Research Article

SMART TRASHCAN

Ashwin kumar D¹, Augustin Jebakumar M², Gospel Zealton Ezra B³ and VanithaLakshmi⁴

¹,²,³ UG Scholar, Department of ECE, S.A Engineering College, Poonamallee-Avadi Main Road, Veeraraghavapuram, Thiruverkadu post, Chennai 600 077, India

⁴Assistant Professor, S.A Engineering College, Poonamallee-Avadi Main Road, Veeraraghavapuram, Thiruverkadu post, Chennai 600 077, India

DOI: http://dx.doi.org/10.24327/ijrsr.2020.1104.5293

ABSTRACT

Nowadays, trash has become an issue in the general public and the biological system because of the manner in which individuals dispose of it. The greater part of trash is covered or consumed or even kept in spots to which it doesn't have a place. Large volumes of trash discarded and the techniques used to store it cause air, water, and soil contamination. Luckily, individuals can rely on different strategies to diminish the amount of delivered litter. An answer is reusing by re-utilizing the materials. At present, the customary method to isolate squander is to utilize various holders for every sort of waste isolating rubbish physically, which doesn't generally work. The point of this task is to introduce a Smart Trash Can (STC) which can supplant the customary method for managing waste; the proposed gadget gets the approaching waste and places it naturally in various holders by utilizing a MQ 135 sensor to isolate natural (wet) waste and inorganic (dry) waste. Trash is a worldwide issue that influences every single living animal. As per an examination, India creates around 62 million tons yearly midpoints out to 450 grams of waste for every individual every day [1] out of which 5.6 million tons is plastic waste, 0.17 million tons is biomedical waste, dangerous waste age is 7.90 million tons for each annum and 15 lakh ton is e-squandering. India is among the 10 nations on the planet creating the most elevated measure of metropolitan strong waste, and the more concerning issue is that roughly 70-75% of this waste stays untreated. This untreated misuse of 31 million is generally dumped into landfills. Additionally, 70% of its junk is utilized once [2] and 45% is covered or consumed, such waste is paper, plastic, and so on India faces major ecological difficulties related with squander age and deficient waste assimortment, transport, treatment and removal. Current frameworks in India can't adapt to the volumes of waste created by an expanding urban populace, and this effects on the earth and general wellbeing. The difficulties and boundaries are noteworthy, however so are the chances. In India, a great deal of spots like the colleges, metros, and shopping centers have various holders for explicit waste. India is among the best 10 nations on the planet creating the most elevated measure of waste, 0.17 million tons is biomedical waste, dangerous waste age is 7.90 million tons for each annum and 15 lakh ton is e-squandering. India is among the 10 nations on the planet creating the most elevated measure of metropolitan strong waste, and the more concerning issue is that roughly 70-75% of this waste stays untreated.
Another method of waste segregation uses Image processing and artificial intelligence. The datasets of the different waste materials are created initially. Then using MATLAB, the features are detected from the datasets using Feature Extraction algorithms. The detected features are then stored in a bag of Variables. The variable is trained using SVM in MATLAB. Once the training is complete, the output variable is stored for prediction.

The drawback in this method of waste separation and segregation is that, before Image Processing, it needs a lot of data to compare with. Acquiring huge amounts of data is a very difficult task. The image processing will give more accurate output, the more data is available in the dataset. Also, the data must be updated more often. Continuous feeding of the dataset will improve the prediction capability and improves machine learning.

**Proposed Method**

The Smart Trash Can proposes a simple and effective method in collection and separation of waste materials. This method uses low cost components and sensors to detect the waste and separate them [5]. Multiple sensors are used to detect the type of waste. The detection of the material by which the waste is made up of is initially found out before separating them into their own compartments. A combination of two or three sensors is used to detect organic or decomposable materials.

The Smart Trash Can is designed for specific purposes based on the place or location of usage. Each environment be it schools, colleges, hospitals, corporates, households etc. each produce a variety of waste. Developing a system that will minimize the complexity of possible waste can hugely impact the method to separate waste. Cost to design an occupational specific model is only a fraction of how much it will cost to design a model that suits for all environments.

**Waste Detection Algorithm**

**Ultrasonic Sensor**

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. It works by sending out a burst of ultrasound and listening for the echo when it bounces off of an object. It pings an object with ultrasound [6].

**Stepper Motor**

A stepper motor, also known as step motor or stepping motor, is a brushless DC electric motor that divides a full rotation into several equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed [7].

**Inductive Proximity Sensor**

Inductive proximity sensors are utilized for non-contact recognition of metallic articles. Their working rule depends on a loop and oscillator that makes an electromagnetic field in the nearby environmental factors of the detecting surface[8]. The nearness of a metallic item (actuator) in the working territory causes a hosing of the wavering plentifulness. The ascent or fall of such wavering is recognized by a limit circuit that changes the yield of the sensor. The operating distance of the sensor relies upon the actuator's shape and size and is carefully connected to the nature of the material.

**IR Sensor**

Infared sensor works on the principle of reflected light waves. Infared light reflected from articles or sent from an infrared remote or reference point. Infared sensors are additionally used to gauge distance or proximity. The reflected light is distinguished and afterward a gauge of separation is determined among sensor and object [9].

**Working: Principle**

- The robot is placed in one corner of the room. The robot moves around the room in a zigzag pattern to find trash in its path [10].
- The ultrasonic sensor is used to detect the obstacle. If the obstacle is detected, the vacuum turns ON and sucks the object and transfers it to the Initial compartment, where the scanning is done.
- The scanning is done using a sensor array which consists of multiple sensors to determine the type of material. Based on the material type, it is sent to the corresponding compartment [11].
- The sensor array consists of Inductive Proximity Sensor, Infrared Sensor, NDIR Sensor, Ultrasonic Sensor.
- The inductive proximity sensor is used to detect metals.
- The NDIR Sensor is used to detect food and other organic wastes.
- The combination of Ultrasonic and Infared Sensors is used to detect plastic. The Infrared Sensor is similar to the Ultrasonic Sensor except that in case of plastic, the Infared sensor gives output as 0. As the Infared Sensor also gives output as 0 when no obstacle is placed in-front of it, the Ultrasonic sensor is used in addition to it [12].
- According to the Sensor’s output, the waste is directed to the corresponding compartment using a segregator.

**SIMULATION RESULTS**

Software Output – 1
Software Output – 2

```cpp
int triPin = 9;  // define variables
int echoPin = 10;

void setup() {
    pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
    pinMode(echoPin, INPUT);  // Sets the echoPin as an Input
    Serial.begin(9600);
}

void loop() {
    digitalWrite(trigPin, LOW);
    delay(1000);
    digitalWrite(trigPin, HIGH);
    delay(1000);
    digitalWrite(trigPin, LOW);
    duration = pulseIn(echoPin, HIGH);

    if(duration <= 0.0044/2) {
        Serial.println("PLASTIC");
    } else {
        Serial.println("NOT A PLASTIC");
    }
```

Software Code

Hardware Output - 1

![Hardware Output - 1](image)

Hardware Output - 2

![Hardware Output - 2](image)
The simulation shows better and improved performance than conventional methods of waste disposal. The cost of manufacturing is very less compared to other methods that involve image processing etc. Easy to use since it is automated and saves time.

**Future Enhancement**

The design involves use of multiple individual sensors that take up a lot of space. Integrated sensors can be used in the place of individual sensors. A high performance system that can do the job a lot quicker can be used.

### References

1. Kumar Sunil; Smith Stephen R.; Fowler Geoff; Velis Costas; Kumar S. Jyoti; Arya Shashi; Rena null; Kumar Rakesh; Cheeseman Christopher (2017). "Challenges and opportunities associated with waste management in India". *Royal Society Open Science.*
2. About 70 percent of trash can be recycled (Online). Montgomery Advertiser, Ala. URL: http://www.redorbit.com/news/science/341544/about_70_percent_of_trash_can_be_recycled/.
5. https://www.rakeshmondal.info/4-Wheel-Drive-Robot-Design
8. https://robokits.co.in/
10. https://www.iot-experiments.com/flashing-esp8266-esp01/

**How to cite this article:**

DOI: http://dx.doi.org/10.24327/ijrsr.2020.1104.5293

*******