Research on Two-Dimensional Code Packaging Advertising and Anti-counterfeiting Based on Blockchain

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Abstract. With the rapid development of Internet technology and the national economy, the brand awareness of consumers and businesses is getting stronger and stronger. However, how to identify application solutions for counterfeit and shoddy goods is a serious challenge for commodity brand. This paper designs and implements a two-dimensional code packaging advertising and anti-counterfeiting model based blockchain. It is applied to process the commodity information in the packaging field, based on the decentralization, openness, autonomy, anonymity and non-tamper ability of blockchain, combined with two-dimensional code technology. The model is based on network transmission interaction, has the advantages of high unforgeability, low cost, easy implementation, fast access, etc. It has a good technical reference value for implementing packaging advertising, anti-counterfeiting and blockchain application.

Keywords: Blockchain · Two-dimensional code · Packaging Anti-counterfeiting · Advertising supervision

1 Introduction

With the rapid development of the market economy, in order to obtain high profits, some criminals have become increasingly rampant in the production of counterfeit and inferior products in the market. The fraudulent behaviors of food, non-staple food, medicine, health care products and other industries have not only caused huge losses to enterprises, but also threaten people's physical health and mental health; many high-quality imitations such as bags, jewelry and other valuables also damage the vital interests of consumers and affect the integrity of the market; the loss of confidence in

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the purchase and the loss of trust in the brand, have caused an incalculable impact on individuals and the market [1]. In order to increase consumers' credibility of products and safeguard the interests of businesses, anti-counterfeiting technology has begun to enter people's sights [2]. With the rapid development of the mobile Internet and the popularity of smart terminal devices, the application of two-dimensional code has been further promoted, especially in the application of packaging, which has been recognized and favored by many end users [3–6]. The two-dimensional code anti-counterfeiting technology encodes the corresponding information of each product into a two-dimensional code. The consumer can check the product information by scanning the two-dimensional code to check the authenticity of the product. However, the generation method of the two-dimensional code is convenient and simple. The copying cost is low, and the two-dimensional code of the counterfeit product is still the real product information released by the merchant, which makes the fake goods still rampant. So, it is urgent to need some safer and more reliable technical means to achieve the purpose of anti-counterfeiting. In 2009, the blockchain was first proposed by Nakamoto Satoshi [7] as a public ledger for recording bitcoin transactions that did not involve third parties. On the blockchain, each block contained some information, including the block hash value of the previous block, which forms the chain [8] from the creation block to the current block. This property of the blockchain guarantees the integrity and immutability of the data and can be used to verify the authenticity of the data [9]. With the development of technology, people realize that it is its true value by applying blockchain technology to the industry and promoting the economic development of the industry. Blockchain traceability anti-counterfeiting is considered to be one of the most promising blockchain landing areas, and it is also one of the primary areas where giants compete for blockchain application technology.

In order to solve the above problems, this paper combines two-dimensional code and blockchain technology to propose a packaging advertising and anti-counterfeiting model. The model is double-encrypted and more secure, and it also proposes a new model of advertising supervision. The main contributions of this paper are:

(1) Double encryption security anti-counterfeiting. Based on encryption with two-dimensional code and blockchain technology, it is double encrypted and integrities checking for the data. It guarantees the authenticity of the goods.
(2) New model of advertising supervision. Based on two-dimensional code and blockchain technology, brand safety is achieved through traceability, precision marketing and platform monitoring, providing a new mode of advertising supervision.

The remainder of this paper is organised as follows: Sect. 2 introduces the terminology and the related work. In Sect. 3, we also introduce the proposed packaging advertising and anti-counterfeiting model and algorithm design. In Sect. 4, we present the results and analysis for the experiment. Finally, we conclude in Sect. 5, and briefly touch on the future work.

2 Related Research

In order to increase consumers' credibility of products and protect the interests of businesses, anti-counterfeiting technology has begun to enter people's sights. At present, the anti-counterfeiting means in the packaging industry can be described as numerous, and are mainly classified into the following four categories according to their functional characteristics [2]. (1) Destructive anti-counterfeiting packaging: It is also called disposable anti-counterfeiting packaging. After the packaging function is once applied, it will not be restored once it is opened. Such forms of packaging are commonly found in packaging boxes, packaging bottles, packaging covers, and so on. (2) Laser holographic anti-counterfeiting mark: The laser holographic anti-counterfeiting mark uses an anti-counterfeiting means for laser-printing all information with anti-counterfeiting functions onto the substrate. It is not easy to be copied, but the cost is relatively high. (3) The telephone anti-counterfeiting system: it is to set a random string on each product and archive its records in the database. Consumers can use the telephone text message to check the authenticity of the product. (4) Printing anti-counterfeiting technology: it mainly refers to print on the packaging by using different printing processes and printing inks. This anti-counterfeiting technology is simple and easy, but once the process leaks, its anti-counterfeiting effect is completely lost. However, the above anti-counterfeiting technologies have the disadvantages of high anti-counterfeiting cost, easy copying, and difficulty in authenticity detection. Therefore, it is urgent to develop a simple and effective anti-counterfeiting technology instead.

As a new economic growth point, two-dimensional code has been the first development direction of the Internet of Things with its strong information capacity, high information density, high recognition rate, confidentiality, strong anti-counterfeiting function, wide coding range and low cost of use. The two-dimensional code anti-counterfeit packaging formed by the combination of traditional packaging technology and two-dimensional code will gradually lead the new trend [6]. As an important carrier for product integration transportation and distribution display, product packaging can transmit more abundant information by means of QR code, realize information integration of multi-level packaging, quality chasing backwards, anti-counterfeiting, business O2O Hutong, promotion advertisement push APP download and other functions. However, the current two-dimensional code generation method is simple, and the copying cost is low. Therefore, some safer and more reliable technical means are urgently needed to achieve the purpose of anti-counterfeiting.

Blockchain is an Internet database technology, which is characterized by decentralization, transparency and transparency, so that everyone can participate in database records. The blockchain is a unique way to store data in cryptocurrencies such as Bitcoin. The self-referencing data structure is used to store a large amount of transaction information. Each record is linked from the back to the front, and has the characteristics of openness, transparency, tampering and traceability [10–13]. Blockchains can generally be divided into three types: alliance chain, private chain and public chain. In the alliance chain, the blockchain's block and transaction validity are determined by a predetermined set of verifiers. This verification group forms an alliance. For example, to make a block in the alliance chain effective, an alliance is

required. More than 50% of the members are signed, the new block is valid, the information on the blockchain can be public, or only visible to the members of the alliance; The private chain is a fully centralized blockchain, only the creation of the private chain. It is only possible to write information into the blockchain, which is a good choice for organizations that want to conduct internal audits; On the public chain, all data are publicly visible to anyone, all transaction information related to the address in the blockchain can be viewed by the public. However, many financial transactions do not want to be visible to everyone, so data privacy on the public chain is a relatively short issue.

3 The Model of Two-Dimensional Code Packaging Advertising and Anti-counterfeiting Based on Blockchain

3.1 System Architecture

The package advertisement and anti-counterfeiting model proposed in this paper is based on two-dimensional code technology and the blockchain network, aims to implement packaging anti-counterfeiting and advertising application scenarios. It has a three-tier system architecture, including: user, system service and blockchain, as shown in Fig. 1. In this architecture, the blockchain acts as the underlying platform, interacting mainly with system services, processing data, and providing data collaboration capabilities such as: decentralization, security and credibility, non-tamperable, smart contracts, collective maintenance, etc. A block contains Hash value, random number, block link, mining mechanism and Trading information; System service, supporting user and blockchain network interaction in the server, mainly includes two-dimensional code technology, packaging anti-counterfeiting technology, advertising supervision platform, system maintenance, etc.; The user includes three types of individual, enterprise user and supervisory platform user, and directly uses the application to perform system services such as two-dimensional code scanning, anti-counterfeiting, and advertisement supervision.

3.2 Model and Algorithm

The model proposed in this paper mainly completes the following functions: (1) packaging anti-counterfeiting technology; (2) advertising supervision platform. It quickly enters the functional module through the two-dimensional code, and obtains the corresponding result by the blockchain technology. The proposed model is as shown in Fig. 2.

Packaging Anti-Counterfeiting Technology. Double encryption, with two-dimensional code encryption and blockchain encryption, is more secure. At the consumer level, through opening the terminalized anti-counterfeiting two-dimensional code and transparent blockchain technology support, users can easily check the authenticity of the goods, cultivate the user's genuine awareness, and enhance the brand value.

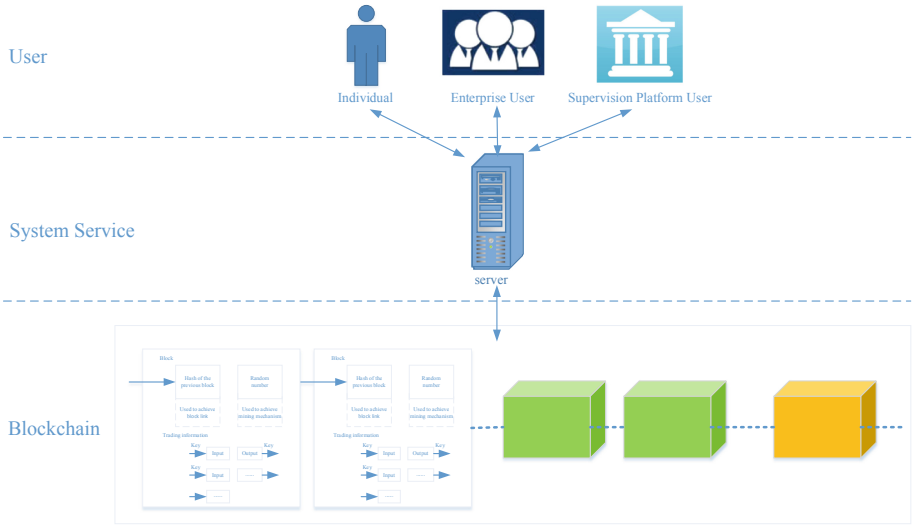

Fig. 1. System architecture.

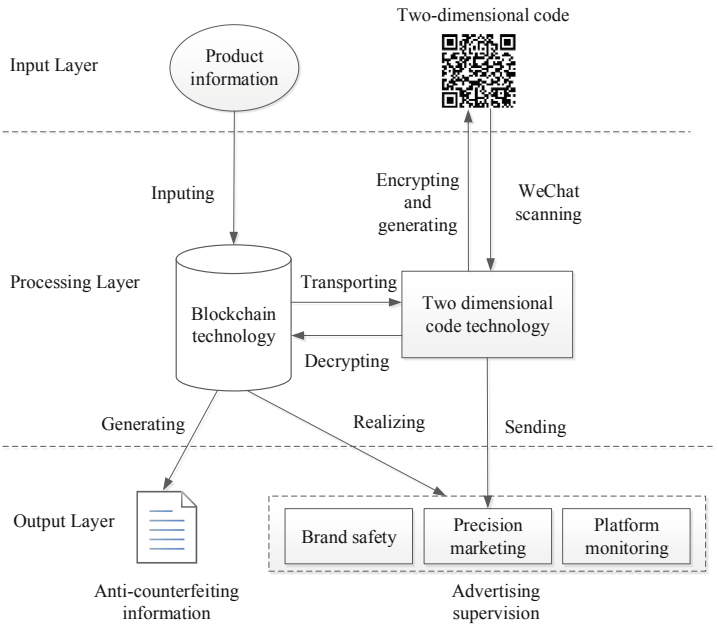

Fig. 2. Two-dimensional code packaging advertising and anti-counterfeiting model based on blockchain.

Step 1. Encrypt product data M to M′ through a blockchain;
Step 2. Encrypt M′ to M″ by two-dimensional code technology again;
Step 3. The user scans the two-dimensional code M″ by WeChat and obtain the anti-counterfeiting information.

Packaging Advertising Supervision Scheme. By implementing the functions of brand safety, precision marketing and platform monitoring to achieve comprehensive, accurate, scientific, digital and intelligent advertising supervision.

(1) Brand safety. Through the traceability function, the blockchain technology is used to integrate the information of all links from production to warehousing and write into the blockchain. Each piece of information has an independent special blockchain ID with digital signature of the product. And the time stamp, is to achieve a trace of the whole process of one thing and one code.
(2) Precision marketing. Through the intelligent contract of the blockchain, seen an advertisement each time and accepted by the user, the smart contract takes effect. Then the advertiser directly rewards the user and the traffic owner for improving the shopping experience of the consumer.
(3) Platform monitoring. It realizes the real-time advertising supervision, improves the efficiency of advertising supervision, guides users to timely discover and report illegal and illegal advertisements, and creates a good atmosphere for the integrity management of the advertising industry.

4 Experiment and Evaluation

In order to verifying the feasibility of the model and services designed in this paper, the authors build a blockchain environment and combine the two-dimensional code technology to simulate specific application examples.

4.1 Function Realization

Development Environment. The operating system we installed on the PC is Windows 10, the Python runtime environment is Python 3.6.4; the program development platform is PyCharm 2018.1.4 and Django web framework, and the database uses MySQL 5.5.

Packaging Anti-counterfeiting Technology. The function of packaging anti-counterfeiting is as show in Fig. 3. It includes anti-counterfeiting code, query number. It used to verify the authenticity of commodity.

Advertising Supervision Platform. The function of brand safety is as show in Fig. 4. It is the traceability function. Integrating the information from the production to the warehouse into the blockchain. Each piece of information has a unique and special blockchain ID, with the digital signature and time stamp of the product, providing users data support of a good bottom layer and quality control. It guarantees the quality of the company's own products.

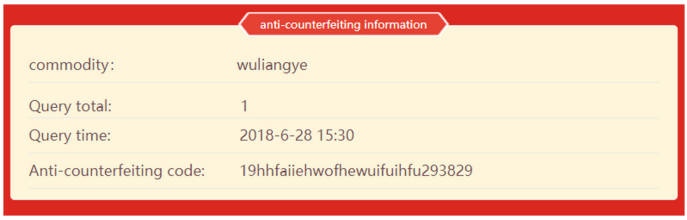

Fig. 3. Anti-counterfeiting information.

Fig. 4. Traceability information.

The function of precision marketing is as show in Fig. 5. It includes recommending users to view commodity advertising, signing smart contract, and rewarding the user. It improves the user's shopping experience.

Fig. 5. Precision marketing information.

The function of platform monitoring is as show in Fig. 6. It includes verifying advertising delivery, counting the users, and Monitoring advertising traffic. It creates an atmosphere of integrity management in the advertising industry.

Fig. 6. Platform monitoring information.

4.2 Security Analysis

Firstly, blockchain technology makes distributed ledgers difficult to be hacked because it does not use a single database to store transaction records. Instead, it keeps multiple shared copies of the same database on the block, so hackers must tamper with the book information. Attacks against all replicas will be effective at the same time. This technology also has the ability to prevent unauthorized modifications or malicious tampering, as each transaction in the block becomes part of a permanent record and has a timestamp, participants can share the data and ensure that all copies of the account book are consistent with other copies at all times, and can be verified in real time using timestamps. If a ledger is tampered, it will be discovered immediately. But the reconciliation data can be tampered easily, when 51% of the members attack together.

Secondly, the information generated by the blockchain technology is encrypted by the two-dimensional code technology in the proposed model. The double encryption method makes the information and the system more secure.

5 Conclusions

By building in Blockchain environment, using two-dimensional code technology and web development technology, the authors realized a packaging advertising and anti-counterfeiting model. The experiments show that the proposed model in this paper achieves an efficient and secure for brand safety. We will improve packaging advertising and anti-counterfeiting algorithms to enhance security and achieve smart packaging in future.

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References

1. Böhme, R., Christin, N., Edelman, B., et al.: Bitcoin: economics, technology, and governance. J. Econ. Perspect. **29**(2), 213–238 (2015)
2. Sriram, T., Rao, V.K.: Application of barcode technology systems. IECON Proc. **1**, 5–10 (1996)
3. Atzori, L., Iera, A., Morabito, G.: The internet of things a survey. Comput. Netw. **54**, 2787–2805 (2010)
4. Wang, Z.M.: Anti-counterfeiting of two dimensional code. China Brand Anti-counterfeiting **3**, 61 (2001)
5. Shu, C.: Application of two-dimensional code in advertising. Northeast Normal University (2015)
6. Gao, K., Zhang, Z.Q.: Application of QR code on anti-counterfeiting packaging. China Packag. Indus. **12**, 79–80 (2014)
7. Nakamoto, S.: Bitcoin: a peer-to-peer electronic cash system (2008)
8. Ethereum Homestead Documentation (2016). http://ethdocs.org/en/latest/
9. Blockchain Bitcoin Wiki (2017). https://en.bitcoin.it/wiki/Block_chain
10. An, R., He, D.B., Zhang, Y.R., Li, L.: The design of an anti-counterfeiting system based on blockchain. J. Cryptologic Res. **4**(2), 199–208 (2017)
11. Yuan, Y., Wang, F.-Y.: Blockchain: The State of the Art and future trends. Acta Automatica Sinica **42**(4), 481–494 (2016)
12. Han, Q., Wang, G.: A review of foreign research of BlockChain technology. Sci. Technol. Prog. Policy **35**(2), 154–160 (2018)
13. Wang, Y., Li, L., Hu, D.: A literature review of block Chain. J. China Univ. Min. Technol. (Soc. Sci.) **3**, 74–86 (2018)