Intermediate Project

Simulation of a robotic swarm

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1 Abstract

Simulation of two robots collecting and delivering pucks to the base.
Goals:

- becoming acquainted with the simulator environment
- simulation of the field with pucks and robots
- implementation of the selected swarm collaboration algorithm
- addition more robots and pucks to collect
- implementation of another selected swarm collaboration algorithm

Assumptions of the project were based on the regulations of the "XII Robotic Arena" competition [1]. The main result was a simulation of two robots collecting pucks and delivering them to the base. Only one swarm collaboration algorithm was implemented.

2 Description

Puck collect is one of the competitions in Robotic Arena tournament. Two teams compete to collect pucks in the color of their team (blue or red) and delivering them to the base. Robots must not be bigger than a square of 50cm side. The main board is a white square, side of the size 250cm. Bases are located in opposite corners. Pucks are placed randomly on the main board with exclusion of the bases of the teams. There are 10 pucks of each color [1].

Detection of the pucks may be executed in many different methods. One of most popular one is the use of camera and image processing. In the project, location of pucks was considered to be known beforehand.

Only one team of robots was simulated.

3 Tools

Simulation was realized in Roblox Studio, which id free and immersive creation environment. It implements physical engine and allows to create and upload models design in other programs. The programming language is Lua [2].

Roblox Studio has a well explained libraries of internal functions. Its community is great, and so is the support they provide.

4 Results

The simulation was designed for two robots collaborating in collecting the puck. The implemented algorithm consists of a main controller, which supervises the work of the robots. The controller tracks the position of robots and the amount of pucks left. Controller receives signals from robots. When robot collects the puck it sends "Puck Collected" signal, and when it returned to base "Idle State" signal. Robots work independent of each other. The flow charts of robot and main controller are presented in figure 1 and 2.

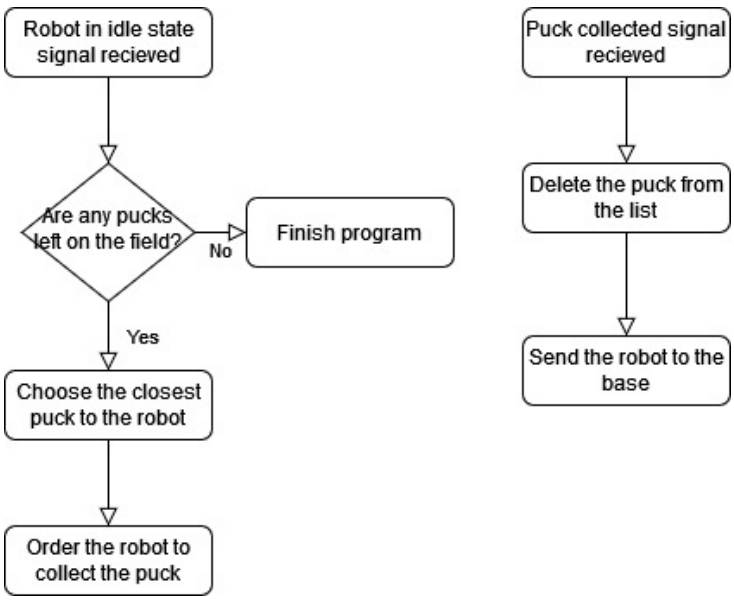


Figure 1: Flow chart of the main controller

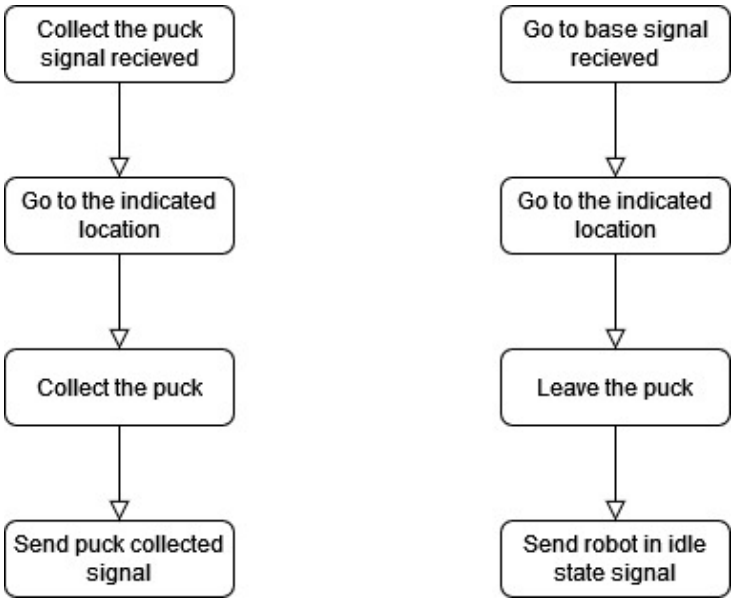
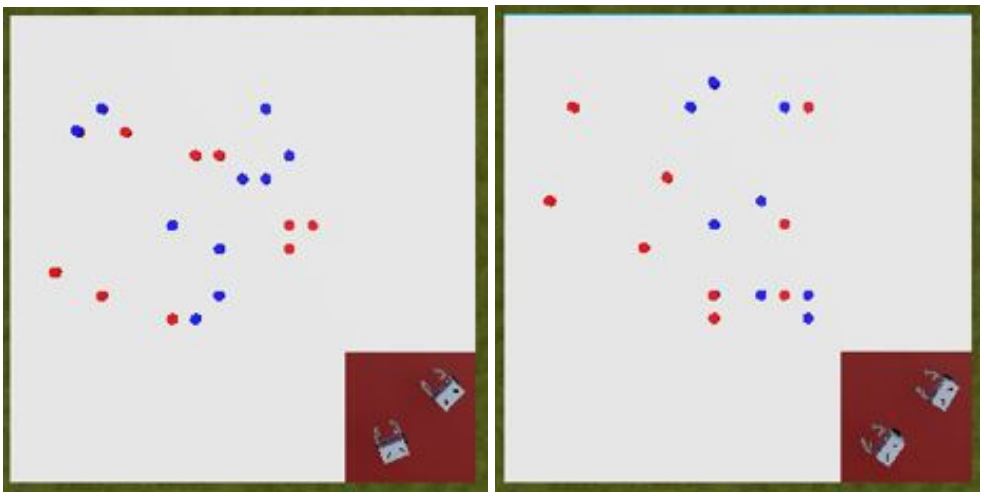


Figure 2: Flow chart of robot controller

Figure 3 presents random placement of the pucks. Sometimes the function places pucks on top of the others. Such behaviour was unwanted.



(a) (b)

Figure 3: Random placement of pucks

Simulation precedes until all pucks are collected and delivered to the base. Figure 4 presents finished simulation.

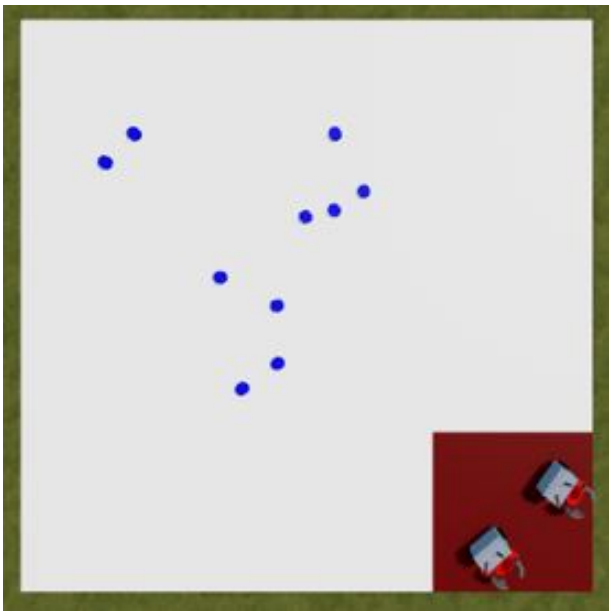


Figure 4: All pucks delivered to the base

Main controller detects robot collisions but does not attend it.

5 Conclusion

References

[1] REGULAMIN ZAWODÓW ROBOTÓW „ XII Robotic Arena ” Kategoria Puck Collect. `https://www.roboticarena.pl/media/filer_public/bf/32/bf323500-2aaa-4471-b7be-80c141dcbf46/puckcollect.pdf`.

[2] Roblox Studio main page. `https://www.roblox.com/create`.