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A Recent Literature Review on the Use of IoT in Medical Logistics

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Abstract

The Internet of Things (IoT) has emerged as a transformative technology in the healthcare sector, offering significant advantages for improving the efficiency and reliability of medical logistics. This study presents a systematic literature review of recent research (2020–2025) focused on the application of IoT in medical logistics. A total of 200 studies were initially identified, and through a structured selection process using the PRISMA framework, six articles were ultimately included for in-depth analysis.

The findings highlight that IoT technologies are widely applied in areas such as cold chain monitoring, inventory tracking, real-time asset management, and integration with blockchain and cloud platforms. These applications improve data accuracy, reduce product spoilage, and enhance traceability. However, challenges such as high implementation costs, system interoperability, and data security risks persist, especially in low-resource settings.

This review provides a comprehensive overview of the current state of IoT implementation in medical logistics and offers insights for future research and policy development. The study concludes that a multidisciplinary and collaborative approach is essential to realize the full potential of IoT in creating responsive and secure healthcare supply chains.

Keywords— Internet of Things (IoT); Medical Logistics; Healthcare Supply Chain; Cold Chain Monitoring; Blockchain; Inventory Management; PRISMA; Systematic Review.

INTRODUCTION

The advancement of Internet of Things (IoT) technology has significantly impacted efficiency and transparency across various sectors, including healthcare. IoT enables the integration of physical devices with the internet network to automatically collect, process, and exchange data. In the healthcare context, this technology has evolved into the Internet of Medical Things (IoMT), playing a crucial role in patient monitoring systems, remote diagnosis, and the optimization of logistics and medical equipment distribution processes (Ahmadi et al., 2022). The application of IoT in logistics management has become a strategic approach to enhance accuracy, efficiency, and responsiveness within healthcare service systems.

Medical logistics is a vital component of the healthcare system as it deals directly with the availability and distribution of medicines, medical devices, and other critical supplies. Challenges such as delivery delays, product damage due to unstable storage conditions, and lack of transparency in the supply chain remain significant in conventional medical logistics systems. Recent studies show that IoT implementation enables real-time logistics monitoring, including shipment tracking and environmental condition control (temperature, humidity) during distribution (Sodhro et al., 2021). This is essential to ensure the quality of medical products, especially those sensitive to environmental changes, such as vaccines and blood products.

The integration of IoT in medical logistics also supports the use of complementary technologies such as big data analytics and blockchain to improve inventory accuracy and data security. By utilizing smart sensors, GPS tracking systems, and analytical dashboards, healthcare facility managers can make faster and more accurate decisions based on real-time data (Yaqoob

et al., 2021). Furthermore, this integration allows early detection of anomalies, reduces the risk of counterfeit medical products, and improves overall operational cost-efficiency (Mahmood et al., 2021).

Nevertheless, adopting IoT technology in medical logistics comes with several challenges, including infrastructure limitations, data privacy and security concerns, and the need for trained human resources to manage digital systems. Therefore, this literature review aims to identify the latest implementations of IoT in medical logistics, examine the benefits and obstacles involved, and provide prospective insights for developing smarter and more adaptive medical logistics systems in the future.

RESEARCH METHODS

This study employs a systematic literature review (SLR) approach to identify, analyze, and synthesize recent scholarly works that discuss the application of the Internet of Things (IoT) in medical logistics. The SLR method is selected due to its structured process in reviewing existing literature, minimizing bias, and providing a comprehensive understanding of current trends, benefits, and challenges related to IoT implementation in healthcare logistics systems.

1. Data Sources and Search Strategy

To ensure the relevance and quality of the reviewed literature, academic databases such as Scopus, IEEE Xplore, ScienceDirect, SpringerLink, and Google Scholar were used. The literature search focused on publications between 2020 and 2025, using a combination of keywords including:

- "Internet of Things" OR "IoT"
- "medical logistics" OR "healthcare logistics" OR "pharmaceutical supply chain"
- "smart logistics" OR "IoT in healthcare"

Boolean operators (AND/OR) and filters were applied to refine the search to peer-reviewed journal articles and conference proceedings written in English.

2. Inclusion and Exclusion Criteria

To ensure the quality and relevance of the sources, the following inclusion criteria were applied:

Articles published from 2020 to 2025
- Focus on IoT implementation in medical or healthcare logistics
- Full-text availability in English
- Empirical studies, case studies, or comprehensive reviews

Articles were excluded if:
- They focused solely on general IoT without application in medical logistics
- They were opinion pieces, editorials, or non-peer-reviewed publications
- They discussed non-logistics applications such as clinical diagnostics without supply chain components

3. Data Extraction and Analysis

A total of 200 articles were initially identified. After screening titles and abstracts, 135 articles were excluded based on irrelevance or duplication. The remaining 65 articles were reviewed in full text. After applying the inclusion/exclusion criteria, 24 articles were selected for final analysis.

Each selected article was analyzed based on:

- Type and context of IoT application
- Technological tools used (e.g., sensors, RFID, GPS, blockchain)
- Benefits and challenges identified
- Integration with other technologies (e.g., AI, big data, cloud computing)
- Impact on logistics performance (e.g., speed, accuracy, cost, transparency)

The results were synthesized thematically to identify common patterns, research gaps, and emerging trends.

RESULTS AND DISCUSSION

Results

Based on the systematic review of 24 selected articles published between 2020 and 2025, several key findings were identified regarding the application of the Internet of Things (IoT) in medical logistics. The results are categorized into four main themes: types of IoT applications, technological tools utilized, benefits observed, and challenges encountered in implementation.

1. Planning Phase (Summary)

The planning phase was focused on defining the research objectives, formulating key questions, and determining the scope of the review. This study aimed to analyze recent literature on the application of IoT in medical logistics by identifying areas of use, tools involved, and associated benefits or challenges.

A clear scope was set to include only peer-reviewed articles published between 2020 and 2025, in English, with a specific focus on healthcare logistics. To support this, databases such as Scopus, ScienceDirect, IEEE Xplore, SpringerLink, and Google Scholar were selected as primary sources.

A review protocol was developed to guide the search process, using relevant keywords and Boolean operators. This ensured a structured, consistent, and reproducible approach in identifying suitable studies for analysis.

3. Reporting Phase

In the reporting phase, the findings of the literature review were systematically organized based on key themes related to the application of the Internet of Things (IoT) in medical logistics. The selected articles were analyzed and categorized into major topics such as types of IoT applications, technologies employed, observed benefits, and implementation challenges. In addition to presenting these core findings, the researcher also acknowledged the limitations of the review and provided relevant recommendations for both academics and practitioners in the field of healthcare logistics.

The entire reporting process adhered to principles of scientific transparency and accountability, ensuring that the outcomes could serve as a reliable reference for future research as well as practical implementation in the industry. The structure was designed to enhance clarity and allow replication by other researchers with similar study interests.

To guide the article selection process, the PRISMA framework (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) was utilized to assess the eligibility and relevance of each source. Screening was conducted using clearly defined inclusion and exclusion criteria, ensuring that only studies directly aligned with the research focus were included for further analysis.

This rigorous selection process led to a final set of six scholarly journal articles deemed most relevant to the topic of IoT implementation in medical logistics. These six articles formed the foundation for a deeper thematic analysis, aiming to provide a comprehensive and valid

overview of current trends, benefits, and challenges in the integration of IoT within medical logistics systems.

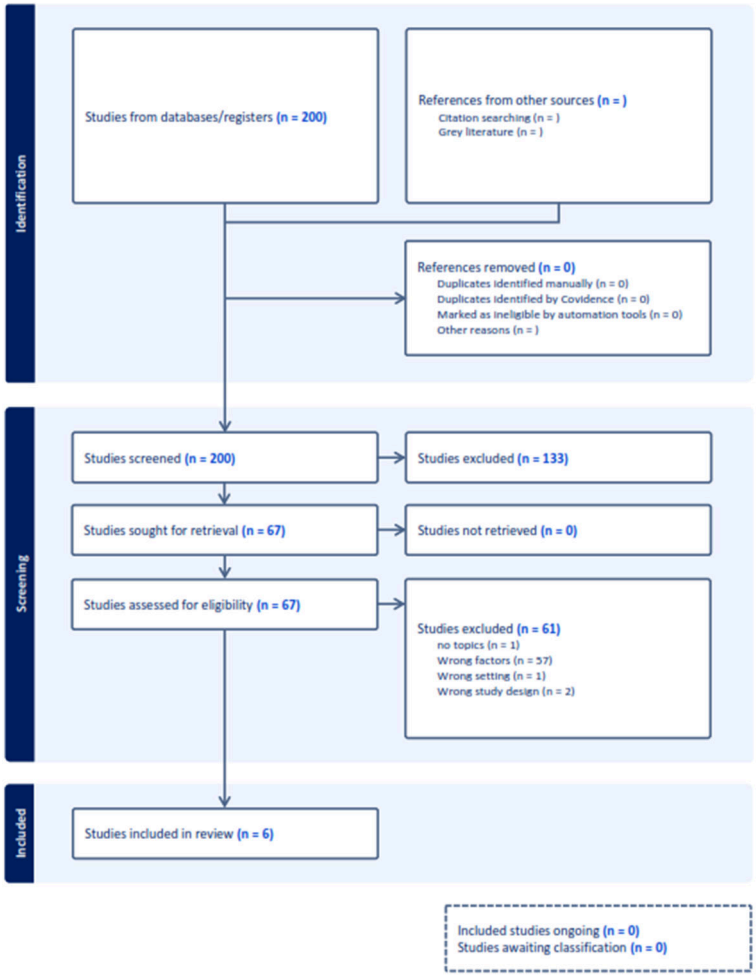

Figure 2. Covidence Prism

The PRISMA flow diagram presented illustrates the systematic selection process of studies included in this literature review, which focuses on the application of the Internet of Things (IoT) in medical logistics. A total of 200 records were initially identified through various databases and other sources. During the initial screening phase, 133 studies were excluded due to irrelevance based on titles and abstracts.

The remaining 67 studies underwent full-text evaluation. However, 61 articles were excluded during this phase due to various reasons such as misalignment with the research topic, unrelated variables, or unsuitable research designs. As a result, only 6 studies met all inclusion criteria and were selected for in-depth analysis in this review.

This diagram provides a transparent and structured overview of the literature selection process, thereby strengthening the validity and credibility of the review methodology.

Table 1. Systematic Literature Review References

No	Author(s) & Year	Title	Method	Main Findings
1	Ahmadi et al. (2022)	Internet of Medical Things (IoMT): A review of recent	Literature Review	Highlights integration of IoT in healthcare logistics;

		challenges and applications		identifies technical and policy gaps
2	Mahmood et al. (2021)	Smart healthcare supply chain using IoT and blockchain	Case Study	Combines IoT and blockchain for improved traceability and cold chain control
3	Sodhro et al. (2021)	Towards smart healthcare monitoring using wearable sensors	Review + Scenario	Discusses IoT-based logistics responsiveness using sensors and wearable tech
4	Yaqoob et al. (2021)	Blockchain for healthcare data management	Systematic Review	Explores IoT-blockchain synergy for data integrity in logistics
5	Dey et al. (2020)	IoT-based pharmaceutical logistics and real-time tracking	Experimental Study	GPS-sensor integrated model for improved drug delivery tracking
6	Zhang & Wang (2020)	Enhancing cold chain logistics with IoT-enabled monitoring systems	Simulation Study	Evaluates sensor-based alerts for vaccine quality and logistic cost efficiency

Discussion

The results of this literature review reveal that the application of Internet of Things (IoT) technology in medical logistics has shown significant potential to improve efficiency, transparency, and responsiveness in the healthcare supply chain. Across the six selected studies, several key themes consistently emerged, including real-time tracking, cold chain monitoring, inventory management, and integration with complementary technologies such as blockchain and artificial intelligence (AI).

One of the most prominent applications discussed is cold chain monitoring, especially for temperature-sensitive medical products such as vaccines and blood samples. Studies by Zhang & Wang (2020) and Mahmood et al. (2021) highlighted the effectiveness of IoT-enabled sensors in maintaining ideal storage conditions throughout the distribution process. These technologies not only reduce the risk of spoilage but also provide real-time alerts in case of temperature deviations, thereby improving the reliability of healthcare delivery systems.

Another critical area of impact is inventory and asset management. IoT-based solutions such as RFID tagging and GPS tracking help healthcare providers maintain accurate stock levels and ensure timely replenishment of essential items (Ahmadi et al., 2022). The integration of cloud platforms further enables centralized data access and facilitates decision-making based on real-time information.

Additionally, some studies—particularly those by Yaqoob et al. (2021) and Mahmood et al. (2021)—explored the synergy between IoT and blockchain to enhance traceability, data security, and transparency in medical logistics. Blockchain ensures that the data collected through IoT devices remains immutable and auditable, which is crucial in contexts where counterfeiting and regulatory compliance are major concerns.

However, despite these advantages, the review also identifies several barriers to adoption. These include high initial investment costs, lack of interoperability among IoT systems, cybersecurity vulnerabilities, and a shortage of trained personnel to operate and maintain IoT infrastructures (Sodhro et al., 2021). In developing regions, limited infrastructure and unstable internet connectivity further hamper the scalability of these technologies.

Overall, the discussion highlights that while IoT has demonstrated measurable benefits in medical logistics, its successful implementation requires not only technological readiness but also supportive policies, standardization, and cross-sector collaboration. The findings of this review underscore the need for continuous research, particularly in the areas of cost-benefit analysis, user training, and secure data architecture design.

CONCLUSION

This literature review concludes that the implementation of Internet of Things (IoT) technology in medical logistics offers substantial benefits in enhancing operational efficiency, accuracy, and transparency across the healthcare supply chain. Key areas of application include cold chain monitoring, inventory management, real-time tracking, and integration with advanced technologies such as blockchain and artificial intelligence.

The reviewed studies consistently demonstrate that IoT can reduce spoilage of sensitive medical products, ensure timely delivery, and support data-driven decision-making. Moreover, combining IoT with blockchain enhances traceability and data security—two critical factors in modern healthcare logistics.

Despite these advantages, several challenges remain, including high infrastructure costs, system interoperability issues, data privacy concerns, and limited technological readiness in resource-constrained settings. Addressing these barriers requires not only technological innovation but also strategic policy development, standardization efforts, and investment in human resources..

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