FTEC5520

UrCar

Used Car Transaction & Information Source Platform

Group 8

Content

1. Introduction

Nowadays, the second-hand car market is booming. According to statistics, the global used-car market size in 2019 was 115.2 million[1]; and according to the China Automobile Dealers Association, China trades 17 million used cars in 2021[1]. Various reasons are driving the growth of the used car market: the improvement of people's income, the increase in the demand for luxury vehicles, the shortening of the car's lifespan, the acceleration of renewal, and the increasing tendency of two-wheeler owners to upgrade to small vehicles.

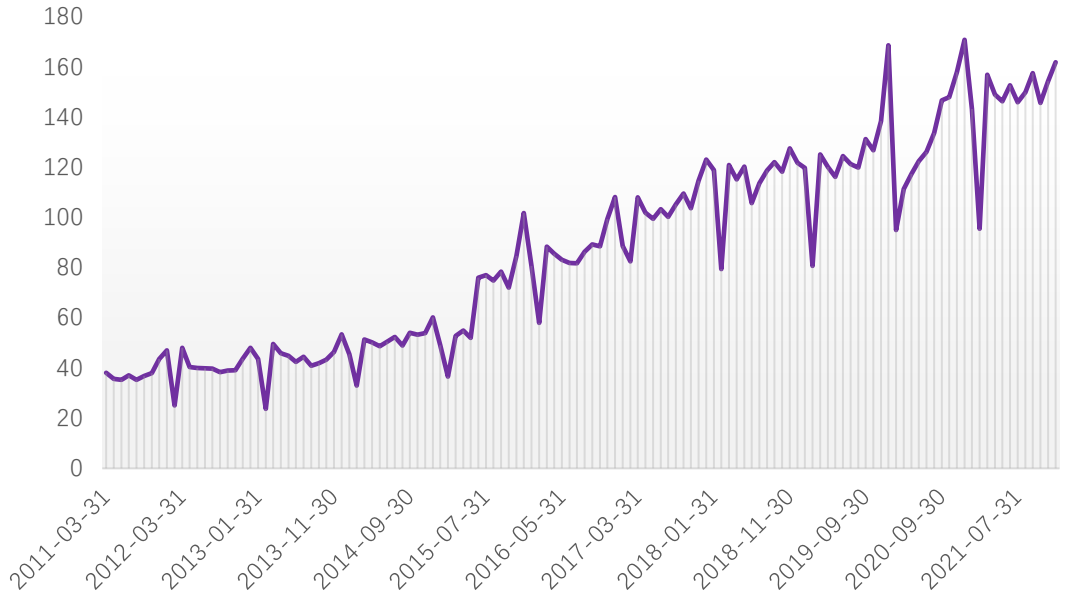

Figure 1. Used Car Transaction Volume in Mainland China

However, the vehicle information about used-car is always asymmetric and disputes always happen on the trading platform. The most common situation is that the sellers tamper or conceal the real information of the vehicle to deceive a potential used-car buyer without a technical background. In order to reduce such problems caused by the lack of transparency during the trading, blockchain is adopted to construct a platform dedicated to eliminating information asymmetry by providing vehicle information storage and sharing service. In this project, blockchain-based vehicle information storing and tracking platform, named Urcar, is proposed.

Urcar allows vehicle manufacturers, repair workshops, insurance institutions to upload the production, maintenance and compensation information via our system. The system can provide a trustworthy history to insurance companies, used-car

[1] http://www.cada.cn/Data/list_86_1.html

dealers and potential buyers by taking advantage of the immutable features of blockchain.

2. Problem Statement

In recent years, conflicts in the traditional used car market have become prominent, and the trading in the used car market is very chaotic. Due to regulatory and market irregularities, car buyers in the used car market are far less satisfied than buying new cars. There are three main reasons for this phenomenon:

2.1 Lack of Authoritative Certification for Vehicle Information

The used car market is a market that suffers severe informational asymmetry. In the concept of "lemon market" by George Akerlof[2], sellers in the second-hand car market may deliberately conceal some defects of second-hand cars due to the asymmetric information, and the sellers may even provide false information to facilitate transactions. The background of vehicles, such as actual mileage, maintenance records, and accident information, lacks an open, transparent and trustworthy platform to record. There is no way for new buyers to verify the vehicle history. Generally, the used cars are assessed by some accessible metrics which are mentioned above but some value like the odometer is easy to be scaled down in order to sell at a high price.

2.2 Pricing

The value evaluation of used cars is arbitrary. At present, some countries do not have a scientific and unified standard for the appraisal and evaluation of used cars. Many evaluation conclusions cannot truly reflect the condition of the vehicle. Due to the information asymmetry in the second-hand car market, adverse selection similar to "bad money drives out good " occurs frequently, and the market cannot adjust prices on its own to form economies of scale. Therefore, it is critical to solve the problem of low reliability under asymmetric information and establish a standard evaluation system in the used car market.

2.3 Isolated Data Island

Isolated data island[3] refers to data interactions between different organizations or between different departments of an enterprise. This problem is very significant in China's used car market. Generally, vehicle historical data is recorded by manufacturers, insurance companies, bureaus of motor vehicles, and certified dealers

in China. For example, the manufacturer is responsible for recording factory information and repair information; the insurance company is responsible for recording accident and compensation information. However, the most valuable data is retained in private, each of the institutions only keeps a small part of information and the data is locally stored and logically disconnected. This has caused the buyers to be unable to obtain the maintenance information and status, odometer, and other information from these institutions as support to comprehensively assess the vehicle, and also gives the sellers the opportunity to deceive the buyers.

3. Literature Review

As a publicly verifiable open ledger, blockchain has the advantages of transparency, decentralization and Tamper proof. Here a literature review is conducted to support the blockchain concept, how people are working on blockchain within the used-car market and other industries and finally how our blockchain-based vehicle information platform can be further expanded by referencing others' inventions.

Iftekhar, Cui, Hassan, Afzai (2020) Application of Blockchain and Internet of Things to Ensure Tamper-Proof Data Availability for Food Safety reveals that the main benefit of the blockchain, immutability, makes it stable and easy to audit trial. The blockchain can be programmed to record almost anything that can be expressed in code. In the manufacturing business, the supply chain is the most important factor. In a typical supply chain scenario, multiple independent parties participate in moving payload from point A to point B, and they must track it to all destinations. A tamper-proof distributed ledger can record the travel of each batch of production that when, where, and who shipped or stored it, or whether it needs to be shipped somewhere in a particular time. The article also reveals that the Internet of Things platform enables the industry to track assets and the environment. The impact on the velocity of asset flows is also significant. As the origin of blockchain technology is its provenance in security and tracking, the application of blockchain technology is emerging in the Internet of Things industry. [4]

Based on all the advantages mentioned about blockchain, how can it apply to other industries? Yang, Li, Dong (2021) A Blockchain-Based Auto Insurance Data Sharing Scheme proposes a blockchain-based sharing model of lightweight insurance policy data and auto maintenance records. The scheme saves the data of the insurance company and the 4S Shop in their database separately and stores the signatures on the blockchain to make the scheme safer and cut all kinds of costs. The model can realize flexible and secure data sharing by using proxy reencryption technology. [5] Jiang,

Sun (2021) A Blockchain-Based Vehicle Condition Recording System for Second-Hand Vehicle Market reveals that blockchain technology is a new way of data management. In the used car industry, customers often have poor information with used car dealers. Many odometer frauds and car accidents occur because they do not know whether the information provided by used-car dealers matches the actual situation. Data fraud and tampering by some auto data providers has not been alleviated. But in blockchain, the nodes can store, manage, and protect the blockchain without anyone trusting anyone, eliminating the potential for a third party to centrally control the data. In addition, each node copies the entire blockchain data through peer-to-peer networks, and so the information is hard to destroy. Thus, blockchain technology can be applied to record the condition of used cars.[6]

From the above applications, it can be seen that the advantage of blockchain lies in the flexibility and security of its data storage and sharing. At the same time, it avoids the phenomenon of artificial data change, eliminates the risk of data tampering, and optimizes the process of automobile insurance and used car transaction in the automobile industry. Traceability of significant events occurring in each vehicle is one of the major challenges facing automakers. In this area, blockchain can increase information transparency and enhance trust between used car buyers and sellers.

4. Why Blockchain Can Help

The main help of blockchain technology to the used car market comes from the three basic characteristics of blockchain.

4.1 Transparency

The data on the blockchain is public and can be read by anyone; Therefore, you can easily query the records and processes of each transaction. Although the state stipulates the rights and obligations of second-hand car dealers, auction houses, platforms, insurance companies and other second-hand car traders through laws, forces the disclosure of second-hand car information and data, including accident information and maintenance information, and prohibits the fraud of second-hand car sellers.[7] Blockchain technology makes it possible for the traceability of second-hand vehicles and the inspection of various information, ensures the authenticity and integrity of data and improves the transparency of transactions.

4.2 Decentralization

The blockchain does not rely on additional third parties to control transactions, and can realize the verification, transmission and management of transactions through each node. Decentralized distributed storage improves the security of data storage and reduces the possible impact of traditional single data storage node failure.

4.3 Tamper Proof

Each block in the blockchain will contain the hash value of the previous block. Therefore, if someone tries to modify the data in a block, the exception will be detected by other blocks and excluded. Therefore, the blockchain cannot be tampered with at will. Under the blockchain technology, each vehicle has a unique identification code on the information platform, and the major information of the vehicle will be recorded, so as to prevent tampering with the mileage and cover up the overhaul information after accident and collision.

5. System Design

The project is expected to deliver a used car transaction and information source platform to help used car buyers and sellers, factories and auto repair shops and other participants in the used car market to eliminate the information asymmetry and trust crisis within them. A lifetime data file will be established for used cars to ensure that used car initial information, maintenance information and transaction information is traceable, promoting the healthy development of the used car market.

Through the system, car manufacturers, car retailers (4S stores), car owners, repair centers, and insurance companies are connected in series as various nodes of the platform. The main information of vehicle status such as maintenance, accident, defect recall, ownership change times, and so on will synchronized, recorded, stored and transmitted at the same time. In this way, our project can ensure the authenticity and immutability of the information, and to make the used car transaction information transparent, so as to solve the problem of "information asymmetry".

The platform consists of three main modules.

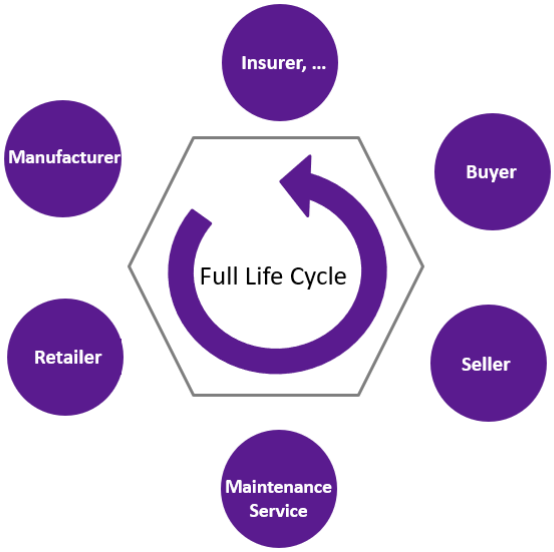

Figure 2. Users of Vehicle Information System Based on Blockchain Technology

5.1 Used Car Information Input and Record Module

The first module is used car information input and record status, in which the main participants are auto manufacturers, retailers, and maintenance service providers.

Auto manufacturers: The auto manufacturers record the delivery, return to factory maintenance and registration of scrapping of parts and components of each vehicle and 4S store on the platform, and continuously links each change of various products and synchronizes it to all nodes on the blockchain, so that multiple users of the platform can jointly check during transactions.

Retailers: The retailers record the retail information, such as when did the car go on sale, sold date, city, price and so on.

Maintenance Server Providers: The maintenance server providers record the maintenance information, such as the which part was repaired, how badly damaged are the parts, and so on. This information will be recorded in word or picture.

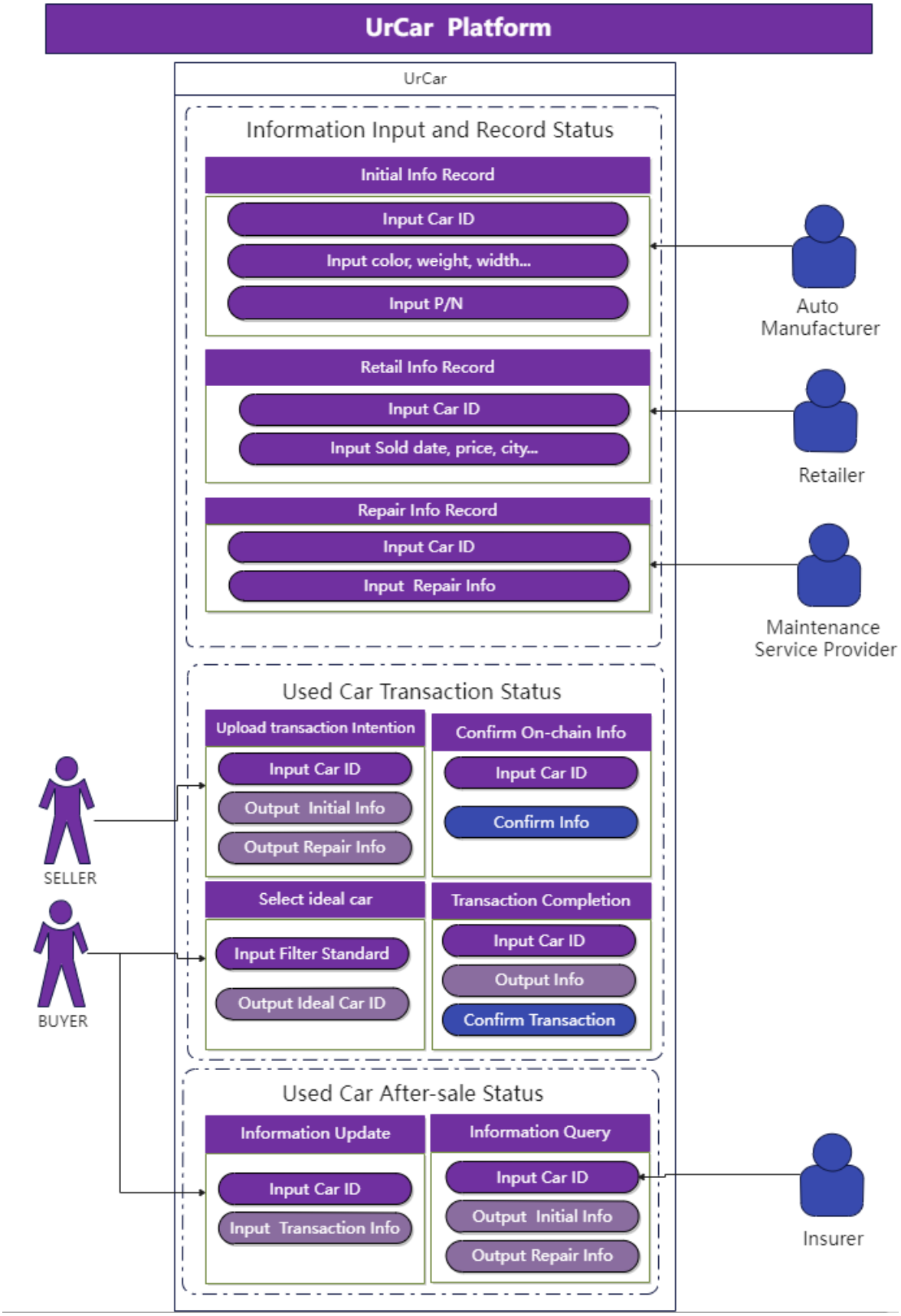

Figure 3. UrCar platform management

It encourages participants to jointly record the real information of vehicles, including basic vehicle information, purchase information, maintenance information, vehicle condition information and so on, through the unique reward and punishment mechanism of blockchain, so that they can jointly verify the data when multiple parties are trading, making the used car trading information open, transparent, and traceable. It will record information during the manufacturing, retailing and maintenance process of cars, and it will build a full life-cycle data chain for cars to establish a life-long digital file for each car that cannot be tampered with. In this way, this platform can realize the authentication and traceability of used car data and provide data support for used cars trading.

5.2 Used Car Transaction Module

The second module is used car transaction module, where the main participants are sellers and buyers.

Sellers: Since the platform spans the factory, retailers, maintenance server providers, the buyer and the seller, a single seller will not be able to tamper with the transaction and maintenance records of secondhand cars. When the merchant repairs or replaces parts without permission, it is necessary to submit the vehicle related change information to the platform for recording. Otherwise, the actual vehicle condition will be inconsistent with that on the blockchain and cannot pass the verification in the sales stage. In this status, car owners, i.e. used car seller, firstly go to this platform to confirm the on-chain information is exact or not. After information confirmation, our platform will make the information of this car public, which could be accessed by potential buyers.

Buyer: The buyer can verify whether the current vehicle information is credible. During the transaction, the buyer can ask the seller to provide digital records of relevant vehicle status changes. The platform will use the same encryption method to calculate its hash according to the current vehicle status and recorded information. If it matches the hash on the current blockchain, the vehicle status and its records are credible. If the merchant conceals or tampers with the situation of a vehicle during the transaction, it will not pass the platform verification, and the buyer has the right to doubt the vehicle information provided by the merchant.

In practice, used car buyers firstly should go to this platform transaction page to set their selection standard, and then he/she will get a list of VIN code of target cars. After selecting the ideal one, he/she could go to query page to search this car’s on-

chain information with VIN code. Finally, he will get the initial, retailing and maintenance information of this car, which is already on-chain. After buyers confirm transaction, this transaction status is finished.

5.3 Used Car After-Sale Module

The third module is used car after-sale module, in which the main participants is used car buyers and insurers. After finishing the transaction status, the transaction information, including used car price, time and so on, will be recorded on block-chain. In this way, if the buyer wants to re-sale this car, this transaction record could be traced.

Besides, to ensure the information traceable when buyers want to buy insurance for his/her new car, in this status, insurer is the other participant. An insurer can easily track the used car information, such as initial information, kilometers and maintenance information, which insurers may concern about.

6. Technical Architecture Design

6.1 Technical Demand Analysis

Our project takes data privacy, security, and non-tampering as the core goal, based on the front-end requirements of the service side, transaction side, and application side (to be developed) of functional modules, with members of the multi-party ecosystem such as auto manufacturers, maintenance agencies, and 4S dealers as data input parties. Our project constructed a car data service platform with trusted data as the label and based on blockchain technology as the core.

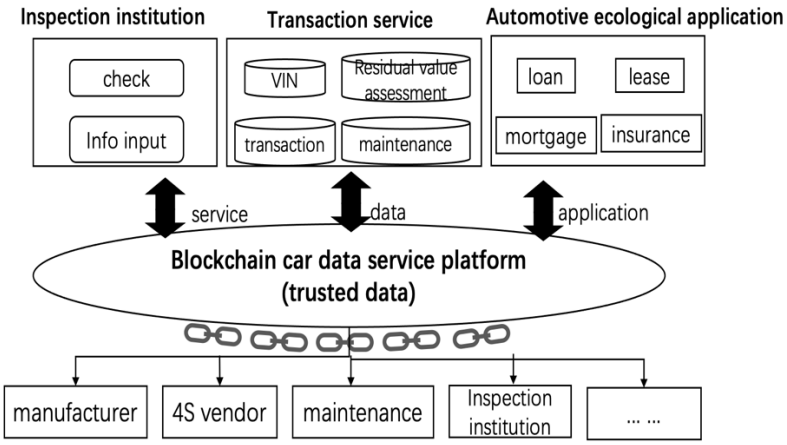

Figure 4. Technical Demand Analysis

6.2 The Underlying Technology Model of Used Car After-sales and Transaction Ecosystem Based on Demand Analysis

The automotive supply chain is: automotive suppliers - dealers - end customers. Based on the demand analysis, the UrCar platform will match the technical model according to the whole chain of the automobile supply chain. The technical model is traceability-blockchain database-smart contract.

Vehicle traceability: The product data is input by each participant, and uploaded to the blockchain after processing. All parties participate in bookkeeping together, and the confirmed data is permanently stored on the blockchain. The user can receive the traceability result returned by submitting a traceability request according to the query interface. If there is a malicious node on the blockchain tampering with the production data, the hash value corresponding to the data will change, and the hash value of the corresponding block will also change, resulting in the block being unable to connect and not accepted by other nodes.

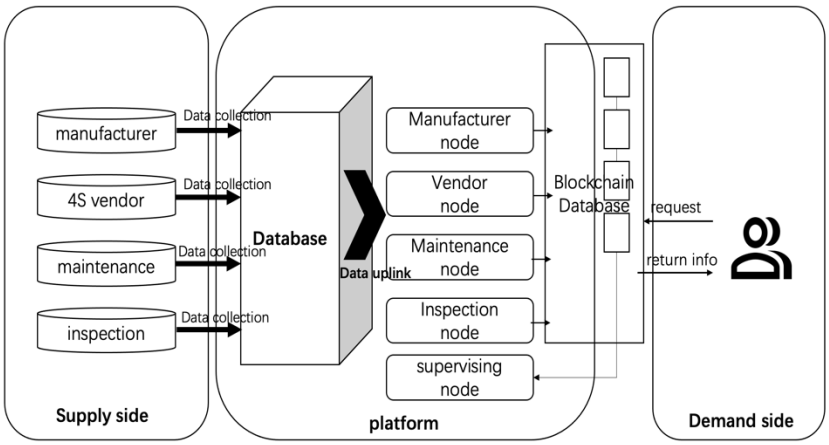

Figure 5. The Underlying Technology Model

6.3 Data Analysis

Non-sensitive data is directly uploaded to the chain, and sensitive data is encrypted and encrypted by hashing.

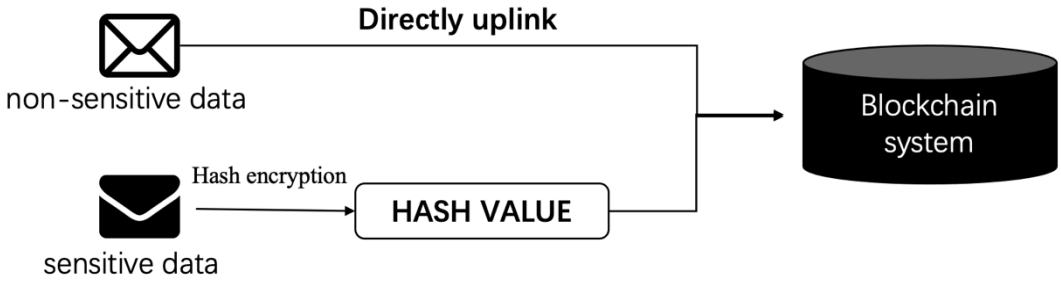

Figure 7. Data Processing

We take three data dimensions, data assets, vehicle assets and service assets. Data assets includes auto data, test evaluation report and maintenance report; vehicle assets include second-hand transaction, auto parts asset transaction and new car transaction. The service asset is still in developing, so early stage of the business is mainly based on data assets, compatible with service assets, and the transaction capabilities of vehicle assets.

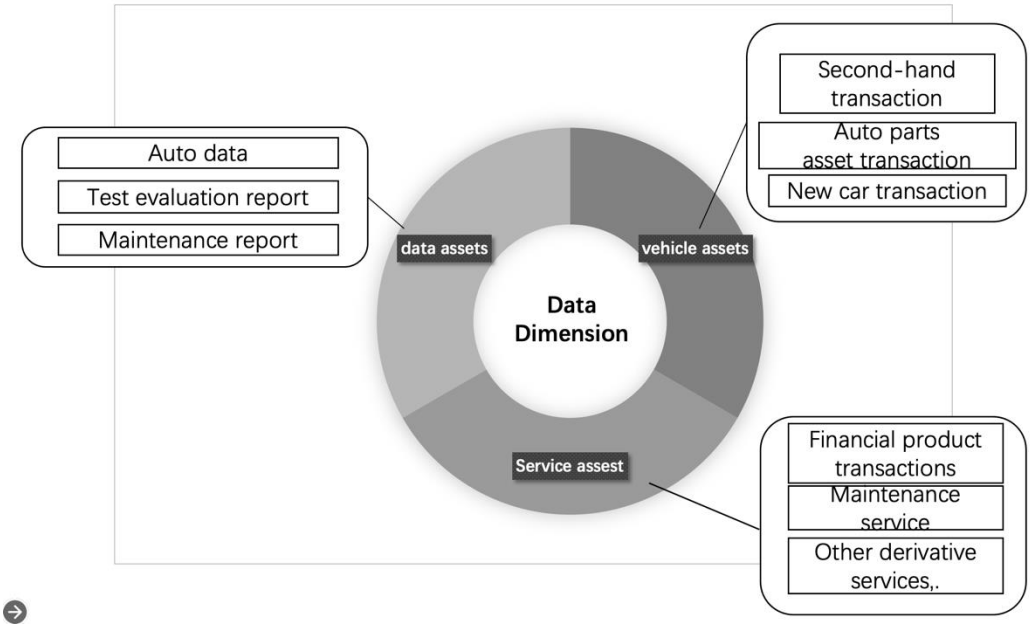

Figure 8. Data Dimension

6.4 Technical Link and Data Flow

1) Front-base webpage-blockchain database- Create smart contract interface - Ganache simulated uplink
2) Environment construction
   Node.js-Git-Web3.js-Ganache
3) Use solidity to build smart contracts
4) Compile, deploy and test

5) Create a user interface to interact with the smart contract

6.5 Platform Architecture Design

According to the data dimension source of the automobile industry and the ecological characteristics of the blockchain, we designed the system architecture.

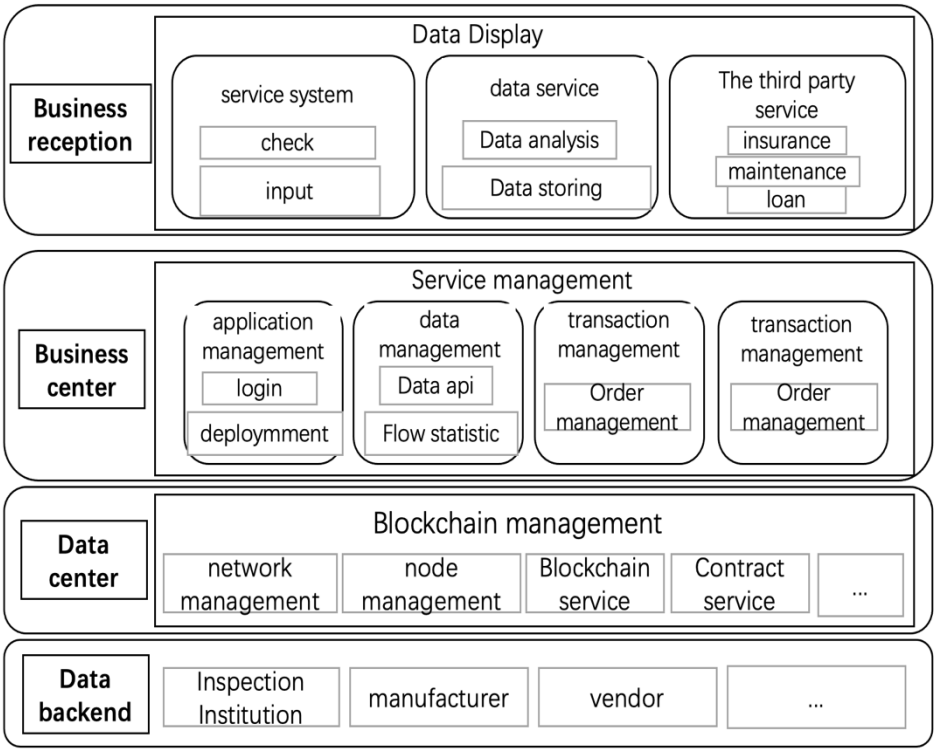

Figure 9. Platform Architecture Design

This platform adopts the logic of business middle platform and data middle platform, and divides the system application into the structure of business foreground (data display), business middle platform, data middle platform and data background to ensure the perfection and support of the system architecture. With the support of the whole automobile ecological data as the data background, the data service, network management and blockchain services are used as the data center, and the data management and digital transaction system as the business center to help data statistics and analysis, commodity management and multiple business reuse such as platform transactions.

Data display: Display the main non-sensitive information related to the system vehicle (including natural information and maintenance record information, etc.), and related data visualization work.

Business front desk: For the automotive ecosystem users, it provides data and application services for data query, data statistics and data visualization, application registration, order management and transaction in the automotive aftermarket. In the future, it can further develop and cooperate with third-party ecological applications to expand operational capabilities (including Provide customers with applications such as automobile inspection service systems, automobile insurance, vehicle evaluation, etc.) Business center: An important bridge connecting the business foreground and data background, providing vehicle data management, application management, order management, transaction management and other services, as the service support for platform data and platform applications.

Data center: For the business middle station, it provides data resource services and management such as system users, car data, and blockchain nodes.

7. Technology Application and Realization

7.1 System Infrastructure

The infrastructure of the blockchain system is mainly divided into: data layer, network layer, consensus layer, contract layer, and application layer. The levels are connected to each other, and each performs its own duties to jointly build a platform for used car maintenance and information transactions.

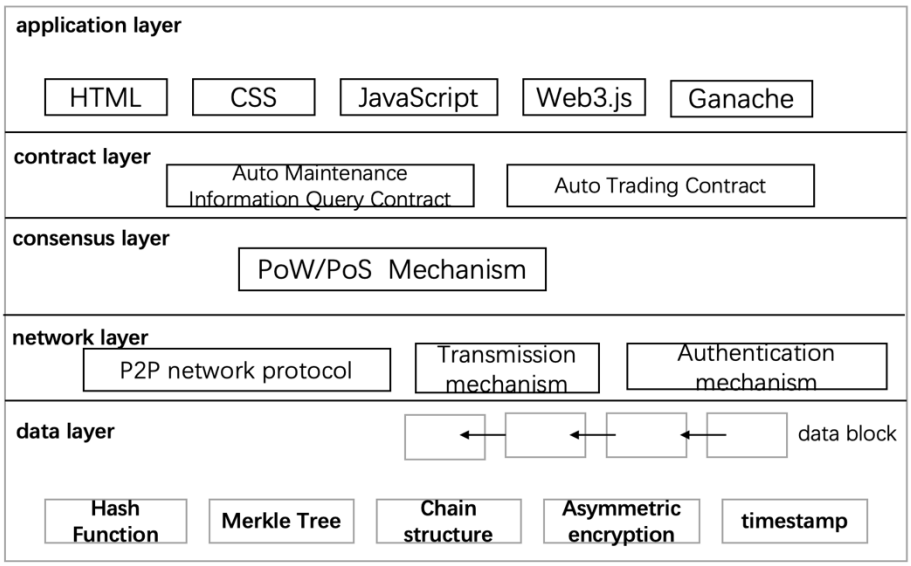

Figure 10. System Infrastructure

The data layer of the blockchain is mainly used to store transaction information and data information between nodes, and is an important part of the vehicle traceability system. A data block consists of a block header and a block body. The transaction data stored in the block body is combined in the form of Merkle tree. All transactions in a certain period of time iteratively calculate the root hash value, and store the root hash value in the block header. Using the avalanche effect of the hash function, Once the data of the Merkle tree leaf node changes, the root hash value will change accordingly. This property ensures that the block data cannot be tampered with, and the timestamp in the block header provides the time basis for the transaction; the block header also stores the hash value of the previous block, thereby connecting the blocks to form a blockchain. This platform hopes to directly record a series of non-sensitive data such as the natural information and maintenance records of the car on the chain, and the sensitive data is recorded on the chain through hash encryption to ensure the privacy and security of the data.

The blockchain network layer includes P2P network protocol, propagation mechanism and verification mechanism. We adopt the consensus mechanism of PoW+PoS to ensure the consistency of system information and enhance the trust between system participants and users.

The contract layer mainly includes smart contracts and script algorithms, which are the basis for the programmable blockchain. Embedding the code into the blockchain system can implement custom smart contracts, which can automatically execute relevant commands without the need for a third party when certain constraints are met.

The application layer is the window where the user interacts with the system, and the front-end interactive page is developed by JavaScript+Dash+css. An operation interface is provided on the interactive page for information entry. Users can view the vehicle maintenance information record and the traceability information of automobile production through the query interface. Based on the functional requirements of traceability of automobile information, the front-end page has designed interface interfaces for information query, information entry, and transaction window. The front-end operation will completely record the relevant input information and transaction data on the blockchain by calling the smart contract.

7.2 Core Technology Realization

7.2.1 Demo System Design

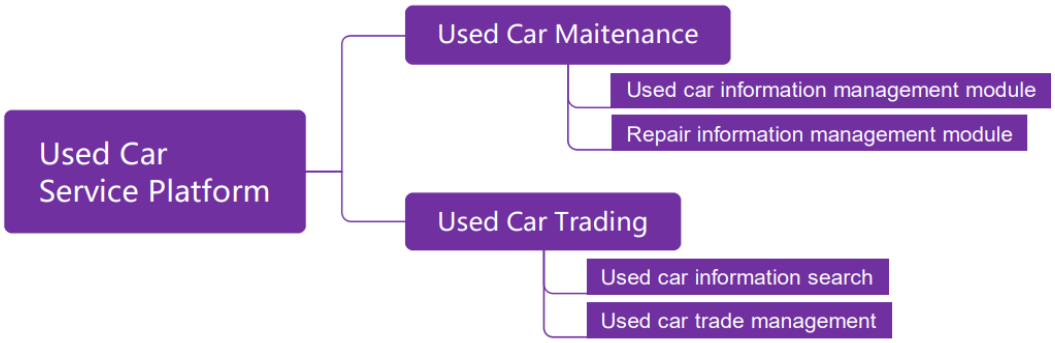

Figure 11. Demo Structure

Our demonstration program is divided into two sections of content, one is used car maintenance and the other is used car trading.

Used car maintenance section mainly contains two functional modules. One is the used car basic information management module, the main function is to register and manage the used car information based on blockchain and smart contract; the other is the repair information management module, the main function is to register and manage the used car repair information based on blockchain and smart contract.

And car trading section includes two main functional modules, the first is used car transaction information search, the main function is to search the basic information of the used car you want to buy, repair information, purchase price, etc.; the second is used car transaction management, the main functions are transaction management, account management, execution of transactions, return transaction results, etc.

7.2.2 Blockchain Design

(a) Architecture

Our used-car trading platform Urcar will be based on our own blockchain Urcar blockchain. The design diagram of the blockchain is as follows:

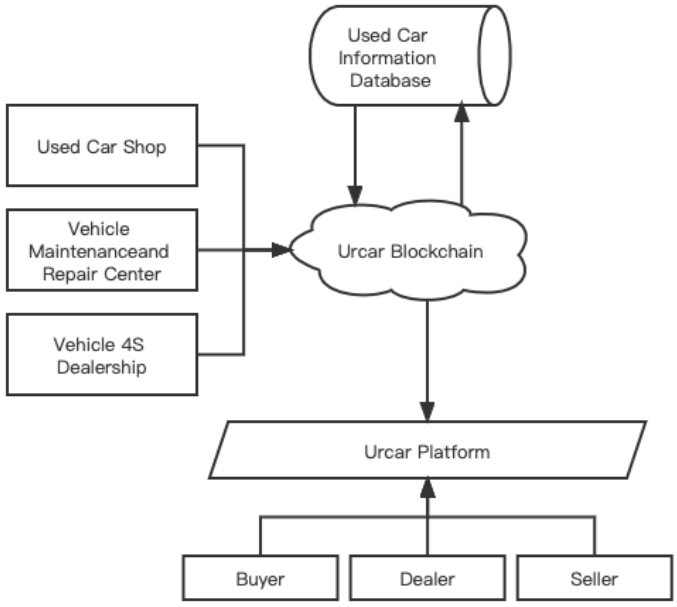

Figure 12. Blockchain Structure

The Urcar blockchain will be the back-end of our Urcar platform. Each node user does not directly participate in accessing the database, but accesses the blockchain through the permissions of the node. The node users are divided into three categories: buyers, sellers and dealers, who will enjoy different permissions when using different functions of the platform.

First, query and verification permissions are common permissions open to all nodes of the platform. Any node can access the information of the blockchain, but cannot modify the content already on the chain.

In addition, user nodes such as used car stores, original car factories and 4S repair shops, that is, official nodes certified by the platform, will be authorized to upload used car data, including exit records, maintenance records and transaction records of used cars. Records can only be chained after being authenticated by POW mechanism by platform distributed miners. Since all nodes cannot directly access the database, and the blockchain applies the workload proof mechanism, once the content is authenticated by the miner node and connected to the chain, it will not be tampered with, which means that the data records such as maintenance transactions of the vehicle will be permanently recorded, which can effectively eliminate the problem of information asymmetry between buyers and sellers and third-party dealers to a certain extent.

(b) Development

i. Development

When building a blockchain, we first define a class "block" and build attributes such as index, timestamp, data, hash, previous hash and record. Each block has the same structure. During each instantiating process, the data of the current block and the hash of the previous block will be stringed according to the same order, and then encrypted into the hash of the current block through the class function sha256 provided by the third-party library hashlib. When querying the vehicle information, we enter the vehicle number CarID, and the system only returns the hash and records the details of each block. Vehicle information records can only be verified, but cannot be tampered with, to ensure the authenticity and effectiveness of each maintenance / ownership change. After the class definition is completed, we also define update and query methods for the blockchain. When recording information on the blockchain, the node can pass in any structured or unstructured data (convert the report or vehicle picture into a string) through the post request of the server. Once the car information is recorded (mined), it will not be tampered with. Calling the update method or mining requires a higher level of permission. When querying and verifying vehicle information, any node can call the "query" method, and enter the vehicle identification information to automatically match the blocks on the chain. The PoW mechanism of our blockchain is designed as H (PP ') = = "0000x" algorithm, which means after initializing the pow of Genesis block, subsequent blocks will iterate according to the algorithm. Miners need to find the hash corresponding to PP' result to obtain the bookkeeping right. The information of Genesis block is "Urcar Genesis block < by ftec5520 $IX group >".

ii. Server Development (blockchain interface of back-end server)

After the blockchain development is completed, the blockchain network server needs to be built. At the current development stage, we develop through Python's Web lightweight development framework Flash, so as to directly configure the ports between the blockchain and the server. Four endpoints of query, mine, repair and trade are set for the local server to realize the functions of query, recording (mining), uploading maintenance information and uploading transaction record respectively. Among them, the endpoints of uploading maintenance information and uploading transaction record can instantiate the new block by sending a request. Users just need to upload the JSON formatted data to the HTTP server by sending a post request at the endpoint. However, all uploaded information needs to be mined and recorded by the miner node before it can be uploaded to the chain. Information that has not been verified by mining will not be uploaded to the blockchain, ensuring that the blockchain will not be attacked by a large number of malicious post requests. After all information records are successfully chained and linked, the query function can be

realized through sending a GET request at the query endpoint, so that all data records of the current Urcar blockchain will be returned by the server.

7.2.3 Smart Contract Details

When the vehicle leaves the factory, a smart contract is created using web3. The contract only has a string variable of info. Except for the constructor, it only provides a query function, so the contract can be queried but not changed. We convert the dict containing the vehicle information into a string and store it in the newly created contract, recording the contract address of the car. Then, when you need to query the vehicle information, you can enter the vehicle ID, and call the query function of the contract according to the contract address.

We provide such a simple implementation of information storage and query, recording and querying immutable information for each vehicle; it will have many optimization links in specific use. In specific use, we use the show-page to display all vehicle data tables without encryption, add the contract recording vehicle information on the add-page, and query the contract content on the query-page.

If a user wants to buy a used car, he will first view all the vehicles on the SHOW page, then query whether the information is reliable on the QUERY page, and finally trade on the TRADE page. When the vehicle information changes, the organization with write permission will add a contract to record the vehicle information

We use two smart contracts. One is to record and query the basic information of vehicles, and the other is to trade cars. It can be seen that the information contract cannot be modified. When new information is added, we need to generate a new contract. The transaction contract is created for each vehicle and records the transaction details.

Information Contract:

```
pragma solidity >0.5.0;
contract Checker {
    string public info;

    constructor(string memory _info) public {
        info = _info;
    }

    function getInfo() view public returns (string memory){
        return info;
    }
}
```

Figure 11. Information Contract

```
Trade Contract:

address private carowner;

//  View current balance
   function getBalance() public view returns (uint){
      return address(msg.sender).balance;
   }
//  Get current address
   function getAddress() public view returns(address){
      return address(msg.sender);
   }
// Change car owner
   function changeCarowner() public  returns(address){
      carowner = msg.sender;
      return carowner;
   }
// Get current car owner
   function getCarowner() public view returns(address){
      return carowner;
   }
// View car owner's balance
   function getCarownerBalance()  public view returns(uint){
      return carowner.balance;
   }

// Transfer money to car owner
     function transferMoney() public payable {
      payable(carowner).transfer(msg.value);
   }
```

Figure 12. Trade Contract

Even if we use the above strategy, we need to pay attention to the following problems to ensure safety. When using the add function, ensure that the user is under supervision and has the add permission. More than two parties should witness the process at the same time to ensure the authenticity of the added information. When using the query function, you should ensure that the correct vehicle ID is entered. Our query process is from ID to address and then to car. Although the addition of smart contract ensures the authenticity of process of address to car, it does not guarantee the process of ID to address.

7.2.4 Front-end Development

(a) Technical application and logic

The program of this system is developed based on JavaScript, Dash and Node.js, and has good execution ability. It can realize the docking with the web page, which is convenient for users to interact with the system. The architecture of the front-end web page adopts the combination of HTML+JavaScript+Dash+css, and realizes the connection between the blockchain and the web page through the web3.js library and the two libraries. Decentralized applications will make the corresponding codes of various operations of the front-end application run on the distributed network, and the information traceability function is realized through smart contracts. The main functions of the system include vehicle information display, adding cars, information

query and transaction.

7.3 Demo Display

7.3.1 Webpage - Show

The show page retrieves all recorded vehicle information from the database and can be filtered according to the conditions entered by the user. On this page, we use an unencrypted form to store data. This form is created when the vehicle is initialized. In order to prevent the information displayed in the form from being tampered with, the user must also confirm the validity of the information in conjunction with the query page.

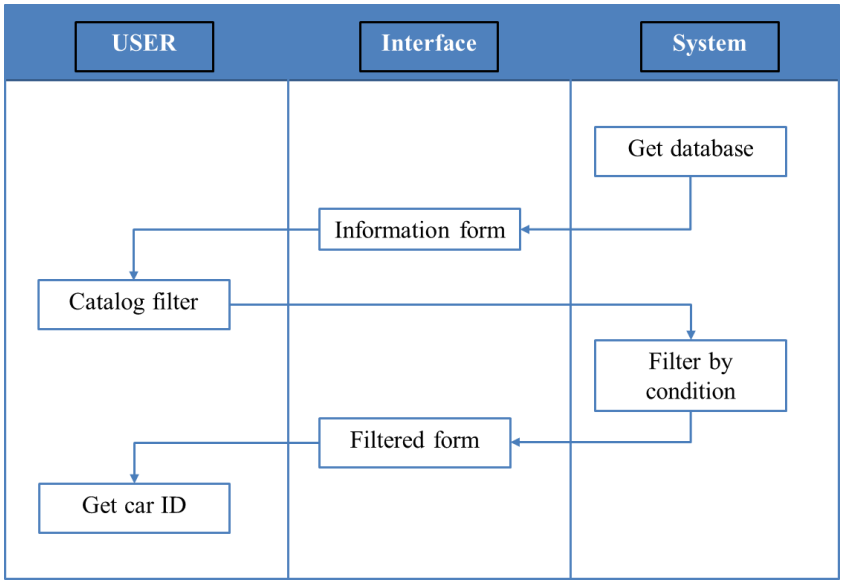

Figure 13. Webpage - Show Interaction Flow

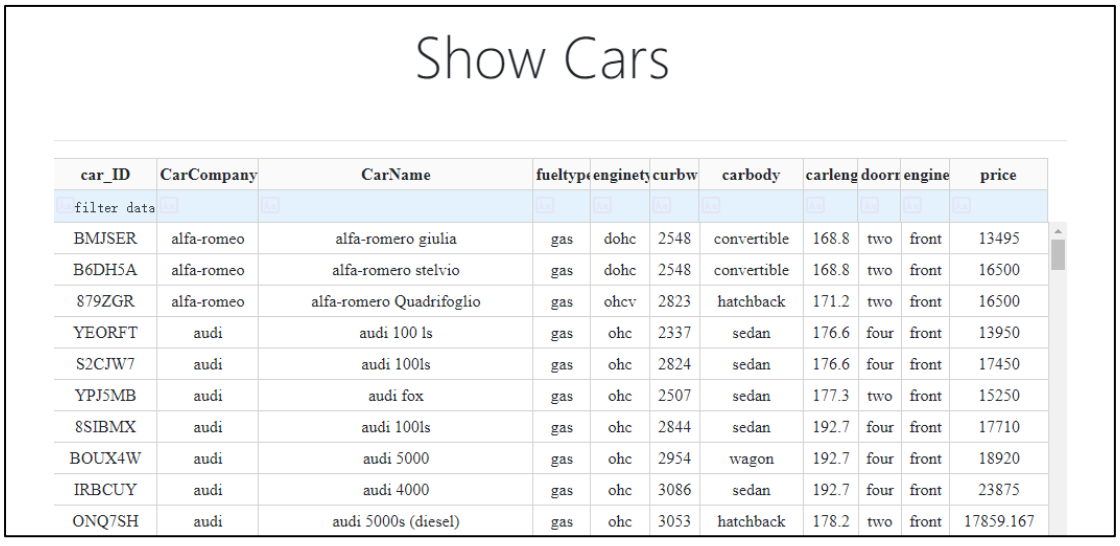

Figure 14. Webpage - Show Design

7.3.2 Webpage – Add

Here is the add page, an organization with permission can create a new smart contract to add new vehicle information. The backend adds a piece of information by creating a new smart contract and calling the constructor of the smart contract. This is just a simple demo, so we don't do permission management for our app. It should be noted that the addition of records should be carried out under supervision, so as to ensure that the information queried is reliable.

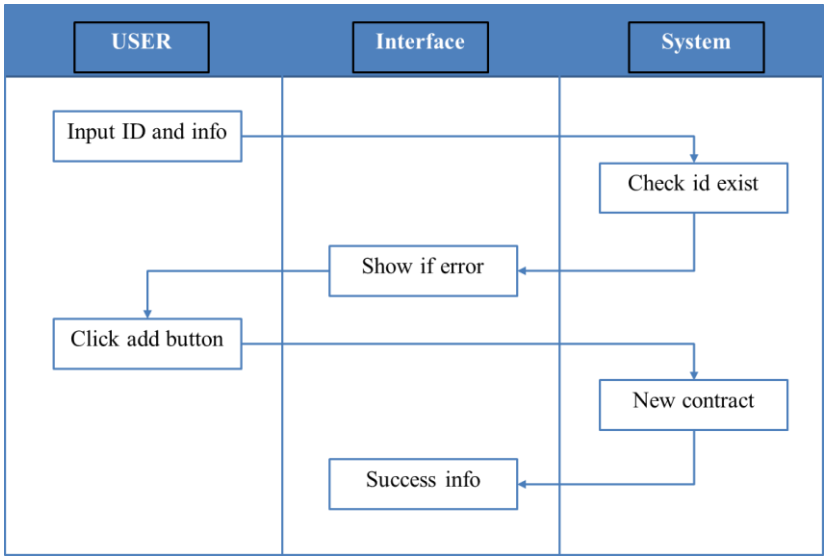

Figure 15. Webpage - Add Interaction Flow

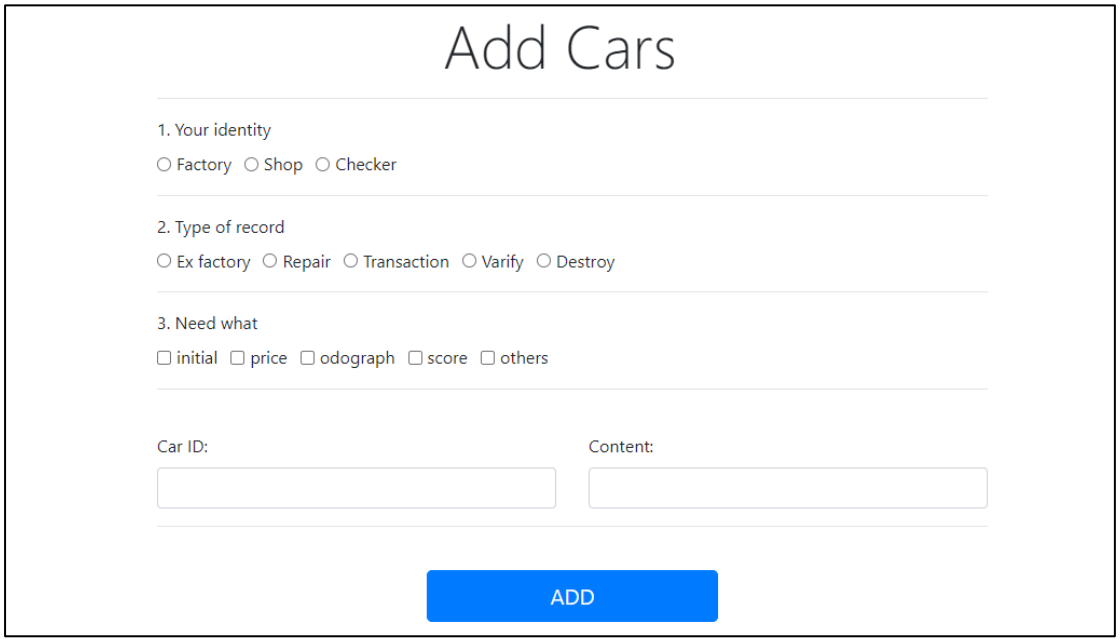

Figure 16. Webpage - Add Design

7.3.3 Webpage – Query

The query page is to query all the smart contract content by inputing the vehicle ID.

What the backend does is to find all the contract addresses of the ID, and then invoke the query function of the contract to get all the recorded information of the vehicle.

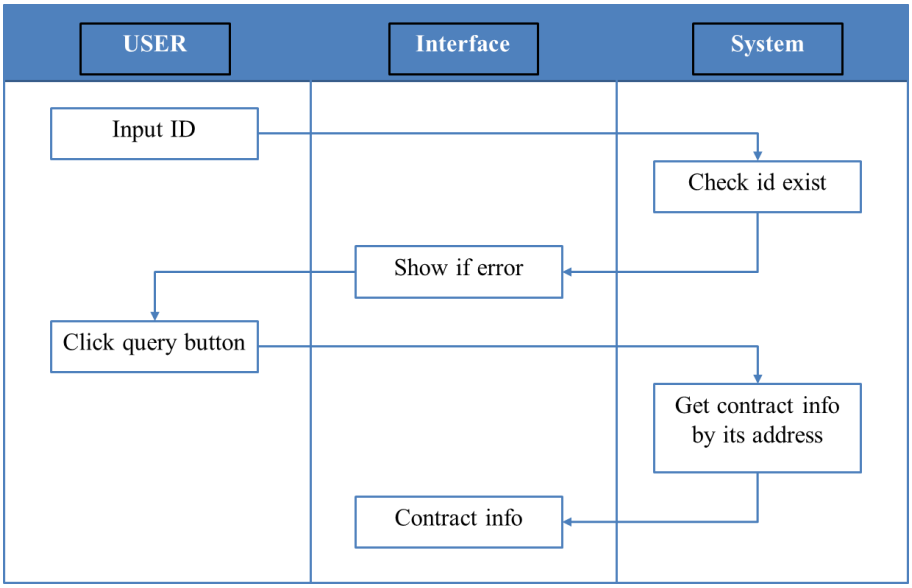

Figure 17. Webpage - Query Interaction Flow

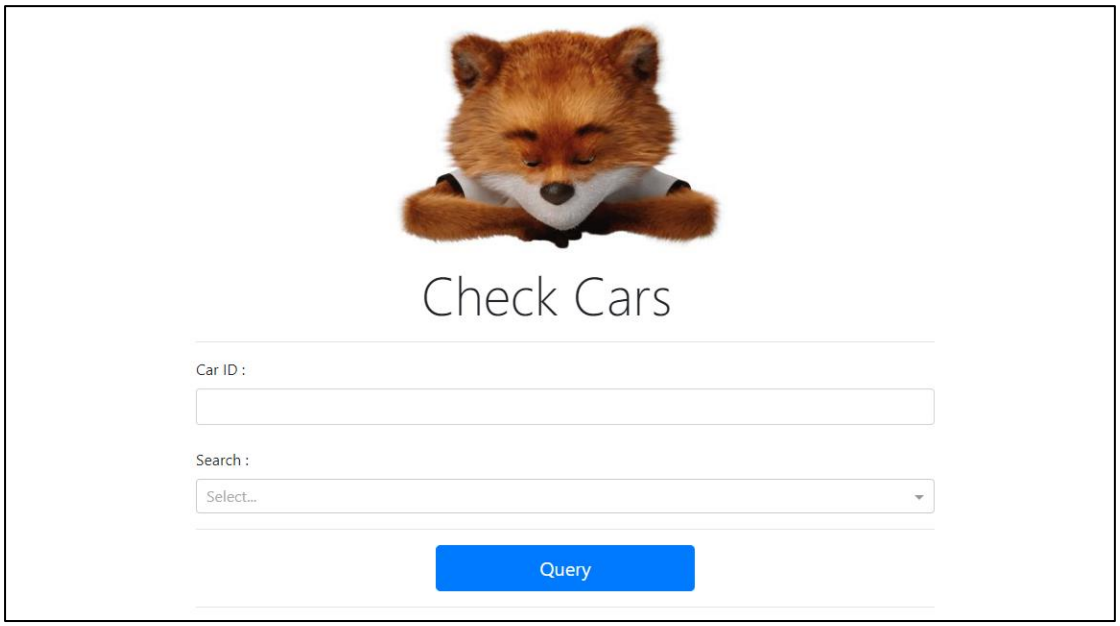

Figure 18. Webpage - Query Design

7.3.4 Webpage – Trade

The image shows the flow of the user once they have entered the page. Once the user has entered the page, the system displays the current user's account address. After the user has selected the used car they want to buy, the system displays the price of the car with the owner's account address. Once the user has clicked on the 'Trade' button, the system will execute the transaction and return the result.

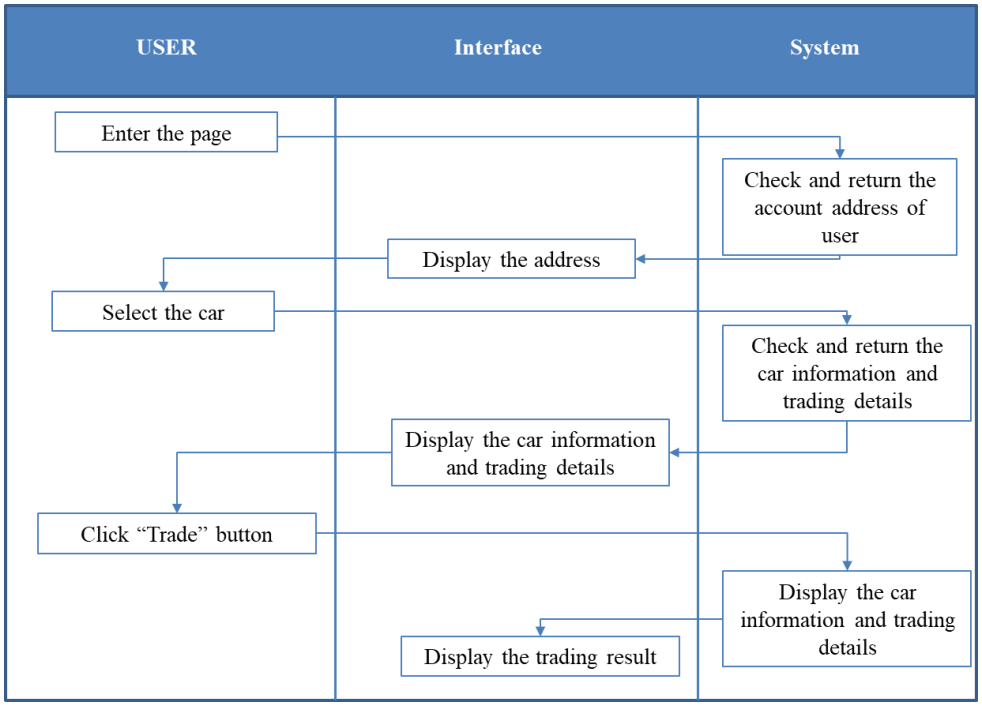

Figure 19. Webpage - Trade Interaction Flow

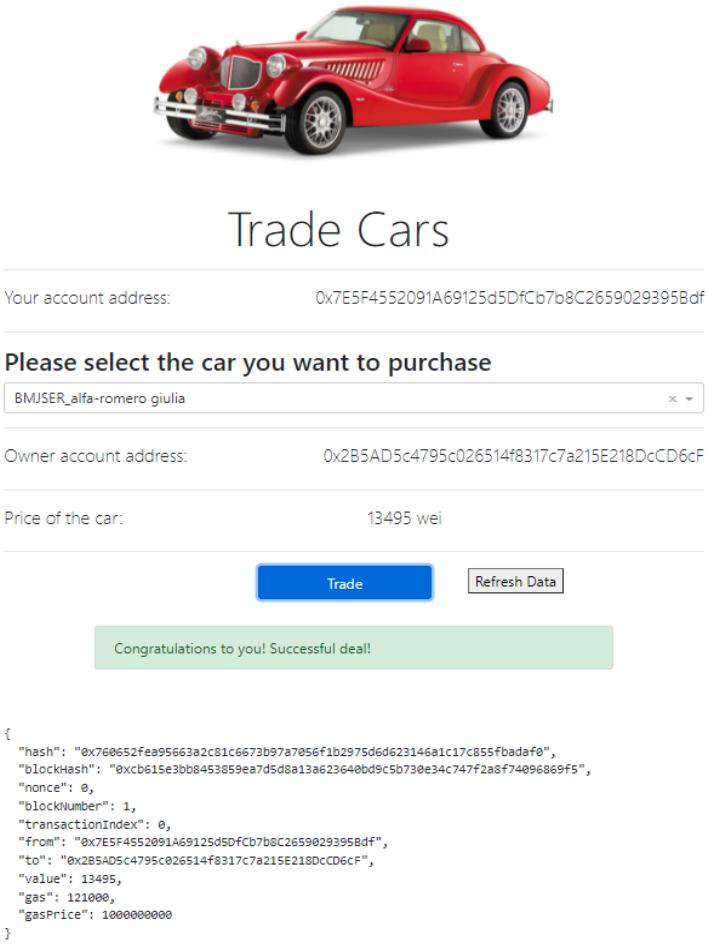

Figure 20. Webpage - Trade Design

8. Conclusion and Future Work

we firstly analyze the current situation and problems of used car market, and find that there are problems such as information asymmetry and information island in used car market. In order to solve these problems, we consulted a lot of data. After confirming that blockchain technology would improve these problems, we applied blockchain technology and smart contract technology to used car trading, realizing information tracking and transparency of used car trading information in the whole life cycle of the car.

In practice, as the auto industry includes various industrial lines, which means it includes not only auto manufacturers, retailer, maintenance and insurers, our platform could develop more nodes that can be accessed by other auto-related company.

In the future, we hope to add more and more nodes to this blockchain platform so that all participants in the automotive industry, from upstream to downstream, can join the blockchain service. In this way, we can realize the industry information transparency and traceability of the whole life cycle of the automobile industry, so as to promote the healthy and orderly development of the automobile industry.

9. Reference

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