

# Waventure

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**Abstract**—Our project is a software that the user would launch at the start of a battle in the game *Waven*. The main goal of our software is to be able to automatically complete the battle, by choosing the best actions to take without any human interaction. The software aims at analyzing and understanding the placement of enemies as well as their types and statistics, but it must also be able to read and know the cards available to play. To do so, he will have to perform two actions: move/attack (in *Waven* the attack is an extension of the movement) as well as cast spells (in the form of cards) to overcome enemies. If we succeed in the project, we can already see multiple ways to improve it. The first is to ensure that the software can launch itself into the game and that it can navigate the menus on its own to choose which fight to carry out. The second would be that he can repeat the same mission a defined number of times to collect rewards in large quantities. We decided to use the easiest character for our software, but it would also be interesting to teach our software to play with characters that have more complicated type of gameplay. We could also work to implement the more complex features of the game, which require more management of our resources during battle, but it would heavily affect the speed of the AI computing.

## I. INTRODUCTION

### A. Motivation

Almost everyone has already played a video game, there are so many genres that everyone can have fun with at least one game. However, some games might require a bigger investment from the players than others, as they ask for a more valuable resource than your money: your time. The act of repeating a certain part of the game is called "farming", and it can be quite an ordeal, depending on if that part is fun or not, but even the funniest part gets boring when repeated. This is why some games implement an automatic way of doing it, where you just spend the resources needed to complete whatever you need to do, and it just gives the rewards automatically, however it is far from a common thing. That is why some programmers decided to take the matter into their own hands and do it themselves by coding programs that will automatically do the actions as if they were the players, but without the need for players. It was while seeing such programs in some of the games we play that we decided to try and do the same for another game we know of : *Waven*. The program, in both cases, does not involve machine learning as it only finds an optimal list of instructions from a game tree, but it could be added later to polish the fittest function we will be using.

As for our educational background, we were interested in how artificial intelligence can recognize an object (whether it is in a video game or not) as well as how software can take decisions with the best output depending on the situation. This project is an opportunity for us to make a first step in the field of AI and learn a lot about its key concepts.

### B. Related Software

When we were looking for other related software, we found AI used on another game from the same studio called *Dofus*. The main difference here is that the latter does have a player-based economy, so the creation and publication of automated applications add to many resources without effort and ruin a major part of the game. In our case, *Waven* doesn't give you any advantage over other players regarding equipment or money, so it only allows you to focus more on the interesting

User, Customer	Arthur, Quentin	Download the software from a website and need an easy to use application to help him automating <i>Waven</i> fights.
Software Developer	Solal	Program a software providing all the requirements planned. He's in charge of design solutions to implement the functionalities
Development manager	Romain	Must guide the development team by giving the deadlines, make sure the requirements are well implemented and find solutions for development related issues.

content of the game and skip the boring but time-consuming one.

## II. WAVEN

”Waven” is a video game released on June 19, 2023. This game is free and developed by Ankama, continuing the storyline of the company’s previous works such as the MMORPG Dofus or the animated serie Wakfu.

In this game, players can move from island to island to accept quests and challenges given by NPCs.



Fig. 1. An image of the islands

These ones always involve battles and can be played solo or with other players.

To participate in these battles, players need to build and upgrade their deck and equipment outside of combat. Since our project focuses only on combat, I will now concentrate on the battles. The goal of the game is to defeat all enemies present on the map. The battlefield is arranged as a 7 by 7 grid on which allies and enemies are positioned.

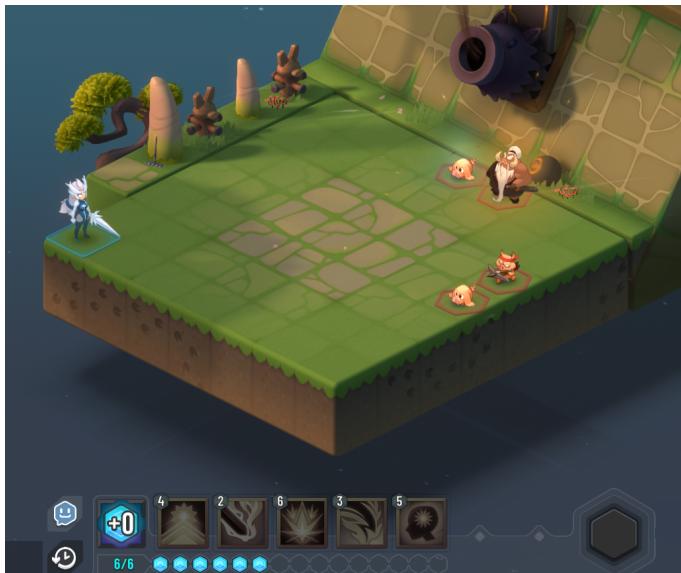


Fig. 2. An image of the field

The combat system is turn-based, and players have various possible actions:

### A. Casting Spells

Spells are used to deal damage, heal, or move characters. Spells have a mana cost. They also have targets marked on them (an ally, an enemy, your character, all allies, an adjacent enemy, etc.). The player must choose and point the spell towards the character they want to affect.



Fig. 3. An image of a casting spell

Some spells also have keywords and extra effects. A particular keyword used by our character is ”Melee.”

If a card has the keyword ”Melee,” it becomes stronger based on the number of enemies surrounding the player’s character. The class’s ability is: if you use a card with the ”Melee” keyword, it gives half of your attack in armor for each surrounding enemy.

### B. Moving/Attacking

During a player’s turn, they can click on their character and create a path on the free squares of the terrain. The player can only move a number of squares equal to or less than their movement points. If the player moves during their turn, they must wait until their next turn to move again, even if there are movement points remaining. When a player finishes their movement path next to another character, they can continue their path towards the character to attack them.



Fig. 4. An image of the movement possibilities and a image of a hit

### C. Ending Turn

To end their turn, the player can press the end turn button located to the right of their spells.

#### D. Summoning Companions

Most spells grant elemental points in addition to the specified action. These points can be used to summon companions chosen during the deck creation. Once summoned, companions can be moved and attacked like the hero but cannot cast spells.

#### E. Turn phase

At the beginning of their turn, the player has 6 mana points to use for spells and draw a new spell card. They can move, cast spells, or use companions in any order they prefer. Once the player finishes their turn, the next player takes their turn, followed by the enemy turn. There are also interactions that depend on the character's class. After winning a fight, the player can obtain new cards, new equipment and experience to level up and become stronger.

#### F. Class

In the game Waven, when a player wants to create a character, they must choose a class. There are 5 classes available now:

- Cra (Archer)
- Iop (Warrior)
- Xélor (Mage)
- Eniripsa (Healer)
- Sram (Trapper)

To facilitate the program's creation, the decision was made to take the easiest class to control, Iop (Warrior). Once the class is chosen, the player must choose from 5 different subclasses for each class. The Iop's subclasses are:

- Spectral Armabladegeeddon (summoner warrior)
- Bovalor Orok (charging warrior)
- Flamboyant Kasai (elemental warrior)
- Stalaktoss Glaive (speed)
- Brutal FairBlade (Armor)

Again, the simplest subclass to control was chosen, Brutal FairBlade (Armor).



Fig. 5. An image of our personage

In Waven, players choose to create a deck around their subclass's passive ability. The ability of Brutal FairBlade

provides armor. Armor is an additional pool of hit points that absorbs damage.

This class was chosen because it is easy to use and does not require much strategy; you simply charge at the enemy and cast as many spells as possible, accumulating armor.

Waventure needs the Brutal Fairblade to work, but the goal is to use this pretty simple class to collect enough rewards to let you play easily with other classes and have fun discover new ways to approach combats.

### III. REQUIREMENTS

#### A. Launching the software

To launch our application the user must have a computer, which will serve as support to launch the game "Waven" and our software. The user must have previously downloaded python and the libraries needed.

#### B. Recognize the situation

Once the challenge is selected, the software will launch it and begin to extract all informations needed to find the optimal turn.

#### C. Find all possible lists of instructions

Once all the information are obtained, the software must resolve the situation by finding the best list of instructions to make an optimal turn. It will generate all possible board states with the options available for the player. We also need to give a score to the boards to choose the best one and check if the fight is resolved on the board.

#### D. Choose the right instructions

On one hand, if a board ends the fight, then we want to reach it. On the other hand, if the timer ends without any end-board, we want to reach the most advantageous one.

#### E. Apply optimal list of instructions

The software must be able to execute the list of instructions previously found using simulated mouse inputs. We can also consider the possibility to run the AI after each action if the running time allows it to adapt against critical hit, moving foes or other random game features to optimize our turn.

#### F. Recognize new turn

The software must be able to differentiate a turn where it needs to find the best list of instructions and the foes turn where it is just waiting for them to take their actions and move to new positions.

#### G. Launch the combat again

Once the combat won, the software will navigate in the menus to launch the same combat again.

## IV. DEVELOPMENT ENVIRONMENT

### A. Software Development Platform

Our software is entirely built and aims to be used on a personal computer. No purchase of software or hardware is expected at all.

For our development platform, we will be using Windows 11 as it is the operating system we all already have in our laptops and it does provide all the resources needed for our project. The overall performances of the computer must be enough to launch the game, the software won't add significant burden on your hardware.

As for the programming language, it will be Python. The two main reasons are the abundance of resources to help us program, extract the data from the screen and implement the AI, and the overall simplicity of the syntax when it comes to write the code.

As Python is a slow language and we're constrained by a time limit, we might change to C++ if the AI's running speed is too slow. It also has all the resources needed and is significantly faster, but significantly harder to program our software with.

### B. Software In Use

In addition of our software, you will need to download the game "Waven" from the official website [1]. Waven is a turn based RPG where you need to resolve combats against your different types of enemies in a small arena to gather equipment, companions and powerful spells in order to face more difficult challenges.

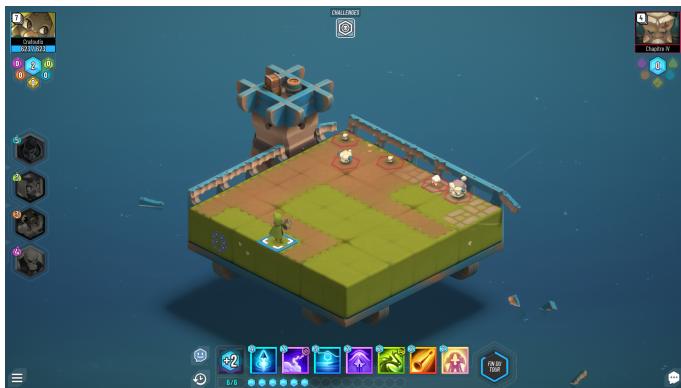


Fig. 6. An image of the board

You will also need character of the right class, level 30 with all the equipment needed. To do so, we suggest you to use our account if you want to easily test the software, please send us an email or directly ask us for ID and password.

### C. Task Distribution

Our project will be divided into two main subjects:

First, handle all the interactivity with the game, from extracting the data and store it in the right variable to the implementation of simulated mouse inputs. This task will be completed by Arthur and Solal.

Then, program the AI with all the necessary features in python. This task will be completed by Quentin and Romain.

Finally, write the documentation and manage the GitHub. All the members will help for this according to how they manage their tasks and the relevance of doing it.

## V. SPECIFICATIONS

### A. Launching the software

The software will be designed to be launched as a python file from a python IDE like VSCode, Visual Studio or Spyder. Once the application is launched, it will give the user a window with two main features.

Firstly, a button linked to start the session. Once the button clicked, the software will search for a Waven session running on the computer. Once it is found, the Waven window will be resize and place on the up-left corner to ensure the important pixels coordinates are coherent. The Waventure window will be placed on the right.

If no window named Waven have been found, an error message will show up.

Secondly, a button to properly quit the software.

An error message will be shown to the user if he pressed the start button without Waven open.

As the software aim to control the user mouse it's not recommended to do anything on the same computer while an automatic fight is running.

### B. Recognize the situation

To gather all the data needed in order to run our AI we must extract it from the game.

We will first scan the 7x7 board to note the free and occupied cells by checking the color of the board pixels : if a pixel isn't of the color of the ground, the cell is occupied. For all occupied cells, we will create a character object, drag our mouse on it to open a little window with the needed stats and read them.

To do so we first color the unnecessary pixels to only have digits left. For each digit we check surrounding pixels' color to recognize it. Once all digits recovered, we use them to complete our character object.

Then we observe the color of a critic pixel for each spell card in our hand. It allows us to know what spell card is available. Each time a spell card is recognized, its ID is stored in the hand array.

Finally, we drag the mouse on the player portrait to show his stats and extract them as well.

### C. Find all possible lists of instructions

Once all the data is extracted, the software will run the AI. We will generate all the outcomes and choose the best one.

First we will check all the available cells to move (in blue on the image). Then we will check for all cells connecting to an enemy. The goal here is to perform a melee attack on the enemy adjacent of our character. If at least one enemy is reachable, we won't check the boards with no enemy attacked as it will always be less interesting.

Then we will use all combinations of available spells on the remaining foes to generate all the possible final boards. We have a limit of 6 resources to spend in our spells as we do not implement the bonus resource.



Fig. 7. An image of the spells

Once all boards are generated, we generate for each of them all possible enemy turns based on our assumption of their functioning.



Fig. 8. An image of the available cells

#### D. Choose the right instructions

Each time a board is generated we launch a fittest function on it to give it a score. A greater score means a more advantageous end board.

Our fittest function gives points for damages, enemies defeated but deduces some if we take damages or are defeated ourselves .

#### E. Apply optimal list of instructions

Once a board has been choose, we will apply the list of instruction needed to reach it directly in-game by controlling the player mouse to take actions.

Once the list of instructions is applied, we pressed the button to end the turn.

#### F. Recognize new turn

As soon that the program is launched, we will run a while loop checking for clues about who's turn it is. The goal here is to check the color of the pixel forming the player turn's clock to see if it began.

We also check the overall luminosity of pixels on screen. In fact, those ones become darker once the fight resolved. If that's the case, the fight ends and the program will continue.



Fig. 9. An image of the buttons

#### G. Launch the combat again

Once the fight over, the program collects the rewards and launch the same challenge again by being on specific tile before the program was started and click on the needed elements of the screen.

## VI. ARCHITECTURE DESIGN AND IMPLEMENTATION

#### A. Overall architecture

The overall architecture of our software looks like this :

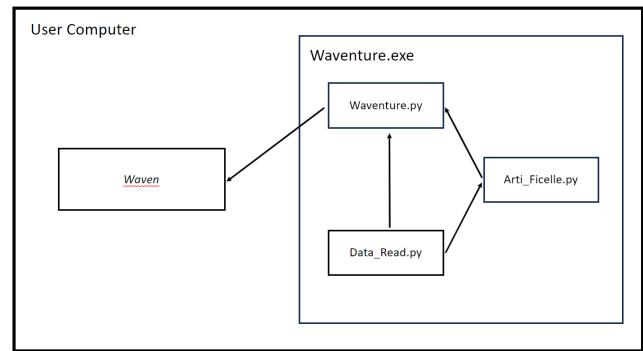


Fig. 10. Waventure overall architecture

#### B. Directory Organization

Directory	File Name	Module Name
/Waventure/src/	Requirements.txt	Requirements
/Waventure/src/program	Waventure.py	Waventure
/Waventure/src/program	Arti_Ficelle.py	Arti Ficelle
/Waventure/src/program	Data_Reading.py	Data Reading

### C. Requirements

Contains all the libraries needed to facilitate their installation.

### D. Waventure

This script handle the user interface and the overall good operation of the software.

It checks the existence of the Waven window, launches the AI and applies the instructions on the game, ends the turn and the challenges.

### E. Data Read

This program contains all the functions needed to extract the data from the game screen and their coordinates.

First for spells, the program check a pixel color to identify which spell is available to the player. All spells have a different color on the chosen pixel.

It's similar to know if a cell is free or not. It check the color of each cell knowing the color of the usual background. If the color differs, it's not free.

Then to read statistics of a character, it takes a screenshot of the statistics on the screen and then use Tesseract.exe to read the numbers.

Finally, to know if it's the player turn, the program check the color of the clock pixels. If it's blue, it's our turn.

### F. Arti Ficelle

This program call Data Read.py functions and variables to collect all the data related to the current turn in order to find the optimal outcome we can reach.

It contains three python classes to store the data : Board, Spells, Character.

Board store the overall situation with each characters and the spells available but also and ID and a list of instruction to reach it from the original state.

A character store all the informations related to it such as health, armor, attack power, etc.

Spell store all the informations about a specific spell of the deck such as its cost, damages and potential extra effects.

The program also contains all functions to simulate all outcomes from an original state and return the instructions to follow in order to reach the best outcome.

### G. Tesseract

This program is use to read the numbers from the screenshots of the functions of Data Read.py.

## VII. USE CASES

### A. Launching the software

Our user Paul wants to use Waventure. He launches the file Waventure.exe and the user interface appears.

Paul didn't launch the game and receive an error message. His reaction is to log in with his account before restarting Waventure.

Once launched again, his Waven's window is resize, placed on the top-left corner while the Waventure's window is placed on the right.

### B. Automate a challenge

Our user Julie launched the software, now she clicks on the start button. Since no stage is selected, she received an error message.

Julie select a stage and clicks again on the start button. She now waits for the challenge to end while watching the software play or doing something else away from her computer.

Once all combats finished, she collects the rewards or finds her character dead.

## VIII. SOFTWARE INSTALLATION GUIDE

Here is a guide to install our software :

- First you need Waven, download it from the official site if needed [1] install all the librairies named in requirements.txt If your using your native CMD and pip, type this command in the source folder : pip install -r requirements.txt
- log in with the appropriate character, all informations can be found here : [2] If needed, contact us to give you our test account
- Disable the full screen option in the settings
- launch frame.py from a Python IDE (such as Vscode or Spyder)
- Make sure your game is recognized
- Go on this specific tile on bouftou island, the diagonal from the cat, normal zoom on your character:

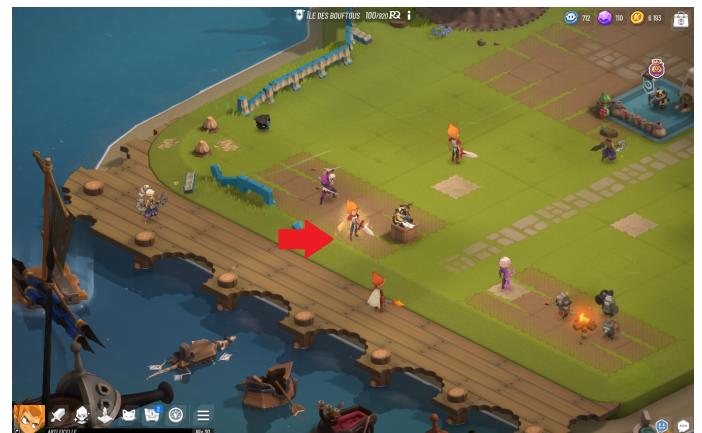


Fig. 11. Arti Ficelle's spot

- Click on the quest cat, select any level and press the start button on Waventure.
- Enjoy

## IX. DISCUSSION

Embarking on the task of developing an autonomous gaming AI for a group project involves a pragmatic approach to technology and collaboration. The team, comprising individuals with diverse skill sets such as programmers, machine learning enthusiasts, and gamers, focuses on the shared objective of creating an AI capable of autonomously playing a designated game.

The project's success depends on collaborative efforts during brainstorming sessions where ideas are rigorously evaluated and refined. The development process involves coding algorithms that analyze game patterns, predict opponent moves, and adapt strategies. Regular code reviews and debugging sessions are conducted to address issues and improve the AI's decision-making capabilities.

Effective communication and project management are critical for keeping the team aligned with objectives and timelines. Regular updates and milestone acknowledgments contribute to a sense of progress and motivation.

In essence, this collaborative effort serves as a practical exploration of technical skills and a collective endeavor to advance artificial intelligence and gaming. The development of an autonomous gaming AI reflects a commitment to innovation, showcasing the team's capability to navigate challenges with a measured and focused approach.

## REFERENCES

- [1] Waven official website - <https://www.waven-game.com/fr/season>
- [2] Arti Ficelle's build - <https://wavendb.com/builds/show/1C4PyJR6KDrB6gratoo6wv>