NRB A/C Digital Onboarding Platform at Mutual Trust Bank PLC

by

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A thesis submitted to the Department of Computer Science and Engineering
in partial fulfillment of the requirements for the degree of
B.Sc. in Computer Science and Engineering

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Brac University
June 2025.

Declaration

It is hereby declared that

1. The thesis submitted is my own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. We have acknowledged all main sources of help.

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Approval

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Abstract

This thesis presents the design and implementation of the MTB NRB Account Digital Onboarding Platform created for Non-Resident Bangladeshis (NRBs). The account opening process was traditionally lengthy and time-consuming, requiring manual documentation and extensive back-and-forth communication with bank officials. But this project proposes a system that eliminates these inefficiencies by offering a fully digital, paperless, and user-centric onboarding platform.

With this solution, customers can now independently open their NRB accounts from anywhere in the world using any device. The platform supports both Self Mode, where customers open accounts independently, and Assisted Mode, where NRB officials help customers complete the process.

Acknowledgement

I would like to thank Almighty Allah first, because thanks to His mercy and advice, I finished my internship on time and faced no considerable problems.

I am deeply thankful to Md. Jahidur Rahman, FAVP and Manager, Mutual Trust Bank PLC, for letting me take part in the respected institution as an intern. The help, useful thoughts and wise advice offered by my mentor during the internship made a big difference in how I see working as a professional.

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I am thankful to every team member of Mutual Trust Bank PLC for always helping me and for providing information about the company. The conditions under which we learned made it both easy for me and valuable.

I owe many thanks to my parents for sticking by me, giving up so much and for sending me daily prayers. Their trust and drive have allowed my learning to progress to where it is today. I am here and finished my internship thanks to the love and encouragement I received all the time.

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Chapter 1

Introduction

1.1 Preamble

The banking sectors are trying to enhance customer experience and operational efficiency everyday. To achieve that banking industry is progressively adopting technologies. The MTB NRB Account Digital Onboarding Platform is a prime example of such innovation. This project introduces a self-service model allowing users to open savings accounts entirely online, without the need for visiting a bank branch or engaging in manual documentation processes.

Various contemporary technologies together with frameworks enabled the platform construction. The developers used ASP.NET Core as the main programming framework for back-end development. The platform used ASP.NET Core as its back-end technology to create a high-performance web application which utilized modules and provided strong security features across various platforms. The system used RESTful APIs to create a communication channel between front-end and back-end sections which enabled smooth data transfer throughout the platform.

The key characteristic of this platform includes processing identity verification through automation. The system implemented Optical Character Recognition (OCR) for identity verification needs. The system performs efficient digital Know Your Customer (KYC) by using text extraction from scanned identification documents. The system used OpenCV technology for implementing its liveness detection feature. It verified that the user is physically present during authentication.

The Google Translate API was added to the platform to make it more widely available. It allows the users to interact in different languages. Moreover, the system is connected to the Election Commission (EC) through secure API. It verifies National ID (NID) information in real-time provided by the user.

Amazon Web Services (AWS) Face Matching APIs are integrated into the system to enable facial matching capabilities to compare user-submitted selfies with their ID photos while maintaining a high degree of accuracy and security.

This thesis documents the development, challenges, and technical implementation of the platform, serving as a case study in digital banking innovation.

1.2 Problem Statement

The traditional process of account opening for Non-Resident Bangladeshi (NRB) customers was heavily manual. It was also time-consuming and inefficient. Customers had to go through a go through series of steps— scanning and emailing documents or engaging in extended communication with bank officials over the phone and email, which introduced significant delays and increased the risk of errors and data loss.

Moreover, the process required direct, one-on-one interactions with bank representatives, making it difficult for many NRBs to open accounts at their convenience, especially due to differences in time zones or limited access to bank branches and officials. The lack of automation not only impacted user experience but also placed an operational burden on bank staff.

The project was started to address these issues and provide solutions. The new system removes the need for physical presence or manual documentation and provides both self-service and assisted onboarding modes, improving accessibility, speed, and user satisfaction.

1.3 Project Objective

The primary objective of the MTB NRB Account Digital Onboarding Platform is to simple. It is to digitize, and secure the account opening process. Key objectives of the project include:

- **End-to-End Digital Account Opening:** NRB customers can open their accounts completely online. Customers does not need to visit a branch or deal with manual paperwork.

- **Assisted Onboarding Mode:** If customers need help, bank officials assists and guide them through the process.

- **Robust Identity Verification:** Includes OCR for data extraction, OpenCV for liveliness detection, AWS Face Matching for facial verification, and EC API for real-time NID validation.

- **Multilingual Support:** Google Translate API integration ensures accessibility for diverse NRB users.

- **Secure & Compliant Workflow:** Built-in checks ensure compliance with BFIU and FEPD regulations.

- **User-Centric Features:** Real-time alerts, e-statements, secure login via RESTful APIs, and cross-device compatibility.

The project seeks to improve customer satisfaction, speed up onboarding time, and attract more foreign remittances through these objectives.

1.4 Purpose of Documentation

According to today's International Standard for Bank Internship Programs and as a course in Computer Science and Engineering (CSE) program of BRAC University, this is my one-month report with the Mutual Trust Bank PLC. The report has two primary objectives:

General Objective: This paper's function is to assess the experiences and lessons registered from the internship program.

Specific Objective: In this program, the kind of skills that were learned are described, as the tribulations of the corporate world, and how they were conquered. Further, I emphasize my accomplishments, subactivities, and projects done during my internship as well as my development during the internship process.

This report will also be useful to future students who are likely to undertake their internee at Mutual Trust Bank PLC by providing them with relevant advice and information about the company.

1.5 Information Sources

In this report, I have included the information that was available to me, organizing it into two distinct categories:

1.5.1 Primary Data Source

- Face-to-face communication and dialogue with co-workers
- Personal experience while working at the organizational workplace

1.5.2 Secondary Data Source

- Home page of Mutual Trust Bank PLC
- Collection of information through the internet

1.6 Document Overview

The purpose of this report is to review the experience most likely gained during the period of internship. About Mutual Trust Bank (MTB) I have provided the necessary details for the reader to understand the organization and the work that I undertook and done by me. I worked for the MTB bank one of the best projects that I initiated is the Online Account Opening System for NRBs. Specifically in this project, I was able to be part of the development of an innovative solution for NRB customers residing in other countries: This is possible for opening an MTB NRB Account which does not require visiting a Branch. The Digital Customer Onboarding Platform enables customers to finish the account opening process via any device, including mobile, laptop, or tablet, and upload documents like a valid NID card. This paperless savings account offers the customer easy and more convenient and anytime access to banking services. This service provides a secure, easy-toaccess solution for NRB customers. This particular product is predicted to increase foreign remittances and therefore attract more customers to MTB and consolidate the bank's operation in the financial industry. This report can benefit teachers, students, and anybody interested in learning about how MTB functions, and what is offered at MTB.

Chapter 2

Literature Review

This project's main goal is to design a fully functional digital onboarding system for Non-Resident Bangladeshis (NRBs). The traditional process is replaced by a paperless, user-friendly, and secure platform. The project supports both Self Mode and Assisted Mode.

Modern technologies like OCR for text extraction, OpenCV for liveness detection, AWS Face Matching, and the Election Commission (EC) API for real-time identity validation are integrated into the system. It also includes RESTful APIs and, Google Translate API for multilingual support.

The system was developed using ASP.NET Core and following Agile Scrum methodology. The project delivers:

- End-to-end digital onboarding
- Identity and document verification
- Integration with core banking systems
- Real-time alerts and secure communication

In the future, the platform will evolve into a full-fledged mobile application offering automated deposits, card integration, international payment gateways, and enhanced security features like MFA and biometric login.

This program aims to increase remittance flows from NRBs and enhance operational efficiency and customer happiness, demonstrates MTB's dedication to innovation in digital banking.

2.1 Company's Profile Overview

MTB is a third-generation private commercial bank that offers general account opening services to anyone. MTB earned the DHL-Daily Star Business Awards 2015 as the Best Financial Institution of 2014. The NRB Division of MTB offers Non-Resident Bangladeshi banking services more easily where customers can open an account whenever they wish to through the Digi Customer Onboarding portal, thus reducing branch visits. It is meant to provide NRB consumers with a convenient, and efficient paperless savings account.

2.2 Mission and Vision

Mission: The mission of MTB is to deliver various products and services of high quality, thus aiming at generating important economic added value.

Vision: The Mutual Trust Bank envisions itself as:

- Ranked amongst the leading banks in Bangladesh
- A bank of the first choice among customers
- My vision could best be described as having a truly world-class financial institution

2.3 Company's Objective

MTB believes in better quality service not only meets but exceeds our client's expectations but also customer rules and requirements. MTB focuses on Ethical Value Creation for Shareholders and also advocates for social causes and employment opportunities. MTB is committed to offering different banking services to meet customer needs and also has a strong commitment to its employees by creating a diverse and harmonious workplace.

2.4 How NRB Accounts Operate

There are three types of bank accounts offered by MTB:

- **EKYC (Electronic Know Your Customer):** The observed type of account is targeted at Bangladeshi residents. For an EKYC account, one is just required to input their Date of Birth and National ID. A nominee has to be made so that wherever the account holder is dead, the amount of money is transferred to a nominee.

- **OBU (Offshore Banking Unit):** This account is for non citizens. It is for customers who come to Bangladesh for business and will require opening an account in the bank.

- **NRB (Non-Resident Bangladeshi):** This account is created for all Bangladeshi citizens living in other countries. Earlier, opening an account from abroad could take quite a long time, still, it has become easier and less time-consuming. Thankfully, as part of my project, I was involved in the NRB account process.

NRB account is an internet banking where Non-Resident Bangladeshi can open an account by providing basic personal details with account verification through mail. First of all, when the account is opened, there is a debit restraint, and the user is unable to withdraw any money from it. However, within 24 hours or less the back office team validates the account and the debit freeze is lifted.

This process is much faster than the previous offline system which used many documents and communication was done via post, which proved to be time time-consuming process. They are as follows:

2.4.1 Product Ownership

The product owner holds daily or weekly scrums to review and talk about advancements, achievements, and obstacles and engages with the development team. Being the product owner, MTB controls the project and collects the necessary information about the customers' requirements, to create a product that complies with the legal relevance.

2.4.2 Quality Assurance

At Mutual Trust Bank, there are two main units dedicated to testing:

- **Software Quality Assurance Unit:** This unit is to conduct a front-end test, as a way of ascertaining whether the user interface is deliberately designed.

- **Enterprise Network Management Unit:** The Vulnerability Assessment and Penetration Testing (VAPT) that is covered in this unit enables a methodical determination and remediation of possible security threats on networks.

2.5 User Experience Design

To elevate the user experience, NRB incorporates specific features into its website, which include:

- **REST API Implementation:**
  Promoting data interchangeability so that they become more efficient to support the interdisciplinary pursuit of a common goal.

- **Database (Oracle):**
  Making use of database system facility to maintain data and effectively run the system.

- **Subdomain:**
  Presenting systematically and exclusively separated sections for the site's better structure and convenience.

- **Back Office App Management:**
  Focusing on procedural aspects of organizational activities to improve actual communications with customers.

2.6 Partners and Sponsors

- **OCR-Google API:**
  The API gives precise and swift, making it a complete tool for text extraction in different uses.

- **EC:**
  By partnering with cutting-edge technology providers, the EC (Election Commission) enhances the efficiency and security of election operations.

- **Bootstrap:**
  Bootstrap makes it easier for developers to develop solutionoriented, device-compliant and therefore is a vital front-end framework.

- **Server (Local):**
  This makes sure that the handling and storage of data are measured within the organization thus making it secure and performing well.

- **Database (Oracle):**
  Oracle's database solutions are scalable, secure, and high-performing is one of the reasons it is popular with large organizations.

2.7 How Mutual Trust Bank Operates Business

Here's a general overview of how MTB operates its business:

2.7.1 Retail Banking Services:

- **Savings and Current Accounts:**
  Current and savings account for routine transactions and deposits.

- **Loans and Mortgages:**
  Car loans, home loans, and other personal credit facilities.

- **Debit and Credit Cards:**
  Here MTB offers several cards for personal and business purposes allowing buyers to make payments and withdraw cash freely.

- **Digital Banking:**
  MTB's internet banking, mobile banking, and ATM banking services enable customers to open accounts, pay bills, and transfer funds online.

2.7.2 Corporate Banking Services:

- **Business Accounts:**
  MTB provides different account facilities to business establishments such as current accounts and other accounts for companies.

- **Business Loans and Trade Finance:**
  MTB assists corporate clients in operating expenses through working capital financing, trade financing, and export/ project financing.

- **Treasury and Foreign Exchange Services:**
  The bank also provides foreign currency services; this includes advising businesses on how to counterbalance the risk of fluctuations of foreign exchange.

2.7.3 Non-Resident Banking (NRB) Services:

MTB serves NRBs with specialized services:

- **RB Accounts:**
  This encompasses services such as money transfers and other internet-based activities including banking.

- **Remittance Services:**
  Through MTB, foreign remittance is attracted to the bank since it supports the transfer of money from NRBs to their families in Bangladesh.

2.7.4 Future of Business:

- **Digital Onboarding:**
  Customers can even open accounts over the web, thereby not having to move around to branches physically.

- **Mobile Banking and Payment Solutions:**
  Currently, mobile banking allows clients to transact with the bank through applications from their mobile devices for security reasons too.

- **Integration with Fintech:**
  MTB offers alternatives including touchless payments, instant payments, and mobile money through alliances with innovative businesses.

2.7.5 Compliance and Security:

- **KYC and AML Compliance:**
  The bank operates under the Know Your Customer Act and the Anti Money Laundering to confirm the honesty of transactions.

- **Data Security:**
  To guarantee the potential protection of client information and transaction records, the bank utilizes the most recent encryption and security methods.

2.8 The Software Development Methodology

The primary business objective of MTB is customer satisfaction which both Agile as well as Scrum meet since both forms require client interaction and flexibility. These methodologies are integrated into MTB's development phases to ensure client satisfaction through efficient and integrated practices. These are as follows:

2.8.1 Requirements Gathering

After collating all the relevant data, technical and economic merits are examined by the development team. Moreover, this process involves risk assessment, the definition of communication objectives relative to the business objectives of the project, and the integration of the client feedback as to the approach proposed.

2.8.2 Models of Service Agreement

MTB has been exceptionally effective in offering its services since it centers on the collaboration and quality of services offered.

2.8.3 Design and Development

Once the project is identified, the development team goes through the design and development process with emphasis on quality assurance, and the gradual addition of increment features that meet the specified quality criteria and objectives critical to the customer.

2.8.4 Integration and Testing

The front end is tested by the software quality assurance team by performing unit tests that determine the accurate response of the front end and the enterprise network management unit tests the system for security threats.

2.8.5 Review

It highlights the need to bring input on the product to meet user expectations and specifications on the product.

2.9 Requirement Process

Mutual Trust Bank's requirement process helps the business stakeholders and the development team stay in close contact so that project objectives can be met as planned. To achieve these objectives several artifacts like mock-ups, and requirement documents are used.

2.10 Project Timeline

To efficiently construct the NRB Digital Onboarding Platform, we established a structured timeline by coordinating major development activities with personal requirements and available resources. This project was executed using the Agile Scrum methodology. Through frequent reviews, short sprints, and ongoing stakeholder participation, it enabled us to make progress iteratively.

2.10.1 Timeline Overview

- **How long the internship is scheduled for:**
  From January 1, 2025, until June 1, 2025

- **Duration of the Project:**
  February 1, 2025, until April 10, 2025

- **Development Phase (The most active part of construction):**
  February, March, and April 2025

The whole project was split into a series of core phases.

- In February 2025, Requirements Gathering marks the beginning of the process.

- Software Design and Development (This began in February 2025 and has continued with further refinements)

- Integration and Testing (This takes place together with the development work, with extra effort closer to the end of each iteration)

- Review & Feedback (At the end of each sprint) Each sprint included particular tasks that developed from what was achieved in the prior time frame.

2.10.2 Activities and Phases

MONTH-1:

In the first month, planning and analysis are done. From Week 1 through 4, we focused on Business Modeling.

- Resources: Things to have are a pen, paper, a laptop and mind-mapping tools.
- Personnel: Customer Communicator (CC), Planner, Technical Communicator (TC), Risk Analyzer (RA).
- Outcome: Considered how the system will handle working methods, account types and joining stages.

MONTH-2:

The team works on designing the system and developing the process. This section covers Data Modeling over the first four weeks.

- Tools: Windows 10/11 and Oracle
- Personnel: The SD is responsible for designing the various subsystems required for the project.
- Activities: Forming ER diagrams, setting up table structures and applying normalization

Process Modeling (Week 2-4)

- Tools: Both online and desktop versions of MS Word/ Excel
- Personnel: The SD is responsible for designing the various subsystems required for the project.
- Activities: Configuring onboarding for Self Mode and Assisted Mode

MONTH-3: Building, Connecting and Testing

During the first four weeks, the focus is on developing applications.

- Tools: HTML, CSS, Oracle DB, ASP.NET Core
- Personnel: Computer Engineers, Graphics Designer (GD)
- Activities: Working on the frontend user interface, the backend system, REST API and Oracle database.

Weeks 3 and 4 are dedicated to Testing & QA

- Tools: Laptop, Tablet and Mobile (since you are testing on different devices)
- Personnel: QA Testers
- Activities: Testing the process of onboarding new users, including using optical character readers, EC API and Face Matching.

Figure 2.1: Resource Requirement Chart

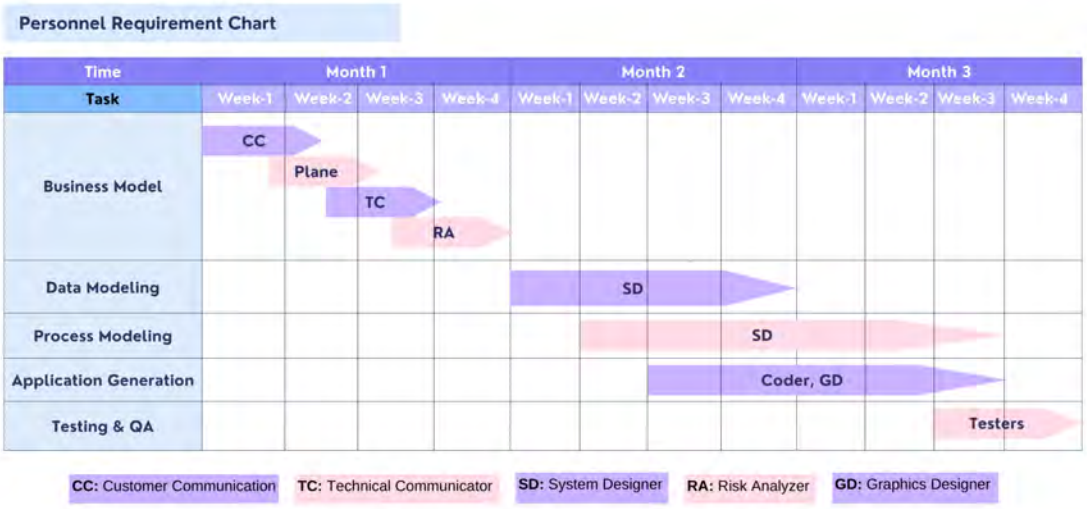


Figure 2.2: Personnel Requirement Chart

2.10.3 Sprint Cycles and Agile Implementation

Sprint Length:
Each sprint lasts for 2 weeks.

What happens during a Sprint:

- **Sprint 1:**
  The focus is on business modeling and listing requirements.

- **Sprint 2:**
  Creating and reviewing models for data and processes, designing the system's architecture.

- **Sprint 3:**
  Initial work on developing the frontend and including the API.

- **Sprint 4:**
  Development is completed, including changes to the User Interface and testing individual parts of the system.

- **Sprint 5:**
  Bugs are fixed and everything is tested for the final time.

A variety of tools and technologies have been used as the timeline progresses.

- **Tools for Development:** HTML, CSS, JavaScript, ASP.NET and Oracle DB.
- **Tools for Designing:** Excel spreadsheets and mind maps are useful.
- **Testing Tools:** An example of integration is having Postman, browser-based testing and device testing all working together.
- **Collaboration:** Scrum sessions taken once a week, checks with stakeholders and product ownership supervision.

2.11 Cost Estimation

2.11.1 Personnel Costs

Developers, business teams and testers:
3 are Developers, 3 are Business People and 1 is a Tester

Calculating the total personnel cost for a construction project:
The salary is 70,000 BDT every month.
Members on the team: 7 (3 developers, 3 business analysts and 1 tester)
The duration is set at 3 months.

Personnel Cost = 70,000 × 3 × 7= 1,470,000 BDT

2.11.2 Infrastructure Costs

- **Configuring a Local Server:**
  Installation and maintenance for one time: 45,000 BDT

- **The Oracle Database License:**
  The assumed price for academic/ institutional copies is 75,000 BDT

2.11.3 Software Costs

- **Visual Studio comes with all IDE Licenses (IDE Licenses):**
  With 5 licenses needed, the overall cost will be 15,000 BDT

- **Various Other Tools & APIs (OCR, AWS Face Match, etc.):**
  The cost for using these services is predicted to be 30,000 BDT

2.11.4 Hardware Costs

The development team will get 6 laptop units.
When you multiply 6 by 10,000, you get 60,000 BDT.

Testing Equipment:
The tablet costs 20,000 BDT
Mobile: Tk 10,000
The total amount is 30,000 BDT

2.11.5 Building Costs

- **Rent offices (Shared/allocated office spaces):**
  The bill is 60,000 BDT, as you have to pay 50 BDT/sq.ft for 400 sq.ft rented for 3 months.

- **Utilities such as electricity and water:**
  3,000 BDT $\times$ 3 = 9,000 BDT

2.11.6 Internet & Communication

- **Internet:**
  Each month of 2,000 BDT must be multiplied by 3, giving 6,000 BDT.

- **Use Slack and Zoom for messaging and videoconferencing:**
  Other costs that might arise when sending by air worth 4,000 BDT.

- **Training Programs:**
  The total cost for workshops and onboarding is 10,000 BDT.

- **Using SQA and VAPT approaches for testing:**
  About 30 hours worked × 500 BDT per hour = 15,000 Bangladeshi Taka.

Overall cost is expected to be 19.95 Lakh BDT.

1	Category	Estimated BDT
2	Personnel	1,470,000
3	Server Setup	45,000
4	Oracle License	75,000
5	IDE + APIs	30,000
6	Hardware (Laptop + Devices)	90,000
7	Rent + Utilities	69,000
8	Internet & Communication	10,000
9	Training	10,000
10	Testing (SQA + VAPT)	15,000
11		
12	**Subtotal**	**1,814,000 BDT**
13	**Final Estimated Total**	**≈1,814,000 BDT**

Figure 2.3: Total Cost Estimation

2.12 Technical Expertise

- **Web Design:** In-depth experience in HTML and CSS for creating goodlooking layouts and good experience in JavaScript and jQuery.

- **Web Services:** Specific knowledge in creating and using REST APIs and Web Service APIs.

- **Database Management:** Competent in SQL Server and Oracle to respond to database management and data storage proficiently.

- **Frameworks and Development:** Proficient in Bootstrap, ASP. NET, and Web API to implement the application having better scalability of the application.

- **Development Environments:** Employing popular IDEs: Microsoft Visual Studio 2022 and Sublime Text 3.

- **Source Control:** Uses Git as the version control system to guarantee the security and efficiency of the development processes.

2.13 Project

2.13.1 Assisted Mode

In this mode, the account opening process is directed by a Relationship Manager (RM). The RM has the duty of assessing the customers' documents as well as ensuring that all the set banking and regulatory measures have been met. The customer directly engages with the RM stationed at the branch level and uploads relevant identification, the valid passport or MRP, through the online interface.

2.13.2 Self Mode

Through the Self Mode that NRB customers effectively deploy the use of Digital Customer Onboarding Platform allows customers to open their accounts at a convenient time.

2.13.3 Key Features of MTB NRB Account

- **Eligibility:** Any NRB above the age of 18 with a valid passport and Residence visa or Work Permit.

- **Zero Initial Deposit:** An account can be opened with the bank without depositing any minimum amount.

- **Digital Banking Services:** Online banking, daily or weekly sms, monthly estatements, and real-time banking by using BEFTN, NPSB, RTGS, and MFS.

- **Account Types:** A single account is offered and in addition, a joint account where two NRB customers can open the account jointly is also provided.

- **Additional Services:** Checkbook service, debit cards, locker facilities (discounts related to these services are available for customers).

- **Simple Onboarding:** Customers can open an account at any branch or through the self-service Digital Account Opening Platform.

Chapter 3

Internship Training Phase

3.1 Overview

During my graduation program at BRAC University, I got an opportunity to work at Mutual Trust Bank PLC as an Internet Web Development Intern. To me, this internship offered an invaluable opportunity to learn in a working environment.

3.2 Tasks and Projects

MTB provided me with a supervisor who gave me web development projects of frontend and backend APIs so that I could get familiar with how they work.

3.2.1 Web Application Design

I studied the basics of web application design through practical coursework and education received at MTB.

3.2.2 Database Design

I used Oracle and learned how to design schemas about web applications within a short period and learned how to search data and even manipulate it most efficiently.

3.2.3 API Development

I got to work with JWT tokens for secure authentication in REST APIs is a functionality that I deal with to make sure API users have secured ways of logging into systems. I also have experience in creating and implementing databases, and calculating and checking the reliability, speed, and efficient usage of data.

3.2.4 Getting Familiar with Postman

My supervisor first directed me to Postman by showing me how to set it up and giving me exercises to use HTTP requests to extract data from the database. For this purpose, I employed the use of Postman to check whether their responses were as required and further to test how well the APIs would perform given different scenarios.

3.2.5 REST API Testing Project

The project involved testing a variety of key REST API operations, including:

- **GET method:** To pull down data from the server.
- **GET with Parameters:** To delete or to add to or change in some way the data that the application is retrieving from the database.
- **POST method:** To transfer records to the server for their creation by the system.
- **PUT method:** For purposes of updating data on the server, the above chart has been useful.
- **Search with Keywords:** For the Viewpoint search where one can search the data with specific query terms.
- **DELETE method:** To delete records from the database.
- **API Validation:** Validating the data that is being employed within the API process to ensure that the data created meets the necessary structure and validation.
- **API with Resources:** The use of resources in the systematic representation of data.
- **API File Upload:** Allowing the users to submit files through the API.

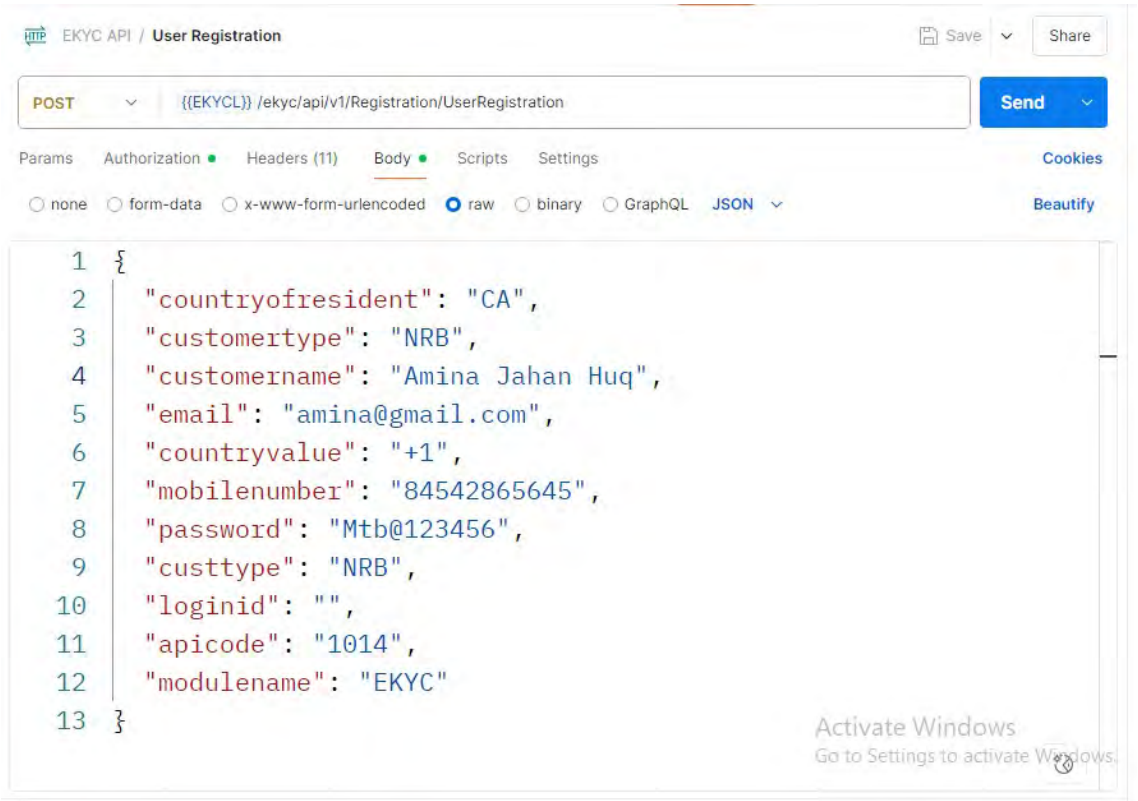


Figure 3.1: Customer Registration (API)

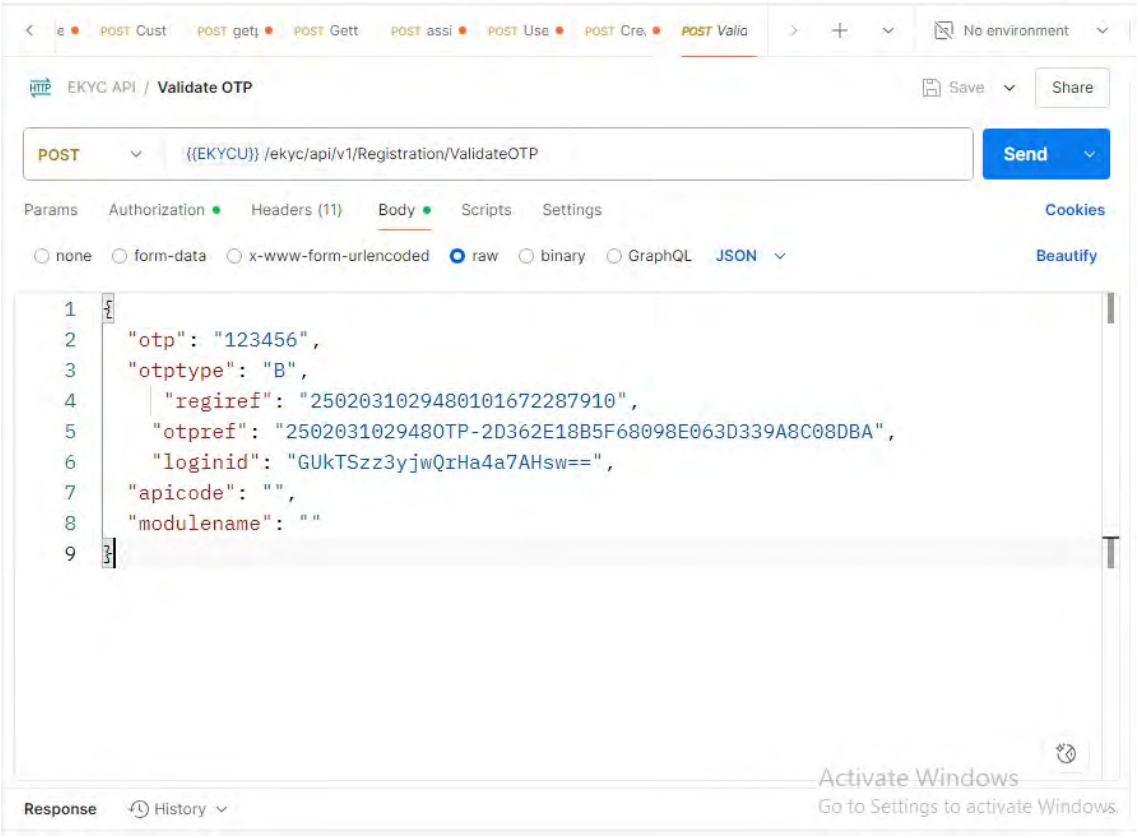


Figure 3.2: OTP Validation (API)

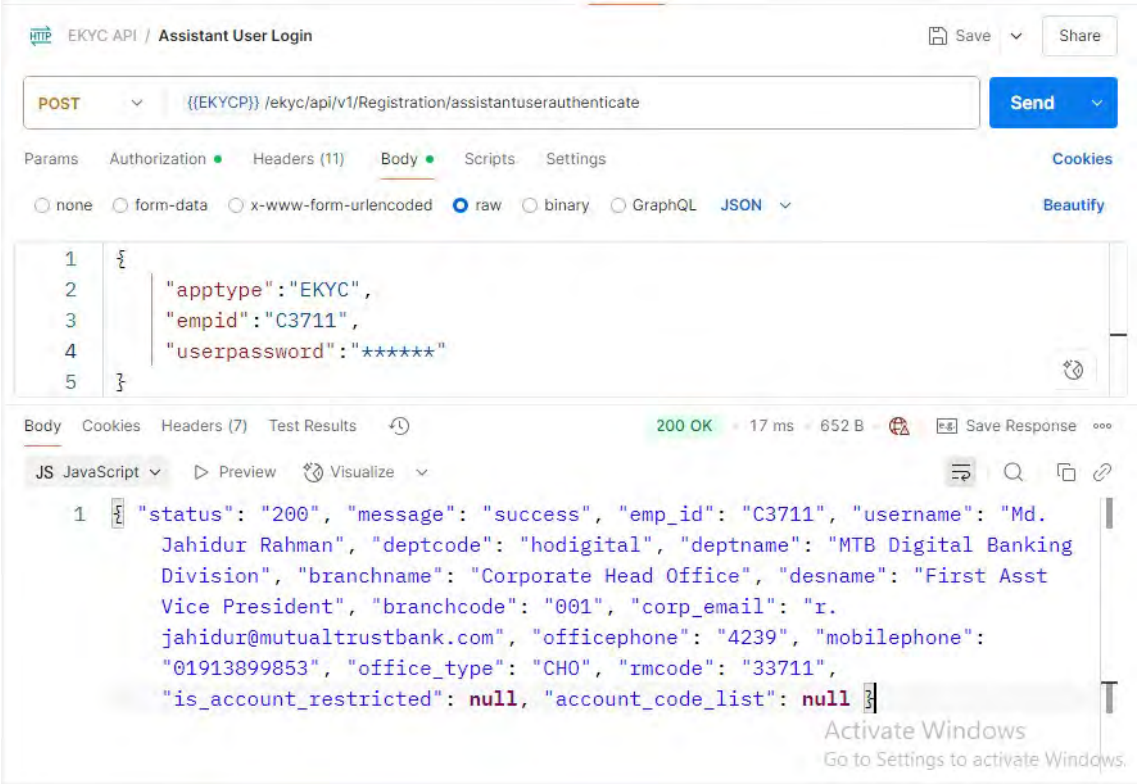


Figure 3.3: Assisted User Authentication (API)

3.2.6 Database Normalization for MTB NRB Account Information

- **TEKYC_AC_MASTER (Account Master Table):** It is the home to all, the account level details that can be used to access various specifics of each account with a high degree of ease and accuracy.

- **TEKYC_ALLOWED_ACCOUNT_PARAM (Account Type Table):** The following table in sequential order defines available customer accounts: This table is used in categorizing accounts, and the rules and features for handling each category of account are implemented here.

- **TEKYC_ASSISTANT_USER (Employee Details- Assisted User):** This table contains information about bank employees who engage customers in account opening or administration of accounts.

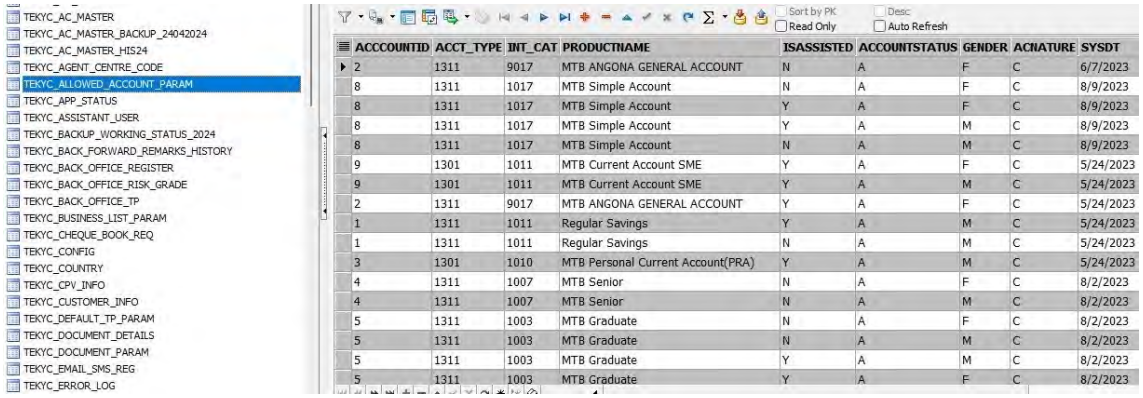
- **TEKYC_NID_VERIFY_REQUEST (NID Verify Request):** It enables the system to monitor requests made for NID verification.

- **TEKYC_CUSTOMER_INFO (Customer Information Parameters):** It gives a detailed analysis of the customer to manage their needs.

- **TEKYC_DOCUMENT_DETAILS (Customer Documentation):** This is crucial concerning KYC, as it provides the necessary assurance regarding the status and identity of the customer.

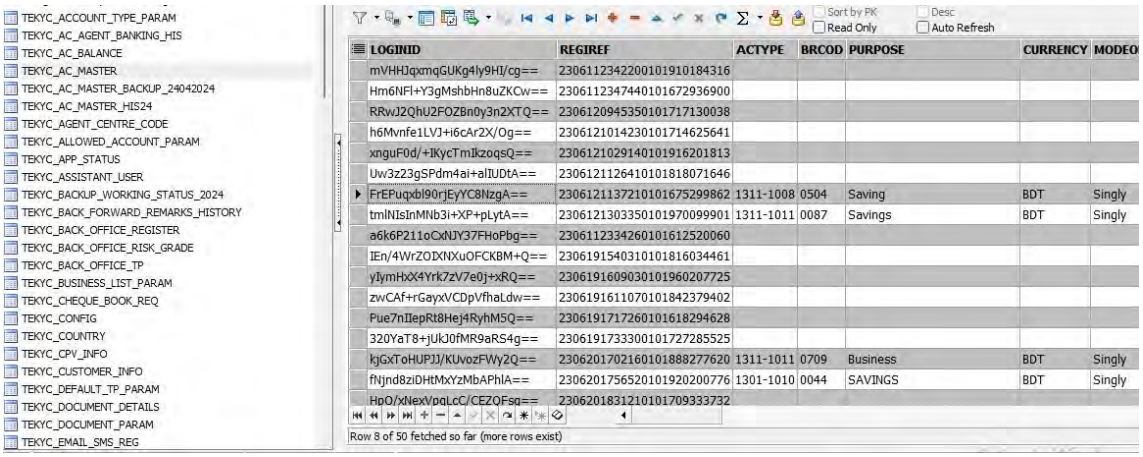
- **TEKYC_NOMINEE_NID_VERIFY_REQUEST (NID Verification of the Nominee):** This table records those requests made to confirm the NID details of a nominee appointed by the customer.

- **TEKYC_NOMINEE_INFO (Information About the Nominee):** This table contains the nominee's name, the nominee's contact details, the nominee's type, etc., relating to the account nominee.



ACCCOUNTID	ACCT_TYPE	INT_CAT	PRODUCTNAME	ISASSISTED	ACCOUNTSTATUS	GENDER	ACNATURE	SYSDT
2	1311	9017	MTB ANGONA GENERAL ACCOUNT	N	A	F	C	6/7/2023
8	1311	1017	MTB Simple Account	N	A	F	C	8/9/2023
8	1311	1017	MTB Simple Account	Y	A	F	C	8/9/2023
8	1311	1017	MTB Simple Account	Y	A	M	C	8/9/2023
8	1311	1017	MTB Simple Account	N	A	M	C	8/9/2023
9	1301	1011	MTB Current Account SME	Y	A	F	C	5/24/2023
9	1301	1011	MTB Current Account SME	Y	A	M	C	5/24/2023
2	1311	9017	MTB ANGONA GENERAL ACCOUNT	Y	A	F	C	5/24/2023
1	1311	1011	Regular Savings	Y	A	M	C	5/24/2023
1	1311	1011	Regular Savings	N	A	M	C	5/24/2023
3	1301	1010	MTB Personal Current Account(PRA)	Y	A	M	C	5/24/2023
4	1311	1007	MTB Senior	N	A	F	C	8/2/2023
4	1311	1007	MTB Senior	N	A	M	C	8/2/2023
5	1311	1003	MTB Graduate	N	A	F	C	8/2/2023
5	1311	1003	MTB Graduate	N	A	M	C	8/2/2023
5	1311	1003	MTB Graduate	Y	A	M	C	8/2/2023
5	1311	1003	MTB Graduate	Y	A	F	C	8/2/2023

Figure 3.4: Account Information Table



LOGINID	REGIREF	ACTYPE	BRCOD	PURPOSE	CURRENCY	MODEO
mVHHJqxmqGUKg4ly9HI/cg==	230611234220010191018431 6					
Hm6NFl+Y3gMshbHn8uZKCw==	230611234744010167293690 0					
RRwJ2QhU2FOZBn0y3n2XTQ==	230612094535010171713003 8					
h6Mvnfe1LVJ+i6cAr2X/Og==	230612101423010171462564 1					
xnguF0d/+lKycTmIkzoqsQ==	230612102914010191620181 3					
Uw3z23gSPdm4ai+alIUDtA==	230612112641010181807164 6					
FrEPuqxbl90rjEyYC8NzgA==	230612113721010167529986 2	1311-1008	0504	Saving	BDT	Singly
tmlNIsInMNb3i+XP+pLytA==	230612130335010197009990 1	1311-1011	0087	Savings	BDT	Singly
a6k6P211oCxNJY37FHoPbg==	230611233426010161252006 0					
IEn/4WrZOIXNXuOFCKBM+Q==	230619154031010181603446 1					
yIymHbX4Yrk7zV7e0j+xRQ==	230619160903010196020772 5					
zwCAf+rGayxVCDpVfhaLdw==	230619161107010184237940 2					
Pue7nIIepRt8HeJ4RyhM5Q==	230619171726010161892462 8					
320YaT8+jUkJ0fMR9aRS4g==	230619173330010172728552 5					
kjGxToHUPJJ/KUvozFWy2Q==	230620170216010188827762 0	1311-1011	0709	Business	BDT	Singly
fNjnd8ziDHtMxYzMbAPhlA==	230620175652010192020077 6	1301-1010	0044	SAVINGS	BDT	Singly
HpO/xNexVpqLcC/CEZQFsq==	230620183121010170933373 2					

Figure 3.5: Account Type Parameter

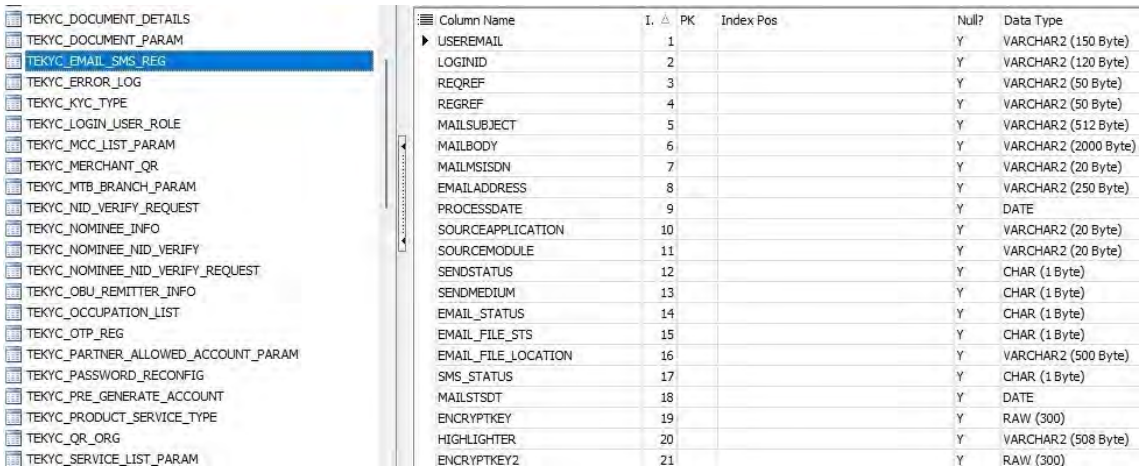


Figure 3.6: Email SMS Register Table

3.3 Challenges

Working with new tools such as Oracle 12c, ASP.NET Core, and JWT authentication was my challenge during the internship. QA with Postman and rapid Agile sprints were a challenge to my learning as well. Although it came with the learning curve, these challenges made me develop technically and perform better in a team.

3.4 Guidance and Support

My supervisor gave me information on resources to use to assist in my learning advised me whenever I faced difficulties in my work and assisted with other online tools and tutorials like Code Step by Step.

3.5 Communication

At MTB while serving my web development internships I have found that everyone is very supportive and cooperative with each other. My peers have been friendly and inclusive and where they deem that I require it they will offer me assistance and encouragement.

Chapter 4

Work Plan

4.1 Work Plan

MTB NRB Account Digital Onboarding Platform was created and introduced by using Scrum methodology. The Agile methodology is famous for following an iterative and incremental pattern. This approach was used mainly because it adapts well, responds quickly and puts emphasis on how team members share information which were needed in a project involving many fields and banking systems.

4.2 Project Development Plan

Including frequent delivery, embracing change, close collaboration, simplicity, and continuous improvement all 12 Agile principles were applied. These guided the fast, user-driven development of key features (OCR, API verification, and facial recognition).

The Product Owner prioritized features and maintained alignment with business goals, the Scrum Master facilitated daily stand-ups and removed blockers, and the development team delivered new functionality in 1–2 week sprints. Regular sprint reviews supported a cycle of ongoing improvement.

Scrum helped the team deliver faster results. It made the work easier since the work was by breaking the project into smaller, manageable pieces. It also enhanced collaboration across departments, supported the development of user-driven features, and encouraged continuous refinement of both the product and development practices.

Based on the analysis, the following flowchart was created for the website:

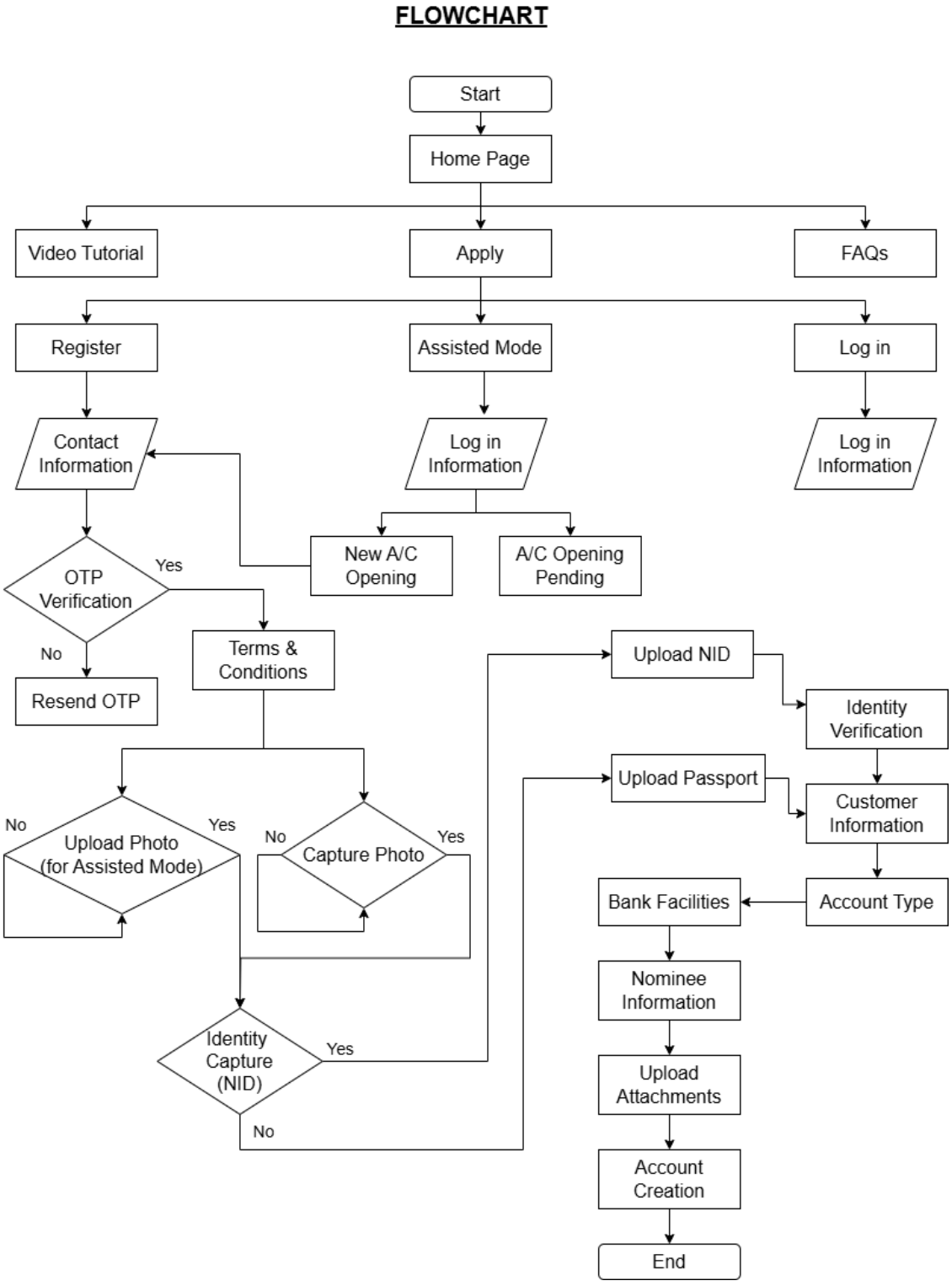
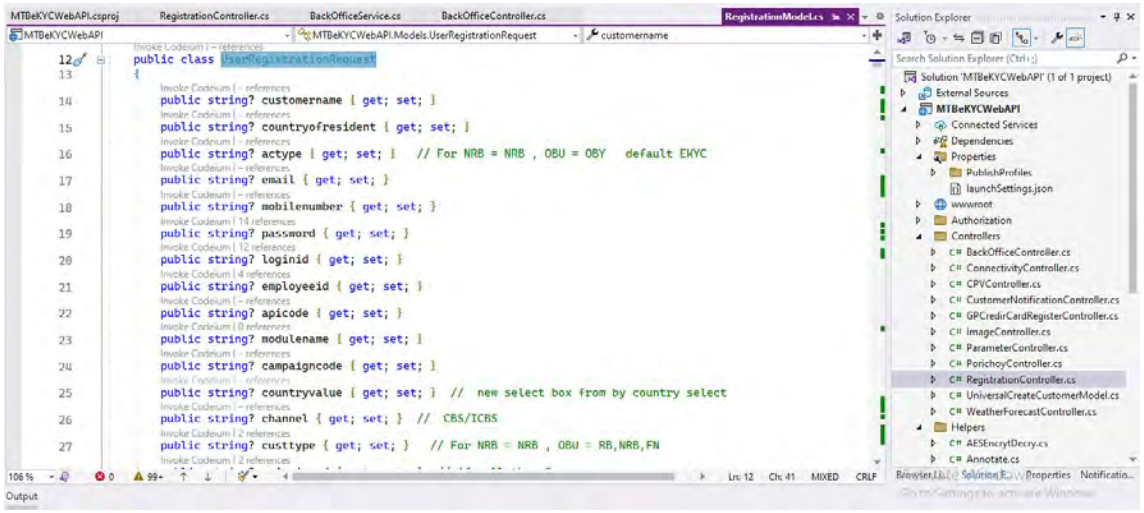
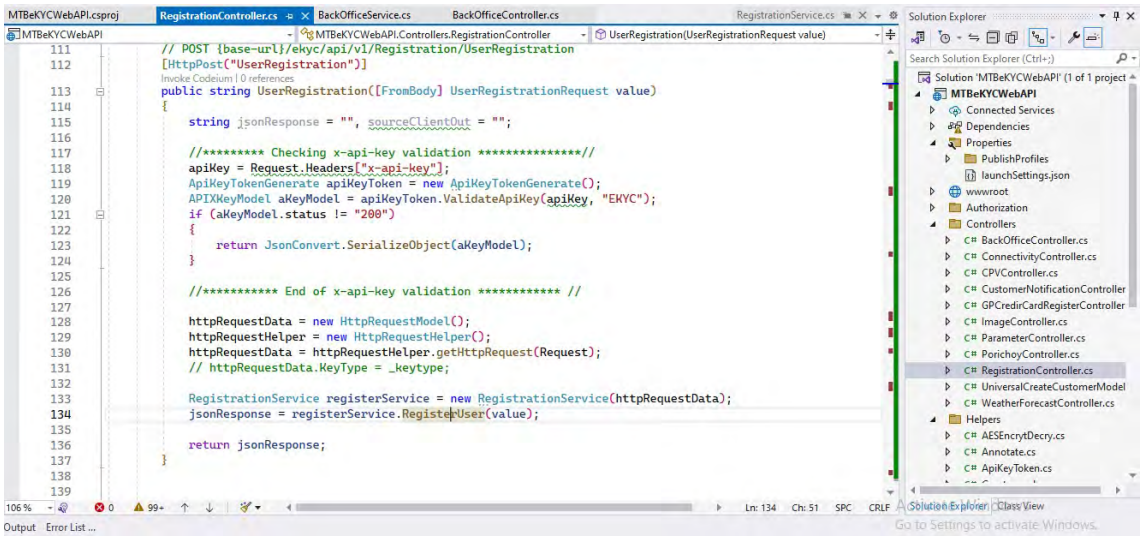


Figure 4.1: Flowchart of MTB NRB Account



```
public class UserRegistrationRequest
{
    public string? customername { get; set; }
    public string? countryofresident { get; set; }
    public string? actype { get; set; }   // For NRB = NRB , OBU = OBY   default EKYC
    public string? email { get; set; }
    public string? mobilenumber { get; set; }
    public string? password { get; set; }
    public string? loginid { get; set; }
    public string? employeeid { get; set; }
    public string? apicode { get; set; }
    public string? modulename { get; set; }
    public string? campaigncode { get; set; }
    public string? countryvalue { get; set; }  //  new select box from by country select
    public string? channel { get; set; }  //  CBS/ICBS
    public string? custtype { get; set; }   // For NRB = NRB , OBU = RB,NRB,FN
```

Figure 4.2: Model



```
// POST {base-url}/ekyc/api/v1/Registration/UserRegistration
[HttpPost("UserRegistration")]
public string UserRegistration([FromBody] UserRegistrationRequest value)
{
    string jsonResponse = "", sourceClientOut = "";

    //********* Checking x-api-key validation ***************//
    apiKey = Request.Headers["x-api-key"];
    ApiKeyTokenGenerate apiKeyToken = new ApiKeyTokenGenerate();
    APIXKeyModel aKeyModel = apiKeyToken.ValidateApiKey(apiKey, "EKYC");
    if (aKeyModel.status != "200")
    {
        return JsonConvert.SerializeObject(aKeyModel);
    }

    //*********** End of x-api-key validation ************ //

    httpRequestData = new HttpRequestModel();
    httpRequestHelper = new HttpRequestHelper();
    httpRequestData = httpRequestHelper.getHttpRequest(Request);
    // httpRequestData.KeyType = _keytype;

    RegistrationService registerService = new RegistrationService(httpRequestData);
    jsonResponse = registerService.RegisterUser(value);

    return jsonResponse;
}
```

Figure 4.3: Controller

The UserRegistrationRequest model specifies exactly how users submit their customername, mobilenumber and password data. Inside the RegisterUser controller method the inputs get validated before checking if essential form fields remain empty and verifying that the 11-digit mobile number contains only numbers. Users obtain JSON messages instantly in case of validation errors to ensure the database contains clean accurate information.

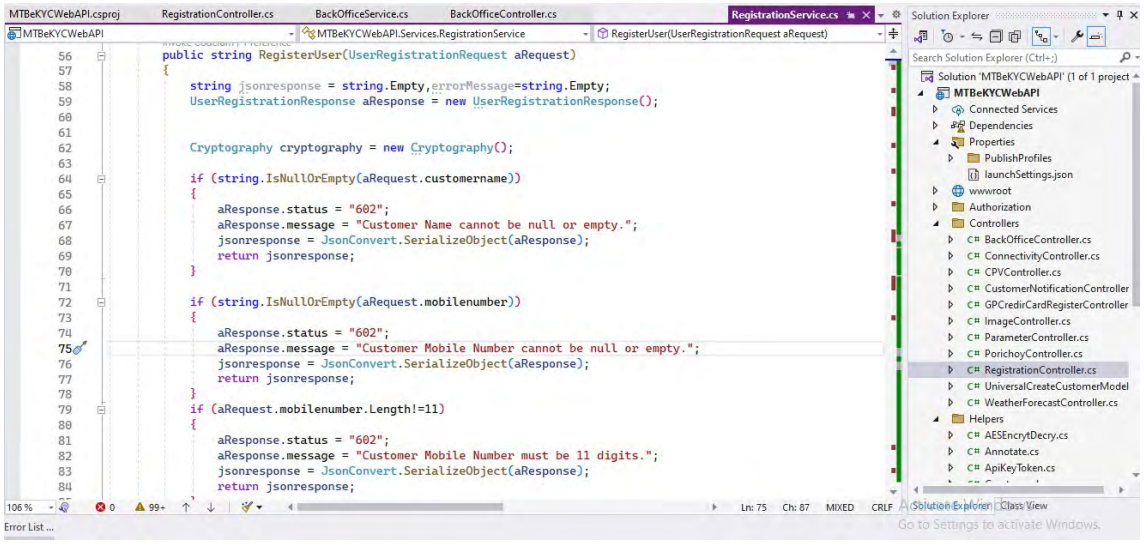


Figure 4.4: Service

The service guarantees new user security through key validation with API registration and database storage of data alongside dual authorization through email and mobile OTP verification.

Chapter 5

Early Stages of Development

5.1 Analysis

Analyzing systems is very important in the banking industry. It helps banks understand what customers want, spot problems before they grow, and come up with smarter, more practical solutions. When it comes to launching any digital financial service, doing a proper system analysis first is a must. Digital platform system analysis is very important before implementing any financial service. The main focus of this project was to simplify the account opening process for Non-Resident Bangladeshis (NRBs) while ensuring security and accessibility.

The goal of this system is to make the journey smooth, paperless, and fully accessible from anywhere in the world. We focused on building a system that includes the following key functions:

- NRB customers can open accounts digitally without visiting a physical branch.
- Documents can be uploaded easily through the Digital Platform.
- The system has been built to fully comply with BFIU and Foreign Exchange Policy guidelines, making sure KYC and compliance requirements are properly handled.
- The back office and compliance team check account statuses as soon as they are updated.
- The bank's core banking system (CBS) is fully linked, so deposits and transactions happen without issues.
- Ensure your documents are handled correctly and your messages are safe by using email indemnity and digital storage.
- Supports other additional services like SMS Banking, Internet Banking, and Cheque/Debit Card requests.

This project helped create a digital-first banking solution much more convenient for NRB customers. The project also helps MTB's goal of expanding its reach to a global audience.

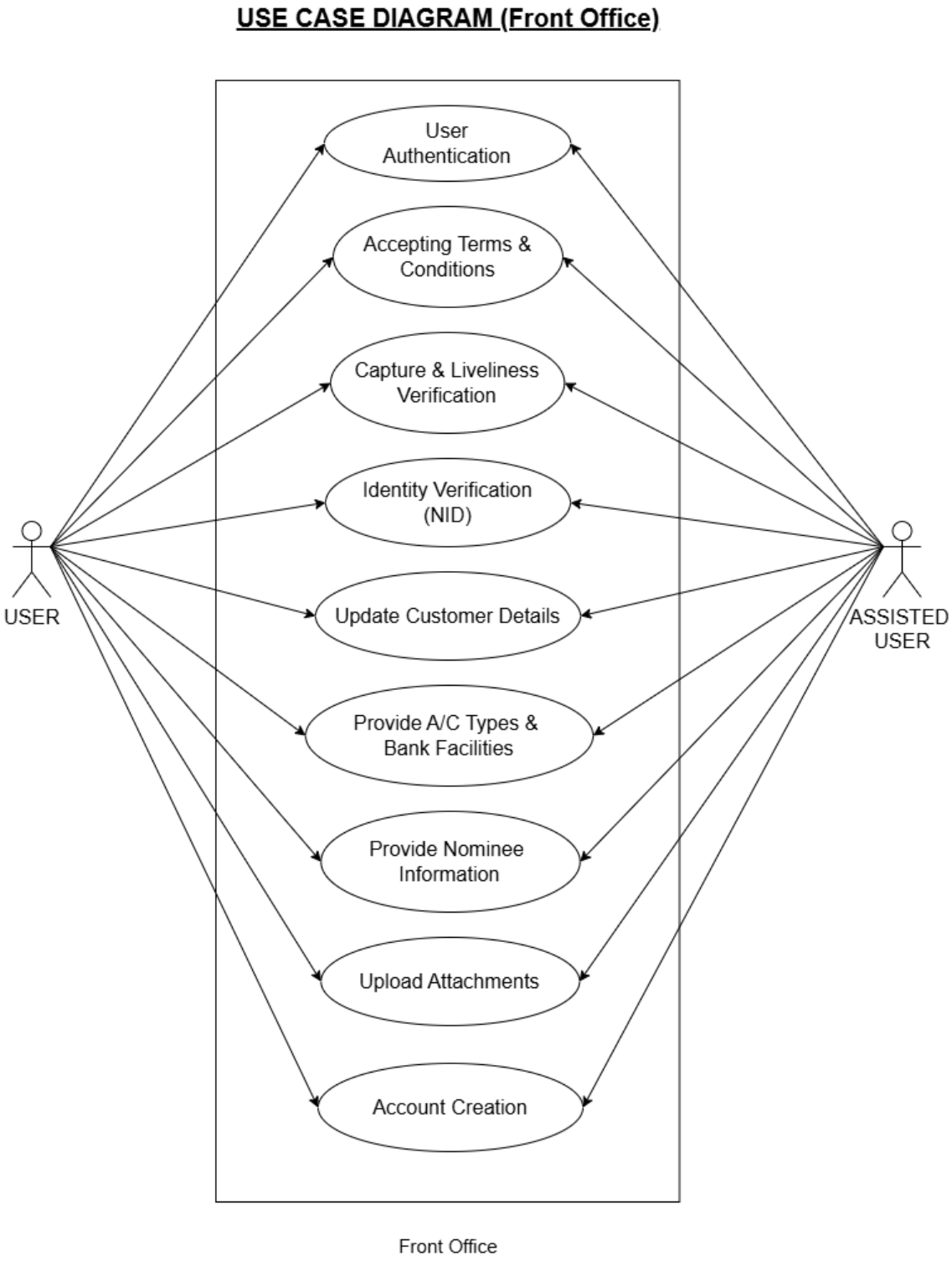


Figure 5.1: Use Case Diagram for Front Office System

The use case diagram displays the key steps done in the front office. Both Users and Assisted Users use the system to complete different tasks. Accepting the terms, checking if accounts are active, uploading papers and filling in nominee and account details are clearly shown on this diagram. This diagram gives a clear look at how users interact with the system.

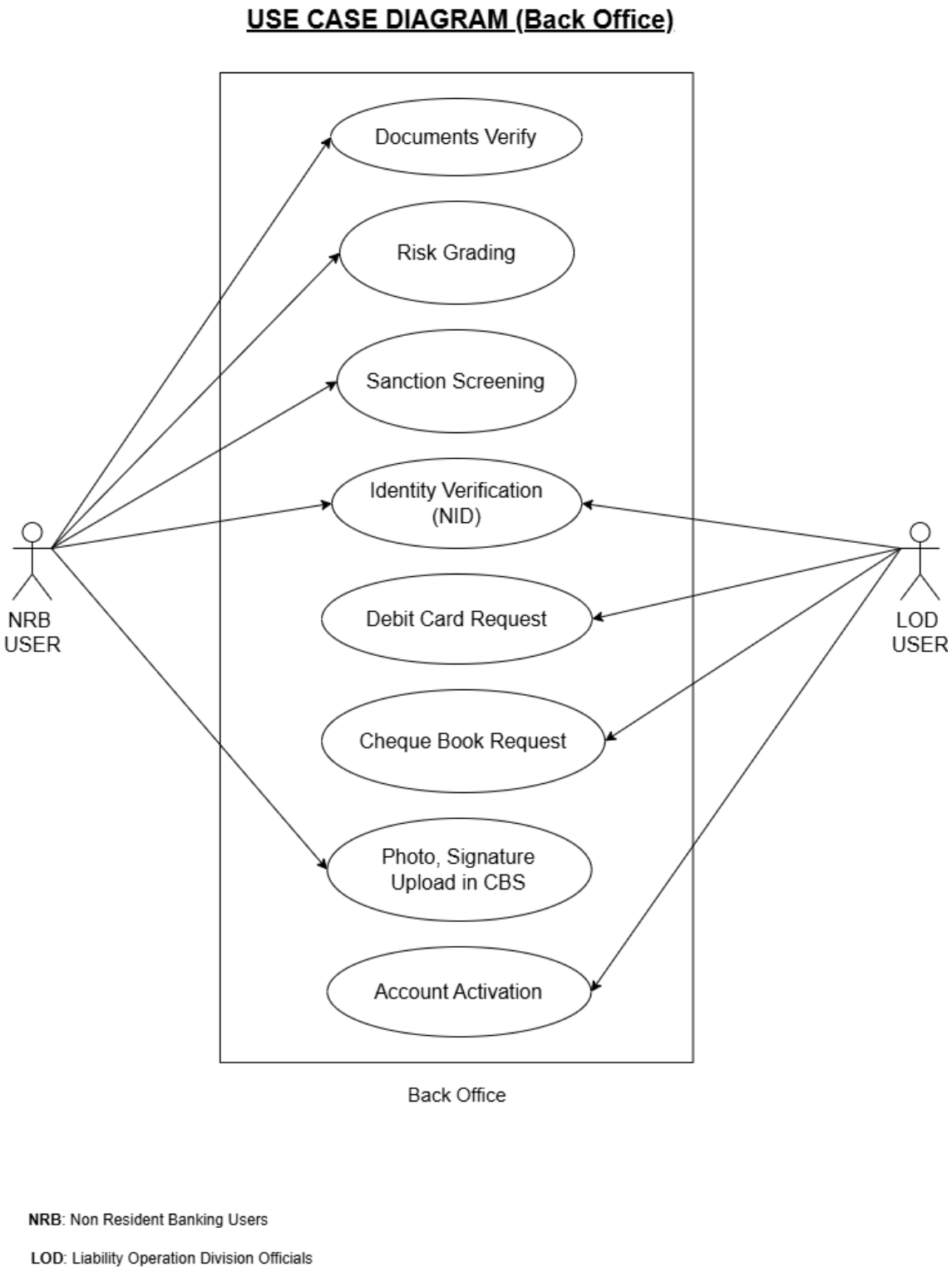


Figure 5.2: Use Case Diagram for Back Office System

In this use case diagram, the back office operations are shown. Both NRB Users and Liability Operation Division (LOD) Users interact with the system behind the scenes. The process involves handling service requests such as issuing debit cards and checks, inputting customer details into the CBS and finishing account setup with final activation.

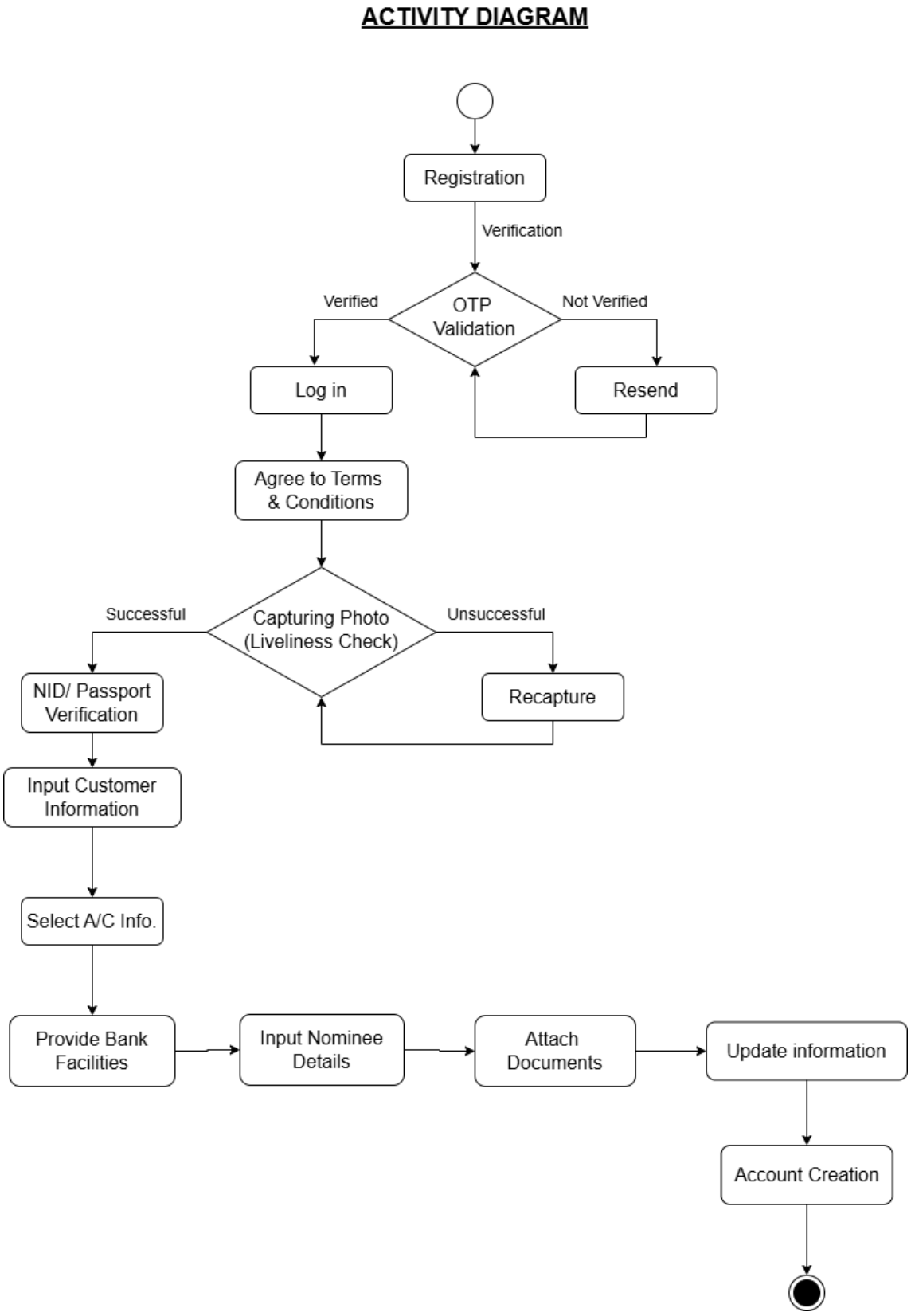


Figure 5.3: Activity Diagram of MTB's NRB Account

The activity diagram illustrates the complete workflow of the NRB digital account opening process. It starts with user registration, followed by OTP verification. Upon successful login, users proceed to agree to the terms and conditions, then perform

a liveliness check through photo capture. If successful, the user progresses through the next stages.

5.2 Design

This project is built using Agile Scrum. It follows iterative development. It's all about working closely with stakeholders and improving as we go. It allows the development process to be adapted according to needs, because it is not as straightforward as the Waterfall model. Within every sprint, requirements are gathered that allow the team to respond right away to any changes or suggestions they receive. Every time the design phase is examined to see that the system is keeping up with users' needs. These diagrams were made during design changes and system learning as part of several sprints.

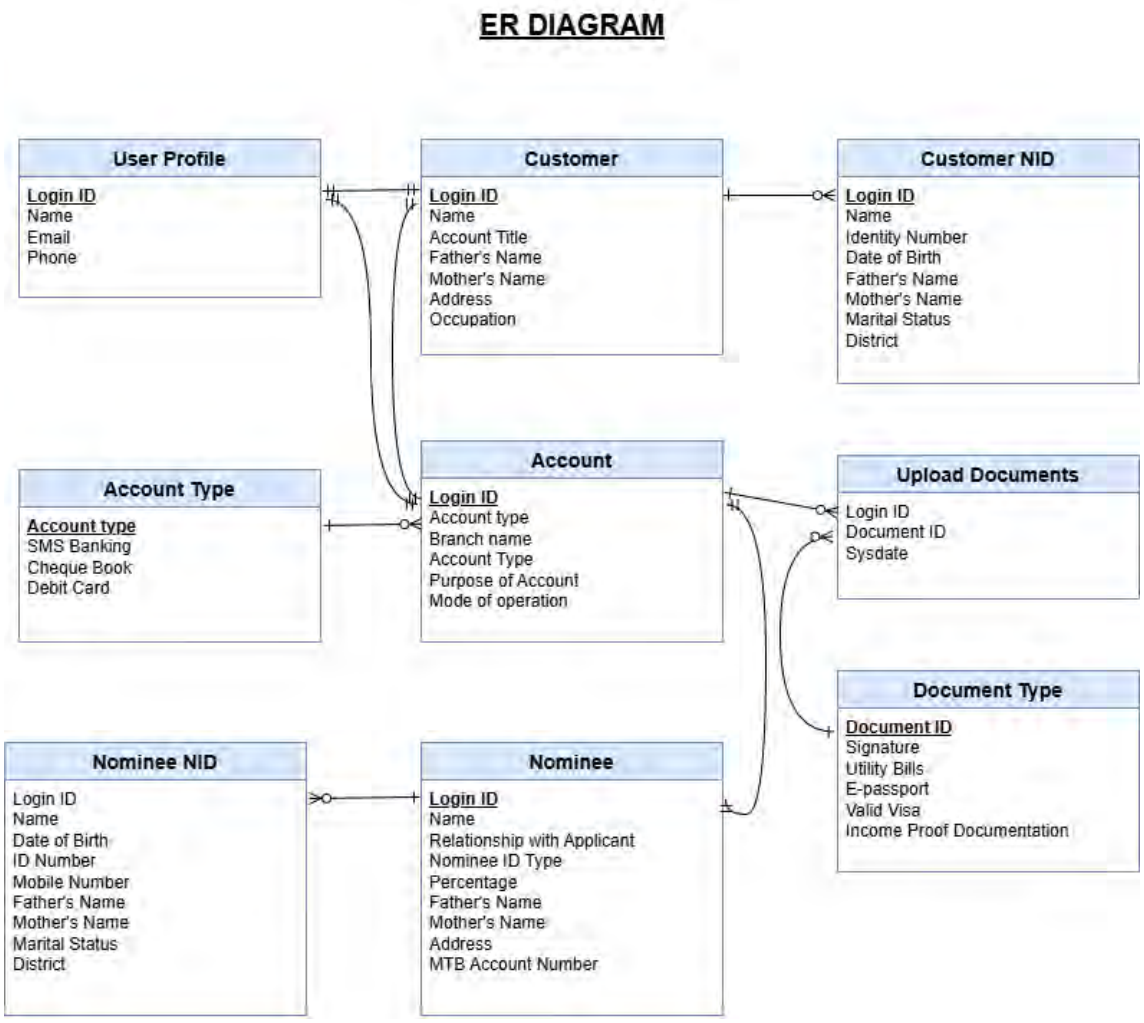


Figure 5.4: ER Entity Relationship) Diagram of MTB's NRB Account

An ER diagram represents the data structure used in the NRB account opening system. It illustrates the ties among the four entities User Profile, Customer, Account, Nominee and two documents, NID and proof of identity. All entities are described by their important attributes. The diagram makes data standard and maintains the

correlation between various details, for example, the account type and document type needed for a proper and safe onboarding experience.

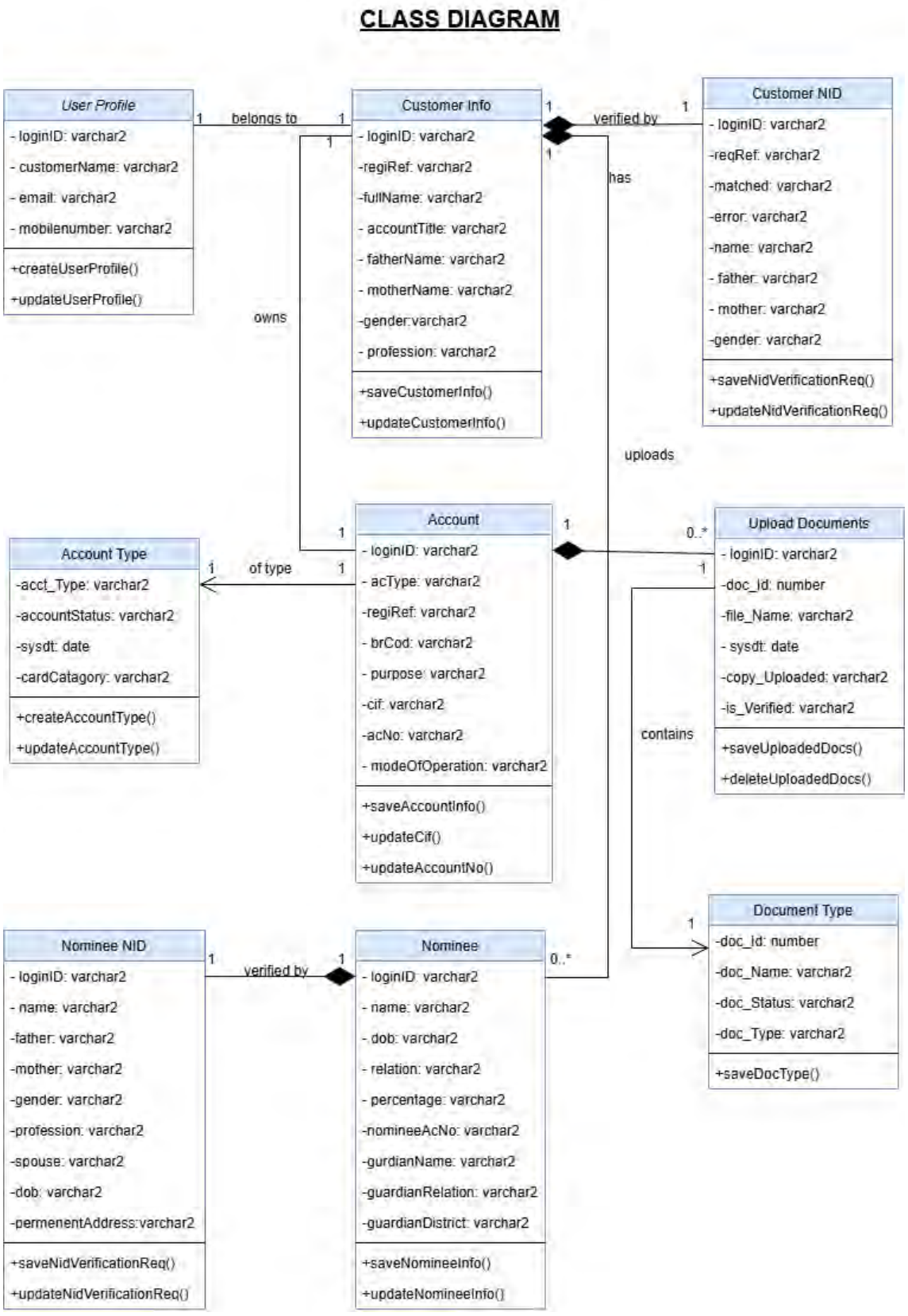


Figure 5.5: Class Diagram of MTB's NRB Account

The class diagram for the system includes User Profile, Customer Info, Account, Nominee and related document groups. The system structure contains these entities with defined features and rules for verification steps and document uploads and account maintenance.

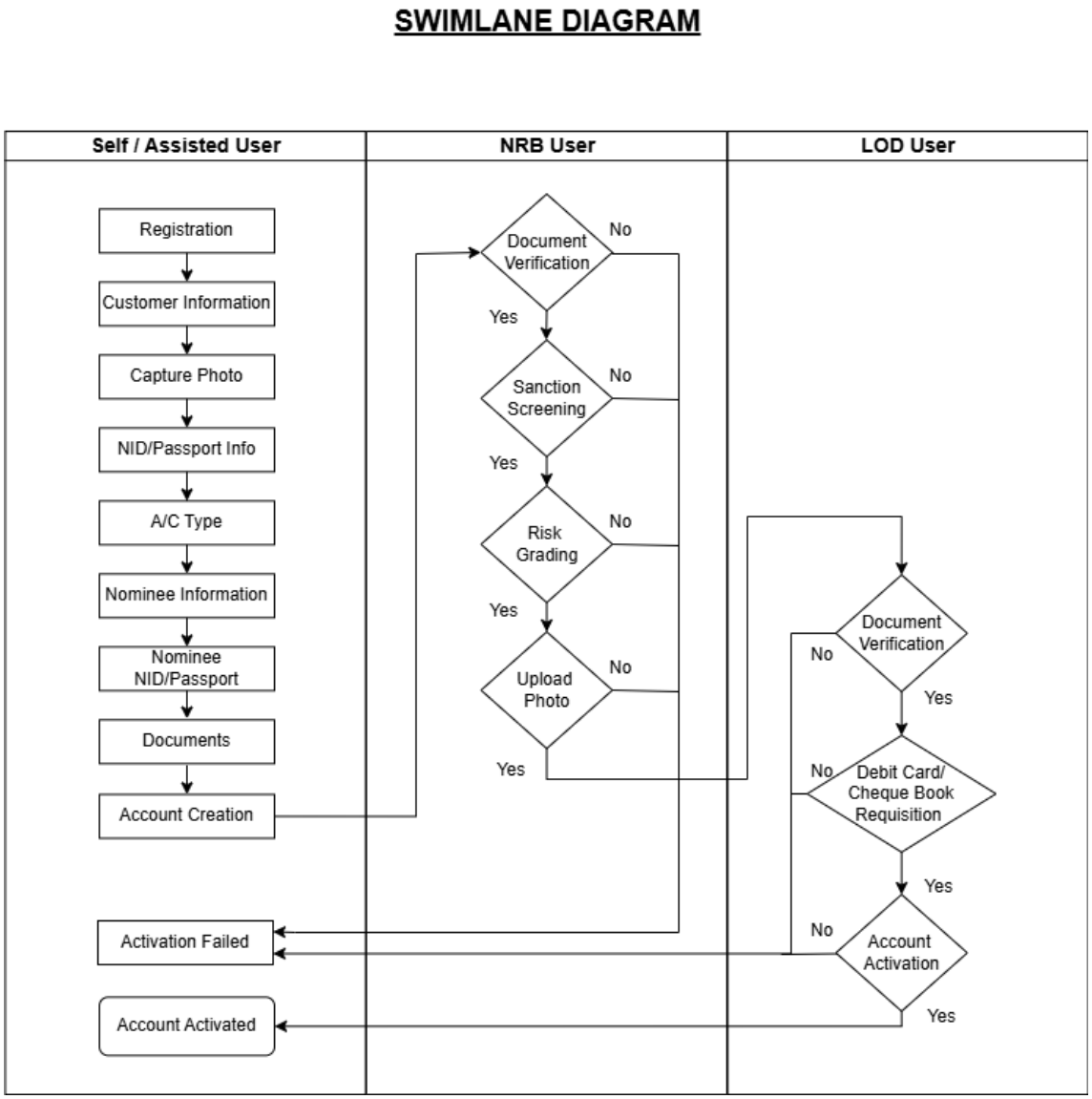


Figure 5.6: Swimlane Diagram of MTB's NRB Account

The swimlane diagram showcases the responsibilities based on role: Self/Assisted User, NRB User, and LOD User. It separates activities based on roles. This allows us to follow the process steps involved in creating and activating an account. When verification or activation is unsuccessful, it indicates the function paths for failure, allowing easy identification of roles.

5.3 Project Illustration

It is now very simple for NRBs (Non-Resident Bangladeshis) to open a savings account with MTB. This is a digital platform called MTB NRB Account Onboarding

System. It allows Non-Resident Bangladeshi (NRB) customers to open a savings account without limit, from any place using any device. It allows you to complete your application from any device at your preferred location. The platform can be experienced by anyone, whether registered or not. You need official information and document uploads that follow the rules to get total access and set up an account.

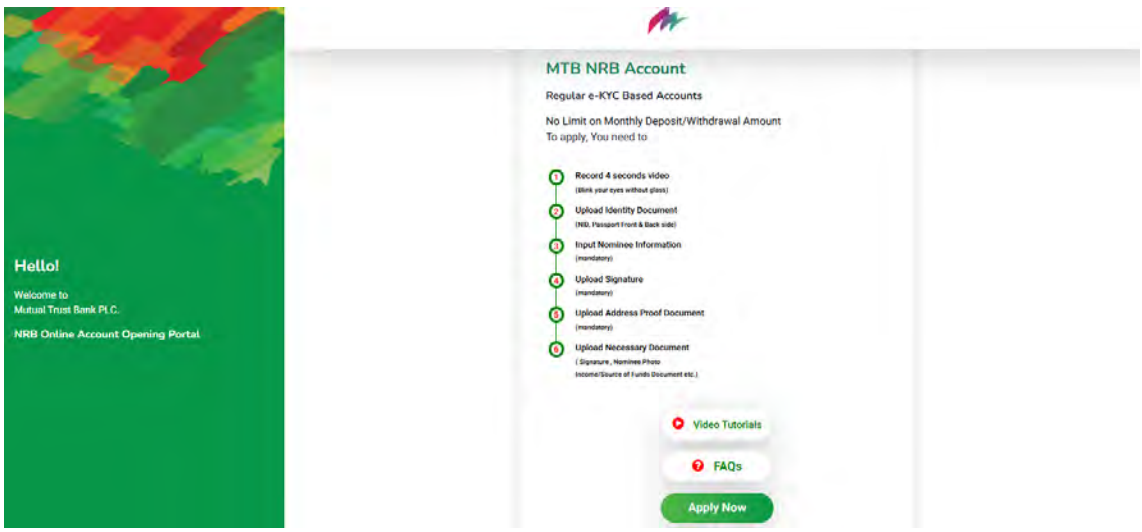


Figure 5.7: MTB NRB Account Opening

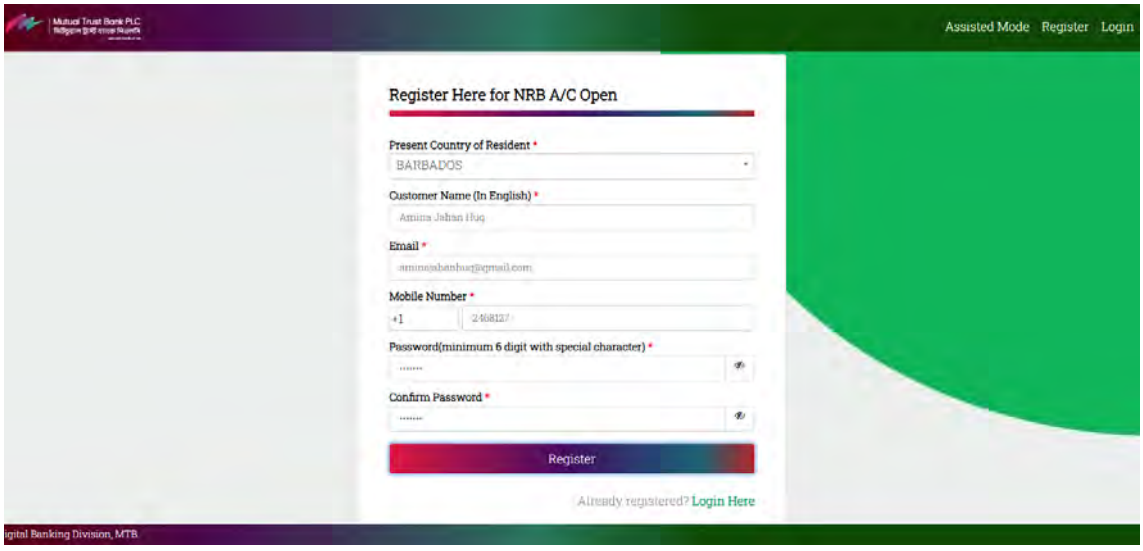


Figure 5.8: Registration Page

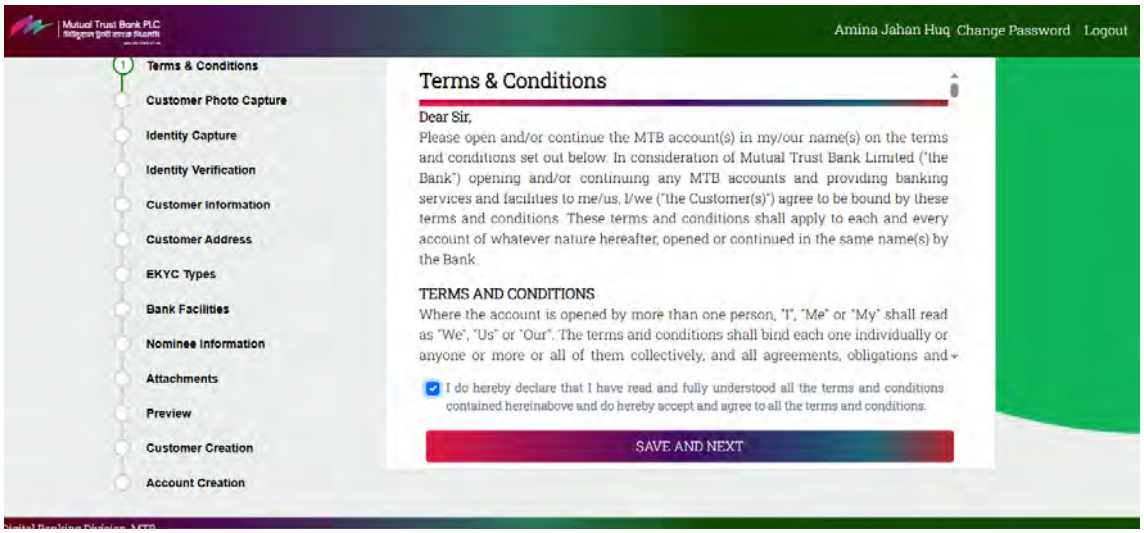


Figure 5.9: Terms and Conditions

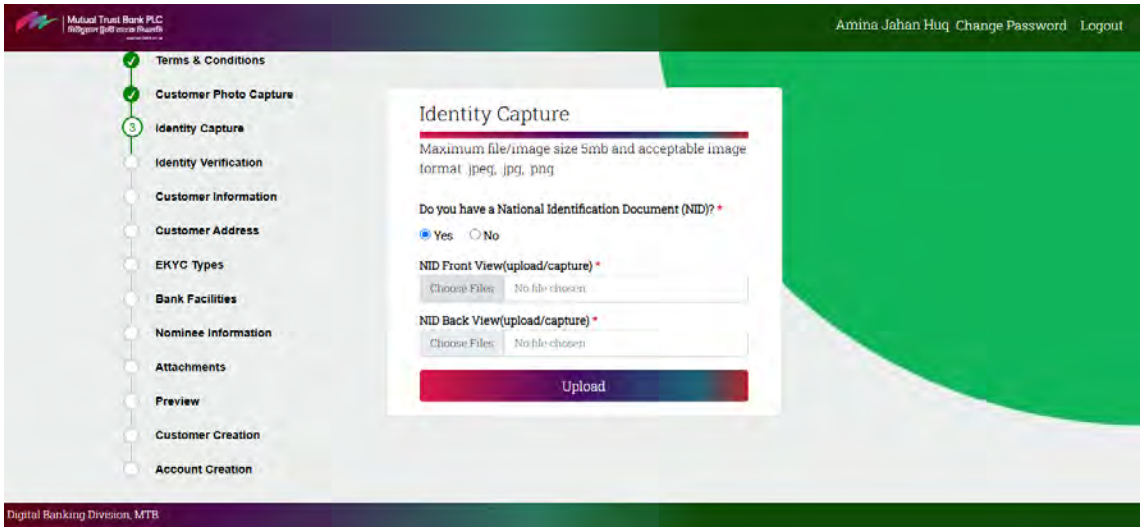


Figure 5.10: Identity capture of NRB account

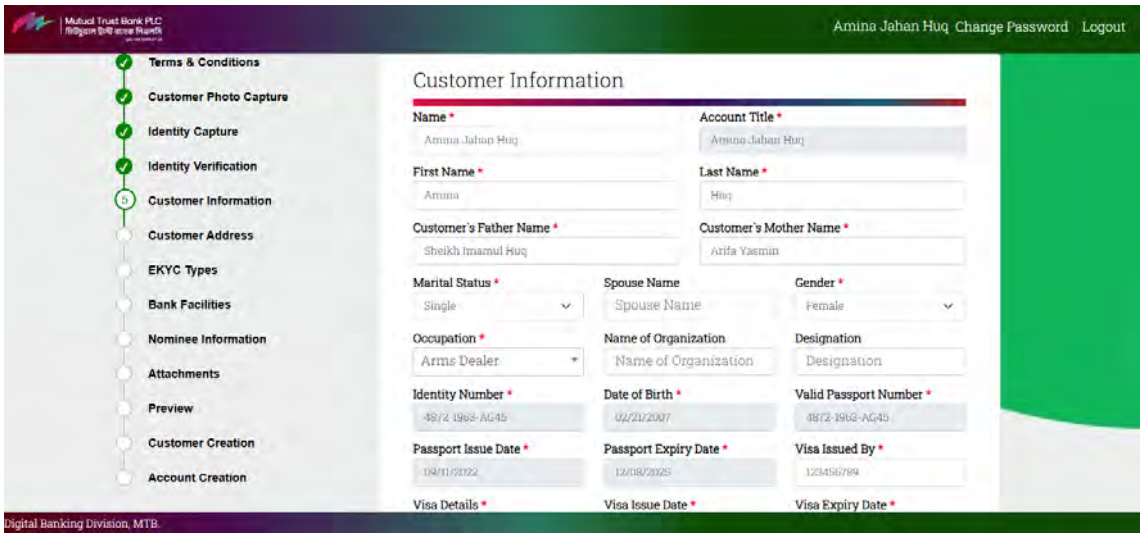


Figure 5.11: Customer information

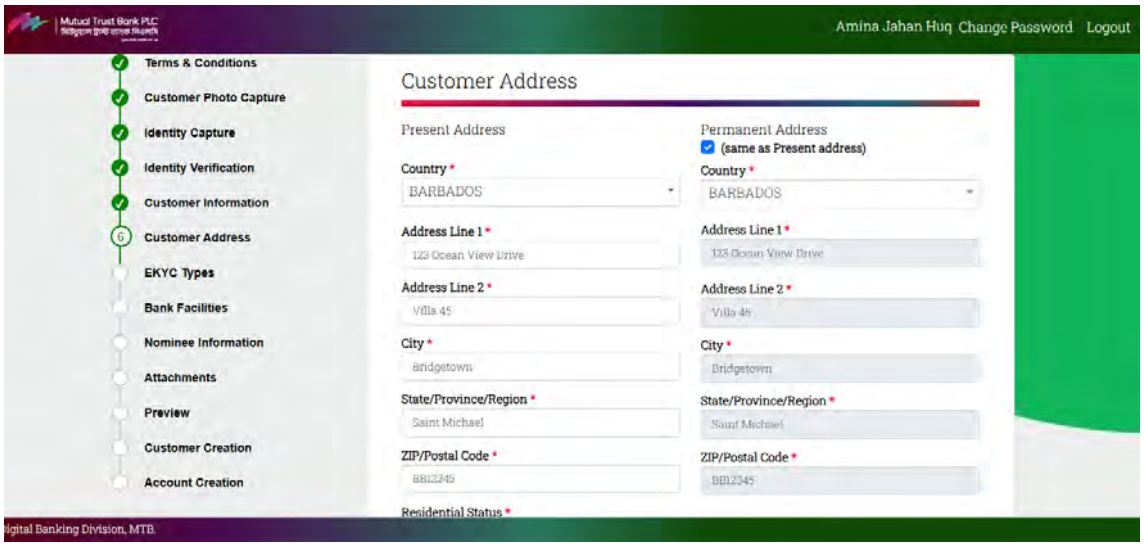


Figure 5.12: Customer address

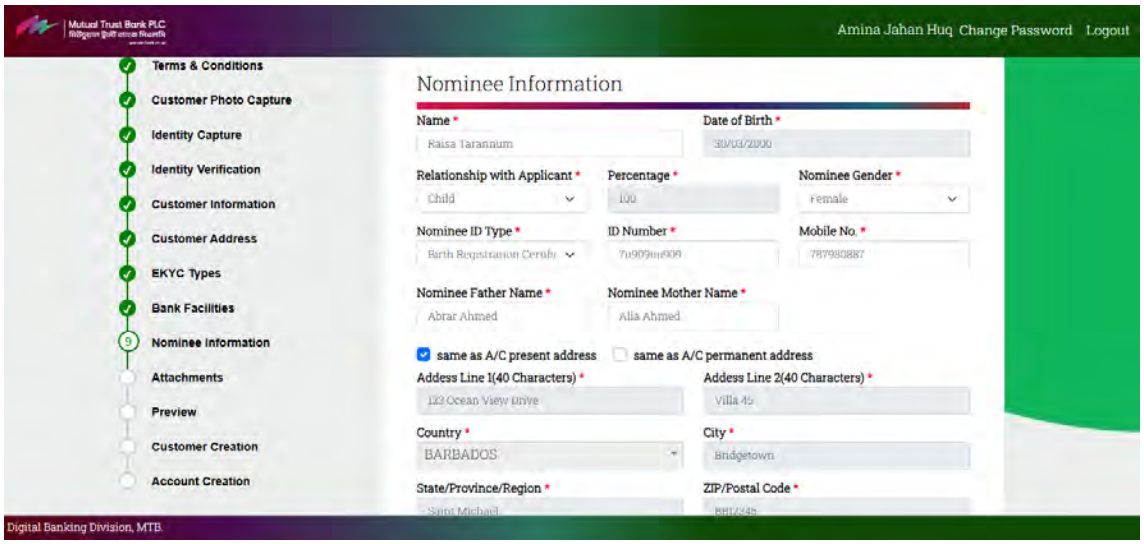


Figure 5.13: Nominee information

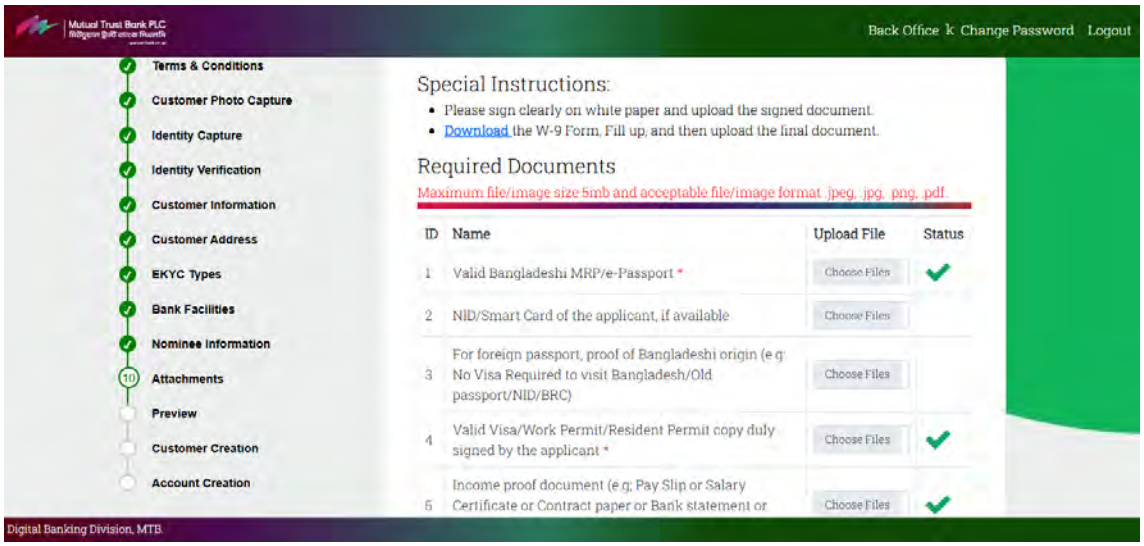


Figure 5.14: Required documents for NRB account

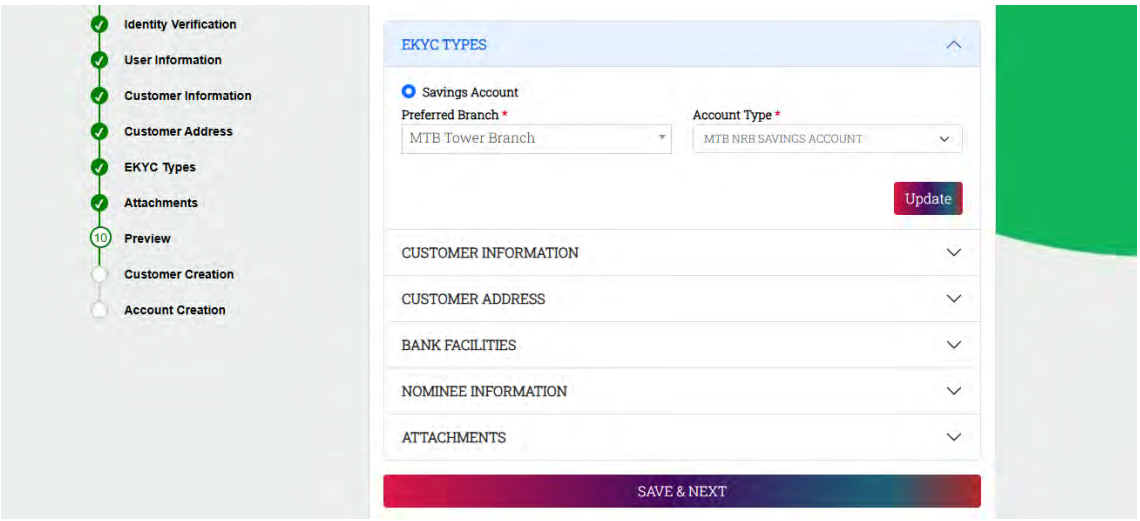


Figure 5.15: Preview

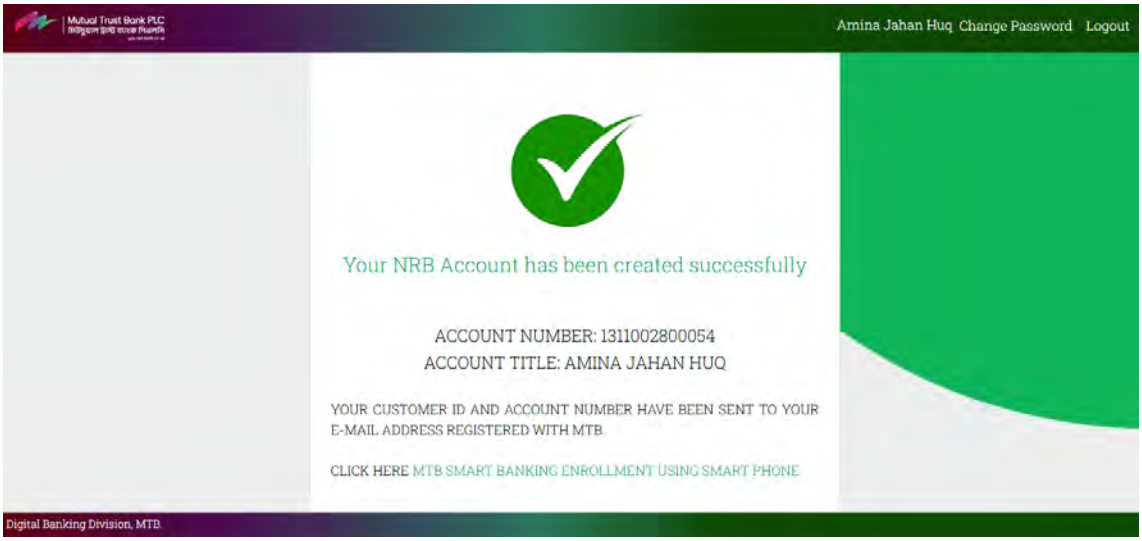


Figure 5.16: Account creation

Chapter 6

Future Plans

After fulfilling all the essential requirements in this project, MTB plans on enhancing user experience and other additional services in the future.

6.1 Launching MTB NRB Application

One of the key future goals is to launch a dedicated MTB NRB application to enhance accessibility, which will allow the customers to manage deposits, conduct transactions directly from their smartphones from anywhere in the world.

6.2 Enhanced User Interface and Experience

MTB plans on enhancing the user interface (UI) and user experience (UX) of the application to ensure easy navigating features. The goal is to make the banking experience as smooth as possible, regardless of the device being used.

6.3 Security Enhancements

MTB will be focusing more on the security of the data, given its sensitivity. Multifactor authentication (MFA), biometric login options (such as face recognition or fingerprint scanning) will be used in the future.

Chapter 7

Growth

7.1 Team Work

Throughout my internship at Mutual Trust Bank PLC, I had the opportunity to work closely with developers, analysts, and project supervisors. Collaborating on the NRB Digital Onboarding Platform taught me the value of clear communication, shared responsibilities, and synchronized effort in delivering a complex system. I observed how every team member contributed their expertise, and I learned how to coordinate tasks, take feedback positively, and align my work with group goals. This experience enhanced my understanding of teamwork in a professional, fast-paced environment.

7.2 Time Management

Working on a real-life banking solution with fixed deadlines taught me how crucial time management is. Applying the Scrum methodology meant working in sprint periods and aiming to complete tasks according to schedule. One of the ways I made progress was to focus on technical work, writing documents and attending review meetings. The steps listed earlier have made me more productive and prepared me to manage future projects more successfully.

7.3 Technical Growth

During my internship, I learned a great deal technically by helping with a major banking solution using advanced technologies. I also spent a lot of time learning to structure secure and efficient RESTful API endpoints. I set up JWT tokens in my APIs to securely manage user sessions in today's applications. I was tasked with building Oracle databases according to normalized models and making sure the structure supported long onboarding processes. I also became more proficient in API authorization logic, which was crucial for managing user roles and permissions securely. My programming knowledge improved significantly, especially in ASP.NET

Core for backend development and JavaScript for dynamic front-end behavior. I also participated in unit testing and used tools like Postman to test APIs, which helped reinforce my understanding of validation, error handling, and response structure. Ultimately, applying what I learned gave me clarity on creating secure banking applications in real time.

7.4 Personal Growth

7.4.1 Improved Communication & Confidence

Through my internship, I got used to facing a group without being afraid. Thanks to the company's support and constant guidance from my superiors, I was able to become more self-assured presenting my ideas. This situation let me play an active role in group discussions and put forward new ideas for developments to the project. Therefore, my skills at work and social communication began to expand.

Being part of a group where everyone collaborated made me grow a lot. My team appreciated me and let me be a part of the discussions from the start. Because I was so open about it, I believed in myself and tried to engage with more confidence. By completing my internship, I became involved in meetings, guided others through my projects and could communicate openly.

Chapter 8

Conclusion

In short, MTB's Non-Resident Banking Unit has developed an easy-to-use and economical system for Non-Resident Bangladeshis. As a result of this project, MTB can offer easier account opening and digital services to clients. Through my involvement in the project, I have explored how to design and implement a major banking solution.

Bibliography

Bangladesh Bank. (n.d.). Guidelines for Foreign Exchange Transactions. Retrieved April 10, 2025, from https://www.bb.org.bd/en/index.php/financialactivity/forex

Mutual Trust Bank. (n.d.). NRB Savings Account – NRB Deposit Products. Retrieved April 10, 2025, from https://www.mutualtrustbank.com/nrb-products/nrb-deposit/nrb-savings-ac/

Lucidchart. (n.d.). UML class diagram tutorial. Retrieved December 22, 2021, from https://www.lucidchart.com/pages/uml-class-diagram

Microsoft. (n.d.). Introduction to ASP.NET Core. Learn Microsoft Docs. Retrieved April 10, 2025, from https://learn.microsoft.com/en-us/aspnet/core/introduction-to-aspnet-core

Amazon Web Services. (n.d.). What is Amazon Rekognition? AWS Documentation. Retrieved April 10, 2025, from https://docs.aws.amazon.com/rekognition/latest/dg/what-is.html

OpenCV. (n.d.). Face detection and recognition. OpenCV Tutorials. Retrieved April 10, 2025, from https://docs.opencv.org/4.x/d7/d00/tutorial$_m eanshift.html$

Google Cloud. (n.d.). Cloud Translation API overview. Google Cloud Documentation. Retrieved April 10, 2025, from https://cloud.google.com/translate/docs

Scrum Alliance. (n.d.). What is Scrum?. Scrum Alliance. Retrieved April 10, 2025, from https://www.scrumalliance.org/why-scrum