

System Requirements Specification

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1 Abstract

Over the last four decades [2], South Africans have become dependent on Automatic Teller Machines to satisfy their banking needs. This begs the question, did the ATM keep up with the rapid technological advancements? When looking at the numerous benefits that ATMs have provided we can truly see that it has revolutionized the way people and banks interact. According to [1], these benefits include: allowing clients flexible account access at their own comfort, increased hours of operation and more clients can be reached beyond the branch network. Even though more clients can be reached, the issue of long queues still persists in densely populated areas. These queues often frustrate clients. It is also imperative for owners, of the ATMs, to keep the machines well maintained. This includes mechanical maintenance and ensuring that there is always enough money to dispense to clients. The maintenance and the transportation of cash has become impractical and a financial burden. Thus, we are in need of a new system that will cut expenses and improve user satisfaction. This paper outlines a conceptual system to solve the problem at hand.

2 Introduction

2.1 Purpose

The purpose of this document serves to provide an in-depth analysis into the user characteristics and requirements for a next generation automatic teller machine (ATM) that will be utilising the latest technologies in the industry in the hopes of modernising the existing infrastructure.

The intended audience for this specific document mainly focuses around the outsourcing party, FNB, as it is vital that the FNB is aware of the foundations of the system to ensure that the system delivers on the requirements that have been set out. The other primary audience for this document is the system design team as they will be required to transform the requirements stipulated in this document into an accurate design of the system whilst ensuring that needs of the FNB are still met.

2.2 Scope

The product that is outlined in this document is a next generation automatic teller machine system. It is a modernised ATM that is to be considered for implementation by FNB.

The system will be utilised for three primary transactions:

- Cash withdrawal,

- balance enquiry, and
- provide a mini-statement

The system will also be used as a mechanism to manage clients in terms of CRUD (Create, Read, Update and Delete), although this is not the primary focus of this particular document. The system will also implement an intricate audit logging system in order to conform with industry regulations set out by FICA.[5]

However, the proposed new system has its intricacies founded in the use of modern technologies which aspire to change banking as we know it today. Two-factor customer authentication (2FA) will be used as a means to authenticate users and ensure that they are correctly identified and as well as to ensure that their information is secure in accordance with POPI (Protection of Personal Information Act).[8]

The primary objective of the system is to reduce customer contact time with the ATM terminal by simply removing the physical ATM, whilst still keeping the ability to withdraw physical money. In this particular system money can be withdrawn from a participating outlet instead of a physical ATM via the use of a QR code or NFC. This not only affords users the opportunity to queue multiple transactions remotely, but provides users with the option of withdrawing money from any participating outlet via the use of a QR Code or NFC at their convenience. The system also has an intricate mechanism for the verification of transactions as well as ensuring the expiration of unused transactions. The location of outlets, which support the technology, is provided and a simple one-step option to navigate to the location via any third party navigation application of the user's choice is also available. The user may use either a QR Code or NFC as a means to authenticate and execute their transaction. This ensures that our system remains flexible and caters for the user's needs. In order to ensure that the user's information is secure, two-factor authentication is used in terms of fingerprints. If the client's phone does not support fingerprint authentication, Google Authenticator [6] will be used to ensure two-factor authentication.

An offline option for our system is also available. The offline system makes use of USSD to ensure that users without internet connectivity or smart phones still have the opportunity to make use of the modern ATM. The offline system works identically to the online system with the exception of using USSD.

In accordance with FICA[5] and other legislation that exists regarding financial services in South Africa, a reliable and secure audit logging functionality is essential as it logs the information of registered users, their accounts as well as their transaction history. This feature is included to ensure that all transactions and users can be easily identified.

The benefits of the system are the following:

- Contact time with physical ATMs is dramatically reduced due to the ability to set-up and queue transactions prior to the execution of the transaction, as well as the fact that users can now withdraw money from any participating outlet. This has reduced the need for a physical ATM, whilst still remaining true to the concept of physical money.
- The implication of removing the need for physical ATMs results in a substantial reduction in maintenance costs, as now the physical equipment is outsourced to participating outlets.
- The ability to set-up, queue and execute a transaction from anywhere, at any time of the day provides a considerable increase in flexibility as well as accessibility. Transactions can now be set-up and queued from the comfort of one's home, as well as simultaneously executed during the convenience of a daily grocery run or petrol stop.
- Due to the offline functionality of the system, users without connectivity or access to a smart device still have the opportunity to utilise the system. Again, this improves the system's accessibility.
- The system provides an incentive to outlets to participate as it will, from a business point of view, heavily increase the foot traffic in the business. This ensures that participation from outlets is expected to be substantial.
- Due to the functionality of the system in terms of authentication and the use of user profiles, a user can use the system across multiple devices and this therefore increases the accessibility of the system.

Therefore, it can be seen that the benefits of the system are far reaching. The system improves flexibility and accessibility, whilst significantly reducing the costs of maintenance as well as the time customers spend queuing at ATMs. This system is appealing to not only the users with smart devices, but also to users with feature phones or low connectivity.

2.3 Definitions, Acronyms, and Abbreviations

The following definitions, acronyms and abbreviations are outlined as a means to ensure the correct interpretation of this document.

- **ATM** - Automatic Teller Machine, which is a machine that dispenses cash or performs other banking services when an account holder interacts with the system.
- **FNB** - First National Bank, which is a financial service and credit provider in South Africa.

- **2FA** - Two-factor authentication, which is a method to identify and authenticate a user by using two different combinations of something they know, have or are.[3]
- **NFC** - Near-field communication, which is a set of communication protocols where devices are able to communicate with one another by bringing them close together.[4]
- **USSD** - (Unstructured Supplementary Service Data) is a Global System for mobile (GSM) communication technology that is used to send text between a mobile phone and an application program in the network.[7][9]
- **Customer** - The customer refers to a user of the system who is already a registered FNB client, but may not necessarily be registered for the use of the ATM functionality. The customer may perform any operation set out in the use case.
- **Participating Outlet** - This refers to any store, petrol station, or other outlet that has agreed to participate in the dispensing process of money on behalf on FNB and has the necessary equipment to handle the dispensing process.

2.4 Overview

The remaining content in this document sets out to analyse the user characteristics as well as the requirements of the system as stipulated by the client(FNB). A trace-ability matrix is also included in order to provide an overview of the functional requirements.

The user characteristics outline the various user profiles that are intended to interact with the system. The requirements are separated into two main spheres, namely, functional requirements and quality requirements. The functional requirements seek to provide a detailed description of how the system is to function as well as how the system receives and responds to certain interactions made by the user. These requirements are illustrated by the use case diagram. The quality requirements, on the other hand, deal with how the system supports the functional requirements. Finally a trace-ability matrix is included to ensure that all requirements that are stipulated by the client have been included.

3 User Characteristics

The above mentioned system was designed to cater specifically for existing FNB users. The system can be adapted to accommodate new clients, however, this falls out of scope for this particular project. The typical user of the system is characterised as a client of FNB who desires to save time as well as to have

more convenient options with regards to the process of visiting an ATM. The services that the system offers are designed for clients with the need to:

- Withdraw cash,
- balance enquiries, and
- request a mini statement.

The users can be further subcategorised into:

- **Smart phone users:**

This category of user is described as any existing client of FNB with access to a smart phone that can install and run the system with the ability to connect to the internet via the use of mobile data/wifi hot-spots. This user will also have NFC capabilities and an understanding of how to use NFC as well as a basic understanding of how to navigate through mobile applications.

- **Feature phone users:**

This category of user is described as any existing client of FNB without access to a smart phone which can install and run the system. This includes clients who do not have access to online capabilities associated with mobile data/wifi hot-spots. This category of user, also, has access to a network connection with a service provider that allows for the use of USSD codes. This user will not have NFC capabilities, however they will have an understanding of how to use USSD codes.

4 Specific Requirements

4.1 Functional Requirements

The functional requirements seek to provide a detailed description of how the system is to function as well as how the system receives and responds to certain interactions made by the user.

4.1.1 Functional Requirements

- **Customer Subsystem**

- **R1.** The system should allow the customer to create a profile
 - * Profile creation refers to an account that will be registered with the bank, and is not dealt with in detail in this document.
- **R2.** The system should allow the customer to view their profile details

- * Profile details include personal details (full names, physical address, postal address, ID number, etc.), bank account numbers, username and active devices.
- **R3.** The system should allow the customer to update their profile details
 - * Refers to updating aforementioned profile details (as per requirement R2)
- **R4.** The system should allow the customer to delete their profile
- **R5.** The system should display the menu once a customer has logged into their profile which allows the user to specify the type of transaction they want to perform
 - * The display menu will include possible transactions, balance checking, generation of a mini-statement, as well as an option to edit system settings and user preferences.
- **R6.** The system should allow the customer to edit system settings
 - * System settings include personal authentication methods (passwords, 2FA, biometric options, and Google Authenticator), daily transfer/transaction limits, general security and other settings that pertain to the operation of the system.
- **R7.** The system should allow the customer to manage their preferences
 - * Preferences such as the look and feel of the application from an aesthetic perspective, layout of the home screen and colour schemes will be editable from this menu.

• Authentication Subsystem

- **R8.** The system should allow the customer to log into their profile
 - * The authentication methods mentioned in requirement R6 will be used to authenticate the customer before confirming a login. Authentication methods and the differences between approaches are discussed in requirement R10.
- **R9.** The system should allow the customer to log out of their profile
 - * Once a customer has logged out of their profile, encryption of sensitive local data can occur based on system settings which were discussed in requirement R6. The system has the capability to automatically log a user out of the application after a certain amount of time has elapsed, when the application is closed or when the device is locked.
- **R10.** The system should be able to authenticate the customer's identity

- * Certain login methods will require external communication with a server to verify credentials (usernames and passwords). In comparison to this, some methods will locally authenticate credentials (fingerprints, iris scanning and facial recognition) such that no sensitive data is stored anywhere other than the local operating system.

- **Transaction Subsystem**

- **R11.** The system should allow the customer to withdraw money
 - * **R11.1.** A withdrawal menu should be displayed which allows a user to specify their transaction details
 - The withdrawal menu will allow the user to specify transaction details such as the amount of money, the account to withdraw from (in the case of multiple accounts), a reference number for personal use and a reference number for external use (in the case of a transfer of funds to another customer)
 - * **R11.2.** The transaction details should be verified against the current standings of the selected withdrawal account
 - The system will verify that the specified transaction is indeed possible given the current account standings. For example, the system will check account balances, daily limits and other account-specific settings.
 - * **R11.3.** The user should be given a choice between different transaction methods (QR Code or NFC)
 - Based on the selection made in this step, either a QR code will be generated or the NFC chip will be enabled to make the transaction possible.
 - * **R11.4.** The verified transaction should be appended to the transaction list
 - This will be done to ensure the user has the possibility of viewing past transactions (pending, verified or cancelled) and access such transactions in their time of need. In certain cases, transaction details can be verified and queued up for execution/confirmation at a later stage, if the user does not wish to perform the transaction at that moment in time. At this stage, a unique reference number pertaining to the transaction will be generated for use by the system at a later stage.
 - * **R11.5.** The system should invalidate the pending transaction after a set duration of time
 - As discussed in requirement R11.5, certain cases will merely verify transaction details without execution/confirmation of the final transaction. It is important to note that in such

cases, transactions will be allowed to remain in the "pending" status up to a maximum of 7 days before they are automatically cancelled (but will remain in the transaction history under the "cancelled" state).

- * **R11.6.** The user should be able to execute a pending transaction
 - The execution of a pending transaction refers to the scanning of the transaction-specific QR code or NFC code. The execution in this stage should reference the transaction by means of a reference number, which was generated in requirement R11.4, and change the state of the transaction from "pending" to "confirmed".
- * **R11.7.** The system should log a completed transaction
 - The logging in this requirement is not visible, nor is it accessible by the customer and is exclusively on the side of the FNB for auditing purposes. The reason that the logging only occurs at this stage is because we believe that there will be an extensive amount of overhead traffic involved with logging pending and cancelled transactions.
- **R12.** The system should allow the customer to view their account balance
 - * In the case of multiple accounts/cards, multiple balances will be available for the customer to view.
- **R13.** The system should allow the customer to view a mini-statement
 - * The mini-statement will include more intricate details (date, time, merchant involved, account fees, service fees) pertaining to all transactions and financial actions performed in the specified month.

4.1.2 Use Case Diagram

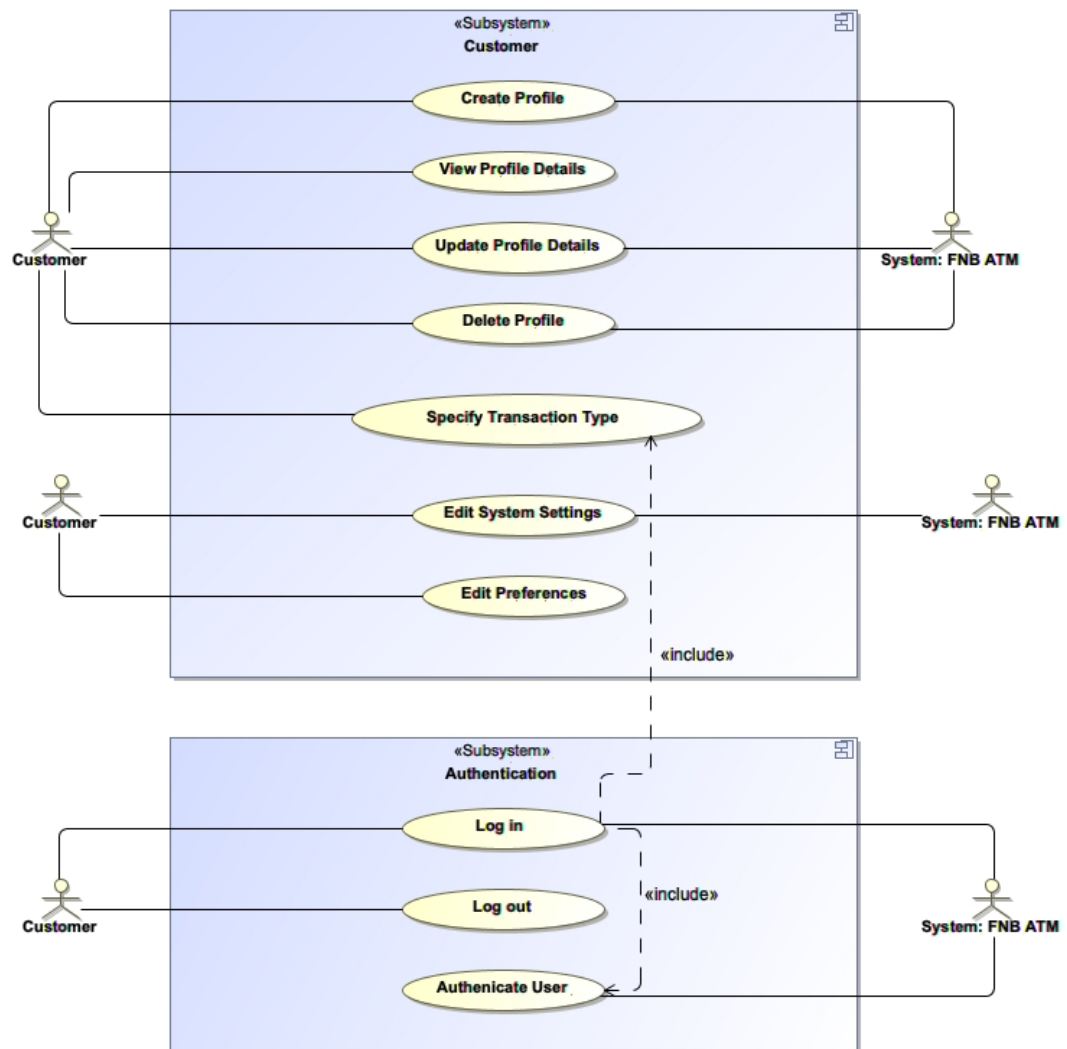


Figure 1: Customer Subsystem

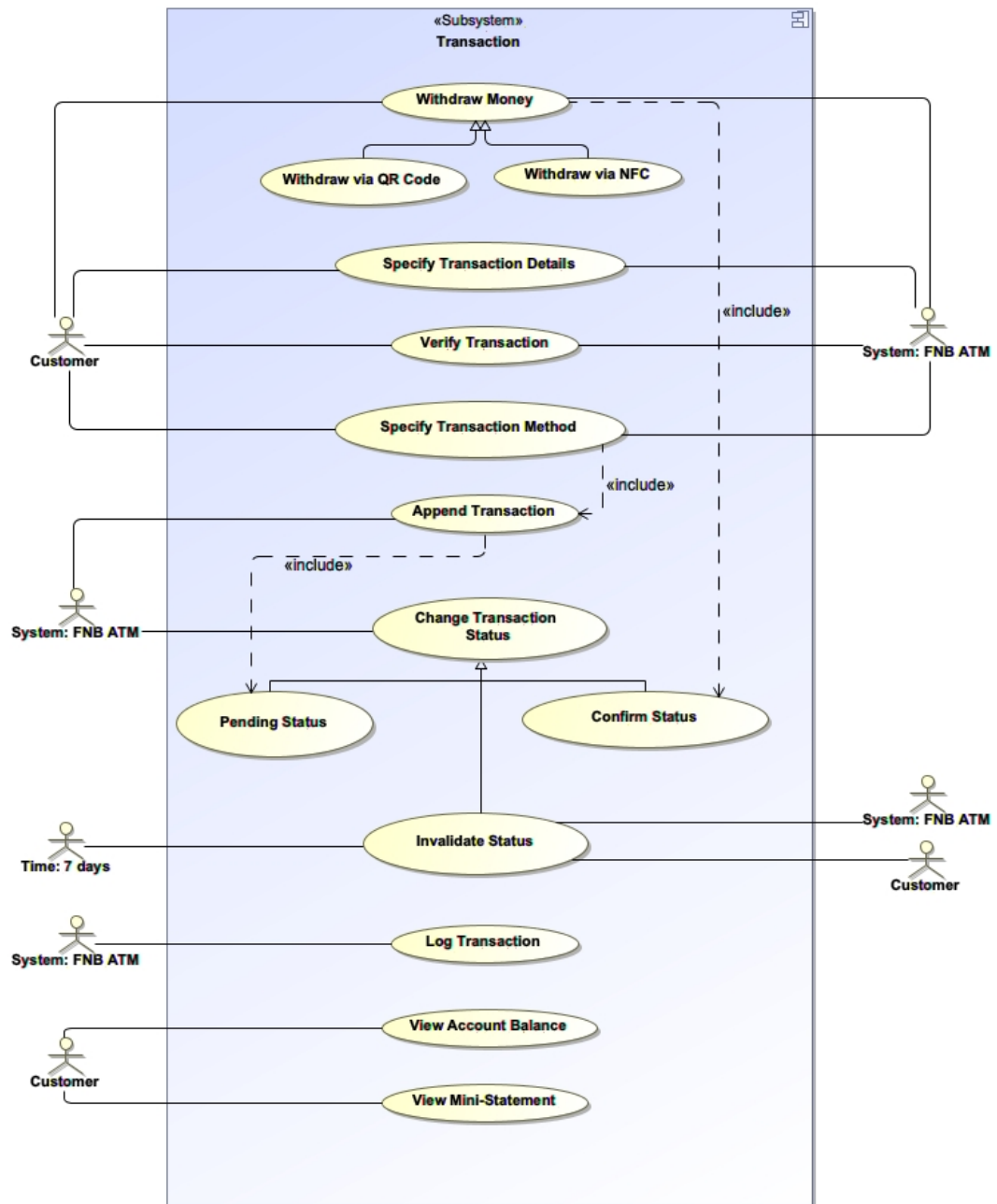
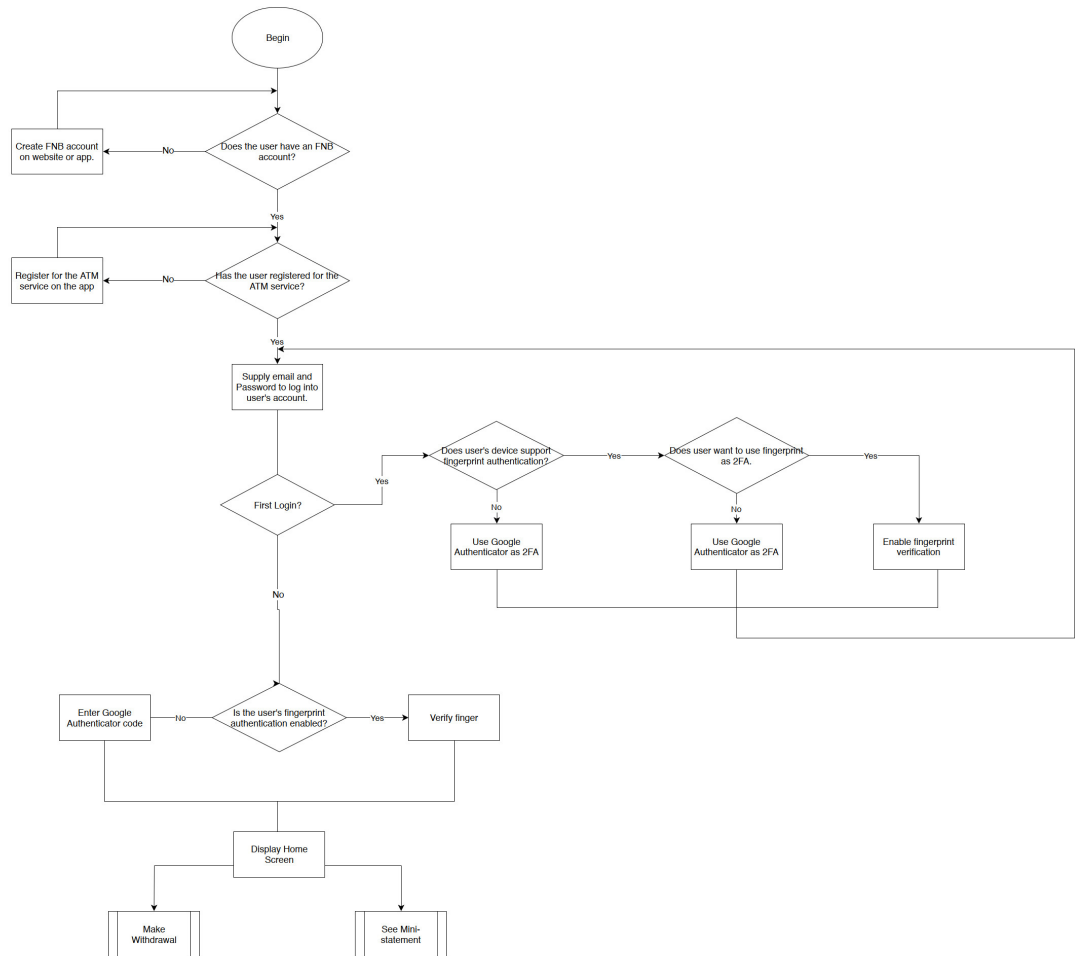


Figure 2: Transaction Subsystem



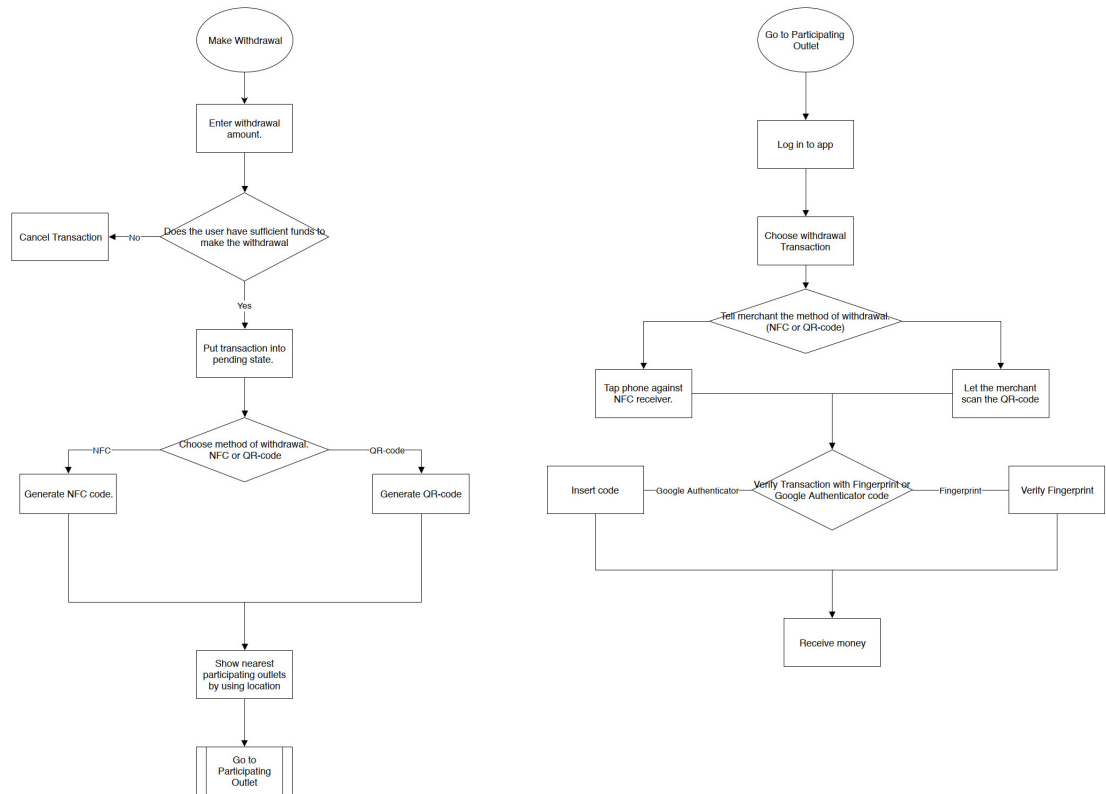


Figure 3: System Flowchart

4.2 Quality Requirements

Non-functional requirements describe how the system works while functional requirements describe what the system should do.

4.2.1 Availability

Perhaps the most critical aspect is ensuring operation and accessibility remains unimpeded by any external or internal events during use of the system. We overcome this by enabling users to be able to use the ATM even when data connectivity is lost and only GSM is available.

4.2.2 Performance

Another critical factor when using the system is to ensure that all tasks are completed within a time-frame as the entire purpose is to reduce or eliminate times where one is idle such as in a queue.

4.2.3 Data Integrity

All sensitive data must remain accurate during transactions therefore we encrypt data not only on the phone but also the information sent between devices during transactions.

4.2.4 Flexibility

As part of availability we strive to ensure multiple different ways to accomplish tasks in the event of possible disruptions which could impede events. Our solution tries to be as redundant as possible for maximum flexibility.

4.2.5 Maintainability

We divided the system into separate modules to ensure low cohesion and high coupling with high quality code to ensure that problems are easily detected and improvements can be made without much difficulty. This also allows changes to be made easily reinforcing the flexibility as well as maintainability of the system.

5 Traceability Matrix

	Customer Subsystem	Authentication Subsystem	Transaction Subsystem
R1	X	X	
R2	X		
R3	X		
R4	X		
R5	X		
R6	X		
R7	X		
R8	X	X	
R9	X	X	
R10	X	X	
R11			
R11.1	X	X	
R11.2			X
R11.3	X		X
R11.4			X
R11.5			X
R11.6	X		X
R11.7			X
R12	X		
R13	X		

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