3D visualization of autonomous underwater robots

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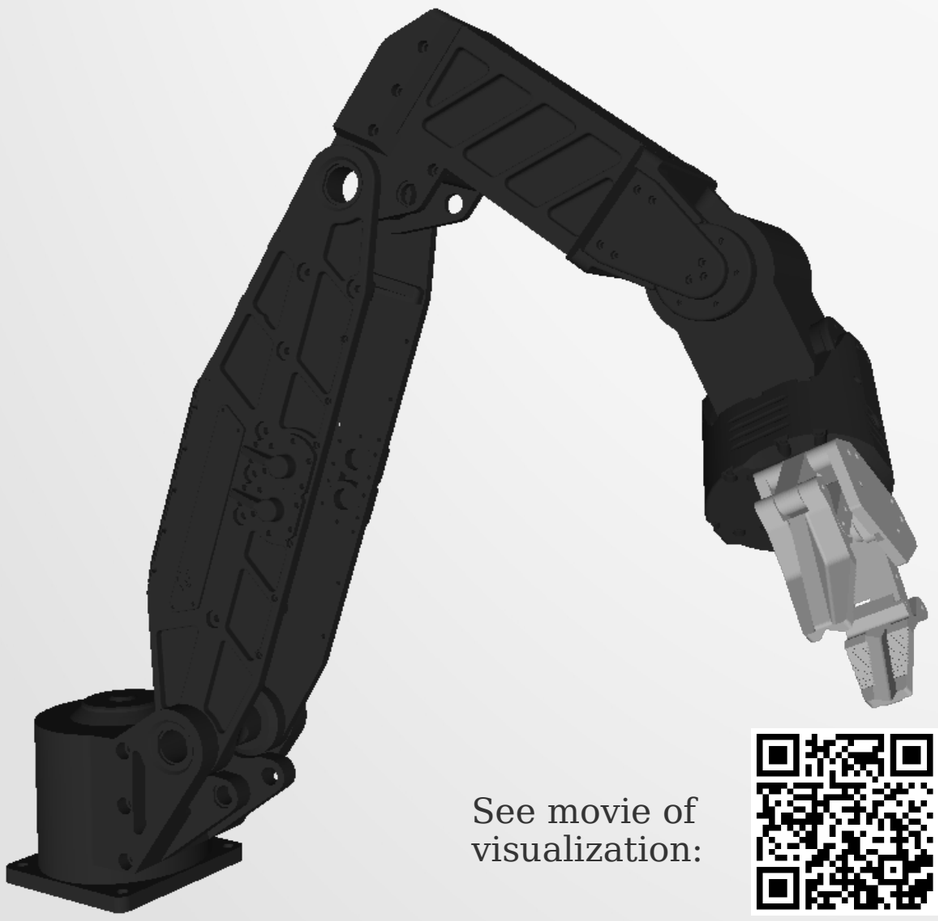
Introduction

Utilization of the seas resources is becoming more important every day and also more challenging. Increased demands for fuel, food and energy is forcing the industry to seek more inaccessible resources in ultra deep water and in rougher and more fragile environments. Safe and controlled operations are more important than ever, and the industry is putting in huge efforts and money to make sure the operations is conducted as planned with no damages on humans or the environment.

Scope of work

The goal in this thesis is to develop a 3D visualization of a manipulator system that can provide an close to reality visualization of a manipulator arm built for harsh environments, such as in underwater operations.

The manipulator is an 'Raptor - Force Feedback Manipulator' produced by Kraft TeleRobotics. Such tool will provide the operator with improved situation awareness and the risk of failures such as collision, damages or other obstacles will hopefully get lower. Also visual data such as cameras can be used by the system to determine the environmental status, locate objects and determine the position. This is an important field that is in a huge development process because there are many big challenges in the industry that requires such solutions now and in the future.



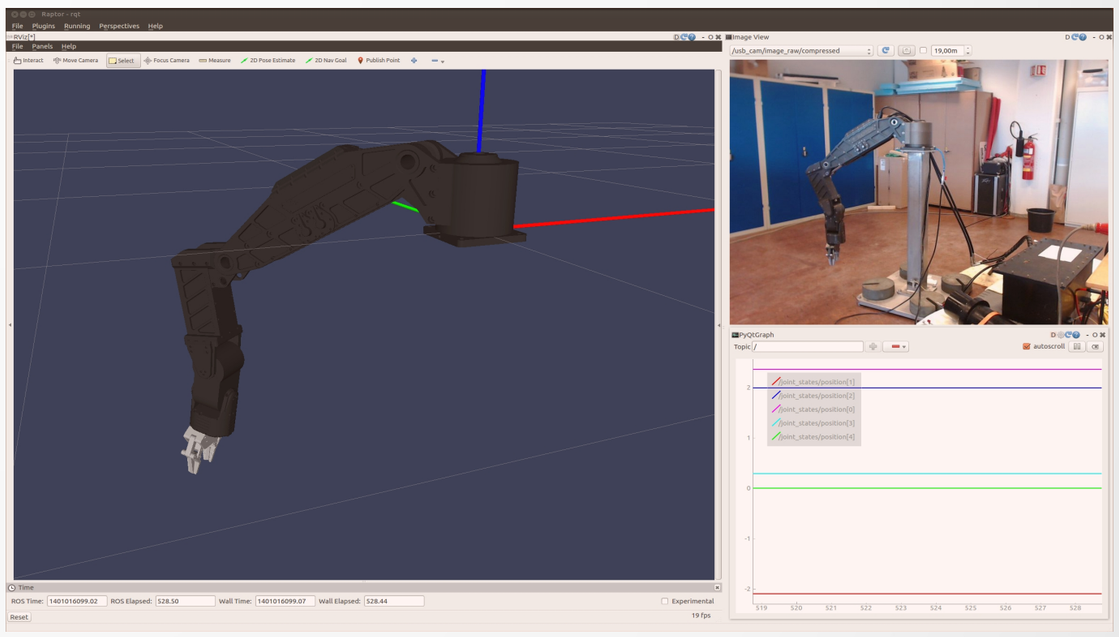
See movie of visualization:

Software

The software used for the development is a combination of different CAD-solutions for modeling and measurements. For visualization the open source Robot Operating System (ROS) framework was used. Including user scenarios such as debugging, logging, controlling and development, ROS can also be used for visualization and monitoring. This combination of different opportunities makes this framework a great choice for such an application because of the possibility to expand it functionality.

Modeling and simulations

After developing a kinematic model of the arm, it was implemented into the visualization package in ROS called rviz. This software is able to convert states collected from the real manipulator, and visualize it in the 3D-model.



By doing this during operation a real time visualization of the arm is visible at all times. If visual sources such as cameras is unavailable, the operator still has the visualization for support during operations.

Conclusion and further work

The model was tested by feeding the software with simulated states, and the results became very good. For further work this software can be used as a base for a complete controlling and monitoring system. The ROS framework has a huge amount of opportunities and developers all over the world has joined the community. This is a huge advantage since support and resources is easy to obtain through this network.