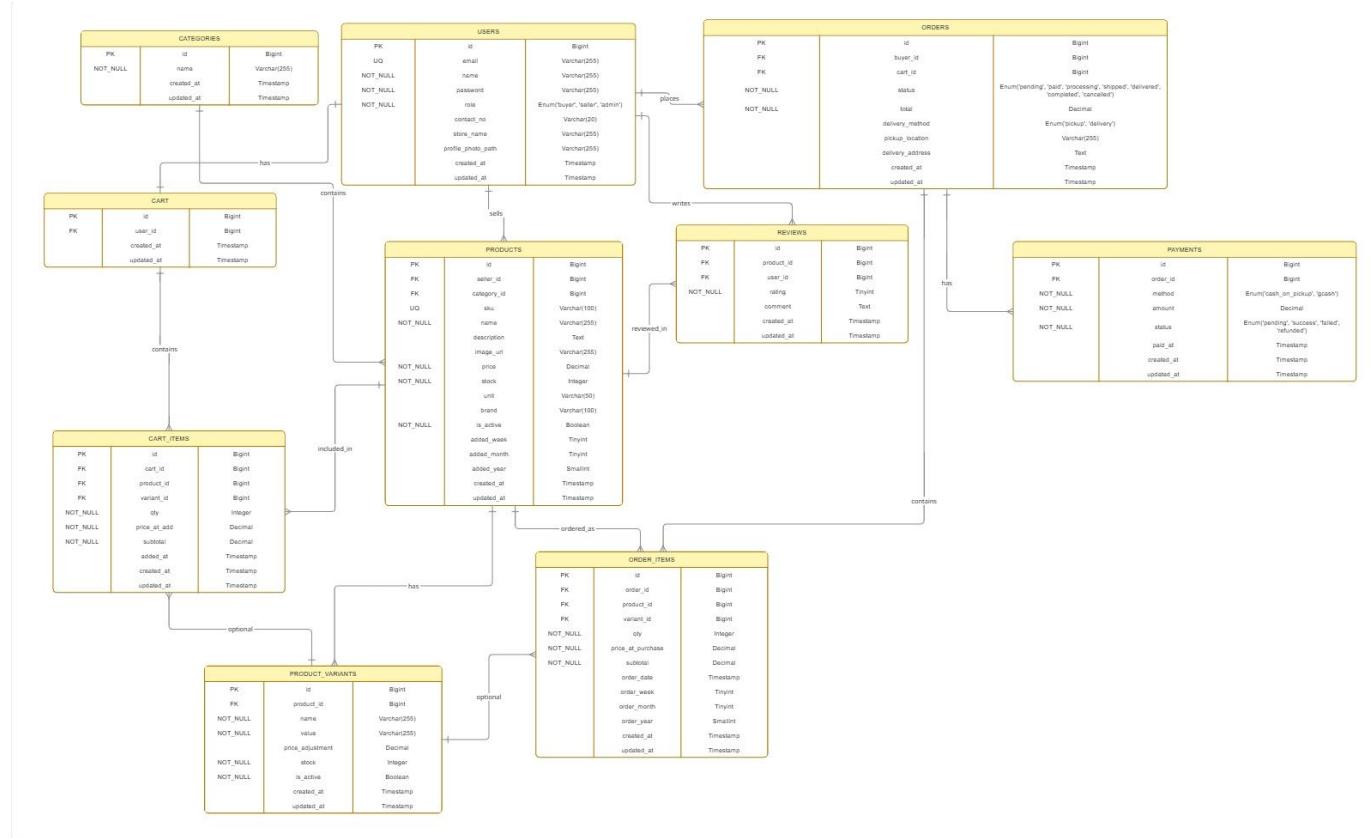


# Entity Relationship Diagram (ERD) Documentation

## CarSUCart – Campus E-Commerce System

### Overview

The CarSUCart database uses a relational model with 10 core entities supporting a campus e-commerce platform. The schema supports role-based access (buyers, sellers, admins), product management, shopping cart operations, order processing, payments, and reviews.



Entity Relationship Diagram

## 2. Entity Description [Dissected each table]

### 2.1 USERS

**Purpose:** Stores user accounts for buyers, sellers, and administrators.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
name	VARCHAR(255)	NOT NULL	Full name
email	VARCHAR(255)	NOT NULL, UNIQUE	Email (login)
password	VARCHAR(255)	NOT NULL	Bcrypt hash
role	ENUM	NOT NULL, DEFAULT 'buyer'	'buyer', 'seller', 'admin'
contact_no	VARCHAR(20)	NULLABLE	Contact number
store_name	VARCHAR(255)	NULLABLE	Store name (sellers)
profile_photo_path	VARCHAR(2048)	NULLABLE	Profile photo path
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- One-to-Many with PRODUCTS (as seller)
- One-to-One with CART
- One-to-Many with ORDERS (as buyer)
- One-to-Many with REVIEWS

### 2.2 CATEGORIES

**Purpose:** Product categories.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
name	VARCHAR(255)	NOT NULL	Category name
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- One-to-Many with PRODUCT

### 2.3 PRODUCTS

**Purpose:** Product catalog.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
seller_id	BIGINT	FOREIGN KEY → users.id, CASCADE DELETE	Seller
category_id	BIGINT	FOREIGN KEY → categories.id, NULLABLE, NULL ON DELETE	Category
sku	VARCHAR(255)	UNIQUE, NULLABLE	SKU
name	VARCHAR(255)	NOT NULL	Product name
description	TEXT	NULLABLE	Description
image_url	VARCHAR(255)	NULLABLE	Image URL
price	DECIMAL(10,2)	NOT NULL	Unit price
stock	INTEGER	DEFAULT 0	Stock quantity
unit	VARCHAR(255)	NULLABLE	Unit of measure

brand	VARCHAR(255)	NULLABLE	Brand
is_active	BOOLEAN	DEFAULT true	Active status
added_week	TINYINT	NULLABLE	Week added
added_month	TINYINT	NULLABLE	Month added
added_year	SMALLINT	NULLABLE	Year added
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- Many-to-One with USERS (seller)
- Many-to-One with CATEGORIES
- One-to-Many with PRODUCT\_VARIANTS
- One-to-Many with CART\_ITEMS
- One-to-Many with ORDER\_ITEMS
- One-to-Many with REVIEW

## 2.4 PRODUCT\_VARIANTS

**Purpose:** Product variations (size, color, etc.).

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
product_id	BIGINT	FOREIGN KEY → products.id, CASCADE DELETE	Product
name	VARCHAR(255)	NULLABLE	Variant name (e.g., 'Color')
value	VARCHAR(255)	NULLABLE	Variant value (e.g., 'Black')
price_adjustment	DECIMAL(10,2)	DEFAULT 0	Price adjustment
stock	INTEGER	DEFAULT 0	Variant stock
is_active	BOOLEAN	DEFAULT true	Active status
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- Many-to-One with PRODUCTS
- One-to-Many with CART\_ITEMS (optional)
- One-to-Many with ORDER\_ITEMS (optional)

## 2.5 CART

**Purpose:** Shopping cart per user.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
user_id	BIGINT	FOREIGN KEY → users.id, UNIQUE, CASCADE DELETE	User
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- One-to-One with USERS
- One-to-Many with CART\_ITEMS

## 2.6 CART\_ITEMS

**Purpose:** Items in a shopping cart.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
cart_id	BIGINT	FOREIGN KEY → cart.id, CASCADE DELETE	Cart
product_id	BIGINT	FOREIGN KEY → products.id	Product
variant_id	BIGINT	FOREIGN KEY → product_variants.id, NULLABLE, NULL ON DELETE	Variant
qty	INTEGER	DEFAULT 1	Quantity
price_at_add	DECIMAL(10,2)	NOT NULL	Price at add time
subtotal	DECIMAL(12,2)	NOT NULL	Line subtotal
added_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Added timestamp
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- Many-to-One with CART
- Many-to-One with PRODUCTS
- Many-to-One with PRODUCT\_VARIANTS (optional)

## 2.7 ORDERS

**Purpose:** Customer orders.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
buyer_id	BIGINT	FOREIGN KEY → users.id	Buyer
cart_id	BIGINT	FOREIGN KEY → cart.id, NULLABLE, NULL ON DELETE	Source cart
status	ENUM	DEFAULT 'pending'	'pending', 'paid', 'processing', 'shipped', 'delivered', 'completed', 'cancelled'
total	DECIMAL(12,2)	NOT NULL	Order total
delivery_method	ENUM	DEFAULT 'pickup'	'pickup', 'delivery'
pickup_location	VARCHAR(255)	NULLABLE	Pickup location
delivery_address	TEXT	NULLABLE	Delivery address
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- Many-to-One with USERS (buyer)
- Many-to-One with CART (optional)
- One-to-Many with ORDER\_ITEMS
- One-to-Many with PAYMENTS

## 2.8 ORDER\_ITEMS

**Purpose:** Line items in an order.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
order_id	BIGINT	FOREIGN KEY → orders.id, CASCADE DELETE	Order
product_id	BIGINT	FOREIGN KEY → products.id	Product
variant_id	BIGINT	FOREIGN KEY → product_variants.id, NULLABLE, NULL ON DELETE	Variant
qty	INTEGER	DEFAULT 1	Quantity
price_at_purchase	DECIMAL(10,2)	NOT NULL	Price at purchase
subtotal	DECIMAL(12,2)	NOT NULL	Line subtotal
order_date	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Order date
order_week	TINYINT	NULLABLE	Order week
order_month	TINYINT	NULLABLE	Order month
order_year	SMALLINT	NULLABLE	Order year
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- Many-to-One with ORDERS
- Many-to-One with PRODUCTS
- Many-to-One with PRODUCT\_VARIANTS (optional)

## 2.9 PAYMENTS

**Purpose:** Payment records.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
order_id	BIGINT	FOREIGN KEY → orders.id, CASCADE DELETE	Order
method	ENUM	NOT NULL	'cash_on_pickup', 'gcash'
amount	DECIMAL(12,2)	NOT NULL	Payment amount
status	ENUM	DEFAULT 'pending'	'pending', 'success', 'failed', 'refunded'
paid_at	TIMESTAMP	NULLABLE	Payment timestamp
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- Many-to-One with ORDERS

## 2.10 REVIEWS

**Purpose:** Product reviews and ratings.

Attribute	Data Type	Constraints	Description
id	BIGINT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier
product_id	BIGINT	FOREIGN KEY → products.id, CASCADE DELETE	Product
user_id	BIGINT	FOREIGN KEY → users.id, CASCADE DELETE	Reviewer
rating	TINYINT	NOT NULL	Rating (1-5)
comment	TEXT	NULLABLE	Review comment
created_at	TIMESTAMP	NULLABLE	Creation timestamp
updated_at	TIMESTAMP	NULLABLE	Last update timestamp

**Relationships:**

- Many-to-One with PRODUCTS
- Many-to-One with USERS

## 3. Relationship Summary

Relationship	Type	Cardinality	Foreign Key	Description
USERS → PRODUCTS	One-to-Many	1:N	products.seller_id	User sells products
USERS → CART	One-to-One	1:1	cart.user_id	User has one cart
USERS → ORDERS	One-to-Many	1:N	orders.buyer_id	User places orders
USERS → REVIEWS	One-to-Many	1:N	reviews.user_id	User writes reviews
CATEGORIES → PRODUCTS	One-to-Many	1:N	products.category_id	Category contains products
PRODUCTS → PRODUCT_VARIANTS	One-to-Many	1:N	product_variants.product_id	Product has variants
PRODUCTS → CART_ITEMS	One-to-Many	1:N	cart_items.product_id	Product in cart items
PRODUCTS → ORDER_ITEMS	One-to-Many	1:N	order_items.product_id	Product in order items
PRODUCTS → REVIEWS	One-to-Many	1:N	reviews.product_id	Product has reviews
CART → CART_ITEMS	One-to-Many	1:N	cart_items.cart_id	Cart contains items
ORDERS → ORDER_ITEMS	One-to-Many	1:N	order_items.order_id	Order contains items
ORDERS → PAYMENTS	One-to-Many	1:N	payments.order_id	Order has payments
PRODUCT_VARIANTS → CART_ITEMS	One-to-Many	0:N	cart_items.variant_id	Variant in cart (optional)
PRODUCT_VARIANTS → ORDER_ITEMS	One-to-Many	0:N	order_items.variant_id	Variant in order (optional)
CART → ORDERS	One-to-Many	0:1	orders.cart_id	Order from cart (optional)

## 4. Key Constraints and Business Rules

### 4.1 Primary Keys

All entities use **id (BIGINT, AUTO\_INCREMENT)** as the primary key.

### 4.2 Foreign Key Constraints

- **CASCADE DELETE:** Deleting a user deletes their products, cart, orders, and reviews.
- **CASCADE DELETE:** Deleting a product deletes its variants, cart items, order items, and reviews.
- **CASCADE DELETE:** Deleting an order deletes its items and payments.
- **NULL ON DELETE:** Optional relationships (category\_id, variant\_id, cart\_id) set to NULL on deletion.

### 4.3 Unique Constraints

- **users.email:** Unique email addresses
- **products.sku:** Unique SKU (if provided)
- **cart.user\_id:** One cart per user

### 4.4 Enumerated Types

- **users.role:** 'buyer', 'seller', 'admin'
- **orders.status:** 'pending', 'paid', 'processing', 'shipped', 'delivered', 'completed', 'cancelled'
- **orders.delivery\_method:** 'pickup', 'delivery'
- **payments.method:** 'cash\_on\_pickup', 'gcash'
- **payments.status:** 'pending', 'success', 'failed', 'refunded'

### 4.5 Business Rules

- **Stock management:** Stock cannot be negative (enforced at application level).
- **Price preservation:** price\_at\_add and price\_at\_purchase preserve historical prices.
- **Role-based access:** Sellers can only manage their own products.
- **Order integrity:** Orders are created within transactions to ensure atomicity.
- **Variant optionality:** Products can exist without variants; variants are optional in cart and order items.

## 5. Data Flow Summary

- **User Registration** → Creates USER record
- **Seller Product Creation** → Creates PRODUCT linked to USER (seller\_id)
- **Buyer Cart Operations** → Creates/updates CART and CART\_ITEMS
- **Checkout Process** → Creates ORDER, ORDER\_ITEMS, and PAYMENT records
- **Stock Deduction** → Updates PRODUCT.stock and PRODUCT\_VARIANTS.stock
- **Review Submission** → Creates REVIEW linked to PRODUCT and USER

## 6. Database Normalization

The schema follows **Third Normal Form (3NF)**:

- **1NF:** All attributes are atomic
- **2NF:** Non-key attributes fully depend on primary keys
- **3NF:** No transitive dependencies (e.g., category names stored in CATEGORIES, referenced by ID)