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 its 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