Databases & Web Services Project 2024

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1 Project Overview

The **Sustainable Shopping Assistant** is a web service aimed at promoting eco-friendly shopping habits by providing users with environmental ratings of products. The service helps users make informed decisions by showing the carbon footprint, eco-ratings, and sustainability certifications of products in various categories ranging from electronics, groceries to clothing.

Functional Overview

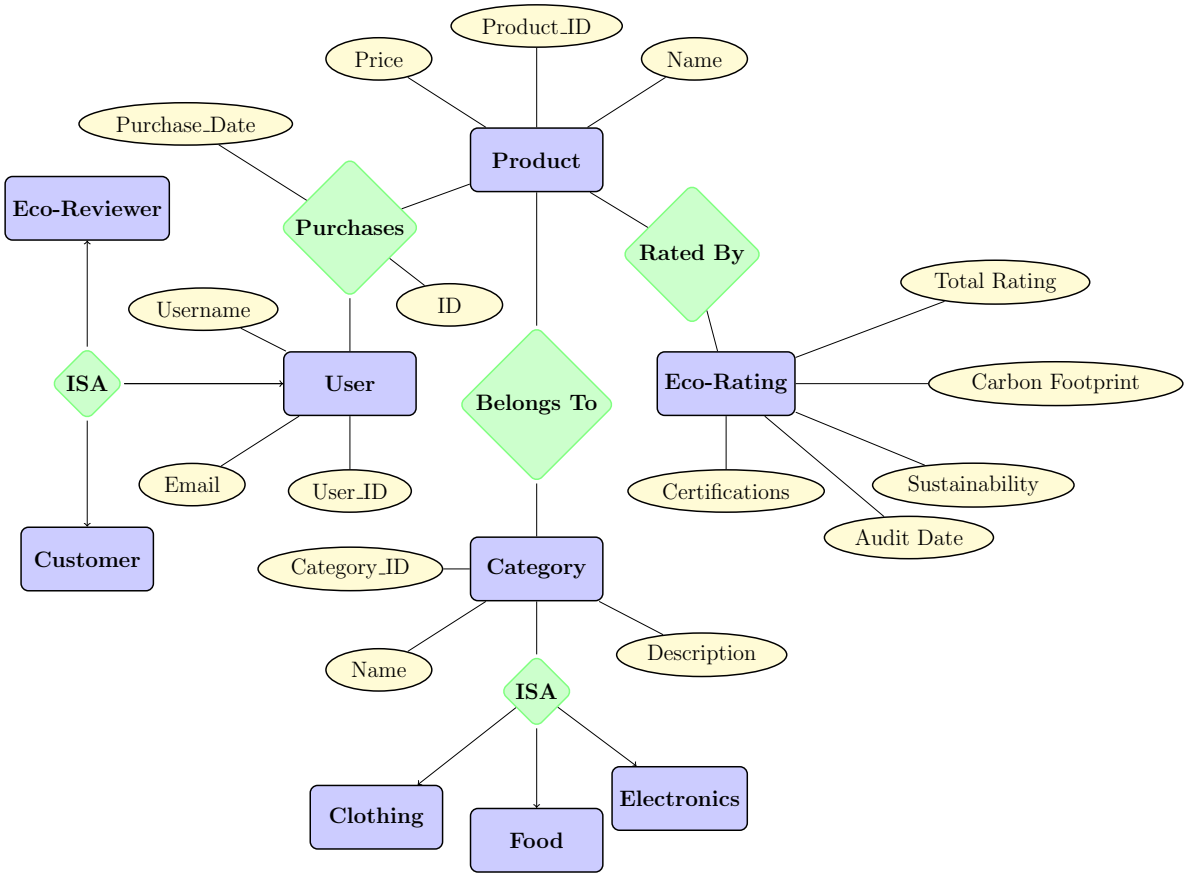
From the user's perspective, the system allows the following actions:

- **Search for products by category** (e.g., electronics, clothing, groceries).
- **View detailed eco-ratings**, including carbon footprint, environmental certifications, and sustainability scores.
- **Compare products** based on their environmental impact and find alternatives.
- **Set preferences** to receive suggestions for eco-friendly versions of desired products (e.g., plastic-free, organic).
- **Add products to a wishlist** and access seen eco-friendly alternatives.
- **Rate products** based on their perceived eco-friendliness.

The service aims to make the process of environmentally conscious shopping easier for the general public while encouraging sustainable consumer habits.

2 ER Diagram of the Miniworld

The ER diagram below includes the main entities involved in the system. For a team of two ($N = 2$), the system includes two "ISA" hierarchies: one for the products categories and another for users (customers and eco-reviewers).



3 User Interactions

Below is an outline of how the user will interact with the system:

- **Search Products**: Users can search for products by entering a keyword or filtering by categories (e.g., electronics, food, clothing, etc.).
- **View Eco-Scores**: When users view a product, they are presented with an overall "Eco-Score," which includes details like carbon footprint, sustainability certifications (e.g., Fair Trade, Organic), and material composition.
- **Set Preferences**: Users can input eco-friendly preferences, such as seeking products that are plastic-free, organic, or have a minimal carbon footprint. The system will recommend relevant options accordingly.
- **Add to Wishlist**: Users can add eco-friendly products to their wishlist for future reference.
- **Rate a Product**: Eco-reviewers can rate products they have used on a scale from 1-10 based on sustainability factors. Users with sufficient credibility can add reviews and scores.
- **Error Handling (Invalid Actions)**:
  - Searching for a non-existent product will result in a friendly message indicating no such product is found.

- Users attempting to unfairly rate a product multiple times will be shown a restriction message.
- Invalid eco-preference selections (e.g., choosing incompatible preferences) will prompt the user to adjust their input.

4 SQL Schema

4.1 Product Table

```
CREATE TABLE Product (
    product_id INT PRIMARY KEY AUTO_INCREMENT,
    price DECIMAL(10, 2),
    name VARCHAR(255)
);
```

This table stores product details. Each product has a unique `product_id`, a `price`, and a `name`.

4.2 User Table

```
CREATE TABLE User (
    user_id INT PRIMARY KEY AUTO_INCREMENT,
    username VARCHAR(255),
    email VARCHAR(255),
    role ENUM('Customer', 'EcoReviewer') NOT NULL
);
```

The `User` table includes both customers and eco-reviewers. The `role` field determines the user type. This is part of our inheritance strategy (explained below).

4.3 Category Table

```
CREATE TABLE Category (
    category_id INT PRIMARY KEY AUTO_INCREMENT,
    name VARCHAR(255),
    description VARCHAR(255),
    category_type ENUM('Clothing', 'Food', 'Electronics') NOT NULL
);
```

This table defines categories for products, with `category_type` distinguishing between different product types.

4.4 EcoRating Table

```
CREATE TABLE EcoRating (
    eco_rating_id INT PRIMARY KEY AUTO_INCREMENT,
    total_rating INT CHECK (total_rating BETWEEN 1 AND 100),
    certification VARCHAR(255),
    audit_date DATE,
```

```
    sustainability INT,
    carbon_footprint INT
);
```

The `EcoRating` table stores sustainability-related metrics for products.

4.5 Purchases Table

```
CREATE TABLE Purchases (
    purchase_id INT PRIMARY KEY AUTO_INCREMENT,
    purchase_date DATE,
    user_id INT,
    product_id INT,
    FOREIGN KEY (user_id) REFERENCES User (user_id),
    FOREIGN KEY (product_id) REFERENCES Product (product_id)
);
```

This table records purchases made by users. The many-to-many relationship between users and products is captured by linking `user_id` and `product_id`.

4.6 Rated By Table

```
CREATE TABLE RatedBy(
    product_id INT UNIQUE,
    total_rating INT,
    PRIMARY KEY(product_id, total_rating),
    FOREIGN KEY (product_id) REFERENCES Product (product_id),
    FOREIGN KEY (total_rating) REFERENCES EcoRating (total_rating)
);
```

This table handles the many-to-one relationship between products and eco-ratings, where each product can have only one eco-rating.

4.7 Belongs To Table

```
CREATE TABLE BelongsTo(
    product_id INT UNIQUE,
    category_id INT,
    PRIMARY KEY (product_id, category_id),
    FOREIGN KEY (product_id) REFERENCES Product (product_id),
    FOREIGN KEY (category_id) REFERENCES Category (category_id)
);
```

This table defines the many-to-one relationship between products and categories. Each product belongs to exactly one category.

5 Inheritance Strategy: Alt 3 (One Big Relation)

In this design, we adopted **Alt 3: One Big Relation** for handling inheritance. Instead of creating separate tables for the `Customer` and `EcoReviewer`, we used a single `User`

table with an `ENUM` field, `role`, to distinguish between the two types. This approach was chosen for the following reasons:

1. All users, regardless of their type, are stored in a single table. This reduces the complexity of queries, as there is no need for joins between multiple user tables.
2. Since most operations (like purchases) involve both customers and eco-reviewers, this strategy eliminates the overhead of joins and simplifies data retrieval.
3. While some inheritance strategies may introduce many NULL fields in a large table, our design minimizes this by ensuring that all users share common fields, and the `role` column handles user type distinctions.

6 Mapping Approach

- **One-to-Many (1:n) Relationship:** Many products can belong to the same category, but each product belongs to exactly one category. This is captured by the `BelongsTo` table.
- **Many-to-One (n:1) Relationship:** Each product can have only one eco-rating, but multiple products can share the same eco-rating. This is represented by the `RatedBy` table.
- **Many-to-Many (n:n) Relationship:** Many users can purchase many products. The `Purchases` table captures this relationship between `User` and `Product`.

7 Useful queries

1. **Joining Product with EcoRating:**

```
SELECT Product.product_id, Product.name, RatedBy.eco_rating_id,
EcoRating.total_rating
FROM Product
INNER JOIN RatedBy ON Product.product_id = RatedBy.product_id
INNER JOIN EcoRating ON RatedBy.eco_rating_id = EcoRating.
eco_rating_id;
```

2. **Joining Product with Category:**

```
SELECT Product.product_id, Product.name, BelongsTo.category_id,
Category.name
FROM Product
INNER JOIN BelongsTo ON Product.product_id = BelongsTo.product_id
INNER JOIN Category ON BelongsTo.category_id = Category.category_id;
```

3. **All products with an eco-rating higher than 80:**

```
SELECT Product.name, EcoRating.total_rating
FROM Product
INNER JOIN RatedBy ON Product.product_id = RatedBy.product_id
INNER JOIN EcoRating ON RatedBy.eco_rating_id = EcoRating.
eco_rating_id
WHERE EcoRating.total_rating > 80;
```

4. **Get the minimum total rating and certification grouped by audit date:**

```
SELECT MIN(total_rating), certification
FROM EcoRating
GROUP BY audit_date;
```

5. **Get the sum of prices grouped by product name:**

```
SELECT SUM(price), name
FROM Product
GROUP BY name;
```

6. **Count the number of products for each category that have been purchased:**

```
SELECT COUNT(Purchases.product_id) AS total_purchases, Category.name
FROM Product
INNER JOIN Purchases ON Product.product_id = Purchases.product_id
INNER JOIN BelongsTo ON Product.product_id = BelongsTo.product_id
INNER JOIN Category ON BelongsTo.category_id = Category.category_id
GROUP BY Category.name
HAVING COUNT(Purchases.product_id) > 2;
```

8 Website Design and Corporate Design (CD)

The *Sustainable Shopping Assistant* website was developed with the goal of promoting eco-friendly shopping habits by providing environmental ratings for products. The website design follows a clean and simple layout, aligning with the principles of a clear, recognizable corporate design (CD). The design emphasizes a minimalistic and eco-conscious theme, reflecting the sustainability focus of the project.

8.1 Corporate Design Elements

8.1.1 Logo

The logo consists of a simple and clean icon featuring a leaf and a cart, symbolizing sustainability and eco-friendliness. It is placed prominently in the header section alongside the website name, *Sustainable Shopping Assistant*, with the word *Sustainable* highlighted to reinforce the primary theme. The favicon is a reduced version of the logo, ensuring consistent branding across different platforms.

8.1.2 Typography

The website uses the *Poppins* font, sourced from Google Fonts, which is a modern, sans-serif font that ensures readability and a clean, professional appearance. Different font weights (300, 400, 600) are used to create a visual hierarchy, with headings and titles in bold and regular text for the body content.

8.1.3 Color Scheme

The color scheme of the website uses a combination of green and neutral tones, symbolizing nature and environmental consciousness. Green highlights important sections and call-to-action buttons, while white and light gray are used as the background to provide a clean and spacious layout.

8.1.4 Layout

The layout is designed to be responsive and user-friendly. It is structured into three main sections:

- **Header:** The header includes the logo and a navigation menu with links to key pages, such as Home, Categories, Wishlist, and Imprint.
- **Main Content:** The main content includes an introductory section (hero), followed by an *About* section where key features of the website are presented, such as eco-ratings, product comparison, and personalized suggestions.
- **Footer:** The footer contains a disclaimer and external links, in compliance with German regulations.

8.2 Implementation of the Design

The HTML files focus only on content and structure, while the layout and visual aspects are controlled entirely by CSS. Key CD elements like typography, color, and layout are defined in the `style.css` file

8.3 Submission

The project is hosted on the university's server, with the home page and imprint page accessible through the following URL. All images are stored in a separate `images/` directory, and the CSS file is stored in the `public_html/` directory.