Mini Project Report

On

Smart Bin

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We also take this opportunity to thank our friends, peers who have directly or indirectly helped in the process.

Abstract

Automation is a system of operating or controlling a process by highly automatic means as by electronic devices, reducing human intervention to a minimum. It has helped businesses across all domains to cut labour costs and to perform efficiently. Then why waste management is done manually but we see a lot of environmental problems. The main crux lies in the improper segregation at the municipal level and directly disposing off to landfills directly. Therefore, segregation of waste at household level is the need of the hour. But due to lack of awareness on what is dry, wet and metallic waste, sometimes the waste is collected together instead of separately. So, automation is required to make these tasks smooth. This project proposes an automatic waste identifier and segregator that detects and segregates the waste as dry and wet at the household level. The system detects the debris using an ultrasonic sensor and after that it is separated as the wet and dry waste using capacitive detector. Also, with the help of infrared (IR or proximity sensors) we can sense when the person is about to throw the waste and opens the lid accordingly. Experimental results depict that the isolation of waste into dry and wet has been successfully implemented.

Contents

Introduction

India generates 62 million tonnes of wastes each year. About 43 million tonnes (70%) are collected which about 12 million tonnes are treated and 31 million tonnes are dumped in landfill sites. With changing consumption patterns and rapid economic growth, it is estimated that urban municipal solid waste generation will increase to 165 million tonnes in 2030.

Waste segregation at source is mandatory. Households are required to separate wastes into Wet waste or biodegradable waste (banana peel, apple peel, …) or Dry waste (plastic, paper, …). Properly distinguishing wet and dry waste lets us to recycle it more efficiently and saves us a labour effort and money. With the plastic ban in place, Automatic waste segregator can help dispose of the waste properly and efficiently without any problems. The wet waste can be used as compost and some of dry waste can be recycled.

Automatic bin identifies the type of waste and segregates it and it is done by machine, thus limiting the manual segregation done by humans. The bin will also have an automatic door at the top of the bin which opens when a person comes to dispose of any waste thus avoiding touching of bins.

Literature Review

There are research papers written on segregation of waste using Arduino, servo-motors and sensors and so on. There are different versions of these using smart bins or using IoT to monitor the real-time garbage levels. Some involved also waste collecting routing problem to focus on reduction in cost of waste management. At an advanced level, in Smart Cities that uses surveillance system, RFIDs, cameras… where data sharing with truck-drivers happens dynamically and optimizing the route generated.

This project focuses on identifying the waste and segregates accordingly and by using of IR sensors it controls the opening of lid. For that we have used:

- ESP32 development board
- Servo-Motors
- Capacitive sensor
- IR sensor
- Indication LEDs
- Arduino IDE

Project Objectives

The main objectives of the project are:

- **Waste Segregation**:

  Smart bin segregates the waste into dry and wet waste.

- **Sanitation:**

  Automation of the bin ensures that the user will not have to touch the bin.

- **Waste identification:**

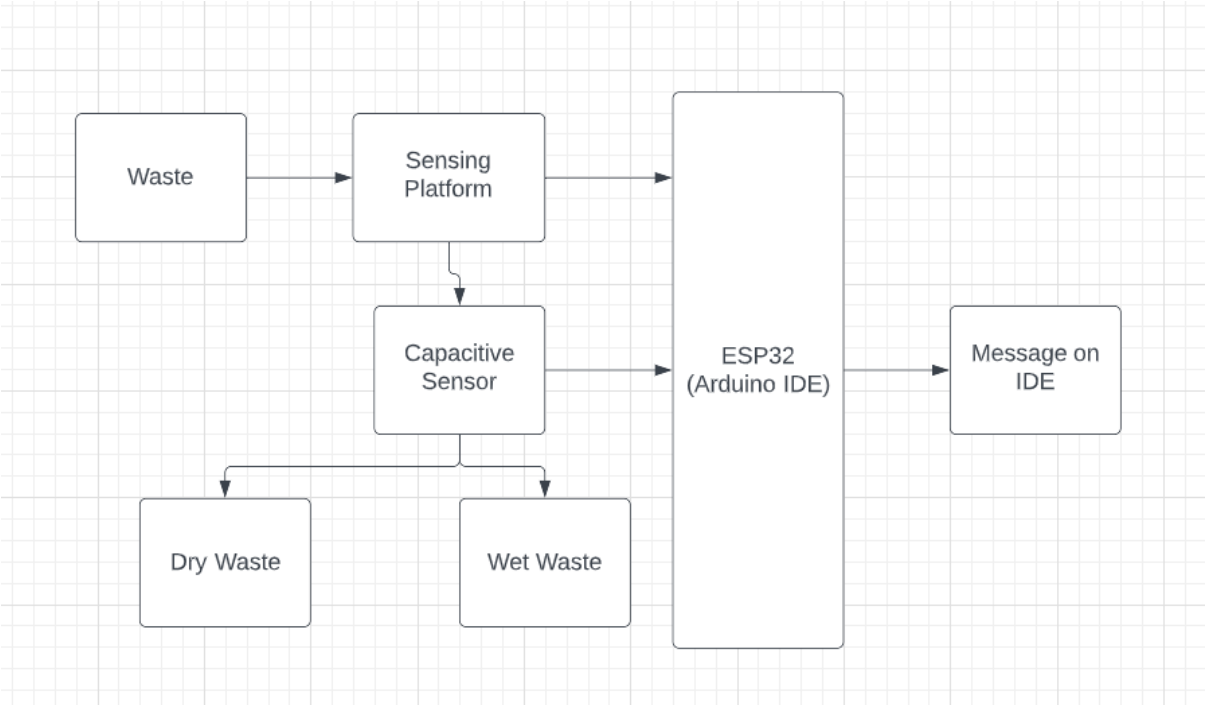
  The waste can be identified using capacitive and reflective properties.

- **3Rs of waste management:**

  Reduce, Reuse & Recycle.

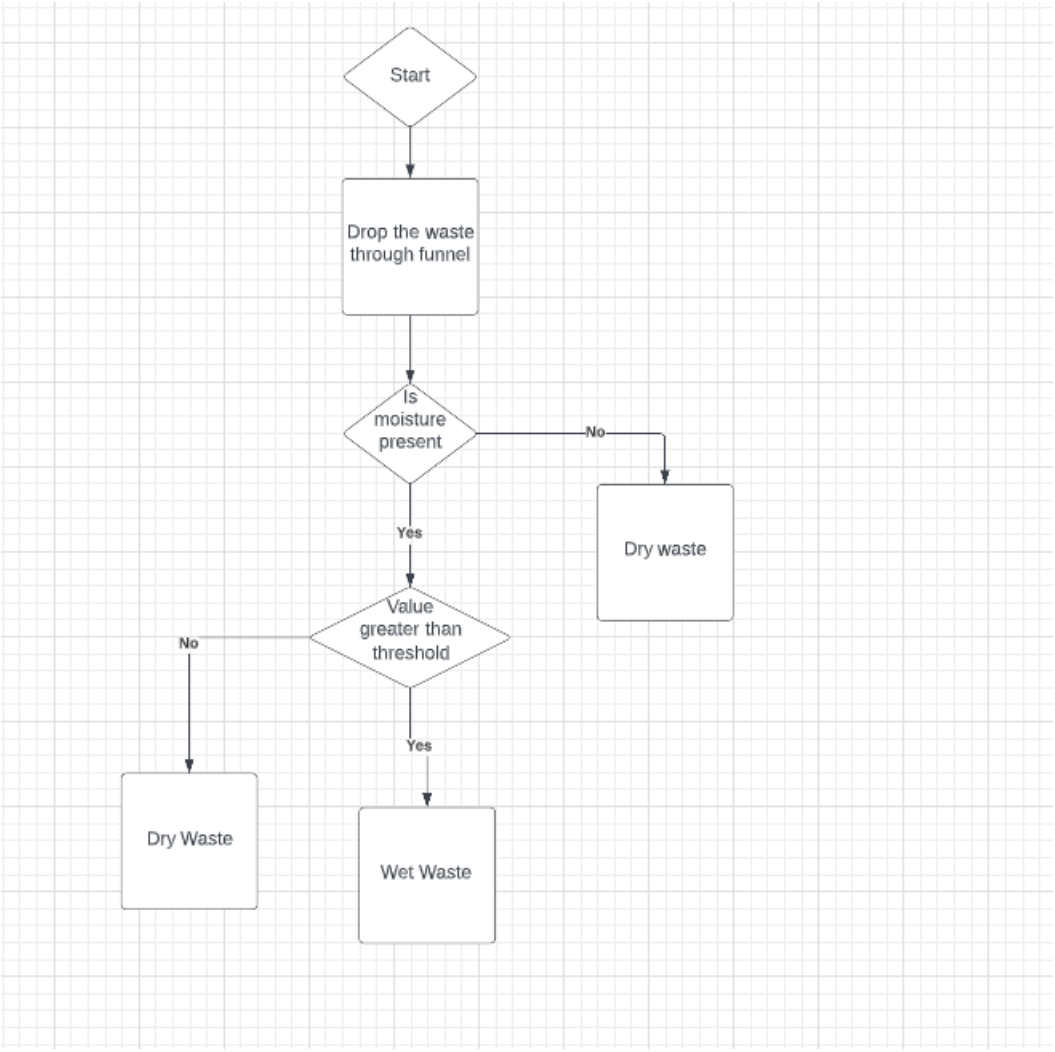
System Design

The below block diagram depicts the working of Smart Bin. It happens at various stages.



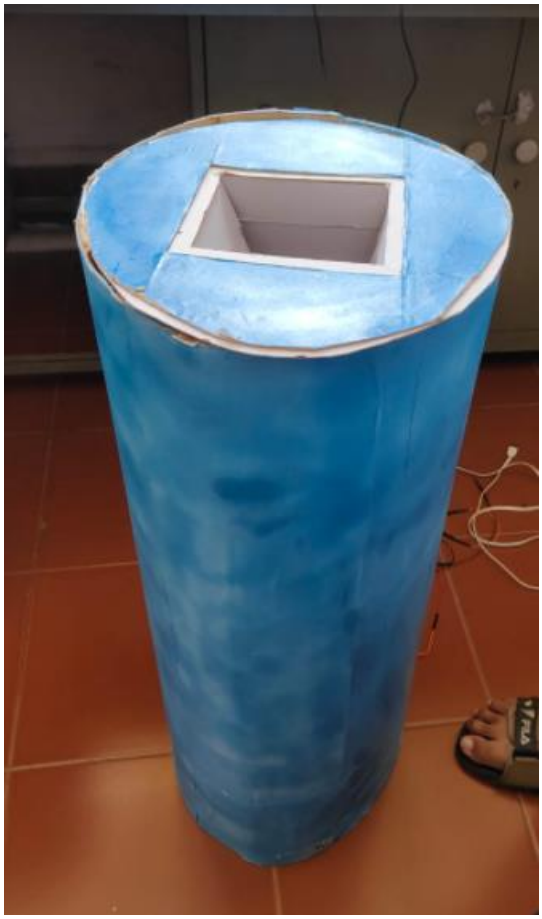
At first, waste is pushed through a funnel wherein the system detects the arrival of garbage with the help of the capacitive sensor. Once the presence of waste is detected, it will send a signal to the microcontroller and the system will be switched on. As soon as the object passes through the funnel, the capacitive sensor checks for any moisture content. If the moisture is detected, the sensor sends the signal to Arduino. On receiving the signal, the Arduino provides the value of the moisture detected and triggers the servo motor, which in turn drives the motor. The motor flips the platform towards the wet bin. If the moisture content is lower than the threshold, the object will be dry waste. Accordingly, motor will flip and the object is thrown into dry bin. Therefore, the waste is segregated into a dry, wet waste without any human intervention.

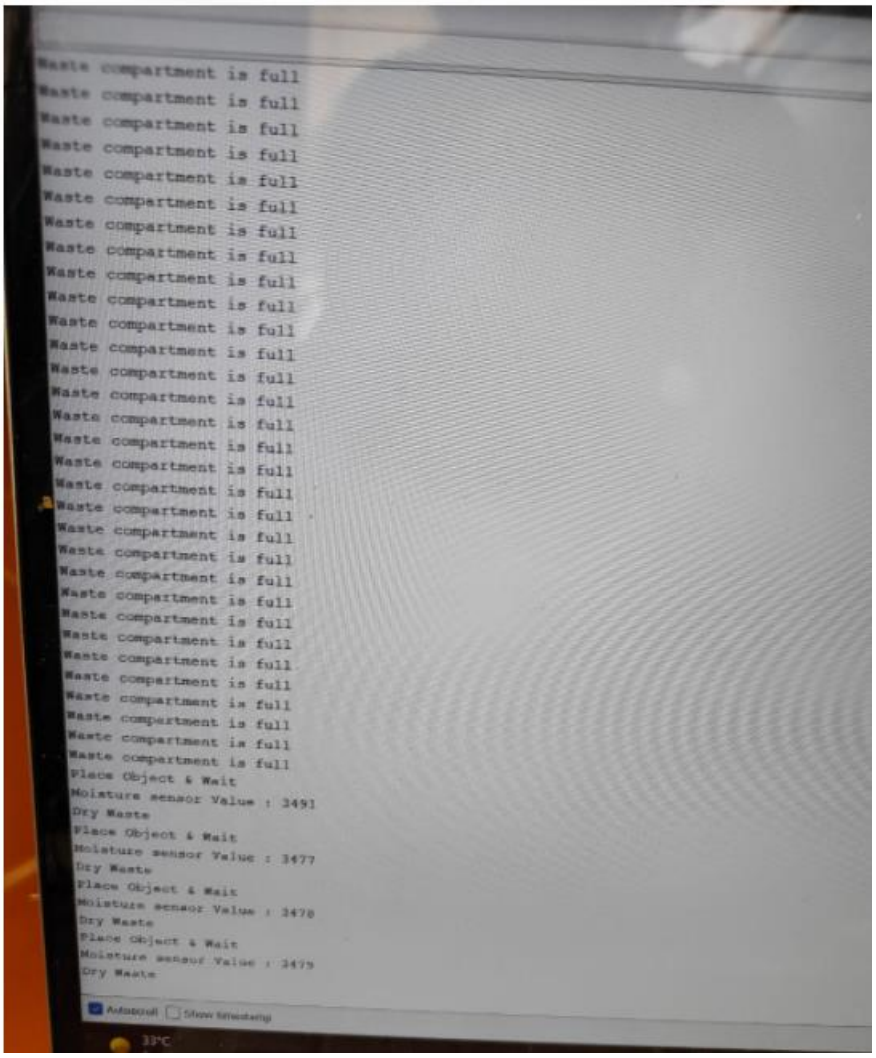
Further, the garbage level of each respective bin is continuously monitored with the help of the IR sensor. This sensor detects the garbage level as it sends infrared rays. If the dustbin is 100% full then the system sends an SMS stating that dustbin is full.



Flowchart of smart bin (waste detector and segregator).

Experimental Results





The above pictures show the setup of Smart Bin.

The values at in the last picture makes an observation that waste is properly segregated through its threshold moisture value that determines whether it is dry or wet waste. We tested it with paper for dry waste and moist tissue for wet waste.

Conclusion

The Smart Bin allows us to effectively and cleanly dispose of the waste. The automatic lid opening system ensures that waste disposal by the humans is completely hands-free and hence hygienic. Waste thrown away is sorted according to its threshold value of moisture. Wet waste has significantly higher threshold value than dry waste.

Future Scope

The idea can be very well implemented in Smart Cities project and can be advanced by picking up one category of waste and optimising the path using Dijkstra algorithm for truck drivers and all. It can also fully harness the economy of Waste Management and 3Rs effectively.

References

- Smart Bin (Waste Segregation and Optimisation)- IEEE paper
- IoT based Automatic Waste Segregator- IEEE paper
- Garbage Collection System using IoT for Smart city- IEEE paper