

VREP pathfinding using A* algorithm

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Introduction

- This project's goal is to develop a controller for a mobile car-like robot. The aim is to drive the robot from point A to point B following a given path.
- The project is developed in C++14 using the following additional libraries:
 - ▶ Boost version 1.58.0
 - ▶ OpenCV 2.4
 - ▶ VREP Remote API

A* algorithm

$$f(n) = g(n) + h(n) \quad (1)$$

Where n is the final node, $g(n)$ is the cost of the path from start point to n and $h(n)$ is a heuristic function. $g(n)$ can be calculated using euclidean distance from n to the finishing point:

$$g(n) = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \quad (2)$$

$h(n)$ is a heuristic function which represents the numbers of steps done from the starting point to n :

$$h(n) = \text{step}(0..n) \quad (3)$$

Main scene

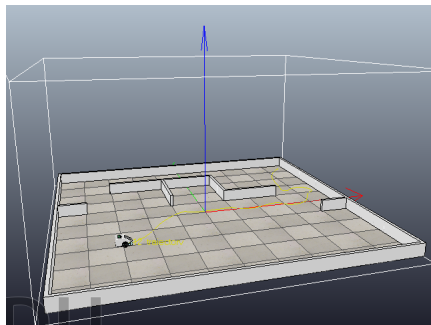


Figure: Main scene with vision sensor

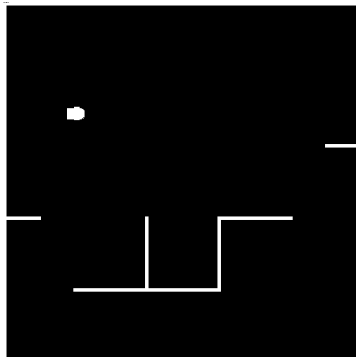


Figure: Vision sensor image

Image processing and finding a path

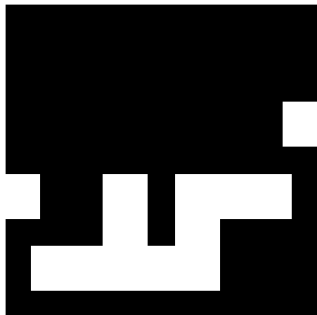


Figure: After processing (robot's figure deleted, image dilated)

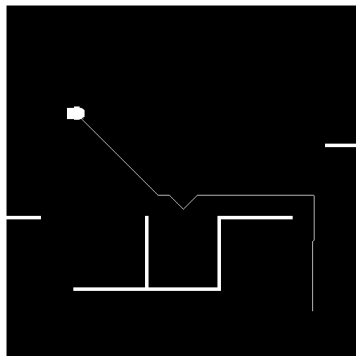


Figure: With final path

Robot controller

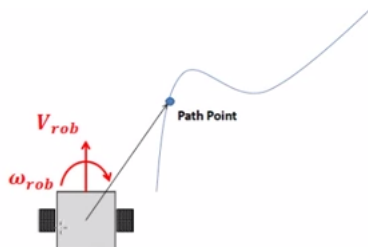


Figure: Robot controller

Implementation of the controller

The velocity of the right and left wheels is:

$$speedRight = speed + d * rotationSpeed * orientation; \quad (4)$$

$$speedLeft = speed - d * rotationSpeed * orientation; \quad (5)$$

where d is the distance between the wheels.

The wheel rotation velocities are:

$$\omega_r = speedRight / r; \quad (6)$$

$$\omega_l = speedLeft / r; \quad (7)$$

where r is the radius of the wheels.

- Nikolai K. - 03: Path Planning with a Differential Drive Robot — V-Rep Tutorial (<https://www.youtube.com/watch?v=OfpB87pRoUk>)
- Claudiu Popirlan, Mihai Dupac - An Optimal Path Algorithm for Autonomous Searching Robots

Source code and documentation of this project can be found here:
https://github.com/Ernyoke/VREP_Pathfinding.git