Project: Autonomous Solar-Powered Plastic Waste Collector
Project Title: Autonomous Solar-Powered Plastic Waste Collector Robot
Institution: East West University, Department of EEE

1. Executive Summary

This project proposes the development of an autonomous robotic system designed to actively scan, detect, and collect plastic waste from university campuses, public parks, and urban spaces without human intervention. Powered by solar energy and guided by artificial intelligence, this robot supports the *Smart Dhaka Vision 2041* by offering a sustainable, high-tech solution to urban littering and plastic pollution.

2. The Problem: Urban Litter & Inefficiency

Organizations and municipalities currently face significant challenges regarding waste management:
• **Irregular Cleaning:** Parks and campuses frequently accumulate plastic bottles and wrappers due to limited workforce availability and irregular schedules.
• **Environmental Hazard:** Uncollected plastic clogs drainage systems, contributing to urban flooding and hygiene issues.
• **High Operational Costs:** Manual waste collection is labor-intensive, slow, and recurringly expensive.

3. The Solution: Smart Green Automation

Our robot combines control systems, embedded programming, and computer vision to automate the cleaning process.
Autonomous Navigation: The robot utilizes sensors and intelligent algorithms to safely navigate crowded areas, avoiding obstacles while ensuring full coverage of the designated zone.
AI-Powered Detection: A camera system equipped with image processing (trained on local data) identifies plastic bottles and wrappers, distinguishing them from non-waste objects.
Automated Pickup & Dumping: A mechanical gripper/roller system collects the waste into an onboard bin. Once full, the robot autonomously locates a larger stationary container and dumps the waste, (readying itself for the next cycle).

4. Value Proposition for Stakeholders

Why is this solution relevant to your organization?
• **Cost Reduction:** Reduces the dependency on manual labor for routine cleaning tasks, allowing staff to focus on more complex maintenance.
• **Corporate Social Responsibility (CSR):** Adopting this technology demonstrates a tangible commitment to sustainability, green automation, and the circular economy.
• **Operational Efficiency:** The robot can operate in areas that are difficult for humans to access constantly and provides consistent cleaning performance.
• **Data & Insights:** The system can potentially report data on waste volume and collection hotspots, aiding in better facility management.

5. Technical Feasibility & Scalability

• **Feasibility:** The project integrates proven technologies (YOLO/MobileNet for vision, SLAM for navigation, and solar MPPT for power) adapted for the specific environmental conditions of Dhaka (dust, lighting, terrain).
• **Scalability:** The design is modular. It can be piloted in a small university courtyard and scaled up to cover large tech zones, housing societies, or public parks.

6. Our Request: Feedback

We are currently gathering requirements to ensure this robot meets real-world needs. We value your input on:
• **Operational Constraints:** What specific challenges do you face with current waste collection?
• **Pilot Opportunities:** Would you be open to a small-scale trial run on your premises?
• **Feature Priorities:** Which capabilities (speed, capacity, silence, safety) matter most to your operations?

☑ Impactful & Relevant Question Set for BPCL (with Options)

1. What type of plastic waste is most commonly generated in BPCL's operational environment?

- ☐ PET bottles
- ☐ Packaging films / wrappers
- ☐ Industrial plastic scraps
- ☐ Mixed plastics from workers' usage
- ☐ Others: _____

---

2. Where does BPCL face the most difficulty in managing plastic waste?

- ☐ Factory premises / internal yards
- ☐ Loading–unloading zones
- ☐ Surrounding community areas
- ☐ Drainage and open spaces
- ☐ We do not face major problems

---

3. In your opinion, which function of an autonomous waste collector would be most valuable for BPCL?

- ☐ Automated detection of plastic
- ☐ Autonomous collection in open areas
- ☐ Real-time reporting of waste amount
- ☐ Solar-powered operation to reduce energy use
- ☐ None of these are relevant

---

4. Would BPCL find value in deploying such a robot for CSR/community cleanup programs?

- ☐ Yes, high relevance

- ☐ Possibly, depending on cost
- ☐ Relevant only for public spaces, not inside BPCL
- ☐ Not relevant at this moment

---

5. What level of mobility is suitable for BPCL's environment?

- ☐ Flat smooth surfaces only
- ☐ Semi-rough industrial floors
- ☐ Outdoor uneven terrain
- ☐ Mixed terrain (both indoor/outdoor)

---

6. What is the acceptable waste-carrying capacity for such a robot?

- ☐ 2–5 kg
- ☐ 5–10 kg
- ☐ 10–15 kg
- ☐ Above 15 kg
- ☐ Not important for our environment

---

7. What are your primary concerns regarding autonomous robotics inside or around BPCL?

- ☐ Safety
- ☐ Operational reliability
- ☐ Maintenance requirements
- ☐ Cost
- ☐ No major concerns

---

8. How likely is BPCL to allow a small pilot test if the prototype becomes ready?

- ☐ Very likely
- ☐ Likely, with proper permissions
- ☐ Possibly, but only outside main industrial zones
- ☐ Not likely at this moment

---

9. Which feature would make the robot more acceptable for industrial use?

- ☐ Strong build quality
- ☐ Fire/heat resistance
- ☐ Ability to detect specific plastic types
- ☐ Low noise and safe operation
- ☐ Simple maintenance

---

10. How often should the robot operate to match BPCL's waste generation pattern?

- ☐ Once daily
- ☐ Several times a day
- ☐ On-demand only
- ☐ Continuous operation (shift-based)
- ☐ We are not sure

Bonus: A Final Open-Ended Question

What improvement or feature do you think is essential for this robot to be useful for BPCL?
(Short answer)
