Series 03 – Camera & Communication

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Handout on March 21 2019 Due on March 31 2019

Reading

— Study the lecture notes, including links, and source code available on Moodle

Sections to be completed in the template report

— *2.3 Sensors → Camera*
— *3.4 Behaviours → Color recognition*
— *3.5 Behaviours → Multi-robot coordination*

Camera measurements (only in the physical arena)

On the real e-puck, measure the camera response values on the three color channels for :

a) arena walls,
b) red/green/blue blocks and
c) another e-puck.

Use the provided controller and python script to generate and represent the data using histograms, in order to display how many camera pixels have a specific range of response values. Summarize and discuss your results in the *2.3 Sensors → Camera* section of the report template.

Color recognition

Implement a controller that does not move but acquires camera images and is able to recognize between red/-green/blue blocks when presented in its field of view. Use the results of exercise 1 to improve recognition accuracy. The robot should give visual feedback about which elements it sees.

led rule :

red	left LED on
green	back LED on
blue	right LED on
otherwise	all LEDs off

Hint : exploit differences in the histograms to discriminate between colored objects

Modify your controller to make the robot explore the arena with a Braitenberg explorer behaviour, giving visual feedback about the colors it recognizes (LED rule as above). Record a short video of both static and mobile situations. Explain your solution and discuss both behaviours in the *3.4 Behaviours → Color recognition* section of the report template.

Alternative search

Make robots alternatively search for obstacles : while one moves around (LOVER), the other is stopped at equilibrium distance to an obstacle, i.e. when one finds an obstacle and reaches equilibrium distance, it stops and the other starts moving in EXPLORER until it gets away from the obstacle. At start time both robots move and try to find an obstacle.

— Draw the state machine of the 2 robot system.

— Implement the behavior with **the same controller** for the 2 robots, test **with 2 real robots**

— Test the behaviour **with 3 real robots** and discuss the outcome

Hint : Add a STOP state and make robots send notification messages

Discuss the process and your solution in the *3.5 Behaviours → Multi-robot coordination* section of the report template. Record a short video to illustrate the discussion.

Simultaneous search

Make robots simultaneously search for obstacles : all robots start in LOVER and each one stops at equilibrium distance when encountering an obstacle. Each robot waits until all robots found an obstacle. Then, they **all** switch back simultaneously to EXPLORER until they get away from their obstacle and look for a new one in LOVER state.

Hint : With the number of robots hardcoded, only small modifications of the previous code are needed.

Implement the behavior with **the same controller** for the 3 robots, record a short video and discuss the process and your solution in the *3.5 Behaviours → Multi-robot coordination* section of the report template.

Abstract, Introduction & Conclusion

Once you have completed your report, re-read it and write the abstract, an introduction and a conclusion to it. Submit the completed report.

Abstract It states the report's important contributions and should be synthetic and understandable by itself.

Introduction It exposes the larger context and draws the reader towards the specifics of the report.

Conclusion It summarizes and closes the report.

Hint : Reading abstract, introduction and conclusion should give a good idea of the report's content.