National University of Computer and Emerging Sciences

Credit Risk Liaison (CRL)

FYP Team

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Abstract

Our project aims to develop a web-based platform using MERN Stack technology for the wholesale and retail industry. The platform provides a marketplace for retailers to connect with local wholesalers and allows them to place orders directly. The platform also features a credit scoring system to evaluate retailers based on their past order history and creditworthiness, allowing wholesalers to make informed decisions when accepting or rejecting orders. The system's non-functional requirements include performance, scalability, and security, ensuring the platform can handle many users and transactions securely. The project's successful completion will provide an innovative solution to streamline the wholesale and retail industry, benefiting both retailers and wholesalers by making the ordering process efficient and cost-effective.

Executive Summary

Our project aims to provide a blockchain-based platform for small retailers and wholesalers to connect and conduct transactions in a secure and efficient manner. The platform will leverage the MERN stack to provide a user-friendly web-based interface for the users. The platform will include features such as inventory management, order tracking, and a credit score system to incentivize good behavior.

The primary beneficiaries of our platform will be small retailers and wholesalers who currently face challenges in accessing credit and conducting transactions in a secure manner. By leveraging blockchain technology, our platform will provide a transparent and secure system for conducting transactions, which will improve trust between parties and make it easier to access credit.

We have identified several key risks, such as technical challenges and regulatory issues, but we have put in place measures to mitigate these risks. Our project team consists of experienced developers who will use an agile development methodology to ensure that the project is delivered on time and within budget.

Overall, our project represents a significant opportunity to disrupt the retail and wholesale industry and provide a much-needed solution for small retailers and wholesalers. We believe that our platform has the potential to revolutionize the way small businesses conduct transactions, and we are excited to bring this project to fruition.

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Chapter 1: Introduction

This section provides a basic go through on what, for whom this document is.

1.1 Purpose of this Document

The purpose of this document is to present the design and development of a web-based platform for connecting local retailers and whole-sellers. This platform aims to streamline the buying and selling process, increase efficiency and transparency, and provide a more convenient solution for retailers and whole-sellers for on-credit trading of goods. This document will provide a comprehensive overview of the platform, including the project scope, requirements, design, and implementation details. The document is intended for stakeholders, developers, and project managers involved in the design and development of the platform, as well as potential users who are interested in understanding how the platform works.

1.2 Intended Audience

The intended audience for the document includes our university evaluators who will be grading our project, as well as any stakeholders who may be interested in learning about our project, such as potential investors or industry professionals. It is important that the document is clear and concise, and that technical terms are explained in a way that is accessible to a broad audience.

1.3 Definitions, Acronyms, and Abbreviations

List all important definitions, the acronyms and abbreviations used in this document.
SDG: Sustainable Development Goal
MERN: MongoDB, ExpressJS, ReactJS, NodeJS

Chapter 2: Project Vision

This section provides the complete vision we have for Credit Risk Management. It includes the problem that exists, the solution our project provides, its goals and objectives, the project scope, and its constraints.

2.1 Problem Domain Overview

Our problem domain is the lending and borrowing of goods and services on credit. In traditional lending systems, there is a lack of trust between the parties involved, leading to delayed payments, or even defaulting on payments. Additionally, there is a risk of fraud and manipulation in the lending process. Our system aims to address these issues by using blockchain technology to create a transparent and secure lending platform.

2.2 Problem Statement

The traditional process of lending and borrowing between parties can be complicated and risky, particularly when conducted on credit. There is a lack of transparency and trust between parties, resulting in potential disputes and loss of financial resources.

2.3 Problem Elaboration

The problem we aim to solve is the inefficiencies and risks present in the traditional wholesale market, specifically in the payment and delivery processes. Our solution is to leverage blockchain technology to create a platform that enables secure and efficient transactions between wholesalers and buyers.

One of the main sub-problems we will tackle is the lack of trust between wholesalers and buyers due to the high risk of fraud and default in traditional payment methods. We will address this by implementing smart contracts that use AI models to determine the likelihood of default, and trigger bank transfers to release funds to the appropriate parties based on the terms of the contract.

Another sub-problem we will address is the lack of transparency and traceability in traditional transactions. By recording all transactional data on the blockchain, we will provide a clear and immutable record of all transactions, allowing for easy tracking and auditing.

Furthermore, we will focus on the sub-problem of inefficient delivery processes. By implementing a secure and trackable delivery process on our platform, we will reduce the risk of lost or delayed deliveries and ensure that buyers receive their goods in a timely and efficient manner.

Overall, our platform aims to streamline and secure the wholesale transaction process, improving trust, efficiency, and transparency in the industry.

2.4 Goals and Objectives

The primary goal of this project is to develop a blockchain-based platform that facilitates secure and efficient wholesale transactions between buyers and sellers. This platform will leverage smart contracts and AI models to enable automated payment release and transaction verification, reducing the need for intermediaries and improving trust between parties. Our objectives include designing a user-friendly interface, integrating with existing bank transfer systems to trigger smart contract events, and recording transactional data on the blockchain to ensure transparency and immutability. Additionally, we aim to explore the potential of machine learning models to provide insights into market trends and optimize transaction processes.

2.5 Project Scope

Our project aims to develop a web-based application using React as the front-end technology that will enable wholesalers and retailers to conduct their business transactions seamlessly without the need for intermediaries like payment gateways. The platform will utilize smart contracts and blockchain technology to ensure secure and transparent transactions between parties. The scope of the project includes the development of the platform's front-end and back-end, implementing AI models to facilitate payment verifications, and integrating blockchain technology to record transactional data. The application will support bank transfers, which will trigger the smart contracts to release payments to the appropriate party based on the pre-agreed conditions. The platform will also enable parties to track their transactions and view their transaction history on the blockchain ledger.

2.6 Sustainable Development Goal (SDG)

Decent Work and Economic Growth. Our project aims to create a platform that connects retailers and wholesalers, promoting economic growth by facilitating transactions and promoting fair trade. By providing a platform that simplifies the purchasing process, our project also promotes the creation of decent work by enabling retailers and wholesalers to expand their businesses, potentially leading to job creation.

Figure 1: Sustainable Development Goals

This figure represents all the SDG's that can be target of a FYP

2.7 Constraints

Some potential constraints of the project could include:

- Regulatory compliance: As the platform will be handling financial transactions, there may be legal or regulatory requirements that need to be followed in order to ensure compliance.
- User adoption: The success of the platform will depend on whether users are willing to adopt it and use it for their business needs. It all depends on how we pitch it into the market.

2.8 Business Opportunity

Our platform presents a unique business opportunity as it aims to solve the long-standing problems in the wholesale market industry by providing a secure, transparent, and efficient platform for conducting business transactions. With the increasing demand for global trade and the digitization of transactions, our platform will provide a competitive advantage to wholesale businesses by reducing transaction costs, improving efficiency, and increasing trust between parties.

By leveraging AI models and blockchain technology, our platform ensures accurate and secure recording of transactional data and payment history. This not only reduces the risk of fraud and errors but also enables parties to make informed decisions based on the historical data. Moreover, our platform offers a seamless payment process where lenders can receive payments directly through their bank accounts triggered by smart contracts, eliminating the need for traditional escrow services.

In addition, our platform offers flexibility and customization options to meet the varying needs of different wholesale businesses. This allows our platform to cater to a broad range of wholesale businesses and expand its market reach. With our user-friendly and accessible web-based application with React as its front-end, we aim to provide a seamless experience to users. Therefore, our platform presents a unique business opportunity for wholesale businesses to improve their efficiency, reduce transaction costs, and increase trust in their business transactions.

2.9 Stakeholders Description/ User Characteristics

The users of the system will be divided into two main groups: lenders and borrowers. Lenders are individuals or companies who provide funding to borrowers in exchange for a return on investment. Borrowers are individuals or companies who require funding for their business operations.

The lenders will be able to browse through different loan requests submitted by the borrowers, review the terms and conditions of each loan request and determine whether they want to invest or not. On the other hand, borrowers will be able to create a loan request, set the terms and conditions, and wait for lenders to invest in their loan.

Other users of the system will include administrators who will manage the overall operations of the platform, including handling user accounts, ensuring regulatory compliance, and maintaining the platform's security.

2.9.1 Stakeholders Summary

Stakeholders of the proposed system include borrowers, lenders, and the platform operator. The borrowers are individuals or businesses who require funds to purchase goods from suppliers, while the lenders are investors who are willing to finance these purchases. The platform operator is responsible for providing the web-based platform that connects borrowers and lenders and ensures the smooth operation of the system.

Borrowers will create profiles on the platform and upload information about their business, including their creditworthiness and the types of goods they intend to purchase. Lenders will also create profiles and specify the types of borrowers and goods they are willing to finance. The platform operator will be responsible for verifying the identities of borrowers and lenders and ensuring compliance with regulatory requirements.

Overall, the stakeholders' roles in the system are interconnected, and the success of the platform depends on the cooperation and trust between borrowers, lenders, and the operator. The

platform's success will be measured by its ability to attract and retain a large user base, facilitate timely and secure transactions, and ensure the transparency and fairness of the lending process.

2.9.2 Key High-Level Goals and Problems of Stakeholders

As per the stakeholder's summary, the key high-level goals and problems of the stakeholders can be summarized as follows:

1. Lenders: The lenders are looking for a reliable platform where they can lend their money and earn interest on it. They are concerned about the security and transparency of the lending process, as well as the timely repayments by the borrowers.
2. Borrowers: The borrowers are looking for a hassle-free and convenient way to borrow money. They want a platform that offers flexible repayment terms and low interest rates. They are also concerned about the security and privacy of their personal and financial information.

3. Platform Owners: The platform owners are looking to provide a trustworthy and efficient platform for lenders and borrowers to conduct business. They want to create a sustainable business model that generates revenue through fees and commissions on transactions.
4. Regulators: Regulators are concerned about the legality and compliance of the platform. They want to ensure that the platform operates in accordance with the laws and regulations governing lending and financial transactions.
5. Society: Society benefits from the platform by having access to affordable credit options, which can lead to increased economic activity and job creation. The platform can also help to reduce the prevalence of loan sharks and other predatory lending practices.

Overall, the key high-level goals of the stakeholders are to create a safe, reliable, and efficient lending platform that benefits all parties involved. The problems they face include ensuring security, transparency, legality, and compliance while generating revenue and providing affordable credit options to borrowers.

Chapter 3: Related Work

This section covers the work, studies, and development done in the past by other teams that is related to or somewhat overlaps with the work we will be conducting in this project.

3.1 Explainable AI in Credit Risk Management

This is a study conducted by students at Columbia University and Zurich University of Applied Sciences, which was published in 2021. The researchers were investigating the prospects of using AI and ML for developing a model for credit management.

3.1.1 Summary of the study

In this study, the researchers applied Local Interpretable Model Agnostic Explanations (LIME) and SHapley Additive exPlanations (SHAP) modelling techniques to a massive dataset offered by a major United States lending body, called the Lenders Club. They explain the results obtained by the afore-mentioned analysis algorithms, and their findings include important attributes from profiles of credit borrowers, which show trends that juxtapose their ability to meet their credit commitments. The research concluded that there are attributes of financial profiles that can be very good candidates for training a ML algorithm and latter be used for predicting likelihood of other entities meeting their credit-commitments.

3.1.2 Relation to our work

This research highlights that there are trends in financial profiles of entities which can be shown as a mapping between indicators within the profile against their ability to meet their credit liabilities. This backs our working logic as our model relies on possibility of reliably predicting ability to meet credit by statistical data from financial profiles and trade records. They also highlighted two algorithms (Namely LIME and SHAP) which can be used to parse a huge dataset and spot out trends and correlations in seemingly unrelated data. These algorithms will be helpful when picking out correlated attributes from the dataset which we will be using to train our ML algorithm.

3.2 ANN Approach for Credit Risk Management

This research by Cornell University analyzes performance of multiple Artificial Neural Networks for forecasting the credit risk of a list of Italian companies.

3.2.1 Summary of the study

This used data from 2004, which consisted of financial records of an array of Italian manufacturing companies. They tested performance of two different ANNs and compared the results with the actual outcomes. The study also helps determine the construction of ANN (such as the number of hidden layers) and the effects of changes in construction of the ANN on the accuracy of results.

3.2.2 Relation to our work

The results from this study can be used to further weigh the merits of using AI techniques for Credit Risk Management. It also us view the possibility of using ANN or other perceptron-reliant techniques to server as the backbone of our ML algorithm. It also hints at strategies that can be used to optimize the ANN if it is opted, in order to maximize the reliability of the predictions it makes.

3.3 Machine learning and AI for Risk Management

A study published by Rennes school of business in France, discusses the possible approaches for employing AI to determine credit and default risks.

3.3.1 Summary of the study

This study uses applied an array of techniques to a uniform dataset and evaluates the results and performance for each of these techniques. The tested techniques included Perceptron learning, Regression, Support vectors, Decision trees, and Clustering etc.

3.3.2 Relation to our work

The comparison of success rates of different techniques will be helpful when determining the program structure for our Machine Learning Algorithm. It will also help us explore possibilities for expanding our project beyond analytics and transaction assistance – as a portion of this study covers several other domains of finance that can benefit from assistance of reliable AI-based predictive tools with risk management.

3.4 Provenir

Provenir is a company based in New Jersey that uses AI based predictive models to assist businesses with their decision-making.

3.4.1 Summary of the study

Provenir has an AI-powered platform that assists lenders with managing credit risk. Their services include risk assessment, fraud detection, compliance management, and decision analytics. The company uses undisclosed AI and ML techniques to evaluate borrower credibility and helps lenders decide who to work with.

3.4.2 Relation to our work

There is a degree of overlap between prospective services we hope to offer with our project, and what Provenir offers to their customers. Our AI will be generating similar Analytics fthe decision suggestions, though we hope to go a step further and assist with the actual transaction too.

3.5 Zest AI

Zest AI is a California based company, which has developed a platform which allows borrowers to get credit risk assessments for individual lenders.

3.5.1 Summary of the study

The platform is advertised as a highly customizable interface that can be tailored for different kinds of lenders and accepts data from a variety of sources including credit bureau authorities, banking records, and other internal data that can be manually input by the lender.

3.5.2 Relation to our work

Zest AI’s services overlap with the project we are working on. It also uses AI based predictive techniques on borrower’s financial data to make predictions about their ability to fulfill credit liabilities. It also has partnerships with financial institutions which helps them fine-tune their

analytics with authentic and up to date data from several resources – which bears some similarity to the feedback loops and ranking mechanism we plan on implementing for borrowers who are in business with multiple lenders.

3.6 Conclusion

In conclusion, the related work shows that there is significant research and development in the use of AI and machine learning techniques for credit risk management. Various studies have explored different models and algorithms for predicting credit risk and improving decision-making processes for lenders. Companies such as Provenir and Zest AI are already providing AI-based solutions in this area. However, our project is different in that we aim to provide a platform that not only offers AI-based credit risk assessment but also facilitates the actual transaction process between lenders and borrowers. We also plan to incorporate feedback loops and ranking mechanisms that will help lenders make informed decisions and manage their risks better. In essence, our project is a holistic approach that combines both credit risk management and transaction facilitation.

Chapter 4: Software Requirement Specifications

This section includes all the expected requirements of our software for its proper functioning, along with the details of implementation, functional requirements, and the planned use cases and GUI outlook.

4.1 List of Features

1. Creation and management of contracts between lenders and borrowers
2. Automated payment processing and distribution using smart contracts
3. AI-powered risk assessment to determine creditworthiness of borrowers
4. Recording of all transactional data on a blockchain for transparency and security
5. User-friendly web-based interface with React as the front-end technology
6. Integration with bank transfer systems for seamless payment processing
7. Notification system for timely reminders and updates on contract status
8. Multi-language support to cater to a global user base
9. Secure login and authentication system with role-based access control
10. Real-time analytics and reporting for lenders to monitor their investments and track performance.

4.2 Functional Requirements

1. User Authentication - Users should be able to create an account and log in to the system securely. This functionality will be used by all users of the system.
2. Create Listings - Lenders should be able to create new listings for their consignments, specifying all the necessary details like price, quantity, location, and timeline. This functionality will be used by lenders.
3. Search Listings - Borrowers should be able to search for consignments based on various parameters like location, price, and quantity. This functionality will be used by borrowers.
4. Request Listings - Borrowers should be able to request to borrow a particular consignment from a lender. This functionality will be used by borrowers.
5. Accept/Reject Requests - Lenders should be able to accept or reject borrower requests based on their own criteria. This functionality will be used by lenders.
6. Payment Processing - The system should be able to process payments from borrowers to lenders securely and transparently. This functionality will be used by both borrowers and lenders.
7. Transaction History - The system should maintain a record of all the transactions that take place on the platform. This functionality will be used by both borrowers and lenders.
8. Smart Contract Integration - The system should be integrated with a smart contract to automate the payment processing and enforce the terms of the transaction. This functionality will be used by the system itself.
9. Communication - The system should provide a communication channel between lenders and borrowers to discuss the details of the consignment and transaction. This functionality will be used by both borrowers and lenders.
10. Reporting and Analytics - The system should provide reports and analytics on various aspects of the platform like transaction history, user behavior, and inventory. This functionality will be used by the system administrators.

4.3 Quality Attributes

One of the most critical quality attributes for our project is reliability. As a web-based platform, users will rely heavily on our system to perform their business transactions smoothly and

securely. Therefore, we must ensure that the system is stable and performs reliably under various load conditions. Another crucial quality attribute is security, as we are dealing with sensitive financial transactions. We need to implement robust security measures to protect user data and prevent unauthorized access to the system. Additionally, we must consider usability as a quality attribute to ensure that the platform is easy to navigate and use for our target audience. Finally, scalability is an important quality attribute to consider as our platform will need to support a growing user base and handle increasing amounts of data as the business grows.

4.4 Non-Functional Requirements

1. Performance: The system should be able to handle a large number of concurrent users and data transactions without significant delays or errors. The system should be able to handle at least quite reasonable simultaneous users.
2. Reliability: The system should be highly reliable and available at all times. The system should have a backup and disaster recovery plan in place in case of system failures or data loss.
3. Security: The system should be designed with robust security features to ensure that all user data is secure and protected from unauthorized access or malicious attacks. The system should use encryption techniques to ensure that all data transmissions are secure.
4. Usability: The system should be user-friendly and easy to navigate for all types of users. The system should provide clear and concise instructions and guidance for users to complete tasks efficiently and effectively.
5. Maintainability: The system should be easily maintainable, and updates or enhancements should be easy to implement. The system should also be designed to be scalable to accommodate future growth or changes in the business needs.
6. Reusability: The system should be designed to be modular and reusable, with the ability to be integrated with other systems or applications in the future.
7. Extensibility: The system should be designed to be flexible and easily extensible to accommodate future changes or enhancements to the system. The system should be designed with a clear and well-documented architecture to facilitate future development and maintenance.

4.5 Assumptions

1. The users of the system have a basic understanding of how to use web applications.
2. The users have access to a reliable internet connection and a compatible web browser.
3. The data provided by the users is accurate and up to date.
4. The system will be hosted on a secure and reliable server.
5. The system will be developed and tested on the latest version of the chosen development platform.
6. The users will have the necessary permissions to access and perform all the required functionalities.
7. The system will not be responsible for any fraudulent activities performed by the users.
8. The data provided by the users will be stored securely and will only be accessible to authorized personnel.
9. The system will be developed within the allocated time and budget constraints.
10. The system will be compliant with relevant laws and regulations.

4.6 Hardware and Software Requirements

4.6.1 Hardware Requirements

4.6.2 Software Requirements

- Operating System: Windows, macOS, or Linux
- Web Browser: Chrome, Firefox, or Safari
- Node.js: version 14.x or later
- NPM (Node Package Manager): version 6.x or later
- React: version 16.x or later
- Ethereum blockchain client: Geth or Parity
- Solidity: version 0.5.x or later

Note: These software requirements may be subject to change based on the development progress and specific implementation details.

4.7 Use Cases

This section lists use cases or scenarios from the use-case model if they represent some significant, central functionality of the final system, or if they have a large architectural coverage—they exercise many architectural elements or if they stress or illustrate a specific, delicate point of the architecture.

4.7.1 Login

Name	Log-in		
Actors	Whole-seller, Retailer		
Summary	The user shall provide their email and password on the login form and after successful verification, redirect the user to the home page.		
Pre-Conditions	The user must be in the database records either added by any of the authorized users or added manually by a developer. The user must not already be logged in.		
Post-Conditions	The user's session is successfully established and shall be redirected to the home page.		
Special Requirements	None		
Basic Flow			
Actor Action		**System Response**	
1	The user opens the login page.	2	The login page is displayed asking for email and password.
3	The user enters valid email and password.	4	The system verifies the email and password, establishes a session for the user and redirects the user to the home page.
Alternative Flow			
3	The user enters invalid email or password.	4-A	The system responds with an error message: *Incorrect email or password entered.*

4.7.2 Sign Up

Name	Sign Up		
Actors	Whole-seller, Retailer		
Summary	The user shall provide their name, email, date of birth, CNIC, age and password on the sign in form and after successful verification, redirect the user to the payment method page.		
Pre-Conditions	The client must not be in the database records.		
Post-Conditions	The user's session is successfully established and shall be redirected to the payment method page.		
Special Requirements	None		
Basic Flow			
Actor Action		**System Response**	
1	The user opens the sign-up page.	2	The sign-up page is displayed asking for name, email, date of birth, CNIC, age and password.
3	The user enters valid name, email, date of birth, CNIC, age and password.	4	The system verifies that the name, email, date of birth, CNIC, age and password does not already exist in the database, establishes a session for the client and redirects the client to the payment method page.
Alternative Flow			
3	The user enters the name, email, date of birth, CNIC, age and password that already exists in the database	4-A	The system responds with an error message: *Already a user.*

4.7.3 Log out

Name	Log out		
Actors	Whole-seller, Retailer		
Summary	The user shall click on the log out button and after successful verification, redirect the user to the payment method page.		
Pre-Conditions	The user must be logged in the system.		
Post-Conditions	The client's session is successfully deleted and shall be redirected to the login page.		
Special Requirements	None		
Basic Flow			
Actor Action		**System Response**	
1	The client clicks on the log out button	2	The system logs out the client and redirect to the login page.

4.7.4 View Client Options

Name	View Client Options		
Actors	Registered Retailer/Wholesaler		
Summary	This use case allows the user to view the various options available to them as a retailer or wholesaler on our platform		
Pre-Conditions	The user must be a registered retailer or wholesaler. The user must have logged in to the system. The user must have the necessary privileges to view retailer/wholesaler options.		
Post-Conditions	The user is able to view the available retailer/wholesaler options. The user can select an option to proceed further.		
Special Requirements	None		
Basic Flow			
Actor Action		**System Response**	
1	The user navigates to the retailer/wholesaler options page.	2	The system displays a list of available retailer/wholesaler options.
3	The user selects an option to proceed further.	4	The system navigates the user to the selected option.
Alternative Flow			
3	If the user is not logged in	4-A	The system prompts them to log in first.

4.7.5 Add Local Retailer/Whole seller

Name	Add Local Retailer/Whole seller
Actors	Retailer/Lender
Summary	The user can search for account information of other users by entering their ID.
Pre-Conditions	The actor is authenticated and authorized as a user. The system has user data stored in its database.
Post-Conditions	The user has found the account information of the user they searched for.
Special Requirements	The system should have a robust search function that allows for easy and accurate retrieval of user data. The user ID should be unique and easily identifiable to the user. The system should enforce appropriate access control to prevent unauthorized access to sensitive user data.
Basic Flow	

Actor Action		**System Response**	
1	The user navigates to the search page.	2	The system prompts the user to enter the ID of the user they want to search.
3	The user enters the ID of the user they want to search	4	The system displays detailed information about the user's account, such as their name, contact information, credit score, and other relevant details.
Alternative Flow			
3	The user enters invalid ID	4-A	The system responds with an error message: *The entered ID does not exist*
3	The user sends the other user a link to make account	4-B	The system then links the accounts

4.7.6 Generate Credit Score

Name	Generate Credit Score
Actors	Admin, Business Owner, Store Manager
Summary	Users can generate a credit score based on their transaction history, which is used to determine their creditworthiness for future transactions on the platform.
Pre-Conditions	The user must be in the database records either added by any of the authorized users or added manually by a developer. The user must not already be logged in.
Post-Conditions	The user's session is successfully established and shall be redirected to the home page.
Special Requirements	None

Basic Flow			
Actor Action		**System Response**	
1	The user logs into the system and accesses the credit score generation feature.	2	The System asks the user to upload the required documents.
3	The user uploads the required documents.	4	The system displays the generated credit score to the user
Alternative Flow			
3	The retailer hasn't uploaded the documents.	4-A	The system responds with an error message: *Documents not uploaded ye=t*

4.7.7 Agree upon T&Cs.

Name	Mutual terms and conditions

Actors	Retailer/Lender
Summary	The user can search for account information of other users by entering their ID.
Pre-Conditions	Lender and borrower have created their accounts and logged in to the credit risk management system. Lender and borrower have initiated a loan request.
Post-Conditions	The lender and borrower have agreed upon the final loan terms and conditions. The credit risk management system has generated a loan agreement with the final terms and conditions that have been electronically signed by the lender and borrower.
Special Requirements	None

Basic Flow			
Actor Action		**System Response**	
1	Lender and borrower review the loan details including loan amount, interest rate, repayment schedule, and collateral requirements.	2	The system displays the loan details for review
3	Lender and borrower agree upon the final loan terms and conditions.	4	The credit risk management system generates a loan agreement with the final terms and conditions.
Alternative Flow			
3	The borrower is unable to pay the agreed upon amount in time	4-A	The system reschedules the date to pay back and deducts the credit score

4.7.8 Verify consignment status

Name	Verify consignment status
Actors	Registered whole seller/ retailer.
Summary	The user must verify the delivery and dispatchment of the consignment from their ends respectively.
Pre-Conditions	The credit score generated suggests that the party won't default. T&Cs should be agreed upon both parties.
Post-Conditions	Transactions and payments will be done and viewed.
Special Requirements	None

Basic Flow			
Actor Action		**System Response**	
1	The whole seller verifies that he has dispatched the consignment.	2	The system notifies the retailer and asks him to verify back
3	Retailer verifies about the delivered consignment.	4	The system verifies both sides and lets the users start the next step.

Alternative Flow			
3	Any user doesn't verify from their end.	4-A	The system notifies both the parties and asks them to verify to start the transactions.

4.7.9 View Analytics

Name	View Analytics		
Actors	Admin, Wholesalers/Retailor		
Summary	Allows the user to view their financial analytics over a period of time		
Pre-Conditions	The user will have all the data from the start point where he starts the business on the app, this data will be used in analysis.		
Post-Conditions	The user gets the analytics based on the performance online.		
Special Requirements	The user's record is all maintained on the app by the app itself and is preparing the analytics.		
Basic Flow			
Actor Action		**System Response**	
1	The user goes on to the analytics part.	2	The system shows the overall performance
3	The user has performed some activity on the app i.e., made some business.	4	The system uses this activity to generate the analytics and further depict it as the overall performance.
Alternative Flow			
3	The user has not performed any activity till now.	4-A	The system will not be able to provide any relevant information as nothing's there to analyze.

4.7.10 View Transactions

Name	View Transactions		
Actors	Admin, Wholesaler/Retailor		
Summary	All the activity performed by the user is recorded onto the app and all the transactions are recorded and these transactions can be viewed under the transactions part.		
Pre-Conditions	The user performs activity so that it can generate Transactions.		
Post-Conditions	All the transactions by the activities within the app are stored in the Transaction part.		
Special Requirements	The activity needs to be performed.		
Basic Flow			
Actor Action		**System Response**	
1	The user opens the Transaction page.	2	The system shows the transaction record of

			all the activities in the past.
3	The user performs the activities to add them into transactions.	4	The system adds them into the user's transactions
Alternative Flow			
3	The activity is being performed without taking app into account.	4-A	The system will not be able to generate any of such Transaction history where any deal was done outside the app.

4.7.11 Compare Retailers

Name	Compare Retailors		
Actors	Retailer/wholesaler, System.		
Summary	The User Can select for the retailors to be compared for a better understanding of the best possible options.		
Pre-Conditions	User must be logged into the system and have selected the retailors to be compared.		
Post-Conditions	The system generates the result giving the pros and cons in both of the options selected.		
Special Requirements	The user must select the retailors and then select the compare option.		
Basic Flow			
Actor Action		**System Response**	
1	The user gets on to the Comparison page	2	The System takes the user to the Comparison page giving options of retailors the user wants to compare.
3	The user selects the best of retailors as per his/her wish.	4	The system brings up the result of comparison, depicting a clear picture of the retailer's actual market position.
Alternative Flow			
3	The user selects only one retailor	4-A	The system gives an error as a person can't be compared with himself.

4.7.12 Get Best Suggestions

Name	Get Best Suggestions
Actors	Wholesaler
Summary	The user shall be provided with the best of suggestions among retailers once the credit ratings of particular selected retailer are under the mark.
Pre-Conditions	User must be logged into the system and must be assigned credit score.
Post-Conditions	User receives suggestions based on the credit scores.

Special Requirements	The system must provide the credit rating in order to suggest the retailer of the best available choices.		
Basic Flow			
Actor Action		**System Response**	
1	The user gets on the suggestion page	2	The suggestion page with all its categories appears.
3	User click on get best suggestion button.	4	Retrieves the credit scores and matches with corresponding suggestions.
Alternative Flow			
3	The user goes with ‘already have a customer’ option.	4-A	The system takes it directly to the ‘search by ID’ page as the user has already got the customer.

4.8 Graphical User Interface

This section gives the GUI dumps of each screen, with reference to the users. The navigation flow of each user is also required, and each GUI should mark the functionality/use case that it covers.

4.8.1 Main Page

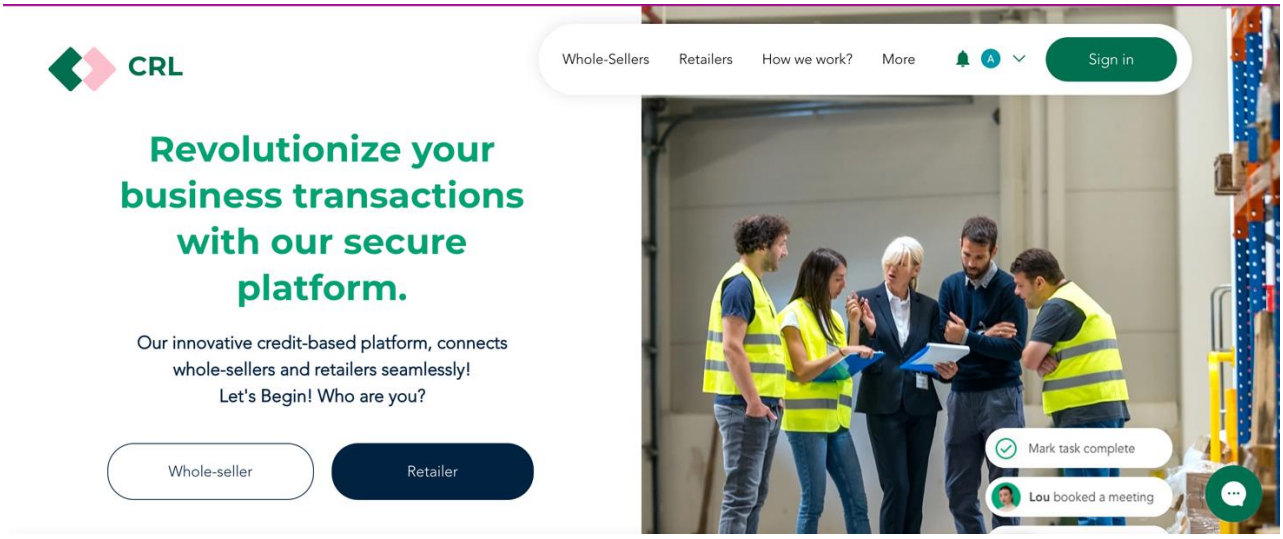

Figure 2: Main Page

This figure depicts the main page of our application

4.8.2 Log In

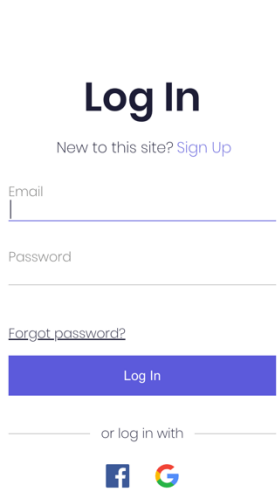

Figure 3: Login Page
This page shows the login page of our application

4.8.3 Sign Up

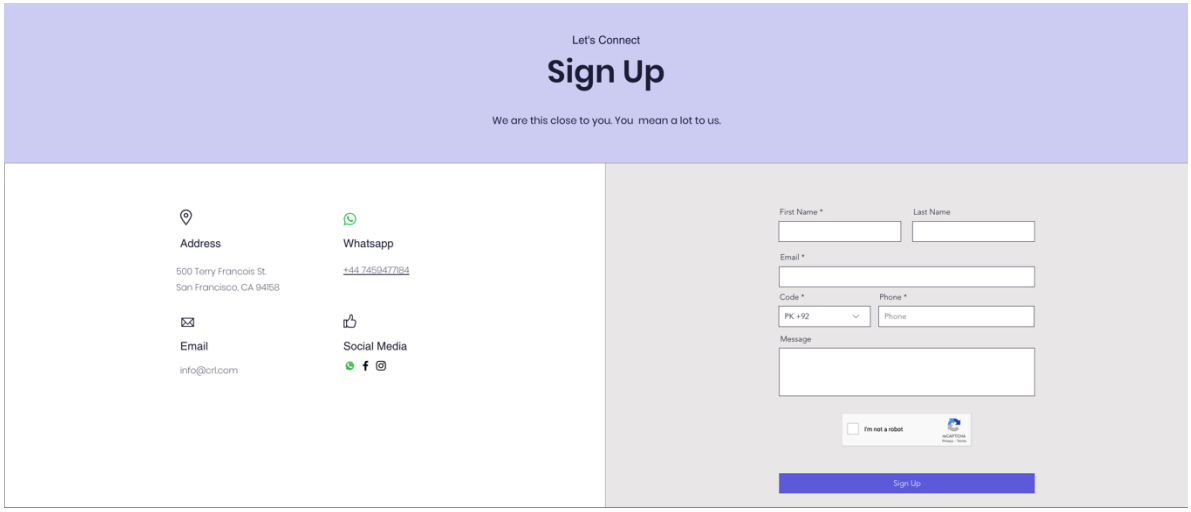

Figure 4: Sign Up Page
This is the sign-up page of our application

4.8.4 Analytics

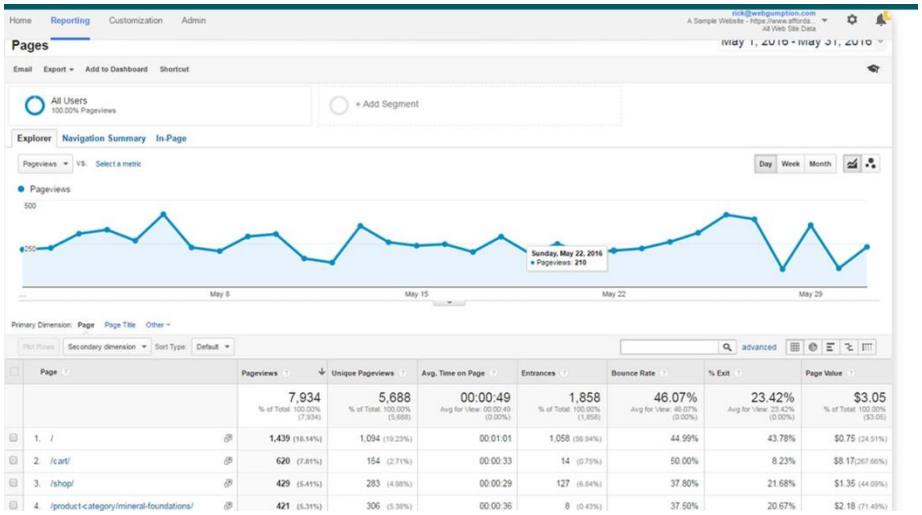

Figure 5: Analytics Page
This is the analysis page of our application

4.8.5 Terms & Conditions

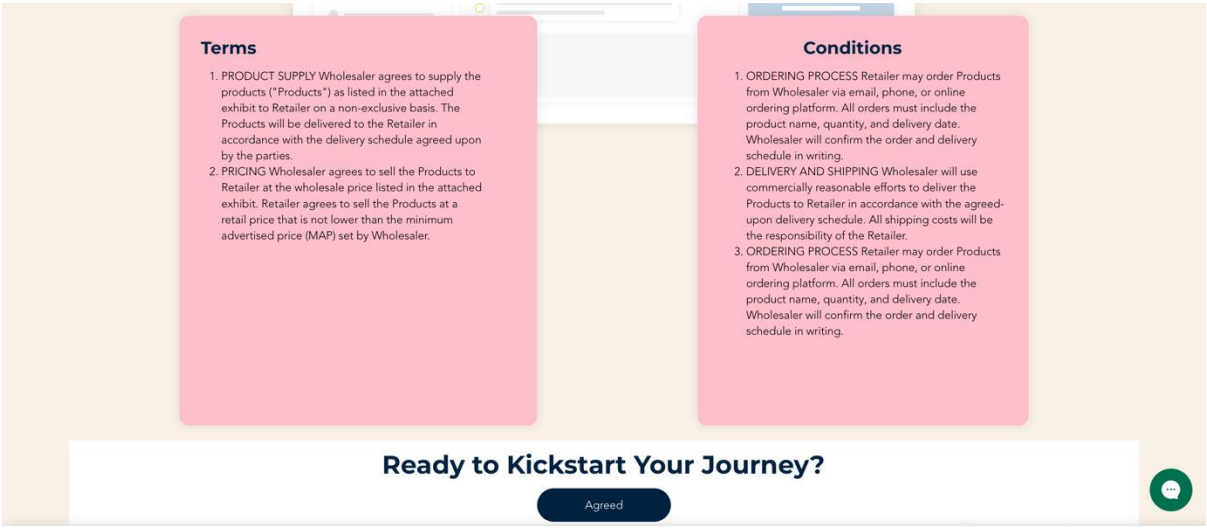

Figure 6: Terms and Condition Page
This shows the policies of our website

4.8.6 Getting Credit Scores

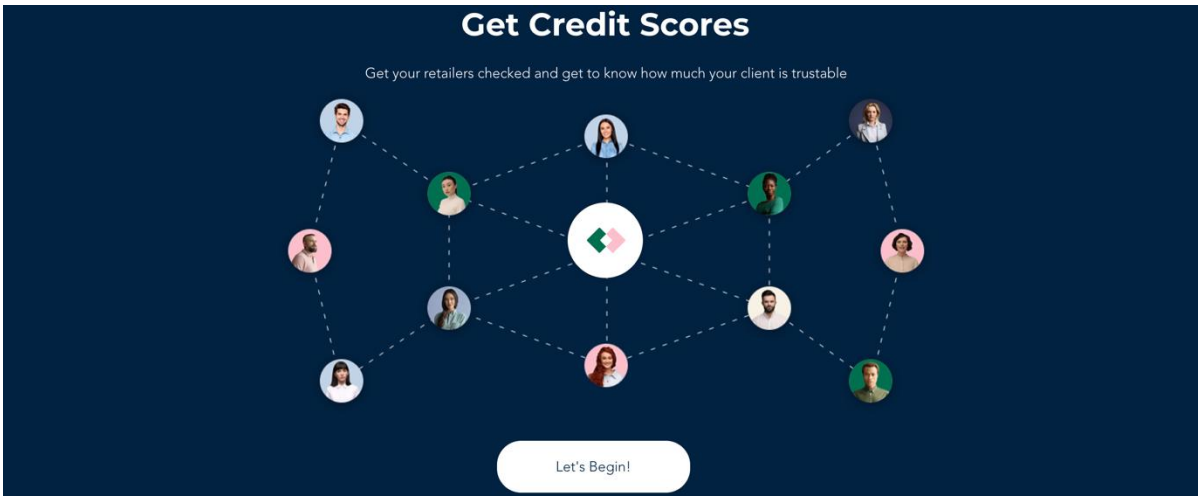

Figure 7: Credit Scores Page
This page shows the credit scores page of our application

4.8.7 Client Options

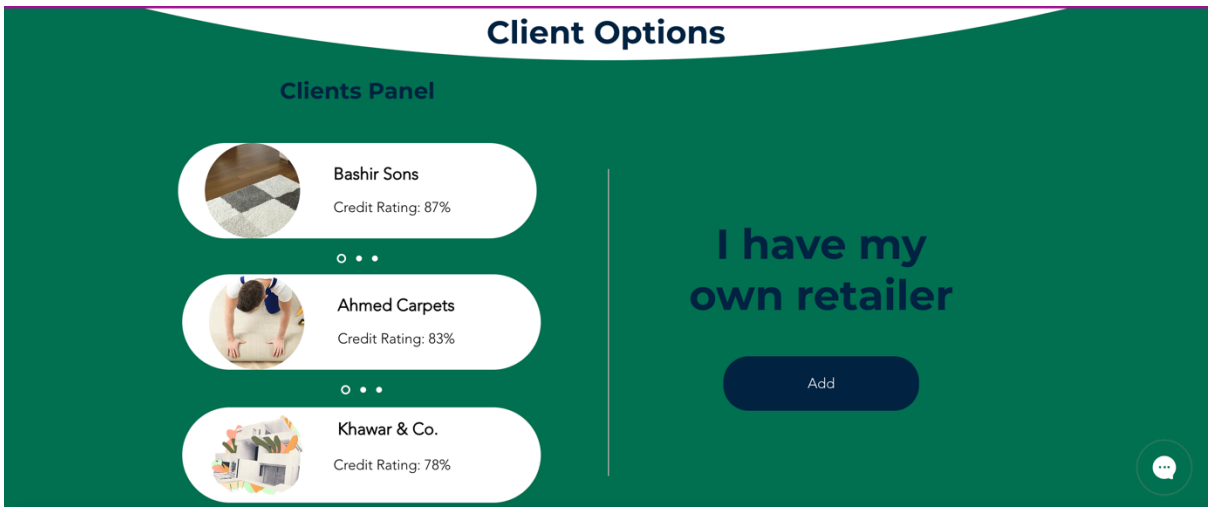

Figure 8: Client Options
This figure depicts the client-side page of our project

4.9 Database Design

4.9.1 ER Diagram

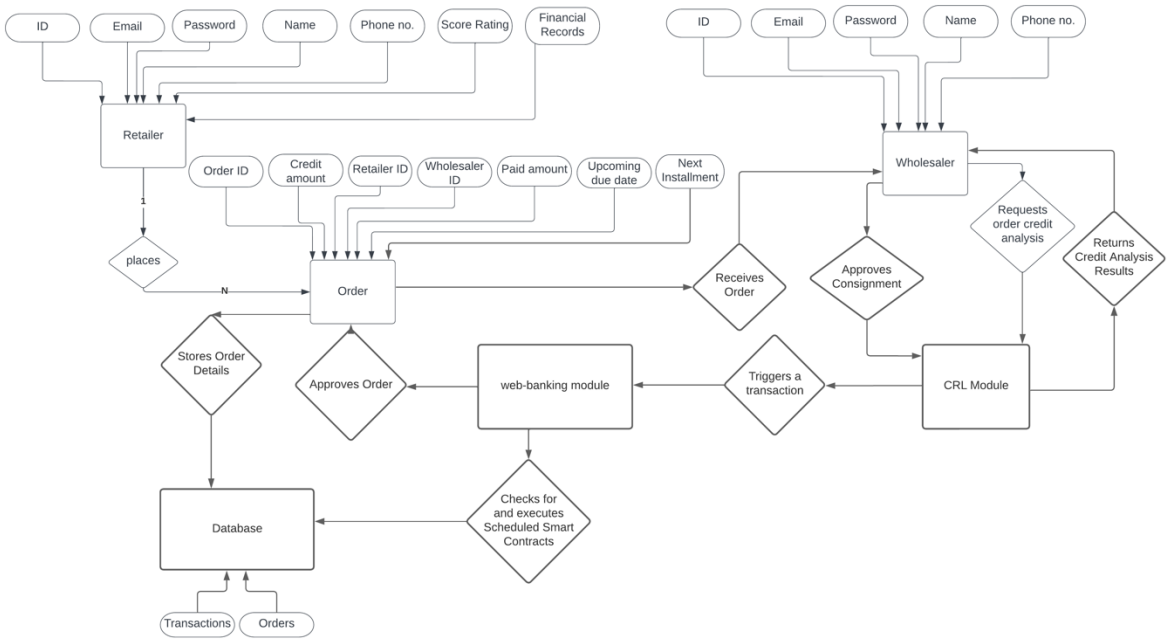

Figure 9: ER Diagram

This figure depicts the ER diagram of our application.

4.9.2 Data Dictionary

Table 1: Data Dictionary

This table gives an overview of our database

Entity	Attribute	Data Type	Nullable	Description
Retailer	id	int	No	Retailer's unique id (primary key)
	name	string	No	Retailer's name
	email	string	No	Retailer's email address
	password	string	No	Retailer's password
	phoneNo	string	No	Retailer's phone number
	scoreRating	string	Yes	Retailer's credit score
	financialRecords	array	Yes	Retailer's financial records
Whole-Seller	id	int	No	Seller's unique id (primary key)
	name	string	No	Seller's name
	email	string	No	Seller's email
	password	string	No	Seller's password

	phoneNo	string	No	Seller’s phone number
Order	orderId	int	No	Order’s unique ID
	credit	float	No	Total credit due on the order
	retId	int	No	Retailer (borrower) ID
	whoId	int	No	Seller (lender) ID
	amountPaid	float	No	Amount paid so far
	nextPayment	float	No	Amount due for next installment
	nextDate	date	No	Deadline for next installment
Database	transactions	DBArray	yes	Details of all transactions
	orders	DBArray	yes	Details of all orders

4.10 Risk Analysis

1. Technical risks: These are risks associated with the technology used in the project, such as the possibility of software bugs, hardware failures, or security breaches. To mitigate these risks, the project team will need to conduct thorough testing and implement appropriate security measures.
2. Business risks: These are risks associated with the business side of the project, such as the possibility of low demand for the product, competition from other companies, or economic downturns. To mitigate these risks, the project team will need to conduct market research, analyze the competitive landscape, and create a solid business plan.
3. Resource risks: These are risks associated with the availability of resources required for the project, such as human resources, equipment, or funding. To mitigate these risks, the project team will need to create a detailed resource plan and ensure that adequate resources are allocated to each phase of the project.
4. Schedule risks: These are risks associated with the project timeline, such as delays in the development process or unexpected changes in requirements. To mitigate these risks, the project team will need to create a detailed project plan, regularly monitor progress, and be prepared to adjust the schedule as needed.
5. Legal and regulatory risks: These are risks associated with compliance with laws and regulations, such as data privacy laws or export regulations. To mitigate these risks, the project team will need to conduct a thorough analysis of the legal and regulatory environment and ensure that the project is designed to comply with all applicable laws and regulations.

References

[1] B. H. Misheva, J. Osterrieder, A. Hirsa, O. Kulkarni, and S. F. Lin, “Explainable AI in Credit Risk Management,” *arXiv.org*, 01-Mar-2021. [Online]. Available: https://arxiv.org/abs/2103.00949. [Accessed: 09-Mar-2023].

[2] J. G. Mooney, P. Rosati, and M. Cummins, “Disrupting finance: Fintech and strategy in the 21st Century,” *OAPEN Home*, 01-Apr-2020. [Online]. Available: http://library.oapen.org/handle/20.500.12657/23126. [Accessed: 09-Mar-2023].

[3] V. Pacelli and M. Azzollini, “An artificial neural network approach for credit risk management,” *Journal of Intelligent Learning Systems and Applications*, 08-Apr-2011. [Online]. Available: https://www.scirp.org/html/4587.html. [Accessed: 10-Mar-2023].