Team Description Paper

Jon Martin, Daniel Ammon, Dominik Heigl, Florian Gramß, Alexander Gsell
, and Tobias Fink

Institute of Technology Georg-Simon-Ohm,
Kesslerplatz 12, 90489 Nrnberg, Germany
`http://www.th-nuernberg.de`

Abstract. This is an amazing abstract. It will be more substantial when more text ist added to the main part.

1 Introduction

The Autonohm@work team at the Nuernberg Georg Simon Ohm University of Applied Sciences was founded in September 2014. The team consists of Bachelor and Master students leaded by a research assistant who guides and supervises them. To develop a functional mobile-robot- manipulator the different groups in the team had put much effort and knowledge into research to develop the packages to manage the robot. Our main focus is attended to mobile manipulation, object perception and navigation in a unconstrained environment. Only two members of the team that took part last year in Magdeburg continue. To compensate that, new members have joined us and the cooperation between the rescue and the atwork teams has been intensified.

2 Hardware Description

We use the KUKA youBot omni-directional mobile platform, which is equipped with a 5 DOF manipulator. At the end effector of the manipulator an Intel RealSense camera with a motion sensor has been mounted. Next to the camera we replaced the standard gripper from youbot with an also youbots soft two-finger gripper. Thanks to it we are able to grasp bigger and more complex objects more precisely.

A Hokuyo URG-04LX-UG01 laser scanner at the front of the youBot platform is used for localization and navigation. We are planning to add a second laser scanner of the same type on the back of the robot. This improves localization quality and ensures better obstacle avoidance mainly when driving backwards with the robot.

Last year we used the internal computer, together with an external ASUS Mini PC (4 GB RAM, Intel Core i3). We used the internal computer in the youbot to start-up the motors and also for the SLAM. That was a huge error because we added an enormous data tranfer between the two computers what

slowed down the complete system. To avoid the communication problems and latency between them both, we decided to run everything except the motor drivers on the external PC. We also replace the slow i3 for a more powerful CPU Intel Core i7-4790K, 4x 4.00GHz. Table XY shows the new hardware specifications in detail.

ref

fill in specs and format table

describe the router and what we need it for

Table 1. Hardware Specifications

PC 1	
CPU	XXXXXXXX
RAM	XXXXXXXX
HDD	XXXXXXXX
OS	Ubuntu 14.04
PC 2	
CPU	XXXXXXXX
RAM	XXXXXXXX
HDD	XXXXXXXX
OS	Lubuntu 14.04
Grasp	
a	XXXXXXXX
b	XXXXXXXX
c	XXXXXXXX
Lidar	
a	XXXXXXXX
b	XXXXXXXX
c	XXXXXXXX
Router	
a	XXXXXXXX
b	XXXXXXXX
c	XXXXXXXX

3   Software

what should come here:

1. mention all software in short even if its obvious (vim, screen, top, eclipse, ...)
2. mention why we need each piece of software

Helmut

3. we should describe the time sync from chrony
4. images (dd, gzip) and backup mainboard
5. also mention ros software –¿ all ros packages - and what we need it for in shorts

jon

6. SIMULATION; own chapter or here

The software architecture is based on the Robot Operating System ROS. The actuators of the robot are controlled by the basic youBot-ROS-drivers. The system runs with Ubuntu 14.04 and ROS Indigo communication infrastructure is used to communicate and pass information between the nodes, as for example camera data or execution orders for the 5 DOF manipulator.

Several software tools are needed for image processing and controlling the system like openCV, PCL and ROS amcl and Stack_Navigation. We also implemented our own software for the SLAM-Localization in ohm_tsd_slam which is open source in GITHUB.

4   Image Processing

add some text here

5   Image Manupulation

Intel RealSense camera the orientations and positions should be determined by given objects. Then this information is made available for the robot.

6   Mapping

what should come here:

1. describe our slam algo
2. describe improvements from last robocup
3. picture from a map
4. refs to our tsd papers
5. github source

7   Localization

here comes amcl/tsd slam stuff...
    The Navigation is based on the ROS Navigation stack.
    what should come here:

1. describe our two possible localization approaches (tsd and amcl)
2. multible laser scanner setup
3. perhaps we are able to implement a mixture
4. we are working on this parts...

8   Navigation

what should come here:

1. describe navigation stack in short (we will use navigation from localization stack)
2. describe problems and approach from last robocup

jon

9   Mission- and Path Planning

For planning issues, a State Machine with singleton pattern design is used. Every state is designed to be as small as possible. The origin and destination is handed over to an A* path planning algorithm. For debugging issues, the nominal value of the joints can be controlled by a virtual master.

more description on the statemachine; jon

10   Object Manipulation

To grasp objects reliably an exact position from the object perception is needed. The position of objects will be calculated based on information, received from optical/infrared sensors (2D and 3D). After the calculation is finished the robot will navigate to a pregrasp position. Once the base has reached the final position, kinematics will lead the arm near the object. For precise gripping a 2D/3D optical/infrared sensor has been attached to the end effector. In gripping stance the arm- 2camera will be activated to measure the final gripping pose. Because manipulation is an upcoming issue in our robotic institute, we decided to build our own inverse kinematic.

11   Conclusion

In this paper we gave a brief description about our robots modification and functions. We use and develop existing software to make it even better but we also have to invent new methods and software.