Internet of Things-Assisted Vehicle Route Optimization for Municipal Solid Waste Collection

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Abstract: The efficient collection of municipal solid waste poses a significant challenge for the prospective development of smart cities. Using Internet of Things (IoT) technology enables the detection of various kinds of waste-related information, facilitating the implementation of a comprehensive plan for efficient waste collection. In this paper, an innovative waste collection mechanism leveraging the IoT sensors and widely recognized Technique for Order of Preference by Similarity to Ideal Solution

(TOPSIS), a robust multi-criteria decision analysis method is introduced. Recognized for its ability to yield optimal solutions amidst multiple influencing parameters, TOPSIS proves particularly advantageous when confronted with diverse factors affecting decision making. A TOPSIS-based algorithm for optimal route selection is developed to collect waste using metrics such as toxicity, volume, and time duration of the waste while minimizing the route distance. To demonstrate the efficiency of our proposed algorithm, a comparative analysis with existing algorithms that are dependent on and optimized for single parameters is conducted. Through rigorous evaluation, it is shown that our proposed algorithm reduces the total distance traveled to collect the waste from all the bins by 14% by effectively considering multiple criteria and optimizing waste collection routes.