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Database Systems

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Database Final Project

**Grocery Store Management System**

**Purpose:**

The purpose of the "New Age Grocery Store" project is to develop an object-oriented software solution that automates and improves the business processes and management of a large grocery store company operating across Pakistan. The focus is on enhancing the customer shopping experience, both in-person and virtually, by transitioning from manual to automated processes.

**Scope:**

The scope of the project includes the development of an integrated software system with various modules catering to different user roles, such as admins, managers, and customers. The software will handle tasks ranging from user registration and login to store and inventory management, online shopping, payment processing, and a store checkout simulation. The system aims to streamline operations, increase efficiency, and enhance the overall shopping experience for customers.

# **Modules:**

## **Registration:**

## Customer Registration: New customers can register with a valid 13-digit CNIC. Password requirements include a length of 9 characters, at least one uppercase letter, and one numeric digit. Personal details like gender, phone number, and address are stored.

1. **Manager Registration**:

Admin-assisted registration for managers. Store assignment is based on location.

## **Login:**

## Admin, Manager, and Customer: Each user type has a predefined username and password. Proper error messages are displayed for incorrect credentials.

## **Home Screen & Sub Menus:**

## User-specific Home Screens: Different home screens are displayed based on the user type after login, featuring relevant menus.

## **Manage Stores and Users:**

## Admin-Exclusive Module: Admin manages store records, adds/removes managers, and handles spam customer accounts.

## **Manage Product Catalog:**

## Admin-Exclusive Module: Admin manages a product catalog with categories such as food, personal hygiene, and household cleaning. Each product is associated with a price and can be further categorized.

## **Inventory Management:**

## Manager-Exclusive Module: Managers can add, remove, and update inventory items in their respective stores. Inventory details are saved in separate files for each store.

1. **Search and View Inventory:**

Managers can view and search for products in the inventory of other stores.

1. **Online Shopping:**

Customer-Exclusive Module: Customers can browse the product catalog, add items to their cart, and place orders online.

Checkout and Payment: Finalized carts are displayed with payment options, including cash on delivery, debit/credit cards, etc. After successful payment, inventory quantities are updated.

**Feedback**: Customers can provide feedback and ratings during checkout, which store managers can manage.

## **Payment:**

## Payment Gateways: Implemented payment gateways for options like cash on delivery, debit/credit cards, easypaisa, jazz cash, etc.

## Additional Charges: Extra charges for cash on delivery based on customer location relative to the store.

# **Overview**:

The Grocery Management System is an object-oriented software designed to enhance the shopping experience for customers of a large grocery store company with branches across Pakistan. The system aims to automate various processes, including user registration, login, store and user management, product catalog management, inventory management, online shopping, and payment.

# **Database Implementation:**

The system utilizes a relational database to store user details, store records, product catalogs, inventory details, orders, and feedback.

Entity-Relationship models are designed for efficient data storage.

Proper indexing and normalization techniques are applied to ensure data integrity.

# **Business Rules:**

1. **User Information:**

* Each user must have a unique UserID.
* Users must provide a valid Username, Password, CNIC, Gender, Phone, and Address during registration.

1. **Admin Information:**

* Each Admin must have a unique AdminID.
* An Admin is associated with one User only.

1. **Manager Information:**

* Each Manager must have a unique ManagerID.
* A Manager is associated with one User only.
* A Manager is associated with one Store only.

1. **Store Information:**

* Each Store must have a unique StoreID.
* Each Store has a specific Location.

1. **Customer Information:**

* Each Customer must have a unique CustomerID.
* A Customer is associated with one User only.

1. **Product Information:**

* Each Product must have a unique ProductID.
* Products have attributes like Name, Category, Subcategory, Company, Price, and Unit.

1. **Inventory Information:**

* Each InventoryItem must have a unique InventoryItemID.
* Each InventoryItem is associated with one Store.
* Each InventoryItem is associated with one Product.
* It keeps track of the Quantity and Status of a particular product in a specific store.

1. **Order Information:**

* Each Order must have a unique OrderID.
* Each Order is associated with one Customer.
* Each Order is associated with one Store.
* It includes information about TotalAmount and OrderDate.

1. **OrderItem Information:**

* Each OrderItem must have a unique OrderItemID.
* Each OrderItem is associated with one Order.
* Each OrderItem is associated with one Product.
* It keeps track of the Quantity of a specific product in a particular order.

1. **Feedback Information:**

* Each Feedback must have a unique FeedbackID.
* Each Feedback is associated with one Store.
* Each Feedback is associated with one Customer.
* It includes a Rating and a Comment.

1. **Payment Information:**

* Each Payment must have a unique PaymentID.
* Each Payment is associated with one Order.
* It includes information about the Payment Method, Amount, and TransactionID.

1. **Relationships:**

* Admins are responsible for managing one or more Stores.
* Managers are responsible for managing one Store each.
* Each Store has multiple Inventory Items, Orders, and Feedback entries.
* Customers can place multiple Orders, each associated with one Store.
* Products have multiple entries in the Inventory and are included in multiple Order Items.
* Each Order can have multiple Order Items.

# **Entities and Relationships:**

**Entities:**

**User (Superclass for Admin, Manager, Customer)**

**Attributes:**

* UserID (Primary Key)
* Username
* Password
* CNIC
* Gender
* Phone
* Address

**Admin**

**Attributes:**

* AdminID (Primary Key)
* UserID (Foreign Key referencing User)

**Manager**

**Attributes**:

* ManagerID (Primary Key)
* UserID (Foreign Key referencing User)
* StoreID (Foreign Key referencing Store)

**Store**

**Attributes:**

* StoreID (Primary Key)
* Location

**Customer**

**Attributes:**

* CustomerID (Primary Key)
* UserID (Foreign Key referencing User)

**Product**

**Attributes:**

* ProductID (Primary Key)
* Name
* Category
* Subcategory
* Company
* Price
* Unit

**InventoryItem**

**Attributes:**

* InventoryItemID (Primary Key)
* StoreID (Foreign Key referencing Store)
* ProductID (Foreign Key referencing Product)
* Quantity
* Status

**Order**

**Attributes**:

* OrderID (Primary Key)
* CustomerID (Foreign Key referencing Customer)
* StoreID (Foreign Key referencing Store)
* TotalAmount
* OrderDate

**OrderItem**

**Attributes**:

* OrderItemID (Primary Key)
* OrderID (Foreign Key referencing Order)
* ProductID (Foreign Key referencing Product)
* Quantity

**Feedback**

**Attributes:**

* FeedbackID (Primary Key)
* StoreID (Foreign Key referencing Store)
* CustomerID (Foreign Key referencing Customer)
* Rating
* Comment

**Payment**

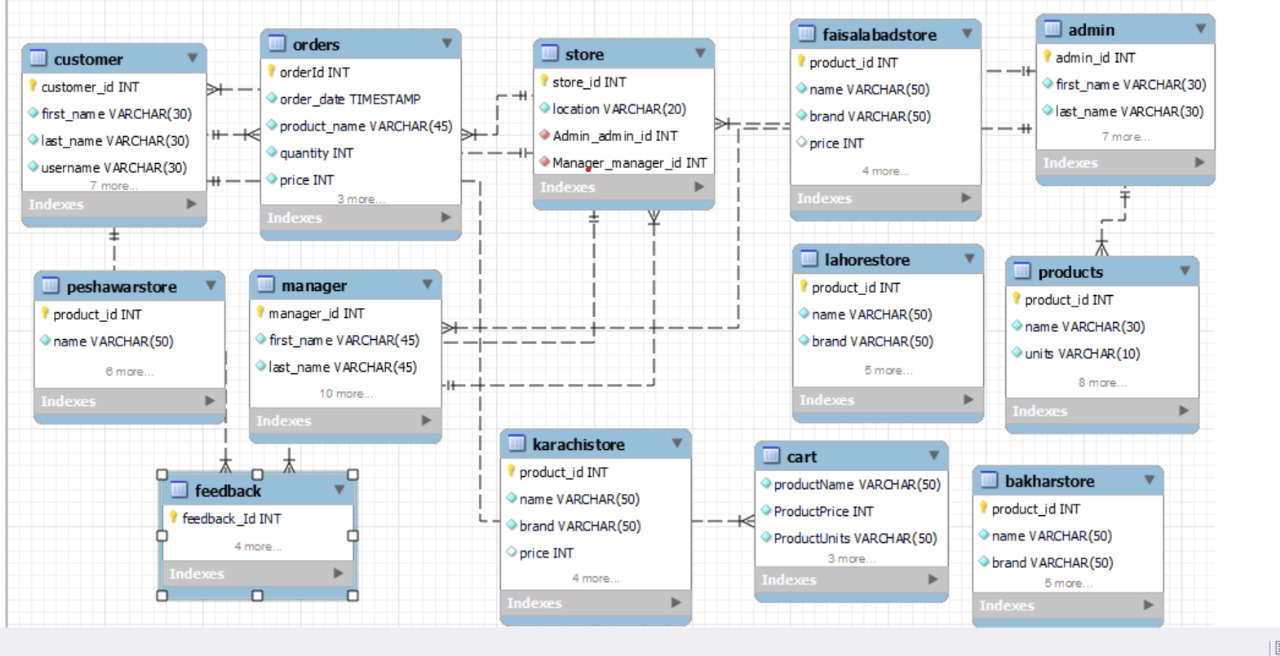
**Attributes**:

* PaymentID (Primary Key)
* OrderID (Foreign Key referencing Order)
* Method
* Amount
* TransactionID

**Relationships:**

* User and Admin (One-to-One)
* User and Manager (One-to-One)
* User and Customer (One-to-One)
* Admin and Store (One-to-Many)
* Manager and Store (Many-to-One)
* Store and InventoryItem (One-to-Many)
* Store and Order (One-to-Many)
* Store and Feedback (One-to-Many)
* Customer and Order (One-to-Many)
* Product and InventoryItem (One-to-Many)
* Product and OrderItem (One-to-Many)
* Store and OrderItem (One-to-Many)
* Customer and Feedback (One-to-Many)
* Order and OrderItem (One-to-Many)
* Order and Payment (One-to-One)

**EER Diagram:**

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**Overall Description:**

**Product Perspective**

The New Age Grocery Store Management System is a standalone application designed to revolutionize grocery store management. As a standalone system, it operates independently, aiming to automate and enhance the management processes of grocery stores. It brings automation to various aspects of grocery store operations and focuses on providing an improved experience for both customers and store managers.

**User Classes and Characteristics**

Anticipated users of the system include customers, store managers, and administrators. Each user class has unique characteristics and roles within the system:

* **Customers:** Interact with the system to register, shop online, provide feedback, and make payments.
* **Store Managers:** Manage stores, handle inventory, and oversee online orders.
* **Administrators:** Have overall control, managing users, stores, and system configuration.

**Operating Environment**

The system is designed to operate on various web browsers, ensuring accessibility for users. Specific hardware and software requirements are outlined in this section, providing details on the environment in which the software will run. For example, compatibility with browsers like Windows Internet Explorer, Firefox, Google Chrome, and Apple Safari.

**Design and Implementation Constraints**

Constraints for the system include the use of specific database engines, programming frameworks, and online payment methods. For instance:

* **Database Engine Constraint (CON-1):** The system shall use the current corporate standard Oracle database engine.
* **Framework Constraint (CON-2):** The application must use Microsoft .NET framework 4.5.
* **Payment Method Constraint (CON-3):** Online payments may be made only through PayPal.

**Requirement Identifying Technique**

The requirements for the system will be identified using a combination of techniques:

* **Use Case Diagrams:** Effective for interactive end-user applications.
* **Detailed Use Cases:** Provide in-depth understanding, especially for user interactions.
* **Event-Response Tables:** Suitable for real-time systems where functionalities are performed at the backend.

These techniques collectively aid in deriving the functional requirements specification based on the project's nature and user interactions.

**Functional Requirements**

**Feature/Use Case 1 Registration:**

**Functional Requirement 1: Customer Registration**

* **Identifier:** FR-1
* **Title:** Customer Registration
* **Requirement:** The system shall allow a new customer to register by providing a valid 13-digit CNIC, creating a password, and providing personal information. Each customer account must be unique.
* **Source:** Customer
* **Rationale:** To create personalized accounts for customers.
* **Business Rule:** Each customer must have a unique account.
* **Dependencies:** None
* **Priority:** High

**Functional Requirement 2: Customer Login**

* **Identifier:** FR-2
* **Title:** Customer Login
* **Requirement:** The system shall allow registered customers to log in using their username and password. Proper error messages should be displayed for incorrect credentials.
* **Source:** Customer
* **Rationale:** To provide personalized access to registered customers.
* **Business Rule:** Only registered customers can log in.
* **Dependencies:** Customer Registration (FR-1)
* **Priority:** High

**Functional Requirement 3: Manager Login**

* **Identifier:** FR-3
* **Title:** Manager Login
* **Requirement:** The system shall allow store managers to log in using their username and password. Proper error messages should be displayed for incorrect credentials.
* **Source:** Store Manager
* **Rationale:** To provide secure access to store management features.
* **Business Rule:** Only authorized managers can log in.
* **Dependencies:** Admin Authorization
* **Priority:** High

**Feature/Use Case 2: Manage Stores and Users**

**Functional Requirement 4: Admin Login**

* **Identifier:** FR-4
* **Title:** Admin Login
* **Requirement:** The system shall allow administrators to log in using predefined credentials.
* **Source:** Administrator
* **Rationale:** To provide secure access to system administration features.
* **Business Rule:** Only authorized administrators can log in.
* **Dependencies:** None
* **Priority:** High

**Functional Requirement 5: Add Manager**

* **Identifier:** FR-5
* **Title:** Add Manager
* **Requirement:** The admin shall be able to register a new manager by assigning a store based on location.
* **Source:** Administrator
* **Rationale:** To manage store managers and their assignments.
* **Business Rule:** A manager can only be registered by the admin.
* **Dependencies:** Admin Authorization
* **Priority:** High

**Functional Requirement 6: Add Product to Catalog**

* **Identifier:** FR-6
* **Title:** Add Product to Catalog
* **Requirement:** System admins shall be able to add new products to the product catalog, specifying category, subcategory, and price.
* **Source:** System Administrator
* **Rationale:** To update the product catalog with new items.
* **Business Rule:** Only admins can add products to the catalog.
* **Dependencies:** Admin Authorization
* **Priority:** High

**Functional Requirement 7: Remove Product from Catalog**

* **Identifier:** FR-7
* **Title:** Remove Product from Catalog
* **Requirement:** System admins shall be able to remove existing products from the product catalog.
* **Source:** System Administrator
* **Rationale:** To maintain an updated and accurate product catalog.
* **Business Rule:** Only admins can remove products from the catalog.
* **Dependencies:** Admin Authorization
* **Priority:** High

**Functional Requirement 8: Update Product in Catalog**

* **Identifier:** FR-8
* **Title:** Update Product in Catalog
* **Requirement:** System admins shall be able to update product details in the product catalog, including price and availability.
* **Source:** System Administrator
* **Rationale:** To ensure accurate and up-to-date product information.
* **Business Rule:** Only admins can update product details in the catalog.
* **Dependencies:** Admin Authorization
* **Priority:** High

**4.5 Feature/Use Case 5: Inventory Management**

**Functional Requirement 9: Add Inventory Item**

* **Identifier:** FR-9
* **Title:** Add Inventory Item
* **Requirement:** Store managers shall be able to add new items to their store's inventory, specifying quantity and status.
* **Source:** Store Manager
* **Rationale:** To manage store inventory effectively.
* **Business Rule:** Only store managers can add items to their inventory.
* **Dependencies:** Manager Login (FR-3)
* **Priority:** High

**Functional Requirement 10: Remove Inventory Item**

* **Identifier:** FR-10
* **Title:** Remove Inventory Item
* **Requirement:** Store managers shall be able to remove existing items from their store's inventory.
* **Source:** Store Manager
* **Rationale:** To maintain an accurate inventory.
* **Business Rule:** Only store managers can remove items from their inventory.
* **Dependencies:** Manager Login (FR-3)
* **Priority:** High

**Non-Functional Requirements**

**Reliability:**

**Reliability of Customer Registration**

* **Requirement:** The customer registration process shall have a reliability of 99.5%, measured by the successful registration of users without errors or system failures.
* **Consequences of Failure:** In case of registration failure, appropriate error messages should be displayed to guide users.

**Reliability of Online Shopping**

* **Requirement:** The online shopping module shall have a reliability of 99%, ensuring successful order placement and payment processing.
* **Consequences of Failure:** In case of order placement or payment failures, customers should be informed with clear error messages.

**Usability**

**Usability of User Interfaces**

* **Requirement:** The user interfaces for customers, store managers, and administrators shall adhere to established GUI standards for fonts, icons, button labels, etc.
* **Consequences of Failure:** Non-compliance with GUI standards may lead to confusion and reduced user satisfaction.

**Usability of Online Shopping**

* **Requirement:** The online shopping module shall allow users to retrieve previous orders with a single interaction, enhancing user convenience.
* **Consequences of Failure:** Inability to retrieve previous orders may lead to frustration among customers.

**Performance**

**Performance of Inventory Management**

* **Requirement:** The inventory management module shall ensure that 95% of inventory-related operations, such as adding, removing, or updating items, complete within 3 seconds.
* **Consequences of Failure:** Slow inventory operations may impact store managers' efficiency in managing inventory.

**Performance of Online Shopping**

* **Requirement:** The online shopping module shall ensure that 95% of web pages generated during the checkout process download within 4 seconds over a 20 Mbps or faster internet connection.
* **Consequences of Failure:** Slow webpage loading during checkout may result in a poor customer experience.

**Security**

**Security of User Authentication**

* **Requirement:** The user authentication process shall ensure the confidentiality of user credentials during login, utilizing secure encryption protocols.
* **Consequences of Failure:** Unauthorized access to user accounts may lead to security breaches.

**Security of Payment Information**

* **Requirement:** The payment module shall implement secure payment gateways for various options (COD, debit/credit card, Easypaisa, Jazz cash), ensuring the protection of customer payment information.
* **Consequences of Failure:** Insecure payment processes may compromise customer financial data.

**External Interface Requirements**

**User Interfaces Requirements**

**Customer Interface**

* **Description:** The customer interface shall provide an intuitive and user-friendly design, following GUI standards for fonts, icons, button labels, etc.
* **Standards:** The design shall adhere to established GUI standards, ensuring a consistent and familiar look and feel for customers.
* **Layout:** Screens shall follow standard layout conventions for ease of use.
* **Navigation:** A help button shall be available on every screen to assist customers with any queries.

**Manager Interface**

* **Description:** The manager interface shall provide access to functionalities related to store management, product catalog, and inventory management.
* **Standards:** The interface design shall comply with GUI standards for consistency.
* **Layout:** Screens shall be designed for efficient management tasks.
* **Navigation:** Standard buttons and functions, including a help button, shall be available.

**Admin Interface**

* **Description:** The admin interface shall include functionalities for managing stores, users, and overseeing the system's overall operations.
* **Standards:** GUI standards for fonts, icons, and layout shall be followed.
* **Layout:** Screens shall be organized logically for effective system administration**.**
* **Navigation:** A help button and standard navigation links shall be provided.

**Software Interfaces**

**Product Catalog Interface**

* **Description:** The system shall transmit product details to the Product Catalog, allowing admins to add, remove, and update products.
* **Interface Type:** Programmatic interface.
* **Data Format:** Data shall be transmitted in a structured format compatible with the Product Catalog system.

**Inventory Management Interface**

* **Description:** The system shall communicate with the Inventory Management module, enabling store managers to add, remove, and update inventory items.
* **Interface Type:** Programmatic interface**.**
* **Data Format:** Data shall be transmitted in a structured format for seamless integration with the Inventory Management system.

**References**

No external references were consulted during the development of this project. The New Age Grocery Store Management System has been independently designed and implemented.