### **Major Functionalities (High Priority)**

### **1. User Management**

#### **Use Case: User Registration**

* **Use Case ID:** UC-01
* **Actors:** User, System
* **Preconditions:** The user must have a valid email or phone number.
* **Main Flow:**
  + User selects **"Sign Up"**
  + System prompts for name, email, phone number, password, and role (**Individual User / Recycling Center**).
  + User enters details and submits.
  + System sends OTP via email.
  + User enters OTP.
  + System verifies OTP and activates the account.
  + User logs in successfully.
* **Alternative Flows:**
  + **A1:** Incorrect OTP → Retry or Lock Account after multiple failed attempts.
  + **A2:** Email/Phone already registered → Prompt Login instead.
  + **A3:** OTP not received → Resend OTP option.
* **Postconditions:** Account is created and verified.

#### **Use Case: User Login & Authentication**

* **Use Case ID:** UC-02
* **Actors:** User, System
* **Preconditions:** Users must be registered and verified.
* **Main Flow:**
  + User enters email/phone and password.
  + System verifies credentials.
  + System generates JWT tokens and logs in the user.
* **Alternative Flows:**
  + **A1:** Incorrect credentials → Show error message.
  + **A2:** Forgot password → Trigger password reset.
* **Postconditions:** User is authenticated and granted access.

#### **Use Case: Profile Management**

* **Use Case ID:** UC-03
* **Actors:** User, System
* **Preconditions:** User must be logged in.
* **Main Flow:**
  + User navigates to profile settings.
  + User updates **name, address (location), waste-related preferences (e.g., types of waste they manage, disposal habits, recycling interests, etc.).**
  + System saves changes.
* **Alternative Flows:**
  + **A1:** Invalid input → Show error message.
* **Postconditions:** Profile is updated.

### **2. Waste Classification (Using Pre-Built API/Model)**

#### **Use Case 1: Waste Image Classification**

**Use Case ID:** UC-04  
 **Actors:** User, System  
 **Preconditions:** User must have an image of waste to upload.

**Main Flow:**

1. User selects "Classify Waste" and uploads an image.
2. System processes the image using a pre-trained waste classification API.
3. System identifies the waste type (e.g., plastic, organic, electronic, metal).
4. System provides disposal recommendations (e.g., "Recycle in Blue Bin").
5. System suggests nearby recycling centers if applicable.

**Alternative Flows:**

* **A1:** Unclear image (Prompt user to upload a clearer image).
* **A2:** Unknown waste type (Suggest manual classification).
* **A3:** Server error (Show error message, allow retry).

**Postconditions:** Waste type is classified, and disposal instructions are provided.

#### **Use Case 2: Identifying Recyclable Waste**

**Use Case ID:** UC-05  
 **Actors:** User, System  
 **Preconditions:** User uploads an image of an item that might be recyclable.

**Main Flow:**

1. User selects "Check Recyclability" and scans/uploads an image.
2. System analyzes the image and determines if the waste is recyclable.
3. If recyclable, the system provides instructions for proper cleaning and disposal.
4. System suggests nearby recycling centers or collection points.

**Alternative Flows:**

* **A1:** Waste is contaminated (Prompt user to clean before recycling).
* **A2:** Non-recyclable waste (Suggest alternative disposal methods).

**Postconditions:** User receives clear recycling guidance

### **3. Waste Collection & Scheduling**

##### **Use Case 1: Requesting Waste Pickup**

**Use Case ID:** UC-06  
 **Actors:** Resident/User, System, Recycling Center  
 **Preconditions:** The user must be registered and logged into the system.

**Main Flow:**

1. User logs in and selects "Request Pickup."
2. User enters waste details (type, quantity, location).
3. System retrieves and displays nearby recycling centers.
4. User selects a recycling center from the list.

**Postconditions:** Pickup request is assigned to a recycling center for fulfillment.

**Alternative Flows:**

* **A1:** No recycling centers available → System notifies the user & suggests an alternative date.
* **A2:** User cancels request before pickup → Request is marked as canceled.

##### **Use Case 2: Displaying Recycling Center Details**

**Use Case ID:** UC-07  
 **Actors:** User, System  
 **Preconditions:** User has selected a recycling center from the search results.

**Main Flow:**

1. User selects a recycling center from the list.
2. System retrieves and displays the center’s details, including:
   * Location (with map view).
   * Accepted waste materials.
   * Operating hours.
   * Contact details.
3. User reviews the information and decides on further actions.

**Alternative Flows:**

* **A1:** Center details unavailable → Display a message stating that information is missing or outdated.

**Postconditions:** The user has access to recycling center details and can take action (e.g., schedule a drop-off).

##### **Use Case 3: Scheduling Drop-Off Appointments**

**Use Case ID:** UC-08  
 **Actors:** User, System, Recycling Center Admin  
 **Preconditions:** User has selected a recycling center that supports appointment scheduling.

**Main Flow:**

1. User selects "Schedule a Drop-Off."
2. System displays available dates and time slots.
3. User selects a preferred date and time.
4. System confirms the appointment and provides a confirmation receipt.

**Alternative Flows:**

* **A1:** No available slots → Notify the user and suggest alternative times or centers.
* **A2:** User cancels appointment → Allow cancellation with confirmation.

**Postconditions:** The drop-off appointment is scheduled, and the user is notified.

##### **Use Case 4: Updating Request Status**

**Use Case ID:** UC-09  
 **Actors:** Recycling Center  
 **Preconditions:** Recycling center must have an assigned pickup request.

**Main Flow:**

1. Recycling center arrives at the pickup location.
2. Recycling center marks the request as **"Collected"** if completed.
3. If unable to collect, the recycling center marks the request as **"Canceled"** with a reason.
4. If pending further action, the recycling center marks the request as **"Pending."**

**Alternative Flows:**

* **A1:** Recycling center cannot locate waste (User receives a follow-up notification).
* **A2:** Waste is not properly sorted (User is asked to correct it before rescheduling).

**Postconditions:** Request status is updated and visible to users.

#### **3. Notifications & Alerts**

##### **Use Case: Pickup Reminders, Leaderboard Updates, and Challenge Notifications**

**Use Case ID:** UC-16  
 **Actors:** User, System

**Main Flow:**

1. System sends notifications for:
   * Scheduled pickup reminders.
   * Leaderboard updates.
   * New challenge announcements.
2. Users receive notifications via email or app.

**Postconditions:** User is notified about the relevant activities.

##### **Use Case: Automated Reminders**

##### **Use Case ID:** UC-17 **Actors:** User, System, Recycling Center Admin **Preconditions:** A scheduled pickup exists.

**Main Flow:**

1. System sends reminders (email, app notification) to users and recycling centers before pickup.
2. System updates users with any changes or delays.

**Postconditions:** Users and recycling centers receive timely reminders.

##### **Use Case: Educational Tips and Articles on Waste Management**

**Use Case ID:** UC-18  
 **Actors:** User, System

**Main Flow:**

1. System sends regular educational tips and articles to users about waste management best practices.
2. Users read the tips/articles to learn how to improve their recycling efforts.

**Postconditions:** Users have access to educational content to improve their waste management practices.

### **Minor Functionalities (Medium to Low Priority)**

#### **1. Gamification & Rewards**

**Use Case 1: Awarding Points for User Activities**

* **Use Case ID**: UC-09
* **Actors**: User, System
* **Preconditions**: User performs an activity that is eligible for points.
* **Main Flow**:
  1. User perform activities such as uploading waste images, scheduling pickups, or completing recycling tasks.
  2. System tracks activities and awards points based on user actions.
* **Postconditions**: User's points balance is updated.

**Use Case 2: Redeeming Points for Rewards**

* **Use Case ID**: UC-10
* **Actors**: User, System
* **Preconditions**: User has enough points to redeem a reward.
* **Main Flow**:
  1. User checks available rewards in the system.
  2. User redeems points for rewards such as discounts or service credits.
  3. System processes the redemption and updates the user's points balance.
* **Postconditions**: Points are deducted, and the user receives the reward.

**Use Case 3: Earning Badges for Milestones**

* **Use Case ID**: UC-11
* **Actors**: User, System
* **Preconditions**: User reaches a defined milestone.
* **Main Flow**:
  1. Users achieve specific milestones such as recycling a certain amount of waste or completing a number of pickups.
  2. System awards badges for these achievements.
* **Postconditions**: User's badge collection is updated.

**Use Case 4: Leaderboard for Top Contributors**

* **Use Case ID**: UC-12
* **Actors**: User, System
* **Preconditions**: User must have earned points.
* **Main Flow**:
  1. System ranks users based on the points they've earned.
  2. Users view the leaderboard to see top contributors in their area or globally.
* **Postconditions**: Leaderboard is displayed and updated.

**Use Case 5: Community Challenges (e.g., Collective Recycling Goals)**

* **Use Case ID**: UC-13
* **Actors**: User, System
* **Preconditions**: A challenge is created by the system.
* **Main Flow**:
  1. System creates community-wide challenges (e.g., a goal to recycle 1,000 kg of plastic).
  2. Users participate by completing actions toward the challenge goal.
  3. System tracks progress and updates the community status.
* **Postconditions**: Challenge progress is displayed, and the community's contributions are tracked.

#### **2. Data Analytics & Impact Tracking**

**Use Case 1: Viewing Personal Impact Statistics**

* **Use Case ID**: UC-14
* **Actors**: User, System
* **Preconditions**: User has recycled waste that can be tracked.
* **Main Flow**:
  1. User navigates to their impact statistics page.
  2. System displays the user's personal data: total waste recycled, carbon footprint reduction, points earned, etc.
* **Postconditions**: User sees a visual representation of their environmental impact.

**Use Case 2: Community Impact Reports**

* **Use Case ID**: UC-15
* **Actors**: User, System
* **Preconditions**: Community-wide recycling data is available.
* **Main Flow**:
  1. User access community reports from the system.
  2. System provides data on the community's collective waste reduction, carbon footprint, and recycling efforts.
* **Postconditions**: User views the collective impact of the community.