Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	24 June 3035
LTVIP2025TMID32454	LTVIP2025TMID32454
Project Name	Clean Tech:Transforming Waste Management with Transfer learning
Maximum Marks	4 Marks

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Example: Order processing during pandemics for offline mode

Reference: https://developer.ibm.com/patterns/ai-powered-backend-system-for-order-processing-during-pandemics/

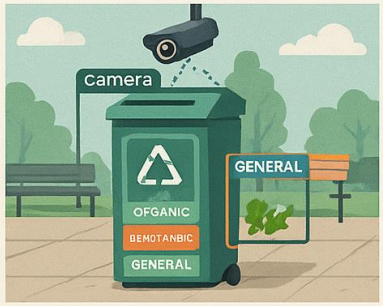
CleanTech

TRANSFORMING WASTE MANAGEMENT WITH TRANSFER LEARNING

HEALTHYVSROTTEN

CleanTech leverages power of transfer learning to revoliucaize municipal waste management. By utilizing advanced deep leaming models pre-trained on extensive datasets. CleanTech aims to enhancing the accuracy and efficiency of waste classification processes. This project involves the Intelligent system capabble of automsticatily identifying and categorizing different types of municipal waste from images.

SCENARIO 1: SMART SORTING SYSTEM IN RECYCLING CENTERS



SCENARIO 2: SMART WASTE BINS IN PUBLIC AREAS

SMART MONITORING OF INDUSTRIAL WASTE

Guidelines:

1. Use pre-trained models with transfer learning for accuracy.
2. Collect high-quality waste images from multiple sources.
3. Train on diverse datasets (organic, recyclable, hazardous).
4. Deploy cameras in bins, factories, and conveyor systems.
5. Ensure real-time image processing for quick classification.
6. Store classified waste data for reporting and analytics.
7. Regularly retrain the model using user feedback.
8. Implement dashboards for city officials and factory admins.
9. Maintain data privacy and image security.
10. Optimize for speed, accuracy, and scalability.

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Web dashboard for monitoring classification results and system status	ReactJS, HTML5, CSS3
2.	Application Logic-1	Waste image acquisition and preprocessing pipeline	Python, OpenCV
3.	Application Logic-2	Transfer learning for classifying waste images	TensorFlow, PyTorch, Keras
4.	Application Logic-3	Real-time decision system for sorting, alerting, or dashboard update	Flask / FastAPI
5.	Database	Stores logs, image metadata, and classification output	MongoDB (NoSQL), SQLite for edge devices
6.	Cloud Database	Centralized storage for analysis and reporting	Firebase, AWS DynamoDB
7.	File Storage	Storage for training data, image logs	AWS S3, Local Filesystem for edge
8.	External API-1	Email/notification system for alerts	SendGrid API, Twilio
9.	External API-2	Location-based waste data mapping (smart cities)	Google Maps API
10.	Machine Learning Model	Transfer Learning Model for waste classification	Pre-trained ResNet50, MobileNetV2
11.	Infrastructure (Server / Cloud)	Hybrid: edge for bins/factories, cloud for training and dashboards:	NVIDIA Jetson, AWS EC2, Docker, Kubernetes

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Frameworks and libraries used in development	TensorFlow, PyTorch, Flask, React
2.	Security Implementations	Secure model endpoints and data access using encryption and IAM	JWT, HTTPS, SHA-256, Firebase Auth
3.	Scalable Architecture	Microservices-based containerized deployment for scale	Docker, Kubernetes, RESTful APIs
4.	Availability	24/7 access ensured via cloud deployment and failover support	Load Balancer, Multi-zone AWS Deployment
5.	Performance	Real-time image inference, caching frequently used model results	TensorRT (for edge), Redis, CDN

References:

https://c4model.com/

https://developer.ibm.com/patterns/online-order-processing-system-during-pandemic/

https://www.ibm.com/cloud/architecture

https://aws.amazon.com/architecture

https://medium.com/the-internal-startup/how-to-draw-useful-technical-architecture-diagrams-2d20c9fda90d