

Smart Waste Segregation System using IOT

Mansi Jonwal¹, Shreya Kharade², Aditya Mandge³, Mr. P.U Palkar⁴

Students, Instrumentation Engineering^{1,2,3}

Assistant Professor, Instrumentation Engineering⁴

AISSMS Institute of Information Technology, Pune, India

Abstract: *The rapid increase in Urban City area population has led to a massive rise in municipal solid waste that is unsegregated and mixed. Manual segregation is often inefficient and difficult as well as poses health risks to workers and people handling it. This paper proposes an automated Smart Waste Segregation System using an Arduino Controller. By utilizing Infrared (IR), Moisture, and Inductive Proximity sensors, the system identifies waste categories and disposes of them into separate bins via a servo-motor mechanism. This system is an energy efficient, low powered and cost-efficient solution to many households and can be a great help in keeping a secure environment*

Keywords: IOT, Smart waste system, Microcontroller, wet and dry waste segregation

I. INTRODUCTION

Waste management is a global challenge. The core of the problem lies not in disposal, but in segregation at the source. Mixed waste reduces the efficiency of recycling processes and gives inefficient results. The main objective of this proposed system is to design a low-cost, automated system that sorts waste into three categories: Metallic, Wet, and Dry. The Bins are created for the respective waste type. The system identifies the type of waste with the help of iot based sensors and the waste is separated in the respective bin.

II. LITERATURE REVIEW

As the world is in a stage of scaling up still there is one major problem, waste is the foul smell around us and we have deal with it most often that is Garbage. Most of the time we see garbage bin is overfull still some people keep on adding garbage over it which makes the surrounding look untidy. This unclean surrounding leads to cause number of diseases as large number of mosquitoes and insects procreate on it. Managing waste appropriately has always been an issue not only in India but also in some other parts of the globe. Therefore, such a system must be developed which can reduced this problem at minimum level. With this growing generation our prime need begins with cleanliness and cleanliness begin with our surroundings.[1]

The objective is to minimize environmental pollution, enhance recycling efficiency, and advance the use of long-term, sustainable waste solutions within communities. By fostering awareness and providing practical solutions, the project aims to create a model that can be adopted at both household and institutional levels for long-term ecological benefits.[2]

Segregation is the initiative to complete waste management. Studies show that majority of the population in urban and rural areas don't segregate wastes being a reason that they notice it inconvenient. Management or assortment of waste is secondary. There are effective systems of waste management for smart alert system for garbage clearance by giving an alert signal to the municipality for fast assortment of garbage in trash bin with correct verification based on level of garbage filling.[3]

III. PROPOSED METHODOLOGY

The system works by separating wet and dry waste by the senses from the sensor.



The system basically has one main bin below which three different bins are kept whose opening is the bottom of the main bin. Once the waste is thrown in the main bin the sensors sense and the microcontroller decides which bin it will go onto, depending on that the servo motor rotates and the Respective bin opens and the waste is put into that.

The following TABLE 1 shows what are the components required and what each component will do.

The system follows a sequential detection process. When waste is placed on the entry platform:

I. Microcontroller:

II. Metallic Sensor Inductive Proximity Sensor. It can detect metal without physical contact.

III. Moisture Sensor: Soil Moisture Sensor. This is used to differentiate between "Wet" (organic) and "Dry" waste.

IV. Object Detection: Ultrasonic Sensor or IR Obstacle Sensor to trigger the scanning process.

V. Actuator: High Torque Servo Motor. Standard small servos (like the SG90) often lack the power to move a heavy waste flap.

VI. Power Supply: 9V/2A DC Adapter

TABLE I: COMPONENT NAME

Sr no.	Component name	function
1	Microcontroller	Arduino.
2	Inductive Proximity Sensor	Detects metallic objects.
3	Moisture Sensor	Differentiates between dry and organic/wet waste.
4	Ultrasonic Sensor	Monitors the fill level of the bins.
5	Servo Motors	Actuates the flap to push waste into the correct bin.
5	Microcontroller	Arduino.

IV. FUNCTIONAL WORKFLOW

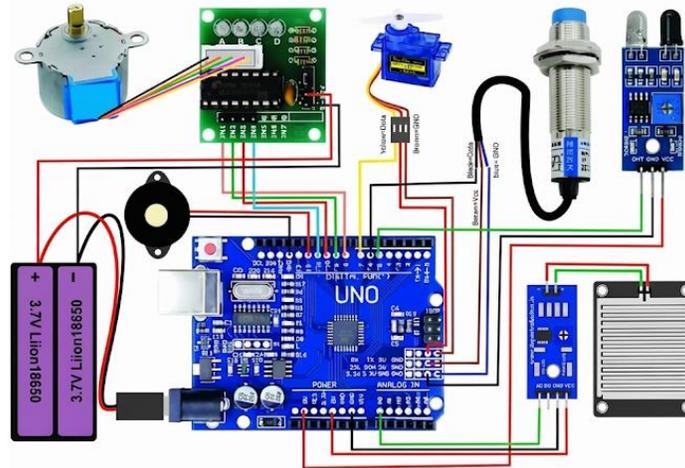


Fig. 1 Sample circuit diagram,

1. The IR sensor detects the object presence.
2. The inductive sensor checks for metal. If positive, the servo rotates to the "Metal" bin.
3. If no metal is found, the moisture sensor probes the waste. High moisture levels trigger the "Wet" bin disposal.
4. Objects with low moisture and no metal are classified as "Dry."



The decision-making process that the system follows is show below:

- I. Condition 1: If Metal Sensor == HIGH, then Target = BinA.
- II. Condition 2: If Moisture Value > Threshold, then Target = Bin B.
- III. Condition 3: Else, Target ==BinC

The system works on the simple logic shown above, the bin a, bin b, bin c, rotate with respect to what waste the system identify it as.

V. RESULTS AND DISCUSSION

While the smart waste segregation works Well for metallic and dry waste, it is difficult to separate other materials in the above system. While that may not be implemented in this system yet , it can be done by other methods such as adding vision to the system and dataset to identify material and actively make it more efficient to segregate waste.

The ml and machine vision may be the key to overcoming this drawback .

VI. CONCLUSION

The smart waste segregation system helps a great deal in separating the waste at source. And also Removes the hassle for the user of checking for what bin the particular waste is supposed to be thrown in. It also helps environment and the User for maintaining comfort and Reducing waste mismanagement.

REFERENCES

- [1]. Automated Dry and Wet Waste Segregator and Monitoring System and Wet Waste Segregator and Monitoring System Varsha Pathak, Shubhi Atri, Sneha Shahu in IRJET
- [2]. Dry And Wet Waste Segregator Uzefa Shaikh, Pooja Shindhe, Dr. Mahendra M Dixit in IJRTI 2025
- [3]. Smart Dustbin-Wet and Dry(Metal) Waste Segregator with Alert System by Mrs.Susan Shiny Mr.M.R.Mohamed Shahidh Meeran in IJCRT 2018
- [4]. Wet Dry Metal Waste Segregation by Drashti Sanghavi and Aakanksha Agrawal in JETIR 2025

