Aricent®

Smart Spaces Solution

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Solution

The United States Occupational Health and Safety Administration estimates that there are about 855,900 forklifts in operation in the US alone. These forklifts are estimated to contribute to more than 100,000 accidents per year, which results in 94,750 injuries a year. Almost 80 percent of forklift accidents involve a pedestrian.

Forklifts are not the only culprit, other material handling equipment such as conveyors and materials storage equipment contribute to injuries. The US National Safety Council has estimated that the average direct cost to a company of an injury is $38,000 and the indirect cost is $150,000.

The ideal approach for reducing the number of accidents—and the associated cost—is through a combination of training and new technology solutions. While there are many safety-related issues that must be managed inside the warehouse environment, this paper will address technology solutions that ensure:

01 — Proper stacking of products
02 — Safe use of forklifts
03 — System awareness of asset and personnel location

01

Improving Safety Inside the Warehouse

Ensure Proper Stacking of Products

There are four common reasons why products can be improperly stacked:

01 — An item or items has been removed from a pallet and/or a neighboring pallet
02 — Products within the pallet are damaged
03 — Improper storage of pallets while placing the material on the shelf
04 — An insufficient gap between pallets

To reduce the risk of improper stacking—and reduce accident risk—requires a customized design, taking into account many factors including the types of materials being stacked, the weight and height of the pallets, and the variables that need to be measured and monitored. Figure 1 shows a typical view of a rack in a warehouse, with pallets stacked side-by-side on the rack. Each pallet includes a humidity, gyroscope, infrared, pressure and temperature sensor

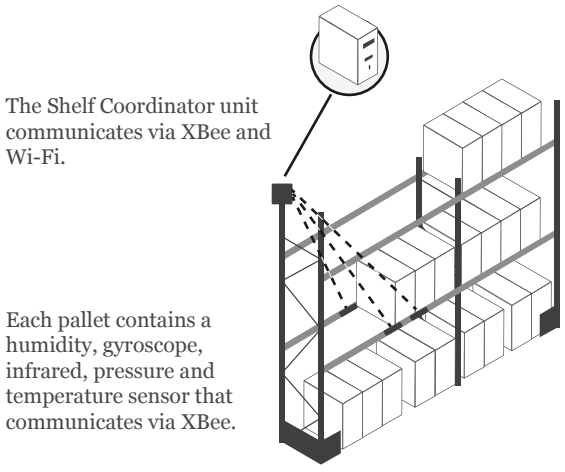

Figure 1: Sensors on smart pallets ensure safe placement on the rack

A Shelf Coordinator unit communicates with all the sensors mounted on the pallets and sends the data to the central server via the cloud where all the data is analyzed for any abnormalities.

As shown in Figure 2, additional sensors mounted on the shelfs help to determine if the placement of the pallets are within the shelf boundaries.

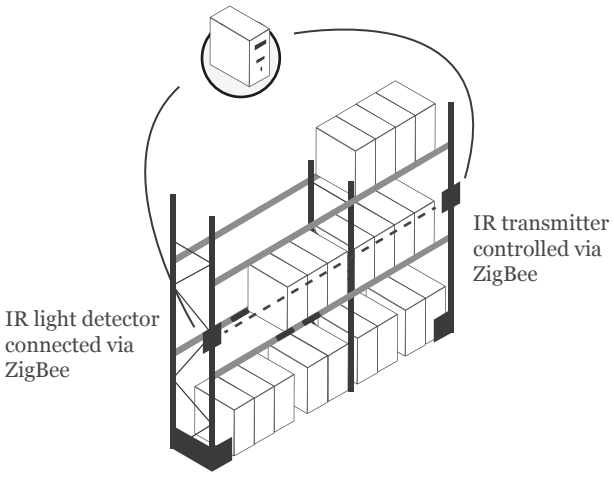

Figure 2: Light sensors are mounted on shelfs to detect abnormal pallet placement

Using image processing and motion detection for real-time tracking, the system will validate if all yellow marked lines are clear and will alert the supervisor in case there are items covering the lines, as shown in Figure 3.

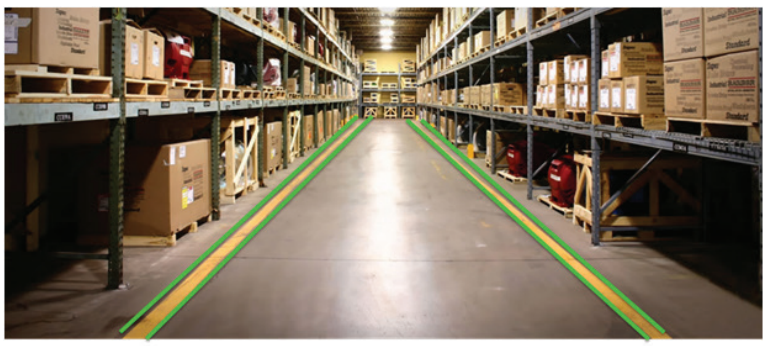

Figure 3: Cameras are placed in the warehouse to detect clear paths

In this sample warehouse, there are five unique technologies that were selected to reduce the risk of accidents and injury:

Pallet Sensors: Five sensors are packaged into a pallet to detect any deviations from the pallet standards. These included:

01 — Humidity sensor to measure the ambient humidity
02 — Gyroscope sensor used to measure the tilt in the pallet position
03 — Infrared sensor to measure the distance from the neighboring pallet
04 — Temperature sensor to measure the temperature
05 — Pressure sensor to measure the weight distribution

Shelf Sensors: Three sensors are mounted on the shelf to monitor abnormality in placement of pallets. These include:

01 — IR transmitter
02 — IR receiver
03 — Vibration detection to measure any shock while placing or removing the pallet

Cameras: A camera is used to monitor in between the aisles to analyze and ensure the pallets are placed correctly. Any visual display of damage to or a tilt of the pallet will be reported. A drone-mounted camera is also an option to capture the placement correctness in every aisle. Drones can also be used to scan for inventory.

Communications: The sensor data transfer is managed through a built-in Wi-Fi /ZigBee module that communicates to the gateway or Wi-Fi access point. If the sensors or cameras detect any placement abnormalities, a signal will be sent to alert the staff, such as a flashing light mounted at the end of the aisle.

Smart Glasses: Eyewear such as Microsoft HoloLens or Google Glass can be used by a supervisor, which will detect the volume and potential damage on the pallet using markers or image recognition.

By implementing this solution, a warehouse can reduce the instances of falling objects due to improper placement by more than 50% and reduce the cost incurred from associated accidents.

02

Safe Use of **Forklifts**

According to the World Health Organization, the majority of the safety risks from using forklifts are caused by one of four things:

01 — Lack of visibility while reversing
02 — Lack of visibility while picking or placing the pallet
03 — Incorrect estimation of the pallet's height and weight
04 — Blind spots that prevent the driver from seeing approaching forklifts

Here again, combinations of sensors can be attached to forklifts to reduce risk. For example, proximity sensors placed on the forklifts can trigger a warning alarm. Depth sensors and cameras placed on top of the forklift can help the driver manage height and depth when placing pallets.

The location awareness of all the forklifts moving in the warehouse provides centralized system intelligence for monitoring the movement of the forklifts. For example, if a forklift exceeds the maximum speed limit, the driver is alerted. Similarly, the driver receives an alert if the forklift is too close to an object, such as another forklift or pallet. These warehouse-wide systems significantly reduce the chance of accidents. In addition, the data collected over time provides useful insights for improving the material placement and operational efficiencies.

This solution enables a significant reduction in forklift accidents that are caused by human errors and lack of awareness of ambient surroundings.

03

System Awareness of Asset and Personnel Location

Management can improve warehouse efficiency by tracking assets in real-time, including both equipment, such as forklifts, as well as staff. Indeed, the order-picking process can be significantly improved with up-to-date information about where the items are located and where the nearest available forklift is located. Over time, the information collected on forklift movements in the warehouse can lead to analysis of how the material should be placed to minimize travel time of forklifts.

As for ensuring the safety of personnel, forklifts moving toward each other at an intersection can be alerted to avoid a possible collision or accident. Figure 4 below shows the structure of Aricent's Indoor Positioning Solution (IPS), which includes Bluetooth Low Energy (BLE) asset tags, a Wi-Fi network, and a full-featured tracking dashboard.

Each asset tag is mounted on a forklift or pallet, together with a hardware device that runs software to identify the signals from the beacons and routers. The beacons are placed across the warehouse at predetermined locations.

The Aricent Unified Tracking Solution (UTS) can be used to navigate robots to instruct them to add and remove items from the shelves. The UTS software accesses the asset's relative position with respect to the beacons. As the beacons are mounted at predetermined places, the UTS software merges this data to determine the absolute position of the tracking device.

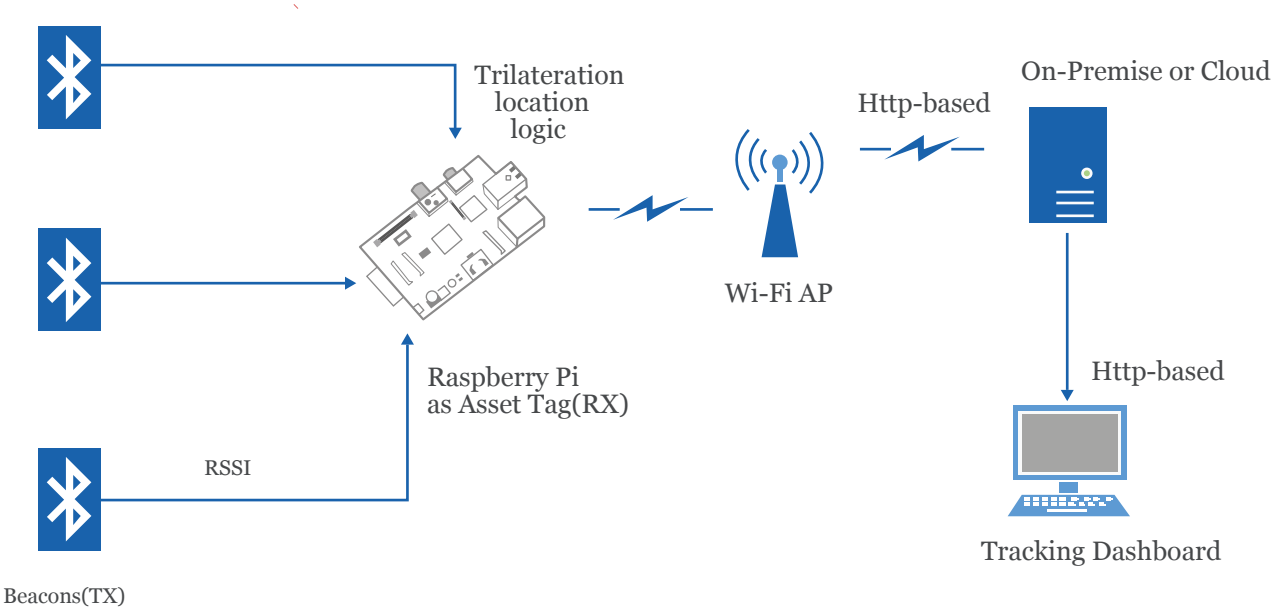

Figure 4. Aricent Indoor Positioning Solution for Asset Tracking

As shown in Figure 5, Aricent's Converged Internet of Things (IoT) solution provides centralization of events from multiple IoT sensors and devices and provides a platform for aggregating these events for upstream applications and systems.

The Aricent Converged IoT solution, along with Aricent ADAPT hardware, enables events from various sensors and gateways that use different formats and protocols for communications to be handled in a unified manner. Event information is consolidated for integration with upstream applications and business processes.

Aricent has leveraged this technology to help customers develop intelligent wearable products that can locate an employee on the factory or warehouse floor. This technology also provides location intelligence to IoT original equipment manufacturers, allowing them to control their devices based on the location information of the users.

Aricent ADAPT is a reference hardware board design that can be adapted to any form factor such as a pallet, forklift mount or a wearable for the worker. It provides connectivity options like Wi-Fi, BLE and XBee and can integrate various sensors for reading ambient conditions.

The Aricent Converged IoT solution enables realization of many IoT use cases like smart parking, smart stadiums, connected homes and smart lighting products.

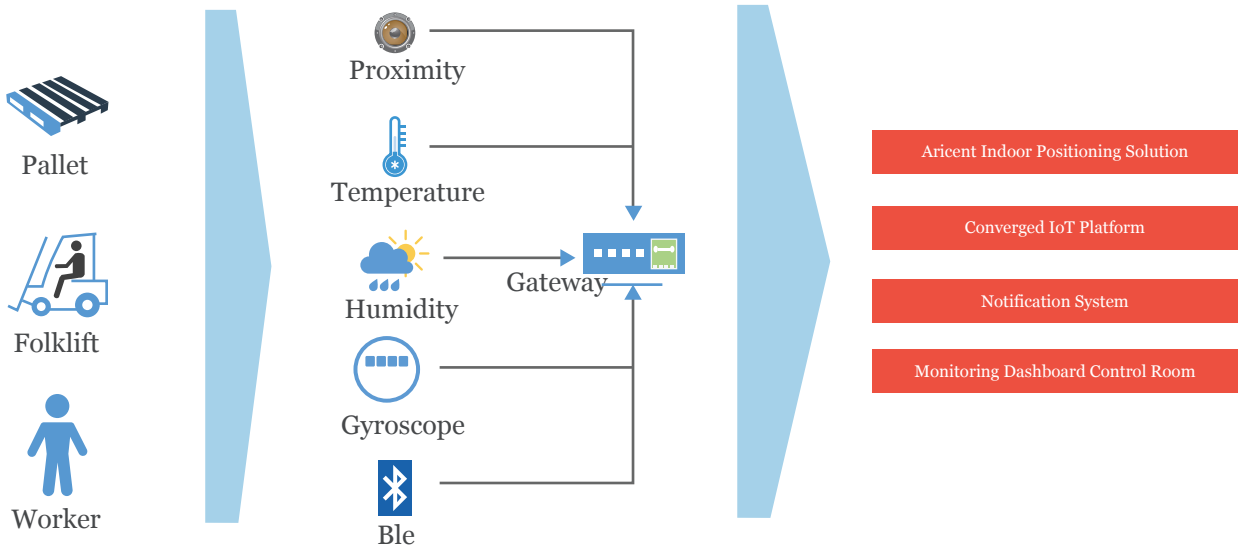

Figure 5: Unified intelligence across multiple vendors

04

Why Aricent?

Aricent provides an array of solutions and services for the development and implementation of software-defined networking, network function virtualization, telco cloud, and Internet of Things to address the critical R&D and operational challenges of our clients. The company's solutions and accelerators reduce the time-to-market for new products and services. Aricent's 25 years of rich history in communication and R&D innovation makes it a partner of choice for network equipment providers and communication service providers.

Contact

If you wish to schedule a call / meeting with an Aricent expert, please email us at **prashanth.chetty@aricent.com**

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About Aricent

Aricent is a global design and engineering company innovating for customers in the digital era. We help our clients lead into the future by solving their most complex and mission critical issues through customized solutions. For decades, we have helped companies do new things and scale with intention. We bring differentiated value and capability in focused industries to help transform products, brands and companies.