Smart Solid Waste Management For Smart Cities

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Abstract-*The analysis and discussion provided aims to help researchers to gather insights on technologies/methods suitable the SWM challenges they have at hand, and on gaps that can be explored regarding technologies or methods that could be useful as well as the processes in SWM that currently do not benefit from using recent methods. The growth in the global population, along with its migration to urban areas and accompanying consumption trends, has led to an uncontrolleable exploitation of natural resources, emission of harmful gases to health, and the appearance of several environmental problems such as change in climate , extinction of species, and an increased solid-waste generation. The solid waste management approach in India is extremely inefficient , using old and obsolete system ,technology for storage collection processing ,treatment and disposal . Sometimes, It is harmful for human beings to treat waste. Automation has brought many changes. Here, It has been tried to frame such a model which efficiently work in order to handle properly solid waste within short required time.*

Keywords-Automation; Smart trash system; Smart vehicle System;

I. INTRODUCTION

Solid waste consists a broad array of problems related to society, economy, technology , economy, environment and much more. It is a serious issue which mostly confronted by urban government either in developing or developed countries The waste generation and management depend on the Solid waste management consists the whole process of dealing with solid waste ,beginning from the collection to ultimately disposing off it hygienically, so that it may not create any harmful effect on nearby community .The solid waste management involves , management at waste generation level, storage at the source of generation , primary collection ,street cleansing , temporary storage at locality level , regular and periodic transportation of this temporarily collected waste to disposing sites and treatment plants[1] . For the municipalities, the difficulties as well as challenges of SWM are continuously increasing due to this urbanization. Now it becomes an urgent priority for the authorities responsible for SWM to improve their services, particularly in low and middle income countries. Municipalities are facing problem with solid waste route optimization for collection that has various effects on collection efficiency, cost and pollutant emissions.

"Big cities in developing and emerging countries need to tackle municipal waste management to keep pace with the exponential growth of towns and to avert health and environmental disasters. There are a number of ways to go about this including cooperating with the informal sector, finding solutions to the financial equation, improving waste treatment modalities and above all, exploring the potential of the waste recycling markets"

No	Waste generation sector	Average	Units
1	Hotel	22.25	Kg/hotel /day
2	Hospital	17.00	Kg/hospital/day
3	Restaurants	16.96	Kg/restaurant/day
4	Chat houses	16.20	Kg/chouse/day
5	Cafeteria	10.83	Kg/cafe/day
6	Educational facilities	9.34	kg/school/day
7	shops	3.64	Kg/shops/day
8	Clinic	3.28	Kg/clinic/day
9	Beauty salon	1.87	Kg/house/day
10	Single family residential	0.402	Kg/person/day
11	Correctional facilities	0.08	Kg/person/day

Fig:- Approximated waste generation of different sectors per day

Using a network of mobile nodes as a generalization of robots for sensing purposes is not a new idea at all.There are many researches on optimization problems such as vehicle routing problem, capacitated vehicle routing problem and vehicle routing problem with time windows have been studied to reduce cost, less emission, serve customers and depot through optimized route. many systems have been proposed to

settle associated issues and maximize waste management efficiency.

Method of solid waste disposal	Frequency	Percentage
Burn it in the open	40	26.7
Dispose of in communal containers/dump site	82	54.7
Bury it at the backyard	28	18.6
Total	150	100

Source: Field Survey, (2014).

II. INTEGRALS OF THE WHOLE FRAMEWORK

The framework will consist spatial technologies based systems which are founded by using graphical information system (GIS) and/or global position system (GPS) or remote sensing (RS) as main technology, radio frequency identification (RFID),Data communication technology[2] .The intelligent system can work in delay and disruption tolerant. The intelligence of the system lies in its ability to adapt to the environment, dynamically optimizing routing algorithms using local and global information and influencing node movement. There is a wide variety of data that can be acquired by means of sensors, ranging from temperature, humidity, or noise levels, for example, to other higher level data such as object or human recognition, movement pattern detection, or plague detection. Being practical, and considering other network evolutions such as the Internet, it would be much more useful to take advantage of such a physical infrastructure, which would allow several applications to simultaneously use the mobile nodes and their sensors in their own way.

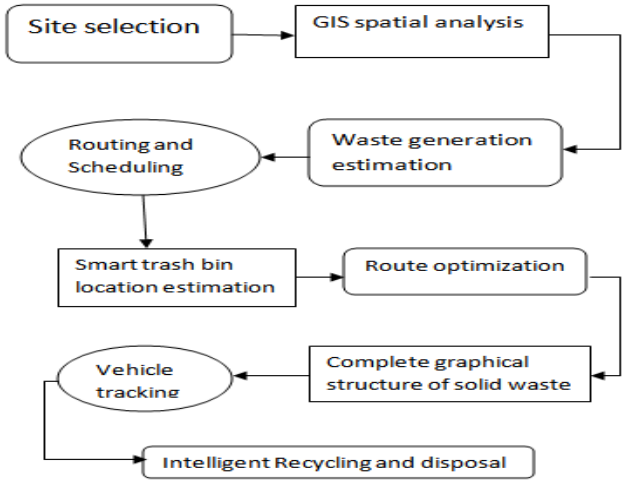

Fig1.1:- framework of complete solid waste management system

III. DIFFERENT INVOLVED SMART DEVICES

a. Graphical information system (GIS) :- SWM operators adopt this systems to monitor the location of trash bins and collection vehicles during collection. It can be used for Site selection; planning; management; estimation; optimization; Route and collection optimization; vehicle tracking; planning; scheduling; billing; Site selection; environmental impact assessment; features monitoring.

b. Radio frequency identification (RFID):- The involved Identification technologies based systems where barcode or radio frequency identification (RFID) tags are installed with trash bins for tracking identification to determine their location and to acquire the time of collection. It is used for Barcode Intelligent recycling; waste disposal; reduce landfill space; risk management; Bin and driver tracking; optimization; sorting and recycling.

c. Data communication technology:- Data communication technologies that are normally used in all previous three kinds of system to facilitate the transmission of captured or analyzed data. It is capable for Sorting; optimization; moisture; energy and odor measurement; scheduling; Waste sorting; route and collection optimization; monitoring

d. Data acquisition technology:- data acquisition technologies based systems that contain several sensory elements installed inside trash bins such as image sensor, distance sensor, volumetric sensor etc. to observe its status. it includes:-gsm/gprs (long range communication) ,zigbee (short range communication), wi-fi (short range communication), bluetooth (short range communication)

IV. INTEGRALS OF THE WHOLE FRAMEWORK

GIS is the mostly used technology that used toimplement systems with targets of site selection, routing and scheduling optimization, waste generation estimation, local management planning, integrated SWM establishment and risk assessment. The GPS based SWM systems are primarily used in collection vehicle tracking, route optimization, collection monitoring and implementation of efficient billing. Applications of RS based systems in SWM includes disposal site selection, environmental features and impact monitoring for solid waste disposal site and environmental impact assessment. Among the identification technologies, barcode based SWM system is used to implement intelligent recycling, minimize avoidable waste and risk assessment. Later the barcode is replaced with RFID and used mainly for tracking of collection vehicles, driver activities and bins. It is one of the more efficient systems which will save more time. Proper information can be received which will reduce the problem of

overfilling and spreading foul smell. It will reduce the human intervention which can be applied on large area by using separate systems. It will make the disposal more convenient and safe as in solid waste collection, the major issue is safety. Every industry tries to teach best safety practices, yet lots of accidents and injuries still occur.

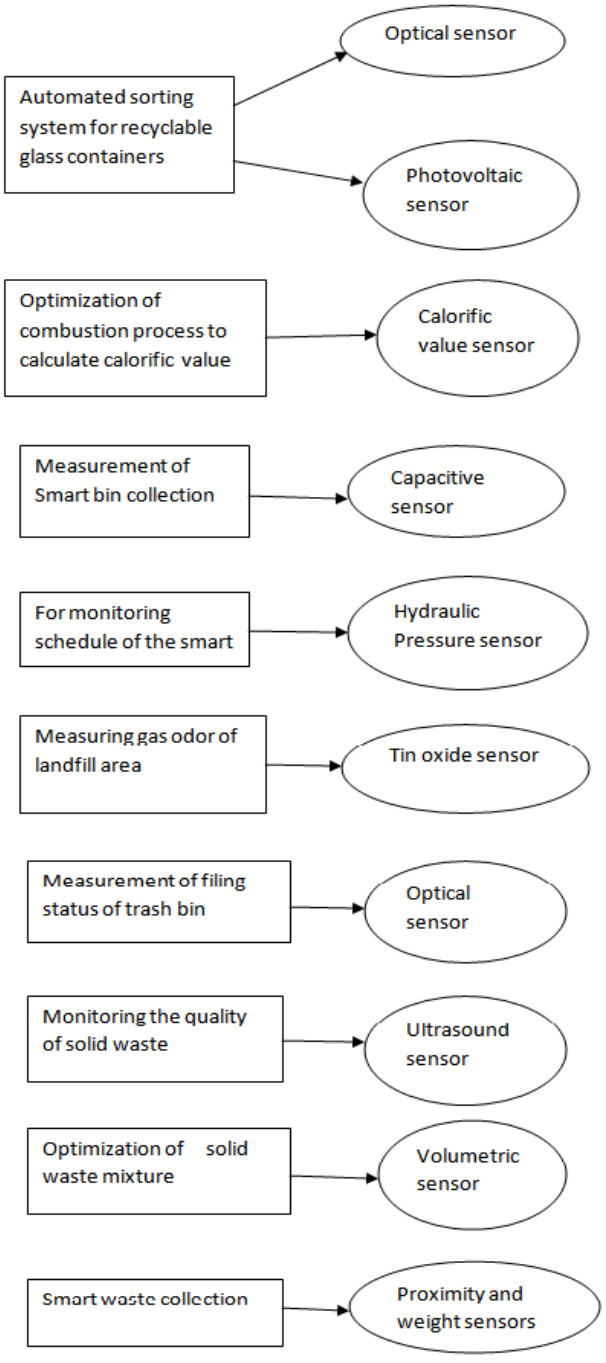

Fig1.2:- Different involved sensors

V. CONCLUSION

GIS is the mostly used technology that used to implement systems with targets of site selection, routing and scheduling optimization, waste generation estimation, local management planning, integrated SWM establishment and risk assessment The GPS based SWM systems are primarily used in collection vehicle tracking, route optimization, collection monitoring and implementation of efficient billing. Applications of RS based systems in SWM includes disposal site selection, environmental features and impact monitoring for solid waste disposal site and environmental impact assessment. Among the identification technologies, barcode based SWM system is used to implement intelligent recycling, minimize avoidable waste and risk assessment. Later the barcode is replaced with RFID and used mainly for tracking of collection vehicles, driver activities and bins,

REFERENCES

[1] Kumar Vijay, Pandit R.K. "Problems of Solid Waste Management in Indian Cities" International Journal of Scientific and Research Publications, Volume 3, Issue 3, March 2013 1 ISSN 2250-3153

[2] HannanM.A. ,Mamun Md. Abdulla Al ,Hussain Aini , BasriHassan , BegumR.A. "A review on technologies and their usage in solid waste monitoring and management systems: Issues and challenges" journal of waste management Elsevier 2015.

[3] Huang J. L., "Optimized Product Design Methodology: A Combinatorial Reverse Logistic Cost-Benefit Analysis Model of WEEPs", Advanced Materials Research, Vol. 650, pp. 692-697, 2013.

[4] Finnveden Goran , Ekvall Tomas , Arushanyan Yevgeniya, Bisaillon Mattias , Henriksson Greger, Ostling Ulrika Gunnarsson , Soderman Maria Ljunggren , Sahlin Jenny , Stenmarck Asa , Sundberg Johan , Sundqvist Jan-Olov, Svenfelt Asa , Soderholm Patrik , Anna Bjorklund, Eriksson Ola , Forsfalt Tomas and Guath Mona "Policy Instruments towards a Sustainable Waste Management" Sustainability 2013, 5(3), 841-881.

[5] F. Boons, C. Monalvo, J. Quist, and M. Wagner, "Sustainable innovation, business models and economic performance: An overview," J Clean Prod, vol. 45, pp. 1-8, 2013.

[6] J. C. Chen , C. H. Cheng, and P. T. B. Huang. "Supply chain management with lean production and RFID application: A case study," Expert. Syst. Appl., vol.40(9), pp. 3389-3397, 2013

[7] Kovács George L. "Reuse and recycling for sustainability" (research on Product Life-Cycle Management using Cognitive Info-communications) Cognitive Infocommunications (CogInfoCom), 2012 IEEE 3rd International Conference

[8] B. K. Reck, and T. E. Graedel, "Challenges in metal recycling," Science,vol. 337(6095), pp. 690-695, 2012.

[9] Li J., Liang G. Q., "A Quantitative Approach to Assessing Product Design for Remanufacturing", Applied Mechanics and Materials, Vols. 110-116, pp. 4893-4898, 2012

[10] X. Zhu, S. K. Mukhopadhyay, and H. Kurata. "A review of RFID technology and its managerial applications in different industries,". J Eng. Technol. Manage., vol. 29(1), pp. 152-167, 2012

[11] Ouyang Y. C., "Disassembly Material Analysis through Time Estimation", Advanced Materials Research, Vols. 538-541, pp. 2745-2748, 2012

[12] Rong J., Ling Q., L., "Research on Green Manufacturing Model for Circular Economy", Applied Mechanics and Materials, Vols. 201-202, pp. 967-970, 2012

[13] Bernstad, A.; La Cour Jansen, J.; Aspegren, H. Life cycle assessment of a household solid waste source separation programme: A Swedish case study. Waste Manage. Res. 2011, 29, 1027–1042.

[14] Chamier-Gliszczyński N., "Recycling Aspect of End-of Life Vehicles – Recovery of Components and Materials from ELVs", Key Engineering Materials, Vol. 450, pp. 421-424, 2011

[15] Noor M.M., Kadirgama K., Rahman M.M., Maleque M.A., "Prediction of Recycle Method Using Relevance Vector Machine", Advanced Materials Research, Vols. 264-265, pp. 943-948, 2011

[16] Swedish Waste Management. Svensk avfallshantering 2010 (Swedish waste management 2010); Swedish Waste Management: Malmö, Sweden, 2011.Swedish Waste Management. Svensk avfallshantering 2010 (Swedish waste management 2010); Swedish Waste Management: Malmö, Sweden, 2011

[17] Ambell, C.; Björklund, A.; Ljunggren Söderman, M. Potential för ökad materialåtervinning av hushållsavfall och industriavfall (Potential for Increased Material Recycling of Household Waste and Industrial Waste); TRITA-INFRA-FMS 2010:4; KTH Samhällsplanering: Stockholm, Sweden, 2010

[18] Tyskeng, S.; Finnveden, G. Comparing energy use and environmental impacts of recycling and incineration. J. Environ. Eng. 2010, 136, 744–748

[19] Barua Pranab K. , Deka D. Electricity Generation from Biowaste Based Microbial Fuel Cells International Journal of Energy, Information and Communications Communications mmunications Vol. 1, Issue 1, November, 2010 Vol. 1, Issue 1, November, 2010

[20] Y. Liu , Chen Z.W." Used Car Dismantling and Recycling of Key Technologies", Applied Mechanics and Materials(Volume 33),October 2010, pp. 655-659.

[21] Olofsson, M.; Sahlin, J.; Ekvall, T.; Sundberg, J. Driving forces for import of waste for energy recovery in Sweden. Waste Manage. Res. 2005, 23, 3–12

[22] L. M.Borges, F. J. Velez , and A. S. Lebres. "Survey on the characterization and classification of wireless sensor network applications,". IEEE Commun. Surv. Tut., vol.16(4), pp.1860-1890,2014.