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Integrated Electronics Store Database Management System

1. Introduction

The Electronics Store Management System is a database-driven solution designed to streamline and automate the operations of an electronics retail store. The system will manage key business processes, including inventory tracking, sales processing, customer management, and supplier coordination. By providing a centralized and efficient way to handle store operations, the system aims to enhance productivity, reduce manual errors, and improve overall customer satisfaction.

2. Business Problems Addressed

2.1 Mission Objectives

The primary objectives of the Electronics Store Management System are:

- **Inventory Management** – Maintain accurate stock levels, track product availability, and prevent shortages or overstocking.
- **Sales Processing** – Automate billing and invoice generation, ensuring smooth and efficient transactions.
- **Customer Management** – Store and manage customer information, including purchase history and preferences, to improve service.
- **Supplier Coordination** – Keep track of suppliers and streamline the procurement process for timely restocking.
- **Employee Records Management** – Maintain employee details, roles, and performance tracking.

- **Financial Reporting** – Generate reports on sales, revenue, and expenses to support business decision-making.

2.2 Business Challenges

- **Manual Inventory Tracking** – Inefficient stock tracking can lead to shortages or excess inventory.
- **Sales Processing Errors** – Manual sales handling increases risks of pricing errors and delayed transactions.
- **Customer Data Management Issues** – Lack of centralized customer data results in poor service and engagement.
- **Unstructured Supplier Coordination** – Difficulty in tracking supplier relationships and purchase orders.
- **Employee Performance Monitoring Challenges** – Inefficient tracking of employee performance and roles.
- **Limited Financial Insights** – Lack of real-time reporting impacts business decision-making.

3. Business Rules

3.1 User Management

- Each employee must register using a unique Employee ID.
- Access levels are assigned based on roles (Admin, Sales Representative, Inventory Manager).

3.2 Inventory Management

- Each product is assigned a unique Product ID.
- Stock levels are updated in real-time upon sales and restocking.

- Low-stock alerts are generated when inventory reaches predefined thresholds.

3.3 Sales Processing

- Each sale must be recorded with an invoice and linked to a registered customer (if applicable).
- Discounts and promotions are automatically applied based on predefined conditions.

3.4 Customer Management

- Customer purchase history is stored and accessible for recommendations and promotions.
- Customers can enroll in loyalty programs for discounts and rewards.

3.5 Supplier Coordination

- Each supplier has a unique Supplier ID and contact details stored in the system.
- Purchase orders are tracked and linked to inventory restocking.

3.6 Financial Reporting

- Daily, monthly, and yearly sales reports are auto-generated.
- Expense tracking is maintained for store operations and product procurement.

4. Entities and Relationships

4.1 Entity List and Descriptions

1. **Customers**
    - Description: Stores information about customers who make purchases and may participate in loyalty programs.

- Attributes:
    - **CustomerID**: Unique identifier for each customer.
    - **Name:** Full name of the customer.
    - **Contact:** Phone number or alternate contact method.
    - **Email:** Customer's email address for communication and promotions.
    - **PurchaseHistory:** Record of past purchase made by the customer.
    - **LoyaltyPoints:** Points accumulated through purchases and promotions.

2. **Products**
    - Description: Represents electronic products available for sale in the store
    - Attributes:
        - **ProductID:** Unique identifier for each product.
        - **Name:** Name of the product.
        - **Category:** Classification of the product.
        - **Price:** Cost of the product per unit.
        - **StockLevel:** Current quantity of the product in inventory.
        - **SupplierID:** Reference to the supplier providing this product.

3. **Sales**
    - Description: Track all transactions made in the store
    - Attributes:
        - **SaleID:** Unique identifier for each sales transaction.
        - **ProductID:** Reference to the product being sold.
        - **CustomerID:** Reference to the customer making the purchase (if applicable).
        - **Quantity:** Numer of units sold in the transaction.

- **TotalAmount:** Total price calculated based on quantity and product size.
- **SaleDate:** Date and time when the transaction was made.
- **InvoiceNumber:** Reference to the generated invoice for the sale.

4. **Employees**
   - Description: Store employee details and role-based access information
   - Attributes:
     - **EmployeeID:** Unique identifier for each employee
     - **Name:** Full name of the employee
     - **Role:** Designation or job title
     - **Contact:** Employee's phone number or email for internal communication
     - **Salary:** Monthly or annual compensation of the employee

5. **Suppliers**
   - Description: Represents external vendors supplying electronics to the store
   - Attributes:
     - **SupplierID:** Unique identifier for each supplier
     - **Name:** Name of the supplier or company
     - **Contact:** Supplier's phone number or email for communication
     - **Address:** Physical location of the supplier
     - **ProductSupplied:** List of products the supplier provides

6. **Inventory**
   - Description: Monitors product availability and stock levels in the store
   - Attributes:
     - **InventoryID:** Unique identifier for each inventory record
     - **ProductID:** Reference to the specific product being tracked

- **StockLevel:** Current number of available units in stock
- **LastRestockDate:** Date when the product was last replenished

7. **Invoices**
   - Description: Stores invoice details for completed sales transactions
   - Attributes:
     - **InvoiceID:** Unique identifier for each invoice
     - **SaleID:** Reference to the related sales transaction.
     - **CustomerID:** Reference to the customer (if applicable)
     - **AmountPaid:** Total amount paid by the customer
     - **PaymentMethod:** Mode of payment (e.g., Cash, Credit Card, Digital Payment)
     - **PaymentDate:** Date and time when payment was received

8. **Purchase Orders**
   - Description: Track orders placed with suppliers for restocking inventory
   - Attributes:
     - **OrderID:** Unique identifier for each purchase order
     - **SupplierID:** Reference to the supplier fulfilling the order
     - **ProductID:** Reference to the product being ordered
     - **QuantityOrdered:** Number of units requested for restocking
     - **OrderDate:** Date when the order was placed
     - **ExpectedDelivery:** Estimated date of arrival for the order

9. **Financial Reports**
   - Description: Stores financial performance reports to aid in decision making
   - Attributes:
     - **ReportID:** Unique identifier for each financial report

- **Type:** Type of report (e.g., Sales Summary, Expense Report, Profit Analysis)
- **DateGenerated:** Date when the report was created
- **TotalSales:** Cumulative revenue generated in the specified period
- **TotalExpenses:** Total costs incurred, including procurement and operational expenses

10. **Discounts & Promotions**
    - Description: Tracks promotional discounts and special offers on products
    - Attributes:
        - **DiscountID:** Unique identifier for each discount or promotion
        - **ProductID:** Reference to the product eligible for the discount
        - **DiscountRate:** Percentage discount applied to the product
        - **StartDate:** Date when the discount becomes active
        - **EndDate:** Date when the discount expires

5. Entity Relationships

1. A **customer** can purchase multiple **products**.
    - A customer can make multiple purchases, but each sale is linked to one customer
    - **Cardinality:** 1 Customer → M Products
    - **Notation:** 1:M
2. A **product** can be part of multiple **sales transactions**.
    - A product can be sold multiple times across different sales transactions
    - **Cardinality:** M Product → N Sales
    - **Notation:** M:N
    - A SalesDetails table can be used to resolve this M:N relationship
3. A **sale** is associated with a unique **invoice**.
    - Each sale generates one unique invoice, and each invoice corresponds to one sale.

- **Cardinality:** 1 Sale → 1 Invoice
- **Notation:** 1:1

4. An **employee** can process multiple **sales**.
    - An employee can process multiple sales, but each sale is processed by one employee
    - **Cardinality:** 1 Employee → M Sales
    - **Notation:** 1:M
5. A **supplier** provides multiple **products**.
    - A supplier can provide multiple products, but each product is supplied by only one supplier.
    - **Cardinality:** 1 Supplier → M products
    - **Notation:** 1:M
6. An **inventory record** tracks stock levels for each **product**.
    - Each product has one corresponding inventory record, and each inventory record is tied to one product.
    - **Cardinality:** 1 Inventory → 1 Product
    - **Notation:** 1:1
7. A **purchase order** is placed for a **product** from a specific **supplier**
    - Multiple purchase orders can be placed with a single supplier, but each purchase order is linked to one supplier.
    - **Cardinality:** M Purchase Orders → 1 Supplier
    - **Notation:** M:1
8. A **purchase order** placed for a **product.**
    - Multiple purchase orders can be placed for a product, but each order corresponds to only one product.
    - **Cardinality:** M Purchase Orders → 1 Product
    - **Notation:** M:1
9. A **financial report** aggregates data from **sales and expenses**.

- A financial report aggregates data from multiple sales transactions.
- **Cardinality:** 1 Financial Report → M Sales
- **Notation:** 1:M
- A financial report tracks multiple expense records over a period.
- **Cardinality:** 1 Financial Report → M Expenses
- **Notation:** 1:M

6. Key Database Design Decisions

6.1 Why Each Entity is Included

- **Customers**: Stores customer details and purchase history for personalized service.
- **Products**: Represents inventory items available for sale.
- **Sales**: Captures transaction details and revenue generation.
- **Employees**: Tracks staff roles and performance.
- **Suppliers**: Ensures smooth procurement and stock replenishment.
- **Inventory**: Prevents shortages and overstocking.
- **Invoices**: Maintains records of completed transactions.
- **Purchase Orders**: Manages supplier coordination.
- **Financial Reports**: Supports business decision-making.
- **Discounts & Promotions**: Enhances customer engagement.

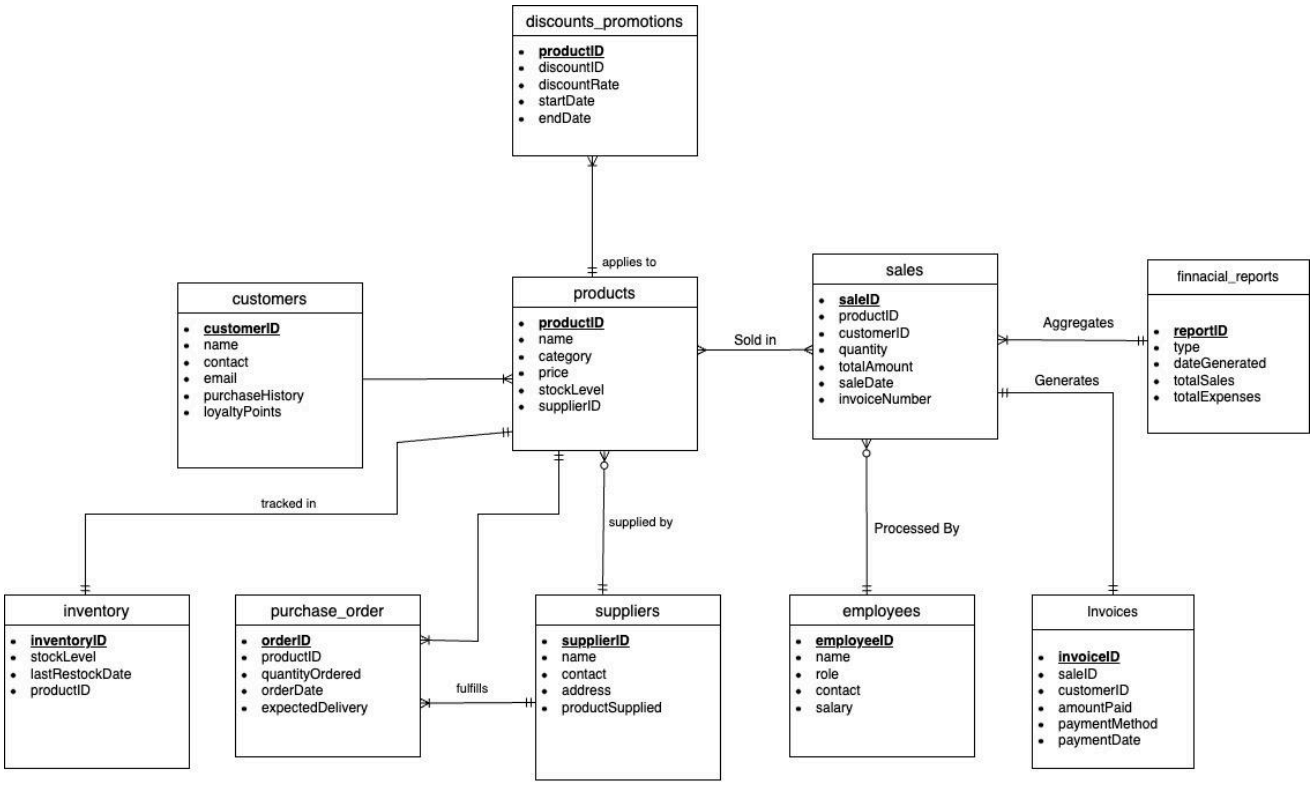
6.2 Database Constraints and Design Considerations

- **Normalization**: Eliminates data redundancy and ensures efficient data retrieval.
- **Primary & Foreign Keys**: Maintain data integrity and establish relationships.
- **Indexing**: Optimized on frequently queried fields like **ProductID** and **CustomerID**.
- **Constraints**:
    - Stock levels must always be greater than or equal to zero.

- Sales transactions cannot occur for out-of-stock products.
- Employees must have unique roles and permissions.

- **Security Measures**:
  - Employee authentication with role-based access control.
  - Customer payment data is encrypted.

7. Entity Relationship Diagram



8. Conclusion

The Electronics Store Management System provides a structured, automated solution for managing retail operations efficiently. It ensures seamless inventory tracking, sales management, supplier coordination, and financial reporting. By centralizing these processes, the system enhances productivity, reduces errors, and improves customer satisfaction.