

Smart Warranty

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Abstract

A series of risks are involved with purchasing items online, particularly whether the product is authentic or not. Paper-based warranties are typically issued by retailers and producers for products as proof of origin, sale, ownership, history, and quality. However, paper warranties are subject to counterfeiting, loss, or theft. In this paper, we have shown how non-fungible tokens (NFTs) and blockchain platforms such as the Ethereum blockchain can be used for digital certification, ownership proof, sale history, and quality. We demonstrate that our proposed NFT and blockchain-based solution can provide a superior alternative in terms of verifiability, traceability, immutability, and security when compared with paper-based warranty and ownership management. If this solution becomes the new normal in the industry, products without a warranty as an NFT may not be authentic, which will allow consumers to choose legitimate items. In this paper, we have presented a system that facilitates the buyer's claim for warranty on the product and decays the warranty card as soon as it goes out of warranty. The record of every transaction is maintained on the blockchain and is accessible to both the buyer and the seller. This system reduces complexity and the number of intermediaries involved.

Keywords: Blockchain, event management, NFT, security, warranty

INTRODUCTION

Smart warranties are simply the “futuristic” version of traditional warranty systems made possible with blockchain technology. To put it more clearly, a smart warranty is a digitalized version of a legal guarantee that a manufacturer issues to a product's buyer, guaranteeing to replace or repair the item, as appropriate, within a given timeframe [1].

In technical terms, a smart warranty is a smart contract on the blockchain which makes it possible to issue digitalized warranties of articles as non-fungible tokens to the customer including but not limited to the traditional advantages of having a warranty card. It is more secure, more credible, unique to the item, and can be easily traced back to the buyer. Thus, undoubtedly, it also makes it easier for the customer to redeem it and for the seller to validate the credibility of the buyer's claim and identity [2].

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The objective here is to replace the physical warranty with a blockchain based warranty using NFT which will ensure authenticity and security. A form of digital ledger technology (DLT) known as blockchain consists of blocks containing records of data and these blocks are securely linked together via cryptographic encryption [3]. The blockchain technology underpins all NFTs and cryptocurrencies. Each block essentially consists of

a cryptographic hash of the one before it, a timestamp, transaction information, and nonce. After a block is added to the blockchain, even a minor change in the block will be detected as malicious activity and will be overwritten automatically [4]. Since blockchain records are practically unalterable, they are secure by design. There is no governing agency in blockchain, and it is managed totally by algorithm which makes it least restricted and most secure choice of future. There have been several cases of warranty card scams. An estimated 12% of warranty buyers fall victim to fraud, resulting in an annual loss of \$2 billion [5] (Figures 1 and 2).

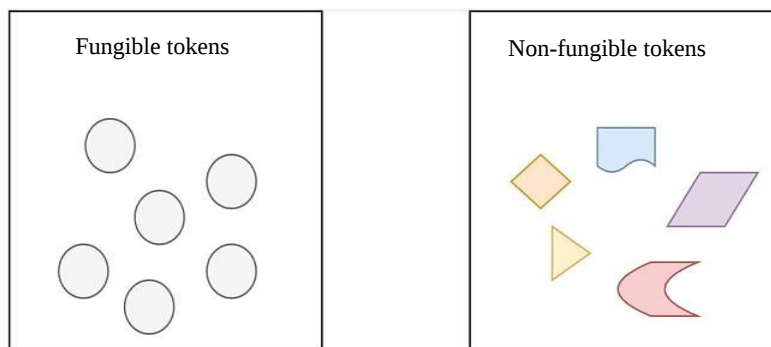


Figure 1. Fungible and non-fungible tokens.

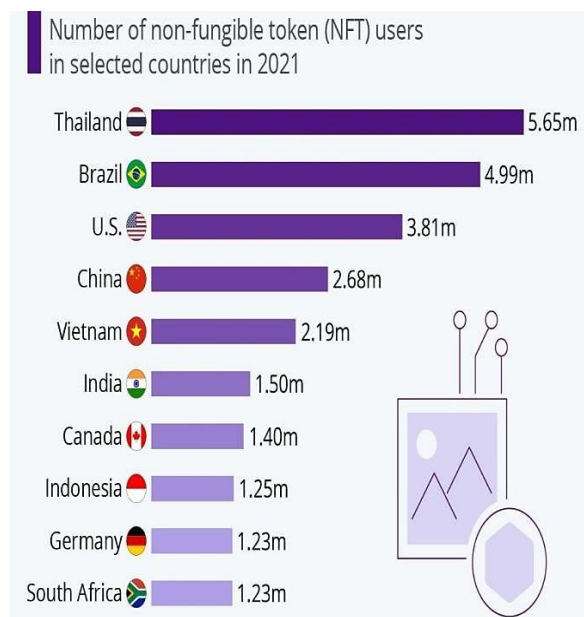


Figure 2. NFT popularity location-wise spread.

Source: Statista digital economy compass 2022

PROPOSED METHODOLOGY

A well-designed system architecture provides the roadmap for the subsequent development process. Before trying to apply a blockchain-based solution right away, we first ensured that our fundamental design decisions are well grounded [6]. Hence, the key activities undertaken are described here.

Study of Blockchain Technology

Since the entire proposed solution revolves around the development of an NFT-based warranty system, and which is provided by blockchain, it will be essential to study this emerging technology in depth to understand its full potential for its application in ‘smart warranty’ (Figure 3) [7]. As technology advances rapidly, it will be necessary to be aware of the many changes that are coming both technologically and at the regulatory, legal, and administrative levels.

Design of Smart Contracts

It is the core of the blockchain network that will allow the registration, modification of attributes, and exchange of the virtual warranty as a digital asset. Smart contracts contains business logic and must comply with specific regulations regarding warranties [8].

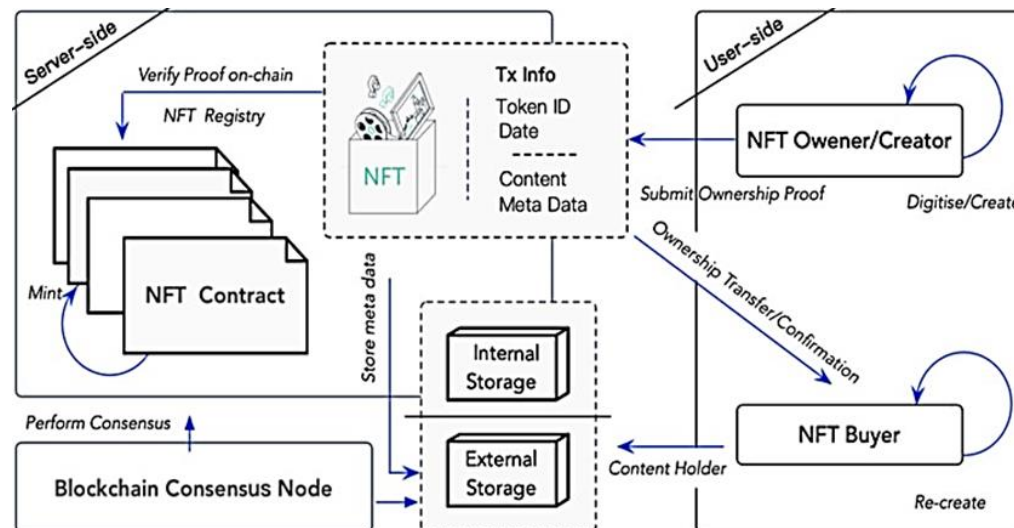


Figure 3. Model of the NFT system.

Integration with Current Point of Sale Systems

This is perhaps one of the most important activities. In the first explorations, a great resistance to change was found in the physical points of sale in this aspect. Current systems are computer tools—in many cases so old-fashioned that points of sale are reluctant to change or modify them. Therefore, it will be necessary for smart warranty NFT to be easy and quick to implement and require the minimum possible changes at the point of sale [9].

The smart warranty NFTs will allow users to prove product ownership. Using NFTs, the application should allow consumers to validate the product's legitimacy. A genuine product will have an NFT associated with it, which acts as proof. As a result, this helps to combat counterfeit goods. The NFTs will serve as the product's warranty card, making the system paperless and smooth. Provide the item's serial number, purchase history, warranty term, and other details. We created a prototype that solves the concerns of both the administrator and the users while sticking to the design goals and design decisions [10].

Admin Roles

The smart contract's storage includes a track of the administrator address. Each user may receive a new warranty NFT from an administrator with the appropriate metadata, such as the product's serial number, the warranty's lifetime, etc. Moreover, the administrator has the option of transferring the NFT rights to another address.

User Roles

With the use of this smart contract, a consumer can look through the blockchain for the warranty NFTs they now own. A user may also transfer any warranties they currently have that are still valid and still allow transfers. The delegate may then operate on the NFT as if they were the original user.

Admin Facilities

Create Product

The create product option will allow the admin to fill in the details like product name, brand, category, and price and publish it on the website for sale.

Connect Wallet

This option allows the admin to connect its blockchain wallet with the admin account. All the transactions occurring on blockchain related to warranty NFT is carried out from this account.

Add Warranty

This option allows the admin to generate a smart warranty NFT for a specified product using the attached blockchain account. The details of the product including its serial number, date of purchase, and warranty period are used to generate an e-warranty card of the product.

Dispatch Warranty

This option utilizes the information of the product and the smart contract on the blockchain platform to generate an NFT of the warranty card. This smart warranty NFT can later be transferred or disposed depending upon the admin. At this stage, the NFT is ready to be used in transactions. This option is generally used when the buyer has made partial or full payment of the product.

Transfer Warranty

This option is utilized when the product is purchased successfully and the warranty NFT generated needs to be dispatched to the user's blockchain wallet. The admin can use the transfer warranty feature to perform a final transfer of the dispatched warranty.

Send the Warranty ID to E-mail

This option is used to trigger the action of sending the unique ID of the smart warranty NFT to the user's preferred E-mail ID using APIs.

User Facilities**Buy Product**

The buy product option enables the user to perform a buying transaction on the seller's website. The user can select from the various product collections and pricing ranges and then buy them as per demand.

Verify Ownership

The unique ID of the smart warranty NFT can be used to verify the ownership of the product in case of discrepancy. The verify ownership option redirects the user to a separate page on which he can verify if he is the legitimate owner of the product.

Verify Authenticity

This option allows the user to cross-check with the manufacturer. This option redirects the user to the manufacturer's legitimate website where he can verify the authenticity of the product by entering the serial number from the smart warranty NFT.

Transfer Ownership

This option can be used in situations where the owner of the product wants to resell the product under warranty. The warranty can be transferred legally to the buyer, and it also allows for a background check on the previous owners of the product. This also allows the manufacturer to directly restrict the number of times a product can be resold legally, after which the warranty will become void automatically.

Common Facilities**Signup/Login**

The signup facility can be used to create an account on the web app. The login facility can then be used to gain authentic access to the site.

Update Profile

This feature allows us to modify our profile details, such as changing blockchain account links or updating basic user or admin data.

Homepage

This page is available for both users and administrators. It will be automatically loaded when the user visits the website.

Explore Page

This page provides us with a variety of products and categories to choose from. Users can access it to buy products whereas admins can add or remove products and categories on this page.

Verify Warranty

This allows the user to prove ownership after entering their unique token ID. Here, we have used the soul-bound token. Information such as warranty period is also provided on the verify NFT page.

The high-level design of the application architecture would be as follows (Figure 4): First, the customer provides their digital identity (blockchain identity in the form of a QR code) at the time of purchase. The point of sale manages the sale and produces information (product ID, manufacturer ID, warranty, price, purchase date, specific conditions, etc.) that is communicated to the API, together with the customer ID. This product information is passed to the smart contract on the blockchain. The smart contract mints the provided information into an ERC-721 non-fungible token whose unique digital identity or key is made available to the admin. On the sale of a product, the smart warranty NFT is transferred to the buyer's account and the user is informed via e-mail about the same.



Figure 4. Smart warranty NFT minting process.

The smart warranty is responsible for collecting this information, along with other information provided on the manufacturer's website (if applicable), processing it, and sending it to both blockchain as well as cloud storage. The documents related to the guarantee, instruction manual, and metadata of the sale are stored in the cloud. When the warranty period of a product ends, the ERC-721 NFT decays by itself by consuming gas.

RESULTS AND DISCUSSION

Traditional warranties cannot prove the authenticity of the manufacturer or item seller company whereas smart warranties' NFT can be used to trace the authentic owner of the product. The serial number on the traditional warranty card and the product itself might be fake. This is fraudulent activity. All information about the product is transparent to the buyer and can be validated on the seller's website. We cannot trace a runaway seller using traditional warranty cards. Such crimes usually remain unsolved whereas in smart warranties, all the transaction details are transparent on blockchain platform and can be used to traceback the seller. In traditional system, someone else's warranty card may be used to put false warranty claims for an out-of-warranty product. The smart warranty provides all the details about the current and previous owners. Paper warranties may get lost whereas smart warranties are digital entities that are saved on our blockchain wallets. There are cases where not-for-resale articles are illegally sold. There is no sales history for these articles. The

seller can restrict the number of transfers of warranties allowed for a particular product. The redemption process is complex in the case of a traditional warranty system, whereas the warranty redemption process in the case of a smart warranty is simplified.

CONCLUSION

In this paper, we have described a solution that uses blockchain and NFTs to provide a safe and reliable digital smart warranty as well as the truthful origin of information regarding the production and sale of goods. The Ethereum blockchain network and ERC-721 NFT smart contracts serve as the foundation for our solution. Our system presents cost and security analyses, making it both economical and protective against cyberattacks and vulnerabilities. Also, we contrasted our strategy with earlier ones, and the results showed that we were able to deliver a comprehensive solution in terms of dependability, security, transparency, and reliability. We also talked about how other sectors that depend on physical assets for delivery and tracking may use our approach. We have looked into NFTs as a modern concept and assessed them as a key attribute of a blockchain-based smart warranty system. We were able to thoroughly analyze and understand the advantages and difficulties of smart warranties as a result of the evaluation procedure for the NFT-based prototype. We discovered that NFTs can benefit from overcoming the present flaws of traditional warranty systems, such as fraud susceptibility, a lack of control over transactions, and ownership verification.

Future Scope

The use of smart warranty system can be extended to several other use cases, like tickets of any kind of events which use the traditional paper ticketing system. Currently, the seller has to connect its wallet and pay the gas fees so we can bring a system that will not require seller's intervention and all the gas fees related to every transaction included decaying of smart warranty NFT will be handled by the creator, hence making the entire process seamless for the seller without even having expertise of blockchain technologies. The digital copy of the smart warranty NFT will also be sent to the buyer's phone number. The smart warranty will have a feature to extend the warranty period of the decaying NFT.

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