Master Thesis Proposal

Title: Localization of Prototype Autonomous Inspection Vehicle during Underwater Missions

Description:

Over the last two decades underwater vehicle technology has found many applications and widespread acceptance in the offshore energy industry. Remotely Operated Vehicles (ROVs) are routinely used for inspection and intervention tasks. However, the requirement for a vessel support with operators directly connected by an umbilical cable makes ROVs operations expensive. The use of Autonomous Underwater Vehicles (AUVs) offers a potential cost effective solution as it does not require vessel support. Although this solution seems good, there are still a number of open problems and technology gaps which need to be solved.

The localization of AUVs during the mission is one of the tasks that still require de-risking. The absence of GPS and sensing characteristics of the environment make underwater localization a hard problem. Lack of visibility and scattering make the use of cameras a difficult. Water also does not allow the use of laser range finders. As a consequence, acoustic systems are the most widely used sensors in the subsea domain – this is despite their relatively noisy and slow update rates. A potential solution to the localization problem is to augment the dead-reckoned navigation system (c.f. odometry) with a system to orient the vehicle from known "landmarks" or features in the environment. This approach is particularly promising the structured environment of a subsea production field.

SeeByte Ltd in SME (Small Medium Enterprise) based in Edinburgh, Scotland, currently working on the design and development of a Prototype Autonomous Inspection Vehicle (PAIV) suitable for deep-water (>1000m) inspection missions for subsea infrastructure such as risers, manifolds and valve trees.The vehicle is shown in figure1. It is a commercial project and is in collaboration of BP, Chevron and Subsea 7. The ultimate aim of the PAIV programme is to develop an AUV suitable for replacing ROVs for many routine subsea inspection tasks.

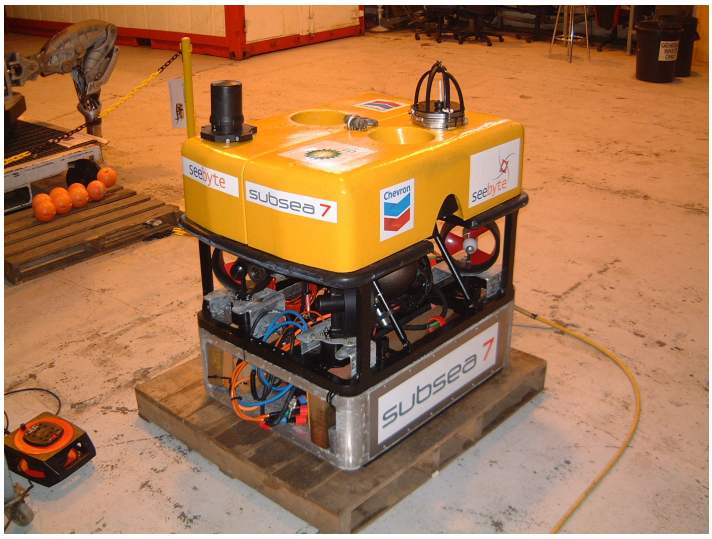

Figure 1: Prototype Autonomous Inspection Vehicle

Aims:

The aim of is project is to develop a real-time embedded software module (component) that can be executed on the PAIV platform that is capable of localizing the robotic vehicle using an appropriate technique(s) and contribute to PAIV's mission profile to complete the effective 3D inspection of target risers and other subsea infrastructure.

Tasks:

The project will begin with literature review to identify suitable techniques, particularly those associated with particle filters which have previously shown promise in this area. MATLAB will be used to develop a prototype algorithm which then be tested to evaluate its performance and suitability. A real-time embedded implementation will then be developed using C++/Linux in keeping with other modules on the PAIV vehicle. This embedded module will first be tested in SeeByte's high-fidelity software-in-the-loop simulator. If time permits, the module will then be integrated onto the real PAIV vehicle and tested in a suitable environment such as tank or shallow-water test (lake/loch). The aim is to evaluate the performance and demonstrate its potential suitability as part of the PAIV mission concept.