

# Wireless Locating and Data Communication in Harsh Industrial Environments

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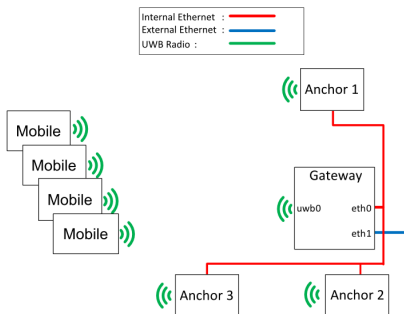
## Introduction

### Target application: Tracking mobile entities on the shop floor

- ▶ Automated guided vehicles (AGV)
- ▶ Products and other assets

### Components of proposed system

1. Fixed position anchors nodes
2. Self-locating mobile sensor nodes
3. Gateway node to plant network



# Communication and Locating in 3D-Space

## Communication using UWB radio

- ▶ Short pulses over a wide band of frequencies instead of modulated carrier wave
- ▶ High resolution time of flight ranging and data communication performed by the same hardware.

## Locating with multilateration

- ▶ Distances measurements to known fixed anchor points allow estimation of own position in space (*three dimensional ranging*)

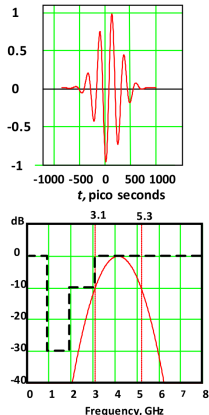


Figure : UWB pulse in time domain and frequency domain

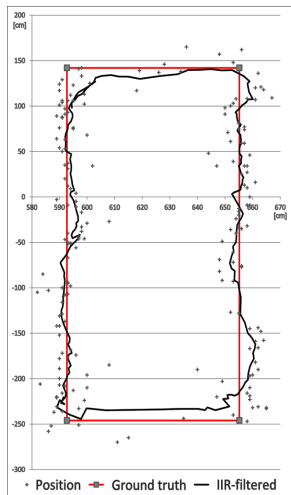
## Experiments and Results

### Evaluation test setup

- ▶ Tracking of a mobile node's position on a conveyor belt system with a length of 950 cm
- ▶ Mobile node calculates it's position four times per second

### Evaluation test results

- ▶ Unfiltered calculated position has a standard deviation of about 20 cm
- ▶ Low-pass IIR-filtered position has a deviation .5m or less from true path



## Conclusion

### The proposed design has been proven to work

- ▶ Tracking of a mobile node is possible with an accuracy of 0.5 m
- ▶ Communication and locating in an industrial environment can be performed using one piece hardware

### Further development

- ▶ Improve postprocessing with *Kalman filter*
- ▶ Employ higher level communication protocols for mobile node network
- ▶ Optimize placement of anchor nodes to increase accuracy

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## Prototype

### Mobile node components

- ▶ Time Domain P400 RCM UWB radio transceiver
- ▶ ARM Cortex M3 microcontroller
- ▶ Integrated sensor module

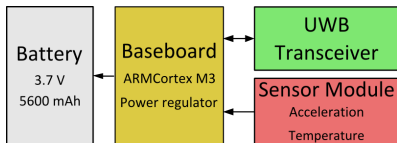


Figure : Block diagram of mobile node



Figure : Prototypical implementation