Software Engineering Principles

SENG8091 – Project Phase 1

Waste Management

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Project Name – Waste Management - Efficient Waste Collection and Recycling System

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**Project Context**

The current waste management system faces significant inefficiencies in collection and recycling, leading to environmental degradation, increased operational costs, and lack of public awareness. The following issues have been identified:

* Waste collection routes are not optimized, leading to excessive fuel consumption and delays.
* Lack of proper segregation at the source results in ineffective recycling.
* Insufficient data-driven insights to improve waste management practices.
* Limited citizen engagement in proper waste disposal and recycling practices

**Stakeholders:**

* Municipal Waste Management Authorities
* Private Waste Collection Companies
* Citizens and Households
* Recycling Plants

**ASSUMPTIONS:**

1. Current waste collection routes are inefficient, leading to higher costs and carbon emissions.
2. Citizens lack awareness and motivation to segregate waste properly.
3. Recycling plants face challenges in processing mixed waste, reducing efficiency.
4. A smart waste management system can optimize collection routes, improve recycling rates, and enhance public participation.

**VALIDATIONS (QUESTIONS):**

**1. Waste Collection Optimization**

* How are current waste collection routes planned?
* What are the major challenges in timely waste collection?
* How frequently are waste bins overflowing before collection?
* Are there existing route optimization tools being used?

**2. Recycling Efficiency**

* What percentage of collected waste is successfully recycled?
* What are the most common contamination issues in recycling?
* Are there policies enforcing proper waste segregation at the source?

**3. Public Engagement**

* What initiatives are in place to educate citizens about proper waste disposal?
* What incentives exist to encourage better recycling practices?
* How can digital solutions (apps, notifications, etc.) be used to improve engagement?

**PRELIMINARY TASKS**

**1. Waste Collection Optimization**

* Analyze current waste collection routes and identify inefficiencies.
* Implement IoT-based smart bins to monitor fill levels in real-time.
* Develop an AI-based system for route optimization.
* Reduce fuel costs and carbon footprint by improving scheduling.

**2. Recycling Efficiency Improvement**

* Research successful waste segregation policies from other regions.
* Implement barcode-based waste categorization to ensure proper segregation.
* Improve recycling plant sorting mechanisms using automated systems.

**3. Public Engagement and Awareness**

* Develop a mobile application to educate citizens about waste segregation.
* Implement reward-based incentive programs for responsible waste disposal.
* Partner with educational institutions to introduce waste management awareness programs.

**BROKEN DOWN REQUIREMENTS**

**Functional Requirements**

**1. Waste Collection Optimization**

REQ1\_001: The system shall provide dynamic route optimization for waste collection.

* Task1\_001: Implement GPS tracking for collection trucks.
* Task1\_002: Integrate real-time fill-level monitoring from smart bins.

REQ1\_002: The system shall generate reports on collection efficiency.

* Task1\_001: Develop a dashboard for waste management authorities.
* Task1\_002: Provide analytics on waste trends and optimization suggestions.

**2. Recycling Efficiency**

REQ2\_001: The system shall categorize waste using barcode scanning technology.

* Task2\_001: Assign unique barcodes to recyclable materials.
* Task2\_002: Ensure scanning devices are available at collection points.

REQ2\_002: The system shall monitor contamination levels in recycling bins.

* Task2\_001: Implement AI-driven cameras to detect contamination.
* Task2\_002: Alert authorities when contamination exceeds threshold limits.

**3. Public Engagement**

REQ3\_001: The system shall provide an interactive mobile application for citizens.

* Task3\_001: Develop an app with waste disposal guidelines.
* Task3\_002: Include waste pickup schedules and reminders.

REQ3\_002: The system shall offer rewards for proper waste disposal.

* Task3\_001: Implement a points-based incentive system.
* Task3\_002: Partner with businesses for discounts on sustainable products.

**Non-Functional Requirements**

**1. Usability**

REQ1\_001: The system shall have a user-friendly interface.

Task1\_001: Conduct usability testing with citizens and authorities.

**2. Performance**

REQ2\_001: The system shall process route optimization within 5 seconds.

Task2\_001: Optimize algorithm efficiency for real-time calculations.

**3. Security**

REQ3\_001: Citizen data shall be encrypted to ensure privacy.

Task3\_001: Implement robust encryption standards.

**4. Availability**

REQ4\_001: The system shall have 99% uptime.

Task4\_001: Deploy redundant cloud infrastructure for reliability.