USE OF SMART CONTRACTS AS DIGITAL CONTRACTS IN E-COMMERCE

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ABSTRACT

With the growing emphasis on applications of e-commerce, the rapid increase in the smart contracts is experiencing the significant expansion of Block-chain Technology which enhances trustworthiness, automate transactions, increase efficiency and security in online market places. **Smart contracts are digital contracts stored on a blockchain** that are automatically executed when predetermined terms and conditions are met. Smart contracts can also be used to ensure secure and transparent payments and shipping, eliminating the need for trust between parties. This can greatly reduce the potential for disputes and improve the overall buying and selling experience. Smart contracts as digital contracts uses the online market places such as e-commerce platforms with a decentralized environment which benefit small business giving them access to a global market. Smart contracts are the computer programs which establishes a connection between only buyer and seller (enforces agreement between the parties) without the intervention of the third party using the Block-chain technology. This paper explains about the development of smart contract, working mechanism of smart contracts with a simple logic, how the block-chain technology is important to make a connection between two parties on a decentralized network using different tools. It also focuses on the major role of EDA usage in smart contracts which focuses on existing framework of EDI where smart contracts are integrated into it to provide multiple benefits including more accurate and reliable business transactions. A model of e-commerce payment system by the concept of smart contracts using block-chain technology is described which gives the clear usage of decentralized networks.

Key Words: Block-chain Technology, Dapps, Cryptocurrency, Ethereum, Solana, Solidity, EDI, IOT, AI-Powered smart contracts, DeFi

1. INTRODUCTION

The world of blockchain has grown from a niche interest to a universe of possibilities, and the use of smart contract design patterns has been an important part of that growth. In recent years, e-commerce has experienced exponential growth, transforming the way we shop and do business. According to Verified Market Research, the smart contract market is projected to reach $770 million in value by 2028, up from its $145 million dollar value in 2020.These contracts add tremendously to the utility, enforceability, and possibility of a web3 world. For example, decentralized applications, or dApps, are applications that run on a blockchain network using the technology of smart contracts to complete transactions.

However, this growth comes with challenges, such as trust issues, payment disputes, and inefficiencies in transaction processes. Smart contracts, powered by blockchain technology, offer a revolutionary solution to these problems, enhancing trust and efficiency in the e-commerce ecosystem.

2. PROBLEM SOLVED BY SMART CONTRACTS

Written contracts are common in businesses of all sizes and industries, but they can often be cumbersome and a source of commercial and legal disputes. Smart contracts provide an effective solution to these traditional contracts by simplifying business and commerce between parties without requiring an intermediary. This results in **reduced formality and costs while maintaining credibility, security, and authenticity**. Challenges of smart contract implementation in e-commerce:

- Technical Complexity: Developing and deploying secure smart contracts requires expertise in blockchain development.
- Scalability Issues: High transaction volume on a blockchain can lead to network congestion and higher fees.
- Regulatory Uncertainty: Legal frameworks surrounding smart contracts are still evolving.

3. DEVELOPMENT OF SMART CONTRACTS

The development of digital contracts and smart contracts is a significant paradigm shift in how contracts are formed, executed, and enforced. A digital contract is simply the electronic version of the traditional paper contract, but a smart contract works on an advanced level using blockchain technology to automatically enforce contractual terms without human intervention.

Smart contracts are a type of software program developed to facilitate, authenticate, and execute the execution of an agreement through the use of blockchain technology. The conditions for the agreement are encoded and placed on a blockchain and, therefore, are self-enforcing when the specified conditions are met. This kind of contract is therefore termed self-executing, Smart contracts are self-executing digital contracts that define the terms of a blockchain transaction using code.

Working methodology of smart contracts is based on blockchain technology: Blockchain technology can help an e-Commerce business to gain confidence in online payments. With the cryptocurrency in place, you can introduce a secure, accurate, and quick payment method in your business. The goal of a smart contract is to simplify business and trade between both anonymous and identified parties, sometimes without the need for a middleman. A smart contract scales down on formality and costs associated with traditional methods, without compromising on authenticity and credibility. This technology can help an eCommerce business to gain confidence in online payments. With the cryptocurrency in place, you can introduce a secure, accurate, and quick payment method in your business.

Smart contracts are computer protocols running on top of blockchain intended to digitally facilitate, enforce, or verify the performance or negotiation of a contract. The protocol and the agreements contained therein exist across a decentralized and distributed blockchain network. Smart contracts in Web 3.0 e-commerce can automate and secure transactions, streamline processes, enforce agreements without intermediaries, enhance transparency, and reduce the risk of fraud. Coin is one of India's first web 3 e-commerce crypto based platform. This uses smart contracts which plays a huge part in transforming the web 3 landscape. While smart contracts have yet to be widely adopted, their numerous advantages cannot be overlooked. Exploring five key benefits of employing smart contracts are

- **Enhanced Security**

Blockchain transaction records are highly secure due to encryption, making it challenging to hack them. Smart contract development services and smart contract security are essential for businesses that want to leverage this technology additionally, since each record is connected to the previous and subsequent records on a distributed ledger, altering a single record would require hackers to modify the entire chain.

- **Automation and Innovation**

Smart contracts have the capability to automate the movement of digital assets and payments, potentially leading to new products and business models in the fintech industry. For instance, smart contracts can facilitate agreements allowing daily payments rather than the conventional weekly or monthly payments in the industry. Solana smart contracts are utilized on the Solana blockchain, and numerous smart contract platforms, such as Ethereum and Cardano, offer developers the ability to create and deploy their own smart contracts.

- **Increased Efficiency and Accuracy**

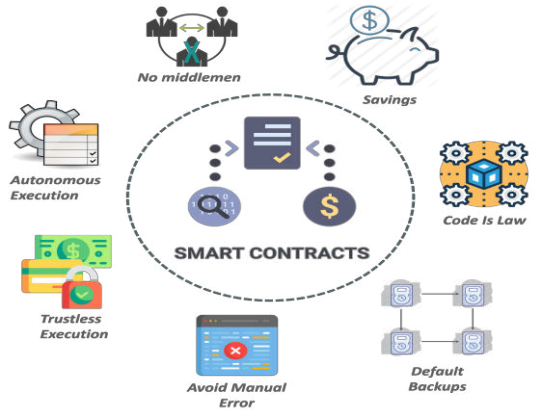
Smart contracts are instantly executed once the specified condition is met. Since smart contracts are digital and automated, there is no need for manual paperwork processing, which eliminates time spent reconciling errors commonly resulting from manual document completion.

- **Reduced Costs**

Smart contracts eliminate the need for intermediaries to facilitate transactions, resulting in a cost-free execution process without time delays and associated fees.

- **Improved Transparency and Trust**

As there is no involvement of a third party and transaction records are encrypted and shared among participants, there is no need to suspect any alteration of information for personal gain.



A smart contract architecture in e-commerce typically involves a system where the terms of a sale, including payment and delivery conditions, are directly written into computer code on a blockchain, allowing for automated execution of transactions once specific criteria are met, eliminating the need for intermediaries and ensuring transparency and security throughout the process.

Key components of a smart contract architecture in e-commerce:

- Blockchain Platform: The underlying blockchain network where the smart contract code resides, facilitating decentralized storage and verification of transactions.
- Smart Contract Code: The code defining the rules and conditions of the sale, including details like payment amount, delivery deadline, and dispute resolution mechanisms, written in a language like Solidity.
- Buyer and Seller Identities: Digital addresses on the blockchain representing the buyer and seller involved in the transaction.
- Escrow Function: A mechanism where funds are held in a neutral account until the delivery conditions are met, ensuring that the seller only receives payment once the goods are delivered.

Oracle Integration (Optional): A system that allows the smart contract to access external data (like tracking information from a shipping company) to trigger actions based on real-world events**.**

4. WORKING OF A SMART CONTRACT

A smart contract acts as a digital contract which consists of its own address in it with the security coding of

the blockchain has details and permissions written in code that require an exact sequence of events to take place that trigger the agreement of the terms mentioned in the contract. It can also include the time constraints that can introduce deadlines in the contract. The contract can be interacted with by using its address presuming the contract has been broadcasted on the network.

Working of a smart contract in e-commerce include, Initiating a Purchase, When a customer places an order on an e-commerce platform, a smart contract is created on the blockchain with the relevant details of the sale (product, price, delivery address), Payment Initiation, the buyer initiates a payment to the smart contract, which holds the funds until the delivery conditions are met. Delivery Verification, Once the seller ships the product, they provide tracking information to the smart contract, which verifies the delivery status through an oracle if necessary. Funds Release, if the delivery is confirmed, the smart contract automatically releases the funds to the seller.

Example which releases a product in e-commerce to a customer, once payment is verified on the blockchain, eliminating the need for a third-party intermediary to manage the transaction; essentially, the smart contract acts as a digital agreement that automatically delivers the product once payment conditions are met, ensuring immediate access for the buyer and secure payment for the seller.

Logic within Smart Contract by using, IF-THEN for example:

- **IF** you send object A, **THEN** the sum (of money, in cryptocurrency) will be transferred to you.
- **IF** you transfer a certain amount of digital assets (cryptocurrency, for example, ether, bitcoin), **THEN** the A object will be transferred to you.
- **IF** I finish the work, **THEN** the digital assets mentioned in the contract will be transferred to me.

Key Components of a Smart Contract

A smart contract consists of several key components such as participants which are the entities that interact with the contract. Participants can be people, systems, or other smart contracts. Next component is the state i.e., the current status of the contract. The state changes as participants interact with the contract. Third component is the functions that are the operations contract can perform. Functions are triggered by participants and can change the state of the contract. Last component is the rules,the conditions that govern how the contract operates.

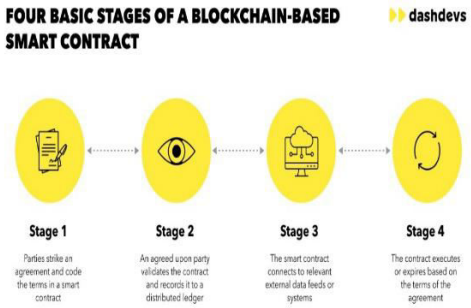
Rules are written into the contract's code and must be satisfied for functions to be executed.

Structure of a Smart Contract with an Example considering a simple smart contract for a sale:

- The participants are the buyer and the seller.
- The state includes variables for the buyer, seller, price, and item status.
- The functions might include 'initiate Sale', 'confirm Payment', and 'deliver Item'.
- The rules might specify that 'confirm Payment' can only be executed if the item status is 'for sale', and 'deliver Item' can only be executed if the item status is 'sold'.
- The events might include 'Sale Initiated', 'Payment Confirmed', and 'Item Delivered'. Each of these events would trigger an update to the item status.

5. SMART CONTRACTS IN BLOCK-CHAIN TECHNOLOGY

A "smart contract" in the context of an e-commerce website is a digital contract that utilizes blockchain technology to automatically execute the terms of an agreement between a buyer and seller, eliminating the need for intermediaries and ensuring transparency and security in online transactions, all coded directly into the system and enforced by the blockchain itself; essentially acting as a self-executing, automated contract where conditions are met and actions are triggered automatically once specific criteria are fulfilled. Smart contracts are self-executing contracts with terms directly written into code, running on blockchain networks. In e-commerce, they automate transaction processes, ensuring transparency, security, and efficiency by eliminating intermediaries and reducing the potential for human error. In e-commerce, a "smart contract" is a self-executing contract with terms written directly into code and run on a blockchain network, automating transaction processes between buyers and sellers, eliminating the need for intermediaries and ensuring transparency, security, and efficiency by minimizing human error involved in traditional agreements; essentially, it is a digital agreement that automatically executes when predetermined conditions are met. A smart contract operates as a self-executing code that automatically enforces and performs contractual terms once predefined conditions are met. Its primary functions include automating processes, which reduces the need for intermediaries and minimizes human error by executing transactions and actions based on coded rules. Smart contracts facilitate trustless transactions, allowing parties to interact without needing mutual trust, as the contract’s execution is governed by code and blockchain verification. They also ensure the secure and transparent execution of agreements, as all transactions are recorded on a public ledger that is immutable and transparent. Furthermore, smart contracts reduce costs by eliminating traditional fees associated with contract enforcement and transaction processing. They enable the creation and management of decentralized applications (dApps) and complex financial operations, such as token transfers, asset management, and compliance with regulatory requirements. Through these functions, smart contracts enhance efficiency, security, and trust in various blockchain-based transactions and applications.



The smart contract is written in virtual language and has the power to execute and enforce itself, autonomously and automatically, based on a series of programmed parameters. With blockchain technology, its main value lies in reinforcing security, transparency and trust between signatories, avoiding misunderstandings, falsifications or alterations and dispensing with intermediaries. To use functions in a smart contract, you first need to define them within the contract's code using a programming language suited for blockchain development, such as Solidity for Ethereum. Functions are written to perform specific actions or computations when triggered. For instance, you might create a function to handle token transfers, validate conditions, or interact with other smart contracts. Once defined, these functions are integrated into the smart contract's overall logic and structure. To invoke a function, you initiate a transaction or call it through an interface, such as a Decentralized Application (dApp) or directly via a blockchain explorer. Functions can be categorized as state-changing (modifying the contract's data), view (reading data without altering state), or pure (performing calculations without accessing contract state). By using functions, you can automate processes, enforce rules, and facilitate secure and transparent interactions on the blockchain. This modular approach ensures that your smart contract operates efficiently and reliably, adhering to the defined business logic and contract terms.

6. EDI USING SMART CONTRACTS

In e-commerce, "EDI using smart contracts" refers to leveraging blockchain technology's smart contract functionality to automate and streamline the exchange of electronic data interchange (EDI) documents like purchase orders, invoices, and shipping notices between businesses, significantly improving transaction transparency, efficiency, and security within the supply chain by eliminating the need for manual intervention and centralizing data on a decentralized ledger. Working of it includes,Data encoding: EDI documents are converted into a standardized digital format compatible with the blockchain.

Smart contract deployment: A smart contract is deployed on the blockchain, containing the business rules governing the EDI transaction, such as payment terms and delivery conditions. Transaction initiation: When a business initiates an EDI transaction (e.g., sending a purchase order), the relevant data is written to the blockchain, triggering the smart contract execution. Automatic execution: The

smart contract automatically performs the necessary actions based on the pre-defined conditions, like updating inventory levels or initiating payment upon delivery confirmation.

Automating EDI Processes with Smart Contracts can automate various aspects of EDI transactions, such as invoicing, payment, and delivery confirmations. They achieve this by embedding specific business rules in smart contracts. Smart contracts offer the ability to automate these processes. Integrating smart contracts into existing EDI frameworks offers multiple benefits including more accurate and reliable business transactions. With blockchain EDI integration, smart contracts can automatically generate invoices. Companies can code their business logic in smart contracts and automate the contracts' execution.

Smart contracts improve both the security and reliability of EDI transactions in a few ways. Smart contracts offer enhanced security because the blockchain the smart contracts reside on is secured with cryptography. The chain of records on the blockchain is virtually tamper-proof because each transaction is cryptographically connected to the previous transaction. Due to the decentralized nature of blockchains, it is extremely difficult for any rogue actor to alter transactions or prevent contract execution. The end result is an increased level of trust for all participants and unprecedented EDI transaction security.

Smart contracts can automate various aspects of EDI transactions, such as invoicing, payment, and delivery confirmations. They achieve this by embedding specific business rules in smart contracts. Smart contracts offer the ability to automate these processes. EDI process automation results in a positive impact on operational efficiency and reduced transaction times. Smart contracts offer the ability to accelerate the transaction lifecycle beginning with order placement and ending with ultimate delivery and final payment; cash flow management improves as a result.

7. MODEL OF E-COMMERCE PAYMENT SYSTEM USING BLOCKCHAIN WITHOUT PG SYSTEM STRUCTURE

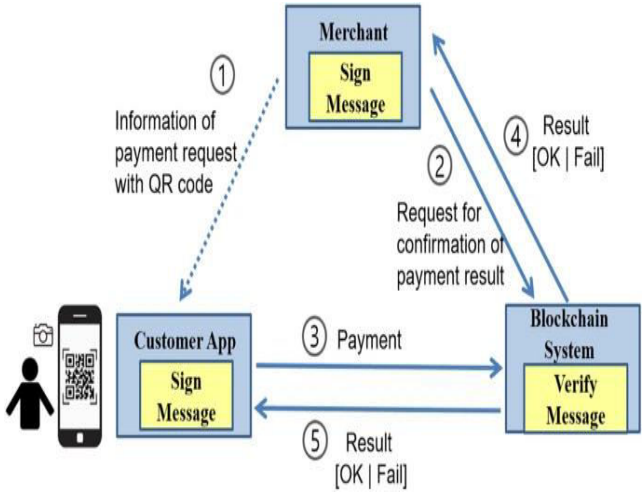
The proposed blockchain e-commerce payment system comprises the merchant, customer's smartphone application, and blockchain system. Shows the overall system structure, and the payment processing procedure is as follows: (1) after selling its products and services, the

merchant requests the customer to make payment using a blockchain cryptocurrency. This process is indicated with a dotted line because the merchant makes the payment request through a QR code displayed on the customer's web browser, rather than a separate online channel. By contrast, requests indicated with (2), (3), (4), and (5) are all represented with solid lines as they use separate telecommunication lines.(2)

To confirm whether the customer has made the payment, the merchant requests confirmation to the blockchain system.(3)After purchasing products and services from the merchant, the customer scans the QR code to pay the price to the merchant. The payment is not transmitted directly to the merchant; a payment request is made to the blockchain system, which contains the transaction ledger. (4)

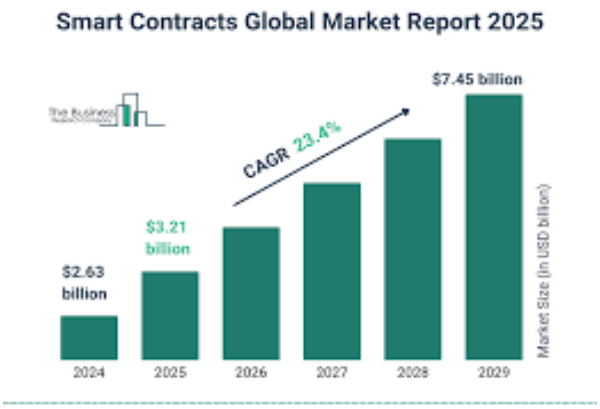
The blockchain system deducts the payment amount from the customer's account and raises the same amount in the merchant's account. After executing this transfer between the accounts, the blockchain system transmits the results to the merchant. When the merchant confirms that the payment was processed normally, it delivers the purchased product or begins to provide the purchased service to the customer.(5)

The blockchain system also transmits the payment result information to the customer's smartphone application.



8. THE FUTURE OF SMART CONTRACTS IN E-COMMERCE

The potential of ***smart contracts in e-commerce*** is immense, and their adoption is expected to grow in the coming years. As blockchain technology continues to evolve, we can anticipate further innovations and improvements in smart contract functionality.Future Developments in Smart Contracts includes blockchain interoperability, integration with IoT, and AI-powered smart contracts. These advancements will further enhance the capabilities and adoption of smart contracts in e-commerce. The integration of smart contracts with IoT can revolutionize e-commerce by enabling automated actions based on real-time data. For example, smart devices could automatically reorder products, with payments and deliveries managed through smart contracts.AI can provide advanced data analysis and decision-making capabilities for smart contracts. AI-powered smart contracts can optimize supply chain processes, predict consumer demand, and personalize shopping experiences, further enhancing e-commerce operations.



9. CASE STUDIES AND REAL-WORLD APPLICATIONS:

- **OriginTrail:** OriginTrail is a blockchain-based platform that uses smart contracts to enhance supply chain transparency for e-commerce businesses. By recording each step of the supply chain on the blockchain, OriginTrail ensures the authenticity and quality of products. Consumers can scan a product's QR code to access detailed information about its origin, production process, and journey to the store, building trust and confidence in the products they purchase.

- **Shopify and Blockchain Integration:** Shopify, a leading e-commerce platform, has explored integrating blockchain technology and smart contracts to improve its services. By leveraging smart contracts, Shopify aims to automate payment processes, enhance data security, and provide transparent and verifiable records of transactions. This integration could streamline operations for millions of Shopify merchants worldwide.

- **OpenBazaar:** OpenBazaar is a decentralized marketplace that uses smart contracts to facilitate peer-to-peer e-commerce transactions. Unlike traditional online marketplaces, OpenBazaar does not charge listing fees or take a commission on sales. Smart contracts ensure that transactions are secure and transparent, with funds held in escrow until the buyer confirms receipt of the goods. This model reduces costs for sellers and provides a trustless environment for buyers.

10.CONCLUSION

Smart contracts have the potential to transform e-commerce by enhancing trust, efficiency, and transparency. Smart contracts provide a solution to the issue of trust in the digital realm, promoting honesty, security, and fairness. The use of smart contracts continues to gain traction in various industries. There are numerous examples of smart contracts, including NFT smart contracts for the sale and transfer of digital art, and ether and Solana smart contracts for decentralized finance (DeFi) applications. The use of smart contracts in online marketplaces can create a more efficient, transparent, and trustworthy e-commerce experience for both buyers and sellers. It's important to keep an eye on this technology and its development as it has the potential to change the way we interact with e-commerce.

By eliminating intermediaries, automating processes, and providing secure and immutable records, smart contracts address many of the challenges faced by e-commerce businesses today. While there are challenges to overcome, the ***future of smart contracts in e-commerce*** looks promising, with the potential to revolutionize the way we buy and sell online.

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