



Design of SmartGate Technologies for Enhanced Material Handling

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AT THE UNIVERSITY OF BREMEN

Michael Lütjen, Michael Teucke, Marc-André Isenberg, Hendrik Thamer,
Claudio Uriarte, Stefan Kunaschk

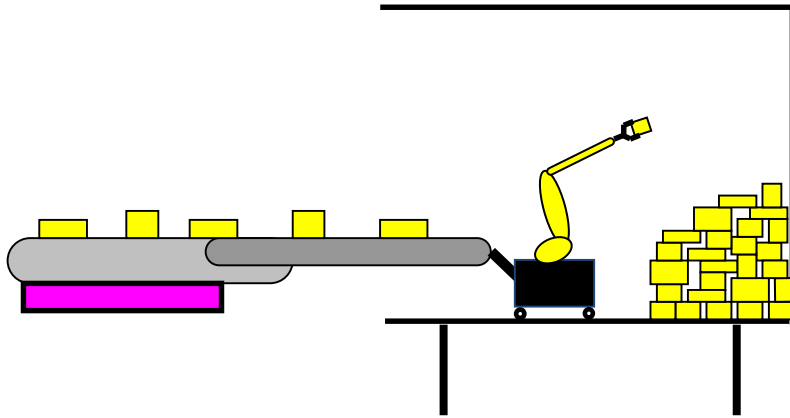


State of the art in cargo handling

- Continuous growth of transported packaged goods
- In Europe, 64% of goods are suitable for automatic cargo handling due to their size, shape and weight *
- Goods can be separated in cubical-, cylindrical-, and sack-shaped
- Manual loading/unloading of containers is still the most popular solution in logistics

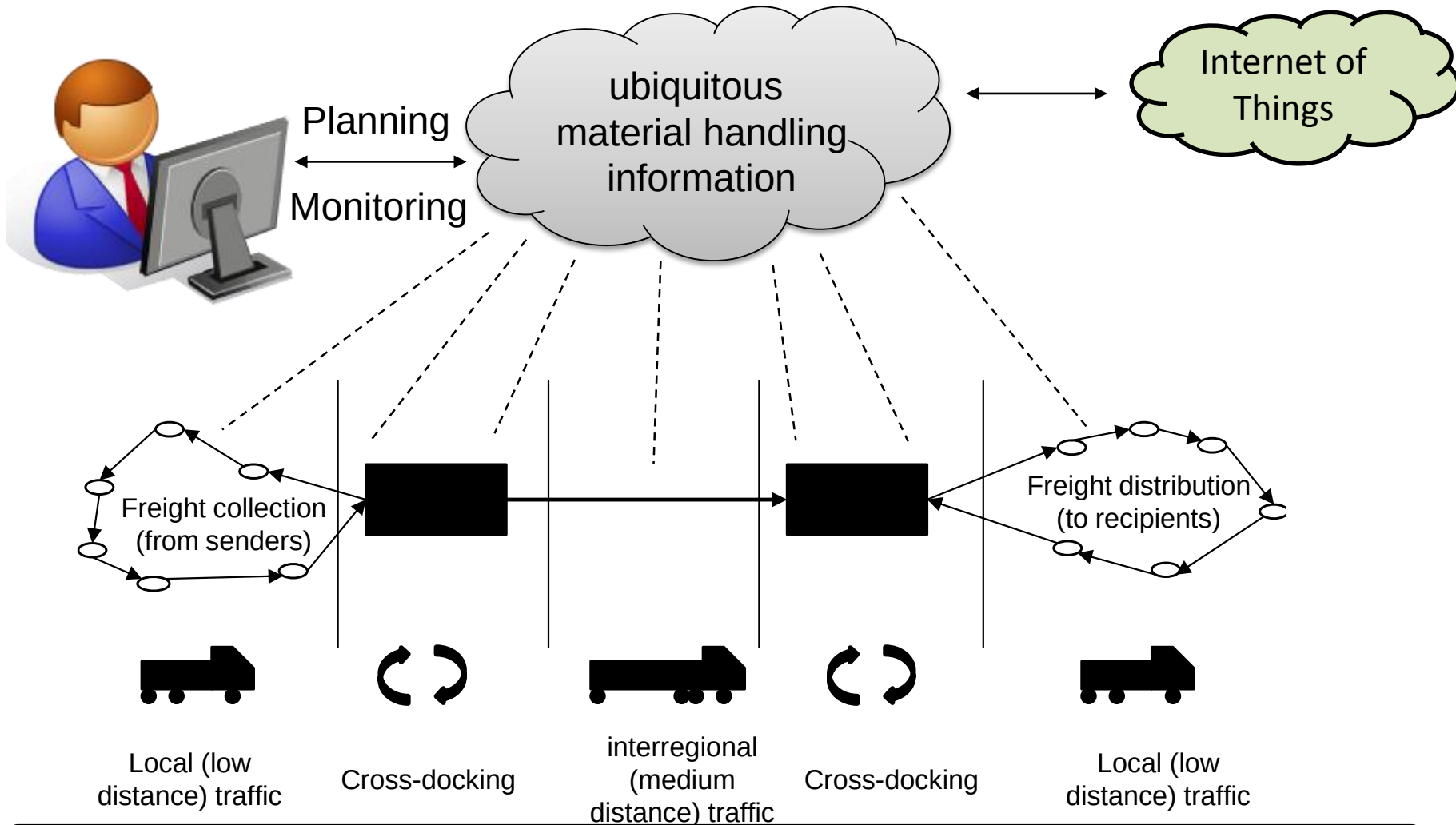


*[Akbiyik, H., Kirchheim, A., Echelmeyer, W. (2009) Latest Trends in the Container Market. Bremer Value Report, Vol. 3. Bremen (Germany)]

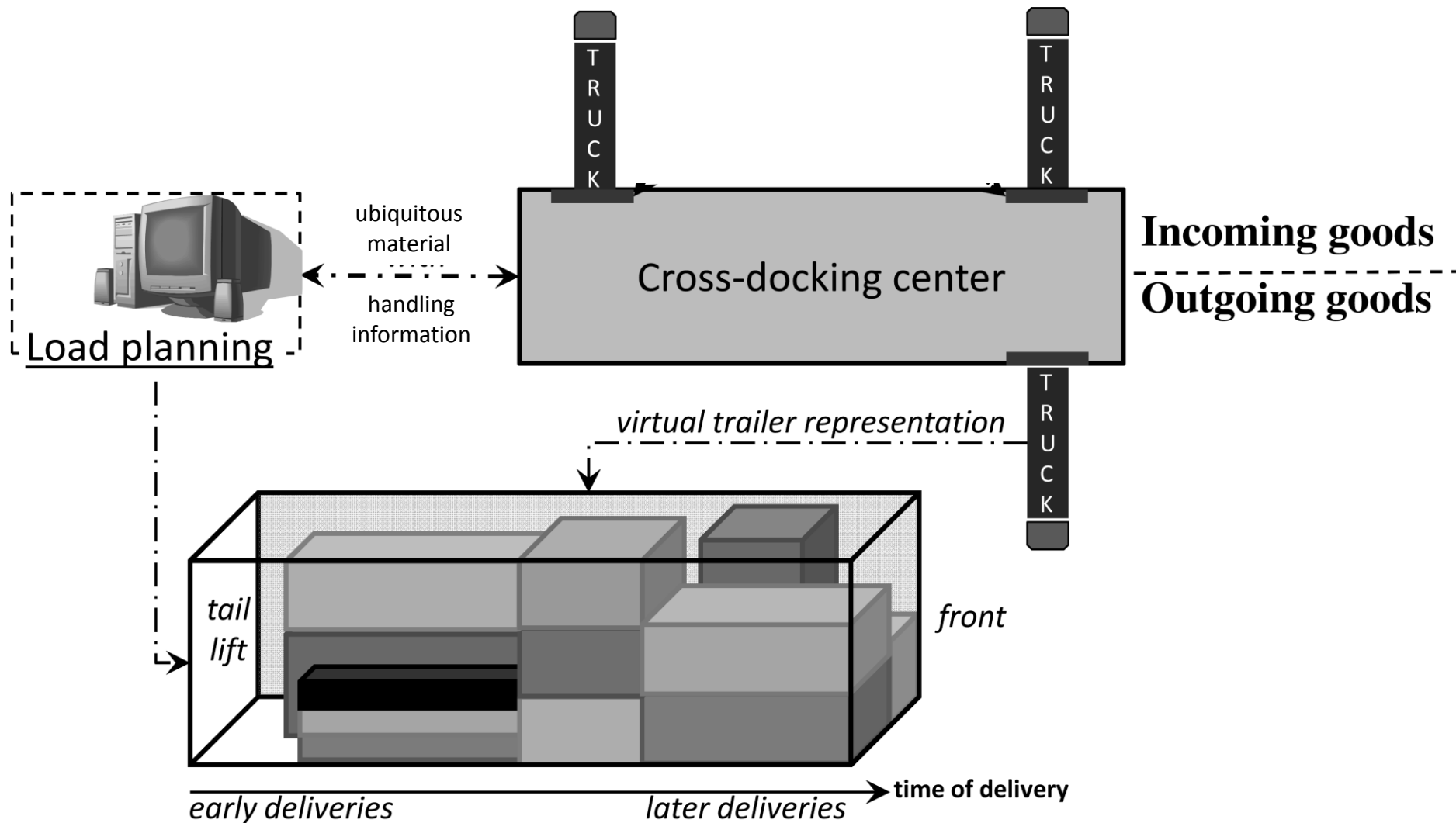


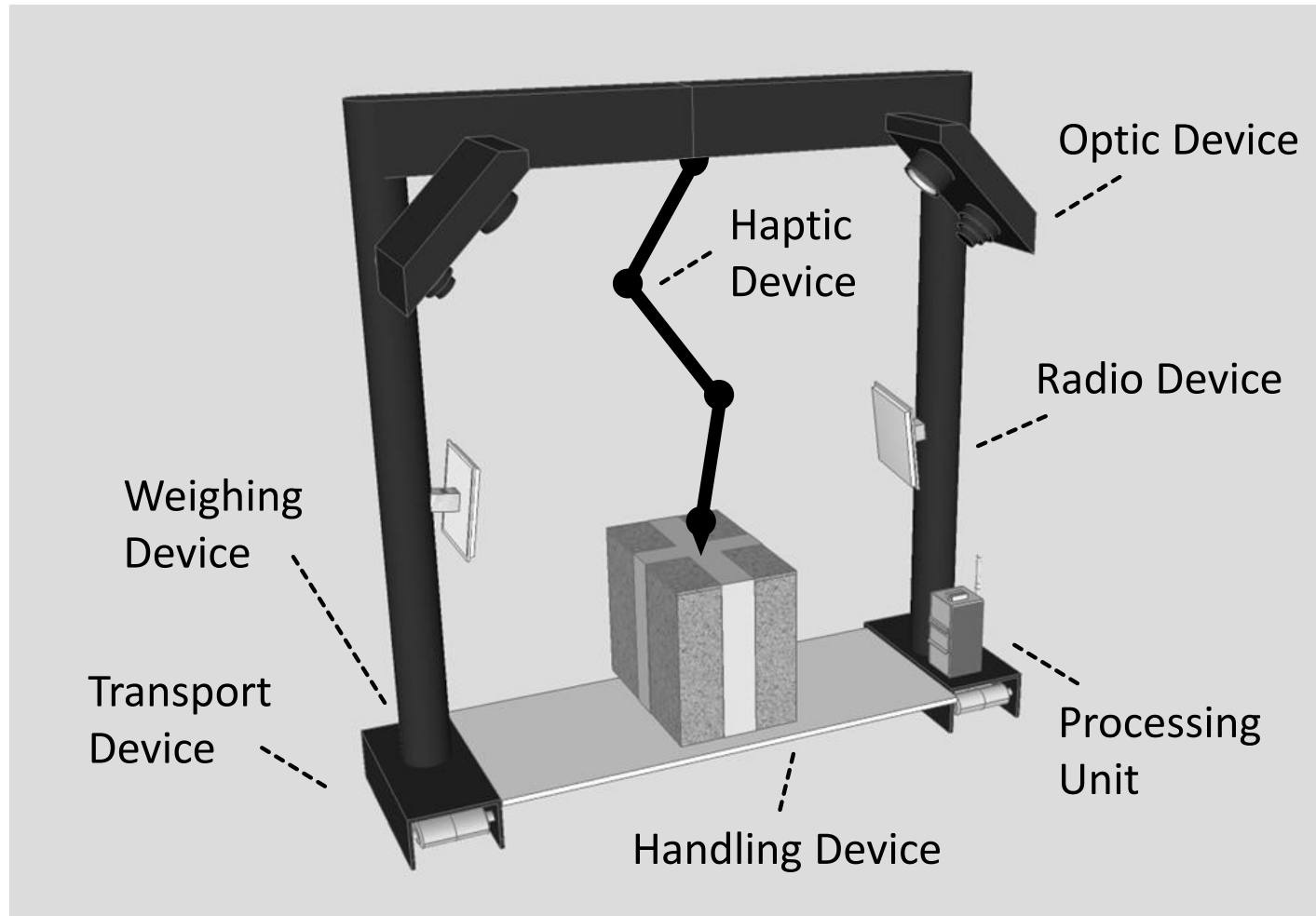
- Robotic system requires material handling information in order to improve the cognition capabilities:
 - size
 - weight
 - hardness
 - position
 - orientation
 - condition
- Computing of ideal gripping positions is very tricky, for
- Ubiquitous material handling information should contain gripping positions defined by sender

Idea of ubiquitous material handling information



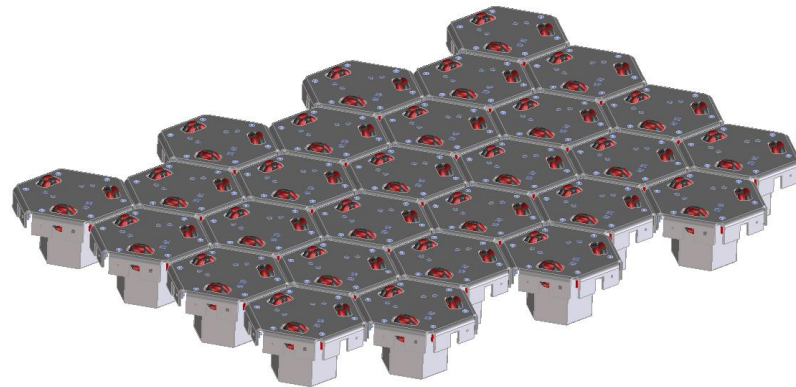
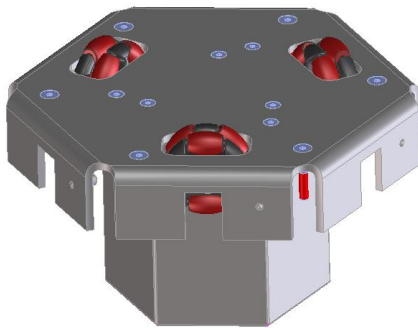
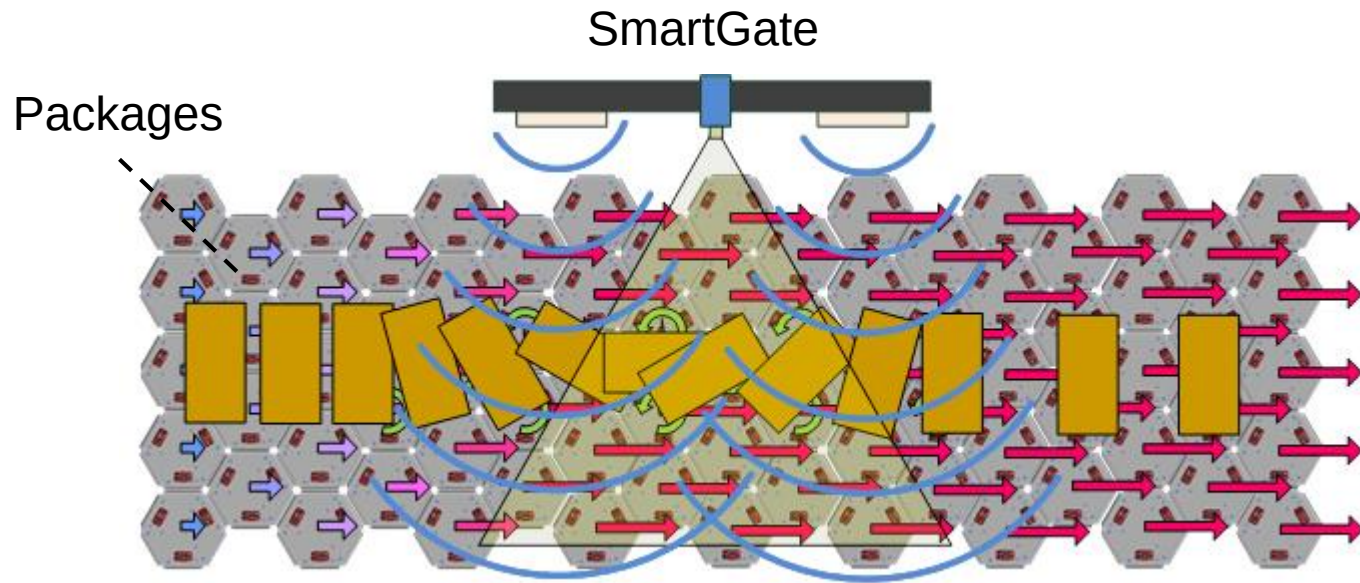
„The use of ubiquitous material handling information will improve cargo shipment“





Material properties and metrology

Knowledge about object	Exploratory procedure
<i>Substance-related properties</i>	
– Texture	– Haptic / Optical device
– Stiffness	– Haptic device
– Temperature	– Haptic / Optical device
– Weight	– Weighing device
<i>Structure-related properties</i>	
– Condition	– Haptic / Optical device
– Volume	– Haptic / Optical device
– Global shape	– Optical device
– Exact shape	– Haptic device
<i>Functional properties</i>	
– Part motion	– Haptic device
– Gripping position	– Haptic / Optical device
<i>Object identification</i>	
– Identification technology	– RFID / Optical device



Volume measurement by 3D sensors

- 3D-Sensors deliver relative distances from sensor to objects
- Several measurement principles
 - Time-of-Flight
 - Structured Light
 - Stereo Vision
- Object recognition for image stitching and complete model creation



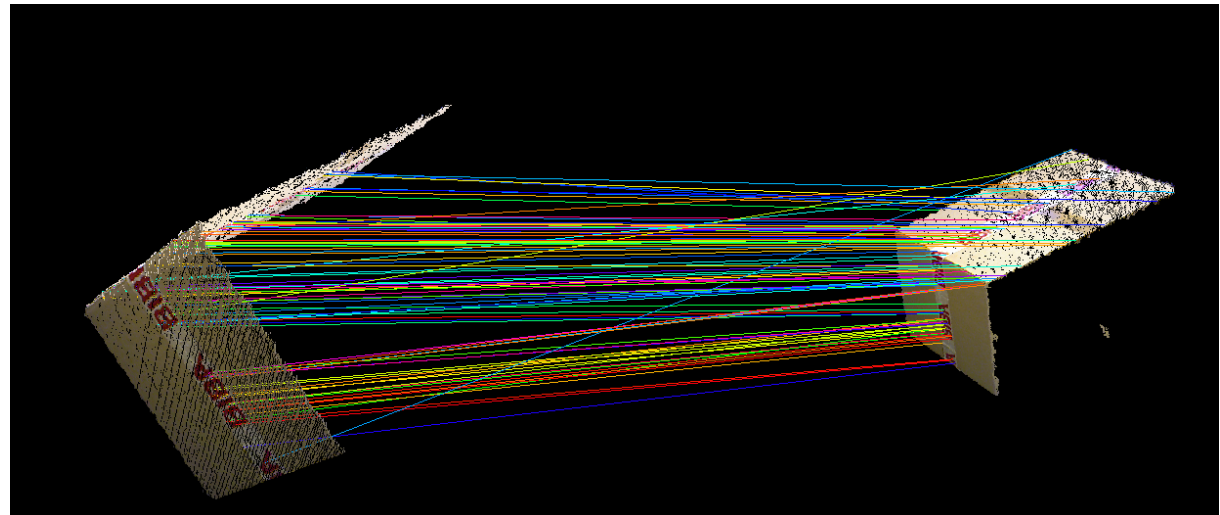
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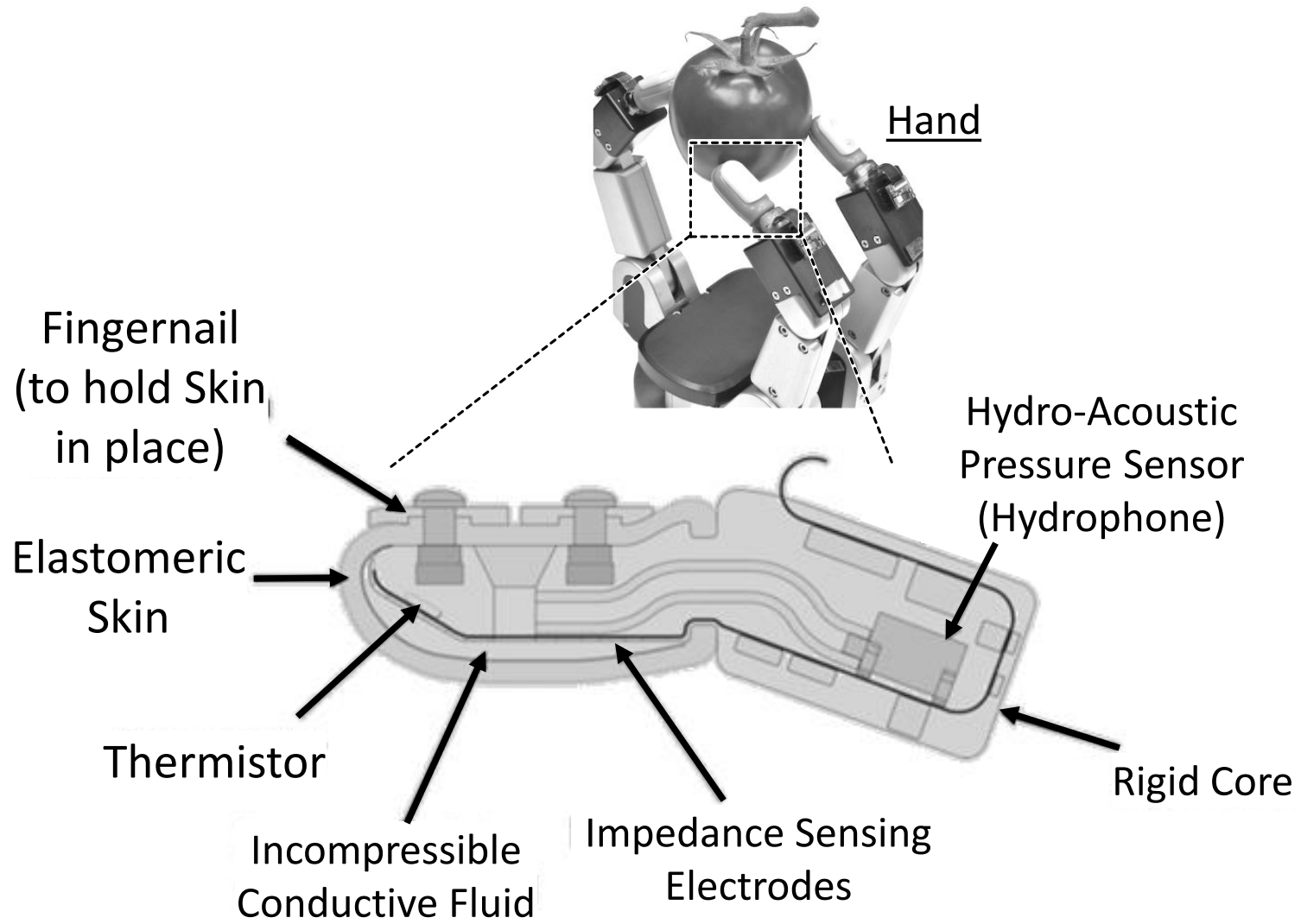


[PMD CamCube 3.0]



[Microsoft Kinect]





Summary and Outlook

- Continuous growth of transported packaged goods
- Ubiquitous material handling information can help to realize automation of logistic process
- Different SmartGate technologies exist in order to gather properties of transport materials and their handling options

Challenges in the future

- Development of integrated demonstrator with application of all SmartGate technologies
- Development of methods for deriving handling information from the measured material properties
- Combination of SmartGate technology and parcel robot in order to realize full automation potential

Thank you for your attention

BIBA - Bremer Institut für Produktion und Logistik GmbH
an der Universität Bremen

Postanschrift: Postfach P.O.B. 33 05 60 · D-28335 Bremen / Germany
Geschäftssitz: Hochschulring 20 · D-28359 Bremen / Germany
USt-ID: DE814890109 · Amtsgericht Bremen HRB 24505 HB
Tel: +49 (0) 421/218-02 · Fax: +49 (0) 421/218-5640
E-Mail: info@biba.uni-bremen.de · Internet: www.biba.uni-bremen.de
Geschäftsführer: Prof.-Dr.-Ing. K.-D. Thoben

Contact details:

Michael Lütjen
Universität Bremen
Hochschulring 20
28359 Bremen, Germany
Phone: +49 421 218 50123
E-Mail: LTJ@biba.uni-bremen.de

