

## *Tap+: From Cashless to Cardless*



## **1. Introduction**

In an era characterized by the relentless pursuit of technological advancement, the realm of banking and financial services has been no exception to the transformative power of innovation. The traditional services of banking have gradually been digitized over the years, making personal finance management more convenient than ever through the help of banking applications that provide services straight from users' mobile devices. Given these fast-paced improvements, users' attention is shifting more towards security enhancements that could help them maintain control over their personal finance data. Noticing this shift in consumer preferences, our team wanted to develop new features that could be added to current banking applications that aim to fill in the security loopholes that continue to put users' financial information at risk.

Our Tap+ project represents a groundbreaking expansion of your typical online banking applications, with a focus on transforming how customers approach traditional financial services. This initiative introduces two pioneering features: "Tap and Pay" and "Tap and ATM Access," offering users secure and convenient methods for making payments and accessing cash using their smartphones.

The project encompasses milestones such as comprehensive requirements analysis, development, rigorous testing, user interface enhancements, integration with payment systems, thorough security audits, user training and education, and a strategic marketing campaign. Overall, Tap+ is poised to enhance customer satisfaction, drive increased app engagement, attract new users, and firmly establish our bank as a leader in digital banking innovation, aligning our services seamlessly with the ever-evolving landscape of digital payments and mobile banking.

## **2. Problem Statement**

The finance and banking industry faces substantial challenges related to credit card security, which have given rise to opportunities for financial scams. Credit cards, once considered revolutionary in replacing traditional cash payments, now pose significant security risks. Physical possession of these cards makes them susceptible to theft, and criminals have devised methods like credit card skimming to capture card information discreetly at ATMs, gas pumps, and point-of-sale terminals. These skimming devices are often difficult to detect, enabling thieves to steal card data effortlessly. This lack of post-theft security measures and the inconveniences associated with lost or stolen credit cards remain prevalent issues.

Mobile payment solutions like Apple Pay aim to tackle these problems, but they encounter their own set of obstacles. They rely on third-party apps and face limited compatibility with certain devices and merchants. While they offer enhanced security features, their adoption can be hindered by these challenges.

On the other hand, ATM services have seen minimal changes since their inception. Users still depend on physical debit cards, and the reliance on a 4-digit PIN for security raises concerns, as

these can be easily forgotten or exploited by criminals. This outdated approach puts users' financial security at risk and contributes to the inconveniences associated with ATM usage. In addition to security concerns, the inconvenience factor plays a significant role in ATM services' unpopularity among users. Finding a functioning ATM, navigating the process of accessing one's account, and conducting transactions can be cumbersome and potentially risky due to criminal activity around ATMs.

In summary, credit card security issues and inconveniences persist, and the introduction of mobile payment solutions seeks to address them but faces its own set of challenges. Meanwhile, ATM services have lagged behind in terms of security and user convenience, making them a prime candidate for innovation and improvement within the finance and banking industry.

### 3. Scope

The scope of the new proposed system is as follows:

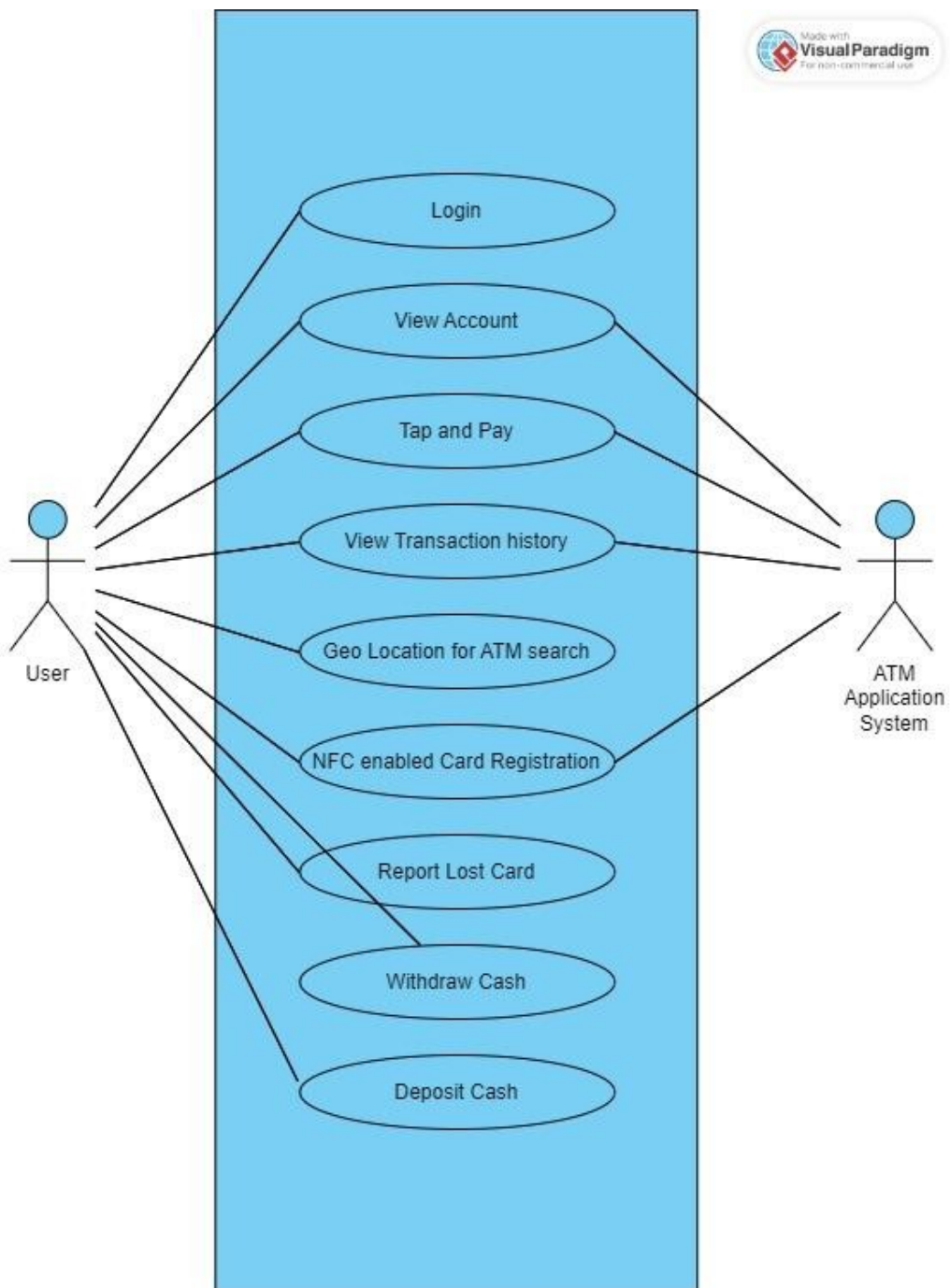
- 1) **Security Challenges:** Examining the evolving security threats associated with traditional credit cards, encompassing theft and credit card skimming, and assessing their impact on users and financial institutions.
- 2) **Technology Deficiencies:** Evaluating the shortcomings of existing credit card technology, particularly in terms of post-theft security measures and its limitations during user forgetfulness.
- 3) **Inefficiencies and Vulnerabilities in ATM Services:** Investigating the persisting inconveniences and security vulnerabilities inherent in ATM services, such as the reliance on physical cards and 4-digit PINs.
- 4) **Mobile Payment Solutions:** Analyzing the potential of mobile payment solutions, including Apple Pay, Samsung Pay, and Android Pay, as alternatives to traditional credit cards and ATM transactions.
- 5) **User Experience:** Considering the impact of these issues on the overall user experience, including security concerns, convenience, and accessibility.
- 6) **Market Dynamics:** Examining the competitive landscape and market dynamics surrounding traditional credit cards, ATM services, and mobile payment solutions.

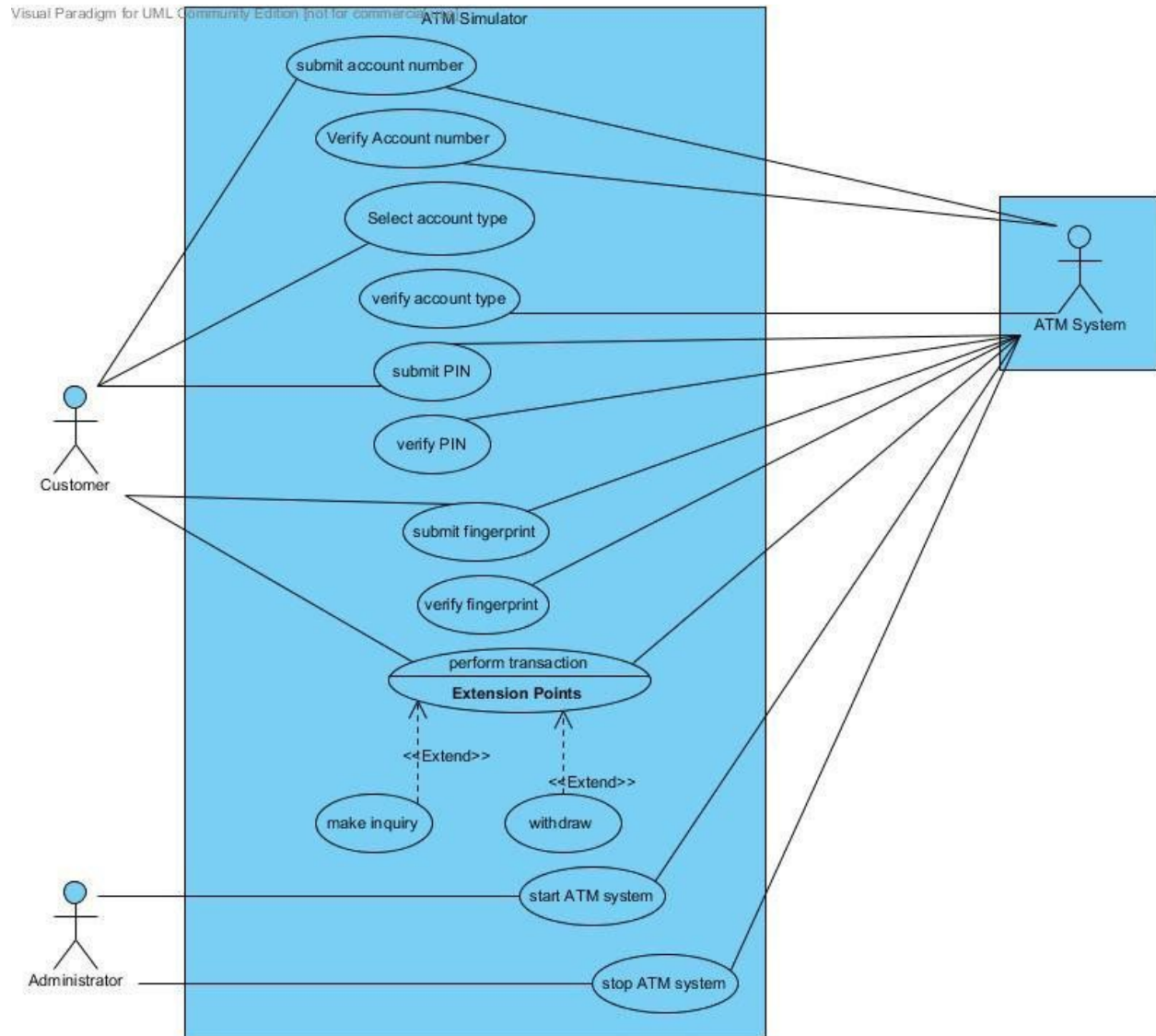
### 4. Proposed Solution:

Knowing the drawbacks of the current technologies, our team aims to create an extension to current banking applications that could allow consumers to engage in important banking services without having to worry about security or convenience. Through this extension, banks would be able to improve user experience and engagement with their own banking application instead of having to rely on other third-party applications. For the consumers, they can enjoy a wider array of services that is easily accessible through their current banking applications. In this way, current banking applications can truly become a one-stop shop that could satisfy all of users' banking needs, right from their mobile phones. Our Tap+ project focuses on the development of the following features:

- **Tap and Pay:** "Tap and Pay" enables effortless contactless payments at point-of-sale terminals, fortified by advanced encryption and seamless integration with major mobile wallet providers. This means that our extension would allow users to initiate ATM withdrawals through the mobile app without needing a physical debit or credit card.
- **Mobile Check Deposit:** Enable users to deposit checks by capturing images of the check via the mobile app, making remote deposits convenient.
- **Digital Identity Verification (Tap Authentication):** Implement identity verification solutions that use biometrics or AI for enhanced security during account setup and transactions.
- **Tap and ATM Access:** "Tap and ATM Access" revolutionizes ATM services by enabling cardless cash withdrawals, enhancing transaction security with multi-factor authentication. Users can initiate transactions from their mobile phones, select an ATM, and complete the transaction swiftly upon arrival. Using NFC and a unique code, users access their accounts, reducing wait times at the ATM teller.
- **Geo-Fencing and Geo-Location:** Use GPS data to create geo-fencing for ATMs, allowing users to access the ATM only when they are in a specific location, enhancing security against remote fraud.

## 5. Use Case Diagrams and Descriptions:





\*Important - Mentioned security features:

- **Tap Authentication:** During the process of completing transactions, the customer will often be prompted to use the NFC-enabled card to tap on either the POS or ATM machines (which are NFC-enabled). After tapping, the machine authenticates the user using NFC and a secured tokenization feature. If the authentication is successful, the rest of the transaction proceeds. If the authentication fails, the user can try again. If the customer is engaging in an ATM service, after failing to be authenticated 3 times, the customer will receive an OTP (one-time passcode) sent to their phones so they can complete the transaction. If the customer is making NFC-enabled credit card payments at a POS, no OTP will be sent and the customer will have to work with the bank regarding the failed transaction.

- **Geo-Fencing:** User can only access the designated ATM that offers our services when they are in a specific location

1: Deposit Cash at ATM:

<b>Use Case Name:</b> Deposit Cash at ATM
<b>Primary Actor(s):</b> Banking Application User
<b>Stakeholder(s):</b> Corporate Bank
<b>Pre-Conditions:</b> The user has installed the Tap+ extension and registered their biometric data with the banking application.
<b>Post-Conditions:</b> Transaction is marked as “Completed” and the deposited amount is reflected in the account balance.
<b>Trigger:</b> User needs to deposit cash into their desired bank account
<b>Brief Description:</b> The user depositing cash in ATM machine
<b>Normal Flow of Events:</b> <ol style="list-style-type: none"><li>1) The user logs into their banking application using user login details or biometric authentication.</li><li>2) User accesses the Tap+ main menu.</li><li>3) From there, the user selects “Cash Deposit” from the “ATM Services” menu.</li><li>4) User chooses the account where they wish to deposit cash and enters the amount to be deposited.</li><li>5) User confirms the transaction.</li><li>6) Application sends the transaction details to the bank’s ATM network.</li><li>7) At the ATM machine, after the user taps their NFC-enabled card (Tap Authentication) linked to the transaction, ATM will automatically pull up the transaction details.</li><li>8) When ready, the user can drop the cash in the ATM and the machine begins to tally and verify the amount deposited.</li><li>9) User checks the amount displayed on the application and then taps on “FINISH”.</li><li>10) The transaction is then marked as “Completed” in the app</li></ol>
<b>Exception Flow:</b> <ul style="list-style-type: none"><li>• If an ATM machine is out of order, the user will receive a notification and recommendations to reach another ATM location that is convenient for them to finish the transaction.</li></ul>
<b>Related Use Cases:</b> N/A

2: Withdraw Cash at ATM

<b>Use Case Name:</b> Withdraw Cash at ATM
<b>Primary Actor(s):</b> Banking Application User
<b>Stakeholder(s):</b> Corporate Bank
<b>Pre-Conditions:</b> The user has installed the Tap+ extension and registered their biometric data with the banking application
<b>Post-Conditions:</b> Transaction is marked as “Completed” and the amount withdrawn is reflected in the appropriate account balance

<b>Trigger:</b> User needs to withdraw cash from their desired bank account
<b>Brief Description:</b> The action of withdrawing cash from the ATM machine.
<b>Normal Flow of Events:</b> <ol style="list-style-type: none"> <li>1) The user logs into their banking application using user login details or biometric authentication.</li> <li>2) User accesses the Tap+ main menu.</li> <li>3) From there, the user selects “Cash Withdrawal” from the “ATM Services” menu.</li> <li>4) The user chooses the account from which they wish to withdraw cash and enters the amount to be withdrawn.</li> <li>5) User confirms the transaction.</li> <li>6) Application sends the transaction details to the bank’s ATM network.</li> <li>7) At the ATM machine, after the user taps their NFC-enabled card linked to the transaction, ATM will automatically pull up the transaction details.</li> <li>8) When ready, the ATM machine will provide the appropriate amount of cash corresponding to the user’s confirmation.</li> <li>9) User checks the amount displayed on the application and then taps on “FINISH”.</li> <li>10) The transaction is then marked as “Completed” in the app.</li> </ol>
<b>Exception Flow:</b> <ul style="list-style-type: none"> <li>• If the amount to be withdrawn is larger than the account’s available balance, there will be a warning to the user. The transaction cannot be confirmed until the appropriate amount is entered.</li> <li>• If an ATM machine is out of order, the user will receive a notification and recommendations to reach another ATM location that is convenient for them to finish the transaction.</li> </ul>
<b>Related Use Cases:</b> N/A

### 3: Read Tap+ Transaction History:

<b>Use Case Name:</b> Read Tap+ Transaction History
<b>Primary Actor(s):</b> Banking Application User
<b>Stakeholder(s):</b> Corporate Bank
<b>Pre-Conditions:</b> The user has installed the Tap+ extension and registered their biometric data with the banking application
<b>Post-Conditions:</b> Transaction history is displayed with up-to-date, accurate information for the user
<b>Trigger:</b> User needs to look back on their transactions using Tap+ or search for a specific transaction that they made in the past
<b>Brief Description:</b> The user reads their Tap+ account’s transaction history, i.e specific to only the transactions made using the tap feature. Helps to track down specific transaction quickly in comparison to accessing the whole card statement.
<b>Normal Flow of Events:</b> <ol style="list-style-type: none"> <li>1) The user logs into their banking application into the tap+ menu.</li> <li>2) User navigates to the card-related services and chooses “Transaction History” option.</li> </ol>



- 3) The application validates the cards and accounts linked to the tap+ application and requests the bank for transaction histories of said cards and accounts and find all transactions with a transaction code (all transactions made using the Tap+ application).
- 4) Application displays the transaction histories and sorts them by available date/account/amount options.

**Exception Flow:**

- If there is no card or if the database is unreachable, then the option will be greyed out.
- If there are no previous transactions, then nothing will be displayed.

**Related Use Cases:** N/A

**4: Tap and Pay:**

**Use Case Name:** Tap and Pay

**Primary Actor(s):** Banking Application User

**Stakeholder(s):** Corporate Bank

**Pre-Conditions:** The user has installed the Tap+ extension and registered their biometric data with the banking application.

**Post-Conditions:** Payment is made and the transaction is recorded in banking application's payment history

**Trigger:** When User wants to make a cardless payments at the store

**Brief Description:** The user makes card payments with NFC

**Normal Flow of Events:**

- 1) The user logs into their banking application using their login details or biometric authentication.
- 2) User accesses the "Tap+" main menu and selects "Tap and Pay."
- 3) User confirms their identity with "Tap Authentication."
- 4) After confirmation, user can choose from the cards they have registered to make the payment
- 5) The user then only needs to confirm the transaction by tapping their phone on the NFC-enabled payment terminal (Point of Sale).

**Exception Flow:** The user can additionally add a widget on the phone for the quick pay feature using single sign in.

**Related Use Case:** N/A

**5: Geo-Location for ATM Search**

**Use Case Name:** Geo – Location for ATM Search

**Primary Actor(s):** Banking Application User

**Stakeholder(s):** Banking Application

**Pre-Conditions:**

- The user has installed the Tap+ extension and registered their biometric data with the banking application.
- The user has enabled location services on their mobile device

**Post Conditions:** All nearby ATMs are shown, and available statuses displayed

**Trigger:** User wants to see nearby ATMs and their status to engage in ATM Services

**Brief Description:** Geo-Location allows for the user to identify nearby ATMs and know their details

**Normal Flow of Events:**

- 1) The user opens the Tap+ main menu, selects “ATM Services”, and then select “ATM Search”
- 2) The application uses the device’s location and identifies nearby ATMs within the designated geo-fenced area.
- 3) The app presents the list of ATMs along with relevant details such as proximity, status of the machine, whether it is Tap-activated, and any associated fees.
- 4) The user may select the preferred ATM and will be directed to “ATM services” for cash deposit or withdrawal if within a geofenced area.

**Exception Flow:**

- If the user's mobile device cannot determine their location accurately, or the ATM machine is not available due to technical issues then the user will be notified of the issues and will be recommended with alternative locations

**Related Use Cases:** Withdraw Cash at ATM, Deposit Cash at ATM

**6: NFC-Enabled Card Registration with Tap+**

**Use Case Name:** NFC-Enabled Card Registration with Tap+

**Primary Actor(s):** Banking Application User

**Stakeholder(s):** Banking Application: Provides the registration feature.

**Pre-Conditions:** The user has installed the mobile banking application and has a physical debit or credit card that supports the tap feature.

**Post Conditions:** The user’s physical card has been successfully registered with the tap feature.

**Trigger:** User wants to activate Tap+ features for a card (Enabling the NFC tap features)

**Brief Description:** Users of the mobile banking app register their physical debit or credit cards for contactless payments and ATM transactions, enhancing transaction speed and convenience.

**Normal Flow of Events:**

- 1) The user logs into their banking application using user login details or biometric authentication.
- 2) They navigate to the card-related services and select “Card Registration with Tap+” option by providing the necessary physical card details.
- 3) The application validates the provided card details to ensure it is eligible for the tap feature that is if it is “tap-enabled” by the bank.
- 4) If the card is eligible, the app displays a confirmation message of successful registration.

**Exception Flow:**

- If the card details provided are incorrect or incomplete the app may prompt the user to correct or resubmit the information.
- If a user faces any technical issues, they may be given the option to seek assistance from the support or retry the registration process.

<b>Related Use Cases:</b> N/A
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7: Risk Management for lost cards

<b>Use Case Name:</b> Risk Management for lost cards
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<b>Primary Actor(s):</b> Banking Application User
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<b>Stakeholder(s):</b> Banking application: provides the card management feature.
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<b>Pre-Conditions:</b> The user has reported the card as lost on the banking application or blocked it via customer care assistance.
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<b>Post Conditions:</b> The user is able to successfully use their card via the tap+ feature if required until the replacement card arrives and updated in the system.
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<b>Trigger:</b> User wants to use their lost card or block it if required.
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<b>Brief Description:</b> In this use case, the user can either continue using or block lost cards with the app's card management feature.
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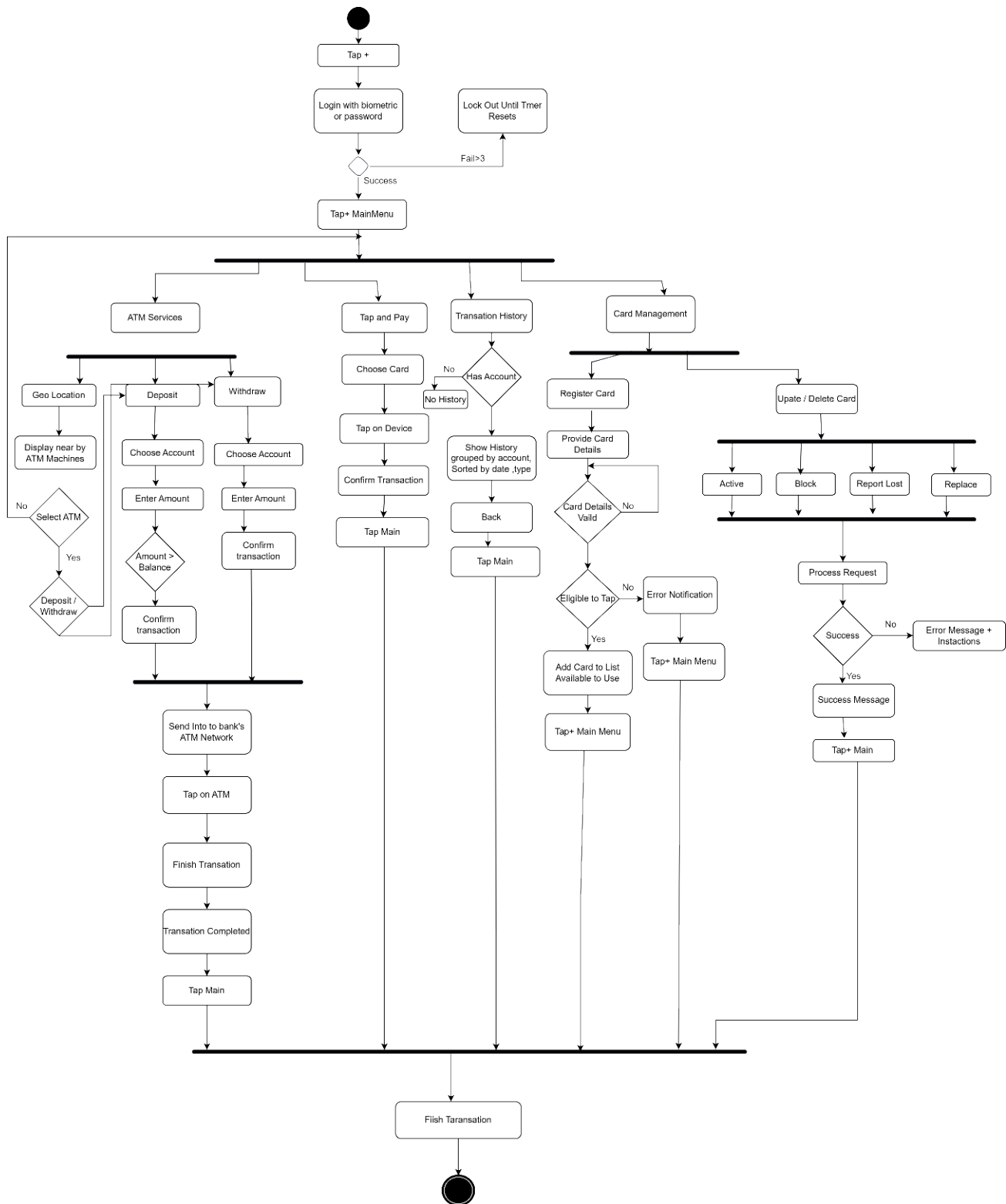
<b>Normal Flow of Events:</b>
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| <ol style="list-style-type: none"><li>1) The user logs into the application.</li><li>2) They navigate to card management section and can choose actions such as "Block Card", "Report Lost Card" or "Update Card".</li><li>3) The application validates the user's information with banking system through card details or verification code.</li><li>4) The app then processes the request based on selected card management action with the banking system and performs the requested task.</li><li>5) Upon successful completion of the action the app displays the confirmation message and provides the user with further instructions.</li></ol> |
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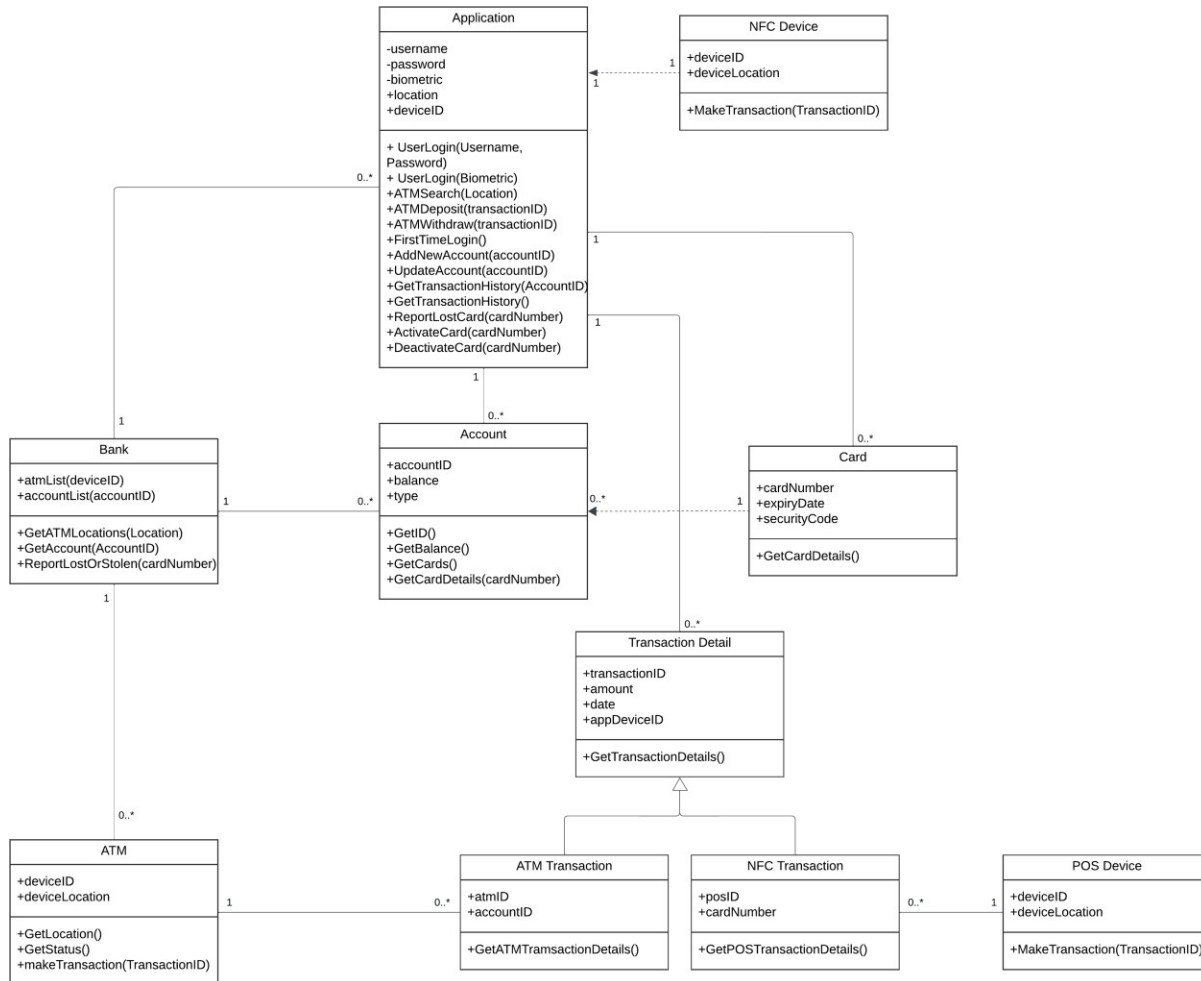
<b>Exception Flow:</b> IF the card is lost, the user can keep using it if required until the new card is updated by the bank.
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<b>Related Use Cases:</b> N/A
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## 6. Activity Diagram:



## 7. UML Class Diagram:

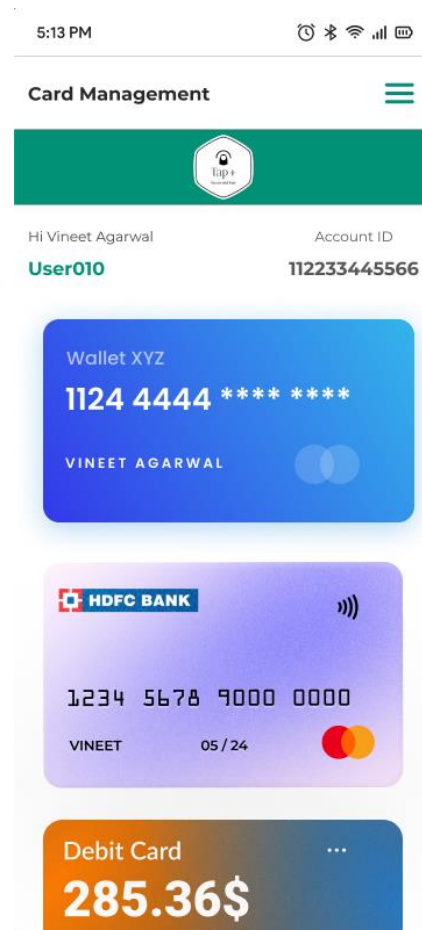


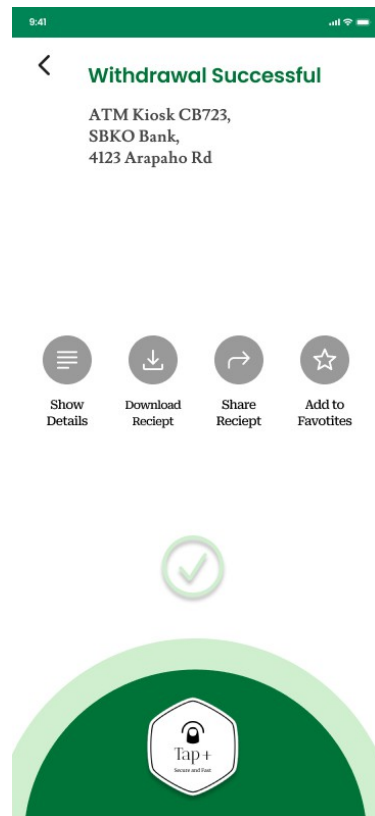
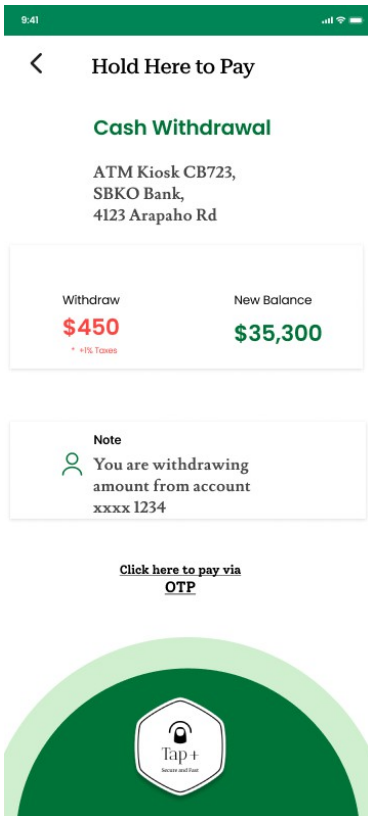
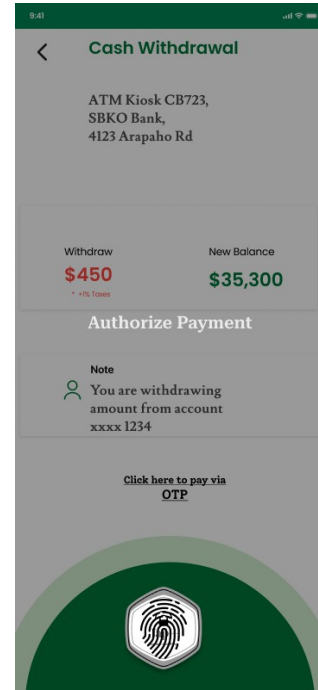
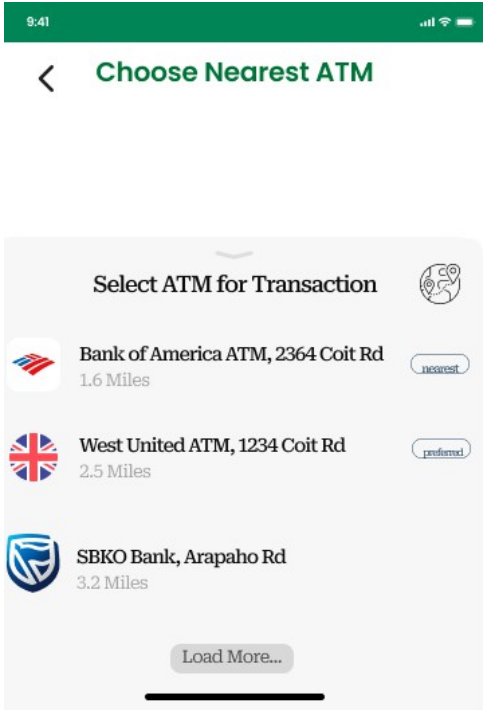
## 8. User Interface (UI) Designs:

Here are some Sample Mockups which depict specific scenarios of the user journey for a user to be able to make a transaction via the mobile application.

The user can start the application from the home screen for quick pay after which they need to select the card, which is like the card management page in the application.

After selecting the type of payment, (withdraw/deposit/POS Tap), the user is directed to the nearby ATMs to choose from.

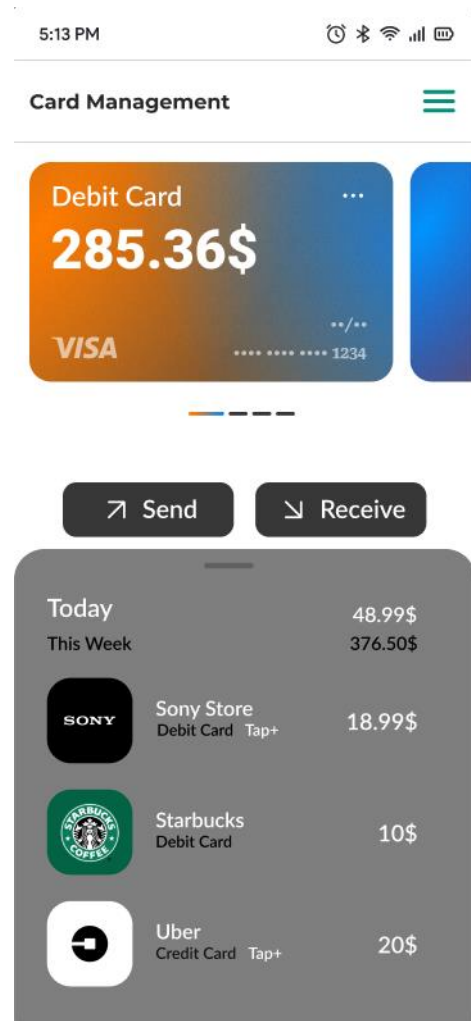
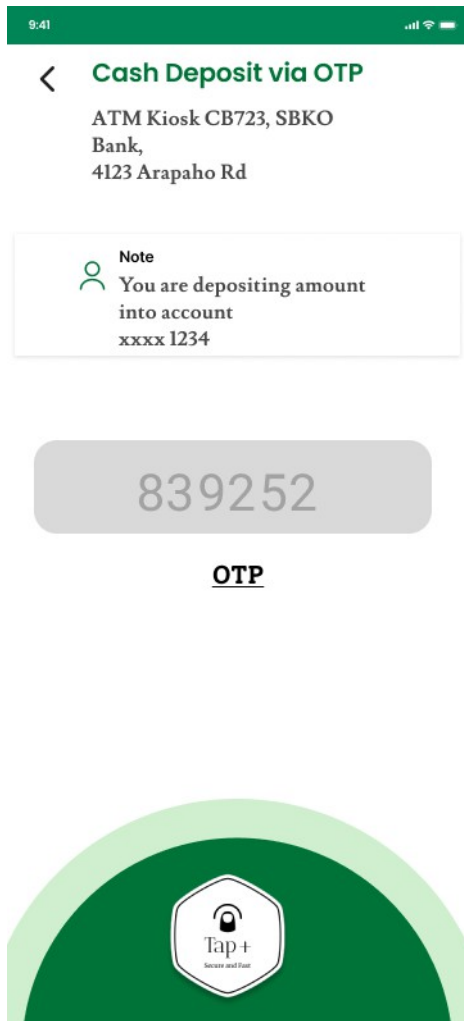




Similarly, as depicted are some instances of the payment page, where after entering the required details, and/or tapping, the 2FA security asks for a biometric login.

Also, if the tap mechanism fails, there is an alternate option to make the payment via OTP which will need to be entered on the ATM machine.

Lastly, here are some mockups of the last page of payment, once completed along with an image of the card management page, which displays the different transactions done on the card.





## **9. Conclusion:**

With the implementation of these new features, our Tap+ project hopes to make cardless banking more accessible to the average consumer and make the transition to NFC-based banking technologies smoother and faster. These innovations promise unparalleled convenience, security, and accessibility for our customers, positioning our bank as an innovative and customer-centric financial institution. The Tap+ project represents a significant step forward in modernizing our online banking app and providing customers with innovative, convenient, and secure financial services. By embracing the Tap, Pay and Tap and ATM Access features, we are poised to lead the industry in digital banking innovation.