2020 Management Science Informatization and Economic Innovation Development Conference (MSIEID) | 978-1-6654-1541-5/20/$31.00 ©2020 IEEE | DOI: 10.1109/MSIEID52046.2020.00070

Research on the Application of Block-chain in Internet of Vehicles Insurance

Hui Liu
Business School
Nanfang College of Sun Yat-Sen University
Guangzhou , China
691006744@qq.com

Shaohe Zhang
School of Economics
Guangzhou College of Commerce
Guangzhou , China
Corresponding author:441660898@qq.com

Mingfang Ho
School of Economics
Guangzhou College of Commerce
Guangzhou , China
Corresponding author:hmf_gaoshu@163.com

Ping Wang
School of Economics
Guangzhou College of Commerce
Guangzhou , China
Corresponding author:1040168586@qq.com

***Abstract*—On the basis of the connotation and characteristics of block-chain, combined with the reality and opportunities of Internet of vehicles insurance, this paper explores the application of block-chain technology in the scientific and reasonable pricing, accurate service, prevention of fraud insurance, and provides customers with more reasonable value-added service of Internet of vehicles insurance, so as to accelerate the development of Internet of vehicles insurance.**

Keywords- blockchain ; Internet of vehicles; Usage-based Insurance

I. INTRODUCTION

The birth of bitcoin has brought an unprecedented impact on the current currency issuance, payment, and clearing settlement system. Its underlying blockchain technology has created the world's first set of decentralization based on timestamp and asymmetric digital encryption technology. Distributed anonymous open source programmable, borderless digital encryption currency and payment system. At present, blockchain has broad and innovative application prospects in banking, payment, securities, insurance, bookkeeping, authentication, cloud storage, music, medical care, government, and public welfare.The Internet of vehicles collects a lot of information, and there are risks in the basic issues of trust, security and privacy. Block-chain has obvious advantages in trust, storage, and transaction. Research on the application of block-chain in Internet of vehicles insurance will bring innovative solutions to the insurance industry with far-reaching meaning.

II. THE COURSE OF INSURANCE RATE ARRANGEMENT AND FORMULATION OF INTERNET OF VEHICLES AND CHARACTERISTICS OF BLOCK-CHAIN

A. Research status of Internet of vehicles and the course of insurance rate arrangement and formulation of Internet of vehicles

First of all, the connotation of Internet of vehicles. Combined with the definition of technological innovation strategic alliance of intelligent networking automobile industry (2011), it is believed that Internet of vehicles is an integrated interactive network service platform for processing, computing, sharing, and providing intelligent traffic management, monitoring, guidance, service, and dynamic information sharing, with the help of sensors, GPS, image processing equipment, dynamic collection and analysis of interaction state and environmental information of V2V, V2R,V2H, and V2S based on Internet and mobile Internet.

Secondly, the research status of Internet of vehicles. Currently, researches on Internet of vehicles at home and abroad pay attention to the connotation, techniques, business model, industry and service standards, industry policies, and technology application scenarios of Internet of vehicles, etc.

Thirdly, the revolution and development trend of the course of insurance rate arrangement and formulation of Internet of vehicles. Baige Duan(2012) and other scholars studied the thought process of The thought course of vehicle insurance and divided it into four stages, including[1] :Stage one, variable cost theory of vehicle insurance raised by Levs (1925)[2];Stage two, the Pricing method based on consumption of gasoline tax or average tire life of different models advocated by Vickrey (1968)[3]; Stage three, the pricing standard of vehicle insurance according to the mileage proposed by Bulter (1990)[4]; Stage four, the mileage insurance based on Internet of vehicles that is closer to risk cost, is pointed out by Lemaire (1995)[5].Wang He, the vice president of PICC (2015) has suggested three pricing models of vehicle insurance, that is, insurance limit, vehicle models, and vehicle usage. At present, domestic vehicle insurance is mainly pricing based on insurance limit. The UBI insurance is in general use [6]. Wang He(2016) puts forward that block-chain and Internet of vehicles insurance are highly similar, which can be regarded as the future development direction [7].

978-1-6654-1541-5/20/$31.00 ©2020 IEEE
DOI 10.1109/MSIEID52046.2020.00070

B. The connotation, characteristics, and classification of block-chain

Firstly, the connotation of block-chain. William Mougayar believes the block-chain is a a transparent distributed bookkeeping database from the perspective of technique; the block-chain is a point-to-point value transfer and transaction network from a commercial point of view; and a de-intermediary transaction verification system in the eyes of the law [8].

Secondly, the characteristics and classification of block-chain. There are five technical features in block-chain, including decentralization, consensus mechanism, asymmetric encryption, time stamp, and smart contract. According to the usage scope and read-write permission of block-chain, it can be divided into public chain, private chain, and alliance chain.

III. INNOVATIVE APPLICATION OF BLOCK-CHAIN IN THE FIELD OF INTERNET OF VEHICLES INSURANCE

In the light of different demands for Internet of vehicles insurance, this paper combines the types and characteristics of block-chain neatly and constructs the following innovative applications.

A.Establish decentralized personal car use files based on public chain

Through sensing devices, Internet of vehicle collects a vast number of information about cars, roads, people, and environments, as well as some accounts information. On the one hand, it accelerates the process of vehicle insurance information forensics sampling and makes insurance transaction more convenient; on the other hand, the Internet of vehicles may be attacked, resulting in information being tampered with and stolen. By using the public block-chain to record the personal car files of the Internet of vehicles and remove the data processing center of the Internet of vehicles, each participating node can record the driver's driving behavior in real time, and the point-to-point broadcast data of the whole network can be stamped with a time stamp once confirmed, which is both true, open, and transparent. Since the cost of forging and tampering with files is very expensive, it reduces the risk of fraud. To confirmed personal credit rating by accumulating big data, built decentralized mutual trust, and ensure data backup security by distributed cloud storage will prevent personal car files from being lost or damaged due to a fault.

B.Set up a dynamic adjustment mechanism of vehicle insurance rate to improve the renewal rate of high-quality customers based on public chain

In 2015, the China Insurance Regulatory Commission (CIRC) announced policies to remove obstacles to promote the reform of dynamic management system of commercial vehicle insurance terms and rates. The public block-chain personal vehicle files completely record the real data of users' car use.

First of all, public block-chain information is open and transparent. Customers can check the information at any time, calculate the required insurance expenses, and independently choose the vehicle insurance and Internet of vehicles services that meet their consumption level and habits, thus reducing the risk of information asymmetry.

Secondly, by comparing and analyzing data of different traffic accidents, the public block-chain can help the Internet of vehicles and insurance companies to understand the accident, correctly analyze the risk factors causing the accident, explore the relationship between risk factors and loss, and build a model to scientifically and reasonably customize the optimal premium for each customer, establish a dynamic adjustment mechanism for insurance premium rate of Internet of vehicles, and give high-quality customers those who are less likely to get out of danger more favorable car insurance rate, so as to improve the retention rate of high-quality customers.

Thirdly, the public block-chain personal vehicle files look for potential demands of users for Internet of vehicle platform, provides customers with personalized service in real time, corrects users' bad driving habits and reduce driving risks while providing users with convenient service and information. It guarantees driving safety, while also expands the business space of the upstream and downstream associated enterprises to realizing a multi-win-win situation.

C. Protect customer privacy based on private chain

Electronic tracker and transmission camera equipment are required to be installed when using Internet of vehicle. However, the customer's itinerary, as well as the relevant identity information, such as address, contact information, e-wallet address, security password creation date, and other digital information involved in the insurance contract belong to customer privacy and need to be kept confidential. As the information collected by the Internet of vehicles spreads on the network, there is a risk of being leaked by an illegal third party. Therefore, some customers are worried and refuse to use the Internet of vehicles products. User information can be stored on different types of block-chains. For example, data related to user identity, personal information, property account, and security can be input into private block-chain, which is only read and written by the customer. The public block-chain and private block-chain are associated by keywords which are encrypted by asymmetric encryption algorithm or digital fingerprint, and the password is mastered by the customer. The customer's ID of public block-chain is just a cluster of digital sequence that is processed by the secondary hash encryption algorithm. The real identity is hidden and customer privacy is protected to the greatest extent.

D.Protect intellectual property based on alliance chain

In addition to insurance policies, the variety of Internet of vehicles insurance products is single and the homogenization is serious. Due to the lack of legal awareness of financial institutions and the lag in the construction of Internet financial regulations, a new insurance scheme, an actuarial algorithm, or a product will be imitated and copied by peers once coming out. On the one hand, insurance companies can hardly rely on characteristic differences and high-quality services to obtain customers. They can only arouse customers' attention through price comparison, which reduces the industry profits and narrows the living space; on the other hand, the insurance copyright fails to be protected, which limits the innovation and development potential and power of the insurance industry.

The current copyright registration process is cumbersome, including submission of applications, official acceptance, examination, approval of registration, and issuance of certificates. It has the defects of long time and high cost. Moreover, in case of copyright disputes, the copyright certificate is limited to giving certain legal support.

The access right of copyright alliance-chain in Internet of vehicles insurance shall be handed over to the CIRC, insurance institutions, and insurance industry associations to ensure that each insurance institution has a unique identification number. Once a new insurance product or plan is recorded on the insurance alliance-chain, a time stamp will be sealed. It means that the product or plan exists and has its ownership. The record cannot be altered. Meanwhile, the copyright will be automatically registered and granted the copyright ID of encryption processing. Any insurance contract using the product or plan will be automatically stamped with copyright ID, and the Smart Contract will determine whether or not to pay royalties. This not only protects the insurance copyright but also realizes the knowledge sharing and stimulates the innovation power.

E.Prevent from defrauding insurance based on alliance chain

Vehicle insurance claims involve car owners, enterprises related to Internet of vehicles equipment network, the insurance company, traffic police, repair garages, parts suppliers, hospital, and other main bodies, thus forming the industry chain of Internet of vehicles insurance. Each link may have the potential of over reporting, false reporting, and missing reporting. In the block-chain, all the specifications, parameters, prices, production address, and other vehicles and accessories transaction data will be loaded into the alliance chain Immediately with distributed nodes to maximize the openness, transparency, and sharing of information about the quality, price, turnover, and transaction process of auto parts. This information cannot be distorted. The institutions and personnel involved in the industrial chain can share use and query, and effectively play the role of the block-chain:

Firstly, prevent the repair garages from replacing the high-cost original parts with low-cost and low-quality accessories during the maintenance process.

Secondly, avoid collusion between inside and outside of the insurance company to earn the price difference.

Third, the accident data will be directly collected through the Internet of vehicles equipment monitoring and uploaded to the alliance chain, and the accidents will be judged, the accident identification certificate with electronic signature, casualty certificate, medical records, medical expense lists, and other data will be issued, and the insurance claim terms will be used automatically by Smart Contract. This can effectively prevent car owners from using various means to falsely report and over report vehicle insurance accidents. At the same time, it can effectively avoid the occurrence of malicious default, misappropriation, and refusal to pay premium, and reduce the probability of disputes.

Fourth, standardize license plate registration process, ensure the consistency of the car and the license plate, in case of fraud.

By reasonable applying different types of insurance transaction service system of Internet of vehicles based on block-chain (Figure 1.), it can protect privacy and insurance intellectual property. At the same time, it can level the organizational structure of the industrial chain, improve the operation efficiency of the Internet of vehicles insurance, customize the insurance for customers, provide value-added services that customers really need, and improve the renewal rate of high-quality customers.

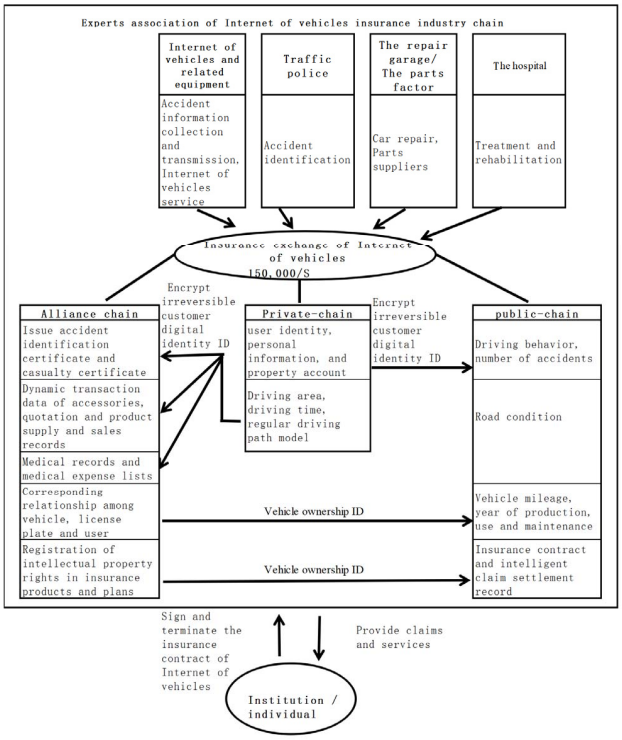

Figure 1. Insurance transaction service system of Internet of vehicles based on Ethereum block-chain

IV Bottlenecks and countermeasures of blockchain application in the insurance industry of Internet of Vehicles

A.Bottlenecks

Firstly, Limited response speed and storage capacity: The combination between the insurance data of Internet of Vehicles and the three-dimensional state of vehicles, environment and people is inseparable from massive sampling as well as real-time transmission and processing of data. However, the operation speed and storage space of blockchain technology are backward at present.

Secondly, Vague business model: At present, the concept of "Insurance Market of Internet of Vehicles" is unpopular in China. The industrial chain of insurance products of Internet of Vehicles covers a wide range, including telecom operators, automobile manufacturers and maintainer, Internet of Vehicles terminal manufacturers, data collectors, Data integrators, TSPs, insurers and related institutions like traffic control bureaus,

hospitals and copyright bureaus. There is lack of unified and standardized cross-border industry standards.

Third, typical application scenario construction: For the insurance business of Internet of Vehicles based on blockchain technology, the Internet development of traditional insurance products of Internet of Vehicles needs to be promoted. What is more, it is necessary to combine blockchain technology with the insurance industry chain business of Internet of Vehicles, develop and meet the deep customer experience in multiple aspects and promote the innovation on the sales channels and service of the insurance industry of Internet of Vehicles as well as the enhancement of the competitiveness of the insurance industry of Internet of Vehicles.

B.Countermeasures

Firstly, strengthen top-level design planning, unify industry standards and establish a sustainable business model. The insurance industry of Internet of Vehicles based on blockchain technology is involved with the application of new technology as well as the change of business models. It is necessary to carry out "top-level design" at the national level, coordinate some industrial supporting conditions like laws, policies, frameworks, processes and business models, unify and standardize industry standards and integrate resource. It is aimed to create a win-win environment for the development of blockchain technology in the insurance industry of Internet of Vehicles so as to promote the long-term development of the industry.

Secondly, make up for the shortcomings of blockchain technology and build an insurance network system framework for Internet of Vehicles hierarchically with the help of advanced technology. Build a unified and open vehicle insurance sharing platform with the complementary functions of end management cloud platforms. It is suggested to build the network hierarchical architecture:(1) blockchain technology: blockchain technology is taken as the underlying technology of the insurance network of Internet of Vehicles.(2) 5G mobile communication network: Information transmission pipelines are provided through the transmission rate and bandwidth of 5g as well as its stable and reliable performance with ultra-high capacity and ultra-short delay to make up for the shortcoming of the response rate of blockchain technology.(3) Cloud system: Provide the cloud storage service for Internet of Vehicles, such as secure, multiple-redundant and mass storage, real-time access monitoring and convenient application management. It is aimed to improve the problem about the insufficient capacity of blockchain technology.(4) Desk system: The information about vehicles, roads, people and network is perceived and collected through vehicle intelligent perception and communication terminal to realize information interconnection in the industry.(5) End system: The end system is connected with vehicle insurers, users, vehicle network and related companies as well as the business of traffic control bureaus, hospitals and copyright bureaus. It is aimed to realize the goal of cross-industry resource and information sharing based on blockchain technology to provide the personalized and automated insurance service for customers.

C. strengthen the exploration on application scenarios.

The application scenarios of blockchain technology and Internet of Vehicles insurance are developed vigorously, special development funds are set up and training and exchange activities are organized according to the market demand to improve the understanding of blockchain in the insurance industry of Internet of Vehicles. The innovation on the sales channel, service mode and business model of the insurance industry of Internet of Vehicles is promoted and customers are provided with the high-quality, low-cost, honest, standardized and customized product service from pre insurance prevention to insurance response and finally to post-insurance treatment. It is aimed to reduce the trial-and-error rate and the compensation cost.

V.CONCLUSION

Application of block-chain in Internet of vehicle enables to provide a high-efficient process with lower cost, more privacy, less risk, and more fair. The ferocious force of reform will change the traditional service mode of the insurance industry, enhance the overall competitive strength of the insurance enterprises, promote the insurance industry from the price competition mode to the new technical service mode, and promote the insurance service from standardization to precision, so as to create a new management and control mode, perfect renewal management, and improve customer experience.

REFERENCES

[1] BAIGE DUAN, DONGFA YU, LIANZHENG ZHANG "On the Theory and Practice of Overseas Mileage-based Pricing of Vehicle Insurance and Its Enlightenment for Chinese Insurers" J. Insurance Studies February 2012..72-79,

[2] Ives, Henry Swift. Compensation by a Tax on Gasoline M. In Selected Articles on Compulsory Automobile Insurance: Liability and Compensation for Personal Injury, edited by Edison L. Bowers. New York, NY:H.W. Wilson Co,1925.

[3] VICKREY W. AUTOMOBILE ACCIDENTS, TORT LAW, EXTERNALITIES, AND INSURANCE: A ECONOMIST'S CRITIQUE J. LAW & CONTEMPORARY PROBLEMS, MARCH 1968. 464-487

[4] BUTLER P, BUTLER T. DRIVER RECORD: A POLITICAL RED HERRING THAT REVEALS THE BASIC FLAW IN AUTOMOBILE INSURANCE PRICING J. JOURNAL OF INSURANCE REGULATION , 1989.

[5] LITMAN T. DISTANCE-BASED VEHICLE INSURANCE FEASIBILITY, COSTS AND BENEFITS[R]. VICTORIA TRANSPORT POLICY INSTITUTE, 2001.

[6] HE WANG. VICE PRESIDENT OF PICC: INTERNET OF VEHICLES WILL LEAD TO AUTOMOBILE INSURANCE REVOLUTION [DB/OL],2015 HTTP://ARTICLE.HAOXIANA.COM/126251.HTML.

[7] Wang He & Zhou Yuntao. Block-chain Technology and Internet Insurance J, E-finance Observation, 2016 (10), PP.74-76.

[8] William Mougayar.Commercial Block-chain: Opening A New Era of Encryption Economy M..Lin Hua el.translate.Beijing: China Citic Press, September,2016