



WILIOT'S ASSET IN-TRANSIT INTELLIGENCE SOLUTION FOR GROCERY

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EXECUTIVE SUMMARY

Some of the key pain points in the grocery supply chain include ensuring product integrity, and adherence to regulatory reporting requirements across long and complex supply routes. Additionally, real-time visibility into the condition of food products and minimizing food waste are ongoing concerns. In the United States, the Food Safety Modernization Act (FSMA)'s Rule 204, which is set to be enacted in January 2026, will require additional reporting obligations across various points of the supply chain.

Ambient Internet of Things (IoT) is a technology that enables most items in a supply chain to be connected to the Internet, delivering real-time triggers and information about location and condition at a minimal cost, using existing wireless infrastructure, without human intervention.

This brief examines the benefits of the introduction of ambient IoT in the grocery supply chain. It aims to identify specific use cases and benefits that can enable continuous real-time monitoring of temperature, humidity, and other critical factors, ensuring that grocers have fresh goods, improved traceability, and reduced food waste.

CHALLENGES FOR GROCERY SUPPLY CHAINS

Lack of Demand Signals

A lack of demand signals in grocery supply chains can lead to inefficiencies like overstocking, out-of-stock, and food waste, all of which directly impact profitability and customer satisfaction. A majority of retailers and players in the food supply chain rely on unreliable forecasting methods, with only [11% of retailers leveraging cloud-based advanced analytics](#) to optimize inventory management.

Without clear demand signals, decision makers in the grocery supply chain will be unable to align stock levels with consumer preferences. This can lead to a lot of food waste and spoilage. The Food and Agricultural Organization (FAO) reported that [nearly 17% of all perishables are being wasted at the retail and consumer levels](#).

This problem is further heightened by the fact that siloed systems across the supply chain do not share data in real time. At the moment, retailers connect Point of Sale (PoS) terminals with demand planning platforms to gain visibility into the demand of individual items, However, this does not give real-time visibility of the full supply chain. Lack of real-time visibility causes delays in adjustments to demand fluctuations.

Modern technologies such as Artificial Intelligence (AI) and predictive analytics can improve demand sensing, but nearly 80% of grocers have yet to integrate such solutions. Addressing demand-sensing gaps could drastically reduce food waste, control costs, and improve profitability across the supply chain.

Product Integrity

Freshness is one of the most important issues for grocers. Products can be compromised when going through the supply chain, especially perishables. Players in the supply chain need to consider that every food product will have different requirements for freshness. Temperature has to be tracked across the supply chain to ensure perishables do not deteriorate, but grocers also need to consider humidity level and light exposure. Cold chains often face issues like poor load/unload practices and equipment failures in refrigerated trucks, which can lead to a loss in food quality, shortening of shelf life, or wastages.

Existing temperature data capture, in places like refrigerated trailers or cold storage, are like flashlights in a black box. Temperature is captured through single readings, not accounting for dynamic deviations that occur over time. In addition, room or trailer-level temperature readings overlook microclimates or batch/item-level variations, making it challenging to maintain consistent quality across all items.

Visibility Issues

Grocers often have minimal visibility into a product between the origin and final delivery point. There is especially a need to have outbound accuracy, as Distribution Centers (DCs) often have issues with inaccurate loading, which can result in higher costs. This can lead to incorrect deliveries, unexpected low-stock or out-of-stock, and empty shelves. Conventional outbound logistics management often lacks real-time visibility of individual items.

Visibility with real-time tracking can help monitor every step of the journey, thus holding transportation providers accountable and meeting consumer expectations for on-time and quality deliveries.

Why Supply Chain Visibility is Important



COMPLEXITY



CUSTOMERS



COMPLIANCE



COMPETITIVENESS

On-Shelf Availability

Complications in inventory management could potentially arise when grocers lack visibility into batch or item level, particularly with perishables, where tracking of expiration dates or shelf life is very important. This limited visibility often leads to overstocking or out-of-stocks, missed price markdown opportunities, and food waste. Solutions that integrate batch-level data and automate product rotation can help improve efficiency and ensure fresher products are available to consumers, addressing a major pain point in grocery supply chains.

Regulatory Compliance

Quality assurance has always been a major issue plaguing the global food industry. Maintaining high standards of quality and safety is imperative to not only ensuring consumer safety but also building trust in the grocer's brand. In the United States, the FSMA has significantly increased food safety protocols. Rule 204 (d), also known as the Food and Drug Administration (FDA) Food Traceability Final Rule, is aimed at improving food traceability and enabling faster identification of foodborne illnesses.

One of the key aspects of Rule 204 (d) is the creation of a Food Traceability List (FTL), a list of high-risk grocery items such as ready-to-eat foods, cheeses, nut butters, herbs, leafy greens, eggs, and other fresh produce. Items on the FTL are subject to additional reporting across different points of the supply chain. As stakeholders within the food supply chain are required to maintain records containing Key Data Elements (KDEs) such as Traceability Lot Codes (TLC) associated with Critical Tracking Events (CTEs), providing real-time visibility will be crucial to meeting traceability requirements.

Depicts Where KDE Recording Obligations Occur



Food Waste Reduction

[A study earlier this year from the Pacific Coast Food Waste Commitment showed that grocery retailers made significant process in the United States on reducing food waste.](#)

It was reported that from 2019 to 2022, grocers successfully decreased the number of tons of unsold food in their regional operations by 25%. However, there is still a lot of work that needs to be done. In the United States, nearly 38% of food becomes food waste.

Actors throughout the supply chain operate First In, First Out (FIFO) systems. However, improved efficiency and real-time tracking are needed to limit the high levels of waste caused by products expiring before reaching the Point of Sales (POS), enabling a First Expired, First Out (FEFO) system.

Production, Harvest & First Processing



FOOD LOSSES

Industrial Processing & Distribution



Wastage Causes: Forecasting Errors, Distribution Limitations and Excess Purchases

Retail & Domestic Consumption



FOOD WASTE

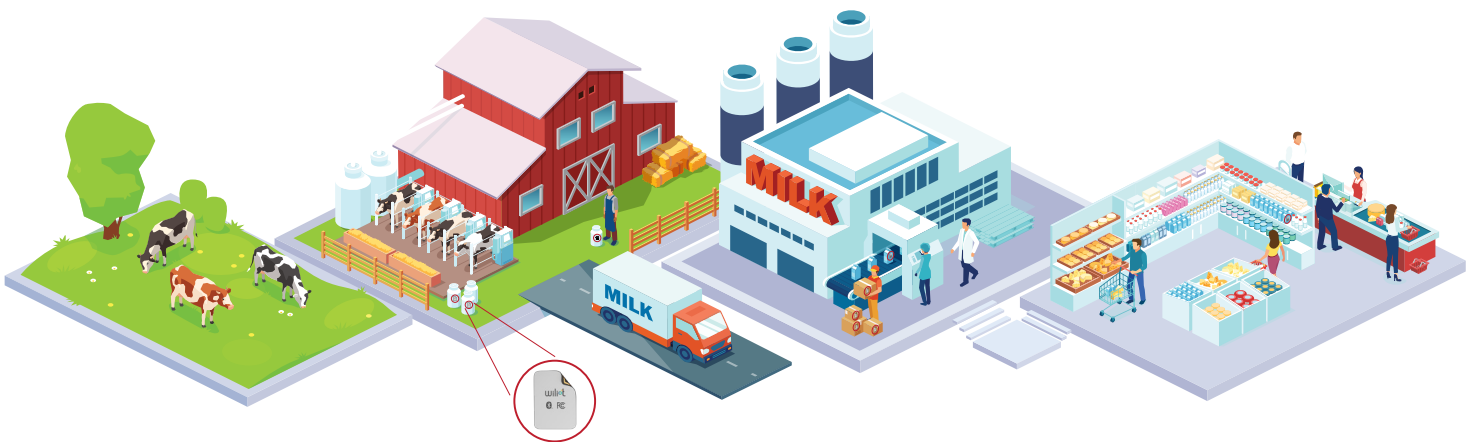
AMBIENT IoT AND USE CASES

Addressing grocery supply chain challenges requires both granular visibility and data control. Often, grocery supply chains have siloed inventory management across various points of the supply chain, generalized asset tracking solutions, data analysis limited to only checking date and temperature, and manual stock management processes that are prone to human error.

Ambient IoT is a solution that can directly address these current limitations in the grocery supply chain, offering autonomous, granular, and real-time tracking of stock as it moves through the supply chain to the store. Wiliot, a leading provider of ambient IoT, offers a complete solution for transport in the grocery supply chain by not only providing the technology to digitalize food items, but also ingest and process these data in the most seamless way possible.

The Wiliot Ambient Data Platform at a glance:

- IoT Pixels (Bluetooth® stickers) are battery-free stickers that can be applied to shipping labels, pallets, and reusable transport items.
- Bluetooth®-based network devices are installed in transport vehicles that energize the Pixels to relay their sensing and location data.
- Data from IoT Pixels is fed into Wiliot's cloud-based Ambient Intelligence Platform that utilizes Machine Learning (ML) for data analysis, as well as management of devices and connections to Enterprise Resource Planning (ERP) or Warehouse Management Systems (WMSs).



USE CASE	BENEFIT
Cold Chain Monitoring	Monitor product temperatures at the case and asset levels, rather than a single temperature for an entire truck, to limit product quality degradation and reduce waste with real-time alerts to temperature excursions.
Workflow Alerts	Automatically validate that items are loaded onto the right trucks without manual scanning required. Alert staff in real time to any missing items or incorrectly added items, so remediation happens immediately, before the truck pulls away to go to the next stop. Automate FSMA 204 critical tracking event updates for perishable items based on what was actually received.
Reusable Asset Management	Track reusable assets such as totes and pallets to automatically update location inventories and avoid shortages that could halt shipments. Optimize asset allocation with a dynamic view of assets currently in transit, and last seen locations for each asset, to reduce shrink events.
Vehicle Utilization	Real-time data from IoT PIXELS enable delivery route optimization and ensure that vehicles are fully loaded before leaving the dock, reducing the total number of trips, and in turn, lowering shipping costs with fewer emissions and less fuel.
Fleet Monitoring	Monitoring trucks in real time to alert staff to anomalies such as faulty cooling units or items going missing. Automatically update arrival and departure times based on real-time truck location data, rather than pre-planned Estimated Times of Arrival (ETAs).

IMPLEMENTATION CONSIDERATIONS

- Collaborate with Stakeholders to Identify Data Hotspots:** Collaboration with suppliers and logistics partners is crucial to ensure seamless integration of ambient IoT across the supply chain. Grocers need to start with existing product data, map current product information upstream and downstream, identify where the data are insufficient, and collaborate at an early stage to identify data and technical interoperability that will work for their ecosystem.
- Budgeting and Cost Analysis:** Grocers should initially look into breaking costs down into hardware, software, integration, and maintenance. This includes tags, readers, network infrastructure (e.g., gateways or cloud services), and any platform for data management. Starting with a pilot project in a single store or across a specific section of the supply chain (distribution hubs or last-mile delivery) allows grocers to assess the effectiveness and scale up based on initial results.
- Return on Investment (ROI) Considerations:** Focusing on Key Performance Indicators (KPIs) that reflect direct, measurable benefits like inventory accuracy, reduced shrinkage, and better demand signals. These factors are critical for determining ROI. Short-term gains could be reduced labor costs due to automated inventory checks, whereas long-term ROI can be improved customer satisfaction due to reduced instances out-of-stock. Grocers should aim for an appropriate payback period by tracking metrics like cost savings, revenue uplift, and labor productivity to justify further investment.

- **Change Management Is Key:** Set working groups with internal and external stakeholders to educate on changes to operations and systems. Establish best practices and create support channels with the solution provider to ensure that continuous training and enablement is provided. Allocate sufficient budget and time for training your staff on new technologies. Develop a phased approach—start with key decision makers like managers and department heads. Then scale it to general staff via hands-on sessions.
- **Focus on Quick Wins:** Some use cases will have a higher priority than others. While there are many use cases that enterprises may want to address with supply chain visibility, companies need to prioritize according to their internal resources. The priority for grocers should be on use cases that can help gain quick wins. Applying IoT Pixels in crates and pallets to minimize the loss of returnable assets could be an impactful start. Widespread adoption should be a collective ecosystem approach that may involve multiple stakeholders, even competitors, to enable a more open data-sharing environment.



Published January 2025
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About the Sponsor

Wiliot is a company engaged in the design and development of ambient IoT and ambient intelligence products. Wiliot's Ambient Intelligence Platform brings the physical world online using IoT Pixels, battery-free smart tags that push data to the cloud, via Bluetooth®, in real time without relying on manual labor or scans. Wiliot's mission is to add intelligence and automation to products, packaging, and transport assets—enabling responsive, dynamic supply chains.

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