Conception and Realization of an Environment to simulate and control multiple ROS based Drones and Robots

Integrated Simulation and Control Environment for ROS based Drones and Robots

# Project Overview (Technical Part) [1]

The Technical University of Deggendorf is going to produce a show using multiple drone and robots. The technical platform of the drones is the AR Drone Platform (Ar Drone 2, Bebob). The drones are connected via WIFI and can be controlled using an SDK that is provided by Parrot.

In the project the following components are to be used:

1. Multiple Autonomy Drivers to control the drones.
2. Gazebo Simulation environment to simulate the drones and robots
3. TUM simulator to simulate the drones (AR Drones)

The current environment does not fully meet the technical requirements. The following components must be integrated or modified:

1. The drivers must be modified in such a way that they can be scripted. Defined flying trajectories need to be called for each single drone.

In addition, it would be useful if

1. Sound and light synchronization in the simulation environment
2. Integration of humanoid robots into the simulation environment.

# Architectural Environment

Objective of the environment is to create timeline scipts that can be used to simulate the multi-drone environments. In addition, the scripts are used to control the real-time scenarios.

# 

Abbildung 1 Technical Architecture (Draft 2017-06)

In the above Figure the components in blue are software components. The light blue component is to be developed. The orange components are simulation components already existing [2] [3]. The driver is used to communicate with the drone [1]. They need to be integrated and adapted. The green and grey components are additions components that can be integrated or controlled using stand-alone software. [4]

# Nice to Have Features

## Robot Simulation and Control

Currently a second simulation environment is used to simulate the robots. The robots are using the ROS operating system as well. Integration would therefore be useful.

## Sound and Light Control Integration

Sound and light are controlled using stand-alone applications. Integration and synchronization with the simulation is useful, but currently out of scope.

## Double Security - Wireless Protection

Drones are controlled using the control panel. A manual take-over in the emergency case is useful but out of scope.

Login protection on drone and wireless network is required but in version 1.0 out of scope.

# Project Plan

## Objective

The overall objective of the project is to create a simulation and control environment for ROS based autonomic systems, based on existing software components. Simulations are to be rendered and played back using real-time controlled drones.

## Draft Plan

|  |  |  |
| --- | --- | --- |
| # | **Task-Milestone** |  |
|  | Installation Gazebo |  |
|  | Installation TUM Engine | [2] |
|  | Test of Simulation capabilities |  |
| 1.0 | *Simulation Environment ready* |  |
|  | Installation of Driver | [1] |
|  | Test of Realtime Capabilities |  |
| 1.1 | *Control Environment ready* |  |
|  | Configuration of Multi-drone Environment |  |
|  | Test of Mulitdrone Capabilities | [4] |
| 1.2 | *Multidrone Simulation and Controll Environment ready* |  |
|  | Development of Scripting Engine |  |
|  | Ros Integration of Scripting Engine |  |
| 1.3 | *Multidrone Simulation and Control Environment ready* |  |
| 1.4 | Setup of four Workspaces for Project Control and Development |  |
| 1.5 | Documentation of Tools and Workprocess for students |  |

Table Draft Plan (Status 2017-06)

# Literaturverzeichnis

|  |  |
| --- | --- |
| [1] | A. W. Group, „Read The Docs,“ 2015. [Online]. Available: http://ardrone-autonomy.readthedocs.io/en/latest/installation.html. [Zugriff am 25 06 2017]. |
| [2] | T. Simulator, „ROS Introduction to TUM Simulator,“ University of Munich, 2014. [Online]. Available: http://wiki.ros.org/tum\_simulator. [Zugriff am 25 06 2017]. |
| [3] | S. Rady, „Slide share TUM Simulator,“ 06 02 2016. [Online]. Available: https://de.slideshare.net/esraatarekahmedhasansadek/simulating-tum-drone-20-by-ros. [Zugriff am 25 06 2017]. |
| [4] | A. Lab, „Setting up mulitple Drone,“ 07 01 2013. [Online]. Available: https://github.com/AutonomyLab/ardrone\_autonomy/wiki/Multiple-AR-Drones. [Zugriff am 25 06 2017]. |