The Implementation of Business Process Blockchain Technology Based of MSCWR SmartBox Model

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Abstract. Blockchain technology uses in many fields, and one of them is logistics. This study aims to propose designing and implementing a blockchain technology-based application for logistics delivery combined with the Internet of Things (IoT) called MSCWR. Logistics and delivery of valuable products have a common problem, and security is also questionable. Therefore, the research process in making prototypes starts by defining the problem, planning, prototyping, testing, and designing validation. The methodology used is User-Centered Design, focus group discussion conducted with business actors directly, and system or prototype development using the System Development Life Cycle framework. As a result, the business processes create using an activity diagram, the features define using a use case diagram, and the screen design to show the prototype development created at an early stage in the research. Finally, the testing conducts to test how well the system is running. In the end, the validation of test results performs in good results.

Keywords: blockchain, logistic, activity diagram, use-case diagram, prototype.

1. Introduction

Blockchain technology integration with the internet of things (IoT), which is becoming more and more prevalent, is one of the many problems that are starting to be solved one by one with this technology as it grows. Blockchain and IoT integration offers a new method of shipping goods. However, there are some issues with the delivery of the goods. For instance, goods that are damaged upon arrival, arrive later than expected, are lost, or do not reach the buyer [1][2][3]. However, delivery (logistics) is a crucial step in the supply chain. The Indonesian government is now concentrating on the logistics issue. As a result, the research works by concentrating on the application of blockchain technology [4]; As in earlier studies, the use of IoT and blockchain technology in logistics [5][6][7][8] which creates a smart device known as MSCWR. It is very feasible to track and trace shipments using blockchain technology and IoT, as reported in earlier studies [9][10][11][12][13]. This research is establishing the foundational business procedures required for smart boxes. The research process begins with interviews with potential users, for example

jewelry stores and money transfer companies, followed User-Centered Design Methodology. The results are that the business requires solutions like real-time tracking of product deliveries and monitoring of product delivery.

This study creates business processes using the SDLC framework. This research produces an image of the testing phase's infrastructure and creates a use case diagram describing the parties involved in creating business processes. The activity diagram will provide a more thorough explanation of the business process and demonstrate how blockchain technology is used in SmartBox MSCWR business processes.

The testing phase makes use of the application's UI/UX design and, finally, the results of the application's testing log. The study results conclude that the design can run well, and the developed business processes might be applied. Given that blockchain technology is a real-time update, tamper-proof, secure, transparent, and distributed information system, its use is very beneficial.

The next phase of this research has not yet begun, so it is still ongoing, which is more about developing a comprehensive application or management information system from MSCWR SmartBox. In order to complete the test results and provide them to the industry or users in the later stages of the research, the results of this study will then be validated directly on the product to the user.

2. Theoretical Framework

2.1. MSCWR SmartBox

A box with Internet of Things (IoT) features attached to it is the MSCWR SmartBox, which is referred to in this study as a SmartBox. Some of the features in MSCWR SmartBox such such as shutting and locking the box (while keeping track of the GPS location), and then documenting the moment and who performed the locking. Smartbox has the ability to provide box status information every minute (adjustable). It has the capacity to offer up-to-date details on where the Smartbox is in real time. has the capacity to restrict smartbox opening to a specific location. As a result, the smartbox will be opened at the designated site and by the designated individual.

2.2. Infrastructure SmartBox Development

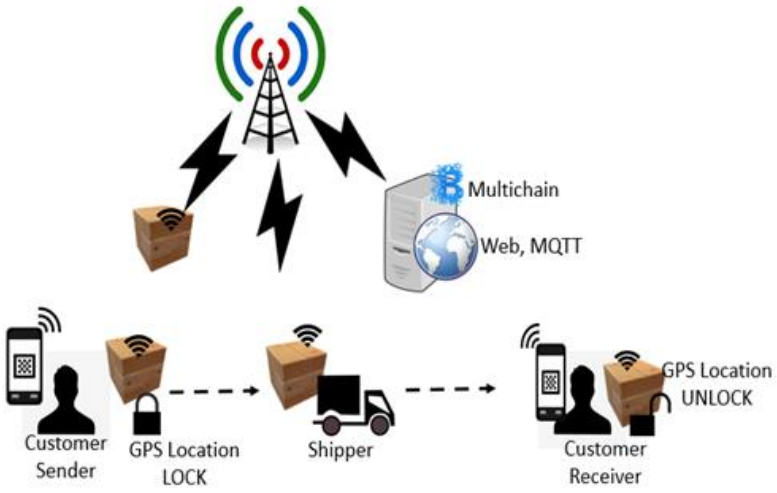

Figure 1. MSCWR SmartBox Infrastructure

Figure 1 depicts how the MSCWR SmartBox research uses the infrastructure design. Figure 1 depicts how the MSCWR SmartBox communicates with the MQTT server directly over a 4G network. The

MSCWR SmartBox mobile application will communicate with the MQTT server, record MSCWR SmartBox activity, and then use the Multichain platform to write that activity to the blockchain [14]. Because GPS location will determine the position of the MSCWR SmartBox, GPS location is crucial to this research. Additionally, the program will keep updating location data from MSCWR SmartBox while it is being shipped by the shipper. The location of an MSCWR SmartBox that has been opened by a known individual will also be determined by GPS (Customer Receiver).

2.3. Diagram of Blockchain Organization

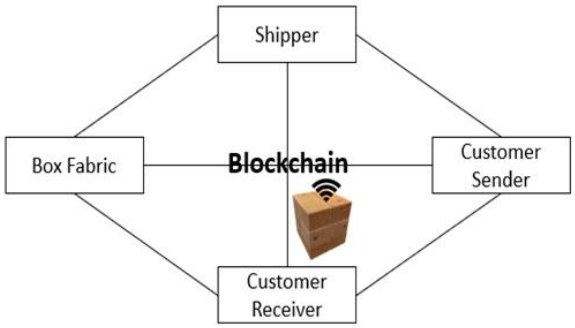

Figure 2. Blockchain MSCWR SmartBox Organization

The MSCWR SmartBox will provide direct access for all parties to information and activities that occur during the business process. Figure 2 illustrates how the organizational structure appears in the MSCWR SmartBox's business process design. The organization that provides the box up until the point of use is Box Fabric. In this instance, the owner of MSCWR SmartBox who registers with the system to make MSCWR SmartBox accessible for users to use or rent is the shipper. The person who completes the order transaction and notifies where the GPS location specified for the box can be opened is known as the customer receiver. The person who will rent the box from the shipper and lock the box is the customer sender.

2.4. Early Research Limitation and Business Model Development

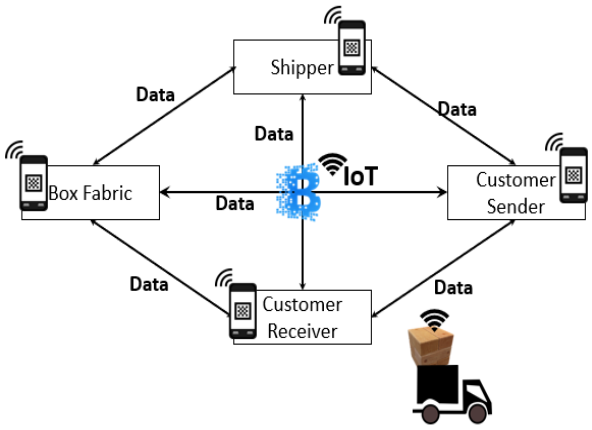

Figure 3. MSCRW SmartBox Process model

Although extensive research has been done in the past regarding IoT tracking, there are still many areas that need to be improved, such as single points of failure [15] that result in centralized data, unreliable data, and information (data or information manipulation) [16][17][18].

In order to address these challenges, the goal of this research is to develop an MSCWR business model and an Internet of Things system based on blockchain technology. As an illustration of how data can be distributed directly using blockchain technology, see Figure 3. Real-time, direct access to all stakeholders, and unchangeable data [19].

2.5. User-Centered Design (UCD)

The study employs the UCD methodology or centers on the user or customer. The objective is for the MSCWR SmartBox results to address customer needs. The UCD process has four stages: user requirements (specify context of use), defining requirements, producing a design solution, and evaluating the design [20].

3. Methodology

3.1. UCD Stages Methodology

The first step in this research is to identify the issue. Literature analysis and FGD with potential users are used to identify problems. It was discovered that there were difficulties with the delivery of goods, particularly valuables. 2) It is necessary to monitor the user requirements and delivery in real-time until the customer receives the ordered goods. The next sentence, which describes application development (prototype) that adheres to the System Development Life Cycle (SDLC) framework, presents produce design and solutions. 4). The final stage is a design evaluation that has also been completed, and the outcomes of the tests conducted directly on the design or application design of the MSCWR Model are shown from the results of the MQTT server logs.

3.2. System Development Life Cycle (SDLC) Prototyping Development

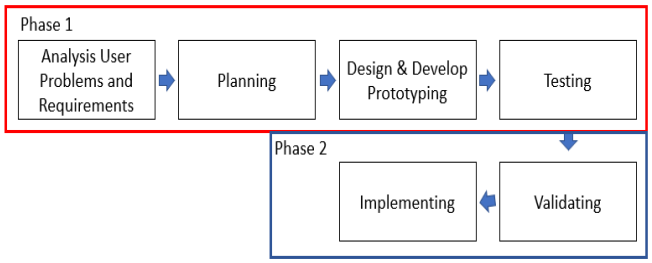

Figure 4. SDLC Prototyping Model

The study's methodology is depicted in Figure 4. The stages described in this article are the findings from the initial phase of research. The System Development Life Cycle (SDLC) theory is the methodology for system development in this study [21][22]. The model uses is a prototyping model.

3.3. User Problems Analysis and Requirements

At this time, business actors (jewelry sellers) and the money delivery sector were the subjects of a Focus Group Discussion (FGD). In previous studies, it was also discovered that logistical issues, such as delayed or damaged delivery of goods.

3.4. Literature Analysis

This is done at this time by looking up relevant literature for application developers, infrastructure development planning, and MSCWR SmartBox development planning. At this stage of planning, brainstorming is done to create a mature design plan that can be implemented.

3.5. Design and Prototyping Development

Several designs are executed at this time:

- Figure 1 depicts the plans for design infrastructure that have been developed and put into practice on a small scale.
- Create an application for the SmartBox MSCWR that is tailored to user needs based on the findings of the FGD that was conducted at the UCD (user requirement) stage.

3.6. Testing Stage

At this stage of testing, it is done on a small scale in a lab rather than on actual users. Phase 2 of this research involves carrying out the user testing plan.

4. Research Result & Discussion

The infrastructure and MSCWR SmartBox application were tested, and the results are presented in this section.

4.1. MSCWR SmartBox Use Case Diagram

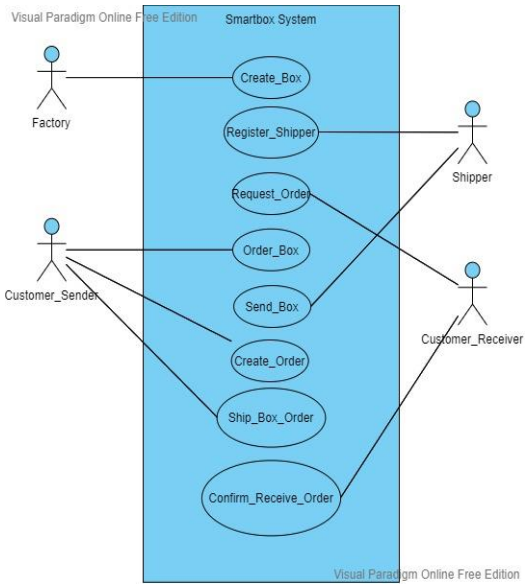

Figure 5. MSCWR SmartBox Use Case Diagram

The use case diagram is shown in Figure 5. It starts with the box being manufactured in the factory and moves on to the shipper registration and box registration. A box belongs to the shipper. Once the shipper and box are registered in the system, the box is made available to the customer for rental.

Senders and receivers are the two categories that customers fall under. The customer sender is a seller of goods who will send the ordered goods after receiving payment from the customer according to the instructions supplied by receiver. Customers who transact and want to ship goods using boxes are known as customer receivers, and they select the boxes.

A person who owns a box and ships goods is known as a shipper. Once the goods are inside the box, the sender can lock it, and the recipient of the goods can only open it at the pre-agreed GPS location. When the box reaches the predetermined GPS location, the keyholder can open it.

4.2. MSCWR SmartBox Activity Diagram

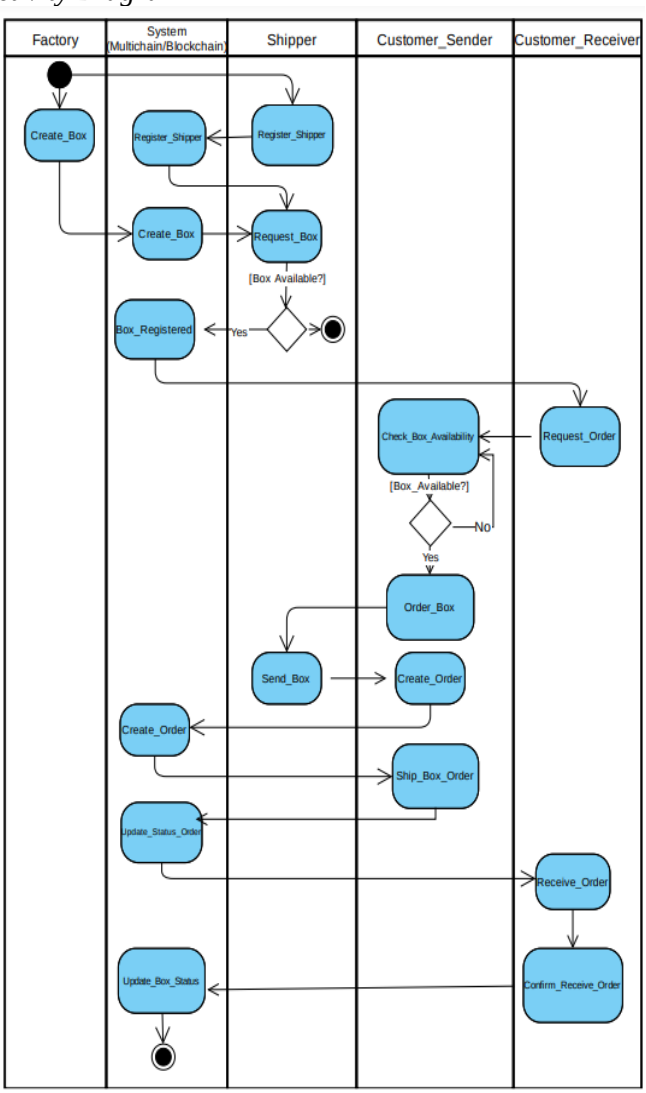

Figure 6. MSCWR SmartBox Activity Diagram

The processes and activities involved in each activity are shown in Figure 6. Box assembly and shipper registration are the first two activities. The box and the shipper are now both ready to conduct business after the shipper registers the box to become the box owner. The customer sender confirms the customer receiver's (buyer's) request, and the transaction starts when the customer receiver decides to use the box and shipper. In order for the transaction take place, the system/application instruct the shipper to deliver the Smartbox to the sender (lock the box). The shipper will turn over ownership of the box to the customer sender after locking it. And based on the GPS coordinates or the address given by the customer receiver, the shipper will deliver the goods. Upon reaching the predetermined GPS location, the box can be opened by the customer receiver (buyer). Then the box will be returned to the shipper.

4.3. MSCWR SmartBox UI/UX Design of Application
This section will show the UI/UX of the application.

- Login Design Screen

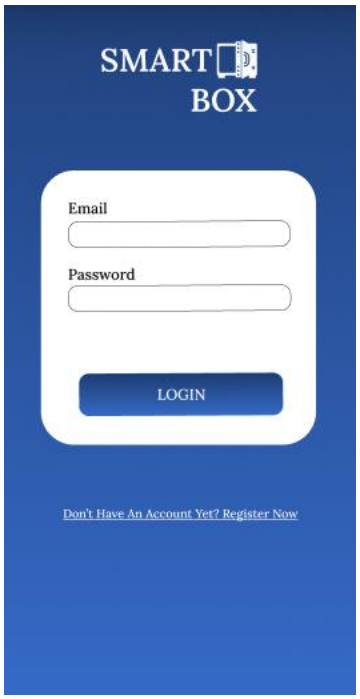

Figure 7. Login Design Screen

To make sure that only users who have registered can use the application, Figure 7 depicts the login page, which is the first page of the program. And the guidelines in the application adhere to the established profile.

- Map Design on SmartBox

Figure 8. Map Design Screen Tracking

A map that will be used to display the box's tracking location is shown in Figure 8. All parties, including the customer sender (seller), shipper, and customer receiver, can see this tracking.

- Scan Box Design Screen

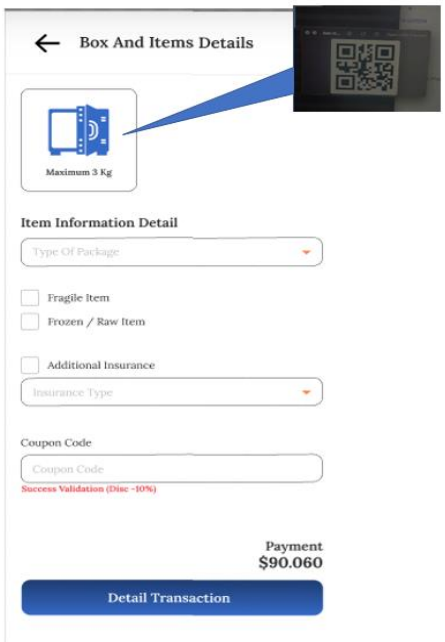

Figure 9. Scan Design Screen

Figure 9 shows how to use the scanner features to open and close the box's lock using the QR code that is attached to it. The box's identity is represented by the QR code.

- Transaction Screen Design.

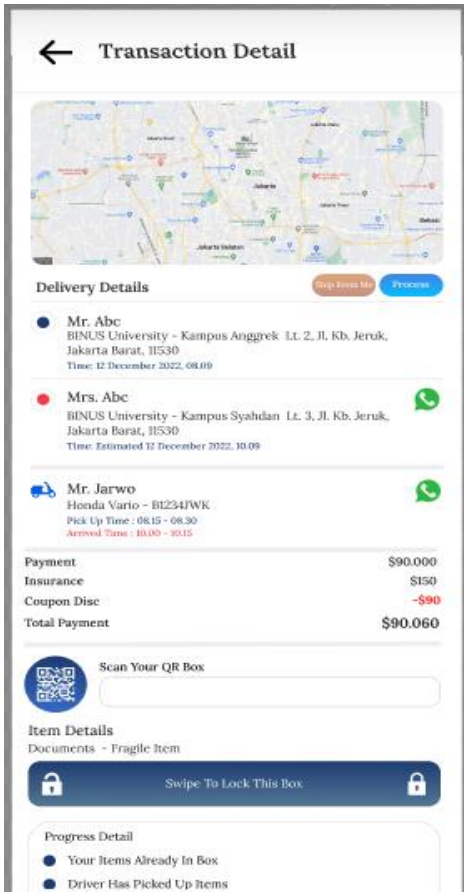

Figure 10. Sender, Receiver and Shipper Transaction Screen

Figure 10 shows the transaction instructions for delivering the box to the recipient as well as shipping items from and to the address.

- Screen Design Status

Figure 11. Status delivery and lock condition

Figure 11. shows current status of box The image depicts the lock status.

4.4. Laboratory Validation and Testing Result

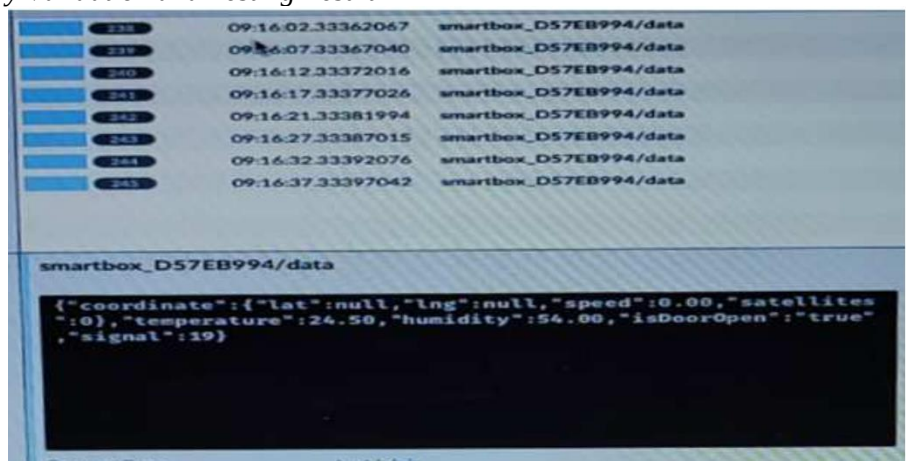

Figure 12. Tracing Result Test of MSCWR SmartBox form MQTT Server log

The results of the MQTT server's testing are shown in Figure 12, and they demonstrate that the MSCWR SmartBox's status is closely monitored, its GPS location can be seen clearly, and it can be determined where it is at any given time.

Name	BOX-0284DBE8
Quantity	1
Units	1
Issuer	owner (1M5Npnk6ETNBqpC4Eny5bMVP8fGTfHdL6YmCtK, local)
status	lock
humidity	12
location	-6.208428,106.7824432

Figure 13. Multichain (Blockchain Apps) status

Figure 13 depicts the box's status (locked) on the specified GPS ordinate, as well as humidity of box level. Verification of prototype design results based on user requirements.

4.5. What is the novelty of this research?

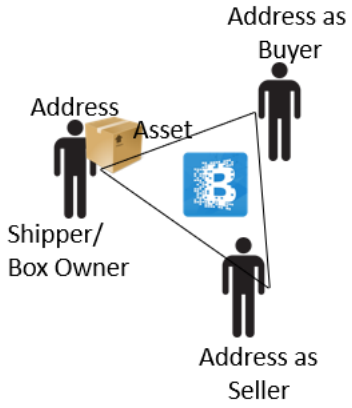

Figure 14. Blockchain Application Structure

Since the Multichain application used for cryptocurrency was used to create the MSCWR Smartbox business process in this study without any changes, it can be inferred from the research that Multichain can be used for enterprise systems. The MSCWR SmartBox is a resource in this study that actors (shipper or box owner, buyer, and seller) assign an address to. It represents a coin. This idea allows for the use of Multichain in the MSCWR SmartBox business model.

Figure 14 shows how to write into a multichain (Blockchain) application so that MSCWR applications can record transactions using the concept of blockchain as a database (Blockchain as database). The image clearly shows that the entity or actor is made up of three parts.

4.6. Discussion

The results of this study show how the implementation of the use of blockchain technology that is integrated with IoT, resulting in a product. The trace and tracing function that has been mentioned in many previous studies [9][10][11][12][13] can be implemented as shown in Figure 12. (log tracking). Stakeholders will receive real-time information about the status of goods delivery using the tracing and tracking features. Because the system's information is constantly updated, the monitoring and security functions have also expanded.

5. Conclusion

This first phase of research has led to the conclusion that the system and application design was done correctly and in accordance with potential user needs and problems. Blockchain technology in conjunction with IoT technology is an excellent solution. The ongoing research will proceed to next phase to validate research result in real condition.

The MSCWR SmartBox application is being considered for integration into the Logistics Management Information System. A 4G network is used for the testing's preliminary stage. A number of other networks, such as LoraWan, Wifi, and Bluetooth technology, will be used for phase 2 testing.

6. Acknowledgment

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