

ATM Management System Database

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[Section I] Project Description

Automated Teller Machines (or ATMs) are a staple of today's society. Many ATMs allow a greater range of flexibility for the average user to perform transactions such as deposits, cash withdrawals, or make payments wherever an ATM is. However, the world is trending towards a new age of convenience very rapidly. With this greater desire for convenience and efficiency comes with a greater need to make the world around the ATM better.

The purpose of the ATM Management System Database project seeks to do just that. On the surface, the ATM Management Management System Database will continue to make every day processes like clients using ATM machines as simple and efficient as can be. Behind the scenes, this project seeks to enhance the world around the simple transaction. This includes improving security for users and ensuring that these machines can continue to serve thousands of customers weekly. With this management system, there will be no more vending machine dilemma of having currency not being accepted by the cash slot or a user's card being stuck inside the machine.

Beyond better management of the ATM machine experience, this project seeks to improve the management within the bank as well. This includes an enhanced method of ensuring employees understand their roles and what they bring to the table. For the banking institution itself, it can better manage transactions and operate smoothly on a day-to-day basis.

[Section II] Use Cases

1. [Use Case] Inefficient and Poor ATMs

[Actors] Bank Owner Fells Wargo, ATM machine, Customer, Bank

[Description] Fells Wargo is the owner of a bank, where his bank often competes with the other local bank, DT Bank. Recently, his clients often complain about his ATM machines, especially when they don't have enough money or they fail to accept bills or checks. Now, Fells is losing clients to DT Bank and other competitors because of clients being unhappy with the service given by Fells' ATM machines across town. Now, Fells must look for a solution that will help bring back his previous clients and bring in new clients to his ATM machines.

The ATM Management System Database will help Fells bring in clients by maintaining his ATM machines better. This includes maintaining the physical devices associated with the ATM and being able to oversee the various transactions that go about at his bank.

2. [Use Case] Withdrawing Money from a Checkings Account

[Actors] User Thomas, ATM Machine, Debit Card, NFC scanner, Keypad, Check

[Description] Thomas is a hardworking marketing analyst at a big corporation. After being laid-off during the pandemic, Thomas has learned to be better by saving some of the money at his new job. After work, Thomas goes to the local ATM about five minutes from his workplace. Thomas taps/scans his debit card along the NFC reader, and he promptly enters his pin into the keypad. After the ATM machine verifies that it is Thomas, he deposits a check that is worth 20% of his weekly paycheck into his savings account. Promptly after depositing his check, he ends his login

session at the ATM machine to prevent the next person in line from stealing his money. Thomas has become a smarter man by saving his money for the next rainy day, ..or pandemic.

The ATM Management System Database will better help the everyday user with common tasks like depositing checks into their savings account. For Thomas, that means quickly getting what he needs to get done at the ATM after a long week at the office. Most importantly, Thomas can rest well knowing his money is well-managed and secure.

3. [Use Case] Managing a College Student's Checking Account

[Actors] User Mia, ATM Machine, Debit Card, Checking Account, Notifications

[Description] Mia is a college student who is living away from home. She must manage every day finances, including paying for groceries and making sure she pays her monthly rent. The other day, Mia withdrew a sizable amount of money (\$1,400) to pay for her monthly apartment rent. A few days later, Mia makes a grocery run at her local Target. She decides to splurge and buy a nice, big piece of steak. She charges her debit card in order to pay for her \$76 worth of groceries. After she is done paying, she gets a notification from her bank on her phone stating she overcharged her checking account, going from an original balance of \$62 to a -\$14. Mia must now pay the \$14 owed, as well as the overdraft fee of \$30 for each week she fails to pay off her debt and stay above a negative balance. Luckily for Mia, she can pay off her debt and overdraft fee the following day, when she gets her weekly paycheck from working as a tutor.

The ATM Management System Database will help maintain an efficient manner for banking institutions as well as general users. While Mia

is unhappy with overspending, she is at least grateful to not be blindsided by weekly overdraft fees and can promptly pay off both charges soon.

4. [Use Case] Attempting to commit fraud

[Actors] User Rose, User Robert, ATM machine, debit card, NFC card reader, keypad

[Description] Rose is a regular at her local bank's ATM machine. However, Rose is in a rush today because she has to get to her doctor's appointment on time. As she rushes to her car, she drops her debit card on the floor without her noticing. Eventually, Robert comes along and picks up the card. Instead of giving it to the teller inside the bank, Robert attempts to use the card at the ATM machine. He scans the card along the NFC reader, but struggles to enter the correct pin after several attempts. Following these attempts, the ATM machine locks Robert out for an hour after many failed attempts, and notifies Rose via text message that suspicious activity has taken place at this particular ATM machine.

The ATM Management System Database ensures a better and safer experience for the average user. Instead of creating an environment where fraud could easily take place, this management system creates a better sense of security and ease for verified users like Rose. This gives Rose the opportunity to take action about her lost debit card.

5. [Use Case] Making a Loan

[Actors] User Fiona, the Bank, a Loan

[Description] Fiona lost her job at the beginning of the pandemic. However, all is not lost. Fiona had money saved up, and began a small business selling her crafts on various marketplaces online. In order to make the next step, she

applies for a loan at her local bank. After a few days, the bank approves the loan and Fiona can get to work on the next chapter of her business. The loan is now tied to her bank account, and she must pay off the loan at an interest rate of 4% over several years. Fiona decides to invest some of the money into marketing and advertisements. A few months later, one of her promotions goes viral and she receives many orders in the following weeks. Fiona will have no problem paying off her loans, especially while her business is booming.

The ATM Management System Database will help users like Fiona transform their lives. Through efficient banking practices and quick loans, Fiona will spend less time worrying about finances and can spend more time doing the things she loves.

6. [Use Case] Looking for an Affiliate

[Actors] Bank Owner John, Affiliate Winter

[Description] John is an owner of a fairly new bank. Unlike his competitor banks, who have been well-established for many years, John has struggled to bring in a large volume of clients on a consistent basis. He seeks an affiliate who is well known in the community. Here's Winter, a trusted person well known in the community and appears in many advertisements. John works out a contract with Winter to be affiliated with his bank. Winter's appearances in new advertisements listing out their affiliate helps bring John more consistent clients to his bank.

John is brought to tears of joy by the new found flow of clients that his affiliate Winter has brought him. His new affiliate has changed the way his bank operates for the better, and he hopes to bring in more affiliates in the future.

[Section III] Database Requirements (Business Rules)

1. General User
 - a. An employee is a verified user
 - b. A general user shall be able to create at least one bank account
2. Verified User
 - a. A verified user is a general user
 - b. A verified user is an employee
 - c. A verified user can apply for a loan
 - d. A verified user has many verified devices
3. Cash
 - a. A cash is had by one verified user
 - b. A cash interacts with one cash dispenser
4. Check
 - a. A check is had by one verified user
 - b. A check interacts with a check deposit slot
5. Bank Account
 - a. A bank account is a checkings account
 - b. A bank account is a savings account
 - c. A bank account belongs to only one general user
 - d. A bank account is managed by one bank
 - e. A bank account is linked to at least one form of verification method
 - f. A bank account has at least one role/permission
6. Bank
 - a. A bank manages at least one bank account
 - b. A bank owns at least one ATM machine
 - c. A bank is owned by at least one owner
 - d. A bank has at least one employee

- e. A bank authorizes many transactions
 - f. A bank has many security alarms
 - g. A bank offers many loans
7. Checking Account
- a. A checkings account is a bank account
8. Savings Account
- a. A savings account is a bank account
9. Verification Method
- a. A verification method is tied to only one bank account
 - b. A verification method is a card
 - c. A verification method is a digital wallet
10. Card
- a. A card is linked to many digital wallets
11. Debit Card
- a. A debit card is a card
12. Credit Card
- a. A credit card is a card
13. Digital Wallet
- a. A digital wallet is linked to at least one card
14. Transactions
- a. A transaction is conducted by an ATM machine
 - b. A transaction is authorized by a bank
15. Cash Withdrawal
- a. A cash withdrawal is a transaction
 - b. A cash withdrawal is processed/fulfilled by one deposit cash slot
16. Cash Deposit
- a. A cash deposit is a transaction

- b. A cash withdrawal is processed/fulfilled by one deposit cash slot
- 17. Check Deposit
 - a. A check deposit is a transaction
 - b. A check withdrawal is processed/fulfilled by deposit check slot
- 18. Payment
 - a. A payment is a transaction
 - b. A payment can be made to pay off many loans
- 19. Transfer
 - a. A transfer is a transaction
- 20. Notifications
 - a. A notification is received by many verified devices
 - b. A notification is prompted by one security alarm
- 21. Logins
 - a. A login session is linked to only one verified user
 - b. A login session supports one device
- 22. Verified Device
 - a. A verified device receives many notifications
 - b. A verified device is owned by only one verified user
- 23. Languages
 - a. A language is supported by many ATM machines
- 24. Devices
 - a. A device is had in an ATM machine
- 25. NFC Scanner
 - a. An NFC scanner is a device
 - b. An NFC scanner interacts with one verified user per login
 - c. An NFC scanner scans one verification method per login
- 26. Card Reader

- a. A card reader is an device
- b. A card reader scans with one card per login

27. Keypad

- a. A keypad is an device
- b. A keypad interacts with one verified user per login
- c. A keypad triggers many security alarms

28. OLED Screen

- a. An OLED screen is an device
- b. An OLED screen interacts with one verified user per login

29. Cash Dispenser

- a. A cash dispenser is an device
- b. A cash dispenser processes many cash deposits per login
- c. A cash dispenser processes many cash withdrawals per login

30. Check Deposit Slot

- a. A check deposit slot is an device
- b. A check deposit slot processes many check deposits per login

31. Receipt Printer

- a. A receipt printer is an device
- b. A receipt printer prints out a transaction

32. Speaker

- a. A receipt printer is an device

33. Manufacturer

- a. A manufacturer manufactures at least one device
- b. A manufacturer manufacturers at least one security alarm

34. Owner

- a. An owner owns at least one bank.

35. Affiliates

- a. An affiliate is affiliated with many banks

36. Security Alarm

- a. A security alarm is installed in many banks
- b. A security alarm is triggered by many keypads
- c. A security alarm informs many security guards
- d. A security alarm is manufactured by one manufacturer
- e. A security alarm prompts many notifications

37. Employees

- a. An employee works for one bank
- b. An employee is a verified user
- c. An employee can be an admin, which is also an employee

38. Admin

- a. An admin is also an employee
- b. An admin manages at least one ATM machine
- c. An admin maintains at least one device
- d. An admin handles a least one role/permission

39. Roles/Permissions

- a. A role/permission is handled by at least one admin
- b. A role/permission is had by many bank accounts

40. Security

- a. A security guard is an employee
- b. A security guard is informed by at many security alarms

41. Analyst

- a. An analyst is an employee

42. Teller

- a. A teller is an employee

43. Consultant

- a. A consultant is an employee

44. Loans

- a. A loan is offered by many banks
- b. A loan is linked to one bank account
- c. A loan can be paid off by many payments

[Section IV] Detailed List of Main Entities, Attributes, and Keys

1. General User (Strong)
 - a. user_id: key, numeric
 - b. name: composite, alphanumeric
 - c. first_name: alphanumeric
 - d. last_name: alphanumeric
 - e. email: alphanumeric
 - f. ssn: numeric
 - g. address: multivalued, alphanumeric
 - h. phone_number: alphanumeric
2. Verified User (Weak)
 - a. verified_user_id: key, numeric
 - b. user_id: key, numeric
 - c. privileges: numeric
3. Cash (Strong)
 - a. cash_id: key, numeric
 - b. cash_type: alphanumeric
 - c. cash_amount: alphanumeric
4. Check (Strong)
 - a. check_id: key, numeric
 - b. verified_user_id: key, numeric
 - c. check_amount: alphanumeric
5. Bank Account (Weak)
 - a. bank_account_id: key, numeric
 - b. bank_id: key, numeric
 - c. account_number: numeric
6. Bank (Strong)

- a. bank_id: key, numeric
 - b. name: composite, alphanumeric
 - c. address: composite, alphanumeric
7. Checking Account (Weak)
- a. checking_account_id: key, numeric
 - b. balance: numeric
 - c. fees: numeric
8. Savings Account (Weak)
- a. savings_account_id: key, numeric
 - b. balance: numeric
 - c. interest_rate: numeric
9. Verification Method (Weak)
- a. verification_id: key, numeric
 - b. user_id: key, numeric
 - c. verification_type: alphanumeric
10. Card (Strong)
- a. card_id: key, numeric
 - b. type: alphanumeric
 - c. CVV: numeric
 - d. zip: alphanumeric
 - e. exp_date: multivalue, timestamp
11. Debit Card (Weak)
- a. debit_card_number: key, numeric
 - b. CVV: numeric
 - c. zip: alphanumeric
 - d. exp_date: multivalue, timestamp
12. Credit Card (Weak)

- a. Credit_card_number: key, numeric
 - b. CVV: numeric
 - c. zip: alphanumeric
 - d. exp_date: multivalue, timestamp
13. Digital Wallet (Strong)
- a. wallet_id: key, numeric
 - b. card_number: key, numeric
 - c. type: alphanumeric
14. Transactions (Strong)
- a. transaction_id: key, numeric
 - b. type: alphanumeric
 - c. amount: numeric
15. Cash Withdrawal (Weak)
- a. cash_withdrawal_id: key, numeric
 - b. transaction_id: key, numeric
 - c. balance: numeric
16. Cash Deposit (Weak)
- a. cash_deposit_id: key, numeric
 - b. transaction_id: key, numeric
 - c. balance: numeric
17. Check Deposit (Weak)
- a. check_deposit_id: key, numeric
 - b. transaction_id: key, numeric
 - c. balance: numeric
18. Payment (Weak)
- a. payment_id: key, numeric
 - b. transaction_id: key, numeric

- c. balance: numeric
19. Transfer (Weak)
- a. transfer_id: key, numeric
 - b. transaction_id: key, numeric
 - c. balance: numeric
20. Notifications (Strong)
- a. notification_id: key, numeric
 - b. message: alphanumeric
 - c. timestamp: multivalue, timestamp
21. Logins (Weak)
- a. logins_id: key, numeric
 - b. verified_user_id: key, numeric
 - c. data: alphanumeric
 - d. expiration: composite, alphanumeric
22. Verified Devices (Weak)
- a. verified_device_id: key, numeric
 - b. verified_user_id: key, numeric
 - c. device_type: alphanumeric
23. Languages (Strong)
- a. language_id: key, numeric
 - b. language_name: alphanumeric
 - c. country: alphanumeric
24. Devices (Strong)
- a. device_id: key, numeric
 - b. manufacturer_id: key, numeric
 - c. type: alphanumeric
 - d. status: alphanumeric

25. NFC Scanner (Weak)

- a. scanner_id: key, numeric
- b. manufacturer_id: key, numeric
- c. status: alphanumeric

26. Card Reader (Weak)

- a. reader_id: key, numeric
- b. manufacturer_id: key, numeric
- c. status: alphanumeric

27. Keypad (Weak)

- a. reader_id: key, numeric
- b. manufacturer_id: key, numeric
- c. status: alphanumeric

28. OLED Screen (Weak)

- a. screen_id: key, numeric
- b. manufacturer_id: key, numeric
- c. status: alphanumeric

29. Cash Dispenser (Weak)

- a. cash_dispenser_id: key, numeric
- b. manufacturer_id: key, numeric
- c. status: alphanumeric

30. Deposit Check Slot (Weak)

- a. check_slot_id: key, numeric
- b. manufacturer_id: key, numeric
- c. status: alphanumeric

31. Receipt Printer (Weak)

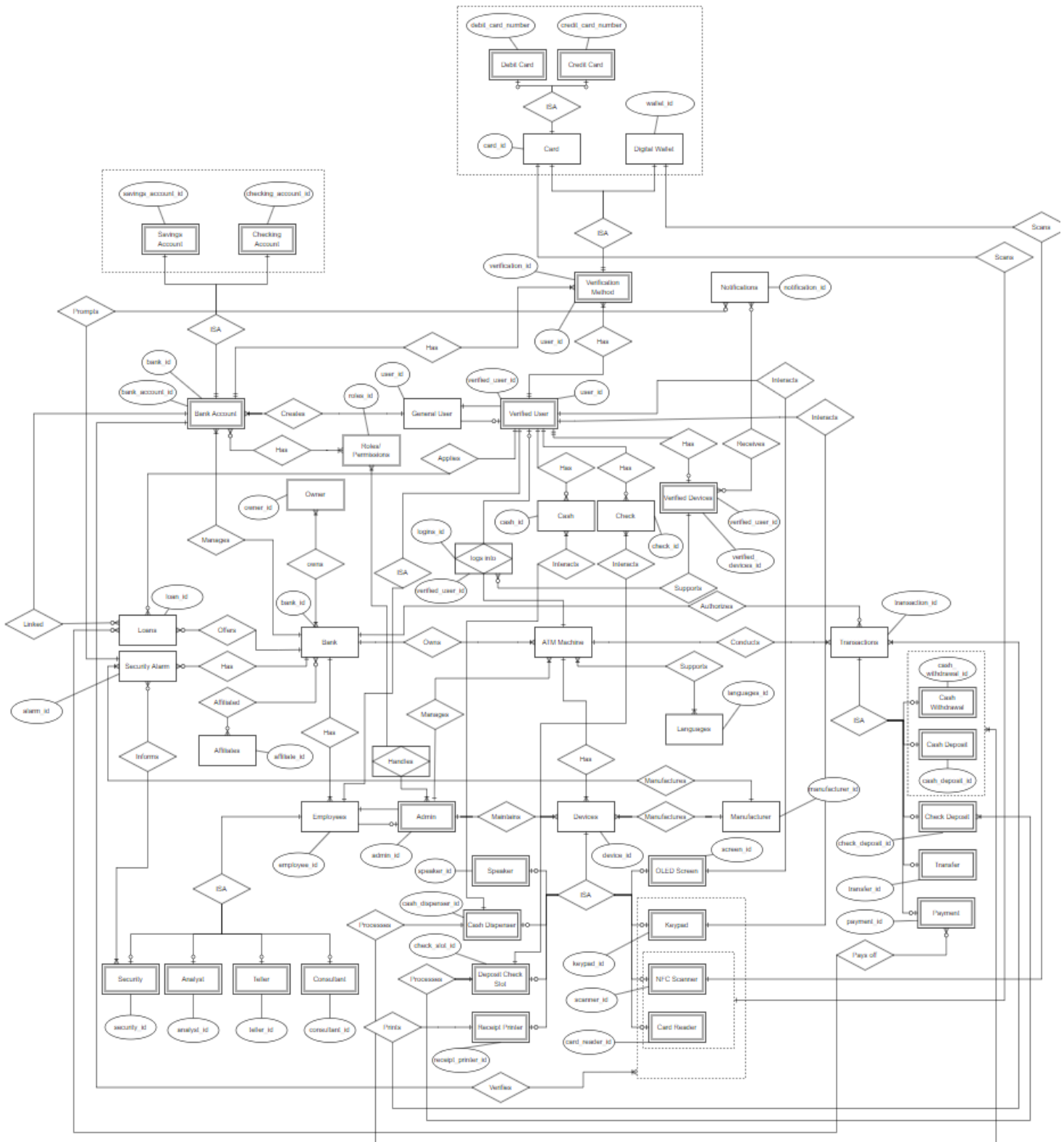
- a. reader_id: key, numeric
- b. manufacturer_id: key, numeric

- c. status: alphanumeric
32. Speaker (Weak)
- a. reader_id: key, numeric
 - b. manufacturer_id: key, numeric
 - c. status: alphanumeric
33. Manufacturer (Strong)
- a. manufacturer_id: key, numeric
 - b. name: composite, alphanumeric
 - c. address: multivalue, alphanumeric
34. Owner (Strong)
- a. owner_id: key, numeric
 - b. name: composite, alphanumeric
 - c. first_name: alphanumeric
 - d. last_name: alphanumeric
35. Affiliates (Strong)
- a. affiliate_id: key, numeric
 - b. name: composite, alphanumeric
 - c. Contract: alphanumeric
36. Security Alarm (Strong)
- a. alarm_id: key, numeric
 - b. manufacturer_id: key, numeric
 - c. range: composite, numeric
37. Employees (Strong)
- a. Employee_id: key, numeric
 - b. name: composite, alphanumeric
 - c. first_name: alphanumeric
 - d. last_name: alphanumeric

- e. email: alphanumeric
38. Admin (Weak)
- a. admin_id: key, numeric
 - b. employee_id: key, numeric
 - c. privileges: numeric
39. Roles/Permissions (Strong)
- a. roles_id: key, numeric
 - b. admin_id: key, numeric
 - c. roles_type: multivalue, alphanumeric
40. Security (Weak)
- a. security_id: key, numeric
 - b. employee_id: key, numeric
 - c. privileges: numeric
41. Analyst (Weak)
- a. analyst_id: key, numeric
 - b. employee_id: key, numeric
 - c. privileges: numeric
42. Teller (Weak)
- a. teller_id: key, numeric
 - b. employee_id: key, numeric
 - c. privileges: numeric
43. Consultant (Weak)
- a. teller_id: key, numeric
 - b. employee_id: key, numeric
 - c. privileges: numeric
44. Loans (Strong)
- a. loan_id: key, numeric

- b. loan_rate: numeric
- c. loan_type: alphanumeric
- d. loan_interest_rate: numeric

[Section V] Entity Relationship Diagram (ERD)



[Section VI] Testing Table

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Description
1	Bank	Manages	Bank Accounts	One to Many	Pass	None
2	Bank Account	Manages	Bank	Many to One	Pass	None
3	Bank	Manages	ATM Machine	One to Many	Fail	An entire bank managing ATMs is too broad. An entire bank won't manage each ATM machine, but a few individuals instead. Changed relation to "Owns"
4	General User	Uses	ATM Machine	One to Many	Fail	A general user must have a bank account as well as the proper credentials in order to use an ATM machine first.
5	General User	Creates	Bank Account	Many to Many	Fail	I considered the possibility of a joint account, but it falls under the possibilities of the same issues (and lack of future flexibility) of an Employees table based on teams. Changed to One to

						Many
6	General User	Creates	Bank Account	One to Many	Pass	None
7	Bank	Owns	Owner	Many to One	Fail	A bank may have multiple owners
8	Bank	Has	Employee	One to Many	Pass	None
9	Bank Account	Has	Savings Account	One to One	Fail	A savings account is a bank account. Change applied to checking account as well
10	Bank Account	ISA	Checking Account	One to One	Pass	None
11	Security	ISA	Employee	One to One	Pass	None
12	Analyst	ISA	Employee	One to One	Pass	None
13	Teller	ISA	Employee	One to One	Pass	None
14	Consultant	ISA	Employee	One to One	Pass	None
15	ATM Machine	Has	Devices	One to Many	Pass	None
16	ATM	Supports	Languages	Zero To	Fail	A functional ATM

	Machine			Many		Machine should have at least 1 language supported in order to function
17	ATM Machine	Has	Devices	One to Many	Pass	None
18	Admin	Monitors	ATM Machine	One to Many	Fail	The relation monitor is a little narrow. Changed to manages
19	Admin	Maintains	Devices	One to Many	Pass	None
20	Manufacturer	Manufactures	Devices	One to One	Fail	A manufacturer can produce more than one device
21	Device	Manufactures	Manufacturer	Many to One	Pass	None
22	NFC Scanner	ISA	Device	One to One	Pass	None
23	Card Reader	ISA	Device	One to One	Pass	None
24	Keypad	ISA	Device	One to One	Pass	None
25	OLED screen	ISA	Device	One to One	Pass	None
26	Cash Dispenser	ISA	Device	One to One	Pass	None

27	Deposit Check Slot	ISA	Device	One to One	Pass	None
28	Receipt Printer	ISA	Device	One to One	Pass	None
29	Speaker	ISA	Device	One to One	Pass	None
30	Verified User	Has	Cash	One To Many	Pass	None
31	General User	ISA	Verified User	One to One (recursive)	Pass	None
32	Admin	ISA	Employee	One to One (recursive)	Pass	None
33	Verified User	Has	Verification Method	One to One	Fail	A verified user can have more than one verification method, like a debit card or a digital wallet
34	Credit Card	ISA	Card	One to One	Pass	None
35	Debit Card	ISA	Card	One to One	Pass	None
36	Card	Linked	Digital	One to	Fail	A card can be linked to

			Wallet	One		many digital wallets. Changed to One to Many
37	Card	ISA	Verification Method	One to One	Pass	None
38	Digital Wallet	ISA	Verification Method	One to One	Pass	None
39	Employee	ISA	Verified User	One to One	Pass	None
40	Verified User	Logs into	ATM Machine	One to One	Pass	None
41	Bank Account	Has	Verification Method	One to One	Fail	A bank account should already have 1 form of verification (debit card), but may have more, including a credit card and/or a digital wallet. Changed to One to Many
42	Verified User	Has	Verified Devices	One to One	Fail	A typical user would probably have more than one device. Changed to One to Many
43	Verified Devices	Views	Transactions	One to Many	Fail	Initially wanted some form of online banking to see transactions, but current implementation would not support this

						well
44	ATM Machine	Conducts	Transactions	One to Many	Pass	None
45	Bank Account	Links	ATM Machine	One to One	Fail	This is redundant since a verified user can log in with their verification method, which is already linked to a bank account
46	Verified Devices	Receive	Notifications	Many to Many	Pass	None
47	Bank	Authorizes	Transactions	One to Many	Pass	None
48	Cash Withdrawal	ISA	Transactions	One to One	Pass	None
49	Cash Deposit	ISA	Transactions	One to One	Pass	None
50	Check Deposit	ISA	Transactions	One to One	Pass	None
51	Payment	ISA	Transactions	One to One	Pass	None
52	Transfer	ISA	Transactions	One to One	Pass	None
53	Verified User	Scans	NFC Scanner/Card Reader	One to One (aggregati	Fail	Verified User doesn't directly scan the device

				on)		
54	Verification Method	Scans	NFC Scanner/Card Reader	One to One (aggregation)	Fail	Digital Wallet can't be read on a card reader
55	Card	Scans	NFC Scanner/Card Reader	One to One (aggregation)	Passes	None
56	Digital Wallet	Scans	NFC Scanner	One to One	Passes	None
57	NFC Scanner/Card Reader	Verifies	Bank Account	One to One	Fails	A keypad must be included for entering a pin
58	Verified User	Interacts	Keypad	One to One	Pass	None
59	Verified User	Interacts	OLED Screen	One to One	Pass	None
60	Verified User	Interacts With	Cash Dispenser	One to One	Fail	A verified user doesn't directly interact with the cash dispenser.
61	Verified User	Interacts With	Check Deposit Slot	One to One	Fail	A verified user doesn't directly interact with the check deposit slot either.
62	Receipt	Prints	Transaction	One to	Fail	A receipt printer should be

	Printer			One		able to print out many transactions
63	Cash Dispenser	Processes	Cash Withdrawal /Cash Deposit	One to Many (aggregation)	Pass	None
64	Deposit Check Slot	Processes	Deposit Check	One to Many	Pass	None
65	Bank	Has	Security Alarm	One to Many	Pass	None
66	Security Alarm	Informs	Security	One to Many	Fails	There may be multiple alarms in the bank that inform security guards
67	Bank	Affiliated with	Affiliate	One to Many	Fails	An affiliate might be sponsored with more than one bank
68	Bank	Offers	Loans	Many to Many	Pass	In this context, a bank should offer many loans.
69	Bank	Offers	Loans	One to Many	Pass	None
70	Manufacturer	Manufactures	Security Alarm	One to Many	Pass	None
71	Payment	Pays Off	Loan	One to One	Fail	A loan may take several payments to pay off. A user may also have several

						loans to pay off
72	Loan	Linked	Bank Account	One to One	Fail	A bank account might be linked to many loans
73	Verified User	Applies	Loan	One to Many	Pass	None
74	Admin	Handles	Roles/Permissions	Many to Many	Pass	None
75	Roles/Permissions	Has	Bank Accounts	Many to Many	Pass	None
76	Security Alarm	Prompts	Notification	Many to Many	Fail	Many alarms prompting a notification would be inefficient, as well as annoying to the user.
77	User	Has	Check	One to Many	Pass	None
78	Cash	Interacts	Cash Dispenser	One to One	Fail	Many cash can be inserted into/taken out of a cash dispenser
79	Check	Interacts	Deposit Check Slot	Many to One	Pass	None