



BIRZEIT UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
Software Engineering (Comp433).

Project Title:

Fingerprint-ATM.

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Section: 1.

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Date: 12/6/2022

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0. Overview:

The Automatic teller machine (ATM) is a device that enables bank customers to access their accounts, view their information and balance and perform simple transactions without visiting the bank. This project aims to enhance the customers' experience by replacing the credit card with the fingerprint of the user.

0.1 Purpose:

All the crucial features and procedures needed to implement the ATM system will be presented in this document. This ATM system will be studied and proposed, setting the functional requirements and analysis the requirements. The objectives, scope, design model, requirements to be specified using the UML language for analyzing and describing the system, monitoring and reporting mechanisms needed for this system will be studied. The software design tool that is going to be used is the Visual Paradigm.

Features:

- Fingerprint Recognition.
- Money Transactions (Deposit, Withdrawal, Transfer)
- Bank Account management (Update after transaction).
- Printing Receipt.
- Daily report.
- Monthly report.

This report document aim is to hand the goals and analysis of this software, by defining its interface, hardware and software requirements. Which tells both the audiences and the clients how this project functions and works. Thus, helping the designer, the team designer and developer to build the software delivery lifecycle processes.

0.2 Background:

Most of people nowadays depend on the ATM machine as their primary tool to make most of their bank account transactions like withdraw or deposit, and a lot of them consider using the ATM as a necessarily part of the day.

working to develop and enhance these machines is a great concern to many researchers, in order to increase the efficiency and the security for the user and also for the bank.

0.3 Scope:

Primarily, this ATM system targets the Banks the in Palestine. It focuses on the banks, the stakeholders and users, which allow for using and accessing bank accounts from the ATM local machines anywhere using the fingerprint. This system is used by banks that use the ATM machine as this project have a newer way of accessing the account and doing the needed transactions.

0.4 Motivation:

Credit card fraud is a type of identity theft that occurs when someone that is not you uses your credit card or account information for an unauthorized charge. Fraud can happen as a result of a stolen, misplaced, or counterfeit credit card, credit card fraud made up a total of 459,297 reported instances of fraud and identity theft combined in 2020.

To solve this problem we have to replace the credit card, in another way that is safer against identity theft, and proposing the idea of using the fingerprint can provide this in addition to some other features such as solving the problem of forgetting the card.

1. Phase One: Group Formation and Project Planning:

1.1 Group Name: Fingerprint Authentication System.

1.2 Group Members:

- A. Osama Rihami (1190560).
- B. Mahmoud Qaisi (1190831).
- C. Ibrahim Nobani (1190278).

1.3 Roles:

- Project Manager: Osama Rihami.
- Technical Architect: Ibrahim Nobani.
- Programmer: Mahmoud Qaisi.

1.4 Management Strategy:

- Meetings: Meetings will be held twice a week. The first meeting will be in person on Wednesday. The other one will be on Saturday using ZOOM.
- Decision Making: Decisions will be made after thoroughly discussing each topic and then conducting a vote to decide on the final say.
- Process Model: The Agile process model will be used in this project to have more freedom in developing the idea as the project progresses.

2 Phase Two:

2.1 USER REQUIREMENTS:

2.1.1 Functional Requirements:

- FR-1: The system should scan the fingerprint of the user and view all the accounts attached to it.
- FR-2: The user shall choose the account and required to enter the PIN after.
- FR-3: A menu is displayed to the user with the following options: Withdraw, Deposit, View Balance and Exit
- FR-4: A user must be able to make a cash withdrawal, in JDS, ILS or USD. Approval must be obtained from the bank before cash is dispensed.
- FR-5: A user must be able to make a deposit to any account linked to the fingerprint, consisting of cash and/or checks, Approval must be obtained from the bank before physically accepting the deposit.
- FR-6: A user must be able to make a transfer of money between any two accounts.
- FR-7: the ATM must print a receipt for any transaction made by the user.
- FR-8: the ATM should go to the idle state when the user chooses to Exit.

2.1.2 Non - Functional Requirements:

- NFR-1: A PIN must be entered within 30 seconds and has 3 attempts only or the account will be temporarily suspended.
- NFR-2: The cash dispenser can be opened and refilled with cash.
- NFR-3: The printer can be opened and refilled with paper.
- NFR-4: the ATM must be secured and provided with a camera and it can shut down and restart at any time.
- NFR-5: the ATM shall cancel any transaction when an error occurs and return to idle state.
- NFR-6: the ATM must have a fast response to any transaction (no longer than 2 seconds).

2.2 SYSTEM REQUIRMENTS:

- SR-1:
 - SR-1.1: The ATM should have an appropriate fingerprint sensor installed.
 - SR-1.2: The System will use the user's fingerprint to identify the accounts attached to it.
 - SR-1.3: If the fingerprint is recognized and there are indeed accounts attached to it, the system will display on the ATM screen the list of accounts.
 - SR-1.4: The System will be able to recognize which account was chosen to be viewed or actions performed on it.
- SR-2:
 - SR-2.1: After selecting an account, the system will require the user to enter a PIN number for the selected account. (Accounts for the same user can have different PIN numbers).
 - SR-2.2: The ATM will have a numpad that will enable the user to enter the PIN of the selected account.
 - SR-2.3: The system will be able to recognize if the entered PIN is correct and give access to the account accordingly.
- SR-3:
 - SR-3.1: The system will display a menu that repents the actions that the user can perform through the atm. Withdraw, Deposit, Exit and Account Summery.
 - SR-3.2: The system should be able to recognize the chosen action and further display more options accordingly.
- SR-4:
 - SR-4.1: The system should be able to recognize the amount of cash the user requires to withdraw from his account with the right chosen currency (JDS, ILS or USD) that matches the currency of the chosen account.
 - SR-4.2: The system should be able to update the balance of the user's account correctly.
 - SR-4.3: The system should also be able to dispense the correct amount of cash to the user.

- SR-5:
 - SR-5.1: The system should be able to recognize the amount of cash deposited and correctly update the balance of the account.
 - SR-5.2: The system should be able to distinguish the marks that will indicate if any of the deposited bills are fake and report if any were found.
 - SR-5.3: The system should be able to recognize the amount the user wishes to deposit via check but will not update the balance until a specialized employee validates the check and the balance of the account the cheque was written from.
- SR-6:
 - SR-6.1: The system should be able to make a transfer to another account as per request from the user if the account has sufficient funds to be transferred.
 - SR-6.2: The system should reliably make the transfer and confirm the completion of the transfer.
- SR-7:
 - SR-7.1: The system should have an error detection algorithm, that can detect and handle any error as soon as it occurs, and return the system to an idle safe state ready for the next transaction.
 - SR-7.2: If the error is unmanageable by the system, it should be able to notify the maintenance department and shut down any further transactions until the error is handled.
- SR-8:
 - SR-8.1: The ATM system should have an Exit option that allows the user to finish his transaction and log out from his account.
 - SR-8.2: The ATM will go into the idle state after exiting.

2.3 Effort and Time Estimation:

User Requirements:	Estimated Effort:	Estimated No of Developers:	Total Effort:
FR-1	2 pw	2	4
FR-2	1 pw	1	1
FR-3	1 pw	1	1
FR-4	3 pw	2	6
FR-5	3 pw	2	6
FR-6	1pw	2	2
FR-7	1pw	2	2
FR-8	1pw	3	3
Total Effort/ AVG	13 pw	1.87 dev on avg	25pw
Schedule time 30%	Min Time: 16.9pw		Max Time: 32.5pw
Cost:		AVG salary: 600\$	19500\$
Profit Margin:		Min:	21450\$
		Max:	25350\$

Table 1:Effort and Time Estimation.

3. Requirements Analysis and Modelling:

3.1.1: Actor Analysis:

Actor:	Description
The customer.	The person who uses the ATM.
The Bank system.	Represents the software in the atm that performs all the transactions and manages the data base of the bank.

3.1.2: Use Case Modeling:

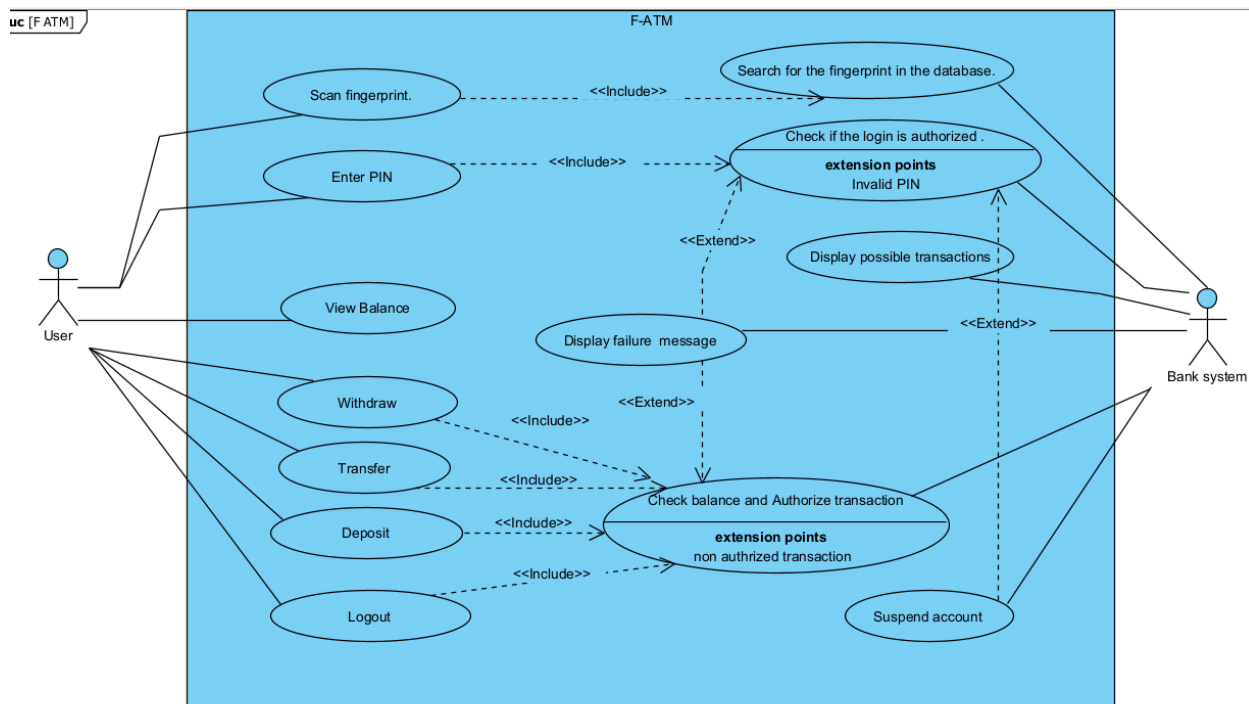


Figure 1: System Model Use case.

3.2.1: Scenario Analysis:

- Scenario for Log in Process: (Author: Osama Rimawi)

Initial assumption: The user wants to use the ATM to login to his account by using his fingerprint.

Normal: At first, the user choose the login option on the screen ,then the system will ask for his fingerprint ,the user will place his finger on the fingerprint scanner ,after the scan is done the system will take the fingerprint information and search for it in the database , if it finds an account that matches that data ,the screen will ask for the PIN code for this account that the user will write on the keyboard pad, if the PIN is correct, the system displays a list of possible transactions that user can perform on the ATM screen.

Alternative: If the ATM scans the user's fingerprint, and the fingerprint information does not exist in the database, the system will display a fault message that "the system can't recognize the fingerprint entered", and it will ask the user try again.

Error: If the user tries to login to his account and he entered an incorrect PIN code in the ATM, the system will display a fault message that "Wrong PIN code", then the system will ask the user to try again, and if the user entered a wrong PIN again for more than three consecutive times, the system will suspend the user account and will display a fault message that "user has tried to access the account so many times so the account is now suspended".

- Scenario for Deposit transaction: (Author: Ibrahim Nobani)

Initial assumption: The user wishes to deposit cash into his bank account. The customer approaches the ATM machine, scans his fingerprint and then logs into his account.

Normal: The customer checks the main menu and chooses the deposit option, the cash dispenser then opens and customer puts the amount of cash he wishes to insert into his account inside the dispenser, after the cash is inserted the dispenser closes, the cash entered is scanned and displayed on screen, the user verified if the value is correct, the account is the updated and the system returns to the main menu.

Alternative: The customer wants to cancel the deposit transaction; the dispenser opens and the customer reclaims his cash. **Error:** If the value displayed on the screen is not equal to the value put in the dispenser, the dispenser opens up to return the cash back to the user, the system returns to the main menu.

- Scenario for Transfer transaction: (Author: Mahmoud Qaisi)

Initial Assumption: The customer has a working active account in the bank that owns the atm. The customer has logged into his account successfully. And wishes to transfer an amount of money to another account.

Normal: The user chooses transfer option from the main menu. The system will ask the user to provide the account number that he wishes to transfer to. The system will validate the account no. to make sure it's an active account that exists. Then the system will request the amount the user wishes to transfer. The system will check if the user's account has sufficient funds to cover the transfer. Then the system will display a summary message. Then the user should confirm the transfer. Then a success message is displayed and the balance of the user's account is updated.

Alternative: If the user doesn't confirm the transfer the transaction is canceled and the atm returns to the atm menu.

Error:

- If the user provides an account number of an account that is inactive or an account doesn't exist. An error message is displayed and the user is asked to enter a valid account number to be checked again. Or the user can abandon the whole transfer and will be returned to the main menu.
- If the balance of the user's account doesn't have enough funds to cover the transfer for the amount he specified. An error message is displayed then the user is asked to enter a new amount to transfer or the user can cancel the transfer and return to main menu.

3.2.2: Use Case Specification:

(Author: Osama Rimawi)

Title	Login Use Case Description
Actors	User/Customer, Bank system
Description	Customer logs into the system by scanning his fingerprint and entering pin code.
Preconditions	Customer has a bank account.
Flow of Events	<ol style="list-style-type: none">1. Customer scan his fingerprint.2. System checks if the fingerprint is already registered in the database.3. Enter PIN if applicable.4. System checks if the login is authorized.5. System displays a list of possible transactions that customer can perform.
Data	Fingerprint, account number, PIN
Trigger	User choose the login option.
Postconditions	Customer logged in to his/her account.
Comments	<ul style="list-style-type: none">• If the fingerprint is not authorized by the bank, System displays failure attempt message and go back to login screen.• If the PIN code is incorrect, System displays a message to reenter the PIN code.• Customer enters pin code again, then System checks if the pin code is correct or it hasn't passed 3 times.• if the user enters incorrect pin 3 consecutive times the bank will suspend his\her account.

Table 2: Log In use Case Specification.

(Author: Ibrahim Nobani)

Title	Deposit Use Case
Actors	User/Customer
Description	Customer wishes to deposit cash into his bank account.
Preconditions	<ol style="list-style-type: none">1. Customer is logged in to his bank account after scanning fingerprint and entering PIN.2. The system deposit service is available.3. The system must have an active cash dispenser.
Flow of Events	<ol style="list-style-type: none">1. Customer selects the deposit transaction.2. Customer inputs the amount of money into the cash dispenser.3. The System scans and determine the cash amount.4. The System shows the cash value and asks the user if its right.5. The System updates the account balance6. The System shows the updated balance.7. The System checks if the user wishes to do another transaction.
Data	Cash amount deposited.
Trigger	The customer chooses the deposit transaction.
Postconditions	The balance of the customer account is increased by the amount deposited.
Comments	

(Author: Mahmoud Qaisi)

Title	Transfer Transaction
Actors	User/Customer
Description	The customer wishes to transfer a certain amount of money from his account into another account.
Preconditions	The customer must have a working active account. The customer has already logged into his account and entered the pin correctly.
Flow of Events	<ol style="list-style-type: none">1. The customer enters the account number he wishes to make the transfer to.2. The account number entered is validated3. The amount that the customer wishes to be transferred is entered.4. The balance of the account is checked if its sufficient to cover the transfer5. A summary of the transactions is displayed6. The customer confirms the transaction.7. A success message is displayed.8. Account balance updated
Data	Account number that the customer wishes to transfer to, Amount of money the customer wishes to transfer.
Trigger	The user chooses transfer transaction from the main window.
Postconditions	The amount of money is transferred into the desired account and the customers account balance was updated.

Comments	<p>2a. The account number is not recognized.</p> <p>2a1. The customer is asked to enter the number again.</p> <p>3a. The account doesn't have enough funds to cover the transaction.</p> <p>3a1. A warning message is displayed.</p> <p>3a2. The customer is asked to enter a proper amount.</p> <p>6a. The customer doesn't confirm the transaction</p> <p>6a1. The entire transaction is cancelled.</p>
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3.2.3: Activity Diagram:

(Author: Osama Rimawi)

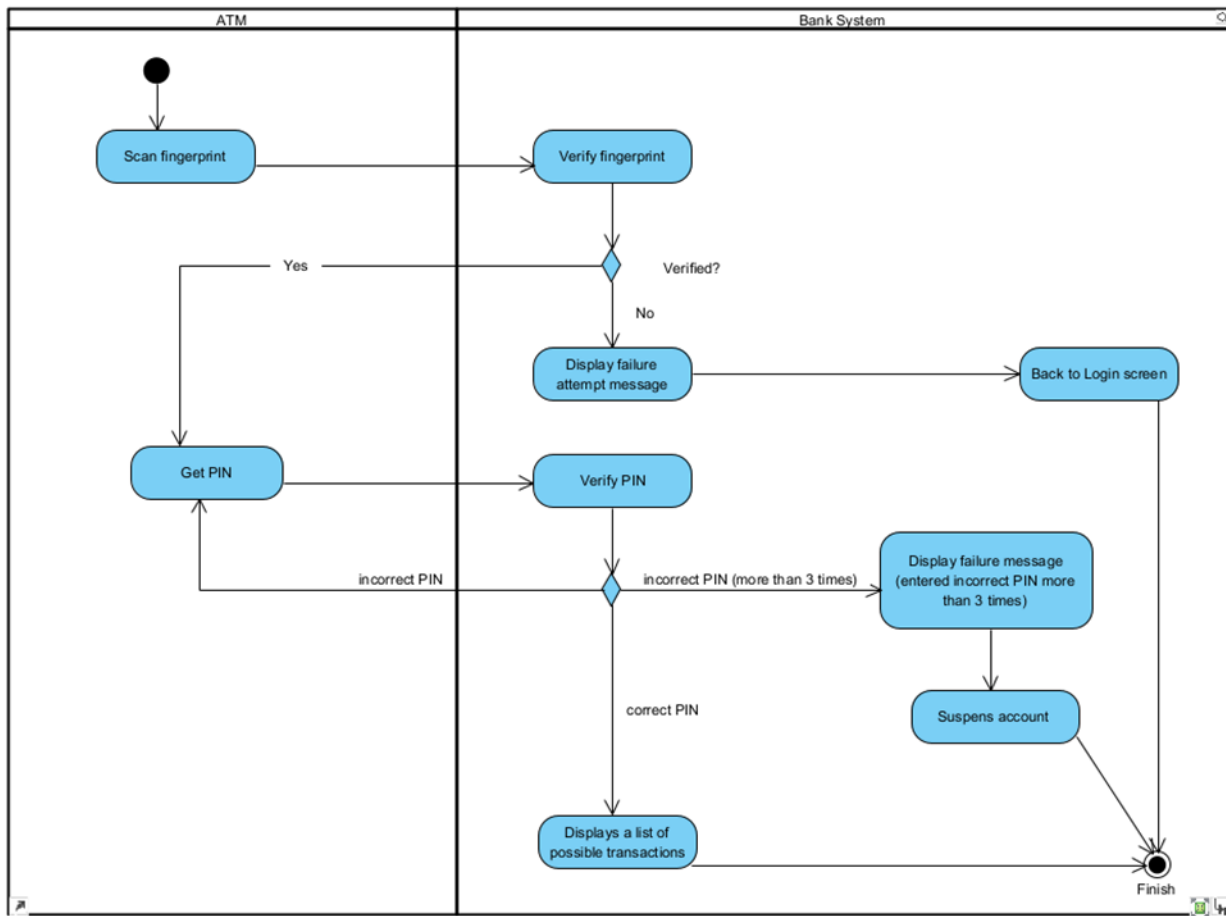


Figure 2: Log in Activity Diagram.

(Author: Ibrahim Nobani)

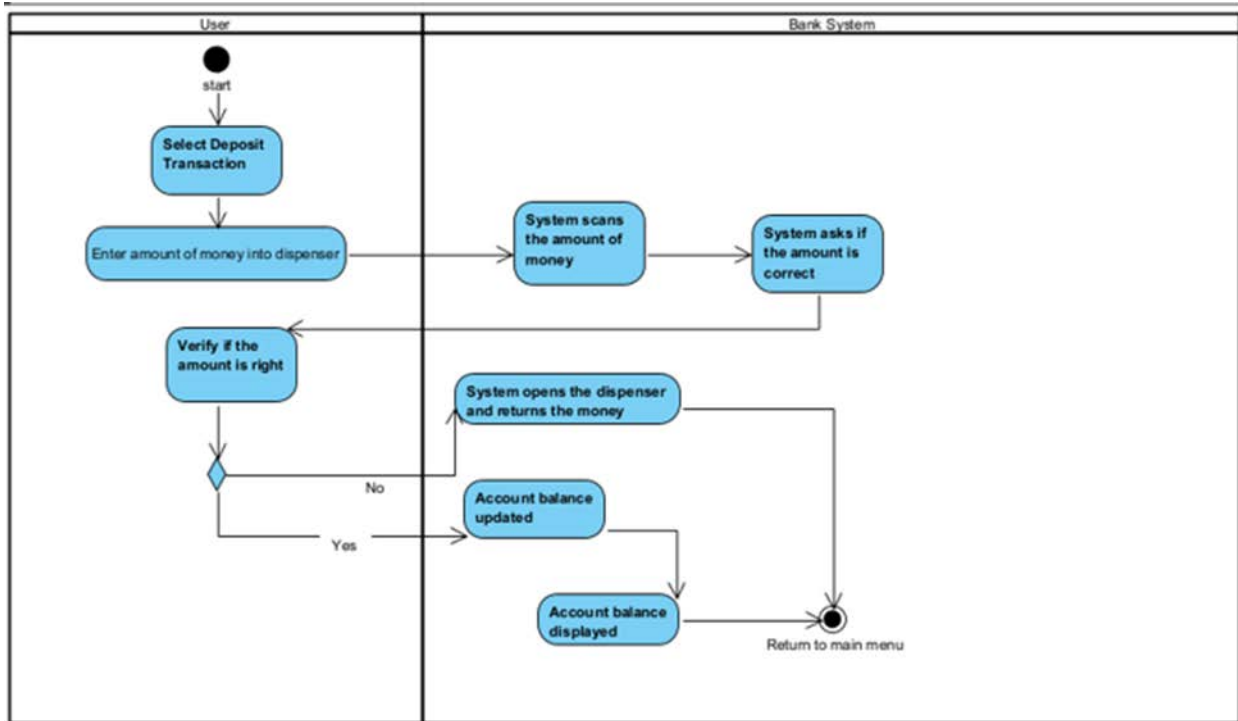


Figure 3: Deposit Activity Diagram.

(Author: Mahmoud Qaisi)

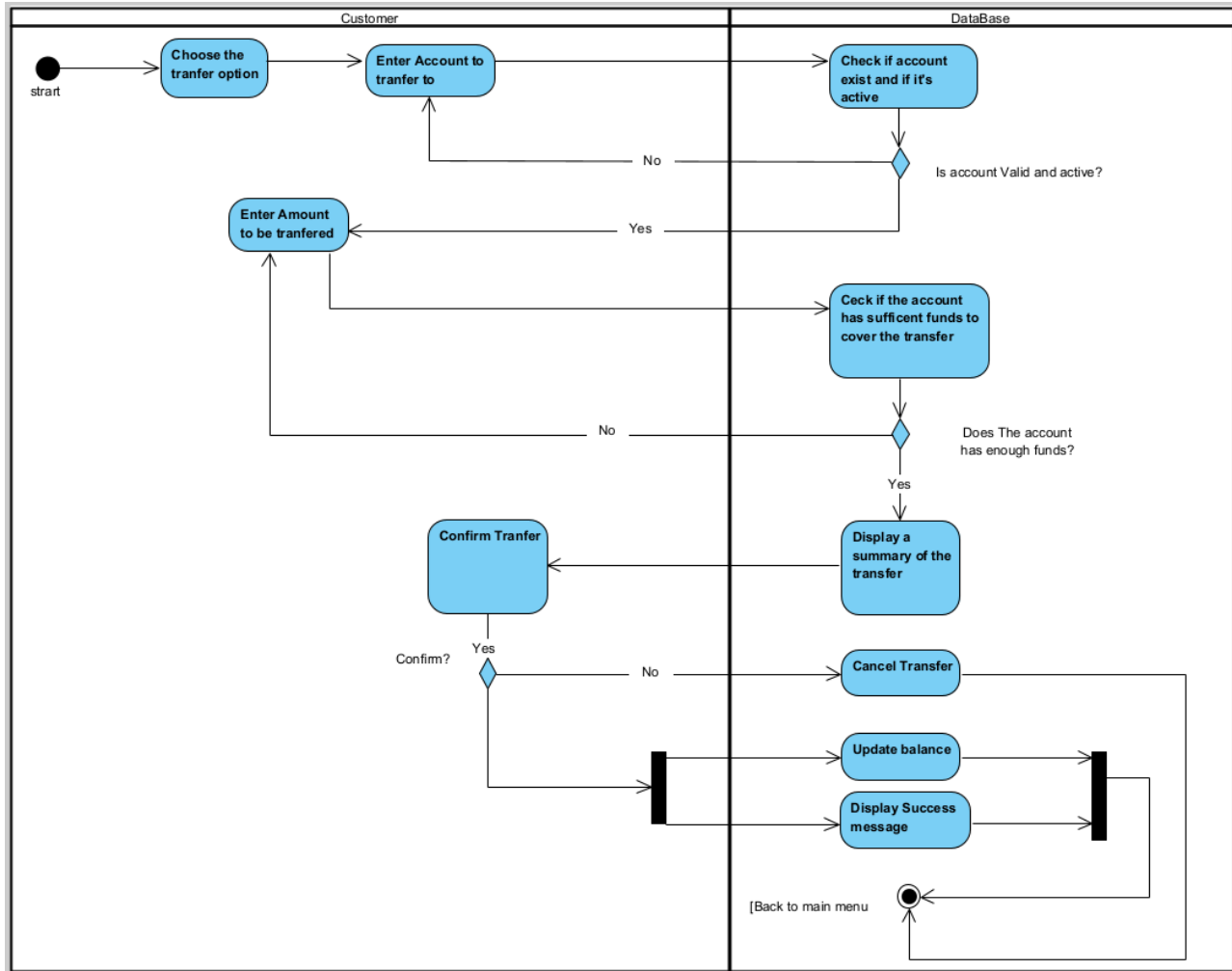


Figure 4: Transfer Activity diagram.

3.2.4: Conceptual Class Diagram: (Group Task, Designer: Osama, Supervisor: Ibrahim, Revised By: Mahmoud)

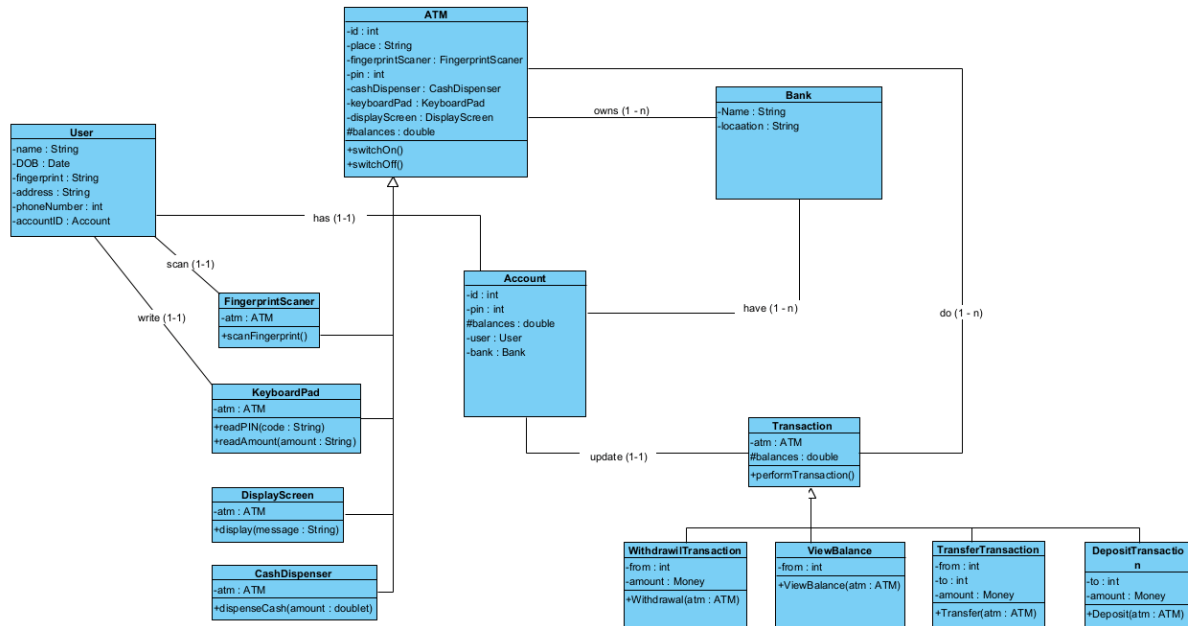


Figure 5: System Class Diagram.

3.2.5: System sequence modelling and analysis:

- Sequence diagram for Log in process: (Author: Osama Rimawi)

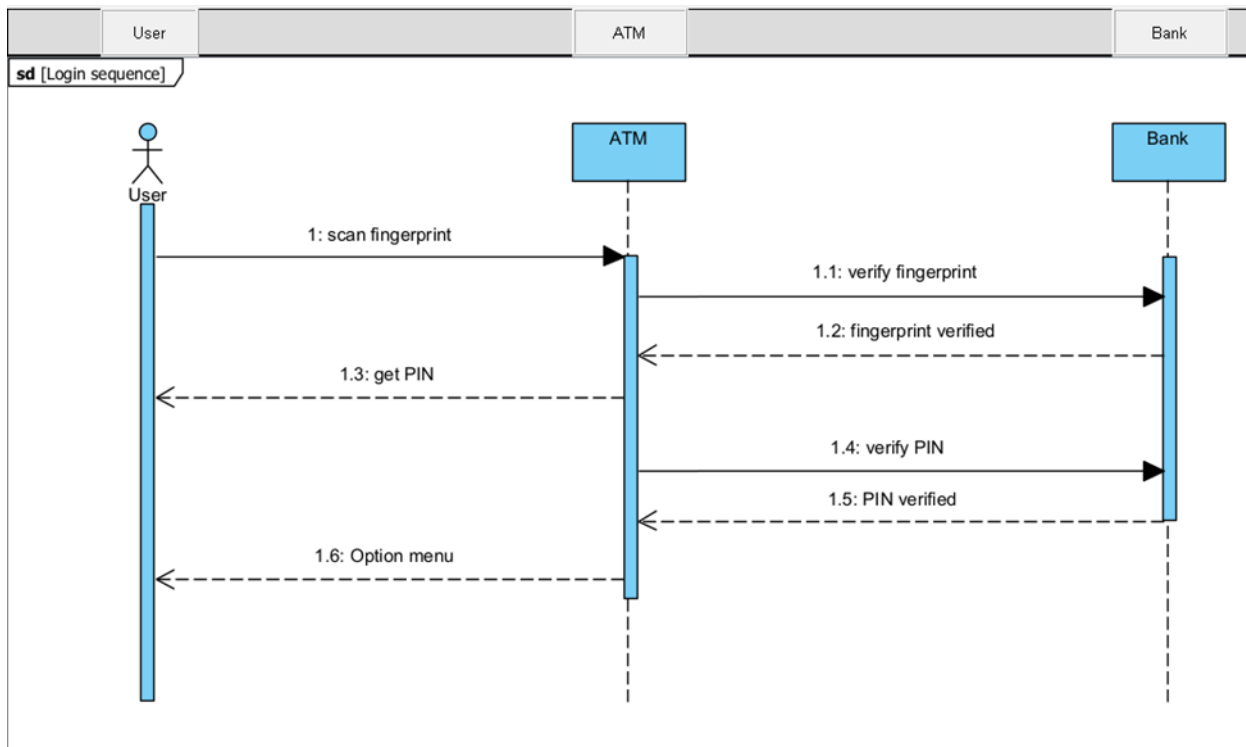


Figure 6: Log in Sequence Diagram.

- Sequence Diagram for Deposit transaction: (Author: Ibrahim Nobani)

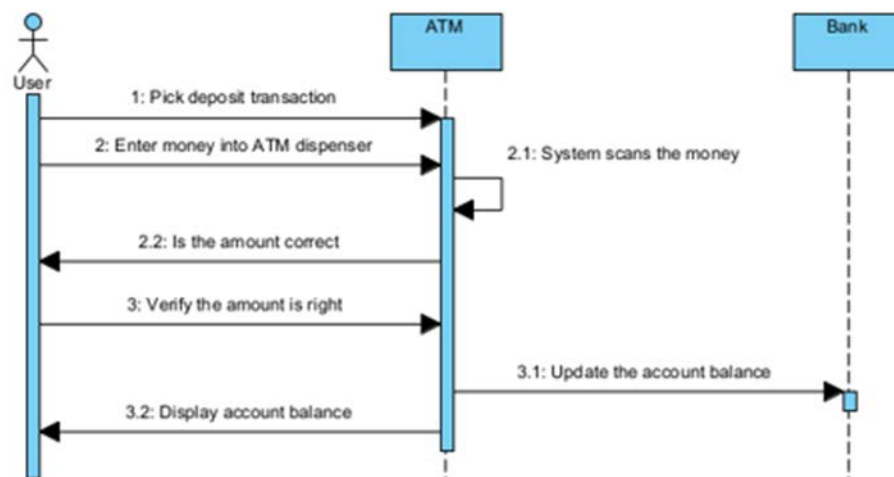


Figure 7: Deposit Sequence Diagram.

- Sequence Diagram for Transfer transaction: (Author: Mahmoud Qaisi)

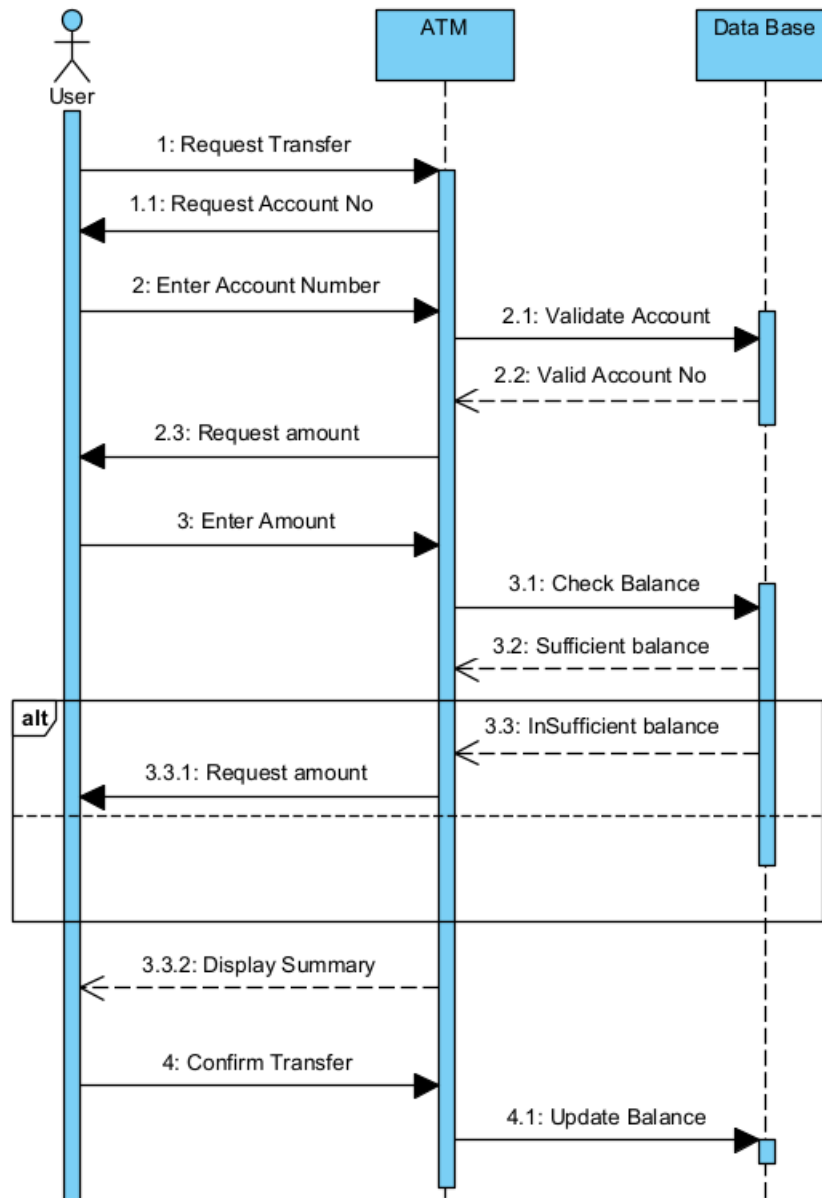


Figure 8: Sequence Diagram For Transfer.

3.2.6: System State Analysis and modeling:

- Log in process state Diagram: (Author: Osama Rimawi)

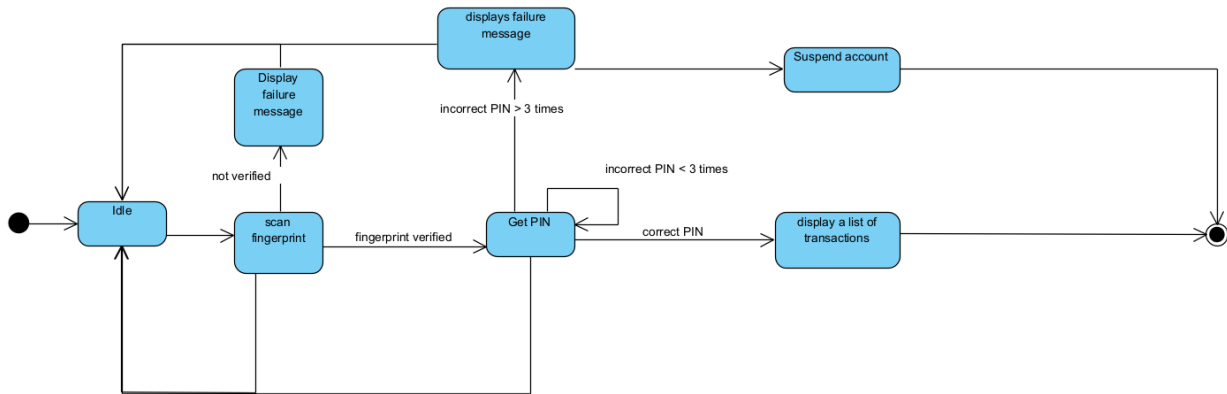


Figure 9: Log in State Diagram.

- Deposit transaction State Diagram: (Author: Ibrahim Nobani)

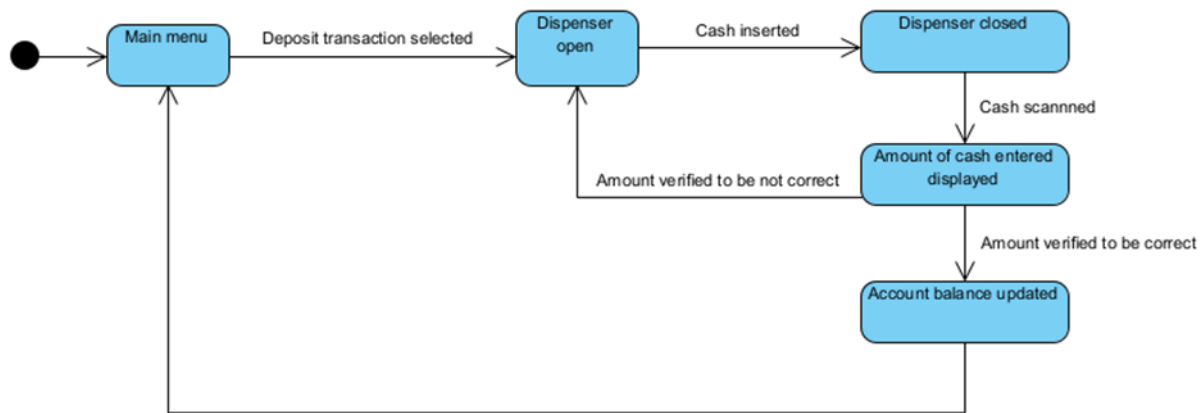


Figure 10: Deposit State Diagram.

- Transfer Transaction State Diagram: (Author: Mahmoud Qaisi)

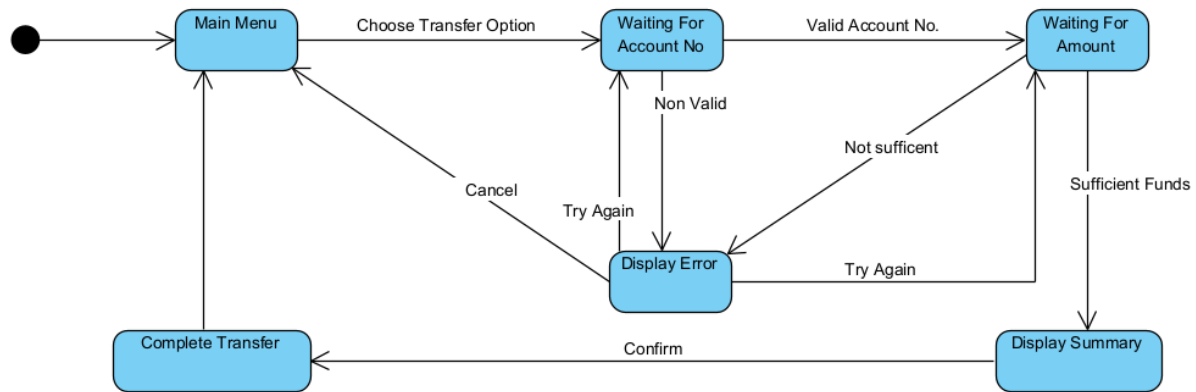


Figure 11: Transfer transaction State Diagram.

4. System Modelling and Design.

4.1. System Design Goals: (Group Task)

1. High Cohesion:

Methods and classes related with each other were kept together as a single component. For example, transaction includes deposit, withdrawal, transfer.

2. Low Coupling:

Methods and classes unrelated to each other were separated as much as possible, operations on the cash dispenser (like deposit and withdrawal) are not connected to the login process.

3. Reliability:

Reliability: we're dealing with a critical system so we will always have a backup in case of any failures that might occur during any operation, also the system will return to the state before the operation.

4. Persistence:

All the transactions and changes must continuous and without any conflict such as two readings and then a writing occurs from one of the readings. Extra measures were added to the data base of the bank to avoid such conflicts from happening.

4.2: System and Component modeling. (Group Task, Lead Designer: Osama Rihami).

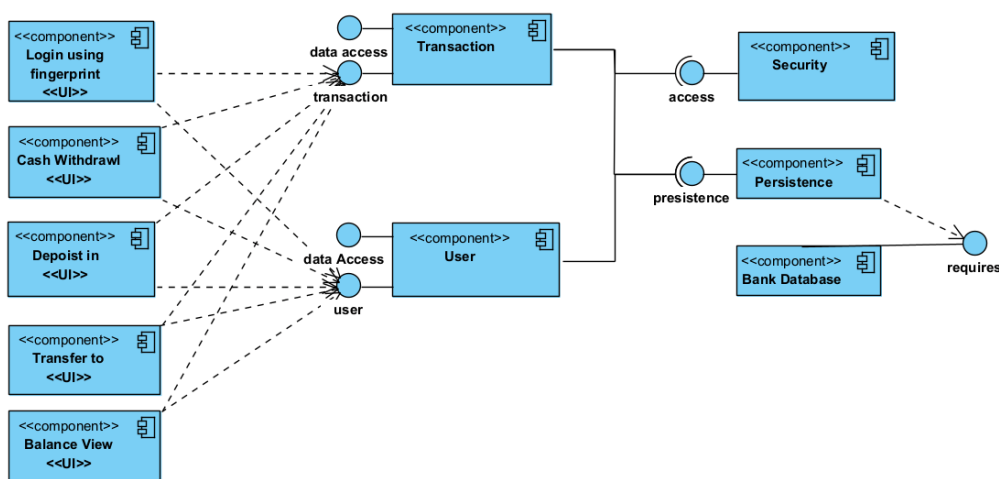


Figure 12: Component Diagram.

4.3 System and architectural Design: (Group Task, Lead designer: Ibrahim Nobani)

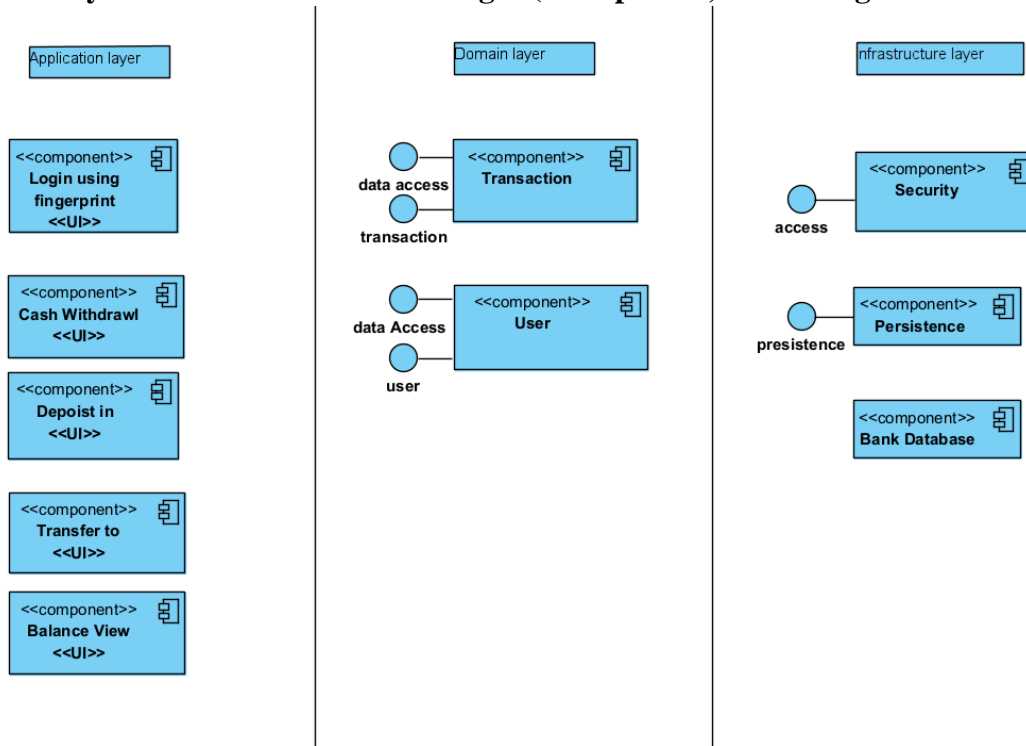


Figure 13: Architecture Design

4.4: System and Deployment modeling: (Group Task, Mahmoud Qaisi)

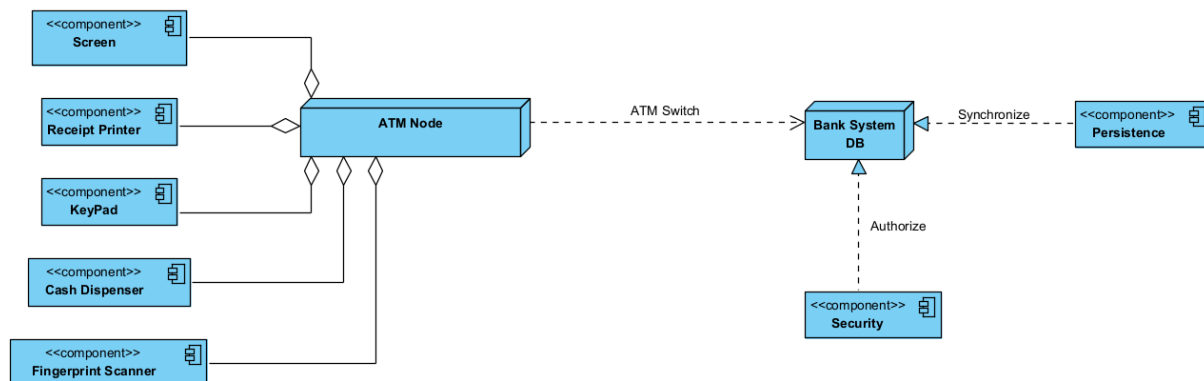


Figure 14: Deployment Model.