Record Management Using Blockchain In Automotive Industry

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Abstract- This is where blockchain can bring a revolution in the sector of automobiles. It will help in improving security, efficiency and transparency, on various car related process such as vehicle manufacturing, supply chain, vehicle servicing as well as insurance. This paper offers an extensive review on the possible use of blockchain in auto sector. The paper talks about how blockchain could benefit every application, as well as some of the problems it should address first before being applied so commonly in the auto industry.

Keywords: Blockchain; Automotive Industry; Data Collection; Security Attacks; Cost; Efficiency; Connectivity; Latency; Monetizing

I. INTRODUCTION

There is an aggressive pace of change in the automotive sector. Electric cars, autopilot, smart car and many other things which are bringing both challenges and opportunities into the industry. Indeed, blockchain technology can help solve these issues as well as form the basis for novel business designs.A blockchain is one of the many distributed ledger technologies that may be used to make recordkeeping secure and untamperable. This may transform how auto industries share as well manage their data.

This paper will discuss the following potential applications of blockchain technology in the automotive industry: Vehicle manufacturing: The blockchain technology can follow how parts or components travel during manufacture, also guaranteeing the reliability of cars. Supply chain management: Transparency and efficiency the automotive supply chain can be enhanced through blockchain.

- Vehicle maintenance: A tamper proofed record of vehicle history by blockchain.
- Insurance: Insurers also need to embrace blockchain in order to streamline the claim management process as well as combat fraud.
- Blockchain Record System for Automotive Supply Chain

The auto supply chain entails a multinational web of manufactures and suppliers. It becomes hard to follow the products movement as well as ensuring all partners are informed through same document simultaneously. These issues may be resolved through blockchain technology that can provide a reliable mechanism for recording the history of events in the supply chain.The movement of goods and materials through the manufacturing process from raw material inputs to finished items could be traced by a blockchain based record management system in the automotive supply chain. These documents may include contracts, invoices, or even quality control reports. Secondly, the system could be utilized to serve as a document storing and sharing facility[1].

Blockchain's use in supply chain records management improves transparency as well as accountability. The records would equally benefit all players involved in the supply chain and no one could do any manipulation on them without informing every other player. This could limit frauds and errors in the supply chain hence increasing efficiency.Moreover, blockchain can aid in increasing data security during the process of maintaining records. The nature of blockchain is that it encrypts its record and distributes those records across a network of computers, making it almost impossible to hack or plagiarize those records. This is significant in the automotive industry since supply chain data could be confidential and priceless.

II.LITERATURE REVIEW

The process of designing and implementing the blockchain-record management system for the automotive supply chain is extremely difficult but it can potentially radically change the existing practice[2].The blockchain in automotive industry can be used in many ways as given in the figure.1.

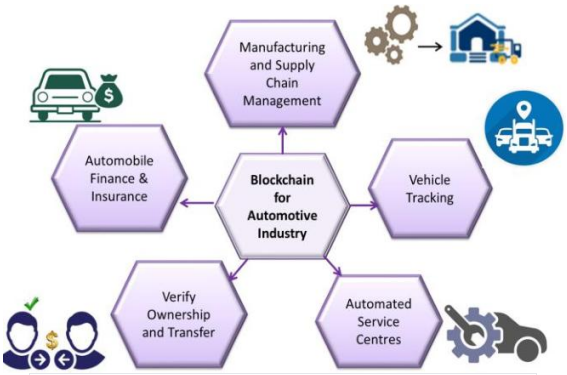

Figure : 1. Blockchain for Automotive Industry

Figure : 2. Blockchain in Automotive industry

Securing Vehicle Maintenance Records with Blockchain

Vehicle maintenance record is a crucial aspect in enhancing the security and reliability of vehicles. Nonetheless, conventional records stored on paper are often mislaid, damaged, or manipulated intentionally. Utilizing blockchain technology also enables storing vehicle maintenance and making it easily available and reliable.The maintenance history for a car could be stored in one place where it can include the date and time of every service done such as when and by whom they were serviced, the parts and labour used in the process. In addition, it would also be possible to keep and circulate critical papers like repair forms or service charts.

In this case, one of the advantages when block chain is applied in maintenance record management in vehicles is to enhance the openness and responsibility. The same information would be accessible by all authorized parties like the owner of a vehicle, service center and insurance companies. It can also be used to reduce frauds and errors to produce a better quality of vehicle maintenance process.Additionally, blockchain may aid in improving data security while facilitating vehicle maintenance record management. Encrypted blockchain records are distributed amongst many different computers and thus very hard to steal from or hack. Vehicle maintenance records tend to be confidential information, especially in the car sector.While blockchain-based maintenance record securing for cars is just one application in its infancy, it may disrupt car maintenance business models significantly[3].

Enhancing Automotive Recall Efficiency with Blockchain

The automotive industry has been facing challenges with automotive recalls. Automakers can incur enormous costs as well as a loss of goodwill from recalls such as this one. Blockchain can be applied in improving the efficacy and transparency of motor vehicle recalls.With this, a blockchain based auto recall can be put in place starting with identifying the problem and ending up with doing necessary repairs. The system can also be utilized in communicating with vehicle owners and giving them updates about the ongoing recall program conducted by the manufacturer[4].

Blockchain can aid in improving transparency as well as accountability when managing automotive recalls. Each of the recognized parties involved like the automaker, the government, and the motorist could obtain similar data. It might also assist in averting fraud and errors and to make sure that all recalls are conducted appropriately and productively.Blockchain provides another advantage in ensuring that the information collected has minimal or no chances of falling into the wrong hands thereby improving data security[5]. Blockchain is hard because it has many records that can be read by anyone as long as they can decrypt them because they are encrypted and can be stored in different places across a network of computers. Vehicle recalls are a critical issue in the automobile sector considering this data is often considered sensitive and vital.A new promising development in the use of blockchain technology on improving efficiency and transparency of automotive recalls. Such a system can bring about the reduction in the costs and time involved in recalls, making vehicles safer on the road[6].

Tracking Vehicle Usage and Mileage with Blockchain

Vehicle usage and mileage tracking assists in insurance, taxation, and fleet management among other things. Nevertheless, these conventional means of determining vehicle use and mileage are imprecise and unreliable. With blockchain, it would be possible to design a more robust and effective tracking system of vehicle usage and mileage.

The information regarding the respective dates, miles taken and amount of gas used to travel in each trip can be stored by a block chain driven automobile application system. Such a system would also enable safekeeping and disseminating vital documents like an insurance policy or registration papers of one's vehicle.Blockchain can be an aid in improving the accuracy and reliability when it comes to vehicles usage and vehicle mileage. Therefore, blockchain transaction records are irreversible and cannot

be simply changed or deleted at will. This is significant in maintaining correct and precise usage and miles data on vehicles[7].

Additionally, block chain can be used to enhance privacy and security in regards to vehicle usage and mileage tracking. The information in blockchain is encrypted and then distributed throughout a network of computers. It offers necessary security features concerning car owners' private information as well as anti-fraud measures here.A blockchain based system on vehicle usage and mileage tracking presents another breakthrough. It would enhance the quality of usage and mileage records by making it more accurate, private and secure.

III.Methodology

Automotive parts life cycle is complicated and comprises many actors in it, such as manufacturers, suppliers, and the distributors. Using blockchain, you will be able to improve the efficiency and transparency of managing the lifecycle of auto parts and components.For instance, a supply chain management tracking system that utilizes blockchain could monitor parts moving from their original ingredients to be used in the manufacturing process for vehicles. Moreover, the system could act as a repository for such documents like quality control reports or warranty details[8].

Blockchain for automotive parts and components LCM provides for increased level of transparency and accountability. Everyone concerned would have a single set of data which no one could edit without telling everybody else. This can help in prevention/mitigation of frauds or errors, and promote general effectiveness of supply chain.Besides, the use of a blockchain can be helpful in enhancing data security for OEMs' parts. The blockchain records are encrypted and stored on several different computing devices in a network thereby reducing their vulnerability. This is especially crucial for the automotive sector where information on automotive parts and components may be confidential and of significance.Management of automotive parts and its component by blockchain technology is still in infant stage, but it may be set on disrupting automotive parts lifecycle management.

Blockchain Solutions for Vehicle Insurance and Claims

The processes of making vehicle insurances and claims processing are very complicated and they take a long duration. Blockchain is an alternative that can be developed, which promotes more effective, trustworthy means of auto insurance underwriting and vehicle damage or claim settlement.All the necessary data including that on the policy holder, the vehicle involved and the insurance premium. In addition, the system could be used to facilitate the claims process as policyholders are able to make their claims quickly.

Block chain use in vehicle insurance and claim processing has shown some successes, especially in promoting transparency and accountability. This would provide a single pool of information that all of the recognized parties, like the insurance company, the policyholder, and the repair shop, would be able to access. This will also assist in reducing fraud and errors while improving customer experience.Blockchain can also offer enhanced database safety with respect to the motor vehicle insurance and claim handling process. Encrypting blockchain records over a network of computers makes them hard for a thief or computer hacker to take. This is necessary to safeguard the rights of the policyholders, and ensure that no frauds occur.A recent advance in this respect involves the application of blockchain technology towards the creation of more effective, transparent systems of vehicular insurance coverage and claim processing. The approach can be beneficial in reducing costs of both claims insurance firms as well as policy holders[9].

Securing Automotive Transactions with Blockchain

Transactions in the automotive industry are usually lengthy and difficult especially when it comes to purchasing a car, hiring a vehicle or making maintenance payments. Automotive industry has advanced with the use of blockchain technology.A blockchain-based automobile transaction network can help automate the whole transaction operation that commences with pricing and end at fund exchanging. These also include storing some essential files like purchase contracts and vehicle registration certificates.

Among the significant advantages of adopting blockchain in the automotive transactions is the provision of enhanced safety and performance. The blockchain encrypts and safeguards the transactions which make it almost impossible to hack or untrace. This is crucial in safeguarding privacy of both buyers and sellers.Blockchain can also be used to improve the reduction of transaction costs in automobile dealings. Therefore, blockchain transactions lack third party entities which include banks and credit card firms. This will cut costs of transaction fees for both buyers and sellers.

One of the emerging applications in the automotive industry involves the application of blockchain technology for efficient and secure transaction processes. Such capability is able to enhance automotive transactions in a cheap, fast and safe manner[10].

Blockchain Collaboration in the Automotive Industry.

The industry of automobiles is a data-centred one. Nevertheless, it is quite difficult for many stakeholders in

the automotive industry, including those on behalf of privacy and safety. As such, blockchain technology has the potential to facilitate a safe and quick way of collecting and sharing data between car manufacturers in the auto sector.The blockchain-supported automotive data sharing & collaboration program would provide various entities with opportunities in this context, including OEMs, suppliers & dealers. In addition, the system could support automated datadriven processes like car construction and logistic.

Using blockchain for auto industry's data sharing and collaboration helps increase transparency, thus improving the accountability. The identical data would be accessible by all authorized parties, and no one could change the data unless everybody knew about it. Frauds and errors should be minimized to enhance the automotive industry's performance.

The other advantage of utilizing blockchain in automotive data sharing and collaboration is enhancing the integrity of data provision. Encryption of blockchain data enables it to be spread in a network of multiple computers thereby making it nearly impossible to steal or hack it. The privacy of automotive stakeholders should also be protected as well as prevent the hijack of critical information.One more significant evolution is the utilization of blockchain to secure and efficient data exchanging and collaboration among automotive. Such a technology can disrupt the entire operation of the industry.

PRIVACY-PRESERVING AUTOMOTIVE DATA WITH BLOCKCHAIN

The automotive-associated data is gaining much value as cars are getting smarter and driverless. Nevertheless, there exist privacy and safety problems associated with auto data. The development of privacy protecting automobile blockchain technologies.Protecting automotive data in a proposed blockchain-based system might involve encryption, differential privacy, or homomorphic encryption. It would be possible for users to define who has access to their data and what they can do with it as well.The use of blockchain in privacy-preserving automotive data management offers one of its major advantages because it empowers the user. In that case, users would select specific entities like automobile corporations and some insurers who could have access to their information, but exclude those whom they wanted to deny any knowledge of their data.Blockchain can also be useful in preventing misuse of automotive data such as unauthorized data mining, traffic accidents analysis etc. The blockchain transactions are encrypted and cannot be spoofed/hacked nor can the data stolen/stolen. Privacy of automotive users also has an important role in this aspect as well as to protect against fraud.The automotive industry must address the critical challenge of developing privacy-preserving automotive data management solutions. However, blockchain technology can be of great importance towards creation of these solutions.

BLOCKCHAIN APPLICATIONS FOR AUTONOMOUS & CONNECTED CARS

We have been hearing about autonomous vehicles and connected cars for long now but they are already becoming a reality. A number of possible blockchain-based applications aimed at connected cars and autonomous vehicles.Blockchain can be used in the management of V2V and V2I communication. This network can support communication between autonomous vehicles, connected cars and infrastructure; it could be secure as well as unchangeable by using blockchain.

Autonomous vehicles could also make use of some distributed network functions of this technology on management of vehicle data sharing an collaboration. Connectivity between autonomous/connected cars and blockchain technology could allow interoperable communication to happen among autonomous vehicles, automakers, and traffic management systems.Additionally, new payment models for autonomous vehicles and connected cars can possibly be developed using blockchain. For instance, blockchain can be applied in designing pay per use insurance model and micro-payment structures for sharing self-driving cars on rent basis.Blockchain technology in autonomous vehicles and connected cars is a comparatively novel concept. However, it could transform how these cars run. Blockchain makes it possible to ensure security of AVs and CAVs, reducing their costs while enhancing safety and efficiency.

IV. RESULTS AND DISCUSSION

Introduction: This document serves as an extensive review of blockchain technologies and their diverse applications in the automotive industry, platform operations, and vehicle ownership models. It addresses the significant transformations underway in these domains and the adoption of emerging technologies such as blockchain and Non-Fungible Tokens (NFTs) for innovative solutions.

Security Aspects of Blockchain: The content highlights the essential security advantages of blockchain technology, including access control, user identity management, and cybersecurity protection. It underscores blockchain's role in enhancing security not only in the automotive sector but also across platform operations.

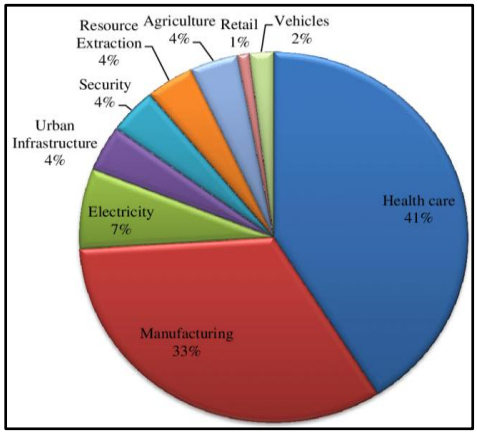

Fig.3 Denotes Projected market share of dominant block chain applications.

Challenges in the Automotive, Platform Operations, and Vehicle Ownership Industries: Challenges are identified for stakeholders in the automotive industry, encompassing issues like transparency in car history and regulatory compliance. In the context of platform operations, challenges span areas such as blockchain development on test networks and the need for robust regulatory frameworks for tokenized assets.

Benefits of Blockchain in the Automotive, Platform Operations, and Vehicle Ownership Industries: Blockchain is recognized for providing a range of benefits in terms of operational efficiency, data integrity, trust enhancement among stakeholders, and the introduction of innovative revenue generation models.

Blockchain in Supply Chain Management in the Automotive Industry: Systematic Literature Review: The content offers insights into the systematic literature review focusing on blockchain implementation in supply chain management within the automotive industry.

Research Identification and Methodology: The study employs a systematic review process to explore research questions related to fractional vehicle ownership and blockchain asset tokenization, drawing on specific keywords and criteria to select articles.

Literature Review on Fractional Vehicle Ownership and Blockchain Asset Tokenization: This section investigates the potential of Non-Fungible Tokens (NFTs) for the automotive industry and introduces a novel car ownership and revenue generation model built on the ERC-1155 token standard. It delves into decentralized technology, tokenization, use cases of NFTs, a proposed revenue model, advantages, limitations, and future research opportunities.

Conclusion: The document concludes by emphasizing the substantial potential of Non-Fungible Tokens and blockchain technology across the automotive industry, platform operations, and vehicle ownership models. It underscores the feasibility of fractional vehicle ownership and revenue distribution through blockchain, but it also highlights the need for further research to unlock the technology's full potential in the transport industry. This includes addressing regulatory aspects, exploring smart city applications, and studying the impact on shared mobility models.

This comprehensive overview offers a detailed perspective on blockchain technologies, addressing their multifaceted applications in the automotive, platform operations, and vehicle ownership sectors. It encompasses discussions on security, challenges, benefits, systematic literature reviews, research methodology, and future research opportunities.

V. Conclusion

The automobile industry could be redefined by blockchain technology. The tool is useful in enhancing various auto-related activities.Still, there are numerous factors that require consideration when introducing blockchain into the automotive landscape. Some of these challenges are related to creation of industry-wide standards, education of stakeholders about blockchain technology, and development of new blockchain-based applications and services.However, some challenges lie ahead on the way toward utilization of block chain technology by the car sector. Blockchain has the potential to improve efficiency, transparency, and security within the automotive industry.

References

[1] Dutta, P., T. M. Choi, S. Somani, and R. Butala. 2020.“Blockchain Technology in Supply Chain Operations: Applications, Challenges and Research Opportunities.” Transportation Research Part E: Logistics and Transportation Review 142: 102067.

[2] Ganesh Babu C; Banupriya N; Nagarajan N, Performance Breakdown and Redistribution Amidst OSPF, EIGRP & IS-IS Dynamic Routing Protocols in IPv6 Network, IEEE Xplore, January 2023, DOI: 10.1109/STCR55312.2022.10009222

[3] M. Anathi, K. Vijayakumar, An intelligent approach for dynamic network traffic restriction using MAC address verification, Computer Communications, Volume 154, 2020, Pages 559-564,https://doi.org/10.1016/j.comcom.2020.02.021.

[4] IBM Institute for Business Value (2018) Blockchain for mobility services: Personalized mobility through secure data, IBM Corporation.

[5] D. Rose, K. Vijayakumar, D. Kirubakaran, R. Pugalenthi and G. Balayaswantasaichowdary, "Neural Machine Translation Using Attention," 2023 International Conference on Artificial Intelligence and Knowledge Discovery in Concurrent Engineering (ICECONF), Chennai, India, 2023, pp. 1-7, doi: 10.1109/ICECONF57129.2023.10083569.

[6] P. K. et al "An Secure and Low Energy Consumption based Intelligent Street Light Managing System using LoRa Network," ICECA, Coimbatore, India, 2022, pp. 638-645, doi: 10.1109/ICECA55336.2022.10009408.

[7] R. Nuthakki, A. S. Murthy and D. Naik, "Single channel speech enhancement using a new binary mask in power spectral

domain," 2018 Second International Conference on Electronics, Communication and Aerospace Technology (ICECA), 2018, pp. 1361-1366, doi: 10.1109/ICECA.2018.8474842.

[8] PS. Rosaline et al, "Predicting Melancholy risk among IT professionals using Modified Deep Learning Neural Network (MDLNN)," (CSNT), Apr. 2022, Published, doi: 10.1109/csnt54456.2022.9787571.

[9] Ahmed Z, Zeeshan S, Mendhe D, Dong X. Human gene and disease associations for clinical-genomics and precision medicine research. Clin Transl Med. 2020; 10: 297–318. https://doi.org/10.1002/ctm2.28

[10] Kouhizadeh, M., S. Saberi, and J. Sarkis. 2021. "Blockchain Technology and the Sustainable Supply Chain: Theoretically Exploring Adoption Barriers." International Journal of Production Economics 231: 107831