was in charge of Multiplayer and Network. This responsibility involved designing and implementing the network architecture required for multiplayer interactions and maintaining a good synchronization between multiple players.

Maravilha was responsible for the Sound design.This role is dedicated to creating the audio atmosphere of the game.Moreover,this included the design,integration and

transition of sound effects and ambient sounds in order to to reinforce immersion and tension in the labyrinth.Maravilha was also in charge of the user interface in the game.

Finally, Francesco was in charge of the website development and deployment. The website serves as a presentation platform for the project, including information about the game, the team members, and the external resources used during development, and allows access to important documents linked to the project.

Thus, each member had a primary role, collaboration between roles was essential throughout the development of the project. Many tasks were closely connected, meaning that one decision made in one task often had an impact on another one.

3.2)Workflow and Collaboration

The development workflow of the Minotaur Project was based on regular communication and a clear system of task priorities. The team focused on implementing core systems first, such as gameplay mechanics and technical foundations, before working on secondary features like items or character skins.

Version control was managed using Git and GitHub, allowing team members to work independently on their respective features. Each member worked on their own branch to push changes safely and avoid issues related to file conflicts or merges. This workflow helped maintain a stable version of the project while enabling parallel development.

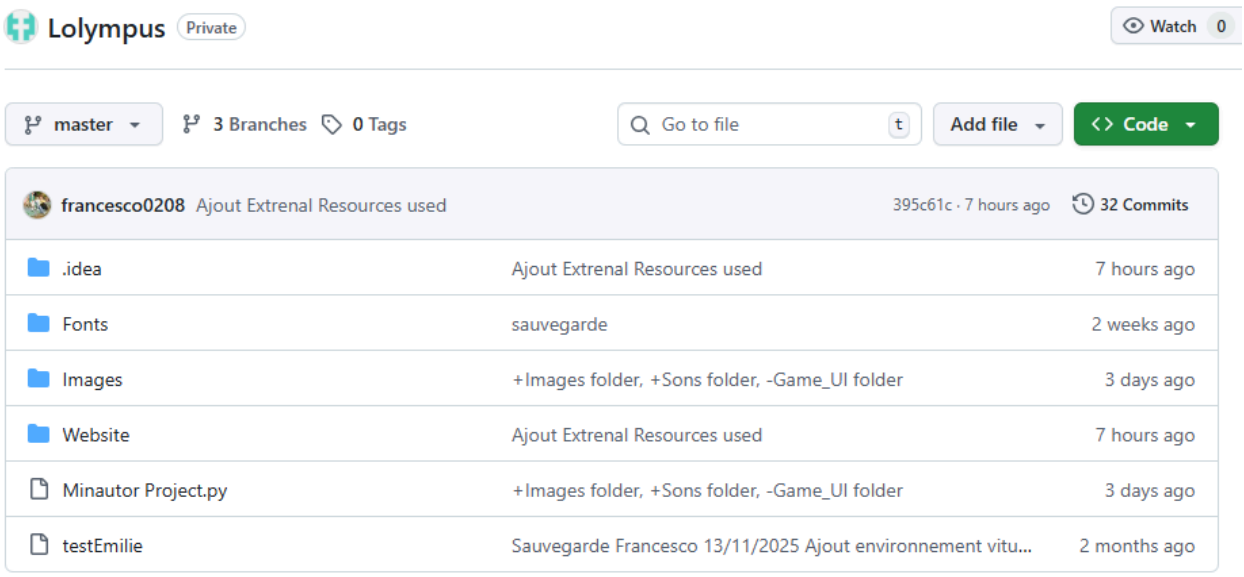

Figure – GitHub repository

4.Gameplay/ Game Design/ Artificial Intelligence

4.1)Basic Gameplay

When the player launches the game, they will see the menu giving the options to access the parameters or to start a game. When the player starts the game, they get redirected to a page where they can customize their champion or enter the lobby to choose between a solo game and a multiplayer game. If the latter option is chosen, they will face other players in a random maze, and the first ones to reach the exit within the allocated time win.
The countdown starts shortly after the game begins.

The player can see that they have ⅗ minutes to reach the exit hidden in the maze. The player can move around in the maze with the other players and can fall into traps or meet bonuses obtained with items.
However, collisions with walls prevent the player from moving freely through the environment. The labyrinth is composed of solid walls and corridors that block movement and force the player to follow specific paths and find the correct ones.
This reinforces the importance of navigation and spatial memory, as players must remember previously explored paths.

The real threat the player will have to face is the Minotaur, who will chase them and the other players in the maze. The player has a health system represented by hearts, which decrease when they are attacked by the Minotaur or hurt by traps. If the player loses all their health or has not reached the exit in time, the game is over, and the player loses. On the other hand, if the player reaches the exit in time, it is a victory. In every case, the player returns to the menu and can choose to start another game

4.2)User Interface (Menu)

Figure - User Interface (Menu)

The User Interface (UI) was designed to be as intuitive as possible while staying true to the main theme of our video game. Indeed, we chose to maintain the universal set of buttons one would find in all games (such as settings, credits, help, etc.) and position them in familiar spots to the user. We made the aesthetic choice of incorporating Greek elements into the design of a few buttons in a way that was both coherent and intriguing. Indeed, our primary goal is to make the young players more interested in the world of mythology, and it was obvious to us to start the immersion right from the Menu screen with mythology symbols that would spark the user's curiosity.

Moreover, the backgrounds were drawn in three different versions with the device's system time in mind. So, depending on when the user opens the video game, the same background image with different hues will be chosen as background to simulate the user already being inside the labyrinth in daytime or nighttime, like in real life.

At this stage of the development, the game's UI is done in terms of aesthetic work. All the necessary buttons are present, and clicking them should redirect the user to their respective pages. To go back to the previous page, the user needs to press down on the ESCAPE key.

4.3)Player movement

The player can wander in the labyrinth however they want. To do so they can use the controls : key up - going up, key down - going down, key left - going left, key right - going right. Moreover, they cannot run into walls. They collide with them.
Today this part is completely done, we only have to add the animations.

4.4)Game Mechanics

4.4.1)Health system

The player isn't immune to the labyrinth traps and to the Minautor's attacks. The player can lose life points represented by three hearts if they happen to be in these two situations. However the player can regain hearts if they encounter the bonus : Hera's protection.
We chose a system with hearts because it is visually more understandable than a life bar. Indeed, it allows the players to see more clearly how many life points a trap or a Minotaur attack can cost. Moreover, this design is often used in video games such as Mario or even Zelda. It is instantly recognisable and can be understood by anyone.
This system has not been implemented yet.

4.4.2)Maps

A map is selected randomly among several pre-made maps at the start of the game. They are made to be large enough to give challenges in terms of labyrinth, but smaller enough for the player to meet other players, encounter bonuses, traps and most importantly the Minotaur.
The map is made with the software Tiled and implemented in the code with the pytmx library. Tiled allows us to make maps with a set of tiles that can be disposed however we want. Tiled has also a tool to draw collision surfaces, which makes the process easier.
The tileset has been drawn in Procreate and today it is almost done. There are small changes to be made as some tiles do not connect with the other correctly. The solution that has been found for the tiles that are not connecting well with the others is to actually cut into several parts the main tile set. This way, it is easier to manage errors due to miscalculations of the measures.
For now we have a few maps to test the code with.

4.4.3)Traps

Traps are not implemented yet in the game. However they are in conception.
Two types of traps were defined in the initial conditions :

- **Warnings Taps Activation** :The warning trap is designed to indirectly endanger the player by attracting the Minotaur rather than causing immediate damage.When the player comes into contact with this trap,a loud buzzing or horn sound is triggered in order to alert the Minotaur of your presence.

- **Life-decreasing traps activation** : This trap is designed to directly penalize the player. Indeed, The life-decreasing trap takes the form of a hidden manhole placed on the ground obstructing the player's path.
  When the player steps on the tile containing the trap,he loses one life point which is represented by a heart losing its color in the user interface.

These features have been postponed because it is not a development priority at this moment.The development team intends to progressively integrate some traps in future versions of the project.

4.4.4)Items/Bonuses

Items and Bonuses are not implemented yet in the game.However there are in conception.Two bonuses and four items were initially imagined in the base design conditions :

- **Speed bonus :** The speed bonus is designed to temporarily increase the player's movement speed,allowing faster navigation through the maze.When the player walks over a speed bonus, the player walking and running speed is automatically multiplied by 1.25 speed for 20 seconds

- **Life regeneration bonus:** The life generation bonus allows the player to recover one lost life point.When the player walks over the boost, and has one or two missing hearts,the bonus will activate and regain one lost life point represented by an empty heart in the user interface filled with color.

- **Ariadne’s thread :** The Ariadne’s thread is an item that helps the player navigate more easily through the maze by revealing a safe path to the exit revealed by a red thread.When the player encounters this item on the map and chooses to activate it, the item has an effect for only 15 seconds.

- **Hermes Shoes :** The Hermes Shoes allows the player to have the same speed as the Minotaur.When the player encounters this item on the map and chooses to activate it, the item has an effect for only 15 seconds.

- **Hera’s protection :** The Hera’s protection enables the player to recover lost health.When the player encounters this item on the map and chooses to activate it, the player restores one heart represented by an empty heart in the user interface filled with color.

- **Icarus’ wings :** The Icarus’ wings temporarily grants the player the ability to fly over the maze.When the player encounters this item on the map and chooses to activate it,the player seems to fly above the map, crossing walls,including the Minotaur during a short period.

These features have been postponed because it is not a development priority at this moment.The development team intends to progressively integrate some items and bonuses in future versions of the project.

4.5)Artificial Intelligence (Minotaur)

The Minautor is the guardian of the Labyrinth. He navigates in the labyrinth following a defined path. However when a player is less than 5 to 4 tiles away, the Minotaur turns into a deadly beast and immediately goes after the player. The Minotaur navigates into the labyrinth during these moments with an *A pathfinding algorithm. It has been chosen because it is one of the most popular pathfinding algorithms, making the access to resources and online tutorials easier. Moreover, it is often used in video games, which made it even more interesting to use. But that is not the main asset of this algorithm. The *A pathfinding algorithm is an extension of Dijkstra's algorithm, instead of looking at every possibility, it prioritizes the paths that are more likely to be closer to the goal.
In order to implement this algorithm, we used the pathfinder module.
To this day, the pathfinding has been started. Starting with a simple prototype in the shell, we quickly moved on with a prototype in pygame where the pathfinding is triggered by mouse clicks. Now the Minotaur can follow the shortest path to the last mouse button click. Even if the minotaur has not reached the last point targeted, if the mouse points to another direction, the Minotaur changes the destination immediately .

The pathfinding is working so far but with a major problem. The pathfinding is not happening on the tileset but on the top left corner of the screen. This issue is due to the fact that the pathfinding does not actually respond to the map of the game but rather to coordinates on the screen. This makes it impossible to implement the camera with the pathfinding for now. However, since we identified the problem, it will be easier to fix this issue.

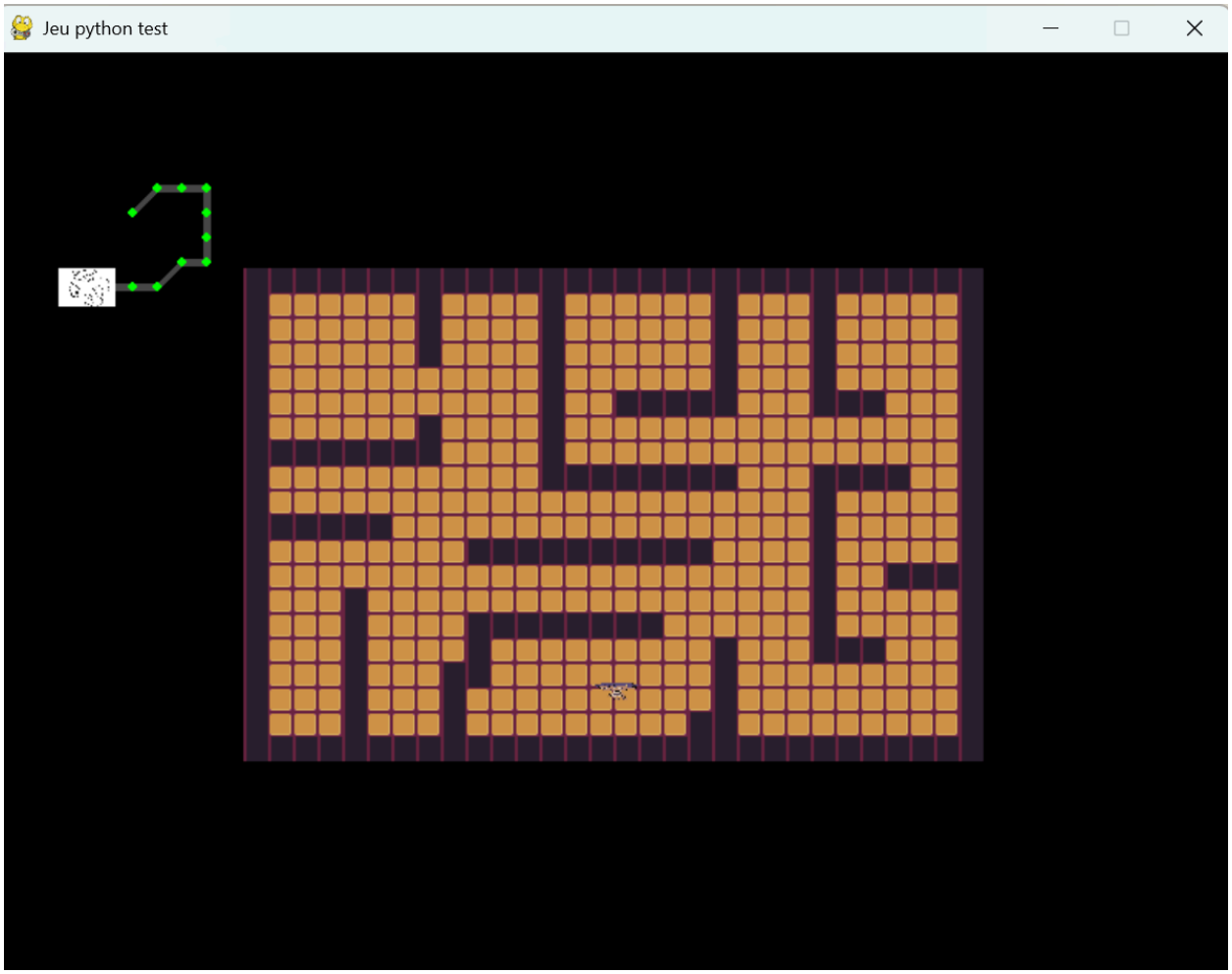

Figure - Screenshot of the pathfinder prototype in pygame on the top left corner, the temporary map in the center and the place holder for the player at the bottom.

5.Multiplayer and Network

5.1)Context and Design Choices

The multiplayer component was designed to transform a local experience into a shared environment. The primary goal was to synchronize player positions in real-time.

We chose TCP using Python's socket library. While UDP is often used for fast-paced games, TCP was selected here for its reliability. It ensures that every position update and synchronization message (like the START coordinates) arrives in the correct order without data loss, which is crucial for maintaining state consistency between two players.

To prevent the networking from "freezing" the game logic, we used Multi-threading. Each player connection is handled by a dedicated background thread on the server, while the client uses a separate thread to listen for coordinates without interrupting the main rendering loop.

We implemented a Local area network setup where the GameServer acts as the central authority. In this architecture, the server is the focal point of all communication : It manages connections, receives data from one client, and broadcasts it to others.This prevents the "peer-to-peer" complexity where every client must know the IP of every other client.

5.2)Current State of Implementation

The current implementation has successfully established a functional "handshake" and data stream. When a client initiates a connection, the server identifies the player and sends a unique START: message containing specific spawn coordinates. This ensures that Player 1 and Player 2 do not overlap at the beginning of the match. The server console provides real-time feedback during this process, successfully tracking events and displaying "Joueur connecté" once the link is confirmed. This confirms that the low-level socket communication is robust and that the server is correctly identifying different game instances.

For the actual transmission of movement, we developed a simple string-based protocol using a pipe delimiter (|). Messages are formatted as x,y|, which is a critical design choice. Because TCP is a stream-oriented protocol, it often groups multiple small messages together in the network buffer.

The delimiter allows our parsing logic to split the incoming data stream and read each position update individually using the .split('|') method, preventing data corruption. Currently, the system successfully communicates the first set of coordinates; when a second player joins, their character is drawn on the first player's screen, which proves that the broadcast mechanism is working.

5.3)Limitations, Challenges, and Future Improvements

Despite the successful data transfer, we encountered a significant challenge with real-time synchronization. In some instances, the second player is drawn on the screen but remains static, whereas in other cases, the movement updates correctly. This intermittent synchronization suggests that packets are being received, but they are not consistently being processed by the game's rendering loop. This creates an unpredictable behavior where the remote player's character may 'freeze' before suddenly jumping to a new position.For the next time I will try to resolve that.

Another priority for future improvement is the implementation of a "shutdown" system to handle the termination problem. Currently, closing the game manually results in a [WinError 10054], which leaves ghost connections on the server and prevents immediate reconnection.

The project will expand to include item synchronization. In a multiplayer environment, it is not enough for players to see each other; they must also see the same game state regarding the environment. We plan to synchronize the state of items, such as collectibles or power-ups, so that if one player picks up an object, it disappears or updates for the other player simultaneously.

6.Sound Design

6.1)Context and Artistic Choices

The sound plays a great role in the impact of the gameplay. Indeed, the choice of adding or removing music, as well as the genre of the music, needed to be thought of thoroughly. Our Artificial Intelligence's mechanics are solely based on tracking and chasing. Moreover, we chose to add a limited time to each game started by the user. As a consequence, we needed to have the player feel both the weight of the timer and the refreshing stress of trying to escape the Minotaur's grasp without falling into too many traps. That is why we chose the epic genre for the soundtracks, as it corresponds with the Ancient Greek aspect of the game, as well as the lore it is based on. However, in key moments, namely the chase, we opted to remove the background music and replace it with a deafening heart-thumping sound that increases in intensity according to how close the Minotaur is. Thus, the player can have fun thanks to the graphics and the puzzle-like aspect of having to remember the good path, but they can also understand Theseus's fears and stress of wanting to escape alive without being found.

6.2)Current Sound Implementation

As of now, sound effects are up to date with the intended advancement. Indeed, the walking sound effects as well as the ones for the running and the Minotaur's attacks are all ready. They have simple triggering mechanics, as the walking sounds automatically start playing when the player presses one of the movement keys. The running sound starts playing when the SHIFT key is pressed. And finally, the attack sounds are activated when the player is within the attack range of the Minotaur.

Meanwhile, the soundtracks are a bit behind due to our wish to make everything by hand. The music for the Home Menu and Game Menu still requires a few adjustments, whereas the music for the gameplay hasn't been tackled yet. However, ready-made soundtracks free of charge were already found and chosen, waiting to be replaced by the handmade sounds of our team once they are ready. After the initial installations, the menu music starts playing when the game application is opened, and the gameplay music starts playing when a game is launched.

6.3)Limitations, Challenges, and Future Improvements

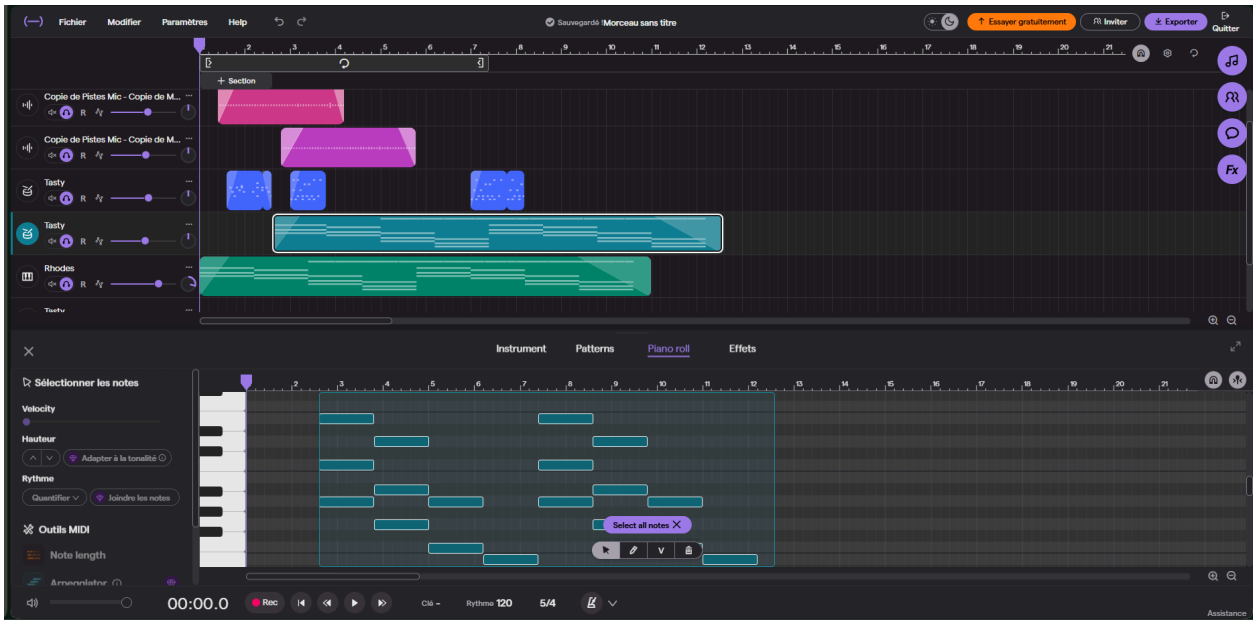

Figure - Music Tool

Some challenges and limitations were encountered while working on the Minotaur Project's sound design. These challenges took the form of school and tools. Indeed, as students, it was difficult to balance time for revisions and the project since all the members are working on multiple tasks either as responsible or as an assistant. Moreover, the sound design priority was lower than that of the other tasks, so as not to affect the game progression, we chose to focus first on the game interface. But, putting this aside, the main issues met while working on this were due to the limited tools at our disposal, be it in the team members' own home devices that do not include professional sound setups or many instruments, as well as the previous apps used to work.

7.Website

7.1)Context and Objectives

The project website was created as an essential part of the Minotaur Project.
Indeed, in accordance with the requirements defined in the Technical Specifications Document, the main purpose of the website is to present the project and provide context about the game.

Another objective of the website is to centralize all relevant information related to the project. By having all this information in one place,the website allows the project to be easily understood by external readers without requiring them to install the game.

Another important objective was to keep a coherence between the website and the rest of the project. The website needed to still coherent with the game's theme and atmosphere, while staying simple enough to remain readable.

7.2)Current Website Implementation

The website was entirely developed by ourselves , without using any website builders or automated tools. Only standard web technologies were used, precisely HTML and CSS. To build our website we use some official HTML and CSS documentation and online references in order to manage the website structure and style.

The website is structured around several pages, each with a specific role :

- The homepage focuses on immersion through a short lore section inspired by the myth. It presents the project and the different game features present in our game.
- Then, The *Project Presentation* page explains our game by presenting the main challenge of the game. It also introduces the gameplay with some key features and includes design elements.
- The team page explains the different main roles in our team and our motivation through this project .

- Finally, the resources page lists all the external resources used in the project, and the downloads page provides access to documents related to the project, such as the current report.

Initially, the website was only hosted locally. It has now been published online using **Neocities**, which helps with the construction and deployment of websites. It is accessible at the following address :
https://lolympe-minotaur-project.neocities.org/

At the current stage of development, the website is close to completion, with approximately 75% already completed, taking into account the website deployment, design, content, and technical documentation. The overall structure is functional and respects the guidelines defined in the Technical Specifications Document.

7.3)Limitations, Challenges, and Future Improvements

Several challenges were encountered during the development of the website, mainly related to design constraints and technical considerations. One of the primary difficulties was finding free and royalty-free images that matched the project's theme while respecting copyright rules.

Another challenge met during the development of the website was structuring content blocks efficiently. It means,creating clear separations between different sections in order to have a good visual result.

Moreover, adapting the layout to different screen sizes was a technical challenge. The website was currently optimized only for desktop usage. A future improvement will consist in adapting the website to mobile devices due to the fact that screen resolutions vary significantly between devices and implies that we need to be careful using CSS layout techniques.

Future improvements will focus on completing the remaining sections, particularly the download page by adding a link to install the game so it can download the repository and the installation procedure , and publishing the website online. Moreover,adding screenshots of the game is also planned to reinforce the connection between the website and the gameplay experience, allowing readers to directly see concrete proof of the game and its actual implementation.

MINOTAUR PROJECT

ESCAPE THE LABYRINTH. SURVIVE THE MINOTAUR.

THESEUS AND THE MINOTAUR — ANCIENT MOSAIC, WIKIMEDIA COMMONS

INSPIRED BY THE GREEK MYTH OF THESEUS AND THE MINOTAUR, THE LABYRINTH DESIGNED BY DAEDALUS BECOMES A DEADLY ARENA WHERE ESCAPE IS THE ONLY HOPE OF SURVIVAL AND GETTING LOST CAN QUICKLY TURN INTO A FATAL MISTAKE.

WELCOME TO THE OFFICIAL WEBSITE OF THE LOLYMPE TEAM

WE ARE LOLYMPE, A TEAM DRIVEN BY THE AMBITION TO BRING TOGETHER THE WORLDS OF GREEK MYTHOLOGY AND VIDEO GAMES. OUR CURRENT PROJECT IS A MULTIPLAYER ADAPTATION OF THE MYTH OF THE MINOTAUR. PLAYERS ARE THROWN INTO A GIGANTIC LABYRINTH RIDDLED WITH PERILOUS TRAPS GUARDED BY THE CREATURE ITSELF. TO WIN, THERE IS ONLY ONE OBJECTIVE: ESCAPE ALIVE.

GAME FEATURES

SOLO & MULTIPLAYER EXPERIENCE

COMPETE AGAINST OTHER PLAYERS IN A DEADLY RACE FOR SURVIVAL THROUGH THE LABYRINTH.

DEADLY TRAPS & THE MINOTAUR

NAVIGATE THROUGH PERILOUS TRAPS WHILE ESCAPING FROM THE FURIOUS MINOTAUR.

ITEMS

COLLECT ITEMS TO HELP YOU ESCAPE THE LABYRINTH AND SURVIVE THE MINOTAUR.

ACTION, STRATEGY & MEMORY

USE QUICK THINKING AND STRATEGIC PLANNING TO ESCAPE THE MAZE BEFORE TIME RUNS OUT.

PROJECT PRESENTATION | TEAM | DOWNLOADS | EXTERNAL RESOURCES

Figure - Home Page of the website

8.Global Assessment

Comparison between current advancement and the advancements that we predicted in Technical Specifications Document :

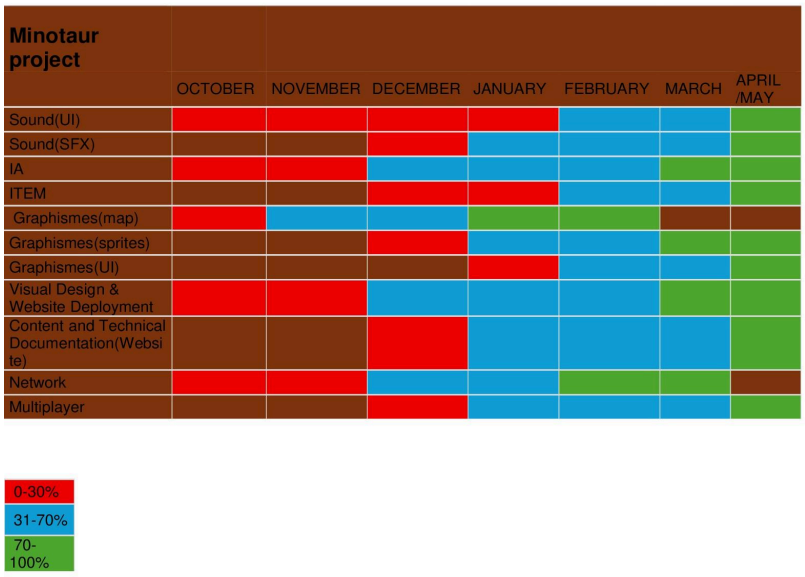

Figure - Gantt chart : Project progress timeline showing the evolution of every task over time.

Tableau d'avancement des tâches	
Tâches	**Soutenance 1**
Sound(UI)	60%
Sound(IA)	40%
Sound(Characters)	40%
Sound(Maps)	30%
Sound(SFX)	25%
IA	90%
ITEM	10%
Graphismes(map)	100%
Graphismes(sprites)	70%
Graphismes(UI)	40%
Visual Design & Website Deployment	70%
Content and Technical Documentation(Website)	40%
Network	100%
multiplayer	60%

Figure - Table of planned advancement of every task

9.Conclusion

Currently, the Minotaur Project has reached a stable state of development, with most of its core components at least at an initial stage of implementation.

Core aspects such as gameplay foundations, graphics (maps), network, multiplayer, and website development are the most advanced. These elements were prioritized early in the development process in order to guarantee a functional and testable project. Nevertheless, these mandatory tasks are not completely finished or perfect. For example, some corrections still need to be made to the artificial intelligence, which is not yet fully functional, and additional maps will be added in the future.

Thus, at the current stage of development, the team intentionally chose to limit the work done on items, traps, and the sound effects associated with them.
This choice of prioritization is a conscious development strategy focused on stability and core functionality before introducing additional gameplay functionalities not mandatory.

Overall, the project remains quite consistent with the objectives defined in the Technical Specifications Document and with additional development time, the game could be further improved and expanded.