New possibilities – Next generation robotic systems for inspection and maintenance operations

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Outline

- Motivation
- Heat exchanger cleaning
- Firefighting / water spraying
- Pipe-inspection
- Remote control of oil platforms
Motivation

- Estimate: Losses at 0.25 % of GDP of industrialized nations due to fouling in heat exchanger

- Germany: Communal sewers add up to 400 000 km and many are old, but only 11 % are accessible to humans

- Estimate: 49 000 service robots to be installed world wide 2009 - 2012
Outline
Outline
Heat exchanger cleaner - HexCleaner

- Intro to heat exchangers
  - Common component in process plants
  - Transfers heat from one medium to another
  - Problem with fouling – regular cleaning intervals needed
Heat exchanger cleaner - HexCleaner

- **Case**
  - Hydrogen gas
  - 2 m diameter
  - 2000 tubes
  - **Only access:** two inch pipe stub

- **Challenge**
  - Bring inspection and cleaning tools inside
Heat exchanger cleaner - HexCleaner

- Robot demonstrator
  - Diameter 40 mm
  - Reach 2 m!
  - Drive: hydraulic and electric
Outline
Fire-fighting / water spraying robot

- **Concept**
  - Intelligent **snake robot** for challenging operation

- **Idea**
  - Equip a fire hose with water hydraulic motors

- **Why?**
  - Enable the fire hose to perform fire intervention on its own

- **How?**
  - Exploit the hydraulic energy inside the fire hose
Fire-fighting / water spraying robot

- Fire extinguisher
- Search and rescue
- Situation awareness

SnakeFighter: Water-hydraulic fire hoses
Fire-fighting / water spraying robot

- High risk areas
Fire-fighting / water spraying robot

- Tunnel fires
- First responders
Fire-fighting / water spraying robot
Fire-fighting / water spraying robot
Fire-fighting / water spraying robot

AIKO
Obstacle-aided locomotion
Outline
Piko – Pipe-inspection robot

- Inspection and maintenance
  - Water and sewer systems
  - Chemical and nuclear plants
  - Air duct systems
  - Oil and gas pipelines
Snake robots

- **Generic application**
  - A *transportation system* for arbitrary *tools* and *sensors*

- **Advantages**
  - Stability
  - Traverse rough terrains
  - Small cross-sectional area
  - Redundancy

- **Tools and sensors**
  - **Snake robot**
  - **Challenging environment**
Outline
Remote I&M of oil platforms

- Concept
  - Remotely operated oil & gas platform monitored and controlled by operators onshore

- Motivation
  - Environment, Health, and Safety (EHS)
  - Reduce investment and operating costs of the platform
  - Dry wellhead area (not subsea)
Remote I&M of oil platforms

- Located in Trondheim, Norway
Remote I&M of oil platforms
Next generation robotic systems for inspection and maintenance
Thank you for your attention!

Questions?

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