Bytexl's guided project

Final Project report

Name of the educator	Aamir Jardawala
Project title	Drone based Garbage monitoring system for Swachh Bharat
Tools / platforms used	Drone,Docker,Tensorflow

Title: Drone-Based Garbage Monitoring System for Swachh Bharat

About the Project :

This project leverages drone technology to support the Swachh Bharat mission by automating the monitoring of street cleanliness. The system uses drones equipped with advanced sensors and AI for real-time image processing, enabling the detection of garbage accumulation and potholes. Data collected is analyzed and integrated with existing municipal waste management frameworks, allowing for faster response and efficient resource allocation. This approach reduces manual labor, enhances urban hygiene, and provides a scalable model for future environmental monitoring.

System Requirements:

- **Software:**
  - TensorFlow for AI and machine learning models
  - Python libraries for image processing and data analysis
  - GPS navigation software
  - Google Colab for machine learning tasks
  - Docker for deployment simulations
- **Hardware:**
  - Drones (e.g., DJI Phantom 3) with GPS, high-definition cameras, and infrared sensors
  - Computer with internet connectivity for drone control and data processing

Functional Requirements:

- Autonomous drone navigation for targeted urban zone surveillance
- Image capture and processing to identify and categorize waste hotspots
- Real-time reporting and notifications for immediate action by local authorities
- Integration with municipal waste systems for seamless data sharing

User Interface Requirements:
A dashboard interface for monitoring drone-captured data, viewing analysis reports, and accessing alerts for critical areas.

Inputs and Outputs:

- **Inputs:** Images captured by drones, GPS coordinates, and categorized waste data
- **Outputs:** Real-time analysis reports, alerts for critical waste zones, and data for integration with municipal systems

List of Subsystems:

1. **Drone Navigation and Control** – Manages autonomous navigation and GPS waypoint setting
2. **Image Processing and Analysis** – Processes images to detect garbage and assess cleanliness
3. **Notification System** – Alerts authorities based on analysis results
4. **Integration Module** – Connects data with municipal waste management frameworks

Applications in Other Contexts:
This model can be adapted for other monitoring tasks, such as pothole detection, air quality analysis, and illegal dumping detection, making it versatile for smart city applications.

Designing of Test Cases:

1. **Navigation Test** – Ensures drones follow designated paths accurately
2. **Image Processing Test** – Verifies the model's accuracy in identifying waste
3. **Notification Test** – Confirms timely notifications are sent for waste hotspots
4. **System Integration Test** – Checks the successful integration with waste management frameworks

Future Work:
Potential expansions include adding air quality sensors, improving image classification accuracy, and scaling the project for multiple cities. Exploring public-private partnerships for enhanced coverage and data-sharing is recommended.

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Reflection of the Project Creation:

- **Technical Challenges:** Managing drone battery life, ensuring accurate GPS navigation, and processing high-resolution images for real-time analysis.
- **Benefits:** Improved skills in autonomous navigation, AI-based image processing, and integration of IoT with municipal frameworks.
- **Additional Knowledge:** Deeper understanding of regulatory policies for drone usage and experience with high-efficiency hardware for outdoor environments.