Setting-up and Using the UUV Simulator for system integration tests in realistic AUV scenarios

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ABSTRACT

As the relevance of adequately assessing the state of the oceans and offshore installations grows, AUVs and ROVs are acquiring an increasingly important role as tools to remotely monitor, explore or operate in submarine locations otherwise hard to access. A key step on developing these vehicles is the simulation phase, due to the complexity involved in testing them in the real domain and the risk of losing them. Given the changing dynamics of the subsea environments and the kind of technology they use for interacting with their surroundings, the modeling and simulation of submarine robots is way behind their equivalent counterparts for ground and indoor mobile platforms. Thus, in this tutorial we aim at introducing the UUV underwater simulator [1], an open-source tool based on ROS [2] and Gazebo [3] being used and extended within the SMARC center to help fill the gap. The attendees will gain basic skills with this tool on replicating subsea conditions and testing vehicles missions underwater. They will benefit from our experience choosing and adapting a simulator to the requirements of research in underwater platforms and get a glimpse on the potential of this tool for their own needs.

ABBREVIATIONS

AUV Autonomous underwater vehicle

FLS Forward looking sonar

MBES Multibeam echo sounder

ROS Robot Operating System

ROV Remotely operated vehicle

BRIEF DESCRIPTION AND OBJECTIVES

The goal of this hands-on tutorial is to introduce the users to the basics of the simulation of underwater mobile platforms through a practical demo with the SMARC simulator. A mission in which a SMARC AUV performs an autonomous inspection of a pipeline sitting on the seabed is proposed to the attendees, who are then walked through the design and implementation of the scenario and the robotic system.

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As a first step, some generic software tools commonly used in robotics will be presented at an introductory level, focusing on ROS, Gazebo and RVIZ. Hereafter, the tutorial will show how to reproduce the subsea scenario in the simulator and how to tune the physics of the scene and the mobile platform as necessary. After, a basic navigation system for the AUV will be built out of already existing core components and sensors so that the platform can carry out the proposed mission. Finally, the demo will be run while showcasing some possible ways to visualize data from the sensors and the system and log it for offline analysis.

The ultimate objective is to provide engineers and researchers in underwater mobile robots with a new tool to replicate vehicles behaviors in submarine conditions in order to test their performance in a mission.

TARGET AUDIENCE

This tutorial is aimed at an audience of engineers and scientists with a background in robot platforms and sensing instrumentation or working with sub-aquatic vehicles, both unmanned and remotely controlled. Other researchers and engineers in contact with this technology with an interest in broadening their understanding of how the core components of these systems work during a mission are also welcome.

Given the practical approach of the session, some prerequisites are assumed for the attendee to carry out the practicals. User-level skills with Linux-based systems and a basic knowledge of mobile platforms and/or instrumentation is expected. Previous programming skills or experience with ROS or Gazebo are not required but a plus.

FORMAT OF THE SESSION

Each participant or group of participants should bring a PC or be provided one for this tutorial. A 10 GB virtual machine with an Ubuntu installation containing all the necessary software tools to carry out the practicals will be made available prior the session or installed in the provided computers. The guests are expected to have installed the VM before the beginning of the tutorial.

Two presenters will interactively walk the attendees through the tutorial. The main one will be carrying out the demo setup on his own PC connected to a projector, with a combination of speaking and live coding, while the other one offers assistance as requested. The audience is then expected to follow and execute the same instructions as the main presenter.

The limit in the size of the audience is expected to depend on the number of available PCs and the size of the classroom/auditory. However, in order to be able to assist the attendees with two presenters, a reasonable number of participants would be 20.

REFERENCES

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