The Virtual Terminal: Visualizing Automated Container Terminals

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Presentation Outline

• Automation in container terminal design: why and how?
• Challenges in a multi-actor environment: the need for presenting ideas.
• 3D interactive visualization: a solution.
• Evaluating the Virtual Terminal.
• Conclusions.
Designing automated container terminals

from abc.net.au

from thegreenergrass.org

TU Delft
Why automation?

Various advantages:

• **Automation leads to lower life cycle costs.**
• **Automation improves safety and labour circumstances.**
• **Automation can significantly reduce the level of damage.**
• **Automated equipment can easily be electrically driven. Automated systems can increase the level of service.**
Complexity of the decision making process
A need to visualize new designs

- Different actors are involved in the decision making process, visualization helps achieve **shared understanding**
- How to do it?
  - 2D cad drawings: too technical
  - Custom 3D video: time consuming to produce and not interactive
  - Maquettes: too costly and time consuming to produce
Requirements for solution

We aim at constructing a solution that adheres to the following requirements:

• **Easy and quick** construction of presentation material.
• Present **realistic and compelling 3D imagery** of an automated container terminal.
• Contain the **vast amount of information** gathered from different sources.
• Serve as a **communication medium** between actors.
• Provide the **context and an overview of the knowledge** present in the container terminal.
• Provide **interaction with the actors** involved.
• Contain **sufficient details** for decision making.
The Virtual Terminal

The “Virtual Terminal” serves as a tool...
• ... to present future terminals to customers,
• ... to share design ideas throughout a (non-technical) design team,
• ... and to share information of existing and future terminals.

From design to virtual environment in 3 steps:
• Create a design in AutoCAD
• Convert the design to an XML
• Visualize the XML in the “Virtual Terminal”-client
How does it work?
Designing in AutoCAD
Designing in AutoCAD

*Designing takes place in AutoCAD with predefined building blocks.*

**Why?**
- Powerful tool, *de facto* industry standard
- Comfortable and known environment for designers

**How?**
- Using predefined CAD-blocks
- Using specific layers for lining (rails, streets, etc)
Conversion from CAD to VR

Virtual Terminal

AutoCAD
Conversion from CAD to VR

The AutoCAD drawing is converted to an XML file that contains a description of the whole scene.

Why?
- Complete independent from original CAD drawing
- Human readable and adaptable file

How?
- Custom made plugin is loaded into AutoCAD
- Conversion takes place based on an ontology
Visualizing the future terminal
Visualizing the future terminal

The future terminal is visualized highly detailed using state-of-the-art game rendering technology

Why?
- Realistic imagery of a non-existing terminal
- Possibility to visualize very large sceneries

How?
- Custom made optimized 3D models
- Specialized algorithms to feed the visualization
Supporting the design process
Evaluation

- Evaluation of three aspects:
  - Usability: does the software environment support the user in his task?
  - Usefulness: does the software environment support the organization?
  - Usage: does the software environment provide future possibilities?
Results of the evaluation

Results from the evaluation:
• No major usability issues were identified, users were able to complete their tasks.
• The design team highly valued the high realistic and compelling 3D imagery provided by the VT.
• The VT supports the communication between both internal and external stakeholders.
• The VT contains sufficient details for decision making.
Conclusions

• Visualization to
  • convey knowledge between different people
  • to gain insight into complex multi-actor environments

• Building a software environment presents challenges: we tackled these challenges and presented the results, the Virtual Terminal.

• We have evaluated the Virtual Terminal to understand how to employ it and how it helps the different actors in understanding the problem.