Summary of ERF workshop on Inspection and Maintenance

The Minimum Viable Product Approach: A way to bridge the valley of death in Inspection & Maintenance Robotics

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Outline

Topic group on Maintenance and Inspection

Background and objective of workshop

Summary of brainstorming session
Topic group on Maintenance and Inspection
euRobotics TG on Maintenance and Inspection Robotics

Started in 2014

Led by Ekkehard Zwicker, GE Inspection Robotics, until Oct 2016

Now led by Aksel A. Transeth, SINTEF

Ca 120 members

Goal and scope: To influence and to drive the research, development and operative deployment of robotics in the domain of maintenance and inspection of process plants such as oil&gas facilities, power stations or chemical plants by connecting the stakeholders from research and industry.
2.6.3. Sub-Domain Inspection and Maintenance

2.6.3.1 Sub-Domain Overview

Robotics provides significant advantages over current methods of inspection and maintenance for example 24/7 working, and have the ability to operate in hazardous, harsh and remote environments. The utility and energy domains have begun to explore the potential of this technology. There is an emerging trend for these industries to include robot based maintenance and inspection within their forward planning. However there is currently no wide scale adoption or validation of this technology.

The lack of wide scale adoption can be attributed to a number of different factors, insufficient availability of robust technical solutions and the concern of implementing innovative technologies without track record. At the root lies a disconnect between the robot technology being developed for this industry and the requirements of the users. This is due to an insufficient understanding of what challenges are being faced by asset owners for inspection and maintenance tasks, basic requirements that drive their needs for robotic technology uptake.
Collaboration

This workshop is produced as a joint effort between the TG on Maintenance and inspection robotics and the SPRINT Robotics Collaborative.

Promotion of development, availability and application of robotics techniques in technical inspections and maintenance of capital intensive infrastructure
Background and objective of workshop
Workshop program

14:00-14:10: Introduction to the session and the MVP approach.

14:10-15:00: Presentation from different stakeholders: asset owners, service providers, technology providers and research institutes.

15:00-15:25: Brainstorming Session. Golden Question: How can the MVP approach help robotics to bridge the valley of death in a conservative industrial environment?

15:25-15:30: Summary and follow-up

Ca. 60 people participated on the workshop

Detailed Program for stakeholder presentations:
14:00: Aksel Transeth, SINTEF
14:05: Ekkehard Zwicker, GE Inspection Robotics
14:10: Kris Kydd, Total
14:17: Russell Brown
14:24: Barend van den Bos, Dekra Industrial AB
14:31: Ekkehard Zwicker, GE Inspection Robotics
14:38: Andrew Graham, OC Robotics
14:45: Aksel Transeth, SINTEF
14:52: Marco Hutter, ETH
Objective of the workshop

The objective of this workshop is to showcase the MVP approach with views from research, robotic technology provider and enduser and to discuss and brainstorm if and how this approach can be further applied to get faster and more efficient from research to working solutions applied in daily industry life.

Inspection & Maintenance is a rather conservative business. Although robotics provides a significant value it is difficult to establish robotics as a common practice, especially in the energy sector (Oil&Gas, Power generation). As a consequence the valley of death for new robotic solutions is bigger and hotter than in other industries. Several actions have been taken to bridge the valley of death (robotic contests, EU funded projects). All with promising results but it will take further time to open the market for robotics.

A promising approach seems to the “Minimum Viable Product” (MVP) approach. With the MVP approach the value of robotics can be demonstrated and a common understanding of the robotic capabilities is established – all this with a limited invest for all parties involved.
Summary of brainstorming session
A frequently used analogy used throughout the workshop was that a "wedding cake" represents a full-feature product with "all" functionality/features/etc, while a "cupcake" represents a product with only one feature or a smaller set of functionality of the finished product.

In the summary of the brainstorming we will in some cases use this same analogy.
Background / intro (cont'd)
Define the full-feature product early, but realize it step by step

It is important to have an understanding of what the full-feature product (i.e. the "wedding cake") should look like in the beginning of the process.

- Then break it down into sub-versions ("cupcakes") where each can contribute to value creation. Need to establish an understanding of how many steps are needed in order to realize a solution.
- One option is to realize a mid-TRL version of the desired full-feature product. This has been the approach in the ARGOS challenge (www.argos-challenge.com). Then, break it down to sub-versions that can be realized commercially at a higher TRL.
- It is important to get each sub-version right. If it fails, then there might not be a new chance to try to enter the market with it.

Getting the requirements right: Difficult to distinguish between what are "cup-cakes" and "wedding-cakes". Start with dividing into "must do" and nice to have" requirements. Need to avoid local minima for a full-feature product.

- At the start, many requirements can seem as "must have". Needs iteration on this between the providers and the end-users.
- Putting a prize on a "must have" requirement can easily lead to that the requirement becomes a "nice to have".

Handle changes in the market: The market needs may change underway in a development process. It is important to still consider which sub-components can be used further instead of scrapping the whole solution being developed.
Joint learning through cooperation

Joint learning throughout the value chain: Do the industry actually understand the challenges that they are trying to overcome? No. There is a problem defining what we are actually trying to achieve. It is not fully understood by the end-users and not fully understood by the suppliers.

- Work with the operators. Observe what they are doing. To understand what needs to be done. But it is a challenge to get people out on the plants that do not "need" to be there (i.e., that are not part of daily operations).
Define *detailed* business cases

Business cases for I&M robotics: Increase safety – remove people from potential explosive atmospheres. Reduce plant downtime. Save cost.

- Challenge: May be difficult to translate "reduce downtime" into something more concrete. E.g., "which type of pressure vessel leads to the most downtime"?
- There needs to be added value to introduce a robotic solution. If not, then there is no apparent reason to change from today's mode of operation.
- Sell the "wedding cake"-vision: A "cupcake"-version may not as a stand-alone product contribute with sufficient value creation in order to spark sufficient interest from the end-users to get the version operational at a plant.
Products are already out there!

Integration instead of development when possible: Need to understand what are the capabilities of the robotic solutions which are already available. From that we can define what should be developed further – to define new versions with additional functionality.

Go around and talk to the operators: "Here's our robot. Here's what it can do. What to you want to use it for?". Get the added value from already existing and new products.

Test facilities: It can be difficult to find a location for a pilot test (e.g., in oil & gas). Need to find the right field operation manager who is willing to test it.
Synergies between industries

Cooperation and exchange of solution between industries To some extent, all the different industries are developing their inspection robots in somewhat of isolation. Should look at commonalities between the industries.

Informal survey at the workshop:

- Ca 30-35 % of participants on the workshop have been involved in projects on I&M within nuclear and oil & gas.
- Some have been involved with in projects regarding water utilities ~ 20 %
- Few have been involved in projects regarding power utilities and renewables, ~ 10 %