An Undergraduate Internship/Project on Topic Marketplace for Digital Artworks/Products

By

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Summer, 2021

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September 9, 2021

Dissertation submitted in partial fulfillment for the degree of Bachelor of Science in Computer Science

Department of Computer Science & Engineering

Independent University, Bangladesh

Attestation

This is to confirm that the report has been completed by me, Redwan Alam Bishal (ID:1720750), and that it has been submitted in partial fulfillment of the requirements for the degree of Computer Science and Engineering from Independent University, Bangladesh (IUB). It has been successful. Md. Fahad Monir supervised the completion of the project. I also attest to the fact that all of my authentic work is something I discovered during my internship. All of the information sources this project has made use of it, and the report has been properly recognized.

Signature	Date
Write Your Name Here	
Name	

Acknowledgement

I would like to thank Almighty Allah for keeping me and my family safe during this COVID-19 situation. I would like to again thank him for giving me an opportunity to complete my graduation from a reputed University in Bangladesh and complete my internship from a well-known software farm. I would like to express my gratitude to my honorable supervisor Md. Fahad Monir, Internship Supervisor Lecturer, Department of Computer Science Engineering, Independent University, Bangladesh, for his helpful assistance, tolerance, time, constructive criticism, and careful counsel on several elements of my internship and report preparation. I would also like to express my gratitude to Mr. Sanzar Adnan Alam, CEO, DebugBD for giving a chance to prove my worth and skills in his company and work on a wonderful project. The knowledge and experiences I've gained here have greatly aided me in my work as a Developer and System Analyst, and they will undoubtedly aid me in my future endeavors. I would also like to thank my teammates, my friends and family for always helping me through the hard times while working on this project. Without them this journey would have not been easy.

Letter of Transmittal

September 10, 2021
Md. Fahad Monir
Lecturer
School of Engineering, Technology & Sciences
Independent University Bangladesh.

Subject: Submission of Internship Report,Summer 2021.

Dear Sir,

I, Redwan Alam Bishal, from Summer 2021, Section 9, would like to submit my Internship report with due dignity and respect. This report is produced to inform you that my internship program and report have been finished. My internship began on June 5, 2021. DebugBD was where I finished my internship. This report is based on my internship experience and the work I completed at DebugBD. My main goal for the internship was to obtain experience in all of the company's technology-related disciplines, such as research and development, documentation, content writing, and software development, as well as to learn about software development processes and practices.

Over the period of my internship at DebugBD, I found out that I learned and applied a lot of new skills and technologies. The company comprises of a small team for Blockchain developers, who learn, collaborate, and innovate together. I would like to thank you immensely for all your guidance and support. I hope and pray that this report fills all the requirements and is up to your expectations.

Sincerely,
Redwan Alam Bishal
ID: 1720750
Student, SECS

Evaluation Committee

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Signature

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Supervisor

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Internal Examiner

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Abstract

PlayToshi is a web-based digital marketplace where people can buy and sell their unique digital goods. This cross-platform marketplace is fully based on blockchain technology which is relatively new but much more powerful. Blockchain is a ledger technology which stores data in several blocks and are related to each other. This prevents data from being tampered or lost. As our system will deal with the uniqueness of the data so it is very crucial for us to maintain integrity of the system. Just like any other e-commerce platform PlayToshi enables users to upload and mint their digital products. This process happens in two steps, our system will first verify the user and then start the minting process. Minting is a process where a product becomes a part of the blockchain. And same goes for the selling process too but there's another process where our system will verify whether the buyer has enough credit in his wallet or not. For this, both seller and buyer need to connect their virtual crypto wallets to our system. There are several options for crypto wallets, and we've added most of them to our system. To make the buying and selling process easier the UI was made clean and all the components were redesigned. It will show items according to user's preference and buying history. We also have an option for auctioning items. If the item is very rare or high in demand seller can put it up for auction. Buyers can bid for the item and after a certain timeout the highest bidder gets the item. Our system does not specifically target one region or country, but it is made international so anyone from anywhere can make transactions. There's also a community option for users where they can share their experiences, give solutions to problems, or provide feedback. Our system is not new as there are already many marketplaces like this which are discussed in the "Related Works" section. But we are trying to improve user experience than any other competitors in the market. Through this project I was able to learn industry grade skills and project management. I also got insight of the digital marketplaces which are trending worldwide.

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Chapter 1

Introduction

In this digital era of technology, the world has become so small that it is often considered with the term "Global Village". After the invention of the internet, it became a superpower for all of us. Now we don't need to be physically present to accomplish something or go to a restaurant to order our food. All these can be done with a click on our smart devices. Just like that, buying and selling products through online stores revolutionized the ecommerce industry. Everyday millions of products are being purchased or included in online ecommerce stores. At present ecommerce is not only limited to physical products like bags, shoes, or other accessories but also digital products. After the invention of Bitcoin and Blockchain, the market for digital products started growing. People wanted to own something that is secured, easily portable and yet have a significant value unlike other physical products. Now media companies are selling their digital products like photographs, or video footage which are memorable or have a significant value. For example: CNN, Moto-GP, NBA are giving their fans an opportunity to own their digital products which are unique. These digital products can either be a photograph of a famous player, or a famous winning moment of a team. Anything that has a great value to their fans. Our system deals with the same kind of features. Users can directly post or buy digital goods that are rare or one of a kind. For transactions, users need to connect their virtual wallets to our system. This will enable them to buy and sell items instantly. Auction system is added for items that are very rare or very high in demand. On a live feed users will be able to see the leaderboard where top seller and buyer will be listed. And with each purchase users make, our system will log their ownership history, meaning before buying it whose product was it, and who's the current owner and his details etc. Of course, Blockchain is working behind the scenes in terms of protecting the product's uniqueness, or privacy of the users. Soon the entire world will move to blockchain networks and digital trading which is much more secure and creates reliability.

1.1 Overview/Background of the Work

With everything being digitalized, many people want to own or sell a digital product for themselves which is unique. It can either be a photograph, a winning moment or a video cut out. In the digital world these are called NFT or Non-Fungible Tokens. The company that I'm working for is trying to create a platform for users or companies from all over the world where they can sell or buy digital goods which will be unique. A user can add items which can be valuable for other users and set a price tag for that. Users who are interested to buy can either pay a fixed price or bid in certain products. As we will be handling the uniqueness of the data that's why the platform is made on the base of blockchain technology. A blockchain is a digital log of transactions that is copied and distributed throughout the blockchain's complete network of computer systems. This will increase security and reliability. And for ecommerce point of view this will terminate all the risk factors like data being replicated, data tampering or data being lost etc. Solving those problems this will make the whole user journey very smooth.

1.2 Objectives

- The main objective is to enable users to own or sell digital goods on a reliable platform.
- Prevent data being tampered or duplicated by other users.
- Enable users from all over the world to trade on our platform.
- As it is an online based platform, users can access to their products anytime through their smartphones or computers.
- Provide a clean UI and automate most of the tasks to get a good user experience.
- Collaborate with other big companies in the future to expand the platform.

1.3 Scopes

- **Dashboard:** A customizable dashboard for users where they can see the products that own. Check their following and followers list. Recharge their wallets and more.
- **Listing products:** Users can list their digital products and set an expected price for that. Before listing a product, they must go through minting process and pay a small fee.
- **Place bid:** For rare items, the owner can place them for auction where other users can bid to purchase that item.
- **Wallet management:** User can have multiple virtual wallets for cryptocurrencies. With them they can purchase items. They can also convert their local currency to cryptocurrency and store them in wallets.
- **Edit Information:** Users can edit their personal information (i.e., social media handler, wallet address, bio, username etc.).
- **Rewards:** For multiple purchases users will get free points/gift cards which will get them discounts for their next purchase.

Chapter 2

Literature Review

2.1 Relationship with Undergraduate Studies

The fundamentals of understanding how real-world applications operate in general were taught throughout undergraduate courses. Starting from CSE 203, Data structure course helped me building the basic building blocks of programing such as linked list, stack, queue, graph, pointers etc. In CSE 213, Object oriented programing I learned about representing data as objects and how to interact with other objects. In CSE 303, database management system I learned how to work with databases. How to push or pull data from databases and represent it to the frontend users as they want it which was helpful in this project. CSE 307, System Analysis and Design: This course covers the Use Case Diagram, Use Case Scenario, and SDLCs, as well as how to apply them to a project. CSE 309, Web Application and Internet which taught students how to create web applications. HTML, CSS, PHP, JavaScript, jQuery, Node.js, React.js and MongoDB were among the technologies studied, and they are all in great demand in the market. Finally courses like CSE 416, Distributed database systems gave me a knowledge of how to work with unstructured and huge datasets.

2.2 Related works

Many people are selling their owned digital products in various markets where the price may differ from site to site. Some of the big companies have already implemented this system to sell their player's top moments, photographs, winning moments etc. Even some media companies are also slowly getting involved in selling their digital assets. Some of the system that our project is related to are listed below:

Figure 2.1: NBA TOPSHOT

- **NBA TOPSHOT**: NBA is one of the most popular sports association who are putting their player's collectibles or famous winning moments up for sale. The nba-topshot is a web-based platform where users can buy their favorite basketball player items.

Figure 2.2: MOTOGP IGNITION

- **MOTOGP IGNITION**: MotoGP is another popular sport in the world. And just like NBA they are also selling their player's collectibles and digital moments in their web-based platform MotoGP ignition..

Figure 2.3: RARIBLE

- **RARIBLE:** Unlike NBA and MotoGP, Rarible enables user to post their own digital goods in their platform. The products are categorized in different sections where buyers can choose what they want to buy. This platform also tracks the highest seller and rank them accordingly.

Chapter 3

Project Management & Financing

3.1 Work Breakdown Structure

A work breakdown structure (WBS) is a deconstruction of a project that is visible, hierarchical, and focused on deliverable. It is a useful diagram for project managers because it helps them to work backwards from a project's product to identify all the actions required to complete the project successfully [1]. For this project, we've also created a WBS which reflects our workflow, visualization of scopes, responsibilities in a structured way.

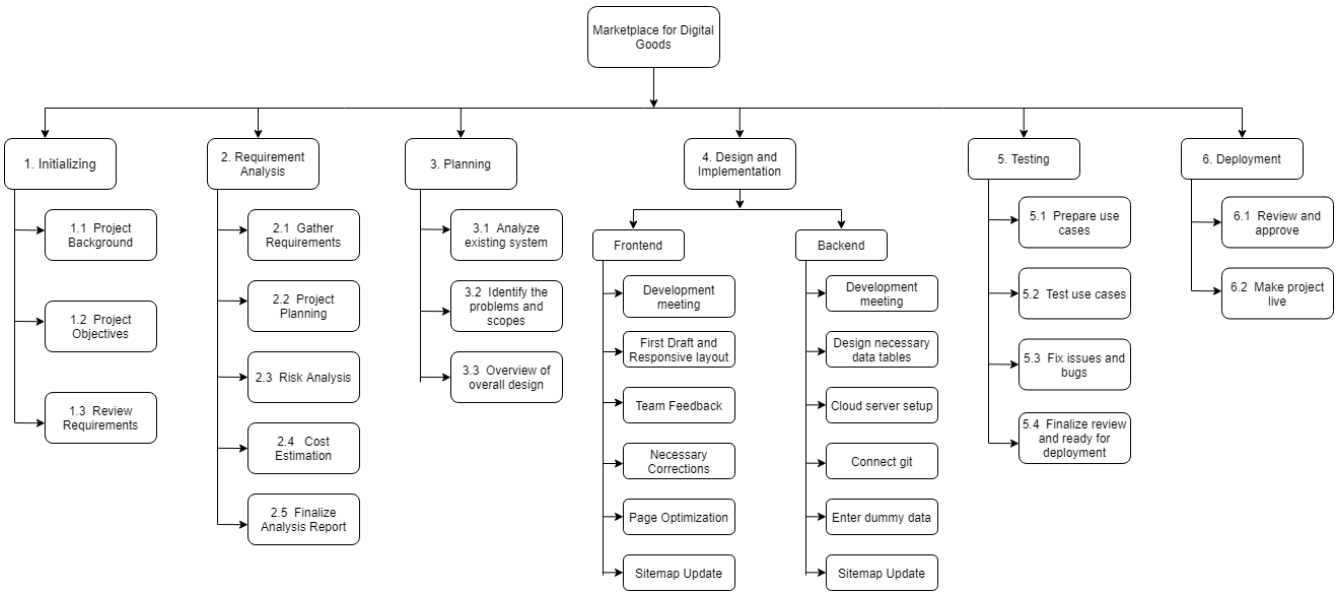


Figure 3.1: Work Breakdown Structure

3.2 Process/Activity wise Time Distribution

The critical route is the longest series of tasks that must be done from beginning to end to effectively complete a project. Critical activities are actions that are on the critical path because if they are delayed, the entire project will be delayed. You can determine the overall length of a project using the critical route, and you'll have a clear idea of the project's true timeline. As the duration of the project was 3 months, the total workflow and the time duration is shown by using the critical path method.

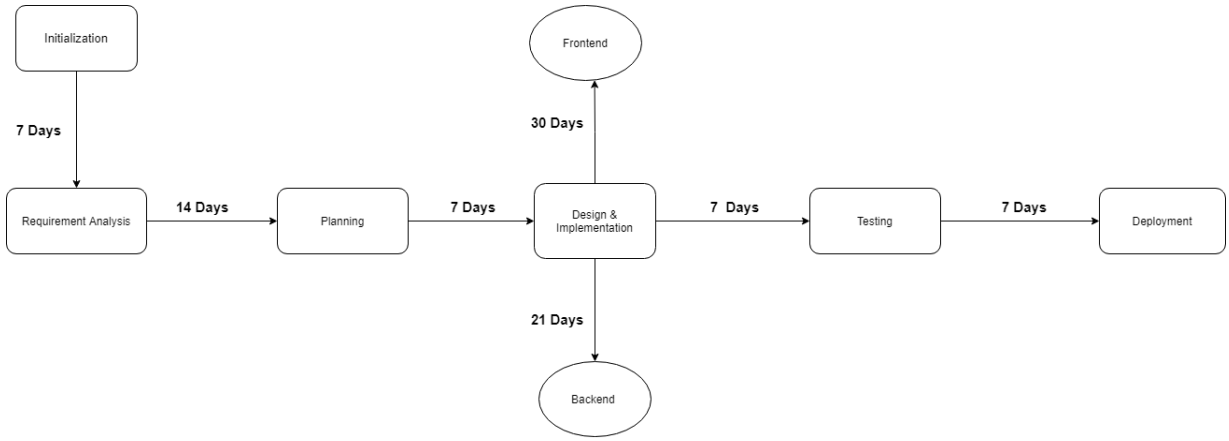


Figure 3.2: Activity wise Time Distribution

3.3 Gantt Chart

Gantt chart, which is widely used in project management, is one of the most popular and useful ways to depict activities (tasks or events) against time. A list of the activities may be found on the left side of the chart, and a suitable time scale can be found along the top. Each action is represented by a bar, whose location and length indicate the activity's start, duration, and end dates. This allows you to quickly see various activities, start and end time of activity, activity duration etc [2].

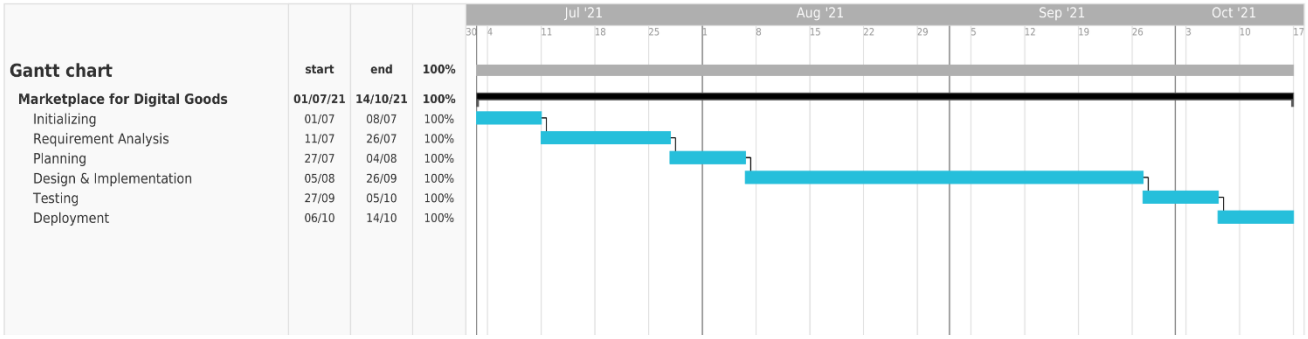


Figure 3.3: Gantt Chart

3.4 Process/Activity wise Resource Allocation

The marketplace we're creating for digital goods is for the users who are mainly interested in collecting collectibles which have significant value and easily available anytime anywhere. To make this come to life, we've been working on various resources. So, it was very crucial for us to allocate right resource at right time. The developers played a main role in developing this application. So, every development tool such as computers, internet, server, electricity etc. are considered as resources in this project.

- **Initializing:** This is the first stage of the development process. Where brainstorming about the project took place. We developed the idea of creating such platform and began to initiate it.

- **Requirement Analysis:** In this stage we worked on getting the requirements for this project. For example: How many computers will be involved and their specifications, how many developers and marketing team required. We also considered the features we're going to add.

- **Planning:** In this stage, we started planning our look and feel of the applications. We set our goals and planned on how to execute it. Also planned on implementing different features that are different than our competitors.

- **Design Implementation:** This is the stage where the main work started. After planning the UI, we designed the frontend. First, we set goals to develop different sections of the app. Every day we reached our goals and start developing the next goal. We faced some issues while developing, that's why in the midway the process became slow as we had to find solutions for it. After completing the whole frontend, the next goal was to develop the backend. And just like the frontend we designed the tables and the data we were going to store in the server. The backend took less

time than frontend as all the required fields were already decided while developing the frontend.

- **Testing:** In this phase, our app was almost ready and ready for testing. First, we tested using the dummy data and fake user. We checked the transaction process and product uploading and purchasing process. The errors we faced were corrected immediately. And this process continued until there were no errors.

- **Deployment:** After passing the testing phase, the project is ready for deployment. And the final product is deployable which met each deadline perfectly.

3.5 Estimated Costing

The total cost of this project is based on total manpower, resources and maintenance used in this project. The evaluated cost was 1,26,000 Taka. This can increase in the future if changes are brought.

Requirements	**Quantity**	**Costing (Taka)**
Salary (3 months)	3	90,000
UI/UX design	1	10,000
Domain & Cloud Server (per year)	1	10,000
Maintenance (per year)	1	10,000
Internet Bill (3 Months)	1	3,000
Electricity Bill (3 Months)	1	3,000
Sub Total	.	**1,26,000 Taka**

Table 3.1: Estimated Costing

Chapter 4

Methodology

For a web app which deals with crypto transactions, there's always a chance of system failure or being attacked by hackers. So, it is very crucial for us to consider all the risk factors and decide a method based on which the whole system will be built. Here we are following the waterfall method. Because in the waterfall method, each step is carried out sequentially. It also gives room for to track back and fix issues in the previous step which is flexible for the development process [3].
In our project at first, we conducted research about the existing marketplaces, how they are doing and what are the scopes available for a new company. Then we analyzed those requirements and did the initial planning. Then, being inspired from those markets, we created a design for our own marketplace. After several revisions when the design was finalized, we created a demo for our web app using the latest web technologies (Html, CSS, React.js, Flow etc.)

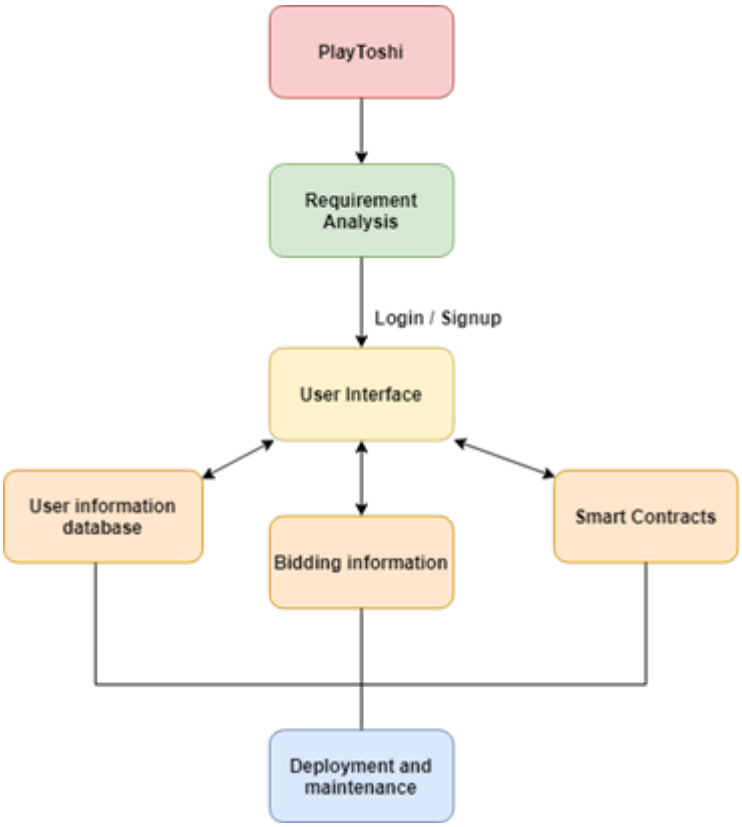


Figure 4.1: Methodology

After the demo, we worked on making it an actual working app and focused on the blockchain part. We mainly focused on creating smart contracts which will work as a backend for this project. Then we tested it on our own servers and with some dummy data. we had to fix a lot of issues, especially with the transaction part. We kept testing until it was finally solved. We did some additional testing to maintain the integrity of the system. After everything was set, we received the final instruction from the manager to deploy it globally. We are conducting maintenance twice in every week to keep the system prime. Also, we're acting for the complaints we're getting from our users.

Web technologies used for this project:

HTML: It is used as a basic building block for web-based applications. It works as a skeleton for our application.

CSS: CSS was used to beautify our application. The colors, borders, texts, all other styling components are there because of CSS. CSS makes an application visually appealing.

React.Js: To make the user interact with our application we used this modern JavaScript library. It makes our application divided into smaller components so that

they are easier to maintain.

FLOW: Flow is the blockchain technology that is used for this project. It is simpler than other blockchains out in the market. Besides the transaction fee is very low in flow.

Cadence: Cadence is a resource-based language which works as a backbone for Flow. From creating resources to handle user interactions, cadence is responsible for everything from backend.

Chapter 5

Body of the Project

5.1 Work Description

PlayToshi is a web-based platform to make the process of buying and selling digital products much simpler. The core team for this project was formed by the CEO which consisted of 4 members. After analyzing the existing systems in the market, the whole team formed a plan about the whole idea and structure of the project. The team leader assigned daily tasks for all of us and took a daily report at the end of the day. This way workload was divided among us. As a part of this project, my job was to develop both frontend and backend of this system. For frontend I had to use HTML, CSS, React.js and React-Bootstrap. And for backend Flow Blockchain, Cadence, Node.js and MongoDB was used. To keep track of daily tasks and planning some other external tools like Notion was also used.

5.2 System Analysis

5.2.1 Six Element Analysis

Process .	**Human** .	**Non-Computing Hardware**	**Computing Hardware**	**Software** .	**Database** .	**Communication and Networking**
Login / Signup	User email/ password	Access to email account for verification	Keyboard, mouse and computer	VScode, MongoDB, Compass, Web Browser	MongoDB to store and retrieve data	Internet .
Buy product .	User selects product	Wallet information, account id	Keyboard, mouse, computer	VScode, MongoDB, web browser	Cadence, Flow to store data	Internet .
Mint product .	User Clicks product	Wallet information account id	Keyboard, mouse, computer	web browser payment gateway	Cadence, Flow to show info.	Internet .
Sell product .	User put item on sell	Wallet information, account id	Keyboard, mouse, computer	web browser payment gateway	Cadence, Flow to show info.	Internet .
Connect Wallet	User selects and connect	Wallet account .	Keyboard, mouse, computer	web browser payment gateway	Cadence, Flow to connect	Internet .
Auction .	User puts item or bid	Account information	Keyboard, mouse, computer	web browser payment gateway	Cadence, Flow to show info	Internet .
Account Management . .	User can change their wallet id, name email etc.	Account information . .	Keyboard, mouse, computer . .	MongoDB, Web Browser . .	MongoDB to store data . .	Internet . . .

Table 5.1: Six Element Analysis of Digital Product's Online Market System

5.2.2 Feasibility Analysis

A feasible analysis indicates the strengths and risk factors of a project. It also uncovers the opportunities and threats present in the project. A feasibility study assesses the project's likelihood of success; hence, perceived objectivity is a key component in the research's credibility for possible investors and financing institutions. It must thus be performed objectively and impartially to offer information on which judgments may be made. In its most basic form, the two factors for determining feasibility are the money necessary and the value to be obtained. Investment plans involving large sums of money are almost always irreparable. As a result, before beginning a project/proposal, it is important and imperative to determine whether it is viable or not [4]. Some of the feasibility types are: Operational feasibility, technical feasibility, and Economical Feasibility.

- **Operational feasibility:** The operational feasibility of a solution is a measure of how well it will work in the company. It is also a reflection of how people see the system/project. In this project, after getting access to the accounts, users can see the products that are up for selling or buying. They can also interact with them however they want. As a result, this project is operationally viable.

- **Technical feasibility:** The technological resources of the company are the subject of this examination. It helps businesses determine whether their technical resources are sufficient and whether their technical staff can convert ideas into working solutions. A technical feasibility analysis also involves an evaluation of the proposed system's hardware, web application, and other technical requirements.
  As for our system, it had enough resources and manpower to convert the idea into reality, so it is technically feasible.

- **Economic feasibility:** The financial component of every project must be considered prior to the start of the project. The nature of investment choices and financial benefits are studied in economic feasibility. This evaluation is intended to assist the company in determining the project's costs and benefits; it is essentially a cost/benefit study. In our project the cost and the benefits were same as we had analyzed before starting the project. There was no extra cost or manpower needed to complete the project.

5.2.3 Problem Solution Analysis

The problem analysis includes identifying the overarching problem and determining its causes and consequences. One essential part of this study will guarantee that "the fundamental causes" are recognized and addressed in the design of the project, not simply the symptoms of the problem

- **Wallet connectivity issue:** For transaction users couldn't connect their virtual wallets to our systems and each time the transactions were failed. To solve this issue, we had to rewrite the API that let interact users with their wallets.

- **Sever issue:** To handle huge amount of data transactions and user data, we had to find a strong server that can handle any amount of load. After analyzing many server providers, we decided to go with AWS services as they are much reliable.

- **Slow loading of data:** At the test run, our system was taking a lot of time to load. This could create a negative impact on users. To solve this, we had to rewrite our components such as product page, auction page and the user profile page. We also had to optimize to product images for faster loading time.

- **Login/Signup issue:** After signing up for an account, the users couldn't login to their accounts as it was showing error. After analyzing the problem was identified. The user data wasn't being saved on the mongoDB server. To solve this, we had to fix mongoDB table code and rewrite some of the variables.

5.2.4 Effect and Constraints Analysis

There are restrictions and dangers to be handled with each project to ensure the eventual success of the project. Time, scope, and costs are the three main limitations to project managers. Often known as the three limitations or the triangle of project management. For example, extending the scope of the project will probably need more time and money, while accelerating the schedule of the project can save expenses as well as decrease the scope.

- **Constraint 1: Time**
  Time is a crucial factor in any project development. In our project, all employees were working from home and giving their daily update at the end of the day. This kept our project on track and no such delays were reported.

- **Constraint 2: Cost**
  The budget of a project comprises both fixed and variable expenses, including material, permits, work and the financial effect of the project team members. As several evaluations were already made for our project, the budget was already estimated.

- **Constraint 3: Scope**
  The scope is the project's limits. It comprises elements to be achieved by the project and the organization. In scope, you will not only discover deliverables, but also procedures for producing them. In our project, the scopes were already defined at the beginning so there was no backtracking.

5.3 System Design

Design is highly important for the area of web application development as it leads you throughout the workflow process. In this project, we contributed to the design and design of the project as one of the main activities. However, the ideas had to be modified and rebuilt throughout time as they anticipated, faced with various system modifications. In general, several actions need to be taken throughout the development phase.

5.3.1 Rich Picture

A rich image is a representation of a situation which displays the key parts and relationships needed to change the condition. They comprise of photographs, texts, symbols, and icons, all of which represent the issue graphically. It is known as a rich photo because it shows how rich and complicated a scenario is [5].

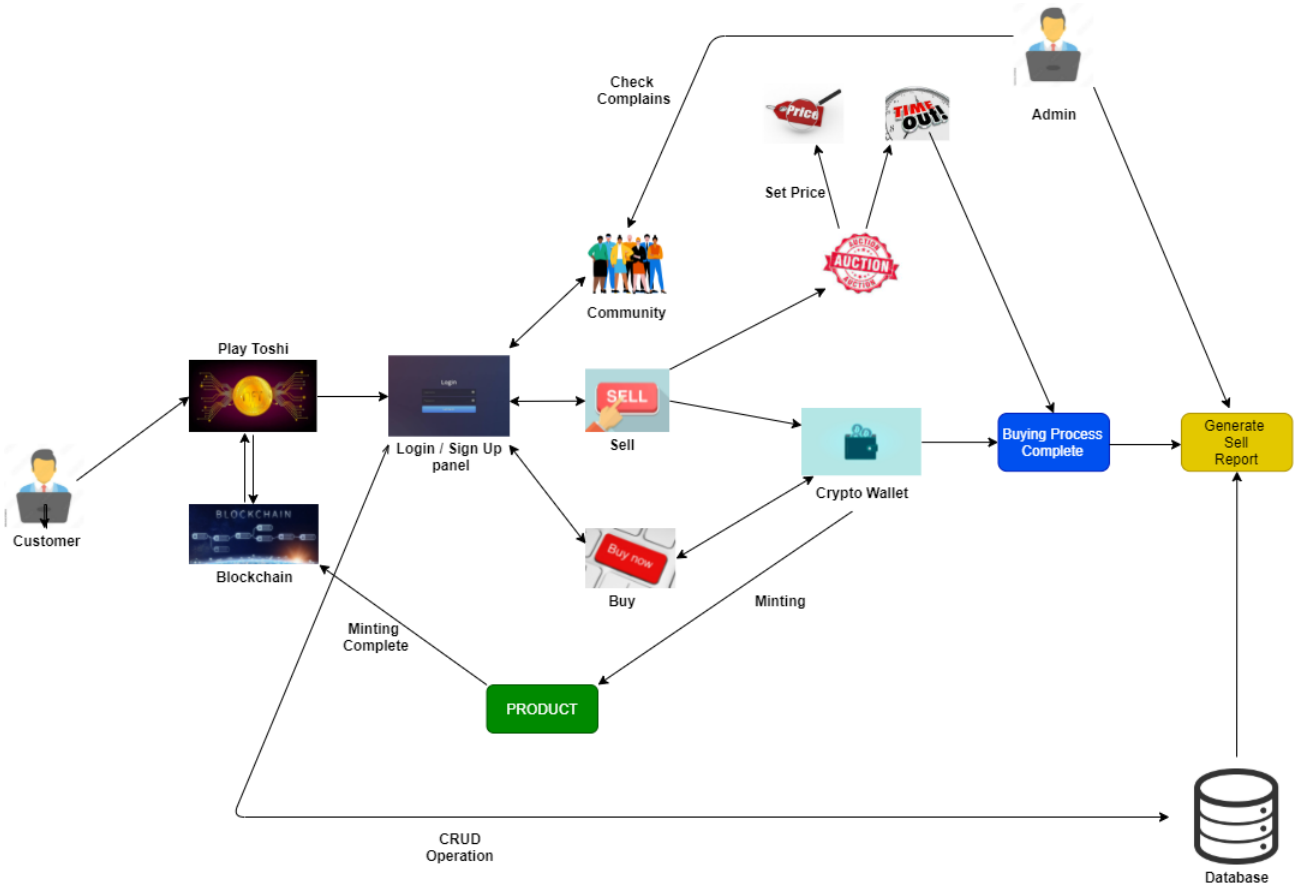


Figure 5.1: Rich Picture of the System

5.3.2 UML Diagrams

UML is an architecture, design, and implementation of large web application systems. It stands for Unified Modeling Language. When you write code, an application has a thousand lines and tracking the relations and hierarchies inside the web application system is tough. Divide UML diagrams into components and sub-components [6].

Activity Diagram of User

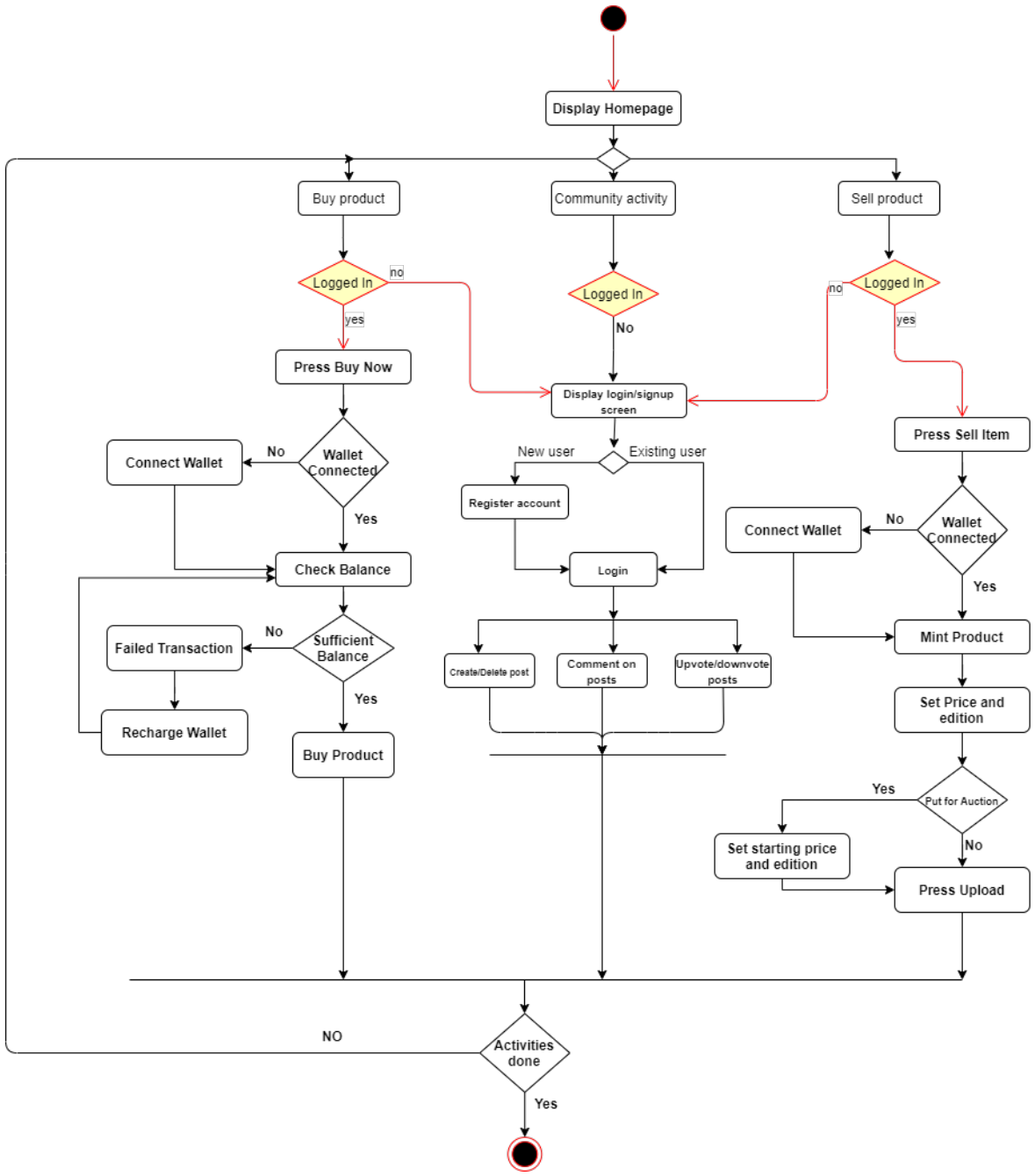


Figure 5.2: Activity Diagram of User

Activity Diagram of Admin

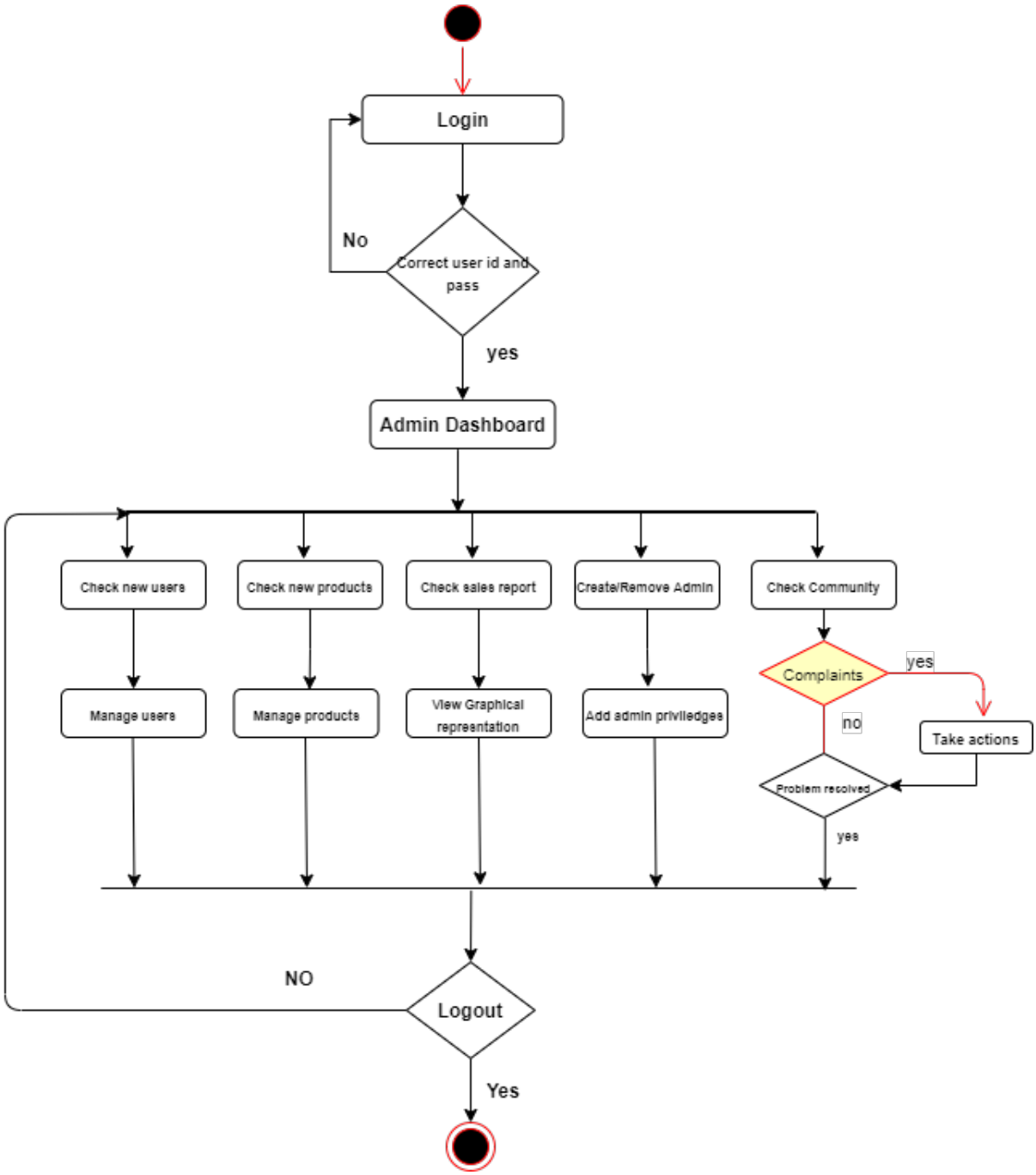


Figure 5.3: Activity Diagram of Admin

Use case Diagram of System

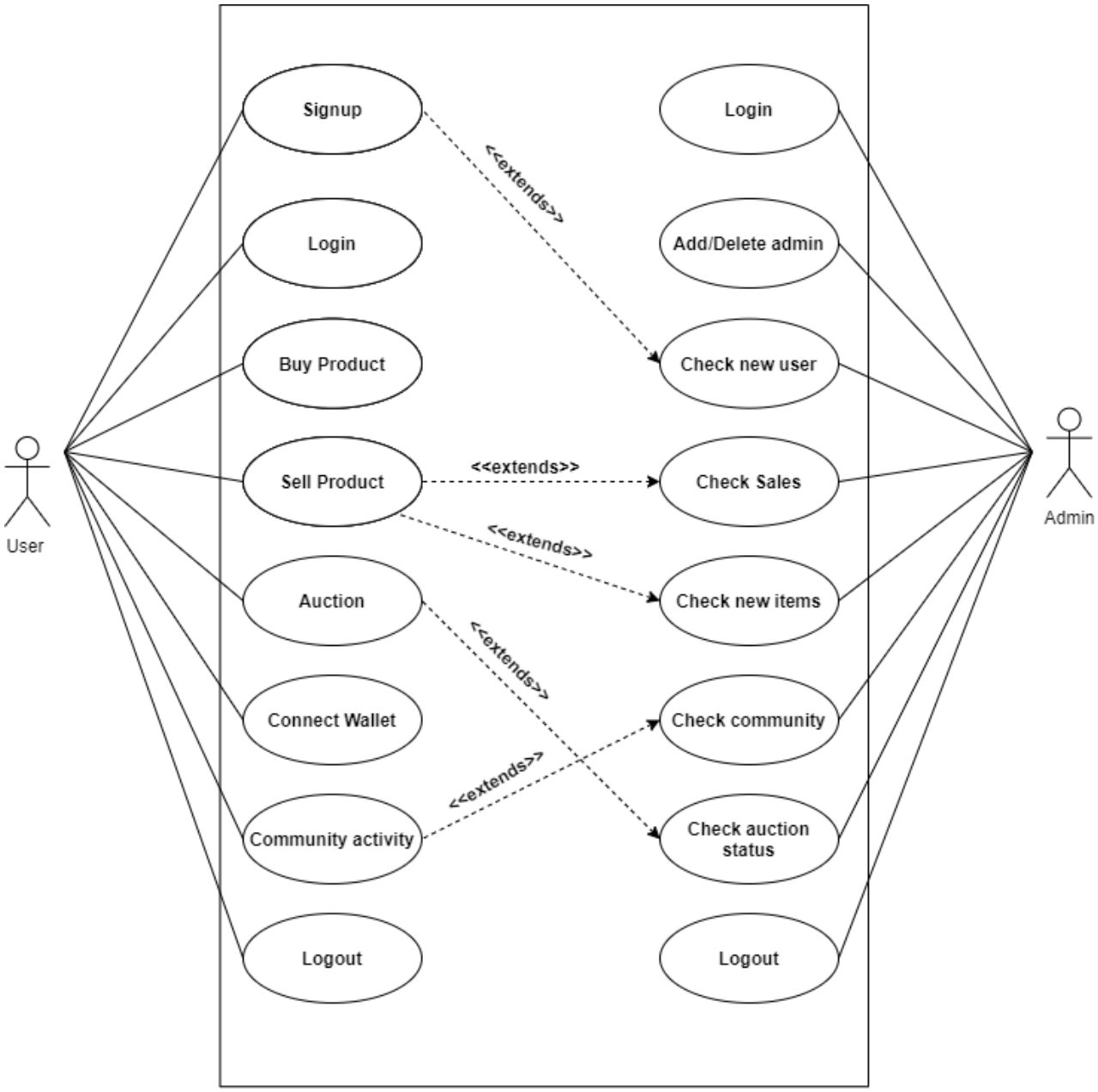


Figure 5.4: Use case Diagram of System

Use case Diagram of Admin

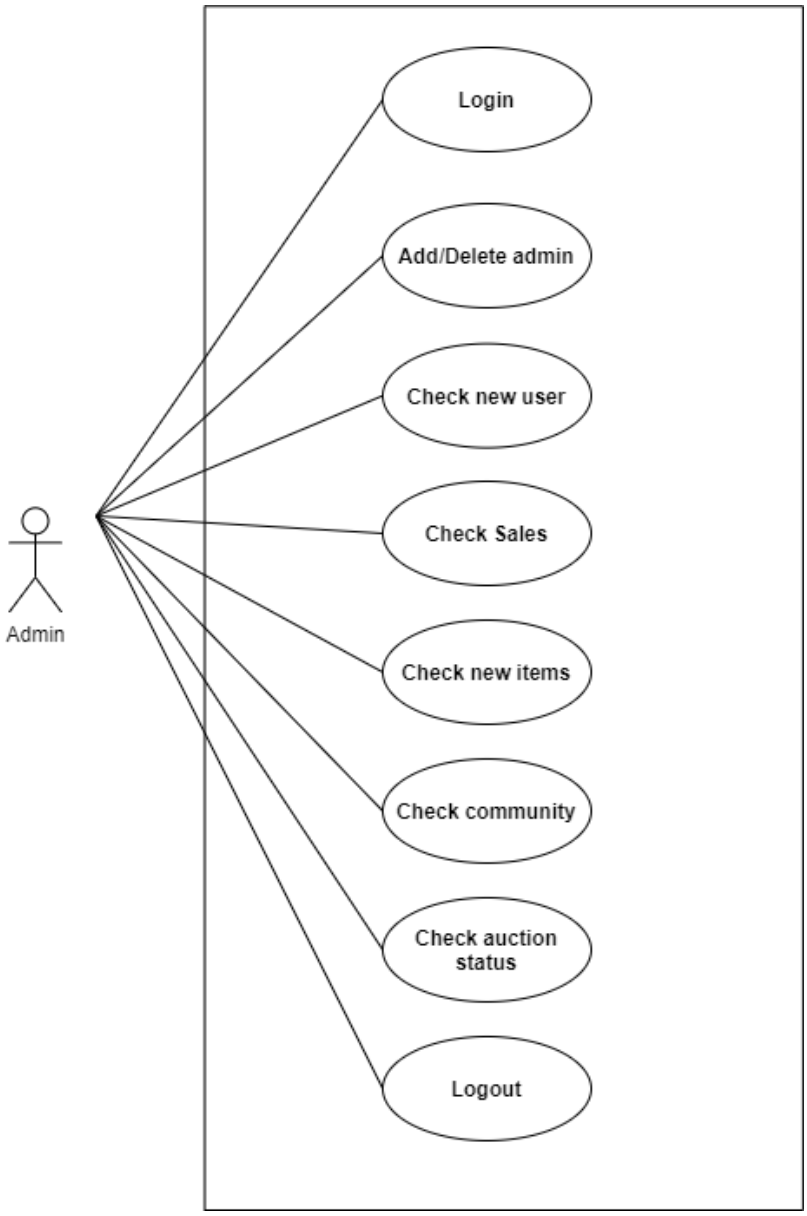


Figure 5.5: Use case Diagram of Admin

Use case Diagram of User

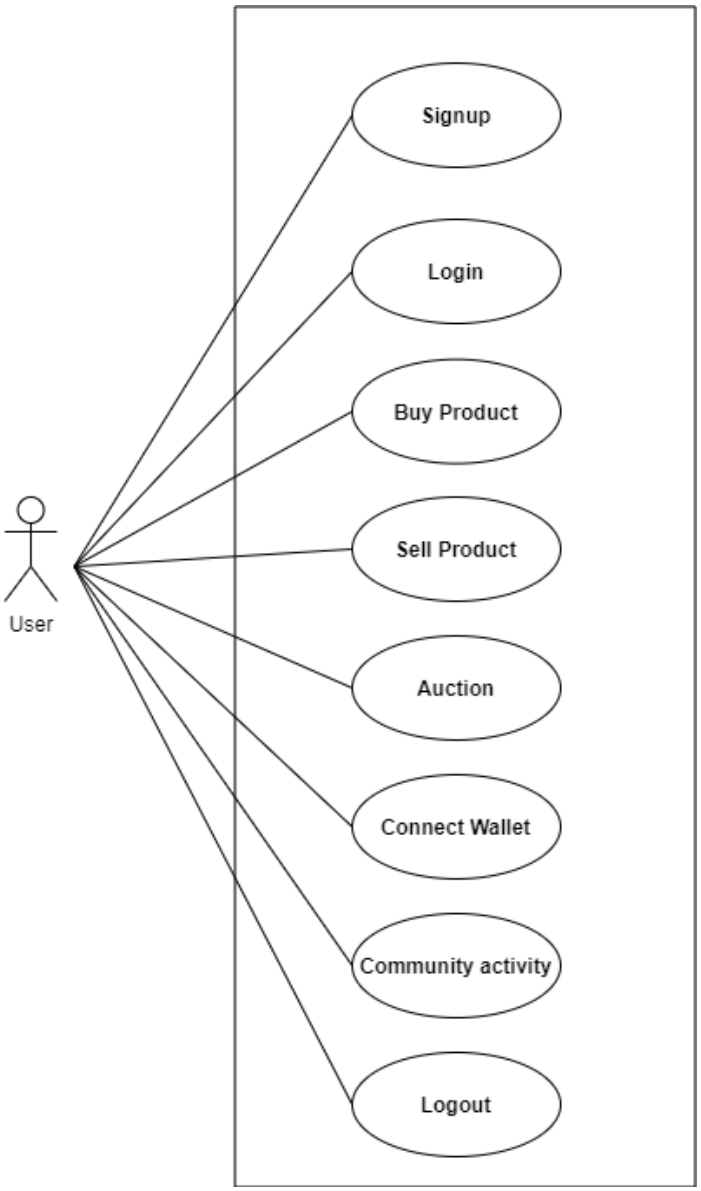


Figure 5.6: Use case Diagram of User

Entity Relationship Diagram of System

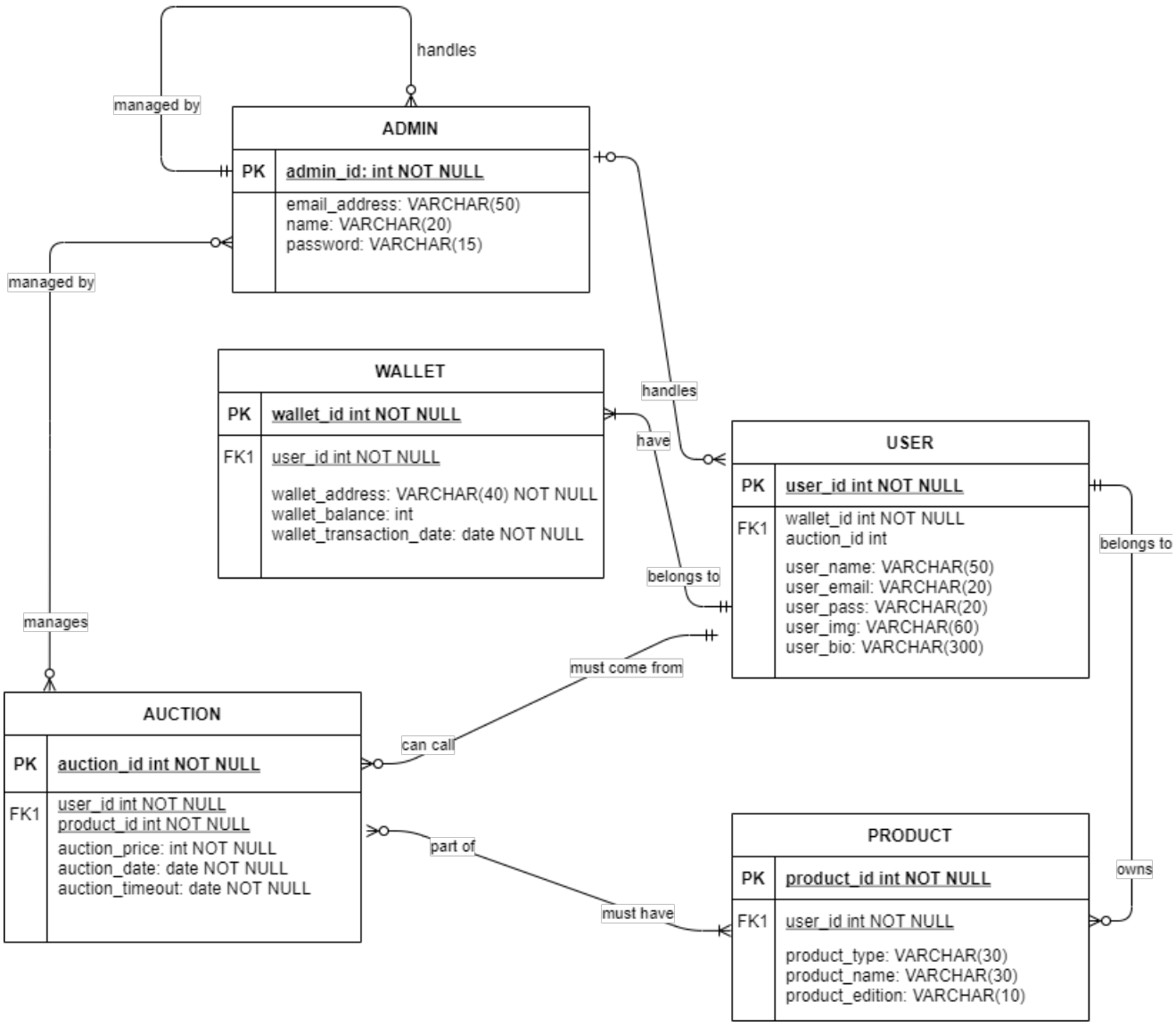


Figure 5.7: Entity Relationship Diagram

5.3.3 Functional and Non-Functional Requirements

Functional requirements are the conditions expressly requested by end users as the system's fundamental capabilities. All these functions must be integrated as part of the contract necessarily in the system. These are shown or indicated in the form of the system input, the operation, and the intended outcome. They are essentially the requirements of the user, and unlike non-functional requirements, which can be seen immediately in the finished product [7].
A further example of how a system should comply, as well as the limitations of its usefulness, is a non-functional requirement. Non-functional requirements include all other needs that do not fall under the functional requirements. Instead of behaviors, criteria which assess the functionality of a system.

Functional Requirements:

- After entering user email and password, the system authenticates if the user is valid or not. If the user doesn't exist, the system generates a user-friendly message.
- For signing up process, the system sends verification codes to user defined email to confirm user validity.
- If the user has forgotten his/her password, the system will send a confirmation email in their email address to allow users create a new password.
- For any kind of transactions, the user must connect his virtual wallet to our system.
- If the user wants to buy any item, the system will check his wallet balance and then proceed to next step.
- If the user wants to sell his collectibles, he must set a price and the edition of that product.
- If the user wants to participate in auction he has to bid above the mentioned price and his wallet must have sufficient funds.
- If the user wants to put his items up for auction, he must mention the starting price and all the details about his product.
- If the user has forgotten his/her password, the system will send a confirmation email in their email address to allow users create a new password.
- After signing in the user will be able to post comments, talk about features and sales, like other's post etc.

- The admins can also check the new users and their information.
- Admins can also check the auction information and will be able to add new moderator.
- Admins can check community activity and take actions on any reported bug.
- The users can customize their dashboard view and will be able to see the total number of products they own, their activities and followers.

Non-Functional Requirements:

- All kind of data validity will be checked and if any data is invalid or not found the system will return a 404-error code.
- The system will go under maintenance 3 times a year.
- To give a modern look and better UI the whole system has a theme of black and grey.
- The system can be accessed from any devices such as computers, smartphones, iPad etc.
- The user data privacy will be maintained strictly, and all the transactions are encrypted.
- There will be a backup of user data for safety and in case the system fails.
- The system is accessible from any part of the world.

5.4 Product Features

- **Login/Signup:** Login and signup are the basic features of any secured web application. In our system, for any kind of activity user needs to login. If the user is new, then he/she must go through signup process.

- **Buy products:** The user can buy products in our system by paying specific price or take part in auctions.

- **Sell product:** Users can sell any item they own after minting. They can also put their items for auction if it is very rare.

- **Mint Items:** Minting is a process through which the item becomes a part of the blockchain. For this user needs to pay a small price and after this his item will be enlisted on the marketplace for sell.

- **Auction:** If any item is rare or has great number of customers, sellers can put them up for selling and set their asking price. Buyers can bid in the product and highest bidder gets the product after a certain timeout.

- **Manage Dashboard:** Users can customize their dashboard according to their preferences, this includes managing their items, see followers and followings, their activity in community etc.

- **Community:** Users and admins can post about new features or their experiences in the community and take feedback from other users. They can also post about bugs and request features.

- **Storing data:** The system will store user data for login purposes also their buy and sell history. This data will help create reports for admins to get a overview of daily transactions.

- **Connect wallet:** Users can connect multiple virtual wallets to our systems. This will help them do direct transactions through cryptocurrencies.

5.4.1 Input

Login Page

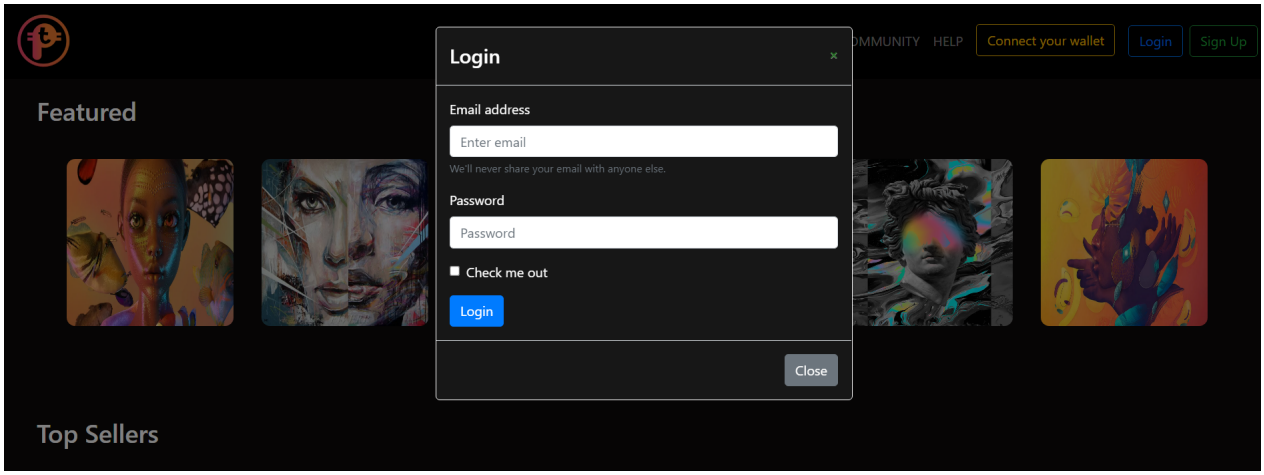


Figure 5.8: Login Page

Signup Page

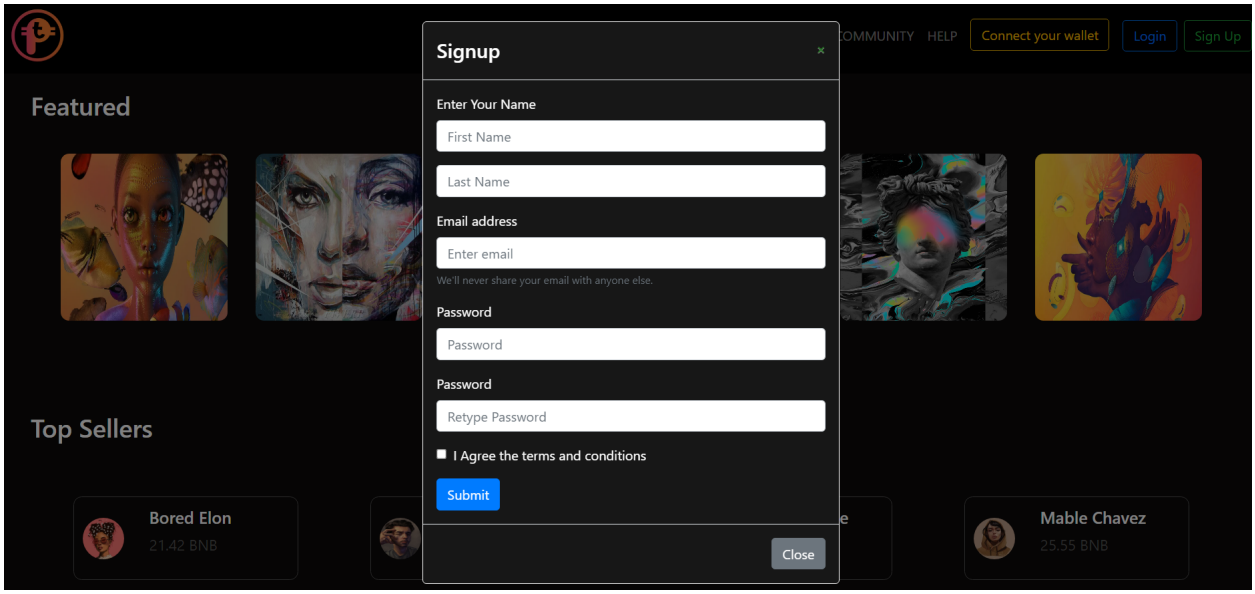


Figure 5.9: Signup Page

Auction Page

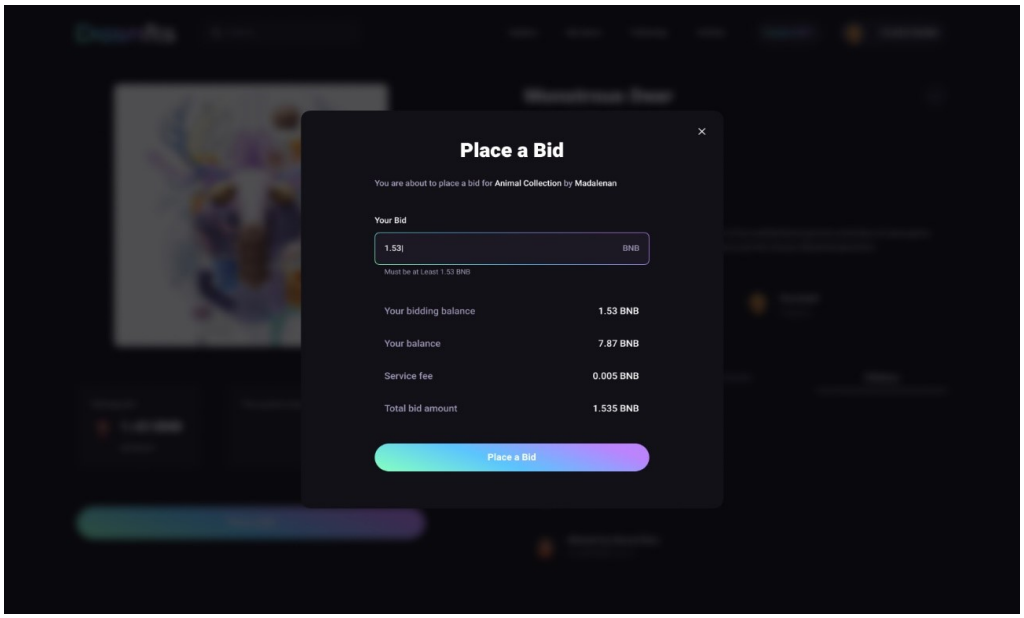


Figure 5.10: Auction Page

Minting

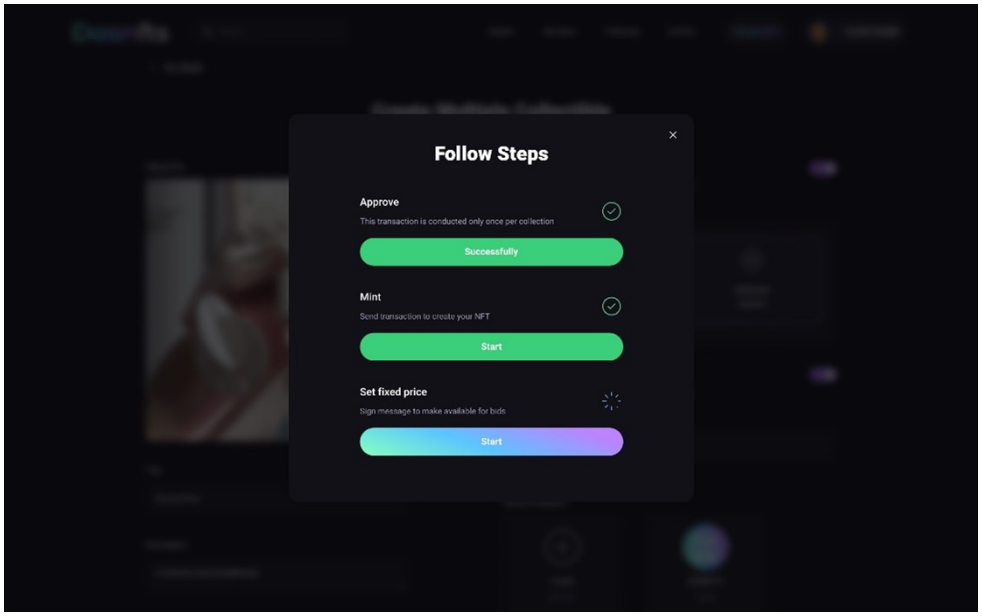


Figure 5.11: Minting

5.4.2 Output

User Dashboard

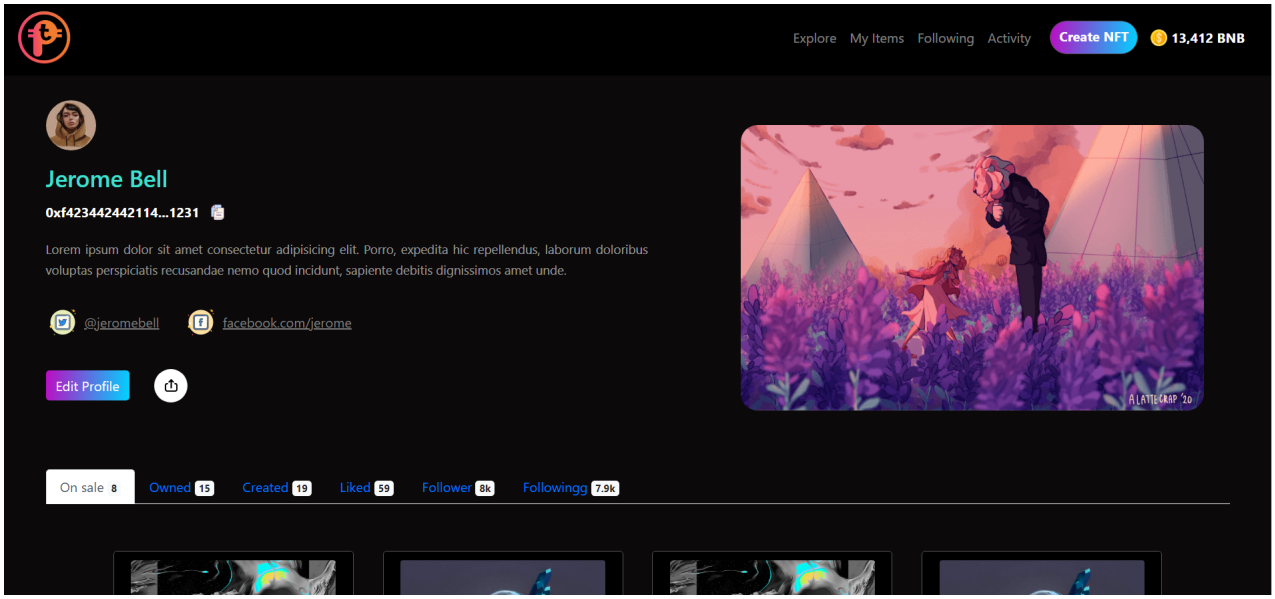


Figure 5.12: User Dashboard

Bid placed

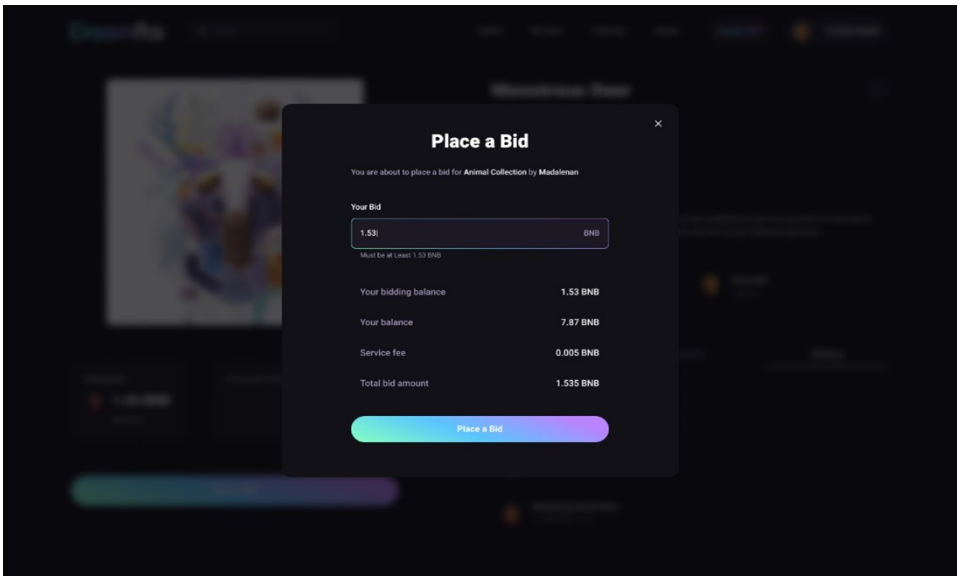


Figure 5.13: Bid placed

Product page

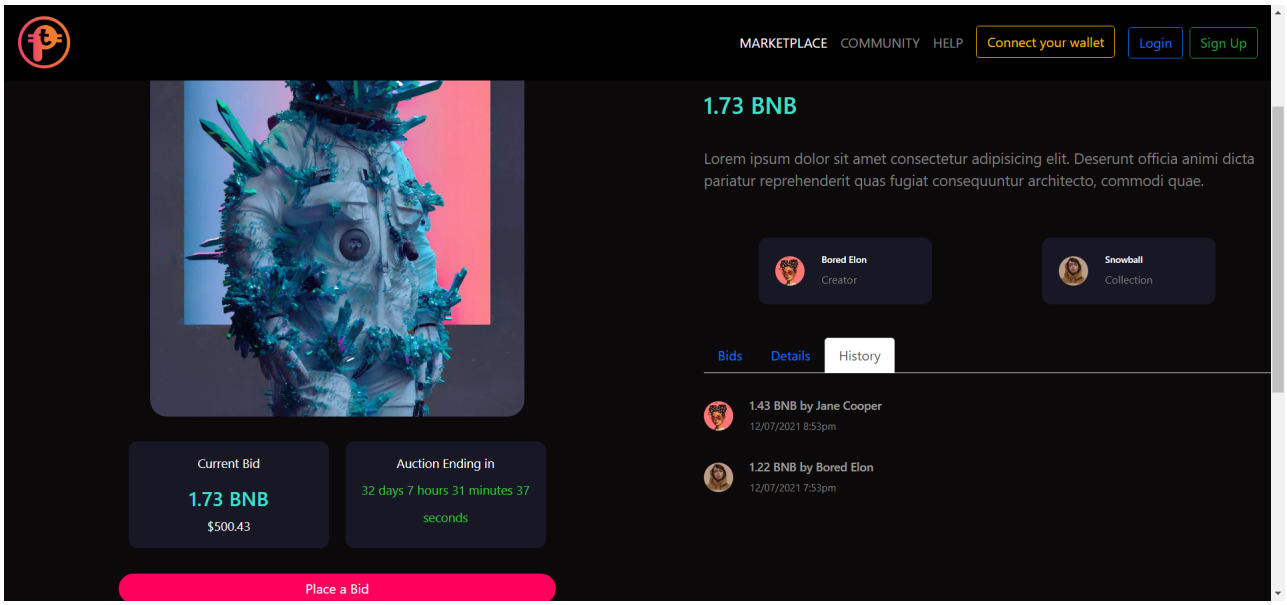


Figure 5.14: Product page

5.4.3 Architecture

The system's architecture shows the organization or structure of the system, as well as how it acts. A system consists of component collection that performs a certain function or set of functions. In other words, the architecture of the program offers a solid foundation for the construction of web application. The quality, performance and maintenance and the overall success of the system affect several architectural choices and trade agreements. Failure to consider typical issues and long-term effects may jeopardize the system. Many high-level models and concepts of architecture are frequently employed in current systems. These are frequently known as styles of architecture. The web application system architecture is hardly restricted to one architectural style. Rather, the entire system frequently consists of a mix of styles.
In our system, the whole application is divided into 3 parts, Frontend, Backend and the database.

Frontend: For frontend we've used the modern JavaScript ES6 and JavaScript library React.js. We have also used some libraries for styling purpose, for example: react-bootstrap, styled-components. For navigational purpose we've used react-router-dom and context-api. The whole system is made user friendly and responsive with the help of CSS. In the future, bases on our user feedbacks we will improve and bring changes.

Backend: As our system mostly deals with crypto transactions for buying and selling purpose, we have used blockchain as backend. There are several blockchain languages but we're using Flow Blockchain as it is easier to implement. We've also used the Cadence language to control the Flow Blockchain and implement our functionalities. This blockchain will hold all the user products and their metadata. As the product changes ownership, the data will be automatically updated in Flow. Flow also handles the transaction fee that user must pay for minting their products. To connect backend data to our frontend we've use Flow SDK to connect React.js to Flow. For some functionalities and smart contracts Go programming language is also used. In future, as our applications grows there will be more functionalities and the backend structure will be changed accordingly.

Database: We have used external database as we need not store all data in the blockchain. This data contains user/Admin login information, user metadata, wallet metadata etc. This also works as a backup for important information. For the database, we've used mongoDB and Node.js to pull and push data into the mongo cloud. In future, we have plan to store data in AWS which will be more secured.

Chapter 6

Results & Analysis

6.1 Overview

After conducting several analyses on the exiting systems worldwide and brainstorming our own ideas we finally had our own system. We tried to create a system that is more user-friendly, secured, and attractive to our users. To achieve this, we had to undergo many RD process and the structure had many corrections. We also had to rebuild our smart contracts so the linkup between frontend and backend goes seamlessly.
The project is currently in the backend development stage, but the achieved results are:

Step 1:

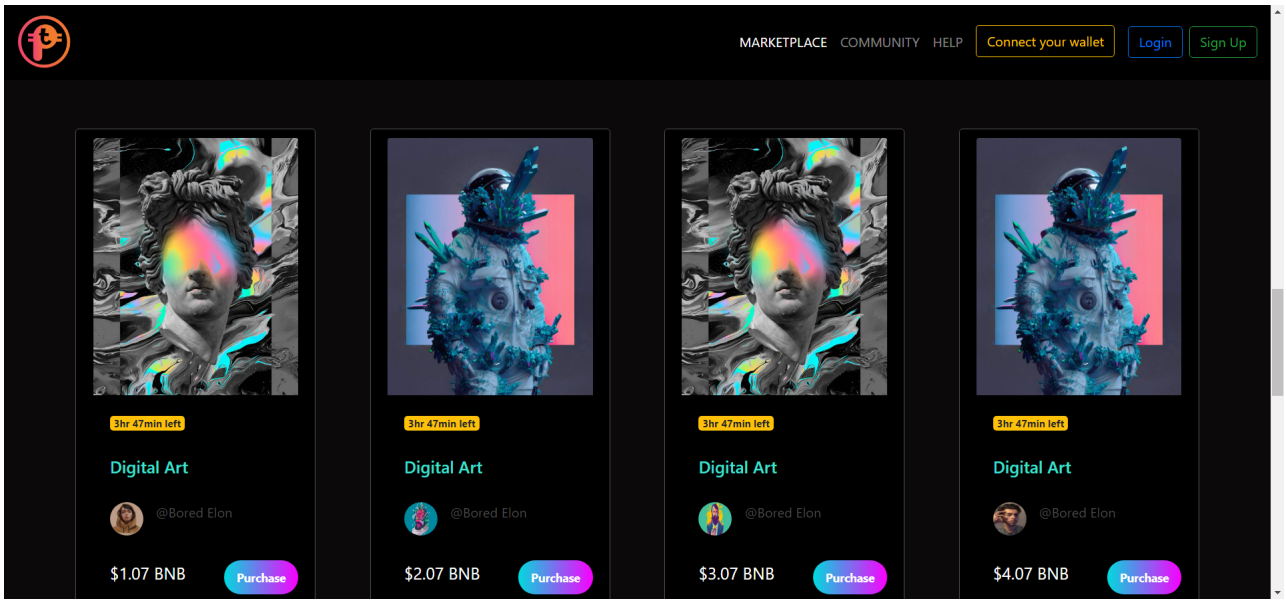


Figure 6.1: Homepage

After entering the site, the user will be able to see the whole view of the marketplace where the items enlisted by other users will be shown. If the user wants to buy any of the items, he will go to the next step.

Step 2:

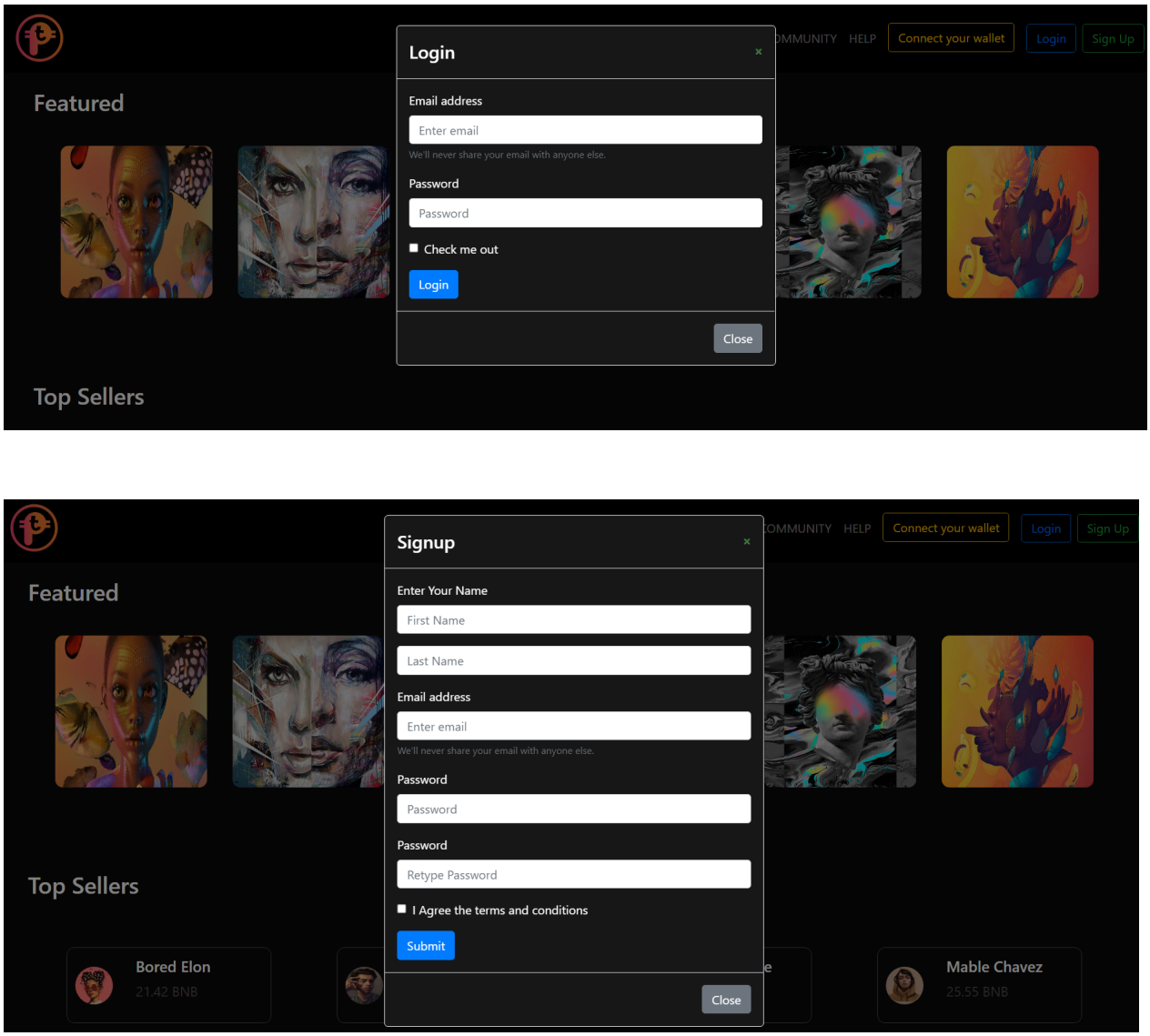
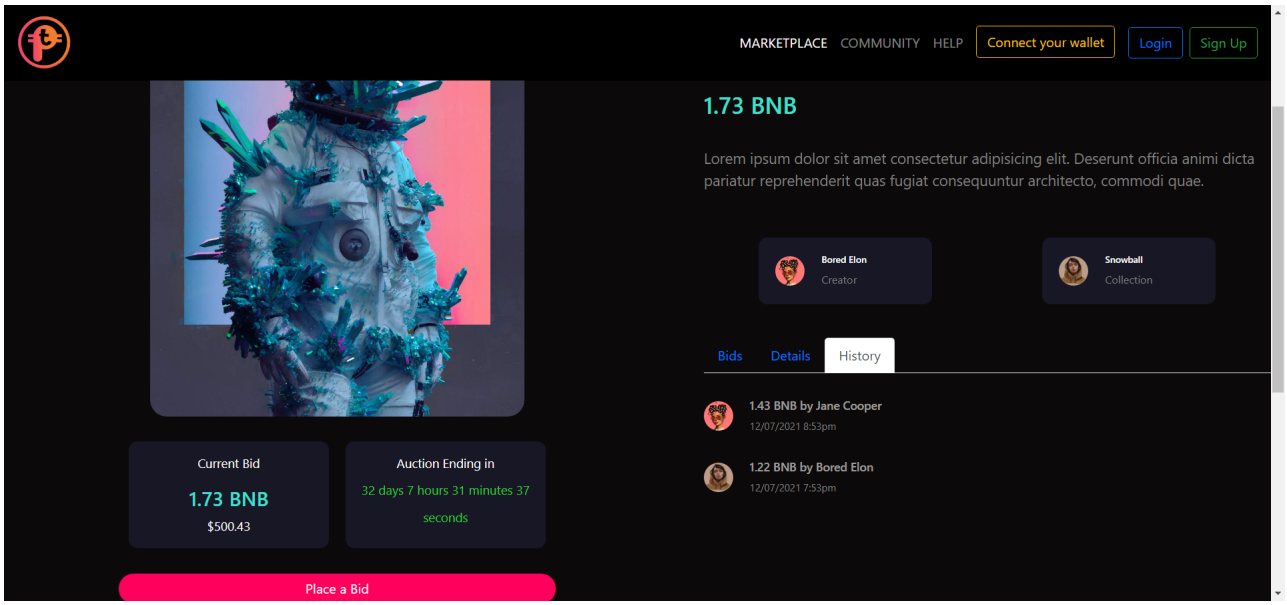
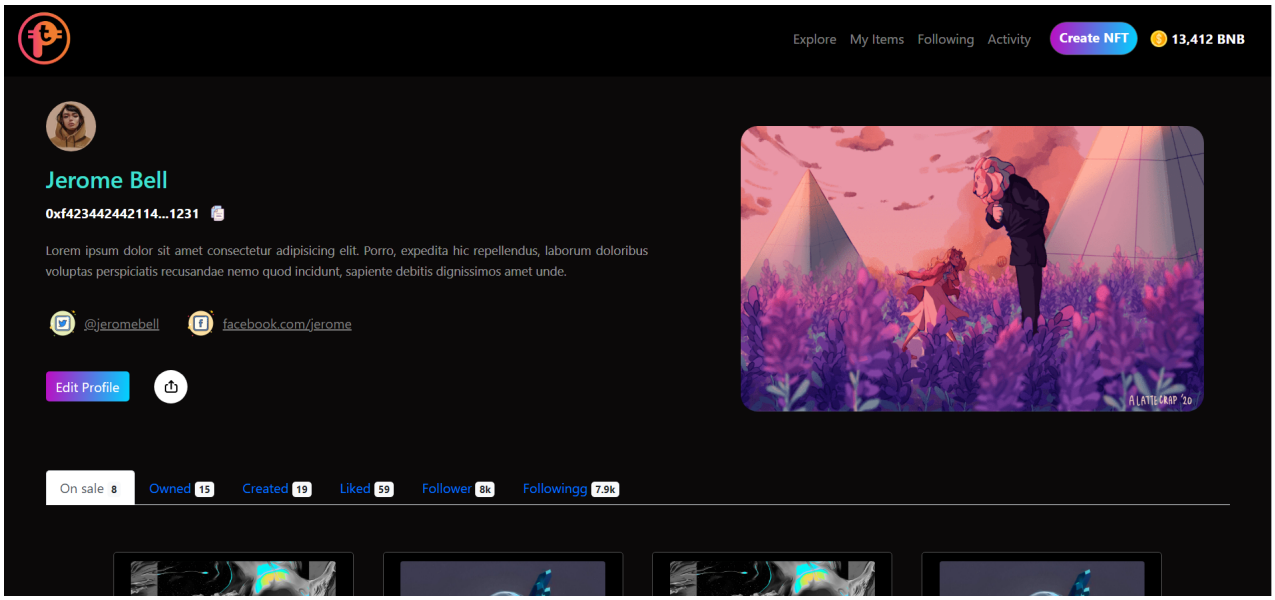


Figure 6.2: Login/Signup Page

If the user wants to buy something he has to login first if not already logged in. If the user doesn't have any account, then he can signup first which will take him to his account dashboard.

Step 3:


MARKETPLACE
COMMUNITY
HELP
Connect your wallet
Login
Sign Up
1.73 BNB
Lorem ipsum dolor sit amet consectetur adipisicing elit. Deserunt officia animi dicta pariatur reprehenderit quas fugiat consequuntur architecto, commodi quae.
Bored Elon
Creator
Snowball
Collection
Bids
Details
History
1.43 BNB by Jane Cooper
12/07/2021 8:53pm
1.22 BNB by Bored Elon
12/07/2021 7:53pm
Current Bid
1.73 BNB
$500.43
Auction Ending in
32 days 7 hours 31 minutes 37 seconds
Place a Bid


Explore
My Items
Following
Activity
Create NFT
13,412 BNB
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facebook.com/jerome
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On sale 8
Owned 15
Created 19
Liked 59
Followe 8k
Followingg 7.9k

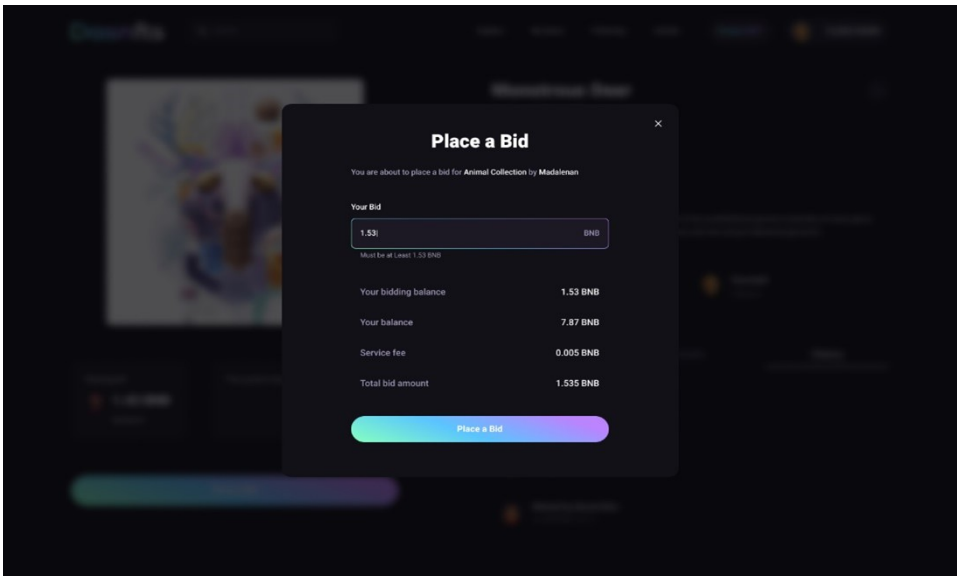
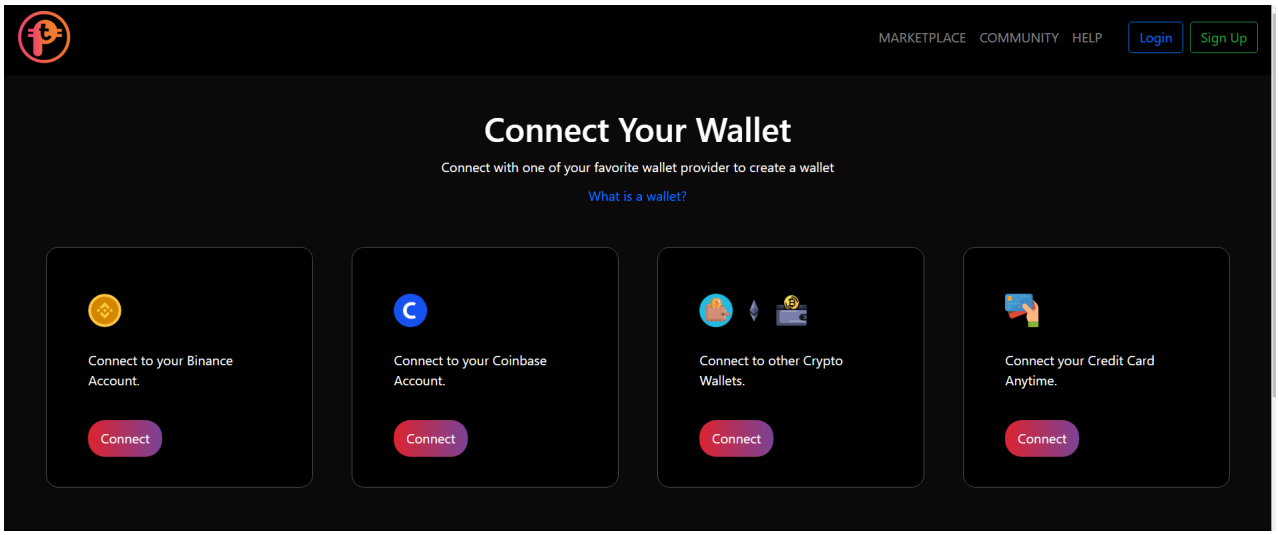


Figure 6.3: User Dashboard and Product Page

After logging into his dashboard, a user can change his profile data. He can also purchase products from other users. In the products page, the buyer can see all the details about that product. This includes the price, the edition, previous owners and also the popularity level. If the seller has set the product in auction, then the buyer must place bids and after a certain timeout if he's the highest bidder he will own the product.



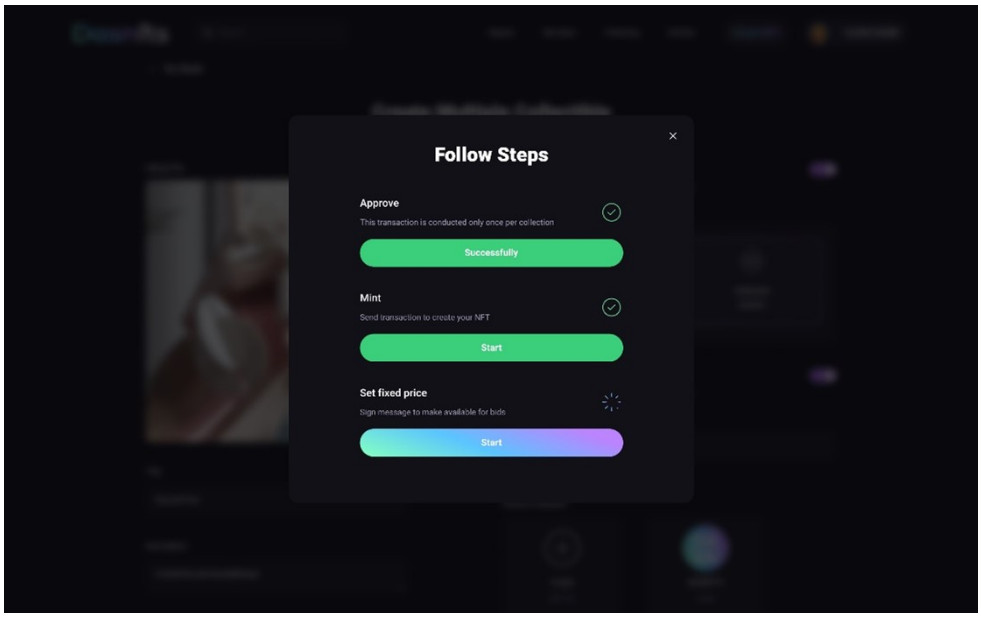


Figure 6.4: Wallet Connecting and minting

For any kind of transaction, whether it is buying or selling the user needs to connect his virtual wallet to our system. There are several options for this, and user can choose any of them. For selling, the user must mint his product before enlisting in our system. Minting is a process through which the product becomes a part of the blockchain. For minting, the user needs to pay a fee which varies from product to product. This fee directly goes to the miners who works to verify the minting process.
As this system is still in development period, there are many features yet to be implemented. The backend developer team is working on making the smart contracts through which our system will talk to blockchain and store items. We are also working on implementing other features through Flow SDK. Soon we'll come up with the early edition of this system.

Chapter 7

Project as Engineering Problem Analysis

7.1 Sustainability of the Project/Work

Sustainability is a business model which balances the environmental, social, and economic elements of project-based activities to address stakeholders' present demands and without compromise or overload of future generations. Sustainability also relates to the maintenance of the project. The main outcome from this project is to provide a platform for users to buy and sell digital goods in a secure way. To maintain the system's integrity, it is required to go through maintenance after certain periods of time.
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7.2 Social and Environmental Effects and Analysis

Social Effects: Our system is a web-based platform which deals with the buying and selling of digital goods between users. Owning a rare digital format of extraordinary moments or artwork is becoming a new trend in the world. This also represents the social status of an individual. People need not go to a physical marketplace or auction center to buy these. All can be done with just a few clicks and as the transactions are made immediately so there's no waiting time. Also, during this COVID-19 situation people should stay indoors. As this is an online platform, people can buy and sell by staying at home. This will keep them safe from getting infected by the virus.

Environmental Effects: In our system the people will do any kind of transactions through digital currency. This reduces the use of physical currency made of paper or metals which will have a positive effect on the environment. As people will be dealing with digital goods, the use of paper and wood which was used for actual artworks will be reduced. As people are slowly getting used to digital goods, there will no longer be the need for actual artworks or physical collectibles which have a great impact on the environment.

7.3 Addressing Ethics and Ethical Issues

Whenever we are talking about a system that deals with online activities, there's always a security concern for user data. If somehow user data gets leaked, it can be misused anywhere. This is a major security threat. For this we've used an end-to-end encryption system to ensure user data never gets leaked or hacked. We are also working on increasing the security layer as there will be many transactions per minute.

Chapter 8

Lesson Learned

8.1 Problems Faced During this Period

While working on any project it is very normal to face problems. I also had faced several problems while working on this project. As this project is still under development, problems arise now and then. The main problem we encountered was how to execute several smart contracts on a single button click. As there are transaction related features so a button click can start several events. Just like that, smart contracts are one of the most important parts of this project. They hold all the user data and are responsible for any kind of successful transactions. So, executing several smart contracts all at once was a big challenge for us as we had practiced only one smart contract at a time. There were also some design related problems such as some CSS properties not working properly after the page finished loading. We also faced problems with the payment gateway where the users could not connect their virtual wallets through our system.

8.2 Solution of those Problems

We had to find solutions for those problems as the deadline was getting closer. So, for the first problem to execute several smart contracts all at once, we had to create a new JSON file for flow language. And in that JSON file under the smart contracts object we declared an array of smart contracts. We put all the smart contracts that we want to use and used the reference in the button click. That did solve our major problem. And for the CSS issue we deleted the traditional CSS styling that we were using and used React styling libraries such as react-bootstrap and styled-components. This also solved the issue for styling and all the components were loading seamlessly. For the payment gateway issue, there was some problem with the API key that we were using to connect our system with the digital wallet platform. We had to recreate the API and use it in our system's backend. And this solved our problem.

These were some of the major problems that we solved during our development period. As this system gets to a more advanced development phase, we hope to solve all the future problems.

Chapter 9

Future Work & Conclusion

9.1 Future Works

As this project is still in the development phase, we have plans to add more features to it to make it strong against the other competitors. We have plans to add more user related features such as opening a referral system for users, import products from other marketplaces etc. In future, we also have plans to collaborate with big companies and bring a mobile app version of this system.

9.2 Conclusion

Throughout the development of this system, I had a wonderful experience. I learned many things that are not only academic for example: new programming language, new libraries, and new workspace etc. but also soft skills such as managing workload, maintaining time, working as a team and building a good relationship with teammates. The teammates and the CEO all were very supportive and helped solve any problems that I faced.
To conclude, every moment working on this system was a great lesson for me and truly a great experience. I really hope to use the experiences I earned in my future endeavors.

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