



A SECURE E-COUPON GENERATION SERVICE BASED ON BLOCKCHAIN SYSTEMS

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Abstract

As the realm of e-commerce expands, electronic coupons (e-coupons) have become increasingly prevalent due to their convenience and accessibility. However, traditional e-coupon systems, relying on centralized servers for information management, often face security vulnerabilities. Issues such as coupon forgery and double-spending pose significant challenges in maintaining the integrity of the system. To address these concerns, we propose a novel e-coupon service leveraging blockchain technology to enhance security.

Our approach involves two key components. First, we introduce a dedicated server responsible for managing the e-coupon service and interfacing with the blockchain system. Second, we develop a smart contract deployed on the blockchain to ensure the integrity of both the e-coupon business logic and its associated information. Specifically implemented on an Ethereum-based blockchain, our experimental results demonstrate that our proposed solution offers heightened security while incurring only minimal performance overhead compared to conventional e-coupon services.

In summary, our innovative approach harnesses the power of blockchain to fortify e-coupon systems against common security threats, paving the way for safer and more reliable transactions in the digital marketplace.

Keywords:

E- Coupon , Blockchain System , Security , centralized Server , Smart contract , Ethereum-based Blockchain.

1. INTRODUCTION

As the electronic commerce market continues to expand, electronic coupons (e-coupons) have emerged as a potent marketing tool, offering efficiency for coupon providers and convenience for customers [1], [2]. Leveraging digital codes, e-coupons facilitate online distribution and enable easy tracking of usage statistics, while customers can conveniently manage them via mobile devices or PCs. The exponential growth of the global mobile coupon market underscores the significance of e-coupons, with a projected compound annual growth rate (CAGR) of 73.14% from 2016 to 2020 [3].

Despite the benefits they offer, e-coupons face challenges, particularly in terms of security. Most e-coupon services adopt a centralized approach for information management, which, while facilitating easy administration, also renders them vulnerable to manipulation. Instances of fraud, such as double spending or manipulation of discount rates, underscore the need for enhanced security measures [4]. Addressing these concerns, Hsueh et al. [5] proposed an e-coupon system integrating hash chains with blockchain technology to enhance security.

Our study builds upon this foundation by proposing a comprehensive approach to safeguarding e-coupon integrity through blockchain technology. In addition to ensuring the integrity of e-coupon information, we extend our focus to encompass the integrity of operations related to e-coupon management. Central to our solution is the development of a secure smart contract, which not only guarantees the integrity of e-coupon information but also safeguards the processes involved in managing e-coupons.

Expanding on our approach, the utilization of blockchain technology offers a decentralized and immutable ledger that enhances the security and transparency of e-coupon transactions. By distributing the management of e-coupon information across a network of nodes, blockchain mitigates the risks associated with centralized systems, reducing the likelihood of fraudulent activities. Additionally, the immutable nature of blockchain ensures that once e-coupon transactions are recorded, they cannot be altered retroactively, providing a reliable audit trail and enhancing trust among stakeholders.

Furthermore, the implementation of a secure smart contract on the blockchain system adds another layer of security and automation to e-coupon management processes. Smart contracts are self-executing contracts with predefined rules encoded on the blockchain, ensuring that transactions occur only when specific conditions are met. This eliminates the need for intermediaries and minimizes the potential for human error or manipulation in e-coupon transactions. By automating processes such as coupon validation and redemption, smart contracts streamline operations while maintaining the integrity and security of the e-coupon system.

In conclusion, our proposed approach leverages blockchain technology and smart contracts to address the security challenges inherent in centralized e-coupon systems. By decentralizing information management and incorporating automated, tamper-resistant processes, our solution enhances the integrity, transparency, and efficiency of e-coupon services in the electronic commerce landscape. Moving forward, continued research and development in blockchain-based solutions will further bolster the security and resilience of e-coupon systems, ensuring their continued effectiveness as a marketing tool in the digital era.

2. LITERATURE SURVEY

In Nakamoto's seminal work on blockchain technology, he proposed a solution to the double-spending problem by utilizing a peer-to-peer network. Transactions are timestamped and hashed into a continuous chain of proof-of-work, creating a record that cannot be altered without repeating the proof-of-work. Despite the network's unstructured simplicity, it proves robust, yet concerns remain regarding the inability of payees to confirm if coins have been double-spent [17].

Crosby et al. (2016) highlight blockchain's capacity to provide security, anonymity, and data integrity without relying on intermediary organizations, sparking increased interest in blockchain research. A blockchain, a distributed ledger of all transactions in a bitcoin mining operation, could play a pivotal role in the architecture of the Internet of Things. However, scalability remains a pressing issue, with Bitcoin currently processing only seven transactions per second. The challenge of scaling blockchain technology is a key area of innovation [4].

Jani and Shailak (2020) focus on various blockchain platforms, including Ethereum, Hyperledger Fabric, Corda, and others, emphasizing concepts such as decentralization, distributed ledger technology, and smart contracts. Smart contracts, built into blockchains, enable the automatic enforcement of contract terms without relying on a trusted third party [8].

Garg et al. (2002) proposed an architecture for the secure generation and verification of electronic coupons, addressing security concerns such as manipulation, exchange, duplication, and double spending. They advocate for distinct protocols to ensure secure coupon transactions, highlighting the importance of safeguarding electronic coupons against various threats [9].

Hsu et al. (2020) underscore the encryption methods employed in blockchain technology, including hashing algorithms, asymmetric encryption, and digital signatures, to enhance data integrity and identity verification. Traditional paper-based vouchers are susceptible to forgery, duplication, and low operational efficiency, necessitating the adoption of blockchain-based solutions for improved security [10].

Buterin (2014) discusses the advantages of blockchain technology in document management, citing its speed, effectiveness, and reliability compared to traditional methods. While blockchain ensures secure and transparent transactions, challenges remain, including the susceptibility of traditional documents to falsification and the risk of data breaches by hackers [21].

3. MATERIALS AND METHODS

a. EXISTING SYSTEM

We examine the current e-coupon processing mechanism with a focus on security and e-coupon trading. Nevertheless, e-coupon services frequently encounter security vulnerabilities due to centralization. For instance, if e-coupon information stored in a centralized e-coupon server is tampered with, it becomes challenging to verify the association between the user and the e-coupon's rightful owner. Additionally, expired e-coupons can be exploited for repetitive use.

To address these security concerns, we propose leveraging blockchain technology to enhance the integrity and security of e-coupon services. By decentralizing the storage and management of e-coupon information across a distributed network of nodes, blockchain can significantly reduce the risk of tampering or manipulation. Each transaction involving e-coupons can be securely recorded on the blockchain, creating an immutable and transparent ledger of transactions. This ensures that e-coupon usage and ownership can be reliably verified, mitigating the risk of fraudulent activities such as double spending or unauthorized use of expired e-coupons.

Furthermore, incorporating smart contracts into the blockchain-based e-coupon system can automate and enforce the terms and conditions associated with e-coupon usage. Smart contracts are self-executing contracts with predefined rules encoded on the blockchain, ensuring that transactions are executed only when specific conditions are met. By embedding the rules governing e-coupon redemption and expiry directly into smart contracts, the system can automatically validate e-coupon transactions and prevent unauthorized or fraudulent activities. This not only enhances security but also streamlines the e-coupon redemption process, providing a seamless experience for both users and merchants.

b. PROPOSED SYSTEM

Our proposal introduces a novel service aimed at facilitating secure e-coupon trading through the utilization of an e-coupon smart contract deployed on a blockchain system. The deployment of the e-coupon smart contract is automated to streamline the process. Initially, we develop a dedicated server responsible for enabling the e-coupon service and establishing communication with the blockchain system. Subsequently, we design and implement a smart contract on the blockchain system to ensure the integrity of the e-coupon business logic and associated information. The implementation of our proposed service is executed on an Ethereum-based blockchain system. Through experimental validation, our results demonstrate that our service enhances security while incurring minimal performance overhead compared to existing e-coupon services.

c. ARCHITECTURE DIAGRAM

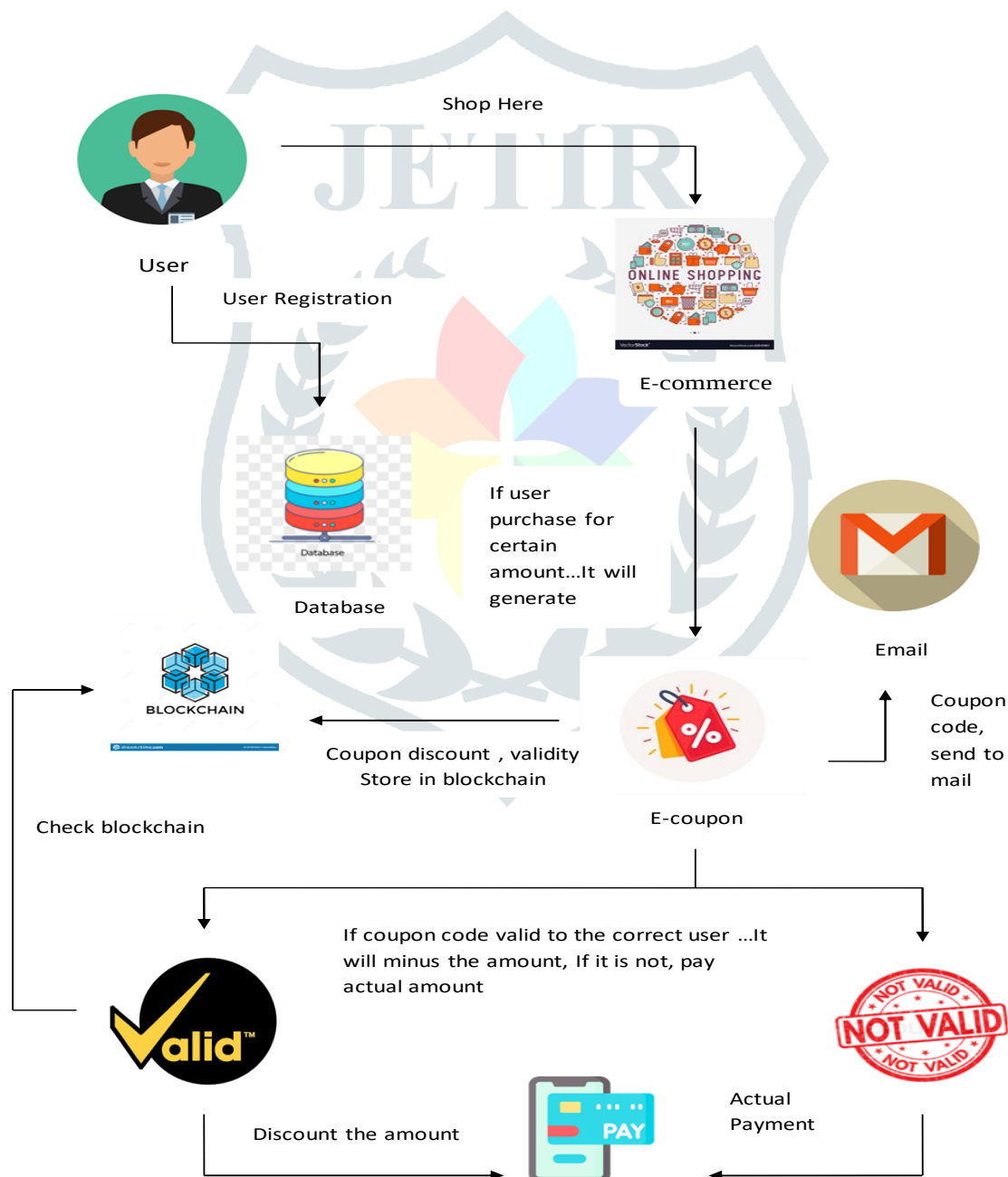


Fig.1

d. THE HMAC(Hash-based Message Authentication Code) ALGORITHM

The HMAC (Hash-based Message Authentication Code) digital signature algorithm plays a crucial role in ensuring the integrity and authenticity of transactions in an E-coupon generation service utilizing blockchain technology. In this system, HMAC is employed to sign and verify E-coupon transactions, providing a secure mechanism for users to generate, redeem, and manage E-coupons.

Firstly, when a user requests the generation of an E-coupon, the relevant details of the coupon, such as its value, expiration date, and associated terms, are hashed using the HMAC algorithm. This hash serves as the digital signature of the E-coupon, ensuring that any subsequent alterations to the coupon's information are detectable.

Secondly, the signed E-coupon transaction is broadcasted to the blockchain network for validation and inclusion in the distributed ledger. The blockchain network verifies the authenticity of the digital signature using the public key associated with the user's private key. This process ensures that only authorized users can generate valid E-coupons, preventing unauthorized parties from tampering with the coupon information.

Furthermore, when a user redeems an E-coupon, the redemption transaction is also signed using the HMAC algorithm before being broadcasted to the blockchain network. This digital signature provides assurance that the redemption request originated from the legitimate owner of the E-coupon, enhancing the security and trustworthiness of the transaction.

Overall, the integration of HMAC digital signatures into the E-coupon generation service using blockchain technology enhances security, integrity, and trust in the system, providing users with a reliable and efficient platform for managing E-coupons securely in the digital ecosystem.

4. EVALUATION METRICS

a. OUTPUT

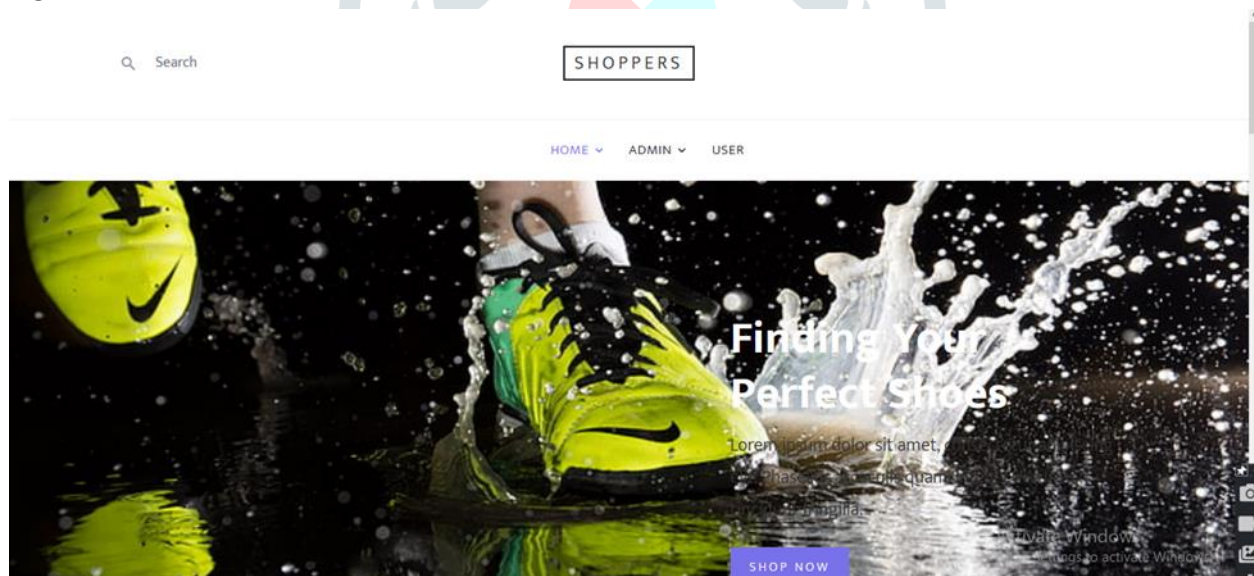


Fig.2

Q Search

SHOPPERS

HOME ADMIN USER

Welcome Admin

Be a part of India's most active community of creators, performers

E-mail

your-email@gmail.com

Password

Your Password

Remember me ☒

Forgot Password

LOG IN

Activate Windows

Go to Settings to activate Windows.

Fig.3

Home / About

Welcome back, Admin

Easily manage your data from this admin CMS

Categories

Manage the categories section here.

MANAGE

Products

Manage all the products here.

MANAGE

How We Started

Lorem ipsum dolor sit amet, consectetur adipisicing elit. Eius repellat, dicta at laboriosam, nemo exercitationem itaque eveniet architecto cumque, deleniti commodi molestias repellendus quos sequi hic fugiat asperiores illum. Atque, in, fugiat consectetur, error corporis aliquam unde nostrum quas.

Go to Settings to activate Windows.

HOME PRODUCTS LOGOUT

Home / Back

Fig.4

ADD CATEGORY

SNO	Product	Update	Remove
1	pant	UPDATE	X
2	shirt	UPDATE	X
3	kurthis	UPDATE	X

Activate Windows

Go to Settings to activate Windows.

Fig.4

[HOME](#)
[VIEW CATEGORY](#)
[LOGOUT](#)

Get In Touch

Category Name*

SUBMIT

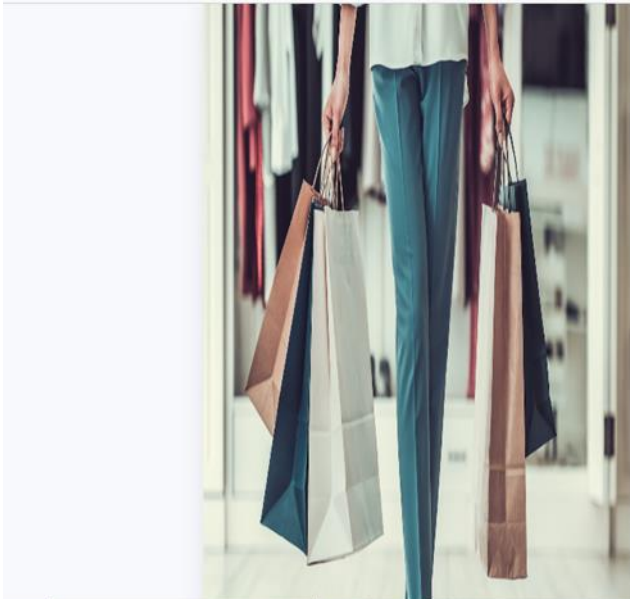
Activate Windows
 Go to Settings to activate Windows.

Fig.5

SN	Preview	Product Name	Category	Update	Delete
1		T-shirt	shirt	UPDATE	X
2		kurthi	kurthis	UPDATE	X
3		shirt	shirt	UPDATE	X
4					

Activate Windows
 Go to Settings to activate Windows.

Fig.6



Sign Up

FIRSTNAME

LASTNAME

EMAILID

PASSWORD

Sign Up

☒ Remember Me

[Forgot Password](#)

Not a member? [Sign In](#)

Activate Windows
 Go to Settings to activate Windows.

Fig.7

Fig.8Fig.9Fig.10

5. CONCLUSION

In conclusion, the E-coupon generation service leveraging blockchain systems presents a paradigm shift in how coupons are managed, ensuring enhanced security, transparency, and efficiency in coupon transactions. The decentralized and immutable nature of blockchain technology provides a robust foundation for securely storing and verifying E-coupon transactions, reducing the risks associated with centralized systems.

The integration of smart contracts automates and enforces the terms and conditions of E-coupon issuance and redemption, streamlining processes and minimizing the potential for errors or fraud. This automation not only improves operational efficiency but also enhances trust and reliability in the E-coupon system.

Furthermore, the interoperability of blockchain-based E-coupon services enables seamless integration with existing systems and infrastructure, facilitating broader adoption and scalability. By adhering to open-source blockchain protocols and standards, such as Ethereum or Hyperledger, the service ensures compatibility across diverse platforms and networks.

Moreover, the transparent and auditable nature of blockchain transactions enhances accountability and traceability in E-coupon management, fostering compliance with regulatory requirements and bolstering consumer confidence. Each transaction recorded on the blockchain ledger provides an immutable and tamper-proof record that can be verified by all parties involved.

In conclusion, our proposed web extension is a highly efficient and effective way of detecting whether a URL is safe or unsafe. It provides an added layer of security, which is crucial in today's world where cyber threats are on the rise. By automating the detection process and providing users with an easy-to-use tool, we can help ensure safe browsing for all users.

6. FUTURE SCOPE

1. Integration with Emerging Technologies :

The future scope of the E-coupon generation service involves integrating with emerging technologies to enhance functionality and user experience. For instance, the service could leverage artificial intelligence (AI) and machine learning algorithms to analyze user behavior and preferences, enabling personalized coupon recommendations and targeted promotions. Additionally, the integration of Internet of Things (IoT) devices could enable location-based coupon delivery, allowing businesses to offer timely and relevant discounts to customers based on their proximity to physical stores.

2. Expansion of Blockchain Networks and Interoperability :

As blockchain technology continues to evolve, the future scope of the E-coupon generation service includes leveraging advancements in blockchain networks and interoperability protocols. This could involve expanding the service to support multiple blockchain platforms, such as Ethereum, Hyperledger, and Corda, to accommodate diverse business requirements and preferences. Furthermore, interoperability solutions, such as cross-chain communication protocols and atomic swaps, could facilitate seamless exchange of E-coupons across different blockchain networks, enhancing accessibility and usability for users and businesses.

3. Enhanced Security and Privacy Features :

In the future, the E-coupon generation service could incorporate advanced security and privacy features to safeguard user data and transactions. This could include the implementation of zero-knowledge proofs and homomorphic encryption techniques to protect sensitive information while enabling secure E-coupon transactions. Additionally, the service could leverage decentralized identity solutions, such as self-sovereign identity (SSI) frameworks, to enhance user privacy and control over their personal data, thereby fostering trust and confidence among users.

4. Integration with Decentralized Finance (DeFi) Ecosystem :

The future scope of the E-coupon generation service extends to integrating with the burgeoning decentralized finance (DeFi) ecosystem. This could involve tokenizing E-coupons as non-fungible tokens (NFTs) on blockchain platforms, enabling new opportunities for trading, lending, and liquidity provision. Moreover, the integration with DeFi protocols, such as decentralized exchanges (DEXs) and automated market makers (AMMs), could facilitate secondary markets for E-coupons, allowing users to exchange or sell their coupons peer-to-peer without intermediaries.

5. Adoption of Sustainability and Social Impact Initiatives :

Looking ahead, the E-coupon generation service could embrace sustainability and social impact initiatives to promote responsible consumption and corporate social responsibility (CSR). This could involve partnering with eco-friendly brands and organizations to offer green discounts and incentives for environmentally-friendly purchases. Additionally, the service could support charitable causes and social initiatives by enabling users to donate E-coupons to charitable organizations or participate in fundraising campaigns through coupon-based incentives, thereby driving positive social change and community engagement.

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