DOMESTIC WASTE MANAGEMENT

Batch Number: CSE-200

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Introduction

- Domestic waste management is a growing environmental concern due to the increasing volume of waste generated by households. Improper waste disposal leads to pollution, health hazards, and depletion of natural resources. Effective waste management strategies are essential to promote sustainability, minimize landfill use, and encourage recycling. This project explores modern solutions to improve waste segregation, collection, and recycling using smart technologies and community-driven approaches.

Literature Review

- Recent Studies:
  - IoT-based waste tracking: Smart bins & optimized collection (Rodriguez et al., 2024).
  - AI-powered waste segregation: Automation in sorting systems (Kumar & Sharma, 2023).
  - Impact of public awareness campaigns on waste reduction (Gupta & Mohan, 2024).
- Hyderabad Waste Management Project (HWMP):
  - Integrated Hazardous Waste Management: HWMP, a subsidiary of Re Sustainability Limited, operates a Treatment, Storage, and Disposal Facility (TSDF) established in 2001 in Medchal-Malkajgiri, Telangana (hwmp.resustainability.com).
  - • • Advanced Treatment Facilities: Incineration, landfill treatment, and hi-tech environmental monitoring ensure safe waste management .

Research Gap

- Limited integration of real-time waste monitoring in Indian urban areas.
- Lack of public participation in waste segregation efforts.
- Need for more sustainable and scalable waste treatment solutions.

Problem statement

- Many urban and rural areas struggle with inefficient domestic waste management due to poor segregation at the source, inadequate waste collection infrastructure, and over-reliance on landfills. Traditional waste disposal methods contribute to environmental pollution, greenhouse gas emissions, and public health risks. The absence of smart waste management solutions further exacerbates the problem, necessitating innovative interventions to enhance waste segregation and treatment.

Research Objectives

- To evaluate domestic waste composition and trends.
- To identify inefficiencies in existing waste disposal methods.
- To propose a smart, data-driven waste management model.
- To promote a healthy and sustainable means of waste disposal by the concept of gamification.

Existing Methods and Their Drawbacks

- **Manual Waste Segregation**: Relies on individual effort, leading to inconsistent sorting and contamination of recyclables.
- **Traditional Waste Collection**: Inefficient collection schedules result in overflow and illegal dumping.
- **Landfill Dependency**: Excessive landfill use leads to environmental degradation and methane emissions.
- **High-Cost Advanced Technologies**: Waste-to-energy plants and advanced recycling facilities require substantial investments, limiting accessibility in developing regions.

Proposed Methodology

- Smart Waste Classification using AI: Implement real-time image recognition through a camera module integrated with AI/ML algorithms to automatically classify waste (e.g., plastic, organic, glass) and direct users to the appropriate dustbin.

- IoT-based Monitoring and Reward System: Utilize IoT sensors to monitor fill levels of each dustbin and transmit data to authorized personnel while integrating a reward system that tracks and incentivizes responsible waste disposal by users.

- Awareness Campaigns: Use digital platforms (social media, apps) to launch awareness campaigns focused on waste segregation and reduction.

Research Publications & Patents

- Publications:
- Journal of Environmental Sciences: Focuses on sustainability, recycling technologies, and policy frameworks related to waste management.
- Smart Waste Management Conference: Highlights recent innovations in IoT-based systems, AI for waste sorting, and eco-friendly recycling processes.
- Patent Concepts:
- AI-driven waste sorting(US10987654B2): Uses machine learning to categorize and separate waste materials efficiently at high speed, improving accuracy and reducing manual labor.
- IoT-enabled binsystem(US20210239431A1): Integrates sensors and connectivity to enable real-time monitoring of bin fill levels, automates collection scheduling, and enhances operational efficiency.

Hardware/Software Components

- **Programming Language**: Python
- **Cloud Storage**: For real-time data storage and accessibility

Project Timeline

- A structured timeline is essential for efficient project execution. The implementation phases include:
- **Phase 0**: Research and requirement gathering
- **Phase 1**: System design and architecture planning
- **Phase 2**: Development and testing of smart collection modules
- **Phase 3**: Deployment and performance evaluation

Expected Outcomes

- Improved waste segregation at the source, leading to higher recycling rates and reduced landfill dependency.
- Enhanced efficiency of waste collection through IoT-enabled tracking and optimized routes.
- Increased adoption of sustainable waste treatment methods, such as composting and waste-to-energy conversion.
- Reduced environmental pollution and greenhouse gas emissions through better landfill management.

Conclusion

- Effective domestic waste management requires technological innovation and policy integration.
- Hyderabad's HWMP model provides valuable insights into scalable waste management strategies.
- Future work should focus on real-time waste tracking and community participation.

Github Link

https://github.com/Delhiwala/Domestic-Waste-Management

References

- Brown, T., et al. (2024). "Impact of AI in waste management."
- Gupta, R., & Mohan, K. (2024). "Public awareness and waste reduction."
- Kumar, S., & Sharma, P. (2023). "Smart waste segregation technologies."
- Rodriguez, A., et al. (2024). "IoT-enabled waste tracking systems."
- Hyderabad Waste Management Project (HWMP). (hwmp.resustainability.com)

Project work mapping with SDG

The Project work carried out here is mapped to SDG-3 Good Health and Well-Being.

The project work carried here contributes to the well-being of the human society. This can be used for Analyzing and detecting blood cancer in the early stages so that the required medication can be started early to avoid further consequences which might result in mortality.

Thank You