Automated Waste Segregation System using IoT

Rifath Jahan[1,] M.G. Jhansi Rani[2], U.L.N. Manasa[3], G. Susmitha[4], M.K. Girija[5], P. Nikitha[6]

[1]*Assistant Professor, Dept. of Electronics, Sujatha PG College for Women, Hyderabad, Telengana, India.*
[2-6]*PG Students M.Sc (Electronics), Sujatha PG College for Women, Hyderabad, Telengana, India.*

---***---

Abstract – *Due to the Rapid increase in population has led to improper waste management in metro cities and urban areas which has resulted in spreading of diseases. The segregation, transport handling and disposal of waste must be managed properly to minimize the risks to public health and environment.*

An efficient method to segregate the waste has been proposed in our article, "Automated Waste Segregation System using IOT". It is mainly designed to sort the waste into different categories like metal, wet and dry Using Arduino Microcontroller, which is easy to operate and efficient . After segregation the system monitors levels of all the bins/containers located at different areas, when bin reaches to the threshold limit, the system will transmit the level along with the unique ID provided to that bin. a web page is built to show the status of each bin. *These details can be accessed by the concern authorities from their place with the help of internet and an immediate action can be made.*

Hence the system has the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Key Words: Segregation System, Sensors, Drivers, Microcontroller, IOT.

I . INTRODUCTION

As the world's population size has grown, waste generation has increased rapidly. Cities are centers of garbage production, and the amount of garbage they create is increasing even faster than their populations, according to a recent report from the World Bank and for cities in many developing countries, it's rapidly a becoming an environmental and economic disasters. This creates huge issues over people's health all over the world. Proper management of waste materials urban and rural areas is very important to maintain hygienic and healthy living environment to live. Majority of infections are spread because of bacteria and viruses in unhygienic and polluted environment. The technology sources are needed for safeguarding the environment at present. Majority of the environment in the public and

residential areas are being polluted with the waste materials in public, residential and industrial areas.

Garbage and liquid waste that end up in water bodies negatively change the chemical composition of the water, it effects ecosystem existing in water, including fish and other animals drinks that polluted water. Direct contact with waste can result in skin and blood infections through wounds. This had a significant effect on humanity, wildlife and the environment.

The common method of waste disposal is by uncontrolled and unplanned open dumping at landfill sites. This is a crude method and creates adverse effects on the health of the society living in and around the area. Segregation of waste is generally done by hand-picking methods. This method is carried out by people who generally are unaware of the after-effects of this method. When the waste is segregated into basic streams, the metallic waste could be reused or recycled. Wet waste can be decomposed into biogas. Even though there are large scale industrial waste segregators present, it is always much better to segregate the waste at the source itself. The benefits of doing so are that a higher quality of the material is retained for recycling which means that more value could be recovered from the waste [12].

The occupational hazard for waste workers is reduced. Also, the segregated waste could be directly sent to the recycling and processing plant instead of sending it to the segregation plant then to the recycling plant. . When the waste is segregated into basics streams such as wet, dry, metallic, the waste has higher potential of recovery, and consequently, recycled and reused. The wet waste fraction is often converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy [23].

II. Literature Survey:

In "What a Waste: A Global Review of Solid Waste Management," by Daniel Hoornweg and Perinaz Bhada-Tata, examine how rising urban populations are creating larger and larger waste management problems for cities

all over the world. Unsurprisingly, authors found that the world's urban residents are producing significantly more waste than they were just 10 years ago[1].

While the urban populations of upper-middle and upper-income countries are expected to largely maintain their levels of waste production in 2025, the urban populations in lower- and lower-middle income countries like India, Nigeria and Kenya will more than double the amount of waste they produce. As this chart shows, the increases for cities in these places are expected to be huge[1].
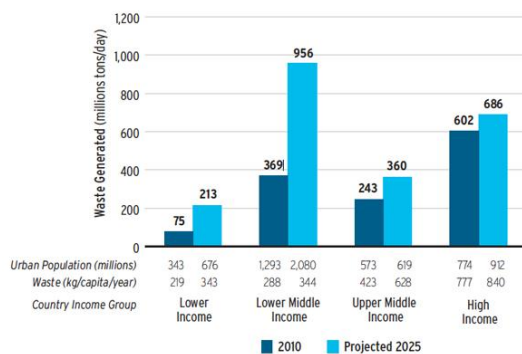
"Municipal solid waste management is the most important service a city provides," the report notes. "A city that cannot effectively manage its waste is rarely able to manage more complex services such as health, education, or transportation… Improving MSW is one of the most effective ways to strengthen overall municipal management and is usually a prerequisite for other, more complicated, municipal services."[1].

It was estimated that in 2006 the total amount of waste generated was about 2.02 billion tones, showing 7 percent rapid increase since 2003.the segregation, handling and transportation of waste must be properly managed. In order to reduce the risk to health of public and to ensure the safety of environment. The economic value of waste is best realized when it is segregated properly. Poor waste disposal activities engender severe environmental problems on a location. Improper waste disposal is the disposal of waste in a way that has negative consequences for the environment. Examples include hazardous waste that is dumped into the ground, and not recycling items that should be recycled [23].

Several non-governmental organizations are working in the field of waste management like Clean Ahmedabad Abhiyan, Waste-Wise, Mumbai Environmental Action Group, Vatavaran and Srishti. They all successfully create awareness among the citizens regarding their rights and responsibilities towards management of solid waste and the cleanliness of their city. These organizations promote education and awareness in schools and they also encourage involvement of communities in the management of solid waste[3].

Various Types of waste:
- Wet waste
- Dry waste
- Garden waste
- E-waste
- Sanitary waste
- Domestic hazardous waste

Wet Waste: Kitchen Waste (Tea Leaches, Egg Shells, Fruits And Vegetable Peels, Meat And Bones), Garden And Leaf Litter, Including Flowers, Soiled Paper, House Dust After Cleaning, Coconut Shells, Ashes.

Dry Waste: Newspaper, Paper, books and magazines, Glass, Metal objects and wire, Plastics, Cloth Rags, Leather, Rexene, Wood/Furniture, Polystyrene/Paging material.

Domestic Hazardous Waste: Aerosol cans, Batteries, Bleaches and household kitchen and drain cleaning agents and its container, Car batteries, oil filters and car care products and consumables, Chemicals and solvents and their container, Cosmetic items, chemical based insecticides and their containers, Paints, oils, lubricants, glues, thinners, and their container, Pesticides and their container, Photographic audio/video tapes and their containers, chemicals, Styrofoam and soft foam packaging of furniture, packaging and equipment, Thermometers and mercury-containing products, Discarded medicine and disposable syringes[25].

Many type of waste can be utilized /used properly to reuse/recycle to reduce pollution, serve as main source of energy, maintain natural and healthy environment and sustain the environmental resources.

III. A.Technical Background

The mixed waste is sorted based on the conventional methods at the industrial level. Normally most of the unused and waste materials are found to be metal, wet, dry etc. Here two sensors are used namely inductive proximity sensor and capacitive proximity sensor. For level detection ultrasonic sensors are used to indicate the bins are full. The three materials found in waste are

Metal, Dry and Wet . These are the materials that can be recycled and the first step towards recycling is segregation. There are numerous benefits of recycling the waste materials. The technology adopted in this article is to resolve the issue of waste segregation is by making the entire process automated which reduces the man power.

The purpose of Internet-connected sensors (in this real time system) has been enable to communicate with each other, processes and to generate real-time data that we can then analyze and take further action.

B. Proposed System:

Waste is pushed onto conveyer belt, first the waste moves for detection with inductive sensor to detect it is metal. If it is detected as metal, motor rotates to in a direction to collect the metallic waste. Then demagnetization takes place and waste is dropped into bin. for non metal it moves further, now the capacitive proximity sensor detects, if the wet waste is detected motor rotates at a certain angle and it is dropped into next bin or if it is detected as a dry waste motor rotates with a different angle and it falls into another bin. Three different bins are used to collect metal dry and wet waste. If any out of the three bins become leveled then it is sensed by the ultrasonic sensors. This process of segregating the waste will help the people from not being effected to the pollution caused by the waste. Ultrasonic sensors are used for monitoring the level of bins, using the WiFi modem this information is updated on webpage.

IV. DESIGN AND IMPLEMENTATION:

A. System Block Diagram:

The Block diagram shows the different sensors embedded in the system entitled with "Automated Waste Segregation System using IOT". It consist of Power Supply, inductive proximity Sensor , Capacitive proximity Sensor and Ultrasonic Sensor, with the Help of these Sensors, the system can segregate the waste collected at collection point itself.

Three Separate bin are designed for automatic waste collection and segregation. The sensor senses the content of the bin and sends the signals or the data to the microcontroller then the microcontroller reads the data from the sensor and process the data, using WiFi, system informs about the level of garbage collected in the garbage bins via a web page to the Govt

office/authorized people. Wi-Fi modem is used for sending data . Whereas a web page is built to show the status of each bin with its reference ID provided to each bin, after segregation. This information can be accessed at different areas, so that the authorized persons can schedule the trash collection based on this information. The LCD screen shows the status of the each bin. the buzzer will be on when the level of bin crosses the limit. Thus this system helps to keep the city clean.

By allowing physical devices to communicate, it is taking the data that is individually collected, sharing it, and then translating the information into ways to make our current systems more efficient.
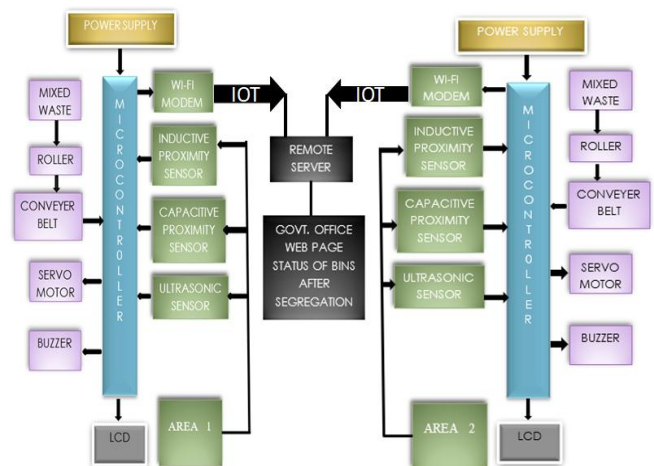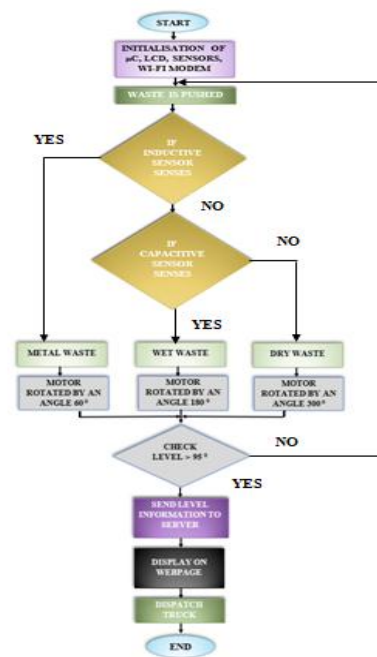

Fig: block diagram

B. System Flow:

V. Advantages:

The automatic segregation process reduces man power. The recycling and reusing process becomes easy. System is fully automated Efficient, Time saving and very easy to Control. Complete Information can be accessed only by authorized persons using the web pages. Any time we can monitor the status of bins after segregation. Automation of daily tasks leads to better monitoring of devices.

The main Advantage in this system, is to track individual bins and targeting these bins based on the information supplied by the devices. In a way, it provides a more "personalized" system that could potentially increase efficiency and reliability. Additionally, with the increased amount of devices connected to the Internet the Smart Grid expands, conserving more energy. Devices can make decisions and adapt without human guidance to reduce their energy usage.

VI. Future Scope:

The power to the system can be supplied by solar panels. Movable robots can also be implemented to collect and sort the waste where people get suffocated to waste. Inlet section can be incorporated with a crusher mechanism to reduce the size of the incoming waste.

VII. Conclusion:

Overflowing garbage bins causes five impacts on health environment are diseases like increasing the risk of contracting with salmonella, typhoid fever, food poisoning, gastric problems and major illness. we can reduce or control such kind of problems by Implementing of real time waste collection and segregation system by using IOT, In this system the information of all smart bins can be accessed from anywhere and anytime by the authenticated person and authenticated person can take a decision accordingly.

By implementing this system the cost reduction, resource optimization, effective usage of bins can be done. By reducing unnecessary rounds for garbage collection this system indirectly reduces traffic in the city. This system will inform the status of each and every bin in real time located throughout the city, so that the concerned authority can dispatch the garbage collection vehicle only when the bin is completely full or is about to full. The traditional garbage collection system is changed into a smart and intelligent system. The integrated IoT system is very useful to remotely monitor the garbage levels in bins. This system also reduces human efforts and it is user- friendly system.

This system will help to make our environment neat, clean more suitable for living, reducing global warming and making the world healthier.

REFERENCES:

1. "What a Waste: A Global Review of Solid Waste Management", Daniel Hoornweg and Perinaz Bhada.
2. "A Unique Technique for Solid Waste Segregation" ,Mahesh Kumar A S, Rajesh A S, 2019.
3. "Design and Development of an Automatic Clustered, Assorted Trash Segregation System", Narendran Siva Kumar, Aditya Raj Kunwar, Sandeep Kumar Patel, Santosh Kumar, Pushpa Mala. S [2016].
4. "A Survey on Smart Self Segregating Bin" N. Laxmisowmya, V. Adarsh, Aravind Kumar, C. S. Veena.
5. "SMART BIN FOR SMART CITIES", G.Keerthi Bhavani, Jaya Shree, Rifath Jahan Engineering Sciences International Research Journal Volume 7 Spl Issue-2019.
6. "Automated Waste Segregator", Amrutha Chandramohan, Joyal Mendonca, Nikhil Ravi Shankar, Nikhil U Baheti, Nitin Kumar Krishnan, Suma M S-[2014] .
7. "Automation of Plastic, Metal and Glass Waste Materials Segregation using arduino in Scrap Industry", Mohammed Rafeeq, Ateequrahman, Sanjar Alam, Mikdad –[2016] .
8. "Automatic Waste Segregator", Sharanya. A, U. Harika, N. Sriya, Sreeja Kochuvila-[2017].
9. "Smart Bin-Automatic waste segregation and collection", Manisha Jayson, Sanket Hiremath, Lakshmi H R–[2018].
10. "Automatic Waste Segregation", Nimisha S Gupta, Deepthi V, Mayakunnath, Rejeth Pal S, Badsha T S, Nikhil Binoy C- [2018].
11. "Automated Waste Segregator" Amrutha Chandramohan, Joyal Mendonca, Nikhil Ravi Shankar & Nikhil U. Baheti, , Texas Instruments India Educator's Conference, 2014, IEEE publication. pp. 1-6.
12. "Innovations in Waste" Claudine Capel, Waste management-world, Volume 11, Issue 2, Mar 2010.
13. "Microcontroller based Automatic Waste Segregator",M. K. Pushpa, Aayushi Gupta,

Shariq Mohammed Shaikh, StutiJha, Suchitra V, IJIREEICE, Volume 3, Issue 5, May 2015.

14. "Smart Trash System: An Application using ZigBee", Pavithra, IJISET, Volume 1, Issue 8, October 2014.

15. "Design and Development of Smart Waste Sorting System", Ruveena Singh, Balwinder Singh, IJRECE, Volume 3, Issue 4, October-December 2015.

16. "E-Waste Management", M. K. V. J. M. Bipin Nair, and R. M. Pushpa, International Journal of Commerce, Management and Technology, vol. 2, no. 1, pp. 109-120, January 2014.

17. "Automated Waste Segregator" Amrutha Chandramohan, National Level Analog System Design Contest, 2013-2014; conducted by Texas Instruments. India.

18. "A USN based Automatic Waste Collection System", Waheed Ahmad Arbab, 14th International Conference on Advanced Communication Technology(ICACT). 2012.

19. "Automatic Waste Segregator and Monitoring System", Aleena, Kavya Balakrishnan, Rosmi, Journal of Microcntroller Engineering and Applications 2016.

20. "Smart Garbage Management System" Vikrant Bhor,Pankaj Morajkar, Maheshwar Gurav,Dishant Pandya. (IJERT)2015.

21. https://sites.google.com/a/cortland.edu/the-internet-of-things/home

22. "IOT BASED GARBAGE MONITORING SYSTEM" Akash k t, Dineshchoudhari S Y, Sandeep C U, Prof. Rashmi P M, (IJARCET) Volume 6, Issue 4, April 2017.

23. "Real Time Waste Segregation", Ranjitha C, Sarga V, Sreelakshmi P K, Vishnu Suresh, Arya Paul , IJFRCSCE Volume: 4 Issue: 5 , May 2018,

24. Wireless green house security by embedded systems, Ajit hajare, Rifath Jahan, Shiba Farooq.

25. "BULK SOLID WASTE GENERATORS"A Step by Step Guidance for Urban Local Bodies to implement the Solid Waste Management Rules, ministry of housing and urban affairs-Govt of India-2016