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GitHub Repository Link: https://github.com/3704F23Team2/3704_F23_Team2

Project: Cashierless Store

Use Case 1

Buying a product off the shelf in the store and checking out process

Primary Actors: Customer, Store Software

Functional Requirements (11): customer input processing, item verification software, customer payment software, tax calculation, non-employee checkout process, employee intervention, Id verification, merchandise database, return counter(for not wanting to a buy a item already scanned, not full return counter case), specials and coupons applied at checkout, checkout inventory management

Non-functional Requirements (4): stable server status, GUI software for checkout counter, compliance with retail standards, customer data should be encrypted

Stakeholders and Interests:

- Customer
 - Wants quick and easy shopping experience
- Store Owner
 - Needs to be able to track the payment of the product and the handling of the product in/out of the store system
- Credit Card Company
 - Verifies the customer's credit card information, if applicable

Preconditions: The customer chooses an item/product from the store to purchase. They then submit a payment through the store to purchase the product and the store gets the payment from the customer

Success guarantee: The customer should be paying the store the listed amount of money plus sales tax, the store subtracts the item from its database system, the item is verified to be the correct product before checking out

Main success scenario and extension: In the main case, the customer takes the item/product from the store shelf and goes to the store checkout counter. The item is scanned correctly into the system and the customer is presented with the correct price plus tax of the item for the transaction. During this interaction the system verifies that the product scanned is the correct item through the barcode scanned and the video feed as well as weight checking on the product. The customer inputs their payment method, which is either cash or some card payment. The system accounts for the money, subtracts the item from the store database and

the product is not listed as stolen as the customer gets a receipt and leaves the store with the item.

Extra Scenario 1: Payment is Declined at checkout

If the customer has finished scanning products at the checkout counter and the system has finished processing and verifying the items scanned, before the system subtracts the items from the database the payment method used by the customer is declined, mostly for cards that are misread or declined the asking amount from the system. The system will still hold the items in a limbo-like state where they are scanned into the system but not fully processed out of the database before the customer inputs a payment method where the system will accept. Once the customer inputs a payment method that is accepted the system will finish fully processing the items out of the item database and allow the customer to leave with the paid items.

Extra Scenario 2: Customer scans items but declines the checkout order

If the customer has finished scanning products at the checkout counter and the system has finished processing and verifying the items scanned, but before the customer scans their payment into the system, the customer may decide to subtract an item from the order or cancel the order altogether. The system needs to be able to take the item or items from the checkout order and replace them back into the item database and make sure to track the item from the checkout counter back to the return counter in the store. This is so that the customer doesn't take the item out of the order but still walks out of the store with the product. Once the customer puts the item back onto the return counter the store prints out a label to put on the item to be marked for return onto the store shelf by an associate during after hours. Finally, the customer continues to checkout and finishes purchasing the rest of the items from the store.

Extra Scenario 3: ID Verification

Among the items scanned by the customer are items that require a minimum legal age to purchase, such as alcohol. When the item is scanned, the system will prompt the customer to either enter their ID information or remove the item in question from checkout. If the customer enters ID information, the system will verify the customer's age by checking it in a database. If the ID information is invalid or the customer is determined to be underage, the customer will be prompted to re-enter it, and will not be allowed to proceed with checkout until they either enter correct information or remove the item. If the customer is determined to be of proper age, or if the item is removed, checkout will continue as normal.

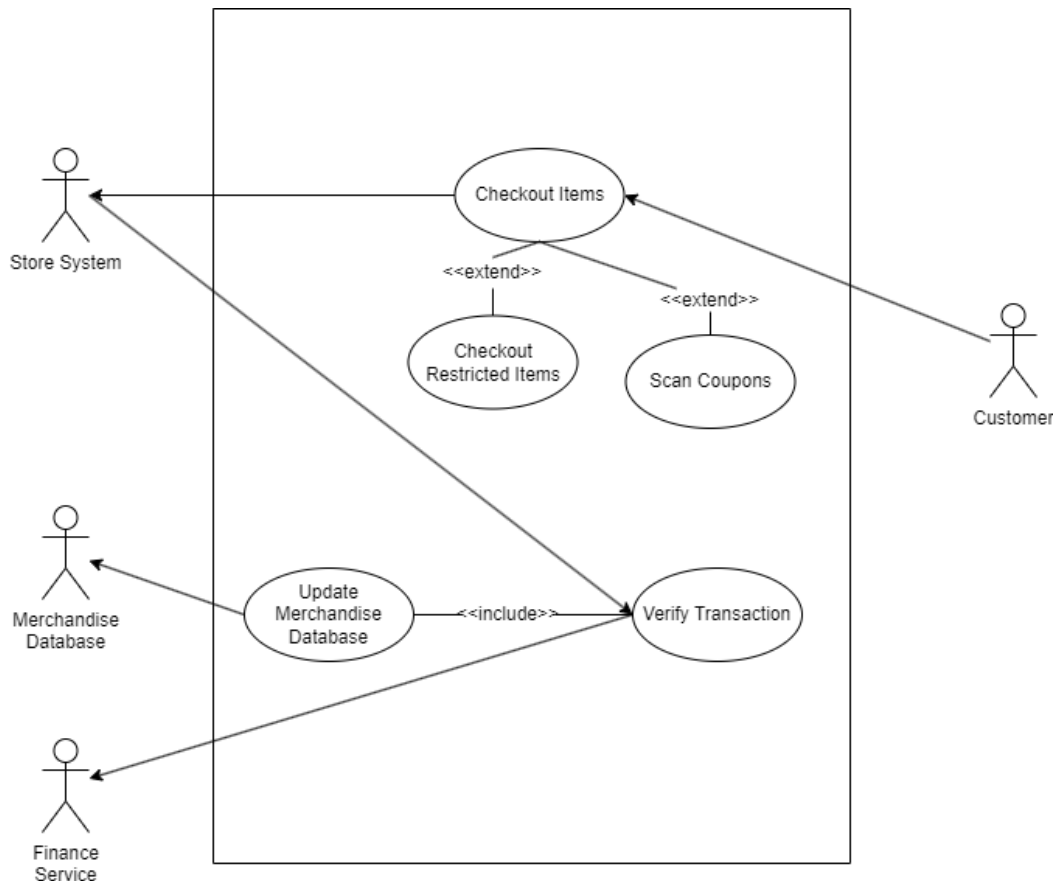
Extra Scenario 4: Specials and Coupons at checkout

During checkout, the customer has the option to scan promotional discount vouchers such as coupons. If the customer has such a coupon, they access a special option within the GUI, which will prompt them to scan the coupon. Customer scans the coupon, and the system checks if it is valid using its database. If the coupon is valid, the discount is applied as directed by the coupon's code, and the checkout process continues. If not, the system will notify the customer that either the scan failed or the coupon is invalid.

Technology and Data Variations List:

- The customer can pay with cash or card for the item
- The store item verification and tracking software during the checkout process
- The store will print any relevant receipts or strikers during the checkout process
- The store database is updated once the purchase is verified or returned after scanning at checkout
- Any promotions or coupons is applied to the purchase
- The store verification software is updated on the purchase and marks the item as “bought” so it doesn’t mark it as stolen
- The store calculates the correct state tax amount onto the total order

Use Case Diagram:



This diagram depicts the process of checkout and payment, the system’s most important process. Interactions between the customer, the store system, and its service dependencies will be required. It accounts for the slight differences in the process that would arise from checking out restricted items and if the customer chooses to use coupons.

Use Case 2

Database backup and store control software (lighting, thermostat)

Primary Actors: Store System, Customers

Functional Requirements (3-4): Database backup plans, secure database server banks, store control software secured and compliance with retail standards, the customer can give feedback on the store environment

Non-Functional Requirements (2): the store is comfortable with customers that want to shop there, robust system

Stakeholders and Interests:

- Customers:
 - Can give feedback on store environment for future improvements and they expect the store system to work properly at all times
- Store Owner:
 - Wants to ensure the integrity of the store system following outages.
- Employees:
 - May be called upon to manually restore the system if it cannot restore itself.
- Emergency Services:
 - May be called in cases of extreme environmental disbalance, such as fires.

Preconditions: The system has been operational prior to unexpected outage.

Success guarantee: Upon rebooting, the system should be able to remember and restore the state of its database in most cases. In the cases where it is unable to, employees are able to modify the database to its correct state from previous versions.

Main success scenario and extension: In the main case, the customer's throughout the store can enjoy regulated environments such as temperature, AC, smell and overall atmosphere from the lighting. The store will not fall into one of these systems breaking without alerting authorized personnel first so that employees or maintenance staff could come out and fix the issues. During this time the system is secured with safe functions so that the data is not leaked to the customers for other reasons. It will keep up a steady feedback to the backup servers in the case of the system and store being attacked or damaged in any way so that the most recent data is safe and stored for future retrieval. The customers currently in the store will be alerted of the issue, and in any worse case asked to leave the store immediately, such as in the case of card monoxide poisoning and whatnot situations. In any case of complete store failure, such as fires, water damage throughout the store, electricity outages, etc, the store will alert the customers using a backup system to quickly leave the store for their own safety. During this the emergency services will be alerted of any issues from a backend system that notices if the store systems stop responding to the backup server so that they can come to issue any help to the customers. During this time the backup system will try to store all the data from before the system stopped functioning for holding the last available records of the databases in the store. The data will be secured in a black box system for employees to recover at a later date after the store is safe to go inside of.

Extension Scenario 1: Customer wants to give feedback on the store environment

If any customer wants to give feedback on the store systems and processes, all they need to do is go to the store feedback machine near the front of the store for valid input to better the environment for customers.

Extension Scenario 2: False alarm in the store system, system fails

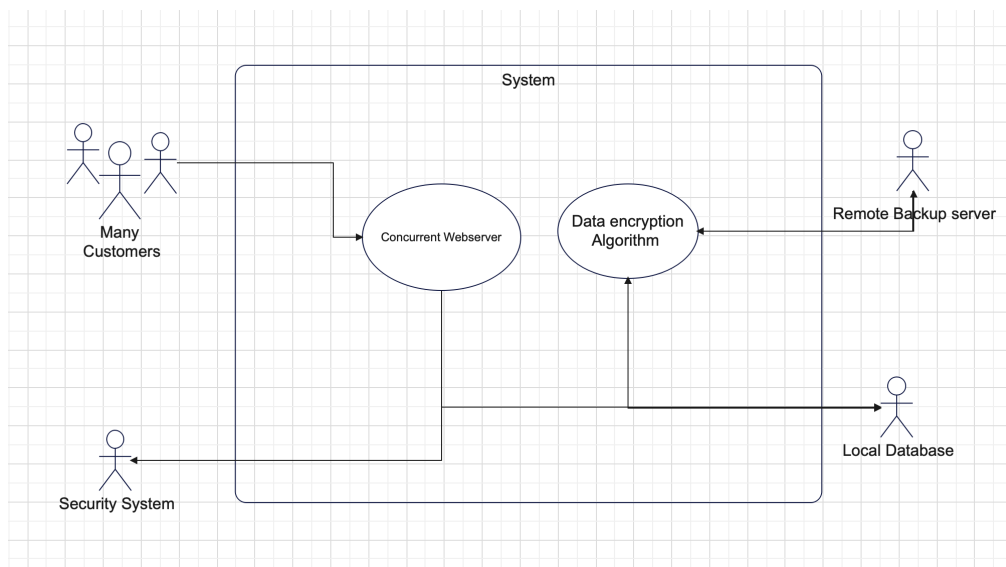
If there are any false alarms in the system, either the system that failed can be replaced or called upon to be looked at by trained professionals to examine it to see where it went wrong and if they could fix it. If not, it is to be replaced with a more functional system for the store. If the store system that failed caused damage to any of the customers the store owner and company may need to help pay the customer back for any injuries and inconveniences. Also the video feed will be in place to help the store company track any false allegations from customers against the company.

Extension Scenario 3: Backup servers go down

If somehow the backup servers go down, the store manager and owner will be alerted to come and solve the problem as quickly as possible to come and possibly replace the systems and databases for better security and safe going of the store data.

Technology and Data Variations List:

- Backup servers inside and outside the store
- Store environment systems (ac, temperature, lighting, etc.)
- Monitoring systems of the store, checking for damages and issues for the customers' safety
- Call out systems for alerting proper authorities in case of issues in the store



The idea with this use case diagram is that many customers can be reliably served by the server application. But if the server ever picks up or flags any suspicious activity, it will report

that to the signal handler. Additionally, regular activities the customers produce are loaded to the local database, encrypted, and sent to the remote server.

Use Case 3

Robbery and Hacking defenses

Primary Actors: Store System, Emergency Services

Functional Requirements (4): Emergency/employee intervention case, Fraud Detection, Hacking defenses, Report of Stealing / Robbing

Non Functional Requirements (3): Maintainability(regular updates/patches), responsiveness, emergency services communication

Stakeholders

- Store Owner
 - Wants to keep the store a secure and honest environment for customers.
- Customers
 - Entrusts their security and personal data to the store owner and store system.
- Emergency Services
 - Will be called in the occurrence of major criminal threats.

Preconditions: The store has a functional security system including surveillance cameras and emergency communication system. The store's network is operational and contains customer and transaction data. Emergency Services are available and reachable.

Success guarantee: Robbery and hacking attempts are promptly identified, reported, and managed. Customer data and store assets are protected

Main success scenario 1: Robbery / Hacking Attempt Detected

1. The store system detects an unusual activity, either physical or digital
2. The system immediately alerts the store owner and security personnel
3. The system automatically contacts Emergency Services if the threat level is above a predefined threshold
4. Relevant data are stored securely for further investigation.

Extension:

1a) A false alarm is detected:

- 1) The system logs the event for further analysis and adjustment of sensitivity parameters.

1b) The system fails to detect the incidents

- 1) A post-incident review identifies the oversight and adjusts the detection parameters and algorithms to prevent recurrence
- 2) Investigate any potential system tampering or malfunctioning to determine the cause of the failure to detect the incident

2a) The system fails to alert the store owner/security personnel

- 1) Implement a secondary or backup alerting mechanism to ensure redundancy in critical alert delivery.

4a) Data storage or transmission is compromised

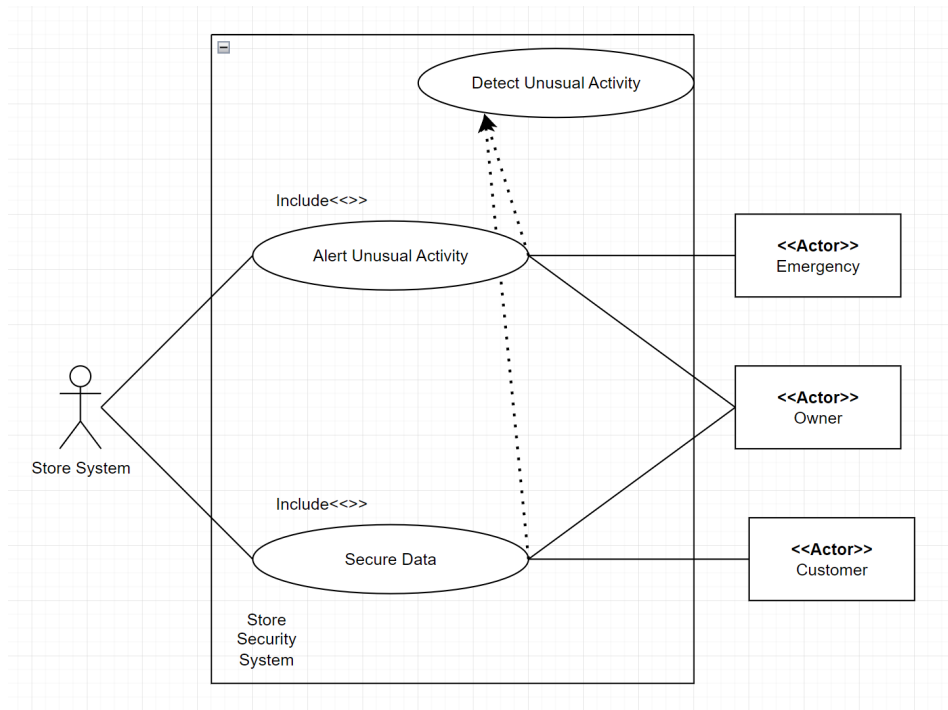
- 1) Initiate an immediate security audit to understand the nature of the compromise and to isolate and resolve the security breach.
- 2) Ensure data backup mechanisms are in place to retain critical incident data even in the face of compromised primary data storage.
- 3) Engage in a review of data protection protocols and possibly integrate additional layers of security

Technology and Data Variations List:

- Surveillance Technology such as motion detection.
- Various firewalls, VPNs, and anti-malware solutions.
- Different standards and protocols to communicate with Emergency Services and stakeholders.

Special Requirements

- The system should initiate alerts and communication with emergency services within a predefined time limit upon detection of an incident.
- The system should facilitate regular updates and patches to address new threats and vulnerabilities.



This diagram illustrates how the system will deal with suspicious activity and secure the customer's personal information. Emergencies will be handled on both automatic and manual bases, with the latter being reported by the store owner. Customer data will be secured on the system behind layers of malware protection.

Use Case 4

Restocking during after-hours

Primary Actors: Store System, Employees

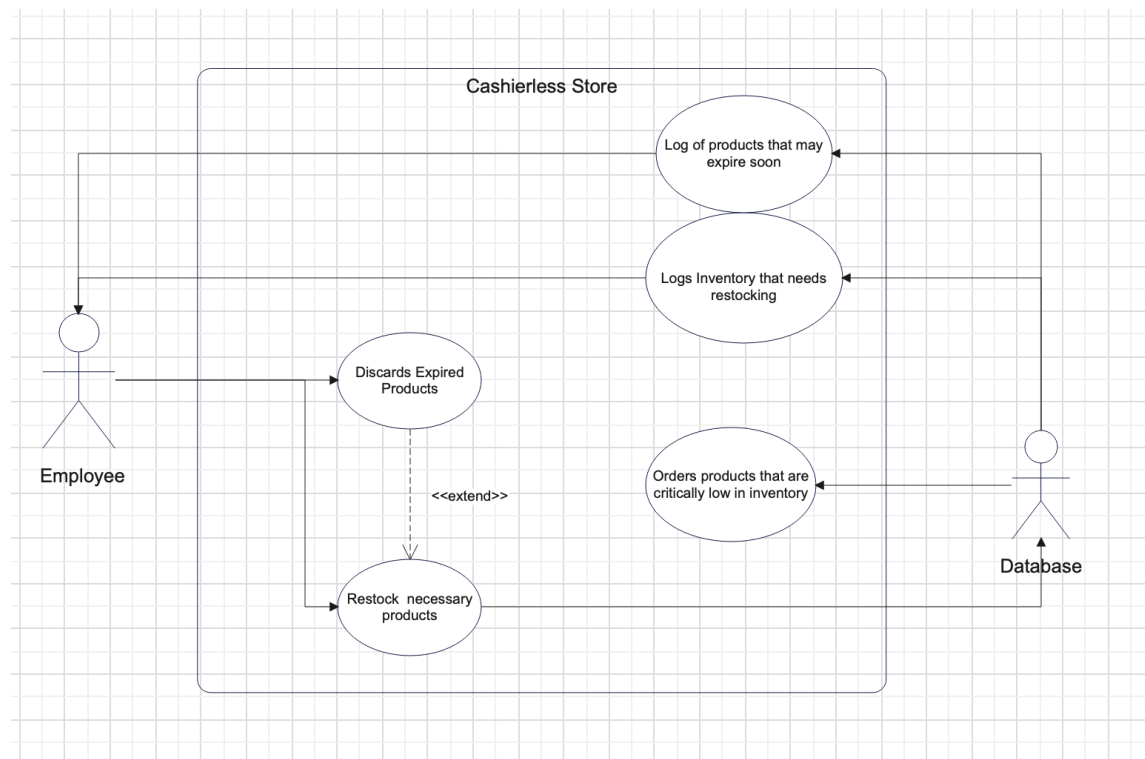
Functional Requirements (2): Product Database, Item Scanning Software, Employee Scheduler + Manager

Non Functional Requirements (3): Compliance with retail industry standards, customer notification system, Encrypted Database

Stakeholders and Interests:

- Store Owner: Wants to ensure that goods are always available, and that they are sold before expiration.
- Employees: Tasked with restocking the store and notifying the system of what is available.
- Customers: Will expect a variety of items to be available when the store opens.

Preconditions:



This use case diagram illustrates a scenario where a database reviews the activities in the store for that day, compiles them into a log, along with any other products that need extra attention (like perishable products) and sends them to the employee. Any products it knows are not in stock anymore are automatically ordered.

The employee takes this information and acts accordingly in the store.

Use Case 5

Returning an Item

Primary Actors: Employees, Customer

Functional Requirements (5): Merchandise Database, Item Lookup Software, Employee Intervention Standard, Scanning of item barcode, capturing reason codes/comments on why item is being returned

Non Functional Requirements (2): Self Service Recovery - Helps customer if they lose receipts/credentials, Authentication - only authorized store employees can access the return systems

Stakeholders:

Employees - need clear processes and training to handle customer questions about returns.

Customer - wants to easily return an unwanted or defective item to be able to receive refund

Store Owner - wants returns handled per store policy to maintain profits and inventory control

Preconditions: Customer has a receipt and original form of payment. Item is in resaleable condition.

Success Guarantee: Valid returns are processed properly and the customer receives the correct refund.

Main success scenario and extension: Customer brings item to returns desk with receipt. Clerk verifies item condition and validity receipt. Clerk checks the store return policy and confirms eligibility. Clerk processes the return in the point of sale system and provides a refund. Customer receives a refund in the original form of payment. Items are restocked or routes to appropriate departments.

Extension:

1. The Item is damaged

Clerk inspects the item and notes any defects or damage. Comparing conditions to store's return policy created for acceptable returns. If the damage exceeds the policy limits, the clerk declines the return and explains the policy to the customer. May offer

store credit or exchange if there are some minor defects. Marks items as rejected in the system.

2. Return Window Expired

Clerk checks the purchase date on the receipt. Compared to the store's return window policy. If beyond cutoff, inform customer items can not be returned.

3. Original Payment is unavailable

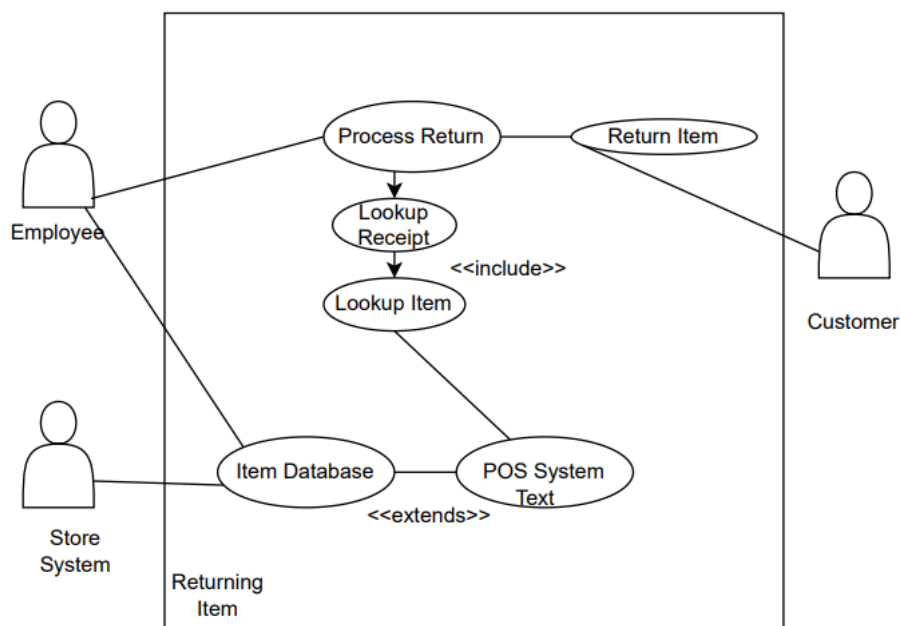
If the original payment method is unavailable, the clerk issues store credit. Common if the original payment was by credit card that was lost/canceled. Clerk explains the store credit policy: Use within a given time period.

Technology and Data Variations List:

Point of sale system to process returns

Inventory management system

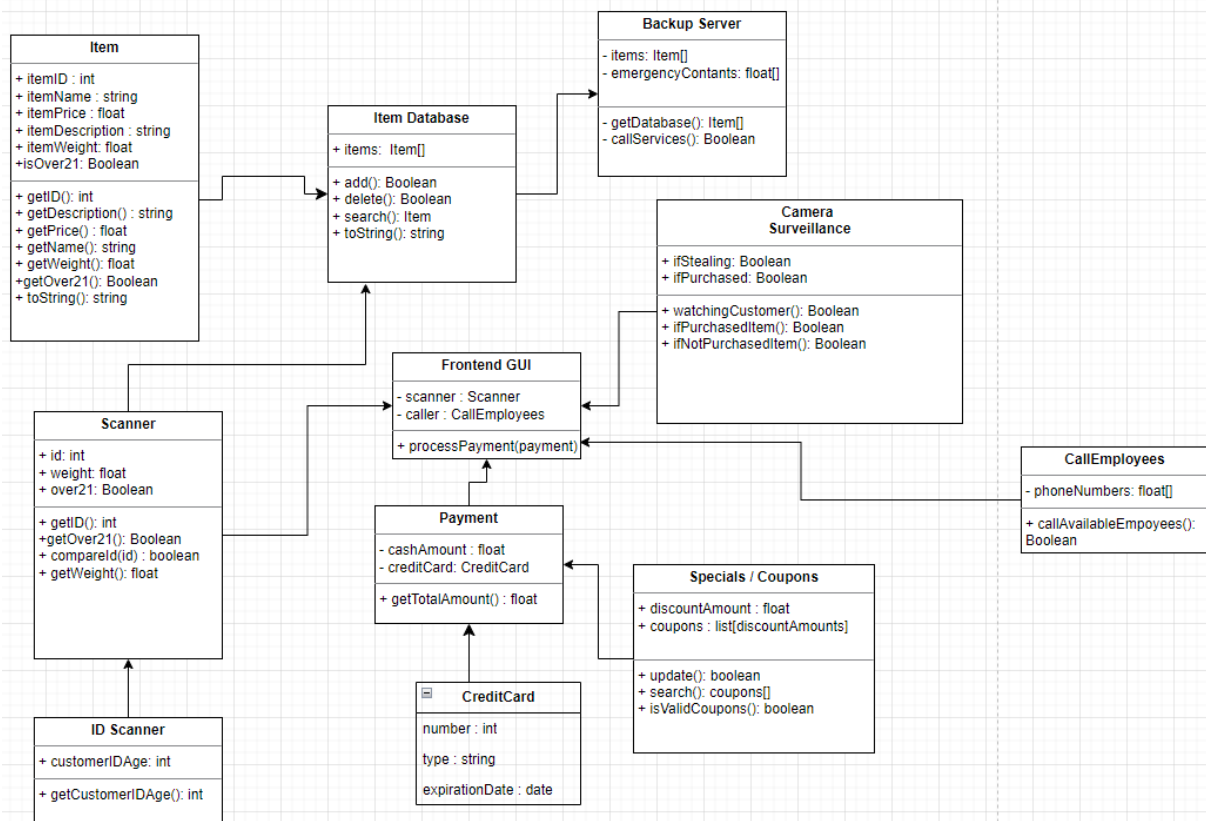
Security Controls - employee login and video surveillance to help prevent fraudulent returns



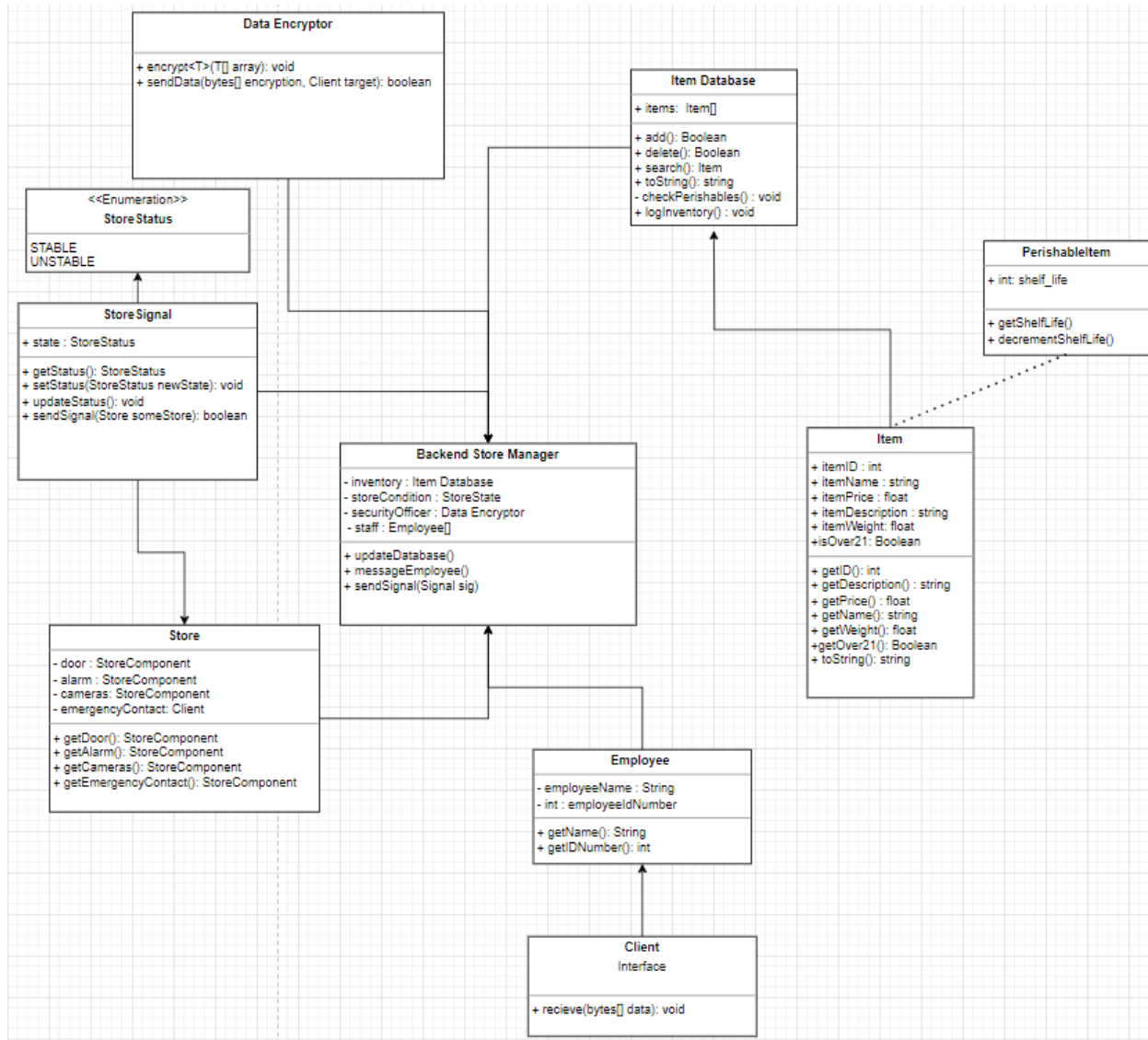
This diagram shows the process for a customer returning an item to the store, involving the customer, employee, and back-end store software systems. The key steps include the employee looking up the receipt and item details and processing the return transaction via the store software, resulting in a refund for the customer.

Conceptual Class Diagrams:

Class Diagram Main



Frontend: User interface and transaction processing



Backend: Merchandise management and facility information

Supplementary Requirements:

Database management software is applied correctly and notifications are updated once purchases are processed/returned into the store database. The store needs to have stable server status with the checkout counter and the store item databases. The GUI for the checkout counter needs to be decent for anyone to understand since there aren't any employees in the store. The checkout counter needs to be able to handle questions customers may have about the purchasing processes. In case of power outages the databases need to be updated regularly and stored in a secure environment for data protection and backup plans. Any customer data processed, credit card information and emails, need to be secure and encrypted into the databases so that unauthorized personnel cannot view them. The checkout counter can handle fake ID's and personal information that doesn't match any state databases concerning any legal age products. The backup servers will be in constant communication with the store systems and database so that in any case of the store not responding to the backup servers the

servers can hold in the last available data as the last version of the data from the store. The store will have a good environment and atmosphere for customers to want to come and shop in.