Route Optimization Of Solid Waste Management For Ghole Road Dumping Yard , Pune

#1Akolkar Omkar Bharat, #2Chaudhari Chaitanya Santosh, #3Dethe Vedant Rajesh,
#4Gore Atul Uddhav, #5Jadhav Pratik Bharat

1omkarakolkar830@gmail.com
2pratikjadhav102.pj@gmail.com
3chaitanyachaudhari61@gmail.com
4atulgore930@gmail.com
5vedantdethe2@gmail.com

#12345DEPARTMENT OF CIVIL ENGINEERING

TSSM'S
PADMABHUSHAN VASANTDADA PATIL INSTITUTE OF TECHNOLOGY, PUNE.

ABSTRACT

Over the past few decades increasing human population and the associated phenomenon of urbanization and economic development has resulted in the generation of huge quantities of municipal solid waste (MSW). The purpose of Municipal Solid Waste Management is to optimize the route for collection and transportation of municipal solid waste of the Ghole road dumping yard using geo informatics techniques. This will help in efficient management of daily operations for transporting solid waste, managing fuel consumption and generating work schedules for the workers and vehicles for overall cost minimisation. This will eventually help to reduce impact on environment.

ARTICLE INFO

I. INTRODUCTION

Technological development, globalization and population growth have accelerated the dynamics of the urbanization process in developing countries. Daily human activity creates huge amounts of waste, particularly in urban areas. With continuous economic development and an increase in living standards, the demand for goods and services is increasing quickly, resulting in an increase in per capita generation of solid waste. Increasing population levels, booming economy, rapid urbanization and the rise in community living standards have greatly accelerated the municipal solid waste (MSW) generation rate in developing countries like India. The impact of waste on public health has prompted engineers and scientists to explore waste management solutions with more favourable environmental footprints. many Indian cities deficient in infrastructure services like water supply, sewerage and solid waste management. If this situation is not handled in a proper manner within time then it would lead to worse consequences on a global level. There has been development of new technologies for improving the waste management systems. GPS is one of the new technologies which have contributed a lot in very less time span to the waste management society. "The Geographic Information System (GIS) helps to manipulate data in the computer to simulate alternatives and to take the most effective decisions."

Necessity of Solid Waste Management

(a) To control different types of pollution, i.e., air pollution, soil pollution, water pollution etc.;

(b) To stop the spread of infectious diseases.;

(c) To conserve all our environmental resources, including forest, minerals water etc.

(f) To recycling of hazardous wastes for further production.

To implement proper wastes management policy, successful and safe disposal of solid and liquid wastes are very necessary.

In this connection the Government of any country has to follow the steps below:

(i) Collection

(ii) Segregation

(iii) Dumping

(iv) Composting

(v) Drainage

(vi) Treatment of effluents before discharge.

II. PROBLEM STATEMENT

Since the garbage collection system is not well managed in different areas in Pune, people dispose the garbage wherever possible mostly in the drainage or river banks. This has led to huge environmental pollution deteriorating the health of mankind and the other living being. Due to lack of knowledge of disposing the wastages, people trash the garbage in a way they want. We can see garbage all around Pune city including roads, playgrounds, parks and even in hospitals. People throw the garbage without realising that it is affecting their own health and will deteriorate the future generation living standard.

OBJECTIVE
1) The objective of the present study is to review and evaluate the solid waste management practices adopted by the Pune Municipal Corporation.
2) To assess the present Municipal Solid Waste Management system like collection, storage, segregation, transportation, processing and disposal of it to Ghole Road Dumping Yard.
3) To assess the solid waste management system by using Geospatial tools, it may aid in quick and useful decisions for the purpose of administration and planning for a sustainable urban environment.
4) Enhancements of the various solid waste management process on the basis of population Waste generation.

SCOPE OF WORK
The scope of the project is to develop an improved road network data set for the study of the Ghole Road Dumping Yard area. This involves different parameters which are related to the route optimisation of solid waste management. The results from the new route will be examined and compared to existing plan which will be helpful to achieve economy in transportation, cost and time.

LIMITATIONS OF STUDY
1) Ill practices used by people throw garbage wherever possible therefore it is very difficult to collection and segregation of solid waste.
2) Increase in traffic congestion and frequent hike in fuel prices.

RESEARCH METHODOLOGY
GPS provide a powerful context to import, manage and analyse spatially based data.
i.   patial database of study area.
ii.   eallocation of waste bins in study area using GPS.
iii.   ptimization of routes, minimum time, and in three steps

III. LITERATURE REVIEW

A GIS based transportation model for solid waste disposal a case study on Asansol municipality M.K. Ghose , A.K. Dikshit , S.K. Sharma (2005)[10]
Uncontrolled growth of the urban population in developing countries in recent years has made solid waste management an important issue. Very often, a substantial amount of total expenditures is spent on the collection of solid waste by city authorities. Optimization of the routing system for collection and transport of solid waste thus constitutes an important component of an effective solid waste management system. This paper describes an attempt to design and develop an appropriate storage, collection and disposal plan for the Asansol Municipality Corporation (AMC) of West Bengal State (India).A GIS optimal routing model is proposed to determine the minimum cost/distance efficient collection paths for transporting the solid wastes to the landfill. The model uses information on population density, waste generation capacity, road network and the types of road, storage bins and collection vehicles, etc. The proposed model can be used as a decision support tool by municipal authorities for efficient management of the daily operations for transporting solid wastes, load balancing within vehicles, managing fuel consumption and generating work schedules for the workers and vehicles.The total cost of the proposed collection systems is estimated to be around 80 million rupees for the fixed cost of storage bins, collection vehicles and a sanitary landfill and around 8.4 million rupees for the annual operating cost of crews, vehicles and landfill maintenance. A substantial amount (25 million rupees/yr) is currently being spent by AMC on waste collection alone without any proper storage/collection system and sanitary landfill. Over a projected period of 15 yr, the overall savings is thus very significant.

Review :
In this paper an attempt has been made to design and develop an appropriate storage, collection and disposal plan for the Asansol Municipality Corporation (AMC) of West Bengal State (India).

Route Optimisation For Solid Waste Management Using Geoinformatics of soil, Samidha Siddam, prof. Isha Khadikar, Prof. Anil Chitade (2012)[3]
Due to rapid industrialisation, population of Chandrapur city of Maharashtra state of india is increasing day by day, hence increasing the soild waste generation. Around 0.25KG per person per day soild waste is generated and around 80tonne waste are dumped in dumping site daily. Collection and transportation is one of the important functional components of solid waste management. Thus, to keep city clean and environmentally healthy, the management of solid waste has now becoming an important issue. Geoinformatics is proposed to determine the minimum cost or distance efficient collection paths for transporting the soild waste to the dumping site. This uses information on population density, Waste generation capacity, road network, storage bin and collection vehicle etc.

Review :
From the analysis of data and the results obtained the following conclusions are drawn. Geoinformatics proves to be powerful tool for route optimisation for solid waste disposal.

Assessment of Municipal Solid Waste Management of Pune City using Geospatial Tools

Nitin Mundhe, Ravindra G. Jaybhaye (2014)[4]

Abstract :

Solid waste manage ment is among the basic essential services provided by municipal authorities in the country to keep cities clean. Due to industrialization, rural to urban migration and high growth rate of population have induced rapid urbanisation in developing countries and obviously in India also. The haphazard urbanisation created acute problem of solid waste management. The per capita waste generation rate in India has increased from 0.44 kg per day in 2001 to 0.5 kg per day in 2011; such a steep increase in waste generation within a decade has severed the stress on all infrastructural, natural and budgetary resources. Pune is one of the fastest developing city, it generates total quantity of waste is about 1300 to 1400 metric tons per day. So, there is need of the proper waste collection, transportation route for prevention of environment form the hazardous waste disposal. The proposed work emphasizes on the assessment of detail process of solid waste management such as collection, storage, segregation, transportation, treatment and disposal by using Geospatial tools like RS, GIS and GPS. It may help in sustainable urban environment of Pune city.

Review :

The study demonstrated the capacity to use GIS, GPS and remote sensing technology for the effective assessment of solid waste management system will minimize the environmental risk and human health problems.

Optimization of Solid Waste Management using Geographic Information System (GIS) for Zone A under Pimpri Chinchwad Municipal Corporation (PCMC)

Kadam Puja Chandrakant, Hema Patel (2015)[2]

Abstract :

 Rapid urbanization, surging population numbers, limitations of funding, emerging limitations of both energy and raw materials coupled with increasing industrial, commercial and economic development in Pimpri-Chinchwad area has given rise to an increased generation of various types of wastes. Among these wastes, managing of solid waste is a major problem faced by the city. Maintaining daily logs of collection and transport of solid waste is time consuming and difficult as it involves huge data and statistics. 80% of the total cost of solid waste management is being spent on collection and transportation so there is a need of proper monitoring of the system. This paper attempts to analyze the existing status of location of municipal bins along with the various secondary routes followed for the solid waste collection of Zone A under PCMC. Then using Arc GIS 3.2 a, a GIS based urban solid waste management system is proposed for the study area by proper optimizing the waste transportation routes and reallocating the bins f or efficiency in distance travelled and time taken. Thus Geographical Information System model would reduce the complications in waste management system to some extent and exhibit remedies for the same in the study area.

Review :

In this Study Based on various criteria and restrictions adopted in Arc GIS Network Analyst, different routing solutions were created.

Application of GIS in Solid Waste Management for Kolhapur City. Pratiksha Babare, Shweta Jadhav, Rashmi Patil, Supriya Patil (2018)

Abstract :

Solid waste management is of the major problem faced by today's world. There is an increase in commercial, residential and infrastructure development due to population growth and it leads to negative impact on the environment. Kolhapur City, with an area of 683.31 sq. km and a population of 549249(As per Census-2011) about generates about 200 tons of solid waste per day. Collected waste is transported directly to disposal ground at dumping ground by KMC vehicles and KMC-hired vehicles. Lack of proper planning and inadequate data regarding solid waste generation and collection compound the solid waste management problem. GIS as a tool can recognize, correlate and analyses relationship between spatial and non-spatial data. It can thus be used as a decision support tool for efficient management of the different functional elements solid waste e.g. bin location, number of bins required, waste transportation, generating work schedules for workers and vehicles. Based on the above focus, the present study focuses mapping of waste bins and waste generation of Kolhapur area and on suggesting and administratively transparent solutions to waste disposal problem.

Review :

The municipal officer involved in the solid waste management should be clear about the function and their role in terms of managing the cities effectively with the help of GIS system. These Thematic maps will help officers to identify and monitoring the more waste generated wards.

IV. METHODOLOGY

Data collection and information from questionnaries and other sources.

First we have visited ghole road kshatriya karyalay for collecting all the necessary data required for successful completion of the project . We discussed our project with Health Inspector Mr. Inamdar and Sub Health Inspector Mr. Shivaji Gaikwad .
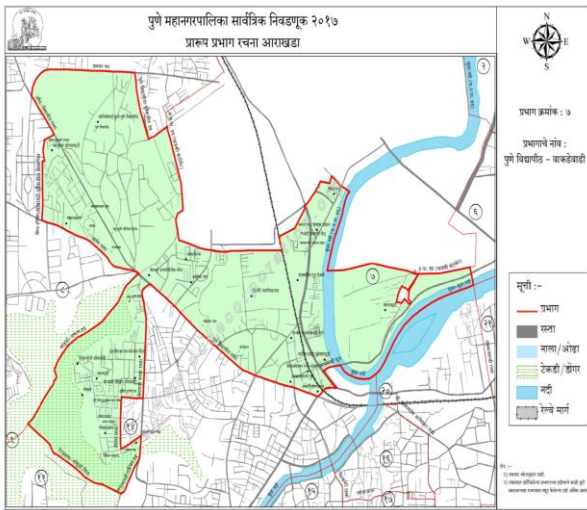
Analysis of present situation and survey of actual area

After discussing with the concerned officers, and based on information we have studied the existing waste collection system.
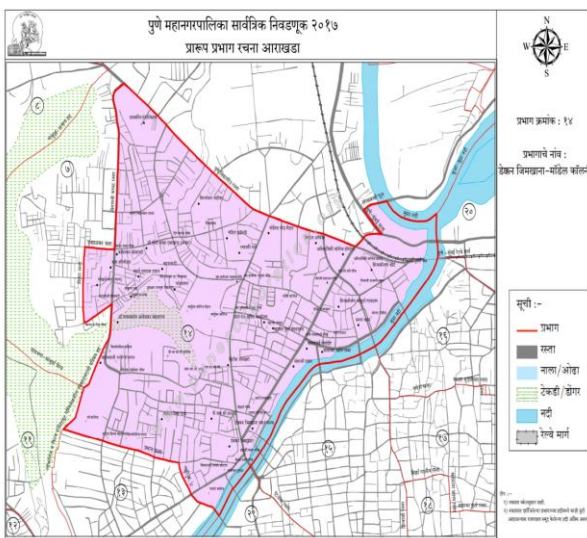
GPS Analysis

By using GPS we have optimised the existing route for waste collection and relocated bins location.
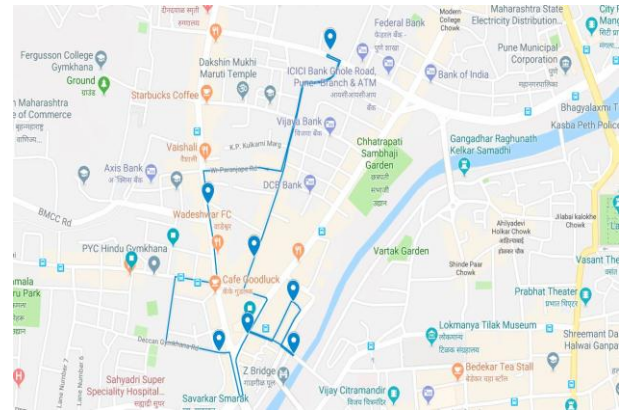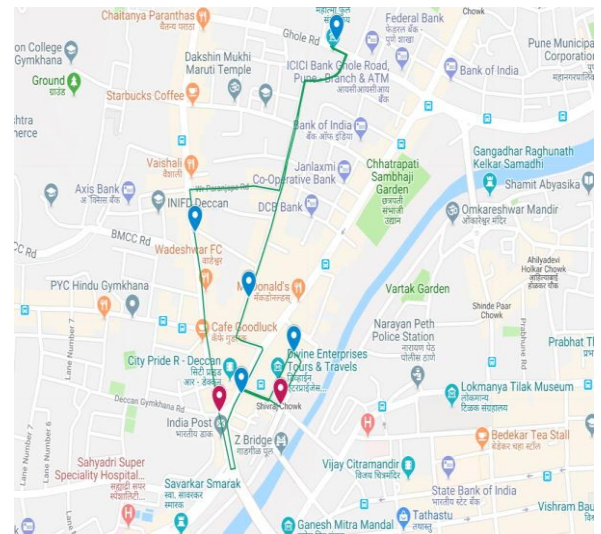
Survey Location
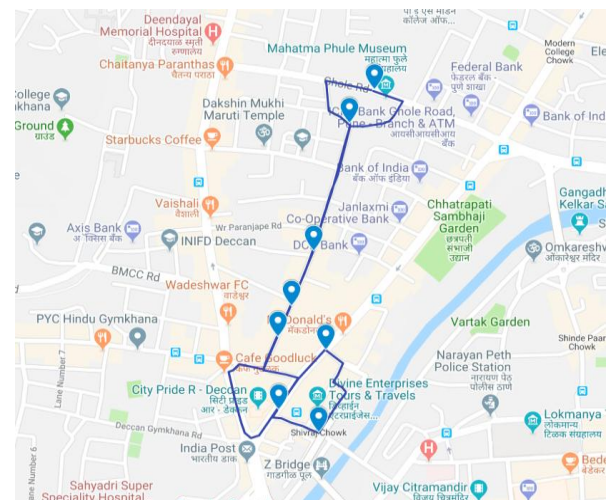
Ward No.07

Ward NO. 14

FACTORS	EXISTING ROUTE	OPTIMIZIED ROUTE
DISTANCE	3.81 KM	3.34 KM
TIME	2.35 HRS	2.17 HRS
FUEL CONSUMPTION	1.26 L	1.10 L
COST	86.94 Rs	75.90 Rs

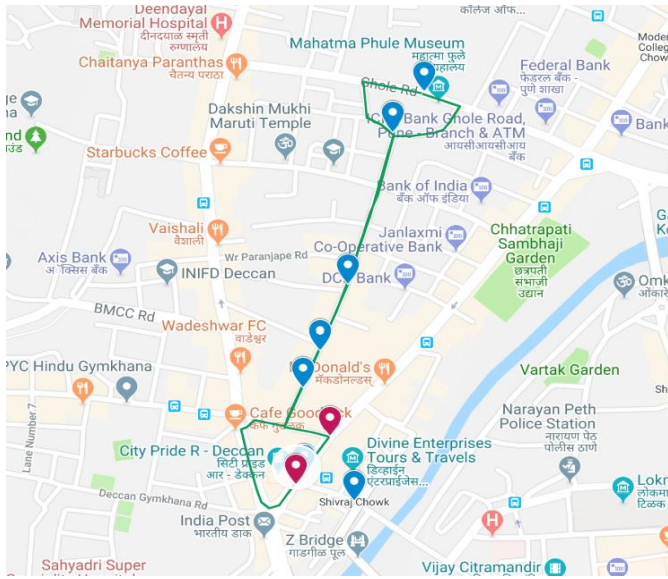## V.   RESULTS AND DISCUSSION

OPTIMZATION OF ROUTES WITH RESULTS

1)   **ROUTE 1: VEHICLE NO. 3300**

   EXISTIING ROUTE

Existing Route map of Vehicle No. 3300

OPTIMIZED ROUTE

Optimized Route map of Vehicle No. 3300

Red Markers shows Relocation of Bins & No of Relocate bins are 2

2) ROUTE 2: VEHICLE NO. 422

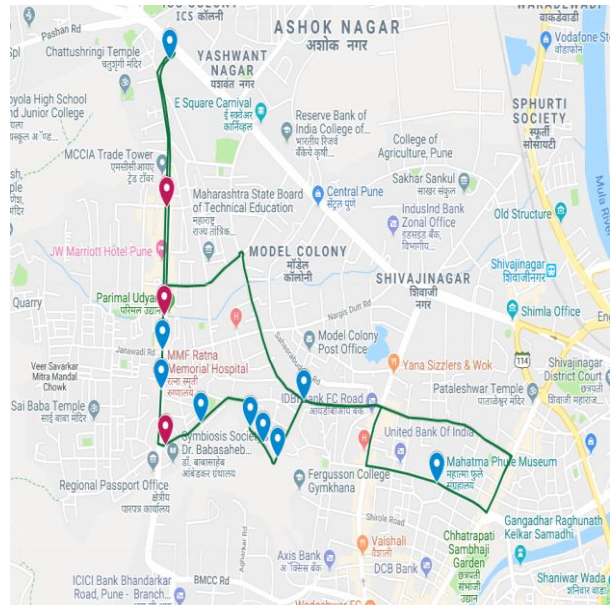**Existing Route map of Vehicle No. 422**

OPTIMIZED ROUTE

Optimized Route map of Vehicle No. 422

Red Markers shows Relocation of Bins & No of Relocate bins are 2

**3) ROUTE 3 : VEHICLE NO. 430**

Existing Route map of Vehicle No. 430

FACTORS	EXISTING ROUTE	OPTIMIZIED ROUTE
DISTANCE	3.08 KM	2.65 KM
TIME	2.18 HRS	2.17 HRS
FUEL CONSUMPTION	1.01 L	0.87 L
COST	69.69 Rs	60.03 S

FACTORS	EXISTING ROUTE	OPTIMIZIED ROUTE
DISTANCE	9.89 KM	8.42 KM
TIME	4.24 HRS	3.55 HRS
FUEL CONSUMPTION	3.26 L	2.77 L
COST	224.94 Rs	191.13 Rs

OPTIMIZED ROUTE

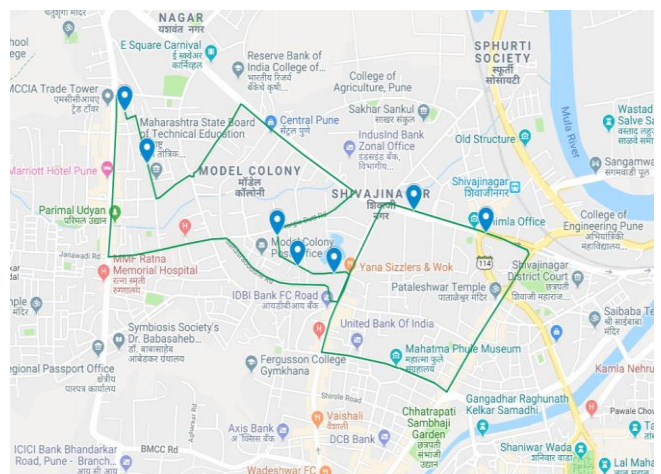**Optimized Route map of Vehicle No. 430**

- Red Markers shows Relocation of Bins & No of Relocate bins are 3

   2) ROUTE 4 : VEHICLE NO. 374
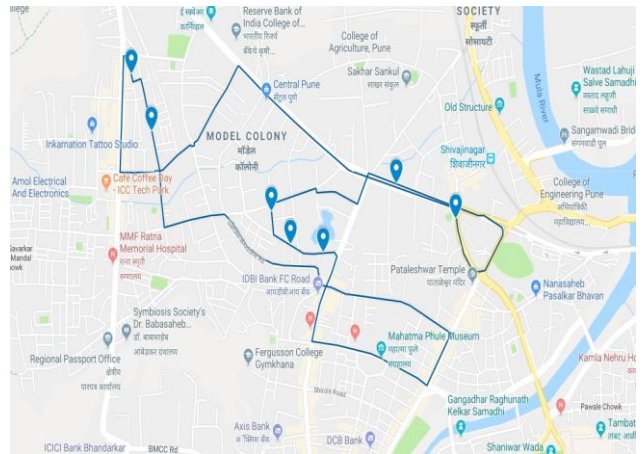
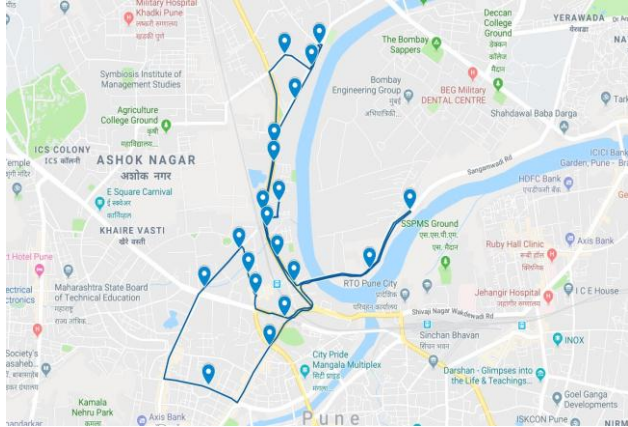**Existing Route map of Vehicle No. 374**

OPTIMIZED ROUTE

Optimized Route map of Vehicle No. 374

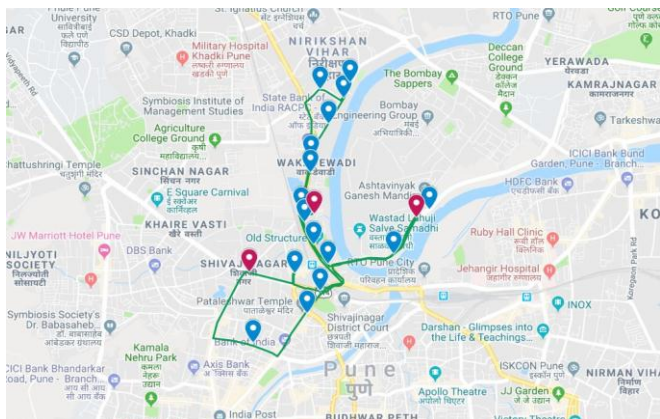- **Red Markers shows Relocation of Bins & No of Relocate bins are 2**

5) ROUTE 5: VEHICLE ROUTE NO. 7971

Existing Route map of Vehicle No. 7971

OPTIMIZED ROUTE

FACTORS	EXISTING ROUTE	OPTIMIZIED ROUTE
DISTANCE	10.01 KM	8.94 KM
TIME	4.32 HRS	4 HRS
FUEL CONSUMPTION	3.30 L	2.95 L
COST	227.7 RS	203.55 s

Optimized Route map of Vehicle No. 7971

- **Red Markers shows Relocation of Bins & No of Relocate bins are 3**

FACTORS	EXISTING ROUTE	OPTIMIZIED ROUTE
DISTANCE	13.5 KM	12.5 KM
TIME	5.12 HRS	4.40 HRS
FUEL CONSUMPTION	4.455 L	4.125 L
COST	306.70 Rs	284.62 Rs

VIII. CONCLUSION

The present study attempts to optimize the routes for transport of solid waste from ward number 7 & 14 to Ghole Road Dumping Yard in Pune city integrating GIS application ArcView alongwith GPS tools to track the various routes. It demonstrates the effectiveness of GIS/GPS technology in optimizing the waste transport routes to achieve time and distance savings eventually resulting in a most economic transport model.

REFERENCES

Pratiksha Babare, Shweta Jadhav, Rashmi Patil, Supriya Patil (2018) Application of GIS in Solid Waste Management for Kolhapur City, IJARSE, Volume no 07, Special Issue no 01, March 2018, ISSN:2319-8354."

1) Kadam Puja Chandrakant, Hema Patel (2015) Optimisation of Solid Waste Management Using GIS for Zone A under Pimpri Chinchwad Municipal Corporation, IJSR, ISSN: 2319-7064, Volume 4 Issue 6, June 2015."

2) Samidha Siddam, prof. Isha Khadikar, Prof. Anil Chitade (2012) "Route Optimisation for Solid Waste Management using Geo-Informatics, IOSRJMCE, ISSN: 2278-1684, Volume 2, Issue 1, July-August 2012."

3) Nitin Mundhe, Ravindra G. Jaybhaye (2014) :- "Assessment of Municipal Solid Waste Management of Pune City using Geospatial Tools, International Journal of Computer Applications, Volume 100-No.10, August 2014, ISSN: 0097-8887."

4) A.V. Bhambulkar, Isha. P. Khedikar (2011) "Municipal Solid Waste collection route for Laxmi Nagar by Geographical Information System, IJAET, Vol.2, Oct-Dec 2011, ISSN 0976-3945."

5) Byung-In Kima, Songbae Kimb, Surya Sahoob (2005) "Waste collection vehicle routing problem with time windows" Computer and Operation Research 33(2006) 3624-3641

6) Mufeed Sharholy , Kafeel Ahmad , Gauhar Mahmood , R.C. Trivedi (2007) "Municipal solid waste management in Indian cities – A review" Waste Management 28(2008) 459-467

7) Zhu Minghua, Fan Xiumin , Alberto Rovetta , He Qichang , Federico Vicentini, Liu Bingkai,

Alessandro Giusti , Liu Yi (2008) "Municipal solid waste management in Pudong New Area, China" Waste Management 29(2009) 1227-1233

8) G. Tavares, Z. Zsigraiova , V. Semiao , M.G. Carvalho (2008) "Optimisation of MSW collection routes for minimum fuel consumption using 3D GIS modelling" Waste Management 29(2009) 1176-1185

9) M.K. Ghose , A.K. Dikshit , S.K. Sharma (2005) "A GIS based transportation model for solid waste disposal a case study on Asansol municipality" Waste Management 2006 ;26(11):1287-93