Whitepaper
VR and AR in Logistics
Areas of application – Techniques - Benefits

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Virtual Reality and Augmented Reality in Logistics - Applications

- **Planning**
  - Integration conveyor technology, Layout, architecture
  - Planning order picking systems and procedures

- **Training**
  - Order picking procedures
  - Systems engineering

- **Commissioning**
  - Training beforehand
  - Conveyor technology
  - Hardware-in-the-Loop

- **Process support**
  - Order picking (Pick-by-Vision)

- **Visual Analytics**
  - Logistics systems (e.g. cube analysis)
  - Layout & flow orientation
Logistics planning with VR, AR

Integration layout, architecture
- Integration layout, architecture
- Integrative overall model of building (technology), equipment, logistics areas, transport routes
- Virtual walkthroughs
- Group visits
- Planning air, light, sound reinforcement in simulation models possible
Logistics planning with VR, AR

- Integration conveyor technology
- Scheduling and digital test of geometric-functional models of conveyor technology
- Consideration of material flow simulation systems for flowcharts (for dimensioning buffers, warehouses, surfaces in advance)
Logistics planning with VR, AR

- Planning tool: factory planning desk
- Simultaneous 2D layout (desk) and 3D perspective (wall)
- Cooperative & simple
Logistics planning with VR, AR

- Checking the flow orientation of the layout
- Flows of goods laid over the layout
Logistics planning with VR, AR

Rescheduling
- New warehouses
- New conveyor technology
- New products with old conveyor technology
- One of the questions: absence of collisions?

Four possibilities:
- Very good documentation of all installations and modifications
- Mock-ups, phys. space models
- Laser scans

Laser scan (Source: ScanTec3D)
Logistics planning with VR, AR

Rescheduling
- Possibility 4: Augmented Reality
- Planning new trades into existing structures
- Animation
- Viewing along the interfering edges: check for collision
Logistics planning with VR, AR

Rescheduling - Augmented Reality
- Geometric measuring function possible
Logistics planning with VR, AR

- Augmented Reality – planning and evaluation of workplaces
- Ergonomics
- Reachability analyses
- Planning and evaluation of procedures
- View/ work analyses
Logistics planning with VR, AR

Planning and evaluation of routes and procedures

- Consideration of routes/ distances
- Consideration of removal and storage
- Consideration of IT operation

Source: TU München
Training with VR, AR

- Pre-presentation of the facilities
- Pre-presentation of the operation
- Pre-presentation of repair/ maintenance/ service
- Pre-inspection of operation, workflows
Training with VR, AR

Advantages
- Realistic illustration of complex overall systems
- Intuitive, interactive and psychologically high involvement of the person that is trained → good transfer
- Thereby reduction of training time
- Training without interrupting the real system
- Training and analysis of not yet existing processes
- Presentation of dangerous situations

Problems
- Data preparation
- Investment costs in VR systems
- Benefits difficult to quantify
- Accustoming time

Source: TU München
Commissioning with VR, AR

- Building an integral overall model of factory building model and conveyor technology
- Animation and collision check
- Real control to digital model: Hardware-in-the-Loop
- Placement of sensors and actuators
- Test control and sensors
- Export control code
Process support with VR, AR

Interactive instruction:
- Maintenance
- Repair

Source: Fraunhofer IPA
Process support with VR, AR

Virtual Reality monitoring
- For logistics planning
- E.g. with tablet PC
- Illustration of stocks, ranges, storage periods

Process support with VR, AR

Pick-by-Vision
- In-situ support with Augmented Reality order picking
- Fade-in of instructions, article information, order information, direction and location of items to select

Source: TU München
Process support with VR, AR

- Pick-by-Vision: Illustrations in display

Source: TU München
Visual Analytics

- Visual Analytics as an interdisciplinary topic combines data mining and information visualization
- How can you visualize very large and multidimensional data sets and make them interactively usable for the user?
- Focus: interactive visualization and an intelligent reduction of complexity
Visual Analytics

Visual Analytics tries to support the human cognition in six ways:
1. Expanding cognitive resources: graphical storage complements human memory
2. Reduction of search by displaying a lot of information in a small space
3. Support the formation of patterns (e.g. transformation time → space)
4. Support for easy recognition of relations, which are difficult to establish otherwise
5. By supervising the perception of a large number of possible events
6. Flexible presentation medium, which allows the exploration of a changing parameter space
Visual Analytics - Logistics

Example cube analysis:

- **Axis ABC**: articles by sales
- **Axis XYZ**: articles by regularity of retrieval (XYZ-analysis for material requirements planning, warehouse planning, calculation)
- **Temporal component** (e.g. turnover rate, throughput time, replenishment time)
Visual Analytics - Logistics

Cube analysis:
- Use of the three axes as spatial axes
- Large projection
- Detection of agglomerations, patterns, outliers
- Assignment of articles and groups

Source: Fraunhofer IPA
Visual Analytics - Logistics

- Mapping on factory layout
- Representation of material flows
- Setting in relation to operating materials
- Verification
  - Flow orientation of manufacturing
  - Considering further criteria such as value, regularity, throughput time
Literature VR/AR in Logistics

Thank you very much for your interest!
You are interested in this topic and you are looking for contact persons/ implementation partners? Please contact us.

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