



UWB Real-Time Location Systems in Factory Automation - Examples from the Automotive Industry

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Agenda

UWB RTLS (real-time locating system) – the Ubisense implementation

Example – Process Tracking - cars are tracked through the rework-process to speed up delivery and avoid unnecessary build up of stock

Example – Controlling Torque Tools – controlling the tightenings on a car is mandatory, identifying the individual vehicle to store tightening data correctly has been a manual and error prone process.

Ubisense RTLS using UWB

- based on ultra-wideband 6-8.5GHz (ETSI EN 302500-1)

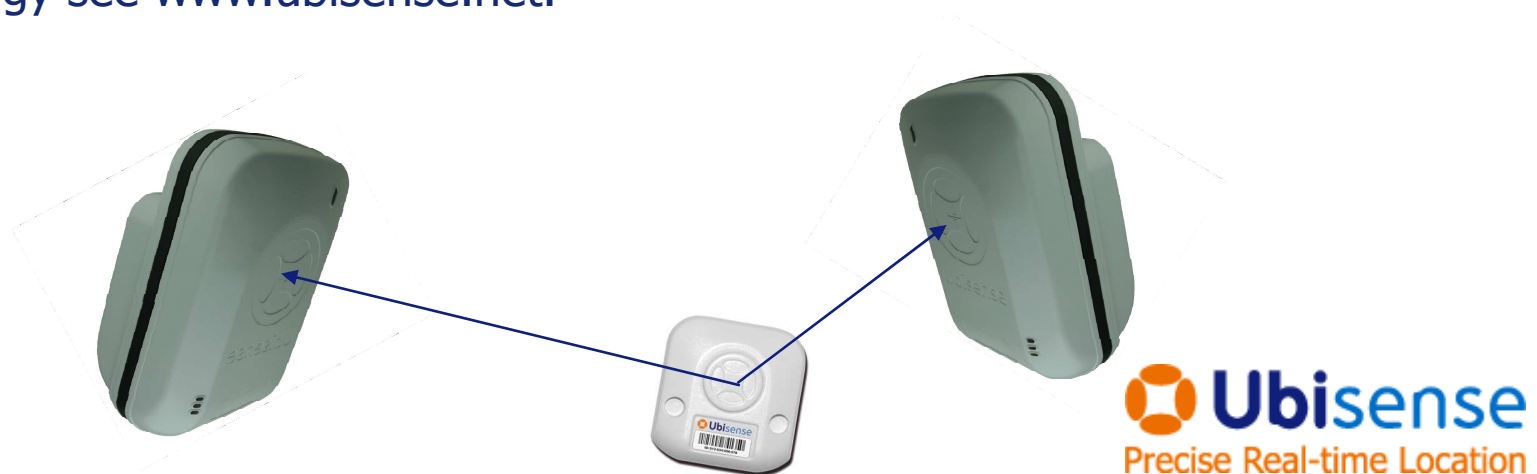


Transponder Frequencies

LF		HF		VHF	UHF			UWB	
125	134	8.2	13.56	433	868	915	2.45	3.4 - 4.8	6-8.5
kHz	kHz	MHz	MHz	MHz	MHz	MHz	GHz	GHz	GHz

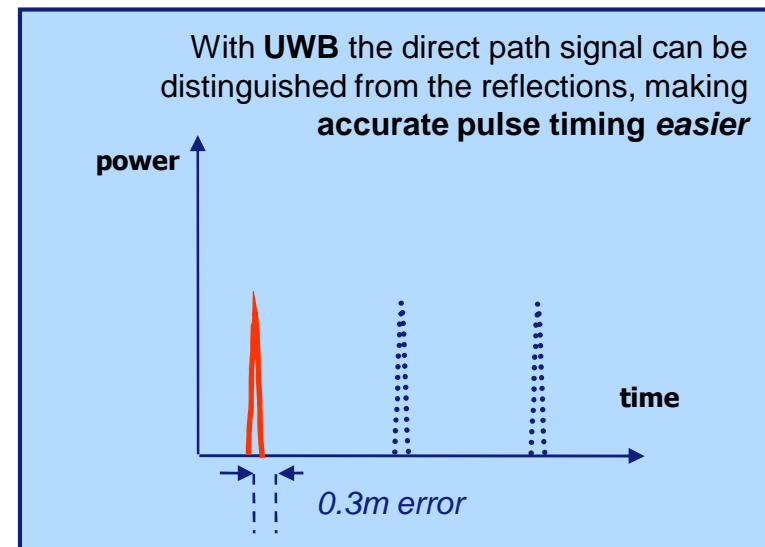
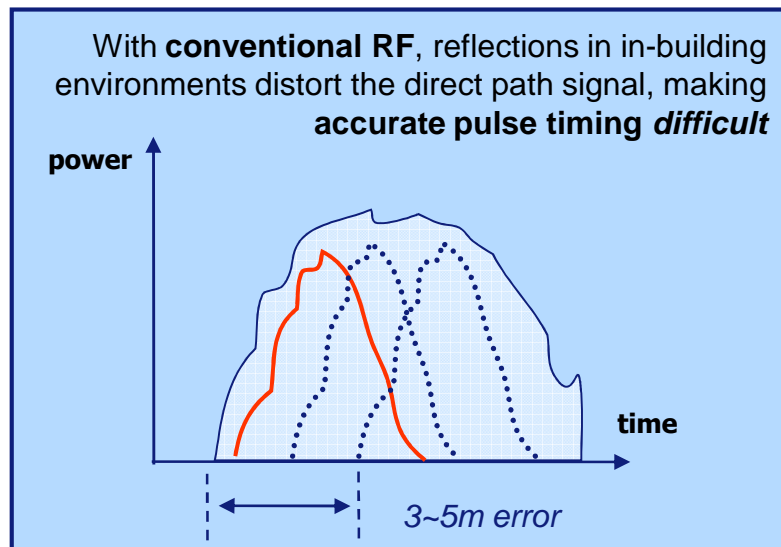
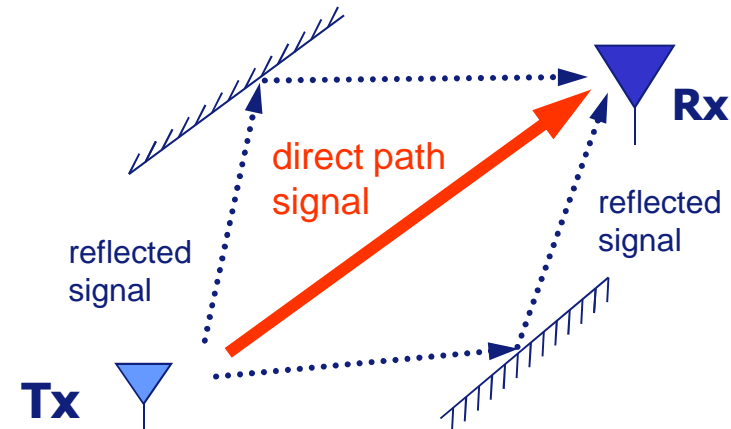
www.ubisense.net

- Sensor infrastructure locates small, active transponders ('Tags') - scalable, reliable, accurate and in real-time. Technology see www.ubisense.net.

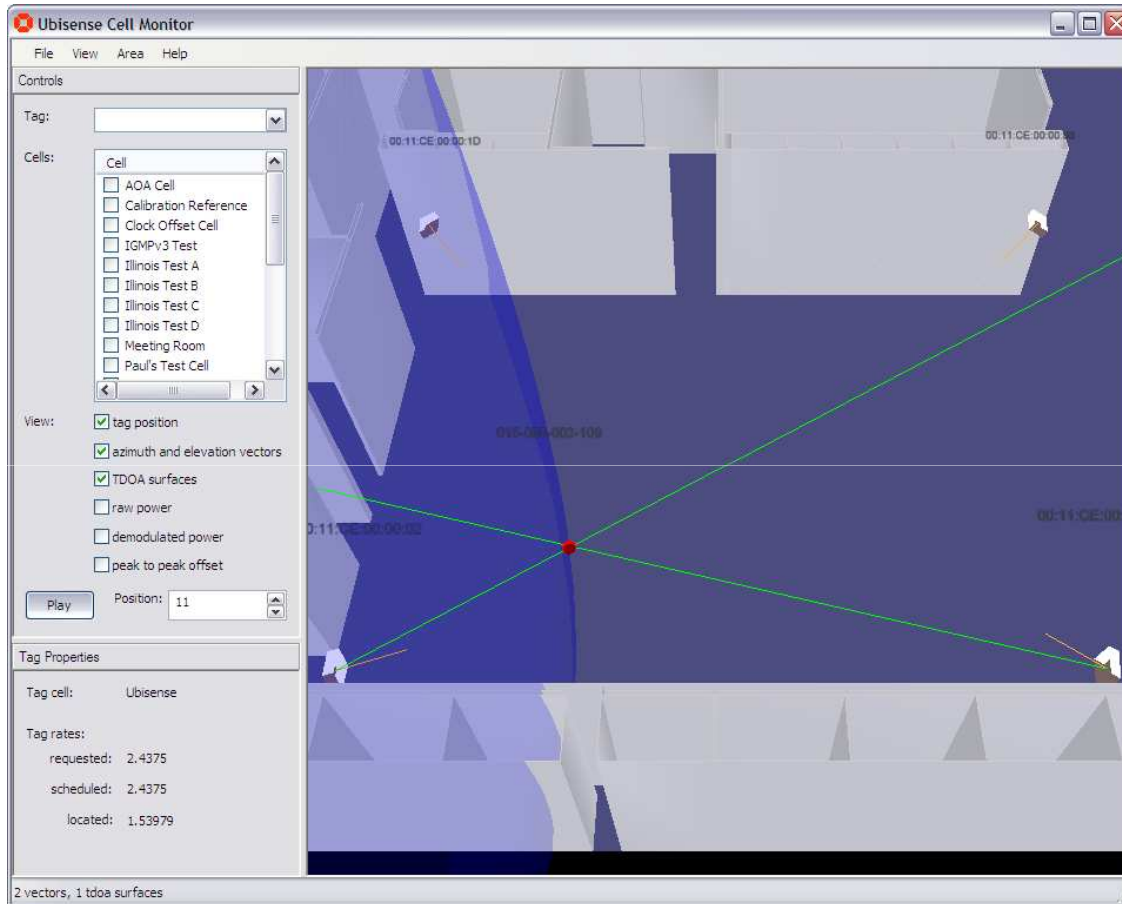


UWB Location in Indoor Environments

- Determining location with radio is done by measuring the path from transmitter to receiver
- Only the direct path signal determines the true location, reflections are errors



2 Sensors provide a precise 3D location



- the system requires only two sensors to provide a precise 3D position
- AOA vectors drawn in green from each sensor
- TDOA curve drawn in blue
- Intersection marks tag position
- Tag position can be calculated from any two pieces of information e.g. TDOA and one AOA; or two AOA's
- More measurements fed into position calculation provide greater confidence of the accuracy

'Process Tracking' - Example



Asset	Step	Text	Level	Time	Ack
01213318	Headlight Alignment	asset taking a long time in process step	1	10/09/2007 10:01:41	<input checked="" type="checkbox"/>
01213318	Rolling Test	asset taking a long time in process step	1	10/09/2007 10:01:41	<input checked="" type="checkbox"/>
01213318	Fine Paint Inspection	asset stuck in process step	2	14/09/2007 14:18:25	<input type="checkbox"/>
01213319	Waiting Area 1	asset stuck in process step	2	14/09/2007 14:18:25	<input type="checkbox"/>
01213320	Fine Paint Inspection	missing required process step	2	10/09/2007 10:10:09	<input checked="" type="checkbox"/>
01213320	Waiting Area 1	asset stuck in process step	2	14/09/2007 14:18:25	<input type="checkbox"/>

Ubisense Process Tracker

Map View Alerts View



Problem

As cars come off-line into finish and rework areas, they can become 'stuck' for a considerable amount of time, creating unnecessary build up of inventory.

The Ubisense solution

The RTLS network tracks the vehicles as they come 'off-line' and move through specific process stages (rolling road, wheel alignment, paint inspection, etc.). Defined rules specify process order and dwell time thresholds (time spent in given stage). Exceptions trigger alerts visible to shop-floor operators and reported on intranet.

Result

Time reduction off the line and throughput improvement as cars are always visible through the finish and rework process.



'Process Tracking' - Example

The screenshot displays the 'Process Tracker' application interface within a Mozilla Firefox browser window. The browser's address bar shows the URL `http://localhost:85/processtracker/`. The application interface is divided into several sections:

- Top Navigation:** Includes 'Steps View', 'Alerts View', and 'Map View' buttons.
- Search and Filter Panel (Left):** Contains input fields for 'Build No:', 'Process Step:', 'Alert:', 'VIN:', 'ModelYear:', 'Series:', 'Colour:', 'Trim1:', and 'Country:'. A 'Clear Query' button is located below these fields.
- Main Map Area:** Displays a floor plan with several regions highlighted in green. Labeled regions include 'Off-line Tunnel Entry', 'Audit', 'CAL Bays', 'Wheel Alignment', 'Headlamp Alignment', 'Rolling Road', 'Undertray', 'V12 TIP Bays', 'Electrical Rectification', 'Road Test Rectification', and 'Pre-CAL Exit'. A 'Layers' control at the bottom right of the map area shows checkboxes for 'Map', 'Regions', and 'Tracked', all of which are checked.
- Bottom Section:** A duplicate of the search and filter panel is visible, with a status message 'Transferring data from localhost...' above it.

...beyond 'Process Tracking'

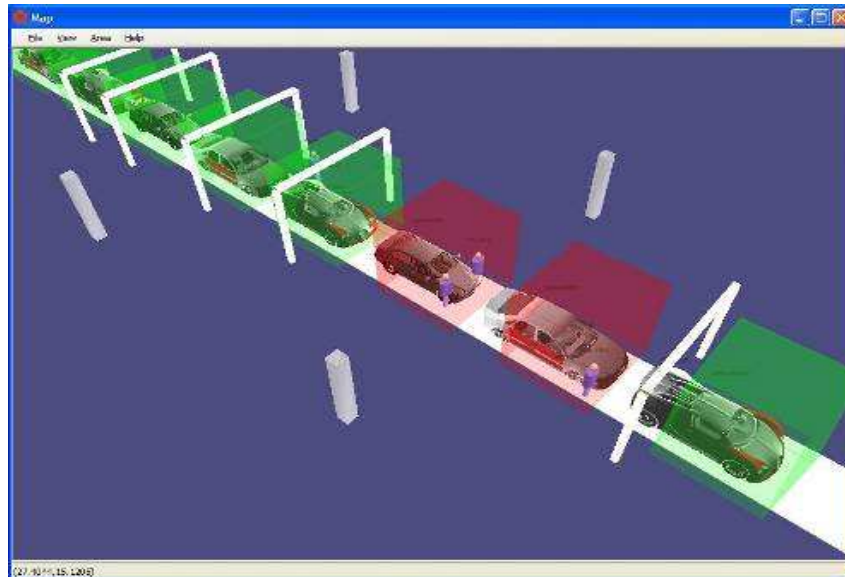
„CMEP has reduced the number of hours spent locating out-of-process engines from 11.25 hours to 30 minutes per week using Ubisense.“

TOM NIELSEN, Project Manager, Cummins Columbus Midrange Engine Plant

Location Systems which are **integrated** into automation and **process-control** provide an even **higher added value**.



'Process Control' - Example



Problem

Cars on the production line are manually scanned for ID. Production Management System returns task list with tool program steps which are uploaded to the torque tool.

The Ubisense solution

The RTLS network tracks both vehicles and tools enabling the Spatial Platform to detect when the tool is brought close to the vehicle. The required tool program is obtained from the PMS and sent directly to the Tool Management System to program & enable the tool. Data on the success of the operation and the tightening result are returned and automatically stored in a database system.

Result

Cost and time reduction on the line and quality improvement by excluding human error and re-work

'Process Control' - challenges

relying on a locating system to automatically control tools in a production line brings several challenges:

- required accuracy is 30cm in 3D
- out of 65M calculated positions per day, find the 150,000 where a tool was close to a vehicle
- load the configuration in real-time within 1sec
- don't get it wrong. 4ppm is the maximum tolerated error rate.

Benefit: 150,000 manual barcode scanning operations (~5sec) saved per day per plant.



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