Mapping
And
Realtime
Course
Optimization

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Background

This project was part of the CDIO-course TSRT10 at Linköping University and was performed in collaboration with FOI. The goal of the project was to develop a system for an autonomous robot which should be able to autonomously create a map of an unknown indoor environment.

Localization

The localization was carried out using an extended kalman filter. The angular velocity and odometric information were processed in order to estimate the robot's state $(x, y, \psi)^T$. The option to use corners in the environment as landmarks to decrease drift was also implemented.

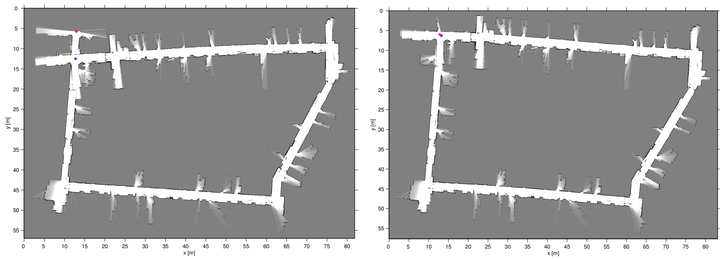

Figure 1: Mapping results without landmarks to the left and with landmarks to the right.

Mapping

The map of the surroundings was built up using an occupancy-grid method with the range data from the laser and the estimated pose from the localization.

Path planning

The path planning algorithm used a binary representation of the environment to ensure that a safe path was planned from the current position to a desired end point (target). The method used was a modified version of a path finding algorithm called A-star. The path targets were found by studying discontinuities in each laser range scan.

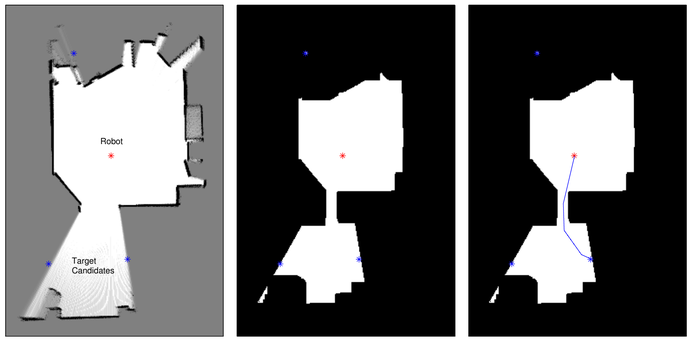

Figure 2: Illustration of the path generation.

Results

A localization algorithm, a safety system for avoiding collisions, a path finding algorithm and a PD-controller for the path following were developed and implemented to run on-line. When there are no more areas left to explore, the robot stops and draws the map.

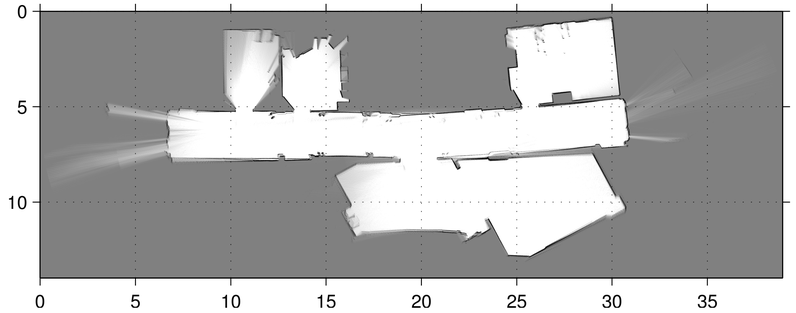

Figure 3: Finished map [m]

Further development

- Improved position and orientation estimation
- Smoother path generation
- Off-line refinements of the map
- Smoother path following algorithm
- Parallel computing