Gameboj project

Presentation :

This is a big programming project developed during the first year of bachelor. We developed a “Gameboy emulator “ : any gameboy game can be played with the finished gameboj program.

Please consult the official project’s presentation if you are interested :

https://cs108.epfl.ch/archive/18/p/00_introduction.html

Extensions :

What I want particularly to show you are the graphical extensions that I added to the project. Those extensions permit the user/gamer to have a good idea of how the Gameboy processes the data encoded inside the game’s cartridge. Those improvements were fully “designed“ and implemented by myself, the teacher originally only provided some ideas of extensions.

This is the finished emulator without any bonus features, running Super Mario Land

We implemented a few features, but those framed in red colour are the most important ones

2.1 Travail à réaliser

L'obtention d'un bonus implique l'ajout d'une ou plusieurs améliorations non triviales au programme. Le choix de ces améliorations est libre mais la liste suivante donne quelques idées:

- offrir la possibilité de redémarrer (*reset*) la simulation et de sauvegarder son état complet dans un fichier pour pouvoir le restaurer ultérieurement,
- offrir la possibilité de changer la vitesse de simulation, soit pour l'arrêter, soit pour l'accélérer temporairement (mode «turbo», utile pour passer les parties ennuyantes de certains jeux),
- offrir la possibilité de faire des copies d'écran en cours de jeu, et/ou d'enregistrer des vidéos.
- offrir des fonctionnalités de visualisation des données graphiques du système: images des 384 tuiles, des deux images de fond/fenêtre de 256 pixels de côté, des *sprites*, etc.
- offrir des fonctionnalités de déboguage utiles aux personnes développant des programmes Game Boy: exécution pas à pas du programme, désassemblage, visualisation du contenu de la mémoire, etc.
- sauvegarder dans un fichier les données de la mémoire non volatile se trouvant sur certaines cartouches,
- simuler le synthétiseur sonore du Game Boy (probablement très difficile),
- optimiser considérablement la vitesse de la simulation en déterminant les problèmes de performance existants et en les résolvant,
- etc.

The **Bonus Version** of the simulator displays informations of the game, and indicates which keys to use for each settings/features. I encoded every letter of the alphabet pixel per pixel in a file.


```
SUPER MARIO LAND.GB
 T TURBO MODE :   1.0
 D DISPLAY INFORMATION :  NORMAL
 C COLOR :  BLACKWHITE
 P SCREENSHOT
 TIME   0H0M17S
```

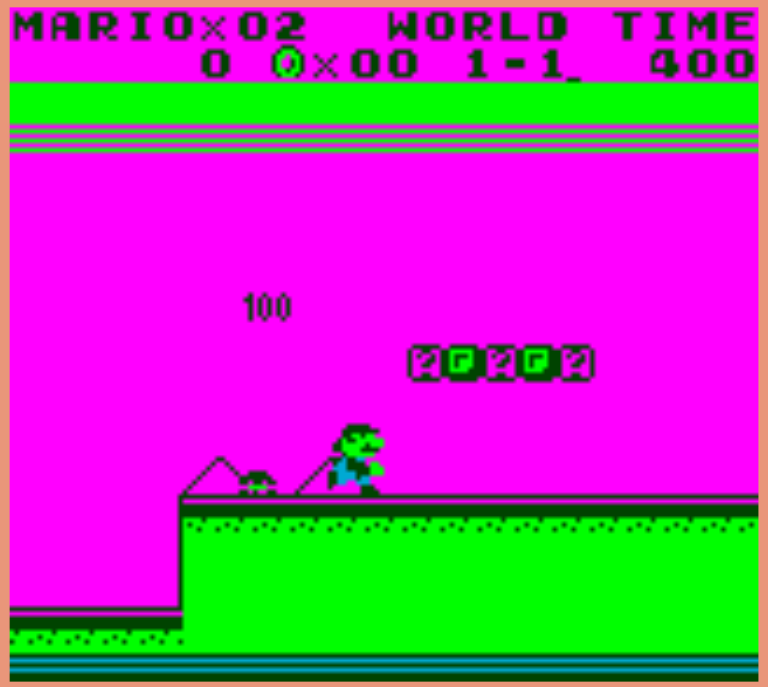
Visual Features

1. Colour Mode

Using the C key on the keyboard you can change the colours used to display the game evolution. Here it is set to Black and White mode


```
SUPER MARIO LAND.GB
 T TURBO MODE :   1.0
 D DISPLAY INFORMATION :  NORMAL
 C COLOR : BLACKWHITE
 P SCREENSHOT
 TIME   0H0M17S
```

Weird Mode



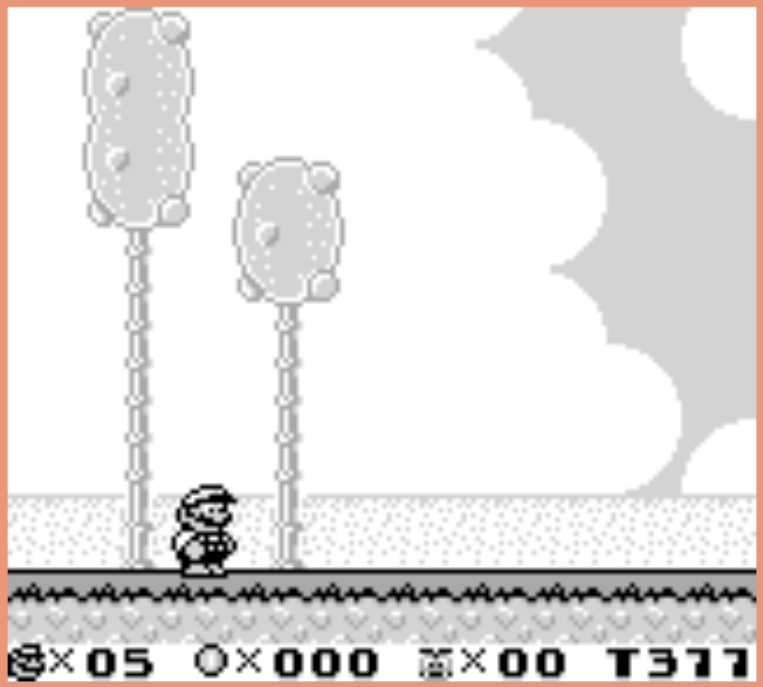

```
SUPER MARIO LAND.GB
 T TURBO MODE :   1.0
 D DISPLAY INFORMATION :  NORMAL
 C COLOR : WEIRD
 P SCREENSHOT
 TIME   0H0M29S
```

Gameboy original Mode

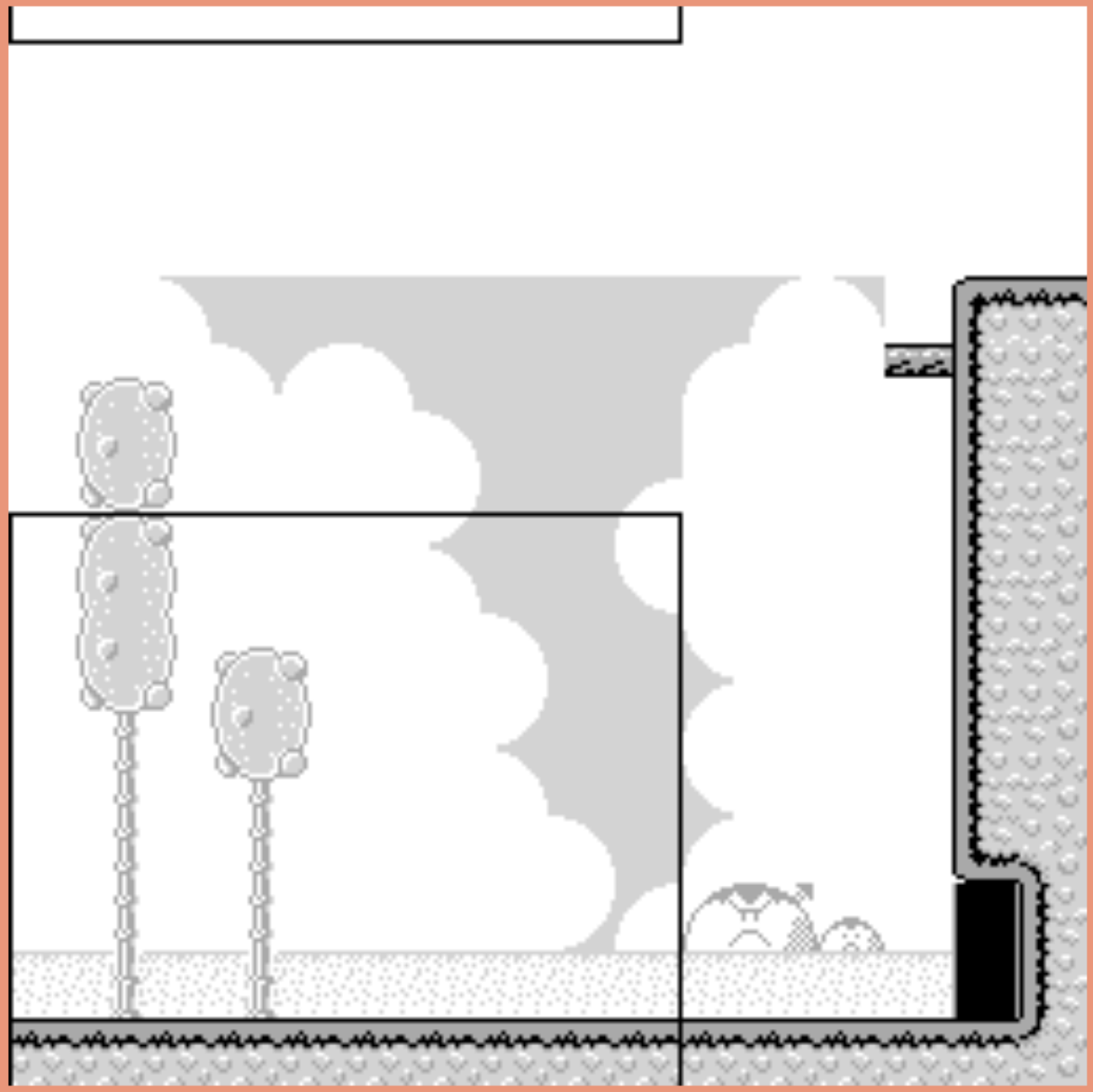

```
SUPER MARIO LAND.GB
 T TURBO MODE :   1.0
 D DISPLAY INFORMATION :  NORMAL
 C COLOR : ORIGINAL
 P SCREENSHOT
 TIME   0H0M57S
```

2. Background Visualisation

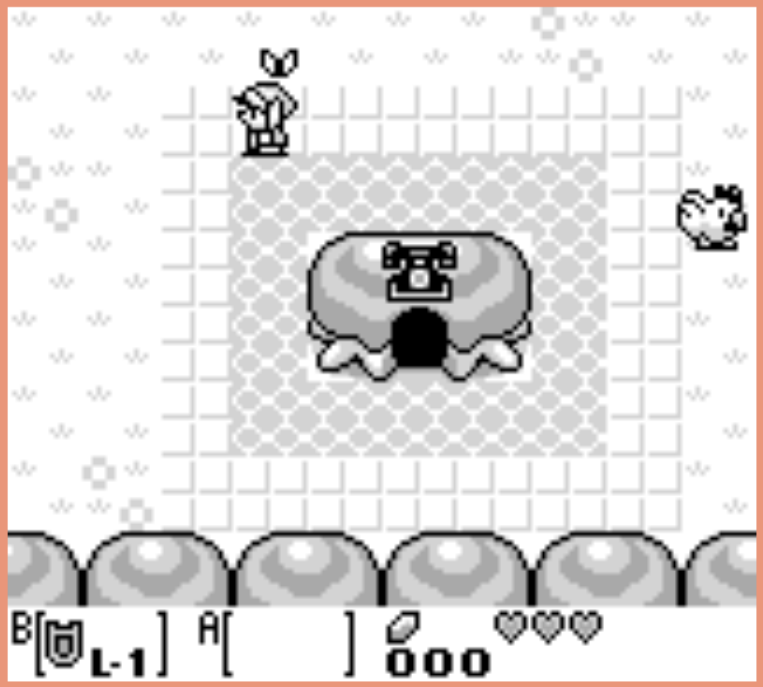
Background visualisation : Super Mario Land

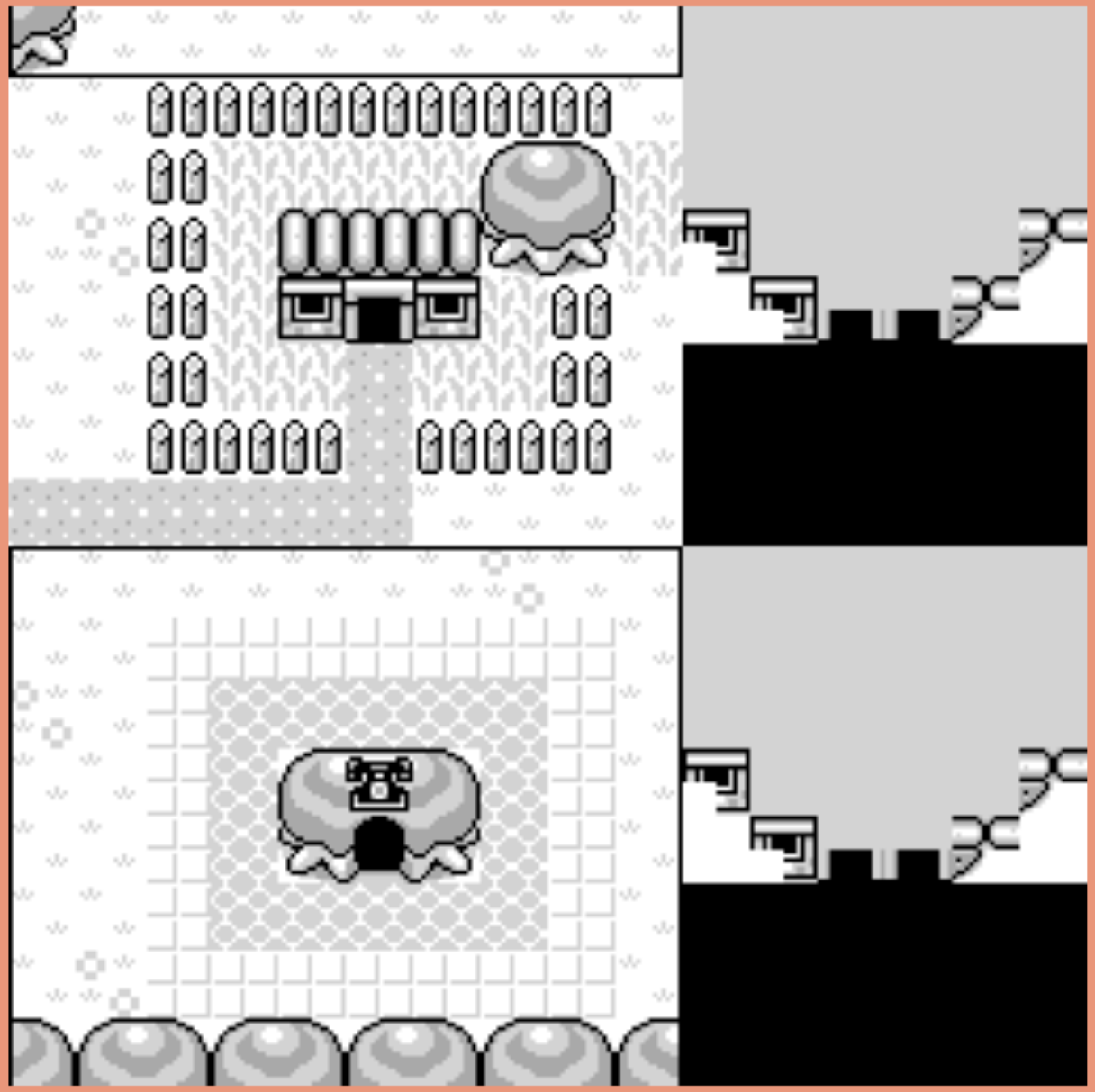


For optimal performance, the background of the game is loaded from the game's cartridge into the Gameboy's RAM. But only a small defined part of that background is displayed on the screen of the Gameboy. This extension shows the entire background with the framed part.

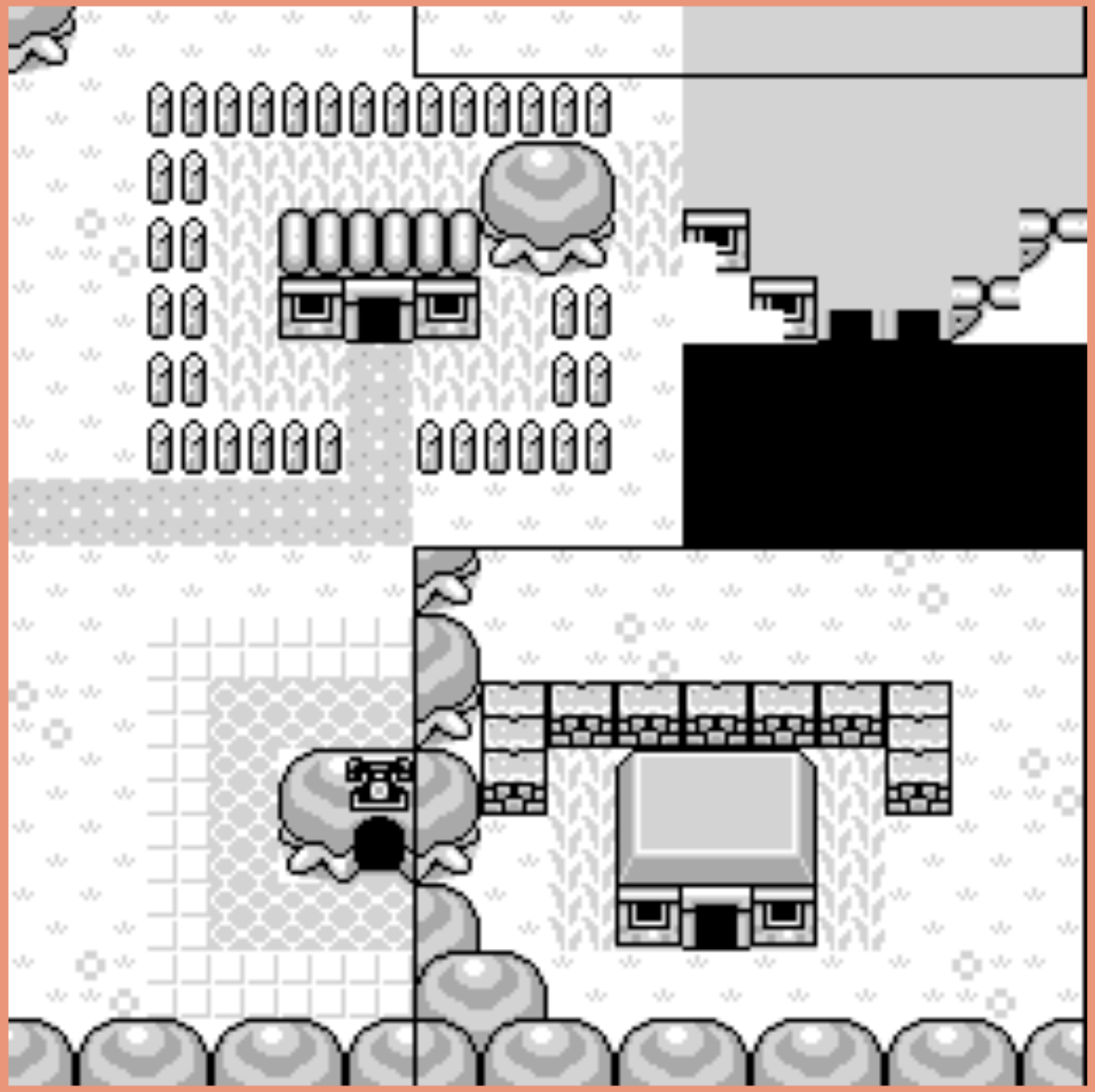


Background Visualisation : The Legend of Zelda





Background Visualisation : The legend of Zelda



3. Tiles Visualisation

Tiles Visualisation : The Legend of Zelda

In fact, the background as well as the other image components are loaded as **Tiles** from the game cartridge to the Gameboy's RAM. Indexes indicates to the gameboy which tiles to use for display. This extension shows the tiles as they are encoded in the Gameboy's RAM.

Tiles Visualisation : The Legend of Zelda

Tiles Visualisation : Super Mario Land

4. Sprite Selection

Sprite Selection and Visualisation : The legend of Zelda

The tiles images that compose the background are different to those that compose the characters in the game, named **Sprites** . You can click on the image on the left, to see which tiles are parts of a sprite.

Sprite Selection and Visualisation : Super Mario Land

5. Tiles Modification

Tiles Modification : Super Mario Land

As we have full control on the RAM of the Gameboy, we can manipulate “manually“ the tile’s pixels encoded in the RAM. Just click on one tile in the right panel, for example the tile that compose the little Goomba.

The chosen tile appears in big, the user is able to click on each pixel to change it’s color

The user modifies the tile according to his preferences, then clicks on « Enter » to encode his new tile in the RAM.

We can see that the RAM is updated, and that the new tile is displayed

Run the program :

It is a little bit tricky to build and run the program. I did it using eclipse, I don't know if there are simplier way to do it. What you need to be installed on your computer are :

- java 9 SDK or later
- Javafx (included in java 9 and 13)
- JUnit (version 5 at least)

Please see the teacher's tutorial for installation and running :

- https://cs108.epfl.ch/archive/18/g/default-jre.html
- https://cs108.epfl.ch/archive/18/g/config.html
- https://cs108.epfl.ch/archive/18/g/junit.html

When you run the code, you can chose between running as **Java Application**, or **JUnit test**. You need the run the file *Run* as JUnit test. If you want to change the game, you can modify the file *Run.* You can play other games as well, and download them on the website :

https://www.loveroms.online

How to use the program :

Basic buttons:

- A : button A
- B : button B
- S : button START
- Space : button SELECT
- RIGHT/LEFT/UP/DOWN keys are the same that the ones on the Gameboy

Extension's buttons:

- T : change the speed of the game
- C : change the colour display
- P : take screenshot (only game screen)
- D : change data visualisation feature