ETHEREUM AUTOMOBILE INDUSTRY

Hitesh Kale- B2020083

Nishtha Garg – B2020093

Hiren Panchal -B2020094

Sarthak Thakur- B2020111

Shikhar Mishra-B2020113

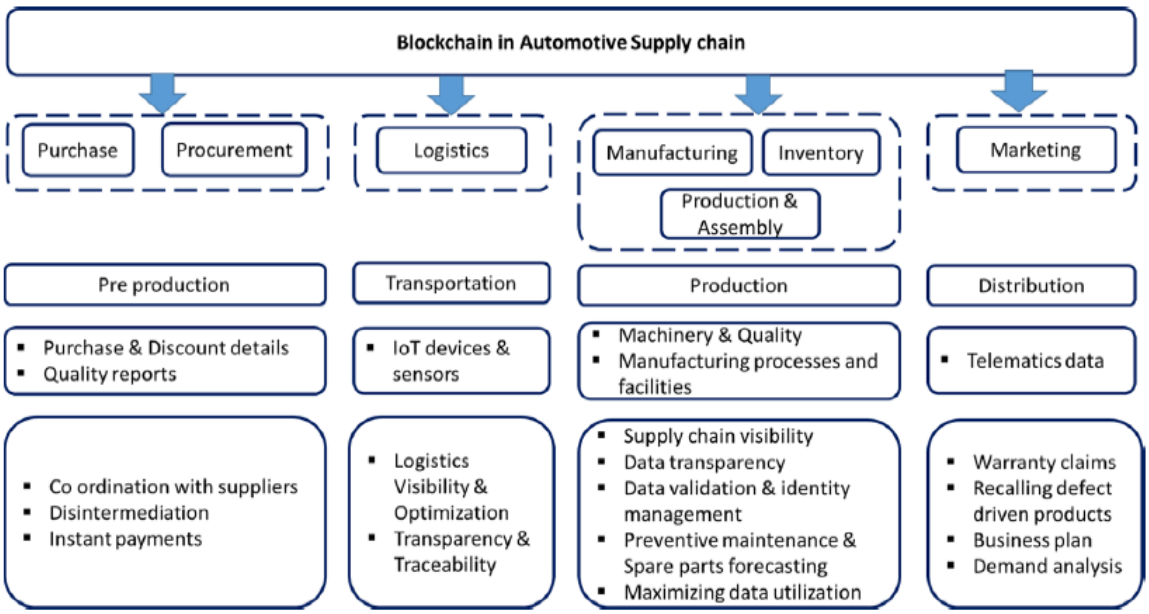
Shlok Borole-B2020116

GOA INSTITUTE OF MANAGEMENT

Contents

Abstract

Blockchain technology offers important opportunities for supply chain management. This project aims to overview employment of blockchain technology in the field of supply chain. Although the technology has been widely associated with cryptocurrencies, non-financial applications such as supply chain, power and food industry are also promising. Blockchain can provide a permanent, shareable, auditable record of products through their supply chain, which improves product traceability, authenticity, and legality in a more cost-effective way. Blockchain can drive increased supply chain transparency to help reduce fraud for high value goods such as diamonds and pharmaceutical drugs. Blockchain provides all parties within a respective supply chain with access to the same information, potentially reducing communication or transfer data errors.



1. Introduction

1.1 Why this High-Level Design?

HLD provides a high-level overview of the entire solution, product, system, platform service, or platform. High-Level-Design (HLD) is an architectural approach that defines architectural design in the context of a larger system.

The primary goal of this document is to add the details required to describe the current project in order to represent a good coding model. This document also intends to aid in the identification of inconsistencies prior to coding and can be used as a reference for module interactions at the next level.

Elements of HLD:

- Overview Design element
- High level information of every process and stage of the project.
- Outline the user's daily process flow and performance needs
- Includes the project's design elements and architecture.

1.2 Scope of HLD

The High-Level Design documentation presents the structure of the system as the application/database architecture, application flow and technology architecture. High-Level Design documentation may use some non-technical terms unlike Low Level design which should be strictly technical jargon.

2 General Description

2.1 Product Perspective

Blockchain technology, in fact, is a type of parallel and distributed computing architecture. It allows to eliminate central servers or trusted authority in digital interactions of partners. Thus, it is classified as a disruptive technology which has potential to transform radically most of the processes in our daily life. Simply, copies of the data, called ledger, are stored on thousands of computers working together, and all changes to the data are provided by consensus of partners. Every change made on data is recorded with a time stamp to ensure transparency. The parties of the system do not have to trust each other. The factors that ensure the trust among the stakeholders of the system are that changes on the stored data can only be made according to the specified rules, these changes are kept in a ledger whose content is transparently open to audit, protected by cryptographic techniques, and a copy of this chain is available to all parties. It becomes possible for digital data to change ownership like assets in the physical world

2.2 Problem Statement

The main objectives of the supply chain are listed as cost, quality, speed, dependability, risk reduction, sustainability, and flexibility. Manufacturing has been globalized, leads well defined supply chain management more crucial and valuable. In today's supply chain systems, it is difficult for customers to know exactly the value of a product due to lack of transparency. In addition, investigating supply chains mostly is not feasible in case of suspicion of illegal or unethical activities. Heavy paperwork, process costs, and slow processes are other main challenges of the supply chain.

Demand volatility, process unpredictability, supply chain complexity, and information ambiguity all contribute to a VUCA reality. To deal with this situation, businesses are turning to developing technologies for business excellence, one of which is Blockchain.

The automotive supply system is being hampered by a volatile climate, uncertain timetables and information, complex supply chain networks, and ambiguous judgments (ASC). As a result, in the VUCA world, Blockchain can be employed to solve ASC difficulties.

2.3 Proposed Solution

Blockchain technology is not a "one size fits all" solution. Recent problems raise related to blockchain and other assisting technologies should also be addressed to realize projects in supply chain domain. Blockchain based supply chain systems need various new legislative regulations. Current blockchain platforms cannot exactly fit the important level of transaction throughput requirement of supply chain systems. Supply chains combine diverse participants with varying interests. Thus, incentives need to be provided such as efficiency gains, improved liquidity, and data security to motivate all participants. Security and privacy are other critical issues. Data security concerns with IoT and lack of commonly accepted baseline protocol standards for IoT interaction. The current IoT ecosystem is built on a central model in which IoT devices are identified, connected, and validated. Thus, there is need for transformation for blockchain adaptation.

Table: How blockchain can improve the existing limitations of supply chains

Supply chain participants	Current limitations	Blockchain impact
Producer	Lack of ability to prove the origin and quality metrics of products transparently	Benefits from increased trust of keep track of the production raw material and value chain from producer to consumer
Manufacturer	Limited ability to monitor the product to the final destination. Limited capabilities of checking quality measured from raw material.	Added value from shared information system with raw material suppliers and distribution networks
Distributor	Custom tracking systems with poor collaboration capabilities. Limited certification ability and trust issues.	Ability to have proof-of-location and conditions certifications registered in the ledger.
Wholesaler	Lack of trust and certification of the products' path.	Ability to check the origin of the goods and the transformation /transportation conditions.
Retailer	Lack of trust and certification of the products' path. Tracking of products between consumers and wholesalers.	Ability to handle effectively the return of malfunctioning products.
Consumer	Lack of trust regarding the compliance of the product with respect to origin, quality and compliance of the product to the specified standards and origin.	Full and transparent view on the product origin and its whole journey from raw material to final, purchased product.

2.4 Tools used

Tools used in this project are:

1. Python
2. GitHub
3. Postmen
4. Spyder

2.5 Constraints and Current Challenges:

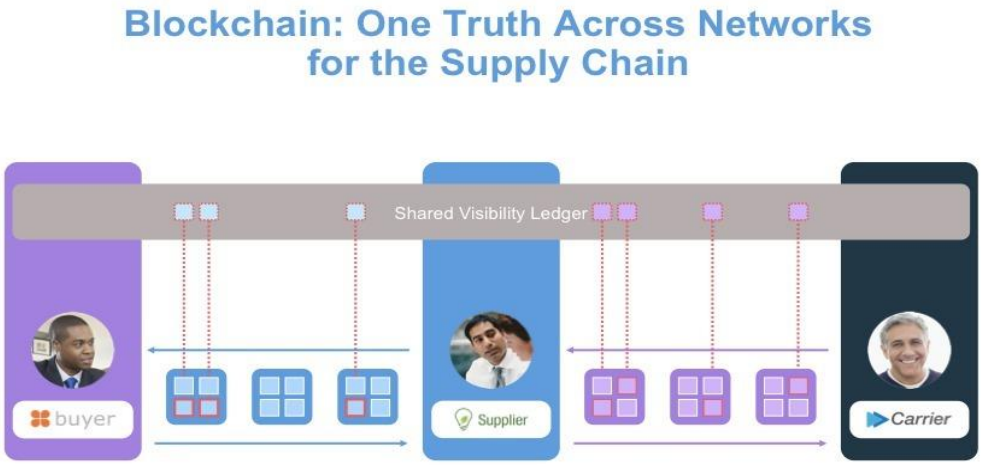
1. The automotive industry is no exception to the VUCA world (volatility, uncertainty, complexity, and ambiguity).
2. The significant presence of intermediaries, and various levels of suppliers with large supplier bases contribute to the complexity of the automotive supply chain.
3. Inefficiency in sharing real-time data related to inventory, demand, transactions, etc., with supply chain members.
4. Lack of real-time data sharing which results in inventory obsolescence
5. Data duplication and inconsistent alert systems without verified data, while the same data is being utilized for analysis.
6. Lack of transparency and traceability in supply chain activities and Logistics and poor visibility
7. Uncertainties in data resulting in the bullwhip effect
8. Difficulties in following up with suppliers and their services, with an absence of a platform for validating the actual status of the inventory position of suppliers and their supply related capacity constraints
9. Risk of defect driven products and product recall issues
10. Inclusion of paperwork in logistics and the presence of numerous intermediaries

2.6 Assumptions

In the automotive business, counterfeit items are a big problem for producers. Furthermore, the present counterfeit spare parts market is estimated to be worth several billion dollars. Directly or through aftermarket providers, such products can enter the supply chain. Counterfeit spare parts are unreliable since their quality has deteriorated and they frequently fail, causing unhappiness among end users and ultimately leading to a loss of faith in the brand. Using blockchain technology to combat counterfeit items is a huge win since it allows spare components to be individually identified and represented digitally. The method is more transparent with digital identification of spare parts, and it may be shared among many parties in the network.

2.7 Blockchain Implementation

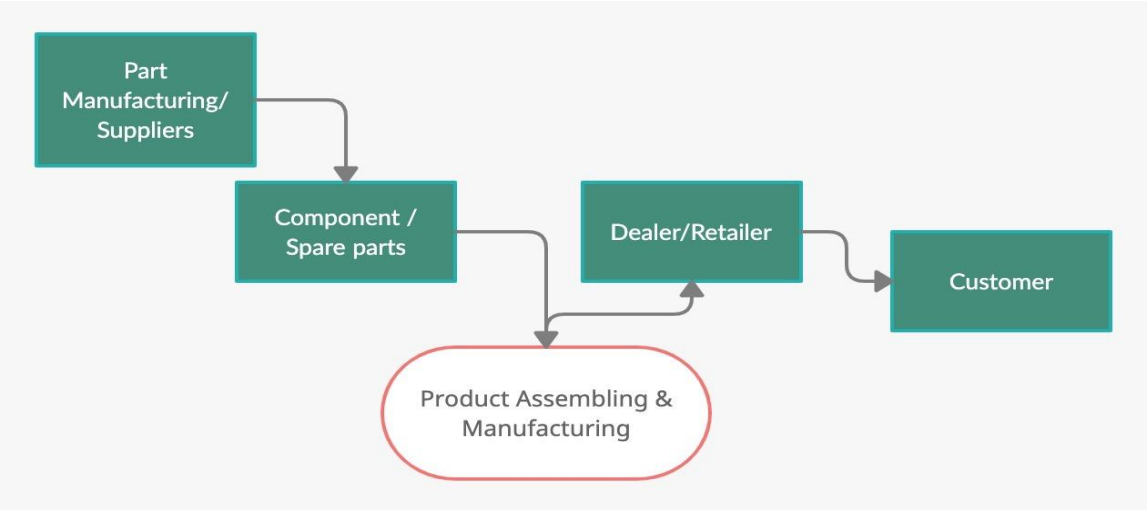
The traditional supply chain is a model that satisfies intermediary supply demands. This model has flaws, such as ties between supply chain members or customers' lack of knowledge about product origins. We're leveraging Blockchain to create a new supply chain paradigm. To do so, we compared the old supply chain to the new blockchain-based supply chain in order to identify a model that fulfils our requirements. This blockchain approach is a new technology that provides organizations with efficient and secure solutions. This new model strengthens the system's reliability by ensuring transparency and traceability across all chain operations, assets, and financial resources, as well as eliminating many of the previous supply chain's drawbacks. In addition, the Blockchain organizes all supply chain transactions and multi-agents.



3 Design Details

3.1 Proposed Methodology

Let's take a look into the high-level understanding of the steps of how can Blockchain help Supply Chain.



Assembling and Manufacturing of Products:

Spare parts and components are assembled on the basis of the requirements to manufacture the desired product. After manufacturing, the products are assembled in certain category and batches. Some of the features used in storing and searching database are as follows:

- Serial Number
- Engine Number
- Chassis Number
- Model Number
- Vehicle Category
- Manufacturing Batch
- Manufacturing Date

Product Shipment to Dealer/ Retailer:

Whole process of Shipment of product and payment consignment to Dealer is recorded and can be tracked. Some of the features of databases are as follows:

- Serial Number
- Engine Number
- Chassis Number
- Model Number

- Vehicle Category
- Color
- Dealer ID
- Dealer Name
- Transaction Date
- Payment Amount
- Payment ID

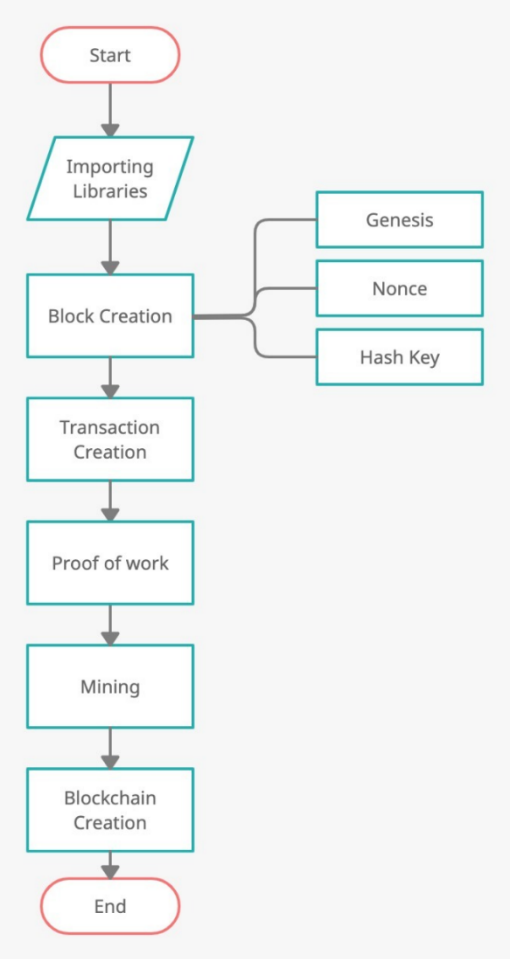
Product Selling to Customers:

Product is sold out to customers that can be recorded and tracked on the basis of following:

- Serial Number
- Engine Number
- Chassis Number
- Model Number
- Vehicle Category
- Color
- Customer Name
- Sell Date
- Payment Amount
- Payment ID
- Vehicle Registration No.

3.2 Process Flow – The Blockchain Supply Chain Process

Let's take a look into the low-level understanding of the steps of how can Blockchain help Supply Chain.



Importing Libraries:

Importing of required libraries need to be done in order to create Blockchain and do necessary mining.

Block Creation:

Block is a data structure used for keeping a set of transactions which is distributed to all nodes in the network. We need to create a block and set it up by initialising some of the functions. In order to create block, we need to create Genesis Block, Nonce Block and Hash Key.

Transaction creation:

It is a smallest building block of a blockchain system (records, information, etc.) that serves as the purpose of blockchain. Each block in the chain contains a number of transactions, and every time a

new transaction occurs on the blockchain, a record of that transaction is added to every participant's ledger.

Consensus Protocol:

It is proof of work where we need to set rules and arrangements to carry out blockchain operations. If everyone abides by them, they become self-enforced inside the blockchain.

Mining:

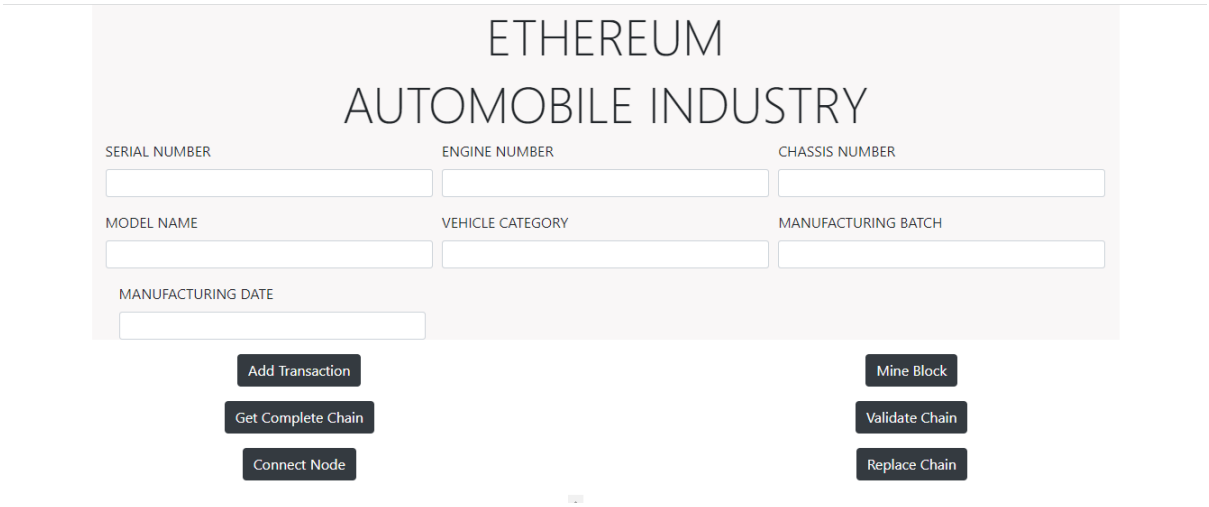
It is a block verification process before adding anything to the blockchain structure. Nodes interact via private/public keys. They use private key to sign their transactions and public key to address on network. The neighbouring peers make sure this incoming transaction is valid before relaying it any further in network.

Blockchain Creation:

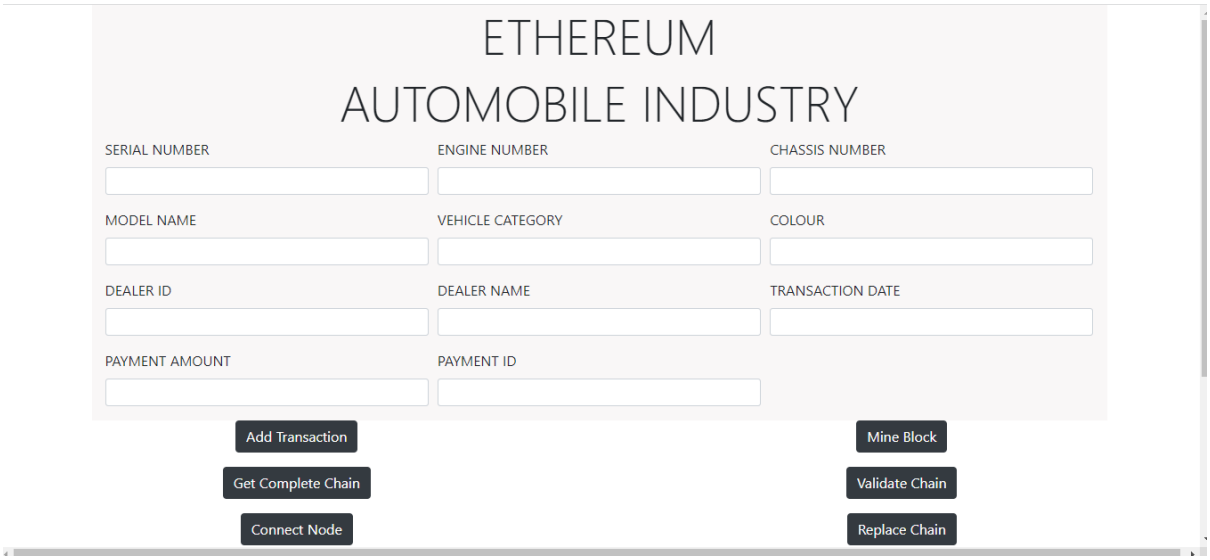
It is a process of creating a sequence of blocks in a specific order. Once a new block is created, it is sent to each node within the blockchain system. Then, each node verifies the block and checks whether the information stated there is correct. If everything is alright, the block is added to the local blockchain in each node.

3.3 UI Interface

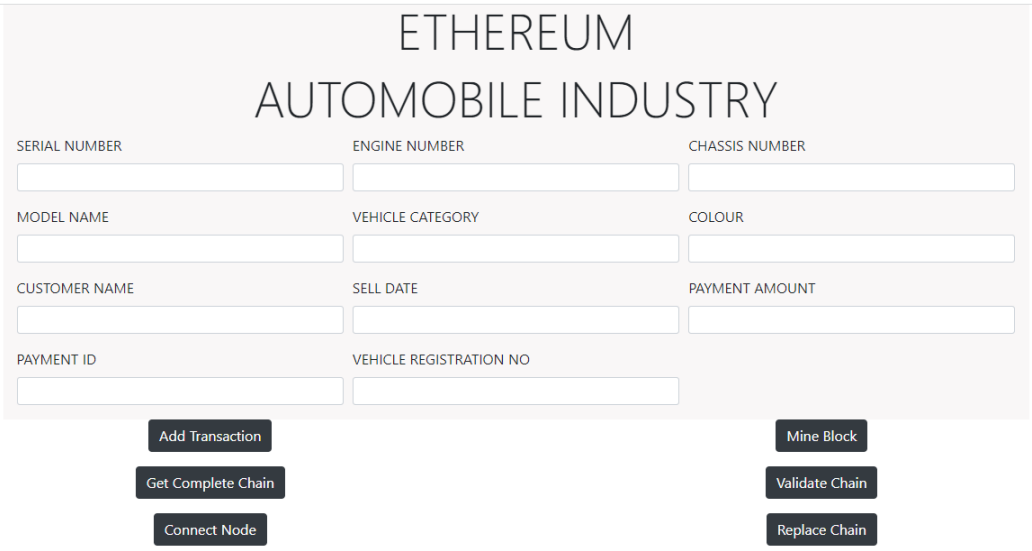
1] Product Assembly & Manufacturing



2] Product shipping to dealers



3] Product sold to customers



4 Conclusions

The use of Blockchain to improve the traditional supply chain attempts to eliminate some data barriers and increase the chain's traceability. Lack of security, information sharing, and system integration challenges are just a few examples. Furthermore, the agent system makes advantage of transactions to better manage all aspects of the supply chain. Our methodology is being used to improve the automotive supply chain. Through automation provided by the agent system, the suggested model will improve numerous aspects of trust, safety, and efficiency. Import and export items can be traced, production can be authorised, and proof of all transactions can be maintained and not modified by integrating the Blockchain. It will increase openness and boost client satisfaction.

5 References

https://www.researchgate.net/

https://www.researchgate.net/publication/339850964_How_Blockchain_Make_Better_the_Supply_Chain_in_the_Automotive_Industry

https://magazine.automotivepurchasingandsupplychain.com/magazine/issue32/blockchain.html