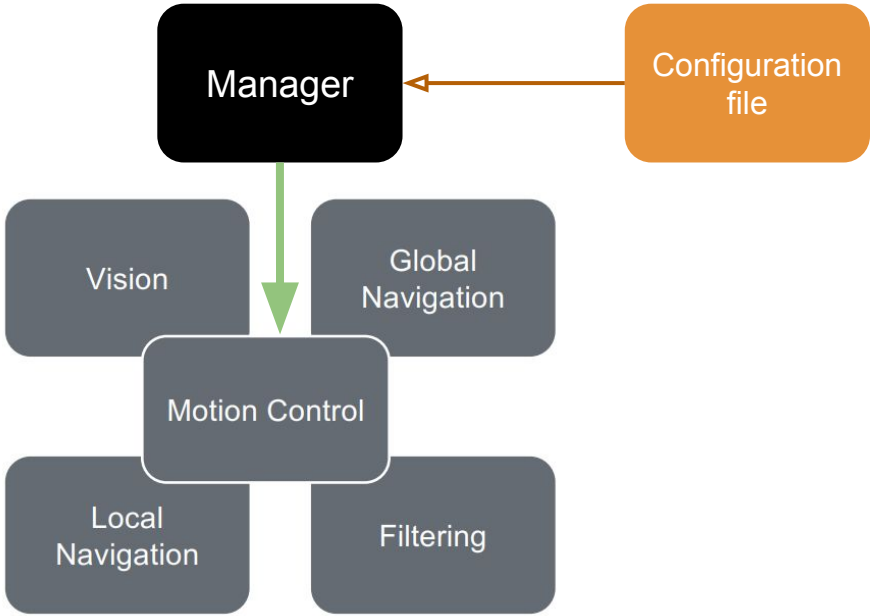
THYMIO ROBOT

MICRO 452

Groupe 36

Vincent Gherold
Yifei Luo
Vicente Carbon
Emeric de Galembert

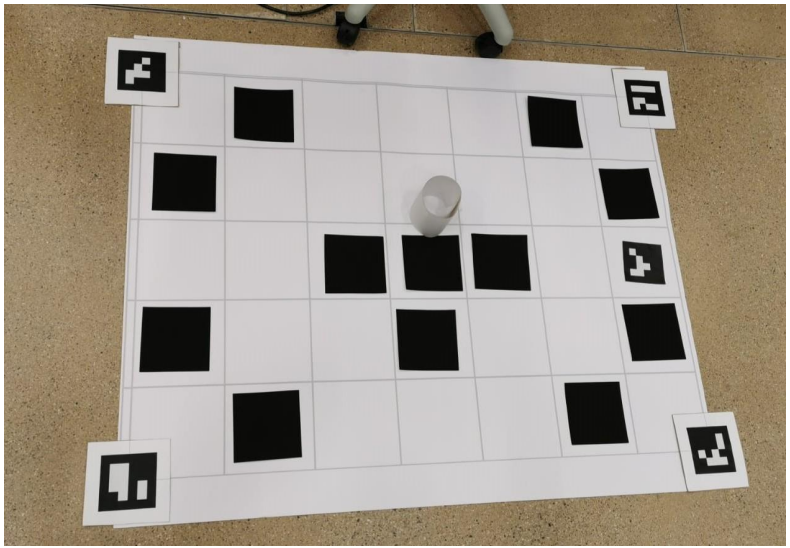
Project Architecture



Overview

Agent: Thymio mobile robot

Assignment Environment: map defined by occupied and available grids with local obstacle

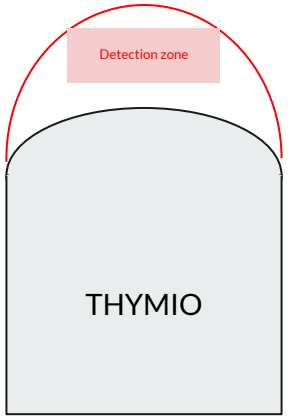


Local navigation

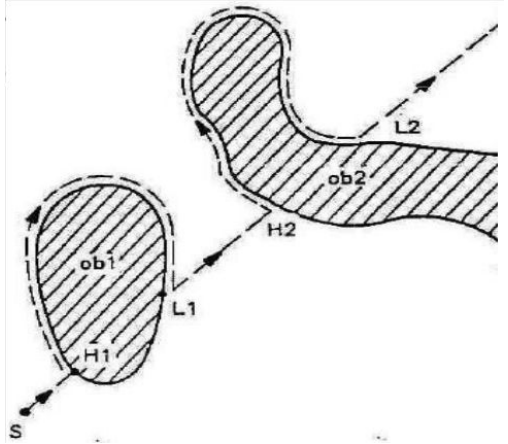
Assumptions on the obstacles:

- **Not** completely **blocking** the path
- Will be light **reflective**
- Will have a simple **convex geometrical** section

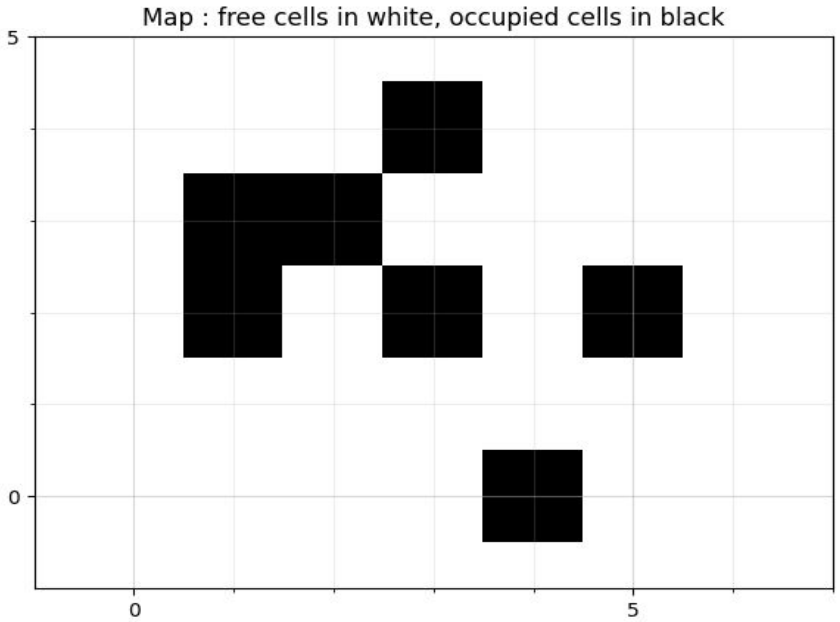
Different threshold intensity depending on the sensor:

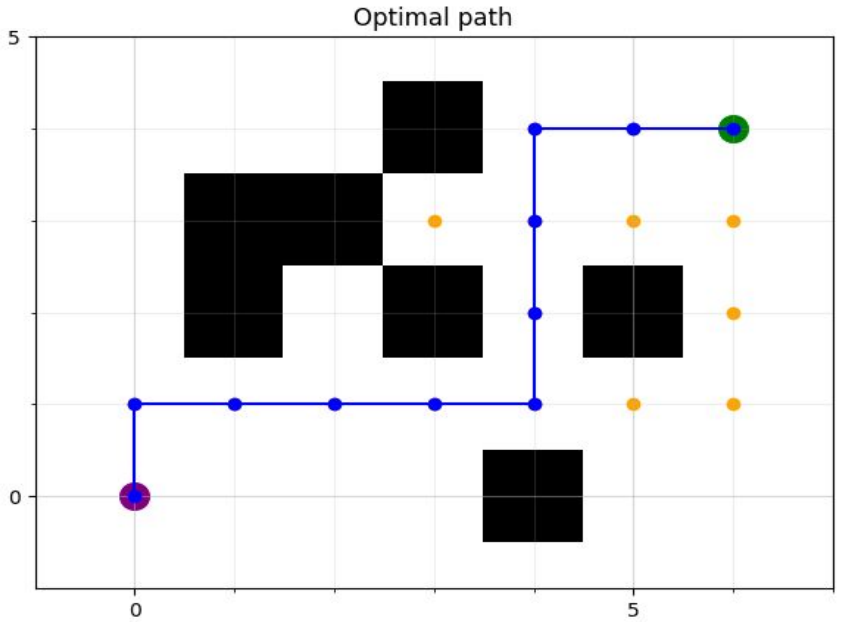


Stopping condition:



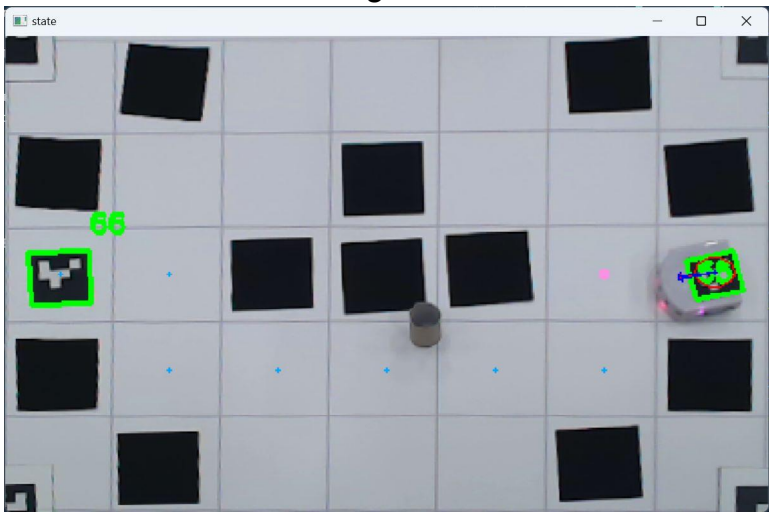
Global navigation





Vision

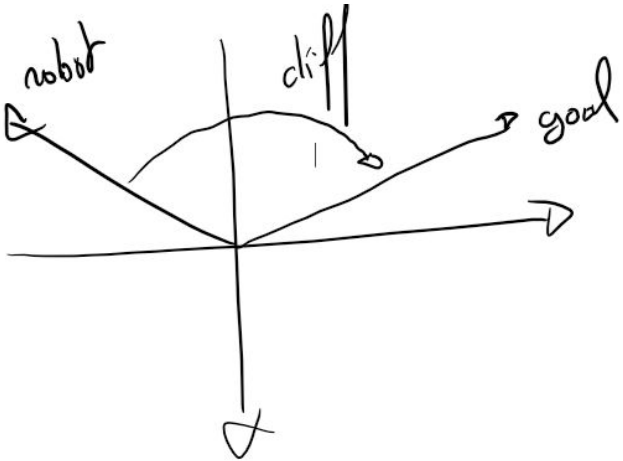
Detection of the goal and the robot

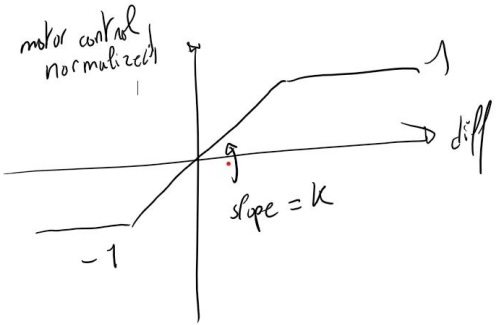


- **Aim:** building the map, detecting the robot for state estimation module.
- **Difficulties:** lightening invariability, disturbance from irrelevant features, features easy to detect…
- **ArUco marker**: robust feature for object detection and localization.
- **Procedure:** pre-processing, mapping, detecting.

Thymio interface

- Control the thymio
- Get the sensors data
- Usage of a P controller

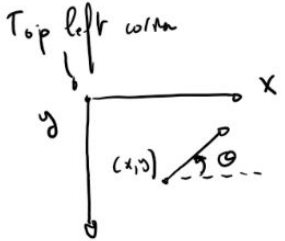


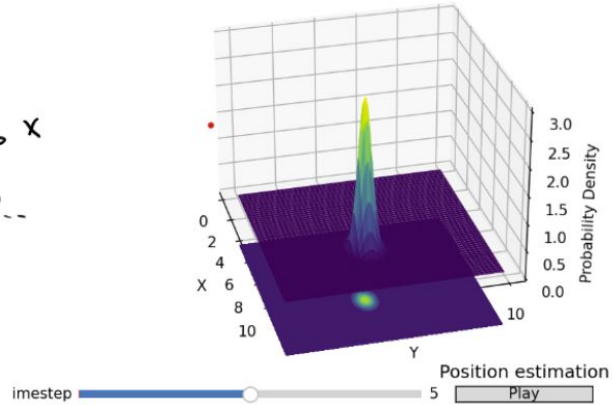


Robot state estimator

$$z_{k+1} = f\left(z_k\right)$$

$$z^+ = \begin{pmatrix} x \\ y \\ \theta \\ v_r \\ v_l \end{pmatrix}^+ = \begin{pmatrix} x + \frac{v_r+v_l}{2}\cos(\theta)T_s \\ y - \frac{v_r+v_l}{2}\sin(\theta)T_s \\ \theta + k_s\left(V_r - V_l\right) \\ v_r \\ v_l \end{pmatrix} + w$$





$$z_{k+1} = h\left(z_k\right)$$

$$z^+ = \begin{pmatrix} x \\ y \\ \theta \\ v_r \\ v_l \end{pmatrix}^+ = \begin{pmatrix} x_{\text{mesured}} \\ y_{\text{mesured}} \\ \theta_{\text{mesured}} \\ v_{\text{r mesured}} \\ v_{\text{l mesured}} \end{pmatrix} + v$$

$$Q = \begin{bmatrix} 0.04 & 0 & 0 & 0 & 0 \\ 0 & 0.04 & 0 & 0 & 0 \\ 0 & 0 & 0.02 & 0 & 0 \\ 0 & 0 & 0 & 6.153 & 0 \\ 0 & 0 & 0 & 0 & 6.153 \end{bmatrix} \quad R = \begin{bmatrix} 1.798 & 0 & 0 & 0 & 0 \\ 0 & 1.798 & 0 & 0 & 0 \\ 0 & 0 & 0.002 & 0 & 0 \\ 0 & 0 & 0 & 6.153 & 0 \\ 0 & 0 & 0 & 0 & 6.153 \end{bmatrix}$$

Questions?

How can we improve our system?

- Usage of PD controller
- Make the robot more robust for the local navigation
- Increase the refresh rate of the action by using thread
- Make the robot moves faster
- Have a unified coordinate systems