

Automated Teller Machine Database Management System

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Project Summary:

The goal of this documentation is to discuss a database management system for an Automated Teller Machine, ATM. Specifically, an ATM designed to not only carry out regular teller operations but manage crypto currency wallets as well. There are a plethora of concerns that need to be addressed, however we can delegate them into two different categories; non-functional and functional. Under these two categories we introduce the problems and devise a solution.

Addressing our non-functional concerns, these include how ATMs will be managed, maintained and secured at all times. Given that the theoretical ATM machine will be located in several public places, such as banks, airports, malls, parks, etc. We also want to determine how our clients will access these ATMs as well and how we plan to monetize from the service our ATM provides via transaction fees and rental fees. Will there be numerous ways how a client accesses their account or a single way? We must address these issues in order to have the machine be accessible to the majority of the public who wish to use it to make transactions utilizing their own assets from their own bank or crypto currency wallet. If solved properly, we can guarantee the safety, security, reliability and accessibility to our machines.

Now we must address our functional concerns. These issues heavily affect our client's user experience, how their assets from their bank account is managed as well as their crypto currency wallets. It's worth noting that this ATM is not directly correlated to any bank or financial institution. This machine is entirely its own entity and is managed by a 3rd party corporation or institution that isn't directly related to another banking institution to preserve the nature of crypto currency and be accessible to clients regardless which bank they are currently under. This enables clients who use this ATM the ability to manage multiple wallets and withdraw assets from any banking institution as they please.

The world has already been ushered into the digital age and as we enter, the concepts and objects we've conceived previously have been or will be digitized at some point. Crypto Currency is a prime example of this phenomenon. So in order to adapt to the ever so changing economic jungle, we must now take into account how people can access their assets in this modern age.

Use Cases:

Functional Focused

Stan loves the new digital age. Every account he wishes he can control them from a single device. When smartphones became more popular and the use of apps Stan was overjoyed. He can now access his favorite videos, watch movies, and shop at the palm of his fingers. After a while he grew tired of having to organize his apps and accounts. He found this truly inconvenient for managing his financial applications that controlled his; banking accounts, stock market accounts and his crypto wallets. He wishes he had a central place to access those accounts. He then discovered our ATMs. He loves the fact that he can access all of his banking accounts, and crypto wallets from a single account from an ATM. Because of this he decides to create an account and enter all of his bank account information and his crypto wallets. He now makes trips to the ATM rather than troubling himself with using his phone because it provides him a good excuse to walk outside and the ATM allows exchange between his crypto wallet and his bank accounts.

John is at the park and is very parched, he wants to purchase a drink at a stand but currently has no cash on his person. John would like to make a withdrawal at the park's ATM. He wants to access his funds as fast as possible so he can buy his drink because he is dangerously dehydrated! He walks over to the ATM and simply connects to it with his phone. He could have used his PIN or his card but this was a serious situation. Upon connecting, he gains access to the interface of the ATM on the machine itself, grabs the money desperately needs to withdraw from his primary bank account with no transaction fees and leaves to the nearest food stand.

Clara is on her way to her friend's house and gets a call from her mother. The mother states that her little brother who went to study abroad is low on funds and needs some cash just to get by for the rest of the week because he does not get paid until then. Seeing as Clara's mother just lost her job she cannot help her own son. Clara being the eldest daughter with a successful industry job decides to help. She and her brother had both opened up Crypto wallets in the past after they initially invested in Bitcoin. She determined that the price of sending Bitcoin through a cryptocurrency wallet app was cheaper than sending actual money out. She also determined this method to be the fastest way to send her brother some assets he could use to convert to cash from the ATM. So on the way to her friend's house she visits a

nearby grocery store that has our ATM and uses her card to make the transaction. The transaction which Clara sends Bitcoin from her wallet to her brother's wallet.

A caring father **Micheal** wants to teach his son the importance of budgeting and currently has two checking accounts from the same bank. One is for himself and his own personal uses and the other is for his son that he recently opened. Now Micheal shows our ATMs to his son because it's more convenient to access rather than your typical bank ATM since there's always one to be found in convenient public places. Now Micheal shows his son how to use the ATM machine to access own checking account and advises his child to do the same. Both Micheal and his son own a card from the same bank but have different sets of numbers that correspond to the different checking accounts. So Micheal can see his own bank account but not his son's. Using their own card they access their accounts and withdraw money. Micheal would also like to be able to have the ATM sense the withdrawal limit that the bank had set on his son's. Micheal wants to also be able to transfer money into his son's checking account as well via ATM in the case of emergencies or supplying his son with an allowance.

Cryptocurrency trader **Simon** had recently reached a breakthrough. He had taken a big chance with DogeCoin and ShibaInu. With big risks come along the chances of big rewards and Simon experienced this first hand. As a cause for celebration, he wants to use some of his investments to celebrate at a local pub. He also wants to limit his spending and decides to stick with cash as his payment method for that night. Simon strolls on his way to the pub and finds one of our ATMs, logs in his credentials for a given bank with his phone and accesses his crypto wallet. He then proceeds to use the ATM to exchange his cryptocurrency coins into \$200 USD and transfers it onto his bank account which he then withdraws. He did face a transaction fee for his exchange but it was priced reasonably enough for him to not care. After his swift withdrawal, he is merrily on his way to the bar!

A young man named **Henry** is starting off his first business as a computer technician. He figured that he was ready to at least use this as a second source of income. Seeing as his business is new, he takes only two forms of payment; Cash or a transfer of payment through an application called Venmo. Now Henry does not feel comfortable having physical money always in his person or in his house. Given this, he decides to find our nearest ATM which happens to be conveniently placed closer to him than his local bank. So after his first customer who paid with cash, he reaches our nearest ATM and performs a deposit with no transaction fee. As he interfaces with our ATM he notices he has the option to deposit into one of his bank accounts some of which are from different banks or purchase cryptocurrencies which will go directly into one of his multiple wallets. Astonished and really impressed, Henry decides to deposit into his bank account that is tied with his business. Although Henry chooses to deposit into his businesses bank account, he is happy that he can also choose to purchase crypto currency, he's satisfied he wasn't charged for putting money into his bank account and has a new idea of his business now accepting cryptocurrency as another method of payment because he can access it so easily with our ATM as well.

Joseph is vacationing in Italy. He's excited as he feels it's a long needed break since he's been working extra hours at his job and because of it he has extra money to spend. As he wakes up from his hotel room he decides to spend the morning at a local cafe. The local cafe is known for their cappuccinos and Joseph loves them. As he visits the shop, he quickly realizes that they cannot take cards as a method of payment. The shop only accepts cash because it does not have enough time and does not want to pay any transaction fees per purchase. So reluctantly Joseph goes back outside to look for an ATM, currently he's in a plaza and finds our machine. He at first was puzzled that the interface was in a different language but he was happy he could switch it back to english. He proceeds to make his withdrawal and discovers that the ATM dispensed Euros rather than USD. He initially thought he'd need to take a trip to a currency conversion stand but this was even better. This ATM not only contacted his bank and formatted his

information but also converted it to the region's specifications, leaving little work for Joseph's end. Now Joseph goes back to the cafe and proceeds to enjoy his vacation.

Non-Functional Focused

A new Plaza has been established in the town of San Bruno, California. The owner of the plaza; **James** Waterson, wants to start leasing property for businesses to enter. He was interested in renting out ATM's from specific banks but realized he would need to commit to one that was only controlled and managed by a single bank. James also understands visitors can have multiple bank accounts from different banking institutions so as a good way to promote business he wants any visitor to be able to use the ATM. He also requires that the ATM is well maintained, secure and has safety precautions for customer safe use. He had previous experiences where his rented ATM was stolen and the notification/alert system was late to alert authorities of its location. James' mind would feel at rest if the ATM can not only track its location but contact local or nearby authorities if needed. Also since he is renting this ATM, he should not have to worry about filling it with money but having the nearest bank refill the amount that is inside these machines. Lastly, as James recognizes, crypto currency is significant nowadays and wants to capitalize on people's use of it so he's looking for an ATM that provides such a service. Per transaction that does have crypto currency related will result in a merchant tax that credits back to James as a form of payment to him.

Ashton, an avid party goer, heads her way to San Francisco for a fun time! Her plan was to hit every other club in the city with her friends and attend 2 after parties. As she rode Uber on the way to the heart of the city she quickly realized she forgot her wallet at home. Luckily she keeps her ID attached to her phone but how else was she going to fund her oncoming escapades? On her way to her destination she sees these specialized ATMs at almost every other critical public area such as Bart, Malls, etc. She is relieved and upon arriving at her destination she managed to find one literally within a block away from Union Square. She took a big sigh and realized she may need her card to access the machine but to her surprise there are multiple ways to access her bank account from her ATM. She quickly interfaces the machine, chooses her bank, logs in with her credentials as if it was a computer and quickly withdraws the money she'd need for the night.

A cybersecurity engineer **Wallace** is going about his day shopping for his weekly groceries. Realizing he forgot his phone at home he is forced to pay with his card. Wallace is frustrated because he doesn't usually leave his phone at home and is fearful of using any of his cards to make purchases. Throughout his career as a cybersecurity engineer he understands the perils of using credit card sliders and knows all about the security flaws of a magnetic strip. He also does not trust establishments to maintain and secure their card readers. Given this level of mistrust he decides to pay with cash. Now our ATM is nearby and Wallace notices it. He loves our company because each ATM is examined for any alterations weekly and has fail safe alarms for when it has been tampered with. Once tampered with, he knows the ATM will cease all transactions from this current machine and will essentially lock itself until the alteration is fixed. With confidence Wallace makes his withdrawal and continues his day.

Known in the underground world for his skill in thievery and heisting skills, **Rick** has had his eyes on our special ATMs. Since there's an abundance of them around his area, he's confident that the cooperation that maintains these machines have a hard time keeping track of all of them and that the authorities would have trouble tracking them down because he is a master at breaking ATMs open quickly. Simply put, he is confident in his skill, has been in this business for quite some time and has never been caught. What Rick does not realize is that upon stealing the ATM, the machine's set of sensors are present to detect if any alterations have been made and or if it's being transported to a different location. The machine itself checks a database to see if these actions are authorized and if not it will go into a lockdown and secure state. In this state the ATM does the following; it places its interface in an inaccessible state, takes note of its current location every 5 minutes and notifies the nearest police station every 10 minutes. Upon realizing Rick has less time than he anticipated he decides to stop his car with the ATM machine and tries to break the lock. I realized that in order to access the contents of the ATM, you not only need a specific physical key unique to its machine but also know a digital encrypted key as well to access its contents. Upon attempting to break into the ATM the authorities make it right on time to catch Rick in the act and put him to jail.

Jorge was going to his niece's quinceanera and wanted to withdraw money as an addition to the gift that he plans to give her. As he uses our application on his smartphone to look for our nearest available ATM, he eventually finds it and notices that the machine is broken. Now Jorge has some spare time so he decides to call the 'HELP' number that is located on the side of the machine and notifies the operator that an ATM from his current location is broken. The operator proceeds to ask the state of the ATM machine, asking which parts seem to be visibly broken or unusable and lastly asks for the machine's identification number that has been engraved on the back side of it. Upon receiving the identification number the phone operator queries the database and finds the state that the ATM is in. The ATM card reader according to the operator has been tampered with. Upon hearing this news Jorge was relieved he did not use this machine and was happy he reported it. After contact between Jorge and the phone operator ended, the phone operator sends in the nearest maintenance crew to pick up the ATM and authorize its movement.

An elderly lady named **Mildred** was thinking about giving her grandson money for his birthday. Mildred loves her grandson but doesn't see him quite often so she doesn't know what to buy him, so in her mind money as a gift is the perfect idea. As she strolls around the park on her daily walk she spots our ATM and proceeds to use it. Unfortunately Mildred isn't used to technology and becomes frustrated trying to interface with the machine, she requires help. Luckily there's a button that dials a phone operator that calm's Mildred down and instructs her on how to use the machine. Mildred in a calmer state thanks the young woman speaking to her and finishes her withdrawal process.

Project Requirements:

Functional Requirements:

1) Stan:

- a) An Account is accessed through login credentials, phone, pin or a card.
- b) A User has at least one account.
- c) An Account must have at least one bank account.
- d) An Account can have many crypto wallets.
- e) An ATM connects to at least one host processor.
- f) A host processor communicates to one bank computer.
- g) A Bank has a Bank computer

2) John:

- a) A user must have at least a phone, a pin, or a card.
- b) A phone, pin or a card is associated with a user.
- c) A User has at least one bank account.
- d) A User can use many ATMs.
- e) An Account can perform at least one transaction.
- f) Withdrawing money is a transaction.
- g) An ATM has at least one location.
- h) Withdrawing money does not have a transaction fee.
- i) A bank account has money.

3) Micheal:

- a) A bank account has a withdrawal limit.
- b) A bank account can access many bank accounts.
- c) A transaction between bank accounts is a transfer.
- d) ATMs can log into many accounts.

4) Clara:

- a) An Account can have many cryptocurrency wallets.
- b) A Cryptocurrency wallet belongs to an Account.
- c) A Cryptocurrency wallet has many cryptocurrencies.
- d) Cryptocurrencies can be stored inside wallets.
- e) Cryptocurrency can be exchanged for money.
- f) A crypto wallet can send cryptocurrency
- g) Sending Cryptocurrency via a wallet is a transaction.

- h) ATMs have access to many crypto wallets.
 - i) A crypto wallet can perform many transactions.
 - j) Cryptocurrency can be exchanged for money.
 - k) Bitcoin is a CryptoCurrency.
- 5) Simon:
- a) DogeCoin is a CryptoCurrency.
 - b) Shiba Inu is a CryptoCurrency.
 - c) A Person can use at least one ATM.
 - d) Exchanges from cryptocurrency converted money have a transaction fee.
- 6) Henry:
- a) Depositing is a transaction.
 - b) Depositing does not have a transaction fee.
 - c) A bank account is associated with one banking institution.
 - d) An Account can purchase cryptocurrencies.
- 7) Joseph
- a) An ATM is at least in one country.
 - b) A country has at least one currency.
 - c) An ATM dispenses many currencies.
 - d) USD is a currency.
 - e) The Euro is a currency.
 - f) A currency can be converted to another currency.

Non-Functional Requirements:

1. James
 - a. ATMs have access to at least one banking institution.
 - b. ATMs are maintained by one maintenance employee.
 - c. A Property owner can rent many ATMs.
 - d. An ATM has an alert system.
 - e. An ATM has a location.
 - f. A Bank fills many ATMs.
 - g. Chargeable transactions create one payment.
 - h. Property Owner receives many payments.
2. Ashton
 - a. An ATM has a certain proximity to the next ATM.
 - b. ATMs are placed in many public areas.
 - c. The ATM has an interface.
3. Wallace
 - a. An ATM has an alarm.
 - b. An Alarm becomes active when tampered with.
 - c. An ATM will cease a User's transaction if tampered with.
 - d. An ATM notifies maintenance if the ATM has been altered.
4. Rick
 - a. An ATM has at least one sensor.
 - b. A sensor has one trigger.
 - c. An ATM can be authorized to change locations.
 - d. An ATM alerts at least one police station if the location has changed without authorization.
 - e. An ATM alerts a police station every 10 minutes if the location has changed without authorization.
 - f. An ATM records its location every 5 minutes if the location has changed without authorization.
 - g. The ATM has a unique physical key.
 - h. The ATM has a digital key.
 - i. A Digital key is encrypted.

- j. Maintenance Crew can access an ATM if digital and physical keys are both present.
5. Jorge
- a. An ATM has a unique identification number.
 - b. A Phone operator can look at the state of many ATMs
 - c. A Maintenance Personnel is in charge of maintaining at least one ATM.
 - d. A Maintenance Department has at least one maintenance vehicle
6. Mildred
- a. An ATM has many phone operators

Entity Description:

❖ Strong Entities:

- Person
 - person_id: Numeric, Key
 - first_name : Alphanumeric
 - last_name : Alphanumeric
 - dob: Date, Compound
 - age: Numeric, Derived
 - ssn: Alphanumeric
- ATM
 - atm_id: Numeric, Key
 - isAuthorizedToMove: Boolean
 - machine_balance: Numeric
 - isEmpty: Boolean
- Renter
 - renter_id: Numeric, Key
 - monthly_payment: Numeric
 - date_joined: Date
 - active: Boolean
- Location
 - location_id: Numeric, Key
 - street: Alphanumeric
 - city: Alphanumeric
 - zip_code: Alphanumeric
 - geographical_coordinates: Alphanumeric
 - location_description: Alphanumeric
- Country
 - country_id: Numeric, Key
 - name: Alphanumeric
 - primary_language: Alphanumeric
- Currency
 - currency_id: Numeric, Key
 - name: Alphanumeric
 - value_in_gold: Numeric
- Bank
 - bank_id: Numeric, Key
 - bame: Alphanumeric
 - date_joined: Date
- Payment
 - payment_id: Numeric, Key
 - amount: Numeric
 - date_processed: Numeric
- Host Processor

- host_processor_id: Numeric, Key
- distance: Numeric
- ip_address: Alphanumeric
- mac_address: Alphanumeric
- isActive: Boolean
- Crypto Currency
 - CryptoCurrency_id: Numeric, Key
 - Blockchain: Alphanumeric
 - Name: Alphanumeric
- Department
 - department_id: Numeric, Key
 - number_employees: Numeric
 - date_established: Date
 - address: Alphanumeric
- Keys
 - key_id: Numeric, Key
 - inUse: Boolean
 - type: Alphanumeric
 - last_used: DATE
- Alert System
 - System_id: Numeric, Key
 - Name: Alphanumeric
 - Company: Alphanumeric
 - Date_Applied: Date
- Police Station
 - station_id: Numeric, Key
 - phone_number: Alphanumeric
 - distance: Numeric
 - active: Boolean
 - chief_name: Alphanumeric
- Phone
 - phone_id: Numeric, Key
 - phone_number: Numeric
 - service_provider: Alphanumeric
- Language
 - language_id: Alphanumeric, Key
 - country_origin: Alphanumeric
 - name: Alphanumeric

❖ Weak Entities

- Transaction Details
 - Transaction_details_id: Numeric, Key
 - name: Alphanumeric
 - wasExchange: Boolean

- wasCryptoTransfer: Boolean
- amount: Numeric
- Transactions
 - transaction_id: Numeric, Key
 - date_processed: Date
 - isChargeable: Boolean
- Sensors
 - sensor_id: Numeric, Key
 - type: Alphanumeric
 - isTriggered: Boolean
- Guest Assistance
 - guest_assist_id: Numeric, Inherited, Key
 - country_located_id: Date
 - President_Name: Alphanumeric
- Guest Assistance Employees
 - GA_Employee_id: Numeric, Key
 - Department_id: numeric
 - Date_Joined: Date
 - Date_Of_Birth: Date
 - Age: Numeric, Derived
 - Position: Alphanumeric
 - SSN: Alphanumeric, unique
- Phone Operator
 - operator_id: Numeric, Key
 - MAC_Address_Phone: Alphanumeric
 - MAC_Address_Computer: Alphanumeric
- Maintenance
 - Department_id: Numeric, Inherited
 - Date_Established: Date
 - President_Name: Alphanumeric
- Maintenance Employees
 - Maintenance_Employee_id: Numeric, Key
 - Department_id: Numeric
 - Date_Joined: Date
 - Date_Of_Birth: Date
 - Age: Numeric, Derived
 - Position: Alphanumeric
 - SSN: Alphanumeric, unique
- Maintenance Personnel
 - Operator_id: Numeric, Key
 - employee_id: Alphanumeric
 - certified: Boolean
- Digital Key
 - digital_key_id: Numeric, Inherited

- hash_alg_used: Alphanumeric
- last_rehash: Date
- Physical Key
 - physical_key_id: Numeric, Inherited
 - maker: Alphanumeric
 - creation_date: Date
- Refiller
 - Filler_id: Numeric, Key
 - bank_id: Numeric
 - atm_id: Numeric
- ATM Connections
 - Connection_id: Numeric, Key
 - atm_id: Numeric
 - host_processor_id: Numeric
 - isConnected: Boolean
 - last_conn_Established: Date
 - port: Numeric
- Accepted Currency
 - accepted_curr_id Numeric, Key
 - country_id: Numeric
 - currency_id: Numeric
- Bank Computer
 - bank_Computer_id: Numeric, Key
 - mac_address: Alphanumeric
 - ip_address: Alphanumeric
- Bank Account
 - bank_account_id: Numeric, Key
 - routing_number: Alphanumeric
 - bank_id: Alphanumeric
 - account_Number: Numeric
 - isChecking: Boolean
 - isSaving: Boolean
 - amount: Numeric'
- Account Assets
 - asset_id: Numeric, Key
 - account_asset_id: Numeric
 - isBankAccount: Boolean
 - account_id: Numeric
- Language Display
 - language_display_id: Numeric, Key
 - country_id: Numeric
 - language_id: Numeric
- Crypto Wallet
 - wallet_id: Numeric, Key

- public_address: Alphanumeric
- private_address: Alphanumeric
- crypto_currency_id
- Account
 - account_id: Numeric, Key
 - username: Alphanumeric
 - password: Alphanumeric
 - date_joined: Date
 - card_id: Numeric
 - phone_id: Numeric
- Card
 - card_id: Numeric, Key
 - card_Number: Numeric
 - pin: Numeric
 - card_owner_id: Numeric
- KeyRing
 - key_ring_id: Numeric, Key
 - physical_key_id: Numeric
 - digital_key_id: Numeric
 - atm_id: numeric
- Phone Assistance
 - phone_assist_id: Numeric, Key
 - phone_operator_id
 - atm_id

Test Cases:

Pass	Fail	Fixed
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Test Cases for Person interacting with the ATM general features :

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Desc.
1	Person	use	ATM	0/1 to M		
2	Person	login	Account	1 to 1/M		
3	Person	access	Account	1 to M		Failure if a person has an account but doesn't have a Pin, Phone, and a Card. Allowed users to have a phone as an option and login via an account with a card or a phone.
4	Person	uses	Interface	1 to 1		
5	Person	performs	Transactions	0 to M		
6	Person	has	CryptoWallet	1 to M		
7	Person	has	Bank Account	1 to M		Failure if a Person Does not have a Bank account.
8	Person	Language Display	Language	1/M to 1/M		

Test cases for ATM being responsive to Location:

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Desc.
1	ATM	Language Display	Language	1/M to 1/M		
	ATM	Spoken Language	Country	1/M to 1/M		
	ATM	Accepted Currency	Currency	M to 1/M		

Test Case for Employees interacting with the ATM or Person:

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Desc.
1	Maint Emp	has	Digital Key	1 to 1		Maintenance should have keys to multiple ATM's in their area otherwise 1 Maint Employee per ATM
2	Maint Emp	has	Physical Key	1 to 1		Maintenance should have keys to multiple ATM's in their area otherwise 1 Maint Employee per ATM
3	Maint Emp	access	ATM	N/A		There was no notice of the Maint Emp accessing the ATM by Keys
4	Phone Operator	N/A	Person	N/A		Phone Operators cannot assist a person.

Test Cases for Alert System and its components interacting with ATM:

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Desc.
1	ATM	has	Alert System	M to 1		Implied that an ATM can have no alert system
2	ATM	Active Sensors	Sensors	M to M		
3	Alert System	has	Location	1 to M		
4	ATM	has	Alarm	1 to 1		
5	ATM	alerts	Police Station	1/M to M		

Test Case for Bank and its components interacting with ATM:

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Desc.
1	ATM	Comm.	Bank	M to 1 Only		Means people will only be able to access their bank account if they have that specific bank.
2	ATM	Comm	Bank Computer	M to 1		
3	ATM	Refiller	Bank	M to 1/M		

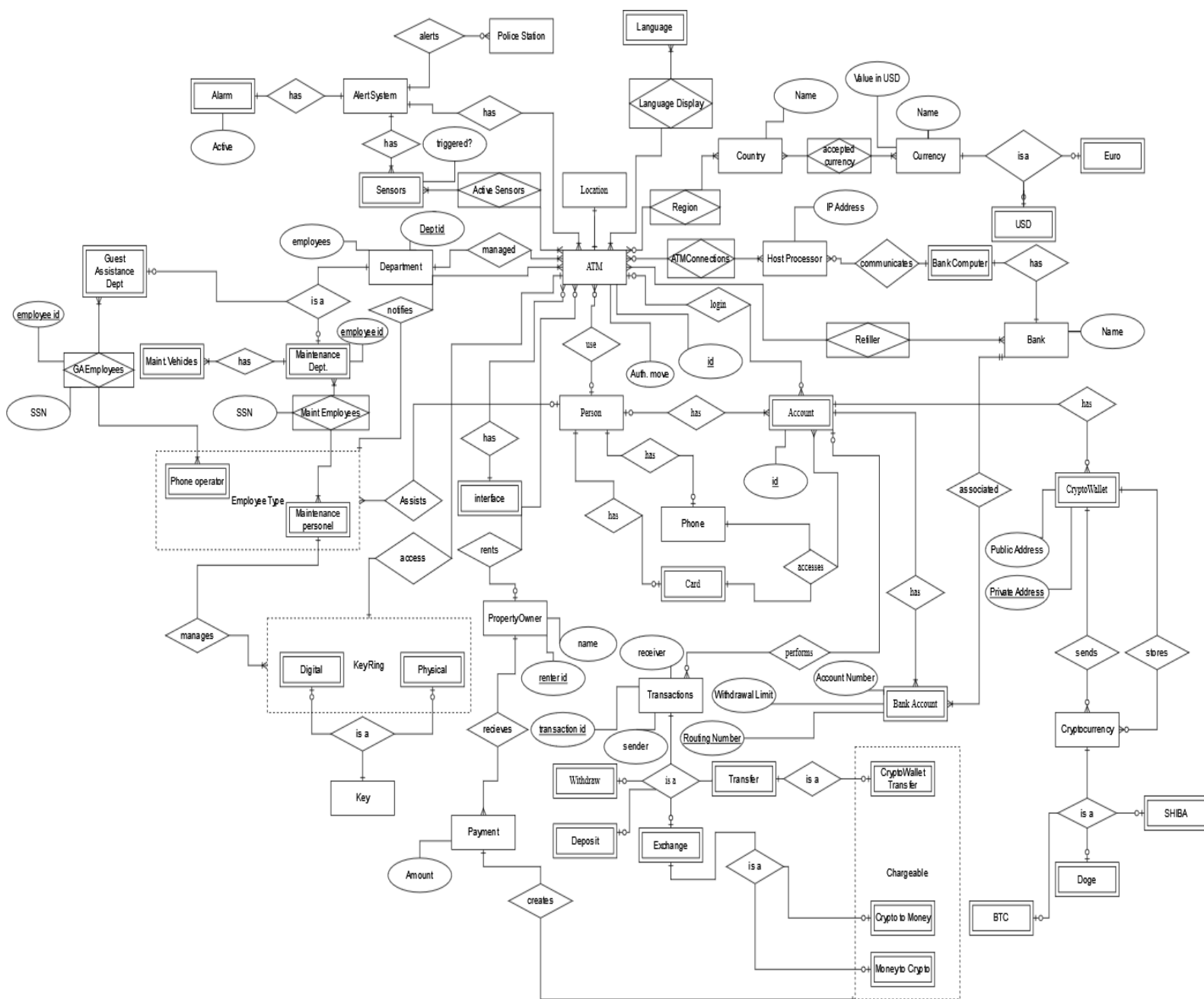
Test Case for ATM handling Bank Account and Cryptocurrency related transactions:

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Desc.
1	ATM	performs	Withdrawal	1/0 to M		
2	ATM	performs	Deposit	1/0 to M		
3	ATM	performs	Exchange	1/0 to M		
4	ATM	performs	Transfer	1/0 to M		

Test cases for Property Owner interactions with ATM:

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Desc.
1	PropertyOwner	rents	ATM	1/0 to M		
2	ATM	creates	Payment	1/0 to 1		
3	Payment	received	PropertyOwner	M to 1		

Entity Relation Diagram (Remodeled):



Enhanced Entity Relation Description:

Table	FK	ON DELETE	ON UPDATE	Comment
ATM	account_id	NO ACTION	NO ACTION	An ATM should not be deleted if a user decides to delete their account with us.
ATM	renter_id	NO ACTION	NO ACTION	An ATM should not be deleted if a renter decides to not rent one of our atms
ATM	location_id	NO ACTION	CASCADE	ATM should be up to date on information about its current location.
ATM	language_display_id	NO ACTION	CASCADE	ATM should be able to reference the language it displays based on location only.
ATM	alert_system_id	NO ACTION	CASCADE	If an alert system is deleted, does not mean the atm should not exist or stop working.
ATM	police_station_id	NO ACTION	NO ACTION	If a police station is deleted, does not mean the atm should not exist but should be reassigned to the next nearest station.
ATMConnections	atm_id	CASCADE	NO ACTION	If an ATM is deleted that means it should no longer connect to anything. Nothing to update
Account	card_id	NO ACTION	CASCADE	If an account receives a new card and an old card gets deleted does not mean the account should also be deleted. Also if the card needs a change of pin.
Account	phone_id	NO ACTION	CASCADE	Account can change their phone number but on delete should not mean the account should be deleted as well.
AccountAssets	account_id	CASCADE	CASCADE	We don't need to keep the link to their assets and its information when they delete their account with us.
AccountAssets	account_asset_id	CASCADE	CASCADE	If they delete their asset we should delete that in relation to

				their account.
BankAccount	bank_id	CASCADE	CASCADE	Bank Account must be able to reference the banking institution that hosts the assets.
BankComputer	bank_id	CASCADE	NO ACTION	If a bank is deleted, the Bank Computer will no longer be active to access bank information.
BankConnections	host_processor_id	CASCADE	CASCADE	Must be able to keep track of the connection to the host processor to see if it's still a viable route to communicate with the bank computer.
BankConnections	bank_computer_id	CASCADE	CASCADE	Must be able to keep track of the bank computers state to see if it's still a viable route to communicate with the bank.
Card	card_owner_id	CASCADE	CASCADE	If a person has an account with us, that card is linked to his account, whether he decides to leave or dies, we must be able to take access away from the card.
Country	primary_language_id	NO ACTION	NO ACTION	Countries should be able to keep record of a primary language spoken, but if language disappears does not mean the country also does.
DigitalKey	digital_key_id	CASCADE	CASCADE	Relation to the parent table Key, so if a key is deleted so should the information of anything about it being digital as well.
CryptoWallet	cryptocurrency_id	NO ACTION	NO ACTION	A crypto wallet must be able to keep track of the currency it's holding but not disappear if the currency is no longer valid.
GAEmployees	guest_assist_dept_id	CASCADE	CASCADE	If a department gets removed from the system, so do all the employees under that department.
GuestAssistance	dept_id	CASCADE	CASCADE	Supposed to hold the inheritance of the department of

				the db.
KeyRing	physical_key_id	CASCADE	CASCADE	If a key gets updated or deleted, it must be recorded because this controls the access to the atm for maintenance.
KeyRing	digital_key_id	CASCADE	CASCADE	Similar reason for the physical key, it is needed to access the ATM for maintenance.
KeyRing	atm_id	CASCADE	CASCADE	KeyRing needs to be able to keep track of the atm it is allowed to access and if it's removed only if the atm is removed.
Keys	physical_key_id	CASCADE	CASCADE	Removal/update of the key should delete/update the existence of the inheriting parent table.
Keys	digital_key_id	CASCADE	CASCADE	Similar reason for physical_key_id, due to its inheritance of the Key table.
Language	country_id	NO ACTION	NO ACTION	If a country gets deleted or updated does not imply the language is lost or changed.
LanguageDisplay	country_id	NO ACTION	NO ACTION	People inside a country can speak many languages.
LanguageDisplay	language_id	NO ACTION	NO ACTION	People can speak any language in any country.
Location	country_id	CASCADE	CASCADE	ATM's location should always know which country the atm is in and if the country happens to be deleted then same should be with the atm.
Maintenance	dept_id	CASCADE	CASCADE	Maintains relation of inheriting table Department. Similar reason for GuestAssistance dept.
Maintenance	location_id	NO ACTION	CASCADE	Should change on update so the maintenance department can be relocated.

MaintenanceEmployee	maint_dept_id	CASCADE	CASCADE	Direct reference to which department the employee belongs too, if that department gets removed or updated so should the employee.
MaintenancePersonnel	employee_id	CASCADE	CASCADE	Still an employee of a department so it should update accordingly if changes occur in the department's list of employees.
MaintenancePersonnel	key_ring_id	NO ACTION	NO ACTION	Just because a keying is removed, or updated does not mean maintenance personnel that manage the atm machine should change/remove.
Payment	transaction_id	NO ACTION	NO ACTION	Payments to the atm renter should be recorded and have the details of the transaction that was applied. On Update and Delete should not be affecting payment records.
Payment	renter_id	NO ACTION	NO ACTION	Must keep track of payment history to our renters for records.
Phone	owner_id	CASCADE	CASCADE	Phone numbers can be changed or removed by people all the time.
Phone Assistance	phone_operator_id	CASCADE	CASCADE	Change of phone operator that assists users using are atms is a must. Also on delete, means there's no one assisting that atm.
PhoneAssistance	atm_id	CASCADE	CASCADE	Needs to keep track of which atm phone operator can assist. Phone Operators can change and assist many atms. If an atm is removed, so does the Phone Operator's responsibility to assist that atm.
PhoneOperator	employee_id	CASCADE	CASCADE	If an employee changes or is removed, we must do the same since he is working for a specific position in the department.

PhysicalKey	physical_key_id	CASCADE	CASCADE	Relation to the parent table Key, so if a key is deleted so should the information of anything about it being physical as well.
Refiller	bank_id	CASCADE	CASCADE	We must update or delete in this manner to make sure that there's a bank that's always able to refill an atm.
Refiller	atm_id	CASCADE	CASCADE	We must update or delete in this manner to make sure that the bank has an atm to fill. If an ATM is removed or updated the bank will know.
Renter	person_id	CASCADE	CASCADE	A renter is still a person and we'd like to keep track of their information and update/delete them accordingly.
TransactionDetails	cryptocurrency_id	NO ACTION	NO ACTION	Just because a cryptocurrency is no longer valid or is removed from the system, we should still be able to keep track of that transaction detail for customers.
Transaction	transaction_details_id	NO ACTION	NO ACTION	Transaction details should be kept on record for use and should not be updated at all to prevent abuse.
Transaction	sender_id	NO ACTION	NO ACTION	Notate the sender, no updates and removals require for record keeping
Transaction	receiver_id	NO ACTION	NO ACTION	Notate the receiver, no updates or removals required for record keeping.
Transaction	atm_id	NO ACTION	NO ACTION	Notate the atm the transaction was performed. Update or removal of an atm should not affect a previous transaction.
Sesor	atm_id	NO ACTION	NO ACTION	Just cause a sensor is deleted does not mean the whole atm should. Neither should an ATM care about updates.

SQL Insertion Tests:

Pass	Fail
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Entity	SQLQuery	Pass/Fail	Error Description	Possible Solution
AcceptedCurrency	DELETE		NONE	NONE
AcceptedCurrency	UPDATE		NONE	NONE
Account	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
Account	Update		NONE	NONE
ATM	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
ATM	UPDATE		NONE	NONE
ATMConnections	DELETE		NONE	NONE
ATMConnections	UPDATE		NONE	NONE
Bank	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
Bank	UPDATE		NONE	NONE
BankAccount	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
BankAccount	UPDATE		NONE	NONE
BankComputer	DELETE		NONE	NONE
BankComputer	UPDATE		NONE	NONE
BankConnection	DELETE		NONE	NONE
BankConnection	UPDATE		NONE	NONE
Card	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise. .

Card	UPDATE		NONE	NONE
Country	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
Country	UPDATE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
CryptoCurrency	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
CryptoCurrency	UPDATE		NONE	NONE
CryptoWallet	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
CryptoWallet	UPDATE		NONE	NONE
Currency	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
Currency	UPDATE		NONE	NONE
Department	DELETE		NONE	NONE
Department	UPDATE		NONE	NONE
DigitalKey	DELETE		NONE	NONE
DigitalKey	UPDATE		NONE	NONE
GAEmployees	DELETE		NONE	NONE
GAEmployees	UPDATE		NONE	NONE
GuestAssistance	DELETE		NONE	NONE
GuestAssistance	UPDATE		NONE	NONE
HostProcessor	DELETE		NONE	NONE
HostProcessor	UPDATE		NONE	NONE
KeyRing	DELETE		NONE	NONE

KeyRing	UPDATE		Duplicate entry '3' for key 'keyring.atm_id_UNIQUE'	Set a table relationship where KeyRings are allowed to be changed between atms. Concept of Key reuse applied. Reconfigure foreign key atm_id.
Keys	DELETE		NONE	NONE
Keys	UPDATE		NONE	NONE
Language	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
Language	UPDATE		NONE	NONE
LanguageDisplay	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
LanguageDisplay	UPDATE		NONE	NONE
Location	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
Location	UPDATE		NONE	NONE
Maintenance	DELETE		NONE	NONE
Maintenance	UPDATE		NONE	NONE
MaintenanceEmployees	DELETE		NONE	NONE
MaintenanceEmployees	UPDATE		NONE	NONE
MaintenancePersonnel	DELETE		NONE	NONE
MaintenancePersonnel	UPDATE		NONE	NONE
Payment	DELETE		NONE	NONE
Payment	UPDATE		NONE	NONE
Person	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
Person	UPDATE		NONE	NONE
Phone	DELETE		NONE	NONE

Phone	UPDATE		NONE	NONE
PhoneOperator	DELETE		NONE	NONE
PhoneOperator	UPDATE		NONE	NONE
PhysicalKey	DELETE		NONE	NONE
PhysicalKey	UPDATE		NONE	NONE
Refiller	DELETE		NONE	NONE
Refiller	UPDATE		NONE	NONE
Renter	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
Renter	UPDATE		NONE	NONE
TransactionDetails	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
TransactionDetails	UPDATE		NONE	NONE
Transaction	DELETE		NONE	NONE
Transaction	UPDATE		NONE	NONE
AlertSystem	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
AlertSystem	UPDATE		NONE	NONE
PoliceStation	DELETE		Cannot delete or update a parent row: a foreign key constraint fails	Check to see if the relation between tables is correct. Check the foreign keys and make sure the relationship is valid. Reconfigure foreign keys otherwise.
PoliceStation	UPDATE		NONE	NONE
Sensor	DELETE		NONE	NONE
Senser	UPDATE		NONE	NONE

Enhanced Entity Relation Diagram:

