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Applied Practices on Blockchain based Business Application

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Abstract

With the development of blockchain technology, the scope of blockchain applications has expanded rapidly. Blockchain decentralization allows transaction participants to make transparent and safe transactions without a third trust agency. A distributed ledger-based system enables transparent and trusted business for anonymous users. For this reason, many companies *apply blockchain to various fields such as logistics, electronic voting, and real estate. Despite this interest, there are still not enough case studies confirming the potential of blockchain as a concrete business model. Therefore, it is necessary to study how blockchain technology can change the existing business model and connect it to a new business model. In this paper, we propose blockchain-based business models and workflow types in various fields such as healthcare, logistics, and energy. We also present application cases. We expect to help companies apply blockchain to their business.*

Keywords: *Blockchain based Business Model, Workflow, Blockchain Logistics Service, Blockchain as a Service(BaaS)*

1. Introduction

The blockchain proposed by Satoshi Nakamoto has been mainly used in the financial field [1]. With the development of blockchain technology, the scope of blockchain applications has expanded rapidly [2]. Many companies have started to apply blockchain in their businesses [3]. Blockchain decentralization allows transaction participants to make transparent and safe transactions without a third trust agency. The transaction information verification and sharing system through a distributed ledger in the blockchain enable transparent and reliable business even among anonymous users who do not have a trust relationship [4]. Therefore, many companies apply blockchain to various fields such as logistics, electronic voting, and real estate.

Blockchain provides an immutable record by cryptographically signing blocks containing transactions [5, 6]. The actor configures a P2P(Peer-to-Peer) network in a distributed environment to verify the transaction independently. Furthermore, the actor adds the transaction to the blockchain. In cross-organizational workflow management, the actor must agree to the state of work [2]. This is because it determines the next valid activity of the process. The system uses blockchain transactions to record workflow activities or states. So, to apply blockchain, companies need to consider the workflow in the blockchain business. However, research on blockchain-based business models is very insufficient. Many companies recognize the potential of blockchain.

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However, there are insufficient demonstration cases on how blockchain technology can change existing business models and connect them to new business models. This paper investigated blockchain-based business models and workflow types in various fields such as healthcare, logistics, and energy. We also present application cases. We look forward to helping companies apply blockchain to their business. This paper is organized in the following order. Section 2 explains the blockchain business model. In Section 3, we describe the blockchain business model and workflow. Section 4 mentions application cases. Section 5 remarks future research directions with conclusions.

2. Related Works

2.1 The Blockchain Business Model

A business model is a company's plan or strategy to sell a product or service and profit [4]. Each company creates a business model that meets its business needs. The blockchain business model allows P2P transactions and creates a trusted network. This model uses tokens to generate revenue. The decentralized nature of the blockchain allows it to change and maintain the way business functions in areas such as transaction flow, entity change, and profit. Blockchain business models improve business and benefit end-users.

There are four types of blockchain business models [3]. The first is BaaS (Blockchain as a Service). This model is the most popular. End users do not have to worry about how the blockchain works. Also, end-users do not need to set up the blockchain before working. Businesses eliminate the need for hardware through BaaS. As a result, companies can focus on the development cycle. The second is the token economy-utility token business model. This model uses tokens to power business functions. The best practices of this model are Ripple and Stellar. Banks that are part of the network can use XRP (Ripple) or XLM (Stellar) tokens to facilitate money transfers. These are utility tokens that power the network and facilitate network activity. The third is a blockchain-based software product. Businesses need to purchase a blockchain solution and integrate it into their system. This method will help present new solutions and sell them to larger companies. The fourth is the P2P blockchain business model. This model provides P2P-based business. This allows end-users to interact directly with each other. This business model can generate revenue in various ways, such as BaaS, tokens, or transaction fees. Finally, it is a specialized blockchain service.

3. Blockchain-based Business Models and Workflows

Blockchain technology can reduce transaction costs and prevent data forgery and alteration. In addition, this technology can be combined with various industries to increase efficiency and create new economic value. This section describes blockchain business models and workflows for each field.

3.1 Logistics Service

Figure 1 is a conceptual diagram of a blockchain-based logistics service. Blockchain can be applied to distribution and logistics processes to increase transaction efficiency. In addition, blockchain can share distribution process information with stakeholders through the blockchain platform. Blockchain provides consumers with unfalsified data. TradeLens, developed by Maersk and IBM, is a blockchain-based supply chain management platform [4]. Maritime logistics involves many institutions and organizations. Shipping fees increase through product quantity and quality verification procedures at each stage. In addition, the speed of logistics services slows down. This platform can reduce the risk of forgery by sharing logistics movement information in real-time through blockchain technology. Companies can reduce the time and cost required for the approval process of the logistics transaction process [7].

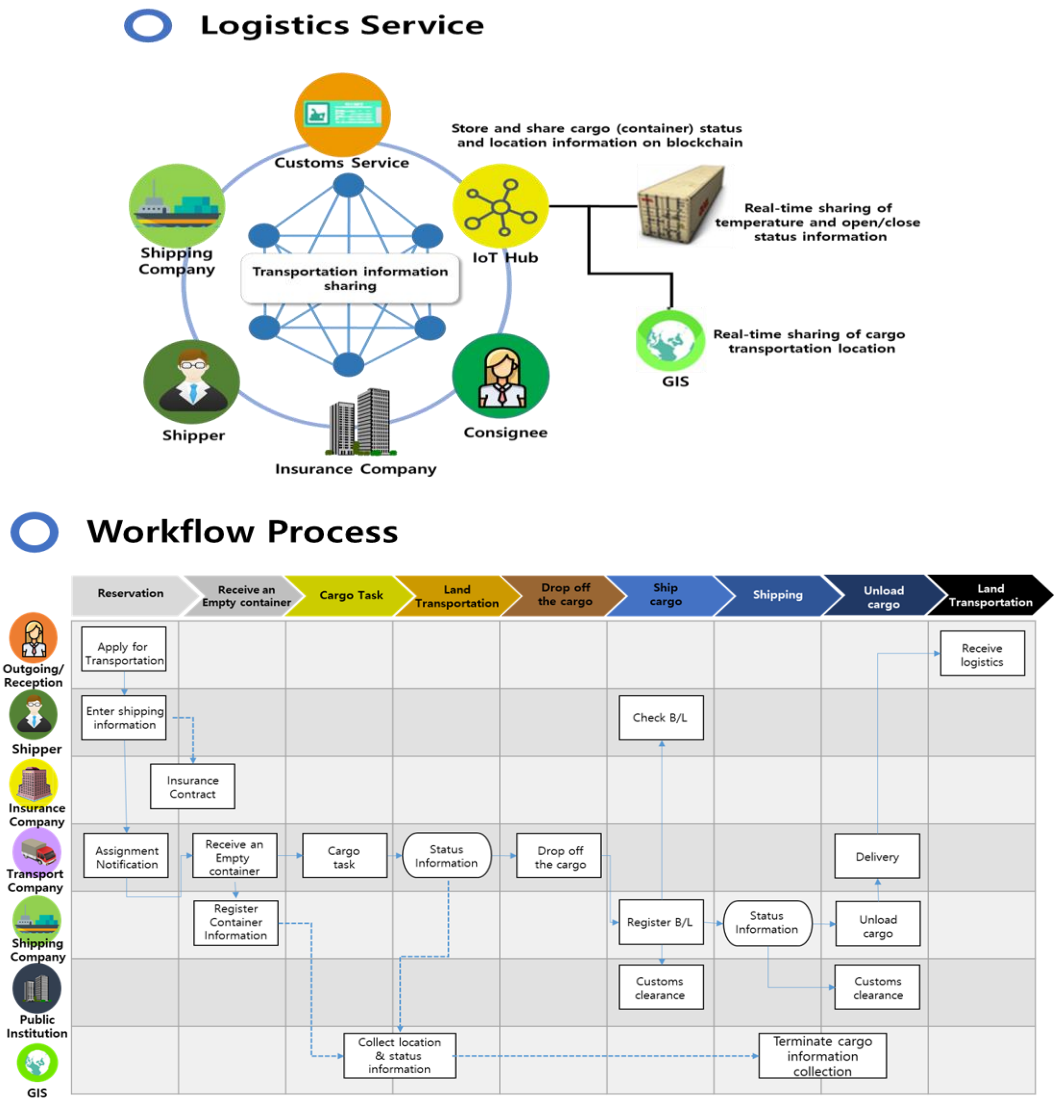

Figure 1. Concept diagram of blockchain-based logistics service

3.2 Energy Service

Figure 2 is a blockchain-based P2P power transaction conceptual diagram. A blockchain-based energy platform can produce, store, consume, and trade between individuals or businesses. The energy trading process uses blockchain technology. The distributed ledger transparently records energy production and sales records. This platform allows anyone to check the transaction details. This is a feature of smart contracts. If certain conditions are satisfied, the user can trade without an intermediate trader. The existing system requires a contract with the central authority, Korea Electric Power Corporation(KEPCO). In addition, since the existing system is a centralized method, transactions between neighbors are impossible. However, the blockchain-based energy platform introduced distributed resources to the intermediary market. Therefore, intermediaries can participate in the electricity market by recruiting small-scale electricity resources. In other words, it connects energy producers and consumers with blockchain technology. Then, it is changing to a peer-to-peer business model that generates revenue when transacting between sellers and buyers. Blockchain-based systems use virtual currencies to incentivize both producers and consumers. This incentive is a fee generated from the transaction. By introducing the incentive concept, we can expect the activation of the eco-friendly energy market [8].

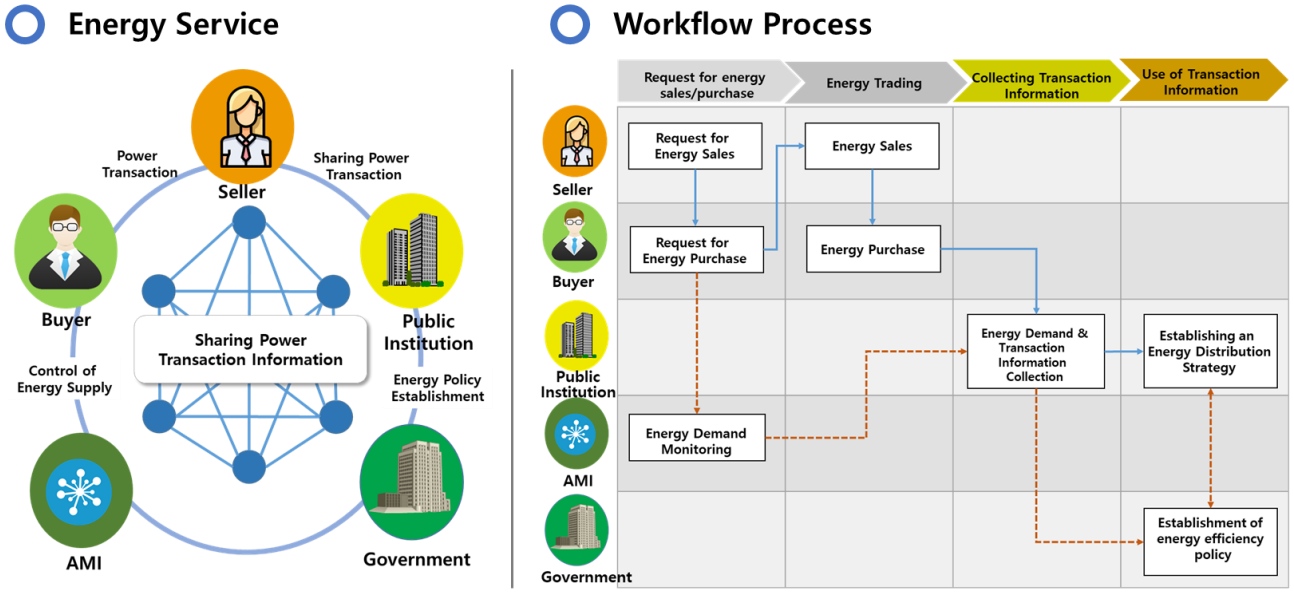

Figure 2. Concept diagram of blockchain-based energy service

3.3 Healthcare Service

Figure 3 is a conceptual diagram of blockchain-based healthcare service. The existing medical information system is operated mainly by medical institutions. However, sharing information outside of medical institutions is not permitted except when a patient requests his/her records to protect personal information [9]. Therefore, as it becomes difficult to transmit and share medical information, patients have to receive treatment in duplicate. In addition, the patient must pay additional medical expenses. Existing systems do not guarantee the reliability of medical data. So, the existing system degrades data usage. Therefore, it is necessary to develop a patient-centered medical information system through blockchain technology. Blockchain can safely store and share personal medical information. Therefore, we can utilize personalized medical treatment and data through blockchain technology. A blockchain-based healthcare service distributes and stores patient medical records. Therefore, this service can maximize treatment efficiency.

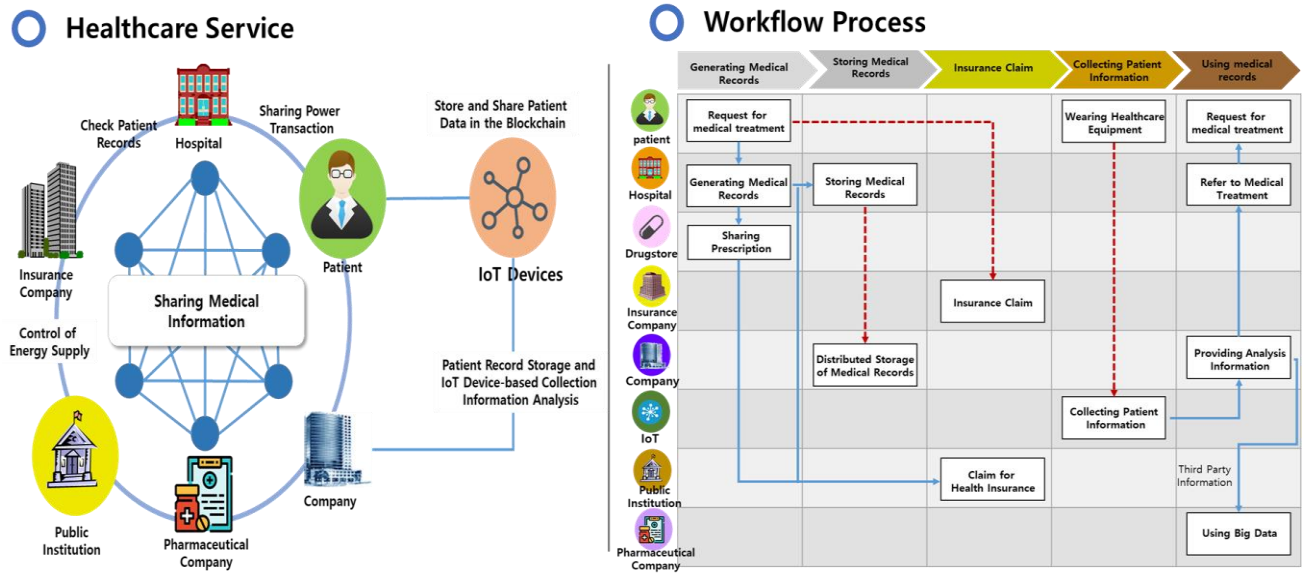

Figure 3. Concept diagram of blockchain-based healthcare service

3.4 e-Voting Service

Figure 4 is a conceptual diagram of a blockchain-based e-voting service. Existing electronic voting does not guarantee the reliability of voting, and forgery may occur due to server attacks [10, 11]. To solve this problem, researchers use blockchain technology. The workflow process of blockchain-based e-voting is as follows. Voters apply to vote and authenticate themselves. Local polling stations store qualified voter data. Public institutions provide services to verify voters. After confirming the voter, the public institution gives the voter the necessary authority (gas) to vote. Voters vote, and the electronic voting counting system conducts electronic voting. The electronic voting counting system aggregates the voting status in real-time. After the voting is over, the Election Commission announces the counting result. Blockchain-based voting systems can expect an increase in turnout and a cost reduction effect. In addition, blockchain is applied to various fields such as intelligent billing, Document & Monitoring services, Property Management Service.

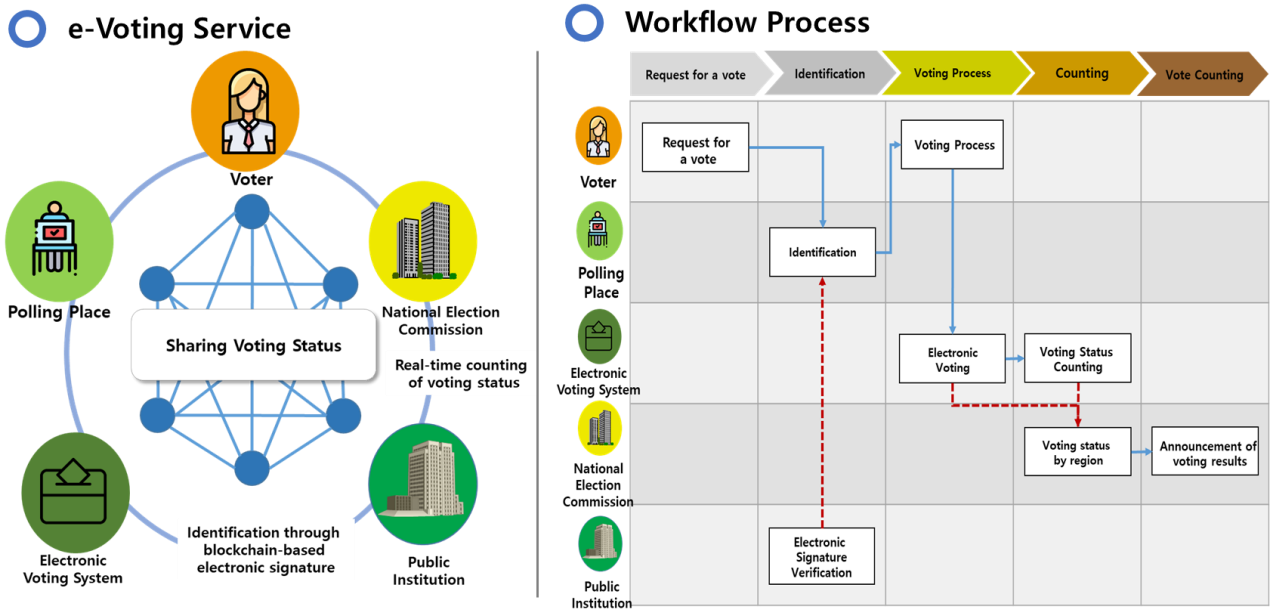

Figure 4. Concept diagram of blockchain-based e-voting service

4. Case Study

We introduce a blockchain-based logistics service case [11]. This case is a blockchain-based service that enables real-time distribution history tracking. It uses the PoN consensus algorithm to record and securely store information about fresh products through blockchain to prevent counterfeiting. Figure 5 shows a blockchain-based logistics service platform [2]. Product information is collected and generated through IoT provided by producers and contains detailed product information. Producers enter information through this platform. The input information is verified again through the platform and stored. This service records environmental information about factors (temperature, humidity, influence) that affect products using IoT technology. This service records and manages the product distribution process in blocks. This process can provide end-to-end logistics services to producers, logistics/distributors, and consumers.

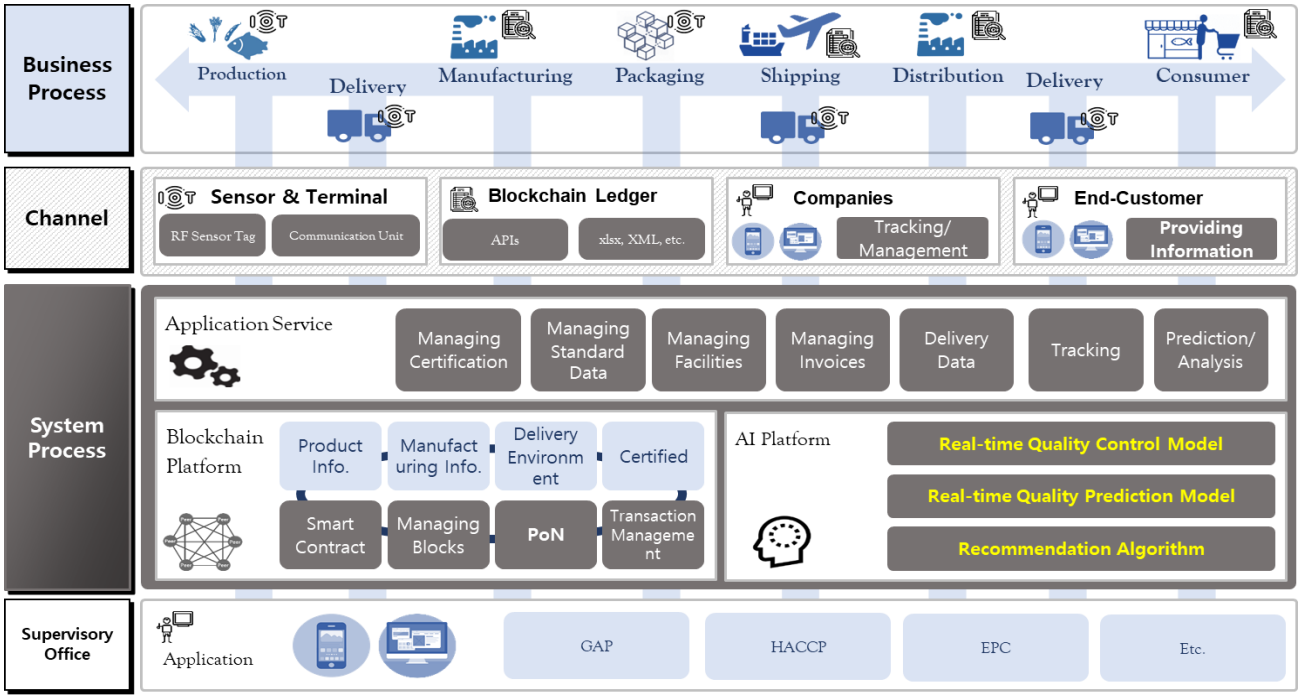

Figure 5. Blockchain-based logistics service platform

Figure 6 shows the business model of a blockchain-based logistics system. The workflow of the product logistics process is as follows. ① A manufacturer makes a product. The manufacturer attaches a unique serial number to each product. ② The manufacturer ships the product to the warehouse. This system utilizes IoT technology to record environmental information such as serial verification, distribution history check, and temperature and humidity in the blockchain during the delivery process. ③ Before shipping a product, the system records the following information on the blockchain: product, production information, outgoing product, delivery address, and transporter information. In addition, the system continuously monitors product status and records product status information on the blockchain. ④ When a product is shipped, the administrator can check the delivery address for each shipped product. The system records the distribution path of the product, temperature and humidity, impact volume information, delivery time, and product quality status information on the blockchain. In this case, the system delivers risk information and prediction information in real-time. ⑤ When product delivery is complete, the system notifies stakeholders of delivery information. The system checks the quantity and genuine product, the product condition, and any deterioration in the transportation process. After acceptance, the system registers product acceptance information. Based on this workflow, we develop a blockchain-based logistics system.

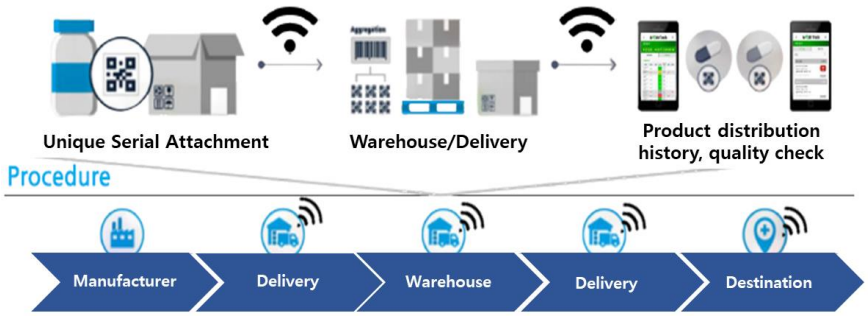

Figure 6. The business model of blockchain-based logistics system

Figure 7 shows the main page of a blockchain-based logistics system. At the bottom of the page are icons for fleet management, temperature and humidity monitoring by order, order management, storage management, accident monitoring and producers. Each icon is linked to a service provided by this platform.

Figure 7. Blockchain-based logistics system main page

Figure 8 is a blockchain-based logistics service monitoring system. The manager checks the overall distribution status and location flow in real-time through the monitoring system. In case of quality abnormality, the system provides information to the administrator via SMS and PSH. The system also detects communication problems with the sensor tag during delivery. By tracking delivery routes and monitoring forgery in real-time, the company can safely deliver products to consumers.

Figure 8. Logistics service monitoring system

5. Conclusion

As blockchain technology develops, many companies apply blockchain to their business areas. Despite this interest, there are still not enough case studies confirming the potential of blockchain as a concrete business model. A company needs to choose a suitable business model according to the nature of the business it wants. Therefore, it is necessary to study how blockchain technology can change the existing business model and

connect it to a new business model. In this paper, to improve these problems, we analyze blockchain-based business models and workflow types in various areas such as healthcare, logistics, and energy. We present application cases. We identified different business models and workflows for each business area. Before applying blockchain technology, companies need to analyze their business area's business model and workflow in detail. Based on the analysis results, companies should apply blockchain technology.

In the future, we will study various business models incorporating blockchain technology.

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