MOBILE BANKING APP DEVELOPMENT AND TESTING

Project report submitted in partial fulfillment of the requirement for

the degree of Bachelor of Technology
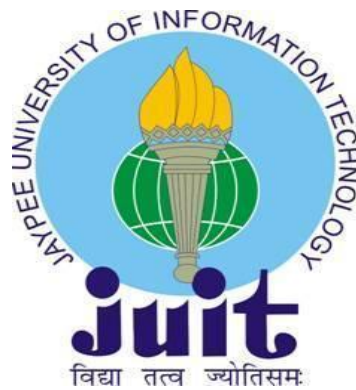
in

Computer Science and Engineering

By

Jeet Dhamija (191377)

Under the supervision of

Mr. Siddhartha Dutta

Dr. Saurabh Shrivastva

Dr. Ruchi Verma

Department of Computer Science & Engineering and the

Information Technology

Jaypee University of Information Technology Waknaghat,

Solan-173234, Himachal Pradesh

CANDIDATE'S DECLARATION

I hereby declare that all of the work carried out in this report with the title "Mobile banking development and testing" for partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering/Information Technology submitted in the Computer Science & Engineering Department, the Jaypee University of Information Technology Waknaghat is a genuine record of my own effort carried out over a period from February 2023 to May 2023 under the supervision of Mr. Siddhartha Dutta, Vice President, Shivalik Small Finance Bank, Dr. Saurabh Shrivastva & Dr. Ruchi Verma (HSS and Computer Science and Engineering Department). I also validate that I have carried out the above-mentioned project work under the proficiency stream Artificial Intelligence The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Jeet Dhamija (191377)

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

Mr. Siddhartha Dutta
Vice President
Shivalik Small Finance Bank

Dr. Saurabh Shrivastva
Assistant Professor
Department of Mathematics

Dr.Ruchi Verma
Assistant Professor
Department of Computer Science and Engineering

PLAGIARISM CERTIFICATE

ACKNOWLEDGEMENT

TABLE OF CONTENTS

Chapter 5 Result

LIST OF FIGURES

LIST OF ABBREVIATIONS

- API: Application Programming Interface

- CASA: Current and Savings Account

- KYC: Know Your Customer

- OTP: One Time Password

- PAN: Permanent Account Number

- CIBIL: Credit Information Bureau (India) Limited

- CRIF: Center for Research in International Finance

- CIF: Customer Information File

- IMPS: Immediate Payment Service

- NEFT: National Electronic Funds Transfer

- RTGS: Real Time Gross Settlement

- WIP: Work In Progress

- AEPS: Aadhaar Enabled Payment System

- PIN: Personal Identification Number

- OD: Overdraft

- REST: Representational State Transfer

- SOAP: Simple Object Access Protocol

- JSON: JavaScript Object Notation

- MSME: Ministry of Micro, Small & Medium Enterprises

- SFB: Small Finance Bank

- SQL: Structured Query Language

- SSMS: SQL Server Management Studio

- CRM: Customer Relationship Management

- CRUD: Create, Read, Update, and Delete

ABSTRACT

Designing and implementing a secure, user-friendly interface that enables users to access their financial accounts and conduct transactions on their mobile devices is a necessary step in developing and testing a mobile banking application. Building the application architecture, connecting it with back-end systems, putting security controls in place, and testing the programme's usability and functioning are all parts of the development process. Testing include carrying out many kinds of tests, including functional, performance, security, and usability tests. To make sure the programme is stable, responsive, and safe for users, testing is done. In order to provide users with a seamless and safe experience, designing and testing a mobile banking application takes careful planning, teamwork, and testing.

CHAPTER 1 : INTRODUCTION

1   Company

Shivalik Small Finance Bank has always placed a strong emphasis on technology, with customer centricity as a fundamental tenet. The Infosys Finacle Core Banking and Digital Banking Suite, which includes online and mobile banking, power the Bank. The Bank has unequalled agility thanks to the cloud-based architecture, which enables cost-effective scale management and growth. Shivalik is a direct member of the National Financial Switch and is accessible on all retail payment platforms.Shivalik became the first bank in the history of India to transition from an urban co-operative bank to a small finance bank. The Bank has over 23 years of banking experience in offering retail banking products and services. Shivalik is live on every retail payment platform and is a direct member of the National Financial Switch. We are proud to serve our 4.5 lac unique customer base through 31 branches and 324 banking agents. The Bank services the needs of more than 20,000 borrowers across the states of Uttar Pradesh, Madhya Pradesh, Delhi and Uttarakhand.

Fig1.1 Shivalik small finance bank logo

1.1 Footprint

Shivalik continues to stand as a retail focused bank addressing the rising needs of the lowest-income economic strata in the areas of its presence, through a combination of loan responsiveness, superior service and affordable cost – a compelling value proposition. From the outset, the bank has focussed on India's small businesses. The needs of their businesses and their expanding working capital requirements form the core of our lending book. In addition, we focus on catering to the personal needs of the business owners too through products such home loans, personal loans, education loans and others. India's small

businesses and business owners are the mainstays of the local economy in many regions and Shivalik aims to be the go-tobank for them. Shivalik has 31 branches across the states of Uttar Pradesh and Madhya Pradesh. In Uttar Pradesh, it is present in Saharanpur, Shamli, Meerut, Muzaffarnagar, Hapur, Ghaziabad, Noida (National Capital Region) and Lucknow. In Madhya Pradesh, it has its presence in Indore, Dhar, Khargone, Ujjain and Dewas

1.2 Awards and Recognition

- Received 'Client Innovation Award' for customer journey reimagination and modern technology-led innovation at Finacle Client Awards, 2020.
- Received 'Banking Service Excellence Award' in 2017.
- Received 'The Best I.T. Head FCBA Award' in 2016.
- Adjudged with India's top 100 cooperative banks 2015 awards and received 'Certificate of Excellence' by BitStream Mediaworks.
- Received 'Young Achiever's Award' by Hindustan Media Ventures.
- Mr. Suveer Kumar Gupta (MD and CEO) was awarded 'The Best Youth CEO' under the mid-sized co-operative bank category in the FCBA Awards

1.3 Products & Services

Deposits
- Savings
- Fixed deposits
- NRE deposits
- Flexi recurring deposits
- Current
- Door-to-door deposits

Loans
- Home loans
- Personal and consumption loans
- Gold loans
- Car / auto loans
- Two-wheeler loans
- Loans for working capital
- Reverse mortgage loans
- Roof top solar loans
- Loans to professionals and self-employed
- Loans for micro/SSI units
- Retail traders loans
- Commercial building loans
- Commercial vehicle loans
- Self Help Groups (SHG) & mini SHG
- Loans against warehouse receipts
- Shivalik Green Card (Kisan Credit Card)
- Agriculture term loans

Digital Services
- Internet banking
- SMS banking
- Debit card
- ATM banking
- Cash deposit machines
- POS machine
- AEPS (AADHAR Enabled Payment System)
- Fund Transfer (RTGS/NEFT/IMPS/NACH)
- e-commerce
- Mobile banking

Add-on services
- Insurance
- Remittances
- Lockers
- Business correspondents
- Forex

Fig 1.2 List of products and services

1.4 Credit Portfolio

Shivalik Bank's competent credit management is built around a riskmanaged, balanced and diversified portfolio of loans and advances. We are focused on small ticket size borrowers in retail segments serving the hinterlands. Our focus on secured lending makes it possible to hedge the company's exposure to unforeseen market developments and not risk the company's loans and advances portfolio through economic cycles, a fact that is visible with the asset quality the Bank has shown through the ongoing pandemic. The Bank's diversified credit portfolio comprises credit products for a range of needs of individuals and MSMEs through products such as business loans, housing loans, loans against property, gold loans and Microfinance. Key highlights for FY2020-21 were:

● Maintained asset quality better than most peers with a Gross NPA of 3.9% as on March 31, 2021. This included pro-forma NPA of 1.6%, which were recognized in the last week of the financial year following the removal of the stay on NPA marking.

● Grew the loan portfolio by 12% over prior year including 2x growth in gold loans (at 75% LTV), which emerged as a key segment to focus on during the pandemic, offering immediate liquidity to customers and a safe product class for the Bank

● Shivalik offered a moratorium to its customers as a default option but launched an awareness campaign for customers around the need to opt out if they could. As a result, the moratorium uptake at Shivalik by August end was 56% vs other UCBs of 64% and SFBs at 68%.

● Maintained a secured lending focus with 90% of the Bank's portfolio backed by property, gold or fixed deposits.

● Continued its focus on priority sector lending and loans below H25 lac in preparation of the transition to become India's first SFB from a UCB. In recent years, even as India's banking sector widened its credit portfolio of

unsecured loans, Shivalik has remained away from this category and this decision has been vindicated during the ongoing pandemic.
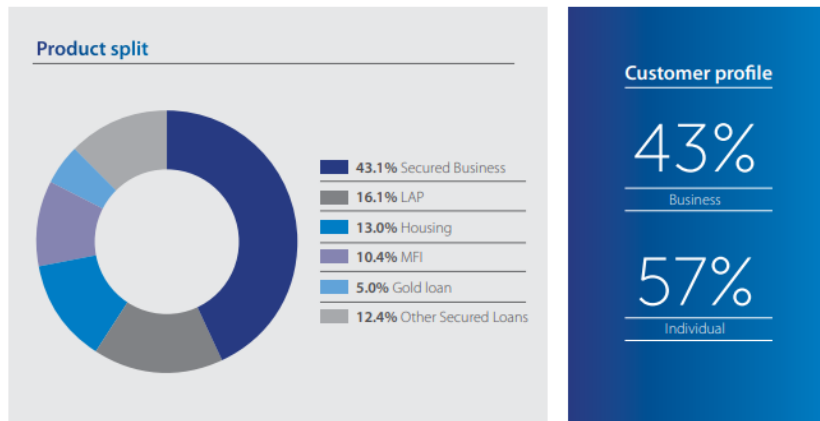
Fig 1.3 Product Split Graph

1.5 Performance During FY 22-23

We are pleased to announce that Shivalik Mercantile Co-operative Bank grew its total deposits by 9.2% to H1,245 lac in FY2022-23. The Bank's CASA ratio increased to 31.1% during the year under review. Meanwhile, the total advances increased by 12% in FY2020-21, out of which loans up to H25 lac comprised 52.5% of the portfolio. The Bank's NII grew by 7.3% to H4918 lac, while the NIM stood at 4.16% for the year ended March 31, 2021. Shivalik displayed strong asset quality, withstanding the pandemic due to its secured lending philosophy. It ended the year with a Gross NPA of 3.9%, which included 1.6% of pro-forma NPAs marked post the lifting of the stay on NPA marking by the Hon'ble Supreme Court on March 23, 2021. Given that the Bank has to follow due timelines for recovering through the auction of col laterals, the recoveries materialized in the subsequent financial year. Shivalik recorded a profitable year in FY2022-23, with the pre-provisioning operating profit standing at H922 lac,

a year-over-year increase of 166% and the profit after tax being valued at H331 lac, witnessing a rise of 47% over the year. The Company's employed capital increased during the year under review, primarily in preparation of the Bank's transition from a co-operative bank to a small finance bank.

1.6 Shivalik's Customer Focus

Shivalik's customer focus During the pandemic, we reached out to all our customers through telephonic communication with the objective of checking on the well-being and health of the customers as well as checking if any banking related support was required. Each branch was given the task with the responsibility to reach all customers. Besides, the customers were encouraged to make transactions over digital channels - e-banking and m-banking. Registration for both of these services was made available over SMS banking to ensure that the customers could access banking services without leaving the security of their homes. Transaction limits on digital channels were enhanced after obtaining additional insurance coverage by the Bank to protect customers in case of any cyber frauds. This allowed the customers to manage their fund transfers with ease on the Bank's internet and mobile banking platforms. There were cases where the customer's KYC was expiring. In such cases, additional time was granted to complete their re-kyc without putting any restrictions on their accounts.

1.7 Key Digital Banking And Technology Developments

 Shivalik continued to strengthen its technology framework in FY2020-21, having rolled out a new core banking application in the previous financial year along with an enhanced and featurerich digital banking suite of internet and mobile banking products. From a customer stand point, the Bank went live on UPI and QR-based payments. This was a definite need of our customers especially with the pandemic accelerating the use of digital transactions. In addition, digital transaction volume increased substantially in the prior year with

80% of all transactions in the Bank being on one digital channel or the other. Penetration of internet and mobile banking channels increased between 2-3x over prior year. The Bank's digital channels were appreciated by the customers in their time of need. In addition, the Bank introduced the SMS-based activation of digital channels as well which allowed first time digital users to quickly activate these services. For employees, remote working facilities with the ability to video conference from any device was introduced. In addition, mobile-based learning programs and virtual town halls were conducted to ensure that employee learning and motivation remains high through the challenging period of the pandemic.

1.8 Transition To a Small Finance Bank

The Bank received an in-principle approval to transition from a co-operative bank to a small finance bank in January 2020 from the Reserve Bank of India. Shivalik was the first bank to receive this approval under the RBI scheme. This warranted the formation of a banking company, design processes to transfer assets and liabilities from the co-operative society to the banking company after factoring all material factors (including taxation) This was a pioneering journey undertaken by your Bank and it is fitting in its journey where Shivalik has been a pioneer on so many fronts, such as being the first multistate urban co-operative bank in UP and being the first to host its core banking technology infrastructure on cloud. The management and the operating teams have worked incredibly hard in the FY2020-21 to complete the major steps involved in the transition. The Bank was able to show a readiness for transition to the RBI by late 2020 and on January 1, 2021, the Bank received the license to operate as a small finance bank, thereby making history in the process. Within a few months of this, the Bank pushed ahead and went live as a small finance bank on April 26, 2021, ahead of the 18 month timeline allowed by the RBI from the date of the in-principle approval.

1.9 The Pandemic Impact

The pandemic has inspired a rethink in a number of approaches in the way business will be done in the future. The cumulative impact of these changes could translate into a fundamental change in the way banks operate. For one, we believe that the transition of banks from physical locations will accelerate towards the digital model; this will moderate costs on the one hand, strengthen our virtual presence, deepen a hybrid approach with a growing smartphone relevance and put a premium on superior customer service. Thanks to sweeping digitalisation, banks are increasingly using digital channels to offer a range of services, including the onboarding of new customers through video KYC, deposits, withdrawals, outward remittances and payment collections, among others.

1.10 Outlook

The decline in the pandemic outbreak could not be sustained as there was a sharp second wave of the COVID-19 pandemic towards the later part of FY2020-21, which spilled into April and May 2021. This rebound did not affect the country's economy as severely in the first quarter as it had done in the previous corresponding quarter of FY2020-21; India recorded a YoY GDP growth of 20.1%. As of October 2021, the country had vaccinated over 100 crore people, catalysing the economy. IMF projects that India is likely to report GDP growth of 9.5% during FY 2021-22, primarily on account of extensive vaccine rollout. Besides, the global economy is projected to grow at 5.9% in 2021, mainly on account of the accelerated global vaccine rollout, coupled with additional policy support within the large economies. In FY 2021-22, we see exciting prospects as we transition to Shivalik Mercantile Cooperative Bank. There will be a growing focus on servicing the growing needs of small businesses. The newly-turned small finance bank will balance the brick-centric and click-driven model, the latter being catalyst by partnerships with fin techs. We believe that a prudent investment in technology will empower the company to enhance earnings, widen the net interest margin and strengthen asset quality. In view of this, we believe that the Bank will grow operations profitably, the basis of business sustainability. I must assure our stakeholders that this direction will only

accelerate as we have transitioned from an urban co-operative bank to a small finance bank, empowering our customers and building a stronger bharat

2 Regulating Bodies
2.1 RBI

The Reserve Bank of India, the nation's central bank, began operations on April 01, 1935. It was established with the objective of ensuring monetary stability and operating the currency and credit system of the country to its advantage. Its functions comprise monetary management, foreign exchange and reserves management, government debt management, financial regulation and supervision, apart from currency management and acting as banker to the banks and to the Government. In addition, from the beginning, the Reserve Bank has played an active developmental role, particularly for the agriculture and rural sectors. Over the years, these functions have evolved in tandem with national and global developments This book aims to demystify the central bank by providing a simple account of the Reserve Bank's operations and the multidisciplinary nature of its functions. The Bank today focuses, among other things, on maintaining price and financial stability; ensuring credit flow to productive sectors of the economy; managing supply of good currency notes within the country; and supervising and taking a lead in development of financial markets and institutions. The book serves to highlight how the Reserve Bank's decisions touch the daily lives of all Indians and help chart the country's economic and financial course. We hope that readers would find the book, authored by the staff of the Bank, useful in getting a better appreciation of the policies and concerns of the Reserve Bank

2.2 NPCI

The Reserve Bank of India (RBI) and the Indian Banks' Association (IBA) launched the National Payments Corporation of India (NPCI), an umbrella organisation for managing retail payments and settlement systems in India, in accordance with the provisions of the Payment and Settlement Systems Act, 2007, in order to build a strong payment and settlement infrastructure in the country.

With the intention of providing infrastructure to the entire Indian banking system for both physical and electronic payment and settlement systems, NPCI was established as a "Not for Profit" Company in accordance with the provisions of Section 25 of the Companies Act 1956 (currently Section 8 of the Companies Act 2013). This was done in consideration of the utility nature of NPCI's objects using technology to increase operational efficiency and expand the use of payment systems.

State Bank of India, Punjab National Bank, Canara Bank, Bank of Baroda, Union Bank of India, Bank of India, ICICI Bank Limited, HDFC Bank Limited, Citibank N. A., and HSBC make up the list of the ten core promoter banks. The shareholding was broadened in 2016 to include 56 member banks and other banks from various industries. New organisations that fall under RBI regulation were added in 2020, including Payment Service Operators, Payment Banks, Small Finance Banks, etc. The shares were distributed in accordance with the 2013 Companies Act's applicable requirements for the issuance of equity shares through a private placement.

3 Problem Statement

A mobile banking app's development and testing can be a difficult and time-consuming process, and comprehensive testing is necessary to make sure the app is reliable and satisfies user expectations. Without AI-powered testing tools, the development and testing process may be more time-consuming and prone to human mistake, increasing expenses and delaying the release of the app. Additionally, manual testing might not be able to catch every potential problem or spot user behavior patterns that could affect the usability, performance, or

security of an app. In order to increase the effectiveness and accuracy of developing and testing mobile banking apps, as well as to make sure the app is safe, user-friendly, and meets user needs, it is necessary to investigate different techniques and technologies.

4 Objectives

The following goals might be included in the development and testing of mobile banking applications:

1. Ensure app functionality: The main goal of developing and testing mobile banking apps is to make sure that the apps work as intended and offer a seamless user experience. This entails checking that all features and functionality, such as account management, transactions, and notifications, operate as intended.

2. Improve app security: The development and testing of mobile banking apps must take security seriously. The software needs to be built to guard users' private financial data from fraud, unauthorized access, and other security risks. Conducting vulnerability analyses, adopting encryption, and adhering to pertinent security standards and laws are just a few examples of security-related goals.

3. Enhance app performance: The app's design should make it work well and give users a quick and responsive experience. Tests of the app's reaction time, load testing, and performance optimization of the app are all possible performance-related goals.

4. Make sure the app is usable: It should be simple to use and navigate. Conducting user testing, taking user comments into account, and making sure the app complies with accessibility standards are all possible usability objectives.

5. Meet organizational goals: The mobile banking app should be in line with the organization's organizational goals. This might entail boosting client engagement, boosting sales, and enhancing customer retention.

Overall, the objective of mobile banking app development and testing is to create a secure, user-friendly, and high-performing app that meets the needs of customers while aligning with the organization's business goals.

5 Methodologies

There are various methodologies that can be used in mobile banking app development and testing

The following testing procedures are available:

● Manual testing: In order to find any problems or errors, each feature and functionality of the software are manually tested. This approach can take a lot of time and might not catch every potential problem.

● Automated testing: This entails putting the app's performance, security, and other aspects to the test using automated testing tools. Compared to manual testing, this approach may be quicker and more effective, but it might also demand more resources up front.

● User acceptability testing (UAT) entails putting the software to the test on real users to find any usability problems or potential areas for development. UAT can offer insightful input on the user experience and assist in making sure the app satisfies the demands of the intended audience.

● Verify that the app performs as intended: Making ensuring a mobile banking app functions as planned and provides a seamless user experience

is the major objective of developing and testing the app. All features and functionalities, including account administration, transactions, and notifications, are made sure to work as intended as part of this.

- Boost app security: Security concerns must be carefully taken into account during the development and testing of mobile banking apps. The app's design must protect users' private financial information against fraud, unauthorized access, and other security threats. Security-related objectives can be established by doing vulnerability evaluations, implementing encryption, and adhering to relevant security regulations and legislation, to name a few.

- Enhance app performance: The app's design should make it work well and give users a quick and responsive experience. Tests of the app's reaction time, load testing, and performance optimization of the app are all possible performance-related goals.

- Make sure the app is usable: It should be simple to use and navigate. Conducting user testing, taking user comments into account, and making sure the app complies with accessibility standards are all possible usability objectives.

- Meet organizational goals: The mobile banking app should be in line with the organization's organizational goals. This might entail boosting client engagement, boosting sales, and enhancing customer retention.

Chapter 2 : REQUIREMENT

2.1 Finacle(To Create New Custom Data And Test The Api)

Leading provider of online banking systems is Finacle. To encourage better banking, we collaborate with both new and existing financial institutions. Our SaaS services and array of cloud-native solutions assist banks in improved engagement, innovation, operation, and transformation.

We are a division of Edge Verve Systems, a fully owned product subsidiary of Infosys, a market leader in technology with annual revenues of USD 15 billion.

Our functionally rich solution portfolio, compo sable design, start-up-like atmosphere, and entrepreneurial attitude set us apart from the competition. We also have a solid reputation for assisting financial institutions of all sizes in accelerating their digital transformation at scale.

Today, Finacle is used by financial institutions in over 100 countries to assist millions of businesses and over a billion people to save, pay, borrow, and invest better.

Finacle assists banks in improving interactions with their partners, staff, and clients. We accomplish this by assisting banks in creating and offering highly customised goods and services. Our suite, which is based on an original engagement hub, aids banks in client acquisition, sales, service, and

communication. In fact, banks using Finacle have seen an increase in NPS of an average of 19%.

2.1.1 Crm Server (New Cifs)

CRM Server one of the major function used in Finacle it is used to create Cifs and there are Different methods of creating cifs and there are different options of opening cifs if like QDE , normal Cif opening SQDE these all options vary as per the requirement of the bank what they suitable for the customer all these options open Cifs but with different kinds of information . Cif ID which stands for customer information file. This file contains all the basic information of the customer which is required by the bank to open an account . Every customer has an unique Cif ID and different types of accounts can be linked to it for example SBA (savings account) , CA (Current Account) and many other accounts which we will learn about in the upcoming report.

Fig2.1:Cif opening form in Finacle

2.1.2 Enrollment (New Account)

Enrollment Means Enrolling in the banks or opening an account in the bank which can be of any type SBA (savings) , CA (Current Account) , OD(Overdraft), LA(Loan Account) , FD/RD (Fixed deposit account) these all accounts are opened using finacle and done after the customer has successfully generated the cifs with the bank. There are different Interface for every account as different information is required for all types of account. Here are some screenshot attach of different types of account opening interface. Here is the image showing the interface of the account opening this particular image of savings account
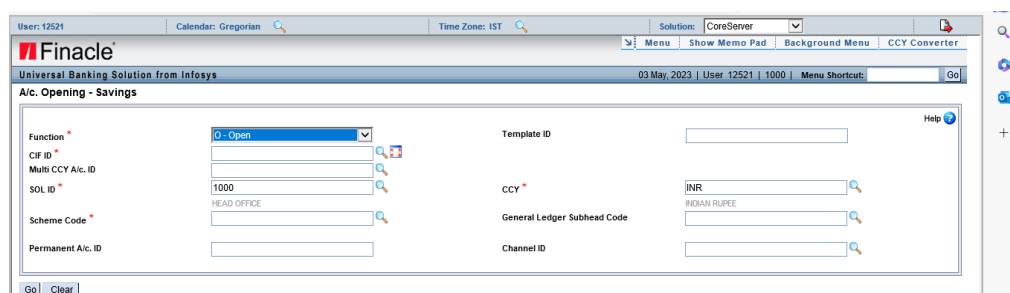

Fig2.2 Account opening form in finacle

2.2 SQL (To Collect Test And Training Data)

In order to operate Relational Databases and perform a variety of tasks, including inserting, modifying, updating, and retrieving data from Relational Databases, SQL is a standard programming language. In Shivalik bank Database plays a major role as it is confidential and contains personal information of the bank retail and co-operative customer. The set of commands used to communicate with databases is called SQL. Users can create, retrieve, update, and delete data with this tool. Of course, this is a simple explanation for such a complicated topic. Let us dig a little bit further.

- The programming language SQL was created specifically for managing data kept in a relational database management system.

- The language a programmer uses to interact with a database and change its data is called SQL.

- The developer is assisted in navigating and organizing the data as they see fit by their guiding hand, voice, and fingertips as they move across a screen.

- It is how a programmer communicates with the computer.

For those who want to work as database administrators, SQL is an essential technology because it is utilized for database architecture and management.

The work of SQL will frequently go unnoticed by persons who are not familiar with computer languages and website architecture. But those who have peeked beyond the curtain will recognize it as one of the key pillars of contemporary database architecture.

Users may deal with multiple database systems independent of the manufacturer thanks to SQL's standardized approach to database interaction. Additionally, SQL is frequently used in business intelligence and data analytics applications because it enables users to draw useful conclusions from huge datasets. As one of the most popular computer languages for managing and accessing databases, SQL was created in the 1970s.

Because of its flexibility and capacity to change, SQL, which was initially developed at IBM in the early 1970s, is simple and straightforward to use. Despite being one of the oldest languages, SQL still has "it."

SQL has firmly established itself as the foundation of data architecture, whereas so many programming languages have struggled to change over time. Need more information? Here are a few of its advantages:

Effective Use: One of the major advantages of the SQL database language is that it enables users to insert, update, remove, or retrieve data fast and easily using short commands.

Users can use administrative features and administer a database much more easily with remote access.

There are four main divisions of SQL code.

1. The ubiquitous yet well-known SELECT statement, which is further broken down into clauses like SELECT, FROM, WHERE, and ORDER BY, is used to conduct queries.

2. Data Manipulation Language (DML) is a SELECT statement subset that includes the INSERT, DELETE, and UPDATE statements as well as control statements like BEGIN TRANSACTION, SAVEPOINT, COMMIT, and ROLLBACK. It is used to add, update, or delete data.

3. The management of tables and index structures is done using the Data Definition Language (DDL). The DDL statements CREATE, ALTER, TRUNCATE, and DROP are examples.

4. Database rights and permissions are granted and revoked using the Data Control Language (DCL). GRANT and REVOKE are its two primary assertions.
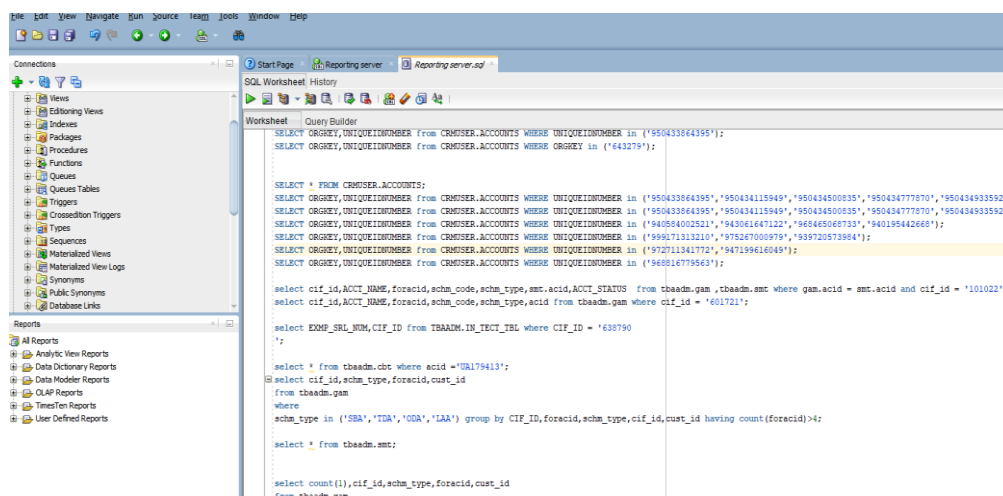

Fig 2.3 Sql commands for collecting data

Below are some common SQL commands.

- SELECT – used to retrieve data from a database

- INSERT – used to insert data into a database

- UPDATE – used to update data in a database

- DELETE – used to delete data from a database

- CREATE – used to create a new table, database, or view

- ALTER – used to alter the structure of an existing table or database

- DROP – used to drop a table or database

- TRUNCATE – used to remove all data from a table

- JOIN – used to combine data from two or more tables

- GROUP BY – used to group data based on a certain column or expression

- ORDER BY – used to sort data based on a certain column or expression

- WHERE – used to filter data based on a certain condition

- HAVING – used to filter data based on a certain condition after grouping

There were also some specific tables which we used to fetched different types of data specif to the bank requirement for example

- GAM

- HTD

- DTD

- CRMUSER.ACCOUNTS

- CRMUSER.DETAILS

And many more..

This below table is example of the gam table which contains all the bank details of the customer like name,cif,balance and much more

Fig 2.4 Sql tables with data

2.3 PUTTY (Check for the API Failures)

Putty was the software which shivalik used for unix The kernel, shell, file system, and a fundamental collection of utilities or applications are only a few of the fundamental parts of Unix, which is a modular operating system. The kernel, a master control program that offers services to start and stop programs, is at the core of the Unix operating system. Multiplexed Information and Computing Service (Multics), a time-sharing system that allows many users to use a mainframe simultaneously, was an effort by General Electric and the Massachusetts Institute of Technology.

Fig 2.5 CDCI tester

Bell Labs abandoned the project due to unsatisfactory results, but computer scientists Ken Thompson and Dennis Ritchie persisted and eventually developed the Unix operating system. Thompson and Ritchie enlisted the help of other Bell Labs researchers for this project, and the two of them created a group of components that served as the operating system's framework. A command-line interface (CLI), a hierarchical file system, and numerous small utility applications made up the components. The notions of computer processes and device files were also introduced by the OS.The kernel, shell, file system, and a fundamental collection of utilities or applications are only a few of the fundamental parts of Unix, which is a modular operating system.

Use of unix in the bank is to check the back end of each and every transaction and look into the failed transaction that why that transaction failed what was the reason and to correct that failure for future the fields that is required to initiate every transaction is pasted below.

```
Pid: 25834 16/03/2023 09:47:35.606 Received 207 Bytes
30 32 30 33 31 32 30 30 f0 30 81 01 08 00 80 00 02031200.0......
00 00 00 00 04 00 00 2a 31 36 39 39 39 39 39 39 .......*16999999
30 30 30 30 30 30 30 30 30 33 37 30 30 30 30 30 0000000000370000
30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 0000000000000000
32 33 34 32 31 35 32 31 33 31 39 38 32 30 32 33 23421521319820223
30 33 31 36 31 35 30 35 32 38 32 30 32 33 30 33 0316150528202303
31 36 32 30 30 30 36 36 30 37 31 31 39 32 33 34 1620006607119234
32 31 35 32 31 33 31 39 36 49 4e 52 33 38 20 20 215213196INR38
53 48 49 20 20 20 20 20 31 30 32 37 20 20 20 SHI      1027
20 20 31 30 32 37 31 30 35 31 30 38 39 32 20 20    102710510892
20 20 20 20 30 30 33 55 50 49 30 32 31 20 20 4d    003UPI021  M
4f 42 46 45 54 43 48 7c 37 35 33 32 38 31 35 31 OBFETCH|75328151
31 33 30 31 30 37 35 33 32 38 31 35 31 31 33 130107532815113
Pid: 25834 Received At: 16/03/2023 09:47:35.609
MessageId: 1200
Field 002: 9999990000000000
Field 003: 370000
Field 004: 0000000000000000
Field 011: 234215213198
Field 012: 20230316150528
Field 017: 20230316
Field 024: 200
Field 032: 607119
Field 037: 234215213196
Field 049: INR
Field 102:  SHI       1027    102710510892
Field 123: UPI
Field 125:  MOBFETCH|7532815113
Field 127: 7532815113
Thu Mar 16 09:47:35 2023, PID[25834], [1678940255.660]
Limo Current Version = [A1]: Process Id = [00025834]: Executing App Id = [SWIF_EXEC]:
38
[tmp_swfso001.cxx,2187]
(fnProcessScriptForISOMsg) Cannot interpret script output[tmp_swfso001.cxx,838]
(fnSWIFProcMsg) fnProcessScriptForISOMsg : Processing Request Using Script

Thu Mar 16 09:47:35 2023, PID[25834], [1678940255.707]
Limo Current Version = [A1]: Process Id = [00025834]: Executing App Id = [SWIF_EXEC]:
583 Message_Id

File=tmp_repmanag Ver=1.14 Rtn=IWGetRepFieldStrWithLen Line=2569
]
CDCI[tmp_swfso001.cxx,4684]
(fnConvertCmnToVndrSwifMsg) Cannot interpret script output[tmp_swfso001.cxx,978]
(fnSWIFProcMsg) fnConvertCmnToVndrSwifMsg : Error while Converting Cmn to Vndr msg

Thu Mar 16 09:47:35 2023, PID[25834], [1678940255.707]
File=tmp_LisrvrMain.cpp Func:main Line:1251
    ErrCode:-7 Message:Proc Msg to Function returned Error Params:
```

Fig 2.6 Back-end of the transaction

These above Image shows the transaction weather its NEFT,RTGS, UPI, ATM Deposit or Withdrawal all the transaction are shown in this way in the back-end which is fetched using APIs

Another use of Putty in shivalik small finance bank is to check the APIs failure and success given to the different partners like IGL,NOCPL,IFL,INA,KML and FSS these are the shivalik banks partner that works with shivalik small finance bank we work with API with them because we cannot share the database with them because of confidentiality so using putty we check the Failure , reason of the failure , analyse the error and try to resolve the error and another main role of the putty software is that we built custom APIs on it and we get that delivered to the vendor or the partner to run that API and that use Power BI to visualize that data and look which API is running smoothly and which one is having error and not working properly and all the function of power BI.

2.4 Power BI (To visualize the data)

Business intelligence is the main focus of Microsoft Power BI, an interactive data visualization software application. It is a component of Microsoft Power Platform. A group of tools, services, and connectors known as Power BI combine to transform disparate data sources into coherent, interactive insights

with a strong visual component. Data can be entered by reading straight from a database, website, or structured files like CSV, XML, and JSON.

The following are important parts of the Power BI ecosystem:

Desktop Power BI

The PC and desktop Windows desktop application is largely used for creating and distributing reports to the Service.

For the analyst, Microsoft Power BI Desktop is designed. Modern interactive graphics are combined with industry-leading data modeling and querying.

Electric BI Service

the internet service that is SaaS-based (software as a service). Previously known as Power BI for Office 365, this is now also known as PowerBI.com or just Power BI.

Mobile Power BI Apps

The Power BI Mobile applications for iOS, Android, Windows phones, and tablets.

Power BI Gateway

Power BI requires gateways for automated refreshes in order to sync external data into and out of the platform. Power Automate (formerly known as Flows) and PowerApps in Office 365 are also able to use it in Enterprise mode.

Integrated Power BI

Power BI users and non-Power BI users alike can create dashboards and reports in bespoke applications by using the Power BI REST API.

Server for Power BI Reports

Companies who refuse to or are unable to keep data in the cloud-based Power BI Service can use an on-premises Power BI reporting solution.

Power BI Premium

Power BI Premium is a capacity-based product that gives users the freedom to share reports widely throughout an organization without needing to obtain separate user licenses for each recipient. more scope and performance compared to sharing

Marketplace for Power BI Visuals

a visual marketplace with both custom and R-powered images. You can breathe new life into your business data and gain knowledge from this outcome.

Using Power BI Dataflow

a Power Query cloud implementation that can be used for data transformations to create a shared Power BI dataset that can be made available for various report developers through Microsoft's shared Data Service. It can be utilized as an alternative to, for instance, doing transformations in SSAS, and it may ensure that various report developers use data that has been changed in a consistent manner.

The Power BI Dataset

A Power BI Dataset can be used as a collection of information for Power BI reports and can be imported or attached to a Power BI Report. One or more Data flows can be used to connect a Dataset's to and obtain its source data.

2.5 SSFB HELPDESK (Helps in Getting Mobile banking tickets)

SSFB help desk is a portal for shivalik small finance bank in which the branch user can raise a ticket for the customer that are facing issue in their mobile banking and internet banking and for mATM lets first understand the EM/MB and micro-ATM
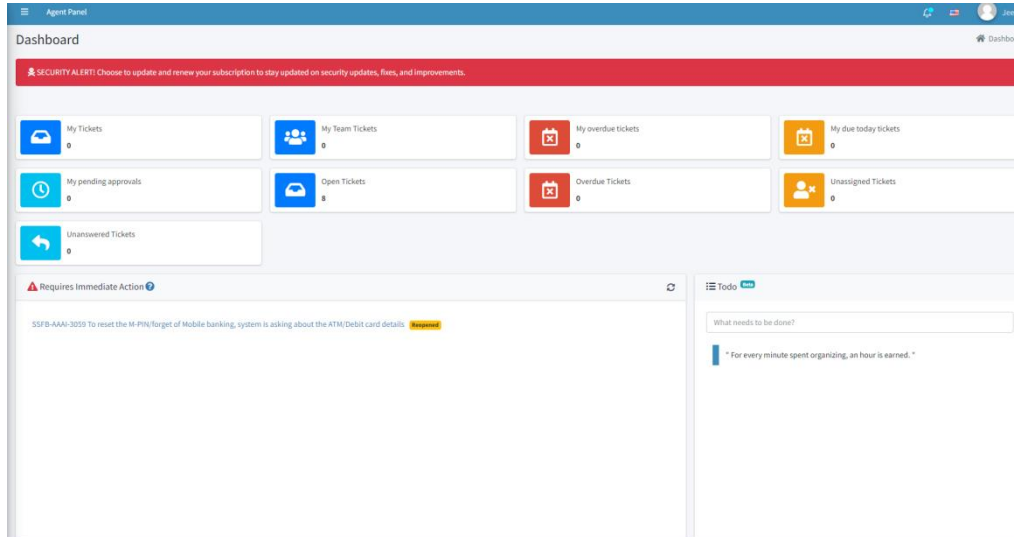

Fig 2.7 SSFB Helpdesk dashboard

Mobile Banking

A bank or other financial institution's mobile banking service enables its customers to carry out financial transactions remotely using a mobile device, like a smartphone or tablet. It uses software, sometimes referred to as an app, offered by the financial institution for the purpose, unlike the related internet banking. Typically, mobile banking is accessible around-the-clock. Some financial organizations have restrictions on which accounts can be accessed using mobile banking and set a dollar threshold for the value of transactions. The presence of an internet or data connection for the mobile device is necessary for mobile banking.

Depending on the capabilities of the mobile banking app offered, transactions through mobile banking can include getting account balances and lists of recent transactions, paying bills electronically, depositing checks remotely, making peer-to-peer payments, and transferring money between one customer's or another's accounts. Additionally, some apps allow customers to download and occasionally print copies of statements at their location.

Because a mobile banking app combines with the user's built-in mobile device security measures, using one promotes usability, speed, flexibility, and security.

Mobile banking eliminates the need for consumers to visit a bank office for non-cash withdrawal and deposit transactions, which from the bank's perspective lowers the cost of managing transactions. Cash transactions cannot be completed using mobile banking; instead, customers must go to an ATM or bank branch to withdraw or deposit cash. Nowadays, a lot of apps offer a remote deposit feature that allows users to send checks to their financial institution digitally using the camera on their device.

Mobile payments, which use a mobile device to pay for products or services either at the point of sale or remotely, similar to using a debit or credit card to process an EFTPOS purchase, are distinct from mobile banking.

Tickets Related Mobile Banking

The tickets related EM/MB are basically those tickets which customers are facing login problem, transaction problem, error in adding beneficiary , some error because of authentication related problem and much more and after the ticket we connect with the branch user and try to understand the customer problem and solve that using different tools which we will discuss in the upcoming report.

Fig2.8 Mobile banking related tickets

CHAPTER 3: SYSTEM DEVELOPMENT

3.1 System Overview

Customers can use mobile devices like smartphones or tablets to access their financial accounts and conduct transactions thanks to mobile banking apps. These apps give users a quick and safe method to manage their money while on the road without having to go to a physical bank branch.

A mobile banking app goes through numerous stages throughout development, including planning, design, development, testing, and deployment. The planning phase is when the project team establishes the specifications, target market, and features of the app. In order to find best practices and potential areas for improvement, they could also perform market research and examine competing apps.

The user interface (UI) and user experience (UX) of the app are designed using wireframes and mockups. Before beginning development, the team might also produce a clickable prototype to test the app's navigation and flow.

The project team creates the codebase for the app during the development stage using programming languages and development frameworks. They might also incorporate third-party APIs for functions like account login and payment processing.

After the app is created, testing is the next step for the project team. This include performing functional, security, and performance checks on the app and correcting any bugs or mistakes. To make sure the app satisfies the requirements and expectations of the target market, they could also carry out user acceptability testing (UAT).

Once the app is fully tested and approved, it can be deployed to the app stores or distributed to customers directly. The app may require ongoing updates and maintenance to ensure it stays up-to-date with changing technology and security requirements.

3.2 System Algorithm

In order to design and train mobile banking apps, several system algorithms are employed, based on the particular features and functions needed by the app. Here are a few illustrations:

- **Algorithms for encrypting data:** Secure mobile banking apps must include encryption, which is one of the most crucial security measures. Data like login passwords and transaction details can be encrypted using one of the many encryption methods available, such as AES, RSA, and Blowfish.

- **Machine learning algorithms:** To identify fraudulent activities, certain mobile banking apps utilise machine learning algorithms. These algorithms may be trained to spot patterns of questionable behaviour and indicate transactions that are out of the ordinary for users.

- **Biometric authentication methods:** To authenticate users and prevent unauthorised access, mobile banking apps may also utilise biometric authentication algorithms, such as face recognition or fingerprint scanning.

- **Algorithms for transaction authorization**: To stop fraudulent transactions, mobile banking applications may utilise algorithms to examine transaction data and approve or refuse transactions in accordance with pre-established guidelines and criteria.

- **customization algorithms:** Based on a user's transaction history and spending habits, certain mobile banking applications may utilise customization algorithms to give personalised suggestions and promotions.

A mobile banking app's usability, functionality, and security may all be ensured using a variety of testing methodologies. Here are a few illustrations:

- **Testing an app's core functions,** such as login, account creation, and transaction processing, is the emphasis of this testing technique. All conceivable user situations are tested in test cases, as well as the app's accuracy in handling user input and output.

- **Testing for security:** This algorithm is made to find holes in the app's security safeguards, including encryption, authentication, and authorisation. In order to guarantee that the app can survive attacks from hackers and other hostile entities, test cases are created to simulate various security concerns.

- **Usability testing:** This technique for testing focuses on evaluating the user interface and overall user experience of the app. Test cases are intended to spot problematic or confusing areas for users, such as menu design, button positioning, and navigation.

- **Performance testing:** This testing technique is made to examine how well the app performs under various circumstances, including heavy user traffic, spotty network access, and a variety of devices. Test cases are created to gauge the app's responsiveness, capacity for managing loads, and resource utilisation.

- **Testing for compatibility:** This testing technique is created to guarantee that the app is compatible with various hardware, software, and network settings. verify cases are made to make sure the app can perform correctly on multiple devices and network settings and to verify the app's compatibility with varied hardware and software configurations.

3.3 System Implementation

The following are some possible processes that may be included in the application development and testing process for mobile banking:

1. **Analysing and accumulating requirements:** Firstly, the first set business was to gather all the data and all the requirements details which is needed to be there for building an mobile banking app for example data for customer with all account variation and with cheque book or not any many more data which was required by us to building a mobile banking application

2. **Design and Prototype:** This process include designing the user interface, user experience, and technological architecture for the mobile banking app. To show off the features and functioning of the app, a prototype could be made.

3. **Development:** Utilise the chosen programming language, development tools, and frameworks to create the mobile banking app. Building and integrating several modules, such as those for account creation, transaction processing, and security measures, may be necessary to achieve this.

4. **Testing:** Use a variety of testing methodologies, such as functional, security, usability, performance, and compatibility testing, to evaluate the mobile banking app. This can entail optimising and repairing bugs.

5. **Deployment:** Make sure the mobile banking app complies with all necessary regulations and standards before releasing it to the app store. This can entail submitting the app to the app store for evaluation and approval.

6. **Maintenance and updates:** Over time, maintain and update the mobile banking app, including bug fixes, new features, and making sure it continues to function on new hardware and operating systems.
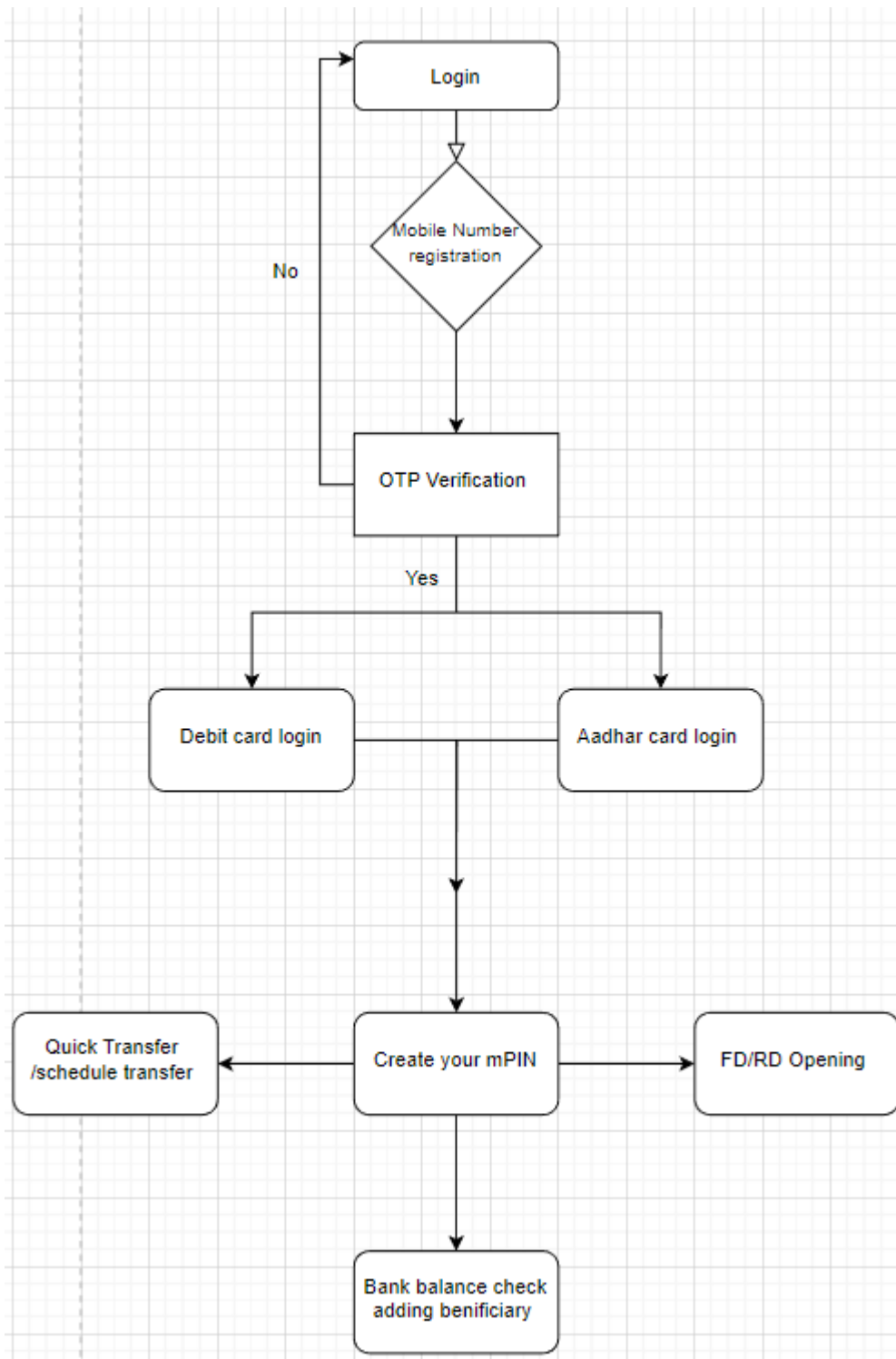
3.4 System Design

Fig3.1 Flowchart of MB App

Chapter 4 : Performance Analysis

Step 1: Registration

- On the opening screen click on get started to continue with the registration process
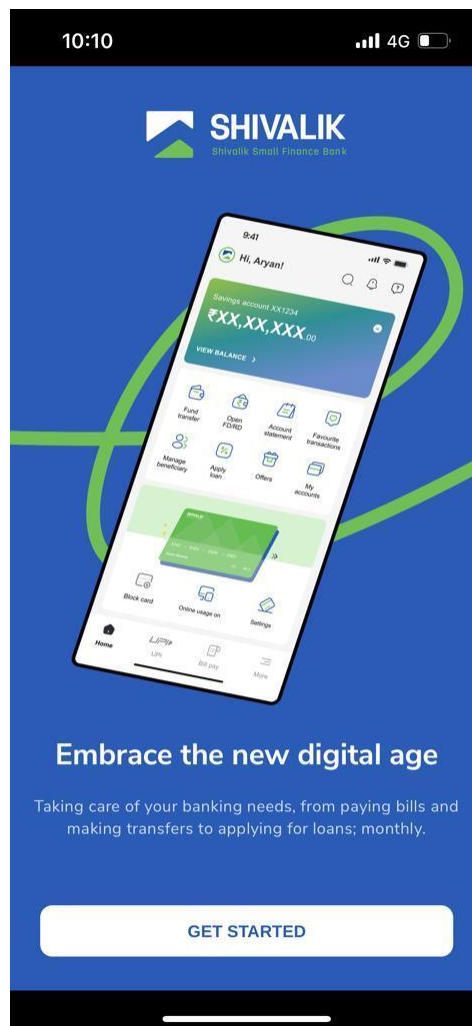

Fig 4.1 Starting screen

Step 2 : Login

- There are two ways you can login to shivalik small finance bank app via debit card or via aadhar card

- After clicking on get started you will receive a OTP on your registered mobile number
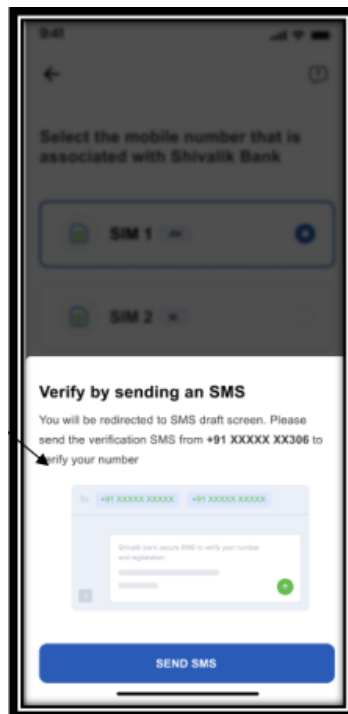

Fig 4.2 SMS verification

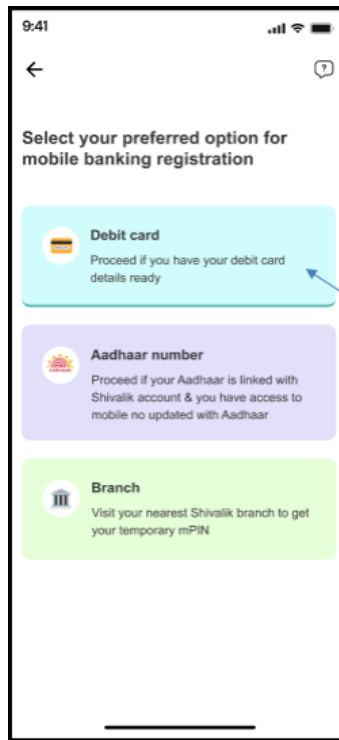- After the OTP verification you will get two option for login

Fig 4.3 Login preference

- Login with debit card

- Login with aadhar card

Fig 4.4 Debit card Details

- In Debit card login , fill your debit card details and continue

- In aadhar card login fill your customer id and aadhar number
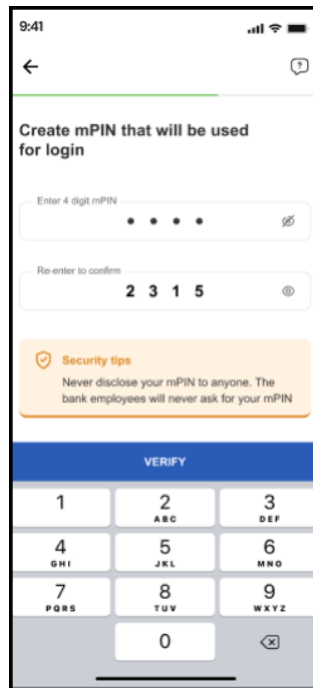
Fig 4.5 Generating mPIN

- Then Create your mPIN

- mPIN should be of 4 number non continuous for safety purpose

Fig 4.6 Biometric Authentication

- After successful creation of the mPIN now enable your biometric authentication

- You will get this message
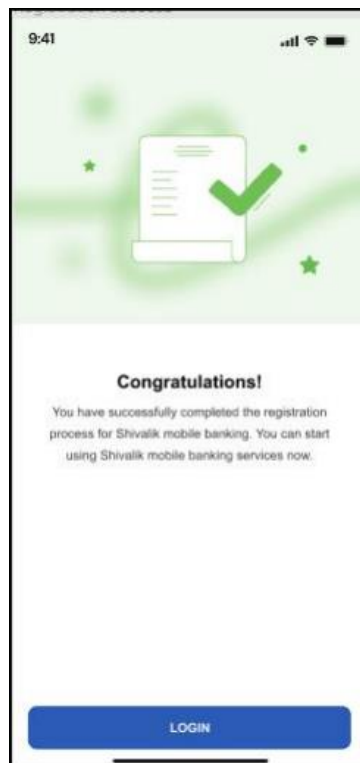
Fig 4.7 successful login

Step 3 :Post Login

Once the Registration Process completed successfully as an ETB Customer can login or view the available features.

1. Customer profile picture (optional) and name
2. Commonly asked FAQ's
3. Setup Quick balance (one time activity) and view the balance (visible for 3 sec)
4. Login through entering mPIN (4-digit) or biometric verification

5. FORGOT mPIN

6. Scan QR: to make payments (Coming Soon)

7. Pay to contacts: transfer money to contact/ phone number (Coming Soon)

8. Open Deposits: create/make payments for FD, Recurring flexi and tax saving deposits. mPIN required.

9. Calculator: To calculate loan/ deposit calculations

10. Offers: to view and access various offers eligible to user by being a Shivalik app user

11. Locate us: where user can search and view nearby Shivalik branches and ATM, along with accessing the directions, call and email

12. Deposit rates: where the user can view the current rates on deposit offered by the bank functionality

13. FAQ: to view the Frequently Asked Questions section

14. UPI (Coming Soon)
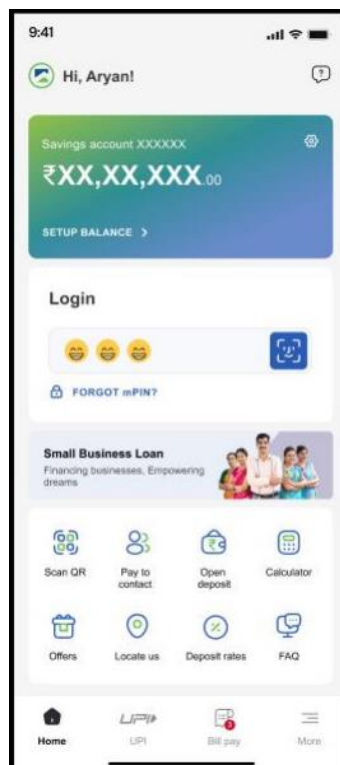
15. Bill Pay (Coming Soon)

Fig 4.8 Post login Page

Step 4 : Setup Quick Balance:

As a registered ETB Customer of the app, want to view account balance without having to login, so that he/she can quickly view their balance.

- click on the setup quick balance

- Customer shall be directed to a page where they shall have to choose primary account preference for viewing the quick balance. (This is a one-time activity) and click on CONFIRM

- Customer shall then enter mPIN / authenticate through biometric to complete the setting up of quick balance journey ➢Now When the user clicks on the Check Quick Balance button the respective account balance would be shown directly to the user for 3 seconds without having to log-in the application.

- Customer wants to disable the quick balance functionality, r clicks on the settings icon in top-right of the card, Customer shall be able to disable quick balance view functionality
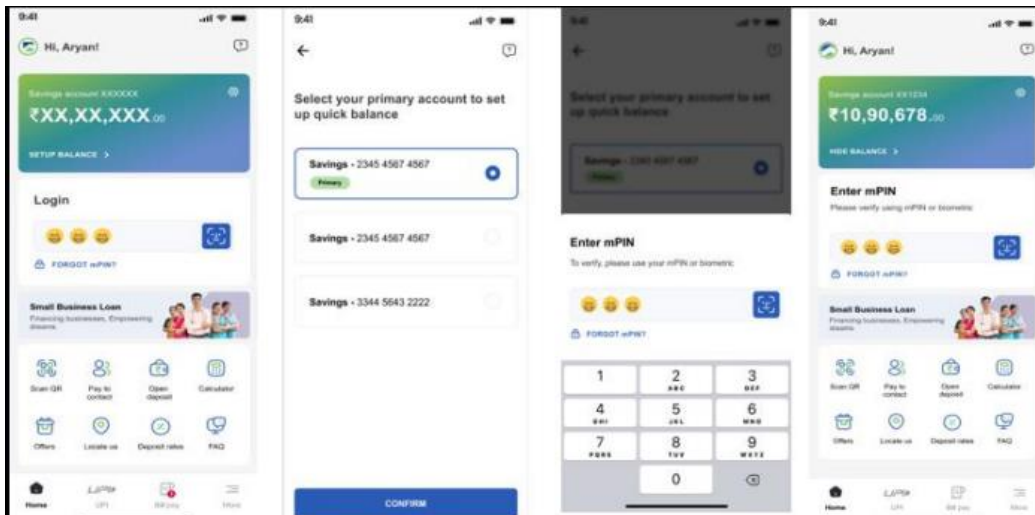
Fig 4.9 Setup balance

Some Features : FORGOT mPIN:

If Customer FORGOT their 4 digit mPIN then they can get using click on FORGOT mPIN link:

There are 2 option to get mPIN

i)   Using Debit card

ii)   Using Aadhar Number For both the above two option Customer needs to follow same instruction which are mentioned in 1.1 and 1.2

Some features : Loan calculator

Gives various features like investment, Loan EMI calculator, RD/RF and FD calculator, Customer shall choose calculator type: Loan/ Deposit
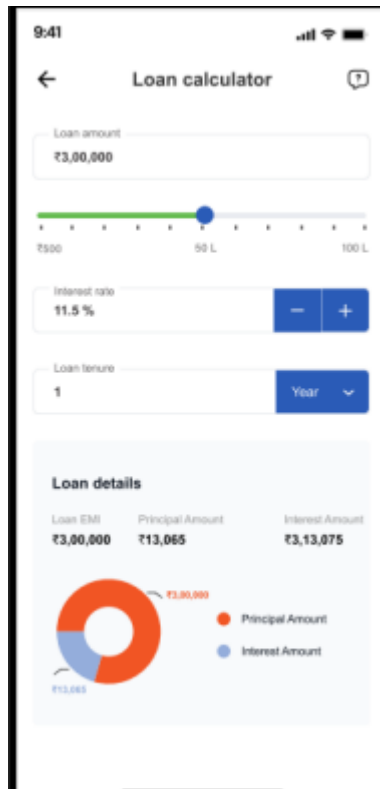
Fig 4.10 Loan calculator

Some features : Locate us

As a registered Customer of the app, I want to view the Locate Us section without having to login, so that he/she can trace nearby branches and ATM's.

Clicks on Locate Us feature from the login screen Map view of nearby Branch's and ATMs shall be visible only if the user has given permission access The icons for Branch's and ATMs shall be colour coded differently If permission access isn't given already, then access request pop-up shall appear, only after the permission access for location is provided, only then the user will be able to locate us
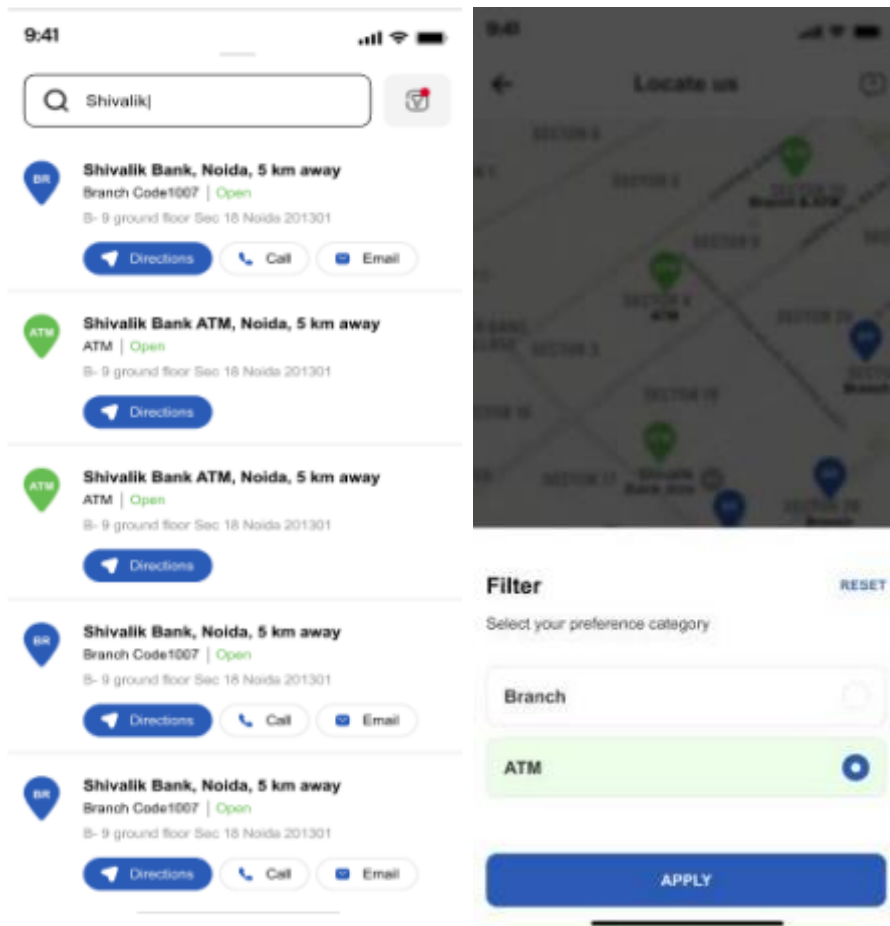
4.11 Locate us

Chapter 5: Result

5.1   Result

The outcome of creating and testing a mobile banking application includes several different elements. Here are some possible results:

- A fully functional and stable mobile banking application with all the required features and services is the main goal of the development process. The app has to be reliable, responsive, and able to securely handle user interactions and data.

- **User Satisfaction:** How effectively a mobile banking application satisfies the requirements and expectations of its users will determine its success. The programme may be improved through testing and feedback collecting to guarantee a seamless user experience, resulting in high user satisfaction.

- **Enhanced Security**: A mobile banking application must have a strong security infrastructure. Testing enables the detection of security flaws and assures the application of essential security controls, including encryption techniques, safe data storage, and defence against fraud and unauthorized access.

- **Seamless Integration:** It's frequently necessary for mobile banking applications to interface with different back-end systems, including payment gateways, core banking systems, and third-party services. Thorough testing assists in confirming the successful integration of various parts, assuring efficient operation and data flow.

- **Performance Optimization**: Testing aids in locating possible performance bottlenecks including long loading times, excessive resource use, or network latency. These problems can be resolved in order to improve the application's performance and responsiveness.

- A bug-free programme is one that has been thoroughly tested in order to find and address any mistakes, bugs, or usability problems. The likelihood of crashes, software bugs, or unexpected behaviours may be reduced by developers through extensive testing, resulting in a more dependable and stable programme.

- **Cross-Platform Support**: Mobile banking apps frequently need to support several operating systems, such as iOS and Android. A thorough testing process with a variety of hardware, software, and screen sizes guarantees that the application runs consistently and effectively on all platforms.

- **Successful Transactions:** Facilitating financial transactions is the main focus of a mobile banking application. Testing ensures that money are moved correctly, bills are paid on schedule, and balances are updated

precisely by confirming the correctness and dependability of transaction processing.

Fig 5.1 Successful transaction

5.2   Future scope

Future mobile banking applications are expected to make great strides. Mobile banking applications are expected to include cutting-edge features given the ongoing development of technology and changing customer expectations. For increased protection, this also features cutting-edge biometric authentication techniques like voice and iris scanning. Chatbots and artificial intelligence (AI) integration will offer tailored client service and financial guidance. Users will be able to conduct transactions and access financial services using speech commands thanks to voice-activated banking. While wearable device

integration will expand banking capabilities to smartwatches and fitness trackers, augmented reality (AR) and virtual reality (VR) may provide immersive experiences. It is also envisaged that the blockchain would be integrated for cryptocurrency transactions, as well as for individualised financial insights and Internet of Things (IoT) integration.

Chapter 6 : Conclusion

In conclusion, a mobile banking application's development and testing are crucial steps that set the stage for a positive and safe banking experience for consumers. A user-friendly design is built through careful development, ensuring simple navigation and accessibility to numerous financial services. An application that is stable and trustworthy is the product of thorough testing, which helps find and fix any flaws or problems. The safety of user data and transactions is ensured by the deployment of strong security measures, such as biometric authentication and encryption methods. The functionality of the app is improved by seamless connection with backend systems and third-party services. The app offers a fluid and uniform experience across devices and operating systems by placing a high priority on speed optimisation and cross-

platform compatibility. Successful testing also guarantees adherence to industry rules, boosting confidence and confidence among users. Ultimately, the culmination of development and testing efforts leads to the creation of a secure, user-friendly, and feature-rich mobile banking application, setting the stage for a successful banking journey for users.