Continuous Cold Chain Logistic Solutions

Staying Cool with LoRa Connectivity and the WISE-PaaS IoT Cloud Platform

The importance of cold chain logistics to global commerce has only increased in recent years. By maintaining perishable goods within desired low-temperature ranges, cold chain solutions ensure and extend the quality and shelf life of a wide range of products, from fresh produce and meats sold in supermarkets and convenience stores to industrial chemicals, vaccines, and other pharmaceuticals. Relatedly, the growing demand among consumers for convenient access to an ever-increasing variety of fresh food and other

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perishable products has spurred retailers, wholesalers, logistics operators, and others to further invest in the development of cold chain capabilities.

However, maintaining a cold chain process is a substantial technological challenge requiring the precise coordination of order processing, production, shipping, and delivery. Moreover, good manufacturing practice requires that any cold chain be thoroughly measured, analyzed, documented, and validated to ensure the safety and quality of the delivered goods. To this end, the use of Internet of Things (IoT) technologies such as Long Range (LoRa) technologies and IoT cloud platform combine to create the optimal option for operators aiming to maintain their products within certain temperature ranges throughout the storage, transportation, and sales processes.

LoRa Outperforms Competing Transmission Technologies in the Cold Chain Industry

Used in a wide range of applications from smart bus scheduling and natural disaster prediction to the monitoring and protection of endangered species and cattle, LoRa enables long-range data transmissions (including transmissions over distances of more than 10 km in rural areas) with low power consumption. While cold chain operators have various technological options for setting up Low-Power Wide-Area Networks (LPWANs) for signal transmission, including Narrow Band Internet of Things (NB-IoT) and Sigfox technologies, LoRa offers the ideal primary transmission architecture due to its long-distance, high-penetration data transmissions and low power consumption.

Comparison of wireless technology options

<table>
<thead>
<tr>
<th>Supported by</th>
<th>Zigbee Alliance</th>
<th>Wi-Fi Alliance</th>
<th>Sigfox</th>
<th>IBM/Cisco</th>
<th>3GPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency band</td>
<td>Un-Authorized 800/900 MHz 2.4 GHz</td>
<td>Un-Authorized 2.4/5 GHz</td>
<td>Un-Authorized Sub-1 GHz</td>
<td>Un-Authorized Sub-1 GHz</td>
<td>Authorized LTE In-Band/Guard Bands/Standalone</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>2 MHz</td>
<td>20, 40, 80 MHz</td>
<td>100 Hz</td>
<td>125–500 KHz</td>
<td>180 KHz</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>50–300 M</td>
<td>100–300 M</td>
<td>Urban areas : 10 KM Suburban areas : 50 KM</td>
<td>Urban areas : 3–5 KM Suburban areas : 15 KM</td>
<td>15 KM</td>
</tr>
<tr>
<td>Transmission speed</td>
<td>250 Kbps</td>
<td>300 Mbps</td>
<td>100 bps</td>
<td>300 bps ~ 50 Kbps</td>
<td>50 Kbps</td>
</tr>
</tbody>
</table>

These advantages, in addition to LoRa’s capacity for integration with operating frequency and spread spectrum modulation technologies, make it the preferred signal transmission technology for ensuring stable cold chain operations over long periods of time. More-
over, LoRa operates in the sub-1GHz band, does not incur additional band licensing fees, and is more open than Sigfox, giving operators the freedom and flexibility to quickly establish their own communication networks and develop their application services. In addition, LoRa is highly flexible with respect to sensing, relay, and cloud components, enabling network operators to design and implement their networks according to their actual application needs while also achieving lower overall implementation costs.

Prior to the introduction of LoRa technology, the on-site installation of signal transmission devices for cold chains solutions often involved major alterations to the existing equipment or wiring architecture, since this was usually required during the placement of sensor devices. Meanwhile, aside from time-consuming, and costly implementation, much of the equipment and appliances required for cold chains, such as the freezers, refrigerators, and vehicles used to keep products cool during storage and transportation, are constructed with metals such as aluminum and stainless steel that can create an electromagnetic shielding effect that can disrupt the transmission of signals by less advanced transmission technologies. In comparison, devices that incorporate LoRa technology can be installed quickly and conveniently and boast a high degree of penetrability that make them the ideal choice for cold chain applications.

In addition to the direct advantages provided by its LoRa devices, Advantech also offers a comprehensive range of compatible software and hardware peripherals, such as temperature sensor and gateway products for use in cold storage warehouses, cold chain logistics vehicles, and other locations, as well as handheld terminals that can utilize near-field communication (NFC) to sense and collect data and take infrared temperature measurements to enable product temperature management. When used in conjunction with Advantech's WISE-PaaS Industrial IoT cloud platform, these devices and Advantech's LoRa devices can enable integrated IoT solutions such as real-time monitoring and the issuance of alerts whenever abnormal conditions are detected, providing even stronger protection of product quality and safety.

The WISE-PaaS Cloud Platform Provides an Optimal Service Framework for High-Compatibility Device-to-Cloud Cold Chain Solutions

While the collection and transmission of data such as temperature readings and asset locations are critical to cold chain logistics, effective management of such data is also required to ensure product quality and safety. To that end, asset performance management (APM) is key in helping cold chain operators to maintain a clear picture of the status of their assets through the real-time collection of lifecycle data. Accordingly, Advantech provides an APM service framework through the WISE-PaaS Industrial IoT cloud platform that, in combination with monitoring, diagnosis, warning, and prediction mechanisms, provides root cause analysis to quickly identify problems and ensure the continuous strengthening of asset performance.

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Cloud-Based Cold Chain Solution Powered by WISE-PaaS

In the past, companies often faced bottlenecks when promoting APM for cold chain logistics, as the same set of data collection mechanisms could not be used due to the large number and varying natures of different assets. Simply put, cold chain logistics requires the use of a wide variety of edge devices, with some being responsible for collecting power consumption data while others are responsible for collecting temperature, humidity, and harmful gas data. To address this complicated problem, Advantech provides WISE-PaaS/EdgeX-API with data acquisition software to allow users to host a large number of heterogeneous data types on the WISE-PaaS Cloud using a unified, standardized API and data format to achieve consistent processing and presentation and to realize diversified computing functions. For example, if a user determines that a freezer temperature above 18 degrees Celsius exceeds the required standard, then a rule can be formulated using APM applications to provide alerts whenever the temperature of any of the freezers in the network exceeds the established limit.
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And that’s just one example of the power of Advantech’s comprehensive cold chain solutions. With Advantech’s WISE-PaaS/APM and LoRa devices, it is easy to break through barriers, extensively interface with diverse field devices and communication protocols, and provide large-volume equipment management and workflow integration templates across different fields. With Advantech’s cold chain technologies, users can reduce unexpected downtime, decrease implementation and operating costs, and exert greater control over the quality of their products, ensure product freshness and safety, adhere to food compliance regulations, and secure the continuous loyalty of their customers.

If you have projects this year for supply chain and transportation management system integration to enable new ideas and discover new economies in delivery services, see more details on Advantech iLogistics Solutions.

TREK-120
LoRa Cold Chain Sensor

TREK-530
Vehicle-Grade LoRa/4G Gateway

PWS-472 Infrared Thermometer
5” Industrial Handheld

For more information on Advantech Network Computing Group products see Buy.Advantech.com/Go/ColdChain or call 877-825-4146

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