Problem Description

A smart store system is a brick-and-mortar, checkout-free, “walkout” store.
Implementing this system requires automatic detection of various items in the store as well as recognizing customers purchasing the items.

Customers install the smart shopping system’s application on their smart device and register to the system before going to the store.
Users are required to complete the customer registration process and install the smart store mobile application on their mobile device before shopping at the smart store. Customers need to scan their mobile device (alternatively, a pre-registered credit card) at the entry gate. If any customers do not have Internet, they can use credit card (pre-registered via the mobile app) to enter or exit the store.
Cameras placed at the entry location take images of customers, and the system associates those images with respective customers. These images are used by the system later to recognize a customer inside the store. There are various sensors attached to the items' shelves to identify items- weight sensors, pressure sensors, tag readers. Pressure sensors send information to the system sensing the change of pressure at a certain point on the shelf when a customer is picking up an item; weight sensors send the weight of the item when it is lifted from the shelf; tag readers send the
tag number of an item to the system. The system identifies an item with all these sensors' information.
Cameras installed inside the store take images of customers while they are shopping and associate each customer with the items they took from the shelves. Customers scan their mobile devices or credit cards at the exit gate while leaving the store. The payment service deducts the bill, and then the system opens the exit gate. Customers can set up their preferred payment service beforehand and allow the system to process the payment automatically on exit.
There are staff on the premises for store maintenance, assistance, and shelf restocking purposes. The system recognizes staff in the same way it does a customer. While restocking or organizing a shelf, the system identifies items using the same procedure it does with the customer. However, in the case of staff, the

system does not need to update any virtual cart when it identifies that the item is being picked up by a staff member.

Newly added functionalities:

Real-Time Inventory Management:

- Enhance the system with real-time inventory management capabilities. The system should be able to notify store staff when items are running low and automatically order restocks from suppliers when inventory falls below a predefined threshold.

Advanced Item Return Mechanism:

- Implement an advanced item return feature. If a customer decides to return an item before leaving the store, they can place it in a designated "return bin." The system should recognize the return, update the virtual cart, and adjust the total bill in real-time.