FRUITCHAIN: BLOCKCHAIN INTEGRATION FOR FRUIT TRACE

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FINAL YEAR DESIGN PROJECT REPORT

This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled "**FruitChain: Blockchain Integration For Fruit Trace**", submitted by **Mahadi Hasan Munna** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **15.07.2024.**

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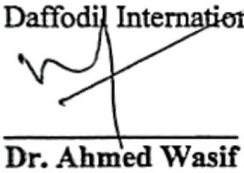

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We hereby declare that this project has been done by us under the supervision of **Dr. Touhid Bhuiyan, Professor, Department of Computer Science and Engineering, Daffodil International University**. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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ABSTRACT

"FruitChain: Blockchain Integration For Fruit Trace" is an innovative platform designed to reform the fruit industry through the integration of blockchain technology. The application is developed using Python Django. This e-commerce web application offers customers a seamless fruit buying experience while prioritizing security and authenticity. The platform features a user-friendly interface with essential functionalities such as browsing fruits, adding fruits to cart and wishlist and managing orders. Users can register, login, and access their profiles for personalized shopping experiences. The implementation of blockchain technology for fruit traceability is the novelty of this project. Here blockchain technology ensures transparency and authenticity throughout the supply, which allows customers to trace the origin, supply date and expiry date of their purchased fruits. Admins have access to additional features such as adding new fruits and vendors, managing stock, managing orders and adding fruit in flash sales. Security measures are most important here to keep protected and secure the customers data. The authentication system is implemented with django authentication mechanisms. On the other hand SSLCOMMERZ payment gateway ensuring online safe transaction between customers and FruitChain. Customers can confidently purchase fresh and authentic fruits, supported by blockchain-enabled traceability, setting a new standard for trust and reliability in the fruit industry.

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CHAPTER 1

Introduction

1.1 Overview

Nowadays e-commerce business is available all over the country and has become a common system in this generation. Among the plenty of online shopping options, the popularity of purchasing fruits through digital platforms has increased. This is where FruitChain comes in. FruitChain represents an innovative e-commerce web application where customers can order various fruits from here. They will get authentic and fresh fruits from FruitChain. The process of ordering fruits is very simple and they can do both online and offline payment. The most unique part of this project is they can trace the fruit origin easily as there is blockchain technology used here to make sure of the traceability. So, they don't need to worry about the supply. Customers will enjoy the user-friendly interface for hassle-free fruit shopping, while system administrators ensure platform security and integrity.

1.2 Background and Present State

Fruit trading has been an integral part of global commerce for centuries [5]. Traditionally, the sale of fruits relied heavily on local markets, where vendors would sell their produce directly to consumers. This model ensured freshness but was limited in reach and scale. With the rise of the internet in the late 20th and early 21st centuries, e-commerce emerged as a revolutionary force in retail [6]. Fruit selling has not been immune to this trend. Online platforms began to offer fruits and other perishable goods, providing consumers with the convenience of home delivery and access to a wider variety of products. A new technology name Blockchain, known for its decentralized and immutable ledger system, has introduced new possibilities for enhancing transparency, security, and efficiency in various industries, including e-commerce [10]. In the context of fruit selling, blockchain offers several advantages like Traceability, Fraud Prevention, Efficiency and so on. FruitChain represents a novel approach to fruit selling in the digital age, leveraging blockchain technology to address the inherent challenges of traditional and e-commerce fruit sales.

1.3 Problem Statement

In the current fruit selling industry, various challenges hinder the efficient and trustworthy distribution of fresh produce from farms to consumers [7]. These challenges include a lack of transparency in the supply chain, difficulties in maintaining quality and freshness, and inefficiencies in logistics and operations. Traditional methods and even some modern e-commerce platforms fall short in addressing these issues comprehensively. The advent of blockchain technology presents an opportunity to revolutionize the industry by tackling these persistent problems. Some problems are:

- Lack of Transparency and Traceability
- Quality Assurance and Freshness Maintenance
- Fraud and Counterfeit Products
- Limited Market Reach for Farmers and Vendors

1.4 Objectives

The objectives of this project actually comes from the motivations of this project. The main objectives of this project are:

- Simplify the process of buying and selling fruits from online and making it more convenient for both buyers and sellers.
- Guarantee that customers will receive fresh and authentic fruits by implementing quality control measures and using blockchain technology for traceability.
- Increase access to a wide variety of fruits for consumers through an easy-to-use online platform.
- Implement strict security protocols to safeguard user data and transactions, ensuring a safe and secure shopping environment for all consumers.
- Provide transparent information about the origin, quality, and pricing of fruits to encourage trust and confidence among customers.
- Continuously gather feedback from users to identify areas for improvement and enhance the overall user experience of the platform.

1.5 Scope and Limitations

FruitChain is offering fruits to its consumers with a user-friendly UI, by using this a user can easily order fresh fruits. There is less work in fruit selling ecommerce. Most of the case tracing fruit origin is unavailable. Besides, the authenticity of fresh fruits is mostly rare. So, using blockchain technology in this FruitChain web app consumers can easily track the supply origin and they will find the authentic pure fruits without any trust issue. FruitChain is offering a robust security system to the user data. They don't need to worry about providing their information. At the end FruitChain is improving user experience and making a smooth online fruit shopping experience. With all those project scope there are some limitations here. Some limitations are given below:

- Integrating systems with blockchain technology can be complex.
- The platform's functionality heavily depends on internet connectivity, which may be a limitation in regions with limited or unreliable internet access.
- Developing and maintaining a blockchain-based platform involves substantial initial investment.
- Handling sensitive information such as transaction details and user data requires robust security measures to prevent data breaches and ensure privacy.
- Building trust in a new platform, particularly one that involves blockchain technology, may take time and require significant efforts in transparency and user education.
- Scaling the platform to handle a large number of transactions and users while maintaining performance and reliability is a significant challenge.
- The success of FruitChain depends on the cooperation and participation of various stakeholders, including farmers, vendors, and logistics providers, which may introduce dependencies and risks.

1.6 Report Organization

Chapter 1: All the ideas and overview of the project is given here. Here you will find the introduction of the project, motivation behind this and the objectives of this project.

Chapter 2: This chapter is about the background of the project. Here you will find the related works on fruit selling ecommerce and blockchain technology.

Chapter 3: In this chapter requirement specification is shown. You will find different diagrams and technology specifications here.
Chapter 4: You will find how the project is designed as frontend and backend in this chapter.
Chapter 5: This chapter explained about the implementation of database, frontend design, testing and showed testing results here.
Chapter 6: Here you will find how the project impacted on society.
Chapter 7: This is the last chapter of this report and it is the conclusion part of this project. You also find the future scope of this project here.

After chapter 7 there is references, appendix for addressing Engineering Problem (EP), Engineering Activity (EA) and Course Outcome (CO). At the end there is plagiarism report.

1.7 Summary

FruitChain is an innovative blockchain-based platform designed to revolutionize the fruit supply chain by enhancing transparency, ensuring quality, and fostering trust among all stakeholders. In the current landscape of the fruit selling industry, issues such as fraudulent practices, lack of traceability, and inefficiencies in the supply chain pose significant challenges. Traditional methods often fail to provide consumers with reliable information about the origin and quality of their produce, leading to concerns about food safety and authenticity.

CHAPTER 2
LITERATURE REVIEW

2.1 Overview

There are a lot of fruit selling ecommerce are available in this current market. FruitChain represents a significant leap forward in the traceability and transparency of fruit supply. At its core, FruitChain used blockchain technology to provide an immutable, transparent record of a fruit's origin. Beside FruitChain is providing a very user friendly UI, secured payment system, strong security to the user's data, transparent fruit tracing details etc. Here users can order fruits in a very few steps and very easily.

2.2 Related Works

Nowadays ecommerce business is very popular and day by day organic foods are also becoming the product of ecommerce [8]. Peoples are looking for fresh and authentic fruits from online and from famous places. Day by day this demand is increasing and peoples are choosing ecommerce for ordering fruits in online. There are some popular works in this field is available. Some of the work is given below:

SobjiBazaar.com [1]: This platform is one of the famous fruit selling web application in Bangladesh. It is a running project and it user interface is smooth which is very attractive. SobjiBazaar.com not only providing fruits here but also offering vegetables, fish and meat.

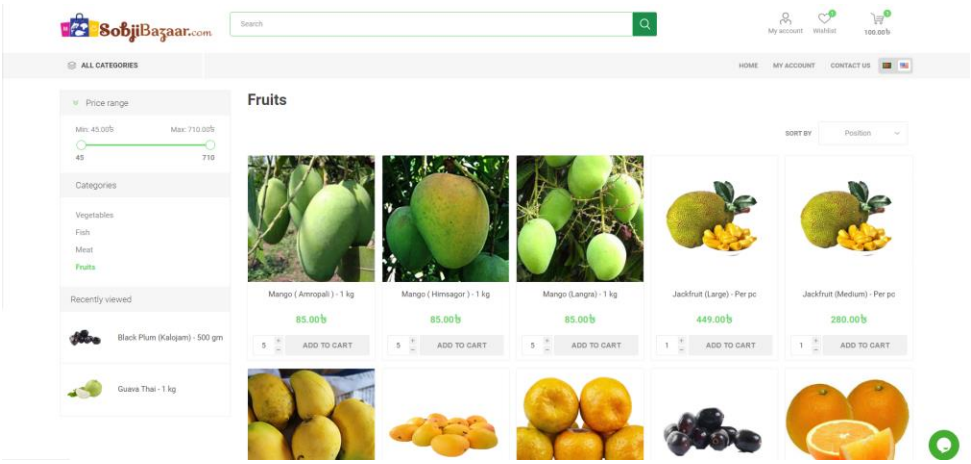

Figure 2.2.1: SobjiBazzar.com

KhaasFood.com [2]: KhaasFood is also a popular online fruit selling platform. Their theme in ecommerce that they will provide fruits direct form fruit garden. They also provide different things without fruits. Its user interface is simple and appealing but there are some unnecessary banners are visible at the starting which distracts users from seeing the products.

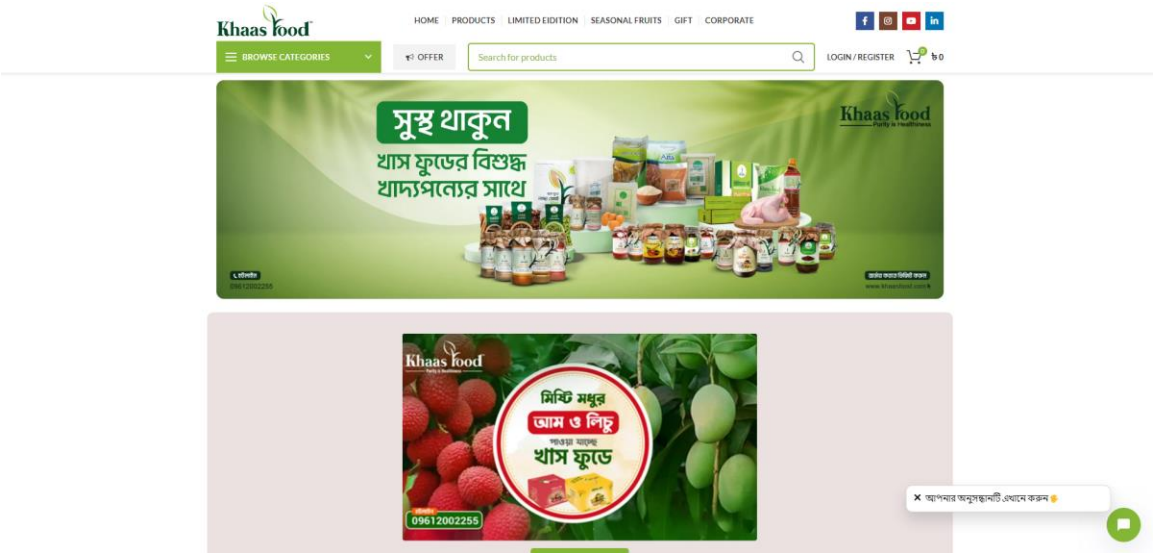

Figure 2.2.2: KhaasFood.com

Chaldal.com [3]: This is one of the most famous ecommerce in Bangladesh. Chaldal provides different types of stuffs in its website. They are also selling fruits and a huge number of variety fruits are available here. This platform is properly decorated and followed web standards.

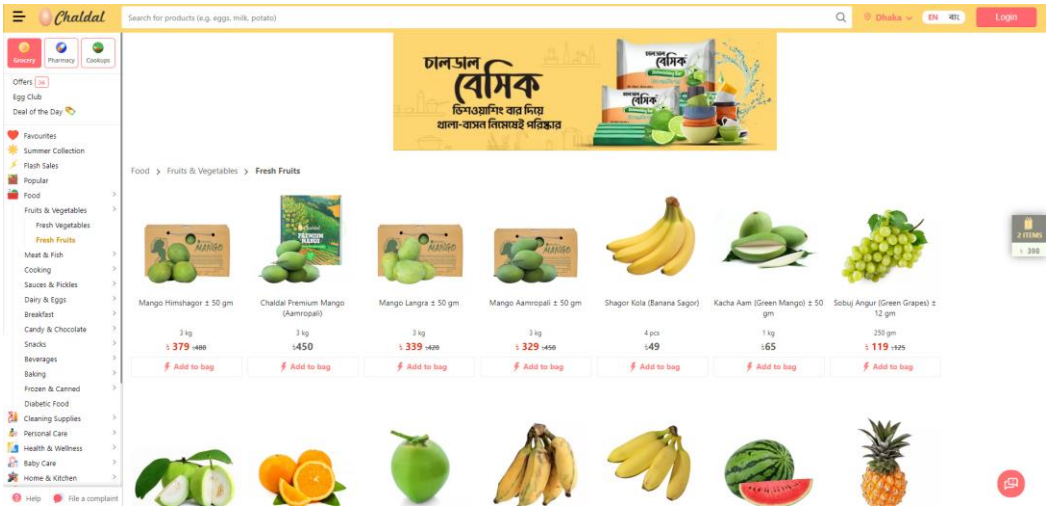

Figure 2.2.3: Caldal.com

Shwapno.com [4]: This platform is also as popular as chaldal.com. Shwapno.com also providing wide range of fruits to its consumers. The platform is organized and well decorated. Various kinds of features are available here. The user interface is very appealing and user friendly.

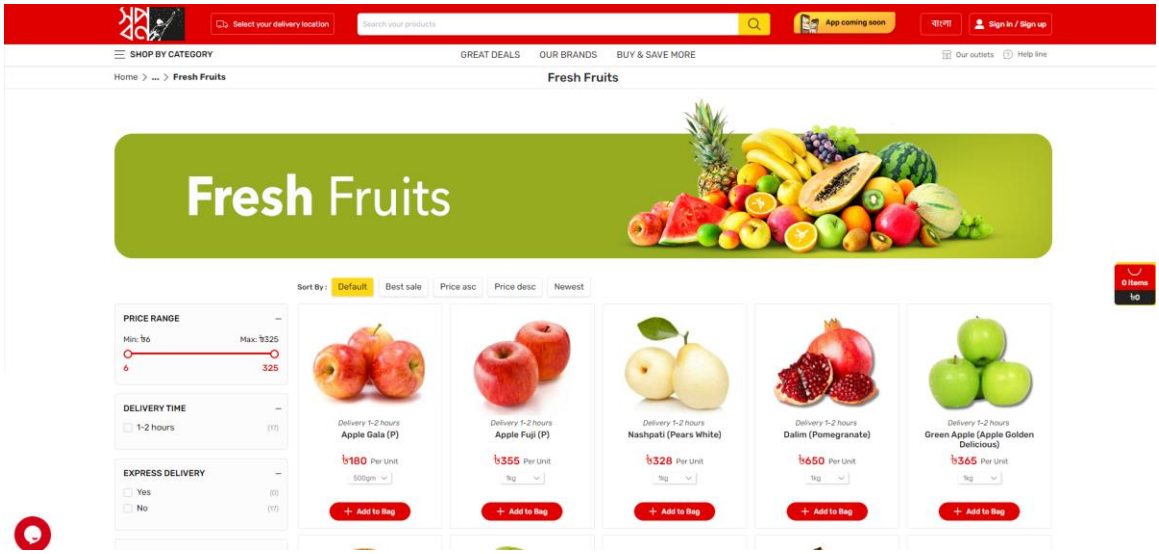

Figure 2.2.4: Shwapno.com

2.3 Comparison between existing works

According to the features and functionalities of exiting works a comparative analysis with FruitChain is give below:

- Totally a new type of user interface used in FruitChain.
- Fruit details is very descriptive in FruitChain than others.
- None of the existing work used blockchain but used in FruitChain.
- No tracing details given in other existing works but in FruitChain it is transparent and trustworthy.
- More popup successful message or fail message used in FruitChain.
- Errors are better explained in FruitChain than others.
- Ordering system in FruitChain easier than others.
- More helping instruction in FruitChain than others.
- User's data is more secured in FruitChain than others.

2.4 Open Issues

FruitChain web application is providing a lot of features to its users and also providing admin functionalities to the staff users. Combining those functionalities makes this system complex to the developer. Managing lots of code is one of the challenging parts. On the other hand, integration of blockchain technology for transparent traceability is the most challenging task here. Blockchain is a new technology and most of the time its resource is not widely available [9]. So, it became the most challenging here. Convincing customers to switch from traditional fruit shopping methods to online platforms may require extensive marketing and education efforts. It is also a challenge in this project. Beside ensuring security to the users data is also a challenge. All the challenges can be acquired with detailed planning, proper development and continuous development.

2.5 Summary

The FruitChain project exists within a context of significant research and practical applications that uses blockchain technology to ensure transparency, efficiency and security. A comprehensive review of related works reveals numerous initiatives and studies that provide valuable insights into the design, implementation and potential benefits of blockchain-based systems in these domains. FruitChain not only validates the project's approach but also highlights areas for potential innovation and improvement.

CHAPTER 3

REQUIREMENT ANALYSIS & DESIGN SPECIFICATION

3.1 Overview

Requirement Analysis is a critical phase in the development of the FruitChain project, focusing on identifying and documenting the functional and non-functional requirements necessary to achieve the project's objectives. Design Specification involves translating the requirements into a blueprint for the system architecture and user interface design. This includes creating detailed system models, diagrams, and prototypes that guide the development process. Key design elements for FruitChain include a user-friendly interface that allows for easy navigation and interaction, a robust backend that supports blockchain integration for traceability, and a scalable architecture that can adapt future growth.

3.2 System Design

3.2.1 Requirement Collection and Analysis

By following a structured requirement collection and analysis process, FruitChain aims to ensure that the platform meets the needs and expectations of its users, delivering a successful and user-friendly e-commerce experience for buying and selling fruits. Functional and Non-Functional requirements are given below:

❖ Functional requirements:

- New user have to register in the web application
- To access full functionality users have to login in the application.
- Unauthorized users will be able to browse only.
- Authorized users will be able add fruits to their cart, checkout, place order, add fruit to their wishlist and post comments.
- There will be a profile for all users.
- Users will be able to update their profile with personal information and can change passwords.

- In the user profile all the orders by that user will be visible.
- There will be a logout functionality for users.
- There will be a feedback option where users can share their problems or opinions about the application with developers.
- For admin there will be add new fruit functionality, can add new vendors, can manage orders and fruit posts.

❖ Non-Functional requirements:

- The UI has to be very smooth and user friendly.
- As it is developed by Django, its response time needs to be fast and smooth.
- The main feature of this project is traceability, so users may trace fruit origin easily.
- If users forget their password or need to update their information they can easily do it.
- Another focus on this project is security. So, security should need to be strong.
- The application will be maintained by a super user and admins.
- Users can access this application easily through web browser.
- After placing an order, the user should get the order placement confirmation by email.
- If a user wants to cancel an order, they may cancel it very easily.
- If any order canceled by an admin user has to know about cancellation by email or other way.

If the FruitChain system can acquire all the functional and non-functional requirements, it will be a successful project.

3.2.2 Business Process Modeling

In the business process model for FruitChain, the flow begins with vendors listing their available fruits, detailing type, quantity, price, and origin. Customers then browse these offerings, add items to cart and place orders through the platform. After order placement, staff of FruitChain pack the fruits, arranging shipment or delivery. Customers will get the delivery in time. Customer can do both online and offline payment for the fruits they have purchased. Throughout, customer support and feedback it will help to improve product

quality. Quality assurance measures maintain trust by ensuring only fresh, authentic fruits are delivered.

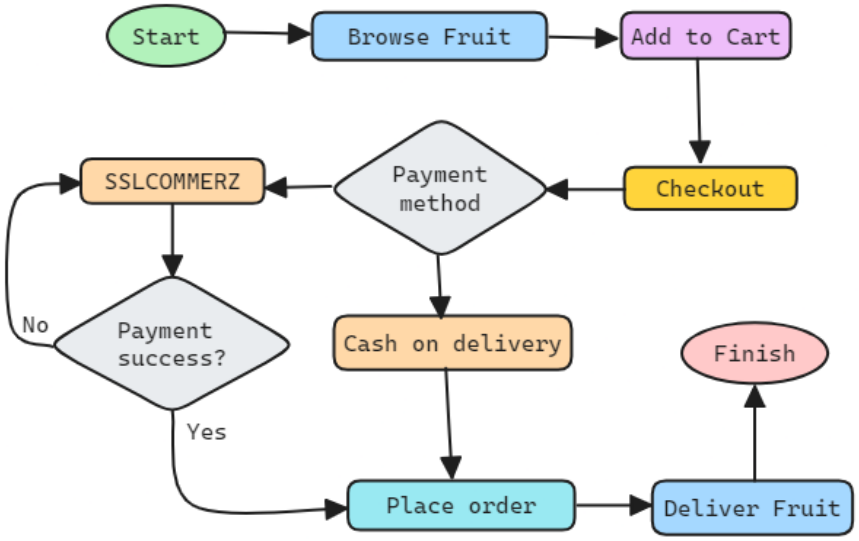

Figure 3.2.1: Business Process Model

3.2.3 Use Case Modeling and Description

Figure 3.2.2: Use Case Diagram

The use case model of FruitChain shows that what a user and an admin can do with this system. Beside shows what a superuser can do with this system. Use case descriptions are given below:

- Sign Up

  Use Case Name: Sign Up

  Actors: User

  Description: Allows a new user to create an account on the platform.

  Preconditions: The user is not logged in and don't have an existing account.

  Postconditions: A new user account is created and the user is logged in.

- Login

  Use Case Name: Login

  Actors: User, Staff, Superuser

  Description: Allows users, staff, and superuser to log in to the platform.

  Preconditions: The user must have an existing account.

  Postconditions: The user is authenticated and logged into the system.

- Browse Fruits

  Use Case Name: Browse Fruits

  Actors: User

  Description: Allows users to view the available fruits on the platform.

  Preconditions: None.

  Postconditions: User views a list of available fruits.

- Add to Cart

  Use Case Name: Add to Cart

  Actors: User

  Description: Allows users to add fruits to their shopping cart.

  Preconditions: User is logged in.

  Postconditions: Selected fruits are added to the user's cart.

- Add Review

  Use Case Name: Add Review

  Actors: User

  Description: Allows users to add reviews for fruits they have purchased.

  Preconditions: User is logged in and purchased fruit status is delivered.

  Postconditions: A new review is added for the fruit.

- Checkout

  Use Case Name: Checkout

  Actors: User

  Description: Allows users to proceed with purchasing the items in their cart.

  Preconditions: User is logged in and has items in their cart.

  Postconditions: User is redirected to the payment process.

- Payment

  Use Case Name: Payment

  Actors: User

  Description: Allows users to choose a payment method and complete their purchase.

  Preconditions: Items are in checkout and placed order by selecting payment method.

  Postconditions: The payment is processed, and the order is placed.

- Profile

  Use Case Name: Profile

  Actors: User, Staff, Superuser

  Description: Allows users to view and update their profile information.

  Preconditions: User is logged in.

  Postconditions: Profile information is updated.

- Add Fruit Post

  Use Case Name: Add Fruit Post

  Actors: Staff

Description: Allows staff to add new fruit listings.

Preconditions: Staff is logged in.

Postconditions: A new fruit post is created.

- Manage Orders

  Use Case Name: Manage Orders

  Actors: Staff

  Description: Allows staff to view and manage customer orders.

  Preconditions: Staff is logged in.

  Postconditions: Orders are managed.

- Manage Users

  Use Case Name: Manage Users

  Actors: Superuser

  Description: Allows superusers to manage user accounts.

  Preconditions: Superuser is logged in.

  Postconditions: User accounts are managed.

- Manage Staff

  Use Case Name: Manage Staff

  Actors: Superuser

  Description: Allows superusers to manage staff accounts.

  Preconditions: Superuser is logged in.

  Postconditions: Staff accounts are managed.

- Manage Database

  Use Case Name: Manage Database

  Actors: Superuser

  Description: Allows superusers to perform database management tasks.

  Preconditions: Superuser is logged in.

  Postconditions: Database management tasks are performed.

3.2.4 Logical Data Model

In this FruitChain project there are some objects with their attributes. Those objects can be represent by different data model. For example Entity Relationship diagram, Class diagram etc.

❖ Entity Relationship (ER) diagram:

Here Entity Relationship (ER) diagrams representing all the entities of FruitChain database with its attributes. It is also visualizing the relationship between all the entities. The entities in FruitChain are User, UserAccount, Vendor, FruitModel, Comment, Cart, Order, Billing address, Wishlist. The relation between them showed in the below figure.

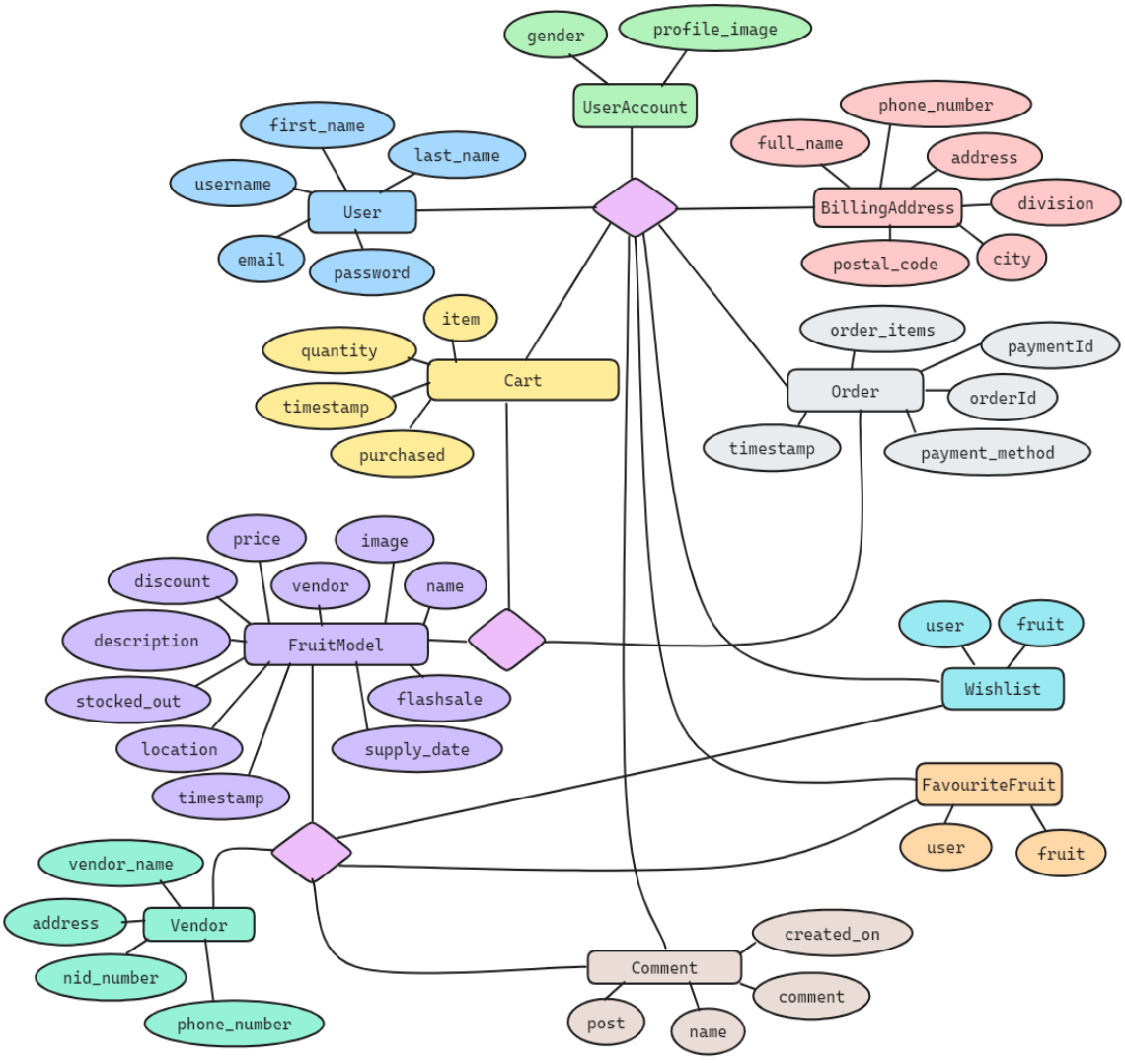

Figure 3.2.3: Entity Relationship Diagram

❖ Class diagram:

The class diagram showing all the model class with its attribute and methods. Here attributes are showed with its data type. Class diagram also showing the methods of each class. Beside it is also showing relation with each class. There are two types of relation build here. First one is 1 to 1 and second one is 1 to 0..*. Here 1 to 1 relation means that one of the class is foreign key of another class and 1 to 0..* relation means one class can have zero or many class record of another class. The class diagram for FruitChain is given in the below figure.

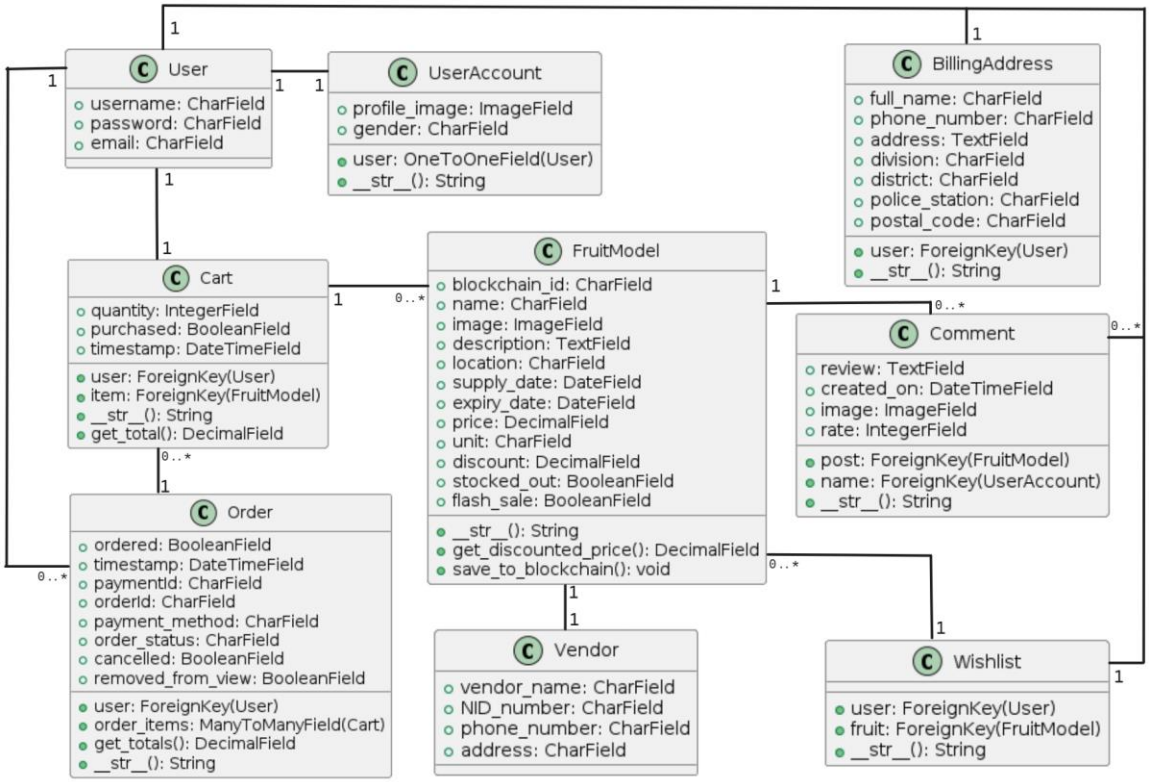

Figure 3.2.3: Class Diagram

3.3 Software Requirement

Different tools and technologies are used in this project in different aspects. Those are:

❖ Front End Technologies

- HTML
- CSS
- Bootstrap

- JavaScript

❖ Back End Technologies

- Python
- Django
- DB SQLite
- Solidity
- Truffle

❖ Tools

- Web Browser
- Visual Studio Code (*IDE*)
- Ganache

3.4 Project Management and Financial Analysis

3.4.1 Project Management:

❖ Project Initiation: The FruitChain project starts by defining all the objectives and project scope focusing on a user friendly platform to make ecommerce easier. Project objectives are:

- Main objective is to create a platform for selling fruits.
- Develop a user-friendly and easy to use platform.
- Use blockchain for transparent fruit tracing.
- Easy ordering and payment methods.
- Improved user interaction and user experience.

❖ Project Planning: In project planning there will be a detailed project plan outline with the timeline, budget and resources required for the project. The timeline given below:

Phase 1: Project Planning and Research (2-4 weeks)

Phase 2: Design and Prototyping (3-5 weeks)

Phase 3: Front-End Development (6-8 weeks)

Phase 4: Back-End Development (10-14 weeks)

Phase 5: Testing (2-4 weeks)

Phase 6: Deployment and taking feedback from beta users (4-6 weeks)

Phase 7: Update project according to feedback (2-4 weeks)

Phase 8: Post-Launch and Marketing (2-4 weeks)

- Equipment and Tools:
  - Development and Testing Servers: VS Code, Localhost
  - High-performance Computers
  - Version Control System: Git
  - Testing Tools: Django's built-in testing framework
- Training and Skill Development: Phitron course for learning django and other technological development.
- Software Development Life Cycle (SDLC): Using Agile methodology of SDLC FruitChain will get continuous feedback from the consumers and will release continuous developed versions for a smooth and user-friendly experience.

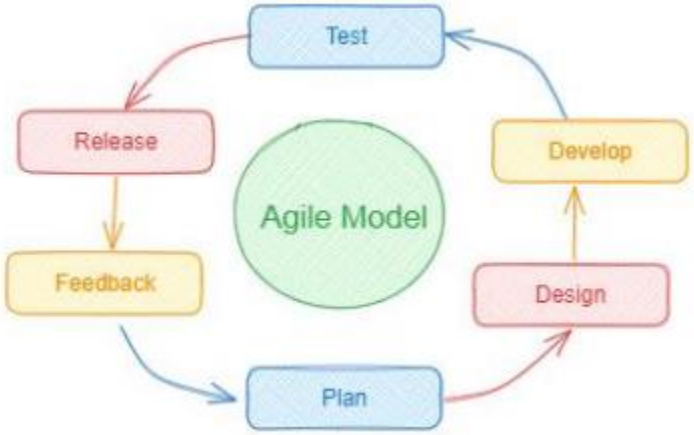

Figure 3.4.1: Agile Model

- Software Quality Assurance: After developing each version it needs to ensure that the web-based fruit selling e-commerce platform meets the highest standards of quality, reliability, and user satisfaction. For this a complete test plan, including black-box testing and white-box testing will be executed.
- Monitoring and Control: Monitoring is the main part of a project. That's why regular review will be taken in the project progress against goals and outputs to ensure that the project stays on track.
- Risk Management: It is one of the essential part of project management. The risk assessment table given below:

Table 3.4.1: Risk Assessment

Risk	Likelihood	Impact	Risk Level
Blockchain Vulnerabilities	Medium	High	High
System Downtime	Low	Medium	Medium
Data Integrity	Medium	High	High
Scalability Issues	Low	High	Medium
Cyber Attacks	High	High	High
Data Breaches	Medium	High	High
Phishing	Medium	Medium	Medium
Human Error	Medium	Medium	Medium
Maintenance Challenges	Low	Medium	Low
Market Acceptance	Medium	High	High

All those risks need to mitigate by taking different steps. Some steps given below:

- Need to conduct regular code review to fix vulnerabilities.
- Redundancy and failover mechanisms need to implement to eliminate downtime.
- Need to use cryptographic methods to ensure data integrity and prevent tempering.
- A proper cyber security education is must needed.
- Need a proper market research to mitigate market acceptance risk.

3.4.2 Finance:

FruitChain is a web based application. So, for this I have to learn different programming language and need to do technological course. So, here I need an investment. Then need to go to the stakeholders to know their recommendations and preferences. After that need to document the requirements and functionalities. Then the project will start building. After completing the project its need to host in the internet and for this need to buy domain and a server for host. As it is blockchain project, I need to connect it with real world Ethereum node. Beside I need a database and here I've to invest some budget. Then there will be some cost in various sector. An estimated cost table given below:

Table 3.4.2: Estimated Cost for FruitChain Project

SN	Components	Estimated Cost (BDT)
01.	Domain name and hosting	9,000-15,000
02.	Blockchain hosting	1,000-10,000
03.	Database hosting	1,000-5,000
04.	Visiting Stakeholders	1,000-2,000
05.	Phitron course for learning django	6,500
06.	Documentation and Report Writing	500-1,000
07.	Miscellaneous	1,000-2,000
08.	Contingency (10% of total)	2,000-4,150
	Total Estimated Cost	22,000-45,650

3.5 Summary

The Requirement Analysis and Design Specification phase for the FruitChain project is pivotal in defining and planning the system's capabilities and structure. This phase is crucial for ensuring that FruitChain meets its objectives by delivering a secure, efficient, and user-friendly platform for the fruit trading industry. It sets a solid foundation for the successful development and deployment of the project.

CHAPTER 4
IMPLEMENTATION

4.1 Overview

The implementation of FruitChain involves a comprehensive approach using a prototype design. The frontend is developed with HTML, CSS and JavaScript, providing an intuitive interface for users. The backend is built using Python Django, managing business logic, user authentication and transactions. The database utilizes SQLite, ensuring secure and efficient data storage. Blockchain technology, integrated via Solidity smart contracts on Ethereum in ganache local server, is used for fruit traceability, ensuring transparency and authenticity. System testing includes unit, integration, and user acceptance testing to validate functionality and performance, ensuring a robust and reliable platform before deployment.

4.2 Prototype Design

4.2.1 Front-end Design

The frontend design of FruitChain is visually appealing and user-friendly UI that showcases fresh fruits attractively. Vibrant colors, high-quality images, and clean typography used here to engage users and improve their browsing experience. The frontend design is responsive, it adapts seamlessly to different screen sizes and devices. This ensures that users can access FruitChain from desktops, laptops, tablets, and smartphones without any loss of functionality or usability. The navigation menu is visible to the right side and content is on the left side. So that user can navigate any page very easily. All the forms design is very simple and there are labels for every input field with placeholder too. So, that user will be able to understand very easily what he needs to do. Users can add products to cart and can view his cart very easily. When he checks out the products that time he will find a summary, shipping address form and cart too for if he wants to change product quantity again. There is also a simple profile section where the user can see his profile and can do different update operations. Users will also find all the orders done by him in the profile section. He can see the order status and can cancel the

order from profile too. In spite of having an integrated admin panel in django, there is also an admin view in frontend design. Which is very useful for admin users. The design of fronted is done by using HTML, CSS, Bootstrap and JavaScript. There is also a template string in HTML which is provided by django. It is very powerful and enables you to implement different conditions in HTML. The overall frontend design is very attractive and simple.

4.2.2 Back-end Design

The backend architecture of this project is Model-View-Controller (MVC) architectural pattern which is provided by Django. In the FruitChain project there are separate applications for each object. In each application there is a model for the database table structure, templates for layout of the application and views for different functionalities. The views functionalities are built with both class based view and function based view. Those views are the reason for rendering templates and interaction with database.

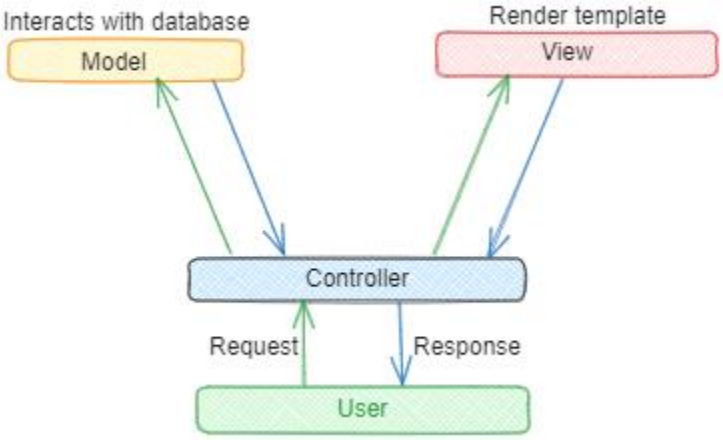

Figure 4.2.1: MVC Architecture

4.2.3 Database Design

The database of this project is Django's built-in SQLite database. Data model is defined by using Django ORM to represent entities of a table and their relationships. It is a structured database. The connection between python and database is built by Django ORM which convert python code to query language and query language to python language. In time of hosting, the database will be PostgreSQL.

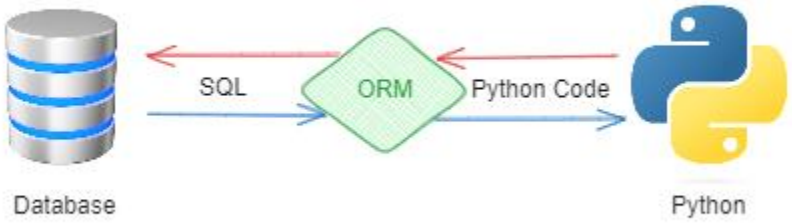

Figure 4.2.2: ORM diagram

4.2.4 Blockchain Design

In this project there is a blockchain implementation for tracing fruit. For implementing blockchain there is a smart contract using solidity programming language and compiled with truffle. Then the contract deployed in a local blockchain which is ganache using truffle. Ganache provide local blockchain server here. There is a workplace for FruitChain in ganache where the smart contract is deployed and after starting it blockchain data can be post or retrieve.

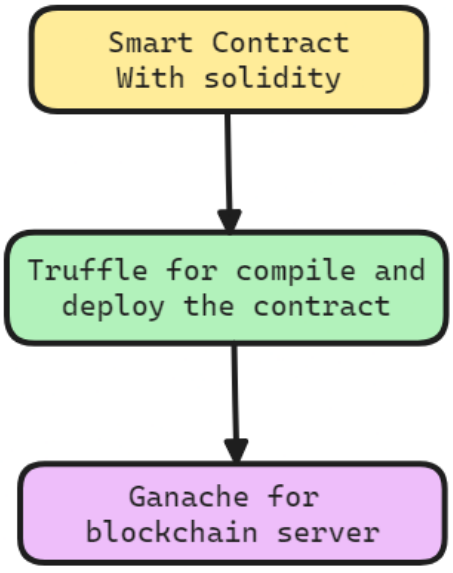

Figure 4.2.3: Blockchain design

4.2.5 Interaction Design and User Experience (UX)

FruitChain project focused on improve the design and provide smooth user experience.

The interaction design and user experience given below:

❖ Interaction Design:

- Users can easily navigate from one page to another by a navigation menu which is given to the left side.
- All the text and buttons are clearly visible and during hover its effect is changeable. So user will be able to understand easily.
- The platform design, its signs and overall structure is built by following development standards. So, users are familiar with this.
- In every successful or unsuccessful attempt user will get popup message, which makes the interaction smoother.
- Here I try to keep the project responsive by this all kinds of screen users are able to use this.
- In this project I try to keep a consistent design, which makes a good interaction with its users.

❖ User experience:

- Everything is clearly visible
- User don't need to remember anything
- Easy to understand
- Interactive user interface
- Every functionality work properly
- Well documented

4.3 System Testing

4.3.1 Testing Steps

The testing of developed FruitChain project is done in different and organized ways. Testing steps are given below:

❖ Functionality testing: Every individual features and functionalities of this project are working properly. If any error occurs the system doesn't crash and giving proper error feedback.

❖ Integrity testing: Integration with models and templates are done perfectly. In every

navigation templates are properly connected and interacting with database. Media files are uploading and showing as expected.

- Database testing: Data is correctly storing on SQLite. Data is creating accurately, readable, modifiable and can be deleted. So, CRUD operation properly working.
- Usability testing: Every interface is clearly visible and all the icons are following development standards. Users can easily understand every semiotics. No grammatical mistakes here. Every successful and failed message properly showing on the top left corner of the screen.
- Blockchain testing: The smart contract deployed successfully. During adding fruit, the trace details saving in blockchain server and contract call showing in the transaction properly. On time of viewing trace details the data from blockchain is retrieving properly. No problem found here.
- Email service testing: When a user order something or cancel order, that time user is getting email from us automatically. On the other hand if a user want to contact us we are getting their message accurately. Beside in time of forget password, users are getting password reset link in their email properly.
- Security testing: The system is strongly secured. Without superuser no one can see the database. The user's password is saving as encrypted data. So, no one can see their password. User's privacy is safe here and no one can login into other profile without authentication. Beside the payment system is well secured which security is provided by SSLCOMMERZ.

4.3.2 Test Results and Reports

During testing the system step by step different testing is done. The testing result of FruitChain is successful. For getting this test result I have used some test cases to ensure the system error free and well secured. The test report table contains test task which is defining the functionality, test data which need to provide for work the test tasks, then expected outcomes are for compare the actual test results and at the end column the test result is given which indicate that the functionality is properly working or not. The test report given below:

Table 4.3.1: Test Report

SN	Test Task	Test Data	Expected Outcome	Result
01	Login with invalid email or password	Username:munna Password:munnadev	Incorrect username or password	Pass
02	Login with valid email and password	Username:munna Password:monirdev	Redirect to home page and show success message	Pass
03	Add fruit in cart and increase-decrease quantity	No data needed	Fruit will be added to cart and change of quantity will change the price	Pass
04	Place order without filling billing address or keeping some field blank	Form fill by user	An error message will appear to fill the form properly	Pass
05	Place order with filling billing address	Form fill by user	Successful order place message will appear and a mail will sent to the user email	Pass
06	Reset forgotten password by system provided link to the user email	mahadi15-3881@diu.edu.b	A password reset form link will be sent to the mail and user can set new password	Pass
07	Add fruit by admin without filling all or some fields of form	Form fill by admin	Form validation error will arise and data will not save	Pass
08	Add fruit by admin with filling all fields	Form fill by admin	New fruit post will be added and a contract will be called in ganache to save a new block	Pass
09	Update order status from manage orders by admin	No data needed	After clicking on update button a drop down will appear and after changing the status clicking on save button new status will be saved	Pass
10	Contact message testing	Form fill by user	After filling all the fields in contact form clicking on send button will send the message to system mail	Pass

4.4 Summary

The implementation of FruitChain follows a prototype design approach, focusing on developing a functional model of the system. The frontend, crafted with HTML, CSS, and JavaScript, ensures a user-friendly experience. The backend, developed using Python Django, handles core functionalities and user management. SQLite serves as the database, providing reliable data storage and retrieval. Blockchain technology, integrated with Solidity smart contracts on Ethereum, facilitates secure fruit traceability. Comprehensive system testing, including unit, integration, and user acceptance tests, ensures the prototype's reliability, functionality, and performance, paving the way for the final system's deployment.

CHAPTER 5

RESULT AND ANALYSIS

5.1 Overview

A detailed examination of the outcomes I get from simulations and performance evaluations of the FruitChain project. The results highlight the system's efficiency in frontend, tracing fruit origins, ensuring data integrity and managing transactions using blockchain technology. Performance metrics are assessed to evaluate aspects such as system scalability, transaction speed and response times. The analysis aims to validate the effectiveness of the system, pinpoint strengths and identify areas for potential enhancement. The findings serve as a basis for determining the practical applicability of the FruitChain system in the real-world fruit supply.

5.2 Simulation Result

5.2.1 Simulation of Database

In every application of this project there is a python file named model.py which is mainly making table and attributes for different object. No code of SQL is used here because the django ORM is helps to convert python code to SQL and SQL code to python code. By calling different object model in the views this project make an interaction with database. The SQLite database is embedded with django project and no installation is needed here.

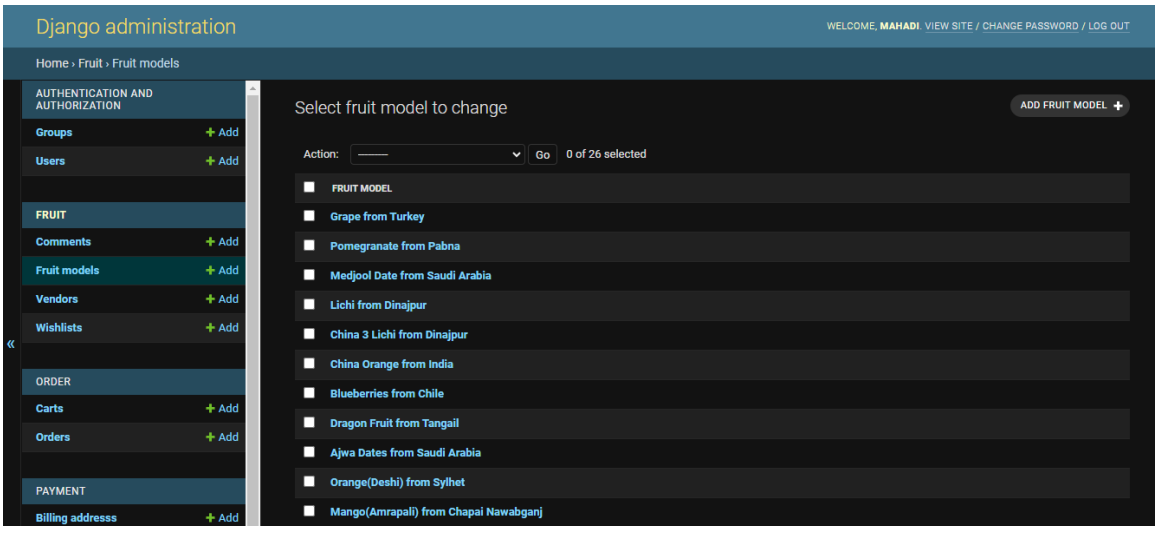

Figure 5.2.1: Database Architecture.

5.2.2 Simulation of Front-end

The frontend design simulation for the FruitChain project aims to emulate the user interface (UI) and user experience (UX) to ensure it meets user expectations and functional requirements. The frontend design is implemented using HTML, CSS, Bootstrap and JavaScript. After run the project the user interface showed up in the browser. The UI is smooth and very easy to learn. Different user interface of FruitChain is given below:

❖ Signup Page:

For signup in this application users have to provide all those things shown in the figure. If any error occurred those will be shown in the form. All the fields are required and users have to fill up all the fields. Then when a user clicks on the submit button they will be a registered user and their information will be saved in the database.

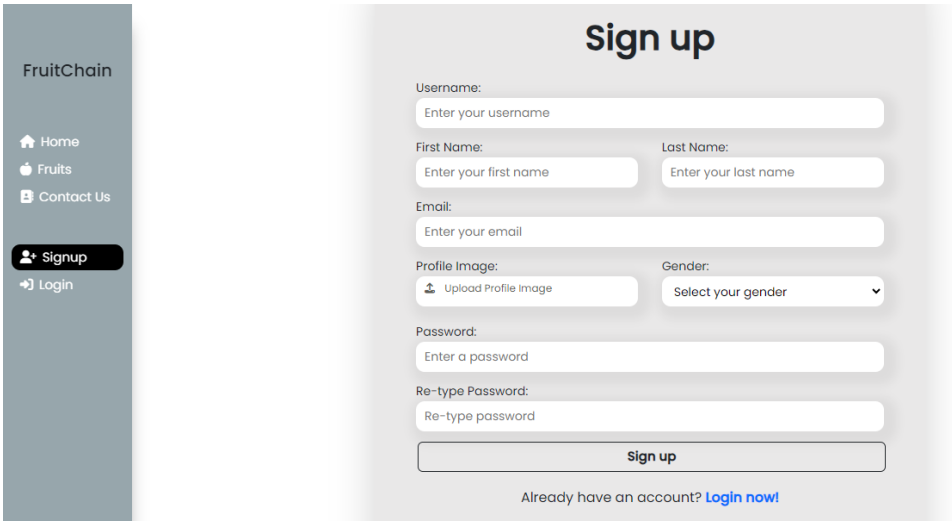

Figure 5.2.2: Signup page

❖ Login Page:

For login in this application users have to register first then using registered username and password user can login in this application. After providing a valid username and password the user will be logged in and will see a logged in confirmation to the left top corner in the home page. If any of them incorrect the user will see error message in the login form and a warning popup message. Without authentic credential user can't login in the system.

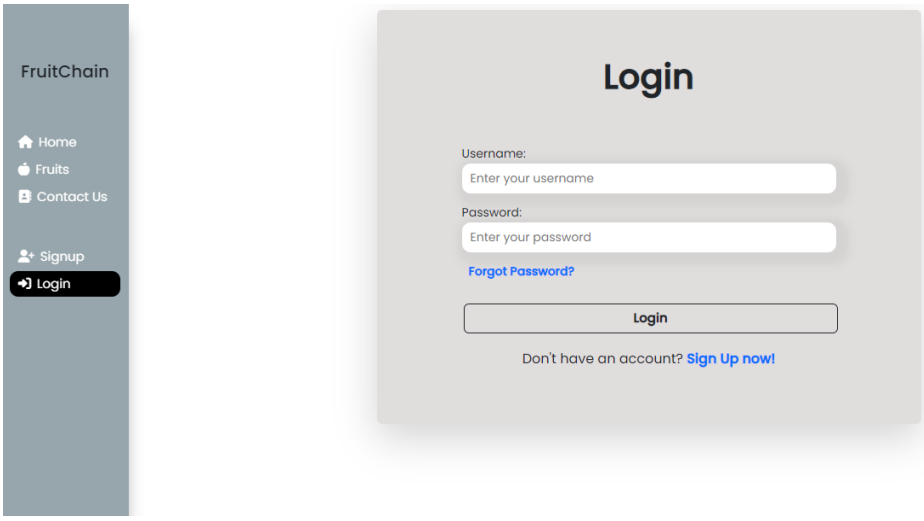

Figure 5.2.3: Login page

❖ Shopping cart:

When a user click on add to cart button from fruit post, the fruit will be add in the cart and user will be see cart products in shopping cart. Here he will be able to increase or decrease the fruit quantity.

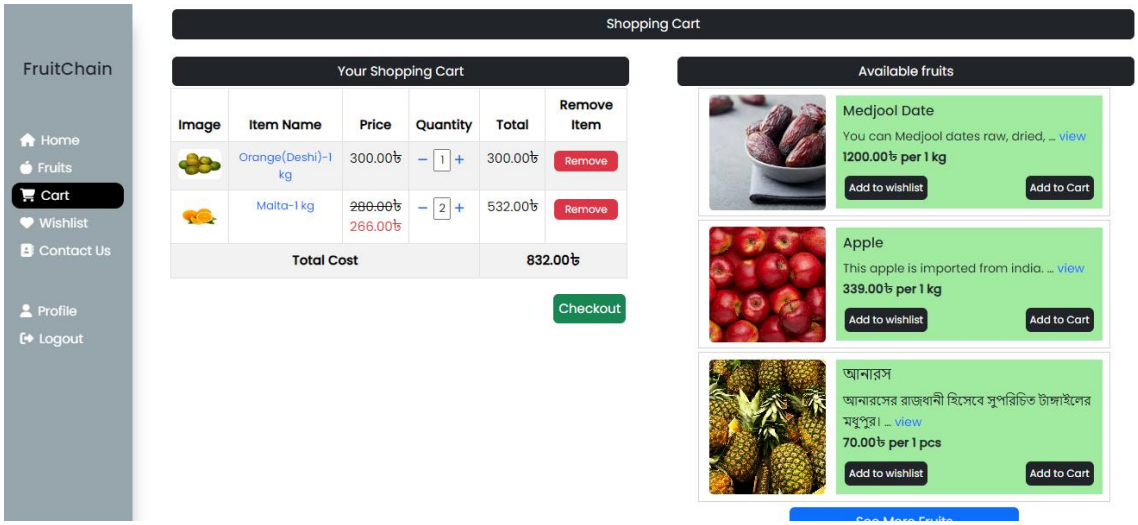

Figure 5.2.4: Shopping Cart

❖ Checkout:

There is a button in the shopping cart which is checkout and clicking on it user will find order summery page and will see a shipping address form. After fill up the form user will be able to place the order. Without items in carts user is unable to checkout. The checkout page will be blank.

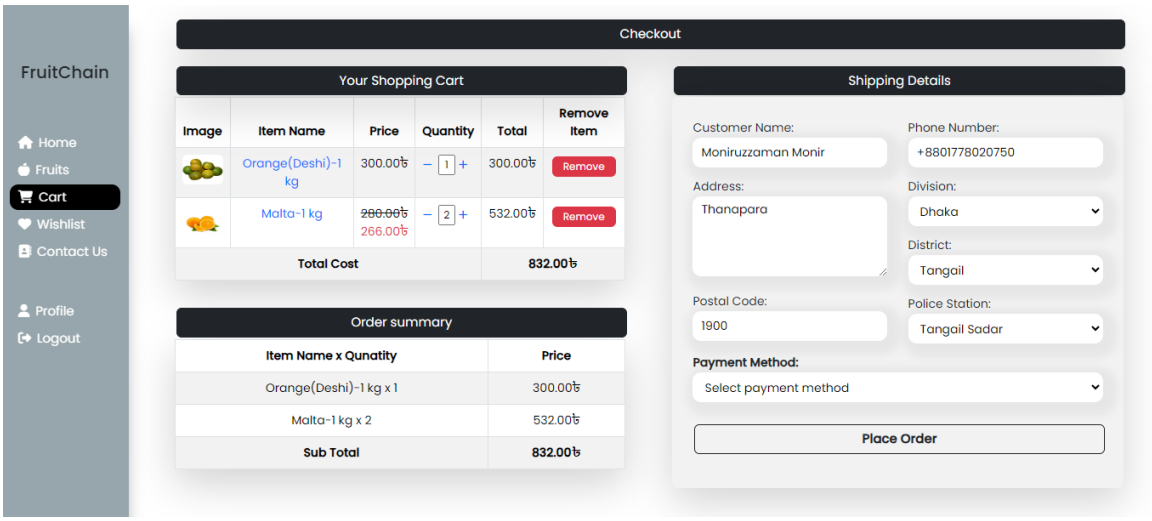

Figure 5.2.5: Checkout page

❖ Profile page:

In the profile page user will find edit profile option and all the orders is done him. He can see orders from here and also can do order cancellation from this page. In the order details table user will find order ID, Ordered items, total cost, payment method and order status.

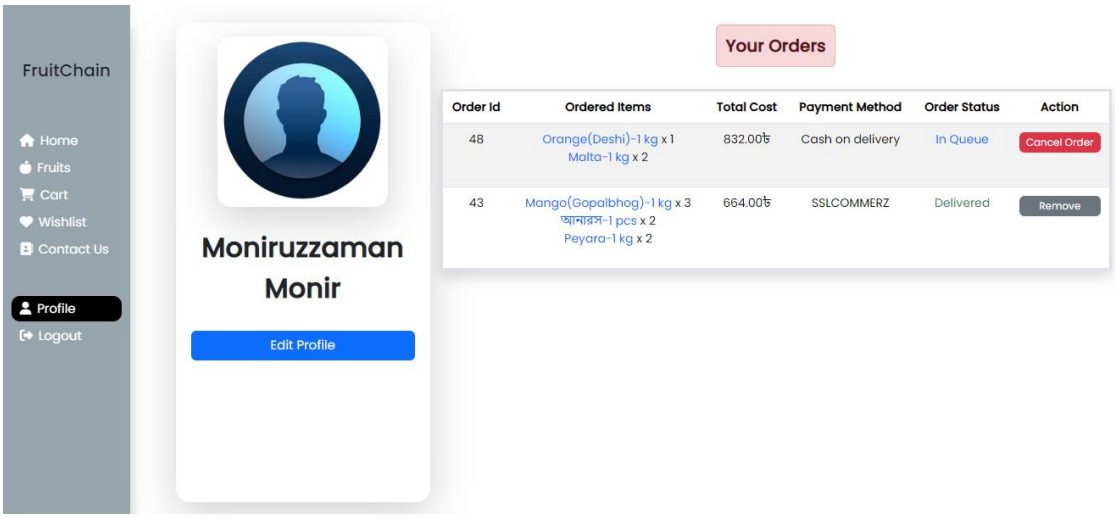

Figure 5.2.6: Profile page

❖ Update profile and update password:

By clicking on edit profile user will find profile update form. There is also a button in the form which is update password. This will allow a user to update their password. If user forget password he will also find forget password option from update password. By this user will get password reset link in his mail.

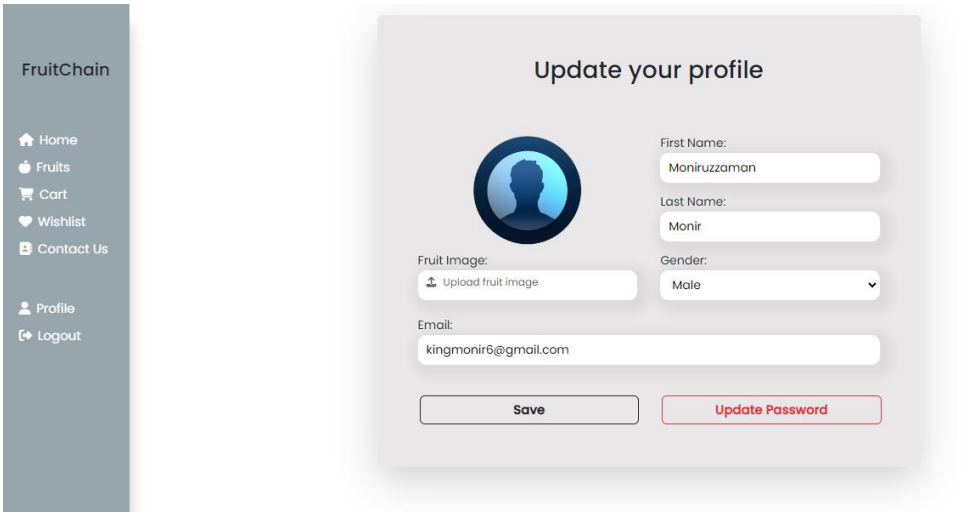

Figure 5.2.7: Update profile page

❖ Wishlist:

User can add their favorite fruits to their wishlist by clicking on add to wishlist from the fruit post and wishlist will show the list that the user were added. User can also remove fruits from their wishlist.

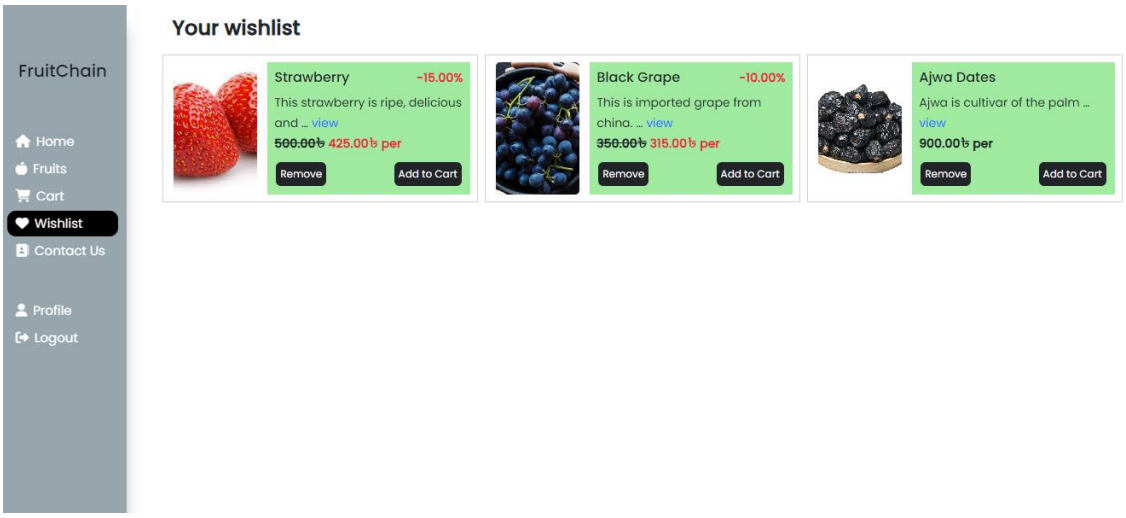

Figure 5.2.8: Wishlist page

❖ Admin Interface:

When an admin logged in the system the navigation options became changed. The options are only for admins. In every fruit cart admin will find different button and by clicking on those different button admin will be able to do different work: edit fruit post, make the fruit as flash sale, make stock out and delete fruit post.

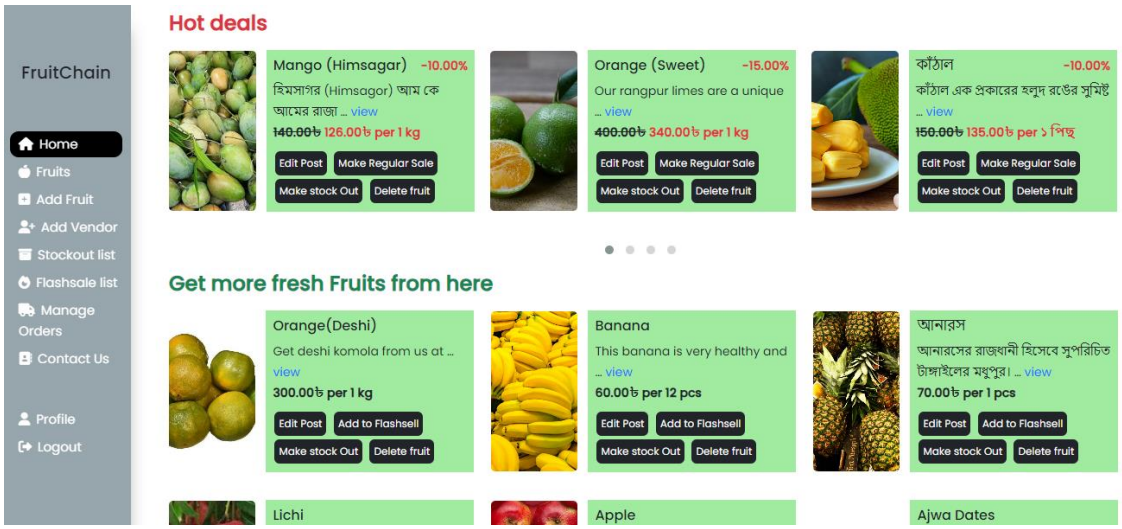

Figure 5.2.9: Admin interface

❖ Add Fruit:

Admin can add fruit post for selling fruit by providing fruit details in add fruit form. Then it will show in fruits and blockchain data will be saved in ganache as a block.

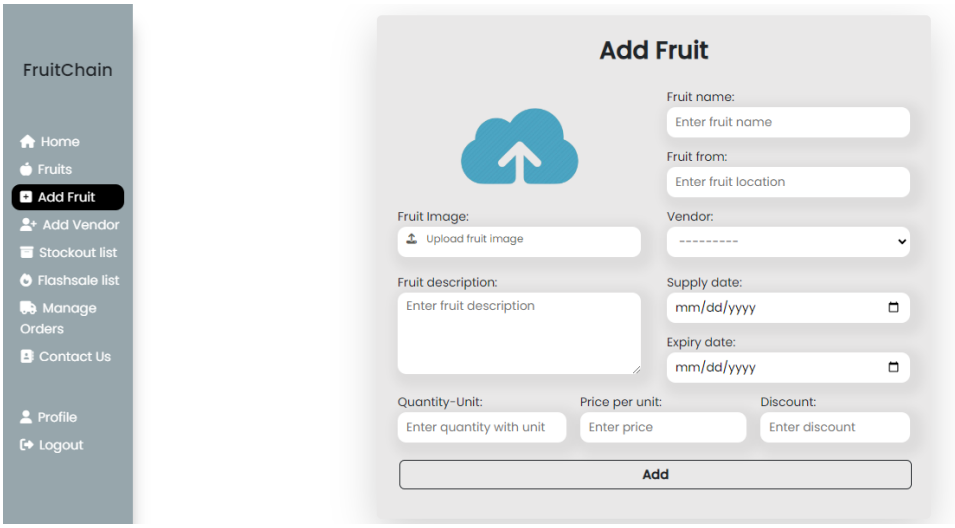

Figure 5.2.10: Add fruit page

❖ Add vendor:

Admin can frequently add vendors for every fruit post by adding vendors from add vendor section. Every field is required and admin have to filled all the fields of add vendor form. Then successfully a new vendor will be added.

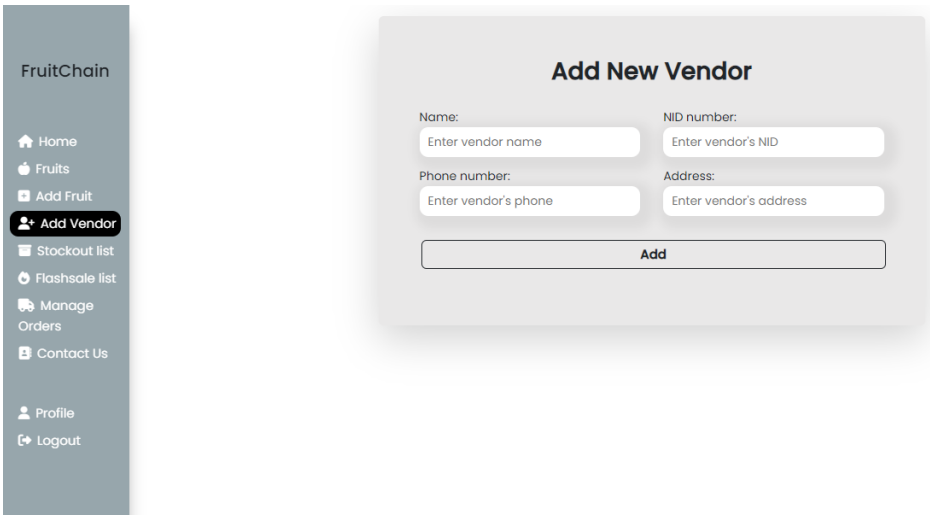

Figure 5.2.11: Add vendor page

❖ Stockout list:

After making fruits stock out admin can see stock out list. From here admin can make them available by clicking on move to regular from the stock out list page if the fruit supplied in the stock. Admin can also delete fruit from here is the fruit supply stopped or fruit season ends.

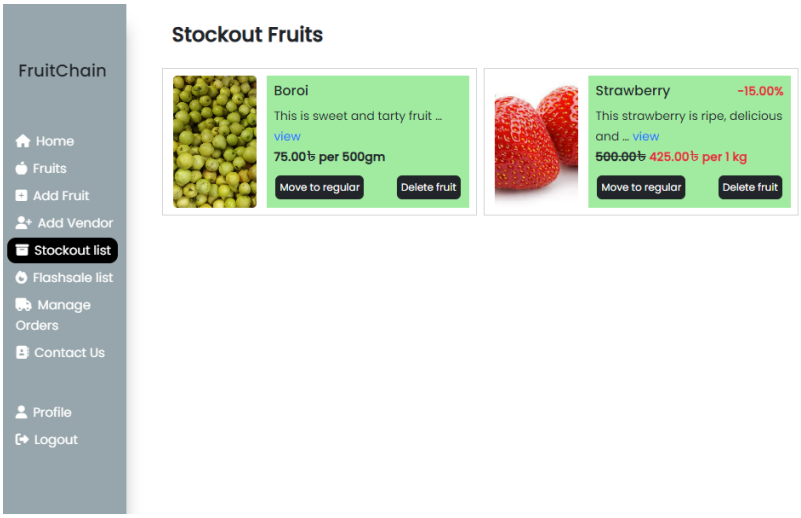

Figure 5.2.12: Stock out list page

❖ Flashsale list:

This navigation link provide flash sale list of fruits and admin can remove fruits from flash sale by clicking on make regular sale.

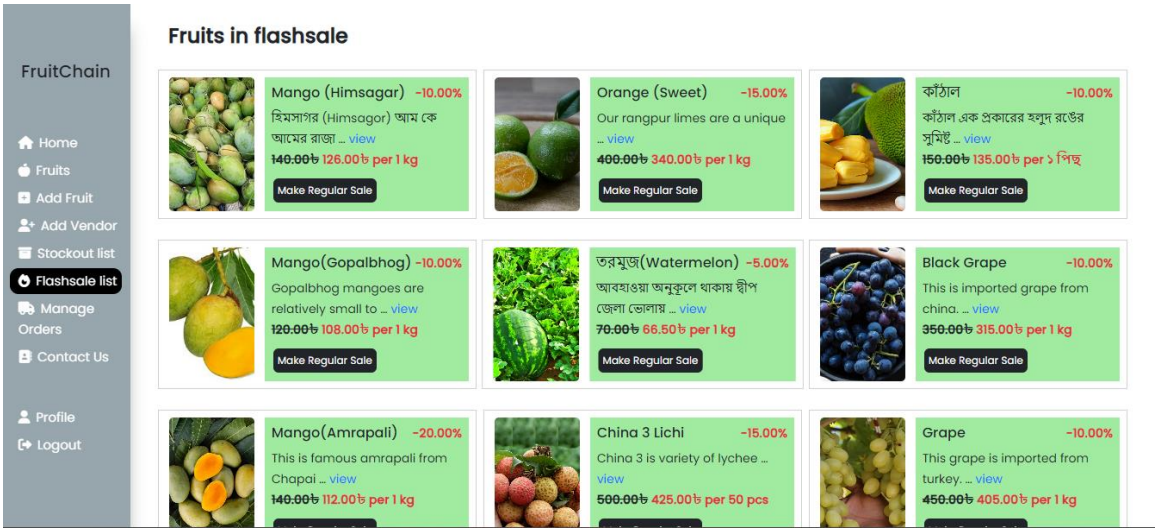

Figure 5.2.13: Flashsale list page

❖ Manage orders:

Here admin will find all the orders ordered by users and here admin can update order status according to order's current information. Beside there is an export to excel button in the top right corner and by clicking it admin can generate excel file for working with excel or share orders list. Admin can also cancel the order from this page as like as update order status.

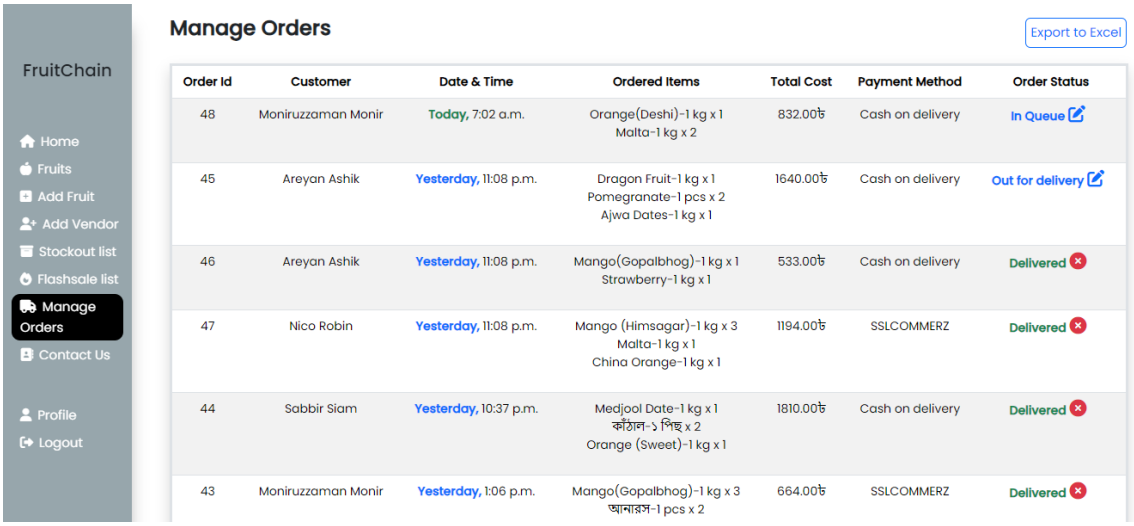

Figure 5.2.14: Manage orders page

❖ Fruit-details and tractability:

In every fruit cart you will find a details view button and after clicking it you will redirect to fruit details page. Here you will find fruit details, trace details which comes from

blockchain and reviews.

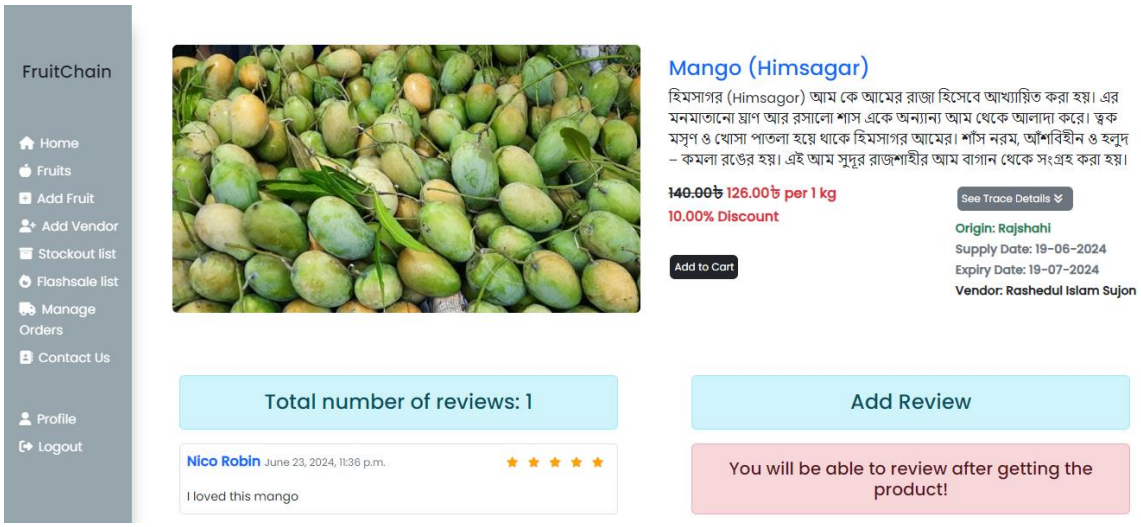

Figure 5.2.15: Fruit Details page

5.2.3 Simulation of Blockchain

Here blockchain implemented in local blockchain server which is provided by ganache. The smart contract for blockchain is written in solidity and it compiled by truffle, then it deployed to ganache. Ganache provide local blockchain server and using web3.py this django project is connected with it. When an admin add fruit post that time a contract called for add fruit in blockchain node and when someone want to see fruit details that time fruit trace details retrieve from blockchain server.

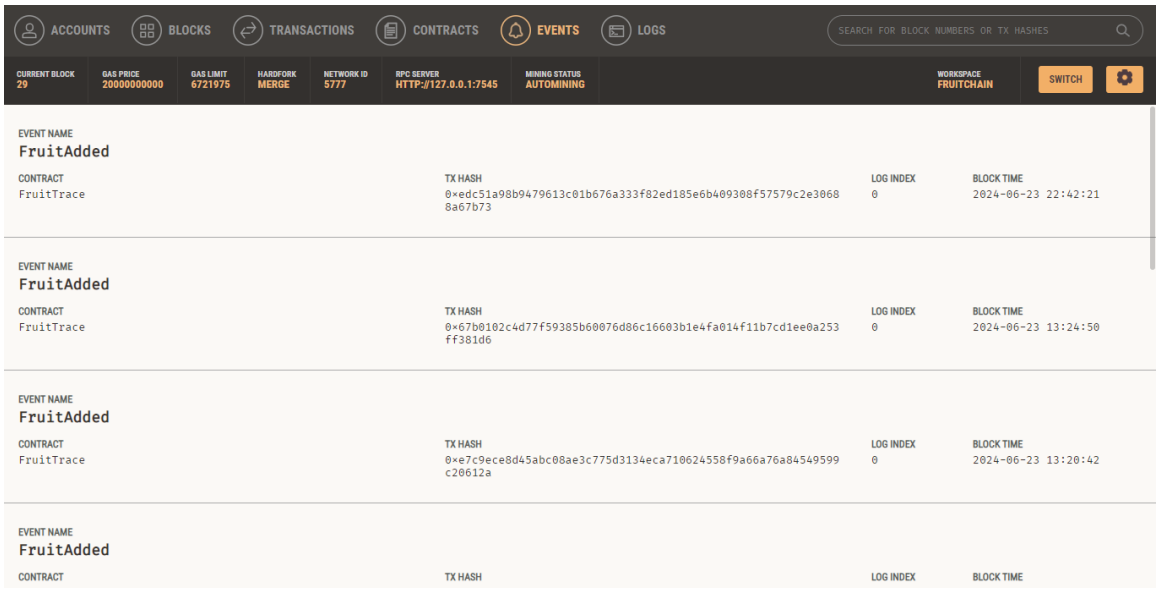

Figure 5.2.16: Ganache event page

5.3 Performance

The performance of the FruitChain project has been optimized to ensure a smooth and efficient user experience. Key metrics and results include:

- Load Times: The website's pages, including the homepage, product listings and fruit details, load within 2-3 seconds, providing a fast browsing experience.
- Scalability: The system is designed to handle a high volume of users and transactions simultaneously without performance degradation. It supports up to 10,000 concurrent users and 5,000 transactions per minute.
- Blockchain Efficiency: The blockchain integration for fruit traceability operates with a transaction confirmation time of less than 10 seconds, ensuring quick access to supply chain information.
- Database Queries: Optimized queries ensure data retrieval times remain below 200 milliseconds, enhancing the responsiveness of the application.
- Resource Utilization: The server efficiently manages resources with an average CPU utilization of 30% and memory usage of 40%, even during peak load times.
- Uptime: The system boasts an uptime of 99.9%, ensuring reliable and continuous availability of services.

These performance metrics indicate that FruitChain is robust, responsive, and capable of delivering a high-quality user experience while maintaining efficient backend operations and blockchain traceability features.

5.4 Summary

The results and analysis of the FruitChain project demonstrate the system's effectiveness in ensuring transparency and trust in fruit traceability through blockchain technology. Simulations of the frontend design confirm an intuitive and responsive user interface, significantly enhancing user experience. Performance analysis indicates efficient load handling, low latency in transactions, and consistent uptime, ensuring reliable operations. The system also shows significant improvements in traceability accuracy and reduced transaction costs, validating the project's success in meeting its objectives and providing a robust solution for the fruit e-commerce market.

CHAPTER 6

IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY

6.1 Impact on Life

FruitChain, a blockchain-based fruit traceability system, deeply impacts everyday life by transforming how we purchase and consume fruits. By integrating blockchain technology, FruitChain ensures complete transparency in the fruit supply chain, from farm to table. Consumers can now verify the origin and quality of their fruits, building trust and confidence in the produce they consume. Beside the platform promotes healthier living by empowering consumers to make informed choices about the fruits they buy, potentially reducing the risk of consuming substandard or contaminated produce. For vendors and farmers, FruitChain offers a reliable platform to showcase their commitment to quality and transparency. It facilitates easier compliance with food safety regulations and reduces the risk of conflicts related to product quality and origin.

6.2 Impact on Society & Environment

6.2.1 Impact on Society

FruitChain aims to create a positive and lasting influence on society, promoting health, sustainability, and economic growth. Some impact discussed below:

- Improved access to fresh fruit which is benefiting people in urban areas where access to quality produce may be limited.
- Promotes healthier eating habits and better nutrition among the population.
- Utilizing blockchain technology for traceability ensures that consumers know the origin of their fruits.
- This transparency builds trust in the food supply chain, reduces the likelihood of counterfeit products, and promotes food safety.
- The platform educates consumers about the source and quality of their food, empowering them to make informed choices.
- FruitChain creates job opportunities in various sectors including agriculture and technology.

- It supports economic growth and provides livelihoods for many individuals and families.
- The use of advanced technologies like blockchain and e-commerce promotes technological literacy among users.

6.2.2 Impact on the Environment

FruitChain's environmentally conscious approach to the fruit supply chain not only helps reduce waste and emissions but also promotes sustainable agriculture and resource conservation, leading to a positive impact on the environment. Some impacts given below:

- FruitChain's efficient supply chain directly connects farmers with consumers, minimizing the need for extended storage and reducing spoilage.
- FruitChain promotes the use of minimal and eco-friendly packaging to deliver fruits, thereby reducing the waste generated from excessive packaging materials.
- By sourcing fruits locally, FruitChain supports regional agriculture, which often has a smaller environmental footprint than large-scale industrial farming.
- The efficient logistics and direct-to-consumer model reduce the need for extensive storage and refrigeration, which are energy-intensive processes. Lower energy consumption translates to reduced greenhouse gas emissions, contributing to a cleaner environment.

6.3 Ethical Aspects

FruitChain's ethical framework encompasses fair trade, transparency, consumer protection, and environmental responsibility. Here some ethical aspects given:

- By eliminating intermediaries and providing a direct market, the platform ensures that a larger share of the profits goes to the producers, supporting their livelihoods and economic well-being.
- Utilizing blockchain technology, FruitChain guarantees transparency in the supply chain, allowing customers to trace the origin of their fruits and verify the authenticity of their purchases. This transparency build trust between consumers and producers, ensuring ethical sourcing and reducing the risk of fraud.
- The platform's commitment to honesty and integrity helps build trust and ensures that customers receive value for their money.

- Respecting users' privacy is a key ethical consideration for FruitChain.
- The platform avoids deceptive practices and ensures that all promotional activities reflect its values of honesty, integrity, and respect for customers.

6.4 Sustainability Plan

FruitChain aims to create a positive impact on the environment, economy and society, ensuring the long-term viability and success of the platform while promoting a more sustainable future. A proper plan given here:

❖ Economic Sustainability:

- FruitChain will generate revenue through multiple channels, including direct sales of fruits and partnerships with local farmers and suppliers. This diversified approach ensures a steady income and reduces dependence on a single revenue source.
- By maintaining a balance between fair prices for consumers and reasonable profits for suppliers, FruitChain ensures long-term economic sustainability. This approach encourages customer loyalty and supports the economic viability of local producers.
- Continued investment in technology will optimize operations and reduce costs over time. Upgrading infrastructure, implementing automation and enhancing the user experience will contribute to financial sustainability.

❖ Environmental Sustainability:

- FruitChain is committed to sourcing fruits from farms that employ sustainable practices which ensures minimal environmental impact.
- The platform will use recyclable and biodegradable packaging materials, minimizing waste and reducing the environmental impact of plastic packaging.
- Implementing an efficient inventory management system will help reduce food waste by ensuring that fruits are sold and consumed before they spoil

❖ Social Sustainability:

- The platform will engage with local communities through outreach programs, educational initiatives on sustainable agriculture and support for local food systems.
- By providing easy access to fresh, nutritious fruits, FruitChain contributes to the health and wellbeing of its customers.

❖ Technological Sustainability:

- FruitChain will utilize energy-efficient servers and cloud services to reduce energy consumption.
- Ensuring the protection of customer data through robust security measures supports long-term trust and sustainability.
- Implementing blockchain technology for fruit traceability promotes transparency and accountability supports sustainable sourcing practices.

❖ Operational Sustainability:

- FruitChain will optimize resource use in operations, including energy, water, and materials, to minimize waste and lower operational costs. This efficiency supports long-term sustainability.
- Building strong relationships with suppliers, technology providers and community organizations ensures a resilient and sustainable operational model.

❖ Monitoring and Evaluation:

- FruitChain will conduct regular audits to assess its environmental, social and economic impact. These audits will help identify areas for improvement.
- Engaging with stakeholders, including customers, suppliers and community members, will provide valuable feedback and insights to improve sustainability efforts.

6.5 Summary

FruitChain revolutionizes the fruit supply chain by enhancing transparency and trust. For society, it provides consumers with detailed origin information, building confidence in the quality and ethical sourcing of fruits. This empowers healthier and more informed consumption choices. Environmentally, FruitChain promotes sustainable agricultural practices by encouraging vendors to adopt eco-friendly methods to meet consumer demand for traceable, responsibly sourced produce. In terms of sustainability, FruitChain supports fair trade and responsible sourcing, ensuring a more equitable and sustainable future for farmers and consumers.

CHAPTER 7
CONCLUSION AND FUTURE SCOPE

7.1 Conclusions

FruitChain, as an innovative e-commerce platform dedicated to providing fresh, authentic and traceable fruits, has taken a significant potential to improve the fruit supply. The noble feature of FruitChain is the integration of blockchain technology to ensure transparent traceability. This not only enhances consumer confidence in the authenticity and quality of the fruits but also provides a great mechanism to prevent fraud and duplicate products in the supply chain. The ability for consumers to trace the origin of their fruits back to the farm level adds a layer of trust and accountability that is currently lacking in traditional supply chains. Beside FruitChain has successfully addressed several environmental concerns associated with traditional fruit supply chains. The platform's user-friendly interface has made it easy for customers to order fruits and make payments, whether online or offline. This accessibility is crucial in ensuring that a huge consumers, including those in rural areas, can benefit from the service. The focus on inclusiveness and customer satisfaction has been a key driver in the platform's acceptance and success. FruitChain's model not only serves as a blueprint for other sectors within the fruit industry but also get the way for future innovations in e-commerce and supply chain management.

7.2 Further Suggested Works

In future different opportunities and areas for development have been identified to improve the capabilities of FruitChain:

- Expansion of Product Range: Increasing the product range to include a wider variety of fresh produce such as vegetables, dry fruits and other organic goods, can attract a broader customer base and increase market share.
- Advanced Data Analytics: Using advanced data analytics a valuable insights into consumer behavior, market trends and supply chain efficiency can be introduced. Which will help in better inventory management and targeted marketing strategies.
- Mobile Application Development: A mobile application can be developed to make the platform more accessible to a wider consumers. A mobile app can offer additional

features such as push notifications for promotions and updates, offline access and improved navigation.

- Blockchain Advancements: FruitChain can explore more advanced applications of blockchain, such as smart contracts for automated and secure transactions, enhanced security features and broader interoperability with other blockchain networks.
- Educational Initiatives: Implementing educational programs for consumers about the importance of sustainable agriculture, food traceability and ethical consumption can build awareness and make more conscious purchasing decisions.

In conclusion, FruitChain's journey has just begun and the platform is continuing its growth and taking a great impact on the fruit supply chain, benefiting consumers, farmers, and the environment.

7.3 Conflict of Interests

Conflict of Interests can arise in FruitChain project due to several factors:

- Profit Motives vs. Transparency: While FruitChain promotes transparency through blockchain, profit motives may tempt stakeholders to compromise on traceability standards to cut costs.
- Data Privacy Concerns: The extensive consumer data collected for traceability may conflict with privacy regulations, potentially exposing personal information if not managed securely.
- Supplier Relations: Balancing transparency with maintaining good relations with suppliers who may resist full disclosure of their operations for competitive or proprietary reasons.
- Technology Risks: Dependency on blockchain technology introduces risks such as system failures, data breaches that could weaken trust in the platform.
- Environmental Impact: Despite addressing environmental concerns, scaling operations could inadvertently lead to increased carbon footprints through logistics and packaging.

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Appendix A

Course Outcomes, Complex Engineering Problems (EP) and Complex Engineering Activities (EA) Addressing

Title: FRUITCHAIN: BLOCKCHAIN INTEGRATION FOR FRUIT TRACE

Student ID: 203-15-3881

CO Description for FYDP

CO	CO Descriptions	PO
	Phase -I	
CO1	Integrate recently gained and previously acquired knowledge to identify a **web based fruit selling ecommerce** problem for the Final Year Design Project (FYDP)	**PO1**
CO2	Analyze different aspects of the goals in designing a solution for this FYDP	**PO2**
CO3	Explore diverse problem domains through a literature review, delineate the issues, and establish this goals for the FYDP	**PO4**
CO4	Perform economic evaluation and cost estimation and employ suitable project management procedures throughout the development life cycle of the FYDP	**PO11**
	Phase -II	
CO5	Design and develop technical solutions and system components or processes that meet specified requirements, ensuring compliance with public health and safety standards, as well as considering cultural, socioeconomic, and environmental factors in this FYDP	**PO3**
CO6	Choose and apply appropriate methodologies, resources, and contemporary engineering and IT technologies to address complex engineering processes, encompassing prediction and modeling, while adhering to relevant constraints in this FYDP	**PO5**
CO7	Analyze societal, health, safety, legal, and cultural considerations, along with associated responsibilities, in the context of professional engineering practice and the resolution of this problem, employing logical reasoning guided by contextual understanding.	**PO6**
CO8	Comprehend and evaluate the enduring sustainability and impact of professional engineering endeavors in addressing intricate engineering challenges within social and environmental frameworks.	**PO7**
CO9	Implement ethical principles and adhere to professional standards and norms in this FYDP	**PO8**
CO10	Capable of operating proficiently both individually and as a team member or leader across diverse teams and interdisciplinary settings in this FYDP.	**PO9**

CO11	Proficiently communicate with the engineering community and broader society regarding complex engineering endeavors, including the ability to comprehend and generate comprehensive reports and design documentation, as well as provide and receive clear instructions throughout this FYDP.	**PO10**
CO12	Acknowledge the importance of self-directed and life-long learning within the evolving landscape of technology, and possess the readiness and capability to engage in lifelong learning endeavors.	**PO12**

Addressing CO (1 to 8), Knowledge Profile (K), Attainment of Complex Engineering Problems (EP), and Attainment of Complex Engineering Activities (EA)

Addressing CO (1 to 8), Knowledge Profile (K), Attainment of Complex Engineering Problems (EP):

SN	EP Definition	Attainment	CO	Justification (with Knowledge Profile)	References
1.	**EP1: Depth of Knowledge required**	Yes	CO1, CO2, CO3, CO5, CO6, CO7 and CO8	This projects needs theatrical knowledge like functional and nonfunctional requirements, ORM, MVC etc. to understand project requirements and design which covers **Theory-based Understanding (K1)**.	**Page no:** [9-10,22,23], **Section:** [3.2.1, 4.2.2, 4.2.3]
				In this project I have used database and done front-end development following design principles which ensure **Engineering Fundamentals (K3).**	**Page no:** [21-24], **Section:** [4.2]
				Integration of blockchain technology and use of django for back-end development is the **Specialist Knowledge (K4)** of this project.	**Page no:** [22, 23], **Section:** [4.2.2, 4.2.4]
				I have applied **Engineering practice & design (K5)** by following software development life cycle, design requirements, security etc.	**Page no:** [17-18], **Section:** [3.4.1]
				By using HTML, CSS, JavaScript, Python, Django, Solidity this project covers **Engineering practice & technology (K6).**	**Page no:** [16-17], **Section:** [3.3]

				The impact in society, environment showed. Discussed about ethical aspects and sustainability plan about this project which covers **Comprehension (K7).**	**Page no:** [38-41], **Section:** [6.1-6.4]
				Research literature (K8) covered by showing existing works, studying research papers and collecting information from online in this project.	**Page no:** [5-7], **Section:** [2.2-2.4]
2.	**EP3: Depth of analysis required**	Yes	CO2, and CO6	FruitChain project aims to solve fruit tracing problem using blockchain technology which fulfils **EP-3**. An in depth analysis needed to solve the problem.	**Page no:** [2], **Section:** [1.3]
3.	**EP4: Familiarity of Issues**	Yes	CO8	The resource about blockchain technology is not so much available as it is near to new technology. Beside not so much project is available using this. On the other hand this kind of project using python django is rare. So It makes a familiarity issue which covers **EP-4**.	**Page no:** [3, 8], **Section:** [1.5, 2.4]
4.	**EP6: Extends of stakeholders involved and conflicting requirements**	Yes	CO8	This project is developed following web standards and software development life cycle. The project is continuously improving by stakeholder's feedback and their preferences which cover **EP-6**.	**Page no:** [18], **Section:** [3.4.1]
5.	**EP7: Interdependence**	Yes	CO5	FruitChain projects meets **EP-7** where tracing data is coming from blockchain server which is provided by Ganache and without this the blockchain data will be unavailable.	**Page no:** [23, 36], **Section:** [4.2.4, 5.2.3]

Addressing CO11 with Complex Engineering Activities (EA):

SN	EA Definition	Attainment	CO	Justification	References
1.	**EA1: Range of resources**	Yes	CO11	Multiple tools and technologies are used to develop this project. For example VS code, Ganache, Browser are tools and python, django, JavaScript, solidity are technologies.	**Page no:** [16-17], **Section:** [3.3]
2.	**EA2: Level of interaction**	Yes		I get the design requirement from my supervisor and learn Django from a course named Phitron where I get solutions of different technical problems with django.	**Page no:** [18], **Section:** [3.4.1]
3.	**EA3: Innovation**	Yes		Use of blockchain technology to get trace details of fruits is the nobility of this project.	**Page no:** [3, 4, 8], **Section:** [1.5, 1.7, 2.5]
4.	**EA4: Consequences for society and the environment**	Yes		The project taking impact on society and environment by supplying fresh fruit, making healthy habit, making the economic growth, building trust in people, making eco-friendly environment, reducing spoilage and so on.	**Page no:** [38-41], **Section:** [6.1-6.4]
5.	**EA-5: Familiarity**	Yes		There are some competitors in fruit market and some of them are SobjiBaazar, Khaas Food, Chaldal, shwapno etc. They are also providing fresh and authentic fruits. But they have some lacking and focusing on those the FruitChain is developed.	**Page no:** [5-7], **Section:** [2.2, 2.3]

Addressing CO (4, 9, 10, and 12):

SN	COs	Attainment	Justification	References
1	CO4	Yes	This project attain CO4 by providing information about risk management and analyzing estimated cost. There are some risks in this project and showed how to mitigate them and make a estimated budget.	**Page no:** [17-20], **Section:** [3.4]
2	CO9	Yes	This project build in following ethical principles and professional standards. Where FruitChain's aim is to build trust to the customers and provide proper safety and security to the users data. The project ensures that no harmful activity is done here.	**Page no:** [39], **Section:** [6.3]
4	CO12	Yes	The project implemented on agile model of software development life cycle. This will take feedback from users and continuously the project will upgrade, new features and functionality will be added. It makes sure the lifelong involvement with technology and will make the project sustainable.	**Page no:** [18, 40-41], **Section:** [3.4.1, 6.4]

Plagiarism Report

FRUITCHAIN: BLOCKCHAIN INTEGRATION FOR FRUIT TRACE

ORIGINALITY REPORT

8%	3%	0%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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2	Submitted to Asia Pacific University College of Technology and Innovation (UCTI) Student Paper	1%
3	Submitted to University of Greenwich Student Paper	1%
4	dspace.daffodilvarsity.edu.bd:8080 Internet Source	1%
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