International Journal of Research Publication and Reviews

Blockchain-Based NFT Ticketing System

Er. Ompal[1], Rahul Kumar[2], Suryansh Gautam[3], Suyash Srivastava[4], Yash Raj Singh[5]

[1]Asst. Professor, Department of Electronics and Communications, UIET, CSJM University, Kanpur
[2]B. Tech Students, Department of Electronics and Communications, UIET, CSJM University, Kanpur

ABSTRACT

In late 2017, a brand-new class of distinct and undivided blockchain-based coins called non-fungible tokens (NFTs) was introduced. While fungible tokens have made it possible for new use cases, such as initial coin offerings, it is yet unknown if NFTs have the potential to be a useful component.

This study fills in this theoretical and practical knowledge gap and shows how effective NFTs are for event ticketing. We create an event ticketing system prototype based on NFTs and rigorously evaluate it using a design science research methodology. By doing so, we show how NFTs can tokenize digital products, stop fraud, and enhance control over secondary market transactions. Additionally, we provide useful information about the advantages and difficulties of NFTs and draw conclusions for both researchers and practitioners. Finally, this work offers managerial suggestions for developing NFT-based applications and makes its findings and design principles available to other researchers.

Paper tickets are not eco-friendly and are readily destroyed. The QR-coded ticket is quite basic and has little collectible value. In this work, we suggest a ticketing system based on Non-Fungible Tokens (NFT) to address the aforementioned issues.

It establishes a traceable, verifiable chain of ownership that can be traced back to the initial record to confirm its veracity. Blockchain encryption is used in the context of event ticketing to validate the legitimacy of ticket purchases.

INTRODUCTION

A radical breakthrough, blockchain technology has the potential to upend or possibly replace current business structures that rely on third parties for trust (Beck and Müller-Bloch, 2017). Through the publication of the Bitcoin whitepaper in 2008, the blockchain concept was initially revealed, and for the first few years, it was primarily employed as the technology underlying cryptocurrencies. Second-generation blockchains, such as Ethereum, were released in 2014 and enable for the programming and execution of software, or "smart contracts," on all participating blockchain nodes. Therefore, on a shared global infrastructure, every user is able to develop and deploy programs (Buterin, 2014; Wood, 2014). According to Christidis and Devetsikiotis (2016), Morabito (2017), and Wust and Gervais (2017), this has resulted in the realization of new concepts intended to facilitate large-scale human interaction and collaboration across a number of industries, including supply chain management, international payments, international trade finance, energy markets, and notary services. The public is particularly interested in the use cases of Initial Coin Offerings (ICOs), which reinvent crowdfunding by utilizing blockchain technology and its capacity to tokenize assets (Fridgen, Regner Schweizer, and Urbach, 2018). The ERC-20 standard has been instrumental in ICOs' phenomenal success, which has seen an estimated 12 billion USD raised globally (AutonomousNEXT, 2018). The developer community voluntarily agreed on this standard, which defines a single interface for fungible tokens that are divisible and undifferentiable, to assure interoperability (Vogelsteller, 2015). A new kind of digital ticketing system called NFT (Non-Fungible Token) ticketing uses blockchain technology to make distinctive and secure tickets for events like concerts, sporting events, and festivals. NFT ticketing offers attendees a safer and more transparent method to buy and transfer tickets. In addition, they can exchange or resell their digital tickets on marketplaces built on the blockchain as proof of ownership and attendance. NFT ticketing has the ability to completely transform the ticketing industry and offers an inventive answer to the problems that existing ticketing systems confront. A new kind of digital ticketing system called NFT (Non-Fungible Token) ticketing uses blockchain technology to make distinctive and secure tickets for events like concerts, sporting events, and festivals. NFT ticketing generates unique digital assets that are impossible to copy or reproduce, in contrast to conventional ticketing systems where tickets are easily copied and sold on the secondary market. These one-of-a-kind digital tickets are produced on a blockchain, a decentralized, impenetrable digital ledger that keeps track of and authenticates transactions. Both event planners and attendees benefit from NFT tickets. For those who plan events, NFT ticketing gives you more control over ticket sales and does away with the need for outside ticketing companies.

Additionally, they can establish guidelines for ticket exchanges to stop price gouging and scalping. NFT ticketing offers attendees a safer and more transparent method to buy and transfer tickets. In addition, they can exchange or resell their digital tickets on marketplaces built on the blockchain as proof of ownership and attendance.

OBJECTIVE

The main objectives of NFT ticketing systems are:

Security: Providing improved security and fraud protection is one of the main goals of NFT ticketing systems. NFT tickets are produced as distinct, unchangeable digital assets using blockchain technology that are impossible to copy or forge. This makes sure that no counterfeit tickets are sold and eliminates the possibility of fraud.

Transparency: The goal of NFT ticketing systems is to promote process transparency. They give event planners more insight and control over the ticketing process by enabling real-time tracking and management of ticket sales. Since ticket prices can be determined and controlled by the organizers, this also aids in preventing ticket scalping and other types of price gouging.

Efficiency: By doing away with middlemen like ticket brokers and resellers, NFT ticketing systems seek to improve the efficiency of the ticketing process. It becomes simpler for event organizers to sell tickets and for consumers to make purchases as a result of cost savings and procedure streamlining in the ticketing process.

Flexibility: NFT ticketing systems give ticket holders more flexibility by making it simple for them to transfer or resell their tickets. As a result, there are more opportunities for attendees to access sold-out events and event organizers can generate new revenue streams**.**

Personalization: NFT ticketing systems can provide attendees with customized experiences by offering special, valuable, and commemorative ticket designs. This can make events more memorable and pleasant by increasing attendee participation and fostering a sense of exclusivity.

Scalability: Small-scale gatherings, as well as massive festivals and concerts, can all use NFT ticketing systems. They are appropriate for events with a big number of attendees because they are scalable and able to handle huge rates of transactions.

Data analytics: Event planners can benefit from data insights from NFT ticketing systems, including information on ticket sales, attendee demographics, and consumer behavior.

The whole experience of attendees can be enhanced by using this data to optimize pricing, marketing, and event planning tactics.

Access control: NFT ticketing systems can offer safe access control for events, making sure that only people with valid tickets are admitted. This can lessen crowding and preserve a secure environment for visitors.

Interoperability: The design of NFT ticketing systems can make them compatible with other blockchain-based programs like payment gateways and loyalty schemes. This could open up new possibilities for platform integration and interoperability, giving guests a more connected and seamless experience.

Sustainability: Last but not least, NFT ticketing systems work to enhance sustainability by minimizing the use of paper waste and actual tickets. NFT ticketing solutions lessen the environmental impact of ticketing and support more sustainable practices in the events sector by offering digital tickets that are simple to transfer and access via mobile devices.

LITERATURE REVIEW

Lei Zhang and Jun Zhang's "Blockchain-Based Digital Ticketing Systems: A Survey" An overview of blockchain-based ticketing systems, including NFT ticketing, is given in this study. It emphasizes the benefits of employing blockchain technology for ticketing, including improved security, transparency, and a decrease in fraud.

Stefano Cavalli and Rocco Panetta's "Non-Fungible Tokens and Digital Collectibles": The usage of NFTs in a number of industries, including ticketing, is examined in this article. It examines the creation of distinctive, verifiable, and tradeable digital assets using NFTs and how doing so can help the ticketing industry by lowering fraud and boosting revenue streams.

Max and Polenov's "Tokenizing the Event Industry: How Blockchain Technology Can Solve Event Ticketing Challenges". The difficulties of the event ticketing sector has been covered in this essay, along with how blockchain technology, in particular NFT ticketing, might help. It also highlights the possible advantages of NFT ticketing, such as lower prices, more openness, and better customer service.

Arun Rai and Christina Soh's "The Future of Ticketing: Exploring the Use of Blockchain Technology for Ticketing and Event Management" This essay examines how the ticketing and event management industries can change as a result of blockchain technology, which includes NFT ticketing. It examines the advantages of utilizing blockchain for ticketing, including lower prices and better security, and it also emphasizes the difficulties that must be solved for blockchain-based ticketing systems to be successful.

Utilizing an NFT ticketing system has a number of advantages, one of which is that it can aid in reducing fraud and counterfeiting. It is far more challenging to make fake NFTs or to resale tickets that have previously been used because each NFT is distinct and can be confirmed on a blockchain. The possibility of giving event organizers more transparency and control is another advantage of NFT ticketing systems. For instance, organizers can establish guidelines for ticket resale and transfer policies and make sure that a portion of all secondary sales goes to them.
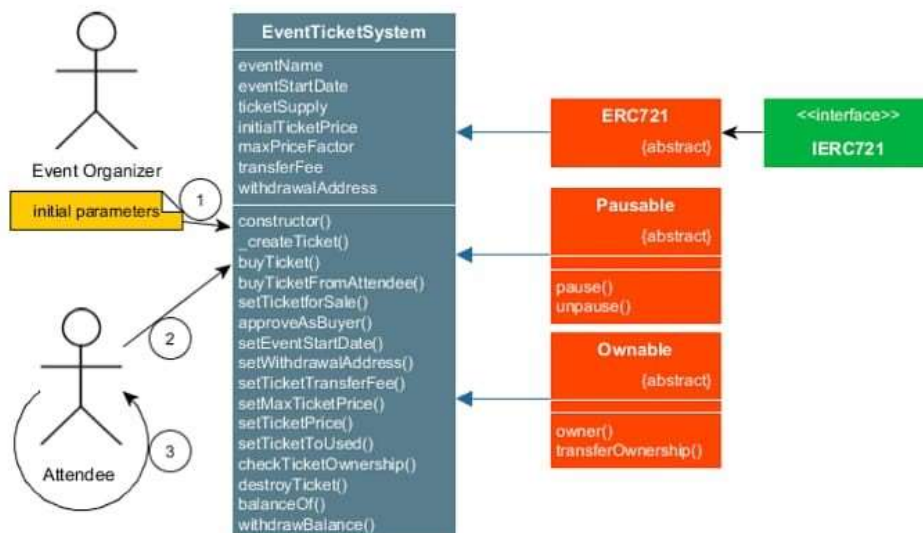
UML Diagram

The use of NFTs for ticketing could present some difficulties, though. The technology is still relatively new and unproven, which is a worry because it may cause problems with adoption or deployment.

Additionally, there are certain worries regarding how blockchain technology may affect the environment, which may become more important as NFTs are utilized more frequently. Despite these difficulties, there have been a number of well-known instances of NFT ticketing systems recently. For instance, some music festivals have used NFTs to sell tickets and merchandise, and the NBA has experimented with utilizing them to sell game tickets. Overall, even if employing NFTs for ticketing has some potential advantages, it is unclear whether this technology will be widely used any time soon. Before NFT ticketing systems become a commonplace option, there will certainly be some difficulties and obstacles to overcome, as with any new technology.

TECHNICAL COMPONENTS

Blockchain

Box Nakamoto's original idea for blockchain was for Bit-coin to employ the proof-of-work algorithm to agree on transaction data in a distributed network. A distributed, attached-only database that keeps track of a list of data records connected and secured by cryptographic methods is known as a blockchain.

With the help of a sizable network of unreliable participants, blockchain offers a solution to the age-old Byzantine problem. Since any modifications to the stored data will render all subsequent data incorrect, the shared data on the blockchain becomes immutable once it has been verified by the majority of distributed nodes. Ethereum is the most popular blockchain platform utilized in NFT schemes because it offers a secure environment for smart contracts' execution. Additionally, a number of solutions—including Flow, EOS, Hyperledger, and Fast—drop their customized blockchain platforms or chain engines in order to support their specialized applications.
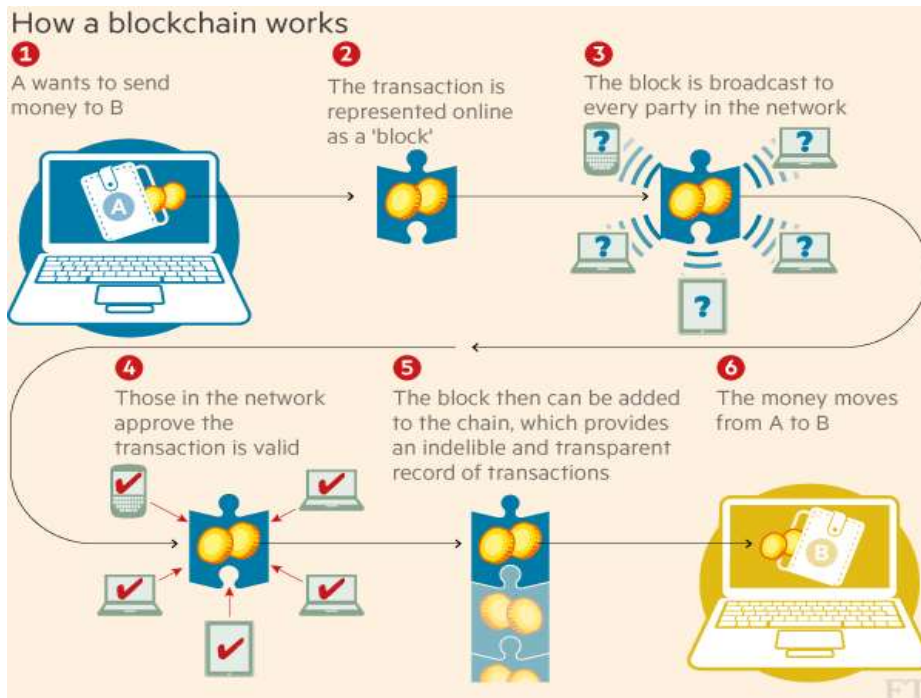
Smart Contract

Szabo first proposed smart contracts with the intention of accelerating, validating, or carrying out digital negotiation. In order to implement complex functions and execute comprehensive state transition replication through consensus procedures to guarantee final consistency, blockchain-based smart contracts use Turing-complete scripting languages. Smart contracts also provide a consistent approach to building apps across a wide number of industries, enabling unfamiliar parties and decentralized participants to conduct fair trades without a trusted third party. All participants have access to the states that contain the parameters and instructions, ensuring transparency in the execution of these instructions and consistency.
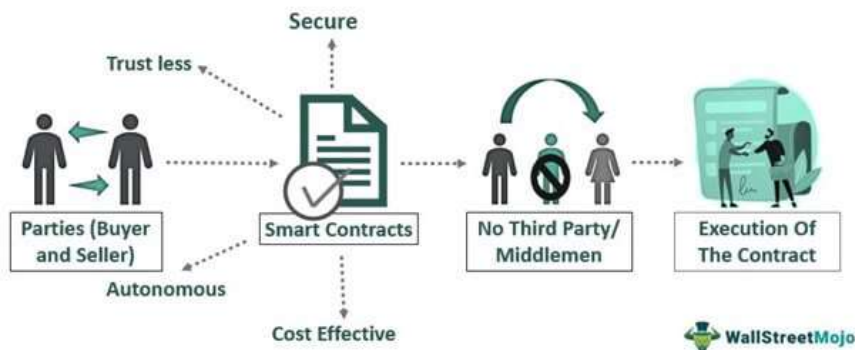
Address and Transaction

The fundamental ideas in cryptocurrencies are the blockchain address and transaction. Similar to a bank account when using funds from a bank, a blockchain address is a user's specific identification for sending and receiving assets. It is made up of a set amount of alphanumeric characters that are created using a set of public and private keys. When sending NFTs to another address with the proper digital signature, the owner must demonstrate that they are in possession of the appropriate private key.
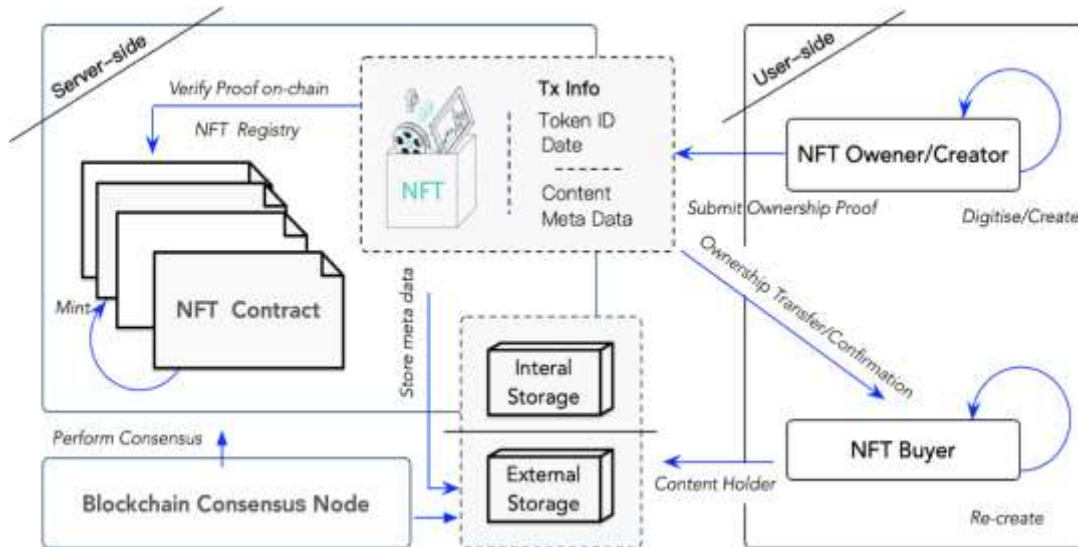
Signature. A bitcoin wallet is typically used to carry out this straightforward procedure, which is represented as sending a transaction to incorporate smart contracts according to the ERC-777 standard.

Data Encoding

The process of transferring data from one form to another is known as encoding. Typically, many data are encoded either in uncompressed formats for high quality or into effective, compressed forms to conserve disc space. Hex values are used to encrypt transactional data in popular blockchain systems like Bitcoin and Ethereum, including function names, arguments, and return values. This means that these regulations apply to the raw NFT data. One effectively owns the original piece of hex values signed by the creator if one assert ownership of the NFT-based intellectual property. Although others are free to replicate the raw data, they cannot claim ownership of it. Based on that, we may deduce that the NFT-related operations (such as buy/sell/trade/auction) must be handled through these four stages, in a manner akin to how smart contracts are typically processed.
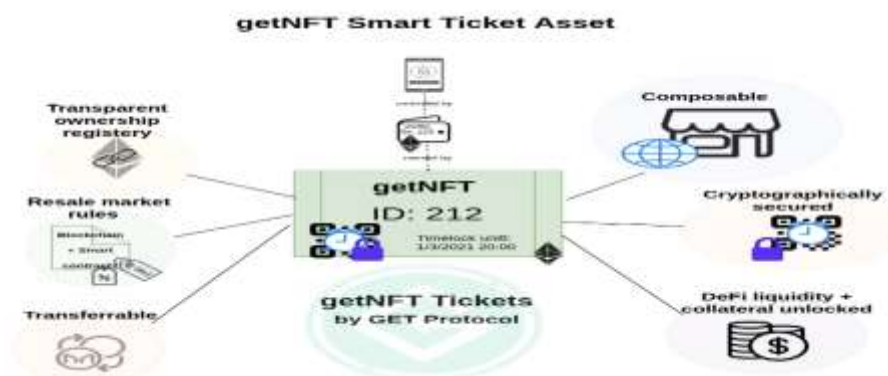
Meta Mask

A software cryptocurrency wallet called MetaMask is used to communicate with the Ethereum network. Users can utilize a browser extension or mobile app to access their Ethereum wallet, which can then be used to connect with decentralized applications. ConsenSys Software Inc., a blockchain software business that specializes in Ethereum-based infrastructure and tools, is the company behind MetaMask. With MetaMask, users may send and receive Ethereum-based cryptocurrencies and tokens, broadcast transactions, store and manage account keys and securely connect to decentralized applications using a suitable web browser or the built-in browser of the mobile app. A user's MetaMask wallet (and any other similar blockchain wallet browser extensions) can be connected to, authenticated, and/or integrated with other smart contract functionality by websites or other decentralized applications

using JavaScript code. This enables the website to send action prompts, signature requests, or transaction requests to the user through MetaMask as an intermediary.
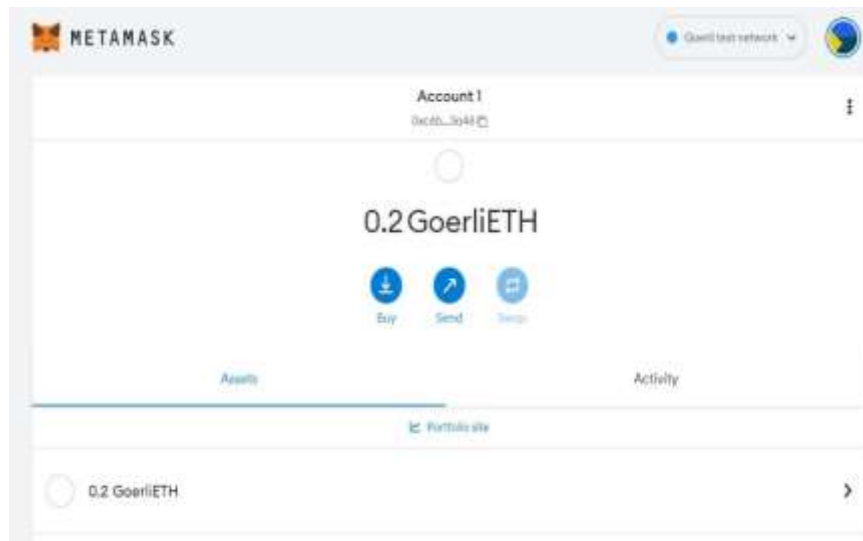
Frontend Interfaces

Event planners can produce and manage NFT tickets using front-end interfaces, and ticket buyers can buy and manage their tickets as well. These interfaces can be created using frameworks like HTML, CSS, JavaScript, React, Node.js, or Angular and can be web-based or mobile-based.


VSCode

Microsoft's Visual Studio Code, sometimes known as VS Code[9], is a source-code editor for Windows, Linux, and macOS that uses the Electron Framework.[10] Debugging support, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git are among the features. Users can add extensions that add functionality, and adjust the theme, keyboard shortcuts, and preferences. In the Stack Overflow 2022 development Survey, 71,010 participants chose Visual Studio Code as the most widely used development environment tool, with 74.48% of them claiming to use it.

Solidity

Solidity is a high-level, object-oriented language that can be used to construct smart contracts. Programs known as smart contracts control how accounts behave in the Ethereum state. The Ethereum Virtual Machine (EVM) is the intended target of the curly-bracket language known as Solidity. It is influenced by JavaScript, Python, and C++. In the section on linguistic influences, you may read more information about the languages that Solidity was influenced by. In addition to supporting inheritance, libraries, and sophisticated user-defined types, Solidity is statically typed. You may design contracts using Solidity for applications like voting, crowdsourcing, blind bidding, and multi-signature wallets.
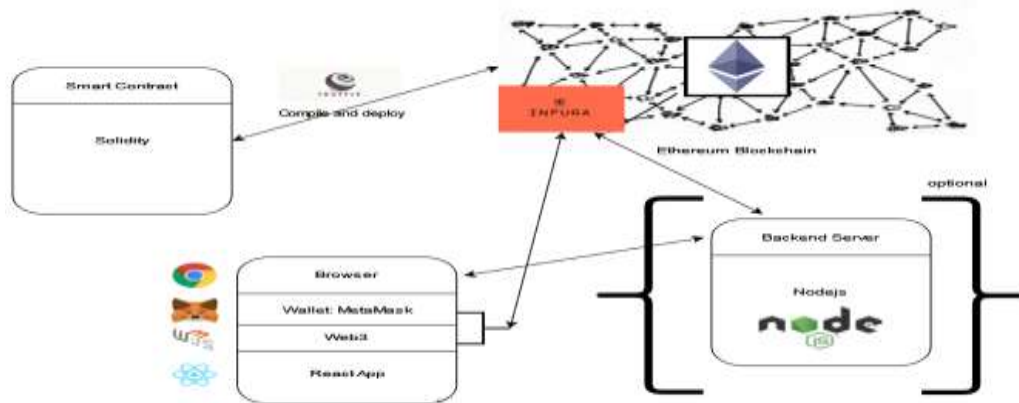
Token Standard

A token standard is a set of rules and guidelines that define the attributes and behaviors of a specific type of token. ERC-721 is the most commonly used token standard for NFTs, and it allows for the creation of unique, non-fungible tokens that can represent anything, including event tickets.

WORKING

Development Plan

When developing a full-stack application, it is best practice to start with the development of the front end before the back end. This is because it is easier to show progress to stakeholders as there is something visual for them to see.
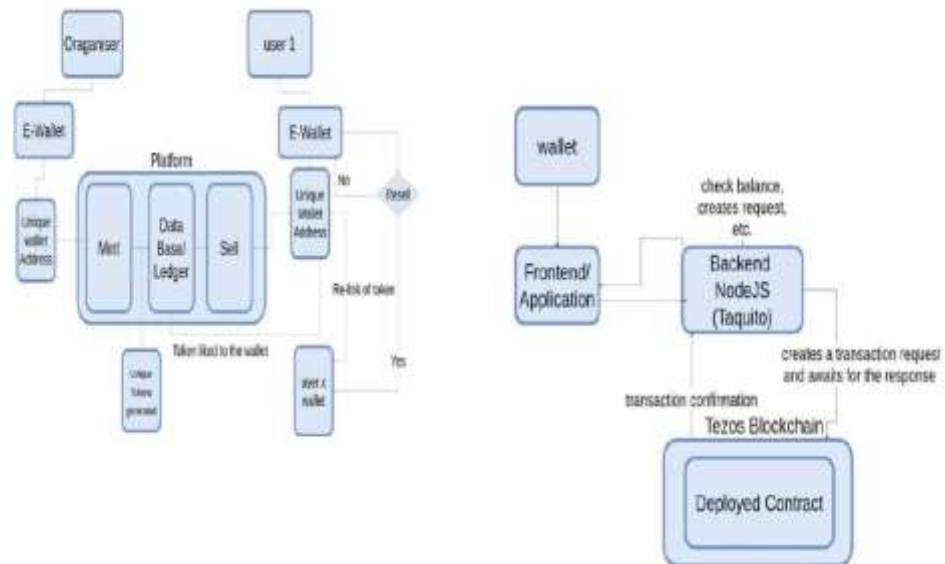

FLOW CHART

Furthermore, because its complete functionality has not yet been established, if there is a feature that stakeholders dislike, it may be modified right away. However, as there was no prior expertise with creating smart contracts, the backend of the programme was created first because it was unclear how long the development would take. The backend also houses the project's essential features, making it more crucial that it be created first to prevent the possibility of running out of time to complete implementation.

Backend Section
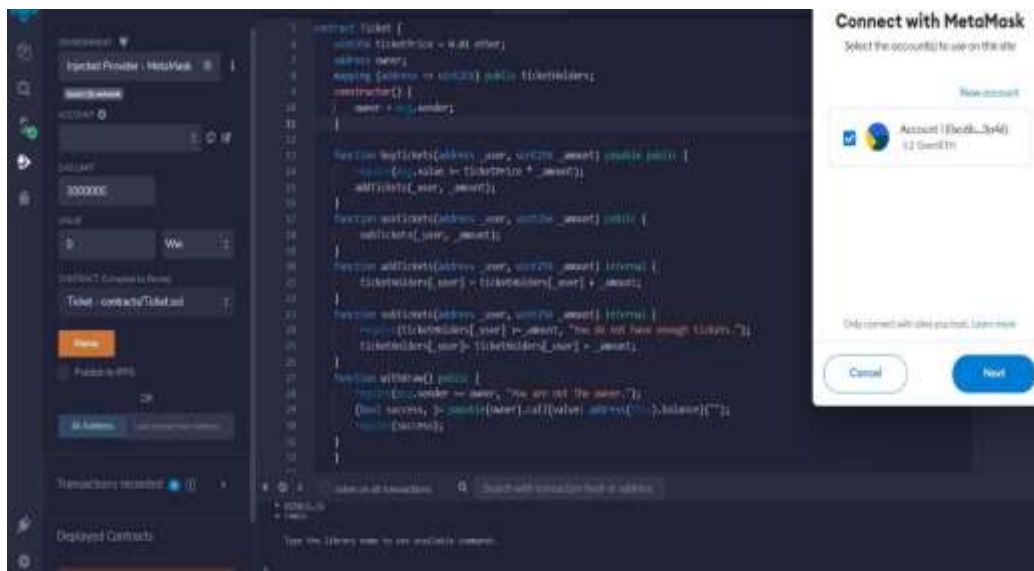
MetaMask Connection is shown
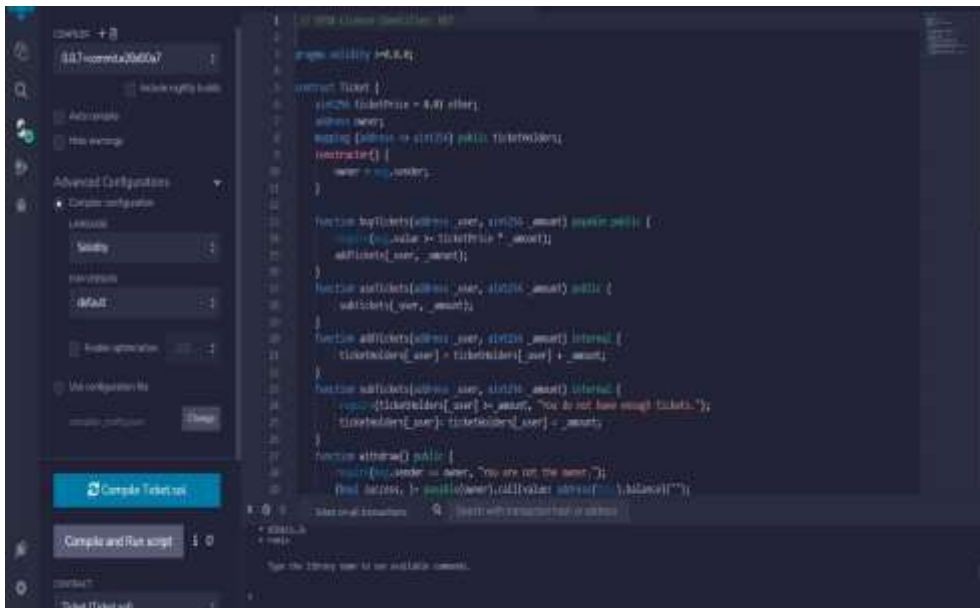


For Deployment of Tickets

Tickets Deployed

Frontend Section

RESULTS/DISCUSSION

You can order some fake GTH tokens to test out dApps and transactions after connecting to the Goerli network. By going to the Goerli ETH faucet website (https://goerli-faucet.slock.it/) and entering your Ethereum address (which can be found in your Metamask wallet), you can do this. Your Goerli network address will then receive some GTH tokens from the tap.

Keep in mind that the GTH tokens you obtain from the tap are fake and worthless. They are only meant to be used on the Goerli network for testing.
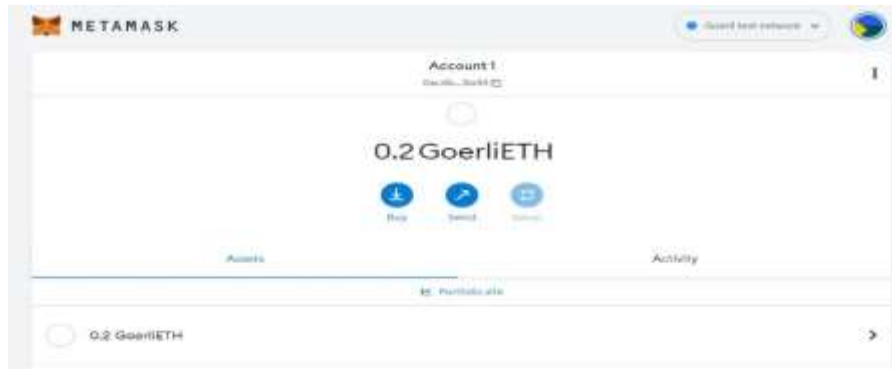
MetaMask With GoerliETH For Dummy Balance

Overall, using a blockchain-based ticketing system with a Metamask wallet and fake balance on the Goerli test network offers a safe and open way to purchase and sell tickets. The use of smart contracts means that the ticketing system's regulations are automatically upheld, eliminating the need for a central organization to oversee ticket sales. The deployed ticket's output is seen here.

Transaction Done

Users could add new events by filling out a form on a website with information on the event's name, organizer, location, date, and time, among other things. Users may be able to add a photo or video to the website to reflect the event.
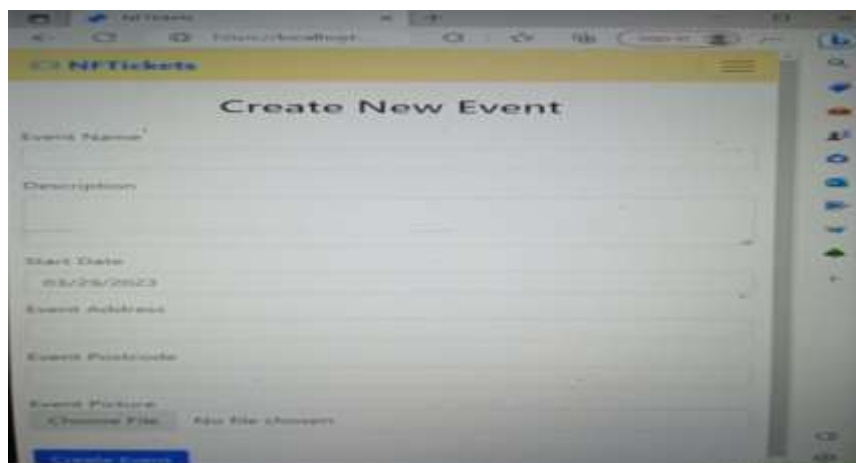
UI Webpage To Host The Tickets

APPLICATION

Music concerts: The ownership of concert tickets can be verified and authenticated using NFT ticketing systems. NFT tickets can be bought by customers, who can then safely transfer them to their digital wallets.

Sporting events: You can utilize NFT ticketing systems to check the validity of tickets for athletic events like basketball or football games.

Festivals: For events like music or art festivals, NFT ticketing systems can be utilized to create and manage tickets. NFTs can be used to confirm the ownership of festival passes and to authenticate it.

Conferences: Conference tickets, including those for business or technology conferences, can be managed using NFT ticketing systems. NFT tickets are available for purchase, and attendees can safely transfer them to their digital wallets.

Museums and exhibitions: Tickets for museums and exhibitions can be managed using NFT ticketing systems. NFTs can be used to authenticate tickets, confirm their ownership, stop fraud, and stop counterfeiting.

Tours and attractions: Tickets for tours and attractions, such guided tours or visits to historical places, can be managed using NFT ticketing systems. NFTs can be used to ensure that only holders of valid tickets are allowed admission and to stop ticket fraud.

Charity events: The management of tickets for charitable events and fundraisers is possible with NFT ticketing systems. NFTs can be used to monitor donations and make sure that the money is going to the charity in its entirety.

FUTURE SCOPE

There are several potential areas for growth and development in the NFT ticketing systems' future application. A few of these are:

Enhanced User Experience: Users can have a simple and secure experience while purchasing and utilizing event tickets thanks to NFT ticketing systems. Users should anticipate even more practical and user-friendly ticketing experiences as developers continue to advance the technology.

Increased Scalability: Developers will need to make sure that their platforms can handle high amounts of transactions as the demand for NFT ticketing systems increases. For this, scalable systems that can handle heavy traffic and quick transactions must be created.

Interoperability: System integration with other blockchain-based systems, such as payment and identity verification systems, is possible for NFT ticketing systems. Users will benefit from a more secure and seamless experience as a result.

Expanded Use Cases: NFT ticketing systems have the potential to be utilized for a variety of ticketing applications, including transport tickets, parking tickets, and more, even though they are now most frequently employed for event ticketing.

Tokenization: Tokenization can be used by NFT ticketing systems to create fractional ownership of tickets. This would make it cheaper for some fans to attend events by allowing them to buy a piece of a ticket as opposed to the complete ticket.

Environmental Benefits: By eliminating the need for paper tickets, cutting down on paper waste, and lowering the carbon footprint of events, NFT ticketing systems can have a smaller negative impact on the environment than traditional ticketing systems.

CONCLUSION

By offering fans a more safe, more effective, and more transparent way to buy and utilize event tickets, NFT ticketing systems have the potential to revolutionize the ticketing business. NFT ticketing systems provide a number of advantages over conventional ticketing systems, including higher security, decreased fraud, and improved user experiences thanks to the usage of blockchain technology.

Although NFT ticketing systems are still in their infancy, we may anticipate continued growth and innovation in this field over the next years. The user experience for fans will likely be further improved, and the overall effectiveness of the ticketing business will increase since new and intriguing use cases for NFT ticketing systems are anticipated to emerge as technology continues to advance. Beyond event ticketing, NFT ticketing systems have the potential to be used in a number of different industries, including transport, parking, museum and gallery exhibits, conferences and trade shows, internet streaming events, and theme parks. This demonstrates the adaptability and promise of this technology, and in the years to come, we may anticipate further development and innovation in this field. Additionally, NFT ticketing systems can offer more revenue-generating options by developing rare or limited-edition NFTs as well as loyalty programs that honor returning customers. This opens up a fresh source of income for event planners, which can be especially helpful in the post-pandemic period when the sector has experienced numerous setbacks.

NFT ticketing systems do face several difficulties and issues, though, including the requirement for scalability, compatibility with other blockchain-based systems, and the possibility of price fluctuation in the secondary market.

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