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Research Article

Research on Automation Control of University Logistics Management System Based on Wireless Communication Network

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Nowadays, individuals with and without technical knowledge have started utilizing the technology to a broader extent. The utilization of technology has gone deeper concerning gadgets that aid in wireless communication with anyone or anything. This advancement has paved the way for a trending technology named wireless communication network (WCN) in recent years. In addition to this, there has been a significant change and development in the field of trading goods. Manual ordering of goods has changed to online ordering, and hence, supply chain management. This research focuses on applying WCN to a logistic tracking information system (LTIS) for a university with automatic control of the system. A novel algorithm named intelligent logistics system construction algorithm is implemented to evaluate the efficiency and performance of data. This model aids in the tracking goods and automatic control of university logistics.

1. Introduction

Human resource advantages such as reduced costs have dwindled as China's economy has grown consistently. Increasing labor costs mean Chinese companies are losing market share to their foreign competitors. These companies must replace human labor with automated production technologies in order to cut operational costs and stay competitive [1]. "Logistical systems that automate themselves" are logistic systems that reduce human labor while enhancing manufacturing efficiency. Automated logistics systems have a technical challenge when using wireless communication [2]. Real-time and stability are critical for system communication. Because of this, there is an urgent need for a wireless communication network environment capable of responding to the complex industrial environment while also having better real-time and stability. Modern logistics tracking information management systems, which are now being developed and implemented, will be extremely beneficial to organizations. Economic inconsistency means that active promotion of logistics development has become an economic necessity due to the logistics industry's late start, small scale, and immaturity of technology [3]. There are logistics companies that use business process restructuring and modern logistics information technology extensively to control and integrate all logistics-related information, thereby realising the sharing and effective use of internal as well as external resources of information and enhancing the economic benefits of the company and its core competitiveness [4]. Commercialization of logistical information, data and code collection in logistics, electronic processing in logistics, and logistical information storage and retrieval systems are all examples of how information technology is affecting logistics. This paper focused on evaluating the automatic control of logistic management systems in universities using wireless communication networks.

2. Related Studies

Due to the tremendous growth of the Chinese economy and society, the logistics business has also expanded rapidly. Internet of Things (IoT) is an emerging logistics technology that is becoming more popular as consumer expectations rise [5]. Wireless sensor networks (WSN) are crucial to the expansion of the Internet of Things (IoT) and the rise of logistics applications. Bad business practices must be monitored and managed in the logistics industry. This is going to be devastating for the company's finances. New logistics technology requirements allow for real-time monitoring and control of all commodities in transit. Bar code identification logistics have a number of drawbacks that RF technology may address and become the industry leader in automatic identification logistics [6].

Throughout the previous few decades, sensor networks, similar to WSNs, have appeared in the traditional information network. In addition to business, technology is regularly used in agriculture, national defense, and other industries. Sensor nodes can communicate and do calculations in this WSN, which is made up of a large number of sensor nodes. It is feasible to create network monitoring and control systems that respond to changes in their surroundings [7]. Microsensors and other network components are collected, processed, transmitted, controlled, and communicated over the wireless sensor network (WSN). The common consensus is that the WSN is an application-driven, data-centric network that can employ a variety of management strategies to satisfy the requirements of various applications [8]. High-level shelves, standard pallets, and storage equipment, such as three-dimensional warehouse stackers, are used in automatic warehouses to streamline operation and reduce labor costs for warehouse workers. Devices such as palletizing equipment, an AGV, and others provide assistance. The rapid expansion of the Internet of Things is being fueled by these four technologies and advancements in smart information technology [9]. There are presently capabilities such as complete perception, information hull reliability, and information processing intelligence in the Internet of Things because it is always expanding and innovating the logistics. Because of this, the groundwork has been laid for logistical information, digitization, and intelligence. Machine-to-machine (M2M) frameworks in Chinese smart logistic systems use more frequent terminology like application, service, and sensory layers in the samples of grounded theoretical approaches. M2M is a broad term when applied in this fashion [10].

In addition to users and employees, the sensory layer also uploads management and product information to a database or server. The data acquisition and access layers make up the majority of the sensory layer of a smart logistic system [11]. Mobile devices and personal computers can employ Internet of Things sensors, bar codes, and radio-frequency identification tags to gather information about the things they are connected to (PC). Uploading to a global IoT network through a mobile, wireless, or wired network is accomplished using the network upload function included in the access layer. As a result of more IT professionals getting involved, the network layers now look effective [12]. All of the claims made on this page are backed up by scholarly research and understanding, and the tone of this piece is quite theoretical. In a smart logistics system built on the Internet of Things, the network layer connects customers to background data. Network transmission and application platforms serve as the platform's foundation because the system's principal goal is to integrate information [13]. Data sharing and real-time communication are critical components of logistics information systems, and the network layer is critical to both. These three key components are essential for the logistics information system's communication network to function properly. There is a network of logistic parks, information on urban logistics, and a wireless communication network. The logistics park network makes it possible to connect your management information systems to the urban logistic information network, ensuring that businesses in the park have quick and easy access to logistical information. To make this happen, we need a system of logistics parks like the one we have now. The urban backbone network connects the logistic park, the logistic public information platform, the trade platform, the industrial management subsystem, and the enterprise logistics information system in order to accomplish organic integration of information resources from major subsystems. Urban logistics information network is what it is known as ULIN [14]. All other logistical information systems including on-site and on-board subsystems, truck tracking and dispatching systems, etc., cannot be connected without a wireless communication network. This can be accomplished by fusing existing mobile communication technologies with new wireless cluster communication systems.

Logistics tracking data is readily available, which is a big improvement over traditional logistics. Consider the development of a logistic tracking information system as an example of how logistics and information might be linked. For example, it comprises information on inbound and outbound shipments, as well as warehouse and transportation activities. A three-dimensional system or collection of various systems composed of computers, communication equipment, and other high-tech devices joined by computer networks make up an information superhighway (IHW) [15]. Each link's operation status can be tracked using a logistic tracking information system. Using fewer resources while also saving money is a win-win situation. Computer communication technology has aided the development of logistic tracking information systems, and WSN (wireless sensor network) is the most significant topic of computer communication study among academics [16]. An important benefit of a WSN is its ability to self-organize and to operate at cheap cost. Its adoption can help a wide range of businesses, including manufacturing, health care, and transportation. A wide range of sources, including universities, private industry, and government and military sectors, have expressed an interest in this topic. The logistics business is expected to grow significantly in the next millennium, according to estimates. Utilizing existing development opportunities, we will help the logistics industry—-which is crucial to the economy's growth [17].

The foundation of logistics modernization is the standardization of logistical procedures. As a long-term development plan for logistics, standardization will have lasting effects over the next hundred years, both practically and historically [18]. People are highly dependent on China's actual logistic needs and best practices from around the world; these logistics operating standards help guide and promote the growth of China's logistics business. For this reason, the American Logistics Association says that logistics companies should also be concerned about information security. There is also a strong recommendation for logistics companies to implement a complete RFID encryption transmission system that also includes dynamic authentication for data communication and higher data transmission encryption, as well as specific system security measures in workflow and logistics links. Scientists have recently become concerned about the security of the Internet of Things (IoT) [19]. Using the logistics management paradigm, a production logistics system can be implemented. A strategic approach to logistics management can improve logistics effectiveness while also lowering logistical expenses.

Consequently, a lot of research into the logistics management model has been part of smart logistics' content from the beginning. Progress in wireless communications and IoT (Internet of Things) technology has also given supply chain management models the essential technical backing to be more effective in the long run. It successfully distributes goods to the final mile because of an innovative logistical approach and a containerized solution [20]. Data networks (such as Wi-Fi, UMTS, and wired networks) are used instead of wired or wireless networks to connect the control units to the logistics operator's system. An integrated cloud manufacturing and Internet of Things infrastructure is supplied in order to provide a smart synchronized control mechanism for production logistics with many levels of dynamic flexibility. This architecture is flexible enough to adapt to changing manufacturing logistics systems over time. Agricultural and food supply chain logistic information systems based on the Internet of Things have been standardized. European Future Internet Program technical enablers use a combination of Internet of Things with cloud computing to provide low-cost solutions for businesses [21]. It provides a dynamic optimization solution for sustainable reverse logistics based on the Internet of Things. To build a real-time information sensing model, the Internet of Things (IoT) is employed. This senses and gathers real-time data from logistics resources. Meanwhile, a bottom-up logistic strategy is implemented to achieve dynamic optimum distribution for logistical activities based on real-time information. Research shows that using the Internet of Things (IoT) in conjunction with software as a service can revolutionize logistics management. It is possible that this paradigm could assist integrate physical resources with cloud-based applications. Firms can build their own cloud-based logistics information systems using the paradigm now being supplied [22]. This system offers logistics managers with information they can use to plan, implement, and control their logistics operations through the use of an interactive interface. Logistics information systems may help with many different application goals, such as improving delivery routes, streamlining the procurement process, and even paying bills in a more intelligent way.

The study shows how an intelligent telematics system based on a van might be constructed by utilizing several wireless communication technologies such as Bluetooth, RFID, Wi-Fi, and others. Pharmaceutical products can be tracked while being delivered from a warehouse to pharmacies without interfering with the regular routines of the carriers. An analytical model that was developed can make comparison among RFID-based traceability information systems. When deciding on a solution to a specific supply chain issue, the model weighs the costs of data collection and query processing, among other things [23]. In order to address issues like long operating durations and a dearth of data integration capabilities in the current material procurement process, the authors of [23] have built a framework for a one-stop logistics service provider with the support of IoT. An innovative smart parking payment system utilizes the Internet of Things (IoT) and third-party payment networks. This system can enhance the number of people who use current parking facilities by deploying basic information management, charge management, job management, and business intelligence modules to the cloud server. 5G telecoms, which will be available in the near future, will allow companies to display IoT-based apps that can meet specific customer needs for customized solutions, services, or goods, according to the business [24]. For smart logistics information processing, storing and analyzing huge amounts of data, especially data from multiple sources, are the biggest problem according to research and applications. Scholars are also concentrating their efforts right now on this subject. Big data, cloud computing, artificial intelligence, and other industries have made progress in solving this problem, but the solutions are still under development [25]. There are different network modelling systems used in logistics management. They are optimization modelling, simulation modelling, and heuristic model [26]. The optimization model is highly dependent upon the mathematical formula involved in evaluating the procedures which provide feasible solution as per the formula. This model highlights some significant aspects in logistics network such as level of customer service, distribution centers, and number of location of distribution centers and manufacturing plants. The simulation model is based on real world. It can be defined as a real model which explains how changes can be done in the model that will influence the cost of the logistics network. The heuristic model is used to minimize a large issue to a manageable size. This model follows the rule of thumb in logistics network. Many studies used optimizations and heuristic model for evaluating the results in logistics networks [27]. This study used the simulation model for analyzing the automation control on logistics management in the university.

3. Methods

The study used an intelligent logistic system construction algorithm for evaluating the performance and efficiency. It can be used for tracking information and managing the stocks used in the university. Wireless sensor network (WSN) is an infrastructureless wireless network that is also implemented ad hoc in a large number of wireless sensors that are used to monitor framework, or environmental impacts. Sensor nodes in WSN are installed with just an inflight processor that appears to be able and monitors its surroundings in a specific area. They are linked to the access

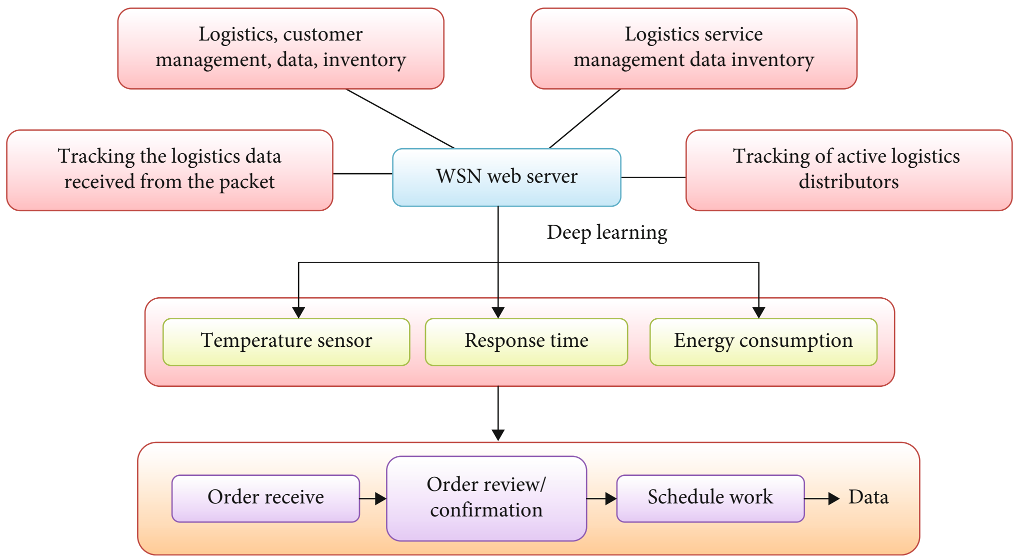

Figure 1: Proposed model.

Table 1: Result analysis for illustration of node 3's energy consumption within the WSN with 10%.

	Wireless sensor network experience time (ms) with 3 nodes under the WSN 10%	
	Intelligent logistics system (%)	Real-time data management (%)
Energy consumption	76	75
Times	30	54

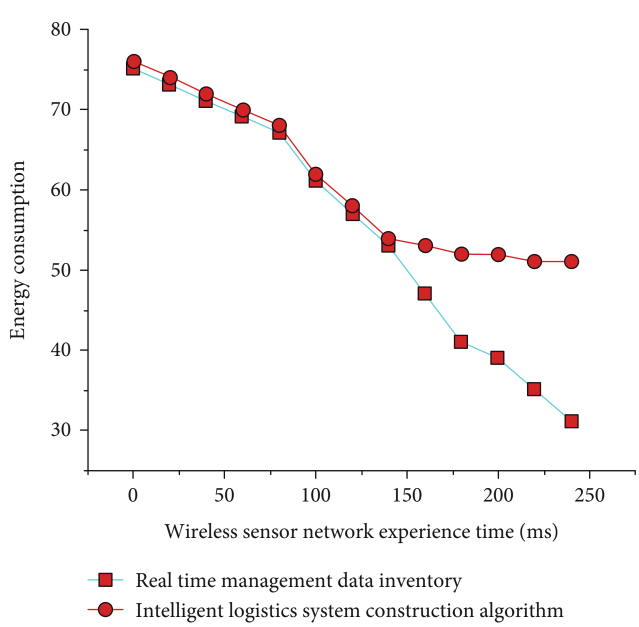

Figure 2: Illustration of node 3's energy consumption within the WSN with 10%.

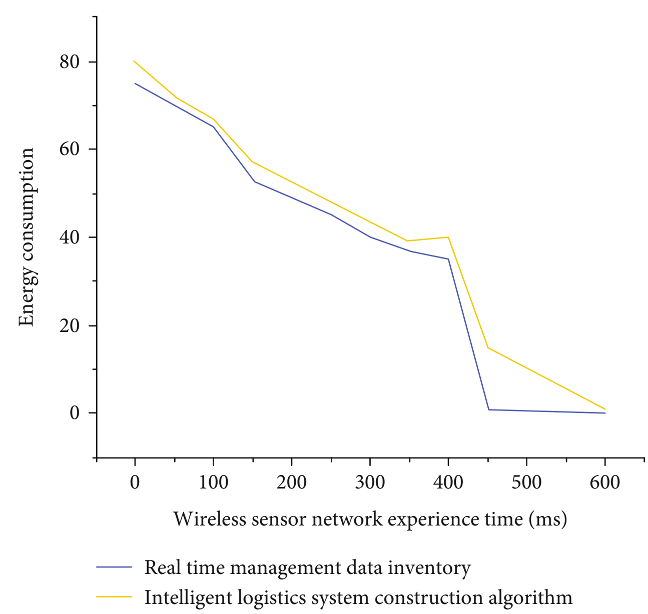

Figure 3: Illustration of node 3's energy consumption within the WSN with 90%.

Table 2: Result analysis for illustration of node 3's energy consumption within the WSN with 90%.

	Wireless sensor network experience time(ms) with 3 nodes under the WSN 90%	
	Intelligent logistics system (%)	Real-time data management (%)
Energy consumption	80	76
Times	15	17

point, which serves as the WSN system's central processor. A WSN system's workstation is associated with the Internet to share information.

Wireless sensor networks (WSNs) have also grown significantly and have high potential in various health, environmental, and military applications. Notwithstanding their

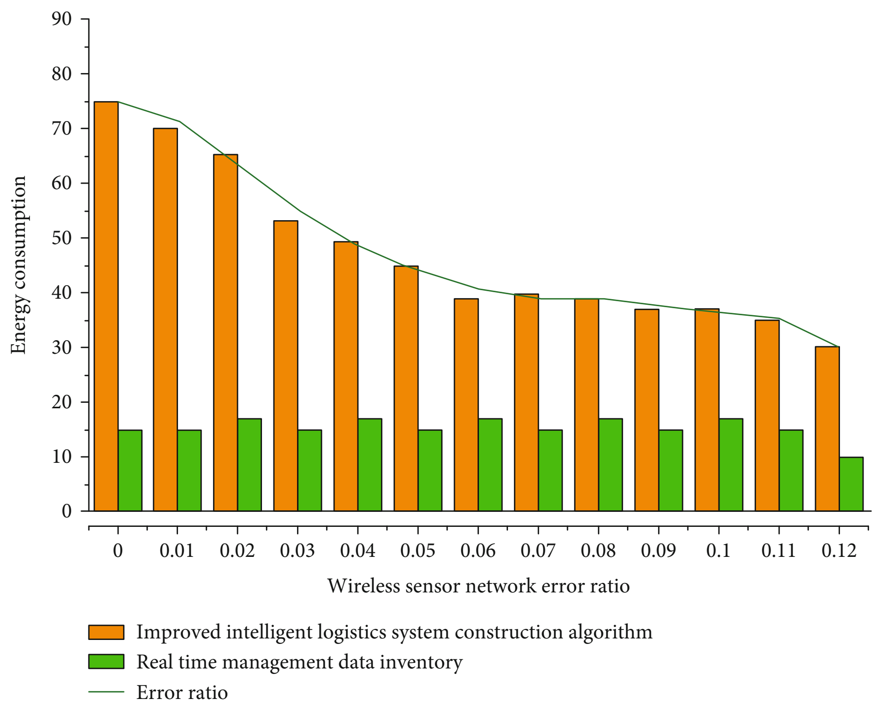

Figure 4: Improved the intelligent logistics system construction algorithm with WSN.

impressive capabilities, the fast growth of WSN remains a difficult task. Several computer program strategies that focus on low-level system issues have indeed been suggested in current actual WSN deployments. The high-level strategy has been recognized, and several solutions have been proposed in simplifying the configuration of the WSN and abstracting from low-level technological specifics. The model-driven engineering (MDE) method, in particular, is emerging as a potential solution.

Figure 1 illustrates the proposed model of this logistics management system. In this model, the deep learning model is used to evaluate the energy consumption, response time, and temperature sensor.

Logistics management system (LMS) is a publication or electronic record-keeping and reporting system. Logistics tracking information system (LTIS) refers to the management way of undertaking out all those activities inside an effective and efficient manner. Logistics seems to be the continuous flow of resources among points of origin as well as consumption in terms of meeting certain requirements, such as those of consumers or businesses. Result analysis for total number of received packets in examples for WSN 3 nodes (A, B, C) when number of modes increased the performance of an intelligent system is more or less equal to a real-time system—modify the data if needed. Hence, in the proposed system, LTIS tracking information systems with the training information will be separated from the sensor network to keep the record and report the system.

To determine the scenario in the proposed WSN application for logistics tracking information systems (LTIS) for the given problem, it is necessary to consider the $V, H,$ and W that represent for the node application of WSN in LTIS and the form of the problem. The usage of WSN in a_x, b_y logistics tracking information systems with the training information will be separated from the start by X, Y which represents for the sensor network in the irregularity qualitative approach, and the unusual parcels would be left to prepare afterwards.

$$E(V, H|\Theta) = -\sum_{x=1}^{X} a_x V_x - \sum_{y=1}^{Y} b_y H_y - \sum_{x=1}^{X}\sum_{y=1}^{Y} V_x H_y W_{xy}. \quad (1)$$

A E database server, distribution center gateway, vehicle gateway, sensor nodes, management node, and customer node comprise the Logistics Tracking System (LTS) with the support of the wireless sensor network.

$$P(V, H) = \frac{e^{-E(V,H)}}{\sum_{X,Y} e^{-E(V,H)}}. \quad (2)$$

The warehouse gateway has the responsibility of organizing and maintaining all the connected sensor nodes of the warehouse; the organizing terminal acts as an operational interface for the managers of logistics for simple management of logistics resources. The vehicle gateway manages the sensor network, which plays a significant role in receiving data packet receiving that was sent by the sensor nodes along with the control of writing information to the sensor nodes and is represented in

$$P(V) = \sum_{Y} P(V, H) = \frac{\sum_Y e^{-E(V,H)}}{\sum_X \sum_Y e^{-E(V,H)}}. \quad (3)$$

In like manner, the likelihood assigned to any WSN

Table 3: Result analysis of an intelligent logistics system construction algorithm with error ratio.

Wireless sensor network experience with 3 nodes under the WSN	Intelligent logistics system (%)	Real-time data management (%)	Error ratio (%)
Energy consumption	75	30	75
Times (ms)	15	17	34

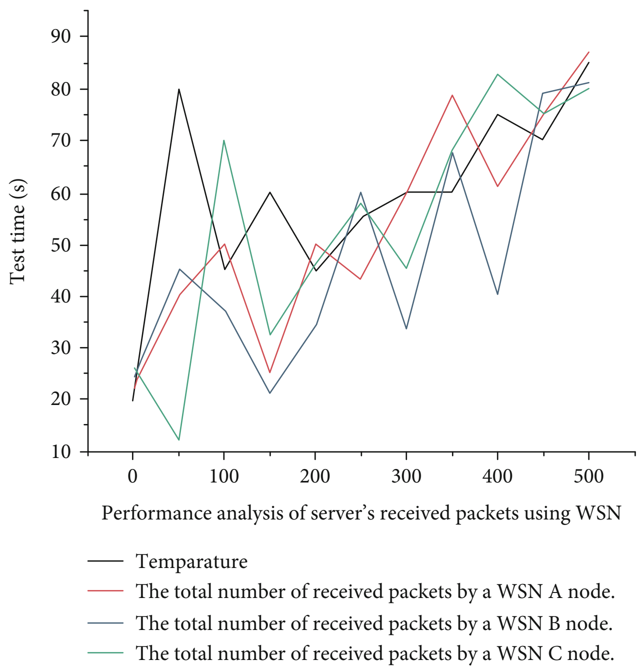

Figure 5: Performance analysis of total number of received packets in WSN 3 nodes (A, B, C).

node is introduced in

$$P(H) = \sum_{X} P(V, H) = \frac{\sum_{X} e^{-E(V,H)}}{\sum_{X}\sum_{Y} e^{-E(V,H)}}. \quad (4)$$

Each implementation work is treated as an analysis of useful, trivial, and complex rules in sequence.

$$P = \left(\frac{|C_1|}{|T|}, \frac{|C_2|}{|T|}, \cdots, \frac{|Ck|}{|T|}\right). \quad (5)$$

The customer device displays data in real time, as well as $T_{\text{CANDIDATES}}$; the customer integrates to a system besides having to log into $C_1, C_2, \cdots, C_k$, the backend server's node interface.

A consumer can order the correlating goods in $\text{Info}(Q) = I(P)$ the system which is based on their requirements, and the backend server P creates orders depending on the type, quantity, and delivery time, as well as $C_1, C_2, \cdots, C_k$ represents the delivery location of the goods, and authorizes who manage the transportation of vehicles and begins the delivery process.

Table 4: Result analysis for total number of received packets in WSN 3 nodes (A, B, C).

Wireless sensor network packet received with 3 nodes under the WSN	Intelligent logistics system (%)	Real-time data management (%)	Energy consumption (%)	Times (ms)
Node A	86	75	76	15
Node B	79	76	75	17
Node C	74	75	76	15

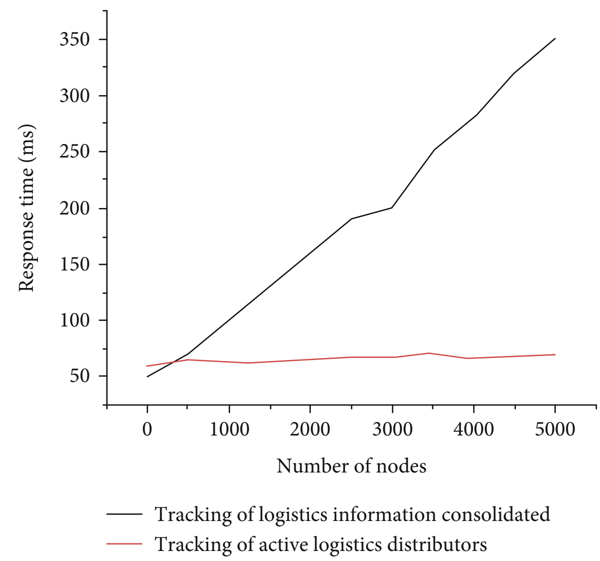

Figure 6: Overall performance analysis for logistics distributors with WSN.

$$\text{Info}(Q) = \sum_{i=1}^{k} \frac{|Ci|}{|T|} * \log 2 \frac{|Ci|}{|T|}, \quad (6)$$

$$\text{Info}(P, Q) = \sum_{i=1}^{n} \frac{|Ti|}{|T|} * \text{Info}(Ti). \quad (7)$$

Logistics management is the coordination of adding, deleting, and changing vehicles but also wireless sensor nodes within a system, as well as keeping C track of their status.

$$\begin{gathered} \{p_i = p_r[C = c_i]\}_{i=1}^{k}, \\ \sum_{i=1}^{k} p_i = 1. \end{gathered} \quad (8)$$

In Equation (8), c_i is the i^{th} class; then, node $H(C)$ is

Table 5: Result analysis for overall performance analysis for logistics distributors with WSN.

	Overall performance analysis for logistics distributors with WSN			
	Tracking of logistics information	Tracking of active logistics distributors	Energy consumption (%)	Times (ms)
Number of nodes	5000	5000	85	15
Response time (ms)	350	70	86	17

defined as in the following:

$$H(C) = -\sum_{i-1}^{k} p_i \log p_i. \quad (9)$$

Identifying the suitable node for building a central server is scientifically dependent on the residual comparison of the component for building the part; the orientation in which the construction constituent has to locate the area and the data gathered by the destination node is based on the desired statistics and is performed by the central build node. This process is given in

$$F^{-1}(p, \lambda) = C = \frac{-\text{In}(1-p)}{\lambda}. \quad (10)$$

The above Equation (10) represents the distance between the node and the base station. The node receives the frequency with head office after message delivery; this interval will never be modified as parameter λ is given in

$$\lambda = \frac{1}{R\bar{\text{Length}}}, \quad (11)$$

where $R\bar{\text{Length}}$ is defined as the identified mean time spent at the page.

4. Results and Discussion

By using the university data, the results have been validated using the deep learning algorithm. The significant factors like energy consumption, temperature sensor, and response time have been taken into consideration (Table 1).

Figure 2 shows how wireless sensor networks differ from traditional computer networks in that they are concerned with both query processing efficiency and network energy consumption. Unlike traditional logistics tracking information optimization techniques, WSN optimization compares the order of tasks of logistics tracking instead of finding the common part of the expression.

The change in the data packets received by the backend server from the three nodes was evaluated after a 15-minute test period (refer to Figure 3). It will not transmit data. We discovered that its data packets sent from the WSN nodes have been substantially lower than with the node in the same surroundings while at the same period comparative analysis of 3 nodes mentioned above. As a result, when compared to a conventional centralized logistics control method, using active logistics status tracking also allows for customized processing actions but also decreases stress just on network as well as backend data centers by ignoring trying to send data redundancy, it is of fewer consideration every time (Table 2).

As can be seen in Figure 4, the algorithm automatically adjusts the number of fitting coefficients to protect data collection accuracy, so that the error can always be controlled within that range. Changes in the neighboring node ratio p influence the occurrence of suitable correlations, in what time series the amount of data transmitted all through algorithm implementation. In the experiment, the amount of data transferred by the intelligent logistics system construction algorithms will be compared (Table 3).

The active and important tracking methodology must be able to adapt to changes within logistics framework quickly also with good attentiveness, and since it is spread local control, the reaction performance and efficiency must be nicer than centralized ones even as network size increases (see Figure 5). To validate all these, the reaction rate of the framework decision of active and important tracking as well as centralized approach has been especially in comparison by activating a lot of data packets in program logic to visualize an expansion in node (Table 4).

In Figure 6, the active tracking method analyses and makes recommendations in wireless sensors which do not need to transfer logistics data here to a web server, limiting highly effected upon that network as well as the backend web service while also improving rule response speed and ensuring legitimate computation.

Table 5 represents the active logistics tracking method analysis for overall data sent to the web server and response to reducing the time and highly effective to save the energy consumption.

5. Conclusions

Wireless communication networks (WCN) have started playing a significant role in every application utilized. It has made life simpler in a single-click event. WCN aids in purchasing goods from any part of the country or world to any other location. The purchase of goods and its transportation support logistics management system (LMS). In this research work, LMIS is implemented for the university logistics with an automatic control system. This work has assisted in the tracking and automatic control of the logistics with the deep learning algorithm and is termed as an intelligent logistics system construction algorithm. From the results, we can observe that the proposed algorithm responds in a concise duration, reduces energy consumption by the nodes, and minimizes the sensors' utilization.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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