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DESIGN AND IMPLEMENTATION OF A SECURE VIRTUAL ATM SYSTEM WITH PIN AND INTEGRATED ONLINE UPI SUPPORT

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1.ABSTRACT
In real-time, users often depend on physical ATMs for banking, but these machines are restricted to basic transactions like withdrawals and transfers. Physical ATMs require debit or credit cards to operate, making them card-dependent. Authentication is done through PIN entry, with limited online security measures. These ATMs have risks such as card loss, skimming, and physical tampering. Additionally, they have high costs related to maintenance and card production. There are also delays in peer-to-peer and interbank transfers. The availability of physical ATMs is restricted to specific locations and traditional banking hours. The Virtual ATM is a platform built in Python that enables users to securely carry out banking transactions online. This system incorporates PIN authentication and OTP verification to improve security measures. It allows users to access and execute transactions anytime and from any location. The system is designed with function parameters and return values to maintain efficient operations. By eliminating the need for real cards and lowering the security risks of card theft, UPI integration allows users to conduct instantaneous peer-to-peer transactions, increasing the effectiveness of digital payments. The study highlights the improvements in transaction security, user convenience, and accessibility while examining the system's architecture, implementation challenges, security features, and performance evaluation.
Key words: Banking transactions, PIN-basedauthentication,OTP verification, Virtual ATM,Peer-to-peer transactions, Transaction security.

2.INTRODUCTION
Guido van Rossum created the Python language in the 1980s following the success of the ABC Programming Language. There are several real-time applications for this high-level programming language. Python 3.0 is easy to use, compatible, has a straightforward syntax, and is bug-fixable. 2008 saw its introduction. various people were attracted in adopting this programming language because of its various capabilities, which led to its rise in popularity.
This paper, named "Design and Implementation of a Secure Virtual ATM System with PIN and Integrated Online UPI Support," is a Virtual ATM system which has PIN and Integrated online

UPI support. It is completely online based system. This system is built using Python programming language. By using this system, the sending of money instantly using UPI become easy. This system has features like log in in with a PIN, getting OTPs for extra safety. One of the main advantage is that the user can do all this anytime, from anywhere there no need to go to an ATM or use a physical card.

Regular ATMs depend on machines and bank cards, and they're only available in certain places at certain times. They also come with problems like card theft, fraud, and high costs for setup and maintenance. On top of that, they can be slow when sending money between people or banks. Our virtual ATM system solves all of this by offering a secure, online solution that uses PINs and OTPs to keep things safe.

The aim of the project is developing cost-effective, convenient, and a secure Virtual ATM system. Through this system we can make the fund transfers faster and also safe using PIN. The system is designed to eliminate the need for physical cards and enable users to complete transactions from the comfort of their homes. It also promotes digital banking and reduces dependency on physical banking infrastructure.

The system is built using Python in a smart and organized way. It uses different sections for things like logging in, making transactions, and handling UPI payments. It checks PINs and OTPs carefully to keep accounts secure. Every transaction is recorded so everything stays accurate and users can trust the system.

The system is just a basic version. It doesn't support a large number of users at once or connect with real bank networks. Fingerprint logins or advanced fraud detection aren't included either. But this project sets the stage for bigger, more powerful systems in the future.

To make everything safe, the system uses strong security methods like PIN and OTP checks. Since it's all online, users don't need physical ATM cards or machines. It's designed in a way that makes user input, checking, and transactions work smoothly. With these safety features, it helps avoid problems that happen with real ATMs—like damage or misuse.

3.LITERATURE SURVEY

S. No	Title / Author(s)	Year	Contributions	Methodology	Findings / Conclusion
1	*Virtual ATM: A Low Cost Secured Alternative to Conventional Mobile Banking* Shabnam Shahreen Sifat and Ali Shihab Sabbir	2020	Proposes a virtual ATM (VATM) system for secure mobile banking using PIN and CDMA module	Device-based implementation with OS-independent setup	VATM offers secure, affordable, and convenient banking with two-layer authentication
2	*Cardless ATM Using 3-Level Authentication System* Velasiri Dwarakamayi Amareswari, Gopi Manoj Vuyyuru	2021	Proposed a cardless ATM model using fingerprint, PIN, and OTP as a 3-level authentication method to enhance transaction security	System design with biometric + PIN + OTP layers	Enhanced transaction security and speed; reduced ATM fraud and restricted unauthorized physical access to ATM booths.

3	*Biometric Based Secured ATM Transaction Incorporating GSM Technology* A. Gokul Raj, B. Tharik Salman, R. Vasudevan, Y	2021	Enhances ATM security using fingerprint biometrics and GSM-linked authentication to prevent PIN-based fraud	Biometric fingerprint scanning + GSM-based OTP link generation	Improved security through biometric validation; fingerprint recognition ensures authentic access and reduces ATM card fraud risks. ATM time-span tracking adds additional security.
4	*Combining PIN and Biometric Identifications as Enhancement to User Authentication in Internet Banking Cherinor* Umaru Bah et al.	2021	suggests a two-level identification system that uses face recognition and PIN/fingerprint.	170 customers of online banking were surveyed; system design	improves important transaction security while taking user preferences into account.

5	*UPI-Based Transactions in India: Adoption and Security* Sharma et al.	2022	Studied user behavior and decision-making in adopting UPI apps.	Survey of UPI users, behavior analysis	UPI is efficient but needs API-level security enhancements.
6	*Adoption of UPI and Implementation of UPI-ATM in India: A Logit Analysis* Dr. Tirthankar Mandal	2023	Analyses the growth of UPI and the upcoming UPI-ATM services, especially in rural vs. urban settings using statistical modelling	State-level logit analysis of adoption patterns in India	Despite digital literacy and connectivity gaps, UPI is growing in rural areas. Continued infrastructure development can boost adoption of UPI-ATM and financial inclusion nationwide
7	*Advanced High Secured Smart ATM System* Narmatha R, Reshma J, Jeevitha K, Janani C	2023	Proposes a secure ATM system using face recognition, PIN, and OTP instead of traditional card-based access	Face detection using OpenCV & Haar Cascade, face recognition with Local Binary Pattern	Combines biometric verification with traditional security layers; improves security, eliminates ATM card dependency, and reduces fraud risk through facial verification.

8	*A Study on UPI Transactions in India* S. Vijay Kumar, Nayeema Unnisa	2024	examines the contribution of UPI to economic growth and financial inclusion.	Examination of internet penetration and UPI usage patterns	highlights the consequences for policy and the effect of UPI on economic growth.
9	*The Growth of Digital Payments in India: A Case Study of UPI* Urja Samwani, Kamini Khanna	2024	examines the expansion of UPI and how it affects internet users in rural areas.	Economic indicator-based regression analysis.	UPI's contribution to digital financial inclusion is demonstrated.

10	*The Sound of Progress: A Case Study on Merchant Adoption of UPI Applications and Soundboxes* Shashank Sharma, Narender Singh Chauhan	2025	investigates the use of sound box and UPI by merchants.	Analysis of a case study on the adoption of technology and merchant behavior	demonstrates how sound boxes help to make digital payments possible..

4.PROPOSED METHODOLOGY

Traditional banking systems, especially ATM-based transactions, depend on physical cards and machines, making them expensive, site-related and insecure for fraud. To solve these problems, we propose a virtual ATM system developed using Python that allows users to carry out safe and practical bank operations using PIN and OTP-based authentication.

Object-oriented design

The system follows an object -oriented programming (OOP) approach, where all the main components are modelled as a classes:

User/card class: Store card number, PIN and balance.

Transaction class: Handle operations such as deposits, withdrawals and UPI-based transfer.

This modular structure increases scalability, code reuse and system clarity.

Modular banking business

All user activities are used on well -defined tasks:

Check the remaining amount: The account shows the remaining account balance.

Deposit money: Funds are added to user account after validation.

Money withdraw: Ensures adequate balance before you retire.

Online Transaction:

Send Money: After OTP verification, the fund is transferred with UPI.

Get money: Balance can be added after OTP confirmation.

Online withdrawal: OTP authenticated online takes money through mode.

3.Security through certification

To increase system security, the two-level authentication is used:

PIN verification: Users get 3 chances to enter the correct PIN code. After 3 attempts Temporary card blocking for 24 hours results.

OTP verification: A randomly generated OTP is used to certify sensitive tasks such as money transfer and online returns, ensuring safe access.

1. Exceptions and incorrectly handling

System uses the try-except block from Python-extension to:

- Handle invalid input (negative amount, non-selection entries).
- Prevent system crashes during unexpected user behaviour.
- Guide users with meaningful error messages without interrupting the session.

2. User interface and interaction

A single console -based interface guides through users:

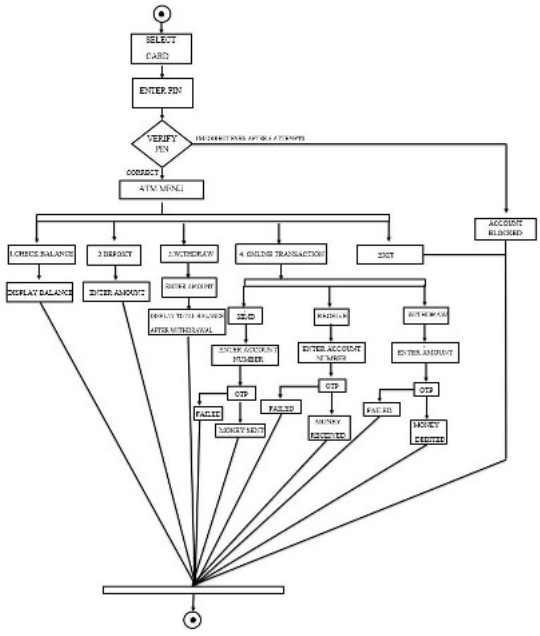
- selection of card
- Menu -based navigation for available services.
- Early response to each action, the system was friendly for beginners

3. Administrator and user module

- Functions of Admin: can create, block or unblock cards, transactions can be monitored, and manage user information securely.

User work: Include all bank functions with security items and quick response.

5.SYSTEM DESIGN / ARCHITETURE



6.ALGORITHM

Step1: Start the program.

Step2: Display the message: Welcome to the Virtual ATM!

Step3: Show all cards offered (10 options).

Step4: Ask users to enter their card number (1-10).

Step5: If the input is valid, then continue; otherwise, exit the program.
Step6: Ask the user to input a PIN for the selected card.
Step7: Is the PIN correct, or is this the third attempt? If yes, then continue; otherwise, exit the program.
Step8: Display the ATM main menu:

- Check Balance
- Deposit
- Withdraw
- Online Transaction

Step9: Exit Take user input.
Step10: If choice=1, show current balance.
Step11: If choice=2:

- Ask for deposit amount.
- If amount>0, add to balance and show new balance.
- Else, invalid amount.

Step12: If choice=3:

- Ask for withdrawal amount.
- If amount>balance, error.
- If amount>0 and ≤balance, subtract from balance and show new balance.
- Otherwise, error.

Step13: If choice=4, display online transaction:

- Send Money
- Receive Money
- Withdraw Cash
- Ask user to pick one.

Step14: Send Money:

- Ask for recipient and amount.
- If amount>balance or amount ≤0, show error.
- Otherwise, generate OTP.
- Prompt user to enter OTP.

If OTP correct, deduct amount and show new balance; otherwise, cancel.
Step15: Receive Money:

- Ask for amount.
- If amount ≤0, show error.
- Otherwise, generate OTP.
- Prompt user to enter OTP.

If OTP correct, add amount to balance; otherwise, cancel.
Step16: Withdraw Cash (Online):

- Ask for amount.
- If amount>balance or amount ≤0, show error.

- Otherwise, generate OTP.
- Ask user to enter OTP.
- If correct, deduct amount and show new balance; else, cancel.

Step17: Returning to the main menu in case of wrong transaction type.
Step18: If the user selects five, the program displays "Thank you for using the ATM. Goodbye!", message and then terminates.
Step19: Show an error message and repeat the menu if the user enters an incorrect menu choice.
Step20: The above two steps shall be repeated from 8 through 19 until the user chooses Exit. Then the program terminates.

7.MODULES

Admin Module

Creating User Card

In the ATM system the admins can create new Card linked with an account for the users. The user details like name, password, UPI ID, and starting balance are entered by the admin. The system checks that all the details are correct and safe to avoid mistakes.

Blocking Card

The system will automatically block the card if the user types the wrong PIN too many times to keep the account safe from unauthorized access. The user cannot make any transactions after 3 wrong tried as the account will be locked by the system.

Unblocking the Card

The admin or the system and help the user unlock the card if the account gets locked due to 3 false trails. It automatically gets unblocked after 24hrs.

Checking User Transactions

The transaction history of the user like money they have deposited, withdrawn, or sent using UPI can be viewed by the admins. By viewing thetransaction history helps keeping an eye on any misuse, solving problems, or spotting anything unusual. Every activity is recorded with the date and time.

User Module

Logging in with a PIN:

Users log in by entering their username and a secure PIN. If the PIN is right, they can access their account. If it’s wrong, the system shows how many tries are left. After three wrong attempts, the account gets locked to keep it safe.

Depositing Money:

Users can add money to their virtual account. The system checks that the amount entered is correct (it can’t be zero or negative). Once the deposit is successful, the balance updates and the deposit is saved in the user’s transaction history.

Withdrawing Money:

Users can take money out of their account. Before the money is sent, the system checks that the amount is valid and that the user has enough balance. If there's not enough money, it shows an error. If everything is okay, the balance is updated, and the withdrawal is saved.

Sending Money with UPI:

Users can instantly send money to others using UPI. The system checks if the UPI ID is correct and whether there's enough balance. If so, the money is sent and the transaction is saved. It makes digital payments fast and easy.

Checking Balance:

Users can check their current account balance anytime. It's always up to date, showing the correct amount based on all deposits, withdrawals, and UPI transfers.

Viewing Transaction History:

This feature shows a list of all the user's past money activities—deposits, withdrawals, and UPI transfers. It helps users keep track of their money and manage their spending.

8.RESULT ANALYSIS

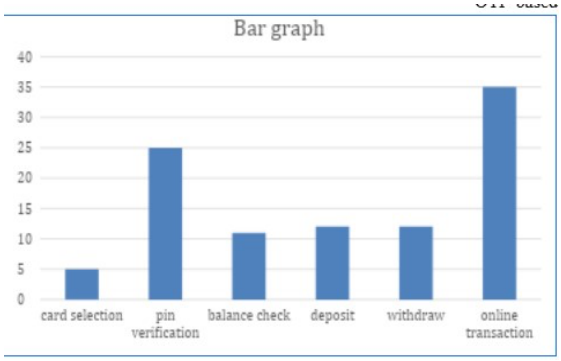


FIG 8: The bar graph illustrates the various functional modules implemented within the program

9.CONCLUSION

The proposed virtual ATM system simulates successful core banking operations such as deposits, withdrawal, balance control and UPI-based transactions using a safe, short-term approach. System transactions are developed using Python, and integrates PIN approval and

OTP verification to ensure transactions protection and security.

Through the user-friendly console interface, the system shows real-time control without relying on a physical card or bank infrastructure. Large security measures, such as limited PIN efforts and OTP-based verification, increase the trust and reliability of the system. Exceptions prevent handling and input handling ensures a smooth user experience.

While the current version is a prototype with simulation of a user and no database or real bank network connection, it provides the basis for future promotion such as biometric authentication, access to multiple users, encrypted cloud storage and integration with real -time bank API.

Overall, the project achieves its goal of providing a cost -effective, safe and accessible banking system that promotes digital economic transactions and reduces the dependence on physical ATMs.

10.FUTURE ENHANCEMENT

In the future, this virtual ATM system can be improved by adding new features that work more like the actual ATM. A big idea is to connect it to real ATM using devices such as Raspberry Pie or Arduino. This will allow us to use real keyboards, card readers (RFID/NFC), small screens and even parts that can pay or retire using engines. By doing this, our project can become a functioning model of ATMs, which is useful for college projects or real -time demo.

we can improve how we protect the user data. Now the data is temporarily stored. In the future databases like MySQL or SQLITE can be used to save the user details, balance and previous transactions. the PIN can also be protected using secure coding methods such as SHA-256 and sent OTP via email or SMS. Using safe internet connections (TLS), all data sent or received will stay private. Adding a proper login system for each user will allow personalized experiences.

Other improvements include replacing the black-and-white screen with a colourful and easy-to-use interface using tools like Tkinter or PyQt. A web version can also be made so it runs in browsers. Users can get messages or receipts after each transaction. More than one user can use the system at once, and we can support different languages and features for people with disabilities. Finally, adding testing and error-tracking will help us find problems and fix them easily. With these changes, the Virtual ATM

11.REFERENCES

[1]. Shabnam Shahreen Sifat and Ali Shihab Sabbir (2020). Virtual ATM: A Low Cost Secured Alternative to Conventional Mobile Banking. International Journal of Scientific and Research Publications, Vol.10, Issue 3, page no:100–105

[2]. Velasiri Dwarakamayi Amareswari, Gopi Manoj Vuyyuru (2021). Cardless ATM Using 3-Level Authentication System. International Journal of Advanced Research in Computer and Communication Engineering, Vol. 10, Issue 2, page no: 25–29.

[3]. A. Gokul Raj, B. Tharik Salman, R. Vasudevan, Y (2021) Biometric Based Secured ATM Transaction Incorporating GSM Technology, International Journal of Engineering Research & Technology (IJERT). Vol. 9, Issue 5, page no:34–38.

[4]. Cherinor Umaru Bah1, Afzaal Hussain Seyal, Umar Yahya (2021) Combining PIN and Biometric Identifications as Enhancement to User Authentication in Internet Banking, ID 2105.09496.

[5]. Animesh Sharma, Megha Agarwal, and Ponnurangam Kumaraguru (2022). UPI-Based Transactions in India: Adoption and Security. In Proceedings of the 18th Symposium on Usable Privacy and Security (SOUPS), page no: 62–65.

[6]. Dr. Tirthankar Mandal (2023). Adoption of UPI and Implementation of UPI-ATM in India: A Logit Analysis, International Journal of Economics and Finance (IJEF), Vol. 3, Issue 1, page no: 45–52.

[7]. Narmatha R, Reshma J, Jeevitha K, Janani C (2023). Advanced High Secured Smart ATM System, International Journal for Research in Applied Science and Engineering Technology (IJRASET), Vol. 11, Issue 4, page no: 88–92.

[8]. S. Vijay Kumar, Nayeema Unnisa (2024). A Study on UPI Transactions in India, International Journal of Applied Business and Management Review (IJABMR), Vol. 2, Issue 1, page no: 15–20.
[9]. Samwani, U. & Khanna, K. (2024), The Growth of Digital Payments in India: A Case Study of UPI, In Proceedings of the 2nd International Conference on Financial Technologies and Digital Economy, page no: 55–63.
[10]. Shashank Sharma, Narender Singh Chauhan (2025). The Sound of Progress: A Case Study on Merchant Adoption of UPI Applications and Soundboxes, Journal of Payments Strategy & Systems, Vol. 19, Issue 2, page no: 112–118.