Gisma University of Applied Sciences

Assessment Submission Form

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Assessment Title	Bank Management System
Module Code	M604A
Module Title	Advanced Programming
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Github	https://github.com/yatikanghan/Banking-Management-Application
Youtube	https://youtu.be/YypJbHAWmcQ

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Signed…Yatik……Ayush……. Date …27/03/2025……

1. Abstract

This project showcases a BANK MANAGEMENT SYSTEM build with Spring boot for back end logics and HTML and CSS for the front end visualization. The system gives a initial banking functionality like account creation, transaction processing, balance enquiry, customer support and user authentication. It also ensures that secure and efficient data management through an SQL database.

This project is designed with a RESTful API architecture and system gives a facilities to seamless communication between front end and back end with a smooth user interface. This project follow a modular, scalable and secure system with using Springboot's API. The data base is designed using SQL and ensuring data integrity and consistency.

This report provides a detail insight into the system architecture, database design, backend implementation, security measures and testing methods used in this project. In extras, we will give a demonstration of this project and discusses the challenges that we haved face during development, solutions implemented and potential enhancements. The banking management system serves as a foundational model for modern applications. With the back end and user centric design.

2. Introduction & Motivation

In digital world, Banking management system plays a vital role in financial transactions, personal financing management, and business operations. Although, many old banking systems still face some challenges like inefficiency, security and less access to the most of features. To over come this issues, we have developed a BANK MANAGEMENT SYSTEM using Spring boot for backend logic and HTML,CSS for frontend.

The real reason behind developing this project stems from the need for a secure, efficient and user friendly system that gives smooth transactions, account management and customer interactions. This project provides a structured, databased-given to handling operation, confirming that users can do initial task such as account creation, transaction and balance enquiry. Customer also can deposit money as a fixed deposit and gain interest on it. These are essential task which can user access and use seamlessly.

By using Spring boot application for backend operation, the management system ensures scalability, hardiness and high performance, during this use of the HTML and CSS for frontend gives a simple yet effective user interface. This project aligns with modern requirement and serves as a foundational model for developing more advanced system in the nearest future.

In more additional, this project is as an opportunity to give a boost to our knowledge of JAVA development, database connectivity, and as well as backend frameworks. During this applying read-world programming. It also fulfiil the requirements of our M604 Advanced Programming course assessment, demonstrats ability to design and implement a web app using technology.

3. System Requirements

The development and implementation of the Bank Management System requires a both components of hardware and software to work smoothly and functionally, securely and scalability. This section outlines the essential hardware specifications, software tools, development environment need for implementations.

3.1 Hardware Requirements

To run Bank Management System easily, the following hardware are required:

3.1.1 Processor

Minimum requirements: Intel core i5(10 Gen or later) / AMD Ryzen 5.

Recommended : Intel Core i7 / AMD Ryzen 7.

3.1.2 Memory(RAM)

Minimum requirements: 8GB (Enough for basic development).

Recommended : 16GB or more (Improved Performance).

3.1.3 Storage

Minimum requirements: 20 GB free disk space.

Recommended : SSD with atleast 256GB for faster Read/Write.

3.1.4 OS(Operating System)

- Windows 10/11(Recommend for easy development with tools like Intellij IDEA)
- macOS(For those who use MacBook)
- Linux(Ubuntu 20.03 or later)

3.2 Software Requirements

The development of the BANK MANAGEMENT SYSTEM involves technologies to ensure a robust, scalable and secure banking system.

3.2.1 Backend Development

The backend is build using Spring Boot, a used java framework for building Restful API.

- Programming Language: Java (JDK 17 or later)
- Framework: Spring boot(Spring MVC, Spring data JPA)
- Build tool: Maven

3.2.2 Database Management

A relational database management system is used to store banking transactions, details and account records securely.

- Database Engine: MySQL
- Database Connector: MySQL Connect for JAVA.
- Schema Management: Hibernate ORM

3.2.3 Frontend Development

The designed with HTML and CSS to create a simple user friendly interface.

- HTML5
- CSS3

3.2.4 Development Environment and Tools

- IDE : Intellij IDEA
- Version Control : Git & GitHub
- API testing tool: Postman
- Database Management tool: MySQL Workbench

4. System Architecture

The project has three-tier architecture which are application's fundamental structure. The three layer include:

1. Presentation Layer(Frontend)
2. Business Layer(Backend)
3. Data Layer(Database)

4.1 High-Level System Architecture

4.1.1 Presentation Layer(Frontend)

- Develop using HTML and CSS to provide a user interface.
- Display account details, transactions and customer support.
- Communicate with the backend via RESTful APIs.

4.1.2 Business Logic Layer(Backend)

- Develop use Spring Boot to handle APIs requests and Logic behind it.
- Implement CRUD operations For manageing bank system and data.

4.1.3 Data Layer(Database)

- A RDBMS for stroing structured banking data.
- Ensures data integrity with compliance.
- Uses Spring data JPA (Hibernate) to interacte with data and database.

4.2 Key Components of the System

4.2.1 API Endpoints

- The backend exposes several RESTful API endpoints to operate banking operations.

HTTP Method	Endpoints	Functionality
GET	/users/{id}	Fetch user detail
POST	/account/create	Create a account
POST	/transaction/deposit	Deposit money
POST	/transaction/withdraw	Withdraw money
GET	/transaction/history	Get trans. history

4.2.2 Security Measures

- User authentication: Implemented using JWT for secure API access.
- Role-based access control: Different user roles like admin, customer have specific access.
- Data encryption : Uses hashing techniques for store sensitive data.

5. Database Design

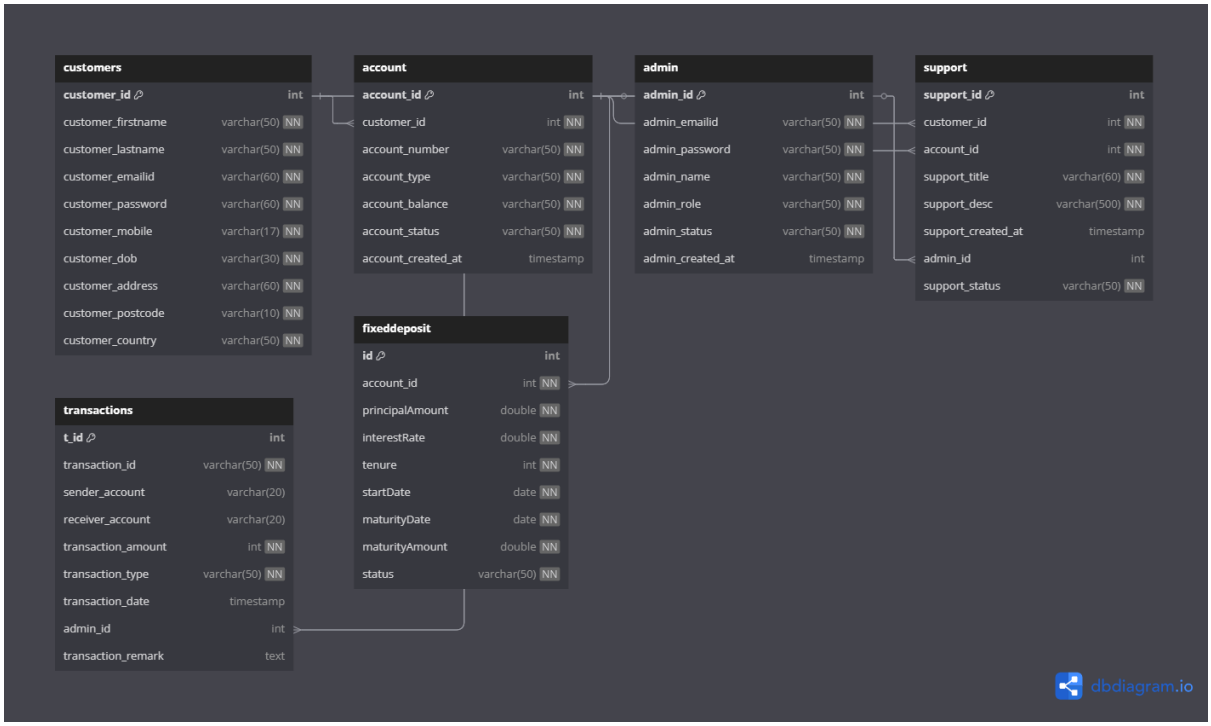
Bank Management System also relies on a well-structured relational database(RDBMS) to store and manages the customer's details, accounts, transactions, and many other operating systems. The system is designed using MySQL with proper constraints and effiecnt query processing.

5.1 Database Overview

In the database below down tables are essentinal tables for banking management system.

- Customers table: Store customer details and credential.
- Accounts table: Manages customer accounts, balance sheet and status.
- Admin table: Keep data of administrator credentials and role.
- Support table: Handle customer support requests.
- Transaction table: Log all financial transactions between accounts.
- Fixed deposit table: Manage fixed deposit accounts and interest rates and other details.

5.2 ER Diagram



5.2.1 Customer and Accounts(One to Many)

- One User can have multiple bank accounts and each account belongs to only one customer.
- Customer_id in the accounts table is a foreign key reference from customer table.

5.2.2 Admin and Transaction(One to Many)

- Admin can authorize multiple transactions, each transaction is associated with only one admin.
- Admin_id in the transaction table is a foreign key refer from admin table.

5.2.3 Accounts and Transactions(One to Many)

- Accounts can have multiple transactions and each transaction links with specific account.
- Sender_account and receiver_account in the transaction table store account_number from accounts table.

5.2.4 Customer and support(One to Many)

- A customer can raise multiple ticket for support, each request linked with single customer.
- Customer_id in support table referering from customers table.

5.2.5 Admin and support(One to Many)

- An admin can handle multiple tickets, each ticket is assign to one admin.
- Admin_id in support table is a foreign key from admin table.

5.2.6 Accounts and Fixed deposit(One to Many)

- An account can have multiple fixed deposits, each deposit is linked with one account.
- Account_id in fixed deposit table is a foreign key from the account table.

6. Backend Development

The backend development of the system is developed using Spring Boot, a java framework that simply backend development by provide RESTful APIs, database interactions. This section details the fundamentally functionalities, API design, security implementation and database integration in backend system.

6.1 Overview of backend architecture

The backend architecture is followed the key components includes:

1. Controller Layer: Handles requests and API endpoints.
2. Service Layer: Contain logical and interact with database.
3. Repository Layer: Manages database using Spring data JPA.
4. Database Layer: MySQL for secure data storage.

6.2 Technology

The backend is developed using this following technologies:

- Programming Language: JAVA(JDK 17 or later)
- Framework: Spring Boot
- Database: MySQL
- Build tool: Maven
- Security: Spring Security with JWT authentication

6.3 API Development

The backend exposes RESTful API to interact with the frontend. Below down are the API endpoints which are use for bank management system.

6.3.1 Customer Login API

HTTP Methods	Endpoint	Function
GET	/login	Customer Login Page
GET	/register	Customer Register Page
POST	/registeraccount	Customer Register new Account
POST	/customerlogin	Customer Logged In
GET	/customerclosedpage	If account closed and still try to login customer

6.3.2 Customer General API

HTTP Methods	Endpoint	Function
GET	/customerdashboard	Customer Dashboard
GET	/profile	Customer Profile
POST	/customerprofilesave	Customer profile save

6.3.3 Customer Transfer API

HTTP Methods	Endpoint	Function
GET	/customertrasfer	Customer Transfer Page
POST	/customertransfermoney	Customer Transfer Money

6.3.4 Customer Support API

HTTP Methods	Endpoint	Function
GET	/customersupport	Customer support
GET	/customeraddsupport	Customer Add Support Form
POST	/customeraddsupportinsert	Customer Add Support
GET	/customersupport/{id}	Customer Support detail

6.3.5 Admin Login API

HTTP Methods	Endpoint	Function
GET	/adminlogin	Admin Login Page
POST	/adminlogin	Admin Loged In
GET	/admindashboard	Admin Dashboard
GET	/adminlogout	Admin Logout

6.3.6 Admin API

HTTP Methods	Endpoint	Function
GET	/adminprofile	Admin Profile
POST	/adminprofilesave	Admin Update Data

6.3.7 Admin Management API

HTTP Methods	Endpoint	Function
POST	/admindetailsave	Admin Detail save
POST	/adminnewadminsave	Add New Admin
GET	/adminnewaccount	Admin List Admin
GET	/adminnewaccount/{id}	Admin Detail Update Form

6.3.8 Transaction API

HTTP Methods	Endpoint	Function
GET	/admindebit	Deposit Money Page.
POST	/admindebitamount	Deposit Amount
GET	/adminwithdraw	Withdraw Money Page
POST	/adminwithdrawamount	Withdraw Amount
GET	/admintransfer	Transfer Money Page
POST	/admintrasfermoney	Admin Transfer Amount

6.3.9 Fixed Deposit API

HTTP Methods	Endpoint	Function
GET	/customerfixeddeposit	Customer Fixed Deposit
GET	/adminfixdeposit	Admin Fixed Deposit
GET	/adminfixdeposit/{id}	Admin Fixed Deposit detail
POST	/adminfdclosed	Admin Closed Fixed Deposit

6.3.10 Admin Login API

HTTP Methods	Endpoint	Function
POST	/adminlogin	Admin Loged In
GET	/deactiveadmin	If Admin is deactive show you are deactive
GET	/accessdeniedpage	IF Admin has not permission so show access denied page

6.3.11 Admin Manage Accounts API

HTTP Methods	Endpoint	Function
POST	/adminacconfirm	Admin account detail save
POST	/adminnewacconfirm	Admin new account verify
GET	/adminmanageaccount	Admin Manage Account
GET	/adminmanageaccount/{id}	Admin Manage account detail

6.3.12 Admin Todo List API

HTTP Methods	Endpoint	Function
GET	/admintodolist	Admin Todo List show
GET	/addtask	Admin Todo List Form
POST	/addtodobtn	Admin Todo Task Add
GET	/deletetodo/{id}	Admin Todo Task Delete
GET	/updatetodo/{id}	Admin Update Task Form
POST	/updatetodobtn	Admin Update Task Update

7. Frontend Development

The frontend of this project is developed with normal HTML and CSS and JavaScript to give a dynamic, simple, clean and user friendly interface of web application to take a seamless data exchange and real time updates.

7.1 Technology

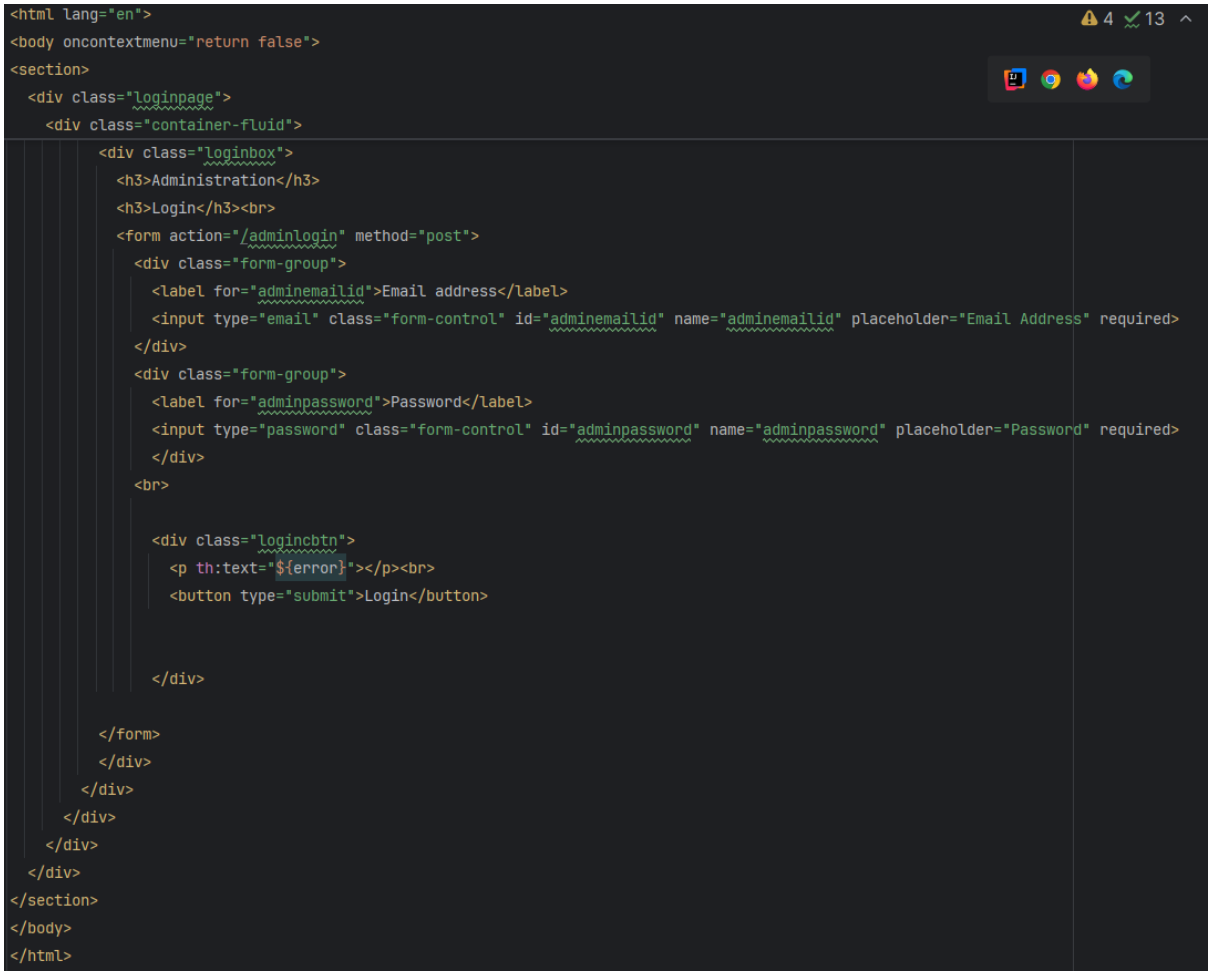
- HTML5 for structure for web pages.
- CSS3 for styles and design.
- JavaScript for handles user interactions and API requests.

7.2 Key UI features

- User Authentication: Customer and admin can login securely.
- Dashboard: Display account details, balance, transaction history.
- Transaction handling: User can deposit, withdraw and transfer.
- Support Request: Customer can raise supports tickets.

7.3 Sample Code(Login page)

Here is the sample code for login page in html.



```
<html lang="en">
<body oncontextmenu="return false">
<section>
  <div class="loginpage">
    <div class="container-fluid">
          <div class="loginbox">
            <h3>Administration</h3>
            <h3>Login</h3><br>
            <form action="/adminlogin" method="post">
              <div class="form-group">
                <label for="adminemailid">Email address</label>
                <input type="email" class="form-control" id="adminemailid" name="adminemailid" placeholder="Email Address" required>
              </div>
              <div class="form-group">
                <label for="adminpassword">Password</label>
                <input type="password" class="form-control" id="adminpassword" name="adminpassword" placeholder="Password" required>
                </div>
              <br>

                <div class="logincbtn">
                  <p th:text="${error}"></p><br>
                  <button type="submit">Login</button>


                </div>

            </form>
            </div>
          </div>
      </div>
    </div>
  </div>
</section>
</body>
</html>
```

8. Security Measures

Security play a vital role in in any kind of application due to sensitive

nature of financial data, user credentials and transactions. This project follows a multi layer security approach to make sure data confidentiality and protect against unauthorized access or cyber threats..

8.1 Authentication & Authorization

8.1.1 User Authentication with JWT

The system uses JWT for authentication. When a user login in the system generates a JWT token, which sent in API requests to verify identity.

How JWT Works:

1. User login using email and password.
2. System validate credentials and generates JWT token.
3. The token is sent in authorization headers with API.
4. The backend validates the token before granting access.

8.2 Role-Based Access control

To restrict unauthorized access, the system uses Role-Based Access Control.

User Role	Permission
Customer	View account, transaction and raise requests
Admin	Manage accounts, approve transaction
Support	Handle customer queries, assist with disputs

The backend uses Spring Security to enforce roled-based access.

8.3 Protection against common threats

The system implements multiple security against common cyber threats:

Threat	Mitigation Strategy

SQL Injection	Uses prepared statement to prevent queries
Cross-Site Scripting (XSS)	user inputs and prevents script injections
Cross-Site Request Forgery (CSRF)	CSRF tokens to validate user requests
Brute Force Attacks	Implement login attempt limits and CAPTCHA verification

9. Challenges and Solutions

During the development of the system, several technical and implementation challenges were identified. The challenges are across backend development, database management, security and frontend integration. Each issues was analyzed with an solution to work smoothly.

9.1 Backend Develop challenges

Challenge 1: Handling Complex Business Logic

Issue :

- During development of transactions, account management, and fixed deposit required handling complex business rules.
- Make sure transactions integrity was tough.

Solution :

- Used Spring Boot Service Layer to separate business logic from main controller.
- Implemented Spring Transaction to rollback database changes if an operation failed.

Challenge 2: Manage API performance

Issue :

- System need to handle large number of transaction easily.
- Querying large datasets caused lack of performance

Solution :

- Used pagination and sort in Spring Data JPA to optimization.

9.2 Database challenges

Challenge 3: Make data consistency and integrity

Issue :

- Banking operates require strict consistency to prevent issues.

Solution :

- Used ACID- compliant transactions with JPA to maintain.

- Applied foreign key constraints and referential integrity in SQL.

Challenge 4: Optimizing queries for faster performance

Issue :

- Queries on large tables were slow due to increasing data.

Solution :

- Used proper indexing on frequently queried columns.

9.3 Frontend & Integration Challenges

Challenge 5: Handle API communication errors

Issue :

- If the backend was down, frontend display errors.

Solution :

- Implemented error handle and load indicators in javascript.

Challenge 6: Ensure Frontend Responsiveness

Issue :

- The initial frontend design was not mobile friendly and lacke appeal.

Solution :

- Used CSS flex and bootstrap for responsiveness.

10. Result & Demonstration

This section gives an overview of outcome of Bank Management System, showcast its feature, performance and real-world usability. The system tested to confirm secure transactions, account management and seamless user interactions. Below down are the screenshots and demonstrations the application.

10.1 Functional Outcomes

The system meets the initial requirements of a scalable banking application.

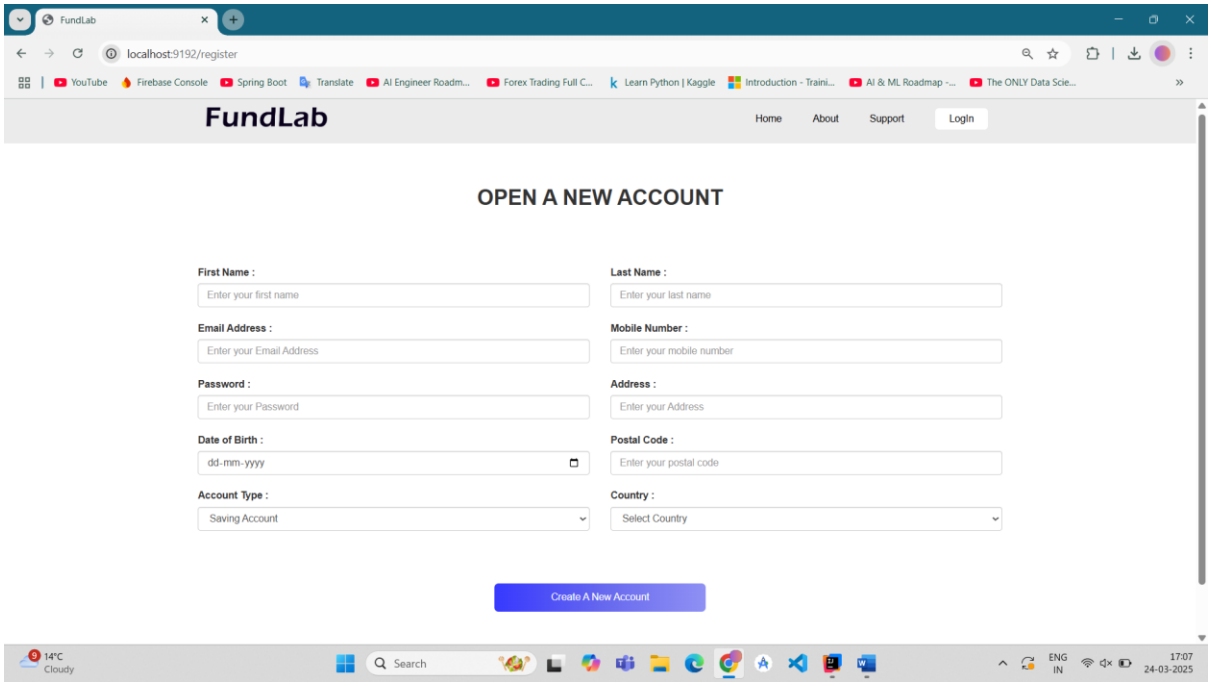
Feature	Outcome
User Authentication	Customers & Admin can securely login with JWT
Account Management	User can create account, view balance and many more
Transaction Processing	Deposit, withdraw & transfer are executed with data integrity
Fixed Deposit	User cab create fixed deposit account
Security Measures	Password encryption, API, role-based access control implemented
Admin & Support System	Admin can approve transaction, manage user, and response support requests

10.2 Screenshots & Demonstration

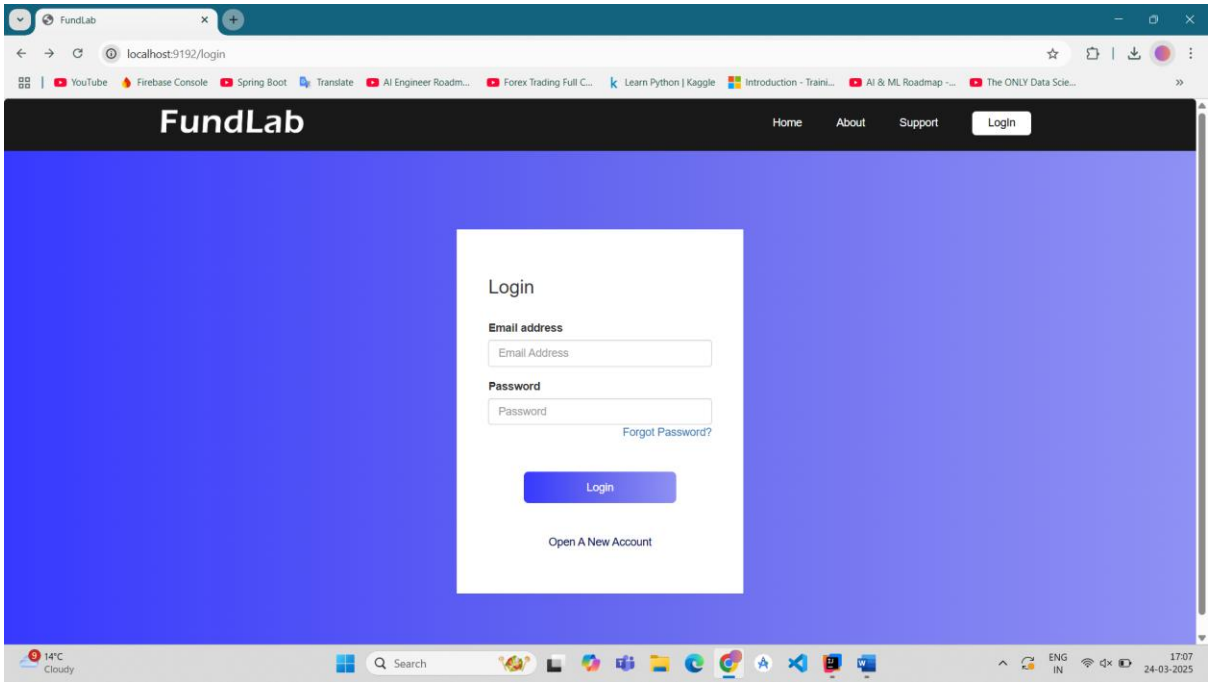
10.2.1 Customer Panel

- Customers can register & login in securely.

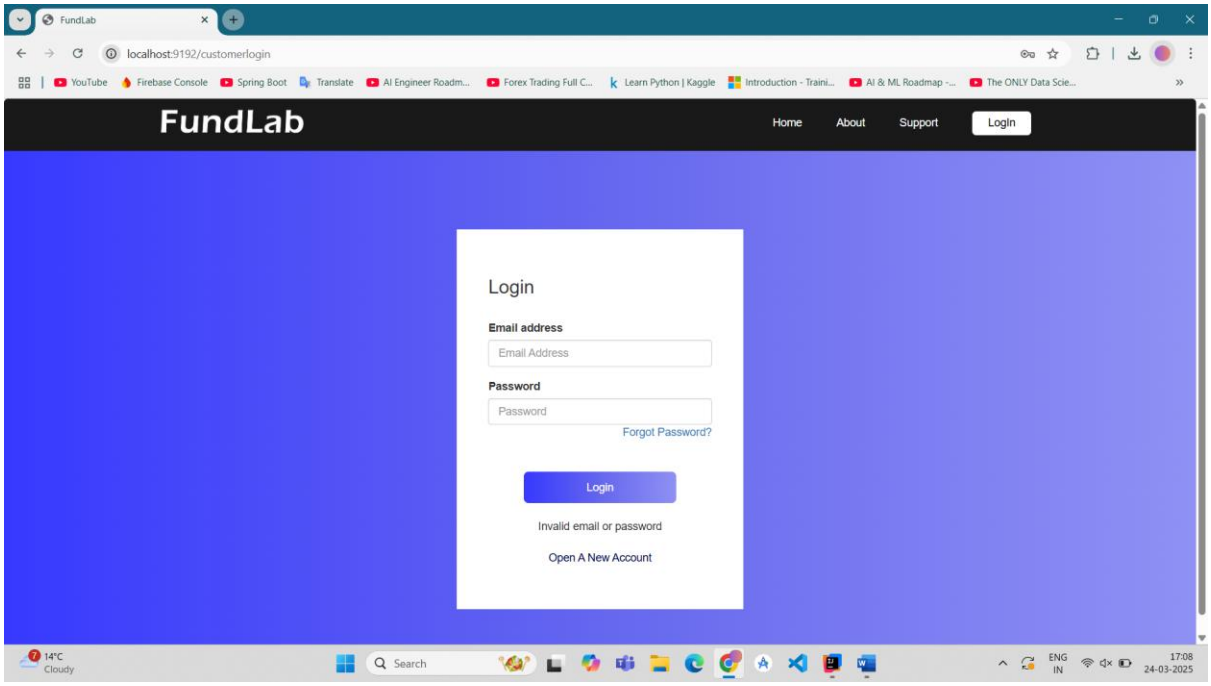
Screen shot : Registration Page



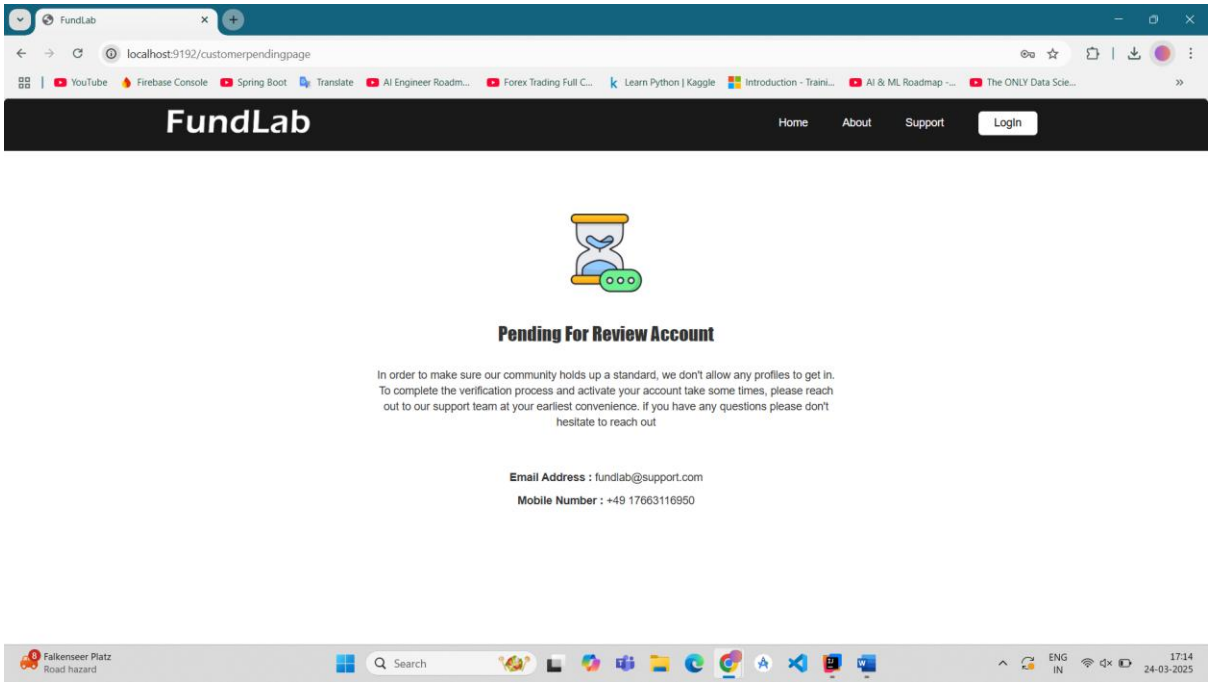
Customers Registration Page



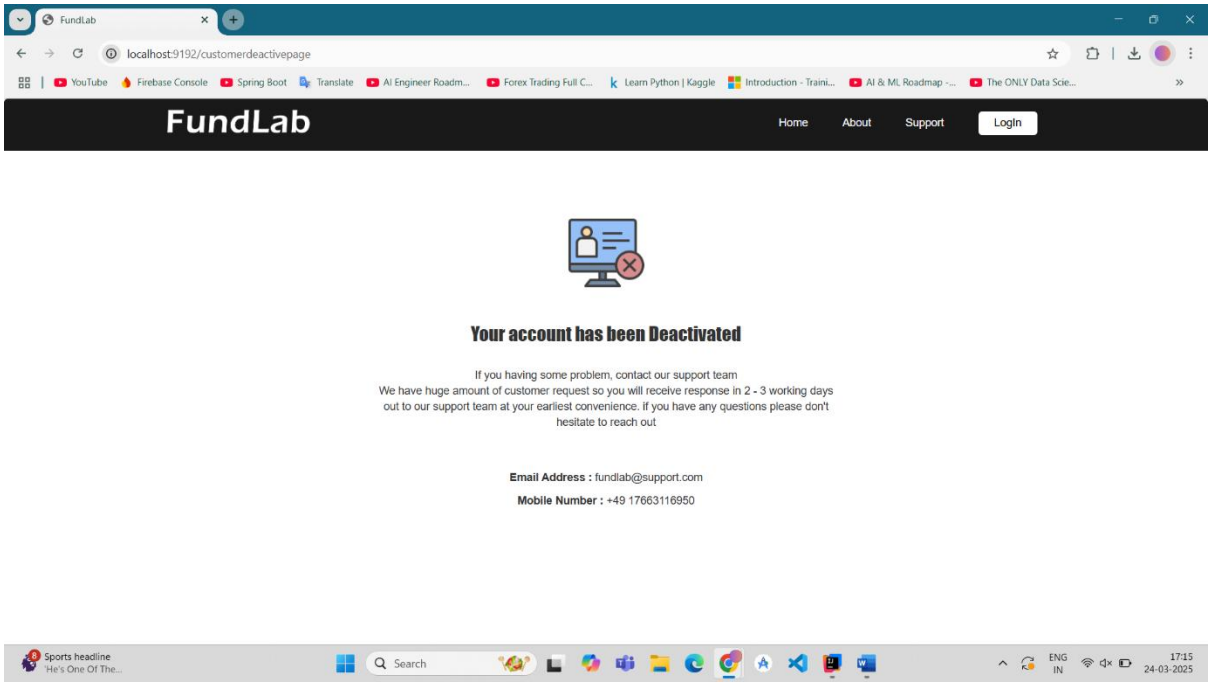
Customer Login Page



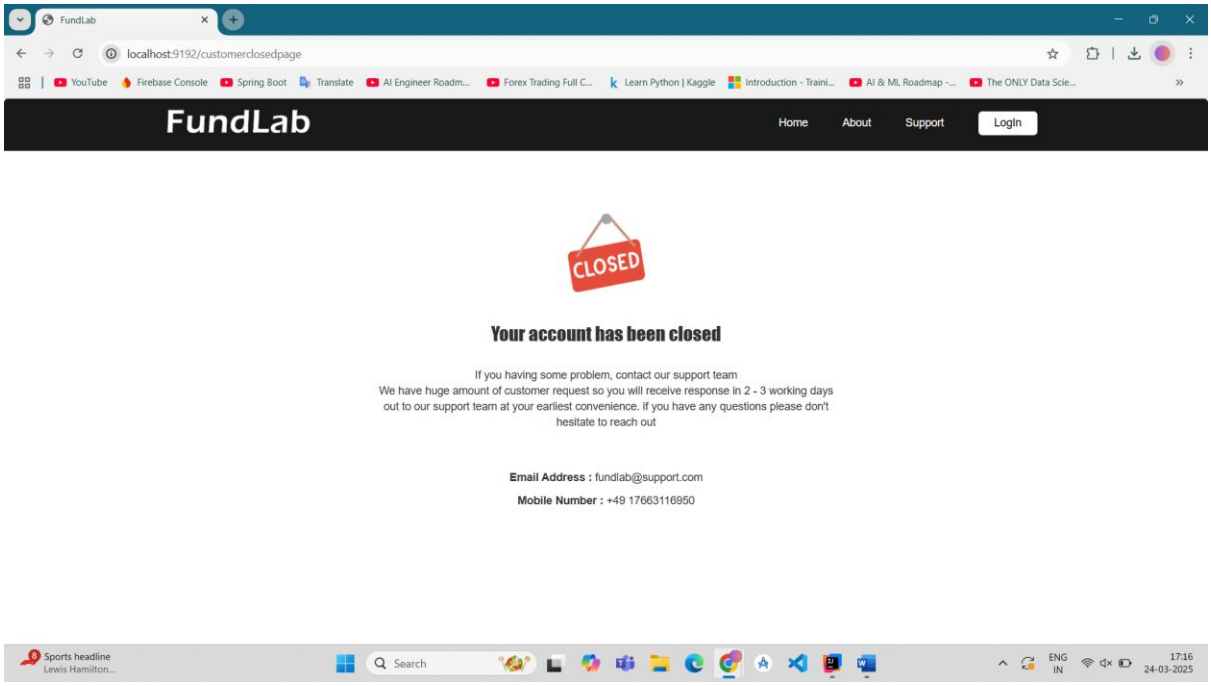
If Customer Login Failed



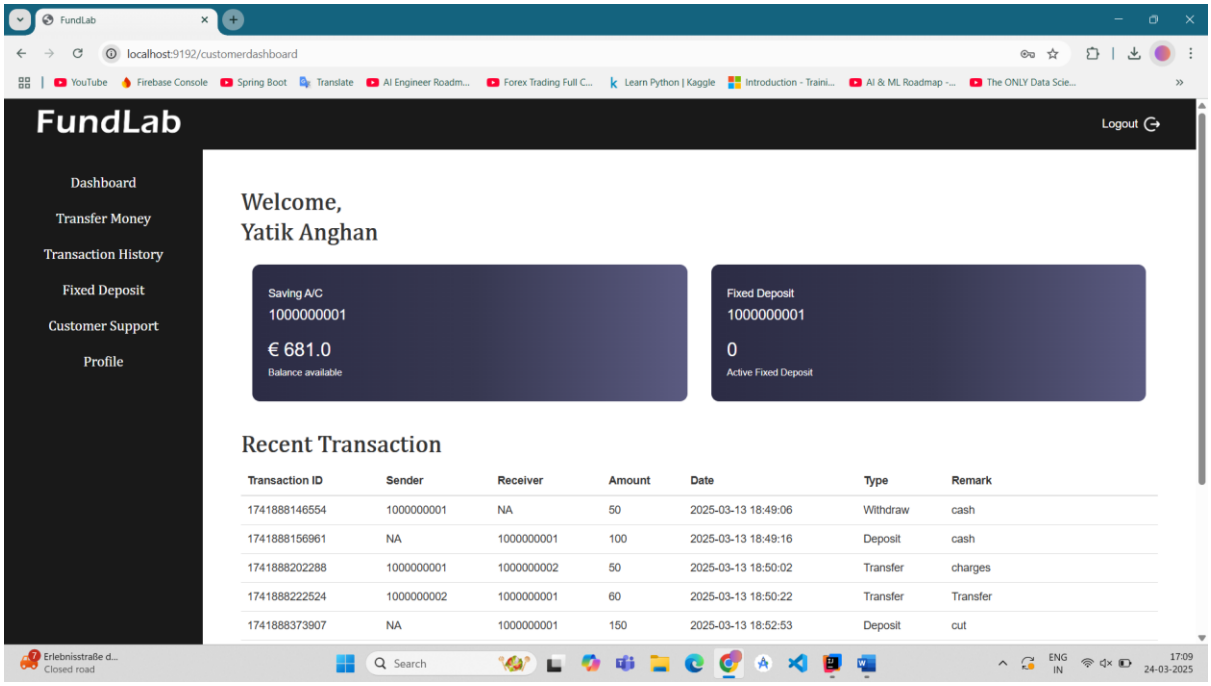
If Customer Logged in but not verified



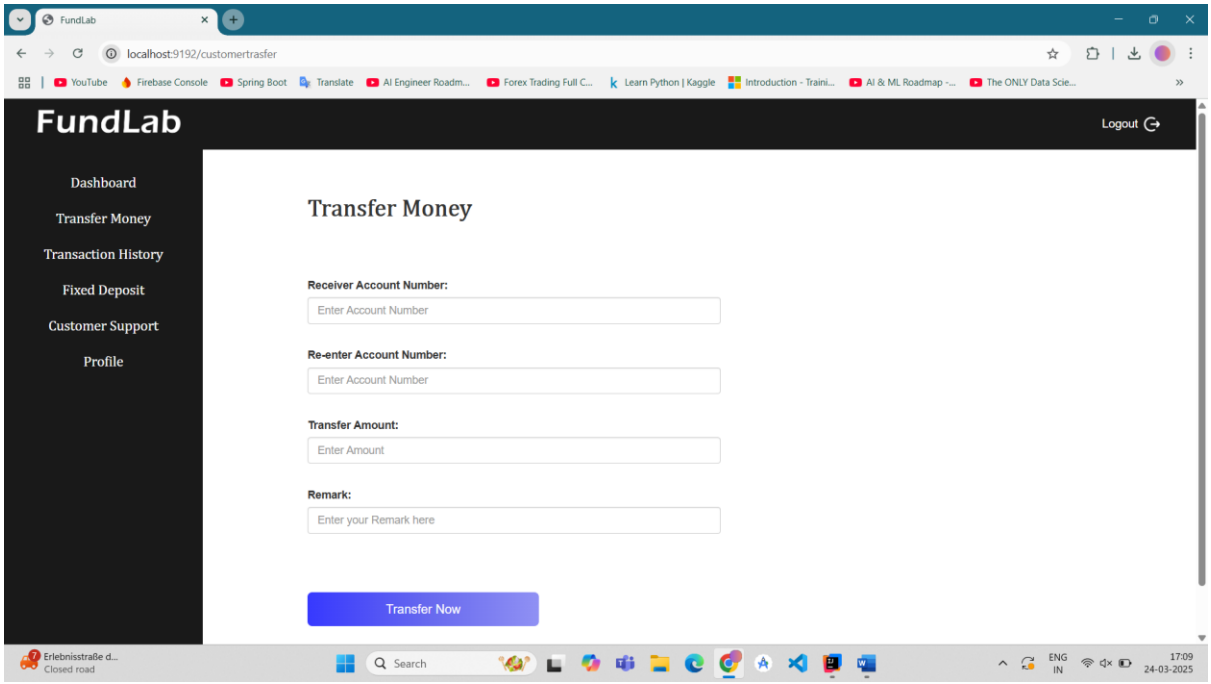
Customer Logged In but account has been deactivated



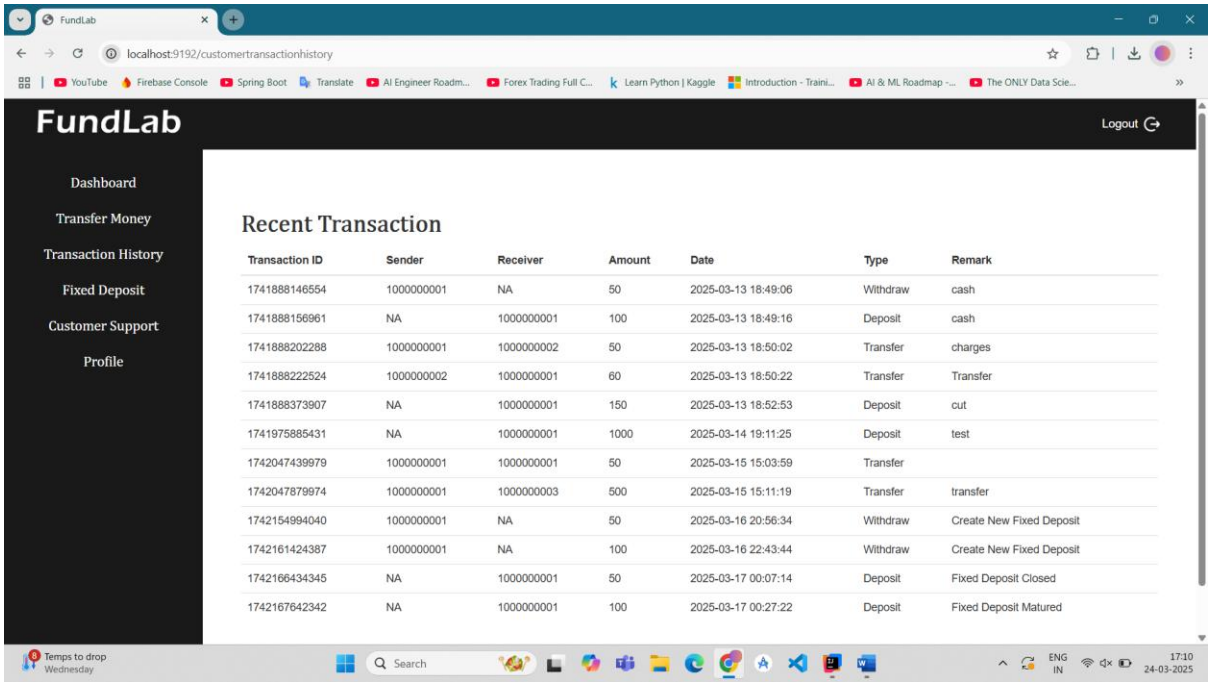
Customer Logged In but account has been closed



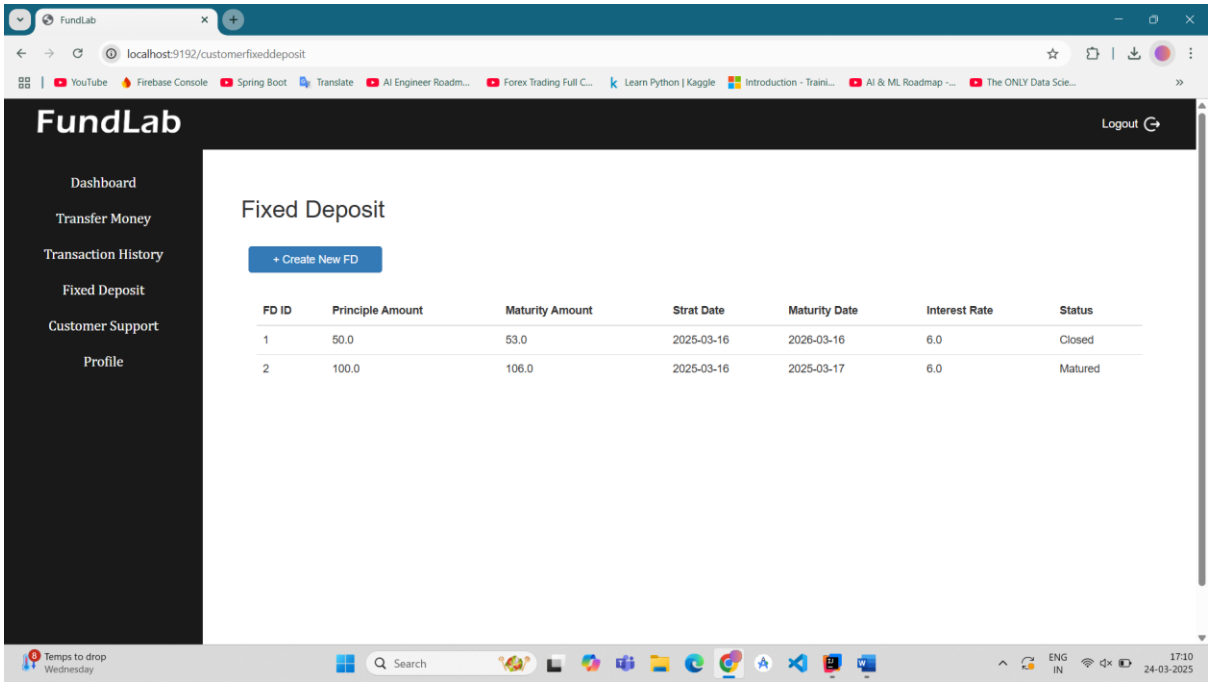
Customer Home Page



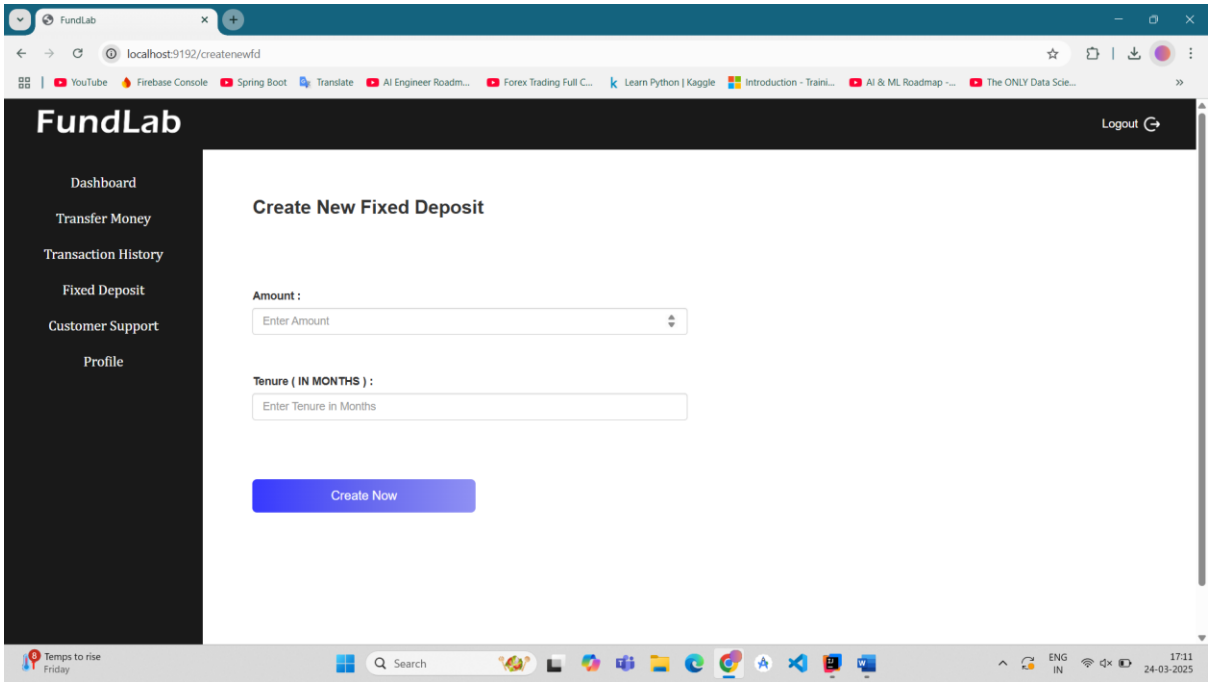
Customer Transfer Money Page



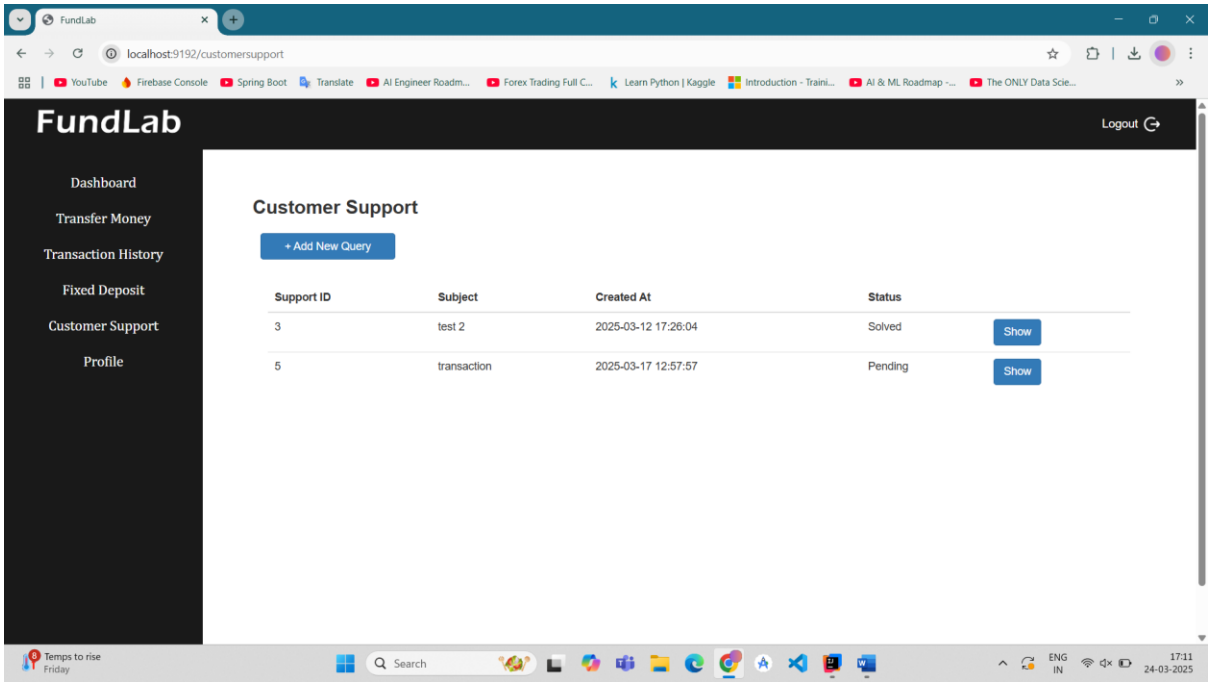
Customer Recent Transaction Page



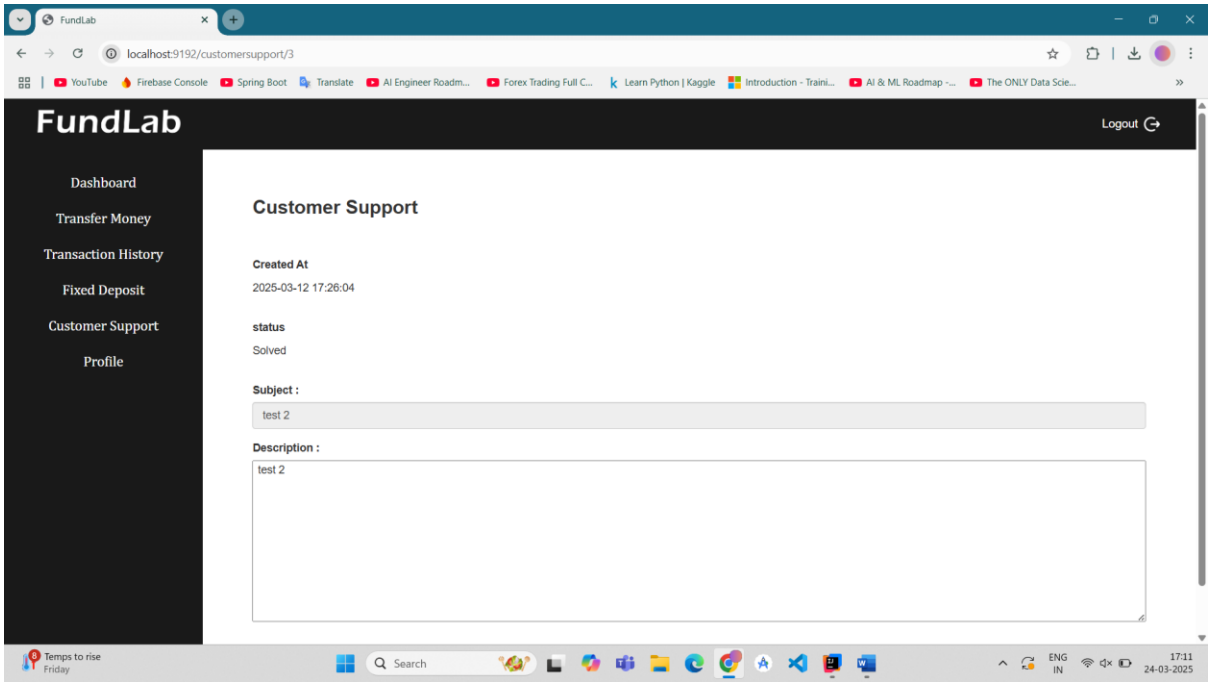
Customer Fixed Deposit Page



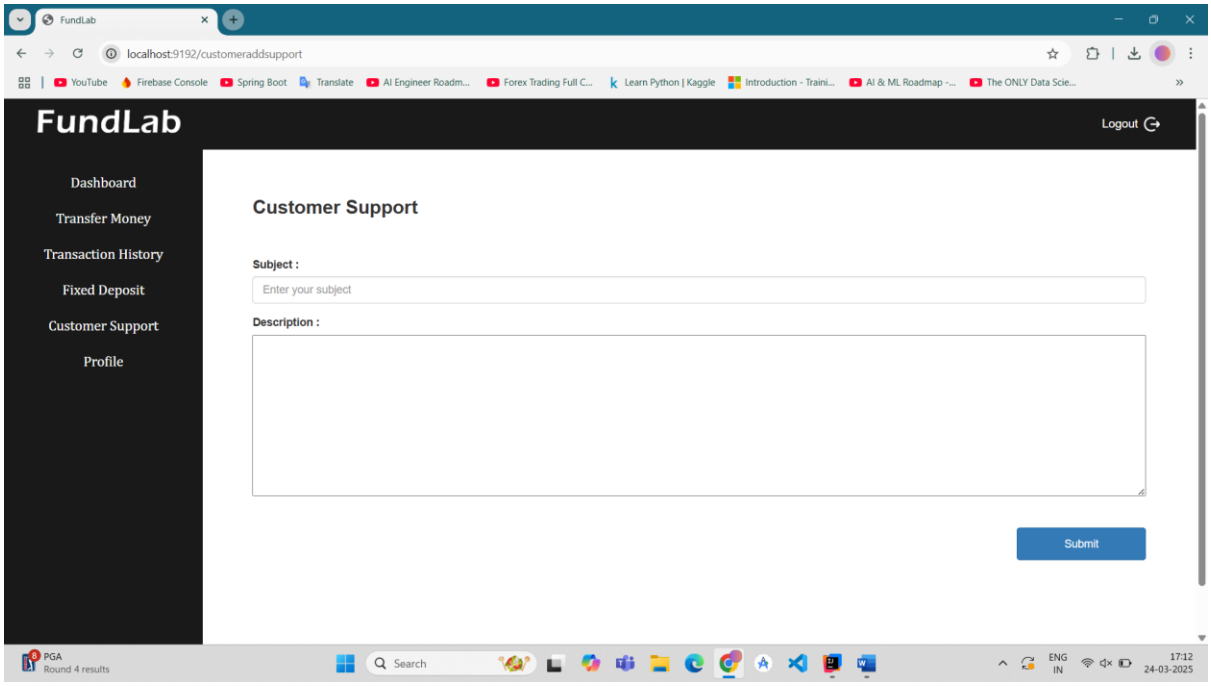
Customer New FD Form



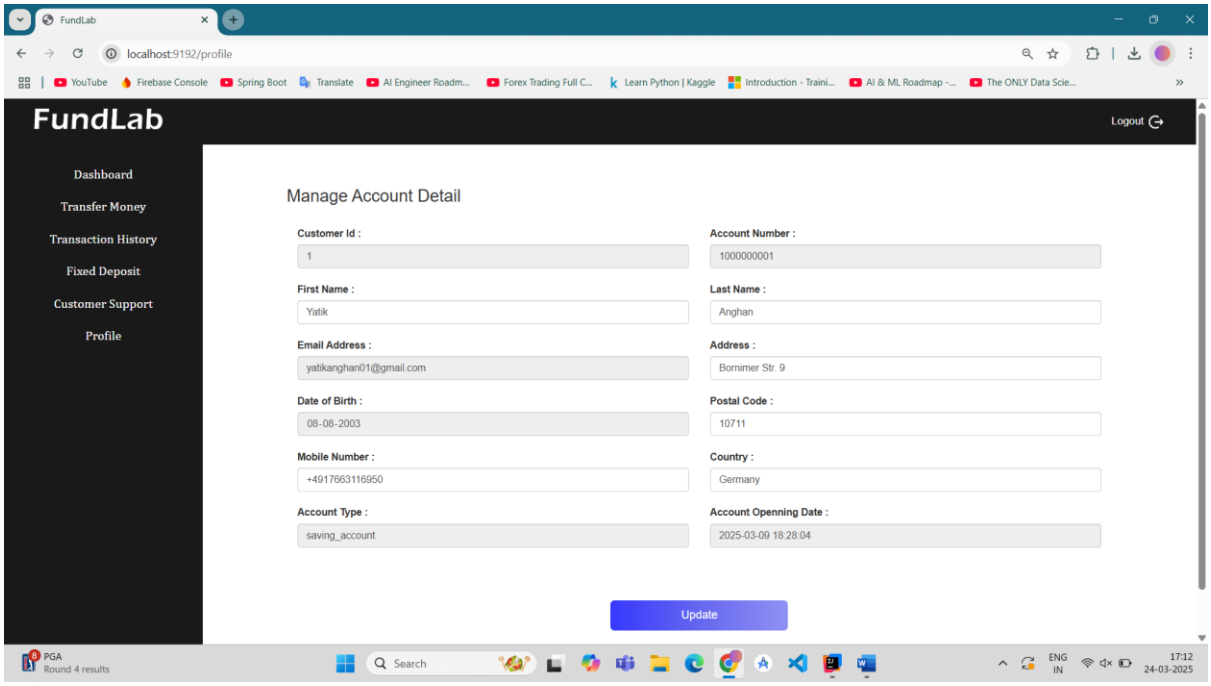
Customer Support Page



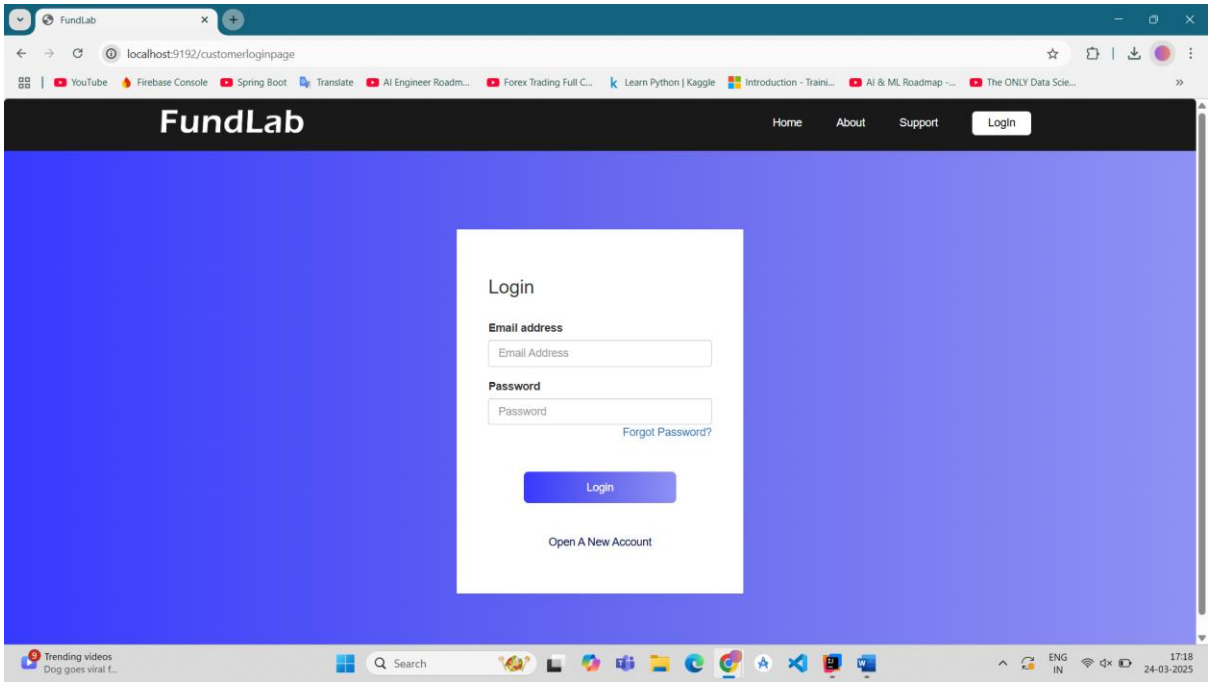
Customer Support Detail



Customer Support Add

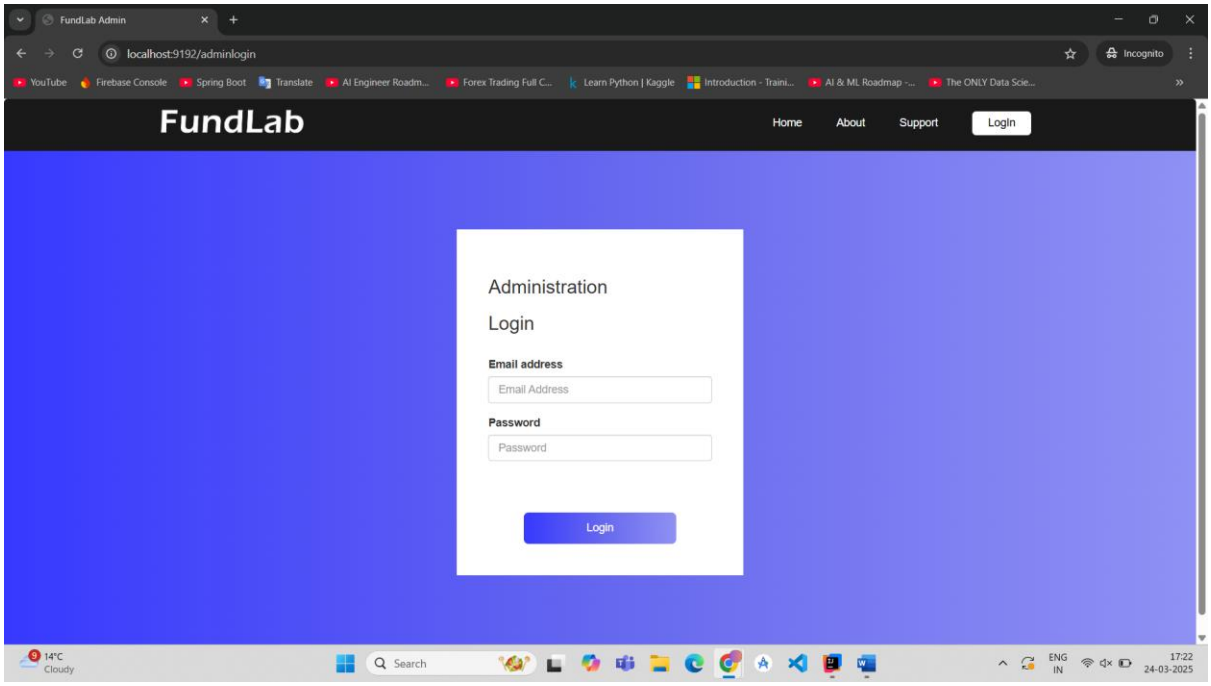


Customer Profile Page

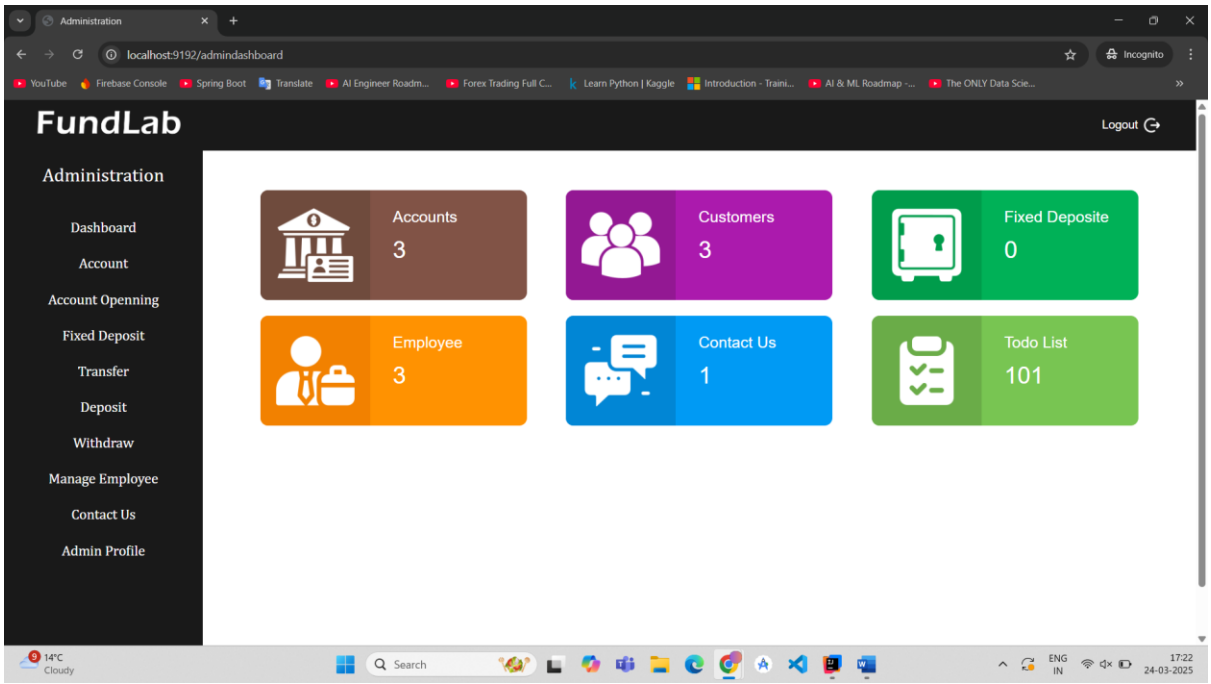


Customer Logout

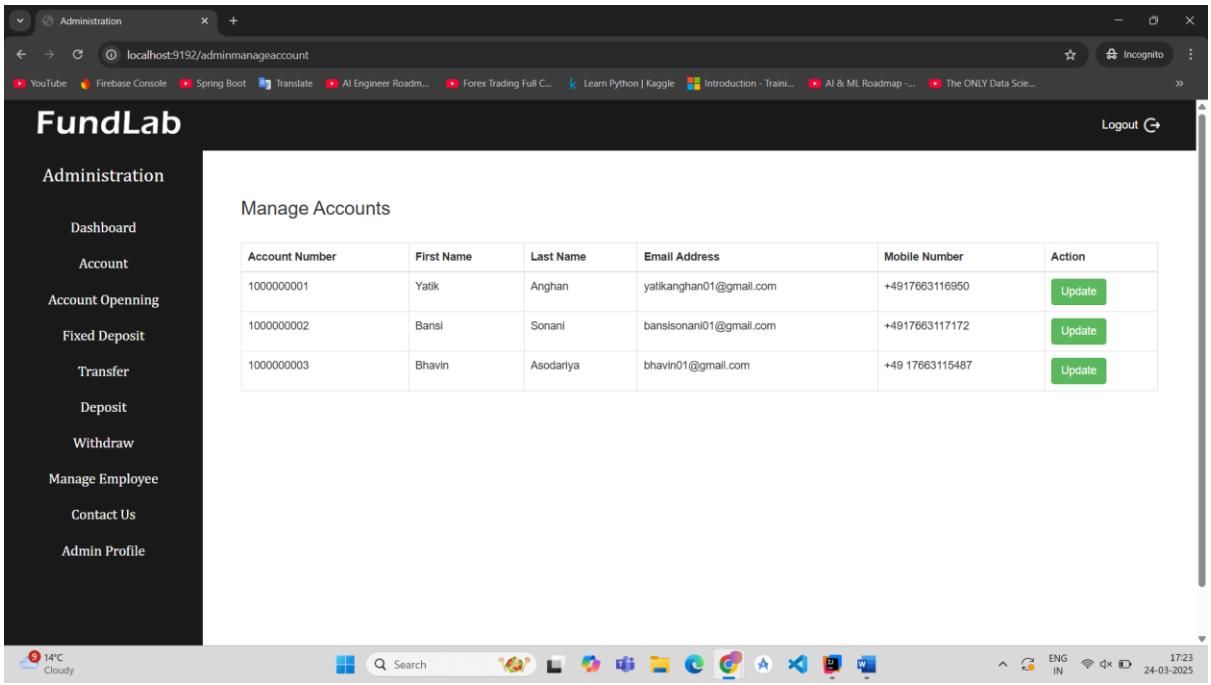
10.2.4 Administrative Panel



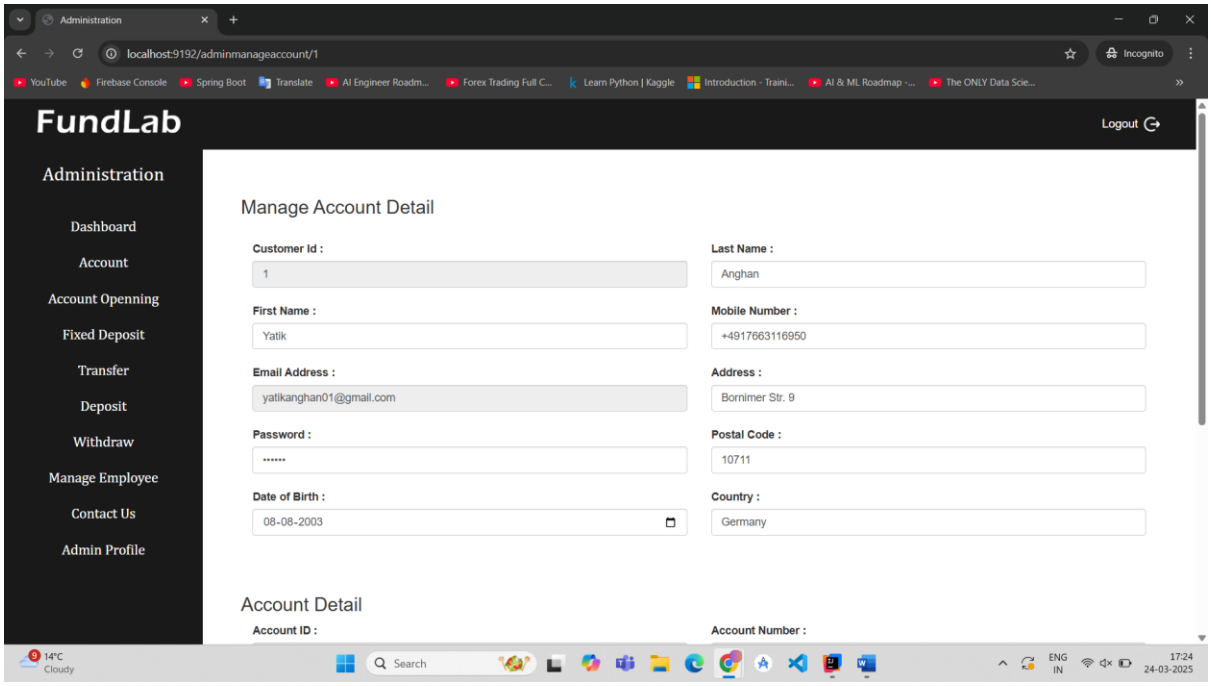
Admin Login Page



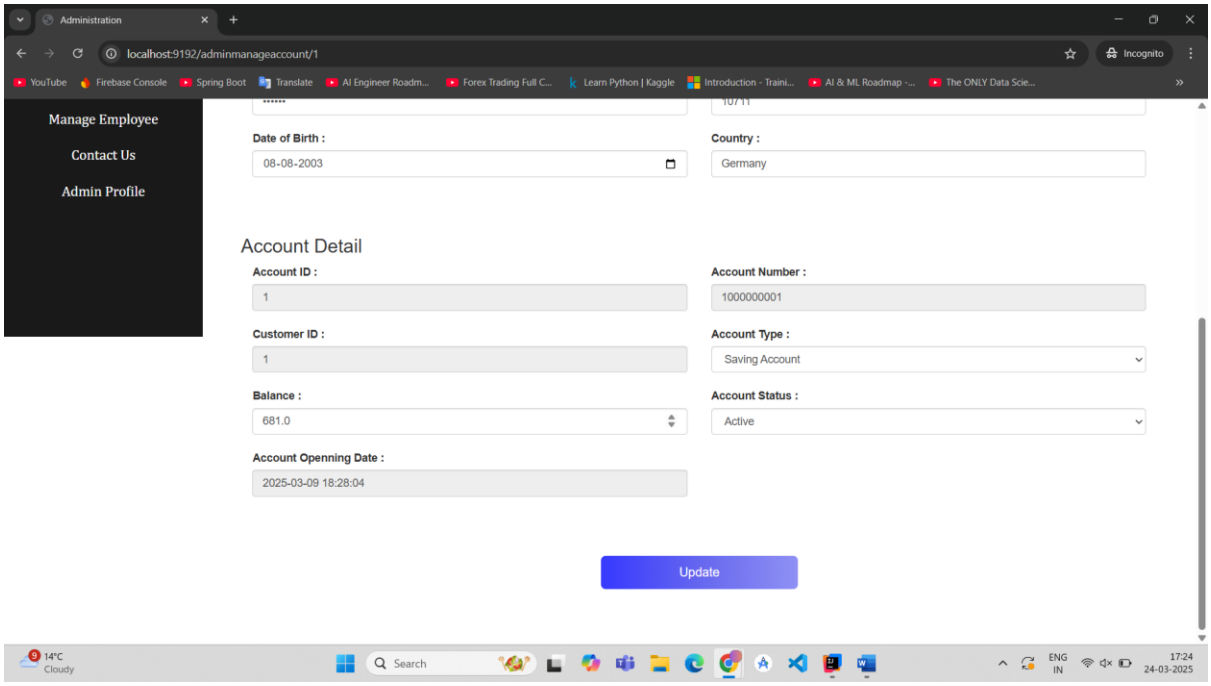
Admin Dashboard Page



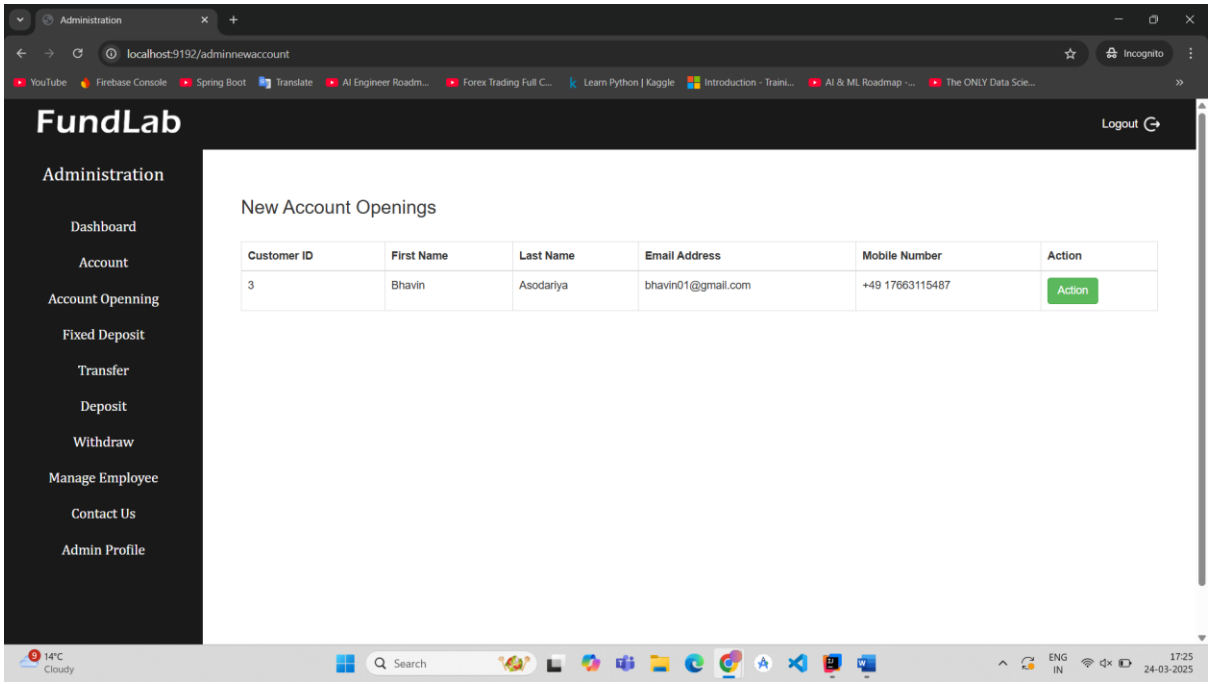
Admin Manage Account Page



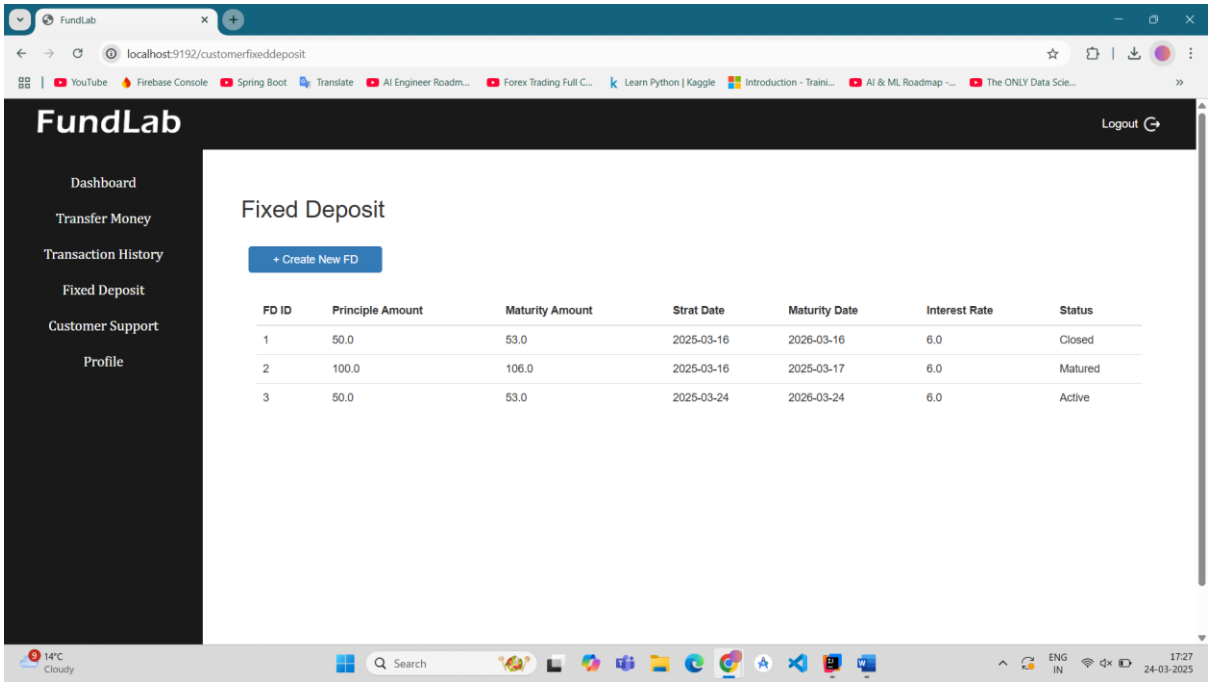
Admin Manage Account Detail Page



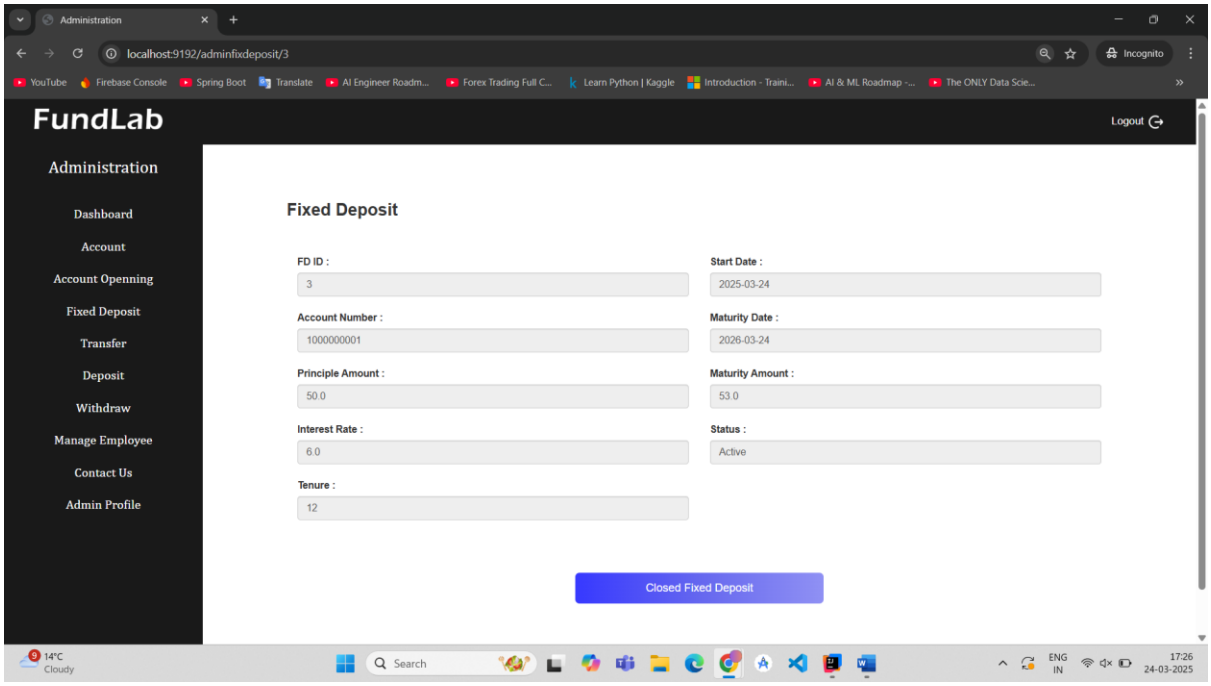
Admin Customer Account Details



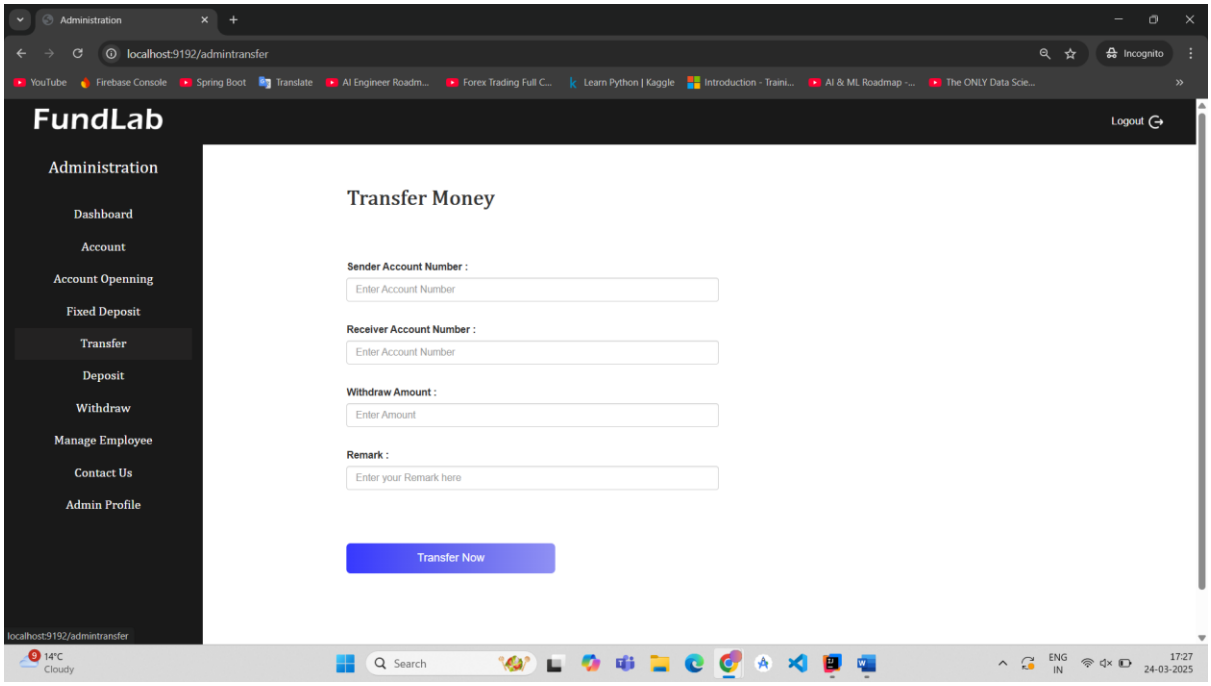
Admin New Account pending for verifications



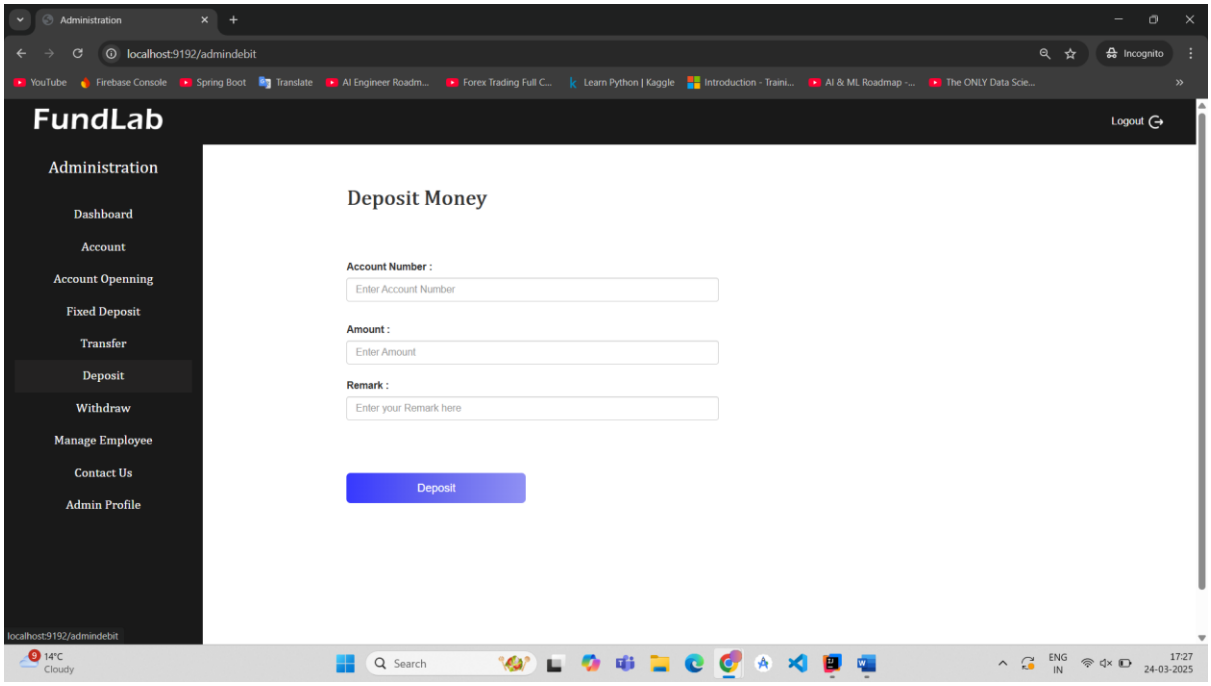
Admin Fixed Deposit Page



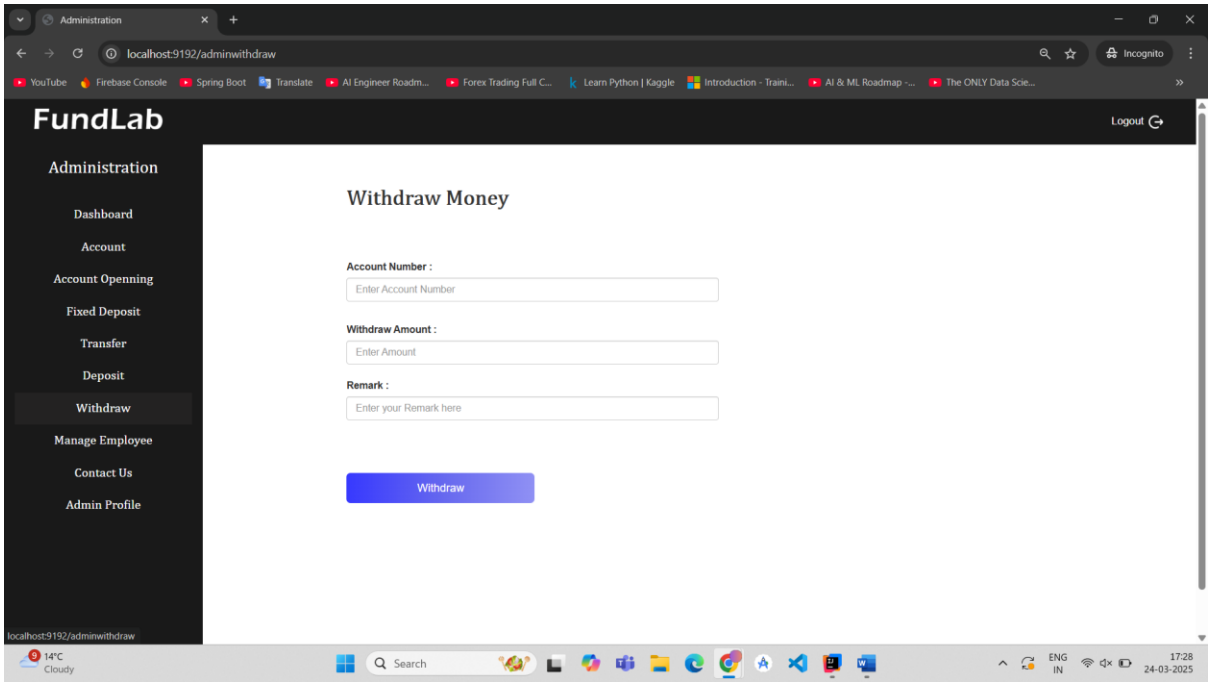
Admin Fixed Deposit Detail



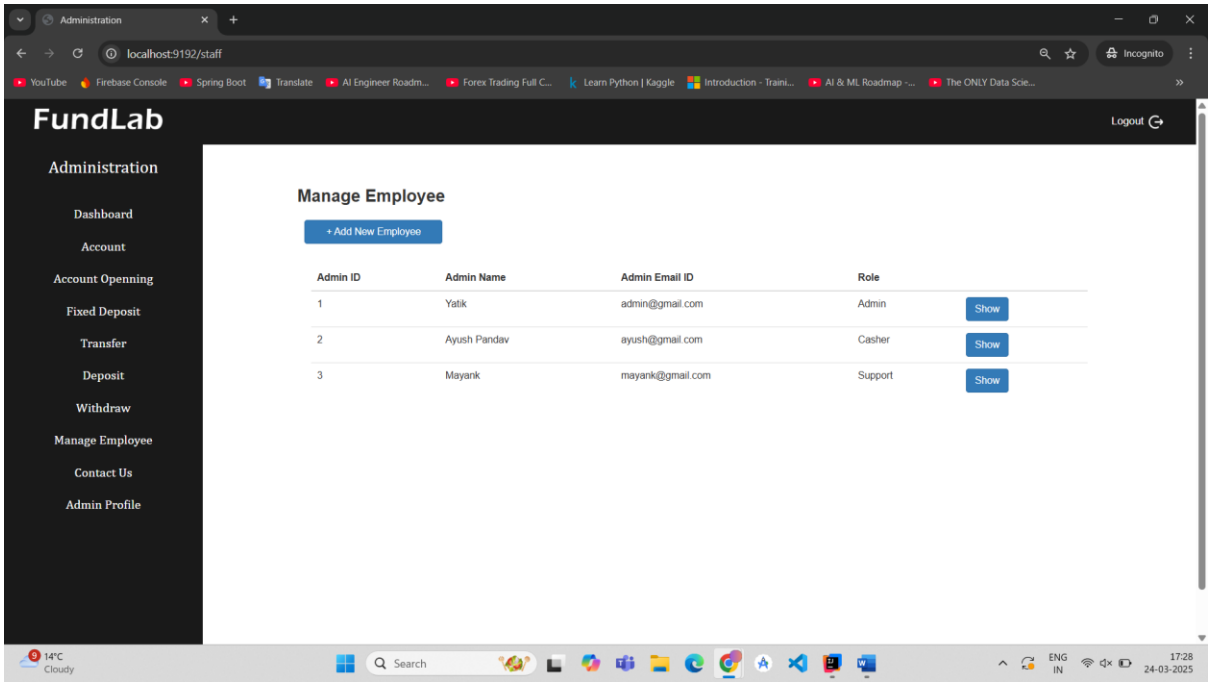
Admin Transfer Money Page



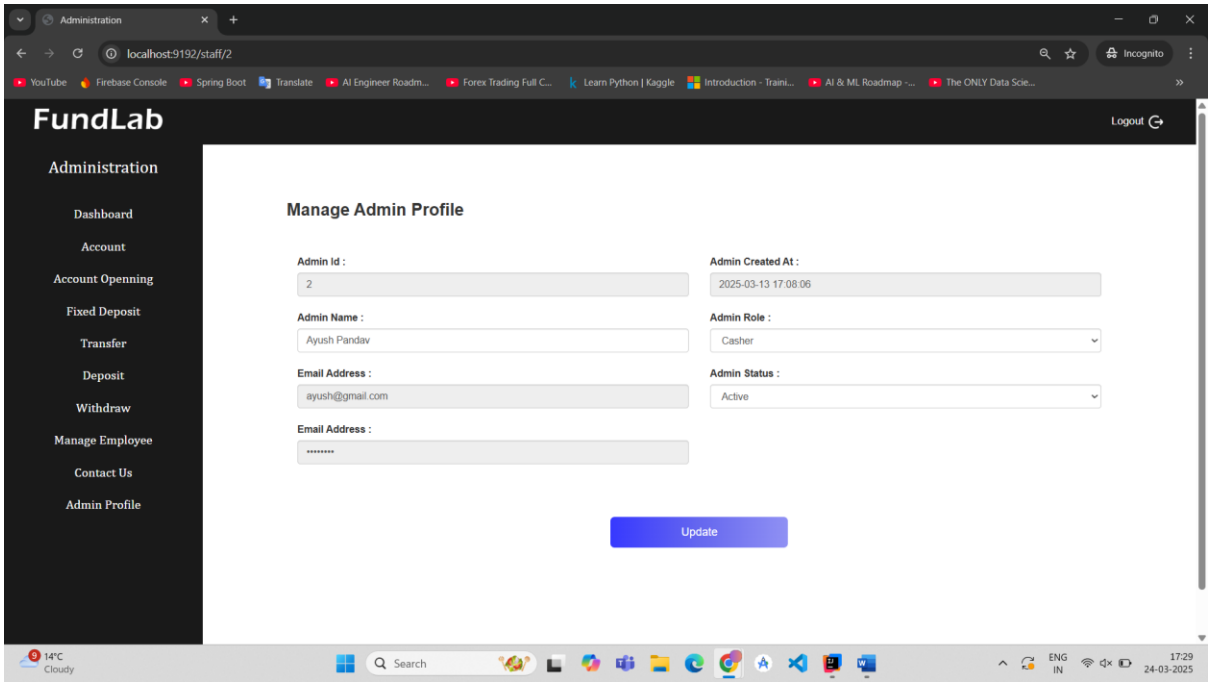
Admin Deposit Money Page



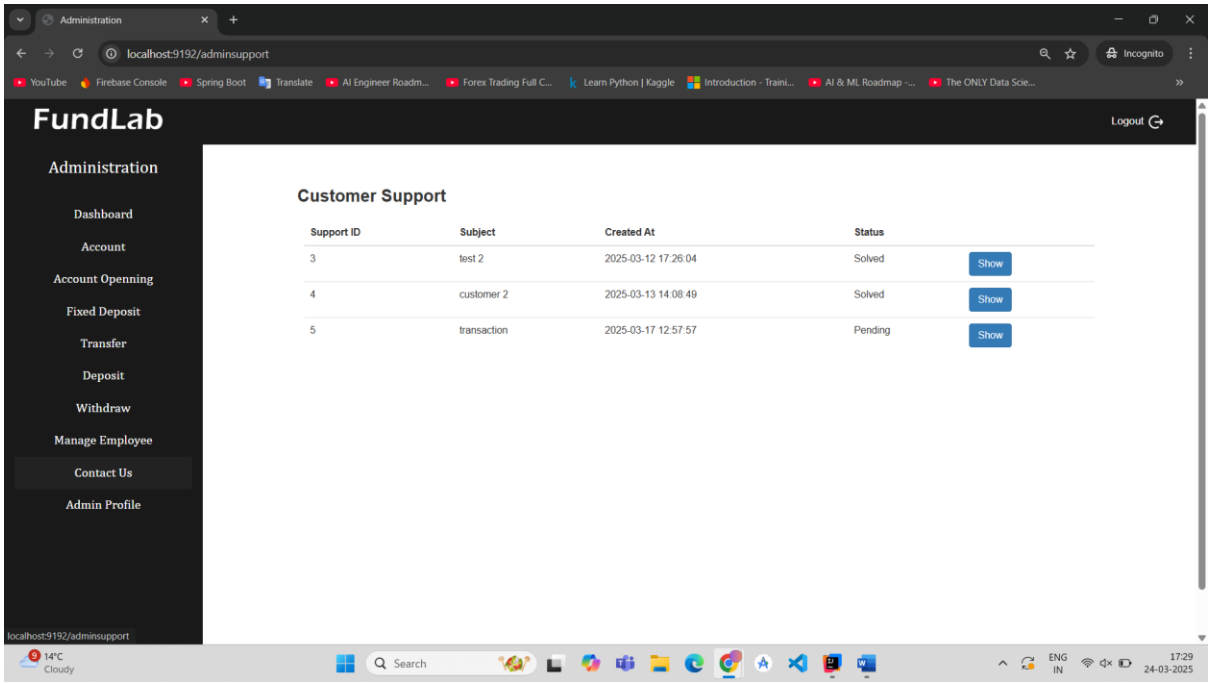
Admin Withdraw Money Page



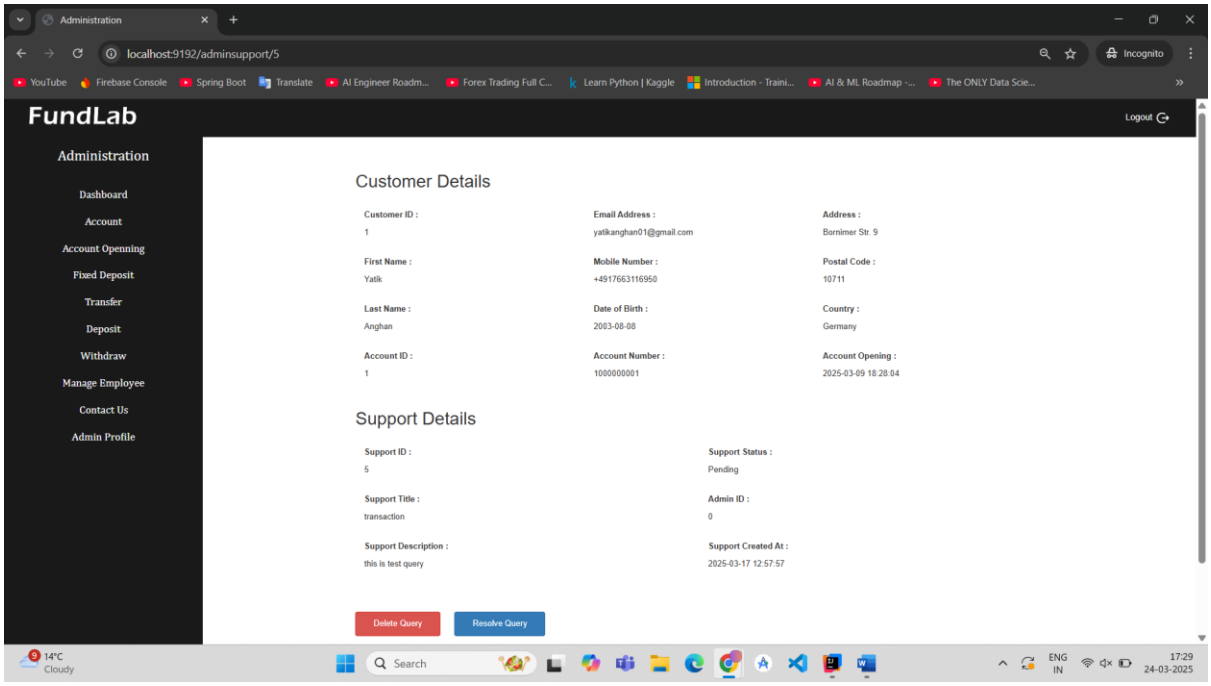
Admin Manage Employee Page



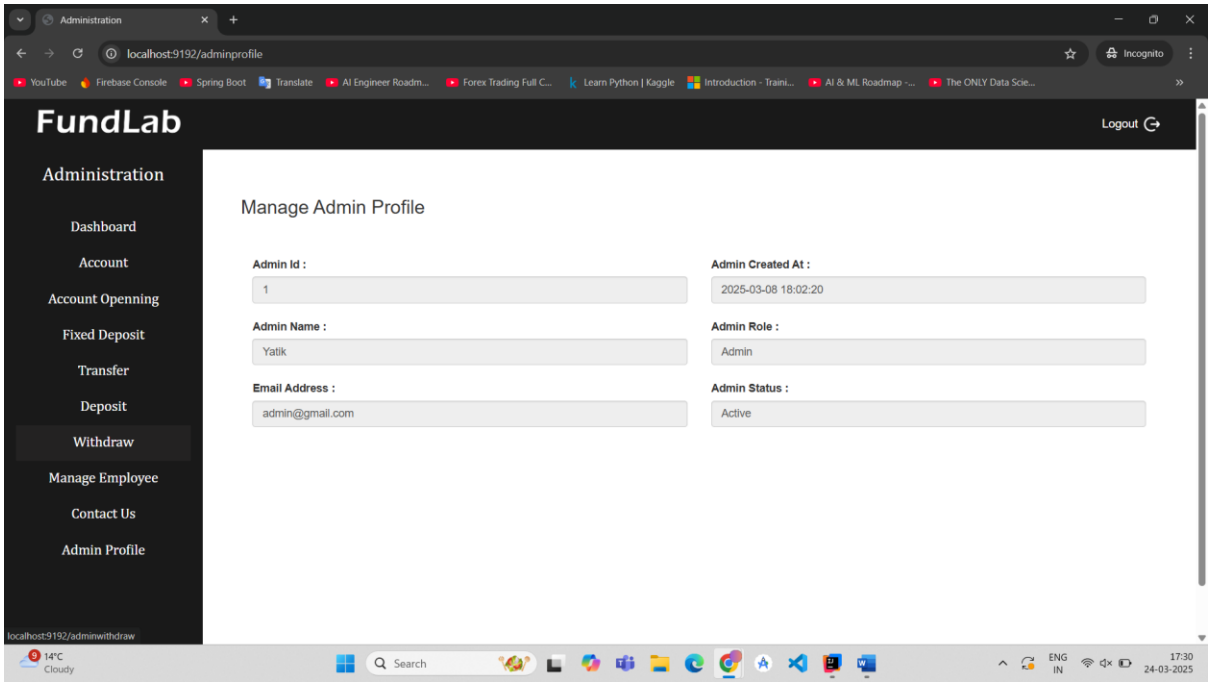
Admin Magane Employee Detail Page



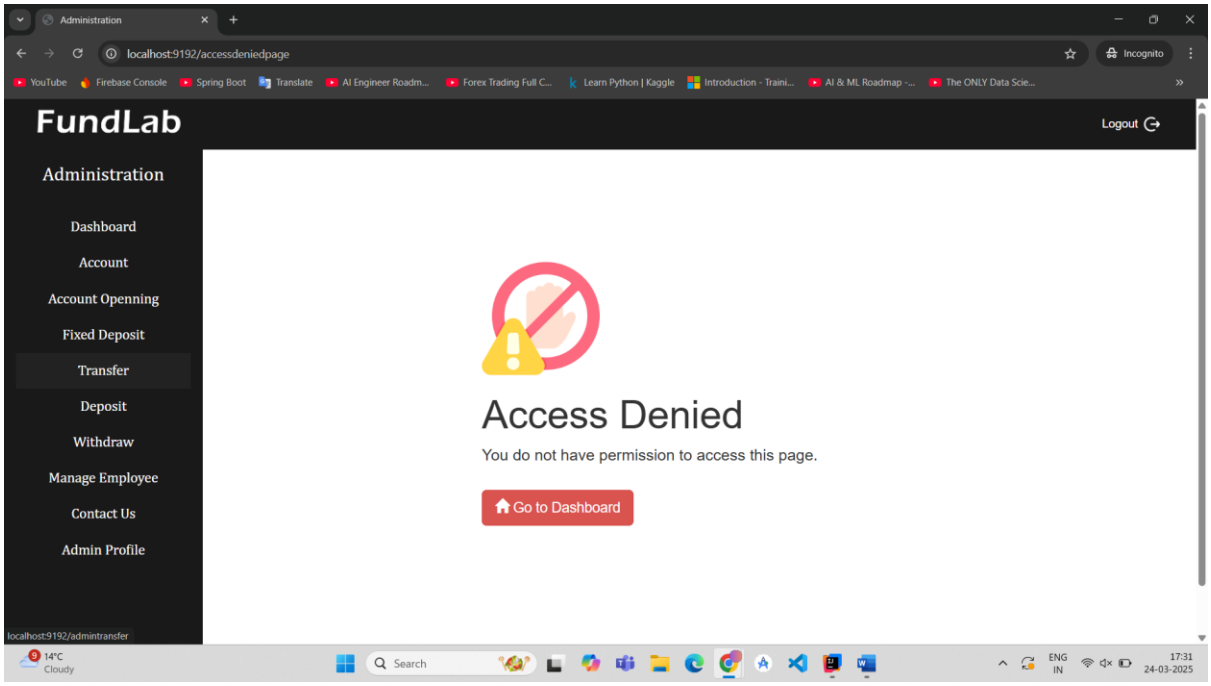
Admin Customer Support Page



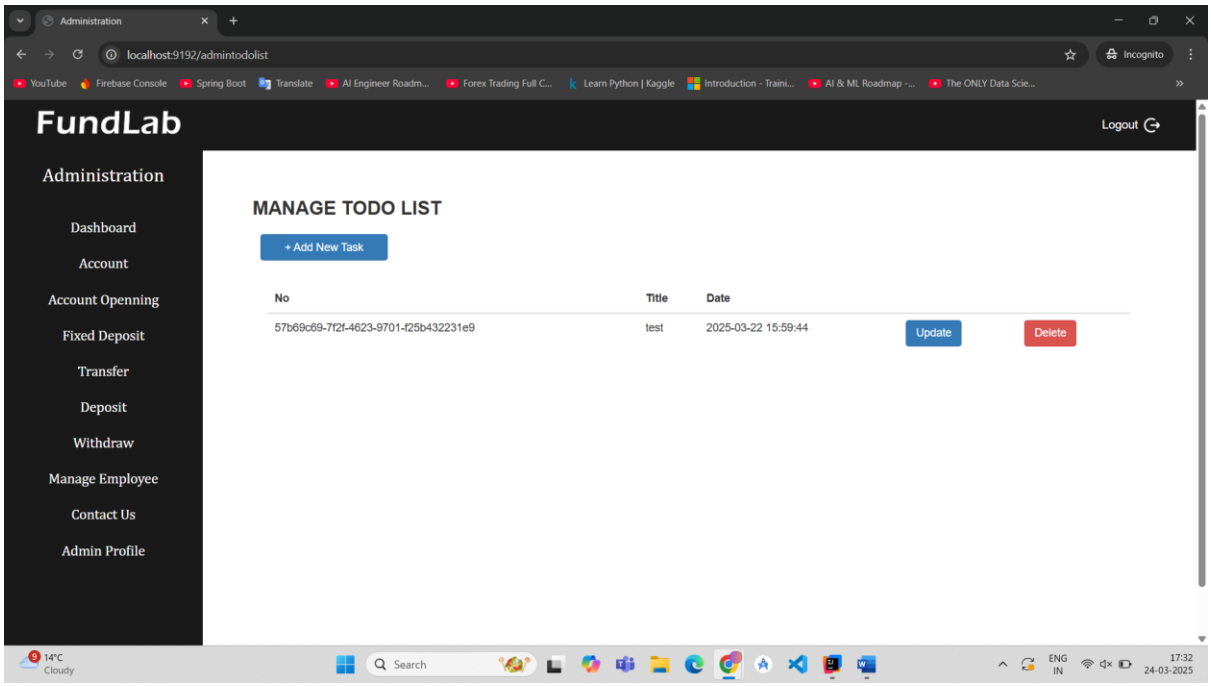
Admin Customer Support Detail Page



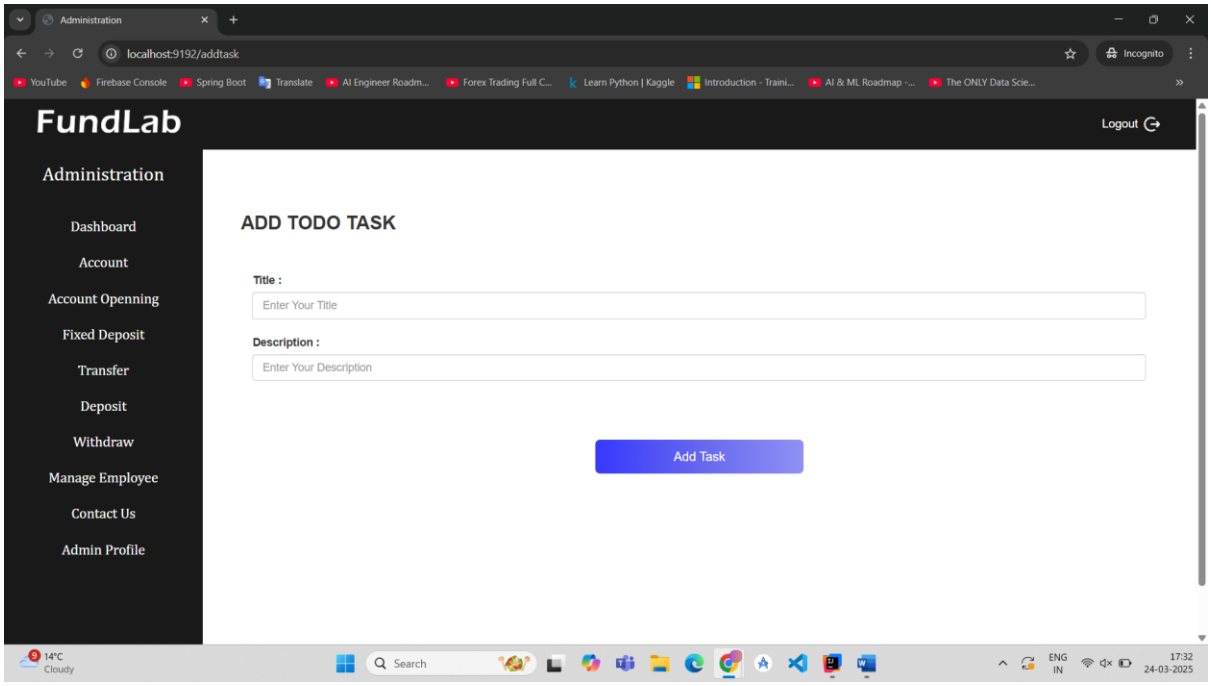
Admin Profile Page



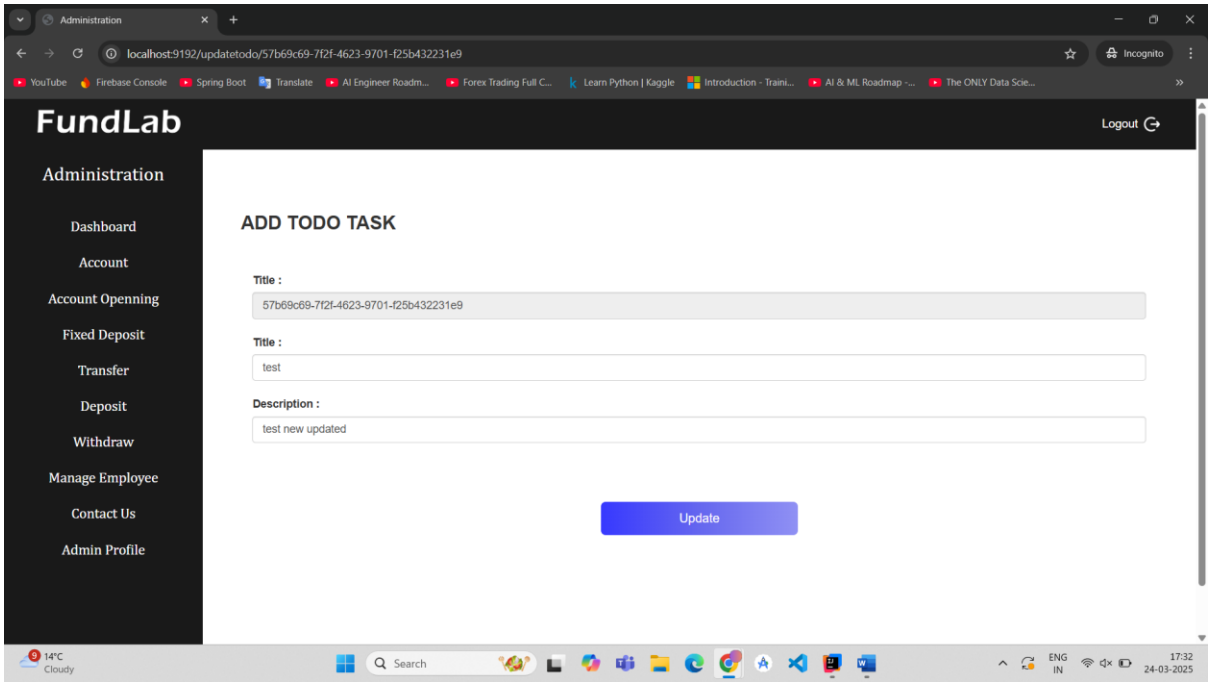
If employee is not access for some feature so that shows access denied page



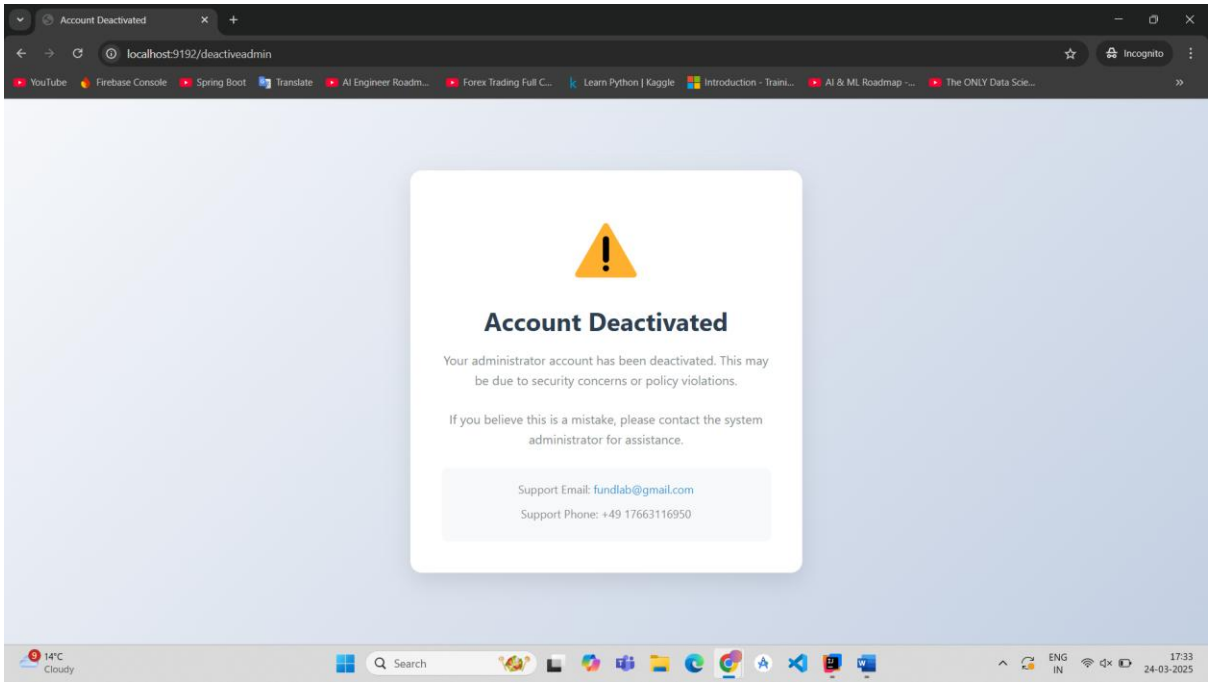
Admin Todo Page



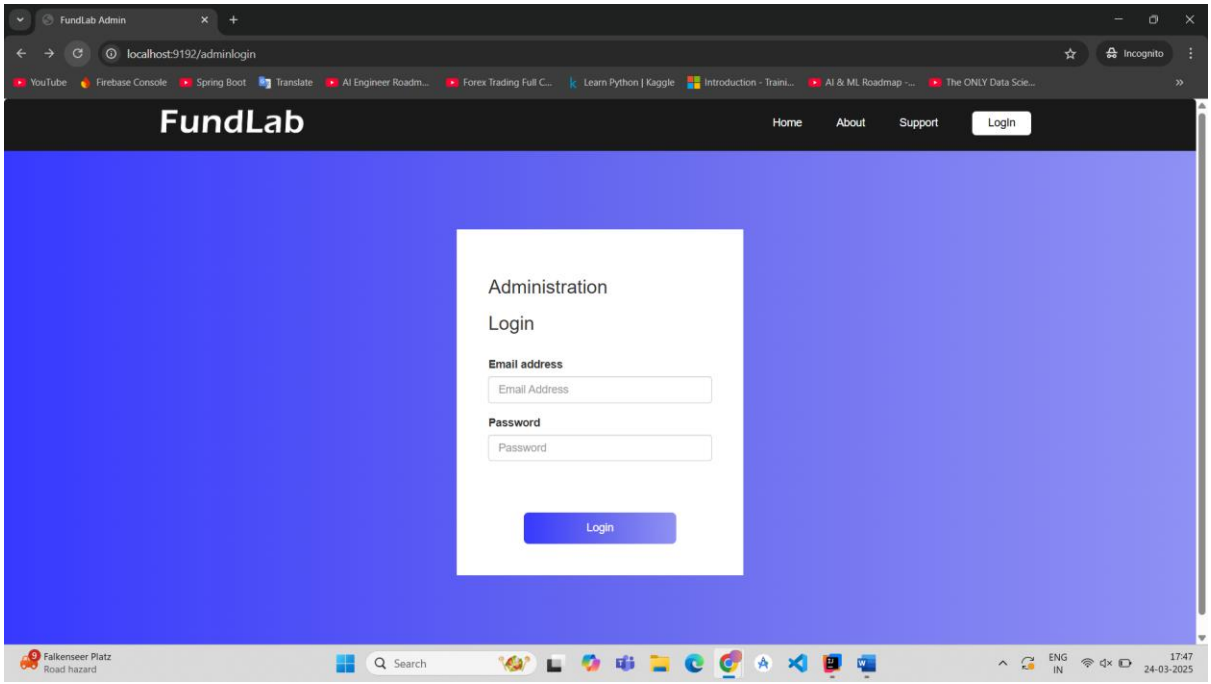
Admin Todo Add Page



Admin Todo Task Detail Page



Employe is Deactivated



Admin Logout

10.2.4 Secure & Error Handling

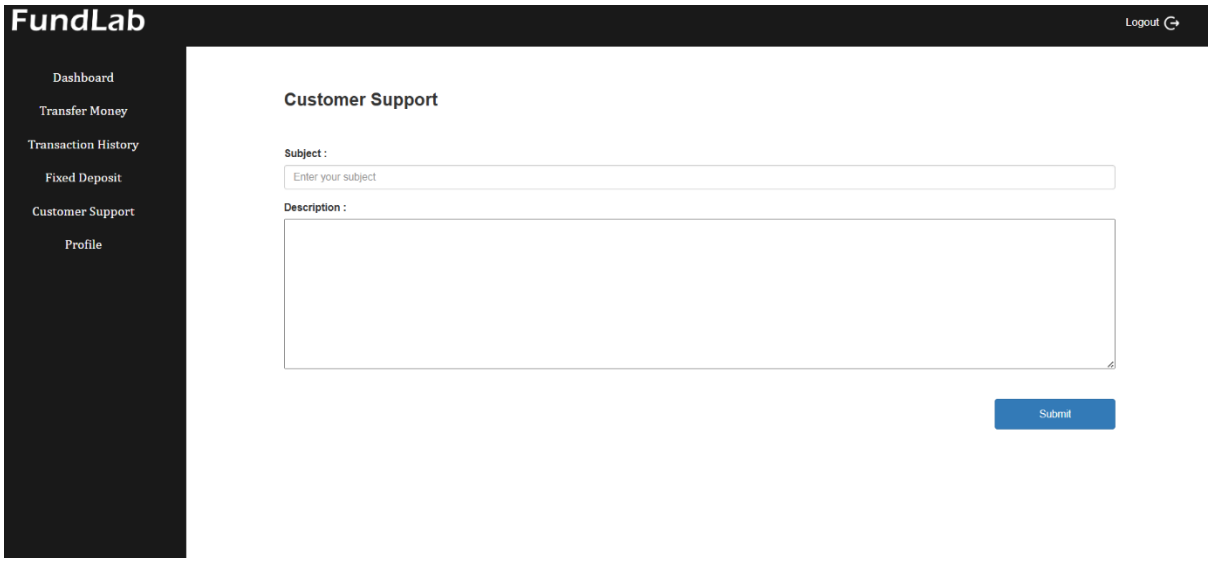
- System prevents unauthorized access and alerts users on failed login attempts.

Screen shot : Security alert for unauthorized login.

10.2.5 Customer Support System

- User can raise support ticket, and admins can respond to system.

Screen shot : Support Ticket Submission



11. Conclusion & Future

11.1 Conclusion

The Bank Management System was successful developed as a web application using Spring Boot for backend development and HTML,CSS and JavaScript for frontend. The system easily handles user authentication, accounts, transactions, fixed deposit, support gives a smooth banking experience.

Through the development, several challenges were faced such as data consistency, security, API performance but in the last project implemented with a secure interaction for customers and administrators both.

The system was tested and got successful outcomes in performance, making it reliable banking solution for financial institutions.

11.2 Future Enhancements

1: Email and SMS notifications

- **Enhancements :** Send automtic email and sms alerts for transactions.
- **Benefits :** Improve user awareness and security without complec technology.

2: Transaction History and Filtering/Sorting

- **Enhancements :** Allow users to filter and sort transactions history by date, type or amount.
- **Benefits :** Make it more easier for users to track transactions without searching.

3: Profile Update Feature

- **Enhancements :** Allow users to update their profile details directly from dashboard.
- **Benefits :** No need to raise ticket to changes and reduces admin works.

4: Downloaded Bank Statements

- **Enhancements :** Allow users to download accounts statements in pdf format.
- **Benefits :** Help users to keep record for personal financial management.

5: Improved error Messages and help section

- **Enhancements :** Display more user-friendly error messages.
- **Benefits :** Helps users understand why an error occurred and how to fix it.

12.References

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