FOOD WASTE MANAGEMENT SYSTEM

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1. INTRODUCTION

1.1 PURPOSE

The Food Waste Management System aims to efficiently connect food waste providers, such as hotels, canteens, and raw vendors, with businesses that can repurpose this waste as raw materials. The system will optimise waste collection, transportation, and distribution through automated workflows, reducing environmental impact and maximising resource utilisation.

1.2 SCOPE

The system will be a **web-based or desktop application** with the following key features:

- **User Management** (FoodProviders, Transporters, Companies, Admins)
- **Food Waste Inventory & Request System**
- **Automated Transport Scheduling & Tracking**
- **Real-time Notifications & Communication**
- **Data Analytics & Sustainability Reporting**

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2. SYSTEM REQUIREMENTS

2.1 USER MANAGEMENT

User Roles & Responsibilities

- **Administrator** - Oversees platform operations, user management, and data security.
- **FoodProvider**- List available food waste, schedule pickups, and track deliveries.
- **Transporters (Truck Drivers)** - Manage pickup and delivery of food waste.
- **Companies** - Place requests for food waste as raw materials.

User Features

- Secure Registration & Login (Role-Based Access Control)

- Profile Management & Password Recovery
- User Role-Specific Dashboards

2.2 FOOD WASTE MANAGEMENT

Food Waste Inventory

- Providers can **list waste food availability** with details on quantity, type, and time slots.
- Companies can **request specific quantities** based on their production needs.

Matching & Allocation

- Automated matching of requests and available waste stock.
- Notifications were sent to all involved parties.

2.3 TRANSPORTATION MANAGEMENT

Automated Driver Allocation

- Intelligent matching of drivers to optimise **route efficiency**.
- Transporters receive real-time updates on pickup locations and delivery destinations.

Real-Time Tracking & Status Updates

- GPS-enabled tracking of deliveries.
- Live updates on status: **Scheduled, In Transit, Delivered**.

2.4 COMMUNICATION & NOTIFICATIONS

- Instant alerts for **pickup schedules, status changes, and delivery confirmations**.
- In-app messaging system for **direct coordination between vendors, transporters, and companies**.

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3. NON-FUNCTIONAL REQUIREMENTS

3.1 PERFORMANCE

- Efficient **database queries and caching mechanisms** to ensure smooth operations.

3.2 SECURITY

- **Role-Based Access Control (RBAC)** for data protection.
- **Multi-Factor Authentication (MFA)** for enhanced security.

3.3 USABILITY

- Intuitive UI for all user roles with a **minimal learning curve**.
- Fully responsive **desktop and mobile-friendly** design.

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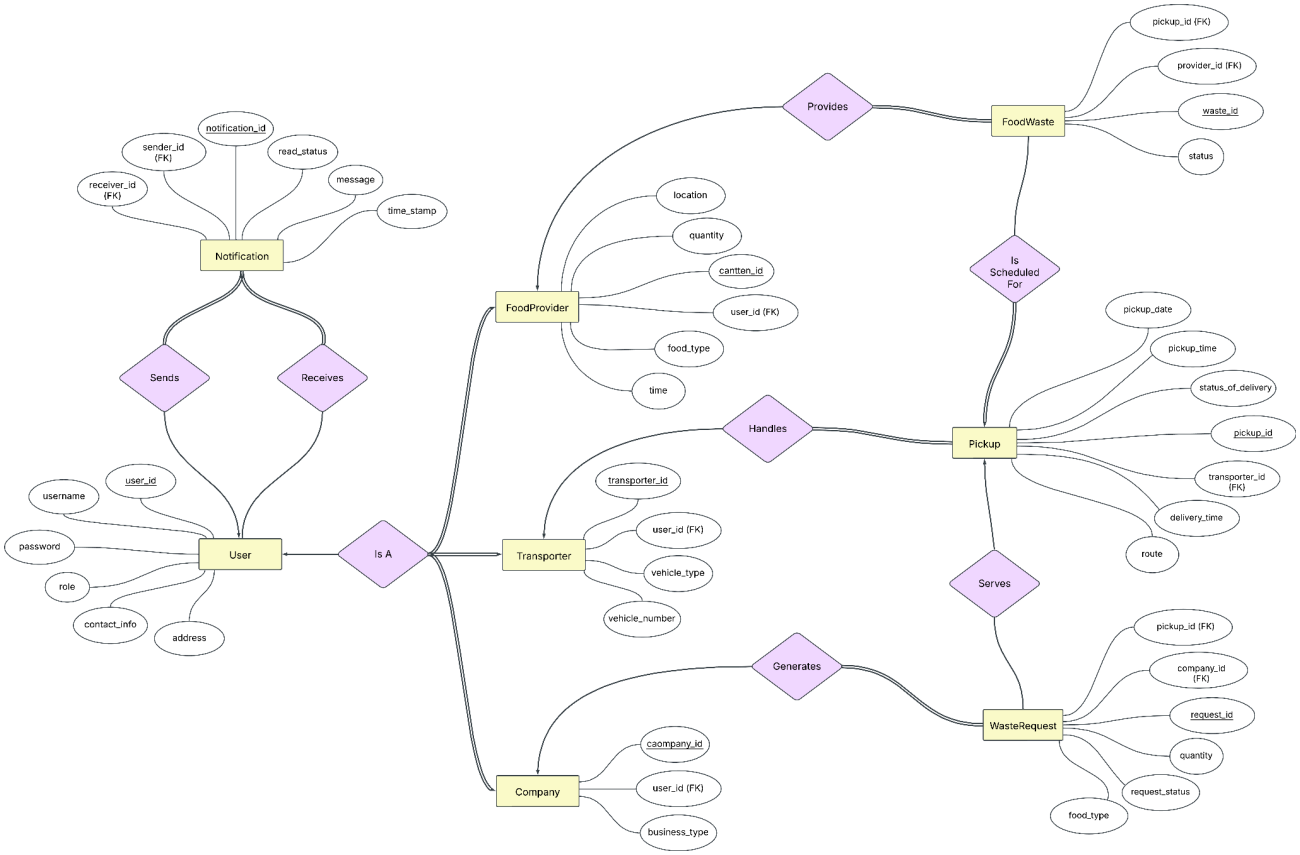
4. SYSTEM DESIGN AND ER DIAGRAM



Link: [ER Diagram's Link]

5. EXPLANATION

5.1 ER DIAGRAM

The ER model represents a food waste management system, capturing the interactions between users, transporters, food providers, companies, and various entities related to food waste pickup and requests. The system is built around the **User** entity, which contains general attributes like `user_id`, `username`, `password`, `role`, `contact_info`, and `address`. A **User** can specialise into one of three subtypes: **Transporter**, **Food Provider**, or **Company**. A **Transporter** has attributes such as `transporter_id`, `vehicle_type`, and

`vehicle_number`. A **Food Provider** manages food waste with attributes like `food_type` and `canteen_id`, while a **Company** is responsible for generating waste requests with attributes such as `business_type`, `quantity`, `time`, and `location`. The specialisation follows a disjoint constraint, meaning a user can belong to only one subtype at a time.

The **Pickup** entity plays a crucial role in managing food waste collection. Each **Pickup** is associated with a **Transporter** who handles the process. A transporter can handle multiple pickups, establishing a **one-to-many (1:M) relationship** between **Transporter** and **Pickup**, with total participation on the **Pickup** side, ensuring that every pickup has a transporter. Additionally, the **FoodWaste** entity represents waste generated by food providers, with a **one-to-many (1:M) relationship** between **FoodProvider** and **FoodWaste**, meaning that a single food provider can generate multiple waste entries, but each waste entry belongs to only one provider. Participation is **total on FoodWaste**, ensuring that every food waste record is linked to a provider.

The system also includes **WasteRequest**, which tracks requests from companies for waste pickup. A **Company** can generate multiple waste requests, creating a **one-to-many (1:M) relationship** where each request is linked to a single company. Participation is **total on WasteRequest**, as every request must come from a company. Waste requests are then linked to **Pickup Scheduling**, ensuring that each request is fulfilled. This results in a **one-to-many (1:M) relationship** between **Pickup** and **WasteRequest**, ensuring that each waste request is picked up by a transporter.

Furthermore, the system includes a **Notification** entity that facilitates communication between users. A notification contains attributes like `notification_id`, `sender_id`, `receiver_id`, `message`, `time_stamp`, and `read_status`. A single user can send multiple notifications to others, forming a **one-to-many (1:M) relationship** between **User** and **Notification**. However, each notification has exactly one sender. The participation in this relationship is **partial**, as not all users must send or receive notifications.

5.2 SYSTEM

Imagine "Fresh Bites Canteen" in Delhi, which generates surplus food waste daily. The canteen regularly provides 50 kg of leftover food each day for pickup at 11:00 AM. This recurring schedule is recorded in the system under the FoodWaste entity, with the status set to "Scheduled for Pickup." As part of its commitment to sustainability, the canteen must ensure that this food waste is collected daily without exception.

The system assigns "Eco Movers," a registered transporter, to handle the daily pickup. Ravi Sharma, a dedicated transporter with Eco Movers, uses a refrigerated truck with vehicle number DL 01 AB 1234 to manage the collection. Every morning at the designated time, Ravi arrives at Fresh Bites Canteen, follows a predetermined route, and delivers the waste to "Green Future Foods," a company that processes edible waste into animal feed.

To maintain smooth operations, the system sends daily notifications to all stakeholders:
- **Fresh Bites Canteen** receives reminders about the scheduled pickup.
- **Eco Movers** ensures Ravi’s availability by notifying him of his daily schedule.
- **Green Future Foods** is alerted about the expected delivery time.

Since "Green Future Foods" has an ongoing requirement for food waste, they have a standing WasteRequest in the system. Daily pickups satisfy such requests. The system tracks every pickup and delivery, ensuring that the transporter's route and delivery times are optimised for efficiency.

All entities seamlessly interact:
- **User** roles (food providers, transporters, and company representatives) ensure accountability.
- **FoodProvider** regularly supplies food waste for scheduled pickups.
- **FoodWaste** logs the daily waste details for record-keeping.
- **Pickup** manages recurring collections' scheduling, route, and delivery.
- **Transporter** ensures timely logistics operations.
- **WasteRequest** continuously tracks the demand from companies seeking food waste.
- **Notification** keeps stakeholders informed daily.

By maintaining a structured daily routine, this system ensures efficient food waste management, seamless communication between stakeholders, and comprehensive data for sustainability analysis, fostering a greener, more responsible future.

6. CONCLUSION

This **Food Waste Management System** revolutionises food waste redistribution by providing an **automated, scalable, and secure platform** that benefits food waste producers and processors. Through **intelligent matching, real-time tracking, and insightful analytics**, the system significantly reduces waste, enhances sustainability, and optimises logistics.

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7. TEAM MEMBERS

Name	Roll Number	Branch
Ashutosh Tiwari	2023154	CSSS
Daksh Singh	2023180	CSAM
Kunal Jain	2023293	CSSS

Priyanshu Pandey	2023406	CSSS

8. SOURCES

1. ChatGPT: This AI model was initially used to help develop the ER Model. We leveraged its assistance to understand how to approach the creation of the ER Model and then refined the extracted information using our own knowledge. Additionally, it was used to rephrase the content of this document, enhancing the reader's experience.
2. The previous year's resources provided in the classroom were used to understand the submission requirements and gain insight into the format and content that should be included in this document.