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AUTOMATIC WASTE SEGREGATOR SYSTEM

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Abstract

The rapid growth in the population has also led to the surge in the volume of waste being generated on a daily basis. This increase in the generation of waste due to continuous growth in the urbanization and industrialization has become a severe problem for the local and the national government. It is also posing a serious problem for the local authorities to manage the wastes being dumped everywhere as landfill. To ensure the minimal risk to the environment and human health, it is necessary to take meticulous measures when segregating and transporting waste. Segregation of waste in a proper manner brings to the limelight actual economic value of the waste. The traditional method used for segregating of waste in India is through rag pickers which are time-consuming and can have adverse effects on the health of the people who are exposed to such wastes. Here we propose the use of an Automatic Waste Segregator (AWS) which is cheap and also an easy to use solution for segregation of household waste. It is designed to segregate the waste into two categories viz. dry and wet waste. The system makes use of moisture sensor for the segregation of wet and dry waste and an LCD display for displaying the result of segregation. It is evident from experimental reports that segregation of waste using AWS has been successful.Presently, there's no automated system for segregation of wastes in household level. This paper shows the event of trash bin that automatically separates dry and wet wastes in household level.

Keywords:-Dry, Wet,Waste,Segregation, Sensors, Arduino UNO, LCD, Motors.

1. Introduction

Waste disposal is a huge cause for concern in the present world. The disposal method of a voluminous amount of generated waste has had an adverse effect on the environment. Unplanned open dumping at landfill sites made by municipal is a common method of disposal of waste. Human health, plant and animal life are affected due to this method.

The harmful method used for waste disposal generates harmful chemicals which contaminate surface and groundwater. It can give rise to disease vectors which spread harmful diseases. This also degrades the aesthetic value of natural environment can degrade the aesthetic value of the natural environment and it is an unavailing use of land resources.

In today's time, waste management is a very common term and is used to describe the series of activities from waste generation to disposal that can help sort the innumerable problems due to improper waste disposal that includes adverse effects on human health and the environment.

In India, rag pickers play an important role in the recycling of urban solid waste. Rag pickers and conservancy staff have higher morbidity due to infections of the skin, respiratory, gastrointestinal tract and multisystem allergic disorders, in addition to a high prevalence of bites of rodents, dogs and other vermin. Dependency on the rag-pickers can be diminished if segregation takes place at the source of municipal waste generation.

When the waste is segregated into basic streams such as wet and dry ,the waste has a higher potential of recovery and consequently recycled and reused. Even though there are large-scale industrial waste segregators present, it is always much better to segregate the waste at the source itself. The benefits of doing so are that a higher quality of the material is retained for recycling which means that more value could be recovered from the waste. The occupational hazard for waste workers is reduced. Also, the segregated waste could be directly sent to the recycling and processing plant instead of sending it to the segregation plant than to the recycling plant.

Currently, there is no efficient system of segregation of dry and wet wastes at a household level. The purpose of this project is the realization of a compact, low cost, and user-friendly segregation system for urban households to streamline the waste management process.

2. Review of Literature

[1]Waste Segregation using Deep Learning Algorithm:-This paper presents automatic waste classification based on Convolution Neural Network. It separates the waste into non-biodegradable and biodegradable categories using Deep learning based image classification. The concept of Deep Learning permits processing of numerous layers through the computational models in order to learn data representations with abstraction of multiple layers. This

is appropriate for huge measure of waste. Classification of the materials in real time is done by using webcam with python index package. Tensor flow and Spyder are the open source software libraries that are used. The training process is very time consuming. It prevents manual work to a large extent. The system reduces pollution level to a large extend and has a possibility of becoming a large framework in the coming years.

[2]Waste Management using Internet of Things (IoT):-This paper studies the amount of time and money that is wasted due to the scheduled visits to the dustbins in the area. There are times when the workers find the bins to be overflowing and other times when the bins are not even filled to the brim. This causes one of the main reasons for inefficiency in proper collection of waste and is also harmful for the environment. Hence a smart bin which is solar powered and compacts the waste is developed. It has sensors present in it which screens how much waste has been amassed and consequently makes the waste compact so that it holds up to 10 times of the ordinary containers. It can remotely transmit the fill level utilizing cloud server. The bin can be utilized as a Wi-Fi hotspot and is powered by either battery or solar energy. It detects how much waste is inside the compartment and remotely transmits fill level data to cloud server. This results in productive utilization of time and keeps the roads more hygienic. [2]

[3]IOT Based Smart Garbage Monitoring and Alert System Using Arduino UNO:-It builds up a system for disposal of garbage by notifying an alarm to the web server of the municipal corporation. It notifies the moment of cleaning the waste in the bin by keeping legitimate check on level of trash filled. The ultrasonic sensor connected to the Arduino UNO is used to measure the trash collected in the container. The entire procedure is maintained by incorporating and utilizing GSM and GPS based on Internet of Things. An Android application is created and it has constant connection to the municipal web server to upload the alert received from the Arduino and ensures remote observing.

[4]Standalone Frequency Based Automated Trash Bin and Segregator of Plastic Bottles and Tin Cans:-The paper shows how the piezoelectric amplifier framework can be utilized for input signal procurement and noise can be eliminated using a comparator. The average frequency response of the object triggers the framework as it hits the platform. The Arduino decides the further processing steps. Galvanized iron is used for the fabrication of the platform and it is associated with a DC engine that isolates the items. There is an overlapping in the frequencies of the metal jars and plastic found with middle values of frequencies in spite of the fact that there were barely any examples which cause the overlapping. When the bottom of the plastic container hit the platform first, results demonstrated the framework's precision when the top hit the stage initially was higher contrasted with the bottom value.

[5]Eco-Friendly IOT Based Waste Segregation and Management:-The viable and effective techniques for assortment and isolation of waste at residential level dependent on the nature of composition are concentrated in this paper. The waste is put away as it needs to be in their particular portions of the dustbin as metal, plastic and biodegradable. The biodegradable waste is distinguished by the discharge of methane gas and after a particular amount of gas, liquid is sprayed on it. The fill status of the dustbin is observed and data is sent utilizing Wifi module. At the point when a certain level is reached, notification is sent to the clien to advise that the specific portion is covered and it must be discarded. The whole setup of the bin is driven by STM32 microcontroller. Likewise the plastic just as metal waste are recognized and isolated into their separate areas utilizing capacitive and inductive sensors respectively.

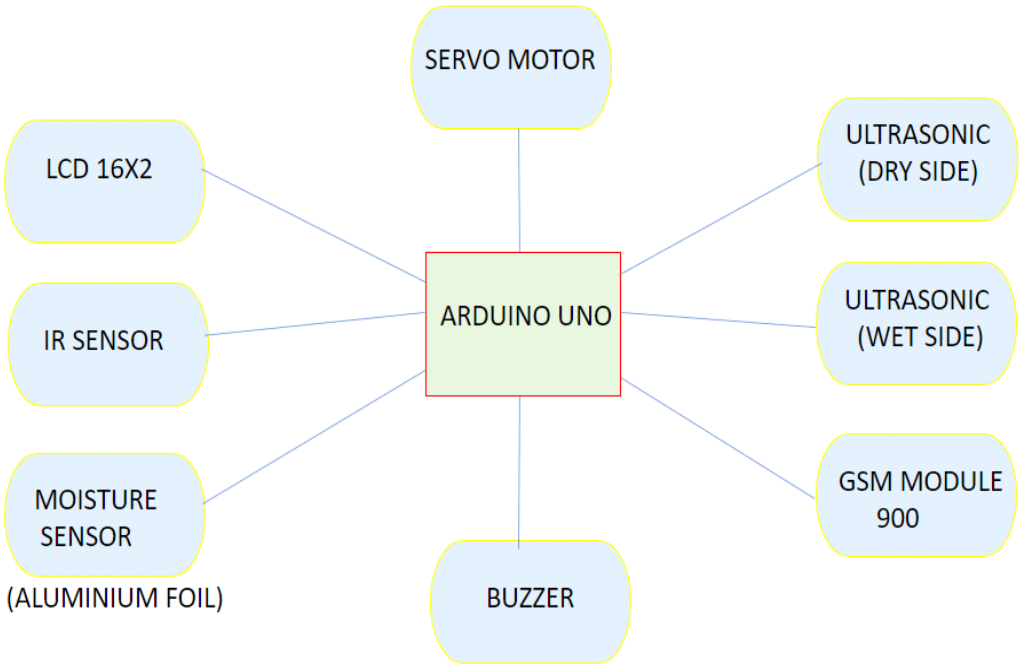
[6] Automated Waste Segregator:-The paper depicts a simple to utilize and a cheap way for segregation by introducing an Automated Waste Segregator. It is segregates the waste into wet waste, dry waste and metal waste. It utilizes capacitive sensors to perceive wet and dry waste and parallel resonant impedance identifying component to perceive metallic things. With an ordered priority of segregating the wet, dry and metal waste, only a single type of waste can be isolated at once. Blended kind of waste is isolated by upgrades which utilize the buffer spaces. The detection of metal waste is comparatively less, and the whole module can be put in a solitary stage where the entity is steady to ensure better results.

[7]A Novel Approach For Waste Segregation At Source Level For Effective Generation Of Electricity Green Bin:-The paper portrays the innovation of automating the isolation of dry waste into plastics, metal, paper and glass at accessible commercial level. The isolation of the waste is determined and influenced when the waste products get contaminated. The Green Bin is intended for mechanized waste isolation at local level itself. It comprises of inductive metal sensor, capacitive moisture sensor, odour sensor and methane sensor. Capacitive based moisture sensor is utilized to decide the moisture level present in the waste. The inductive based metal sensor is utilized to detect metal content in the waste. The affirmation of food waste is determined by methane sensor.

3. METHODOLOGY

The Automatic Waste Segregator System is driven by the Microcontroller Arduino UNO. All the components that are connected to Arduino UNO are programmed using the Arduino IDE. The program is written in Embedded C language and it reads the input/output pins of the components.The servo motors are present to deflect the wet and dry waste into the specific bins. . The dry waste has paper and plastic which are differentiated using the Capacitive Proximity sensor. The wet waste is examined with the help of Moisture sensor. The measure of the dustbin level is calculated by the Ultrasonic sensor connected at the edge of the dustbin. When the dustbin is full, a message- BIN IS FULL is sent to the cleaning authorities. The message is sent using the GSM module that provides the communication between the bin and the authority. The location of the bin can also be sent. The location is known with the usage of GPS module that is connected to the system.

4.BLOCK DIAGRAM:



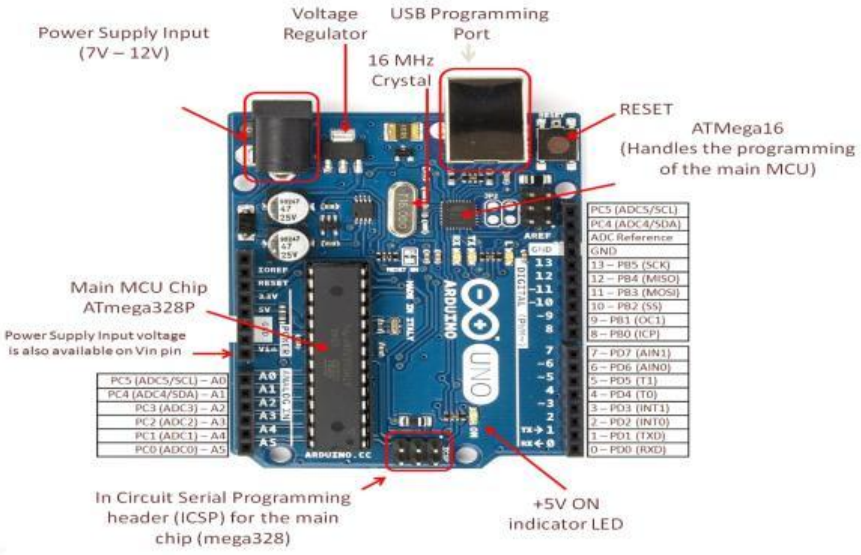
5HARDWARE REQUIREMENTS ARDUINO UNO:-

It is an open-source electronics platform dependent on simple to interface hardware and execute programming. The assortment of chip and controllers is done with the help of Arduino board structures. The Arduino boards are equipped with 14 digital pins for input or output, and 6 analog pins for input that are used to interface different circuits. The customization of microcontrollers is done by utilizing Embedded C and C++ programming codes. Arduino microcontroller gives an Integrated Development Environment (IDE) that supports different programming languages. Current Arduino boards are programmed by means of Universal Serial Bus (USB).

5.1.1Technical Specifications:

1.Operating Voltage: 5V
2.Input Voltage: 7-20V
3.DC current per I/O pin: 20 mA
4.Flash Memory: 32 KB
5.Clock Frequency: 16 MHz.
6.No. of digital pins: 14
7.No. of analog pins: 6

- *General Pin Functions:*
- LED- Arduino Uno contains an onboard built-in LED that is connected to digital pin 13. When this pin is HIGH, the LED glows.
- IN- When powering the Arduino using an external power supply, this pin has to be used.
- 5V- This pin supplies the board a regulated voltage of 5V via the voltage regulator. Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- GND- Arduino Uno consists of 3 ground pins.



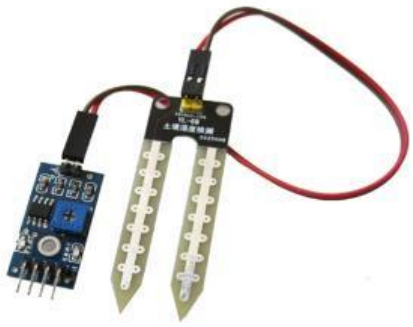
5.1.2 Communication: The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pin 0 (RX) and 1 (TX). ATmega16U2 on the board channels this serial communication over USB and appears as virtual com port to software on the computer.The advantages of Arduino over 8051 or any micro-controller in the 8051 family is countless. Arduino contains inbuilt ADC and DAC which is not the case with 8051. Programming Arduino is simpler because it can be programmed using an IDE that supports C programming, on the other hand, 8051 has to be programmed using assembly language programming.

5.2SERVO MOTOR:-

It is used to deflect the waste to the respective bins. A servomotor is defined by a rotary actuator or linear actuator that takes into account exact control of angular or linear position, velocity and acceleration. A suitable motor is coupled to a sensor for obtaining position feedback. The digital or analog input control signal represents the position directed for the output shaft.

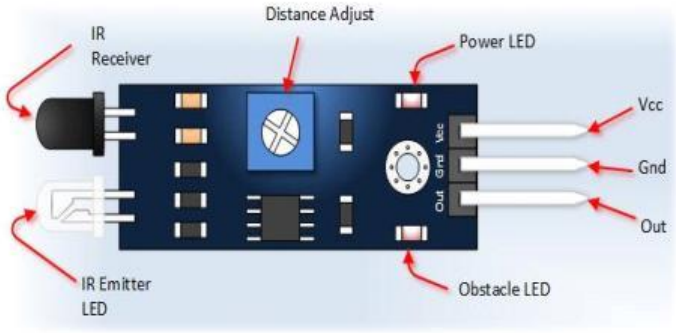
5.3MOISTURE SENSOR:-

It is used to identify if the garbage is wet or dry. The content of moisture in the waste is tested and accordingly it is dropped in the appropriate dustbin.



5.4 IR SENSOR:-

It is usedIto continuously monitor and detect the object(waste) that is placed on the bin.



5.4.1 Technical Specifications:

1.Operating Voltage: 5V 2.Minimum Distance: 2-5 cm 3.Maximum Distance: 10-15 cm

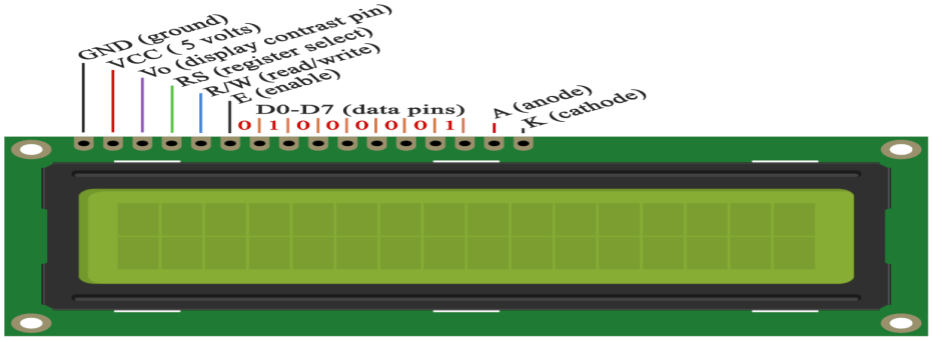
- *Circuit Description: The circuit of an infrared sensor contains the following components-*

1.LM358 IC two IR transmitter and receiver pair.
2.Resistors in the kilo ohms range
3.Variable resistors
A4.Light emitting diode

When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 is used to adjust the output terminals. Resistor VR1is used to set the sensitivity of the circuit Diagram.

5.5 LCD DISPLAY:-

An LCD display is attached to the setup which would display the types of waste that detect in the sensor and display the bins level.



5.6ULTASONIC SENSOR:-

We use ultrasonic sensor to check the level of dry bin and wet bin.

5.7 GSM MODULE:-

Mobile telephone technology is used in GSM to provide a data link to a remote network. It is like a sim that is connected to the Arduino along with various types of data obtained from the board. The board has pins to take out +5V or other values of power and ground connections. TTL-level serial interface with the host is implemented in this technology.

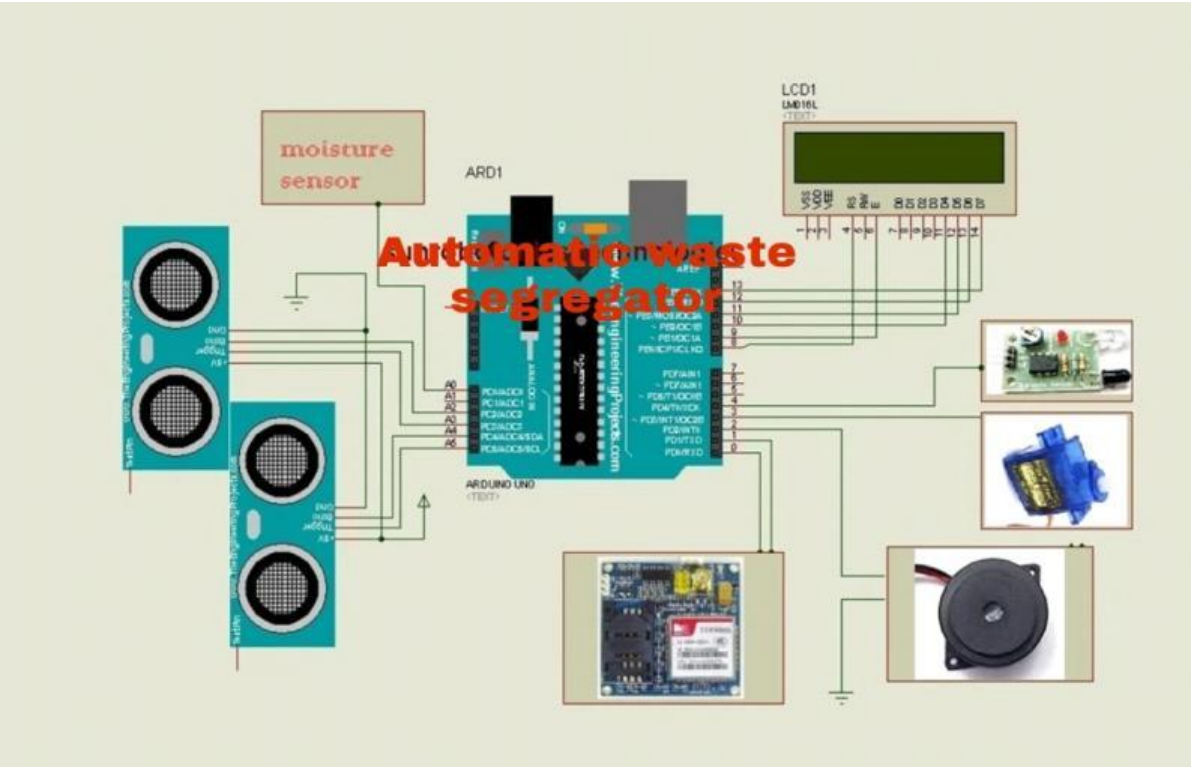
5.8 SOFTWARE REQUIREMENTS ARDUINO IDE:-

A cross platform application comprising functions that are coded in Embedded C and C++. The programs are written and uploaded to Arduino boards using the IDE. In this system, the program is written in Embedded C for the working of the hardware components. The program consisted of separate methods for the detection of dry and wet waste. One method was written for sending the message to the authorities along with the location of the bin. The location of the bin was determined by another method that programmed the GSM module. The program code written on Arduino IDE was then fed to the Arduino for the working of the whole system.

It connects to the Arduino and hardware to upload programs and communicate with them. The IDE consists of two main parts viz.

- void setup (): This is the location where a user can initialize all the variables that will be required during the course of programming a system. As the name suggests, this function is used to set up an Arduino before interfacing it with other circuits. This area can also be used to include libraries of various sensors. The popularly used functions in void setup are:
- pin mode: This function is used to declare pins of Arduino as input or output.
- serial.begin: This function is used when Arduino is communicating with other sensors or devices. This enables a user to set a specific baud rate for communication purpose.
- void loop (): The code written in this space will run over and over again unless Arduino is interrupted using an interrupt or the USB cable is disconnected from the USB port. The different functions that are often used in void loop are:
- DigitalWrite: This function is used to make a specific pin on Arduino logically HIGH or LOW.
- DigitalRead: This function is used when there is a need to read digital data from a sensor or when we have to control something using a switch/ push button.
- AnalogRead: This function comes in handy when we have to read analog data from a sensor ex. Analog read is used when there is a need to read data from a potentiometer.
- AnalogWrite: This function is used when a user wants to supply analog voltages to a component. The best example of analog write is when the intensity of LED is controlled using a potentiometer and analog write function.

6. CIRCUIT DIAGRAM



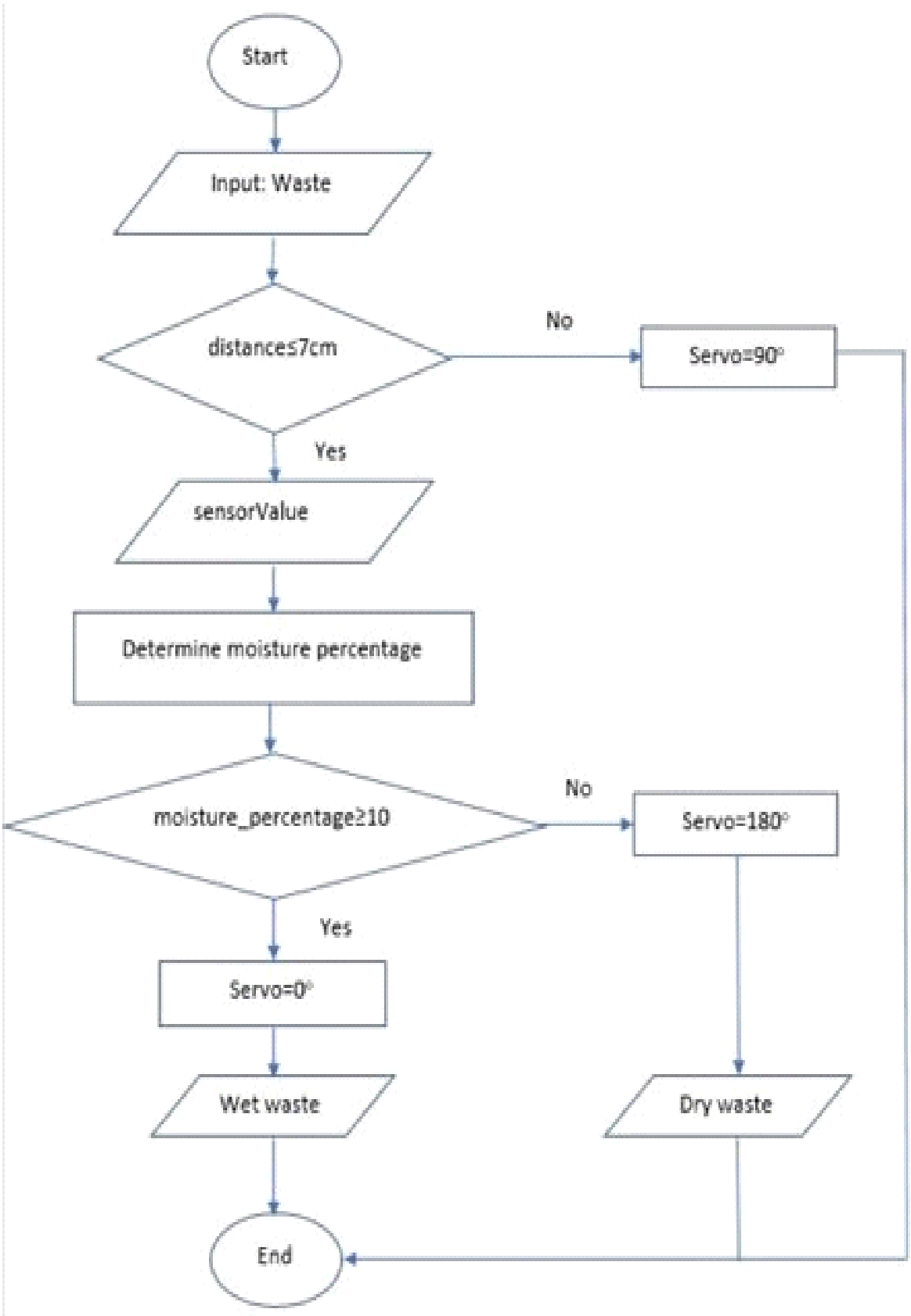
7. WORKING:-

To collect the dry and wet waste separately, we are considering 2 bins connected by a common lid. Lid is covered up with aluminium foil. When an obstacle i.e. garbage is placed on a lid, the IR sensor detects it. After detection of the object, the moisture content is sensed by the moisture sensor and if it's dry, the lid flips towards dry side and vice versa. This flipping of lid is done with the help of servomotor.
As the trash gets detected and sensed, out LCD used will display whether the trash placed is dry or wet and it also gives us the count of the trash. We have used 2 ultrasonic sensor in order to detect whether the trash bin is full or not. When this ultrasonic sensor senses that the bin is full, then there goes a buzzer in order to inform people not to dump garbage furthermore. Meanwhile the GSM module of 900Hz sends the SMS to authority saying that the bin is full and it needs to be disposed.

8. Flow Chart

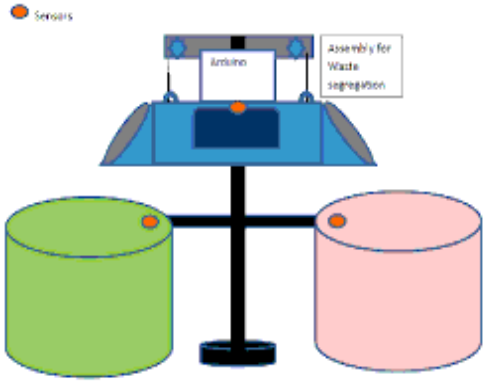
A waste is positioned and is Moved until it reaches the ultrasonic sensor Referring to the flowchart the ultrasonic sensor will detect the presence of the waste by setting the distance in the Arduino coding with ≤ 7 cm.

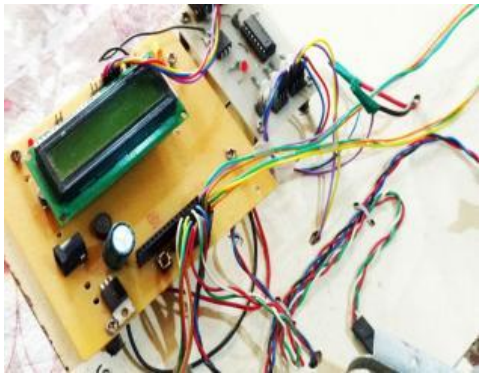
Next, the servo motor and moisture sensor are attached together for them to work simultaneously. The position of the servo is initially set at 90^0 when there is no waste placed on the conveyor belt. This means that the distance for the ultrasonic sensor is not ≤ 7 cm. Once the ultrasonic sensor detects the presence of waste , the moisture sensor is ready to measure the value of resistance to the current of the waste. A delay is set about 7s for the moisture sensor to measure the reading (i.e. 7s is from the moment ultrasonic detect the presence of the waste). Delay is set because the moisture sensor need to be pressed quite hard for it to gain a more accurate value of electric conductivity of the current waste. For moisture sensor, it is set into two conditions:
A. If moisturepercentage ≥ 10; the particular waste is considered as wet waste (residual). For this condition, servo motor will rotate to 0^0 and the waste is pushed into the residual dustbin .
B. If moisturepercentage ≤ 10; the particular waste is considered as dry waste (recyclable). For this condition, servo motor will rotate to 180^0 and the waste continued to stay on the conveyor belt until it reach to the end and entered the recyclable dustbin.


Start
Input: Waste
distances≤7cm
No
Servo=90°
Yes
sensorValue
Determine moisture percentage
moisture_percentage≥10
No
Servo=180°
Yes
Servo=0°
Wet waste
Dry waste
End

9. RESULT:-

The waste gets segregated automatically as wet and dry based on the moisture content present. By this the primary level of segregation is successfully done.





10. Conclusion

Implementation of this system at a local level like societies, educational institutes, etc. can reduce the burden on the local authorities. The automatic waste segregator is one small step towards building an efficient and economic waste collection system with a minimum amount of human intervention and also no hazard to human life. Using this makes the system far more accurate, cost-effective and also easier to install and use at a domestic level. Segregating all these wastes at a domestic level will also be time-saving. While implementing our system we came across many problems like the sensing range of sensor, the accuracy of the moisture sensor, adjusting the range of IR sensors and some more, but using some modifications we tried making the system as reliable as possible.

11. Future Scope

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. Using a robotic arm along with a conveyor belt will make the process of segregation easier. Also, more sensors can be used to segregate bio-degradable and non-bio-degradable waste, plastics, recyclable waste, e-waste, and medical waste.

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