Waste management and Recycling
through AI Power Environmental Monitoring

A Mini Project Report

In Partial Fulfilment of the Requirement for Award of Degree of

Bachelor of Technology of the 2nd Year in Chemical Engineering

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CERTIFICATE

Certified that the Mini Project Report entitled ***"Waste Management & Recycling through AI Power Environmental Monitoring"*** submitted by **Vivek Kumar Sahu** of B.Tech. 4th Semester, in partial fulfilment of the requirements for the award of degree in Bachelor of Technology (B. Tech) in Chemical Engineering, is according to the students their own investigation carried out by them in the Department of Chemical Engineering, School of Studies of Engineering & Technology, GGV, during the session 2024-25.

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1. Abstract

In the past few years, the global waste crisis has become even more serious and urgent due to continued population growth, rapid urbanization, and unsustainable patterns of consumption. The challenges posed by large volumes and ever-increasing types of waste available, along with the limitations of current waste management systems, pose serious dangers to the environment, human health, and economies alike. Artificial Intelligence (AI) offers both significant potential for addressing these challenges through real-time monitoring, primary analytics, and automated processes for waste management and recycling. This paper highlights advances in AI systems, with attention to AI applications in environmental monitoring, emphasizing the coupling of AI with IoT sensors, blockchain technology, along with big data analytics as strategies for waste management. Further, this paper compares different types of recycling technology and situates the advancements AI offers against these technologies. Even with the significant advancements AI offers there are challenges to implementation in regards to costs, data privacy, technical skill gaps, and AI production issues, this paper discusses the challenges to implementation going forward. Finally, the paper discusses potential directions for the future including explainable, AI integration of smart cities for waste management and potential policy support for AI-based solutions for waste.

Keywords: Artificial Intelligence, Smart Waste Management, IoT Sensors, Predictive Analytics, Waste Recycling Technologies, Environmental Monitoring, Waste-to-Energy, Circular Economy, Blockchain in Waste Management, Smart Cities.

2. Introduction

Waste production has emerged as a major environmental dilemma today, with global output surpassing 2.24 billion metric tons every year… projected to reach 3.4 billion tons by 2050, as recorded by the World Bank (Kumar et al, 2022). A lot of this is due to popular growth, industrialisation, and urban development. For example, disposing of waste improperly leads to