WF Wolves @Work Team Description RoboCup 2016

Arne Hitzmann, Alexander Gabel, Philipp Wentscher, and Reinhard Gerndt

Ostfalia University of Applied Sciences, Department of Computer Sciences,
Am Exer 2, 38302 Wolfenbüttel, Germany
{arne.hitzmann,alexander.gabel,p-th.wentscher,r.gerndt
}@ostfalia.de
http://robocup.ostfalia.de

Abstract. This paper details the current state of the hardware and software design of the WF Wolves robot, used for the @Work League in 2016. The development for this competition started in 2011. The platform used is a youBot. The Robot was equipped with additional sensors for enhanced sensoric capability. The newly introduced microsevice oriented architecture will be presented.

1 Introduction

Industrial working with robots imposes a series of challenges. It involves developing solutions for navigating through various environments. Creating a sensor system which is capable to precisely detect a wide rage of objects of different sizes and simulating environments to assure the robot will work proper in various environments. Most of our work is simulation based, because our time spent working on an real robot was limited. The "WF Wolves" RoboCup Team has been participating in international RoboCup since the year 2007 and in a number of national and international robotic events. In 2008 and 2010 the WF Wolves won the world championship in the Mixed Reality League. Developing a sensor system which enable numerous industrial applications is the challenge presented, the approaches used by the WF Wolves will be explained in the following sections. Science 2011 the WF wolves @ Work Team developed its own Software Achitecture on ROS and faced many time with refactoring tasks and challenges that comes with such a complex system. In the newest Version of the System configuration and software version we begin to introduced a microservice based architecture to get an faster and cleaner development life cycle.

2 Research Overview

This section describes the main research and development objectives. The was Research focussed on Simulation. Simulation is still an important part in the development of many robotic systems. Machine learning is a powerful tool in

improving robotic performance. Because of this it is important to have a simulation environment which simulates the robot as realistic as possible. Improving the accuracy of the simulation is one of the major goals. We also use simulation as an attending part for lectures to get students in touch with robotics. But in addition we also extents the current architecture with micro services.

3 Hardware

youBot

As a hardware platform the WF Wolves use the youBot platform from KUKA. The major benefits over other robots which would be suitable are the omnidirectional platform which allows a high agility and gives the advantage maneuvering in small space or approaching a target. The EtherCat based communication allows for a very flexible system which is easily extended to fit more difficult tasks. The manipulator it self uses proven technology and therefore is very likely to full fill all manipulation tasks specified in the rules of 2016 or following years.

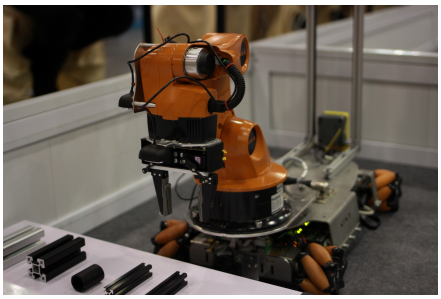

Fig. 1. WF-Wolves Robocup 2016 Hefei

Modifications

The sensor capacities of the youBot platform are limited, to get all the necessary data to perform all tasks some additions had to be made.

Laser Scanners Laser scanners are highly reliable for localization and navigation. The provide accurate data of possible obstacles and therefore improve the capability of the robot to move without collision in an unknown area. The Model "Hokuyo URG-04LX" is used in the Robot, because of its overall performance. Its measuring area reaches from 0.06m to 4.095m with an angle of 240. It also does scans on a 10Hz resolution what will give us up-to-data data about our environment. The scanners are positioned at the front and at the end of the robot to have a good coverage of the surrounding area. Allowing the Robot to move in any direction without the risk of collision.

Camera

Computer Vision is the most important sensor, detecting markers, graspable objects and areas is of high importance for the robotic system. The great advantages of this system is the wide range of people currently using the Real-Sense and the corresponding framework and SDK. The resolution of the depth-camera is 640x480px at 30fps with a 11-bit depth resolution which makes it to our preferred TOF-camera. A color-camera with a resolution of 1080p is also embedded. These characteristics fit our needs for image-processing.

4 Software

ROS

As control software the Robot Operating System by Willow Garage is used. With this powerful framework we was able to develop the whole communication between the actors and sensors within a very short amount of time. And there are even more reasons we decided us for ROS. Its blackboard architecture makes it very easy for all parts of the robot to get informations about the whole system. Further Willow Garage is a very ambitious company which dedicates much resources to enhance the functions of ROS. The ROS community is very active and the modular architecture allows an excellent exchange of software.

Mircoservices

The newest revolution in our robot system is the refactoring of the, over the year grown, Python based, state machine. SMACH was used for modelling behaviour and is still the main part of the architecture. The old software state machine was overloaded, because some important parts was developed on earlier competitions. In the last years we spend a lot of time with refactoring and decided to transform the old SMACH state machine into a micro service based software approach to get a better handling of different module versions and an increase in software quality. The new approach also allows us to easily integrate student project, which where done by students who just participate for several month in the Team, into the complete software ecosystem of our robot platform. Even for undergraduate students it is now easier to get into the platform, because they can focus on smaller parts and don't have to go very deep into the 'big picture' of the over all system.

5 Conclusion

The main advances of the WF Wolves @Work team for 2016 are the improved abilities using the new developed microservice based framework for a modular architecture of our robot control software. The simulating performance has also been increased and our simulation environment, based on Gazebo, is used in

more than one lecture and research topic. With our elaborated sensor model we will be able to pass the contests on a very high level due a very precise world model. The team WF Wolves is looking forward to participate in the RoboCup 2016 in Germany. We will be happy to provide a team member as referee or operator.