



## Transfer project 'Intelligent Container'

Report for CCA Workshop, May 8th, Bonn

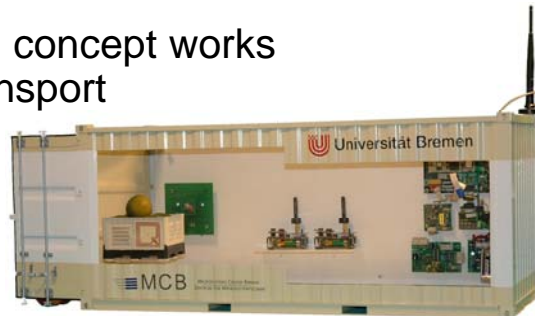
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## Definition of the intelligent container

- Monitoring of temperature
  - Main impact factor on quality
  - Additional sensors for humidity, air flow and gas
- Multiple sensors per truck or container
  - Spatial temperature supervision
  - Sensors at the walls or inside palettes / boxes
- Automated evaluation of temperature data
  - Warning on impending quality losses
  - Prediction of remaining shelf life
- RFID reader at container door (Option)
  - The scanning of incoming goods
  - Automated adaptation to different kind of goods

## Project Goals 1

- Prove that the concept works under real-transport conditions
- Project time
  - 2 years
  - 2008 + 2009
- Field tests
  - Starting in autumn 2008



## Partner companies

- Two institutes of the University Bremen (Electrical Engineering)

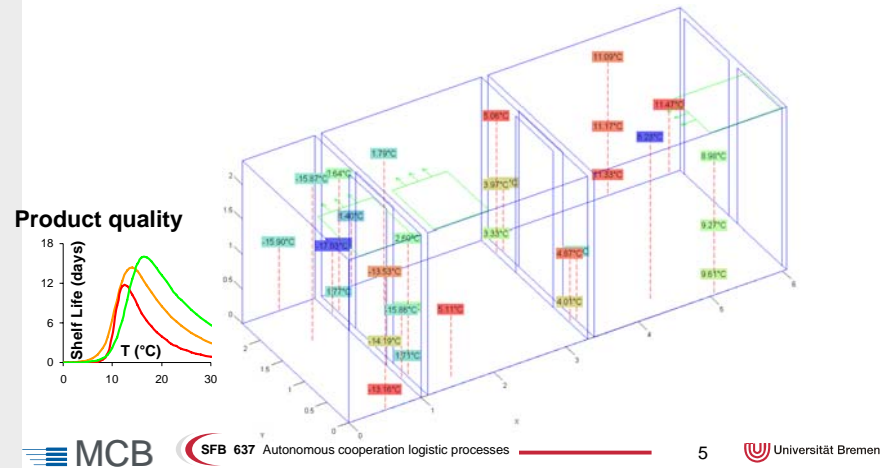


- Cooperation with four industrial partners



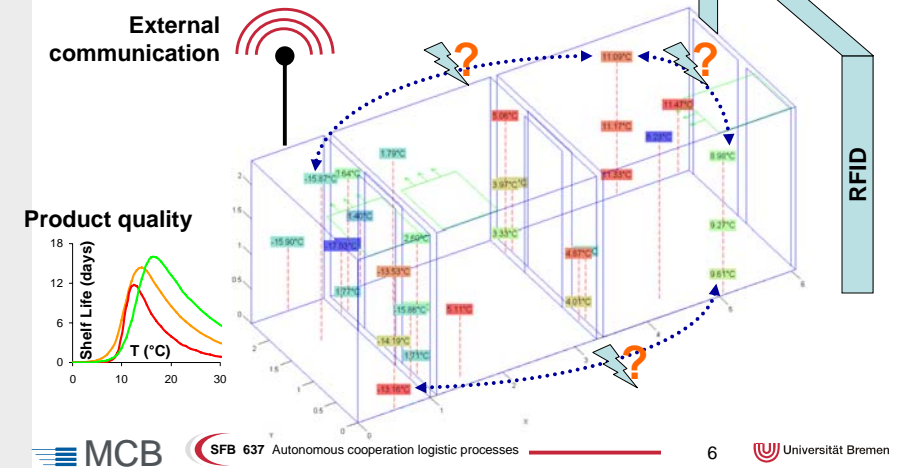
## Project Goals 2

- Collect data about temperature deviations and quality

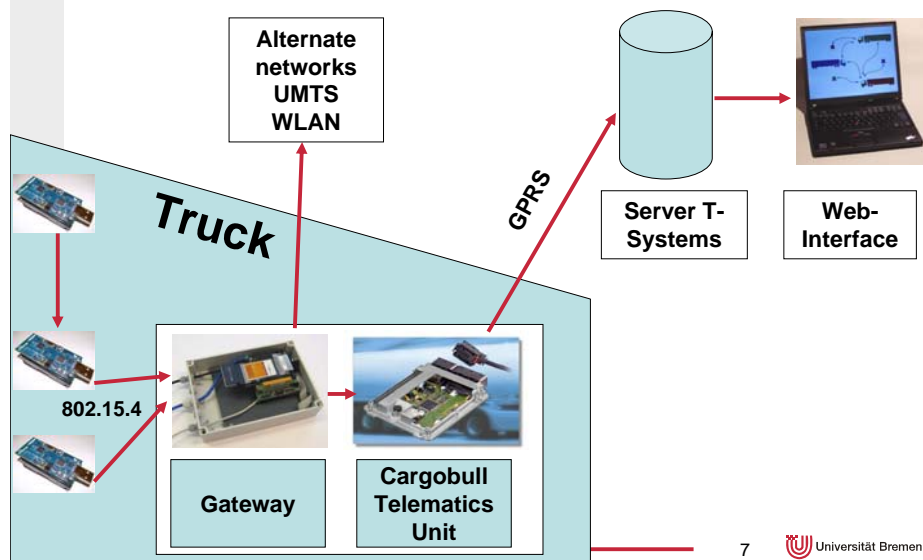


## Project Goals 3

- Collect data about RFID, wireless sensor and external connectivity



## Hardware for road transports



## Web-Interface

The screenshot shows the 'Statusanzeige' (Status Overview) page of the Cargobull Telematics system. It displays a table of vehicle status data for a specific date and time.

Start	Position	Status	Status EBS	Temperatur	Kühlaggregat	Kühlaggregat erw.
14.04.08 18:35	11.04.08 10:02	Entfernung (km) 4,6	auf	22,4	Setpoint 1 (°C)	Setpoint 2 (°C)
	Richtung ONO			22,4	Kühlaggregat	Setpoint 3 (°C)
	Nächste Stadt Bremen, Germany				Abtauzyklus	Betrieb elektrisch (h)
	Positionszeit 11.04.08 10:02		12,4		Status	Betrieb Diesel (h)

- GPS position
- Currently only 2 sensors
  - Spatial supervision
  - Only quality warnings instead of continuous temperature data

## Installation in test truck



CTU



Link to reefer control  
(Data acquisition system)

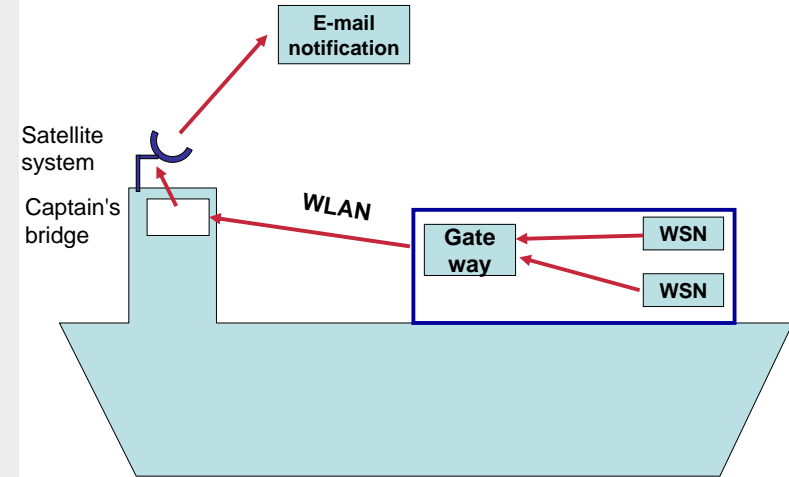


Wireless sensors

Gateway



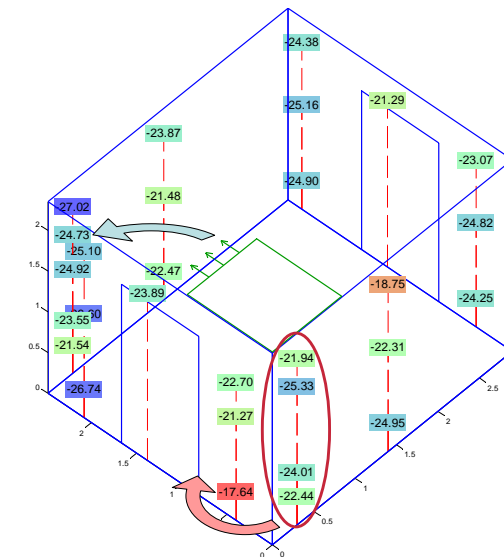
## Hardware for sea transports



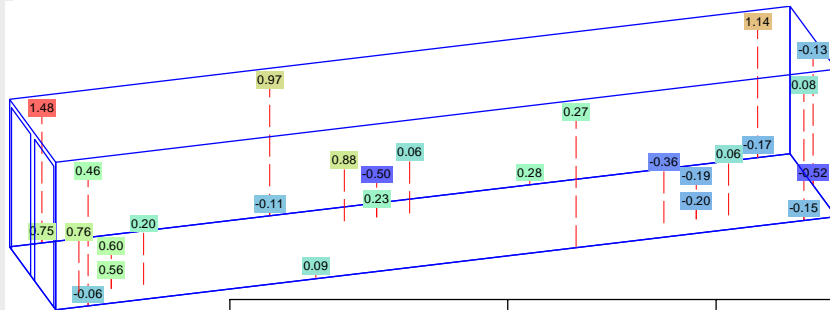
## First results

- Update on measurements from last year
  - Delivery trucks
  - Sea Containers
- Reading range of wireless sensors
- RFID data transfer rate

## Deep freezer after 5 hours cool down



## Measurements in sea containers

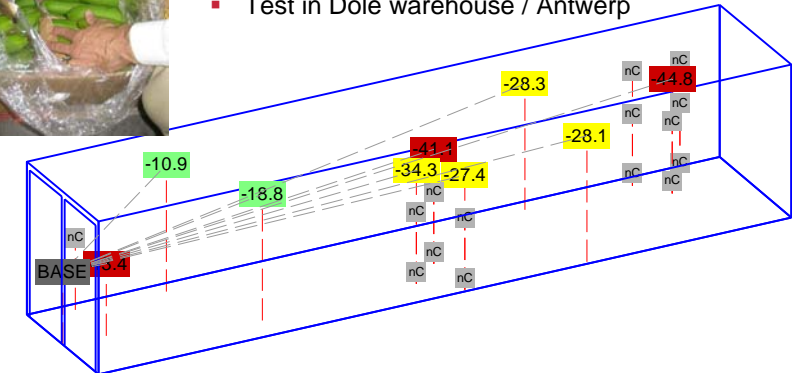


Route	Set point	Deviation
Bremen – Nigeria	-18 °C	5 °C
Chile – England	0 °C	1.8 °C
Hong Kong – Bremen	Non chilled	2.6 °C

## Reading range of wireless sensors



- Container with Bananas was equipped with wireless sensors
- Base station could only 1/3 of all sensors RSSI Received signal strength indicator
- Multi hop protocol required to access all sensor nodes
- Test in Dole warehouse / Antwerp



## The application of UHF RFID

- Just identification
  - Knowing what has been loaded and where your goods are
- Link to sensor system
  - Configuration: The sensors automatically adapt to the kind of good (temperature thresholds, type of shelf life model)
- Writing back data to the tag
  - Write a corrected expiration date to the tag at the end of transport (recalculated according to actual transport conditions)
- RFID temperature loggers
  - Future UHF loggers and shelf life tag

## Test of RFID range and data transfer rate

- Test at pallette wrapper

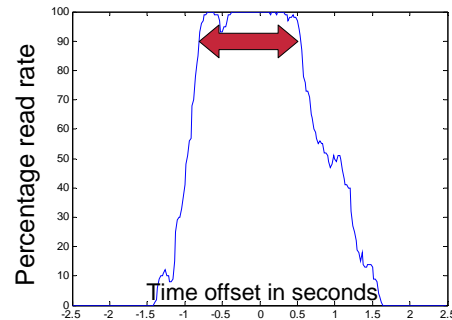
3 RFID Antennas

10 RFID Tags



## Tests results

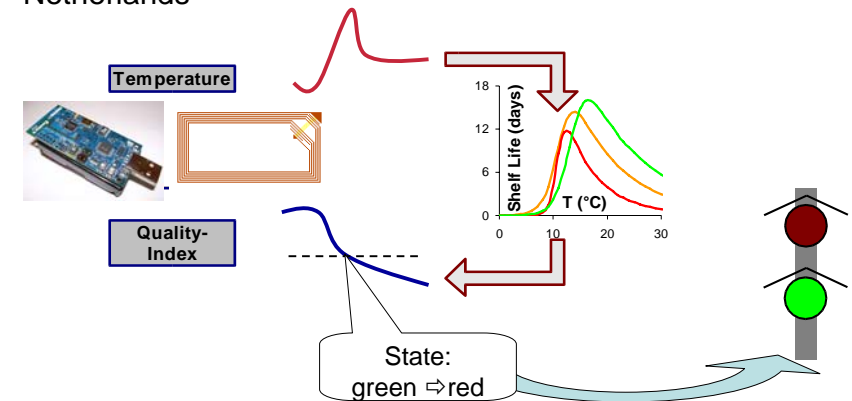
- UHF has a low penetration into moisture containing goods → Access only to tags at surface
- Time window for access at 10 rotations per minute (0.6 m/s) → 1.3 seconds



- Each tag could be identified at least 29 times per turn → uncritical
- But reading and writing data is time critical
- Reading 700 temperature values (predicted) → 0.175 seconds
- Writing 28 byte user memory (quality index + transport info) → 0.2 seconds

## Smart active tags / shelf life calculation by wireless sensors

- Integration of a shelf life model into a sensor node
- Avoid communication bottle neck
- Planned cooperation with Ambient Systems, Netherlands



## The End

Thanks for your attention  
[www.intelligentcontainer.com](http://www.intelligentcontainer.com)

Contact address

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