Assignment 1 - Case Study 2
Smart Waste Management System

SE3070 – Case Studies in Software Engineering **2025 Semester 2**

Smart Waste Management System for Urban Areas

Introduction

In urban centers worldwide, efficient waste management is essential for maintaining public health and cleanliness. A significant source of operational costs and inefficiencies is the collection and processing of waste. Currently, in Sri Lanka, waste management is predominantly manual, involving door-to-door collection and transportation to central processing facilities. With the increasing interest in smart city technologies, there is an opportunity to enhance the efficiency and effectiveness of waste management through digital solutions. Similar systems have been successfully implemented in various parts of the world, such as the Pay-As-You-Throw (PAYT) system in Seoul, South Korea.

Objective

In this case study, your teams are bidding to develop a software solution for the waste management authorities in major urban areas in Sri Lanka. The goal is to create a smart waste management system that optimizes waste collection, monitors waste levels, and improves resource allocation.

- **First Phase**: Develop a design for your software that offers comprehensive functionality to address the complexity of urban waste management, as well as high usability for both waste management personnel and residents.
- **Second Phase**: Develop, test, and evaluate a simulator for your software platform, demonstrating both the usability features and the flexibility of the system to be configured for different cities.

Requirements

In the first phase, you are required to demonstrate your understanding of the domain by creating a software functional design (using UML) and user interaction designs for the software.

Case Study Details

The proposed system will involve individual households and businesses receiving a digital waste tracking device, which will be attached to their waste bins. This device could be a smart tag (similar to RFID systems used in logistics), a bar code, or an integrated sensor system that monitors waste levels and sends data to the central system.

When waste collection trucks arrive at a location, they will scan the digital tags or read the sensor data

to record the collection. This process will provide audio or visual feedback indicating that the waste has been successfully collected. This is crucial in busy urban areas, where waste collection personnel need to ensure that each waste bin is correctly recorded and managed.

Waste Management Account

When households and businesses receive a digital waste tracking device, they will hold an account with the waste management authority. Each account will include information about the type and quantity of waste generated. Residents can monitor their waste production, schedule special waste collections (e.g., for bulky items), make payments for waste collection services online through the waste management authority's website or a mobile application and receive paybacks for certain recyclable waste items such as e-waste.

System Flexibility

The system must be designed to manage different types of waste and collection models. For instance, some cities charge based on the weight of the waste, while others use a flat fee for waste collection. The system should accommodate various waste management models, ensuring that it can be adapted for use in different countries and regions.

Data Analysis and Reporting

Waste management authorities need information from the digital waste management system to plan resources and improve service delivery. For example, to optimize collection routes, identify high-waste areas, and manage processing facilities, they need data on waste generation and collection patterns. The system should generate statistical reports for waste management authorities to analyze different scenarios and make informed decisions.

Existing Systems

Different countries have different needs and regulations when it comes to managing waste. The following resources provide insights into various digital waste management systems around the world:

- Seoul's PAYT System
- Singapore's Smart Waste Management (3 part article)

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Important Note

The information in this document is typical of what you might expect from a client in the industry when developing software systems—possibly incomplete, ambiguous, and vague. You are encouraged to discuss any queries with the module delivery team during tutorials to clarify any aspects of the system design and implementation.

Remember, your clients will rarely be computer-savvy. It is your job as practicing software engineers/computer scientists to translate their requirements into formal designs and ultimately a functional software package. If the clients could do this themselves, they wouldn't need our expertise.