Augmented Reality Gets Deep: The Impact of 3-D and Depth Cameras on Visualization

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About Metaio

- **Founded in 2003**, Metaio is the dedicated AR provider to serve the complete AR value chain
- Extensive Patent & IP Portfolio
- **12 years of experience** in providing AR software and services
- ~80,000 developers on the Metaio AR SDK
- **1000+ B2B customers** worldwide
- **100+ people** working in Germany (HQ) and the USA
IP Portfolio Covering the Primary AR Markets

Trademarks
- Metaio, Junaio, and more are trademarks or registered trademarks of metaio GmbH in Germany and other countries
- Metaio owns a total of 27 registered trademarks in 9 different destinations (e.g. in DE, EP, US, JP and KR)

Patents
- 64 patent families with 134 active patent applications
- Applications cover main AR markets, mainly DE, US, EP, CN and JP
- 41 patents and 2 utility model granted from 23 different patent families
Mission: Always On, Always Augmented

Form Factors (Wearables)

Use Cases (Enterprise)

Enablers (Technology)
## Emerging Use-cases in AR

<table>
<thead>
<tr>
<th>Macro</th>
<th>Micro</th>
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</thead>
<tbody>
<tr>
<td><strong>Outdoor</strong></td>
<td><strong>Indoor</strong></td>
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<tr>
<td><strong>Navigation</strong> (City, Shopping Mall)</td>
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<td><strong>Virtual UI</strong> (home control, device)</td>
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<tr>
<td><strong>Virtual Interaction</strong> (gaming, training, visualizations, visual guidance)</td>
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<td><strong>Virtual fitting</strong> (online shopping, operations, sales, architecture, design, avatar,…)</td>
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<tr>
<td><strong>Virtual Information</strong> (POI in city &amp; buildings, Devices, translation, social net, print media,…)</td>
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metaio product line

**Users**
AR Browser/Apps

**Delivery**
AR Content

**Software**
AR Applications

**Platform**
AR Acceleration
The 2014 IKEA Catalog App

The sequel to the most successful branded app of 2012

Utilizes next-generation SLAM tracking to place and scale furniture in home, easily and conveniently

Influences and educates purchasing decision while driving massive brand awareness

http://www.youtube.com/watch?v=vDNzTasuYEw
Mapping your world using 3D Depth Sensors

3D depth sensing
• Precise measurements of the environment
• 3D model of the physical spaces
• Accurate object scale and shape
• Occlusion handling
• CAD models for 3D printing
• Content generation for the cloud – 3D object recognition, matching, tracking, rendering etc.

Point Cloud processing has a large footprint in terms of memory, power and computation

Absolute need for HW acceleration of key hot spots in the depth sensing pipeline

Images: http://structure.io/; https://matterport.com/
Projective Augmented Reality with Depth Tracking

- Virtual insights on the surface of the actual product
- Multi-user capable and tangible display and user interface
- Fully automatic calibration and registration
- Invariant to illumination, works in the dark

http://www.youtube.com/watch?v=89juuSmH0rQ
Factory Planning

- Remote planning
- Collision check
- Layout planning

- Early detection of planning errors
- Reduces time and costs for planning
3D-depth tracking and reconstruction of face

Accurate depth based tracking and reconstruction
Depth allows for handling extreme pose variations
Augmenting various assets on the face – Virtual Try on
3D Face Recognition
Recent 3D-depth Camera technologies

3D printing technology and 3D cities
Building a 3D model of a brain based on a brain scan
Non-rigid body tracking and reconstruction
Object recognition and tracking

Source: Hao-li.com, pcl.org and http://www.3ders.org/articles/
3D-depth sensing challenges

- To ensure a great user experience applications have to cope with the real-world parameters such as illumination, jitter, scale, rotation, and noise.
  - Fusion of 2D/3D information becomes inevitable.

- HW architectures have to evolve at the same time to provide efficient resources keeping power consumption at an acceptable level.
  - Leading to embedded heterogeneous systems (HMP) with highly specialized HW blocks and dedicated data buses and memory architectures.
  - Complemented by intelligent programming frameworks for scheduling and resource management.

- Combining optimized tracking and reconstruction technologies, with efficient HW IP and easy to use SW development tools to ensure seamless depth based application development on mobile platforms.
AREngine 2

- 24*7 Operation
- Small form factors (wearables)
- Smooth User Experience
- Sophisticated Scenarios
- Lower Power Consumption
  - Algorithm hot spots in HW
- Higher Performance
  - Highly parallel processing
- More Flexibility
  - Free up CPU/GPU