

# A REVIEW OF AUTOMATIC WASTE SEGREGATION SYSTEM METHODS

<sup>1</sup>Dr. Abdul Kareem,<sup>2</sup>Amar C Balaganv,<sup>3</sup>Varuna Kumara,<sup>4</sup>Akshatha Naik,<sup>5</sup>Anil N T,<sup>6</sup>Chandan Kumar C N,<sup>7</sup>Vishnumoorthy Nayak

<sup>1</sup>Professor,<sup>2</sup>UG Scholar,<sup>3</sup>Assistant professor,<sup>4</sup>Assistant professor,<sup>5</sup>UG Scholar,<sup>6</sup>UG Scholar,<sup>7</sup>UG Scholar

<sup>1</sup>Department of Electronics and Communication Engineering,  
<sup>1</sup>Moodlakatte Institute of Technology, Kundapura, India

**Abstract** -: In the world, every nation faces the waste management issue, Governments of particular nations implement several methods for the segregation of waste, in wastes, there are different wastes like waste generated by industries and domestically. Today's era is developing different methods of technologies very rapidly and we are emerging with the concept of smart cities so there is a need for proper solid waste management with automatic methods, proper plan can only way to tackle this problem. The major environmental damage is happening for improper disposal of plastic waste in landfills and failure to segregate the different plastics from the existing plastics.

This paper gives a detailed explanation of how to segregate the different types of waste present in our surroundings. To get the solution from the solid waste we can develop different types of waste segregator systems so "Automatic Solid waste Segregation" Is the most efficient and effective way because it will help to reduce the manual work performed during the separation of different types of waste from the bulk of waste and based on that we can recycle and reuse the different materials from the waste. Thus, we have compared different methods of automated waste segregation methods implemented using trending techniques.

**Index Terms** - *Technologies, Automatic, landfills, Industry*

## I. INTRODUCTION

One of the biggest global problems and it will affect every individual living on this planet, reports of various government and non-government organizations mentioned that they can collect waste from the household and industries but the collected waste was not in the proper manner and mixed, it can have different negative impacts on the human health and environment. it will increase the risk of pollution and increase the operational costs, when different types of waste are mixed, it will very hard to sort and segregate them for proper disposal. As a result, hazardous and toxic materials end up in landfills, which directly harms the environment and human health. The increase in population and urbanization led to inappropriate waste disposal.in developing regions with mixed economics, facing the disposal of waste is more difficult compared to developed regions. most municipal corporations need a worker for the separation of the waste from the mixed waste, In case if we adopted different methods of segregation then we easily reduce the extra expenses for manual workers and reduce the time.

The important aspect of this study is to analyze the existing research methods of waste segregation around the world. This will help to determine the problems an algorithm used and the method of their studies, It also helps us with a future study. The succeeding part will discuss some important research presented, new technologies used to properly segregate waste, and innovations. This will explain as well as gives some methods for sorting waste.

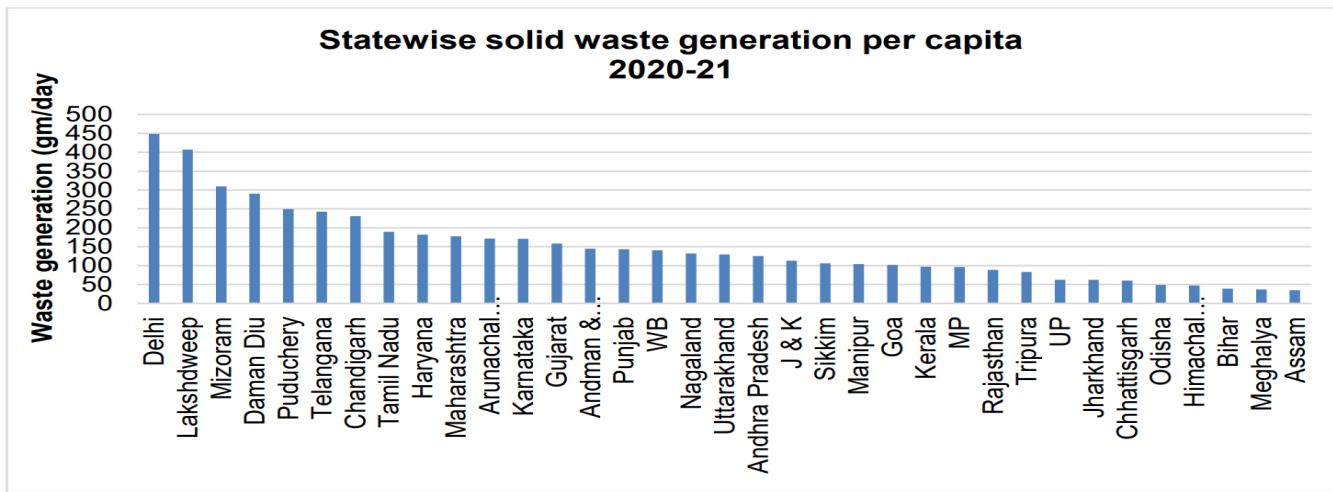
Waste can be classified into various categories based on its properties, In that wastes, some wastes can be recycled and some not, and some are degradable and non-degradable.

**Solid Waste:** solid waste refers to any non-liquid refuse, garbage, or debris generated by households, commercial activities, and industrial operations. these include paper, plastics, glass, and food waste, they can be further categorized into different types based on their origin, and composition.

**Plastic waste:** plastic waste includes bottles, jars, bags, etc. plastic waste is a major environmental problem because of its long lifespan, it can be generated from various sources such as households, industries, and commercial activities.

**Metals:** these are any discarded or unwanted material that contains one or more types of metal, this can include scraps from industries and households, It can be recycled and thus should be disposed of properly and separately.

**Liquid waste:** Liquid materials that are not intended for further use or consumption. includes dirty waste, wash water, organic liquids, waste detergents, and even rainwater.



**Fig1: State wise Waste Generation per capita**

## II. CURRENT SITUATION

considering the current scenario, the world is moving towards digitalization and everything in our surroundings is busy with a modern lifestyle and modern technology an increase in the number of internet users leads to human life easier and gains more efficient. The literacy rate will be increasing in the developing areas but they failed to get the proper knowledge of waste management, In developing Situations also people follow the same methodology of waste management. Taking India as an example government follows the different steps for collecting waste, like community bin collection, house-to-house collection, and collecting on regular pre-scheduling by using the musical bell of the vehicle. They collect different wastes from other areas also. on average a small-town municipal corporation collects 14-15 tonnes of waste from all the different areas. But the lack of automatic segregation methods they funding the money for manual waste segregation and due to less number of manual workers daily segregating only 6-7 tonnes of waste from the collected waste and other wastes getting landfilled. This increases environmental pollution and also harms human physical and mental health.

## III. NECESSITY OF WASTE SEGREGATION

Waste segregation helps in the proper disposal of a variety of waste and helps in identifying the recyclable and non-recyclable materials that can be reused. This reduces the cost of landfilling and transportation and helps in reducing environmental pollution and prevents the contamination of water and soil. Segregating hazardous waste from non-hazardous waste prevents accidents and exposure to harmful materials and conserves natural resources.

## IV. LITERATURE SURVEY:

This part covers the work done by the different researchers using various technologies for the segregation of waste.

### 4.1 Arduino-based waste segregation techniques:

In [1], authors Mohammed Rafeeq, purposed the prototype of waste segregation, in their research waste can be segregated as plastic, glass, and metal using the three bins. initially waste is pushed onto a conveyer belt, the presence of waste is first identified by the use of IR sensors at the start of the conveyor belt, the metal can be detected by using the inductive sensor, if is not metal then moves further to capacitive detection for identifying the material glass or plastic.

Where 3 types of materials are segregated by using Arduino UNO, the collected small range of wastes is placed on the conveyor which runs on a motor of 12V and 2 A, it will be connected to the motor driver and it also contains programmed to run anti-clockwise and clockwise direction by Arduino. The conveyor belt rotates right when both the IR sensor and the Inductive sensors are high indicating metal and collecting the particular bin, The conveyor belt moves left If the IR sensor is high and the Inductive sensor is low indicates material either plastic or glass. the belt moves if the capacitive sensor output is high indicating the object is glass, if not high the object is plastic.

In [2], authors Padmapriya Praveen Kumar purposed a system separate metallic and non-metallic waste, this purposed system is not only cost-effective but also makes very easier to segregate the materials and by using this, the metallic waste can be reused efficiently, this method helps medium scale companies.

The system uses the Arduino UNO to control the whole circuit, wastes are placed on the conveyor model which runs with help of a DC Motor. The proximity Sensor is used to separate the Ferrite waste from non-metallic waste and collected it in a suitable bin, which is placed on the Servo motor. The bin contains two separate compartments, magnetic wastes like nails, and iron wastes are collected by the first compartment. other holds the remaining waste. the proximity sensor value ranges from 140-155 means non-metals, whereas for metals the value ranges from 0-100. The detection of metal and non-metal is done by dumping them into the hardware, i.e., Arduino and other suitable components. It is the better option for the safe management and it is low cost.



## 4.2 IOT-based waste segregation techniques:

In [3], authors Akash Musipatla purposes a system of municipal waste segregator, the smart bin is divided into 3 compartments, each compartment has its function. The compartments consist of an Infra-ray sensor with a metal detector for the detection of metal, and the second compartment consists of an IR sensor with a Moisture sensor. The last compartment collects the segregated waste respectively.

The whole system is controlled by Arduino Mega Board, and various sensors and motors are interfaced with It. This method segregates the dumped waste immediately, The bin can be programmed and send accurate information about the garbage. The required code for controlling the sensor and motors is done by using embedded-C programming language, which helps to define the output and input port easily. In this purpose project, we used the IDE compiler to compile the code and send it to the board using wire, i.e. A-B wire. To provide details of every decision we have used a Liquid Crystal Display device to display the decisions made by the Arduino processor. NodeMCU is a component that can be used to connect to a Wi-Fi hotspot using the 802.11 protocol. NodeMCU when interfaced with ARDUINO MEGA can be used for providing real-time updates, by updating the decisions made by the device on to the specific server, from where the status of the device can be monitored. This project helps to create more resources for recycling as it decreases the portability of contamination.

In [4], authors Santhosh Kumar B R purposed effective and efficient methods of waste collection and segregation at a domestic level based on the nature of components like metal, plastic, and biodegradable, the waste is stored in their respective segments of the bin. This is an Eco-Friendly IOT-based waste segregation and Management method.

The waste dropped into the dustbin is segregated with the help of sensors and the corresponding valves of the segment are opened and the waste is dumped into their respective segment. The biodegradable segment is equipped with sensors to detect microbes and their activities are controlled by chemical treatment when the indicator specifies alarming levels, STM32 controller is used to carrying out all the activities in the bin. Similarly, Metal and plastic can be detected by using their respective segments using inductive and capacitive sensors. The STM32 is the heart of the system. It synchronizes the activities of hardware and software modules sequential manner. Sensors namely moisture, capacitive, inductive, gas level detecting, and microbe sensors, act as input and output controls to the system.

In [5], authors Wesley Pereira proposed system's main feature is garbage segregation. A Smart bin will have 4 different compartments for the waste: plastic, wet, dry, and lastly for wastewater from the auto clean feature. Apart from this, it will also have ultrasound sensors for the bin to open when a person approaches the dustbin to throw garbage thus making it hand-free and more hygienic. The smart bin will also have an analysis done to tell the user the amount and type of garbage they dispose of. Daily, weekly, and monthly garbage disposal will be analyzed through graphs and data through live data reception. The bin will also have a reminder sent to the phone from the app connected to the bin to tell us that it is time to throw the garbage. This idea will help us to dispose of the waste separately and thus also be able to distinguish the recyclable and non-recyclable waste. The smart bin is an efficient and hygienic waste disposal and segregation system with will eventually help in waste optimization

## V. COMPARATIVE ANALYSIS:

After a complete and detailed study of different techniques used to perform the Automatic waste segregation process, we can say that IOT-based projects and technique is used more comparatively than Arduino UNO, The main drawback of Arduino-based systems are they can be implemented in small-scale projects, if we try to implement Arduino based system in large scale it does not give accurate results, like if we implement this to municipal waste segregation, they collect a daily large amount of waste and moving conveyor model back and front consumes the more time. other than The IOT-based system has been collecting accurate data in real-time and load cell the approach. we can use trending techniques like AI and ML-based systems and the disadvantage is expensive hardware and requires a lot of data for processing. In Arduino, it is not suitable to use Raspberry Pi because less flexible and has fewer features compared to IOT.

## VI. CONCLUSION

Different steps and methodologies of efficient and effective waste management and disposal have already been researched and carried out by many researchers. waste management is one of the most difficult threats in front of the world, the change in habitats of people, and rapid development are responsible for the large generation of waste. The detailed study indicates that IOT-based techniques are mostly used for waste segregation but the main drawback of this is cost-effective. To make a cost-effective solution, Artificial intelligence, and machine learning-based system were developed for automatic segregation based on image processing and different type of algorithms with a lot of collecting and training data. The system should adopt Proper collection, storage, processing, transport & disposal of waste so that the impacts of waste can be minimized & the quality of life can be improved.

## VII. REFERENCES

- [1] Mohammed Rafeeq, Anteequrahman, Sanjar Alam, Mikadad, "Automation of plastic, metal and Glass Materials Segregation using Arduino in Scrap Industry ", Mangalore, July 2016
- [2] Super-twisting sliding mode controller with fuzzy logic based moving sliding surface for electronic throttle control Abdul Kareem International Journal of Advanced Mechatronic Systems 2017 7:3, 174-182
- [3] Ajay V P, Pradeep Kumar M, Kishanth A, Vaishnavi Kumar, R. Santhiya Devi, Amirtharajan Rengarajan, K. Thenmozhi, and Padmapriya Praveen Kumar, " Automatic Waste Segregation and Management ",2020 International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA
- [4] A. Kareem, *Fuzzy logic based super-twisting sliding mode controllers for dynamic uncertain systems*, St. Peters Institute of Higher Education and Research, St. Peters University, Chennai, India, March 2014.

- [5] Akash Musipatla, T. Saminathan, P. Manideep Varma, P. Shahid Khan, G. Mahesh Kumar, "IoT Based Automated Waste Segregator for Efficient Recycling" International Journal of Innovative Technology and Exploring Engineering, Volume-8 Issue6S, April 2019
- [6] Santhosh Kumar B R, Varalakshmi N, Soundarya S Lokeshwarii, Rohit K, Manjunath, Sahana D N, "Eco-Friendly IOT Based Waste Segregation and Management", 2017 ICEECCOT
- [7] Wesley Pereira, Saurah Parulekar, Sopan Phaltankar, Vijaya Kamble "Smart Bin (Waste Segregation and Optimization)" 2019 IEEE
- [8] A. Kareem and M. F. Azeem, "A novel fuzzy logic based adaptive super twisting sliding mode control algorithm for dynamic uncertain systems", *Int. J. Artif. Intell. Appl.*, vol. 3, no. 4, pp. 21-34, Jul. 2012
- [9] E. Malleswari, S. Nanda Kishore "Smart Wastage Segregation using Arduino UNO" International Journal of Research Technology and Engineering, Volume-8 Issue 5, January 2020
- [10] Karadimas, N.V., Mavrantza, O.D., Loumos, V.G. "GIS Integrated Waste Production Modeling", The International Conference on Computer as a Tool, EUROCON 2005., IEEE Press, Nov 2005, Vol 2, pp 1279-1282, doi: 10.1109/EURCON.2005.1630190
- [11] Christensen, H. T., Solid Waste Technology & Management, Wiley, 2010, Volume 1 & 2 Haug, T. R., The Practical Handbook of COMPOST ENGINEERING, Lewis Publishers, 1993
- [12] Tchobanoglous, G., Theisen and Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw Hill, 1993.
- [13] Shyam Swaroop Nigam et al, "Effective Utilization of Low-Cost Incineration and Its By-Products in India", IEEE,2014

