

Blockchain Technology for e-Marketplace

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Abstract—We developed a blockchain-based E-marketplace. A decentralized E-marketplace platform utilizing the blockchain technology is implemented. We use the self-enforcement of smart contracts to secure the deposit and process the payment. Each transaction is verified through the blockchain and is recorded to the decentralized ledger. This enables trustless transactions since the smart contract is self-executed. The smart contract is able to perform credible transactions without trusted third parties, and the transactions on the blockchain are trackable and irreversible. Therefore, both the buyer and the seller cannot breach the contract. All processes are recorded on the blockchain including the product launch, purchase, delivery, and payment. It is trackable and could be submitted to courts as electronic evidence to solve the transaction disputes.

Index Terms—Blockchain, E-marketplace, smart contract

I. INTRODUCTION

Blockchain technology, the foundation of Bitcoin [1], is a decentralized ledger technology which performs the transfer, verification, communication, and storage of networked data through distributed nodes without relying on trusted third parties. In blockchain technology, each transaction block which contains the information of transaction and timestamp is depending on the cryptographic hash of the previous block, organizing as a time-related cryptographic hash chain. The blockchain is immutable based on strict cryptography. Not only the digital currency [2], the blockchain technology also provides a promising environment for enforcing the smart contract [3]. Various blockchain-based applications have been proposed such as smart healthcare [4] [5], digital assets management [6], Internet of thing (IoT) [7] [3], supply chain management [8], and crowd fundraising [9], etc.

The applications of blockchain technology mentioned above have several advantages including:

- Public:

Everyone can participate in the execution of the consensus protocol to become a validator.

- Decentralized:

Every validator node is an administrator of the blockchain. The participants are free to join or leave the peer-to-peer network.

- Immutable:

Blockchain technology is based on cryptographic mechanisms. Every transaction is recorded in the blockchain by the hash-based consensus protocol. The transactions written into the blockchain cannot be changed.

- Smart contracts:

A smart contract is a computer protocol running on the blockchain. It aims to digitally facilitate, verify, or enforce the negotiation or performance of a contract. [10]

II. RESEARCH ISSUE

The current e-marketplace ecosystem evolved from Internet technologies. It plays an important role in the global economy. According to the current environment and situation of the e-marketplace, we focus on the following research problem:

- 1) Pervasive computing:

The popularity of smartphones has dramatically changed the consumer behavior of today's e-commerce. From the advertisement of a sport game to the purchase and delivery of sport tickets and the entering to the stadium can all be done on a smartphone. Pervasive computing provides accesses to the context-related information for making instant adaptations to the rapidly changing mobile e-commerce. [11].

- 2) Monopoly:

There is a lot of price-based information asymmetry in traditional businesses. Major e-commerce platforms have caused monopoly, resulting in high commissions, price control, and disclosure control. Furthermore, user purchasing behavior are collected to infer user information, causing privacy concerns. Especially, Amazon's employees leaked data for bribes in China recently.

- 3) Cross-border e-commerce:

The payment is inefficient, slow, and costly for banks and businesses in cross-border e-commerce transactions.

Subramanian [12] believes that the decentralized blockchain-based electronic marketplace can offer many advantages for e-marketplace participants, including security, trust, privacy, lower transaction costs, and transaction integrity.

III. PROPOSAL

We utilize the blockchain technology to develop a decentralized E-marketplace platform. We utilize the self-enforcement of smart contracts to secure the deposit and process the payment. Each transaction is verified through the blockchain and is recorded to the decentralized ledger. This enables trustless transactions since the smart contract is self-executed.

The smart contract can perform credible transactions without trusted third parties, and the transactions on the blockchain are trackable and irreversible. Therefore, both the buyer and the seller cannot breach the contract. All processes are recorded on the blockchain including the product launch,

purchase, delivery, and payment. It is trackable and could be submitted to courts as electronic evidence to solve the transaction disputes. Blockchain-based e-marketplace enables information sharing, co-certification, and storage transaction for all participants on the network. It can connect seller and buyer each other directly, so it can reduce commissions and improve the transaction efficiency. These applications provide more convenient consumption process for user. However, it is very important for the consumer experience.

The smart contract is a protocol to establish a binding between the seller and the buyer, and the executions of the smart contract are triggered by events. The triggers can be internal events like the payment from the buyer to the seller via the cryptocurrencies, or external events such as redeeming a coupon from a buyer. For instance, brands coupons are often not honored by the chain stores, leading to negative consumer experience and negative impact of brand image.

We adopt EOS.IO [13] as our testbed, which provides infrastructures for running decentralized applications and is very efficient, processing millions of transactions per second. EOS.IO implements the delegated proof-of-stake (DPoS) with Byzantine fault tolerant consensus algorithm rather than the traditional proof-of-work consensus algorithm to reduce the transaction latency and improve the transaction volume. The EOS.IO only needs the top-21 block producers, which are selected by continuous voting of EOS token holders, to achieve consensus.

The seller uploads items via web user interface, and the item information will be written to smart contract such as item title, item description, and price. The self-enforcement of smart contract will secure the deposit and process the payment when the buyer purchases the item. After that, smart contract retakes security deposit when the buyer picks up, the seller will get the token and the buyer will get the item at the same time. In the other hand, smart contract will confiscate the secure deposit of the buyer if the buyer does not pick up.

All processes are recorded on the blockchain including the product launch, purchase, delivery and payment when the transaction finish. Therefore, smart contract self-enforces that both the buyer and the seller cannot breach the contract.

E-marketplace services providers do not provide free service. The decentralized application and the smart contract need cost for the maintenance. We proposed a fee-splitting solution. The developer of decentralized application could be paid a small percentage of transaction fee from both the buyer and the seller.

IV. CONCLUSION

The pervasive applications are able to improve the customer experience by the efficient delivery of the content and the rapid responses to the customers' demands. Therefore, to have a better experience in pervasive e-commerce, it is very important to ensure the normal execution of all aspects to complete the purchase.

We believe that the blockchain-based E-marketplace can offer many advantages for e-commerce, that will bring some

benefits such as increase traceability, tamper resistant, and ensures that trust is achieved without the need for centralized power. It also means that consumers have greater transparency and power. There is no central control, which prevents from the monopoly of large companies. The smart contract brings some benefits are overbooking prevention, double-spending prevention, lower transaction costs, and fraud prevention. As we know, bitcoin is the first cryptocurrency and it is truly borderless. It also means the payment will be efficient, fast, and cost-reduced for blockchain-based electronic marketplace.

Currently, we are wrapping up our system, blockchain technology, and decentralized application to build a public chain for future experiments. We also anticipate the application of blockchain technology in mobile computing advertising.

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