Warehouse Insights

IoT and its Implications on Intralogistics

kardex

Introduction

The rapid technological developments of Industry 4.0 have revolutionized intralogistics and warehouse automation to keep up with supply and demand complexities. One crucial element is IoT (the Internet of Things), defined as the ability of devices, sensors and computers to communicate, send data, and monitor in real-time.

Already applied in multiple industries, including healthcare, agriculture, aviation, manufacturing and transport, in intralogistics specifically, IoT is a "new generation of Internet-connected embedded information and communication technology (ICT) technologies that work together to integrate supply chain and logistical activities in a digital environment," gaining "wider acceptance and popularity in warehousing and logistics operations."[1]

Understanding IoT

Through the interconnection of intelligent physical devices, sensors, and systems to utilize real-time data collection for automation and contextual problem solving, IoT has become a worthwhile investment for improving supply chain visibility and inventory management, monitoring conditions, and reforming the end customer experience. Altogether, an "enhanced connectivity across the internal logistics system infrastructure."[2]

While enhancing and enabling automation, IoT works alongside human labor. Repetitive manual tasks may be automated by Artificial Intelligence (AI) and Machine Learning (ML) via the communicative infrastructure of IoT, but human input is still required to implement operational decisions from the real-time data it gathers.

[1] Applications of the internet of things for optimizing warehousing and logistics operations: A systematic literature review and future research directions, Devinder Kumar, Rajesh Kr Singh, Ruchi Mishra, Samuel Fosso Wamba

[2] Cyber-physical systems for performance monitoring in production Intralogistics, O. Morth, Christos Emmanouilidis, N. Hafner, M. Schadler

Solutions

Usage of IoT in intralogistics

With systems like pallet sensors, smart shelves, and VR headsets, IoT's instant data spans the entire supply chain, from sorting and shipping to safety and security. Productivity patterns and the prediction of future outcomes are sourced by collecting data from IoT sensors and scanners used in warehouse automation, helping to improve:

Supply chain visibility
Tracking the location of assets and their movement alongside monitoring inventory levels.

Shipping optimization
IoT data can enable processes that help streamline delivery logistics, cutting downtime and transportation costs by monitoring vehicle tracking, route optimization, and shipping load sizes.

Condition and environment monitoring
IoT devices can control the environmental elements of a warehouse, including temperature and humidity levels for the protection of goods, and monitor for hazards, including water damage and the risk of fire.

Predictive maintenance
Through data collection and analysis, IoT can help access, maintain, and predict the condition of warehouse equipment to optimize efficiency in operations and prevent costly downtime.

CPS systems in intralogistics

One way to utilize IoT-driven analytics is through a Cyber-Physical Systems (CPS) approach – the visual creation of data process chains (contextual information) linked to performance measurement for intralogistics (KPIs). "The application implements a simple data process chain, starting from the acquisition and processing of data [from an area of the warehouse or a piece of equipment], followed by the determination and visualization of appropriate performance monitoring information on a dashboard."[3]

In traditional logistics methods, accurate performance monitoring systems have been hard to come by. Distilling data process chains in this way for each operation category can provide targeted performance information and increase overall equipment effectiveness. "KPIs may target performance measurements in terms of cost, time, quality, flexibility, and sustainability, relevant to different categories of operations, such as production, inventory handling, quality assurance, maintenance, and more. Among KPI targets in manufacturing operations, intralogistics is an important contributor to several aspects of overall manufacturing performance, and especially throughput, utilization, equipment effectiveness, but also to non-functional metrics, for example, sustainability and energy consumption."[4]

Investing in IoT systems will yield results. Studies found that "when companies used CPS (Cyber-Physical Systems) they were evaluated as having increased financial performance and competitiveness, a higher level of logistic service, improved cooperation between certain logistic functions, and more efficient processes with their partners."[4]

[3] Cyber-physical systems for performance monitoring in production Intralogistics, O. Morth, Christos Emmanouilidis, N. Hafner, M. Schadler

[4] Applications of the internet of things for optimizing warehousing and logistics operations: A systematic literature review and future research directions, Devinder Kumar, Rajesh Kr Singh, Ruchi Mishra, Samuel Fosso Wamba.

Implementation challenges for applying IoT

Despite the benefits, implementing IoT in automation logistics requires some necessary prerequisites that can be challenging to apply, including:

Network connectivity
Internet-connected devices require a robust and reliable network to process and cross-communicate to avoid disruption.

Data management
Automated warehouses using IoT will need a cloud system large enough to store the vast amounts of data captured, processed, and analyzed.

Online security control
IoT networks in logistics are just as prone to cyber-attacks and system hacking as any internet system – more so as IoT devices become an industry norm. Installing security measures is paramount to avoiding costly downtime from data breaches and threats to warehouse security systems.

The need for a highly skilled workforce
"As current internal logistics systems are already very complex, the abilities of human operators to understand, manage, and optimize their performance have reached their limits." However, IoT automation in logistics brings challenges "such as the need for higher skilled human operators to handle the technology properly."[5]

Significant investment
Implementing IoT in warehouse automation comes at a high cost. The initial outlay means overhauling an entire technology system and warehouse infrastructure, which can overshadow the benefits and payback down the line.

[5] Cyber-physical systems for performance monitoring in production Intralogistics, O. Morth, Christos Emmanouilidis, N. Hafner, M. Schadler

Industry use case

IoT real-time data in practice for intralogistics is used primarily for optimizing each stage of a production process, improving supply chain transparency, and performing predictive maintenance.

"An extract of applications of intralogistics systems are bulk-good terminals of forwarders, picking systems for the mail order business, assembly lines in the automotive industry, baggage handling systems in airports and high dynamic distribution centres for wholesale and retail. Intralogistics fills a key position between engineering and economy for companies acting in global supply chains."[6]

A Germany-based material handling company upgraded to a smart warehouse, with European forklifts deployed as connected IoT vehicles with integrated telematics. "The use of IoT in forklift trucks, combined with a more flexible and modern data platform, opens up automation possibilities and also reduces the risk of accidents and injuries, while additionally enabling usage tracking and minimizing downtime via predictive maintenance."[7]

[6] The Internet of Things: On Standardisation in the Domain of Intralogistics, Nagel, Roidl and Follert, First International Conference on The Internet of Things IOT 2008 Workshops

[7] Innovative Technologie, Logistik,Toyota Material Handling Deutschland

Value for end customers

"IoT is well known for increasing efficiency, productivity, safety, convenience, and response time and resolving labour shortages in various logistics and warehouse operations while cutting costs and positively influencing the environment."[8] But what about the advantages to the end customer? The use of IoT in warehousing and logistics can also account for the following:

Higher product visibility
Real-time data can provide information on the location of goods at every point, from storage to shipping, and highlight potential supply chain issues. As a result, customers can be proactively and personally informed about the availability of a product and stay up to date about their order as it happens.

Increased product quality
IoT systems monitoring the environmental conditions of warehouse storage and shipping mechanisms can help ensure products, such as perishable items, arrive in top condition.

Faster Delivery
IoT usage in intralogistics can help optimize order processing and reduce delivery backlogs.

[8] Applications of the internet of things for optimizing warehousing and logistics operations: A systematic literature review and future research directions, Devinder Kumar, Rajesh Kr Singh, Ruchi Mishra, Samuel Fosso Wamba

The future of IoT in intralogistics

The demands on supply chains are not slowing, meaning IoT devices will become more commonplace to achieve higher visibility and optimal output. Implementation costs will likely decline as it becomes normalized, and confidence in applying it will increase as more information becomes available, leading to increased adoption.

IoT and AI

IoT's real-time capabilities make it the preferred technology in an industrial context. Yet, as Industry 4.0 technologies merge, IoT's integration with Machine Learning & AI will see greater interconnectivity and more innovative warehouse automation. AI's vast interpretive, predictive, and problem-solving abilities can provide enhanced analysis of the instant data gathered from IoT devices, further improving accuracy and productivity.

Read Warehouse Insights: 4 Ways AI Transforms Intralogistics

IoT solutions from Kardex

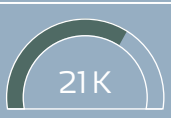
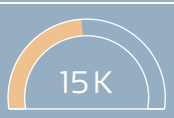
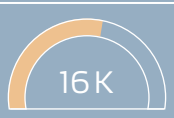
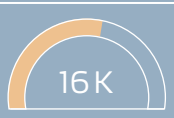
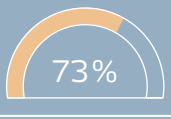
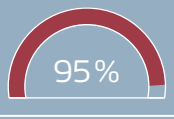
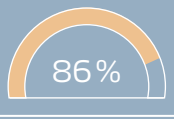
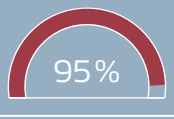
Kardex helps its customers automate their warehouse operations and improve efficiency by implementing IoT technology in logistics solutions, including automated storage and retrieval systems (ASRS) and performance monitoring. Our machines read values in real-time via a range of sensors and counters, providing instant data accessible locally or stored in the cloud with the help of an edge device. Here, it can be processed, analyzed, and displayed in dashboards accessible from anywhere.

Thanks to Kardex Connect, data-driven consultancy is now possible, allowing customized reporting, insights identification, performance, fill rates, and downtime estimation. Benchmarking across machines, countries, regions, and industry segments opens the door to a new level of possibilities to optimize performance. With the future development of Machine Learning and AI models, IoT networks will work even harder to ensure optimized productivity.

- Reduce downtime
- Increase productivity
- Reduce technician labor costs
- Directly access systems

Learn more about how to keep track of the most important productivity metrics, reduce downtime and increase availability with Kardex Connect

Analytics 2.0

	Kardex VLM 1	Kardex VLM 2	Kardex VLM 3	Kardex VLM 4
Cycles per hour	14.8	22.3	19.3	21.5
Cycles per day	271	403	348	402
Remaining cycles				
Fill level				
Front load	726 kg	1,332 kg	1,194 kg	1,308 kg
Rear load	1,108 kg	2,154 kg	2,241 kg	2,026 kg
Total load	1,834 kg	3,486 kg	3,435 kg	3,334 kg

Maintenance Dates

Machine	Daily cycles	Remaining cycles	Estimated maintenance date
Kardex VLM 2	403	14,988	2023-06-18
Kardex VLM 4	402	16,316	2023-06-21
Kardex VLM 3	348	16,565	2023-06-28
Kardex VLM 1	271	20,798	2023-07-27

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