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Autochain platform: expert automatic algorithm Blockchain technology for house rental dApp image application model

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Abstract

This paper deals with the current Blockchain adopted in the various types of trading markets supporting smart contracts that process text-based transaction information only when exchanging cryptocurrencies. Even though the Blockchain itself is decentralized, services can still be provided through a centralized system in order to provide adequate services to the users. It also allows the Autochain to apply Blockchain technology to existing businesses conducted under the Fourth Industrial Revolution to realize higher productivity or competitiveness and improve profitability to a remarkable extent. The Autochain is adaptable to all Blockchain technologies, companies, or research works around the world to overcome the limitations of the existing Blockchain technology. It creates the Blockchain-platform ecology chain and ecosystem, making our lives more convenient while revolutionizing every industry. In addition, it automates all Blockchain-based systems and offers a base for constructing a system wherein everyone can easily provide, operate, and maintain Blockchain services. This paper discusses a number of Blockchain-related technologies and presents a decentralized Application (dApp) exclusively designed for mobile use, taking house rental service as an example. It also presents the existing Blockchain and the Blockchain database storage method and proposes the dApp based on it.

Keywords: Blockchain, IoT, Artificial intelligence, Security, Big data, dApp, Autochain

1 Introduction

Blockchain technology ensures security and transparency by improving existing methods of providing information in a centralized system to connect and share blocks that make up the trading distribution nodes of distributed P2P (Peer-to-Peer) networks [1].

The dApp/Autochain platform presented in this paper is a fourth-generation Blockchain, with many companies now issuing digital encryption in legitimate currencies through financial markets. Using different names, these currencies have their respective market values, and some of which are successfully creating new capital markets and growing steadily.

For this and other reasons, many global IT (information technology) companies are conducting research and development on cryptographic exchange services that are technically and economically feasible and investing heavily in Blockchain technology as one of the core technologies of the fourth industrial revolution. The efficiency of Blockchain technology has already been proven; according to the Santander report, bank infrastructure costs could be reduced by up to $20 billion by 2022. Blockchain technology is said to have reached the third generation as it has become the center of attention in the digital encryption market in the era of the fourth industrial revolution. Recently, EOS announced that their mainnet actually adopted the third-generation Blockchain technology.

Although 1G ~ 3G Blockchain technologies are all composed of independent mainnets, certain problems remain unresolved. For example, at present, information or data generated by each Blockchain cannot be exchanged with another Blockchain as mentioned earlier, and some immediate problems should be addressed to ensure a safer and more efficient exchange of data between the Blockchain platforms. If the technology to solve this problem is made available, it will be able to solidify its position as the most important technology for the development of Blockchain technology in the future. Therefore, this paper discusses the need for existing Blockchain technologies.

As discussed in this paper, the architecture of this Blockchain is making great efforts to shift the paradigm of the existing financial system from centralized to P2P. This explains why the architecture of the Blockchain has become important. Therefore, this paper presents an architecture that uses distributed storage structures by selecting a new XML (Extensible Markup Language)-style architected archival method in the Blockchain in the DBMS (DataBase Management System) and storing it in a cloud server, or FOG computing, which are also some of the reasons such Blockchain services are not applied. It also presents a prototype leaf by applying it to the real estate management system using this architecture. So far, there is clearly an authorized broker for real estate sales. Instead of doing this escrow, however, we are incurring a lot of fees. Overcoming these centralized, validated systems, we propose a new Blockchain architecture, which is the P2P approach for the management of real estate management systems. In the future, Blockchain will be used in many areas. It will also adopt a more convenient method of verifying the deep running of artificial intelligence for these Blockchain services, and this paper proposes the combination of the vast data processing of big data and Blockchain engines.

The rest of this paper is organized as follows: Section 2 presents the methodology, Section 3 discusses the existing research and analysis, Section 4 presents the design and implementation, Section 5 implements the dApp/Autochain applied to real estate, Section 6 shows the Performance Evaluation of Autochain platform of Blockchain, Section 7 presents the result, Section 8 presents the discussion, and Section 9 presents the conclusions.

2 Methods

The methodology in this paper involves a number of technologies and architectures to compare the existing Blockchain with the proposed Blockchain. It presents a methodology for the process of storing and verifying Blockchain using technologies such as Blockchain's DBMS methodology, HTML5 (HyperText Markup Language 5) technology, and JSON (JavaScript Object Notation) language, XML architecture, Https protocol, TCP/IP (Transmission Control Protocol/Internet Protocol) protocol, and UDP

(User Datagram Protocol) protocol. It uses the virtualization technology of distributed DBMS to store the required database and also utilizes Big Data to analyze and validate many unverified data using the existing R programs and Blockchain engines. It also discusses some of the key technologies associated with Blockchain and introduces a Blockchain-based dApp (decentralized applications) for housing rental services available on mobile devices. In addition, it uses automation technology that automatically shows data verification using machine learning and deep learning of artificial intelligence systems. The languages used here are Java, XML, Python, and JSON, developed using Java Virtual Machine (JVM), Geoblus Virtual Machine (GVM), and middleware programs. The database was also stored in the cloud using RDB (relational database).

Thus, this study adopted a software methodology using an agile methodology and which was developed especially by security coding. This paper also suggests ethically agreed-upon methodologies that improve the problems of the existing Blockchain-based research methodologies and presents new theories. Using ERD (entity-relationship diagram) and data flow diagram using the design pattern, various database flows are shown. Using these Blockchain engines, a "Blockchain real estate transaction" dubbed dApp/Autochain is presented, including a methodology for acting as an adapter for application to these various applications.

3 Related research

The Blockchain appeared in the *New York Times* in 2013 along with Beck Coin, which was also named "Word of the year" by Oxford Dictionary. Bitcoin started with Bitcoin (A Peer-to-Peer Electronic Cash System) published by Satoshi Nakamoto in October 2008. Since January 2009 [2], it has been used as an online virtual currency that freely trades between nodes via P2P without an intermediary. This security technology is designed to store and use safely electronic money called "bitcoin" using Blockchain technology. The Blockchain is also called a public transaction book. It is a technology that prevents double payment, which can occur in financial transactions, and cannot be tampered with. It has become a core technology of Pintech in Korea [3, 4]. The bitcoin is the tip of the iceberg, an application example of a Blockchain application. Still, the public has been underestimating the Blockchain by concentrating only on "the tip of the iceberg."

Nowadays, however, we are paying attention to the possibility of expanding the Blockchain as the underlying platform technology. Unlike the local business, which is still in the early stages of business integration, overseas business is a new business platform that combines technologies such as ICT (Information and Communication Technology) and IoT (Internet of Things). Nonetheless, current passwords have difficulties linking them to real-life situations.

3.1 Blockchain

The Blockchain technically enables the replacement of the current centralized ledger structure with the Distributed Ledger by using the public key algorithm and hash encryption technique and incurs low cost thanks to the distributed processing structure. Blockchain technology is regarded as the best payment system because it allows P2P financial transactions between two parties without the involvement of a 3rd party (financial company or trusted third party) as long as an Internet connection is available. The Blockchain

offers a more secure means of transaction, and it is commonly used for virtual money (Bitcoin) [5–9]. In a bitcoin system, the Blockchain plays the role of a distributed digital book that stores the history of changes in values of the bitcoins, announcing them periodically. This book adopts a cryptographic technique to avoid any falsification and keeps a record of transactions and ownership of bitcoins starting from the first block (Genesis Block) [10, 11]. The Blockchain containing all previous transaction information shares the same information with other nodes in the chain. Each distributed database created by Blockchain technology has a fundamentally different digital backbone as the most distinct feature of Blockchain technology [12].

For example, Wikipedia's "master copy" is edited on a server, and all users are able to check the new version. In the case of a Blockchain, every node in the network shares the same information and updates it independently, but the most popular content becomes the de facto official record replacing the original master copy [13, 14]. Trust is a risk judgment between different parties; in a digital world, determining the level of trust means proving the true identity (authentication) together with a validated permit (authorization) for questions such as "Are you who you say you are?" and "Should you be able to do what you are trying to do?" In Blockchain technology, private key cryptography provides a powerful ownership tool that fulfills the authentication requirements. Possession of a private key is essential in proving ownership. It also spares a person from having to share more personal information than he/she is required in a transaction process, protecting him/her from hackers. Authentication by itself is not enough to protect transaction information, so the authorization process requires a distributed peer-to-peer network [15, 16]. The distributed network reduces the risk of centralized corruption or failure, and it must also adhere to the transaction network's recordkeeping and security policies. Approving transactions can only be finalized after the entire network has applied the rules upon which it was designed (Blockchain's protocol). Authentication and authorization methods allow the digital world to carry out transactions without relying heavily on other expensive or complicated means of earning trust. Today, entrepreneurs in various industries around the world are recognizing the value of Blockchain technology in the digital world, and they have started to understand that some type of a new and powerful digital information exchange system can be created with it [17].

Blockchain technology is often described as the backbone for a transaction layer in the Internet network, creating the foundation for the future Internet of Value. In fact, the idea that cryptographic keys and shared ledgers can incentivize users to secure and formalize digital relationships has made it possible to seek a more convenient but secure system [18, 19]. Everyone, from governments to IT firms to banks, is seeking to build this transaction layer [20–23]. The authentication and authorization processes in a Blockchain-based digital transaction are shown in (Fig. 1) [24, 25].

3.2 Application model: autochain

At present, Blockchain is available on various platforms such as Bitcoin, Ethereum, Hyperledger, and EOS, and it serves a unique purpose [26, 27].

Aside from its limited processing or authentication speed, however, the public-oriented Blockchain has several technological limitations [28–30]. First, it is difficult to

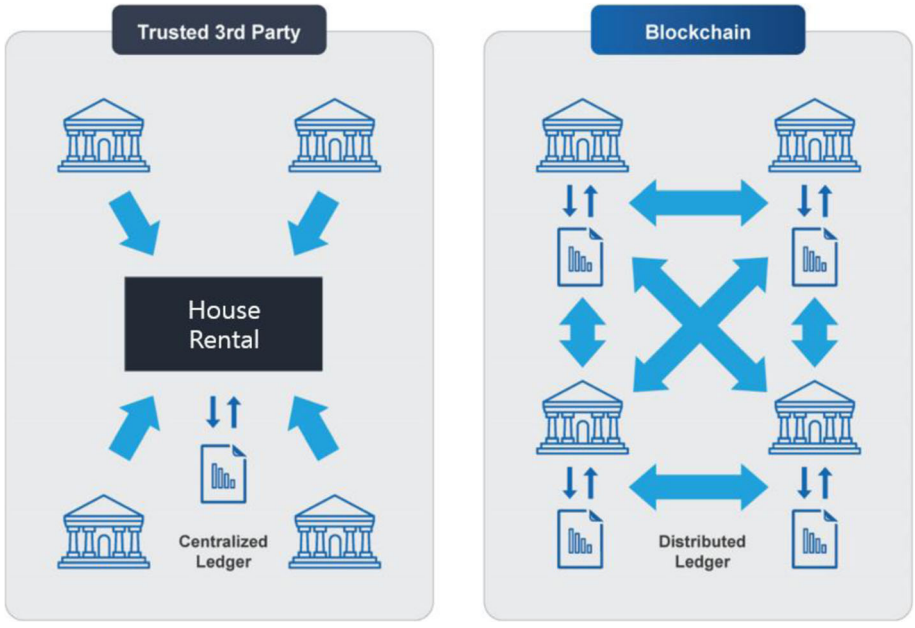

Fig. 1 Blockchain architecture for house rental

process unstructured data such as images, voice, or videos. Second, there is no data standard for the exchange between Blockchains. Third, both critical and personal information are exposed to other Blockchains. Fourth, data exists only in a smart contract, but there is no user-friendly UI (user interface) [31, 32].

The dApp/Autochain can resolve these problems to provide a variety of services. First, the Autochain can handle all MP3, photo, and video data as well as Text, DB, and SMS (short message service) data in a Blockchain. In fact, it can handle all structured and unstructured data to provide them for a Blockchain service. The Autochain is suitable for data exchange as the XML is irrelevant to a specific OS (operating system) or a software supplier. In other words, the XML operates independently of the platform used such that it is quite useful in achieving interoperability between different Blockchain platforms and OS's. It provides a service that enables the Autochain HUB module to exchange data between different types of Blockchains.

Second, in each node in the Blockchain, some specific data such as sensitive personal data will be encrypted to ensure the anonymity and security of the Blockchain [33].

Third, every smart contract in an Autochain provides a UI-type view for the data and involves users on the browser, like a single offline document shown in Fig. 2.

The smart contract is composed of XML data, and the document format adopts XSL (eXtensible Stylesheet Language) so that a dApp can be used to prepare a smart contract. These XML and XSL are used to create a smart contract on the browser by using the XSLT (eXtensible Stylesheet Language Transformations) embedded in the standard browsers. The results can be checked on the browser, and the existing Blockchain is used only in the cryptographic exchange. This paper attempts to address these shortcomings.

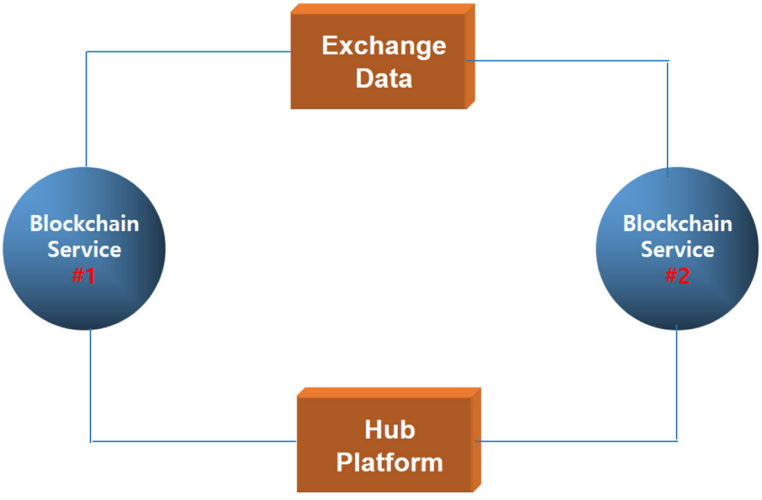

Fig. 2 Autochain hub service

4 Design and implementation of autochain platform of Blockchain

4.1 Issue raising

One of the common philosophies and perspectives on the Autochain is that it is a form of Blockchain that "experts in the field should be able to create and use easily." Currently, Blockchain-based smart contracts are being created by professional programmers who make modifications and changes at a high cost. For this kind of task, it is not easy to extract data from databases, and HTML is prepared manually to complete a Blockchain, thus requiring much time, human resources, and expenses. To resolve this issue, the Autochain allows a general user who does not have sufficient skills in coding for utilizing the automation tools provided by the Autochain platform to create Blockchains in a short time. First, by using the smart contract generation tool, the user can prepare a webform and the details of the contract, and then connect the Hybrid platform engine in the cloud with the Blockchain platform to prepare a fully automated smart contract. Since the Autochain creates the smart contract by using the Hybrid Platform's automation engine, it can be implemented as a distributed system in the form of "XML (Data)" + "XSL (View)," which is optimized for the distribution node in the Blockchain. In addition, by using automated technology, it is possible to prepare a smart contract in a shorter time with less effort to provide an inexpensive yet highly efficient service. The Autochain assists users at their individual industrial sites, rather than developers, to create a smart contract automatically and transmit it rapidly through SNS (Social Networking Service) so that the recipients can use the browsers embedded in various types of devices to check the contract immediately. Every Blockchain in the Autochain (a smart contract) can be used conveniently by general users as if they were using an email system. Due to such technological advantage, the Autochain platform is clearly different from the other Blockchain platforms in terms of costs, human resources, and time consumed [Fig. 3].

Figure 3 shows the existing Blockchain database being stored in the Genesis block in a central DBMS and sequentially stored from DB 1 to DB 2 in the end as DB 6. This method has a distributed storage structure of Blockchain but refers to the same method

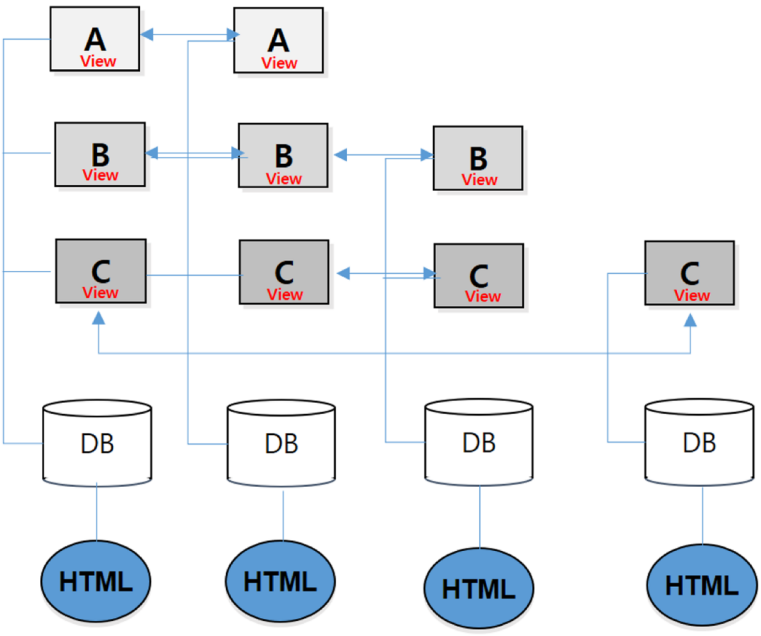

Fig. 3 Existing Blockchain

as using a central DBMS with a distributed structure. This is a problem with the existing DBMS architecture.

The Autochain engine can create a Blockchain automatically because it utilizes a data interworking technology such as EAI/ESB (Enterprise Application Integratio/Enterprise Service Bus) (Fig. 4).

In Fig. 4, traditional Blockchain data is stored centrally, forcing the use of traditional centralized DBMS to store them. Nonetheless, the proposed method suggests storing XML data in an IPFS (InterPlanetary File System)-style file system to deliver it. The advantage of this approach is that the XML chooses to store XSL and View data separately, which is a very simple and light delivery method that stores and communicates View values in address values. Therefore, we suggest an architecture that stores and delivers it a la Autochain. View 1 takes View 1, and View 2 takes View 2.

4.2 Autochain architecture

4.2.1 Autochain architecture model

The Autochain platform is a platform that can express both structured and unstructured data in a Blockchain by using the Autochain Hybrid Platform. Unlike existing Blockchain data models, it does not use RDB but combines “XML” and “XSL” in the distribution node to provide a UI-based view on a built-in browser of the user’s device. The following shows a comparison of the existing Blockchain data (Fig. 5).

To facilitate the standard application of all data serviced to the Blockchain regardless of OS type and support the multi-devices of users, the XML created with Hybrid Platform can be converted into various formats. For example, it is possible to convert a Hybrid Platform-based PDF directly into Solidity, JAVA, Python, or SQL (Structured Query Language), etc. The Hybrid Platform is used by general users to create an XML

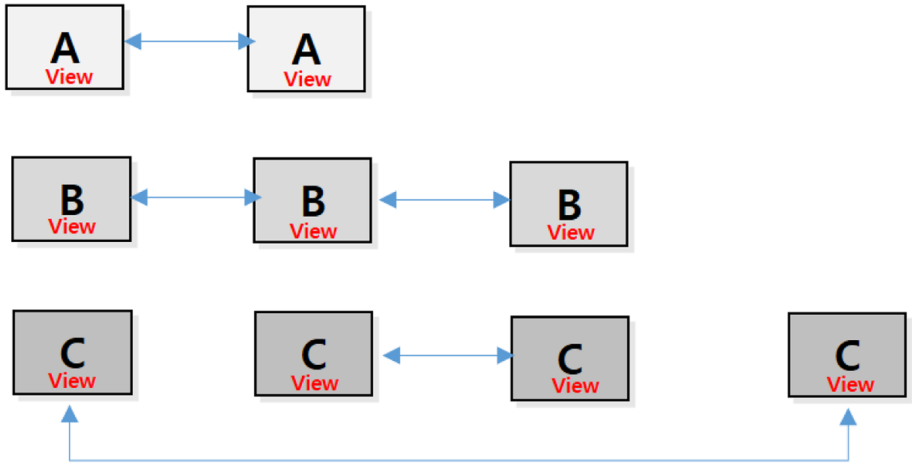

Fig. 4 Autochain architecture

document with a view function and save it in a Blockchain. The Hybrid Platform methodology first involves the creation of an XML document with a view function (N-D document), which is saved in a 2-D DB (DataBase).

4.2.2 Blockchain over HTTP

The Autochain-based Blockchain technology is used to create and save a smart contract having a W3C (World Wide Web Consortium) standard XML database on an HTTP web. Since the W3C standard data format is used, it can support every development language and various types of Blockchain services. It creates the W3C standard XML-based smart contract on the HTTP (HyperText Transfer Protocol) protocol (Fig. 6) including a view to save it in the Blockchain. The Autochain Blockchain is connected to the Blockchain platform such as Ethereum, Hyperledger, EOS, Qtum, and Cardano on HTTP to provide Blockchain services. It is also connected to IPFS or to the distribution DB via HTTP to provide service on a single Blockchain. Thus, the Autochain implements and provides the "Blockchain as a Service" on HTTP.

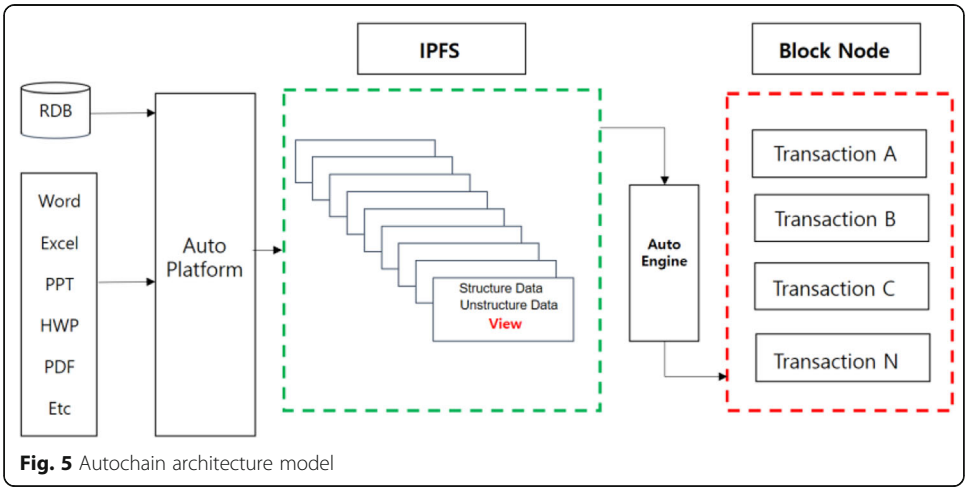

Fig. 5 Autochain architecture model

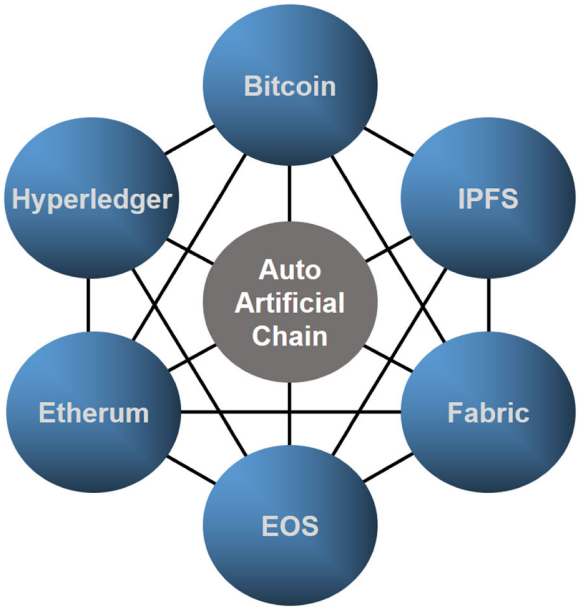

Fig. 6 Autochain of Hybrid platform (Blockchain over HTTP)

4.2.3 Autochain mainnet

The data currently generated in the Fourth Industrial Revolution is far too diverse in terms of type, size, complexity, and degree of importance, making search and analysis of the data's relevance and real-time processing essential. Blockchain 4.0 (Autochain) can save all of the data from every field in the Blockchain, and it can be linked to the legacy system currently being used in most industrial fields. The Autochain can process the following data types in a Blockchain: structured data (data saved to fit the schema type saved in RDB), unstructured data having inconsistent structure and irregular forms (Fig. 7), and geographical data, real-time data, time series data, natural language data, event data, network data, linked data, etc.

This way, the Autochain can save and service all of the data in a Blockchain and subsequently overcome the limitations of the existing Blockchain platform. It provides the Hybrid Platform-based Autochain platform, which supports the W3C standards. The

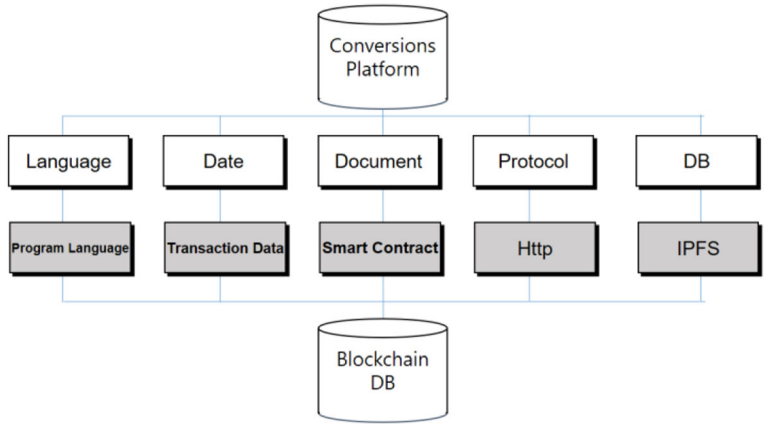

Fig. 7 Autochain mainnet

Autochain is a platform that supports its own Blockchain and token ecology like the mainnet and is expected to support various coin ecologies and eco partners.

4.2.4 Autochain hub chain

Each Blockchain platform implements its own dApp ecology. While it is possible for each of the Blockchain platforms to exchange data within a single platform, however, it is impossible to exchange data with other Blockchain platforms since the required data standardization or protocol standardization is not available. Moreover, the logic to be implemented in the Blockchain has to be developed and applied by using the program language inside the built-in VM (virtual machine) of each Blockchain but has limitations in terms of the language supported by VM, and it is harder to correct or supplement it. When the content of every smart contract is uploaded to VM, its size inevitably increases, causing problems with the processing and transmission speeds. The existing Blockchain VM fully executes the functions to save and share the Blockchains as the most fundamental functions, including the logics through AVM. By using the APIs (Application Programming Interface) provided by various Blockchain platforms, it is possible to integrate the transaction data and linked data provided in each dApp. The W3C standard XML is supported in the Hybrid Platform mounted inside the Autochain platform. Although the existing dApp can be applied to each Blockchain platform, the Autochain platform dApp does not pertain to every Blockchain platform but provides the dApp service in the upper-ranked BaaS (Blockchain as a Service) instead (Fig. 8).

4.2.5 Autochain framework

The Autochain's framework is available as a single integrated architecture based on Blockchain technology, and it can provide an end-to-end service from the time of initial data generation to the time of the final service (Fig. 9).

In layer 1, it implements the foundation of the Blockchain, BaaS (Blockchain as a Service), in order to provide every service in a Blockchain.

In layer 2, the W3C standard XML is used to standardize the data format and support the XML-Standard in diverse industries and the repository supporting SQL & NoSQl DB simultaneously.

In layer 3, a middleware layer, the following functions are performed: Data Management Processing, Web Service, EAI, Configuration, APIs, Query Processing, etc.

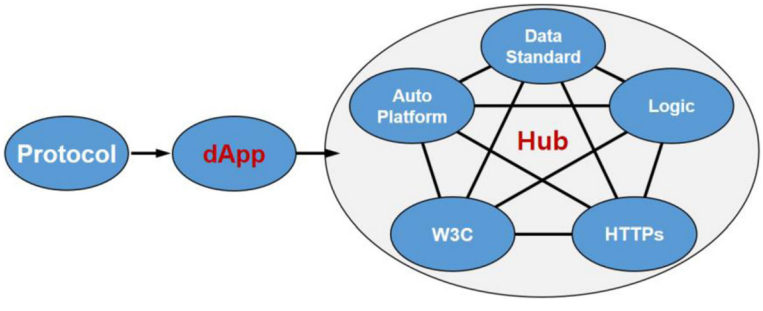

Fig. 8 Autochain hub chain

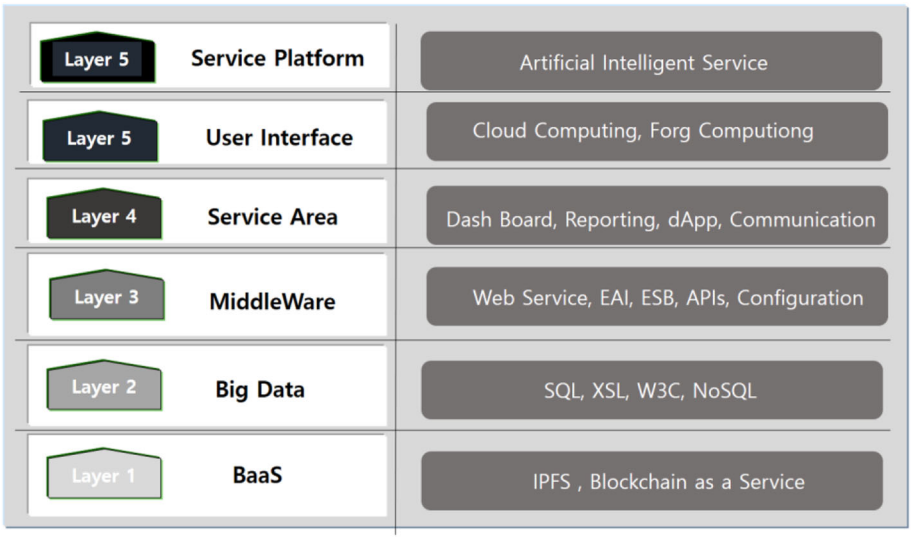

Fig. 9 Autochain framework

In layer 4, various services are provided including dashboards, reporting, searches, analysis, dApps, and community.

In layer 5, a user can use various devices and browsers to provide an HTML5-based view for every service provided by the Autochain in order to provide diverse services.

4.3 Blockchain-based process for house rental

The current process of rental agreements for apartments in In the World is very time-consuming and document-intensive. The process starts once the tenant is selected and the rental terms for an apartment are agreed upon. Most of the time, the property management company enters the data manually into their system, creates a standard rental agreement, and then sends it in duplicate form via regular mail to the tenant. Together with the rental agreement, the following documents are sent to the tenant:

a) Rental guarantee agreement to open an escrow account
b) In some cantons, the official form containing the initial rent—statutory rent form
c) Form to fill out how exactly the name should be inscribed at the door
d) Form on how rent will be paid: direct debit, payment slip, or standing order

Once all the forms are filled out, and the tenant has signed the contract, all documents are sent back by regular mail to the property management company, and the contract is countersigned and sent back to the tenant. Additionally, the property management company has to give notice to the property caretaker, the power station, and the residents' registration office that a new tenant is about to move in to the property. Once these steps are complete, the property management company needs to receive confirmation that the deposit has been placed in an escrow account. Only after that can the apartment be handed over.

To summarize, when a rental agreement is created, it is sent back and forth three times before it is signed by both parties and archived. The payment of the deposit again

takes a few days until it has gone through. Even if everything is done error-free, this process may still require at least 1 week for completion. Given the large number of contractual steps involved, this process may be rendered more efficient using a Blockchain solution (Fig. 10).

After the terms are agreed upon, the Blockchain generates a rental agreement and includes the required documents such as the statutory rent form. The form for the payment terms and the agreement for the rental guarantee for the bank are obsolete, as payments can be triggered using smart contracts. The tenant can check and approve the documents and terms of the rental agreements and fill out the doorbell inscription form. Once done, a smart contract triggers the payment of the deposit amount to the property management company's wallet. As the property management company has already given consent by choosing that specific tenant, counter-approval is not necessary and can be triggered by the system. The rental unit including the new tenant is automatically activated in the system. The Blockchain will trigger notices to the power station, the resident's registration office, and the property caretaker about the new tenant. Since the deposit amount has been automatically transferred, and all other necessary steps are also taken, the acceptance report can be filled out, and the key for the apartment can be handed over.

The legal validity of the contract, although only approved online, is given, as a rental agreement in In the World falls under Art. 11 of the Swiss Code of Obligation stating that it need not be in a certain form, i.e., written form, to be valid—a simple handshake is enough. Although not necessary, the rental agreement is mostly in written form at present as the contract serves as proof in case of disputes. Still, approving the terms online should be enough proof in case of dispute.

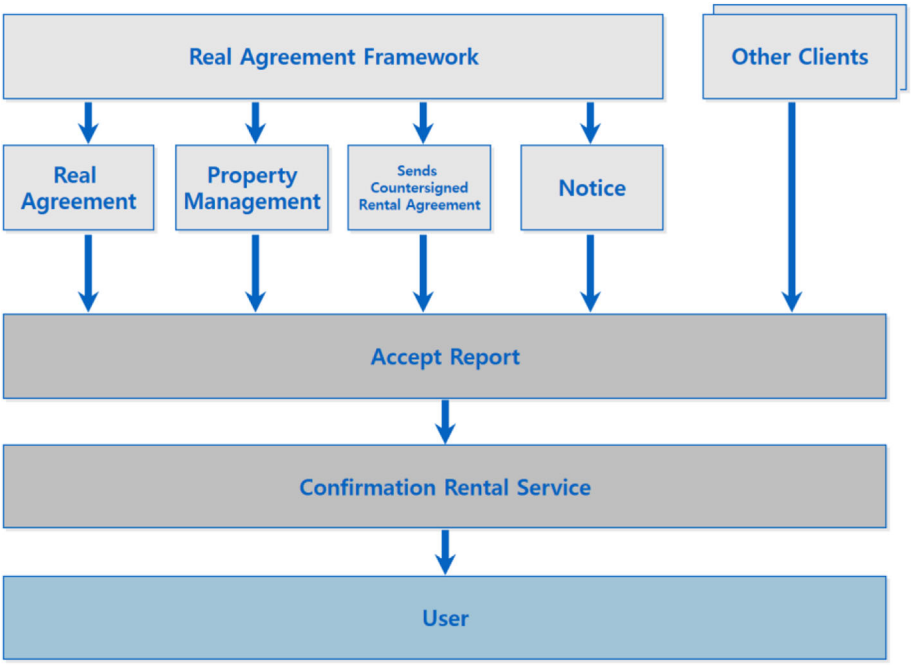

Fig. 10 Overview of the current process

This process will require the Blockchain to be permissioned, probably with a consortium solution, having the tenants and the property management company as users. Access could be granted to the property owners as well. The identities of the users need to be known, as property management companies will need to know the identity of the person approving the contract.

The different users should have different roles and corresponding access levels. In In the World, every building, every apartment has an official identification number. For a building, the unique number EGID refers to important data of the building including address, coordinates, year of construction, and number of floors as well as what type of heating system the building has.

For apartments, this unique identification number EWID refers to the number of rooms and size of an apartment. Every person registered in the official register for residents needs to be linked to a unique building identification number as well as to a unique apartment identification number. This data is already available, and EWID could be used and linked to the Blockchain application in order to be able to identify clearly which apartment a person is renting. A person entering a new tenant on the distributed ledger simply needs to choose the unique identification number of the apartment and add the tenant.

Consensus mechanisms such as voting or multi-party consensus are the ones making the most sense, also due to the fact that they use considerably less computing power and enable faster transactions. Triggering rental payments via smart contracts will require offering a cryptocurrency.

Having this process on a Blockchain will dramatically reduce the time required for a rental agreement to become valid due to the permissioned setting and the pre-defined nodes participating in validating the transaction.

The fact that the proposed use case can be called a Blockchain is controversial as many features of an open-source, public, and fully decentralized Blockchain will not be realized (Fig. 11).

5 Verification of actual application model: house rental dApp image application

The Blockchain can assist individuals in drawing up a (smart) contract for the real estate online directly without involving an agent. The landlord can use the House Rental dApp to list his/her properties on the Internet and discuss the creation of a smart contract with potential tenants. When a tenant signs a created smart contract, it becomes legal; following the contract terms, the tenant should wire the deposit (encrypted money) to complete the deal. Immediately after the final payment, the smart contract is saved in the Blockchain (Fig. 12).

The UML (Unified Modeling Language) diagram described in Fig. 13 authenticates the user with his/her name (or other designations) used in the subscription stage when he/she logs in, and then moves to the main screen of the app. Based on the ID value, the main screen displays a menu consisting of Service and Help options along with some relevant images. The user can send or receive transaction data by using the service. Meanwhile, Transaction Info shows the code authenticated with a verified value. A screen where a receiver, a sender, the generated MSP, the Blockchain type, or the time can be set is provided here.

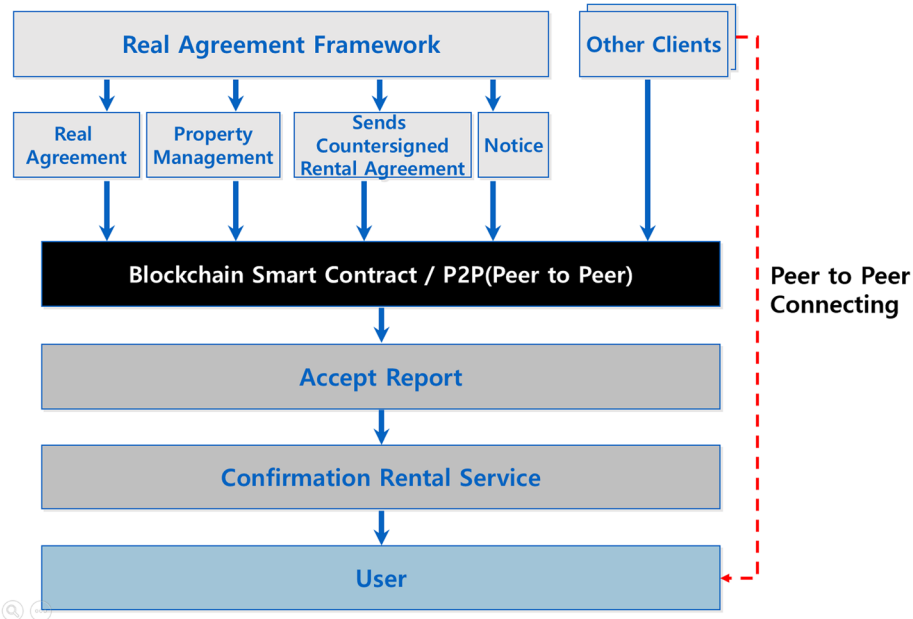

Fig. 11 Blockchain-based process for house rental

Figure 14 shows the UML diagram of House Rental Autochain/dApp Image Application process. In the UML diagram, MainIndex Header in Class Diagram defines its hash value as a 256-bit value and sets the time and other elements. Likewise, the SubIndex Hash value is represented with a 256-bit value for phaseBlock, etc., whereas the header value is set by using the ClockIndex value. Next, Hblock sets the header and stream value before sending it to MainIndex Header.

The following is a sample scenario: David wants to put his house up for rent but has no money to hire a solicitor to prepare a contract, so he enters the Autochain platform and purchases a monthly rental contract. After that, he puts his house information on

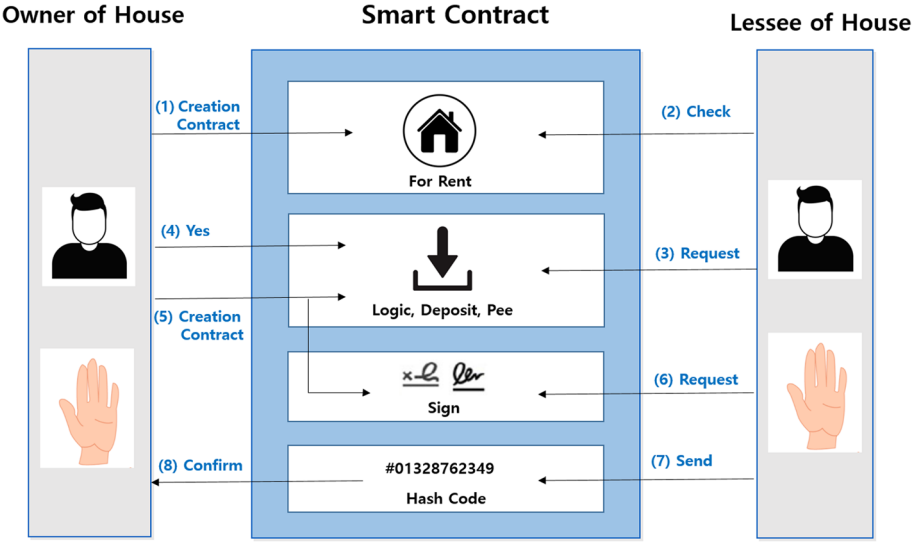

Fig. 12 House Rental model flow

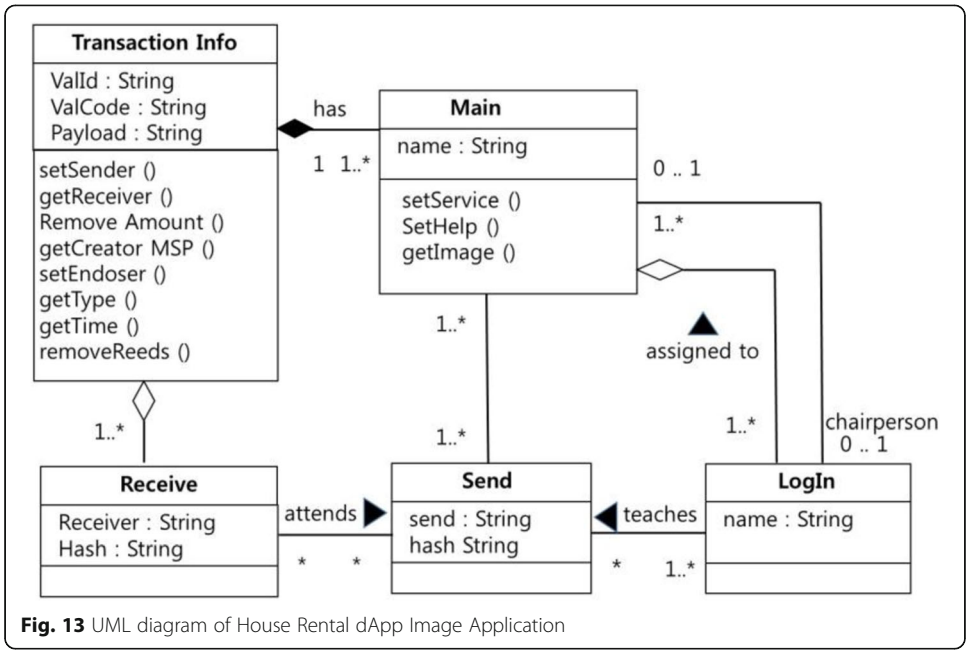

Fig. 13 UML diagram of House Rental dApp Image Application

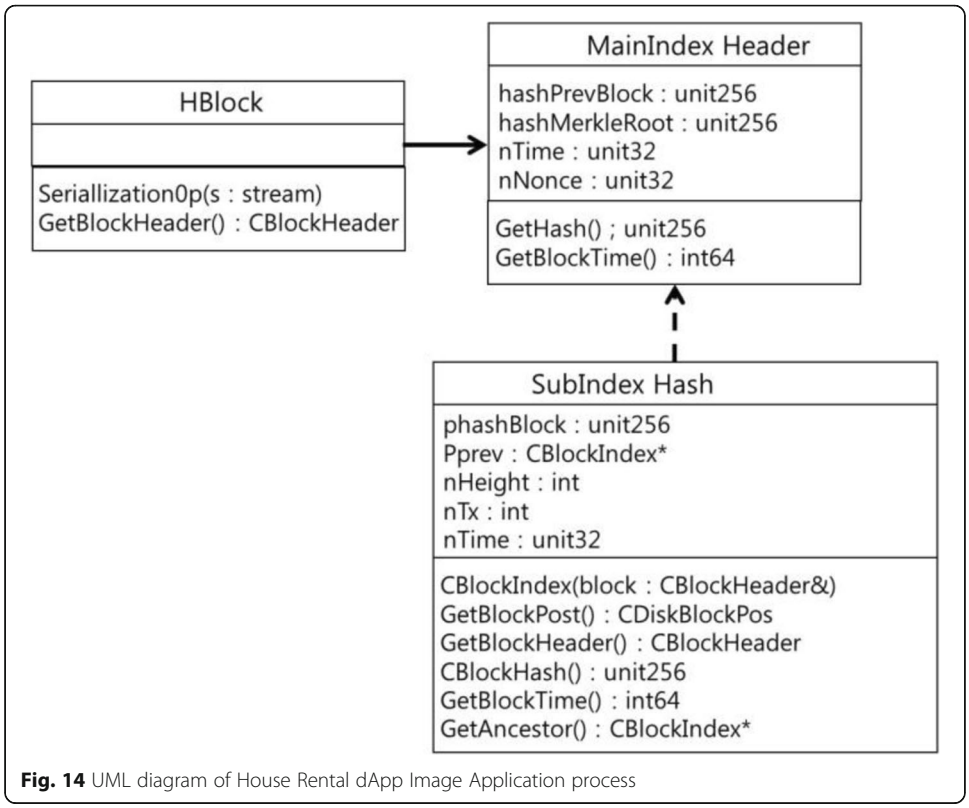

Fig. 14 UML diagram of House Rental dApp Image Application process

the Autochain platform. On the other hand, John is looking for a house with his wife and finds the house information posted by David. He likes the house but feels that it is a bit too expensive and sends David a message requesting him to bring down the rental to 1000 USD. David checks the message and notifies John of his willingness to lower the rent. David makes a new monthly rental contract and sends it back to John with his signature. Then, John receives it, checks the details, and signs it. Once the contract has been established, John wires the deposit to David to complete the contract according to the prescribed conditions. Since all the steps are carried out through the XML contract with a view on the HTTP protocol, it is now possible to conclude the contract in real time and use the Blockchain service to sign a P2P contract.

6 Performance evaluation of autochain platform of Blockchain

6.1 Experimental environment

6.1.1 Performance of artificial intelligence auto Blockchain

Key factors that determine GPU (Graphic Processing Unit) performance are hardware parts and internal network components. GPGPU-SIM considers this, consisting primarily of part of a system simulator running a benchmark program based on hardware components and part of a network simulator connecting each core within the GPU.

6.1.2 System components of artificial intelligence Blockchain simulator

a) Quadro FX6200 of NVIDIA
b) Nvidia SLI MultiOS
c) Multiple Quadro GPU
d) Workstations in virtualized environments (HP ML-800)
e) HA Structure
f) Network networks in the network environment
g) Network topology: mesh

6.2 Blockchain performance statistical analysis

This study used the test net basically to do house rental first. K-means clustering analysis using web metrics shows that the number of nodes is 50, 100, 150, and 200, and traffic indicators can be viewed. The relationship of TPS (transaction per second) metrics can be checked in the desired form by selecting the number of clusters (Fig. 15).

In addition to the functions provided by the solution, the data can be retrieved through API link and statistical analysis, and the Shiny package of R can be used to check clusters in TPS using dynamic dashboards (Fig. 16.

6.3 Blockchain performance node analysis

Also, Fig. 17 above shows the performance value of 1200 TPS and the maximum value of 2000 TPS as a result of 10 simulations of the existing platform. On the other hand, as in Fig. 18, the Autochain platform showed a performance difference of approximately 1.5 times with an average value of about 2000 TPS and a maximum value of 3000 TPS.

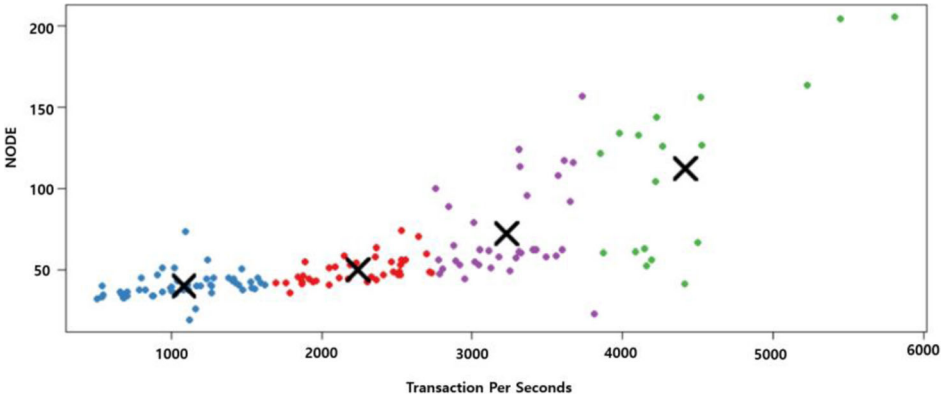

Fig. 15 K-means clustering for TPS

7 Result

The current Blockchain-related technologies are not yet perfect as they are not fully used in real-life situations. In fact, most of the current Blockchain technologies are linked to cryptography for transaction purposes. As these technologies continue to develop, the number of Blockchain platforms will increase continuously, and they will be used in our daily lives in the near future under the Fourth Industrial Revolution. Such expectation can only become a reality if we can resolve the issues pertaining to data integration and service provision between Blockchain platforms, which are also the major limitations in the current Blockchain industry. Autochain could resolve all of these problems and ultimately provide an ecosystem where all the Blockchain platforms act as a single platform. With the growing diversification of Blockchain-related research, the role of the Autochain platform will be emphasized increasingly and extended. The Autochain platform will then secure its position as the key global Blockchain platform, as verifiable and transparent as numerous governments, individuals, and organizations around the world, including the UN (United Nations), require it to be. Blockchain technology has the potential to revolutionize trust models and business processes in many industries. Nonetheless, this technology is still in its infancy, and the distributed

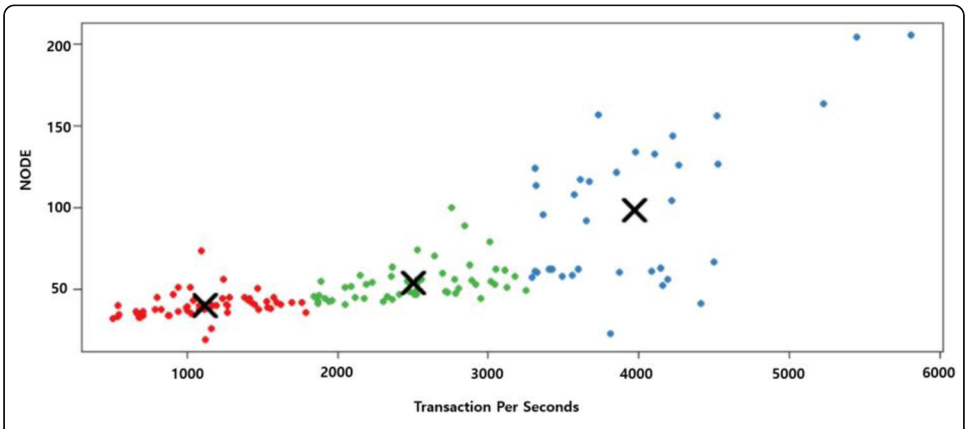

Fig. 16 K-means clustering by using Shiny Package for TPS

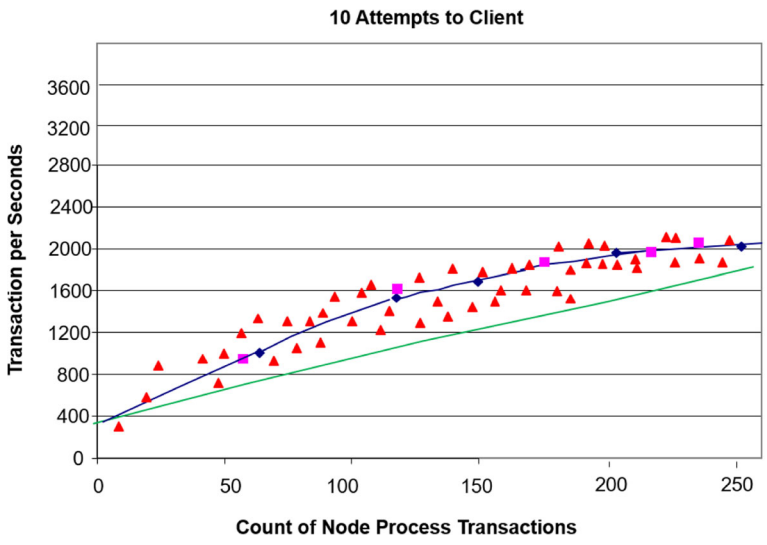

Fig. 17 Traditional platform performance

language technology used for Blockchain technology has not been properly monitored or tested. Despite the positive potential, CIOs (Chief Information Officer) and business leaders are required to consider a variety of risk factors such as software bugs that could occur when introducing Blockchain technology or risks associated with quantum computing technology, for example.

Experts and analysts point out that Blockchain technology may not be appropriate for some business processes. For example, Barrasula, the founder of Ethereum exchange station Leveri, was skeptical about the availability of a Blockchain in the encrypted money sector. He argues that Blockchain technology is unnecessarily expensive, taking longer time to deploy than the traditional transaction technologies including some of the current centralized relational databases. In order for a new block to be added to the Blockchain, a procedure that checks the encryption of all the blocks is

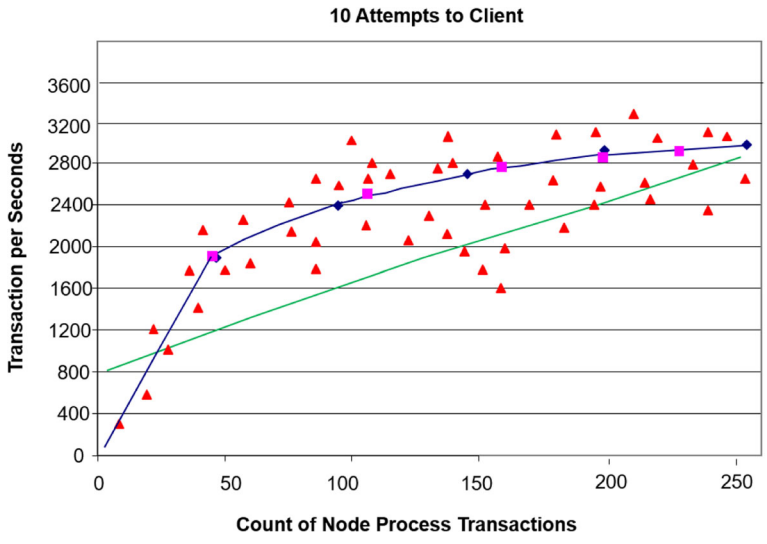

Fig. 18 Autochain platform performance

required. This means that it is not efficient enough to be applied to business areas where fast transactions are essential.

We will compare the existing platform (Table 1) with the Autochain platform by creating a comparison table. We can see that the Autochain platform is better than the existing platform.

Another argument is that the block insert must be serialized because the Blockchain is literally a "chain" type. Because of this, the update rate is slower than the traditional parallel database update method. Forrester Research also focused on the frenzy surrounding the Blockchain and the current state of the technology and remarked that the expectations are too high for Blockchain technology that even many experts do not fully understand. Meanwhile, Forrester's chief analyst Martha Bennett predicts that the proliferation of Blockchain technology will continue to be on a slow and steady pace and that it will be much more likely used in niche markets than in large companies. Today, Blockchain technology is mainly used for creating distributed currencies in the encrypted currency market or virtual finance transactions. Even the most well-known Blockchain platforms, Hyperledger and Ethereum, are still in their infancy, so the introduction of this technology can give rise to unexpected problems.

Blockchain may not be suitable for data storage in some cases. The biggest advantage of Blockchain technology is that data can be shared with many by a single data generation. It is easy to introduce to different nodes on the web, but it is impossible to manipulate each record because it has its own hash. Thus, distributed ledgers through a Blockchain-based network can leave much richer, more comprehensive transaction records than internal systems and blacklist-based selective records. On the other hand, the transaction data need not be part of a Blockchain. For example, if a Blockchain user attaches an image as part of a transaction record, the data capacity will surge; as the data capacity grows in a situation where time-consuming, one-sided addition is possible, this will lead to network overhead. In this case, due to the nature of the Blockchain that distributes the data, all the data must be replicated to all nodes in the chain. As such, for some transactions, it is better to use a relational database running on separate network storage rather than a Blockchain that is difficult to control. There are two main types of Blockchains: public Blockchain and private Blockchain. Public Blockchains can be joined by anyone. For example, those who wish to purchase a bitcoin join in the chain. Because the public Blockchain is open and transparent, all transactions on the chain can be seen transparently by all users. On the other hand, private Blockchains are managed exclusively by the central authority, and accessing them requires approval. They occur only in the form used primarily by a single company or a partner company, or only authorized users can join the chain. Whether public or private, Blockchains are basically impossible to manipulate as each transaction record or "block" cannot be

Table 1 Compare Autochain platform

	Existing platform	Autochain platform
Platform automation	Manual	Automotive
Transaction speed degree of artificial intelligence	Slow	Fast
	None	Great deal
Dapp performance	Apply manually	Apply automatically
Apply automation	Not applied	Application

changed arbitrarily but is linked to all other blocks, guaranteeing its security. To add a new block to this chain of blocks, other users must agree. How much user consent is required depends on the Blockchain used. Some Blockchains require 50% agreement, whereas other Blockchains require more. Although this difference can be small, the Blockchain is basically more secure than any existing networking technology for this reason. Still, it is also true that Blockchain technology relies on application software and encryption technologies; among the hundreds of startups developing today's Blockchain technology, only a few of them are using unverified algorithms. For example, in the case of bitcoin technology, SHA-256, which has already been proven to be secure and effective, is used for hashing. Nevertheless, several recent studies have predicted that quantum computing will ultimately break the algorithm used for this technology.

Hacking a Blockchain network is not easy but also not impossible. The vulnerabilities in the software used for networking could be the problem in this case, especially in coding.

8 Discussion

This study presented the architecture of the Blockchain using Blockchain technology and artificial intelligence technology, which have recently become hot issues. This architecture shows a variety of ways to achieve the unique distributed architecture of the Blockchain. For the existing centrally stored database on the storage form of these Blockchains, this study presented an unrestricted storage format in terms of time and space using the IPFS system, which is a decentralized database storage system, such as embedded cloud system and fog computing. This is based on various web-based languages such as HTML5, XML, and CSS (Cascading Style Sheets) and Java-based distributed object-oriented languages such as JSON. This study presented a practical service model that is available for demonstration models. The reason Blockchain architecture is important is that Blockchain technology creates blocks to avoid modulation and opens them to the entire node. Therefore, they are safe from security threats because they cannot collide with each other as a characteristic of Blockchain. This study presented how to make these Blockchains. Many other Blockchain projects are still emerging, but they could not be put into practice. One of the main reasons for this may be the inability to create a working Blockchain dApp. Thus, in this paper, the concept of making such practical Blockchain dApp was explained quickly and easily. It is also expected to overcome the problems of Blockchain in the future with these Blockchain characteristics. In addition, house rental services are currently being used via the Internet and mobile without interlocks. The reason is that interviewers get a lot of commission. Blockchain is also necessary for transparent transactions between landlords and tenants. These Blockchain technologies address the limitations of existing real estate portals (platforms) by applying security to the verification of real estate data by utilizing Blockchain on private property trading platforms.

9 Conclusions: based on house rental dApp image application model

It reduced real estate transaction fees and increased the reliability of data such as false sales and fraud. The existing real estate market system is overhauled, whereas the incentive system through encryption is applied to secure a large number of participants.

The areas where Blockchain technology applies in relation to real estate are comprehensive research systems, such as sharing and verification of sales lists, smart contracts, land registers and registrations, history management, emotion, collateral and remittance, building management, subcontracting, logistics management, and electronic tax invoice. The tax collection dealt with in this paper applies these many advantages to housing rent.

Moreover, in a traditional architecture, the current Blockchain has mostly been applied to private Blockchain, and much has been done. This study presented an architecture that verifies and stores public Blockchain. This is due to the Half-storage architecture, the inherent threshold of the private Blockchain. That is why, for P2P service in the true sense, this thesis presented various languages, methodologies, and architectures. In the future, we will conduct research on the work engine, various artificial intelligence techniques, and theories of the rougher base so that we can automatically verify and agree on work methods using machine learning and deep learning of artificial intelligence. It also tackled the limitations of the Blockchain, and low data becomes very important. That is because when low data is hacked or integrity is broken, Blockchain becomes hard to trust as well. Therefore, we will study various Blockchains by introducing Big Data analysis techniques that store and verify these low data more safely and artificial intelligence systems that automatically verify these data.

Abbreviations

dApp: Decentralized application; ICT: Information and Communication Technology; IoT: Internet of Thing; JVM: Java Virtual Machine; GVM: Geoblus Virtual Machine; UI: User interface; OS: Operating system; XSL: eXtensible Stylesheet Language; DB: DataBase; XML: eXtensible Markup Language; HTTP: HyperText Transfer Protocol; UML: Unified Modeling Language; W3C: World Wide Web Consortium; P2P: Peer to Peer; SHA-256: Secure Hash Algorithm-256

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Authors' contributions

Conceptualization, S.-K.K.; Formal analysis, S.-K.K.; Funding acquisition, J.-H.H.; Investigation, S.-K.K.; Methodology, S.-K.K.; Project administration, J.-H.H.; Resources, J.-H.H.; Software, S.-K.K. and J.-H.H.; Supervision, J.-H.H.; Validation, J.-H.H.; Visualization, S.-K.K. and J.-H.H.; Original draft preparation, S.-K.K. and J.-H.H.; Review and editing of the manuscript, J.-H.H. The authors read and approved the final manuscript.

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Availability of data and materials
Please contact the corresponding author for data requests. The languages used were Java, XML, Python, Jason, etc., and they were developed using the JVM (Java Virtual Machine), GVM (Geoblus Virtual Machine), and middleware programs. The database was also stored in the cloud using RDB.

Competing interests
The authors declare that they have no competing interests.

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