**P3. DATABASE DESIGN, FINAL ERD**

**Inventory Management Database System**

**Changes made from Feedback:**

1. What is SellerID that is present in different tables.

So initially we were naming supplier as seller because of that confusion we have seller Id in few entities. We have made the necessary changes and included SupplierID instead of SellerID wherever it is required.

1. Should there be as associate entity between order and product?

To ensure the Final ERD is in the normalized form we need to remove all the many – many relationships. The current ER diagram has “OrderDeatils” which acts as associative entity between “Order” and “Product”. Each row in “OrderDetails” represents a specific product in an order, allowing multiple products in a single order.

1. Category is only for single product?

We assumed that category has a single product but after discussion we have concluded that it is not possible for a category to just have one product so we have changed the relationship between the entities ensuring that a product must belong to one item category. A category must have at least one product, but it may have any number of products.

1. StockQuantity is in both Product and Inventory – are they the same thing?

In the previous ERD we assumed that StockQuantity in Product and Inventory was refer to the total quantity of product but since it is redundant to have two same attributes in different tables, we have eliminated the attribute StockQuantity from ‘Product’. This way, the toatal quantity of a product can be determined by summing up the StockQuantity from the ‘Inventory’ related records.

1. Shipment missing relationship to Order.

Our intital ERD was missing a relationship from ‘Shipment’ and ‘Order’, we have changed this as a ‘Shipment’ should have a relationship from ‘Order’ since shipment fulfill orders.

1. Batch and the relationships to it are not clear – 1 batch for each Customer?

Batch-Inventory : The relationship between Batch and Inventory is changed to Optional Many to Mandatory One. Each batch is now tied to one specific inventory (Mandatory One), signifying that every batch originates from a single inventory. On the inventory side, multiple batches can be accommodated or even none (Optional Many).

Batch-Product: The relationship between Batch and Product is changed to Mandatory Many to Mandatory One. Multiple batches are used to dispatch a single type of product (Mandatory Many), but each individual batch contains only one specific type of product (Mandatory One).

1. ProductID there – FK goes to the many sides.

According to the rule the foreign keys (FK) always is on to the many sides of a

One – Many relationships, so we have made the changes according to it for

the respective relationships.

More changes:

* We removed the connection between the ‘Customer’ and ‘Batches’ as it is not necessary, and it already has an indirect relationship through ‘OrderDeatils’ and ‘Product’.
* We have renamed ‘Customer’ to ‘Retailer’ for clear naming purpose as they represent the owners of the stores who purchase the inventory.

**Business Problem:**

An often business challenge in supplying goods to the grocery stores is to make sure to predict how much the need, minimize wastage and manage the inventory stock efficiently. If the predictions are inaccurate, it can lead to overstocking and understocking which directly impact on the customer satisfaction and operational costs. If this problem is not addressed, it can lead to financial losses and negatively impacting the overall profitability of the businesses. To fix this business problem, we make use of the database system, which helps in improving demand predictions, real time inventory tracking. The goal is to establish a reliable and efficient supply chain for the grocery stores.

**Entities:**

1. **Inventory**

* This entity helps in managing stock levels and avoiding overstocking or understocking.

1. **Supplier**

* This entity is included o manage the relationships with suppliers who provide products to the grocery stores.

1. **Retailer**

* This entity helps us manage the Retailer information for order processing and billing information.

1. **Employee**

* This entity is used to track the employees involved in order processing, shipment, and inventory management.

1. **Product**

* This entity represents various items available in the store.

1. **Category**

* This entity is important for effective product organizations. By categorizing items into distinct groups helps in enhancing the overall management of diverse products.

1. **Order**

* This entity helps in tracking and managing the customer orders within the Inventory by enabling the systematic record of customers purchase requests.

1. **Billing Info**

* This entity helps to store and manage customers billing information by ensuring accurate and secure billing process.

1. **Shipment**

* This entity helps in keeping a track of where the product come from. Basically, it ensures transparency in product sourcing and accountability in handling of shipments.

1. **Batches**

* This entity allows us to efficiently manage and trace different batches of products, contributing to a well-organized and effective inventory system.

**Relationships between the entities:**

* **Inventory - Batches**

One inventory can have multiple batches, but each batch is associated with only one inventory. This means that not every batch necessarily has to be linked to inventory, but if it is, it can have multiple associations.

Each inventory is associated with multiple batch, representing a one-to-many relationship between Inventory and Batches entities.

The relationship enables complete inventory item traceability to their corresponding batches and vice versa. Each inventory item can be traced directly back to the batch from which it came.

* **Inventory - Product**

Each inventory item must be associated with exactly one product. This means that every inventory item in the system is linked to a specific product.

A product may have zero, one, or more associated inventory items. Not every product necessarily has to be in the inventory, but if it is, it can be associated with multiple inventory items.

The relationship makes inventory tracking easier for each product. It allows you to keep track of the quantity, status, and other important details for each product in your inventory.

* **Product - Batches**

One product can have multiple batches, but each batch is associated with only one product.

* **Product – Category**

A product must belong to one item category. A category must have at least one product, but it may have any number of products.

* **Supplier – Product**

A supplier can supply many products, but a product comes from one supplier. This relationship represents the source of products and helps manage the supply chain.

* **Order – OrderDetails**

An order can have multiple Orderdetails because each order can have multiple products. Each ‘Orderdetails’ has only one order.

* **Product – OrderDetails**

A ‘OrderDetails’ is associated with one product as the order contains details of a specific product that is purchased such as quantity.

A Product can be associated with multiple OrderDetails. The same product can be ordered by multiple times across different orders or multiple times in the same order.

* **Retailer – Order**

A retailer can be associated with multiple orders, but each order is placed by one and only one retailer. This relationship helps us keep a track of order history of a customer.

* **Employee – Order**

An employee can manage multiple orders, but an order can be processed by one and only one employee. This relationship is helpful to monitor activities of an employee.

* **Billing - Retailer**

A billing entity is associated with one-to-one relationship with retailer as it depends for single purchase.

This will have direct access to retailer to get their billing info after transaction.

* **Employee – Shipment**

An employee can be associated with zero or more Shipments. That means an employee can be working with one or more Shipments or employee cannot be working for any Shipment.

* **Order - Shipment**

One order can be associated with multiple shipments but each shipment is related to only one order. In this relationship, a single customer order can be fulfilled by multiple shipments. This can occur for various reasons, such as when items from the order are shipped from different locations, at different times, or using different carriers. Each shipment, in this case, represents a portion of the order.

* **Supplier - Shipment**

One supplier can be associated with multiple shipments, while each shipment is linked to only one supplier.

* **Employee - Employee**

Multiple employees can be managed by a single employee, but each employee can have only one manager.

**Final ER Diagram:**

**A diagram of a computer

Description automatically generated**