MUNICIPAL SOLID WASTE MANAGEMENT STUDY BY USING GIS IN MEDCHAL DISTRICT, TELANGANA

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ABSTRACT

Identifying municipal solid waste management (MSW) discarding sites and aptly managing them is a not easy task to many developing countries like India. It is a difficult issue in an urban area as mounting population level, rapid economic augmentation and rise in community living standard, accelerates the production rate of municipal solid waste. The study area of medchal district of Telangana state has population of 36,123 members.

According to our survey they are 23 wards in Medchal distrct of Telangana state, where each ward has minimum 1,515 members living. Our study was focused for identifying accurate waste dumping place and to prevent pollution. Geografical Information System (GIS) was used to recommend an well-organized scenario with relocating the existing waste collecting containers and another scenario was proposed with number of containers (55) to accomplish about 92.22% waste collection efficiency including optimization and selection of waste collecting routes for the study area.

KEYWORDS: Geographical Information system, route optimization, Waste collecting routes, Waste collecting containers.

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1. INTRODUCTION

Municipal solid waste (MSW)

The term municipal solid waste is generally used to describe most of the non-hazardous solid waste from city, town or village that requires routine collection and transport to a processing or disposal site, sources of MSW include private homes, commercial establishments and institutions, as well as industrial facilities. However, MSW does not include wastes from industrial processes, construction and demolition debris, sewage sludge, mining waste or agriculture wastes. MSW is also called as trash or garbage. In general, domestic waste and MSW are used as synonyms. Municipals solid waste contains a wide variety of materials.

It can contain food waste(like vegetable and meat materials, leftover food, eggshells etc., which is classified as wet garbage as well as paper, plastic, tetra pack, plastic cans, newspaper, glass bottles, cardboard boxes, aluminum foil, meta items, wood pieces, etc., which is classified as dry garbage. India's urban population slated to increase from the current 330 million to about 600 million by 2030, the challenge of managing municipal solid waste (MSW) in an environmentally and economically sustainable manner is bound to assume gigantic proportions.

The country has over 5,000 cities and towns, which generate about 40 million tons of MSW per year today. Going by estimates of the Energy Research Institute (TERI), this could well touch 260 million tons per year by 2047. The municipal solid waste industry has four components: recycling composing, land-filling, and waste to energy via incineration. The primal steps are generation, collection, sorting and separation, transfer and disposal. Waste generation encompasses activates in which materials are identified as no longer being of value and are either thrown out or gathered together for disposal.

The functional element of collection includes not only the gathering of solid waste and recyclable materials, but also the transport of these materials, after collection be materials, after collection, to the location where the collection vehicle is emptied.

The role of GIS for sustainable waste management

Geographic Information Systems (GIS) are one of the most sophisticated modern technologies to capture, store, manipulate, analyses and display spatial data. These data are usually organized into thematic layers in the form of digital maps. The combined use of GIS with advanced related technologies (e.g., Global Positioning System – GPS and Remote

Sensing - RS) assists in the recording of spatial data and the direct use of these data for analysis and cartographic representation. GIS have been successfully used in a wide variety of applications, such as urban utilities planning, transportation, natural resources protection and management, health sciences, forestry, geology, natural disasters prevention and relief.

2. RESEARCH METHOD

Study of Medchal area

- Geographically, the study area is located latitudes 17.5392° N and 78.4327° E longitudes (Figure 1). The study area is in Medchal- Malkjgiri district which is Ranga Reddy, Telangana state. The total area of the study area is 1,084 sq. km with 25,42,203 no. of population. The area is mainly a residential area and the solid waste mainly generated from domestic uses like; food and vegetables waste, waste paper, plastic, poly bags, metals, glass and wooden materials. Table 1 shows Solid Waste Composition of the study are
- Most of the solid waste in the survey area is dumped from last 30 to 40 days. The most of the dump is plastic and all the food materials where thrown away as shown in Figure 1 and 2.
- The study area of Medchal district of Telangana state had total population of 36,128 members (including voters and non voters).
- The total number of wards in medchal area according to our survey is 23.
- According to our survey they are minimum 1515 members living in each ward.
- In many wards dustbins are not provided properly. In few places dustbins are provided in unwanted places where public is not there.
- Most of the places where not cleaned properly. Due to no proper dustbins, solid waste is thrown in the coridors of the roads n that is forming as dumping yard.

Figure 1. ***Solid waste in ward 1***

Figure 2. ***Waste behind buildings***

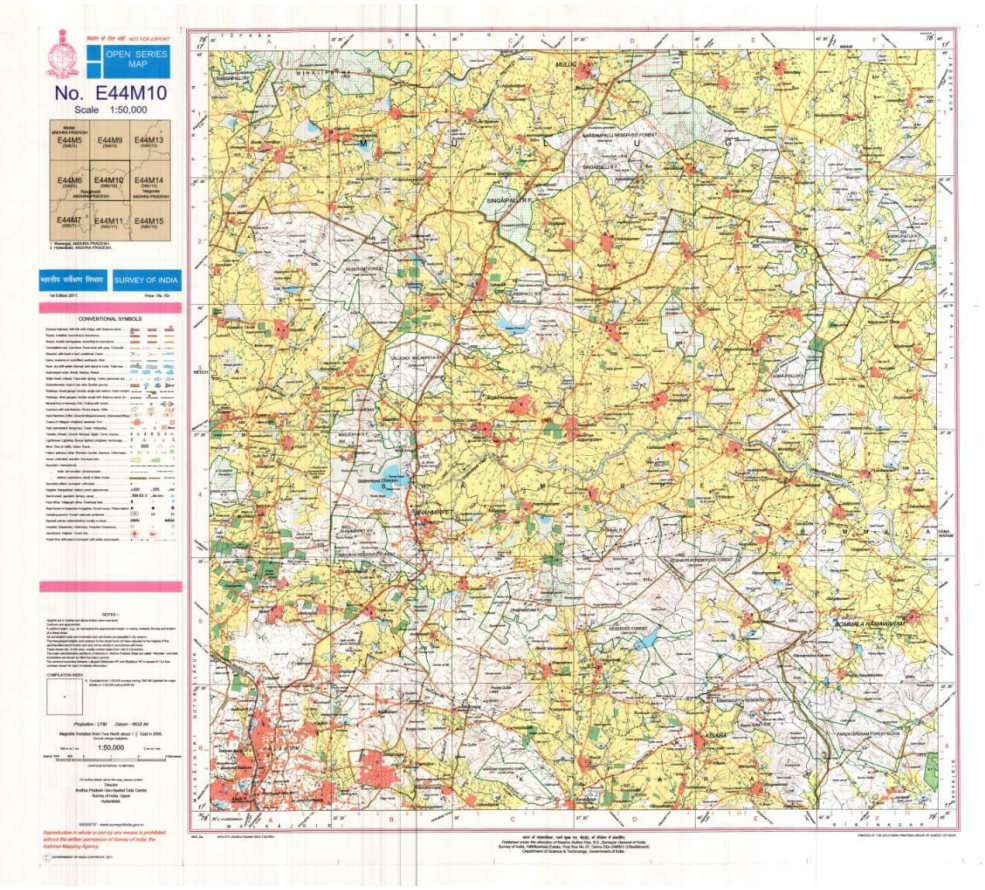

Figure 3. *Toposheet of Medchal (No. E44M6 & No. E44M10)*

Medchal has 2 toposheets (No. E44M6, No. E44M10), shown in Figure 3. Medchal map highlights the national highway, Major roads, District headquarters etc. This map is used for finding the road way for dumping yards.

Solid Waste Composition of the study area

Table 1. *Percentage of solid waste compostion*

S. No.	Waste composition	Percentage by weight
1	Food wastes	82
2	Paper	6.5
3	Plastic and polythene	3.5
4	Wood and leaves	3
5	Glass and ceramics	0.4
6	others	4.6

Global Positioning System

The study used both primary and secondary data. The information of different types and forms has converted into the GIS database. GIS software with its network analyst extension was used to recommend waste bins location, optimization of the route and for the preparation of final maps. Figure 4 shows flow chart of experimemntal work that was carried. Table 2 shows the latitude and longitude of different wards in Medchal area.

Table 2. *Latitudes and longitudes of Medchal*

S. No.	Ward No.	Ward Name	Latitude	Longitude
1	14	Housing board colony	17.6331613	78.4832405
2	21	kistapur	17.6330857	78.4833096
3	20	Pochamma temple	17.6326841	78.415986
4	4	Chandra nagar colony	17.6394698	78.467941
5	5	Uma nagar	17.6367463	78.4860759
6	22	Railway colony	17.6557348	78.4744383

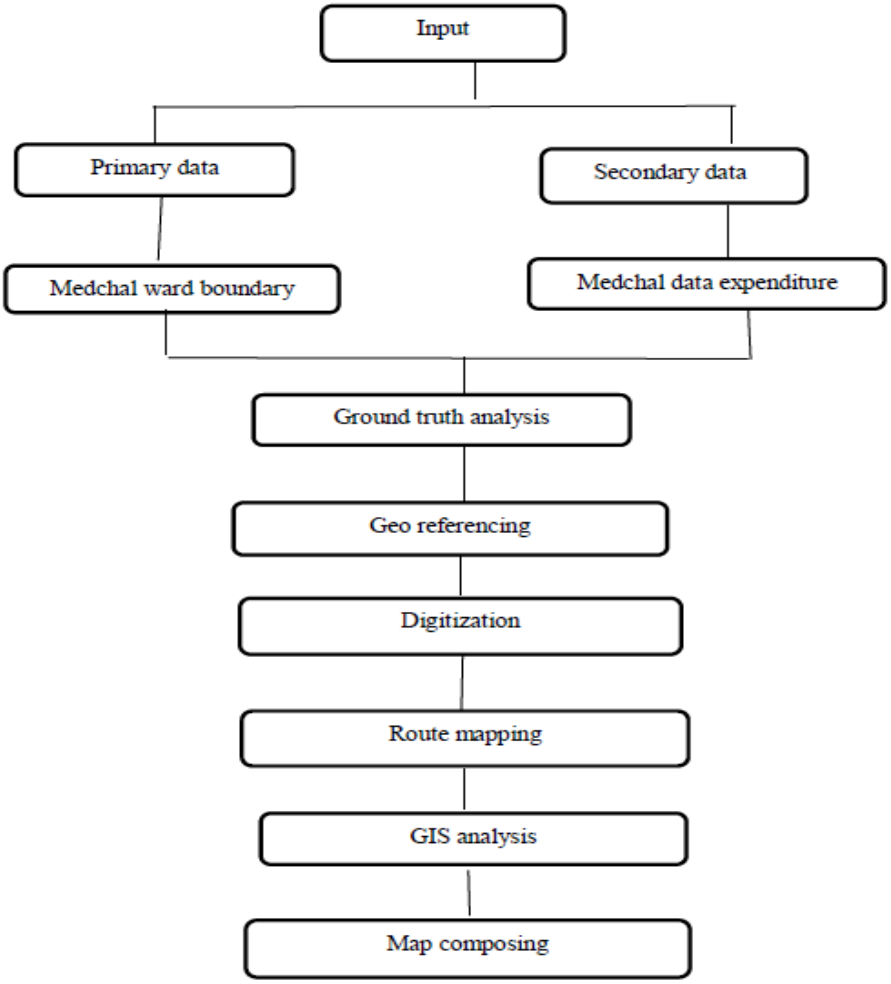

Figure 4. *Flow chart of experimental work*

3. RESULTS AND ANALYSIS

Geo-referencing map of proposed bins

After the study of Medchal area we proposed few bins where there is essential of it. The following map (Figure 5) contains

- Proposed bins
- Dump yards
- Illegal bins
- Buildings
- Boundary

Which is obtained by using quantum GIS.

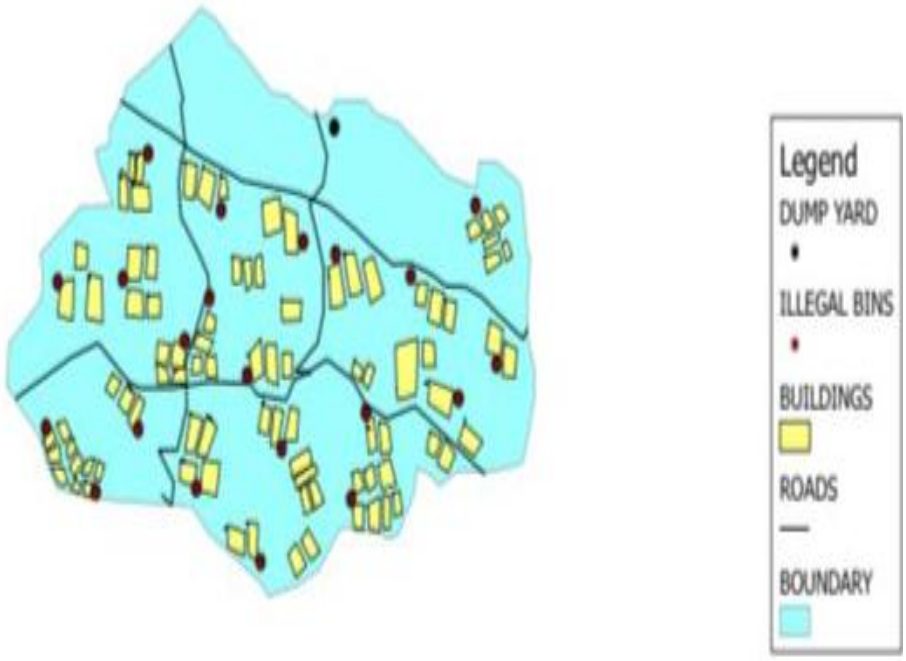

Figure 5. *Geo Referencing Map of Proposed Bin*

Waste collecting route optimization

Using GIS, solid waste collectors can solve fundamental problems in solid waste management such as determining the distribution of waste generation in an area and the optimal route for disposal. This can be achieved by considering factors that affect selection of disposal sites such as topography, geology, road network, land use, water bodies and settlements. The waste containers locations were modified with analyzing route optimization and concerning final disposal site of wastes as shown in Figure 6. The collection time would be reduced and the route selection would be more optimum for the final disposal.

Figure 6: *Geo Referencing Map of Proposed Road Networks*

4. CONCLUSIONS

- This study presents the current waste generation, collection and transportation and disposal situation in Medchal. Increased information is required to remedy the public lack of awareness and concern regarding waste issues.
- Waste management system has been established in Medchal, it fails to achieve the greatest degree of recycling and reuse of resources.
- In this study, all the input data required for analysis are generated from three maps sources , which are topographical maps, geological map, land use maps.
- The proposed waste collecting containers relocation were suggested considering the existing number of containers for the collection of 93.68% MSW & optimum route for waste transport facility.

REFERENCES

1. Abbas, I.I., Nai'ya, R. and Arigbede, Y.A. (2011). "Use of remote sensing and GIS in effective and efficient solid management planning: A case study of Samara, Zaria, Nigeria", Res. J. Earth Planet. Stud., Vol. 2, pp. 46-52.
2. Ahmed, A. and Quader, M.A. (2011). "Environmental aspects of solid waste management: A case study of Narayanganj city", ASA Univ. Rev., Vol. 5 (1), pp. 133-143.

3. Anwar, S.M. (2004). “Solid waste management and GIS: A case of Kalabagan area of Dhaka city, Bangladesh”, MSc. Dissertation, Department of Geography, Norwegian University of Science and Technology (NTNU), Trondheim, Norway.
4. Basagaoglu, H., Celenk, E., Miguel A. M. And Usul, N. (1997). “Selection of waste disposal sites using GIS”, J. Am. Water Resource. Assoc., vol. 33(2), pp. 455-464.
5. Chang, N.B, Parvathinathan, G., Breeden, B. J. (2007). Combining GIS with fuzzy multi criteria decision-making for landfill siting in a fast growing urban region. J. Environ. Manage, vol. 1(11), pp. 1-15.
6. Khajuria, A., Matsui, T. and Machimura, T. (2011). GIS application for estimating the current status of municipal solid waste management system: case study of Chandigarh city, India. Our Nature, vol. 9, pp. 26-33.
7. Mohammedshum, A. A., Gebresilassiea, M. A., Rulindaa, C. M., Kahsaya, G. H, Tesfa, M. S (2014). Application of GIS and Remote Sensing in effective solid waste disposal site selection in Wukro town, Tigray, Ethiopia. The Int. Arch. Photogram. Rem. Sens. Spatial Inform. Sci., vol. 2, pp. 115-119.
8. Nishanth, T., Prakash, M.N. and Vijith, H. (2010). Suitable site determination for urban solid waste disposal using GIS and Remote sensing techniques in Kottayam Municipality, India. Int. J. Geomatics Geosci, vol. 1(2), pp. 19- 209.
9. Ramachandra, T. V. and Saira, V. K. (2003). Exploring possibilities of achieving sustainability in solid waste management. Indian J. Environ. Heal, vol. 45(4), pp. 255-64.
10. Sharholy, M., Kafeel Ahmad, K., Mahmood, G. and R.C. Trivedi, R.C. (2008). Municipal solid waste management in Indian cities – A review. Waste Manage. Vol. 28