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Solid Waste Management by using Geographical Information System (GIS) At JDIET Campus

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ABSTRACT: Proper waste management is basic key to Environmental property. A mini review on various aspect of Solid Waste Management (SWM) (suitable landfill site Selection, route optimization and public acceptance) using Geographical Information System (GIS). It is also addressed how GIS can help in optimizing root for collection of solid waste from transfer station to disposal site to reduce the overall cost of solid waste management. Using GIS for solid waste management to overcome the problem of waste management planning easy, efficient and can be implement quickly. This will reduce the waste management Work load to great extent. Solid waste is defined as discipline related to solid generation, collection, storage, transfer, processing and disposal control.

KEYWORDS: Solid Waste Management, Geographical Information System (GIS), solid generation, collection, storage, transfer.

I. INTRODUCTION

1.1 General

In our Jawaharlal Darda Institute of Engineering and Technology Campus there are various types of waste is generated. Firstly, we identify the sources and types of waste generated in college campus such as, food waste, paper, plastic, tree leaves and sanitary napkins, etc. Approximate 71kg/day of waste is generated in college campus. Waste is deposited to the dumping site on the daily basis.

Firstly, we mark the location of the dustbin. Basically, we put 7 numbers of large dustbin on the ground floor which is of size 60 litters of capacity. These 7 numbers of dustbin are provided at each and every department of the college.



Fig 1: large dustbin, capacity 60lit

We provided smaller dustbin which is of size 20 liters are placed in each classroom, laboratories, library, departmental offices and workshops. Placing large dustbins on ground floor and smaller ones on first and second floor can help facilitate waste collection and make it more convenient for the servants. To collect the waste from 1st and 2nd floor and bring it to the ground floor, we can use designated collection points on each floor.

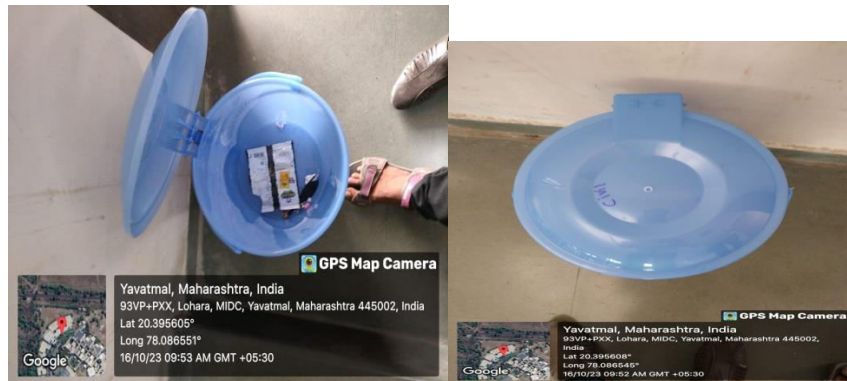


Fig 2: Small dustbin, capacity 26lit

1.1.1 Geographical Information System (GIS)

GIS stands for Geographic Information System. It's a technology that helps manage and analyse geographic data. With GIS, map, visualize, and understand patterns and relationships in data that are tied to specific locations on Earth. It's a powerful tool for various applications, including waste management projects in college campus.

GIS can also help in locating suitable sites for waste disposal or recycling facilities. By analysing factors like proximity to residential areas, transportation routes, and environmental considerations, you can make informed decisions on where to establish these facilities.

GIS is a computer system for capturing, storing, checking, integrating, manipulating, analysing and displaying data related to positions on the Earth's surface. Typically, GIS is used for handling maps of one kind or another. These might be represented as several different layers where each layer holds data about a particular kind of feature. Each feature is linked to a position on the graphical image on a map and a record in an attribute table.

1.1.2 Uses of Geographical Information System (GIS)

GIS, or Geographic Information System, has a wide range of uses in various fields. In the context of waste management in your college campus, here are some specific uses of GIS:

1. Mapping: GIS can help you create detailed maps of your campus, including waste generation sources, recycling facilities, disposal sites, and collection routes. This visual representation allows for better planning and decision-making.

2. Spatial Analysis: GIS allows you to analyse and interpret spatial data related to waste management. You can identify areas with high waste generation, determine optimal collection routes, and assess the proximity of recycling facilities to waste sources.

3. Data Integration: GIS enables you to integrate various types of data, such as waste generation data, campus infrastructure data, and environmental data. This integration provides a comprehensive view of waste management practices and helps in identifying patterns and trends.

4. Planning and Optimization: With GIS, you can optimize waste collection routes, minimizing travel time and fuel consumption. This leads to cost savings and more efficient waste management practices.

5. Environmental Impact Assessment: GIS can be used to assess the environmental impact of waste management activities. By overlaying data on land use, water bodies, and sensitive areas, you can identify potential risks and plan mitigation measures.

II. OBJECTIVES

1. Map out waste generation sources and identify areas with high waste generation.
2. Optimize waste collection route to improve efficiency and reduce costs.
3. Locate suitable sites for waste disposal or recycling facilities.
4. Monitor and track waste management activities to measure progress and identify areas for improvement.
5. Raise awareness and educate the college community about proper waste management practices.
6. Implement sustainable waste management strategies to reduce environmental impact.

III. LITERATURE REVIEW

Locating bins using GIS:

I.A.K.S. Illeperuma, Dr. Lal Samarakoon(2010): The goal of this project is to use GIS to improve solid waste management in Maharagama Urban Council, Sri Lanka. With a 100 m service area, it estimates the number of waste bins required to cover the entire area, and its goal is to find appropriate locations for them. The Maharagama Urban Council, with its 28,000 households, 177,000 residents, and 2.5 kg of waste generated per person, is among the largest in Sri Lanka

Optimizing municipal solid waste collection using GIS:

Christos chalkias, katialasaridi: The article focuses on employing GIS to collect waste in a more effective manner. It entails route optimization, reallocating bins according to predetermined criteria, and building a spatial database. Maps, government data, and GPS are used to create the spatial database. Bins are strategically placed and moved according to building type and population density. ArcGIS Network Analyst GIS software optimizes routing by cutting down on collection time and distance. In addition to outlining the benefits of GIS in waste management, this paper offers a thorough process for enhancing waste collection.

GIS-based locational analysis of collection bins in municipal solid waste management system

Ritesh Vijay Sukumar Devotta, Ajay S Kalamdhad, Apurba Gupta, Ajay Gautam (2008): The use of GIS to improve municipal solid waste management systems is covered in this article. It suggests an algorithm for choosing the best placements for bins based on variables like garbage contribution and collection convenience. By examining accessibility, transit routes, and population density, GIS helps strategically put bins while cutting down on travel times. In order to save travel time, fuel consumption, and emissions, it also optimises collecting routes by taking into account traffic patterns, road conditions, and collection site locations. GIS also aids in determining the appropriate quantity and dimensions of bins for various locations. It helps determine the best locations for waste disposal facilities based on accessibility, surrounding conditions, and the availability of land. Decision-making is improved through the integration and administration of waste management data with GIS. Additionally, it keeps track of waste collection operations for system assessment and enhancement.

A case study on solid waste management in yavatmal city

Abhaychandeker& Roshan umale (Aug 2020): Enhancing and creating successful plans for sustainable waste management in the city requires analysing elements like trash generation, collection, segregation, treatment, and disposal techniques. Reducing, Reusing, and Recycling (or the 3R strategy) can help to streamline trash management. Reducing trash generation, reusing products, and recycling materials can help us greatly lessen our influence on the environment. Recycling efficiency is further increased by proper waste segregation. These simple actions support environmentally friendly waste management techniques.

Management and disposal of solid waste in yavatmal district of Maharashtra district of state of India&howhold unit for waste management unit

Aniket Ravindra Ingole, cheananiiraoyerewar, surajhemantoza, amer raza hafizullah khan rizvee(April 2018): For Yavatmal District to be clean and sustainable, municipal solid waste management and disposal must be done correctly. Educating households on appropriate trash segregation is a crucial part of waste management. Recycling and composting can be substantially aided by encouraging locals to segregate their recyclables, organic waste, and non-recyclables. Encouraging home waste management devices, such as compost bins and biogas plants, can help cut down on waste going to landfills. Recycling and composting are two methods of efficient waste management that include gathering, classifying, and discarding waste to reduce its negative effects on the environment. We can lessen pollution and promote a healthier and cleaner environment in Yavatmal District by implementing these strategies

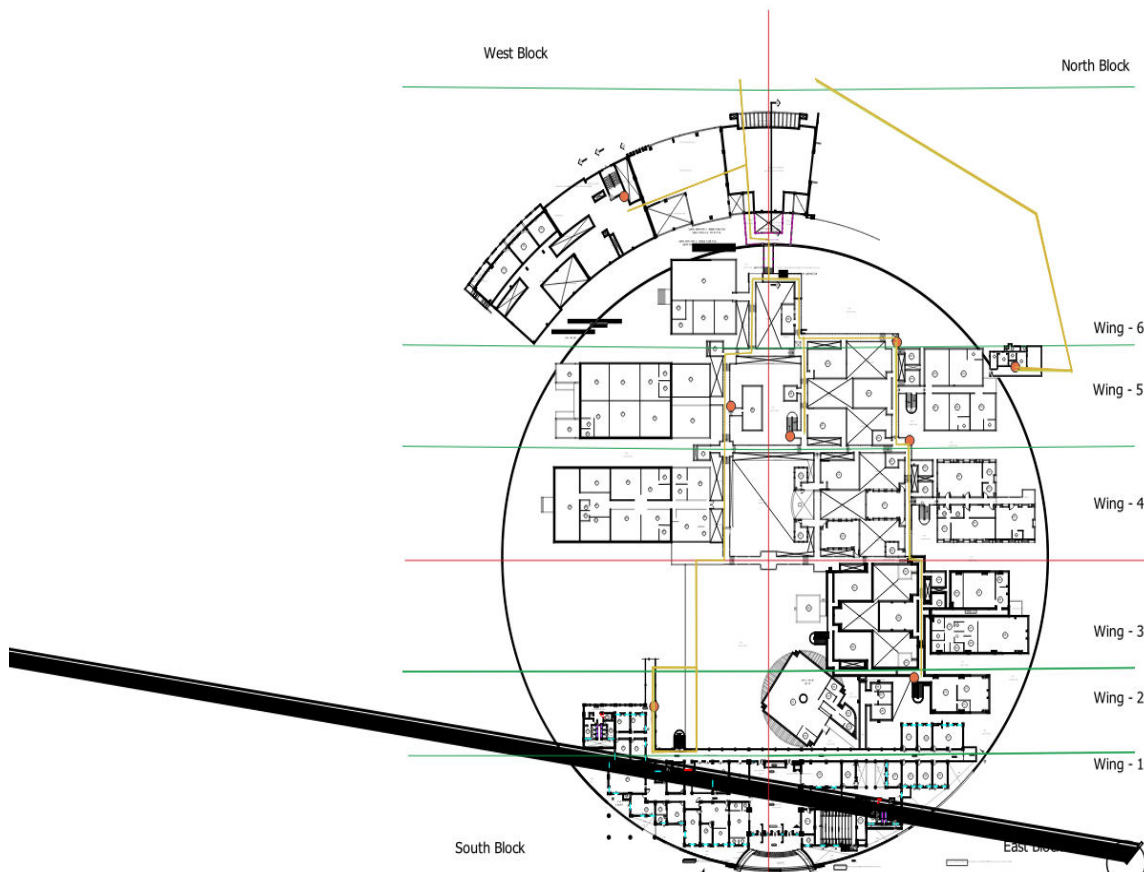
Optimisation of Municipal Solid Waste Management of Indore City using GIS

Mr. Ankit Varma and Prof. B.K Bhonde (2 June 2014): GIS is a useful tool for Indore City's garbage bin allocation optimisation. It builds a geographical database containing information on transportation networks, garbage production, and population density. GIS minimises journey time and expenses by analysing and optimising bin sites depending on a variety of parameters. When alternative solutions are required, it suggests them while taking financial and situational limitations like congested areas and limited lanes into account. All things considered, GIS guarantees effective resource optimisation and waste control in Indore City.

GIS Application for Estimating the Current Status of the municipal solid waste management system in Chandigarh City, India

Anupama khajuria, T. Matsui and T. Machimura (2012): Municipal Solid Waste Management (MSWM) in Chandigarh, India, is covered in the literature study. In order to lessen waste and landfill problems, it emphasises the significance of waste segregation, recycling, and composting. Growing trash volumes and erratic collection are challenges. In addition to highlighting GIS for data management and system enhancement, the publication suggests a waste conversion strategy.

IV. PROPOSED METHODOLOGY



4.1 locations of dustbin using Geographical Information System (GIS)

we put 7 numbers of large dustbin on the ground floor which is of size 60 liters of capacity. These 7 numbers of dustbin are provided at each and every department of the college.

We provided smaller dustbin which is of size 20 liters are placed in each classroom, laboratories, library, departmental offices and workshops. Placing large dustbins on ground floor and smaller ones on first and second floor can help facilitate waste collection and make it more convenient for the servants. To collect the waste from 1st and 2nd floor and bring it to the ground floor, we can use designated collection points on each floor.

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4.1. Steps to manage solid waste effectively are as follows: -

- 1) Generation of waste: - Firstly we identify the sources and types of waste generated in college campus such as, food waste, paper, plastic, etc.



- 2) Collection and transportation: - Establish a systematic collection and transportation system to ensure regular pickup of waste from designated collection points with the help of servants.
- 3) Segregation of waste: - Segregate the waste on site and transfer it to the onsite tank which is situated back side of the college.
- 4) Composting: - Composting of degradable waste to produce nutrient-rich compost that can be used for gardening purpose.
- 5) Disposal: - The non-degradable waste can be transfer to the incinerators for buring the waste.

4.2. Types of solid waste

A) Source and Types of solid waste generated in JDIET

Sr. No.	Source of waste	Type of waste	Waste generated per week Type	Organic	Inorganic
1	Canteen	Food,plastic bottles,food container	50kg/week Approx	Degradable	Non-Degradable
2	Laboratories,offices, classrooms,library etc	Paper,wood	150kg/week Approx	Degradable	
3	Garden	Leaves,tree branches	250kg/week Approx	Degradable	
4	Workshop	Metal	2kg /week 115kg/year Approx		Non-Degradable
5	E-waste	Cable,cds,mouse, keyboard	2 kg/week approx.		Non-Degradable
6	Toilets	Sanitary napkin	12kg/week		Non-Degradable

V. DESIRED OUTCOMES

1. The desired outcome for this project on solid waste management using GIS in JDIET campus is to develop an efficient and sustainable waste management system that utilizes GIS technology to optimize waste collection, collection route disposal sites.
2. The project aims to improve waste management practices, reduce environmental impact, and promote a cleaner and healthier campus environment.
3. Composting is another method where organic waste, like food scraps and yard waste, is decomposed naturally to create nutrient-rich soil. This can be used for gardening and agriculture.

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