**BMIS2003 Blockchain Application Development**

**Task Description**

Name : Ong Yee Yung ID :2309357

Programme : RSD Group :5

Instruction: Answer **ALL** the questions.

1. Please briefly describe the module(s)/function(s) you engaged in the assignment.

**Retailer Management Module**

The DurianTracking system has the Retailer Management Module, which is very significant in managing the stock of the durian products by the retailers efficiently and safely. The retailers have an opportunity to add detailed harvest information to enable tracking of every single stage which a durian goes through, right from harvest up to sales.

Retailers can:

**Add Harvest Information**: The main retailer fills in crucial information about each durian for a unique ID, variety, time of harvest, days taken to ripen, and all other important details of the produce. This information is then kept safe in the blockchain for assured authenticity and transparency.

**View Records by Durian ID**: Using the durian ID, unique within the system, retailers will look into the record of any durian. The information includes, but is not limited to, harvest dates to statuses, pricing, and other updates which may be affected on the product since it entered into the system. This feature is important in quality control and in tracking the life cycle of the product.

**View All Durian Information:** Retailers can also view a list of all durians that they have added into the system. It gives an overview of their inventory and further allows them to monitor the status, ripening period, or any transactions related to their durian stocks.

The retailer can easily organize all data regarding durians through this module to ensure the information is up to date, verified, and accessible. This would not only build further trust in the supply chain, but it would also mean better coordination on the part of the retailers and the consumers who seek transparency in information regarding the origin and quality of their durians.

1. What are the strengths of the modules/functions created by you?

The strengths of the modules and functions in the DurianTracking platform designed for the Retailer Management System could be underlined from many key aspects, such as:

**1. Blockchain Integration for Data Integrity**

* **Strength:** With the integration of blockchain, durian-related information with respect to the actual harvest, status update, and even the actions by retailers become tamper-proof and are stored in a non-accessible environment. Thus, this makes the information quite correct and tamper-proof, hence bringing transparency right through the supply chain.
* **Benefit:** This can ensure that the retailers and customers are indeed certain information is accurate and checked; therefore, they will have more belief in product quality and with the whole system.

**2. Effective Retailer Authorization System**

* **Strength:** The smart contract flexibly manages the authorized retailers whereby the owner of the smart contract authorizes or revokes the retailer. This function ensures that only trusted and verified retailers can interact with the system.
* **Benefit:** That is another layer of security which will enable participation of only persons authorized in accessing and managing the data of durians.

**3. Detailed Harvest Information Management**

* **Strength:** The retailers can add all detailed information about the harvest for each durian, such as ID, variety, price, time of harvest, time of ripening, and status. This will help build an all-rounded dataset on each single durian, contributing to tracking inventories and quality.
* **Benefit:** In fact, due to the traceable nature of these attributes, the retailers would now have better inventory management, monitoring of ripeness and only good quality produce is allowed to reach the consumers.

**4. Durian Record View By ID**

* **Strength:** The system will also provide full record search and retrieval facilities based on a given durian ID. This will ensure that any information related to the status, location, and quality concerning an individual durian is accessed quickly and clearly.
* **Benefit:** This will save the retailer time in managing the inventory of individual durians, attending to customer inquiries, or doing quality control with minimum sifting through the records.

**5. Overall Durian Information Overview**

* **Strength:** It avails all records concerning durian for a view by the retailer. Hence, he is allowed an overview of his stock in store. It would make tracking for stock quite easy with this functionality regarding the stage of ripeness and overall durian lifecycle.
* **Benefit:** Therefore, allow the retailer to plan better in terms of sales, rotation of stock, and when such stocks will have reached their desired level of ripeness, so that marketing and sales can be done at the right time.

1. What are the weaknesses of the modules/functions created by you?

Though there are several strengths with the Retailer Management Module in functions of the DurianTracking system, the following may also be considered as weaknesses or areas for improvement:

**1. Blockchain Complexity**

Weakness: While blockchain ensures security and transparency, it also introduces a certain level of complexity, especially for those non-technical users. Those retailers who are not familiar with blockchain can hardly conceptualize the notion behind this technology and therefore may be affected in terms of user adoption.

Impact: This may imply the need for training for retailers on how to use the system; blockchain benefits may be hard to explain in terms to which retailers and consumers can relate.

**2. Limited Off-Chain Integration**

Weakness: Given the decentralized nature of blockchain systems and the fact that they maintain data on-chain, there could be a lack of seamless integration with off-chain systems, such as traditional databases or ERP systems that a retailer might currently use.

Impact: This could lead to some issues of data synchronizing between the blockchain system and the retailers' inventory management or accounting software. This leads to operational inefficiencies.

**3. High Smart Contract Interaction Gas Fees**

Weakness: Every interaction with the blockchain comes with a transactional fee for gas, either for adding information of harvests or durian status updates, subject to change on public blockchains such as Ethereum, further raising the operating costs of retailers.

Impact: The potential impact is a reduction in the frequency of updates by retailers due to high costs, thus reducing the effectiveness of the system in ensuring real-time data and full transparency.

**4. Potential for Poor User Experience During Network Congestion**

Weakness: A system utilizing a public blockchain may be susceptible to congestion-related flaws within the network that result in slow transaction processing times, such as adding data regarding a harvest or viewing the history of durians.

Impact: This might also make retailers experience delays, reducing their capability to refresh the information or access it in time, which may influence their decisions or interactions with customers.

**5. Limited Control Over Transaction Finality**

Weakness: Blockchain transactions cannot be easily changed or reversed once they have been confirmed. While this enforces immutability, it can turn out to be a weakness if wrong data has been entered or a retailer makes an incorrect entry in respect to harvest or durian information.

Impact: The feeding of data has to be done very carefully by the retailers as correction of lots of mistakes is impossible or it can only be made by adding new transactions. This may cause redundancy and mess up the data.

1. What have you learned in doing this assignment?

**1. Deepened Blockchain Integration Understanding**

Lesson: Blockchain technology offers powerful features like immutability, transparency, and decentralization, which are particularly beneficial in supply chain systems like the DurianTracking system. However, the practical application of blockchain also presents challenges, such as gas fees, network congestion, and the learning curve for both developers and end users.

**2. Smart Contracts into Practical Use**

Lesson: The development and deployment of smart contracts in a retailer management module highlighted efficient design consideration of a contract. Specifically, functions like granting authority to retailers, tracking durians, and updating need to be well-structured so that they minimize the high costs, which in this case are gas, providing smooth interaction among users.

Takeaway: In fact, smart contract development requires consideration of each function in terms of deep economic implications in addition to coding skills, which are crucially important in a public blockchain environment.

**3. Data Integrity and Transparency across the Supply Chain**

Lesson: In the case of durians for example, or other products whose life cycle is traced on the blockchain, it won't be possible to tamper with the data. That creates complete transparency along the supply chain.

Takeaway: This technology is going to flip on its head the conventional ways that industries which rely on the quality and provenance of its products, like agriculture or food supply, make sure the integrity and consumer trust are there.

1. What are the challenges, if any, faced by you while working on this assignment?

**1. Gas Fee Optimization Problem**

**Challenge:**Since each interaction with the blockchain incurs some gas fees, which are expensive. Therefore, the frequent updates like adding harvest information or modify the time lock in smart contract functions for reducing the cost of such transactions.

**Solution:**

I have optimized the contract to include certain updates to be grouped into single transactions, and efficient data structures were used to minimize gas usage.

**2. Testing and Debugging Smart Contracts**

**Challenge:**

Debugging smart contracts is more difficult than traditional applications because of the immutability of the blockchain, added to which each test requires the payment of gas. Smart contracts should be heavily tested before deployment to avoid costly mistakes.

**Solution:**

This has been mitigated by utilizing local test environments, such as Ganache, that are capable of emulating real blockchain interactions sans fees. It helps in the early detection of most of the errors and assures that the system operates correctly before it goes live on the mainnet.

Signature: OYY Date: 22/9/2024