

RFID and Sensor-**DRIVEN** Fresh food Safety and Harvest Management

An InSync Software, Inc
Whitepaper



Fresh Food Safety Management

Fresh food safety has become an issue of paramount importance in the United States in the past year. The concept of food safety is not a new one, and the recent outbreaks of E. coli are not the first in California's fresh produce history. The public's reaction to finding out how vulnerable their fresh food actually is, also is nothing new. Over a century ago Upton Sinclair's 1906 novel "The Jungle" captured the attention of Americans and raised the issue, in often grisly detail, of food safety, cleanliness, and the need for standards. Since his early exploits resulted in significant public concern, industries such as meat packing and poultry faced sweeping reforms in order to safeguard consumers against contamination.

Fresh produce, however, is a different story. The fresh produce industry is dependant on a variety of parties engaged in growing, picking, transport and retail sales. The need for regulation is driven primarily by the need to protect the food supply from contamination. Security in the post 911 world led to the 2002 Bioterrorism act. This Act requires the tracing of foods, yet does not include growers at the beginning of the food chain and stopped short of mandating traceability at the field level. This is primarily due to lack of enforceability and technology available to manage this daunting task. The cost of managing such a program for the growers and distributors would have eat away at the slim margins of the industry, crippling it altogether.

Today, the fresh food industry remains much less regulated than comparable food industries; an issue that has been thrust into the spotlight in the recent months. With sickness and deaths resulting from recent out breaks of E. coli in central California, many in the industry have come to the sobering realization that this issue needs reexamination. While industry-wide regulations are no doubt on the drawing board, (in fact some changes have already been enacted), the issue of fresh-food safety has fallen largely on the shoulders of fresh produce companies.

Timing is critical to assure the freshness and safety of fresh foods. As a harvest moves from field to fork, downstream processes rely on information passed from the upstream processes to guarantee visibility and traceability. Each process manager has limited visibility to the pipeline of arriving and in-transit foods because of disconnected systems. For example, with large producers conducting multiple harvests at peak season, process steps such as chillers, where produce is flash-cooled, become bottlenecks. If produce waits too long, it will parish. As information of the previous process step is not shared, understanding the time elapsed is needed

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to identify and prioritize those lots of produce that have an increased risk of spoilage.

In the case of contamination, the ability to quickly find the source and quarantine items is critical. Safety of fresh produce is managed primarily by identifying and tracing produce batches through the chain of custody. This allows for multiple participants in the supply chain to see a particular batches' origin - including and the history of who was in contact with it, and it's physical condition throughout. As issues arise, they can be quickly be contained and traced back to the origin. The systems must also manage the tracing of items through the packaging process where they may be mixed, (i.e. pre-mixed mixed salad bags) or consolidated with product from a different origin. Systems being put into production are able to now manage this process effectively. More importantly, systems can assess risk based on the sensor information gathered. Efforts are also being made to seek preventative measures through the use of bio-sensors. Universities are making strides towards developing bio-sensors that can detect toxins and organisms in advance of consumption. Unfortunately these technologies are still in their infancy, and come at a considerable cost. Simply, the issue of food safety comes down to a lack of economically viable systems for tracking produce across a business ecosystem.

Limitations of Barcode Tracking Technologies

Tracking fresh food movements has been attempted with a variety of technologies. Early Auto-ID applications for tracking fresh food containers (beyond paper-based solutions) involved attaching barcodes to the bins in the field. While this process managed to improve the situation marginally, environmental conditions in the fields and elsewhere caused barcodes to be damaged during processing. A barcodes inability to be scanned when dirty, scrapped, or wet caused significant misreads. Once damaged, the traceability and management of the bin is lost. Additionally, line of site requirement of barcodes presented a problem when the loaded bins are transported palletized, in bulk. As bin of product leave the growers location, the ability to trace the progress of the produce in the food chain is nearly impossible. Barcodes also do not offer read/write capability, as RFID tags do. Updating a Barcode is not possible, and thus recording time and date information for each bin becomes very challenging. On the whole, the barcode systems provided minimal and inconsistent visibility to the process owners managing the harvest.

Sensor Driven Harvest Management Process

The next generation of Solutions for Fresh Food Harvest Management utilize RFID, GPS, sensors, and a centralized software system that manages the end-to-end processes. The solution begins in the picking stage when RFID tags are sent to the field with the empty bins,

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and secured on-site when produce is loaded into bins. For further protection, the tags can be encased/epoxied within a secure location on the bin to prevent damage. The tags are read in the field by workers using a GPS-enabled RFID handheld reader that initiates the harvest process, sending the bin contents information via a cellular or satellite signal to process owners. Temperature sensors in the trucks and RFID sensors at subsequent stations can signal alerts when pre-defined timing or temperature thresholds are broken.

Once the field portion of the harvest is complete, the location, tag and environmental information associated with the produce, field, and grower are viewable immediately. Alerts are sent to the responsible individuals if there is a determination of risk. With the centralized information, specific bins, their location and level of risk are known by all parties involved. As the history is maintained, any point of contact with the contamination is also known down to the GPS coordinates of the field location where the item was harvested. Information related to a contamination issue is accessible to any of the participants affected, from grower to retailer.

Money Matters – Project ROI

Though not commonplace, systems such as these are in place with leading fresh food companies. They leverage sensor arrays and internet based software to manage the fresh produce process. The cost barrier has been overcome as RFID technology and implementation costs have reduced significantly as the technology continues to mature. While the prime implementation driver is the safety of the consumer, producers are able to charge premium pricing for tracked produce. In all, food safety and economics are now in harmony, allowing for greater adoption in the coming years.