AirFinder

Cost-Effective Solution for End-to-End Manufacturing Visibility

Internet of Things technologies allows low-cost tracking and monitoring of materials and assets in large-scale manufacturing environments.

Intelligent RFID is 1/10th the cost of alternative location technologies, with better accuracy.

Overview

Cost pressures on global manufacturers are enormous. Consolidations and driving toward higher efficiency have created extensive manufacturing operations, but at larger scales, the friction from higher volumes of raw materials, work-in-progress, and finished products can slow production time and increase labor costs. A transformational improvement to manufacturing operations is the real-time monitoring of location and parameters such as temperature, humidity, shock, and vibration. By ensuring that materials are stored and handled correctly and can be found when needed, manufacturers can decrease waste and improve performance.

Traditionally, plant-wide tracking and monitoring solutions required significant investment in infrastructure, often at the cost of about $10 per square meter. While these technologies (Ultra-Wide Band and Passive RFID) offer sophisticated location information, the upfront cost has prevented their widespread adoption. With the advance of lower cost Internet of Things technologies, effective tracking and monitoring solutions can be installed and operated for 10x less.

Successful asset location and monitoring projects include integration with existing business backend systems and are undertaken in a phased approach. Since significant changes in the way work is done are often the result of using such a system, a plant-wide training and familiarization program is vital to ensure a good return on investment. Starting with a pilot in a single facility, and perhaps even a smaller unit within a facility, allows stakeholder groups to learn about the system, and plan for program growth in subsequent phases. Pilots also keeps upfront costs low.

The total cost of ownership, along with required features, are the most important considerations for manufacturers looking to implement an IoT based asset monitoring and tracking solution. This paper seeks to explain why AirFinder can achieve a low cost, both for infrastructure and tags, as well as what features create value in modern manufacturing operations.
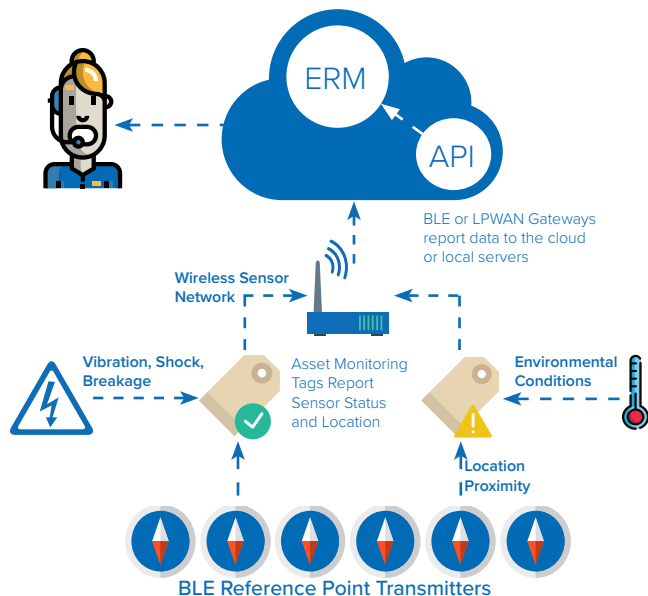
Figure 1. Example Asset Monitoring Scenario

Solution Overview

With the AirFinder Intelligent RFID solution, Bluetooth Low Energy (BLE) reference point beacons are placed through a facility. These low-cost, long-life devices provide a network of location information to asset tags. Asset tags are simple BLE transceivers, which spend a vast majority of their life sleeping. These tags wake up periodically, scan for nearby reference points, calculate location, and then report the location to the wireless sensor network.

This BLE tag is attached to an item in the plant, collects data (temperature, etc.), calculates location, and then connects to a nearby Bluetooth gateway. This Bluetooth gateway then sends the data to the network via a long-range wireless network (LoRa), Ethernet, or cellular. The tag data can then be consumed by on-premise or cloud-based analytics applications. AirFinder offers a full suite of asset tracking applications as an option.

This tag-centric approach means that much less data is transmitted through the system, tags last much longer, the accuracy of location increases, and the latency of location updates is minimized. Alternative BLE based tagging systems require all tags to beacon continuously, which limits scalability, increases wireless interference levels, and lowers tag battery life.

Asset monitoring and tracking solutions enabled by AirFinder™ Intelligence RFID solution overcome several important challenges, including:

Scalable Location Accuracy
The placement of reference points drives the accuracy of location. In areas where the exact location is needed, more references points can be placed. Where zone level accuracy is sufficient, even less infrastructure is required.

Deployment Cost
Since only low-cost BLE based infrastructure is needed, entire plants can be installed for 1/10th the cost of traditional RFID or UWB systems. Gateways can be connected via cellular, which means no IT systems integration is needed, especially during the pilot phase.

Tag Cost
Bluetooth Low Energy based tags can be obtained for less than USD 15. Even when adding additional sensors, tags based on BLE are the least expensive of any actively transmitting tag.

Long Tag Battery Life
Because tags do not need to beacon continuously, they can achieve 3x longer battery life than traditional BLE beacon tags, depending on update rate.

Wireless Sensor Network
The Bluetooth and Long Range Wireless Network that are installed as a part of the system can be used for a variety of monitoring and control applications beyond asset tracking. These include physical security, smart lighting, and HVAC control. The system supports low latency uplink and downlink messages.

High Tag Density
Because tags do not transmit very often, 100x more BLE tags can be in an area vs. a traditional BLE based tagging system. For plants with more than 5,000 assets, this is a critical differentiation.

Interoperability
The underlying wireless protocol at the edge of this system is Bluetooth Low Energy, which is the most widely used standard IOT technology. Additional capabilities and applications can be used on the same infrastructure without the use of any proprietary technologies.

Security
The AirFinder system uses multiple layers of device and data security to ensure your data and IT networks are safe. BLE data is encrypted end-to-end, and modern AES TLS data transport methods are used. By using a "stand alone" data network, which can be connected via cellular, IT network vulnerability can be eliminated.

Food Manufacturer Benefits

Lot-Level Traceability
By monitoring the handling of specific raw materials, food manufacturers have greater ability to track product performance for quality and regulatory compliance purposes.

Indoor Asset Location

Ensure Timely Movement of Components

Monitor Environmental Parameters in Storage

Track and Monitor Goods in Transit

Figure 2. Use Case Examples and Features

Monitoring of Sensor Data

Because tags connect as needed to the wireless data network, additional sensors such as temperature, humidity, light, shock, vibration, tilt, sound, and pressure can be added to asset tags when needed for specific reasons.

Update Data on Tag and Reference Points

The AirFinder BLE tags are connectable BLE devices, so provisioning and updating can be performed directly on the tag via a smartphone. This information can then be replicated to the cloud by the tag when it next connects. This prevents sync issues with cloud-only provisioning methods. This capability allows BLE end-nodes and Reference Points to receive SW and configuration updates over the air via control from the cloud or via a smart phone.

Aerospace and Defense Benefits

Government or 3rd Party Owned Equipment

For manufacturers that have audit and accountability requirements, AirFinder is a cost-effective way to ensure that 3rd Party owned equipment is not lost or mishandled and can be found when needed.

Maintain Kanban Velocity

For Work-In-Progress items that have rework or measurement cycles, automated accountability using a system like AirFinder ensures that materials return to the workflow as quickly as possible.

Backup for Barcode Based Tracking

Many manufacturers rely on a manual barcode scanning process. When a tagging system is overlaid in the process, missteps or misrouted items can be quickly identified.

Tracking Tooling and Fixtures

Many processes require specialized equipment, tools, or personnel. By maintaining an automatic system of location, delays caused by searching can be eliminated.

Solution Architecture

The AirFinder Intelligent RFID system uses a multiple hub-and-spoke architectures to reduce the number of costly components. Tags are based on inexpensive, and widely available BLE technology. Tag readers have multiple backhaul options and include the ability to be battery powered. In large manufacturing plants, readers are usually backhauled via a Low Power, Wide Area Network (LPWAN) system, which requires that only the central gateway have a connection to the network. This can also be via Ethernet or Cellular. And since only tag location or sensor updates need to be sent (instead of all raw BLE RSSI data), the usage of cellular data is much less.

An open data API is available both locally and in the cloud to allow location and sensor data to be used by other applications. Most customers use the AirFinder raw location data as an input to existing Enterprise Resource Management (ERS) systems. The architecture of the system also allows tags to "roam" between plants without re-provisioning.

Additionally, in-transit tags and readers can be used to provide visibility of shipments while in transit. Some tags can be outfitted with cellular backhaul, which allows them to report information about their BLE-only "neighbors" when they are not in the presence the plant-wide wireless infrastructure.

Calculating Return on Investment

Manufacturers and integrators that use the AirFinder intelligent RFID system are leveraging the lowest cost asset location and monitoring solution available. This allows use cases that were previously uneconomical. ROI models often account for savings based on labor savings, on-time production, and reduced waste.

A multi-phase pilot approach allows business case development to target areas most likely to generate significant returns on investment.

For help in creating value through asset location and monitoring, contact your **AirFinder sales representative.**
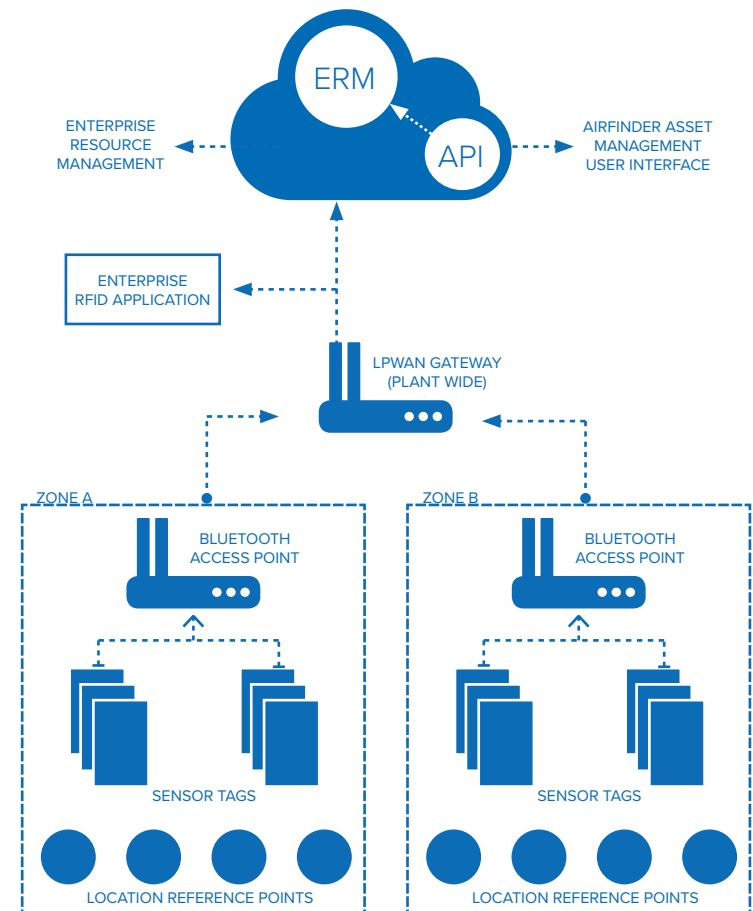

Figure 3. Solution Architecture

All claims depend on the specific scenarios of installation.
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