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Advance Dry and Wet Waste Distribution Monitoring and Tracking System

Mr. A. D. Landge [a], ***Eshika Umredkar*** [b] , ***Urvashi Kale*** [c] , ***Pooja Meshram*** [d] , ***Sakshi Harode*** [e]

[a] **Project Guide, Department of Electronics and Communciation Engineering, Priyadarshini Bhagwati Collage of Engineering, Nagpur, Maharashtra, India.**

[b,c,d,e,f] **Students , Department of Electronics and Communciation Engineering, Priyadarshini Bhagwati Collage of Engineering, Nagpur, Maharashtra, India.**

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ABSTRACT—

Rapid increase in volume and types of solid and hazardous waste due to continuous economic growth, urbanization and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste. The segregation, handling, transport, and disposal of waste is necessary to manage properly to reduce the ill risk of public health and environment. This project aims to make a cost effective and compact automatic waste segregator. Here, the waste segregator is designed to segregate waste explicitly in step by step process using blowers of different to separate dry waste (Plastic and paper) and wet waste and magnets are used along with a scrapper arrangement to separate the metallic waste. They are further disposed into the bins. Further this disposed waste can be easily recycled and reused. The main feature of this project is the use of ultrasonic sensors to detect the level of the bins. All the information is monitor via smartphone application using IOT technology.

Keywords— Waste material, Arduino Controller, Metal detector, Moisture sensor , Servo motor etc.

I. Introduction

In the current situation, India is facing various challenges in the environment by the waste generated such as improper waste collection, treatment, transport, disposal. The most difficult challenge is from its inception to its disposal. Due to the increasing urban population, our country cannot survive the current system which results in environmental and public health pollution.

The economic value of the waste generated is not realized unless it is recycled completely. When the waste is segregated into basic streams such as wet, dry and metallic, the waste has a higher potential of recovery, and consequently, recycled and reused. The wet waste fraction is often converted either into compost or methane gas or both. The metallic waste could be reused or recycled. 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. 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. The purpose of this project is the realization of a compact, low cost and user-friendly segregation system for urban households to streamline the waste management process.

Automatic waste segregator categorizes the waste as plastic, metallic or organic. The monitoring system helps to monitor the waste collection process. New age technology will add in this model like IOT , for live monitoring of status of segregation in dustbin. The common method of waste disposal is by unplanned and uncontrolled dumping at landfill areas. This method is hazardous to human health, plant and animal life. When the waste is segregated into basic streams such as plastic, metallic and organic, the waste has a higher potential of recovery, and then, recycled and reused. The organic waste is 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. The metal waste could be reused or recycled.

II. Problem Identification

• Waste disposal is a huge cause for concern in the present world. The disposal method of a voluminous amount of generated waste has had an adverse effect on the environment. Unplanned open dumping at landfill sites made by municipal is a common method of disposal of waste.

• Human health, plant and animal life are affected due to this method. The traditional method used for segregating of waste in India is through rag pickers which are time-consuming and can have adverse effects on the health of the people who are exposed to such wastes.

• The economic value of the waste generated is not realized unless it is recycled completely. There is a need for a cheap and also an easy-to-use solution for segregation of household waste.

III. Objectives

- The purpose of this project is to design and implement a compact, low cost, and user-friendly segregation system for urban households to streamline the waste management process.
- To design a system that segregate the waste into three categories viz. metallic, dry and wet waste, thereby ensuring a higher quality of the material is retained for recycling which means that more value could be recovered from the waste.
- To reduce occupational hazard for workers involved in the collection and handling of waste.
- To design and construct a low-cost Automatic Waste segregator.
- Use of IOT technology for smart monitoring of status using Application.

IV. Literature survey

Nikolaos Baras, Dimitris Ziouzios, 2020[2] introduces "A cloud-based smart recycling bin for in-house waste classification" urban waste increases as long as modern lifestyle increases. Recycling is the best way to create a sustainable environment and also it needs the segregation of waste materials which is a tedious time-consuming task. It is the minimal cost and effective smart recycling bin that uses the power of the cloud in order with waste classification in personal in-house usage. A centralized Information System collects measurements in smart dustbins, the waste in each bin can be classified using Artificial Intelligence and also neural networks. And it is capable of classifying different types of waste with an accuracy of 93.4%.

Shashank Shetty, Sanket Salvi, 2020[3] This introduces the SAF-Sutra: "A Prototype of Remote Smart waste segregation and garbage level monitoring system", which can remotely monitor and is built at a very minimal cost. The design of the presented system considers the portability and ease of assembly of components as the essential factors during implementations. The demonstration shows the implemented system; its interaction with the user using the mobile along with the web application.

Clude-Noel Tamakloe, Dr. Elena v. Rosca, Introduces the Smart System and the Internet of Things (IoT) for waste management to provide an efficient and effective manner for waste disposal, improving the city's waste management. The proposed system is drawn and makeup a prototype of a solar powered, compact smart garbage bin whose monitoring is done with server side applications. The smart garbage bin is capable of monitoring internal garbage levels, compact them, and also free 25% of the space with each compactness. The bin detects and monitors the total weight and is capable of sending all the information to a secure server side application.

Rania Rizki Arinta, Dominikus Boli Watomakin, 2020[5] introduces the "Improves smart waste management to preserve tourist's attractions Yogyakarta in IoT environment", the main agenda is to make waste recycled, if it is not recycled, it will make the decomposition process more tedious. Therefore, the dustbin is integrated with the smartphone to find out information about the capacity of the garbage by using the ultrasonic sensor. The wi-fi module combined with the dustbin allows the sensor to send the data through the wi-fi module via smartphone.

Chethan Kaushal, Anshu Singha, 2020[6] introduce the Architecture for garbage monitoring systems using integrated technology, proposed the novel architecture of waste management that utilizes the concept of IoT and digital image processing, the architecture acts as a surveillance system to monitor the over the flow of the garbage and delivers the message to the concerned authorities to take the necessary and instant action.

V. Proposed System

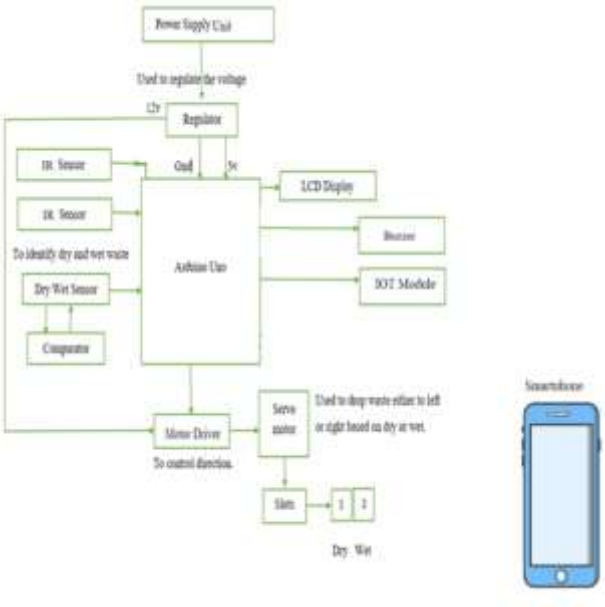

Fig.1. Block Diagram of System

Working Principle

- Power supply unit is used to converts the AC power to DC power using step down transformer. This 12v dc power is used to run all the control boards and components.
- Voltage Regulator is used to convert 12v DC to 5V DC supply. Which is required for sensors, buzzer and display unit.
- In this diagram 3 section will include to run the project, First is Input section , in which all sensors were used to detect the signal from input provide. Second section is processing unit in which Arduino uno controller used. All input signal sends the to controller and then sends to the output. Third section is output unit, in which buzzer , motor and display is used.
- In this proposed system, the two bins were used to store dry and wet waste, these bins are replaceable for cleaning purposes. The waste is placed on the dry wet sensor. The dry-wet sensor is set with a threshold value of moisture.
- This senses the moisture content; the motor driver helps in the rotation of the servo motor in both clockwise and anticlockwise directions hence it moves waste into its respective bins.
- The IR sensors are used to know the level of the garbage in the bin and intimate the message to the on LCD display with Buzzer. The Metal sensor is used to detect the metal waste.
- All the sensed data from Arduino UNO using sensors are sent to the display using MCU. The program would be coded in embedded C. Thus, messages will be displayed to the users in the LCD and smartphone application using IOT , and obtained status will be notified by buzzer to authorized people for bin status.

VI. Advantages

- Sorting of waste at the primary stage will make the waste management more effective and fruitful.
- The dustbins are cleared as and when they are filled, thus giving way to a cleaner environment.
- Eco friendly system.
- Lower initial investment including lower cost of installation.

VII. Dis-Advantages

- The system requires a greater number of garbage bins for separate waste collection as per the population in the city. This results in a high initial cost.
- The sensor nodes used in the dust bins will have limited memory size.

- It is an automatic system where there is no human requirement which results in unemployment.

VIII. Application

a. Sensor-Based Waste Detection:

Discuss the use of sensors (such as infrared sensors, ultrasonic sensors, or color sensors) to detect different types of waste materials.

Explain how these sensors communicate with the Arduino controller to identify specific waste items.

b. Actuator-Driven Sorting Mechanism:

Detail the mechanism of the sorting process, driven by actuators controlled by the Arduino.

Describe how the Arduino triggers the movement of conveyor belts or mechanical arms to divert waste items into separate bins based on their composition.

c. User Interface and Feedback System:

Outline the development of a user interface, possibly using an LCD display or LED indicators, to provide feedback on the sorting process.

Explain how users can interact with the waste segregator machine to monitor its operation and address any issues that arise.

d. Data Logging and Analysis:

Discuss the potential for data logging capabilities within the Arduino controller to track waste segregation statistics over time.

Explain how this data can be analyzed to optimize the machine's performance and identify trends in waste composition.

e. Integration with Recycling Processes:

Highlight the importance of integrating the waste segregator machine with existing recycling processes.

Explain how sorted waste materials can be collected for recycling or further processing, contributing to a circular economy.

f. Benefits and Impacts:

Summarize the benefits of using a waste segregator machine with Arduino control, such as improved efficiency, reduced labor costs, and enhanced environmental sustainability.

Discuss the potential positive impacts on waste management practices and community welfare.

IX. Result and Discussion

The proposed system “automatic waste segregator and monitoring system” sorts wastes into three different categories, namely metal, dry and the wet (organic) waste. Wet waste refers to organic waste such as vegetable peels, left-over food etc. Separating our waste is essential as the amount of waste being generated today causes immense problem. Here, we will be testing the household wastes which are generated in every home today and we will be having following expected result. Tables below show the tested results of the waste when exposed to our automatic waste segregator and monitoring system. The proposed system would be able to monitor the solid waste collection process and management of the overall collection process. It would provide in time solid waste collection.

SI. NO	TYPE OF METAL WASTE	DISCARDED OR NOT
1	SAFETY PIN	YES
2	PAPER CLIP	YES
3	BATTERY	YES
4	NAIL	YES

Table 1: Expected Result of Metallic Waste Separation

SI. NO	TYPE OF WET WASTE	DISCARDED OR NOT
1	KITCHEN WASTE	YES
2	LEFTOVER FOOD	YES
3	VEGETABLE PEEL/FRUIT PEEL	YES
4	ROTTEN FRUITS AND VEGETABLES	YES

Table 2: Result of Wet Waste Separation

SI. NO	TYPE OF DRY WASTE	DISCARDED OR NOT
1	PAPER	YES
2	SMALL BOTTLES	YES
3	HEAVY CARTONS	NO
4	MILK COVER	YES
5	DRY LEAVES	YES
6	CLOTHES	YES
7	TETRA PACK	NO

Table 3: Result of Dry Waste Separation

Rapid increase in population has led to improper waste management in metro cities and urban areas which has resulted in spreading of diseases. This hectic problem all over in the society has led us to do this project for the proper segregation and monitoring of waste in every households and surrounding areas where it need most. The waste segregator as the name suggests, segregates the waste into three major classes: plastic, organic, metallic. The proposed system would be able to monitor the solid waste collection process and management of the overall collection process. Automatic Waste Segregator has been successfully implemented for the segregation of waste into metallic, dry and wet waste at a domestic level. The system can segregate only one type of waste at a time with an assigned priority for metal, wet, dry waste. Sensors are added for monitoring waste collection process. Sensors such as Inductive proximity sensor, IR Sensors and Moisture sensor are used. The Infrared sensor would be placed in the garbage bins. Inductive proximity sensor for the metal waste detection and moisture sensor for wet waste detection.

The experiment has been conducted for wet, dry, glass and metallic wastes. It is found that the change of capacitive count value is greater for wet waste and very less for dry waste. Other objects like glass and wood have intermediate relative dielectric constant and thus are detected as dry waste. Servo motor and a DC motor is used here. Servo motor for rotating the bin and DC Motor for the robotic arm having electromagnet in it. A Wi-Fi module is there and the status of the dry, wet, metal waste bin is given in the webpage created. Experimental result shows that the waste has been successfully monitored and segregated into metallic, wet and dry waste using the Automatic Waste Segregator and Monitoring system.

Fig.2. Project Model

X. Conclusion

This project enhances the cleanliness of the smart cities by the practical application of "Automatic waste management and segregation system using IOT". With urbanization and increasing population, disposal of waste is a major concern. This proposed system is an effective waste segregation system that has no human intervention or interference to separate dry and wet waste. It provides timely collection and disposal. The proposed system can be deployed on a domestic scale in a household or a large scale in public places.

Waste management is all those activities, actions and works required to manage waste from its production to its final disposal. This project is designed such a way that a system which collects from different positions and segregates the wastes. As the bin fills IR sensor senses the level and bin rotates into conveyor waste is collected from different locations and reached to the segregation part through the main conveyor belt. The timing and movement of the conveyor belt are controlled by the peripheral interface controller (PIC microcontroller). As the name suggests automatic waste segregation segregates the waste into three major classes: dry, wet, metallic by using different types of sensors. An internet of things incorporated in this project counted and monitored the waste.

XI. Future Scope

- Enhanced Sensor Technology:

Integration of advanced sensor technologies, such as machine vision or AI-based image recognition, to improve the accuracy and efficiency of waste detection and sorting.

- Smart Sorting Algorithms:

Development of intelligent sorting algorithms that can dynamically adjust sorting parameters based on real-time data, optimizing the segregation process for different types of waste.

- Remote Monitoring and Control:

Implementation of remote monitoring and control capabilities, allowing users to access and manage the waste segregator machine from anywhere via a smartphone app or web interface.

- IoT Connectivity:

Integration of Internet of Things (IoT) connectivity to enable data exchange between multiple waste segregator machines and central management systems, facilitating centralized monitoring and control of waste management operations.

- Energy Efficiency and Sustainability:

Exploration of energy-efficient design principles and renewable energy sources to power the waste segregator machine, reducing its environmental footprint and operating costs.

- Modular and Scalable Design:

Development of modular and scalable waste segregator machine designs that can be easily customized and expanded to accommodate varying waste processing requirements and volumes.

- Integration with Robotic Systems:

Collaboration with robotic systems and automation technologies to implement robotic arms or grippers for more precise and efficient waste sorting, especially in complex or hazardous waste streams.

- Blockchain Technology for Traceability:

Utilization of blockchain technology to create a transparent and immutable record of waste segregation and recycling activities, enhancing traceability and accountability in the waste management supply chain.

- Community Engagement and Education:

Integration of educational components and community engagement initiatives to raise awareness about the importance of waste segregation and encourage active participation in waste management practices.

- Regulatory Compliance and Standards:

Alignment with evolving regulatory requirements and industry standards for waste management, ensuring that the waste segregator machine meets compliance obligations and contributes to sustainable development goals.

- Collaborative Research and Innovation:

Encouragement of collaborative research and innovation efforts involving academia, industry, and government agencies to drive advancements in waste segregation technology and address emerging challenges in waste management.

By exploring these future avenues, the waste segregator machine using Arduino controller can evolve into a more sophisticated and integrated solution for efficient waste management, contributing to a cleaner and more sustainable environment.

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