ON-DEMAND SLAM

ASSIGNMENT FOR AN ADDITIONAL PROJECT
IN THE MASTER ARTIFICIAL INTELLIGENCE

VERSIE 0.1 – 21 FEBRUARY 2010

INTRODUCTION

To allow robots to drive around with a purpose, the robots have to be able know where they are. To be able to known where they are, they need a map; a map that has to be acquired first. To provide robots with an adequate simultaneous localization and mapping (SLAM) capability is one of the core challenges in robotic research. This SLAM capability is demonstrated for a number of sophisticated robot systems equipped with an accurate laser-scanner. Yet, as indicated for instance in the study of Jankowska [1], this capability is difficult to maintain in rough terrain. The overall map, incremental build, is typically distorted due to a few translational or orientation errors build on the rough terrain. It is the task of this assignment not to build incremental, but to recreate the best possible map based on all information (including the information collected after the rough terrain). In the literature [2] this problem is known as the full-SLAM problem. Because finding the solution of the full-SLAM is known to be hard, this should be implemented as a post-processing step.

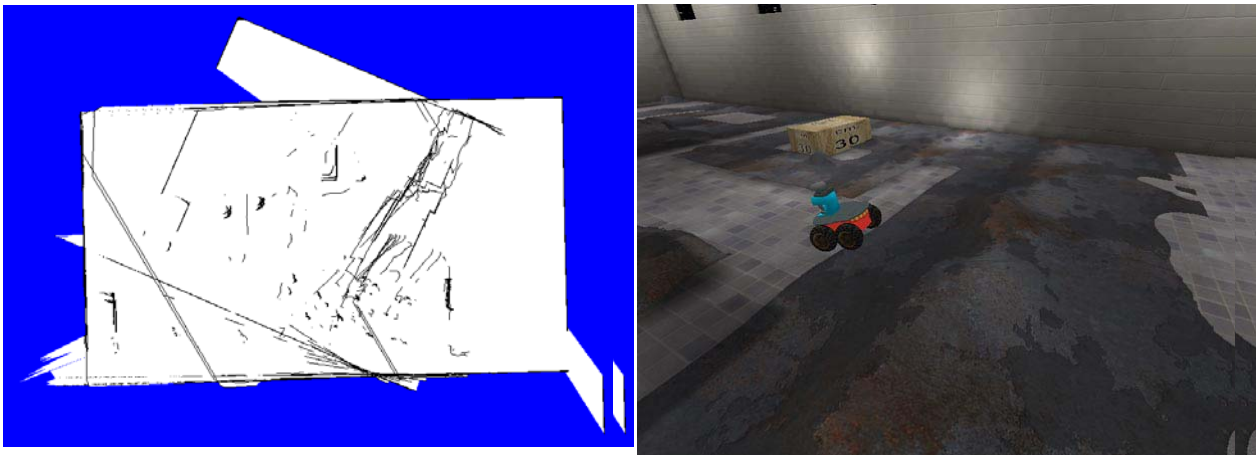

Fig 1. Map (left) created by P2AT robot in a rough terrain (right) (both courtesy from [1])

The solution direction as currently imagined is to follow the following steps:

- Analyze the convergence between the patches and create clusters of good local maps.
- Analyze the locations of overlap between patches of different clusters (this are hypothetical loop closures or merging points between the paths of different robots).
- Start to merge the clusters by getting accurate displacement vectors by scan matching the point clouds of both clusters.

The project will not have to start from scratch. The Amsterdam Oxford Joint Rescue Forces has a code base which contains several scan matching algorithms and methods to handle the patches which make up maps.

ASSESSMENT

The assignment has to be fulfilled in 16 weeks. The results of the research will be accumulated in a paper for the robotics conference (for instance SimPar 2010) which will be the basis of the grade. The student will be supported twice a week in the mobile robot laboratory in the Watergraafsmeer. The student will get a free registration for the RoboCup competition in Singapore. The workload of this assignment is at least 40 days or more than 320 hours. Therefore the load of this assignment is equal to 12 ECTS.

STUDENTS

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Labbook location: http://student.science.uva.nl/~oformsma/slam

REFERENCES

[1] Magda Jankowska, "A Hough Transform Based Approach to Map Stitching", MSc Thesis, Oxford University, published online, September 2009.

[2] Sebastian Thrun, Wolfram Burgard and Dieter Fox, 'Probabilistic Robotics', MIT Press, September, 2005.

Arnoud Visser, based on an assignment description of Peter van Lith (RI)