iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** VI **Month of publication:** June 2020

DOI: http://doi.org/10.22214/ijraset.2020.6331

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue VI June 2020- Available at www.ijraset.com

A Survey on Efficient Waste Management using Machine Learning

J. Preethi Jenifer[1], M. Pratibha[2], Sushmita Sahu[3], Mr. M. Balasubramanian [4]
[4]*M.E, Assistant Professor,* [1, 2, 3]*Dept. of Computer Science and Engineering, S.A. Engineering College, Chennai 600-077*

Abstract: ***Waste Management these years has become a crucial part of eradicating solid waste pollution. Around the globe, startups and giant multinational companies are getting their hands-on in developing solutions to this global crisis of mass production of non-biodegradable waste. This survey focuses on such studies and solutions for managing solid wastes in urban cities. The focal point is to develop an intelligent dustbin than can take the burden off municipal workers of street-to-street collection of garbage waste. Municipal authorities will reimburse user fees for disposal and processing. On the other hand, the municipal corporation is also charged for the garbage being dumped on Landfill sites. If dustbins are made to segregate and even decompose solid waste, that might save enough time and money laid out on recycling and disposal, thus making it less burdensome for acquiring additional acres of the disposal facility. While the public seems not much engaging in the safe disposal of waste, it becomes challenging to urge citizens to stop littering in public places. The solution is simple. Make the user dump in bins by providing them money to the amount of waste they dispose. This work focuses on a similar approach. Users will get paid for the amount of waste they generate on a regular basis. This scheme has also been implemented in developed countries around the world to completely eliminate the need for manually collecting littered garbage, making it easier for municipal corporations to manage and recycle waste. Making money out of waste has become a primary motto in waste management. While segregation is still as challenging and recycling, the study has focused on ways to handle waste by applying Machine Learning algorithms to train bins to distinguish between biodegradable and non-biodegradable waste, enforcing GSM technology to manage money transfer.***

I. INTRODUCTION

Maintenance of solid waste is a problem that has risen dramatically in major urban centers around the world and thus has substantial environmental impacts where communities do not have sufficient resources to handle such waste. When dealing with solid waste, the cheapest and efficient method in handling, recycling and composting is Landfill. With increasing urbanization and waste generation rates, Landfills face demanding crisis in need of mass acre of lands for storage of wastes. Should waste not be minimized and reused waste not collected separately and recycled, they fill up easily.

To increasing landfill costs and problems, landfill contractors are likely to increase the fees charged at these sites for discharging of the garbage. Under the new scheme, the Municipal Corporation has set the charges and fees (i.e. flat rate) for waste collection.

Municipalities typically calculate a waste load for the number of houses or neighbourhoods and then average additional user charges for each household. When waste disposal costs continue to increase year by year, waste producers (people) are seeking a fixed rate. The system proposed did turn out to be largely efficient, as it makes garbage collection simple. A payment system that pays people with a certain amount based on a waste load that separates this method from other intelligent monitoring systems. Because the pricing system profits individuals, there'll be less chance of littering society.

This survey primarily focuses on strategies and solutions to dealing with solid waste management and segregation. Handling waste is of great concern as it faces hurdles ranging from acknowledging citizens of waste segregation to engaging them to throw waste only in dustbins and not litter in public. These challenges are analyzed and summed up into numerous fixes.

II. CURRENT WASTE MANAGEMENT SCHEME

A. Waste Management Strategies used in Municipal solid Waste Management

Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials. The costs for solid waste management are high especially for collection, transportation, treatment and disposal, which are largely borne by city councils. Methods of collection of waste are either door-to-door or using containers or communal bins. All medium and large cities have administrative structures for providing collection services but often, cities in developing countries use non-compaction trucks for daily collection, with a few cities using compaction trucks and hauling trucks. The most common municipal waste management practices include: recycling/recovery, composting, incineration and land filling/open dumping.

In the middle-to-low-income cities, there exists a long-standing practice of informal source separation and recycling of materials. However, since industries would only be interested to use recycled materials when they cost less than the virgin materials, the practice of recycling is so market-driven that recycling has become selective. The disposal of those unselected recyclables remains a problem. Informal waste separation or waste picking takes place in three ways: At source - this is in large urban areas. Here waste pickers sort out the waste before the authorized collection vehicle arrives. During collection, when the collectors segregate recyclable materials during loading and store them inside the truck or on the sides of the vehicles.

B. Solid waste treatment and disposal

Another waste treatment method that is practiced is incineration where 90 percent of non-recyclable municipal solid waste is incinerated. Final disposal of waste is at landfills where 10 percent of non-recyclable municipal solid waste is deposited. However, controversy remains over the soundness of incineration as a waste treatment technology because of greenhouse gas emissions from incinerators. The practice of informal incineration or open burning is, however, still prevalent, not only in the rural areas where waste collection is rare but also in peri-urban and urban areas. Landfills are generally the cheapest and most common disposal method for municipal solid waste. Disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits. A properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly designed or poorly managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation of liquid leachate. The problems associated with landfills, even with those that are clay-lined, include high water table, groundwater contamination and gas migration.

C. Advancements in Solid Waste Management

1) *Sanitary Landfill:* A method of disposing of solid waste on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the solid waste to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operation or at more frequent intervals as may be necessary.
2) *Landfill Regulation*

a) *Burning:* No burning of solid waste should be practiced at a landfill. Garbage cannot be burned without nuisance except in high-temperature incinerators. Any other method of combustion creates odors, air pollution, fire and safety hazards. Such burning adversely affects public acceptance of the operation and proper location of future sanitary landfill sites.

b) *Limited Access:* If public use of a sanitary landfill is allowed when no attendant is on duty, scavenging and indiscriminate dumping commonly occur. It then becomes necessary to divert men and equipment to policing the area to restore sanitary conditions. Therefore, access to a sanitary landfill should be limited to those times when an attendant is on duty and only to those authorized to use the site for the disposal of solid waste.

3) *Salvaging:* Nothing should be tolerated that interferes with prompt sanitary disposal of solid waste. Improperly conducted, salvaging delays landfilling operations and creates unsanitary conditions. The accumulation of salvaged material at the disposal site often results in vector problems and unsightliness, which are detrimental to public acceptance of the operation. Scavenging is an unhealthy, aesthetically-objectionable practice that interferes with the orderly and efficient operation of a landfill. All salvaged materials should be removed from the site by the end of the day.

4) *Operating Hours:* The hours during which the landfill is open for collection vehicles should be closely phased with the solid waste collection schedule. Since it is necessary to allow time for the equipment operator to compact and cover the final loads of waste, the site should be closed at an hour which enables the operator to finish his daily work. In scheduling the hours during which the site is open, consideration must be given to individual residents if they are allowed to dump at the site. A good practice is to place detached containers at the gate for use by individuals during hours the landfill is closed.

Inspection and Evaluation Routine inspections and evaluations of landfill operations should be made by a representative of the state or local health department. A notice of any deficiencies, together with any recommendations for their correction, should be provided to the owner or agent responsible for the use of the land; and the appropriate individual, firm, or governmental agency responsible for the landfill operation.

III. LITERATURE SURVEY

1) "Smart Waste Bin: A New Approach for Waste Management in Large Urban Centers", Kellow Pardini, Joel J. P. C. Rodrigues, Syed Ali Hassan, Neeraj Kumar, Vasco Furtado, August 2018 The paper proposed an integrated system of Identification using load cell and ultrasonic sensor, bin location with GPS and communication using GSM. The aspect of providing citizens with better disposal technique for waste generated by them besides promoting optimized routes for efficient collection is well met and the solution is ready for use by corporates.

2) "Smart Recycle Bin: A Conceptual Approach of Smart Waste Management with Integrated Web Based System", Mohd Helmy Abd Wahab, Aeslina Abdul Kadir, Mond Razali Tomari, Mohamad Hairol Jabbar, October 201 The system uses similar approach as proposed system in which automatically calculates the weight of garbage and converts it to points that are stored in user's RF-id card. A crucial feature of the system is that the bin can report recycling chain when bin is full using RFid technology.

3) "Design and Development of Smart Trash Bin Prototype for Municipal Solid Waste Management", Feisal Ramadhan Maulana, Theo Adhitya S. Widyanto, Yudi Pratama, Kusprasqpta Mutijarsa, October 2018 This work focuses on segregation and garbage collection of municipal waste. It meets the needs that can be defined as a part of urban waste management solution.

4) "RFID-based Real-time Smart Waste Management System", Belal Chowdhury, Morshed U. Chowdhury, December 2007 The application of RF-id and load cell in this system not only brings down waste management costs but also facilitates automating waste identification and management for design of smart waste management systems.

5) "An integrated node for Smart-City applications based on active RFID tags; Use case on waste-bins", Dimitris Karadimas, Andreas Papalambrou, John Gialelis, Stavros Koubias, September 2016 The most important use case of presented system is RFid node for power minimization, accurate fill level estimation with an embedded fingerprint for unique identification of users.

IV. A RELATIVE APPROACH OF PLASTIC WASTE COLLECTION IN URBAN CITIES

The prerequisite exigency for recycling among municipal solid waste management corporates and private start-up companies has an uprising effect towards healthy environment. A similar initiative to cut down landfill levies and reduce the piles of plastic mass on landfills is made possible by various Startups who have come up with innovative solutions to recycle plastic bottles. The PET Bottle

Recycler Machine (PBR Machine), with a processing capacity of 500 PET bottles per day and storage capacity of 5,000 shredded PET bottles, will shred plastic bottles into recyclable granules through the reverse vending process. Customers utilising the facility will be given incentives through the issue of Paytm cashback coupons. As the bottle gets collected, citizens are required to give their phone details, following which they will get cash incentive of certain rupees in their Paytm account. A person can earn between rupees 25-35 per kg of PET bottles.

Fig. 1. Plastic Bottle Crusher at B'luru Railway Station

The end product are utilised by fibremanufacturing companies to produce polyester clothes, carpets, and bags.

The PBR Machine is evolutionary innovation for fundamental treatment of plastic waste. The awareness of recycling among young entrepreneurs is requisite that would help tackle with increasing mass of plastic and non-degradable waste which in turn would increase job opportunities.

V. PRACTICAL IMPLEMENTATION OF

Municipal Waste Monitoring And Optimization

A. *Smartbelly bin from Australia*

Countries around the world are leading in measures to tackle the rising problem of plastic's non degradable nature. A startup in Australia has come up with a solution that promises a smart bin which not only segregates waste at the time of collection for recycling but also creates extra space for garbage when the bin is full.

Fig. 2. Smart belly bin

The SmartBelly bin is also Compostable Friendly. It comes with a capacity of 600 litres that can hold upto eight times the volume of common street litter bins.

The working of these bins is quite simple. BigBelly is a solar-powered machine. As garbage fills up, special sensors placed inside these bins are triggered, yielding up to five times more storage for garbage. It also composts the degradable waste to reduce foully emissions. Thus most of the waste gets treated for recycling.

The machine also gets connected to garbage collectors for efficiently handling the waste.

The solar panels harness solar energy and use sensors to continually compact the waste that is deposited, increasing the capacity by up to 700%, reducing waste collection by up to 85%.

1) The "smart bin" communicates information on fill levels and ensures collection only when the bin is full.
2) Fewer collection visits reduce congestion and traffic interruption, resulting also in cleaner and safer streets.
3) Traffic reduction due to fewer collection visits helps reduce carbon dioxide and other emissions.
4) The "smart bins" are standardized so that they can be emptied with existing equipment.

From a citizen's perspective, the social benefits of "smart bins" – besides their economic and environmental advantages – are interesting. They help to:

a) Raise public awareness of utilizing renewable energy
b) Improve street sanitation
c) Encourage recycling
d) Collect and analyze area-specific data on waste volumes for better planning
e) Increase WiFi coverage with their function as a free public WiFi hotspot

B. *We-Convert Vending Machine*

Through We-Convert, the organization aims in recycling plastic/PET bottles, aluminium cans, and glass scraps. The operation is fairly simple, all one has to do is litter the trash in the bin and follow few simple instructions on the machine. The machine recognises the scrap and segregates it into an allocated cavity. Following this, the machine generates a five-digit code which could be redeemed against vouchers by dialling a simple USSD code.

Segregation of waste has been arduous in urban India. Municipal corporations of the several metropolitan cities have tried hard to implement a scheme which could help in reducing the number of trash ending up in landfills.

Fig. 3. Vending machine

The ultimate solution to the mounting problem is recycling. By recycling 10 million pet bottles, one thousand square yards of landfill is saved. With the assistance of these compact sized and easy to handle machines, it's simple for anybody to assist segregate waste and it's rewarding too.

VI. NOVEL SYSTEM OF WASTE MANAGEMENT

Waste collecting vehicles normally collect garbage from various households and take it to a landfill site for disposal. Landfill disposal sites also become expensive to operate and tend to fill up over time, thus needing to be replaced. With the rising costs and concerns about landfill sites, the landfill operators are likely to increase fees charged for disposing garbage at such sites. The existing system only deals with waste segregation and dumping on disposal sites. It hardly meets the motto of maintaining environment healthy through beneficial scheme as the proposed system.

Municipal Waste Management is aeffort that must be handled both by citizens and municipal corporates. With rising demand to diminish plastic waste and cut down user costs, it has become indispensable to implement waste collection and segregation both in urban and rural area. The suggested system promotes such aided effort with integrated technologies of RF-id and GSM/GPRS. The proposed system uses RFID to authenticate the user (citizen) ,a camera which identifies the object whether it is garbage or not and load cell to calculate the weight of the garbage; as per the weight an amount will be credited to the account linked to the RFID of an user. An SMS which contains details of the user's name and the amount credited will be sent as confirmation to user's mobile. Smart bin will also have an analysis done to tell the user the amount and type of garbage they dispose through Image processing with datasets predefined for certain identification of litter. The weight of trash can be measured using Load Cell, a transducer that measures force, and outputs this force as an electrical signal. This system is profitable as users are benefitted with certain amount based on the garbage they dispose. Such schemes are being initiated in metropolitan cities to oversee waste collection by installing PET machines in Railways and mobbed areas thereby encouraging citizens to ensure healthy environment and annihilating plastic waste.

VII. WORKING PROCEDURE

The novel system presents an intelligent dustbin that can identify the type of waste as if it is biodegradable or non-biodegradable. This helps in segregating waste without much effort by municipal workers. It also can weigh the garbage according to which the system can reward the user with some amount of money. The amount is sent as an sms to the user's linked account number. The following is the process flow of the proposed system

1) User's Identity is gathered using fingerprint or similar authentication approach. This will help the system to manage user data and account details.
2) User is notified with an LCD display to place the garbage in front of camera for identifying garbage type.
3) System is trained to identify the garbage type by either color-based image segmentation or by training datasets as in Machine Learning algorithms.
4) After identifying the trash as garbage, the user is displayed an LCD message to weigh the garbage. It is essential to make use of high accuracy weighing mechanism for further computations.
5) The weight is converted from electrical impulses to digital values and is checked for certain limits or conditions. For instance, if the weight is less than 400 grams then the user must be rewarded at least 10 rupees or so. The system is already programmed to make such decisions.

6) As the amount is found out, the user is informed using an SMS sent to user's linked account number. This data is managed on web server and each time the user receives rewards, the details are updated to server and the user as well.

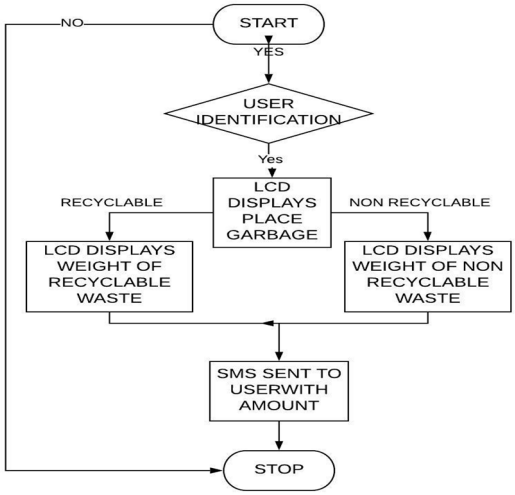


Fig. 4. Flow chart

The system focuses on sustaining healthy environment by engaging citizens to throw garbage only in dustbins and not litter on civic places. It will also help municipality to manage and dispose waste without reaching every corner of area thereby saving enough money for recycling expenses. Similar strategy has also implemented in Australia and other nations to curb the solid waste littering.

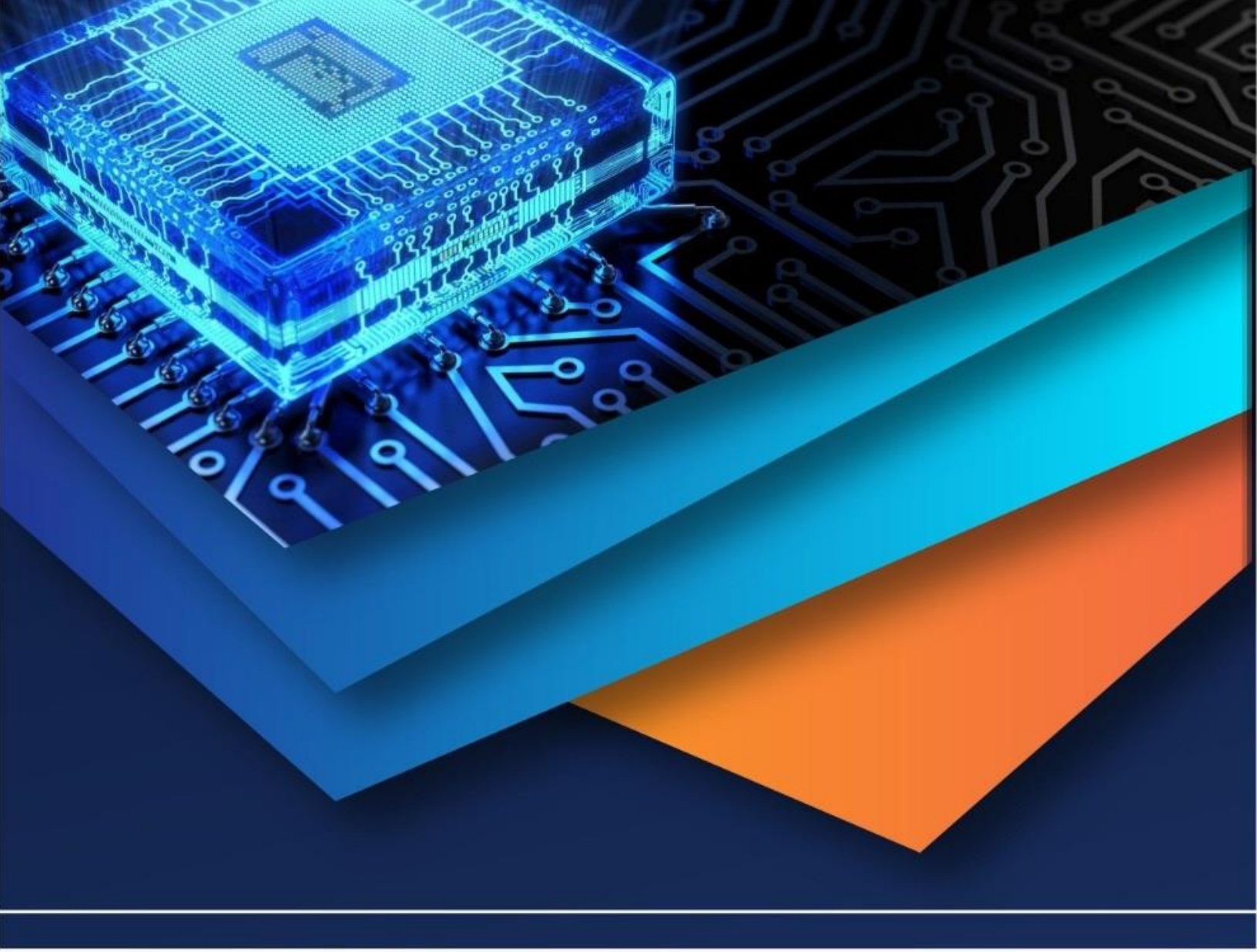
VIII. CONCLUSION

Waste Management is crucial in developing countries with increasing production of masses of solid waste. In order to improve the managing strategies, the developing countries in aid of resources must be funded enough to mitigate the effects of solid waste. The citizens must also make sufficient efforts in curbing down plastic consumption. This will serve as an advancement in civilization of mankind.

The survey conducted on solid waste management to understand the real-time applications implied in developed countries and to comprehend the municipal system functional strategy has lead to various outcomes that will help in incorporating technologies to advance and utterly automate the process of waste collection. The working principle is a blueprint to advancement in waste management and can further be extended by including Machine learning algorithms for training images to identify various types of garbage components, GSM to optimize routes for municipal collectors, high accuracy load cells to calculate the weight of dump and the likes. The system will later help the municipality to efficiently manage waste and help them in recycling without manually segregating waste. It will also curb the street-to-street collection efforts.

REFERENCES

[1] "Smart Waste Bin: A New Approach for Waste Management in Large Urban Centers", Kellow Pardini, Joel J. P. C. Rodrigues, Syed Ali Hassan, Neeraj Kumar, Vasco Furtado, August 2018, http://dx.doi.org/10.1109/VTCFall.2018.8690984
[2] "Smart Recycle Bin: A Conceptual Approach of Smart Waste Management with Integrated Web Based System", Mohd Helmy Abd Wahab, Aeslina Abdul Kadir, Mond Razali Tomari, Mohamad Hairol Jabbar, October 2014, http://dx.doi.org/10.1109/ICITCS.2014.7021812
[3] "Design and Development of Smart Trash Bin Prototype for Municipal Solid Waste Management", Feisal Ramadhan Maulana, Theo Adhitya S. Widyanto, Yudi Pratama, Kusprasqpta Mutijarsa, October 2018, http://dx.doi.org/10.1109/ICTSS.2018.8550013
[4] "RFID-based real-time smart waste management system", Belal Chowdhury, Morshed U. Chowdhury, December 2007, http://dx.doi.org/10.1109/ATNAC.2007.4665232
[5] "An integrated node for Smart-City applications based on active RFID tags; Use case on waste-bins", Dimitris
[6] Karadimas, Andreas Papalambrou, John Gialelis, Stavros Koubias, September 2016, http://dx.doi.org/10.1109/ETFA.2016.7733532
[7] "SWM: Smart Waste Management for Green Environment", Teh Pan Fei, Shahreen Kasim, Rohayanti Hassan, Mohd Norasri Ismail, Mohd Zaki Mohd Salikon, Husni Ruslai, Kamaruzzaman Jahidin, Mohammad Syafwan Arshad, May 2017, http://dx.doi.org/10.1109/ICT-ISPC.2017.8075303
[8] "IoT based Smart Trash Bin for Waste Management System with Data Analytics", Sahana Parvin Muquit, Durgesh Yadav, Lala Bhaskar, Wasim Firuj Ahmed, February 2018, http://dx.doi.org/10.1109/IC3IoT.2018.8668113
[9] "Data Analytics Platform for the Optimization of Waste Management Procedures", Thanasis Vafeiadis, Alexandria Nizamis, Vissarion Pavlopoulos, Luigi Giugliano, Vaia Rousopoulou, Dimosthenis Ioannidis, Dimitrios Tzovaras, May 2019, http://dx.doi.org/10.1109/DCOSS.2019.00074



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY