AUTODESK UNIVERSITY

CS21652

Using Real-Time Location to Improve Construction Safety and Productivity

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Learning Objectives

- Learn what RTLS is and how it can be used on a construction project and through the project lifecycle
- Discover best practices and common pitfalls around RTLS
- Learn how RTLS systems can interact with other systems
- Understand the future potential for RTLS

Description

Construction is still one of the most dangerous jobs in the world, with job sites being complex networks of people, equipment, and activity that are dangerous and ever changing. With continued pressure to drive more value to clients, how do project teams use technology to improve productivity while maintaining safe working conditions? Skanska sought to answer this question and has piloted the use of an Internet of Things (IoT)-based technology called real-time location systems (RTLS) to dynamically track people and assets in order to make our job sites smarter, safer, and more productive. This presentation will focus on how RTLS can enhance environmental awareness and real-time visibility of workers' safety and productivity on active job sites, as well as into operations. Representatives of Skanska and Redpoint Positioning will explore RTLS in action on real projects, along with benefits, challenges, and lessons learned. They will also explore the role of CAD and Building Information Modeling (BIM) tools when deploying RTLS. This session features Revit, AutoCAD, and BIM 360 Field. AIA Approved

Your AU Experts

Albert Zulps is a virtual design and construction (VDC) regional director for Skanska USA Building with over 25 years of experience. As a founding member of Skanska USA's VDC group, he has helped to advance the widespread use of emerging technologies, including pioneering Building Information Modeling (BIM)-based radio frequency identification (RFID) material tracking of precast concrete at MetLife Stadium, implementing the use of prefabrication on multiple projects, and now testing technologies to advance the smart job site. Born and raised in Canada, Zulps earned a Master of Architecture degree from Dalhousie University in. Nova Scotia and a Diploma of Mechanical Engineering Technology from the British Columbia

Institute of Technology, preceded by studies at the Royal Naval Engineering College in Plymouth, England. He served as a marine engineering officer in the Royal Canadian Navy, and an architect with the internationally renowned firms Cook+Fox Architects in New York City, and Henriquez Partners Architects in Vancouver.

Jonathan Horne is co-founder and VP Product Management at Redpoint Positioning Corporation where he is dedicated to bringing safety and efficiency to industrial construction job sites globally using innovative indoor GPS technology. Jonathan received his MS in Electrical Engineering at the University of Colorado, BSEE at Tufts University, and has spent over 20 years developing advanced wireless technologies.

What is RTLS?

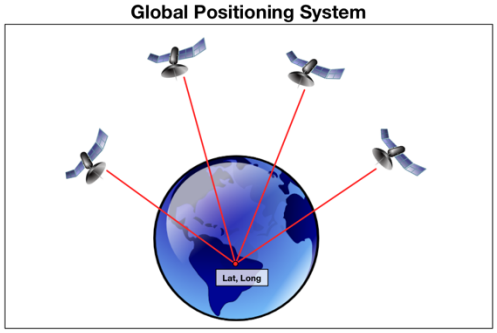
Definition

Real-Time Location Systems (RTLS) represent a class of technologies, that encompass hardware and software, used collectively to provide location information relative to some coordinate system. The GPS based car navigation systems is perhaps the most familiar RTLS, combining complex software with a sophisticated network of satellites that orbit the Earth to tell you precisely where you are in relation to the streets and buildings around you. In short, an RTLS provides location information for people or things on the move.

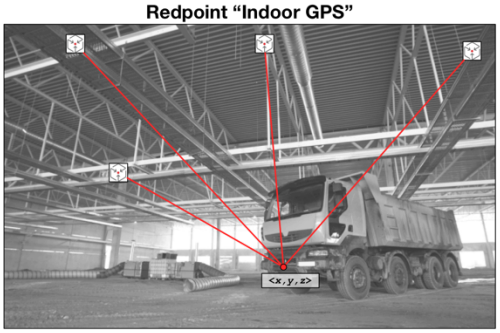
Indoor GPS isn't really GPS

Instead of "RTLS," the term "indoor GPS" gets used in the construction industry because it's a short and convenient means for conveying a familiar concept. The US's Global Positioning System (GPS), along with competing Global Navigation Satellite Systems (GNSS) built by other countries, has infiltrated our lives, from robotic tractors to Google maps running on smart phones. But to be clear, the whole reason RTLS is needed indoors is because GPS satellite signals do not effectively penetrate buildings, leaving commercial GPS receivers searching aimlessly for direction. Indoors, other systems are needed.

Global Positioning System



Redpoint "Indoor GPS"



Common Applications for RTLS

Over the last decade, RTLS systems have been deployed indoors to solve a variety of problems. The following are some commonly discussed and somewhat less commonly implemented applications for RTLS:

- **Hospitals**
- **Factories**
- **Retail (Tracking consumer behavior)**
- **Indoor Navigation (Malls, etc.)**
- **Warehouse (asset tracking, forklift management, logistics, safety)**

Technology Overview

Positioning Concepts

Presence Detection

Triangulation

Trilateration (Multilateration)

RSSI

Time of Flight

SLAM

Visible Light

Applying “Indoor GPS” to Industrial Construction

Safety

Static Geo-fences for Objective Hazards

Dynamic Geo-Fences for a Job Site in Motion

Credentialed Access

Last Known Location & Mustering

Protecting the Lone Worker

High traffic & occupancy Areas

Visibility and Interaction

Real-Time

Historical

Claims resolution
Refine estimates on future projects

Instant Messaging

Broadcast
Per trade/sub
Single worker

- Trend Analysis
- Work activity by task (inferred from WBS and location data)

Efficiency

- Powerful Metrics for continuous improvement
- Efficiency Through Safety
- Workflow analysis
- Context-sensitive documentation
- Geo-referenced punchlists
- Automated Time & Attendance
- Distance traveled by workers
- Site-wide search for people, tools, and materials

Sensors

- Temperature experiences by workers
- Vibration, Humidity, Temperature

Other

- VR/AR
- Robotics
- Drones
- Video bookmarking

Practical Implementation Aspects

Challenges in installing and maintaining a system

Server connectivity issues

Poor cellular connectivity — carrier dependent

Wi-Fi variability

Anchors

Wired vs. Battery

Location identification and monitoring

System

Wall Materials

Drywall

Cement/concrete/brick

Exterior walls, elevator cores, stairwells, columns

Metal

The Human Aspect of Tracking

- Privacy Concerns
- Human Behavior
- Wearability Considerations
    - Impact to safety (lanyard)
    - Mobility
    - Always there (hardhat)
- Charging
    - How long does battery last
    - Who is responsible for charging
- Assigning Users (On-boarding)
    - Connection to existing ID systems

Case Studies and Lessons Learned (Skanska & Redpoint)

Case Studies

Lessons Learned

- Wires suck on job sites
- Battery life is a big deal
- Buildings are built everywhere. Cell towers are not.
- Construction starts before any dirt is moved. (WAT)

Considerations for Selecting an RTLS for Construction

Accuracy

Latency

Global Visibility with History

Reliability

Ease of Install

Ease of Use

The Future

RTLS/IoT Fabric

- Incoming workforce grew up in the age of smartphones
- Increasing willingness among the general populate to trade privacy for convenience
- Technology is accelerating in terms of capabilities, including speed, size, and performance.
- Wearable sensors, 3D AR platforms, drones
- IOT — the age of connected everything
- BIM ubiquity