WASTE MANAGEMENT- SEGREGATION OF WET AND DRY WASTE USING SMART DUSTBIN

A MINI-PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project **"WASTE MANAGEMENT-SEGREGATION OF WET AND DRY WASTE USING SMART DUSTBIN**" is the bonafide work of "**KEERTHIGA K (210701120) and SRUTHI S(210701262)"** who carried out the project work under my supervision.

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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LIST OF ABBREVIATION

ABBREVIATION	ACCRONYM
LCD	Liquid Crystal Display
I2C - Module	Inter Integrated Circuit

ABSTRACT

Trash management systems are facing major issues as a result of the sharp rise in trash creation brought on by the fast urbanization and population growth. Because of insufficient monitoring systems and laborious collection processes, traditional waste management techniques frequently suffer from inefficiencies. This project suggests creating a Smart Dustbin utilizing Internet of Things (IoT) technology for effective trash management in order to address these issues. The Smart Dustbin incorporates a number of sensors, including weight sensors for precise trash content measurement, temperature sensors for environmental monitoring, and ultrasonic sensors for waste level detection. Using Internet of Things communication protocols, these sensors offer real-time data on the dustbin's condition and fill level. The data is wirelessly sent to a central server. A cloud-based software platform forms the basis of the system, processing data from the Smart Dustbins to allow for remote management and monitoring of garbage collection activities. The platform can reduce operational costs and improve overall efficiency by optimizing waste collection routes, scheduling timely pickups, and allocating resources effectively through data analytics and predictive modeling. Additionally, the Smart Dustbin has intelligent features including user feedback interfaces and automatic lid opening/closing mechanisms that improve user convenience and promote good trash disposal behavior. When compared to conventional waste management techniques, the suggested Smart Dustbin system has a number of benefits, such as: **Real-time monitoring:** By keeping an eye on fill levels, proactive garbage collection is made possible and overflowing bins are avoided. **Effective resource allocation:** Data-driven insights enable more efficient resource allocation and route planning, which lowers operating expenses and fuel usage. **Environmental sustainability:** The method lowers carbon emissions and aids in environmental conservation by encouraging effective rubbish collection and cutting down on pointless journeys. Improved user experience Insightful functions and dynamic user interfaces promote community involvement and a sense of environmental responsibility.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The need for more intelligent solutions is highlighted by mixed waste streams and overflowing landfills. In order to address waste management, this project uses Arduino to create a smart dustbin. By using sensors to automatically segregate wet and dry garbage, this creative container encourages proper disposal practices and opens the door to a cleaner future.

1.2 SCOPE OF THE WORK

In order to automate trash segregation, an Arduino smart bin prototype is being built as part of this project to address waste management. Ultrasonic sensors will determine when the bin is full, and moisture sensors will determine if the garbage is wet or dry. Real-time feedback on trash kind and bin capacity will be provided by an LCD display. We may even incorporate alarms for improper disposal or full trash. The main focus of the project is on easily accessible parts, such as Arduino boards, sensors, and LCDs. It also involves writing Arduino code to interpret sensor data, operate the display, and maybe handle alarms. The project will produce a functioning smart bin prototype with waste segregation capabilities and an Arduino code after extensive testing and improvement.

1.3 PROBLEM STATEMENT

Cities suffer from ineffective waste management, with mixed waste streams filling landfills to capacity and impeding recycling. Conventional techniques rely on human sorting, which is error-prone and lacks real-time information on the type of waste or bin fullness. In order to solve these problems, this project uses Arduino to create a smart bin that automatically separates waste, encouraging appropriate disposal and effective waste management.

1.4 AIM AND OBJECTIVES OF THE PROJECT

The goal of this project is to create an automated waste segregation smart trashcan using Arduino in order to tackle wasteful waste management. Conventional sorting techniques lack real-time data and are prone to errors. In order to solve this, our goal is to create a trash can that has sensors—such as moisture and ultrasonic sensors—that can distinguish between wet and dry waste. Through an LCD display, users will obtain real-time data on the type of garbage and the fullness of the bin. We may also include alarms for overfilled containers or improper disposal to promote responsible waste management practices. We want to create a working smart bin prototype with trash segregation capabilities and its related code by creating and testing Arduino code to manage sensor data, control the display, and maybe manage warnings.

CHAPTER 2

LITERATURE SURVEY

In [1] Households are the primary sources of rubbish collection. the waste products, either organic or inorganic, generated by domestic or commercial operations. The only option to gather domestic waste while you wait for municipal corporations is to use a dustbin. Due to the daily increase in waste, the majority of dustbins and rubbish cans seen in public areas and in front of homes and businesses in cities are overflowing. Inadequate waste management poses a significant risk to public health, promotes the spread of infectious diseases, and contaminates the environment. When different biodegradable waste combinations are combined and the trashcan is left unattended for several days, toxic gasses like methane are produced.

In [2] This work offers a consumer-internet-of-things (IoT) based smart waste tracking system with an integrated trash sorting mechanism. It is an easy-to-use solution for garbage separation at the household level, allowing waste to be routed directly to the right processing facility. This paper's main goal is to describe and construct an isolation framework that separates trash into three categories: metallic, glass, and plastic. This system sorts plastic and glass debris using capacitive proximity sensors and detects metallic objects using an inductance-detecting component. Given that it is a valuable tool for separating most types of waste, civil organizations will find this framework helpful in sorting the collected rubbish.

In [3] Waste that is not adequately separated has an impact on the waste management process as a whole. Properly sorting waste into different categories at the source makes it easier to process the waste further, which reduces the amount of waste that needs to be dumped in landfills and increases its recovery and usage. rubbish segregators are machines that automatically sort rubbish, a more recent technology known as automation-based or automatic waste sorting. garbage segregators solve the problem of low citizen awareness regarding the proper bin selection for a given type of garbage, as well as the necessity to assign laborers to the site for segregation.

In [4] The current system lacks sufficient planning for waste collection, which results in an unclean city or town. The authority is not routinely updated by the current system regarding the rubbish bin's level and odor. It merely uses an SMS alert to notify the municipality. Certain systems use an RFID tag and reader to notify the worker inside the truck of the bin's current state whenever the garbage truck approaches the bin. When the trash is full, the employee cleans it. The drawbacks of this approach include higher fuel usage and longer processing times.

In [5] Solid waste management is a major issue in urban areas, not just in India but in the majority of other nations as well. Therefore, a method that can either completely eliminate or drastically lessen this issue must be developed. One of the most effective strategies to maintain a clean and green environment is provided by the project. Though our current Prime Minister proposed the notion of creating 100 smart cities across India a few years ago, the smart city concept is still relatively new in our country. Large amounts of obligations now need to be met in light of the impending rise in smart cities.

CHAPTER 3

SYSTEM SPECIFICATIONS

3.1 HARDWARE SPECIFICATIONS FOR APPLICATION

Processor	:	Intel Core i7
Memory Size	:	256 GB (Minimum)
HDD	:	40 GB (Minimum)

3.2 SOFTWARE SPECIFICATIONS

Operating System	:	WINDOWS 10 AND PLUS
Application	:	ARDUINO IDE

3.3 HARDWARE COMPONENTS FOR PROTOTYPE

Sensor	:	Ultrasonic and Moisture-Sensor
Board	:	Arduino Uno
Actuator	:	Micro Servo Motor 9g
Screen	:	16x2 LCD Display & I2C Module

CHAPTER 4

MODULES DESCRIPTION

Arduino Uno

A basic Arduino Uno microcontroller serves as the system's central component. A microcontroller board is called the Arduino Uno (datasheet). It features a 16 MHz crystal oscillator, 6 analog inputs, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. Smart bins ultrasonic sensors measure the echo time while releasing high-frequency sound waves. An empty bin gives the sound a clear passage, lengthening the echo. But the sound returns more quickly when the trash fills the container. The sensor may successfully identify the presence of a trash object by examining this echo time.

Ultrasonic - Sensor

Ultrasonic sensors measure distance using ultrasonic pulses. The sensor head emits an ultrasonic wave, which the target reflects back. The time interval between emission and reception is used by ultrasonic sensors to determine the target's distance. Unlike an optical sensor, which contains a transmitter and receiver, an ultrasonic sensor uses a single ultrasonic element for both emission and reception.

Moisture Sensor

The Moisture Sensor measures the dielectric permittivity of the surrounding medium by using capacitance. Dielectric permittivity in wet waste depends on the amount of water present. The dielectric permittivity and, consequently, the water content of the waste are determined by the voltage that the sensor generates. Therefore, it aids in distinguishing between dry and wet waste. IR sensor for determining level Waste can be detected and its level determined by an infrared sensor. This measures the level and notifies the microcontroller if it rises above a predetermined threshold.

LCD Module

The LCD in our smart bin acts like a tiny information center. It receives data from the Arduino about sensor readings and translates it into user-friendly visuals and text. This can include what type of waste goes in (wet or dry based on the moisture sensor) and how full the bin is (triggered by the ultrasonic sensor). It might even show the battery level or simple disposal instructions. By displaying this real-time information, the LCD helps users understand the bin's status and encourages responsible waste disposal, ultimately supporting effective waste segregation.

Servo Motor:

A feedback control that detects mistakes and modifies a system's performance is called a servo. It also requires a very sophisticated controller, usually a dedicated module designed for use with servomotors. DC motors that allow precise angular position control are known as servo motors. They are actually DC motors, and the gears cause them to slow down over time. Servo motors typically have revolution cutoff angles between 90° and 180°. Another feature of some servo motors is a revolution cutoff of 360° or more. On the other hand, servo motors do not spin nonstop. Only inside the confines of the predetermined angles are they able to rotate.

I2C Module

This is used as a communication medium between the LCD module and Controller just utilizing 4 pins from the controller whereas to connect LCD directly it needs more pins.

CHAPTER 5

SYSTEM DESIGN

5.1 FLOW CHART

A flowchart is a type of diagram that represents an algorithm, workflow or process. The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem.

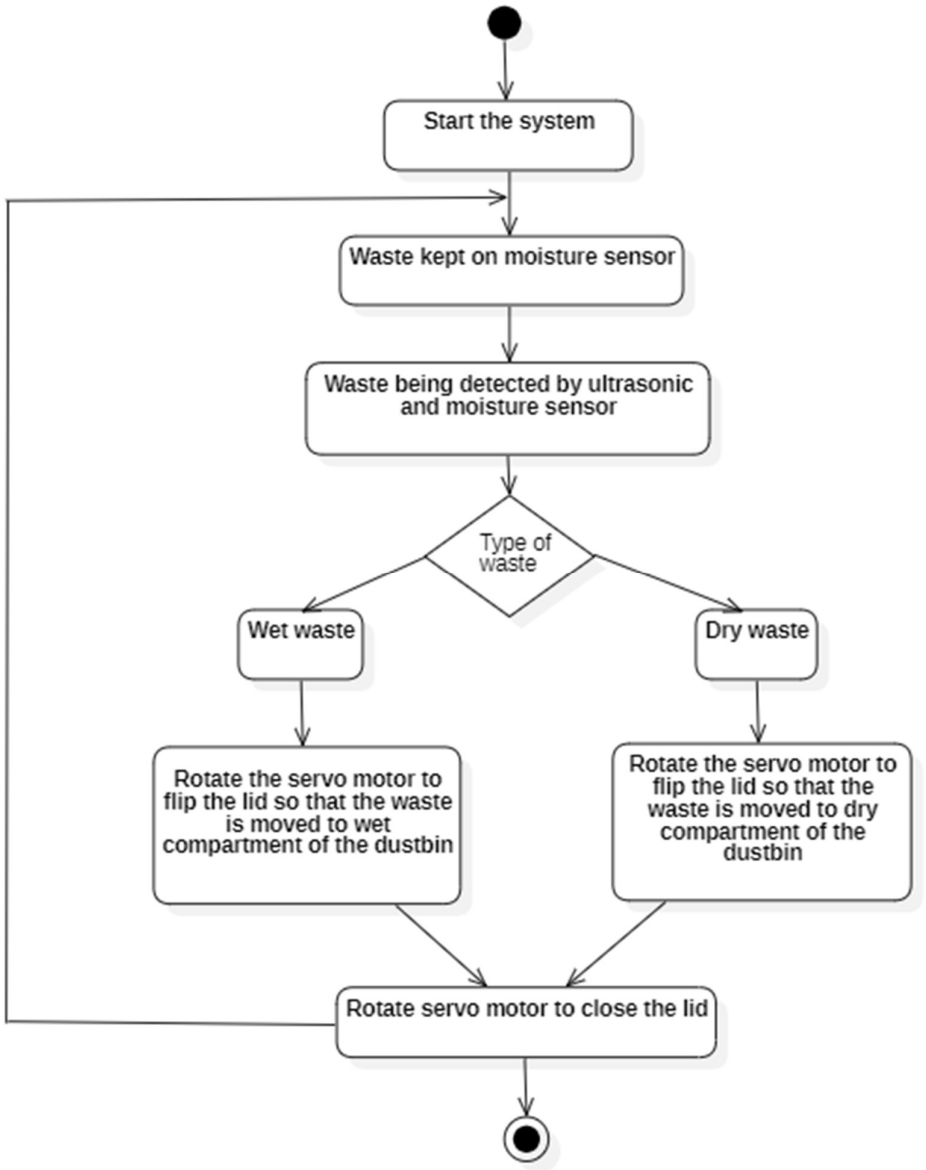

Figure 5.1 Flow Chart

5.2 CIRCUIT DIAGRAM

The circuit diagram explains the connections made with the hardware components and the board. The Arduino uno is connected with the breadboard as the VCC and GND are connected with the rails. The Sensors, LCD and Servo motor is given connection with the rails and the other input/output pins are connected to digital as per the requirements.

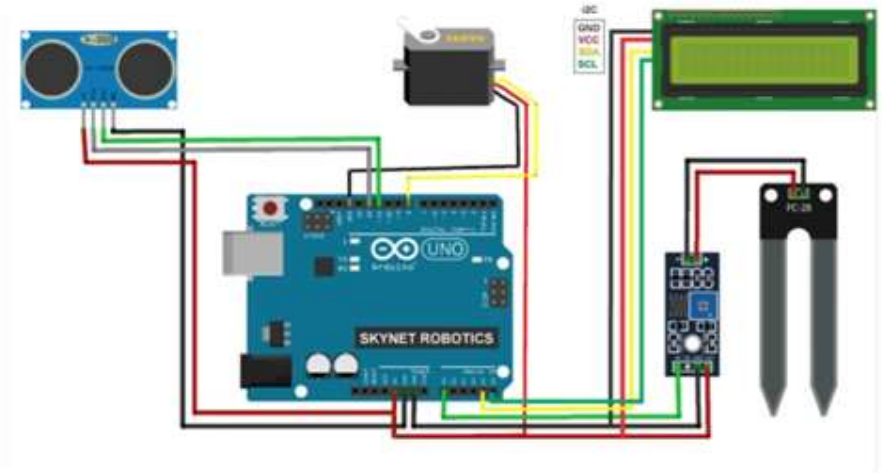

Figure 5.2 Circuit diagram

From the above figure 5.2, the connections are made

CHAPTER 6

CODING

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3,POSITIVE);
#include <Servo.h>
Servo servo1;
const int trigPin = 12;
const int echoPin = 11;
long duration;
int distance=0;
int potPin = A0; //input pin
int soil=0;
int fsoil;
void setup()
{
  Serial.begin(9600);
   lcd.begin(16, 2);
   lcd.clear();
   lcd.print("Skynet Robotics");
    //delay(3000);

//Serial.print("Humidity");
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
servo1.attach(8);
}
void loop()
{
lcd.clear();
lcd.setCursor(1,0);
lcd.print("Dry Wet Waste");
 lcd.setCursor(3,1);
 lcd.print("Segregator");
  int soil=0;
  for(int i=0;i<2;i++)
  {
digitalWrite(trigPin, LOW);
delayMicroseconds(7);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
delayMicroseconds(10);
```

```
duration = pulseIn(echoPin, HIGH);
distance= duration*0.034/2+distance;
delay(10);

  }
  distance=distance/2;
  Serial.println(distance);
if (distance <15 && distance>1)
{
  delay(1000);
for(int i=0;i<3;i++)
{
soil = analogRead(potPin) ;
soil = constrain(soil, 485, 1023);
fsoil = (map(soil, 485, 1023, 100, 0))+fsoil;
delay(75);
}
fsoil=fsoil/3;
Serial.println(fsoil);
Serial.print("%");
if(fsoil>3)
{delay(1000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Garbage Detected!");
 lcd.setCursor(6,1);
 lcd.print("WET");
  Serial.print("wet");
  servo1.write(180);
delay(3000);}
else{ delay(1000);
  Serial.print("dry ");
  lcd.clear();
lcd.setCursor(0,0);
lcd.print("Garbage Detected!");
 lcd.setCursor(6,1);
 lcd.print("DRY");
servo1.write(0);
delay(3000);}

servo1.write(96);}
distance=0;
    fsoil=0;delay(1000)
```

CHAPTER 7

SCREEN SHOTS

1. CONNECTION

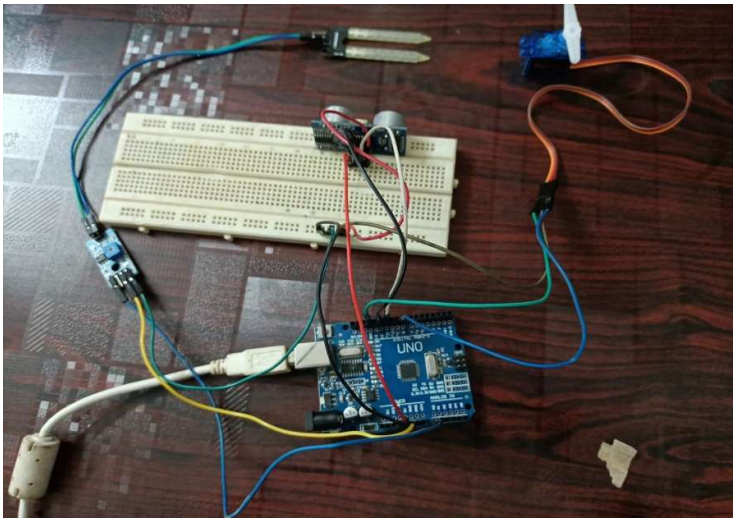

Figure 7.1 Connection Setup

When waste is deposited, it falls straight onto the moisture sensor, which is attached to the upper portion of the segregator. Beside it is a touch sensor that detects dry waste. Servo motors are employed as actuators, and their rotation is contingent upon the nature of the waste (dry or moist). Once placed inside the bin, waste falls across the moisture sensor. The moisture sensor determines whether it is dry or wet based on the threshold that has been set. Servo motors operate in either direction based on the type of trash, and the garbage is placed in the proper compartment as soon as step two is completed. The entire procedure is continuous and autonomous.

CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

In conclusion, the creation of the Smart Dustbin system, which uses Arduino to separate dry and moist garbage, is a major advancement in contemporary waste management techniques. By combining cutting-edge sensor technologies, automated control systems, and intuitive user interfaces, the system presents a viable answer to the problems associated with waste segregation at the source. The Smart Dustbin system helps to promote environmental sustainability and the conservation of natural resources by encouraging effective resource utilization, decreasing dependency on manual sorting procedures, and increasing user participation. This research highlights the potential of Arduino-based solutions to revolutionize waste management procedures and promote a cleaner, healthier, and more sustainable future, even though more optimization and refinement may be needed to address technical issues and increase system reliability.

A system that enables precise sorting by using a camera and machine learning on the Arduino itself to recognize trash categories like plastic bottles or food scraps in real-time. In order to enable segregation of waste beyond just dry and wet, the system could even be expanded to manage numerous bins with servo motors, allowing for the inclusion of categories like paper, plastic, and metal. Another option is waste disposal that is voice-activated. Offering a pleasant and hands-free experience, the system would identify your voice instructions and open the chosen waste type-specific container. To create an even smarter system, sensor fusion might also combine ultrasonic sensors with weight sensors or infrared technologies for metal or bulky garbage detection. The technology might send trash data to a cloud platform for analysis by making a connection to the internet. This would make it possible to better identify trash patterns, optimize collection routes, and ultimately increase the effectiveness of waste management as a whole.

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