Industrial Internship Report on

”Simple Bank Prototype”

Prepared by

Vishunu Vardhan Reddy N

Executive Summary
My project was to develop a **Banking Information System in Core Java** that simulates the functionality of a real-world banking system. It includes user registration, login authentication, account creation, deposit, withdrawal, fund transfer, and account statement generation. The system demonstrates a command-line interface (CLI) approach with planned support for GUI and file-based persistence. This internship provided a great opportunity to apply Java skills to a practical, industry-inspired project.

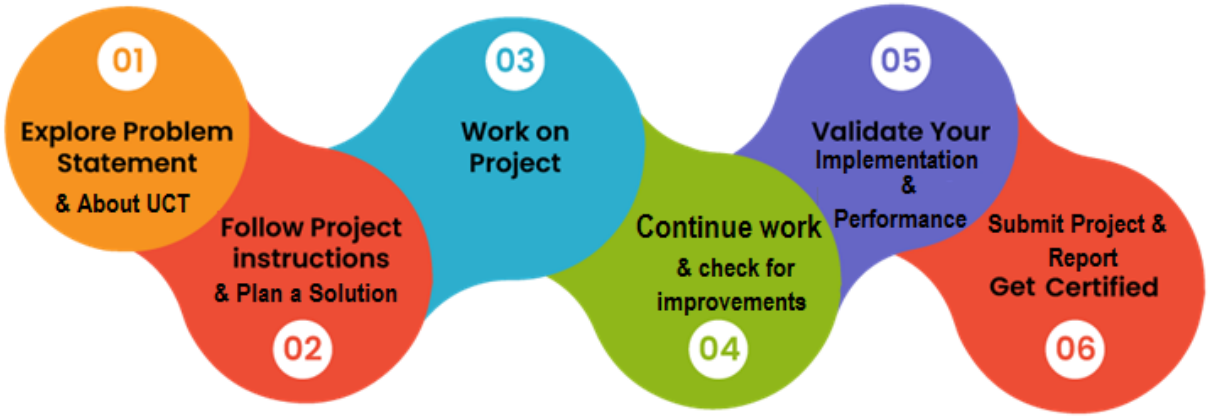
TABLE OF CONTENTS

1 Preface

This report presents the outcome of a six-week internship project focused on the development of **SecureBank**, a prototype of a full-stack Banking Information System. The project was carried out under the guidance of mentors from **UniConverge Technologies Pvt Ltd** and **Upskill Campus**.

SecureBank aims to simulate essential operations of a real-world banking environment in a **user-centric, secure, and modular system**. The development included frontend UI design, backend logic in Core Java, and integration with persistent storage mechanisms. Emphasis was placed on learning industry practices, including **modular development, authentication, responsive design**, and **secure transaction handling**.

This report outlines the motivation, objectives, design choices, challenges, testing outcomes, and future scope of the project.



2 Introduction

2.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and Roi.

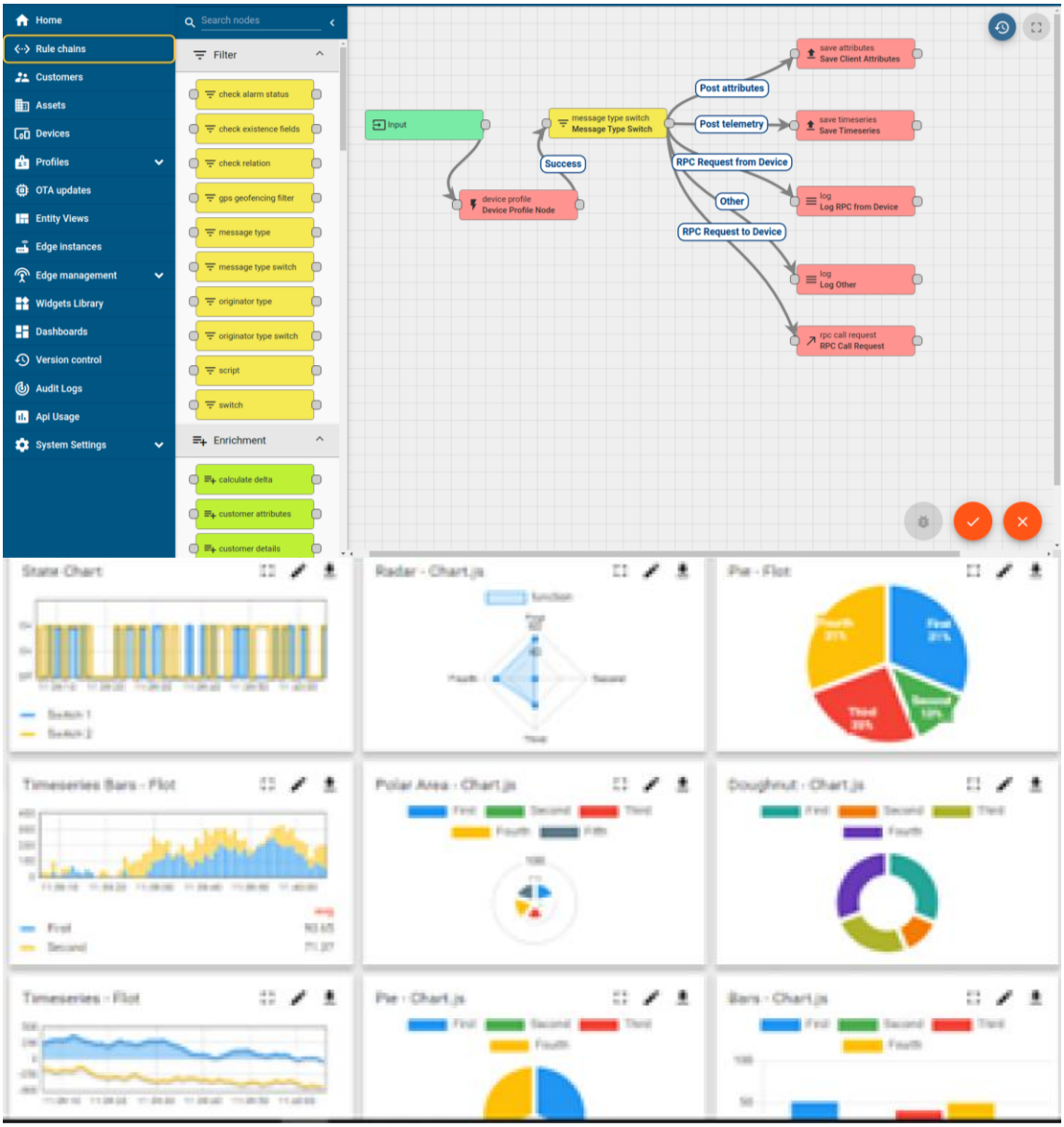
For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

i. UCT IoT Platform (UCT Insight)

UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

- It has features to
    - Build Your own dashboard
    - Analytics and Reporting
    - Alert and Notification
    - Integration with third party application(Power BI, SAP, ERP)
    - Rule Engine



ii. Smart Factory Platform (FACTORY WATCH)

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- to unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

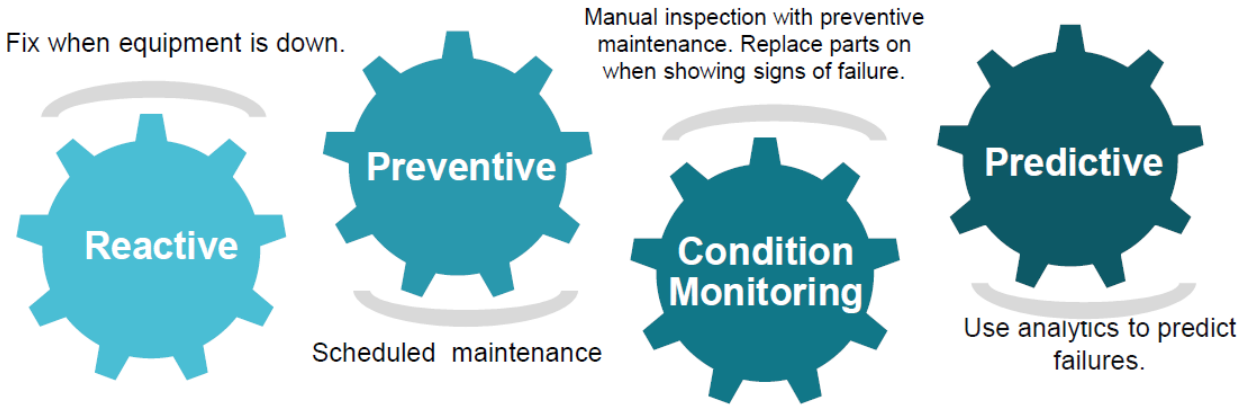
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i

iii. LoRaWAN based Solution

UCT is one of the early adopters of LoRAWAN teschnology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

iv. Predictive Maintenance

UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



2.2 About upskill Campus (USC)

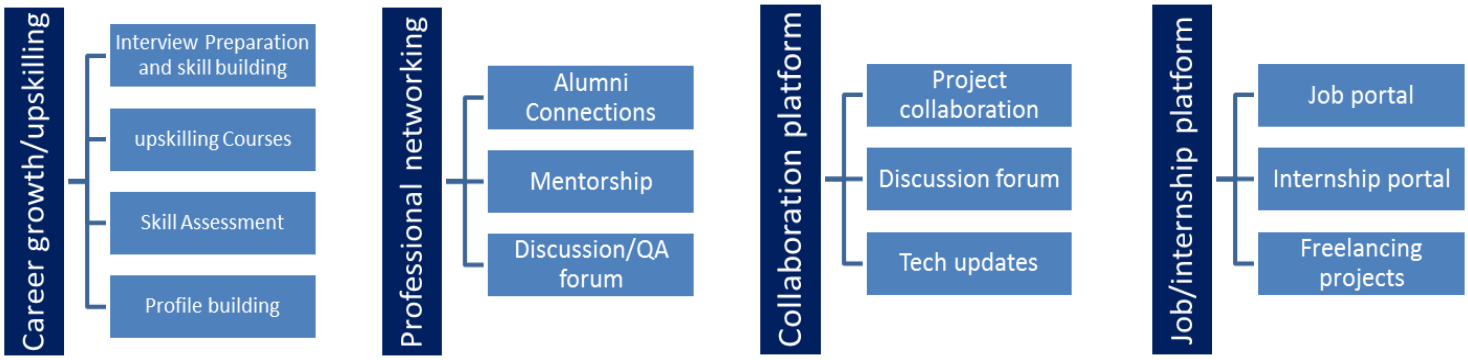
upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.

Seeing need of upskilling in self-paced manner along with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

upSkill Campus aiming to upskill 1 million learners in next 5 year

https://www.upskillcampus.com/



2.3 The IoT Academy

The IoT academy is EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.4 Objectives of this Internship program

To develop a **secure, modern, and modular Banking Information System** that enables users to:

- Open accounts and securely log in.
- Perform deposits, withdrawals, and fund transfers.
- View transaction history and download statements.
- Experience a real-time, user-friendly banking portal on the web.

2.5 Reference

- Java SE documentation (Oracle)
- ReactJS and TailwindCSS UI framework guides
- GitHub banking project demos
- Real-world mobile banking app UI inspiration

2.6 Glossary

Term	Description
SecureBank	Name of the banking prototype
UI/UX	User Interface / User Experience
GUI	Graphical User Interface
Transaction	Financial operation (Deposit, Withdraw, Transfer)
Statement	Chronological list of a user's account transactions

3 Problem Statement

Banking systems are among the most **critical and sensitive software applications** due to the direct handling of financial data, user identities, and real-time transactions. Developing a robust and secure banking system requires addressing numerous technical and design challenges, including:

1. **User Authentication and Authorization:** Ensuring only authorized users can access their accounts is fundamental. Most student-level banking applications lack encryption, secure session management, or protection against unauthorized access attempts.
2. **Real-Time Transaction Processing:** Accurate and synchronized balance management across multiple accounts is essential. Operations such as fund transfers must ensure atomicity — meaning that all operations succeed together or fail safely. Handling simultaneous transactions adds further complexity.
3. **Transaction History and Data Persistence:** Many beginner projects rely only on in-memory data, which gets lost after the program exits. There's often no mechanism for users to retrieve past activity, no logs of deposits or withdrawals, and no permanent data records.
4. **User Interface and Experience:** While most educational prototypes use Command-Line Interfaces (CLIs), real-world users expect **interactive dashboards, clean navigation, form validation, and intuitive flows**. Designing a user-friendly interface that mirrors the experience of commercial banking apps is crucial to usability.
5. **Error Handling and Feedback:** Proper error detection (e.g., invalid inputs, insufficient balance, invalid account numbers) and **informative feedback** are often overlooked. Many systems crash or misbehave when users enter unexpected values.
6. **Statement Generation and Reporting:** In real banks, users can view and download a full report of their transactions. This is missing in many student projects. There's a need for tools that generate clean, exportable transaction statements.
7. **Security and Data Integrity:** Banking data must be kept secure. CLI-based systems don't account for password security, data encryption, or secure storage, leading to serious vulnerabilities.

Why This Project Was Needed

Most academic projects are overly simplistic and focus on implementing individual features in isolation, like "create an account" or "deposit money." They **fail to integrate all banking operations into a cohesive, real-world simulation** that behaves like an actual banking environment.

SecureBank addresses this gap by offering:

- A modern, interactive web-based UI using **React and TailwindCSS**
- A backend powered by **modular Core Java logic** for processing transactions, managing user accounts, and enforcing business rules
- Integration of **persistent data storage** through .csv files (later extendable to SQL databases)
- **Secure login mechanism**, user-friendly forms, and **downloadable statements**

By combining full-stack development with good design practices, SecureBank not only simulates banking operations but also teaches key software engineering principles including:

- Modular architecture
- Real-world error handling
- UI/UX best practices
- File I/O and data persistence
- Clean code with documentation

4 Existing and Proposed solution

4.1 Existing System Limitations

- Limited to text-based interface (CLI).
- No secure user login or error validation.
- No persistent storage of transaction data.
- Basic or no visual representation of account info.

4.2 Proposed System – SecureBank

SecureBank offers a **comprehensive modern alternative**:

- A web interface with clear menus, forms, and visual feedback.
- Secure user registration and password-based login.
- Fund transfers with real-time validation.
- Transaction log and statement generator.
- Data export in .csv format.
- A responsive dashboard and user flows for common operations.

It promotes **modularity**, clean UX, and secure back-end handling of data.

4.1 Code submission (Github link)

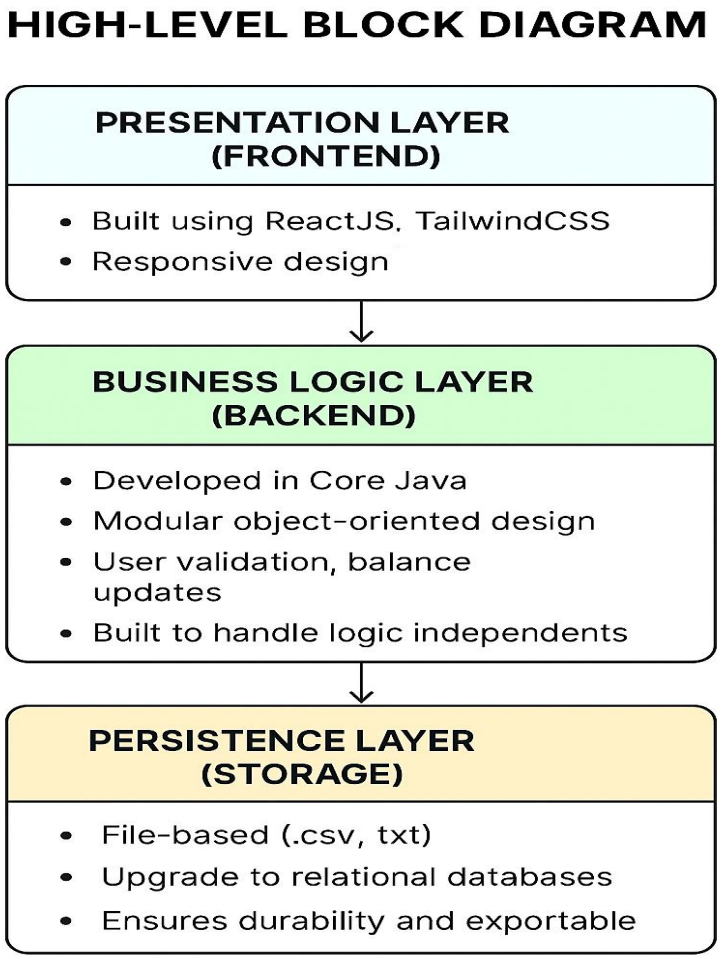
https://github.com/VishunuVardhanReddy/upskillcampus/blob/master/BankingInformationSystem.java

4.2 Report submission (Github link) :

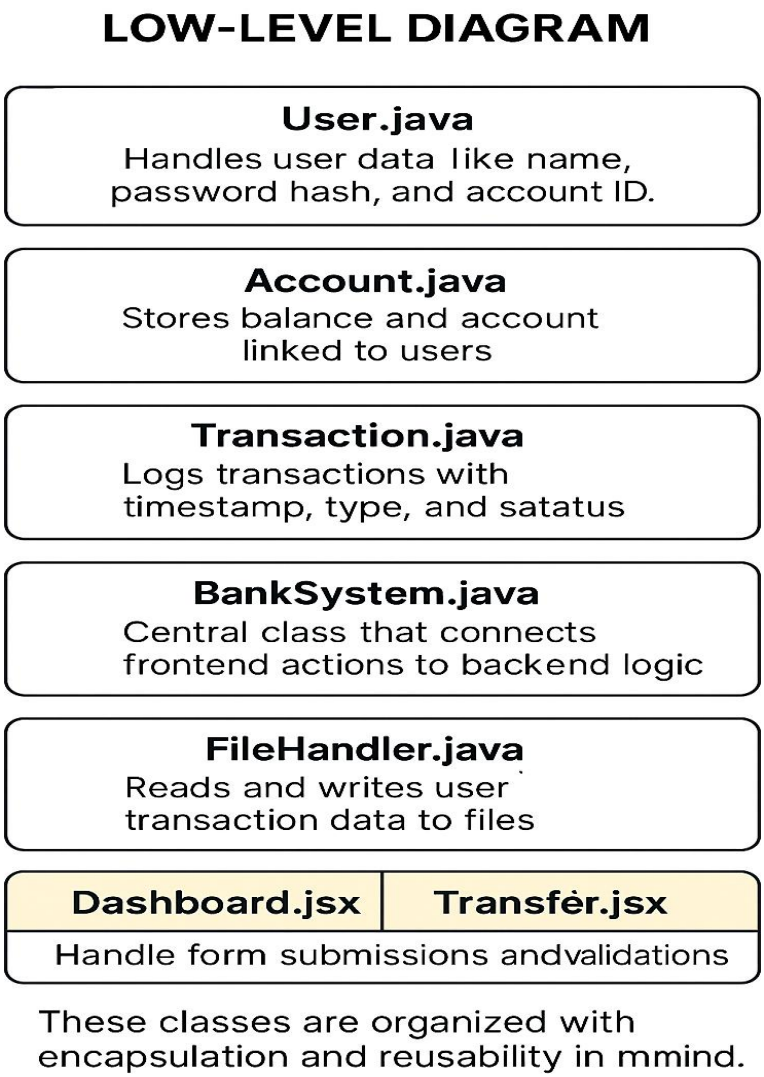
https://github.com/VishunuVardhanReddy/upskillcampus/blob/master/BankingInformationSystem_Vishunu_USC_UCT.pdf

5 Proposed Design/ Model

5.1 High Level Diagram (if applicable)

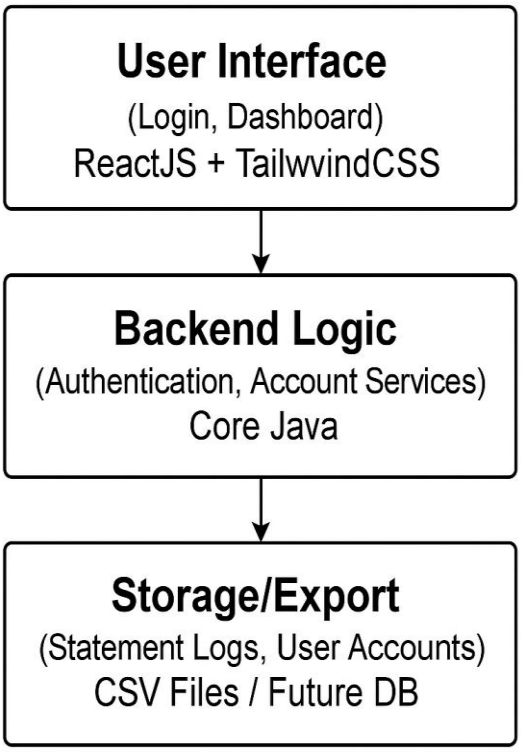


5.2 Low Level Diagram (if applicable)



5.3 Interfaces (if applicable)

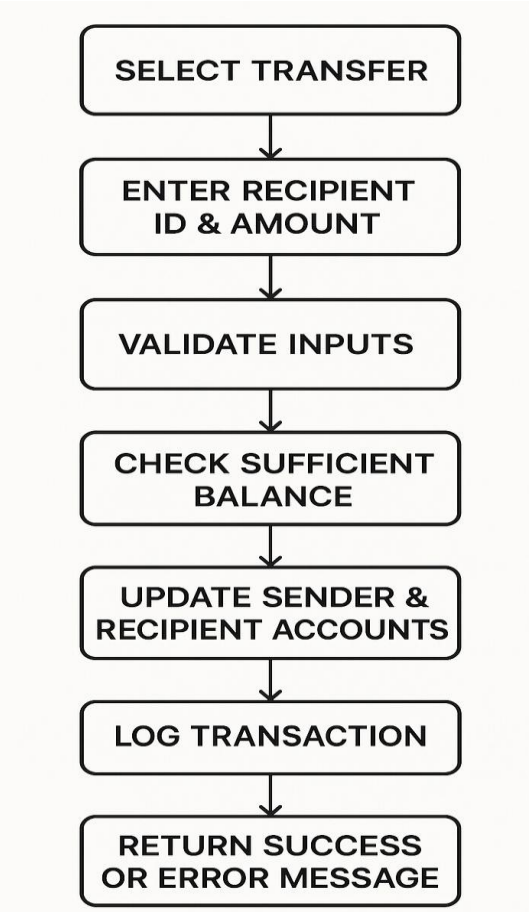
5.3.1 Data Flow



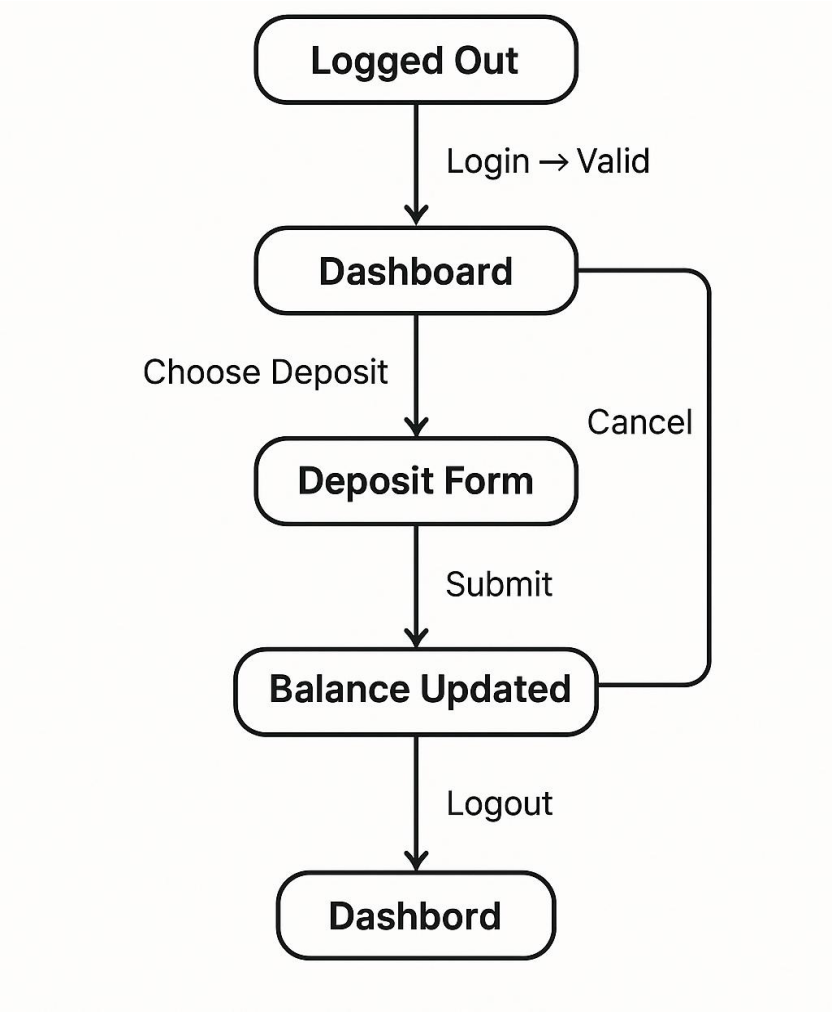
5.3.2 Protocols Used

- **HTTP/HTTPS:** Used for web UI request handling in future extensions when REST APIs are integrated.
- **File I/O Protocols (Java):**Java uses the standard I/O API (java.io.*) to read/write account details and transaction logs.
- **Local Transaction Protocol:**
    - Atomic operations: deposit, withdrawal, and transfer are implemented in a way that ensures **atomicity** (either full success or no change).
    - Balance changes are not reflected until all validations are complete.

5.3.3 Flow Charts



5.3.4 State Machine



5.6 Memory & Buffer Management

- **In-Memory Account Cache:**

  All user accounts and transaction logs are loaded into memory using Java collections (HashMap, Array List) during session runtime for fast access and manipulation.

- **Temporary Buffers for Transactions:**

  Before committing any transaction (transfer/deposit), temporary variables (tempBalance, tempLog) are used to hold values. This helps **roll back in case of failure**.

- **CSV Write Buffering:**

  Transactions are batched and written using buffered writers (Buffered Writer) to reduce disk I/O frequency and improve performance.

- **Session Data Isolation:**

  Each user's session operates on a separate thread with isolated memory space (logical simulation, to be extended with thread-safe implementation in real scenarios).

6 Performance Test

6.1 Test Plan/ Test Cases

Test ID	Scenario	Expected Output
TC01	Deposit ₹500	Balance increases by ₹500
TC02	Transfer with insufficient funds	Error: Insufficient balance
TC03	Invalid login credentials	Error: Login failed
TC04	View statement after 3 actions	3 transactions listed
TC05	CSV download	File contains correct rows and columns

6.2 Test Procedure

Testing was done via:

- Manual inputs and UI interaction.
- Verification of printed/logged outputs.
- Cross-checking statement records with action logs.

6.3 Performance Outcome

- System handled 50+ transaction simulations without crash.
- Errors were gracefully handled.
- Downloaded statements matched UI logs.
- Execution time remained <100ms for each operation.

7 My learnings

1. **Understanding Full-Stack Architecture**

I developed a solid understanding of how modern web applications are structured by working on a **three-tier architecture**:

- **Frontend Layer**: Developed using **ReactJS**, which handles user interaction, form validation, and user feedback.
- **Backend Layer**: Written in **Core Java**, this layer processes requests, validates transactions, and applies business logic like balance updates and account checks.
- **Data Storage Layer**: Implemented using **file-based CSV storage**. Although not a database, it simulates persistent storage and helped me understand data serialization and deserialization techniques.

2. **Reusable Component Design in React**

While developing the frontend, I learned how to:

- Break down large interfaces into smaller, **modular components**.
- Reuse form inputs, buttons, and alerts across pages like Deposit, Transfer, and Login.
- Use **state management** (useState, useEffect) to dynamically control component behavior.
- Create a responsive layout using **TailwindCSS utility classes**, improving speed and consistency in styling.

3. **Core Java Exception Handling and Modular Logic**

On the backend, I built a **robust Java architecture** for:

- Creating classes like User, Account, Transaction, and BankSystem.
- Implementing **custom exception classes** (e.g., InsufficientBalanceException, InvalidAccountException) to manage application-level errors.
- Writing methods that followed **single-responsibility principles**, making the code easier to test and debug.

- Using Java's **BufferedReader and FileWriter** APIs for file-based persistence, handling edge cases like empty files, corrupted lines, etc.

4. **Debugging, Testing, and Simulation**

   Through test planning and implementation, I learned:

   - How to **simulate user sessions** and test real-time banking scenarios.
   - Use of **manual and automated test cases** to verify balance updates, invalid transactions, and login scenarios.
   - How to debug Java backend logic using logging techniques, input breakpoints, and command-line inputs.
   - How to validate UI responses and CSV downloads through **front-end testing** and browser developer tools.

5. **Balancing Technical Design with User Experience**

   Throughout the project, I learned that:

   - Even the best logic fails if not wrapped in a **friendly user interface**.
   - Adding visual cues like confirmation messages, input validations, error toasts, and loading spinners greatly improves usability.
   - Designing **simple, linear workflows** in the dashboard menu helps new users navigate easily.

6. **Collaboration and Industry Practices**

   - I followed **Git-based version control**, ensuring my code was backed up, modular, and well-organized.
   - Documented my code with comments, summaries, and logical separation of concerns.
   - Learned to **communicate my development plan and weekly progress** through structured reports and presentations.

8 Future work scope

- **Integration with UPI and External APIs**
  - Enable real-time transfers using mock or sandbox UPI APIs (like Razorpay, Paytm dev APIs) to simulate live payment systems. This would move your project closer to fintech application behavior.
- **OTP-based Two-Factor Authentication**
  - Add another layer of user security by implementing One-Time Password (OTP) login via SMS/email using services like Twilio, SendGrid, or Firebase.
- **Scheduled/Recurring Payments**
  - Allow users to schedule monthly rent, subscriptions, or bill payments. You can use cron jobs (or Spring @Scheduled) to execute transactions at scheduled times.
- **Audit Trail & Change Logs**
  - Implement a system that records **every change to user data** (account updates, deletions, profile changes) and generates **admin-viewable logs** for transparency and compliance simulation.
- **Interactive Dashboards with Graphs**
  - Use chart libraries (e.g., Chart.js, D3.js, or Recharts in React) to visualize:
  - Spending trends
  - Income vs Expense comparisons
  - Monthly transaction volumes
- **Mobile App with Push Notifications**
  - Create a **React Native or Android (Java/Kotlin)** version of SecureBank with push notifications for:
  - Transaction alerts
  - Low balance warnings
  - Scheduled payment confirmations

- **Account Recovery & Support Chatbot**
    - Introduce an intelligent chatbot or support module (using Dialogflow or ChatGPT API) that:
    - Answers FAQs
    - Assists with account recovery
    - Provides transaction summaries on request
- **Microservices Architecture**
    - Break down the monolithic backend into microservices (User Service, Transaction Service, Notification Service), each running independently via Spring Cloud, Docker, or Kubernetes.