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Certain Investigations Into Smart Waste Management Using IOT

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Abstract: *The aim of this paper is to present a study on smart waste management that uses Internet of Things (IoTs) and big data analytics. This paper considered issues and challenges in smart city applications. The objective of this study is to analyze the problems in computer-based waste management systems and find out possible areas where solutions are required to overcome the drawbacks in web based waste management system.*

Keywords: *Smart waste, big data, task scheduling, data analytics, environment monitoring.*

I. Introduction

Recent developments in Internet and Web technologies have changed the way of managing smart waste in urban areas. The major challenges in waste management systems include changing environment and resource utilization. For most of the cities, the problems such as traffic, water, data communication, environment monitoring, power usage, and health monitoring are to be addressed to provide on-demand services to the needy. Even though these problems are common in cities, the waste collection is a primary task that requires timely service to the people. Otherwise, it may lead to severe health issues to the common citizens. The waste collection task becomes little more complicated because different people require different preferences based on time, type of waste, etc.

Data analytics in this perspective allow understanding of the major causes to analyze the situations and associated problems to identify the remedial measures while dealing with growing large amounts of waste in cities. The aim of this paper is to analyze the methods for addressing the problems in waste management. In this survey, we investigate the efficiency issues and difficulties in collecting waste across cities.

II. Literature Review

This section presents a brief description of existing works related to smart waste collection and management. The methods and techniques that have been proposed in the recent past are being analyzed to deal with efficiency, real-time data collection, and costs. The process of identifying spatial patterns, the mapping of vehicles, and computation of efficiency index has been investigated in [1]. In this process, geo-coded addresses of datasets are being mapped to zip codes. Further, the weight of waste bins for all the zip codes are being collected to improve analysis.

Furthermore, the challenges in solid waste management are described in [2]. And, the feasibility of communication between data collection systems, vehicle operators, and central administrator has been investigated in [3]. This work has suggested using volumetric sensors, RFID, and GPRS communication to send information on the current status of the fill levels of bins. The way of optimizing the routes focused on skipping the unwanted travels when waste bins did not reach a certain threshold.

Since the software components are designed to provide services to the end users, cloud based system has been developed by Authors in [4]. It has focused on development of SaaS services to the waste collection companies only. In another paper, a sensing supported service model using IoT has been presented [5]. The metaheuristics proposed in [6] addressed the vehicle routing problem in waste management. This invention has considered time windows, driver rest period and various disposal facilities.

Furthermore, a GIS based transportation model has been presented in [7]. This paper focused on solid waste disposal. And the authors have presented a case study on Asansol municipality. One of the key technologies to improve the necessary services to the peoples is big data analytics. In this perspective, the applications of big data to smart cities have been discussed in [8]. In big data analysis, data mining plays a

major role. The application of data mining technique presented in [9] shows how it can be used with big data. The following sections are presented with inference from literature followed by concluding remarks.

III. Inference From Existing Works On Smart Waste Management

The cost efficiency of waste collection and management depends upon the number of vehicles, number of employees, collection frequency, agencies, and fractions of collection. The correlation of factors that affects the cost efficiency can be related to the service required and the costs associated with each collection. The data analytical model indicates the influence of various parameters on the cost efficiency.

Initially, the Google Maps API is used to process all addresses to generate a list of location specific coordinates. Analyzing the resources available at a particular point of time, the municipality can decide on the services required skipping unimportant travelling routes. This data analysis involves aggregation of waste for each zip code considering all types of waste. The waste map indicates where there are higher waste densities. In this case, the Jenks natural intervals algorithm [10] is selected to define the breaking time between the different classes. The aim is to achieve less variation on data within the classes. The Figure 1 shows the overall system architecture.

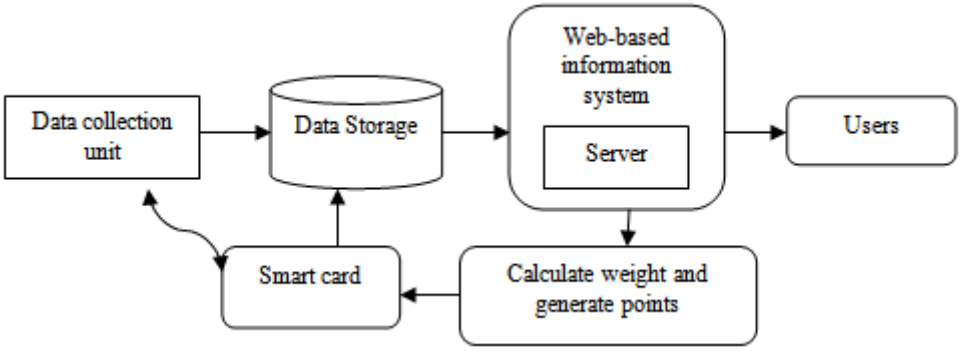

Figure 1 Architectural model of smart waste management system

Further investigations into the traditional methods show that the adaptive neighborhood search algorithm in combination with a clustering method can be utilized to reduce the distance cost and will be able to save time required for waste collection.

3.1 SmartBin

In this method, the system attempts to identify the fullness of waste bin by performing data collection and delivery of data using wireless mesh network. This system employed duty cycle technique to reduce power consumption and maximizes operational time. This method aimed to obtain bin utilization information and seasonality information. This can help providers make better decision to increase productivity.

3.2 Smart Recylce Bin

In this conceptual approach, Radio Frequency Identification (RFID) is utilized to perform pervasive computing for improving smart waste management. Based on information in the smart card, the system automatically calculates the weight of waste and converts the weight into point and then it is stored into the smart card.

The wastes are tracked using RFID system, then, it is integrated with the web-based information system at the host server. In this approach, the user gets the assistance in classification of material wastes. Another benefit is, the smart bin knows actual content and status is reported to the recycling unit.

IV. Conclusion

This study has presented the methods and drawbacks associated with the existing smart waste management systems. It focuses on developing efficient solutions to address some of the challenges in these systems. This analysis enables understanding of a shared task scheduling and the use of geo-temporal patterns to improve waste collection mechanism. Also, the applications of big data analytics in this direction have been considered in this survey.

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