Review on Challenges and Needs of Real-time Waste Transportation Tracking and Monitoring System for Sustainable Environment

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ABSTRACT-

India is a developing country so there is rapid growth in the rate of urbanization due to this reason there is a requirement for sustainable urban development plans for every municipal corporation. India faces lots of environmental challenges related to waste management. Waste management includes lots of activities and actions needed to manage waste from its waste generation to its final step that is waste disposal.

In waste management, there is waste transportation is one of the most important aspects. Transforming developing to a developed country is very beneficial to all peoples living in the country; it will increase living status, mobility, lifestyle, and housing as well as a sat economy of the country. Indian Government taking lots of initiatives for making cities smart. So in waste management, waste transportation plays a very important role in keeping cities clean. How to collect waste in a well-organized manner to reduce ineffective transportation resource management is a very important factor for every municipal corporation. This research paper analyses major contributions to waste transportation management in literature. This paper attempts to provide a roadmap for researching the field of waste transportation management using information and communication technology. This paper reviews the barriers, challenges, and opportunities associated with improving waste transportation management.

Keywords: **Waste transportation management, waste transportation, Waste management literature review**

I. INTRODUCTION

India is the second-fastest-growing economy and therefore the second most populated country within the world. The population of India is expected to increase from 1029 million to 1400 million during the period 2001–2028, an increase of 42% in 26 at the rate of 5.2% annually About 852 million people live in rural areas, and 325 million live in urban areas. The level of urbanization of the country has increased from 26.5% to 38% in the last 50-60 years and is expected to rise to 44% by the year 2026. An important feature of India's urbanization is the phenomenal concentration of the population in Class I cities1 (metropolitan cities), urban agglomerations/cities having a population of more than 1 million, as depicted by the increase in the number of metropolitans from 23 to 35 in the last decade(Sharma, S. et al. 2005)

Municipal solid waste management is a highly challenging issue. Solid waste management has the scope to create a specialized technical solution to move towards the economical advancement of a country. Waste management is more than waste collection. Solid waste management includes lots of activities and actions from the point of solid waste to final disposal. So, the activities included in solid waste management are waste collection, waste transportation, waste segregation & processing, and waste disposal (Ashish R. Mishra, et al. 2014).

With the ever-increasing migration, urbanization, population, and change in lifestyle solid waste generation levels are increasing constantly. Hence, solid waste management becomes a big challenge that is faced by not only developing nations but also developed and advanced nations. Waste management involves three main types of entities: 1) User who generates waste, 2) waste collectors/city admin, 3) Stakeholders (Dr. M. Newlin Rajkumar, et al. 2017). Solid waste management is a big challenge for urban local bodies. According to Municipal Solid Waste Management and Handling Rules of 2000 in India, waste collection and dumping or processing is the responsibility of the Municipal Corporations. But unfortunately, local bodies have not paid enough attention to solid waste management. So, one of the most important functional elements of solid waste management is waste transportation. Waste transportation required route optimization. Route optimization means for waste transportation required to find the shortest route so it will lead to cutting the cost of waste transportation.

II.   SOLID WASTE MANAGEMENT

The MoEF(Ministry of Environment and Forests) issued MSW (Management and Handling) Rules 2000 to ensure proper waste management in India and newly updated draft rules have recently been published (MoEF, 2015). Urban local bodies are responsible for implementing these rules and developing infrastructure and providing facilities for collection, storage, segregation, transportation, processing, and disposal of MSW. The collection and transportation process alone accounts for approximately 60%-80% of the total cost for solid waste management (J.Belien et al. 2011). To reduce waste transportation costs need to be a technical solution. Even there is lots of technical solution available but there is scope to develop a new solution according to requirement, geographical location, etc.

III.   BARRIERS TO IMPROVING WASTE TRANSPORTATION MANAGEMENT

The current status of solid waste management in India is very poor because authorities from Municipal Corporation are not paid attention to making the best and most appropriate strategies for waste collection to disposal.

The following discussion includes findings from case studies, reports, and research papers. The result presents the most frequently cited issues (Nachalida Yukalang, et. al. 2017)

1. **Organizational barriers**

Organizational barriers include problems for the local authorities such as lack of strategic direction, planning, and management (including lack of training) and the communication gap between municipal stakeholders, local authorities, staff, and the community, etc.

2. **Socio and cultural barriers**

Community involvement and awareness are directly connected to the SWM. Socio and cultural barriers in Waste Management include all social and cultural factors which are Lack of community participation in all SWM activities, lack of cooperation, Lack of community concern for waste management, Negative Attitude, communication gap, etc.

3. **Financial Barriers**

To develop a one-shot integrated solution for Solid Waste Management financial factor is very important. Financial barriers of SWM include Insufficient Funding, Problems of waste management fee collection, considering waste has no value, etc.

4. **Technical Barriers**

The integrated solution of the Solid waste management system allows the citizens to dispose of their waste properly. Technical barriers of Solid waste management included insufficient infrastructure, not deciding collecting points properly to reduce fuel consumption, irregular waste collection, Waste collection transportation not monitoring effectively, Inadequate waste collection vehicles, space limitation, etc.

So, to reduce all the barriers there is scope to develop the integrated solution as per the requirement of the Municipal Corporation and the geographic situation of the area of that municipal corporation. One of the most important things from all the activities of MSWM is transportation tracking and monitoring. SWM transportation and management required lots of funds so, there is a need to develop SWM transportation and monitoring systems for Municipal corporations.

IV.   CURRENT SCENARIO IN WASTE TRANSPORTATION TRACKING AND MONITORING MANAGEMENT

Khanh Nguyen et. al(2017) in their research article titled "Optimization of municipal solid waste transportation by integrating GIS analysis, equation-based, and agent-based model", the author stated that Municipal solid waste (MSW) has been rapidly increasing from last decade and in most of the urban areas, waste disposal site is usually located outside the urban areas due to health issues of citizens. So, the transportation cost of waste has been increased. Currently, waste collection and transportation are already overloaded due to a lack of facilities, insufficient resources, no route fixed for waste transportation, etc. The

researcher proposed a model for optimizing MSW collection. In that model firstly the optimized plan is developed in a static context, and then it is integrated into a dynamic context using multi-agent-based modeling and replication. In their research paper researcher also include a Case study related to Hagiang City, Vietnam, the result, it has been found that the cost of MSW collection reduced by 11.3%

Alhassan Sulemana et al.(2018) in their article "Optimal Routing of Solid Waste Collection Trucks: A Review of Methods", the author took a review on the effect of optimization method for collection of solid waste with using mathematical programming and geographic information on system approach in developing countries. Technological approach increase operational efficiency which is served as a decision support tool.

Unfortunately, many developing countries struggle with solid waste collection and transportation management mainly due to the following reasons.

1. Inadequate Finance
2. Lack of Political Will, Priority, and Commitment
3. Poor Operational Scheduling and Vehicular Routing
4. Poor Road Network and Development Planning
5. Inadequate Technical Expertise/Factors.

Gourav Suthar et al. (2017) depicts within the frame of paper some gaps in managing the solid waste such as the inefficient collection of waste, door-to-door collection not being done, and due to poor waste, inadequate collection, and transportation, it leads to inappropriate MSWM.

Kumar S. (2009), in their research author, found that in India, about 25 percent of MSW is not collected and due to inadequate transport capacity in 70 percent of the Indian cities. The unavailability of landfills to dispose of sanitary waste makes the situation worst. The current functional landfill sites are either well prepared or properly managed. Along with this, there is no liner at the landfill sites which lets the impurities contaminate groundwater and soil.

Onam Sahu(2014) in his article titled "Review on Solid Waste Management Practice in India: A State of Art" concludes that India is a developing country and required proper waste management but due to lack of awareness regarding SWM, political issues, lack of attention towards the duties which assign to the sanitary inspectors also other government officers, etc waste management not properly done. As compared to other countries India is not able to cope up with waste management. In India there is a strong case of private sector participation in this area and the private sector can come with its expertise, technology, and capital, improved and efficiently managed service. Public participation has vital importance and can provide big results if sought properly.

V.   CONCLUSION

This Literature review found that it has essential requirement of technological integrated solid waste management system for every municipal corporation in order to reduce some obstacles that are difficulty in monitoring whether the assigned route is visited or not by a particular vehicle for waste collection, difficulty in ensuring that whether the vehicle has visited routes/societies at the specified time or not ,no supervision in counting no. of trips between collections places to disposal place it leads to increasing cost So, real-time tracking of the vehicle is very important, difficulty in supervising complete movements of vehicle like- over speed, excess stoppage time, ineffective transport resource management, no proper routes for vehicles transporting waste from residential, commercial and industrial customers to transfer stations and from transfer stations to landfills, waste transportation digital data bank is not available which is requiring monitoring and taking future decision regarding waste transportation, it has been observed that there is need to improve the system of transportation of waste for quick and useful decisions regarding of administration and planning for a sustainable urban environment.

An effective Solid Waste Management system aims to minimize manual handling and 100 % collection & transportation of solid wastes should be achieved.

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