

Robótica Móvel e Inteligente

2017/18

Project 1

Development of an agent for a robot that follows a wall

Objectives

- Understand the development mechanisms of microcontroller-based robots.
- Use the sensors of a real robot, understand their operation and limitations and develop techniques and methods to mitigate the impact of these limitations on the overall behaviour of the robot.

Project description

The project consists on the development of the control software of a wall follower robot. The project is organized in a sequence of challenges, of increasing difficulty, involving different navigation skills.

The list of challenges will be:

1. Simple navigation in scenario number 1. The robot is positioned just before the start line with the wall on its right side. Once started, it has to perform 2 complete laps following the wall always on its right side. After finishing the second lap, the robot should turn around and complete one more lap keeping the wall on its left side and finally stop at the start line.
2. Navigation in scenario number 1 with a sharp edge. A sharp edge will be added to the existing wall. The rules are the same as in challenge number one.
3. Navigation in scenario number 2. A wall segment will be removed and replaced by a black line on the floor. The navigation rules are the same as in the previous challenges.
4. Navigation in scenario number 3. On one of the straight segments two black lines twice as large as the start line mark the beginning and end of a controlled speed segment of the track. Between these two lines the robot must move at a constant speed (to be defined). Furthermore, after completing the two first laps, the start line will be removed and the robot is supposed to stop as close as possible to the original position of the start line.

Deliverables

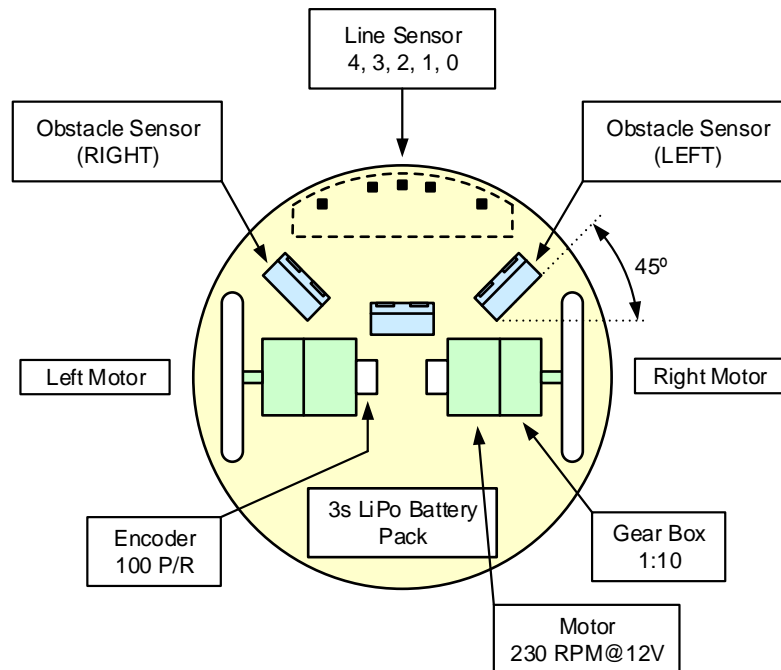
1. The control software developed during the project should be placed in a git repository in the `code.ua.pt` platform (a base repository will be created for all groups).
2. A report describing the approach used in the resolution of the problem should be written and made available in `code.ua.pt`. The report should describe the overall architecture, the implemented skills and how they were combined to solve the problem. It must also contain a results section, where results of the developed control software in overcoming the challenges should be presented, analysed and assessed. It should also contain references to documents (articles, books, reports, etc.) that have supported the development of the work. This report should be written using the LNCS template available at the following link: <http://www.springer.com/computer/lncs?SGWID=0-164-6-793341-0>.
3. Each group must prepare a presentation of its work which consists of three parts: an oral presentation, based on powerpoint or similar (10 minutes, maximum), a demonstration of the robot's performance (5 minutes, maximum) and finally a short discussion of the work. The presentation (in pdf format) should also be made available in `code.ua.pt`.

Evaluation

- Robotic agent (structure and performance): 45%
- Report: 25%
- Oral presentation and discussion: 30%

Important dates:

- Submission of deliverables: October 14, 2017
- Presentation: October 16, 2017



Bibliography:

- "A Robust Layered Control System for a Mobile Robot", Rodney A. Brooks, *IEEE Transactions on Robotics and Automation*, 2(1), pages 14-23, April 1986.
- Part I – Robotic Paradigms of *An Introduction to AI Robotics*, Robin R. Murphy, Bradford Book, MIT Press, Cambridge, Massachusetts, London England, 2000. ISBN: 0-262-13383-0.
- *Behavior-Based Robotics*, Ronald C. Arkin, MIT Press, 1998, ISBN 0-262-01165-4.

Programming the robot

- 1) Use your favorite text editor to edit your program (name it with extension ".c", e.g. **prog1.c**)
- 2) Compile your program:

```
pcompile prog1.c rmi-mr32.c
```
- 3) Copy the binary file to the robot:

```
ldpic32 prog1.hex1
```
- 4) Check the program output in your PC:

```
pterm
```

¹ The first time you use these tools, you may have to perform the following configuration:

- 1) Check that the user belongs to "dialout" group, by executing the following command: **groups**
- 2) Add user to "dialout" group: **sudo adduser \$USER dialout**
- 3) Logout and login again