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Smart Cities: Integrating IoT in Urban Waste Management

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Abstract

The progressive increase in population, industrialization, and consumerism are some of the factors that have contributed to the recent rise in waste generation. Proper management of urban solid waste constitutes a key sustainability challenge, being necessary to avoid landfill disposal. But waste management has also associated impacts: environmental, economic, social, and health. Furthermore, a city without a sanitation system for wastewater is inconceivable in the most developed countries. However, the odorous impact of those facilities is a source of frequent complaints and protests in nearby residential areas. Such pollution often results from the presence of Volatile Organic Compounds (VOCs) and other nitrogenous or sulfurous compounds, some of which have very low olfactory thresholds. Thus, it is essential waste management, resource use, and the most impactful production processes to promote the concept of sustainable cities aligned with social well-being. The objective of this research is the evaluation of an innovative gas detection system to detect and control odor emissions from urban waste collection and treatment. Specifically, the prototype is being optimized for implementation in urban waste containers (the emission sources), with the aim of creating an intelligent alarm system that triggers early collection when unpleasant emission thresholds are exceeded. Complementary studies focus on implementing the sensorized system in urban solid waste management plants, where the odorous impact is generally significant (e.g., composting facilities). The prototype activates misting absorption devices in response to odor peaks, markedly reducing the odorous impact. From a holistic point of view, the applicability of the prototype is also being evaluated in the most critical areas of urban wastewater treatment plants, particularly in those facilities where the generation of abundant and smelly sewage sludge is significant. Such digital technologies and innovative infrastructures might allow improving quality of life and promoting the development of “Smart Cities”.

Keywords: Odor, Sensorization, Sewage Sludge, Sustainability, Wastewater