BLOCK CHAIN WASTE MANAGEMENT USING SECURE DATA STANDARD

ABSTRACT

Old devices are abandoned and replaced. E-waste is the word used to describe these Electronic and Electrical Equipments (EEEs) that consumers abandon. E-waste management involves collecting, sorting, and recycling old electronics in an environmentally responsible way. The unorganized sector still controls a substantial portion of India's e-waste collection and recycling industry, which makes it exceedingly challenging to implement such rules. Using the DES (Data Encryption Standard Algorithm) and block chain technology, we present a novel solution for Modified EWM. Block chain is the technology that allows us to build smart contracts. Smart cities can prevent environmental issues brought on by inappropriate garbage disposal by lowering air pollution, safeguarding the aquatic ecology, and enhancing public health. Nonetheless, the technologies, methods, and systems used for waste management today remain centralized and manual. They are therefore susceptible to manipulation and the issue of the single point of failure. Furthermore, a lot of the current waste management systems in smart cities don't offer characteristics like audit, security, traceability, operational transparency, and trustworthy data provenance.

Keywords: Waste Management, Blockchain, Traceability, and Smart Cities

1. INTRODUCTION

A new era of technical innovation and urban growth has been brought about by smart cities, which have completely changed the way we work, live, and interact with our urban surroundings. The management of resources and garbage has become a major concern as these cities grow and change, leading to the investigation of innovative ways to deal with the issues of sustainability and environmental effect. The use of blockchain technology into waste management systems is one such approach that is becoming more and more popular. Block chain, which was first created as the foundational technology for cryptocurrencies, has applications outside banking, encompassing a number of sectors, including waste management. Insights into the possible advantages, difficulties, and the role of block chain in forming a greener, more efficient, and sustainable urban future are provided by this survey, which examines the developing field of block chain applications in waste management within smart cities.

1.1 BLOCKCHAIN

In the fields of banking and information technology, block chain technology has become a revolutionary force, providing a fresh method for safe, open, and decentralized data management. Block chain, which was first intended to serve as the foundational technology for cryptocurrencies like Bitcoin, has considerably outlived its intended use as digital money and is now relevant in a variety of sectors, including supply chain management and healthcare. Fundamentally, distributed ledger technology, or block chain, offers a degree of trust and transparency that is difficult to attain with conventional centralized systems. It does this by enabling the safe and irreversible recording of transactions or data over a network of computers. Block chain promises to transform the way we conduct transactions, manage assets, and communicate in the digital sphere because of its decentralized structure and cryptographic protections. As a result, it has the ability to completely change how data is stored, exchanged, and validated. Block chain's primary innovation is its capacity to produce a transparent, tamper-resistant ledger that is impervious to fraud and hacking. This technology has the ability to change how we trust and authenticate digital information in a world where data security and integrity are critical.

1.2 WASTE MANAGEMENT

A vital component of contemporary urban living, waste management is essential to maintaining our cities' sustainability, hygienic conditions, and

cleanliness. Waste output has reached previously unheard-of levels as metropolitan centers and the world's population grow, creating serious logistical, environmental, and health risks. Effective trash collection, processing, and disposal has grown to be a major challenge, necessitating creative solutions that support resource conservation while also reducing the negative effects on the environment. In this environment, waste management has changed from conventional landfill-based methods to a more comprehensive strategy that includes sustainable resource recovery, composting, and recycling, reflecting the increasing awareness of the need to lessen our ecological imprint. With a focus on developing technologies, methods, and issues that will shape sustainable trash handling and environmental stewardship in the future, this survey delves into the dynamic topic of waste management. Fundamentally, waste management involves limiting the negative effects that the materials we discard have on our ecosystems while managing them in a sustainable and ethical manner. The urbanization setting adds to the task's complexity as growing cities struggle to manage ever-growing garbage streams. In addition to addressing the practical issues of garbage collection and disposal, the growth of waste management techniques aims to maximize potential for resource recovery and recycling in order to lessen the load on landfills and preserve important resources. This study examines the complex field of waste management, shedding light on the various tactics, innovations in technology, and changes in legislation that are transforming the way garbage is handled to better support the circular economy and environmental sustainability.

1.3 TRACEABILITY

Traceability has become a key idea in a world where sophisticated production and distribution networks and global supply chains are connecting people more and more. It is the capacity to follow goods, products, or information from the place of origin to the destination through a variety of touchpoints. In addition to providing transparency, this traceable pathway gives stakeholders the ability to confirm the legitimacy, caliber, and compliance of the goods or data they manage. In a variety of sectors, including manufacturing, healthcare, agriculture, and food production, traceability is essential for assuring sustainability, accountability, and safety. Essentially, it functions as a potent instrument for augmenting confidence and alleviating hazards in a progressively intricate and worldwide community. The idea of traceability has gained traction as we negotiate the complexities of the twenty-first century because of its significant implications for consumer safety, legal compliance, and moral business conduct. In a time when buyers want more information about the things they buy, traceability offers a way to learn about the history and provenance of products, boosting confidence and allowing for well-informed decisions. Moreover, regulatory agencies have acknowledged that traceability plays a critical role in guaranteeing product safety, facilitating prompt recalls when required, and keeping counterfeit or subpar products off the market. This survey explores the complex field of traceability, illuminating its uses, importance, and the technology that support this vital instrument for transparency and accountability in a world growing more interconnected by the day.

1.4 SMART CITIES

Smart cities are leading the way in urban innovation and have the potential to completely change how we work, live, and interact with each other in our communities. There has never been a greater need for effective, sustainable, and technologically advanced urban development due to the growing concentration of people on the planet's cities. Smart cities are a vision of the future in which urban services are streamlined, environmental impact is minimized, and quality of life is improved via the use of cutting-edge technologies and data-driven solutions. These cities are paving the way for a more integrated, responsive, and livable urban experience by utilizing the power of digital connectivity, automation, and intelligent infrastructure to address the many issues associated with urbanization, from waste management and public safety to traffic congestion and energy consumption. The goal of building technologically advanced, inclusive, and environmentally conscious urban environments is at the core of the smart city concept. Smart cities maximize the potential of emerging technologies such as artificial intelligence, data analytics, and the Internet of Things (IoT) to improve resource allocation, optimize urban operations, and

increase public involvement. They provide a plan for urban expansion that is in line with the changing demands and expectations of contemporary society by placing a high priority on sustainability, resilience, and the well-being of their residents. This survey explores the diverse realm of smart cities, examining the tactics, technologies, and issues that are reshaping urban environments and offering inhabitants worldwide hope for a better, more connected future.

2. LITERATURE REVIEW

2.1 AN IOT-BASED WASTE MANAGEMENT SYSTEM MONITORED BY CLOUD

[1] In order to establish a dynamic and well-organized waste management system, Debajyoti Misra et al. have suggested in this research that clever solid waste bins are essential. This research describes an innovative approach to implementing an automated solid waste management system through an integrated sensing system. The ultrasonic level sensor and many gas sensors that automatically detect harmful gases and the maximum amount of waste are the foundation of the suggested smart waste bin. The method is distinct and makes use of monitoring via mobile apps and the cloud. Two significant aspects of the work include checking multiple foul gasses in addition to the bin's maximum trash level. Notifying the appropriate authority of the information is the other portion of the process. Due to the cloud server's benefits in terms of usability, accessibility, and disaster recovery, this novel technique utilizes it. For quick action, the data can be connected to the municipality's website. Each trash can has a tracking number that indicates its exact position. The eccentric technique can readily be used to contact the appropriate authority and provides all relevant information regarding the physical state of a certain bin.At the host server, a cloud-based web information system connects all of the data. Many technological communities are actively pursuing research subjects that contribute considerably fresh information to the Internet of Things (IoT).

2.2 BLOCKCHAIN FOR SMART CITIES: A REVIEW OF ARCHITECTURES, INTEGRATION TRENDS AND FUTURE RESEARCH DIRECTIONS

[2] In this study, Bharat Bhushan et al. make the proposal that, by dynamically optimizing the city's resources, smart cities have developed as a new paradigm to offer high-quality facilities to the residents. The best services for improving inhabitants' daily lives in terms of healthcare, transportation, energy use, and education can be found in smart cities. Though it has great potential, the idea of a smart city is still developing, and security issues are becoming more and more prevalent. Blockchain's positive attributes, including auditability, transparency, immutability, and decentralization, make it a promising tool for smart city development. Consequently, in order to address the security concerns associated with smart cities, this article introduces cutting-edge blockchain technology. The article first provides background information before examining the applications of blockchain technology in a number of different smart communities, including supply chain management, healthcare, transportation, the smart grid, financial systems, and data center networks. After a thorough review of the literature, several avenues for further study on blockchain-based smart city systems are highlighted. The number of people living in metropolitan areas worldwide has skyrocketed in the last few decades. Currently, over half of the world's population lives in urban areas; over the next 30 years, this percentage is expected to rise to 70%, with an additional 25 billion people expected to live in cities by 2050. The world's population is growing at an exponential rate, and this combined with the fast pace of urbanization is creating a host of social, technological, organizational, and economic issues that threaten the long-term economic and environmental viability of cities. Therefore, in order to maximize the use of both tangible (such as natural resources, energy distribution networks, and transportation infrastructures) and intangible (such as organizational capital in public administration systems, intellectual capital of businesses, and human capital), the majority of governments are actively interested in implementing "smart" concepts.

2.3 CONVERGENCE OF BLOCKCHAIN AND ARTIFICIAL INTELLIGENCE IN IOT NETWORK FOR THE SUSTAINABLE SMART CITY

[3] In this research, Saurabh Singh et al. suggest that by leveraging developments in new technologies, the smart city can transform into an intelligent community in the digital age. In particular, a new paradigm toward a digital smart city ecosystem has been ushered in by the quick uptake of blockchain technology. Numerous blockchain applications offer answers to issues in a wide range of sectors, including risk management, financial services, cryptocurrencies, the Internet of Things (IoT), and public and social services. In addition, the integration of blockchain technology and artificial intelligence (AI) is changing smart city network architecture to create sustainable ecosystems. But when it comes to accomplishing the objectives of building sustainable smart cities, these technological breakthroughs present both opportunities and difficulties. This study offers a thorough analysis of the literature on the security concerns and challenges that affect the implementation of blockchain technology in smart cities. This study offers a thorough analysis of a number of crucial elements that will combine blockchain with artificial intelligence to create a sustainable smart society. We go over ways to improve blockchain security, providing an overview of the main ideas that can be applied to the creation of several blockchain-AI based intelligent transportation systems. We also talk about the open issues and our future research directions, which include new security recommendations and future standards for an ecosystem of sustainable smart cities.

2.4 EVALUATING THE FACTORS THAT INFLUENCE BLOCKCHAIN ADOPTION IN THE FREIGHT LOGISTICS INDUSTRY

[4] In this research, Umar Simonov Kusi-Sarpong et al. claimed that all economic activities are becoming more digitallyized at a rapid rate, with further acceleration predicted in the upcoming years. In 2015, the digital economy made up 22.5% of the world GDP; by 2020, that percentage is predicted to rise to 25.5%. Due to the ever-expanding coverage of internet access, the majority of existing digital resources (e.g., servers, databases, services, or even smart objects, from smart watches to previous generation cars) are connected to the internet. New connection models are being leveraged by the digitization phenomena across the whole supply chain network. Using information and communication technology systems, business processes in the supply chain network have been converted from manual to electronic communication and processing. Furthermore, a decentralized and digitalized freight logistics system is replacing the traditional freight logistics system in the freight logistics sector. In addition to requiring cutting-edge technologies to facilitate the interchange of financial transactions and related data, the digitalized freight logistics system is built upon intricately linked hardware systems. Digitalized and decentralized logistics systems have the potential to create distributed freight logistics markets that support established supply chains and offer financial transparency. Blockchain technology, a distributed ledger that is still in its infancy but facilitates peer-to-peer trading, is necessary for these distributed freight logistics markets. It can help decentralized and digitalized freight logistics systems overcome some of their challenges.

2.5 BLOCKCHAIN ADOPTION: A VALUE DRIVER PERSPECTIVE

[5] Although cryptocurrencies are the main topic of conversation when it comes to blockchain technologies, Jannis Angelis et al. have suggested in this study that blockchain characteristics and capabilities have expanded beyond financial instruments. New functions offered by the technologies also result in changes to the accompanying value proposition. The link between blockchain technologies and the underlying value drivers is examined in this study. We evaluate and discuss four distinct stages of growing blockchain maturity that have been observed. This includes the inclusion of artificial intelligence to facilitate decentralized decision making, as well as the evolutionary technology types centered on transactions, smart contracts, and decentralized apps. Furthermore, we employ a methodology that focuses on blockchain value drivers to solve management concerns related to suitable blockchain deployment, providing decision makers with useful inquiries and suggestions. We provide practitioners an approach to evaluate appropriate blockchain implementation that takes into account the unique value creation linked to a particular organizational strategy. For academics, we offer a structured method for conceptualizing the evolution of blockchain technology, as well as a

critical identification and assessment of the stages of the blockchain and their implications for strategy. Over the past ten years, there have been rapid incremental changes to the blockchain concept that was first put forth by Satoshi Nakamoto1. Like with Bitcoin, the technology was not programmable at first, but blockchain platforms have since evolved with this feature.

3. EXISITING SYSTEM

Smart cities can prevent environmental issues brought on by inappropriate garbage disposal by lowering air pollution, safeguarding the aquatic ecology, and enhancing public health. Nonetheless, the technologies, methods, and systems used for waste management today remain centralized and manual. They are therefore susceptible to manipulation and the issue of the single point of failure. Furthermore, a lot of the current waste management systems in smart cities don't offer characteristics like audit, security, traceability, operational transparency, and trustworthy data provenance. In this research, we investigate the critical role that block chain technology plays in trash management in smart cities since it provides audit features, traceability, immutability, and transparency in a decentralized, trustworthy, and secure way. We go over the advantages that block chain technology offers for a range of waste management use cases and application scenarios, such as fleet management, dependable channelization and compliance with waste treatment regulations, effective waste resources management, protection of waste management documentation, and real-time waste tracing and tracking.

4. PROPOSED SYSTEM

In the context of India specifically, block chain technology presents viable possibilities to transform the e-waste management (EWM) industry. Using block chain technology to create transparent, unchangeable systems can result in a more sustainable and accountable method of managing electronic waste. Using smart contracts is one of the main components of this change. Block chain-powered self-executing contracts have the ability to guarantee accurate documentation of electronic and electrical equipment (EEE) that is brought to market by different manufacturers and sellers. Through the use of smart contracts to specify explicit collection targets, we create a system that holds noncompliant parties accountable. Introducing fines for non-compliance has the potential to be a potent disincentive. Additionally, encouraging clients to send their electronic waste to the official sector can help considerably lessen the unorganized sector's hegemony in EWM. This eventually improves the environment and public health by fostering a more competitive and sustainable industry in addition to encouraging appropriate disposal. We explore the possibilities of blockchain technology and smart contracts to revolutionize e-waste management in India in this study, stressing the need for a comprehensive strategy involving all relevant parties throughout the supply chain.

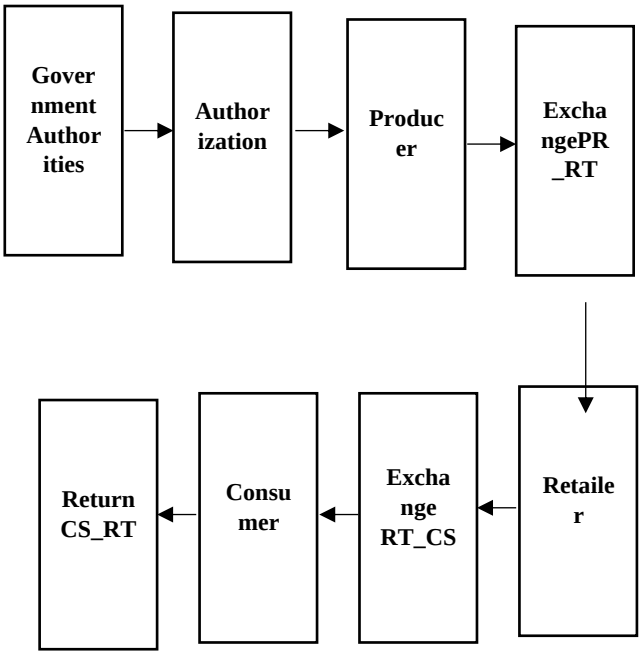

Figure 1block diagram

4.1 AUTHORIZATION MODULE

This particular smart contract module will only be utilized by GAs to grant digital e-waste licenses to PRs, RTs, and owners of CCs or RUs, enabling them to begin operations in India. Each stakeholder's obligations regarding their e-waste collection goals for the next years and the fine for missing the objective will be outlined in this license. The penalty amount, as determined by the smart contract, will be immediately taken out of the stakeholder's account and deposited

into the relevant government account if the stakeholders don't reach these goals.

4.2 PRODUCER MODULE

The quantity of EEEs that each PR intends to supply (Supply Amount) to the Indian market must be kept on file. In addition, they need to indicate which RTs they will supply EEEs to, how much e-waste they have already collected, where it came from, and which CCs on the EWMB they will provide the collected e-waste to. The Producer module needs access to these records. In order to confirm the e-waste contribution provided by PRs, this module will make a call to the Collection Module.

4.3 EXCHANGEPR_RT MODULE

The interchange of EEEs between PRs and RTs will be observed by this module. The RT must start a transaction at the time of purchase. The e-waste license numbers of the RT, the PR, and the record of the units traded between them must all be specified in this transaction. If there is a discrepancy, the module will deny the transaction and penalize the associated PR for their improper behavior.

4.4 RETAILER MODULE

The quantity of EEEs that each RT has acquired (Purchase Amount) must be documented. The Exchange PR_RT Module will be used to verify this amount. Additionally, RTs need to indicate how much e-waste they have already collected, where it came from, and which PRs on the EWMB they plan to buy from. To confirm the amount of e-waste contributed by RTs and whether the PRs they specify match the list provided by the PRs, the Retailer Module will make a call to the Producer Module.

4.5 EXCHANGERT_CS MODULE

The interchange of EEEs between RTs and CSs will be observed by this module. Similar to Exchange PR_RT Module, however CS must start the transaction. The Aadhar number of the CS, the RT's e-waste license number, and the record of the units traded between them will all be specified in this transaction. The Retailer Module will be used to verify the Purchase Amount of each RT by looking through all of the transactions related to that RT.

5. RESULT ANALYSIS

The suggested method performs noticeably better than the current one, with an accuracy of 90.74% as opposed to 85.19%, according to the results analysis. This increase in accuracy indicates that the suggested algorithm is more successful in accomplishing the goal for which it was designed, most likely as a result of improved optimization, more sophisticated methods, or a better model architecture for the given situation. Even though it may appear small, the accuracy gain can have a big impact on the application and produce safer, more effective, or more dependable results. This contrast emphasizes how crucial it is to continuously innovate and optimize algorithms in order to improve performance and produce better outcomes.

algorithm	accuracy
Proposed	90.74
Existing	85.19

Table 1. Comparison table

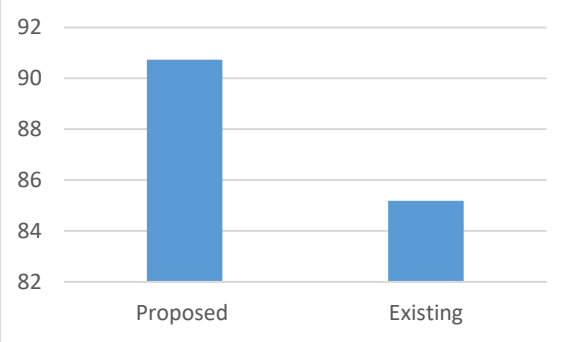

Figure 2. Comparison graph

6. CONCLUSION

E-waste management might be completely transformed by block chain-based smart contract systems, which would increase its effectiveness, efficiency, transparency, accountability, security, and environmental friendliness. Block chain-based smart contract systems can lessen unlawful e-waste

dumping, increase compliance with e-waste management laws and regulations, and aid in the creation of more efficient e-waste management strategies by tracking the movement of e-waste throughout the collection, transportation, and recycling process. It is a challenging procedure, but it is definitely worth trying to create a block chain-based smart contract system for modified e-waste management (MEM). All parties involved in the management of e-waste, including consumers, companies, recyclers, and governmental organizations, can profit from a system that is carefully planned and implemented. To sum up, smart contract solutions based on blockchain technology have great promise for solving the escalating issue of e-waste. We can build more sustainable systems and provide everyone a more sustainable future.

7. FUTURE WORK

Adding more waste categories to the system's scope: Additional waste categories including construction, hazardous, and agricultural trash might also be added to the system. This would assist in lessening the effect that trash of all kinds has on the environment. Creating new smart contracts to automate intricate waste management procedures: New smart contracts might be created to streamline intricate waste management procedures like tracking garbage shipments and negotiating waste disposal contracts. This would contribute to increasing the waste management process' efficacy and efficiency.

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