Smart City Build Up Using Block Chain Based Distributed Framework For The Automotive Industry

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Abstract- *The automotive industry requires personalized on demand and integrated services which are hard to provide owing to the large production size and the adoption of advanced technologies disrupt the OEM's operating and business models. The increased adoption of autonomous cars is expected to disrupt government regulations, manufacturing, insurance, and maintenance services.. To address these issues in this paper, we propose a blockchain-based distributed framework for the automotive industry.*

Keywords- Blockchain automotive lifecycle, supply chain management, smart city

I. INTRODUCTION

The key requirements of the blockchain-based framework for the automotive industry in the smart city. 1) Supply chain management: We can apply blockchain technology for each phase of the supply chain from government regulation and manufacturing to maintenance and the recycling phase of the automotive industry. For instance, in case of automotive part failure or accident, the blockchain-based framework can provide unique identification that will help us determine the root cause as well as who should assume the cost and so on. 2) Unparalleled security: As connected cars become more and more self-driving autonomous cars, so addressing the challenges of connected car data security is a necessity. By inheriting secure means of sharing and storing data through blockchain technology, we can provide different levels of security in the automotive industry. 3) Evidence integrity and secure storage: The framework must ensure that previously submitted evidence remains unchanged despite any attempt to modify historical data to deny liability in case any event occurs. 4) Mobility solution: The framework should provide a platform to allow data, resources sharing, and carpooling services in an autonomous system. 5) Ability to audit records: A blockchain-based automotive framework can do audits because of the immutable nature of the information in the blocks. 6) Automated maintenance services: A blockchain-based automotive framework can be used to automate payments, insurance claims, and provision of maintenance services. It will also provide a platform for facilitating vehicle tracking. 7) Transparency: Due to the decentralized nature of the blockchain and lack of centralized control by a single party, all authorized parties have access to the same immutable information. 8) Execution speed and cost reduction: Numerous computing resources processing each transaction simultaneously due to the distributed nature of the blockchain accelerate the execution compared to the traditional centralized network wherein each transaction must wait for its turn to be processed. It also translates into reduced costs since there is no need for a single party to bear the burden of costly backup servers and remote storage.

II. LITERATURE REVIEW

Brousmiche et al. [1] proposed a framework for automating the life cycle of vehicles using the consortium blockchain. They highlighted the initial phase of implementation and the challenges to be addressed in the future.Supranee et al. [2] illustrated that the blockchain technology can help to improve the supply chain process of Thailand's automotive industry. The research by Daniel et al. [3] presented the challenges and a framework for knowledge exchange among organizations in the automotive industry. Pinheiro et al. [4] introduced a decision-making process model in the multi-agent systems approach to the industry using blockchain. An abstract idea of the reward based smart vehicle data sharing framework is proposed by Singh et al. [5] for intelligent vehicle communication using blockchain. They also presented a crypto IV-TP intelligent vehicle communication to improve privacy [6].Ortega et al. [7] presented a content-centric networking combined with blockchain to handling tasks in the automotive industry effectively. To guarantee the execution of energy recharges, Pedrosa et al. [8] presented an algorithm with a refuelling use case scenario for autonomous vehicles using blockchain. P. K. Sharma et al. presented a vehicular network architecture based on the blockchain in the smart city [9]. Dujak et al. [10] introduced the concept of using blockchain technology in logistics and supply networks. They solved the challenges such as the secure and authenticated logistic system, the control of trust issues, and the ability to exchange supply chain information in supply networks through the blockchain. Mondragon et al. [11] investigated the applicability of blockchain technology in the supply chain, particularly in the manufacturing of structures. Providing an inviolable history of manufacturing, provenance, transportation, and storage, blockchain technology has proven to be effective. In addition, Hofmann et. al. [12] studies reveal opportunities in terms of decentralization, self-regulation and efficiency for the current status as well as for future logistics prospects. All the existing system focused on the very specific phase of life cycle in the automotive industry. There is a need to design a complete framework to provide on-demand, customized services meeting all key requirements as we discussed above for the automotive industry in the smart city

III. PROPOSED SYSTEM

In this section, we introduce a blockchain-based distributed framework model for the automotive industry to meet the current as well as future requirements.

A. Blockchain structure

In this paper, we describe how the blockchain structure model allows the development of secure digital product memory records, from raw material sources and manufacturing up to their maintenance and recycling phase in the supply chain lifecycle.In the proposed framework model, the entire life cycle is categorized into seven phases.

In the first phase, the regulator in the proposed framework model is responsible for creating the new vehicle registration based on government regulations and loading it into the shared ledger in the network. A smart contract ensures that only the regulator has the right to do so.

In the second phase, the manufacturer receives the certified created ownership issued by the regulator, which is called a consensus between the manufacturer and the regulator. Upon receiving ownership, the manufacturer makes the vehicle model, ID, and template available in the network for all relevant parties with appropriate permission using smart contracts.

In the third and fourth phases, the vehicle are transferred to the dealer and leasing companies with the execution of smart contracts in the supply chain.

After the vehicle transfer to the leasing company, the car is finally released to the user, phases in the fifth, sixth, and seventh phases in the supply chain life cycle.

In the maintenance phase, the proposed framework model provides services such as automated payment process, insurance and maintenance services, and dynamic and real-time data for the smart transportation system and personalized, on demand, and automated services to meet user demands.

In the recycle phase, the scrap merchant is allowed to scrap the car at the end of its life by executing a smart contract. The synchronization process continues throughout the supply chain of the car through the end user, maintenance, and scrap merchant.

B. Framework model

The government regulator in the first phase of the supply chain lifecycle creates registration for the new vehicle based on the government rules and policies and building a new block. With the help of the smart contract, we execute the block and ensure that it satisfies the smart contract terms and conditions and initiates the transaction of the new block.

Once the transaction gets validated, the consensus and transfer ownership to the vehicle manufacturer are published in the blockchain-based distributed network. After transferring ownership to the vehicle manufacturer, the manufacturer begins to fabricate the vehicle model, identification, and model and build a new block, and execute a smart contract. If the newly created block satisfies the permitted regulatory smart contract, initiate the transaction of a new block and get validated by miner nodes in the network. Here, transactions are verified and validated by the regulator as well.

Once the transaction are validated, the manufacturer publishes the vehicle template with updated visibility and appropriate permission for all the relevant parties in the network. After publishing the updated templates into the network, the dealer can access information on stock availability from the network and execute their smart contract to initiate transaction of the new block and transfer the vehicle to the dealer. Here, the manufacturer and regulatory participate in the validation process.

In the end, the dealer publishes the vehicle template in the network for all members with appropriate permission to see. In this phase, the dealer can also issue loyalty points that can be used and exchanged as currency in the network. The dealer could complete the purchase of parts with loyalty points redeemed by the customer at a discounted price.

Once the loyalty points have been redeemed, the dealer account will be updated so that participants in the network can see with appropriate permission. The leasing company accesses the updated vehicle template from the network, transfers the vehicle from the dealer, and builds a new block and initiates a new transaction if the created block satisfies the smart contract.

Once the transaction is verified and validated by the regulator, manufacturer, and dealer, they transfer the vehicle to the end user and publish the vehicle's ownership, rights and permission into the network. The proposed framework model connects the entities involved when leasing a vehicle to a customer in a secure manner to perform Know Your Customer (KYC) customer checks such as credit check, ID, and license prior to leasing the vehicle and storage of leasing contract in the blockchain network.

During phases 5 and 6, there are different personalized, on-demand, and real-time services offered for the user such as insurance contract, periodic maintenance contract, and automated fuel payment contract. In this phase, the proposed model allows insurance companies to create customized vehicle insurance contracts based on actual driving behavior and automate the payment of insurance and financial settlement following a claim. Driving behaviors and safety events such as mileage, speed, damaged parts, and collisions of a vehicle owner could be stored in the blockchain network, shared, and used to calculate insurance premiums and payments. Since the record is tied to the owner, the history of the vehicle owner remains available to the insurance company for future insurance quotes even after the sale of the car. In case of ondemand mobility, fuel payment, and ride-sharing services, our proposed blockchain-based framework model records and executes agreements and monetary transactions to allow vehicle owners to monetize trips, pay at fuelling service stations, and exchange data in a seamless, secure, and reliable manner.

At the end of the lifecycle, scrap merchant access vehicle status information, regulatory rules, and policies and execute a smart contract and check if the newly created block satisfies the smart contract, and then initiate the transaction of the new block, with the process validated and verified. In the validation process, all the relevant parties in the supply chain will participate in the process. Once the transaction gets validated, the vehicle will be transferred to the scrap merchant with appropriate permission to dispose of the vehicle at the end of the lifecycle and make the corresponding update in the network.

C. Miner node selection

The fruit fly optimization algorithm (FOA) can be used to select the list of the best possible miner nodes to compute the mining process during block generation. FOA is an evolutionary algorithm inspired by nature based on the food foraging behavior of fruit flies.

Using their sense of smell and vision, fruit flies have a better way of finding food compared to other fly species.We consider fruit flies as miner nodes and food as a transaction initiator node to create a new block The miner modes can be classified into two different groups: a group of active miner nodes and group of newly added miner nodes (or did not participate in the mining process for a long time). In this approach, we take the list of all miner nodes as input and provide a list of the best possible miner nodes to send a transaction request in the mining process when creating a new block.

Initially, we calculate the standard deviation of the generation time of block by each miner node, the time at which the last block created by a miner node, and the trust level of the miner nodes from the list of active miner nodes, and then compute the smell of each miner node. Then we find SD, the standard deviation of the generation time of each miner node At first, the smell of each newly added miner node will be NULL.
In the second step, we select a miner node with the best smell concentration. While all miner nodes search for the food source, we check whether the miner node is active or not. If the miner node is not active, then we set the smell of the miner node from the selected miner node with the best smell and random value, and compute the smell concentration and update the miner node smell values in the miner nodes list. Once we have computed the smell concentration of all miner nodes, we check whether the number of iterations reaches the maximum generation or not. If the number of iterations reaches the maximum generation, we sort the list of all miner nodes based on their smell concentration and return top L miner nodes with high smell concentration; otherwise we repeat the second step.

IV. CONCLUSION

In this paper distributed framework model for the entire life cycle phases of the automotive industry using blockchain technology was proposed.Adopting this technology increases trust among vendors and reduces business friction. Through the shared distributed record keeping structure of the block chain, communication and collaboration among the stakeholders in the automotive industry can be greatly enhanced; It saves a significant time and cost and enables manufacturers and suppliers to protect their brands against counterfeit products.

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