MINISTRY OF EDUCATION AND RESEARCH

TECHNICAL UNIVERSITY OF MOLDOVA

FACULTY OF COMPUTERS, INFORMATICS, AND MICROELECTRONICS

DEPARTMENT OF SOFTWARE ENGINEERING AND AUTOMATION

PROJECT: NFT MARKETPLACE

Internship Report

Students:	_____	Cvasiuc Dmitry, FAF-232
	_____	Costov Maxim, FAF-232
	_____	Tatarincev Denis, FAF-232
	_____	Romasenco Elena, FAF-231
	_____	Petcov Nicolae, FAF-233
Company Mentor:	_____	Dumitrascu Marius, Codwer
Internship Coordinator:	_____	Gogoi Elena

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ABSTRACT

Our NFT Marketplace initiative meets significant obstacles in the NFT industry, including the difficulties of blockchain technology and elevated transaction understanding. Many individuals, especially creators and buyers who are not well-versed in cryptocurrency, encounter difficulties with wallet setup, gas fee payments, and navigating different networks. This often results in limited engagement and less diversity in the market. To address this, we are developing a user-friendly marketplace that simplifies these technical challenges and minimizes costs, that makes the creation and trading of NFTs more attainable.

Nowadays, our system design features a detailed technical framework that includes both functional and non-functional requirements alongside behavioral and structural models. These models illustrate the interactions among users, wallets, and the system, as well as the backend side necessary for the platform. The expected result is a more inclusive and efficient NFT marketplace that provides greater participation and highlights valuable digital assets.

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INTRODUCTION

The NFT market is expanding too fast; however, hard blockchain configurations and fees pose considerable obstacles for both creators and buyers. Numerous users are discouraged to continue because of challenges of establishing wallets and understanding blockchain technology. Furthermore, high transaction fees discourage smaller creators, leading to market diversity and making it more challenging for buyers to discover quality NFTs along the large selection.

Our project solve these challenges by developing an intuitive NFT marketplace that offers lower transaction fees and progressive discovery features. This initiative is designed to encourage greater engagement from both creators and collectors, these way increasing accessibility and participation. By easing the NFT experience, our goal is to promote broader adoption, making the ownership and trading of digital assets more attainable for a wider range of users.

In the subsequent sections, we will present the Domain Analysis of our project, which includes an overview of the issues, the target audience, and the proposed solution: out NFT Marketplace. Additionally, we will look into the System Design, outlining the necessary non-functional and functional requirements along with the behavioral and structural modeling. This complex approach will ensure that our platform not only meets user expectations but also satisfies the technical specifications required for an easily navigable NFT marketplace.

DOMAIN ANALYSIS

Domain Analysis is the process of studying and understanding all objectives of the specific domain, area of solution and key concepts that will be used in the development of the project. This part helps developers to identify common concepts, defines the terminology, gives the information for the whole research and improves the understanding of the problem. This is specifically useful for NFT Marketplace developers to look at the project from the side of user that want to start some activity using their application.

This part will include the Problem Overview of the project, Target Audience of the future app, Solution Concept and its specifics and Market Researches based on competitor web sites and apps.

Problem Overview

One of the most pressing issues in the current NFT landscape is the high barrier to entry for both creators and potential buyers. Many existing marketplaces require a deep understanding of cryptocurrency and blockchain technology which makes new users to stay away from this. The complexity of setting up wallets, big gas fees, and navigating throughout various blockchain networks can be a challenge for those unfamiliar with the technology.

Moreover, the costs associated with minting and trading NFTs on popular blockchain networks, particularly Ethereum, can be prohibitively high. High gas fees discourage small transactions and may price out many creators and collectors, limiting the diversity of participants in the NFT ecosystem. As the number of NFTs grows exponentially, buyers also face the challenge of discovering high-quality assets among the thousands of offerings. This challenge can potentially lead to market saturation and diminish the perceived value of NFTs as a whole.

Resolving these issues is crucial for the continued growth and mainstream adoption of NFTs. By making NFT marketplaces more accessible and user-friendly, we can unlock the potential for a diverse range of creators to participate in the digital economy. Improved recommendation system will ensure that quality content rises to the top. The evolution of NFT marketplaces exists at the intersection of several important trends, including the growing creator economy, the increasing significance of digital ownership in an increasingly virtual world, and the ongoing transformation of online marketplaces. As digital experiences become more significant in our daily lives, the ability to own and trade digital assets securely and efficiently will become increasingly important.

Target Audience

Our project is designed for three primary user segments: creators, collectors, and casual users interested in digital ownership. By understanding these audience groups, we can develop features and functionalities that enhance their overall experience and address their unique challenges.

Creators

Creators are artists, musicians, writers, and other digital content producers seeking innovative ways to monetize their work. Many of them express frustration with traditional distribution methods, which often limit their revenue potential and connection with their audience.

Creators require user-friendly tools that allow them to mint and list their NFTs without needing deep technical knowledge. Additionally, they are concerned about the prohibitive costs associated with high gas fees on popular blockchain networks, which can discourage them from minting their works. Therefore, they prefer platforms that offer affordable fees to maximize their earnings. Moreover,good promotion mechanisms are essential for creators to gain visibility for their work, enabling talented individuals to stand out in a crowded marketplace.

By using our NFT marketplace, creators will benefit from a direct connection to their audience, greater control over their work, and improved profit margins through lower transaction costs. The platform will also provide effective promotional tools, allowing them to showcase their unique creations to a wider audience.

Collectors

Collectors represent individuals interested in buying unique digital assets for personal enjoyment, investment, or status. This group includes both seasoned investors and newcomers exploring the world of NFTs.

For collectors, discoverability is a key concern; they seek a platform that simplifies the process of finding high-quality NFTs. They value robust filtering and search functionalities that enhance their ability to discover desirable assets. Additionally, transparency and trust are critical components in the collectors' decision-making process. They prefer platforms that provide clear information about the asset's history and the credentials of the creator.

Our marketplace will offer collectors a selection of high-quality NFTs. Enhanced discoverability and community features will create a rich environment for collectors to engage, share, and grow their collections, ultimately increasing their confidence in their purchases.

Casual Users

Casual users are individuals who may lack extensive knowledge of blockchain technology or NFTs but are interested in exploring digital ownership. This group includes people curious about NFTs.

Casual users require simplicity to navigate the NFT landscape. They prefer low-price transactions,

which allow them to experiment with minimal financial commitment. By providing a user-friendly interface, our marketplace will empower casual users to confidently explore the world of NFTs. The opportunity to make low-stakes purchases will encourage experimentation and potentially lead to deeper engagement with the digital economy.

The insights gained from our research directly inform the features and functionalities of our proposed solution:

- User-Friendly Minting Tools: We will develop an intuitive minting process for creators, enabling them to create and list NFTs while minimizing transaction costs.
- Curation Mechanisms: Our platform will include robust curation features to help collectors discover high-quality NFTs while ensuring talented creators gain visibility.
- Transparent Provenance Information: We will prioritize transparency by providing detailed provenance data for each NFT, fostering trust and authenticity.
- Community Engagement Features: We will implement community-driven features, such as commentaries which will allow different kind of discussion, to create an engaging environment for all user segments.

Solution Concept

NFTs (non-fungible tokens) are evolving beyond just digital art ownership, opening up a vast array of possibilities. We envision a future where NFTs form the foundation for owning and managing assets, from shares in major brands and projects to exclusive online passes with private access systems. NFT marketplaces will play a crucial role in this transformation, becoming the platform that empowers and connects a wide audience.

Why Should the Public Embrace NFT Marketplaces as the Future?

1. Democratizing Ownership and Investment:

   NFT marketplaces allow users to invest directly in major brands and projects by purchasing shares in the form of tokens. This removes the barriers of traditional markets, where significant capital and intermediaries are often required for participation. By making ownership accessible and straightforward, NFT marketplaces attract both large investors and small-scale participants, opening the market to a broader audience.

2. Exclusive Access and Privacy:

   In today's digital world, exclusive rights and access to unique content or events are increasingly valuable. NFTs can function as digital passes, granting holders private privileges such as access to closed communities, special events, online concerts, or exclusive content. This makes NFT marketplaces crucial platforms for building and managing a digital economy where exclusivity and privacy are highly valued.

3. Stability and Liquidity:

   NFT marketplaces offer a new form of trading, where tokens tied to shares or other real-world assets can be traded transparently and efficiently. This creates a liquid market where users can buy, sell, and trade their NFTs instantly, providing flexibility and stability in ownership. As a result, NFT marketplaces become modern financial tools offering unique opportunities for everyone.

4. Innovative Applications and Real-World Integration:

   Moving beyond digital art, NFT marketplaces have the potential to integrate into everyday life and business processes. From online passes and subscriptions to tokens tied to real assets, the possibilities are endless. The NFT platform becomes a key tool for building future digital infrastructure, transforming industries and creating new ways for brands and users to interact.

In summary, NFT marketplaces are more than just platforms for trading digital assets; they are tools that open doors to a new economy, bridging digital and real-world ownership, and offering new ways for users and brands to create and engage. In a rapidly digitizing world, NFT marketplaces are poised to become a technology the public will embrace, seeing them not only as tools for ownership but as platforms for unlocking new opportunities.

Market Research

Here is represented the SWOT Analysis that represents the Strengths, Weaknesses, Opportunities and Threats of our Solution.

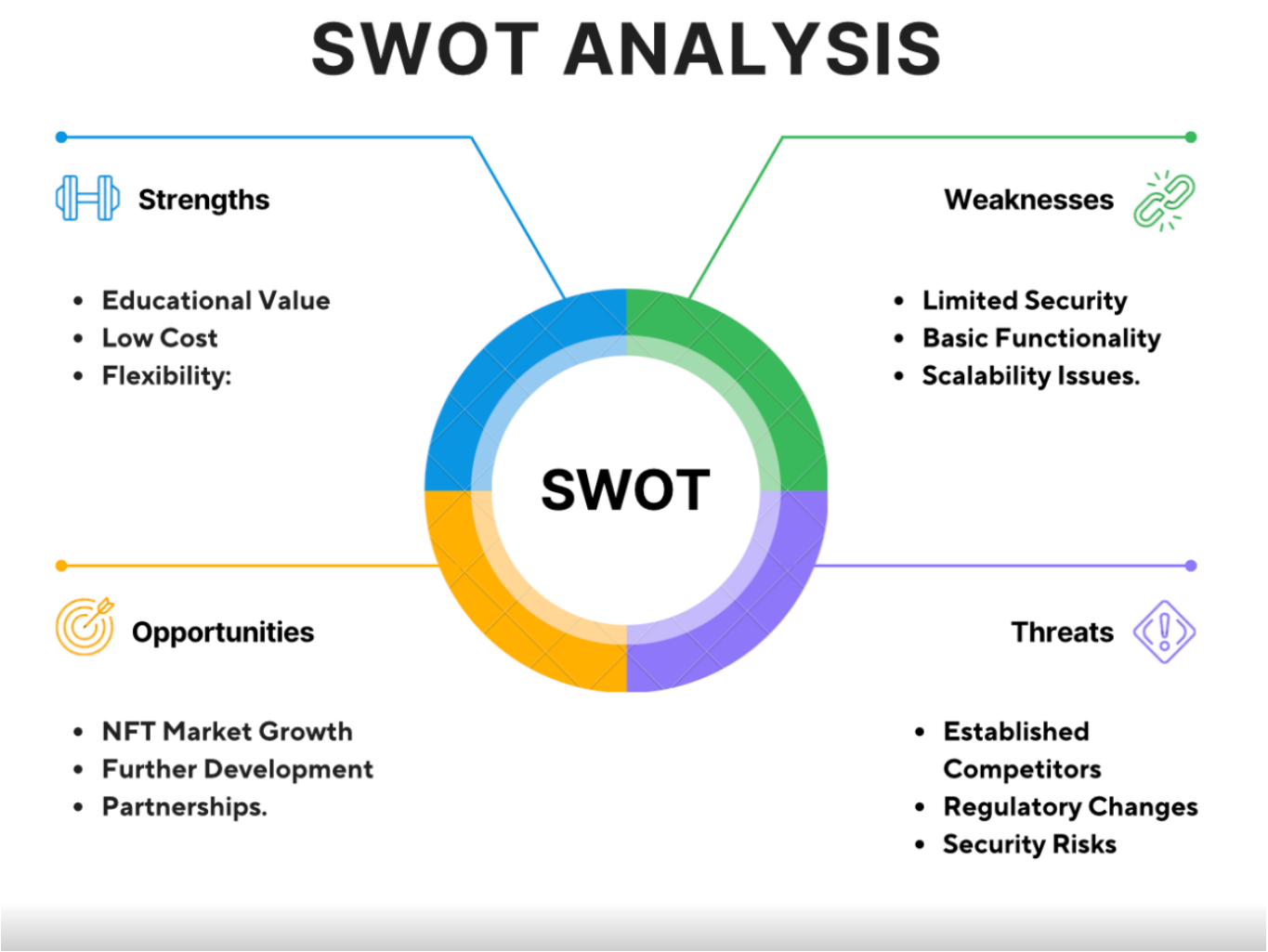

Figure 1 – SWOT Analysis Table

1. Strengths
   (a) Educational Value: Provides practical experience in blockchain and NFTs.
   (b) Low Cost: No transaction fees make it accessible and user-friendly.
   (c) Flexibility: Freedom to experiment and modify without commercial constraints.
2. Weaknesses
   (a) Limited Security: Lacks advanced security features needed for real-world use.
   (b) Basic Functionality: Missing advanced features like auctions and metadata filters.
   (c) Scalability Issues: May not handle high transaction volumes efficiently.
3. Opportunities
   (a) NFT Market Growth: Chance to explore new trends like multi-chain support or DeFi integration.

(b) Further Development: Potential to evolve into a commercial product or entrepreneurial venture.

(c) Partnerships: Possible collaborations with blockchain firms interested in education.

4. Threats

(a) Established Competitors: Platforms like OpenSea offer more comprehensive features.

(b) Regulatory Changes: Shifting laws could impact development and deployment.

(c) Security Risks: Vulnerabilities could harm user trust and project reputation.

Comparative Analysis Table

This part provides a Comparative Analysis of three NFT Marketplaces: Tensor Trade, OpenSea, and our solution. The comparison focuses on platform type, user interface, transaction capabilities, blockchain support, and other relevant features.

Feature	**Tensor Trade**	**OpenSea**	**Our NFT Marketplace**
Platform Type	DeFi Trading Platform	Decentralized NFT Marketplace	NFT Marketplace
Blockchain	Ethereum, Binance Smart Chain, Polygon	Ethereum, Polygon	Ethereum, Polygon
User Interface	Professional, analytics-focused	User-friendly, visual NFT-centric	Simple, beginner-friendly
Primary Use Case	Trading derivatives on crypto assets	Buying, selling, and trading NFTs	Buying and selling NFTs
User Registration	Wallet-based, email registration	Wallet-based registration	Wallet-based registration
Token Support	Cryptocurrencies (BTC, ETH, etc.)	Various NFTs (ERC-721, ERC-1155)	Specific NFT collections
Transaction Fees	Varies based on network and trading	2.5% fee on successful sales	No fee
Customization Options	Trading options, leverage	Metadata, rarity filters, collection management	Basic customization (still in development)
Security Features	Multi-signature wallets, private key	Private key management, two-factor authentication	Basic (project scope limitation)
Additional Features	Advanced trading tools, analytics	Auction, bidding, and instant buy	Limited features (focused on core NFT trading)

Platform Type: Tensor Trade is a DeFi platform focused on trading derivatives and assets, appealing to experienced traders interested in leveraging crypto assets. OpenSea is a mainstream NFT marketplace known for its extensive NFT offerings across various blockchains, making it ideal for collectors and creators. Our project offers basic NFT buying and selling functionalities, ideal for educational purposes, and provides a solid foundation for understanding NFT marketplaces.

Blockchain Support: Tensor Trade supports multiple blockchains, enhancing its versatility. OpenSea also supports Ethereum and Polygon, enabling a wide range of NFT collections and increasing accessibility. Our marketplace primarily supports Ethereum, with limited additional blockchain support, which is reasonable given the project's educational scope.

User Interface and Experience: Tensor Trade's interface is analytics-focused, catering to traders needing in-depth data for decision-making. OpenSea provides a visual and user-friendly interface for NFT discovery and collection management, making it more accessible for a broader audience. Our project has a simpler, beginner-friendly interface, enabling users to grasp the basics of NFT transactions without distraction from advanced features.

Transaction Fees and Monetization: Both Tensor Trade and OpenSea have established monetization models. Tensor Trade varies fees based on trading and network factors, while OpenSea takes a 2.5% fee on successful sales. Our marketplace does not charge transaction fees, aligning with its educational objectives.

Security Features: Tensor Trade and OpenSea employ advanced security measures, including private key management and multi-signature wallets. In contrast, our project, while secure, may lack such advanced features, reflecting the project's focus on basic functionality and learning rather than comprehensive security.

SYSTEM DESIGN

System Design of our application is very important for ever project as it represents the flow of activities of the system, architecture of every function, component and module. It also represents how one type of data cooperate with another type (for example users and NFT collection). This part consists of three chapters Technical Requirements, Behavioral Modeling and Structural Modeling. Each part will be described next.

Technical Requirements

Technical Requirements is the big part of the System Desgn specifically represents the technical aspects of the product. So both the developers and the users can understand the technical part of the product. These requirements in our NFT Marketplace are focused on technologies, system and data performance and the security of the acts according to the smart contracts. This section contains of two subsections: Functional and Non-Functional Requirements.

Functional Requirements

Functional Requirements describe what the system of the NFT Marketplace should do and how this will reflects on the users experiences. They provide the description of the functionality of the application and highlight the way these functions work. They will guide our development processes during the whole semester even after Internship month and they can avoid some clarifications during the development stages. Here are nine most important features:

1. **User registration and authentication**:
   - For every visit of the application the user can provide either registration or authentication. For registration user has just to connect his wallet using Metamask and no more information will be required.
   - For authentication the server should check the connection with the wallet again through the Metamask.
2. **Connecting a cryptocurrency wallet**:
   - The connection with wallet is provided through the registration and after this user doesn't have to make anything more for connection.
3. **NFT search and filtering**:
   - Any user can search the NFTs by name, ID, author or collection.
   - Users can also filter the NFTs by popularity, price, date added and some additional criteria.
4. **Purchase and sale of NFTs**:
   - A possibility to set a price for selling the NFT for author and those users who bought it. The given price is set according to the cryptocurrency (ETH, TON, SOL, etc.). All interactions are provided

only by the wallets, no more data is touched.
   - Selling NFT works in the same way as buying, because it is too sides of one action. one user sell the NFT after setting its price, other one buys it.
5. **Create and mint NFTs**:
   - A user can upload a digital file (image, video, audio, etc.) and create an NFT on the platform.
   - Ability to set up royalties (regular deductions to the author upon resale).
6. **View NFT details**:
   - Users can view full information about each NFT collection: author, issue date, price, metadata, sales history and stuff.
7. **Ratings and reviews (comments)**:
   - Ability to leave reviews and ratings for buyers and sellers.
   - This review can be deleted and users can be banned according to censorship
8. **Integration with social networks**:
   - Users that created an NFT collection can pin their social URL links like Twitter, Facebook so other users can see them and to follow the link
9. **AI comments censorship**:
   - If a user wrote some words that are not allowed according to the censorship system he will be penalised and even banned.

Non-Functional Requirements

Non-Functional Requirements describe the operational aspects of the system and some of them can be even too subjective, but in general there are some standarts for this type of requirements. Meanwhile the functional requirements represent the functionality, non-functional represent the level of efficiency of this feature list. The seven most important of them are:

1. **Performance**:
   - The system response time should be closely to 2-3 seconds when loading NFTs, transactions with them (buying/selling) and other activities that has access to the big data volume.
   - Less demanding activities should not exceed more than 1 second (exceptions can be committed in the situations with bad internet connection).
   - The system should withstand a large number of users (10,000 concurrent users and admins). It can also increase the amount of activity in the specific hours (for example when a new popular NFT collection is minting).
2. **Scalability**:
   - The ability to horizontally scale to handle an increasing number of transactions.

3. **Security**:
   - All transactions and user actions must be encrypted and no-one except the admins should has access to this information.
   - Checking the connection with the wallet and the device.
   - Regular security checks of smart contracts to prevent vulnerabilities.
   - The system must correctly handle interrupted transactions and protect users from data loss.
4. **Usability**:
   - The platform should be intuitive for users with different levels of technical knowledge.
   - The interface should be adapted for mobile devices and tablets.
   - The graphic design should not be very repulsive and not distract users from their actions.
5. **Compatibility**:
   - With major browsers (for example Chrome and OperaGX) and mobile applications that are popular at least at 2% of the world users.
   - With the majority of devices that are not too old for interaction with data (for example an mobile phone from 1990 would not be the best device for using).
6. **Modularity**:
   - Ease of adding new features (e.g. support for new blockchains or payment methods) without significant changes to the core system.
7. **Legal Compliance**:
   - Compliance with regulatory requirements of different countries in terms of cryptocurrency transactions and data protection (for example GDPR for Europe).

Behavioral Modeling

The Behavioral Modeling represents how the system will react to the way user interacts, process and make changes in the system. When user do some actions the system should give this information to the server (or sometimes to the wallet database), so the server will make some changes. This modeling shows how client side of our project is connected to the server side. The most useful types of diagrams that describes this are Use Case Diagrams and Sequence Diagrams.

Use Case Diagrams

Use Case Diagrams summarize the actions between Use Cases, Actors and Systems. Represents only Functional Requirements of the system. Use Case is a system process or a function that can be either automatic or manual. They show what should happens not how. Actor is the one who interacts with the system. They are associated with some Use Cases. Interactions are represented by a line from actors to the use case. System Boundaries in general is the entire System, but in our project the Wallet is also a boundary.

Here is represented the interaction between actors and the system.

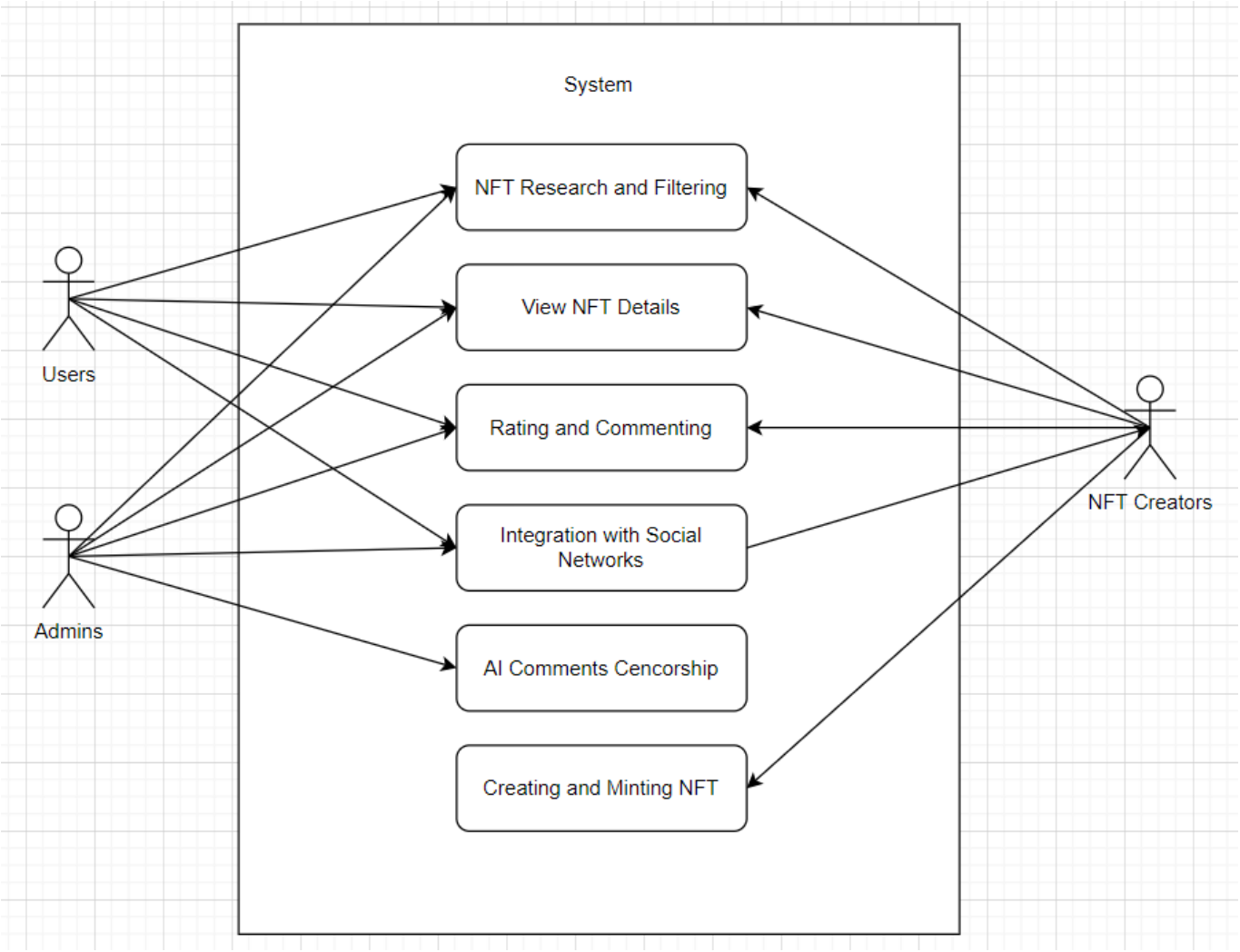

Figure 2 – Use Case Diagram 1

Actors: Users, Admins, NFT Creators

Boundary: System

Use Cases: Users can make NFT researches and use filtering, view NFT details, rate and comment. Admins of the marketplace (our team) has the same functionality but in addition they has posibility to work on AI that takes care of comments censorship. Whenever any of users or admins creates and mints the NFT collection he becomes an NFT creator for our Use Case Diagrams.

In addition: The function ”Integration with Social Networks has two arrows from user and to NFT creator. This is because an NFT collection has the links of social of an NFT creator so simple user following the links comes to NFT creator’s socials.

Next diagram represents the integration between actors and wallet.

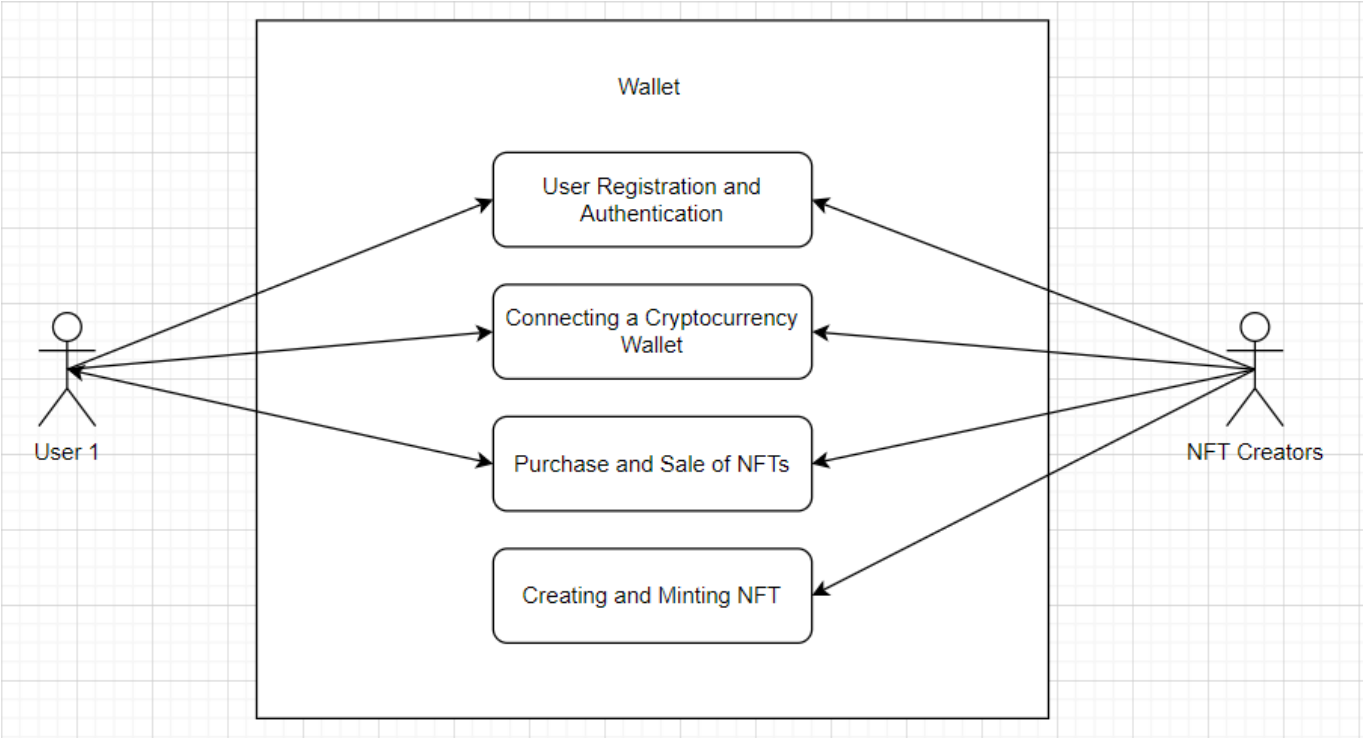

Figure 3 – Use Case Diagram 2

Actors: Users, NFT Creators

Boundary: Wallet

Use Cases: Users have possibility for registration and authentication using only connecting the wallet. Admins have the same functions as users.

In addition: Minting an NFT is both wallet side and server side use case, because the all info is presented in our application (server), but the price is set in different tokens that are located on the creator's wallet. The purchase and sale is open for both users and NFT creators, and in relationship with simple users the interaction is both sided, because buying and selling is one part of one action: one user buys, another sells.

Sequence Diagrams

Sequence Diagrams shows how operations are performed. They capture the interaction between objects and in the context of collaboration and show how elements interact over time and are organised with respect to object (horizontally) and time (vertically). The horizontal line shows the elements that participates in the action that can appear in any order. It represents how an action works inside the server side beginning from the client side with specific behavior.

This diagram represents the flow of operations inside the server side when a user buys an NFT.

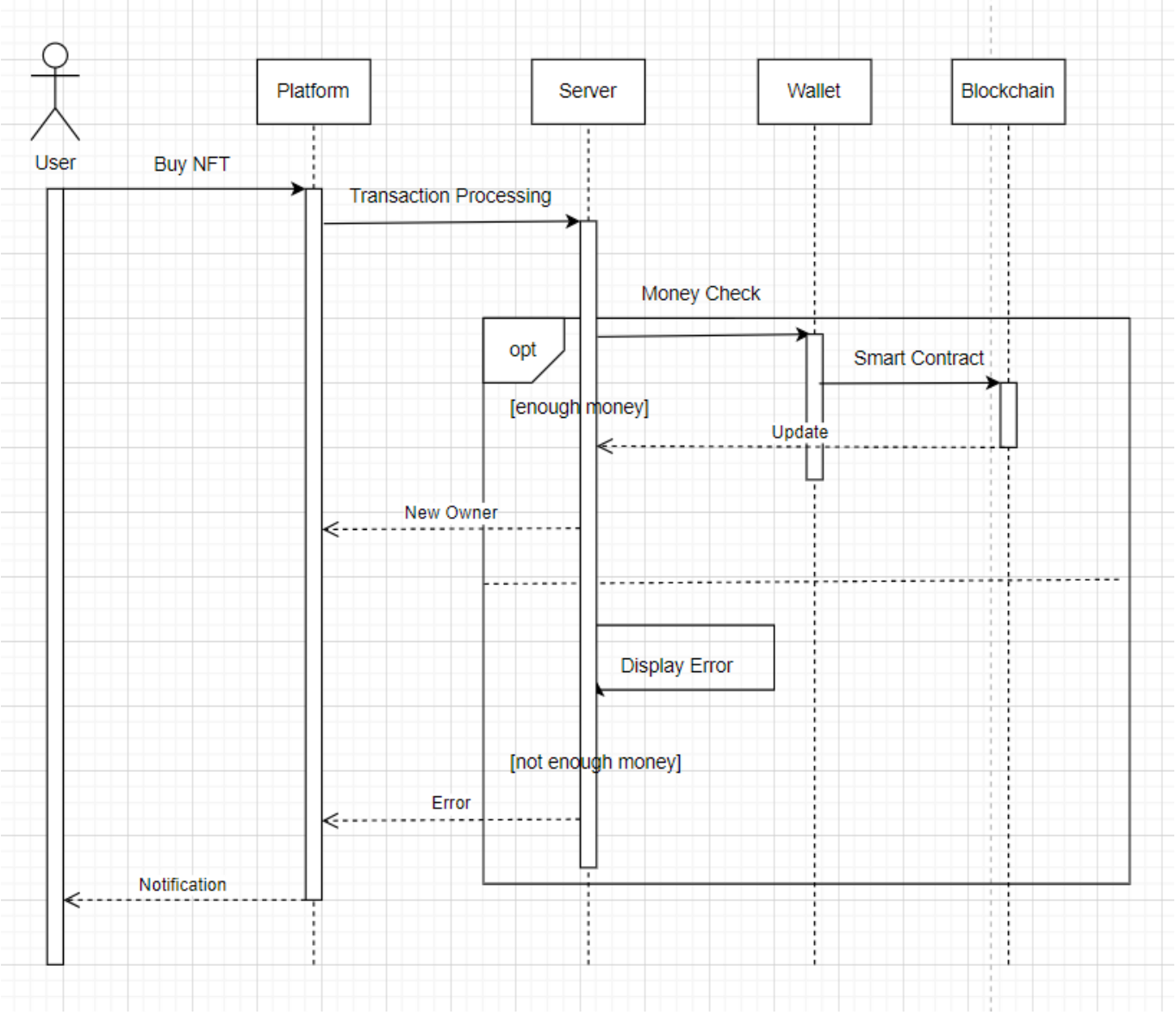

Figure 4 – Sequence Diagram

Actors: User (the one who buys NFT)

Lifelines: Platform, Server, Wallet, Blockchain

Fragments: opt: enough money / not enough money

Messages: User wants to buy an NFT on the Platform - sends transaction processing to the Server

- check if there are enough money for the transaction - if there are ”enough money” it connects the smart contract through the Blockchain - The data updates and is sent to the Server - gives info to the platform about new NFT owner - User gets the notification / if there are ”not enough money” Server prepares an error display on Platform - User gets the notification

Structural Modeling

Structural Modeling in system design represents the static aspects of the system. It shows how the different components such as classes and objects are organized. It is a type of visual representation of the architecture that provides a good and clear understanding of the system by defining the relationships between components. Consists of Class Diagrams and Components Diagrams.

Class Diagrams

Class Diagrams illustrate the structure of the system by describing classes, their attributes, methods and relations.

This diagram represents some types of connections between classes and interfaces.

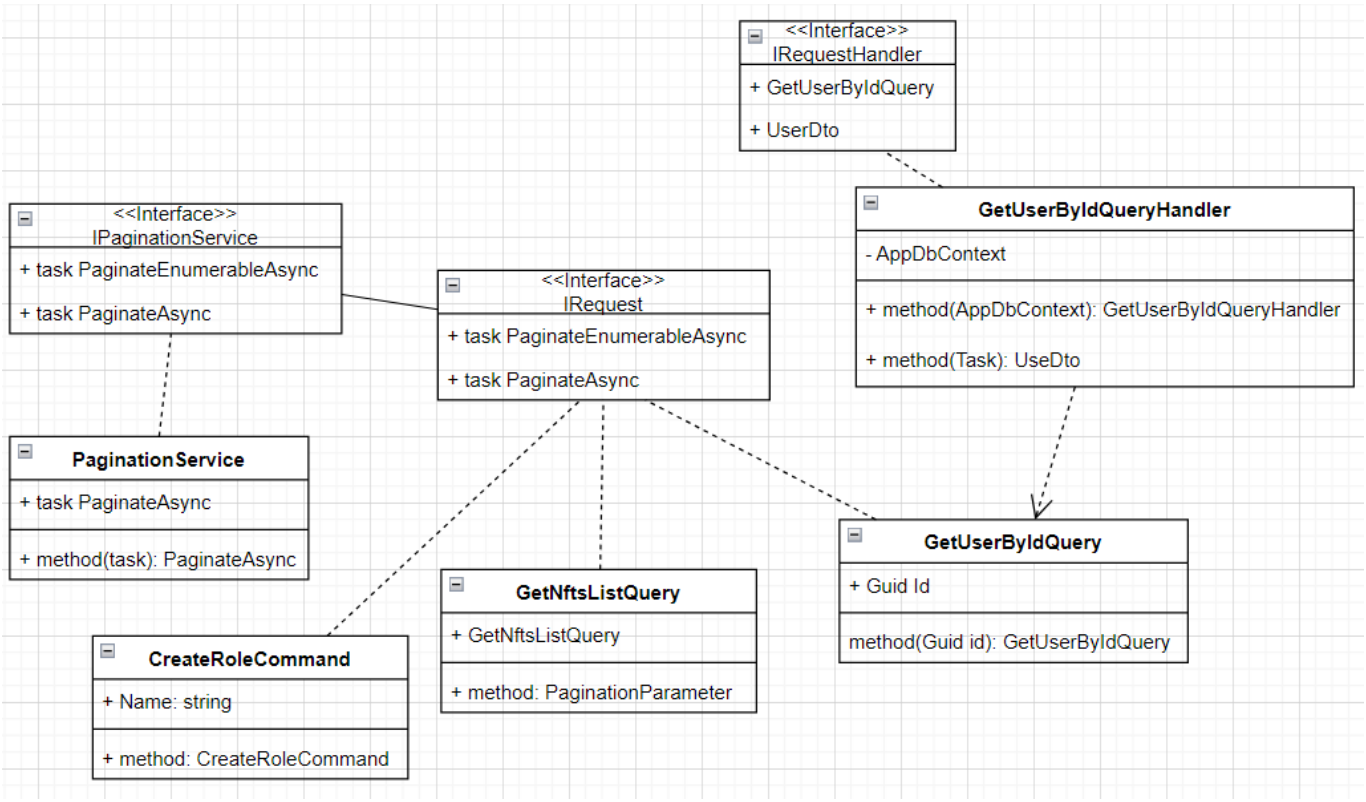

Figure 5 – Class Diagram

Classes: PaginationService, CreateRoleCommand, GetNftsListQuery, GetUserByIdQuery, GetUserByIdQueryHandler

Interfaces: PaginationService, Request, RequestHandler

Relationships: Class PaginationService is implemented in an Interface PaginationService. Classes

CreateRoleCommand, GetNftsListQuery and GetUserByIdQuery are implemented in an Interface Request, meanwhile Interface Request is in association with PaaginationService Interface. Class GetUserByIdQuery-Handler is implemented in Interface RequestHandler and uses Class GetUserByIdQuery.

Component Diagrams

Component Diagrasm are used for modeling physical aspects of object oriented systems that are used for visualising, defining and component systems. Breaks the system into various levels of functionality where each component has one clear goal.

Here is represented a diagram that shows the back-end level.

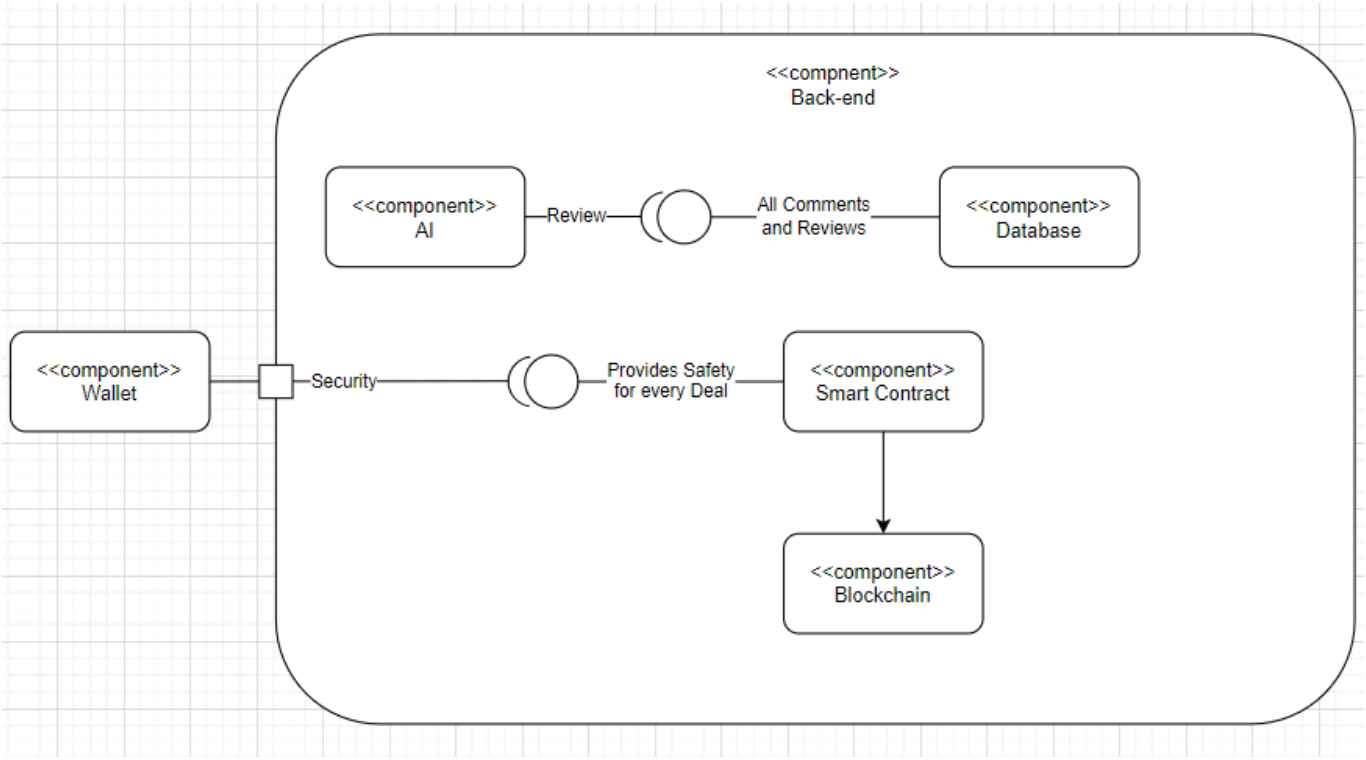

Figure 6 – Component Diagram

Components: Back-End, Database, Smart Contract, AI, Wallet, Blockchain

Interfaces: Security, Review / Comments and Reviews, Safety for Deals

Relationships: The main component is Back-end, so Database, Smart Contract, AI and Blockchain are integrated in this component. After port from Back-End the Wallet is connected. The required interface for AI is an review, and the Database can present all reviews and comments so this is an provided interface. The required interface for Wallet is Security and Smart Contract provides safety for every deal so it is provided interface. Smart contract is associated with Blockchain.

CONCLUSIONS

In summary, our research and design efforts for the NFT Marketplace project have laid a strong groundwork for addressing critical challenges within the existing NFT systems. The Domain Analysis pointed out significant barriers to entry, such as difficult blockchain processes and high transaction fees, which blocks participation from both creators and buyers. This analysis helped us to find our target audience: new users, creators, and collectors, and led us to present a Solution Concept that emphasizes user-friendliness, reduced fees, and escalated NFT visibility. Our Market Research confirmed the demand for these solutions within the escalated digital economy.

During the System Design phase, we concentrated on developing a comprehensive technical framework that includes both Functional and Non-Functional Requirements. Our Behavioral Modeling, utilizing Use Case and Sequence Diagrams, illustrated the interactions between actors (users), wallets and the system, offering insights into how the marketplace acts during essential processes, such as purchasing NFTs, Structural Modeling played a crucial role in outlining the foundational architecture with an accent on class and component diagrams, particularly regarding the Back-End elements.

During the research and design phases, we encountered several challenges, especially in optimisation the NFT buying process without compromising security and efficiency. We resolved these issues through thoughtful design decisions, like enhancing wallet interactions and minimizing fees.

Looking forward, our upcoming actions will focus on the initial implementation of core features and further working on the technical architecture. Areas that could see changes include improving the recommendation system to showcase high-quality NFTs and ensuring smooth integration across different blockchain networks. These achievements aim to make the platform more user-friendly and useful overall.

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