



# AI Application in the Logistics Industry

Xiaoqing Lei<sup>1,2</sup>, Qiaoge Hui<sup>3,\*</sup>

<sup>1</sup>Xi'an Fanyi University, Xi'an, Shaanxi, China.

<sup>2</sup>Woosong University, Daejeon, South Korea.

<sup>3</sup>CAPF of Engineering University, Xi'an, Shaanxi, China.

**How to cite this paper:** Xiaoqing Lei, Qiaoge Hui. (2023) AI Application in the Logistics Industry. *Advances in Computer and Communication*, 4(6), 378-382.  
DOI: 10.26855/acc.2023.12.006

**Received:** November 25, 2023

**Accepted:** December 22, 2023

**Published:** January 18, 2024

\***Corresponding author:** Qiaoge Hui, CAPF of Engineering University, Xi'an, Shaanxi, China.

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## Abstract

The impending decade heralds a transformative era where the pervasive integration of Artificial Intelligence (AI) presents a pivotal challenge to established scientific principles governing engineering and management in production and logistics. The evolution of transit and distribution centers, crucial nodes in logistics, undergoes significant shifts. This paper delves into an extensive literature review system within the logistics industry, focusing on AI applications. It specifically explores inventory management and proposes innovative logistics distribution transport solutions. These solutions hinge upon leveraging automation equipment and intelligent AI technology for resource scheduling management, catalyzing operational mode innovations, enabling real-time supervision, orchestrating intelligent integration construction, and other multifaceted functionalities. The primary objective is to instigate a profound transformation in logistics enterprises, facilitating an extensive upgrade towards heightened wisdom and efficiency in operational paradigms. This anticipates a comprehensive redefinition of logistics infrastructure and processes, fostering a forward-thinking and adaptable logistics ecosystem in the forthcoming era.

## Keywords

AI, logistics, AGV

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## 1. Introduction

With the continuous progress of science and technology, artificial intelligence (AI) technology is becoming more and more widely used in various industries, including the logistics industry. Logistics refers to the process of transporting products from producers to consumers, which involves supply chain management, transportation, storage, and distribution. Through its strong computing and analytical capabilities, AI technology brings many opportunities for innovation and efficiency improvement to the logistics industry. In order to meet the growing demand of the logistics industry, the operation scale of logistics enterprises continues to expand, the hard investment increases accordingly, and the logistics model is also evolving. In the whole logistics operation node, the addition and integration of transit and distribution (distribution, transfer, distribution, etc.) nodes is the core scene of AI application. A series of AI + logistics products, such as artificial intelligence stacker, automatic loading and unloading system, 3D visual picking robot system, and commodity information visual recognition system, further interpret the thinking and layout of the soft and hardware integrated products for various logistics scenarios.

## 2. Background Study

At present, more and more enterprises are integrating AI technology into logistics equipment and solutions. Artificial intelligence and data analysis capabilities enable the introduction of automation technologies such as robotics and automatic guidance vehicles (AGVs) in different areas of production [1]. Smart Logistics aims to successfully

implement a smart Lean Supply Chain [2] based on agile collaboration networks and interconnected organizations. The effectiveness of logistics network design and management of complex and geographically distributed production systems can be measured in terms of direct logistics costs and supply chain production performance. For example, the management of transport logistics involves difficult trade-offs, which often lead to the identification of multiple logistics solutions. The AI-based model is implemented as the modular architecture of the artificial neural network (ANN) [3]. AI technology is widely used in container ports, terminal terminals, intelligent warehousing, retail logistics, sales logistics, food logistics[4], vehicle scheduling, and other environments [1, 3-6], which has had a profound impact on operational efficiency and productivity.

### 3. Application

In recent years, the changes in logistics market demand can be summarized as the following three points: first, the consumer change, the need more flexible and flexible logistics system; second, the rising labor cost, and the young people unwilling to enter the warehouse to move boxes, accelerating the wide application of robot and automated logistics equipment; third, in the fierce market competition environment, enterprises also need to carry out digital and intelligent upgrade to achieve cost reduction and efficiency improvement and optimize management [1, 7].

In recent years, the epidemic has accelerated the application of AI in the logistics industry. For each enterprise, realistic fine management, intelligent operation, and actual resource integration are the best ways to promote enterprise development. Especially in the express delivery industry that the public is familiar with, driven by the scale, intensification, and intelligent development of leading express delivery companies, the competitive pressure of second and third-tier express delivery companies has increased, and it is difficult to compete with first-line express delivery companies. Under such huge competitive pressure, express companies are required to find the most suitable business model and construction model for their own development. There are also various explorations in the industry. Business model. In terms of self-operation, the company is responsible for the setup, investment, operation, and management of all hub transshipment centers, effectively realizing control over core resources and trunk networks. As for the joint party, the receiving and dispatching ends of the entire network are provided by affiliated express delivery operators with good quality alliances, and the final form forms a platform and a holding platform that combines the self-operation of the New York transshipment center and the main line network, and the final joint distribution. operating mode.

This paper mainly discusses the application of AI in resource scheduling management, operation mode innovation, and real-time supervision in the logistics industry.

#### 3.1 Resource Scheduling and Management

Resource scheduling management requires allocating human resources, sites, tools, and other resources to maximize the utilization of resources; close connection and orderly scheduling of vehicles[8]; real-time feedback and real-time adjustment. Specifically, the complete business process is completed from the aspects of appointment, disposal, waiting, passage, and platform operation feedback:

(1) Vehicle information is collected in advance, and the entry vehicles are required to make an appointment in advance. The auto-ID system obtains the real-time data of the vehicles and timely adjusts the personnel situation through the real-time video feedback information according to the different long information of the outbound and incoming goods.

(2) According to the information of vehicle booking for port departure and inbound goods in advance, prepare forklift truck, bar gun, sorting machine, and other equipment and tools in advance, and distribute them as needed.

(3) Identify the license plate according to the exit and entrance gate camera, and statistics the current vehicle pressure of the station. When the vehicle occupying space reaches the threshold, the entrance will be suspended to relieve the pressure in the station.

(4) The vehicle can realize non-inductive passage, complete intelligent weighing in the automatic odometer area, according to the instructions of the mobile phone terminal / SMS terminal / in-site guidance screen, accurately stop at the designated platform/crenel, open the door of the compartment, and loads and unloading the goods.

(5) Real-time video feedback of the platform, understanding the occupation of the platform/crenel, analyzing and feedback the vehicle information, cargo information, operation duration, operation personnel, loading degree information, etc., and speeding up the turnover efficiency of the site.

### 3.2 Innovation Of Operation Mode

In the automation equipment input, personnel action optimization, helps to improve the operation efficiency and reduce the work loss. Logistics operation from manual operation to semi-automation, and finally realize the direction of full automation research and exploration.

(1) Cargo information collection, from manual recording, code scanning gun, weighing weight to machine vision, 3D measurement, and other automatic transformation, to realize the automation of OCR identification, weighing, measurement, and code reading of goods documents;

(2) The movement mode of goods is gradually transformed from manual handling, manual forklift to transmission belt, sorting belt, and automatic forklift;

(3) The sorting mode of goods is gradually transformed from manual sorting, low-speed transmission belt to the robot, mechanical arm system linkage, cross-sorting belt, and high-speed sorting belt;

(4) Positioning technology is linked with intelligent video to realize the real-time positioning and on-site visualization of all people, forklifts, and goods, and to realize the full factor video extraction during the whole time;

(5) For abnormal parts, pay attention to the second-level retrieval of elements, quickly determine the damage and responsibility, and provide sufficient time for public crisis handling.

### 3.3 Real-Time Supervision

The new real-time supervision is mainly reflected in the shift to prior warning and in-process control. On the premise of fully considering the national policy compliance requirements, automatic warning and timely disposal of abnormal situations to reduce the losses caused by improper management and improve the handling of crisis events.

(1) Ensure operation compliance by optimizing personnel behavior, equipment use, and site management of 5S. Personnel tooling, and safety helmet intelligent identification, limit the operation area, to ensure the safety of the site operators. Video inspection replaces on-site manual inspection, and intelligently identifies artificial behavior and its on-site abnormality. Forklift speed limit, overspeed identification, immediate alarm, and strengthened field vehicle management. On-site 5S intelligent management methods, such as goods placement standards, goods storage, and site cleaning, are used to optimize the on-site operation efficiency.

(2) Access authority of key areas, multiple verifications of key information entrance, information traceability, and prevention and control, network access authority, firewall, network gate, etc., data loss and redundancy, or cloud backup storage. In the park, AI analysis, and white list of personnel identities, abnormal warnings, abnormal behavior warnings, and other functions, and both physical protection and network protection.

(3) Casting three protective rings in the perimeter area for early warning, operation area management, and strict control of the core area to ensure the safety of the perimeter and reduce the pressure of manual inspection. Intelligent inspection of the operation area and the operation safety is guaranteed. The core area is strictly controlled, with no loss of assets, and no loss of data.

(4) Intelligent water perception of water pressure situation, intelligent electricity perception of abnormal electricity consumption, and the moving ring system senses real-time environmental data such as temperature and humidity. Video system intelligent recognition, image type smoke sense, flame recognition, safe channel congestion recognition. Fire, security, dynamic ring multi-dimensional linkage, timely discovery and elimination of abnormal, prevention.

### 3.4 Intelligent Integration Construction

The era of big data has come. How to effectively use data and make it generate value is the direction of Stock and its customers and partners. The construction of intelligent integration requires breaking through multi-system barriers, unifying the system entrance, cleaning, analyzing, and modeling specific data, and providing decision-making suggestions for managers.

(1) Through the precipitation of video technology, big data, artificial intelligence, and other technologies, a new operation and management center is created to provide high-quality services for the connectivity and visibility of the enterprise network.

(2) Information interaction and sharing, rapid allocation and push of tasks, accurate reception of multi-region signals, and two-way perception control.

(3) Integrate local / group / third-party systems and data with an open and inclusive information platform to realize the melting of the suite and sharing at different levels.

(4) Establish exclusive authority, interface, and decision-making model for different requirements and different working mechanisms of different departments and positions.

(5) Build an elite team of video + intelligence analysis + decision-making and research and judgment for the transit and distribution center and its operation headquarters, and integrate the system construction with talent training.

(6) The system is a tool, and the implementation is the purpose. Around the actual situation of the center, establish a complete set of action working mechanisms, so that each business can achieve a closed loop.

**Table 1. Examples of AI technical applications**

Technology	Explanation of Technology	Supplier	Application Enterprise
AGV	Robot AGV is the abbreviation of Automated Guided Vehicle, namely automated guided vehicle. It is an unmanned vehicle that can drive independently in factories, warehouses, logistics centers, and other places. It can automatically travel on a pre-determined path and perform tasks such as cargo handling and material transportation.	1) Daifuku 2) KION Group 3) Seegrid Corporation 4) Swisslog 5) Toyota Material Handling	1) Cainiao Network 2) SF Express 3) ZTO Express 4) JD Logistics 5) Yunda Express
Auto-ID systems	Auto-ID systems above the manual workstation are much more efficient. They capture all codes at once - automatically and in a single operation. Only if data capture is error-free in the first step subsequent processes run smoothly and costs can be saved.	1) Honeywell 2) Avery Dennison 3) Datalogic 4) HID Global	1) Tencent 2) JD.com 3) CMHI Logistics
Positioning technology	Positioning technology refers to the techniques and systems used to determine and track the location of an object or person in a given space. It involves the use of various technologies to calculate and identify the precise coordinates of an entity in relation to a reference point or within a specific environment.	1) Locata Corporation 2) IndoorAtlas 3) Ubisense 4) Esri	1) Cainiao Network 2) SF Express 3) JD Logistics 4) ZJS Express

#### 4. Conclusion

From the perspective of industry trends, the deep integration of AI and automation technology will completely change the logistics industry pattern. Seeking productivity from science and technology, the application of automation equipment and intelligent technology greatly accelerates the operation efficiency; the addition of machine vision improves the efficiency of scanning code greatly compared to the original manual operation and greatly reduces the risk of error. The application of handling robots, automatic forklift trucks, and other equipment can not only improve efficiency, but also change the original operation mode of storage and handling, and realize a new business form of logistics and handling.

#### Funding

This research was funded by the Provincial Social Science Foundation of Shaanxi (grant number: 2023D051); Scientific Research Program Funded by the Education Department of Shaanxi Provincial Government (Program No.23JP051).

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