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# Title: NFT MARKETPLACE PROJECT
## Report 2 for Thesis

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# ***Abstract***

*This document is a sister thesis report to the first NFTEAM project report that covers the standardization, constraints and costs and effects of the project.*

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# List of Abbreviations

| | |
|---|---|
| i.e. | Id est (Latin: this means) |
| e.g. | Exempli gratia (Latin: for example) |
| params | Parameters |

# 1 Introduction

This project involved alot more that was previously expected by the team at the beginning of the project, alot of hours went into thinking about the link between contract, backend database and front end(potential security risks for the users, which functions link user metadata correctly etc), Incorporating Packages and design frameworks in to solve particular problems and alot of research and study regarding both the Moralis and ReactJS Documentation. We have separated this document into design, analysis and standardization sections in order to walk you through the making of the marketplace.

# 2 Key Design and Implementation Tools

To create of Decentralized app we incorporated the following components:-

## 2.1 Open Zeppelin Library

OpenZeppelin is an open-source platform for building secure decentralized applications, it takes out security checks on implements security measures to make sure that our dApp is secure. After recognizing the potential problems in the code, they provide a report containing best practices and recommendations to remove the weaknesses in the system. The open zeppelin contract library provided a useful foundation for us to build our smart contracts on, many of the contracts in the library are not expected to be deployed as they are, rather, we used them as foundation pillars to build contracts by adding features to them. The Solidity IDE provides multiple inheritance which aided us in doing this.

## 2.2 React Moralis

The react moralis package is a package that acts as a thin wrapper around moralis, it helps us to easily call functionalities and display data. Particularly the useMoralis hook which provides all the basics functionalities that we needed for authentication and user data, by using this hook we had access to various functions like authenticate() which is the authentication function which authenticates via web3, the user function which is a user object from Moralis.User.current containing the state of the logged in user, the useWeb3ExecuteFunction() hook which executes on chain functions after being provided the correct ABI of the contract, the corresponding contract address, the function to execute, and any other params that you need to send with the function. The react moralis package helped us with everything concerning user variables, login authentication, logout, web3 tasks etc.

## 2.3 Main Dapp Provider

The Main Dapp Provider hook is one which helps us set our market contract ABI, Token ABI, Market contract address and Token address, it also helps us handle changes in the current session variables, so for example, if the user switches accounts, then the hook will detect this and set the wallet address to the zero address(current address) using use state. Functions created in this hook and their children are then made as a wrapper around our Dapp using MoralisDappContext.Provider, essentially making the application responsive to changes in the session variables.

## 2.4 React JS

React JS is a JavaScript library used in web development to build interactive elements on websites, it is a library that particularly helps developers build user interfaces. Reacts is what essentially connects our users with our back-end database and with our smart contracts, for example if for a buy event on our marketplace, we have a button rendered using react for all tokens that when clicked invokes the createmarketsale function on our smart contract by passing the contract ABI, function name and the necessary parameters to the useWeb3ExecuteFunctions(), the react environment allows to then await the results of this transactions, if it was success then we inform the user and push the relavent data to our database, if the transaction failed, we will inform the user what the error is.

# 3 Risk Analysis

Firstly, during the project there was always the risk of project personnel getting ill with covid and/or other diseases, we believe we have mitigated this by adopting the agile methodology since the methodology is easily adapted to change, so if a member is not able to do a task, another team-member can easily compensate for the loss.
There was also a risk of poor time-management, as all group members are in their 4th year of the programs and are doing other side projects and going to work, so it is was important to follow the timeline as closely as we can with the help of the agile methodology.
As with any project there is always the risk of potential exploitation of the

system by malicious users which we have tried to mitigate by following the necessary standards.
There is a risk of our marketplace not getting enough publicity as a result of poor marketing strategies, so it is important to remedy this with very aggressive advertisement.

# 4 Costs Report

- Online Courses for basic knowledge and research will cost us about 12 dollars per course.
- A secondary drive for storing important files will cost us 15 dollars.
- There is also a marketing and advertisement cost for getting publicity on our marketplace, cost of ads vary with the platforms but we will budget 350 dollars for this.
- Compensation for work done(Ahmad Youssef) - 60 dollars per day.
- Compensation for work done(Sadiq Tijjani) - 60 dollars per day.
- Compensation for work done(Baris Tonbul) - 50 dollars per day.
- Improving Computer Specs - 100 dollars per student.
- Finally there is always an implicit opportunity cost of doing any project, any of the group members could be working on or learning something else instead. That being said we can estimate that team member spend in excess of 75 hours in the production part of the project.

# 5 Realistic Constraints

During the production of our marketplace we were faced with a couple constraints namely:-

1. **Limited Resources**: In the course of the project we found that a lot of services that could improve our marketplace had to be paid for(Including an improved server for a higher rate limit and more API requests)

2. **Time**: Since all team members are in their senior year, we all had other projects for other courses going on concurrently with this one which we feel may have taken away from the marketplace as we didn't focus a hundred percent of our time and energy on it, we had to be able to multi-task.

3. **Experience**: Since all team members were new to marketplace and/or Dapp development, we really had to dig deep into the documentation for all components in our project, which took some time, some functions on the front end react could be made more simply , which would've taken less time.

4. **Exposure**: Since the team was creating this project in a vacuum of some sort, it was difficult to gain alot of exposure to industry process of how Decentralized application ought to be made, better blockchain arhitectures access to more advanced server hosting service, so on and so forth.

# 6 Social and Economic Impact

The development of our marketplace is inline with the recent boom in crypto-assets and especially in Non Fungible Tokens, the consequences of this movement at large could mean a whole scale shift in how art is created and consumed in the modern world. This follows in the shift from the analogue to the digital our society has been making in all areas of life, we can now envision a world where art and the facilitators of art consumption(Images, Gifs, Movies, Movie Tickets, Galleries) are all encompassed within the digital realm except with even more security, reliability and immutability provided by the blockchain system, but the use of Non fungible tokens need not be limited to art, it could also be applied in the Real Estate Industry, The Gaming Industry and also the Sports Industry, anything involving contractual agreements.

# 7 Standardization

In the creation of our Dapp, there are a couple guidelines and standards that the team had to take into consideration to ensure user security and to avoid issues or problems that can manifest due to malfunction. The first is the ERC 721(Ethereum Request for Comments 721) standard. The ERC-721 is a specific smart contract standard on the Ethereum network that enables the creation of non-fungible tokens, the main reason behind the development and implementation of ERC-721 was the desire for a system to track digital ownership of non-fungible tokens on the blockchain, it allowed us the following feautures on our smart contracts:-

1. safe transfer function, which ensures transfers can only be initiated by the owner of an NFT, the approved address of an NFT, or an authorized operator of the current owner of a NFT.

2. Ensured that all ERC-721 tokens are enumerable, meaning that wallets and any other users can be able to view all non-fungible assets on the blockchain.

3. A useful collection of tools for wallet applications to quickly use a substantial number of NFTs.

We also took into consideration a couple principles of security and safety from the IET standards regarding Cyber- Security, namely:-

1. **Principle 5**: The organization promotes an open/learning culture whilst maintaining appropriate confidentiality.

   The team incorporated this principle by encouraging the open sharing of new ideas and thoughts regarding the project together with open and constant communication between all team members.

2. **Principle 6**: Organizations are demonstrably competent to undertake activities that are critical to achieving security and safety objectives.

   The team underwent several weeks of research on the security measures for all transactions on our marketplace both in pre-production and during production, we made it a point to only include transactions for which we could safely guarantee their safety and security.

3. **Principle 11**: Safety and security assessments are used to inform each other and provide a coherent solution.

   Implementing the ERC 721 standard in our contracts , the Truffle testing environment, the polygon testnet explorer all come together to allow us to inform us on potential safety and security risks, and help us mitigate these risks.

4. **Principle 13**: System architectures are resilient to faults and attack.

   The ERC 721 standard has enabled us to make contract functions that reduce exponentially the reach of a malicious user, for example, the safe transfer function makes it impossible for a third party to intervene between the transfer of a token between two users, which means The NFT Transfers can only be initiated by:

(a) Someone who owns the NFT.

(b) Someone who holds an approved address of the NFT.

(c) Someone who is an authorized operator for the actual owner of the NFT.

The polygon network will then handle the transfer transactions safely.This principle applies to all other transaction functionalities in our project.

# 8 Contributions

Our three person team , using the agile methodology, divided the workload mainly based on competence and availability(free time), all memebers were assigned tasks according to their skill level, ability to quickly comprehend concepts and amount of free time. We were able to keep the project agile by weekly review of work done by all group members, so as to keep everyone in the know and decided what to improve on next. The work load is as follows:-

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|---|---|
| Ahmad Youssef | Front End React Development<br>Back-end Solidity Development<br>Server Maintenance<br>Database Management<br>Contract testing and deployment. |
| Baris Tonbul | Back-end Solidity Development.<br>Front-end React Component Testing.<br>Front-end Component Debugging.<br>Meeting Coordinator. |
| Sadiq Tijjani | Front End React Development<br>User Interface Development<br>Report Writing<br>Presentation Preparation<br>Document preparation and walk-throughs for project supervisor. |

# References

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