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Reverse Logistics System Redesign with a Focus on Blockchain Driving Force Technology: a Futuristic Approach to Productivity and Efficiency

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Abstract

Purpose: Waste disposal is a pressing issue for humanity and has the potential to become a major crisis in the future. One of the best-proposed solutions is to reuse usable materials found in waste, which requires proper waste separation. Experts suggest that separation at the source is crucial, making a functional Reverse Logistics System (RLS) essential. This research aims to provide a structure that can practically redesign the RLS.
Method: Specialists believe that Blockchain Technology (the driving force of emerging technologies), has many potential capabilities, which can create many favorable effects in industries. In this research, Blockchain Technology has been used to redesign the RLS with a futuristic approach. That, the mutual collaboration of citizens and the waste collection company is necessary.
Findings: A system designed based on this structure is Futuristic and backed by a very effective driving force technology, capable of implementing any policy to increase the separation of waste at source and concluding smart contracts. It is flexible against sudden increases or decreases in supply without causing audio and visual pollution in traditional systems. Additionally, it is very transparent, safe, and practical. With the proper allocation of the fleet, it can collect all segregated waste.
Conclusion: In this system, with a futuristic approach, waste segregation at the source increases significantly. Resource usage is reduced. The waste disposal problem is being managed. A circular economy is formed. The comfort of citizens increases. The damage to the environment is much less. And action has been taken to transform into smart cities.

Keywords: Reverse Logistics, Blockchain, Supply Chain, Waste Management, Futuristic Approach

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Introduction

With a futuristic approach, one of the biggest challenges facing humanity is waste, which poses a serious threat to the environment. Studies have suggested that waste segregation at the source and then recycling is the best solution. Therefore, an efficient reverse logistics system is essential. This system should be able to implement various incentive and punitive policies to increase waste segregation at the source.

The reverse logistics system, which includes waste collection and return, is now being improved with Blockchain technology. This technology includes distributed ledger, trustless, peer-to-peer communication, transparency, immutability, smart contracts, and more. These features are very important and Futuristic because they meet the basic needs of various industries and systems in the future.

In this research looking to the future, the framework is presented that can redesign the existing traditional reverse logistics system and create a reverse logistics system based on Blockchain technology, which is a step toward smart cities. This system is a complete, safe, transparent, flexible, and capable infrastructure for implementing various policies in the field of segregated waste collection.

Theoretical background

A Blockchain is a chain of blocks linked together, similar to a chain, which is immutable and irreversible with distributed ledger technology (Decentralized). In a shared environment, all transactions are verified by users and traceable at any time by every user autonomously. Network members can interact with each other safely without the need for a trusted authority. Verification and storage of all transactions are done through the consensus mechanism. Each block has its unique identifier, the hash of the previous block (the way to connect to the previous block), and a timestamp. The entire structure turns Blockchain into a reliable, transparent, secure, and immutable technology. Contract automation, such as smart contracts, is another feature of the Blockchain (Gao et al., 2018; Li et al., 2020; Min, 2019; Queiroz et al., 2020).

Traditional supply chain management cannot efficiently meet the future needs of industries and also comes with additional costs. The Blockchain industry has the potential to bring change and revolutionize supply chain and logistics management with features such as transparency, authenticity, trust, security, cost reduction, no intermediaries, more efficient operations, and waste reduction. Blockchain helps reduce the risks associated with theft, hacking, vulnerability, contractual disputes, and other issues present in the supply chain. It leads to a reduction in the impact of waves in the supply chain and helps with the timely settlement of orders and automation of production tasks with smart contracts (Araz et al., 2020; Fernández-Caramés et al., 2019; Hughes et al., 2019; Ivanov et al., 2019; Philipp et al., 2019; Saberi et al., 2019; Sheel & Nath, 2019; Zhang et al., 2020).

In the wood, diamond, maritime transportation, and ontology industries, there are successful examples of using Blockchain in supply chains (Choi, 2019; Engelenburg

et al., 2019; Figorilli et al., 2018; Kim & Laskowski, 2018; Liu & Li, 2020; Montecchi et al., 2019; Tan et al., 2018).

The use of Blockchain in supply chains and logistics systems is increasingly attracting the attention of experts, and they are still at the beginning of discovering the true potential of Blockchain technology. It will take several years until it is widely and commercially used. However, the future of using Blockchain technology in supply chains and logistics and transportation systems seems promising (Pournader et al., 2020).

Methodology

In this study, while looking to the future, a framework is presented for redesigning the reverse logistics system using Blockchain technology that meets all the mentioned needs. This framework is in line with the smartification of cities and is also essential in smart cities. It also helps complete the circular economy, provides more comfort for citizens, makes the city more beautiful, and reduces garbage pickers.

When a citizen's level of separated waste reaches a certain level, they send a request on the Blockchain network to deliver a specific amount of separated waste to a specific address and time. This request is reviewed by other nodes and registered on the Blockchain network if approved. The waste collection company allocates the desired fleet based on all registered requests, delays in receiving waste, vehicle speed, etc. The fleet starts collecting waste according to a specific program. Everyone can see the program, the exact location of the vehicles, and the time the waste collector reaches them. The fleet informs each citizen in various ways as it approaches them.

The security of the system is guaranteed with Blockchain so that no one can harm the system. The system is also capable of implementing various incentive policies (such as buying separated waste) and punitive policies (such as fining individuals who enter incorrect information) using smart contracts. To further improve the quality of waste collection, it is better to have multiple waste collection companies that compete with each other to provide better services to citizens.

The reverse logistics system redesigned based on the proposed framework with a focus on Blockchain-powered technology also has some disadvantages. The cost of implementing Blockchain is higher than traditional systems, but with the advancement of technology, it is possible to develop Blockchains that have lower costs. On the other hand, the environmental benefits of this system are much greater than its cost. This system requires training for citizens and responsible companies and also has more hassle for citizens, which can be resolved by proper training and reminding people of their civic responsibilities. Another issue is a 51% hacker attack, which can be prevented by offering private and semi-private blockchains.

Conclusion

The amount of waste produced is increasing day by day. With a Futuristic approach, a fundamental solution must be found for waste management. Experts believe that reusing materials in waste is very important and have suggested waste separation at

the source. Looking to the future, the existence of an efficient reverse logistics system that is in line with smart cities is essential.

By introducing Blockchain in the reverse logistics system, transparency and tracking are improved, and information related to product returns is securely and reliably recorded. This leads to a reduction in errors, prevention of fraud, and improvement of communication between supply chain members. It can be transformed into a dynamic and intelligent system that benefits all supply chain members as a dense ecosystem.

In the proposed framework, the responsible company sends the appropriate fleet after reviewing requests and planning, which results in the least cost and the least amount of separated waste not collected. Traditional unauthorized actors who create noise and physical pollution that disturb citizens and make the city look ugly are eliminated. The speed of vehicle movement is maximized, and delays are minimized. The system's flexibility against sudden increases or decreases is very high. Separation at the source and increased recycling lead to a more complete circular economy.

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