Technology Stack Document

Smart Construction & Demolition Waste Collection Monitoring System

1. Overview

This document describes the complete technology stack used and recommended for the Smart Construction and Demolition Waste Monitoring System.

The system is designed as a web-based monitoring platform for tracking waste collection units, monitoring operations, and managing waste collection efficiently.

2. Current Technology Stack

Frontend:

- React.js
- HTML5
- CSS3
- JavaScript (ES6)

Hosting:

- GitHub Pages

Version Control:

- Git
- GitHub

3. Recommended Frontend Stack

Framework:

• React.js

UI Framework:

• Tailwind CSS or Material UI

Visualization:

• Chart.js or Recharts

Maps Integration:

• Mapbox or Google Maps API

4. Recommended Backend Stack

Backend Framework Options:

Option 1:

• FastAPI (Python)

Option 2:

• Node.js with Express.js

Responsibilities:

• API management

• Data processing

• Unit monitoring integration

• Authentication handling

5. Database Stack

Recommended Databases:

Option 1:

• PostgreSQL

Option 2:

• MongoDB

Option 3:

• Firebase (Recommended for ease of integration)

6. AI Integration Stack (Optional)

Object Detection Model:

• YOLOv8

Programming Language:

• Python

Libraries:

• OpenCV

• PyTorch

Purpose:

• Waste classification

• Construction and demolition waste detection

7. Hosting Stack

Frontend Hosting:

• GitHub Pages

• Vercel

Backend Hosting:

• Render

• Railway

Database Hosting:

• Firebase

• Supabase

8. IoT Integration Stack (Optional)

Hardware:

• ESP32

• Raspberry Pi

• GPS modules

Communication:

• REST API

• MQTT protocol

Purpose:

• Real-time location tracking

• Waste collection monitoring

9. Recommended Final Production Stack

Frontend:

• React.js

• Tailwind CSS

• Mapbox

Backend:

• FastAPI

Database:

• PostgreSQL or Firebase

AI:

• YOLOv8

Hosting:

• GitHub Pages (Frontend)

• Render (Backend)

• Firebase (Database)

10. Folder Structure Example

project-root/

frontend/ React frontend

backend/ FastAPI backend

ai-model/ YOLO model

database/ database scripts

docs/ documentation

11. Conclusion

This technology stack provides a scalable, efficient, and modern platform for monitoring construction and demolition waste collection systems.

The architecture supports future integration with AI, IoT devices, and real-time monitoring capabilities.