

ThingMagic RFID: Powering industrial robotics and automation in 2024

The integration of RFID in industrial robotics and automation opens the door to unprecedented efficiency and precision across various industries. The key component in these applications, however, is not off-the-shelf RFID technology, but customized RFID solutions that lead to successful implementations, like JADAK's custom approach in automation and digitization that has led innovation in many key global industries, consumer-centric sectors, and the future designs of smart factories.

RFID's Role in Industrial Robotics and Automation

The infusion of RFID into industrial robotics symbolizes a major leap in operational effectiveness. This is particularly evident in high-impact areas such as:

- **Process Efficiency:** In the retail sector, RFID's most notable impact is on process efficiency. By reducing manual inventory management, RFID technology allows for smarter allocation of human resources. Robots equipped with RFID efficiently carry out stock audits and replenishments, feeding real-time data into enterprise resource planning (ERP) systems. This integration provides invaluable insights for data-driven decision-making and workflow optimization.
- **Identification and Tracking:** Revolutionizing tracking in industrial environments, RFID technology, in both its active and passive forms, caters to diverse needs. Active RFID tags, with their extended range, are ideal for comprehensive tracking in manufacturing, while the cost-effective passive tags are perfect for detailed inventory management due to their reader-activated nature.
- **Automation Enhancement:** By embedding RFID into automation robotics, industries witness a remarkable reduction in the need for manual inventory checks, streamlining operations in sectors where inventory accuracy is critical.

Case Study: AI Autonomous Humanoid Robot Manufacturer and JADAK Collaboration: RFID-Enhanced Robotic Warehouse Workers

The manufacturer of the world's first commercial autonomous humanoid robot collaborated with JADAK, to enhance robot safety in warehouses. JADAK's RFID system enables the robots to detect and navigate safely around human workers. This feature is critical for preventing accidents in environments where robots and humans coexist.



Figure 1 RFID in automated warehouse concept

JADAK's involvement in the project was pivotal, not just for their RFID expertise but also for their ability to customize solutions to meet the manufacturer's unique requirements. Their global certifications for RFID modules added significant value, eliminating the need for the company to navigate the complex and costly process of obtaining these certifications themselves. This aspect was particularly attractive to the company, as it streamlined their product development and accelerated time to market.

The successful partnership was underpinned by JADAK's proactive approach and understanding of the company's specific needs. The provision of development kits for easy testing and integration of RFID technology facilitated the developmental process, showcasing JADAK's commitment to client support and innovation.

Case Study: JADAK Equips Inventory Control Robots with RFID for Retail

In the dynamic world of retail, a leading manufacturer of inventory robots partnered with JADAK to deploy robots throughout a large global athletic retail chain to autonomously traverse aisles and utilize RFID technology to count products. This approach revolutionizes inventory management by ensuring accuracy and efficiency in a traditionally labor-intensive process.

While the robot's computer vision technology proficiently captured visual shelf data, the company aimed to broaden its capabilities for more precise, real-time inventory tracking. Partnering to achieve this, JADAK's expertise was crucial for integrating RFID technology into their existing systems, thus elevating its data collection and analytical abilities. The collaboration enabled the robots to perform comprehensive inventory scans by reading RFID tags on products, ensuring a higher level of accuracy in stock levels and pricing information.

Expanding RFID Applications Across Consumer-Centric Industries

RFID technology is transcending its traditional industrial and warehouse applications, profoundly impacting consumer-related sectors.

- **Supply Chain:** RFID's implementation in supply chain management is providing real-time tracking and improved goods management. Utilized by logistics companies for container tracking, it optimizes operations at ports and warehouses. Essential in cold chain logistics, RFID monitors temperature-sensitive items like food and pharmaceuticals during transit, enhancing visibility and ensuring timely delivery. Product tags facilitate tracking, improving logistics, and reducing losses of items, making RFID a pivotal element in modern supply chain management.
- **Retail:** In retail, RFID has become crucial for inventory management, loss prevention, and elevating the customer experience. 'Smart shelves' using RFID ensure product availability by alerting when stock levels are low. In fitting rooms, RFID enhances customer interaction, offering product information and suggestions. This technology maintains inventory accuracy, deters theft, and secures product availability, making it invaluable in complex retail settings for efficient product range tracking.
- **Healthcare:** In healthcare, RFID is revolutionizing patient safety and operational efficiency. Employed in hospitals for tracking equipment and patient movements, it's significantly reducing medication errors and enhancing patient care. Its use in blood banks for bag tracking exemplifies its role in ensuring safe blood transfusions and supply integrity. With a projected market growth to USD 22.85 billion by 2030, growing at a CAGR of 17.75% from 2023, RFID is tackling challenges in interference, security, and interoperability, becoming indispensable in pharmaceuticals and patient care.



Figure 2 RFID enables supply chain efficiencies

Case Study: Leading Food Scale System Producer Replies on JADAK RFID

JADAK has successfully implemented RFID technology for the largest producer of industrial and food retailing scale systems in the United States. This venture, enhancing grocery workflows especially in produce, meat, and other perishable items, is part of the scale producer's drive to leverage technology for operational efficiency, backed by its strong industry reputation and OEM partnerships.

The project involved the introduction of the [Pico RFID module](#), a choice made for its compact size and low power consumption, fitting the scale producer's requirement for a seamless and efficient technological integration. This RFID system facilitates real-time inventory tracking in store back-ends. By embedding RFID tags into products, it markedly improves stock management and reduces waste by providing accurate, real-time data.



*Figure 3 -
ThingMagic M7e
Pico UHF RAIN
RFID Module*



Figure 4 – RFID for produce expiration tracking

A standout feature of this RFID system is its capability to alert customers about product expiration dates. In this setup, when shoppers weigh their produce and meat on RFID-enabled scales, they receive instant alerts regarding the freshness of the products. This innovative approach not only elevates the shopping experience by guaranteeing product quality but also aids in effective inventory management by pinpointing products approaching their expiration. The result is a more streamlined, consumer-centric shopping experience, underscoring the transformative impact of RFID technology in retail operations.

CaseStudy : Large Multinational Retail Clothing Company Collaborates with JADAK

JADAK's implementation of RFID technology for one of the largest multinational retail clothing chains, dramatically transformed their inventory management. They adopted Electronic Product Codes (EPC) in the form of Radio Frequency Identification (RFID) tags to address issues of overstock and high markdowns.

This shift allowed the client to move from bi-annual stocktakes to daily counts, providing more accurate inventory records. The result was an improvement in full-price sales and a reduction in end-of-season markdowns due to greater precision and accuracy of inventory data.

The RFID rollout extended to 1,800 stores across 12 markets, indicating a successful adoption of the technology on a large scale. The company's global operations benefited from using RFID tags that operate along the full UHF frequency range, allowing for consistent application across different regions. This standardization also facilitated dealing with multiple tag providers.



Figure 5 - RFID for accurate retail inventory tracking

The Role of RFID in Smart Factories

The integration of RFID with AI and IoT is revolutionizing the concept of smart factories, significantly contributing to Industry 4.0. This synergy enhances manufacturing processes, automates operations, and enables data-driven decision-making. The transformative impact of this integration across various aspects of smart factories includes:

- **Integration with AI and IoT:** Combining RFID with AI results in improved warehouse efficiency and timely order fulfillment. It enables AI systems to leverage RFID data for monitoring safety and identifying potential hazards, promising more powerful future applications.
- **Smart Factory Technology:** Utilizing IoT technologies like AI and machine learning, smart factories perform automated operations and data analysis. This connected ecosystem links machines, communication channels, and computational resources, increasing efficiency and responsiveness.

Benefits of Smart Factory Technologies:

- **Efficiency and Productivity:** Shifting from reactionary to proactive approaches, smart technologies drive efficiency and resilient supply chain management.
- **Security and Sustainability:** Adoption of safer and more sustainable manufacturing processes is facilitated by smart factory technologies.
- **High Quality of Service and Product:** Cloud connectivity and comprehensive production process visibility enable instant analysis and guidance.

Use Cases in Smart Factories:

- **Digital Quality Control:** IoT-connected machinery tracks production data, reducing substandard products and recalls.
- **Factory Monitoring:** AI and IoT systems help eliminate production bottlenecks and optimize critical KPIs.
- **Predictive Maintenance:** Networked machines with sensors predict and prevent failures, reducing downtime.
- **Rapid Prototyping:** Leveraging real-time data collection for rapid prototyping and product modifications.
- **Warehousing:** Real-time inventory information from IoT and AI systems enables efficient autonomous order fulfillment.



Figure 6 - RFID is used throughout smart factories

Synergies with RTLS, ERP/MES Systems:

RFID's integration with RTLS, ERP, and MES systems enhances asset tracking, automated item validation, and real-time location tracking, significantly improving productivity and compliance.

Technical and Economic Considerations of RFID in Manufacturing

The incorporation of RFID technology in the manufacturing sector necessitates a comprehensive evaluation of both technical and economic considerations. These considerations encompass cost-benefit analyses, scalability assessments, long-term impact evaluations, and return on investment (ROI) projections.

Furthermore, the implementation of RFID technology yields tangible benefits in the realms of inventory management, labor cost reduction, and operational efficiency enhancement. The realization of ROI is contingent upon the unique requirements of each business. Active systems have the potential to deliver superior ROI in scenarios that demand real-time data access. On the other hand, passive systems can be more cost-effective for businesses that have lower labor costs and less stringent requirements for real-time data.

Benefits of Working with an Experienced RFID Manufacturing Partner

There are several advantages to working with an experienced partner like JADAK:

1. **THINGMAGIC® Reputation:** JADAK is renowned for its expertise in RFID technology. Their legacy in the field has established them as a leading provider and manufacturer of embedded and fixed RFID technology.
2. **Deep Engineering Expertise:** JADAK's engineering prowess, especially in RFID, barcode technologies, and machine vision, ensures high-quality, sophisticated solutions. Their breadth of knowledge translates into robust and innovative RFID applications.
3. **Collaborative Approach:** JADAK is recognized for its engineer-to-engineer collaboration style, which involves working closely with clients to deeply understand their challenges and develop precise, purpose-driven solutions.
4. **Customization:** Offering custom solutions is a cornerstone of JADAK's service. This capability is particularly crucial for RFID technology, which often requires tailored solutions to meet the unique needs of different industries and applications.
5. **Global Certifications:** JADAK's RFID modules come with comprehensive global certifications, which is a significant advantage for clients. These pre-certifications save companies considerable time and money in getting products market-ready and complying with international standards.
6. **New ThingMagic® M7e UHF RAIN Modules – Product Highlights:** The new M7e line of RFID technology by ThingMagic is now globally available with a short lead time. This line is notable for its advanced features, including enhanced read rate, sensitivity, and a smaller form factor.
7. **Highest Quality in the Market:** ThingMagic products are known for their high quality, setting industry standards in RFID technology. This reputation assures clients of reliable and durable solutions.
8. **Availability of Development Kits for Testing:** JADAK offers development kits, allowing clients to test and integrate RFID technology effortlessly. These kits facilitate experimentation and customization, making them invaluable for businesses looking to implement RFID solutions effectively.

Conclusion

The integration of RFID technology in industrial robotics and automation, propelled by industry leaders like JADAK, has ushered in a new wave of efficiency and precision across various sectors. From revolutionizing inventory management in retail to enhancing patient care in healthcare, RFID's role has been transformative. The ability of RFID to seamlessly integrate with broader enterprise systems has not only streamlined operations but also enabled real-time, data-driven decision-making. As the technology continues to evolve, its potential for further innovations in industrial automation and smart factory solutions remains vast. This paper underscores the significance of RFID as a key driver in the future of industrial operations, highlighting its indispensable role in shaping a more automated, efficient, and intelligent industrial landscape.

About JADAK

JADAK, a business unit of Novanta, is a market leader in machine vision, RFID, barcode, printing, and color and light measurement products and services for original equipment manufacturers. The business designs and manufactures custom embedded detection and analysis solutions that help customers solve unique inspection, tracking, scanning and documenting challenges. JADAK is based in Syracuse, New York, with sales and technical locations across the globe. For more information, visit www.jadaktech.com.