Automatic 3D Mapping of Work Environment

... towards greater autonomy

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Automation in Port Terminals

- Efficient way of tracking and moving cargo/containers

  - - to and from ships
  - - within the port
    and yards
  - - in and out of gate

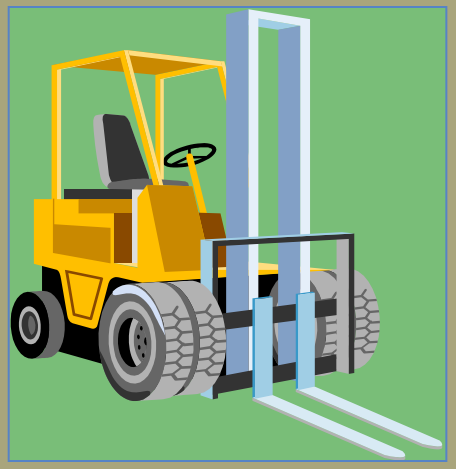
Towards greater Automation

Navigation

Lifting / stacking

Work envelope - safety

Unexpected events



Unmanned

Manual control

Tele-operation
Operator Intervention

Collaborative Workplace

Intelligent machine assisting human OR/AND Human assisting intelligent machine

- Intelligent machine
  - assist/replace human in hazardous work
  - provide mechanical force/motion
  - replace human in repetitive task
- Human operator
  - Decision making/experience
  - intervention in unexpected situations
  - perceive and reason in situations with incomplete information - error recovery
- Machines of different intelligent levels working in the same workplace

3D workplace Mapping

- How much autonomy the smart machine has in reacting to the environment
- When the operator decides to intervene
- How does the operator interact with the task and receive feedback from the smart machine

Human operators and smart machines need information on the physical surroundings related to the task.

The need for automatic 3D workplace mapping

Point Cloud Technology

- **Point cloud** is a set of data points in some coordinate system. In coordinate system, these points are usually defined by *X*, *Y*, and *Z*
- Point clouds could be created by 3D scanners. These data are converted to useful CAD data
- Long range 3D scanning – 2mm accuracy at a distance 130m away

Cargo Handling - ship

Unmanned container loading operation

Loader Crane

Ship cargo hold

3D Scanner/Sensors

http://www.freeimages.com/
http://www.dreamstime.com/

Spins-off

- 3D real work environment for simulation of “new” work processes/installation

  http://www.maritimeinstitute.sg/DATA/0/docs/Newsfiles/SMWorkshop-ClassNK.pdf
  http://www.marinelink.com/news/scanning-industry-marine363572.aspx

- Enhanced safety when information of the work environment could be transmitted to all

  http://www.ri.cmu.edu/pub_files/2013/5/arora_icra_2013.pdf

- Closer collaboration between machines and human operator
- Different mode of implementation of Automation

Thank You