Title

Using private blockchain technology to enhance the security of location-tracking systems in the supply chain.

Background

In modern supply chain management, traceability of the physical location of goods has become recognized as a pivotal component. Nevertheless, it's significant, because of the complexity of the supply chain system and traditional centralized models, location-tracking systems have a lot of challenges in modern technologies.

Blockchain technology, due to its nature of decentralization and immutability, has emerged as an attentional solution to address the limitation of typical location-tracking systems. It offers enhanced data integrity, data transparency, and reliability, which makes it an excellent candidate for improving location-tracking mechanisms(Helo & Hao,2019).

By leveraging blockchain's features, stakeholders can access real-time and tamper-resistant location data, ensuring accountability and establishing a secure and efficient location-tracking ecosystem (Assaqty, M.I. et al*.,* 2020).

Problem definition

The main problems dealing with this research proposal are the inefficiency, lack of transparency, and privacy in modern location-tracking systems. In logistic industries, it is common that these systems are based on centralized database management technologies. This CDB(centralized database) can be vulnerable to security threats and data manipulation, leading to inaccurate or tampered location data. Compromises the reliability of location-based processes, hindering decision-making and potentially resulting in financial losses and falling out of confidence between entities (Manurung, Yudoko & Okdinawati, 2023).

Furthermore, guaranteeing the privacy of location data while providing necessary access to authorized parties presents a challenge. When sharing location data across multiple stakeholders, the balance between data privacy and transparency is essential.

Although blockchain technology is a good candidate for some of the above issues, there are obvious cons depending on the type of blockchain. The public blockchain is the most popular and common type in use. However, it requires heavy energy and cost to maintain them (Assaqty, M.I. et al*.,* 2020). Another problem is its lack of privacy as it's shared over the public network.

Research direction, i.e. what will you intend to accomplish?

The intention of this research is to explore the use of non-public blockchain technology and construct the foundation of blockchain-based logistic location-tracking systems. Also, build an app to simulate the project outcome.

1. Literature Review: Conduct and investigate more comprehensive reviews to have an in-depth understanding of different types of blockchain technologies. Research typical location-tracking systems and existing blockchain-based location-tracking systems to find their advantages and limitations.

2. Design: Based on the research outcome, select blockchain technology that fits the purpose of our project. After that design the architecture of the blockchain-based location-tracking systems and smart contracts.

```
{
orderId: String;
product: ProductInfo;
origin: Address;
delivery: Address;
requestPickupDate: String;
requestDeliveryDate: String;
shipper: {
 shipperId: String;
 createdAt: String;
 updatedAt: String;
 shipperSignature: Sha256 || Encrypted_String;
}
carrier: {
 carrierId: String;
 carrierType: String;
 carrierSignature: Sha256 || Encrypted_String;
 pickupDate: String;
 deliveryDate: String;
 location: {
  lat: Number;
  long: Number;
 }
}
createAt: String;
status: 'Haulier Confirmed', 'In Transit', 'Delivered', 'POD', 'CANCEL';
podSignature: Sha256 || Encrypted_String;
prev: Sha256 || Encrypted_String;
}
```

Figure 1. Early draft version of the contract.

3. Prototype: Develop an Android app prototype to create location data and smart contracts

4. Assessment:: Evaluate and compare the traditional location-tracking system with the prototype. Key metrics can be possibly data integrity, resistance to tampering, and transparency.

References

Helo, P. and Hao, Y. (2019) ‘Blockchains in operations and Supply Chains: A model and reference implementation’, *Computers & Industrial Engineering*, 136, pp. 242–251. doi:10.1016/j.cie.2019.07.023.

Assaqty, M. I., Gao, Y., Hu, X., Ning, Z., Leung, V. C., Wen, Q., & Chen, Y. (2020). Private-blockchain-based industrial IOT for material and product tracking in smart manufacturing. *IEEE Network*, *34*(5), 91–97. https://doi.org/10.1109/mnet.011.1900537

Manurung, H., Yudoko, G., & Okdinawati, L. (2023). A conceptual framework of supply chain resilience towards sustainability through a service-dominant logic perspective. *Heliyon*, *9*(3), e13901. https://doi.org/10.1016/j.heliyon.2023.e13901