UNIVERSITÉ DE LORRAINE | IUT Saint-Dié-des-Vosges

PT3
ALGORITHMS FOR -LAWN MOWER ROBOT-

AISSI AYOUB
&
DELANDHUY MATTEO

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TUTOR: A.BOURJIJ

OUTLINE

I. Introduction :

The Mower Robot is the new way of mowing the lawn. 2 years ago in France, 29 000 robots were sold which means it's a really important business these days.

The Mower Robot is a combination between two parts, hardware and software. The first part, hardware, is the robot in material and its components. The second part, software, consists in the algorithms that allow the robot to move in a certain way to mow, and that was the subject of our project.

II. Project description :

The main goal of the project was to create and develop as many algorithms as we can and simulate all those algorithms on console and a graphic interface.

The main algorithms were the Normal, Spiral and Random.

We also had to develop too many functions for the robot so as to have a complete robot while simulating and approach to the real life conditions, such as the battery level, the grass height...

Then we had to add some obstacles on the interface and console and develop other functions to avoid crashing the robot.

III. To whom ?

- Every person who owns a Mower Robot or want to buy one
- Green spaces guardians or directors
- For every house, institution, or space with a lawn area
- Mower Robot's developers
- Algorithms developers

IV. Technical tools :

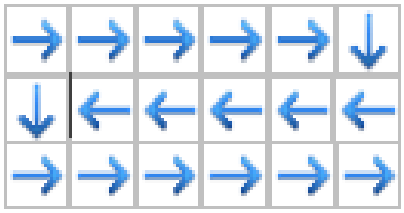
All the project was done using one program, one programming language, and one platform of collaborated work.

- **JAVA :** as we're programming only with java in class the choice wasn't too hard to make
- **ECLIPSE :** for coding and compiling our codes, and launching simulations on the graphic interface
- **GITHUB** : as a platform to share our work

V. Our mission :

As we said we had to create and develop 3 algorithms which are ; Normal, Spiral, Random.

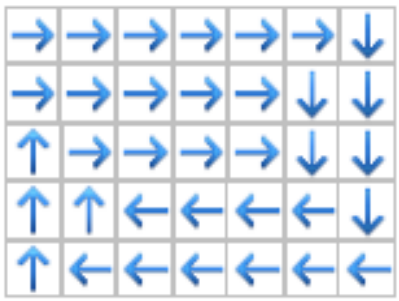
V.1. The Normal algorithm :



Weakness point : Can't proceed with this one if the area contains obstacles it will be too hard and it will spend too much time.

Strength point : it's an optimal algorithm for the areas in square or rectangle shape.

V.2. The Spiral algorithm :



Weakness point : same as the first one, in case of obstacles the algorithm will not be able to work.

Strength point : for small areas and more efficient than the first one in the square or rectangle shape area.

V.3. The Random algorithm :

This one is too special and it's the one that the current robots use, it's full random. The robot go in one direction until it finds an obstacle or a limit of the area then it turns and sort a random angle and go in the direction of that angle until it finds another obstacle, and keep doing the same thing until the lawn is mowed.

Weakness point : Can't mow all the area like the first to ones do, and it may sort the same angle so doing the same area another time which is already mowed and then wasting time for nothing.

Strength point : it's adaptable for any type of gardens, areas...

VI. Working method:

Our working method was a basic one, we decided to split the rock int he middle, Mattéo was in charge of the console part, and Ayoub was in charge of the graphic part.

We had different missions, but we were combining our ideas and results all the time.

Ayoub :

- Graphic mode
- Creating a menu and a graphic interface
- Implementing the robot and the algorithms in a graphic interface
- Developing and adapt the functions & algorithms for the graphic mode

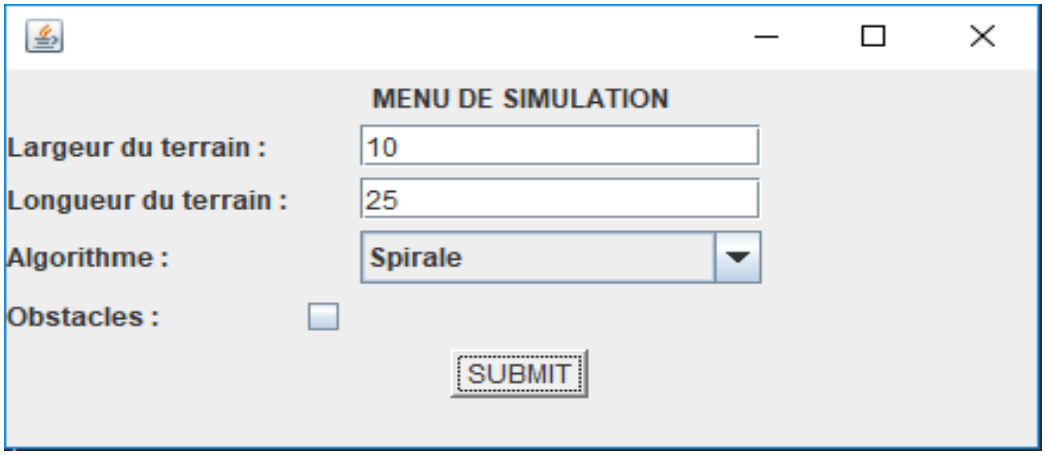
Mattéo :

- Console mode
- Coding the algorithms : Normal, Spiral, Random
- Coding the robot's functions : Battery, Moving, Time ...
- Implementing every possible or additional function

VII. The final result :

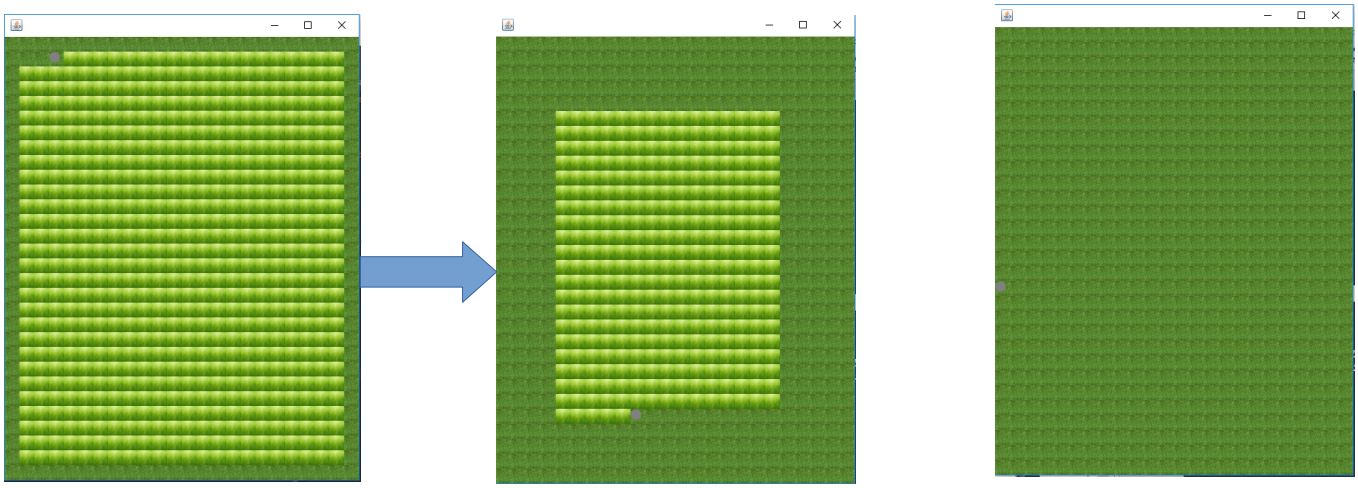
VII.1. Graphic mode :

The Graphic interface provides data entering by the user, and it's really simple to use as you can see below :

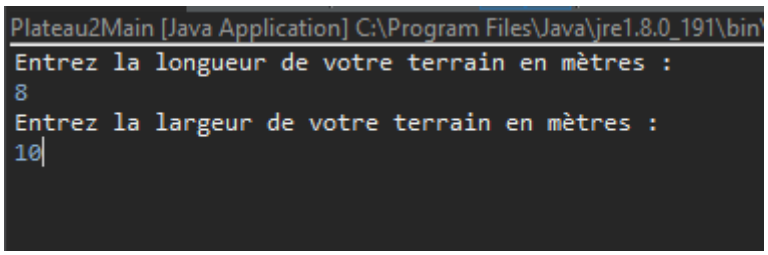


The user can enter his own information height/width of the area, then he can choose the type of algorithm that he wants to simulate, after this he can either choose to generate obstacles on the area or not, this one is optional. Once the data entered he has to click on SUBMIT, then the program will generate the graphic mode, the robot, and the algorithm and the simulation will start just like this :

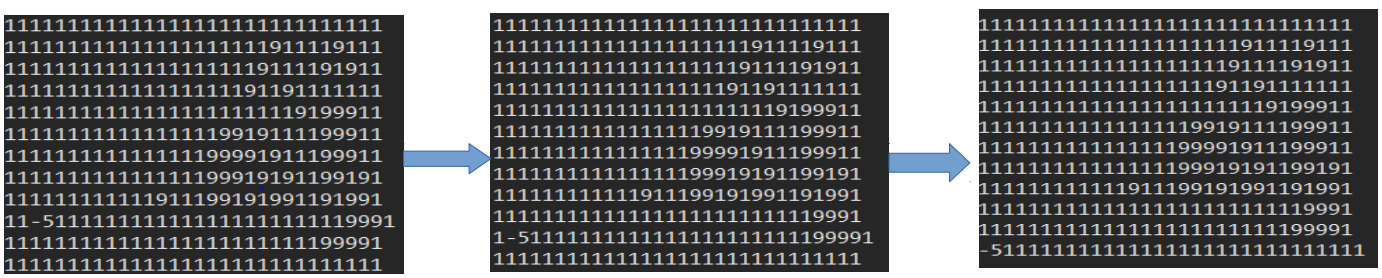
This is an example of a spiral algorithm simulation



There's also a possibility to have a menu on console, it works just like the previous one, the one thing that changes is that you can't choose to generate obstacles or not.



VII.2. Console mode :



```
Le robot a tondu 50 % du terrain en 0.702 kms.
0heures, 29 minutes, 14 secondes.
Le robot a tondu 75 % du terrain en 2.259 kms.
1heures, 34 minutes, 7 secondes.
Le robot a tondu 90 % du terrain en 11.007 kms.
7heures, 38 minutes, 37 secondes.
Le robot a tondu 100 % du terrain en 11.013 kms.
7heures, 38 minutes, 52 secondes.
```

This console mode is the same thing as the previous one on the graphic interface, but it’s a little bit more hard to understand.

The simulation on console is too fast, so we can get all the information we want without having to wait too much time.

VIII. Encountered difficulties & solutions :

VIII.1. Difficulties :

- ✗ Eventual bugs and programming problems
- ✗ Implementing algorithms and simulating on a graphic interface
- ✗ Too much work to focus only on the project
- ✗ Tutor suggested Python instead of Java

VIII.2. Solutions :

- ✔ OpenClassRoom – GitHub – Stack Overflow
- ✔ Testing, adding / removing / replacing lines of code until it works !
- ✔ For the moment there’s no menu yet
- ✔ Working the week-end until 5 am
- ✔ Searching tutorials and solutions online

IX. Conclusion

This project was one of the best things this semester. It was a real pleasure to work on a such exciting and interesting subject. We worked in group as if we were one person, we developed our team spirit, our creativity, our imagination, our communication in group, our skills in programming, and we learned too many things that will be useful for us one day or another.

If we had more time we would have added too many other functions to have an optimized and completed application which can be sold to some clients.

We hope that our tutor is satisfied by what we did, and we hope that our work was interesting for you.