Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: Applications for Ranging
Date Submitted: January 20, 2014
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Re: [Response to Call for Applications]

Purpose: [To present the application for ranging technologies]

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Ranging/Location - Observations

- **Many Applications for Wireless Networks for Sensing and Control deploy hundreds and more nodes in a network**

- **Sooner or later many customer realized that they need to locate Wireless Nodes just for network setup, service and maintenance; otherwise cost of support and maintenance alone went up so high that business cases could not be realized anymore**

- **Additional Motivation through specific applications requiring**

  - Distance measurements

  - Locate objects in stationary scenarios

  - Track Objects

- **Significant Overlap with Active RFID Applications**

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Anti-theft

Production Control

Cold Chain

Access Control

Public Transport

Logistics

Combine **IEEE802.15.4** Technology and **Ranging/Localization** in one solution

Animal Tagging

Payment

eGovernment

Anti-counterfeiting

Libraries

Medical/Health Care

There is a lot of need to **Find** and **Track** People and Items ...

... in case of emergency:
  - inform medical personal
  - find critical patients
  - find critical equipment
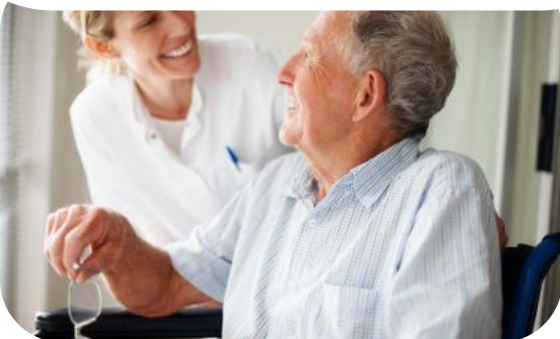
... in Hazardous Situations:
  - find tracks of infections
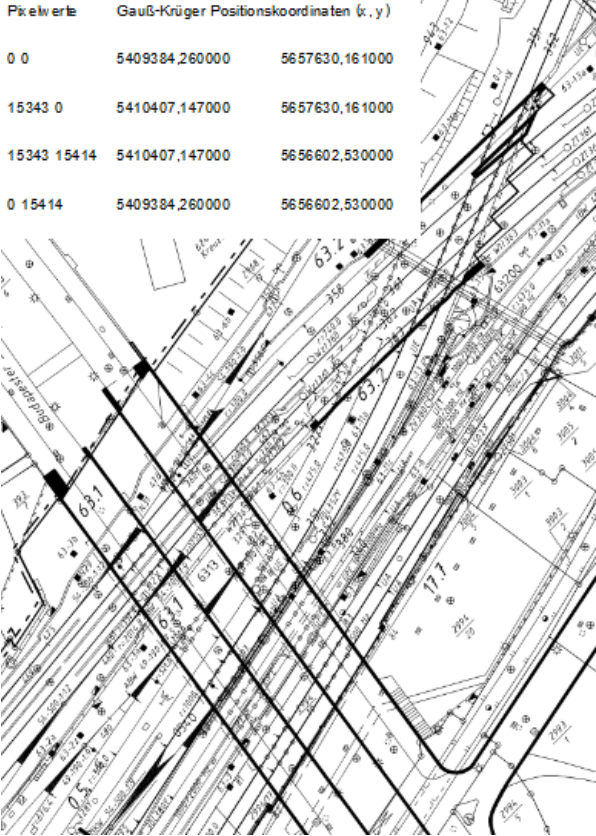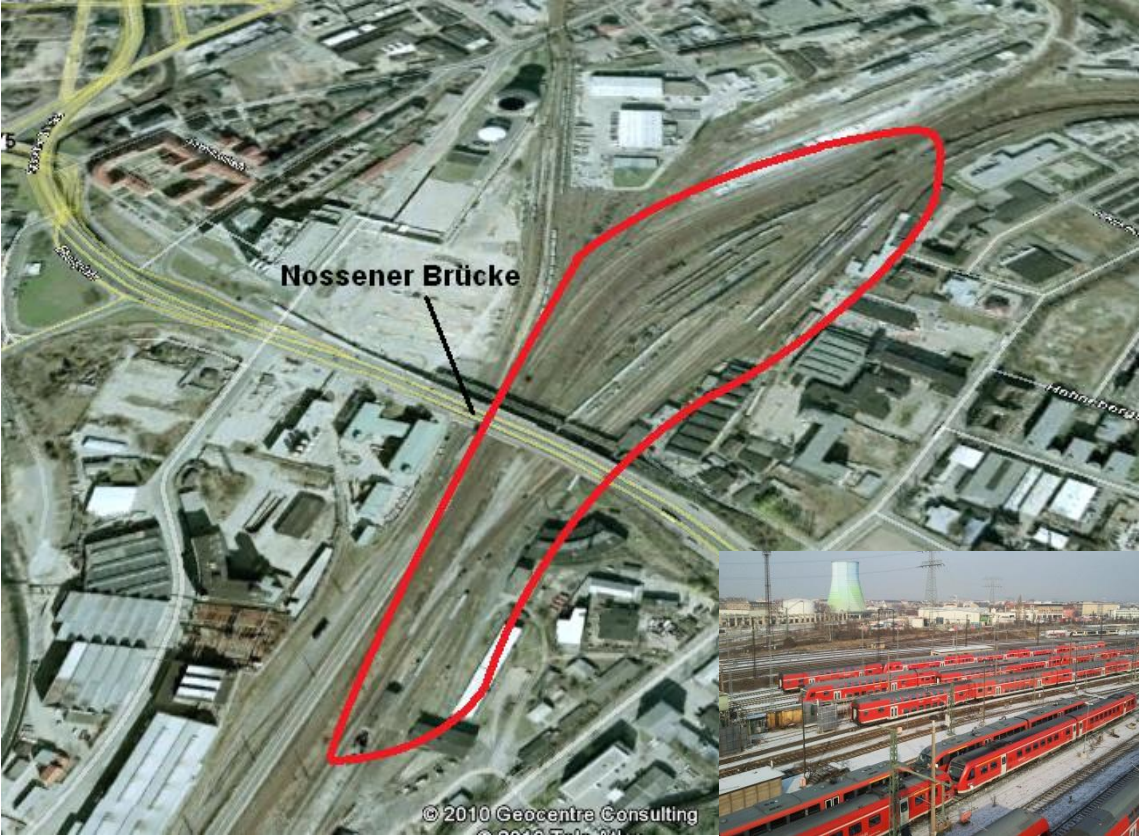
... and their Prevention:
  - track patients, personal and even visitors

... in daily operation:
 - enforce hygiene standards
  - improve maintenance cycles

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Localization of Engines and waggons in railway logistiks

Pixelwerte	Gauß-Krüger Positionskoordinaten (x , y)	
0 0	5409384,260000	5657630,161000
15343 0	5410407,147000	5657630,161000
15343 15414	5410407,147000	5656602,530000
0 15414	5409384,260000	5656602,530000

Digital Rail Plan

Courtesy of Prof. Oliver Micher,
TUD, Chair for Information Technology in Public and Private Traffic

Fixed Anchor Nodes

Mobile Nodes

Courtesy of Prof. Oliver Micher,
TUD, Chair for Information Technology in Public and Private Traffic

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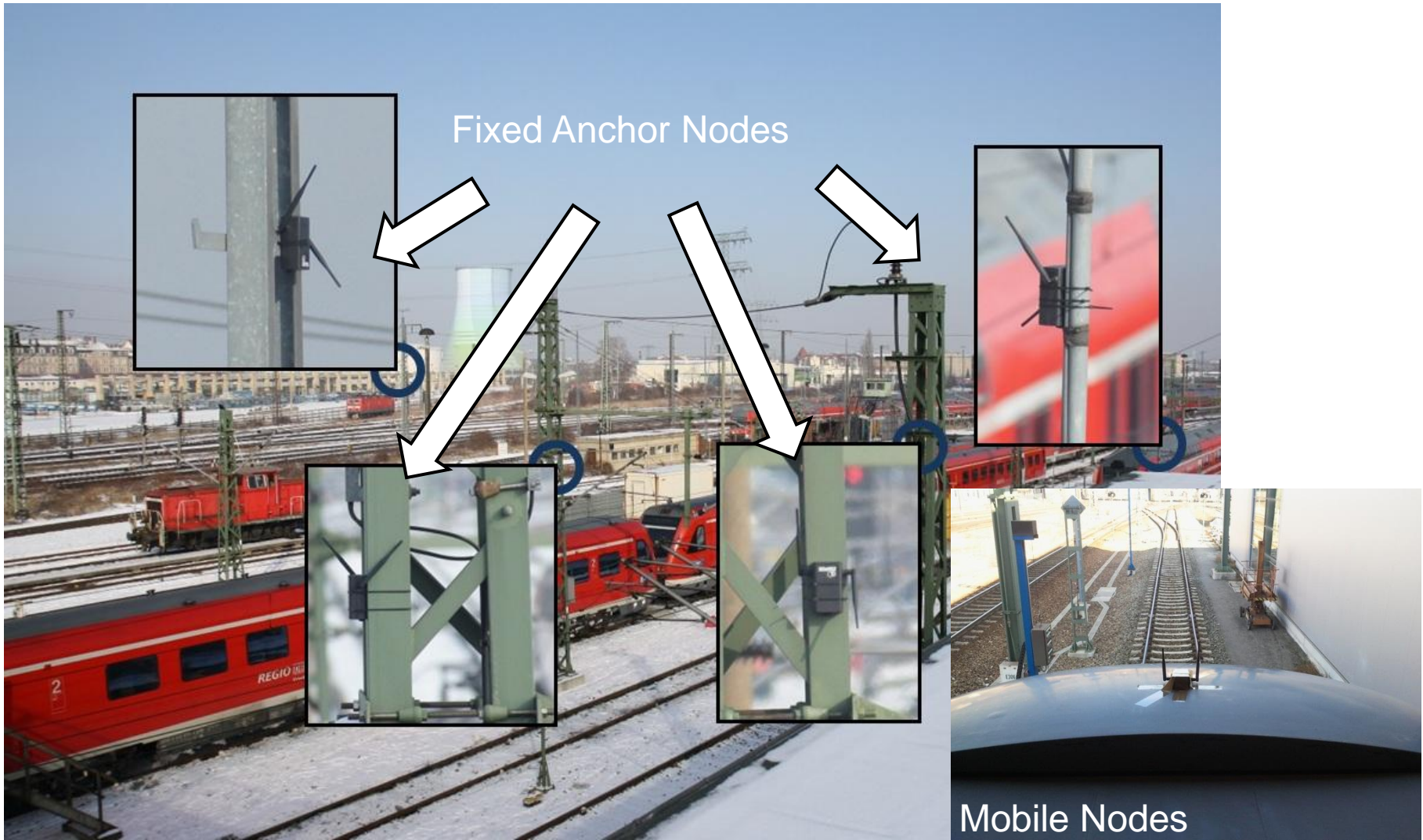
Use Case Examples

- a retailer needs to determine the proximity of a shopper to specific points/displays (+/- 1 meter) and then send the appropriate data

- a medical environment needs to determine the proximity of a staff person to a desired item (+/-1 meter) and inform that staff as to specific data for that item

- lighting control networks need to determine the range of devices (+/- 0.25 meter) to facilitate binding for control, e.g. a specific switch to a specific light fixture

- TV whitespace networks require location awareness via accurate ranging (+/- 50 meters) from multiple devices to determine available frequency bands

- Railroad services desire the ability for a locomotive to determine the distance to various devices for identification on the train and between the train and the environment

- …

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Why a new project?

Support for interoperability (Today)

- Large portions of the ranging today is defined in an informative annex, which defers the actual implementation to the application layer

- Many gaps in terms of distribution of system impairments to enable independent interoperable solutions, which guarantee minimum performance requirements (e.g. crystal offset, filter variations,…)

Scalable system characteristics (Need)

- Need extensible characteristics (Range, Resolution, Acquisition Speed)

- Leverage a combination of parameters (Signal Strength, Phase, Time,….)

- Use available frequency bands (narrow band, wide band approaches, multi-band approach) in compliance with local regulatory requirements

- Various different distributions of complexity to achieve low power (tradeoffs between infrastructure devices and mobile objects; unidirectional, bi-directional, blink and network time)

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Summary

- Location Awareness becomes a more and more essential characteristic for:
    - distributed sensing and control and
    - wireless systems in general
- There are many application requiring location services which have significant market potential attached
                (Don't forget the IoT ☺)
- Interoperability of independent solutions enables joint investments and so faster growth of potential markets
- A standard is needed to support interoperability

802.15.4 today:
Low Power Wireless Networks

802.15.4 tomorrow:
Location Aware
Low Power Wireless Networks