A Study about Advance Waste Management

J. Naveen Kumar, PG Scholar

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Abstract

Municipal solid waste management has become a huge topic in many developing countries, especially the ones with huge populations, like China. MSW can be a gigantic trouble causer for the environment, ecological system and societies without proper management; meanwhile, it can also be a resource pool with tremendous potentials for source retrieving, energy recovering, if treated properly. This paper discuss generally about the current MSW status quo, political frameworks and management situations in China with focus on waste separations, both at-source and on-site separation. By introducing the advanced waste management schemes in industrialized countries like Germany and Japan, to determine what is the problems and recommendations for the waste management and separations in China.

Keywords: Municipal Solid Waste, Waste Management, Waste Separation, At-source Separation, On-site Separation.

Introduction

The trend of making the manually controlled things automatic has become a common practice these days. The process of making the things automatic is being exploited in almost all the major fields of life. Making things automatic reduces burden on the humans. The cost and effort used in manually controlled products is much higher than the automated systems. Considering the fact, that the problem of efficient waste management is one of the major problems of the modern times, there is an utmost need to address this problem.

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The proper waste management system is must for the hygienic society in general and for world as a whole. Solid waste which is one of the sources and causes of environmental pollution has been defined under Resource Conservation and Recovery Act as any solid, semi-solid liquid or contained gaseous materials discarded from industrial, commercial, mining or agricultural operations and from community activities. Solid waste also includes garbage, construction debris, commercial refuse, and sludge from water or waste treatment plants or air pollution, control facilities and other discarded materials. In order to protect human health and the environment from the potential hazards of delayed waste disposal and environmental pollution a systematically supervised and controlled handling of these wastes is must.

The type of wastes which constitute environmental pollution and which this work emphasizes on is domestic refuse consisting of degradable food wastes, leaves, dead animals and non-degradable ones such as plastics, bottles, nylon, medical and hospital wastes, generated in households, hospitals, industries and commercial centers. The complexity of issues involved in municipal solid waste management necessitates development and application of new tools capable of processing data inputs of varying formats, numerical models and expert opinions in multi objective decision making scenario. Decision Support Systems (DSS) are among the most promising approaches to confront such situations. The DSS models should ideally be integrated with geographical information system (GIS) to optimize collection, transportation, processing and disposal processes.

An attempt is made here to present an overview of DSS in the area of solid waste management with specific reference to their development and applications in India. Waste management is a continually growing problem at global and local levels. Solid wastes arise from human and animal activities that are normally discarded as useless or unwanted. In other words, solid wastes may be defined as the organic and inorganic waste materials produced by various activities of the society and which have lost their value to the first user. The domestic waste products are collected through waste bin at a common place at a particular spot for an area/street. A major difficult task is that checking process of waste bins for the collection of wastes.

The usual method by which, a person has to wander through the different spots and check the places for waste collection. This is somewhat complex and time consuming process. The present day waste management system is not as efficient as it should have been taking into consideration the advancements in the technologies that arose in the recent years. There is no surety about the management/ clearing of wastes at all the places. To overcome this problem a new approach, Automatic waste management system is proposed. It is a step forward towards making the waste collection process automatic and efficient in nature. Whenever the waste bin gets filled this is acknowledged by placing a RF transmitter at the waste bin, which transmits it to the receiver at the desired place in the area or spot. The received signal indicates the waste bin status at the monitoring and controlling system.

Automatic Waste Management System

We designed a method for managing the wastes in an efficient way in order to reduce the improper utilization of valuable resources like human effort, time and cost. In our approach, we divided the overall system of waste detection into four subsystems viz Smart Trash System, Smart Vehicle System, Local Base Station and Smart Monitoring and controlling Hut. All these sub-systems work intelligently and in coordination to automate the waste management in the Smart Trash Bin(s) so as to dispose-off the waste as and when required without keeping a continuous eye on the waste bins manually.

Recycling

Only 2% of the solid waste is recycled at a recycling facility. Recycling is practiced informally, but the recycling base of Ghana is in general weak. Households in low income areas do not dispose of plastics, bottles, paper, cardboards and cans readily. Recyclable materials are used and reused for domestic purposes and only thrown away when they are no longer of any use to the owners. In high income areas, domestic servants will sell these materials to middlemen to supplement income instead of disposing them along with the other refuse.

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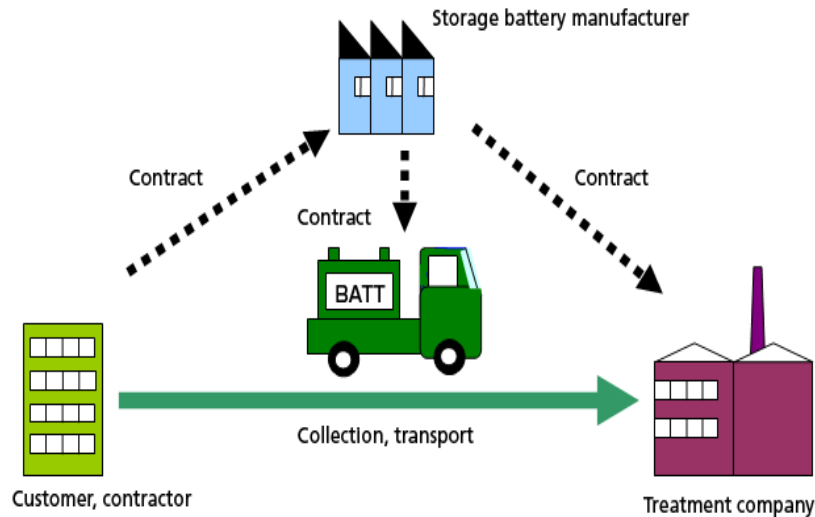
There are two main recycling plants in operation in Accra. Although more waste is generated than can be collected, both recycling plants have been operating under efficiency for years because the waste materials are not separated at the source. Unlike other poor cities around the world, Accra lacks a substantial sector of waste pickers to collect and sort household waste on behalf of merchants, recycling firms, and composting units.29 Encouragement of the waste picker labor market and other participants in the informal recycling sector could help extend the lifespan of the cities landfills through waste diversion.

Incineration

Incineration is a method of burning waste that is combustible at high temperatures in the range of 1000 degrees Celsius to reduce the waste to ashes.39 it is used primarily as disposal for biological waste associated with medical care. Policies governing the appropriate use of incineration exist in Ghana, but Accra incinerators mostly consist of ovens or open pits used to burn bandages and blood products.40 after burning, the ash is usually moved straight to an adjacent landfill, where it takes up only a tenth of the volume of the original waste. Ghana's national policy recommends small scale incineration plants, but primarily as a disposal option for health care wastes.

Waste Processing

Involves the treatment and/or conditioning of waste, where treatment and conditioning are defined as follows] treatment operations intended to benefit safety and/or economy by changing the characteristics of the waste. Three basic treatment objectives are volume reduction, removal of radionuclides from the waste, and change of composition of the waste.

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Conditioning

Operations that produce a waste package suitable for handling, transport, storage and/or disposal are important. Conditioning may include the conversion of the waste to a solid waste form, enclosure of the waste in containers and, if necessary, providing an over pack. The previous issues of this Status and Trends report gave an overview of radioactive waste processing and highlighted topics such as the minimization of waste arising from nuclear facility decommissioning and innovative approaches to waste processing. In the current issue, an example of a waste processing facility is presented. For upcoming issues, additional

Status Quo of Municipal Solid Waste Generation in China

China has become the world's 2nd biggest economic power since the year 2010, replacing Japan, after the United States. The fast economic development in China has lead to an average annual 8% of growth rate of GDP; however, many "by-products" have also tremendously affected China's environmental and ecological conditions, with municipal solid waste (MSW) being one of them.

Smart Trash System

Smart Trash System embodies an electronic device known as Smart Trash Bin, which consists of Sensors and a Radio Frequency (RF) transmitter. The sensors sense the waste status being collected by the Smart Trash Bin. Two types of sensors are used in the Smart Trash Bin. The first one is a Load sensor which is used to sense the load of the waste in the smart trash bin and the second one is an IR proximity sensor whose function is to detect the level of the waste in the smart trash bin. There are two IR sensors, one placed at the middle of the Smart Trash Bin and the second is placed near the top of the Smart Trash Bin.

The use of two IR proximity sensors makes the decisions more reliable and exact. As shown in the diagram below, the RF signal is transmitted only when all the sensors are in a high state. Whenever the Smart Trash Bin is filled up to the specified load and level, the sensors get activated and it generates a signal that is transmitted by the RF transmitter fitted in the Smart Trash Bin. The signal transmitted by the RF transmitter is received by the RF receiver which is present at the local base station. After receiving the signal, the local base station decodes the trash bin location and accordingly sends a signal to the smart monitoring and controlling hut which sends signal to Smart vehicular system about the location of the trash bin. The monitoring and controlling hut in addition to the site of bin also sends the dumping site to the smart vehicular system.

Smart Monitoring and controlling Hut Interface The interface at the smart Monitoring and controlling Hut has been developed using VB.Net which is an object-oriented programming language that can be viewed as an evolution of the classic Visual Basic (VB), and is implemented on the .NET Framework. The software is to be installed on the Computer System in Smart Monitoring and controlling Hut, which receives the information from the local base stations through internet. The Smart Trash Bin through RF transmitter sends signal to LBSs which then forwards it to SMCH via internet.

At the SMCH, the details about the filled trash bin(s) are displayed on the interface like the location of the trash bin, unique trash bin code, etc. Accordingly, the AWMS software

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obtains further information of the trash bin which has sent the signal like the city, locality, area to which this trash bin belongs and then makes a decision about the vehicle to be selected to dispose of the waste. The smart monitoring cum controlling hut smartly selects the vehicle keeping in view the distance, cost and others factors and these factors reduce the implementation cost of the overall system. After the assigned job has been accomplished successfully by the smart vehicle, an acknowledgement is sent to SMCH. This makes the overall system efficient and reliable. The interface provides an initial Login page to authenticate the user. After valid authentication, the user is directed to the Control Panel page which displays the status of the Smart Trash Bin(s). Whenever the Smart Trash Bin gets filled an alarm signal is produced and the details of the filled Smart Trash Bin are displayed on the interface. The total number of Smart Trash Bins and their details like City, Ward, Locality, Street, whether filled or unfilled is also displayed on the interface. The interface consists of the Login Form, Data Control and Control Panel pages.

Login Window

Only authorized users (employees and administration of city Municipality) can access the system. The restricted access is to employ the security in the Smart Monitoring and controlling Hut.

Data Control

The Data Control has a database connected to it where the information of the Smart Trash Bin(s) is stored. It is also used to maintain the information about the Smart Trash Bin(s) installed in the various locations of the city. This includes the insertion, deletion and updating of information. The information is then accessed by the Control Panel to verify the availability of the Smart Trash Bin. This module has been authorized only to the administrator of the system.

Control Panel

The Control Panel module works on receiving the information via internet and then performs logical operations through programming methodology to display the status of the Smart

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Trash Bin(s) and also produces an alarming signal, if the Smart Trash Bin(s) is filled. The screen shots of the three components of the Interfacing module

Operation since the AWMS consists of four sub-systems and the main system on which the others work is the Smart Trash System which has the functional unit called as Smart Trash Bin. It consists of sensors, encoder and the RF transmitter. Sensors are used to detect the load as well as the level of the waste in the Smart Trash Bin. Whenever the Smart Trash Bin gets filled, the sensors get activated and generate a high signal which is encoded by the encoder. This encoded signal is transmitted by the RF transmitter mounted on top of the Smart Trash Bin. This transmitted signal is received by the RF receiver tag which is placed in the local base station.

The RF receiver in local base station receives the signal and then the decoded signal is sent to monitoring cum controlling hut over the internet with the help of a pocket PC. At this monitoring cum controlling hut site, the information and status of the Smart Trash Bin is displayed. The details like Trash Bin ID, location, etc., of the filled Smart Trash Bin are displayed on the Smart Monitoring and controlling Hut Interface.

The Smart Monitoring and controlling Hut then sends the information signal to the Smart Vehicle System. Once the job detail is received by the vehicle, it moves to the spot and disposes off the waste from that Trash bin that has send "Trash Bin full" status to the Monitoring and controlling hut. On the task completion a task done signal is send by the vehicle to the monitoring and controlling hut.

Conclusion

The Automatic waste management system is a step forward to make the manual collection and detection of wastes automated in nature. The developed system integrated by using four sub systems the Smart Trash System (STS), Local Base Station (LBS), the smart Vehicle System (SVS) and the Smart Monitoring and controlling Hut (SMCH) including RFID

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and internet, in which it would pioneer work for solid waste collection, monitoring and management processes.

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J. Naveen Kumar, PG Scholar
Department of Management Studies
Anna University Regional Campus
Madurai 625 019
Tamilnadu
India
KumarNa121@gmail.com

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