Smart Domestic Waste Segregation

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ABSTRACT

Waste Management and segregation is a much-needed process in metro cities and urban areas due to spreading of diseases. It is estimated that India produces 42.0 million tons of municipal solid waste annually at present. Waste lying littered in the surrounding, dumped on open lands, of disease-causing bacteria and viruses hence, segregation, transport, handling and disposal of waste must be managed properly to minimize the risks of the public and environment. When mixed dry and wet waste breaks down in lowland, it creates nasty greenhouse gases. Segregation makes it attainable to utilize and recycle the waste effectively. This waste segregator system can easily segregate waste. When waste is thrown in the pipe, IR sensor will sense the waste. Waste is divided into two categories namely Wet and Dry . Another sensor will sense the garbage category. Similarly, the process will repeat if wet waste is sensed. If the sensor doesn't activate the sensor category, then the waste will be considered to be a dry waste. Segregation system for household use, so that it can be sent directly for processing. It is designed to sort the refuse into wet waste and dry waste. Experimental results show that the segregation of waste into wet and dry waste has been successfully implemented using the AWS.

Key Words: Waste Management, Smart Bin Technology, Recyclable Waste Detection, Automation in Waste Sorting.

1.INTRODUCTION

Effective waste management is a growing global concern, especially with increasing urbanization and population density. Traditional waste disposal methods often lead to inefficient segregation, posing environmental and health hazards. Smart domestic waste segregation offers an innovative solution by integrating technology into household waste management systems. Using sensors, AI, and IoT, these systems can automatically detect and classify different types of waste. This reduces human effort, improves recycling rates, and minimizes contamination. Real-time monitoring and data collection also enhance municipal waste planning. Moreover, smart systems promote eco-conscious Behavior at the household level. They align with sustainable development goals and smart city initiatives. As technology becomes more accessible, its integration into daily life is increasingly feasible. This paper explores the design, functionality, and benefits of smart domestic waste segregation systems.

2. Methodology

The Smart bin is divided into three compartments. Each Compartment has their own function, the first compartment Consists of an IR sensor and the second Compartment consists of another IR sensor and moisture Sensor for detecting dry and wet waste, the last compartment is subdivided into two bins for collection of the segregated waste respectively. The whole system is controlled by Micro controller. Each and every component is interfaced to the microcontroller board. The necessary code for controlling the sensors and the motors is coded using embedded-C language, in which the inputs and the output ports can be defined easily. In

this project we have used IDE compiler to compile the code and upload it to the board using an A-B wire. To provide details of every decision we have used a Buzzer to device for filled bin the decisions made by the Arduino processor. Waste is detected using an ultrasonic sensor. A servo motor separates wet and dry waste into different compartments when coming to dry waste it turns to 90 degree and segregation of wet waste it turns to180 degree. When the bin is filled the buzzer will give the alert .A smart domestic waste segregation system uses sensors to identify and classify waste into categories like recyclable, organic and non recyclable. Arduino uno R3, triggering mechanisms like flip arms to sort waste into designated bins.Now the algorithm is so made that if the waste is dry then the mechanism will bring the dry collecting bin below the pipe and the servo will let the waste fall into the bin. Similarly, the process will be repeated for wet test.

3. System Design and Implementation

3.1 Hardware Components

1.   IR Sensor

Fig 1: IR Sensor

IR sensor is one of the most commonly used sensors in the field of electronics; it has a large number of applications at the domestic as well as at the industrial level.

2.   Sg90 Servo Motor

Fig :2 Servo motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration.

3.Soil Moisture sensor module

Fig 3: Moiture sensor

As the name indicates, this sensor is used to measure the moisture content in a given material.

4.power supply

Fig 4: power supply

The power adapter of 12V – 2A and HLW High Power Battery of 9 V are used to power this Project.

5.Arduino uno R3

Fig 5: Arduino

Arduino UNO is a microcontroller board based on the ATmega328P.

6.Buzzer

Fig 6: Buzzer

A **buzzer** is an audio signalling device that produces sound when powered.

3.2 Software Development

- Arduino IDE

The Arduino integrated development environment (IDE) is a cross platform application (for Windows, MacOS ,Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards**.**

3.3 Working Principle

Smart domestic waste segregation systems use sensors, AI, and IoT   connectivity to identify and classify waste (e.g., Dry and wet) automatically. Sensors detect material types, and the system segregates waste into designated bins. Real-time data is sent to a connected platform for monitoring. This reduces manual effort, improves recycling efficiency, and promotes eco-friendly waste management. This reduces human effort, improves recycling rates, and minimizes environmental pollution by promoting proper waste disposal
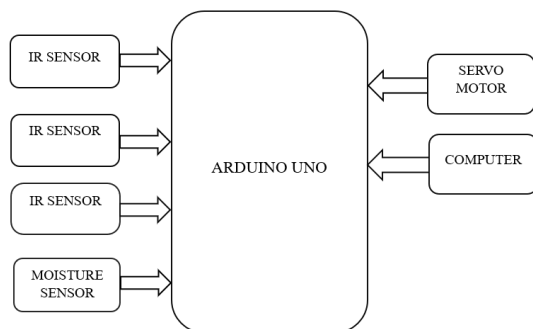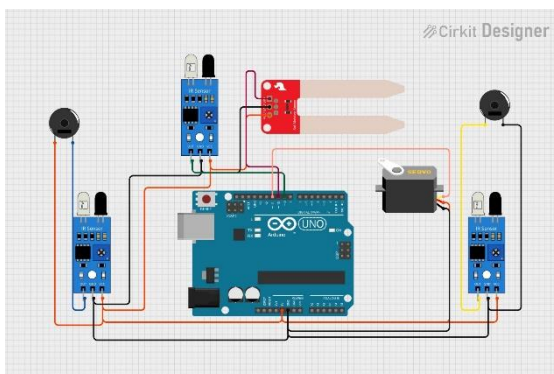

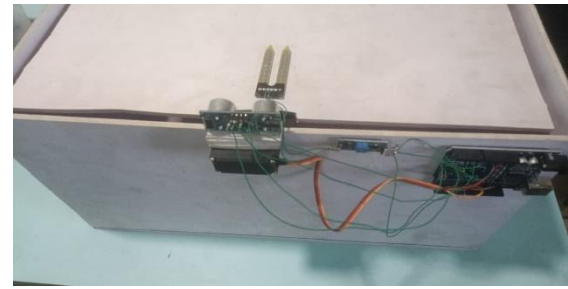Fig 7: Block diagram

Fig 8: Circuit diagram

fig 9: connection hardware

4.Future Enhancements

- AI-Powered Detection:

Integrate advanced machine learning models for more accurate classification of waste types, including recognition of new and uncommon materials.

- User Feedback System:

Add a mobile app or interface that provides users with insights on their waste habits and suggestions for improvement.

- Automated Sorting Mechanism:

Upgrade with robotic arms or conveyor-based systems to physically sort waste more efficiently at the household level.

5.CONCLUSION

Inlet selection can be incorporated with a crusher mechanism to reduce size of incoming waste. Provisions can be made for on spot decomposition of wet waste Solar panel can be used for power supply. This type of product can be used in housing societies, offices, etc. Since it is cost effective, it can be implemented on a large scale as well with some modifications. Also, more sensors can be used to segregate bio-degradable and non-bio-degradable waste, plastics, recyclable waste, e-waste, and medical waste. Conclusion .As the name suggests, it segregates the waste into two major classes Dry waste, Wet waste. The proposed system would be able to monitor the solid waste collection process and management of the overall collection process. Our project provides one of the most efficient ways to keep our environment clean and green.

Acknowledgments

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