

Inspection Robotics and LEO

by Stefano Stramigioli (20-6-2014)

Inspection Robotics has been identified as one of three pillars which will be promoted and explored by LEO – Center for Service Robotics. This document will elaborate on the arguments that were fundamental for this choice.

Business Potentials

The interest of Robotics Technology for Inspection and maintenance is growing rapidly throughout different industries such as Petrochemical, Off-Shore, Power Plants and other Civil Applications. As indicated in the Multi Annual Roadmap of EU Robotics (verbatim):

“The application of robotics technology to the Civil domain is still at an early stage and it is therefore difficult to estimate eventual market size. It is likely that technology limitations will restrict early deployment to well controlled areas of application where robots are operated by skilled personnel for example in nuclear and environmental inspection tasks, including marine inspection.

In the case of marine robots, the Remotely Operated Vehicles (ROV) market is expected to grow at near 14% CAGR (compound annual growth rate) in the period 2011-2015 up to a value of about \$1,546 million in 2015. ROVs sales for defence & security and scientific research equalled 25% of the total market for each sector. In the meantime, also the Autonomous Unmanned Vehicles (AUV) market is expected to grow in the defence and scientific research sectors with a CAGR equal to 12% and 8% respectively by 2016.

It is often the case that unmanned vehicles are cheaper and faster to produce than manned vehicles. Global Unmanned Marine and Ground Vehicles market is foreseen to reach \$1.96 Billion by 2017. The potential market in Europe for Unmanned Aerial Vehicles over the next 10 years could amount to about €11B. In the short to medium term demand is likely to be driven by monitoring and surveillance applications.

The coming decade will probably witness the rapid expansion of decommissioning activity, costing tens of billions of dollars. The decommissioning industry’s performance will be critical to the future of nuclear power generation.

The decommissioning sector has been steadily forming over a few years but it is expected to see some major progress over the next five to ten years. Hundreds of offshore oil and gas platforms will be recovered from the North Sea over the coming years. Analysis by industry body Oil and Gas UK and decommissioning agency Decom North Sea put the value of this work at £30 Bn. over the next 25 years.

Key Market drivers are:

- *Growing interest in UAS not only by US and European countries but also by emerging countries.*
- *Potential for improved coverage of large areas for environmental monitoring.*
- *Increase in quality of monitoring data and regularity of monitoring due to lower cost per task.*
- *Reduction of total operational costs with respect to existing manned systems.*
- *Increasing acceptance of robotics technology.”*

Inspection and Maintenance applications have an advantage on other related fields because of the potential for early robotic deployment and market preparation. This is because in these kind of applications, the intelligence of the system is often substituted or supported by human operators in the loop. It is therefore possible to concentrate on smart mechatronic solutions which can be done robustly and deliver trustful and effective solutions to real problems because of the available expertise within the region in which LEO operates. Furthermore, once a tele-operated system is deployed and properly working, the daily practice of its activities in the field can be used to learn from and to use this knowledge to implement, deploy and test autonomy and intelligence as possible additional features. Furthermore, inspection robotics removes people

from situations in which people could be harmed. It offers solutions to inspection problems in unreachable, dangerous and remote locations which could not be inspected otherwise.

LEO specific importance

Within the Netherlands, the University of Twente is certainly the most active in Inspection Robotics and there is no other academic institution which is currently as broadly involved in this particular field of robotics. Furthermore, a very broad network is present with a number of enterprises like GASSCO AS (NO), Chevron North Sea Ltd. (UK), Koninklijke VOPAK N.V. (NL) A.Hak Industrial Services B.V. (NL), Dekra Industrial AB – DEKRA (SE), Alstom Inspection Robotics (AIR) (CH), OCROBOTICS, (UK), Innospection GmbH (DE), Quasset B.V. (NL), Huisman (NL)

Application Domains and Relation to LEO

A number of projects are already running, a broad network is available within LEO and some new EU proposals have been submitted. These three points will be noted per application Domain:

Petrochemical Industry

- Good contacts within Shell (CTO Gerald Schotman)
- Stefano is Scientific Advisor of PETROBOT
- Contact for project preparations and a national program on robotics with Shell, Quasset, BMT Group Ltd,....
- EU Project submitted for the inspection of raisers
- Topics: inspection of pressure vessels, storage tanks, raisers for off-shore etc.

Offshore Industry

- Roboship project with Meyerwerft for inspection of ballast tanks. This set-up will be on display in the O&O square in a container with a complete rail simulation in it.
- Contact started with Joop Roodenburg, CEO van Huisman for possible collaborations

Power Plants and Energy Distribution

- Contract with ALSTOM for inspection of power plant pipes
- Result on flying inspections of burners are going to be used in product line of ALSTOM
- EU project submitted with the International Atomic Energy Agency (IAEA) for atomic plant inspections and radiation monitoring

Other Civil Applications

- Running project with KIVA for inspection of pipes: unique team worldwide which can travel 6 cm pipes, go through T junctions etc.
- Discussions in progress with Alliander for extra financial support for pipe inspection
- Interest from Wetsus for inspection of water pipes