

IoT Integration in Logistics Network System—Glance

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Abstract

Transportation and logistics plays a most essential role in operations and supply chain management applications. As a medium, it makes it easier for people, things, and products to move from one place to another. At one stage of the supply chain, from 90- 95% of produced goods are transported in containers. Additionally, the global consumer class is predicted to grow by 35% to 40% by 2030, increasing the demands on the transportation sector. As a result, attention is being drawn to the most pressing issues facing the sector, which are sustainability, adaptability, and visibility. In this article modern technology usage is mainly focused in logistics operation in order to improve the efficiency. Transportation and logistics organizations might lessen these difficulties with the help of internet of things (IoT) technologies. Traditional trucks become data-transmitting vehicles with integrated sensors and onboard diagnostics systems, enabling management to monitor their vehicles, react to dynamic surroundings, and spot unproductive activity instantly. This work mainly focuses review of literature on IoT integration in logistics network.

Keywords: Logistics and supply chain management, IoT integration, transportation, efficiency.

INTRODUCTION

An interconnected network of devices known as the internet of things, or IoT, makes it simple to exchange and communicate data online. In terms of supply chain management and logistics, IoT comprises a variety of smart devices, including sensors and software, that can gather and analyze meaningful data in real time. Tracking your assets, keeping an eye on the outside world, and optimizing routes are all simple tasks that will boost the overall productivity and operational efficiency of your company.

IoT encompasses a range of smart devices, including sensors and software, that can gather and analyze meaningful data in real time for supply chain management and logistics. You can effortlessly manage your assets, keep an eye on the outside environment, and optimize routes, all of which will boost the overall productivity and operational efficiency of your firm. Trucks and other corporate

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vehicles can have Internet of Things (IoT) devices installed to monitor fuel usage, track the location of the vehicle with ease, and identify mechanical problems. IoT sensors can also be used in warehouses to conveniently track temperature, humidity, and different inventory levels. Additionally, it guarantees that the product or inventory is kept in the best possible conditions. But to do this, you need state-of-the-art digital solutions. Working with a reputable logistics app development company will assist you in creating an application that integrates with your IoT system without any

issues. The information gathered from these Internet of Things devices offers a number of useful insights that assist entrepreneurs in making better decisions. It has a number of benefits, including improved decision-making, decreased downtime, and increased overall productivity. Real-time automation and visibility are made possible by developing technology. Logistics is becoming a more responsive and efficient system as a result of IoT.

Why IoT Integration in Logistics Is Essential?

There is a need to include IoT into logistics and transportation for the following reasons:

1. Trucks and warehouses with smart IoT sensors offer real-time insights.
2. Cargo containers with IoT capabilities offer useful data on inventory control, route optimization, vehicle maintenance, and other topics.
3. Inventory management is made automated by RFID tags.
4. Aids in cargo tracking, security enhancement, and problem-prediction for enterprises.

Role of IoT in Logistics and SCM

As the world grows increasingly interconnected, the logistics industry is changing dramatically. Supply chain management is now mostly reliant on technology, which is driving logistics firms into a new era of connectedness and efficiency. Transportation and logistics are being reshaped by the Internet of Things (IoT) (Figure 1). IoT in logistics isn't merely a fad; it's quickly taking center stage in contemporary supply chains, improving everything from fleet management to customer happiness.

Uses of IoT in Logistics

Real-Time Tracking: Logistics firms can now follow shipments and assets in real-time thanks to the Internet of Things, which gives them access to real-time location data. Both route management and delivery accuracy are improved by this feature.

Inventory Management: Businesses may automate the tracking and management of their inventory by utilizing IoT devices like RFID tags and sensors. Accurate stock levels and low-supply alerts are guaranteed by this technology.

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

Predictive Repair: IoT systems can save downtime by predicting when a vehicle may need repair before a breakdown happens by analyzing vehicle data.

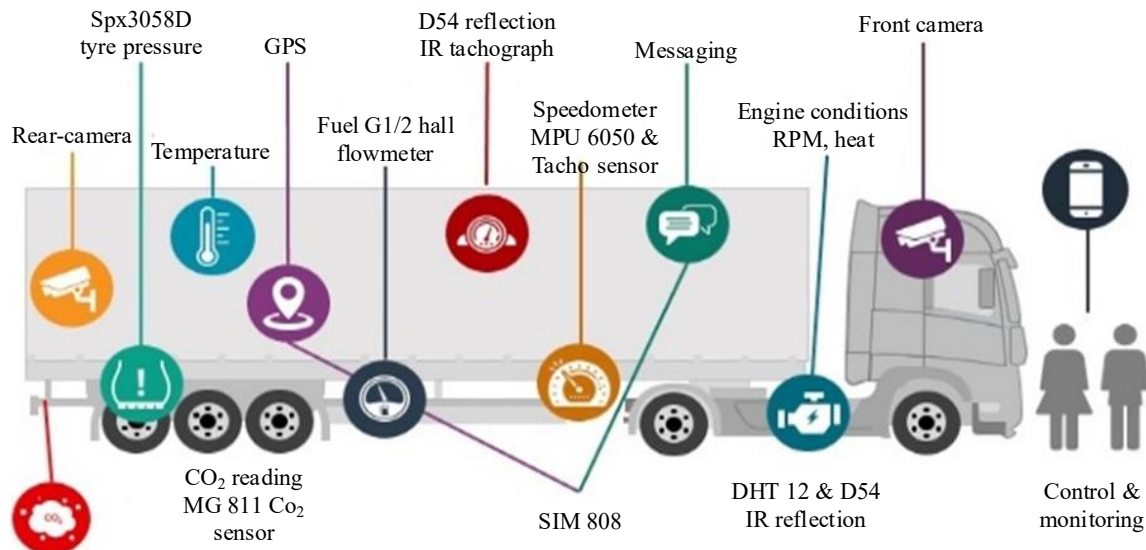


Figure 1. Integrated logistics using IoT technology.

Driver Behavior Monitoring: Internet of Things (IoT) devices have the ability to track driving habits and trends, giving drivers feedback that may result in safer driving techniques and increased fuel economy.

Advantages of IoT for Logistics

There are several strategic benefits to integrating the Internet of Things (IoT) into logistics. From inventory management to real-time tracking, it improves all facets of logistics. We list the main advantages below.

1. **Greater Effectiveness:** Supply chain operations are streamlined by IoT devices, which allow logistics firms to precisely monitor and manage assets. More operational agility and on-time delivery are guaranteed by improved route and delivery process management.
2. **Diminished Operating Expenses:** IoT technology allows logistics companies to drastically reduce expenses. Fuel consumption and vehicle performance data in real time assist minimize waste and maximize resource use, which lowers overall operating expenses.
3. **Increased Contentment with Customers:** IoT technologies increase customer satisfaction by offering quicker service and transparency. Predictive analytics and real-time location data guarantee that consumers receive their delivery on schedule and undamaged, enhancing dependability and trust.

LITERATURE REVIEW

Galina V. Ivankova et al [1] [2020] Industry 4.0, the fourth industrial revolution, offers brand-new tools to fundamentally alter how supply networks and companies function. This essay addresses the Internet of Things (IoT), a new technology that, like other technologies of the fourth industrial revolution like artificial intelligence, cloud computing, and "big data," has the potential to drastically alter the course of history. Businesses can use innovative services faster and with less risk thanks to IoT.

Imen Zrelli et al [2] [2024] Supply chain management (SCM) and logistics are rapidly embracing the Internet of Things (IoT), which represents a dramatic shift toward increased sustainability, security, and efficiency. The development of IoT in logistics and supply chain management is mapped out in this paper using a thorough bibliometric analysis of 2680 publications from the Scopus database. It shows a transition from early experiments to more established applications. The study reveals an intricate thematic framework, emphasizing the transformative effects of IoT and associated technologies like

RFID, the integration of Industry 4.0 with supply chain management (SCM) via AI and the industrial internet of things (IIoT), the strategic function of block chain for improved security and traceability, and the introduction of innovative communication and encryption technologies for safe data transfers.

Bo Feng et al [3] [2021] The logistics business is facing new problems as a result of global collaboration and the integration of online and offline channels. In order to manage the growing volume and complexity of logistics operations, smart logistics has emerged as a viable option. Technologies like artificial intelligence, information communication technology, and the Internet of Things make logistics operations more effective.

Devinder Kumar et al [4][2022] With the advent of Industry 4.0 technologies like cloud computing, artificial intelligence (AI), and the Internet of Things (IoT), the conventional warehousing and logistics sector has undergone a radical transformation, leading to major adjustments in a number of operations and decision-making processes. The primary study on the influence of IoT technology is dispersed and uneven, despite the topic's unquestionable importance. Through a thorough examination of previous research, the current study intends to examine the most recent literature on the use of IoT technology in the logistics and warehousing industry and offer a direction for further investigation. A comprehensive search of the Scopus and EBSCO databases covering the period from January 2011 to December 07, 2021, resulted in the careful selection of sixty-four research publications that examined the uses of the Internet of Things in the warehousing and logistics industry.

Hêriş Golpîra et al [5] [2021] In the last 10 years, practitioners and scholars have paid close attention to the developing logistics internet-of-things (L-IoT) scenario. The expanding number of papers published at international conferences and scientific journals is proof of this increased interest. Consequently, the time has come to present a thorough and methodical literature assessment of recent works in order to construct a historical context and to illuminate possible avenues for further investigation. To do this, this study has thoroughly examined 560 papers in order to suggest a generic design for the L-IoT and to identify current research gaps by developing a precise and accurate understanding. Additionally, it has classified 185 of these papers, which were published between January 2008 and September 2020, in order to offer a suitable classification and comprehensive recommendations for directing future L-IoT research.

Rodolpho Izac Cuenca et al [6] [2020] The ability to adjust to the fluctuating demands of the market is essential for businesses to survive in the current worldwide economy. Industrial logistics plays a crucial role in production flexibility in this situation. In order to address this pressing demand, Industry 4.0 introduces the Internet of Things (IoT). The current study uses the PROKNOW-C method (knowledge development process – constructivist) to conduct a systematic literature review with the goal of comprehending the use of IoT (Internet of Things) in industrial logistics, given the significance of industrial logistics on production line flexibility.

Suwendu Naskar et al [7] [2020] The Internet of Things, or IoT, aims to create an ecosystem in which intelligent, networked things can perceive changes in their environment, interact with one another, analyze information, and actively participate in decision-making. One of the main concerns of manufacturing and logistics companies is supply chain performance optimization. Through object identification and tracking, Radio Frequency Identification (RFID) is assisting enterprises in creating automated and networked smart environments, paving the way for the eventual Internet of Things. This chapter makes an effort to comprehend the body of existing research on RFID applications in supply chain management that uses the Internet of Things. We group Existing literature into two categories: supply chain processes and research methodology.

Moayad Al-Talib et al [8] [2023] The aim of this research is to investigate how information technologies (IT) might enhance supply chain operations. In order to utilize IT and improve supply chain performance, it seeks to execute a systematic literature review (SLR) to pinpoint study areas that need more investigation. The 177 publications in this study—which include journal articles, conference papers, periodicals, theses, and books published between 2013 and 2023—are analyzed using a systematic literature review process. The most suitable method for combining the results of the study's comprehensive literature review was defined as thematic synthesis. With the help of this approach, thematic data is interpreted, and a thorough grasp of the examined literature is developed.

Martijn Koot et al [9] [2021] The desire to invest in big data analytics (BDA) and the internet of things (IoT) does not appear to be influenced by the supply or demand for new technology. Most enterprises can now afford the sophisticated sensing and communication systems that are needed. However, because supply chains are dynamic and unpredictable, businesses need more operational data. What is the reason for delaying the actual deployment of supply chain tracking and monitoring devices? The most recent IoT advancements in supply chain and logistics research are objectively summarized in this report. Finding scholarly works that demonstrate how businesses can use real-time data from physically working objects to inform their decisions is the primary goal.

Soonh Taj et al [10] [2023] The handling and optimization of every aspect of the supply chain process for goods and services is the focus of supply chain management, or SCM. Modern supply chain management is benefiting from the rapidly developing and expanding Internet of Things (IoT) space. Through the automation and digitization of supply chain activities, IoT technology may maximize operational efficiencies while lowering operating costs. IoT device proliferation has completely changed supply chains. IoT devices in the supply chain process use the newest real-time monitoring technology, such as GPS, to track and trace shipments.

Abderahman Rejeb et al [11] [2020] This paper examines Internet of Things (IoT) research in logistics and supply chain management (SCM). The knowledge progress in IoT research within the framework of supply chain management and logistics was objectively and analytically unearthed through a comprehensive review and bibliometric analysis. The selection of 807 journal articles published over a two-decade span served as the starting point for the analysis. After that, bibliometric characteristics such the year of publication, sources, authors, and institutions were used to examine the publications. This relevant literature was clustered using a term co-occurrence network.

Sreeparnesh Sharma Sivadevuni et al [12] [2023] The twenty-first century has brought about significant changes in social trends, technological advancements, and industrial accomplishments. The shift toward automation and a decline in human involvement in the majority of industries (Industry 4.0) are the results of the fourth industrial revolution. This article explores the impact of technology on the Internet of Things (IoT) and its ongoing effects on supply chain management (SCM) in the context of Industry 4.0 by conducting a thorough evaluation of the body of existing literature.

Yasaman Mashayekhy et al [13] [2022] Supply chains have been impacted in all ways by the development of Industry 4.0 technology. By utilizing these new technology, firms have recently attempted to increase the value of their operations. One of the most crucial areas of a supply chain impacted by Industry 4.0 technology has been the warehouse. Procedures: This paper recognizes the importance of inventory management in supply chains and tries to show how IoT technologies affect inventory management in supply chains. It also identifies research gaps in the application of IoT to inventory management through a thorough investigation.

Shehzad Ahmed et al [14] [2021] Among scholars and practitioners, the Internet of Things (IoT) and its advantages and difficulties are the most recent research subjects. Due to the rapidly increasing complexity of supply chains (SCs), businesses would benefit from having high supply chain visibility (SCV) since it would simplify procedures and lower complexity by reducing errors. The organization's capacity to gather and assess data in order to strike a balance between strategy and objectives has been highlighted in the literature that is currently available. The majority of research focuses on examining how IoT affects several domains, including product creation, lean manufacturing, organizational structure, sustainability, and strategic management.

Shuo Zhang et al [15] [2024] The literature on digital supply chains (DSC) is thoroughly reviewed in this study, which also looks into the current state of application and development trends of various digital technologies in supply chain management. The review is carried out from the viewpoint of seven important digital supply chain technologies: 3D printing, big data (BD), blockchain, digital twins (DT), Internet of Things (IoT) and radio frequency identification (RFID), 5th generation mobile communication technology (5G), and intelligent autonomous vehicles (IAVs). It gives an outline of previous research, highlights the key drawbacks and potential of the several DSC technologies, and pinpoints knowledge gaps by describing the benefits, drawbacks, and constraints of each technique separately.

Reza Tavakkoli-Moghaddam et al [16] [2022] This essay analyzes the Internet of Things' (IoT) application in the food supply chain (FSC) and points out the system's advantages and disadvantages. As a review research, this report has examined 93 articles pertaining to IoT applications in the FSC that were published between 2014 and June 2021. A survey of the literature revealed six fundamental uses for this kind of network: FSC transparency, resource/waste management, food production, transportation procurement, food safety enhancement, and food quality maintenance.

Somayya Madakam et al [17] [2015] Internet of Things is one of the buzzwords in information technology (IoT). The Internet of Things is the future, and it will turn physical objects into intelligent virtual ones. The goal of the Internet of Things is to bring everything in our environment together under a single infrastructure, which will allow us to control the objects around us and stay updated on their condition. A comprehensive analysis of academic research articles, corporate white papers, expert talks, and online databases is how the current study tackles IoT topics. Additionally, this study paper concentrates on the definitions, genes, fundamental requirements, traits, and aliases of the Internet of Things.

Ezekiel Onyekachukwu Udeh et al [18] [2024] The Internet of Things' (IoT) critical role in improving supply chains' efficiency and transparency is examined in this review study. Unprecedented visibility and control are made possible by IoT, which is a vital enabler as global industries seek sustainability and simplified operations more and more. This study evaluates the effects of IoT on supply chain dynamics by combining results from a variety of sources, including case studies and empirical research. IoT makes it possible to track products and data in real time, which greatly improves supply chain transparency at every level, according to the report. Adherence to sustainability requirements, regulatory standards, and proactive decision-making are all facilitated by this increased visibility. Furthermore, it has been demonstrated that IoT integration improves customer satisfaction through more dependable and fast service delivery, streamlines operations, and lowers costs.

Alexandra Lagorio et al [19] [2023] The shift in logistics procedures to Logistics 4.0, also known as smart logistics, which is the particular implementation of Industry 4.0 in logistics systems, adds to the growing demand for dependable and effective communication networks in order to handle the substantial volumes of data exchange between workers, products, vehicles, and equipment. The Internet of Things (IoT), big data, cloud computing, and artificial intelligence work together to optimize and

improve a number of logistics processes while also promising sophisticated, reliable real-time communication.

Parvaneh Asghari et al [20] [2019] The Internet of Things, or IoT, is seen as an ecosystem that consists of smart objects with sensors, networking, and processing technologies that integrate and cooperate to create an environment where end users may access smart services. Through an environment where smart services are offered to utilize any activity anywhere and at any time, the Internet of Things is bringing many benefits into human life. The various applications carried out in the Internet of Things environment serve to convey all of these facilities and services.

Mohamed Ben Daya et al [21] [2017] By means of a thorough literature study, this research investigates the function of the Internet of Things (IoT) and its effects on supply chain management (SCM). A number of SCM procedures and applications, as well as the concept of IoT and its primary enablers, are discussed. The existing literature can be categorized in a number of ways, including by methodology, industry sector, and the main supply chain operations. Furthermore, the literature is analyzed bibliometrically. With few analytical models and empirical research, we discover that the majority of studies have concentrated on conceptualizing the impact of IoT.

Mu-Chen Chen et al [22] [2021] In recent years, the logistics business has implemented numerous IoT technologies, which have significantly impacted a number of industries, including shipping, air freight, warehousing, inventory, etc. IoT's development depends on investigating technical prospects and conducting trend analysis, which may be accomplished in a variety of ways. technological-service evolution analysis (TSEA), technological opportunity analysis (TOA), and data analysis and text mining techniques have all been used in this research to examine and track the development of IoT technologies and services. The findings of this research are examined and contrasted with those of a few earlier review studies. In conclusion, this paper's findings offer methodological recommendations for a thorough comprehension of logistics services connected to the Internet of Things.

Maria Matusiewicz et al [23] [2023] Enhancing the utilization of current resources, decoupling, and the circular economy are some strategies to address the energy crisis and the planet's rising temperature. Sharing resources and utilizing logistics are the answers to making the most of them. We made the decision to examine the thoughts and research that have already been done in the field of shared logistics in order to provide an overview of the state of the science, what is known, what is lacking, and what merits enhancement. In this report, the scientific advancements in shared logistics from 2017 to 2021 are compiled.

Rodolpho Izac Cuenca et al [24] [2020] The ability to adjust to the fluctuating demands of the market is essential for businesses to survive in the current worldwide economy. In this regard, industrial logistics plays a crucial role in ensuring production flexibility. The idea of Industry 4.0 introduces the usage of IoT (Internet of things) to address this urgent demand. Given how crucial industrial logistics are to production line flexibility, this study conducts a systematic literature review using the PROKNOW-C method (knowledge development process – constructivist) with the goal of comprehending how IoT (Internet of Things) is used in industrial logistics.

Yanxing Song et al [25] [2021] Logistics is essential to economic growth and a major factor in the competitiveness of nations and businesses. The logistics sector is still beset by excessive expenses and inefficient operations, nevertheless. As smart logistics advances, there are chances to address these issues. One of the key components of contemporary ICT, the Internet of Things (IoT) can generate vast amounts of data and use a variety of mathematical analysis tools to examine the intricate connections between the transactions these data represent.

Goknur Arzu Akyuz et al [26] [2022] The seamless operation, integrity, and traceability of logistics and supply chain (SC) activities are essential for supply chain management (SCM). Businesses are searching for and implementing new technology systems to manage all SC processes and assets from

start to finish, guaranteeing online and real-time monitoring across partners and processes. A thorough literature review is therefore used in this article to thoroughly discuss the function and effects of the Internet of Things (IoT) on SCM. The benefits and difficulties of the Internet of Things are explored from an SCM standpoint, and its applications in the SC are thoroughly investigated. The results demonstrate how IoT, one of the most important technologies of the twenty-first century, drastically affects SC procedures.

Shubhalika Dihulia et al [27] [2017] The security issues with IoT networks are covered in this survey paper. The Internet of Things is a popular study topic. IoT servers and data warehouses are crucial in the age of digital media. Several smart city networks leverage IoT networks. For this reason, maintaining the security of the Internet of Things network is likewise a major undertaking. The IoT-based security network has a lot of gaps. Talk about The security features of IoT networks in this survey paper. Additionally, talk about the various studies' earlier work and earlier IoT security work.

Liu et al [28] [2024] The logistics and warehousing sector is dealing with previously unheard-of opportunities and challenges as a result of the quick advancement of technology and the ongoing advancement of civilization. As the two cornerstones of contemporary technology, the IoT and AI have fundamentally altered the warehouse and logistics sectors. Real-time tracking and monitoring of logistics data, the development of intelligent warehouse management systems, the optimization of intelligent distribution systems, and the comprehensive use of artificial intelligence in supply chain management are just a few of the applications of IoT and AI in contemporary logistics and warehousing that are thoroughly examined in this article.

Nisha Ravi et al [29] [2023] This study aims to provide intelligent solutions for all organizational logistics problems. Modernity is indicated by innovation in logistics. A major emerging technology is the Internet of Things (IoT), which allows objects to connect to other platforms and to one other. The elements that influence the use of IoT in smart logistics should also be investigated in order to address the problems that the logistics sector is now facing. The Internet of Things is a global network of intelligent devices that boosts the efficiency and productivity of a logistics company by integrating the digital world.

Basim Aljabhan [30] [2022] The process of using the Internet of Things (IoT) in supply chain management and logistics is challenging since different businesses have varying standards for embracing new technology. Recent statistics demonstrate that the majority of industrial businesses are using IoT technology more and more to improve supply chain management. However, the expectations of small and large enterprises differ when it comes to implementing new technologies such as the global network of electronic product codes (EPCs) and Radio Frequency Identification (RFID). Therefore, the purpose of this paper is to examine the main effects of integrating IoT technology with suppliers' supply chain management systems. In this paper, a thorough survey is carried out with the aim of examining the elements that influence supply chain management.

CASE STUDY ON IOT INTEGRATION IN LOGISTICS

Compared to 6.3 billion connections in 2016, the worldwide IoT market is expected to reach 1.1 trillion dollars (excluding equipment) in 2025, with 25.2 billion connections (GSMA Intelligence Report). Of these linkages, half should be in the industrial sector, which includes logistics. Wonderful! How might the Internet of Things be applied to logistics, though? How may they be advantageous to you? The following are a few instances.

IoT's Function in Transportation and Logistics

Standards for logistics are evolving to increase precision and speed. In order to assist businesses, provide high-quality services while minimizing expenses, technology is keeping up with this shift. The

Internet of Things, or IoT, is one of these and is important. In logistics, it may present a number of opportunities, including:

1. The supply chain.
2. Freight tracking.
3. Fleet management
4. Storage, etc.

To refresh your memory, the Internet of Things refers to the use of the internet to connect and communicate between items. The general population is familiar with connected objects. This group of technologies is a major force behind the industry's digital revolution. And one of the industries that gains the most from the Internet of Things is logistics. With its sophisticated telemetry capabilities, monitoring solutions, and enhanced decision-making, the Internet of Things has revolutionized the logistics industry. The worldwide market is expanding quickly.

IoT Applications in Logistics, for instance ***Monitoring and Evaluating Stock***

Barcodes are a useful tool for the conventional, fundamental inventory process. But RFID (radio frequency identification) and smart labeling can help. There are several automation and analysis capabilities with this IoT solution. These labels have the capacity to retain and update vital product information in real time. Stock movements may become easier to see as a result.

Making Storage Better

Undoubtedly, one of the most crucial areas of the industry is storage. Storage optimization is essential, and things that are kept there are precious. They are worthy of your whole attention. IoT sensors can aid with this work, for instance, by: · detecting fires; · maintaining a certain constant humidity level; · keeping a place safe; · maintaining a predetermined temperature.

Real-time Fleet Management

The most popular IoT solution for logistics is most likely fleet management. Companies can: · increase delivery time accuracy; · improve driver assignment procedure compliance; · keep drivers and cargo safe by using GPS or satellite trackers to gather vehicle data. Additionally, you may keep an eye on driving habits and fuel use. You can see that there is a human element in this program. A customized training plan for drivers can be developed using data. Their professionalism and job satisfaction will both increase as a result.

Examining the Integrity of Shipments

Both operational effectiveness and consumer happiness are impacted by maintaining shipment integrity. The Internet of Things can provide customized solutions. For instance, a smart sensor can keep an eye on the proper transportation conditions for containers or isolated goods. Theft and improper handling can also be identified. A dashboard that is easy to use and useful can incorporate all of this data.

Observing the Supply Chain

An important and delicate component of optimized logistics is the supply chain. To keep a tight eye on supply chain operations, businesses take action. Once more, the IoT is helpful in this logistical task. Real-time journey tracking, cargo location viewing, and end-to-end supply monitoring are all possible.

Increasing the Security of

ITThreats to cybersecurity are increasing, according to statistics. The logistics industry is no different from other industries. Things that are connected need to be secure. Despite being mostly associated with

the internet, smart objects employ a variety of communication protocols and techniques. Various technologies are used by the various IoT networks to: · lower the danger of cyberattacks; · adjust to local needs.

Summary of Integrated IoT in Logistics

The Internet of Things (IoT) assists companies in tracking each vehicle's location and determining the most cost-effective routes. Businesses can cut overall operating costs by using fewer delivery workers thanks to automated order processing and status updates. For last-mile deliveries, using networked bots can greatly save expenses while also improving customer happiness. Businesses can leverage a variety of data from the Internet of Things, such as how long it takes to sell a specific quantity of inventory in a warehouse, how to optimize supply, which employees have better performance histories, and which distribution facilities have greater conversion rates. Logistics IoT devices give managers the ability to use wearable technology and sensors to keep an eye on employees' physical safety. Employers can use the Internet of Things to shield workers from harmful environments and notify drivers when they are not adhering to safety regulations. Numerous kinds of IoT and logistics anti-theft technologies are available, including alarm systems, smart fences, sensors for real-time asset tracking, and connected intrusion detection devices. IoT logistics solutions are available to business managers that offer enhanced supply chain and inventory transparency along with defenses against fraud, product theft, and tampering. Data security is the most important consideration when implementing any kind of IoT application on your network. Certain systems employ several levels of device and data security to safeguard your information and IT networks.

FUTURE SCOPE OF IOT IN LOGISTICS

In logistics, this translates to a network of sensors implanted in cargo, cars, warehouses, and equipment, creating an interconnected ecosystem. The Internet of Things (IoT) concept is centered on networked devices, sensors, and systems that naturally communicate and exchange data in real-time. By increasing operational efficiency, IoT in logistics offers some of the most obvious advantages. Shipments can be tracked in real time using GPS-enabled sensors, which gives exact location information that facilitates proactive decision-making, route optimization, and delay mitigation. This improves service standards by expediting delivery procedures and enabling logistics firms to provide clients with precise and trustworthy tracking information.

IoT has an impact on inventory management as well because sensors keep an eye on environmental factors, stock levels, and expiration dates. By minimizing stock outs, reducing overstocking, and ensuring ideal storage conditions, this proactive approach lowers expenses and minimizes waste. IoT sensors on smart shelves measure inventory levels, automatically placing reorders and streamlining supply chain processes.

CONCLUSION

There are numerous uses for IoT in supply chain and logistics management, including better fleet management, real-time tracking, increased warehouse automation, and much more. It offers multiple benefits, such as better inventory control, reduced maintenance costs, and increased overall productivity.

Each IoT device transmits data packets that need dependable connectivity, storage, and security, in addition to the exponential development in linked devices. The Internet of Things represents a challenge to an organization's abilities to oversee, manage, and protect an enormous amount of data and connections from dispersed endpoints.

Logistics management functions are the supply chain management machine's linkages, and each one is essential to making sure that goods are delivered on time and within budget. Smart logistics solutions give transportation or logistics companies complete control over their items while they are being

transported, hence addressing their worries. It helps lower the chance of product damage and delivery failures brought on by malfunctions.

REFERENCES

1. Galina V. Ivankova et al, Internet of things (IoT) in logistics. IOP Conf. Series: Materials Science and Engineering 940 (2020) 012033, doi:10.1088/1757-899X/940/1/012033.
2. Imen Zrelli et al, A bibliometric analysis of IoT applications in logistics and supply chain management, Heliyon 10 (2024), <https://doi.org/10.1016/j.heliyon.2024.e36578>.
3. Bo Feng et al, Operations management of smart logistics: a literature review and future research, Front. Eng. Manag. 2021, 8(3): 344–355 <https://doi.org/10.1007/s42524-021-0156-2>.
4. Devinder Kumar et al, Applications of the internet of things for optimizing warehousing and logistics operations: : a systematic literature review and future research directions, Computers and Industrial Engineering, Vol:171, <https://doi.org/10.1016/j.cie.2022.108455> ,2022.
5. Hêriş Golpîra et al, A review of logistics internet-of-things: current trends and scope for future research, Journal of Industrial Information Integration, 2021, doi: 10.1016/j.jii.2020.100194.
6. Rodolpho Izac Cuenca et al, Systematic literature review on the use of the internet of things in industrial logistics, Transdisciplinary Engineering for Complex Socio-Technical Systems – Real-Life Applications J. Pokojski et al. (Eds.), doi:10.3233/ATDE200072, 2020.
7. Suvendu Naskar et al, A literature review of the emerging field of IOT using RFID and its applications in supply chain management, 2020, IGI Global Publishing, doi: 10.4018/978-1-7998-0945-6.ch096.
8. Moayad Al-Talib et al, A systematic review of the literature on the use of information technologies in supply chain management, International Journal of Industrial Engineering and Operations Management, doi 10.1108/IJIEOM-09-2023-0073, 2024.
9. Martijn Koot et al, A systematic literature review of supply chain decision making supported by the internet of things and big data analytics, <https://doi.org/10.1016/j.cie.2020.107076> ,2020.
10. Soonh Taj et al, IoT-based supply chain management: a systematic literature review, <https://doi.org/10.1016/j.iot.2023.100982>, 2023.
11. Abderahman Rejeb et al, Internet of things research in supply chain management and logistics: a bibliometric analysis, <https://doi.org/10.1016/j.iot.2020.100318>, 2020.
12. Sreeparnesh Sharma Sivadevuni et al, Systematic literature review – IOT based supply chain management in industry 4.0, Intelligent Cyber Physical Systems and Internet of Things, Conference, 2023.
13. Yasaman Mashayekhy et al, Impact of internet of things (IoT) on inventory management: a literature survey, Logistics, Vol:6, Issue: 2, 2022, <https://doi.org/10.3390/logistics6020033>.
14. Shehzad Ahmed et al, Towards supply chain visibility using internet of things: a dyadic analysis review, Sensors 2021, 21, 4158. <https://doi.org/10.3390/s21124158>.
15. Shuo Zhang et al, Digital supply chain: literature review of seven related technologies, Manufacturing Rev. 11, 8 (2024) © S. Zhang et al., Published by EDP Sciences 2024 <https://doi.org/10.1051/mfreview/2024006>.
16. Reza Tavakkoli-Moghaddam et al, Applications of internet of things in the food supply chain: a literature review, J. Appl. Res. Ind. Eng. Vol. 9, No. 4 (2022) 475–492.
17. Somayya Madakam et al, Internet of things (IoT): a literature review, Journal of Computer and Communications, 2015, 3, 164-173, <http://dx.doi.org/10.4236/jcc.2015.35021>
18. Ezekiel Onyekachukwu Udeh et al, The role of IoT in boosting supply chain transparency and efficiency, Magna Scientia Advanced Research and Reviews, 2024, 11(01), 178–197, <https://doi.org/10.30574/msarr.2024.11.1.0081>.

19. Alexandra Lagorio et al, 5G in logistics 4.0: potential applications and challenges, *Procedia Computer Science* 217 (2023) 650–659.
20. Parvaneh Asghari et al, Internet of things applications: a systematic review, <https://doi.org/10.1016/j.comnet.2018.12.008>, 2019, Volume 148, 15 January 2019, PP:241-261.
21. Mohamed Ben Daya et al, Internet of things and supply chain management : a literature review, <https://doi.org/10.1080/00207543.2017.1402140>, 2017, PP: 4719-4742.
22. Mu-Chen Chen et al, Exploring technology opportunities and evolution of IoT-related logistics services with text mining, *Complex & Intelligent Systems* (2021) 7:2577–2595 <https://doi.org/10.1007/s40747-021-00453-3>.
23. Maria Matusiewicz et al, Shared logistics—literature review, *Appl. Sci.* 2023, 13, 2036. <https://doi.org/10.3390/app13042036>.
24. Rodolpho Izac Cuenca et al, Systematic Literature Review on the Use of the Internet of Things in Industrial Logistics, *Transdisciplinary Engineering for Complex Socio-technical Systems – Real-life Applications*, 2020, doi:10.3233/ATDE200072.
25. Yanxing Song et al, Applications of the internet of things (IoT) in smart logistics: a comprehensive survey, *IEEE Internet of Things Journal*, VOL. 8, NO. 6, MARCH 15, 2021.
26. Goknur Arzu Akyuz et al, Impact, benefits and challenges of IoT for logistics and supply chain management, *JTOM*(6)2, 1153-1171, 2022.
27. Shubhalika Dihulia et al, A literature survey on IoT security challenges, *International Journal of Computer Applications* (0975 – 8887) Volume 169 – No.4, July 2017.
28. Liu et al, Research on the application of IOT and AI in modern logistics and warehousing, *Journal of Industrial Engineering and Applied Science*, Vol. 2, No. 2, 2024.
29. Nisha Ravi et al, Influence of IOT on smart logistics, *Socialis Series in Social Science*,5, 51-62.
30. Basim Aljabhan, A comprehensive analysis on the adoption of IoT with logistics and supply chain management, 2022 Second International Conference on Computer Science, Engineering and Applications (ICCSEA), <https://doi.org/10.1109/ICCSEA54677.2022.9936196>.