International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435(Online) Volume 14, Issue 12, December 2025)

Exploring the Role of IoT in Smart Logistics for Future using Machine Learning

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***Abstract*— Smart Logistics Powered by IoT and Machine Learning By employing real-time data and predictive analytics to minimize delays, optimize routes, and improve transportation performance, route optimization increases supply chain efficiency. Accuracy, scalability, and rapid decision-making in AI-driven logistics route optimization are significantly impacted by maintaining high-quality real-time data and managing the computational demands of AI models. RFID tags, GPS sensors, and environmental monitors are examples of IoT devices that collect data and give continuous data streams to manufacturers, suppliers, and logistics companies at different stages of the supply chain. Preprocessing is necessary for efficient analysis, data cleaning, and the elimination of noise and redundant entries from unprocessed IoT data streams. The integration of new technologies, particularly blockchain, the Internet of Things (IoT), and artificial intelligence (AI), is the only way to achieve increasingly critical aspects like flexibility, adaptability, and traceability. Without specifically searching for knowledge and data patterns, machine learning (ML) enables the Internet of Things (IoT) to become genuinely pervasive and extract hidden insights from the wealth of observed data. IoT's main objective is to sense what is going on around us and enable intelligent ways to automate decision-making that will resemble human decision-making. IoT is made up of four important technologies: security, actuators, connectivity, and sensing. The world continues to struggle with connectivity. Internet access and mobile connectivity are barriers, especially in low-income nations. Another issue is the current IoT platform's lack of cross-platform functionality, which contributes to its sluggish adoption. Additionally, these cutting-edge technologies pose significant modeling problems to conventional optimization techniques, opening up a wealth of new research opportunities for the development of novel optimization techniques in the field of logistics and transportation studies. Therefore, our goal is to carry out a thorough analysis of significant contributions made in the uses of STs in enhancing logistics operations and transportation network efficiency.**

***Keywords*—Internet of Things (IoT), RFID tags, Artificial Intelligence (AI), Machine Learning.**

I. INTRODUCTION

If we can fully utilize its potential, the Internet of Things (IoT) has the potential to become one of the major technical advancements of our time.

The Internet of Things (IoT) is defined as "a global infrastructure is enabled using advanced services by connecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies." IoT offers real-time visibility into shipments and conditions, AI can optimize routing and automate decision-making processes, and blockchain improves security and transparency. This study explores the potential for supply chain innovation and how these technologies are being used in logistics. The main goal of these growing quantities and varieties of IoT devices is to generate useful information about the entities in the operating environment so that intelligent judgments can be made. This is accomplished by analyzing data from the past, present, and future and granting access to the environment from which we require information. These data enable the best possible decisions about us and our surroundings, potentially in real time. To the best of our knowledge, however, there is currently a dearth of study in the scientific literature about the use of these technologies in the context of smart logistics. It appears obvious that extensive work is required to fully utilize the various features of these technologies in a logistical setting. Global trade now heavily relies on logistics, which requires cost-effectiveness, automation, and real-time visibility. By connecting physical items via the internet, the Internet of Things (IoT) facilitates automation, data collection, and smooth communication. IoT integration in logistics offers a chance to transform conventional procedures and build intelligent, data-driven supply chains.

II. TECHNOLOGIES SHAPING THE FUTURE OF SMART LOGISTICS IN IOT:

Internet of Things (IoT):

The term "Internet of Things" (IoT) describes a network of interconnected physical objects, such as machines, vehicles, devices, or people, that are equipped with sensors, software, and unique identifiers that allow them to gather, share, and process data over a network without the need for direct human-to-human or human-to-computer interaction.

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Artificial Intelligence (Ai):

AI's incorporation into logistics and supply chains is more than just a technical development; it signifies a fundamental shift in how companies run. Businesses may maximize all aspect of their operations, from demand forecasting and inventory management to transportation and customer service, by utilizing machine learning algorithms, predictive analytics, and intelligent automation.

Machine Learning (Ml):

An essential and complex component of the world economy is the logistics sector. It comprises organizing, carrying out, and overseeing the flow of products and data from producers to customers along the supply chain.This blog post will discuss the fundamentals of machine learning, examine statistics related to its usage in logistics, discuss major obstacles, and—above all—discover the many advantages and applications of machine learning in the logistics industry.

Block Chain:

A decentralized digital ledger that keeps track of transactions across several computers is known as blockchain technology. This is essential in the logistics sector since it guarantees safe and transparent data handling.

Blocks of transactions make up a blockchain. Each block ties to the previous one, producing a chain. Every node in a blockchain network has access to the full chain, which is dispersed throughout the network. Transparency in logistics is improved by this decentralization.

*Smart Supply and Logistics***:**

Numerous IoT applications are being seen in sectors that are constantly changing and expanding. IoT generates massive volumes of data in conjunction with cutting-edge communication technology. In today's emerging economies, real-time data analytics enables firms to satisfy customer demands. The impact of IoT in the manufacturing sector is best exemplified by supply-chain management (SCM). Blockchain reduces payment conflicts and boosts confidence between all parties. This increases accountability, which is essential for supply chain businesses looking to enhance logistics and deliver goods at a lower cost.

Additionally, by offering verifiable evidence of ethical sourcing and ecologically friendly activities, blockchain promotes sustainability projects and appeals to stakeholders and customers who care about the environment.

III. Applications Of Iot In Logistics:

The Internet of Things, or IoT for short, is the integration of physical objects that interact and exchange data without human involvement inside the network of the logistics and transportation industries.

Fundamentally, IoT makes it possible for equipment, vehicles, and sensors to connect and sync via the internet, resulting in a logistics environment that is more responsive, dynamic, and integrated. By keeping an eye on circumstances, improving data security, and handling the enormous volumes of data produced, an IoT device is essential to this ecosystem.

Real-Time Tracking: IoT gives logistics firms the ability to track assets and shipments in real time, giving them access to the most recent location information. This feature improves delivery accuracy and route management.

Inventory management: Businesses may automate inventory tracking and management with IoT devices like RFID tags and sensors. Effective inventory management results from this technology's assurance of precise stock levels and notifications when supplies are running short.

Vehicle tracking: By interacting with logistics management and supplying information on position, speed, and route efficiency, IoT solutions provide accurate tracking of every vehicle in a logistics organization.

IV. Current Trends In Iot In Smart Logistics:

Since traditional logistics require a lot of resources and contribute to waste generation, integrating sustainable technologies is crucial. The World Resources Institute claims that over 14% of greenhouse gas emissions worldwide are caused by logistical systems.

Additionally, in order to dynamically improve delivery routes, AI algorithms and machine learning examine traffic and meteorological conditions. In order to choose an effective route, the industry employs telematics to communicate data on traffic conditions, road limits, and fuel efficiency. Because it facilitates quick digitalization, effective administration, transparent and economical operations, and scalable deployment, the cloud logistics market is expanding. Cloud logistics is expanding due to the expansion of the e-commerce sector and the need for cybersecurity in digital operations.

V. Iot Security In Smart Logistics

By examining information requests such as "Explain the cybersecurity measures," we concentrate on some of the most important cybersecurity measures.

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Technological improvements have led to an increase in the value of efficiency and speed. This category includes contemporary modes of transportation. IT businesses have given these vehicles a lot of attention. They are significantly safer than standard cars, according to statistics. Like any new technology, advancements in autonomous and crewless cars have increased the risk of cyberattacks. Hackers think they can gain unauthorized access to the owner's private information by breaking into the system of any targeted vehicle.

VI. IoT Architecture In Smart Logistics

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VII. Conclusion

Blockchain, IoT, and AI have the power to completely change supply chain management and logistics, resulting in notable increases in sustainability, efficiency, and transparency. Adoption of these technologies is not without difficulties, though. Unlocking their full potential will require overcoming obstacles like high costs, integration challenges, and regulatory concerns.

Businesses must adopt these cutting-edge technology as the logistics sector develops in order to remain competitive and satisfy the expanding needs of international supply chains. Integrating blockchain technology with IoT and AI can increase its influence, especially when it comes to supply chains. Logistics operations could become more safe, effective, and transparent as a result of this integration. These technologies are being used to logistics in a number of active initiatives with the goal of improving areas including predictive maintenance, automated decision-making, and real-time tracking.

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