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SMART DUSTBINS FOR SMART CITIES
(Using Arduino, Ultrasonic Sensor & Servo Motor)



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 (NAAC ACCREDITED "A++" GRADE)**



This is to certify that **SANJEET KUMAR** of T.Y.B.Sc.,
Roll No. 29 has completed project satisfactory as partial
 fulfilment of curriculum during academic year 2021-22.

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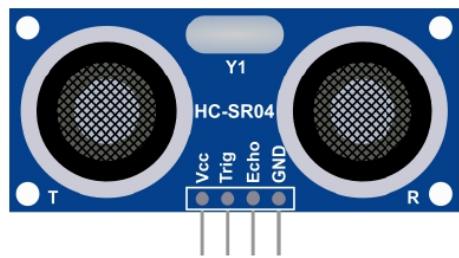
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Title of Project



SMART DUSTBINS FOR SMART CITIES

(Using Arduino ,Ultrasonic Sensor & Servo Motor)



ABSTRACT

The main objective of the project is to design a smart dustbin which will help in keeping our environment clean and also eco friendly. We are inspired from Swaach Bharat Mission. Nowadays technologies are getting smarter day-by-day so, as to clean the environment i am designing a smart dustbin by using Arduino. This smart dustbin management system is built on the microcontroller based system having ultrasonic sensors on the dustbin. If dustbin is not maintained than these can cause an unhealthy environment and can cause pollute that affect our health. In this proposed technology i have designed a smart dustbin using ARDUINO UNO, along with ultrasonic sensor, servo motor, battery and jumper wires. After all hardware and software connection, now Smart Dustbin program will be run. Dustbin lid will open when someone comes near at some range than wait for user to put garbage and close it. It's properly running or not. For social it will help toward health and hygiene, for business i try to make it affordable to many as many possible. So that normal people to rich people can take benefit from it.

INTRODUCTION

The rate increasing population in our country has increasing rapidly and also we have increase in garbage which have increased environmental issue.

Dustbin is a container which collects garbage's or stores items which recyclable or non-recyclable, decompose and non-decompose.

They are usually used in homes, office etc, but in case they are full no one is there to clean it and the garbage are spilled out.

The surrounding of a dustbin is also conducive for increasing the pollution level. Air pollution due to a dustbin can produce bacteria and virus which can produce life harmful diseases for human. Therefore, I have designed a smart dustbin using ARDUINO UNO, ultrasonic sensor which will sense the item to be thrown in the dustbin and open the lid with the help of the motor. It is an IOT based project that will bring a new and smart way of cleanliness. It is a decent gadget to make your home clean, due to practically all offspring of home consistently make it grimy and spread litter to a great extent by electronics, rappers and various other things. Since the smart dustbin is additionally intriguing and children make fun with it so it will help to maintain cleanliness in home.

**It will be applied for various type of waste.
Dustbin will open its lid when someone/object
is near at some range then it will wait
for given time period than it will close automatically.
Here lid will close when you don't want to use
and it will only open when it required.**

LITERATURE SURVEY

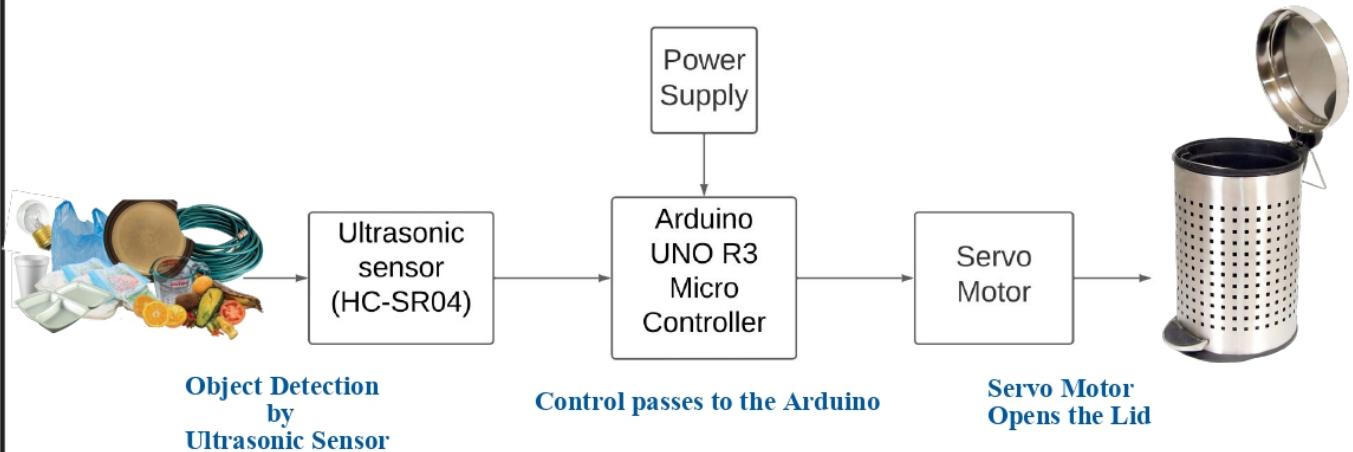
With the aim of creating a unique system we have reviewed papers which deal with similar concepts. Many systems like this were implemented in the past but were not so effective so a research was done to know what was the problem exactly. This research has been done.

- The polluted regions of Guwahati city is taken into account and studied on the basis of municipal solid waste. Various teams have been demarcated for identifying the affected areas. The waste was divided on the basis of biodegradable and non biodegradable waste and how the people dump their waste was observed.[1]
- Smart cities possess a sustainable and hygienic environment for a decent quality of life. Here, garbage disposal plays a vital role. By keeping this in my mind a smart dustbin is designed to automatically alert the municipality when the dustbin gets filled.[2]
- There is a usual existing process where garbage trucks are send from the municipality to collect the waste from the garbage bins. The wastes are loaded in the truck and taken to the dumping grounds.

But the problem arises that there are many regions where the garbage bins get filled well before the cleaning process and the people doing the job of cleaning process are not enough to do the job.[3]

- **The approach for a Smart Dustbin is made which alerts the concerned authorities when the garbage is full in the garbage bins and cleaning or emptying them is of immediate concern.[4]**

BLOCK DIAGRAM



COMPONENT SPECIFICATION

• ULTRASONIC SENSOR

An Ultrasonic sensor is a device which measures the distance to an object by using a sound wave. It measures distance by sending out a sound wave at a specific frequency and waiting for a sound wave to come back by striking the object.

When the signal is received then the distance is calculated by the formulae given below

Speed = distance/time.

By using calculated distance we can perform many different tasks.



FEATURES:

Supply voltage: - 5V

Current Consumption: - 15ma

Ultrasonic Frequency: - 40 Khz

Maximum Range: - 400 cm

Minimum Range: - 2 cm

Resolution: - 1 cm

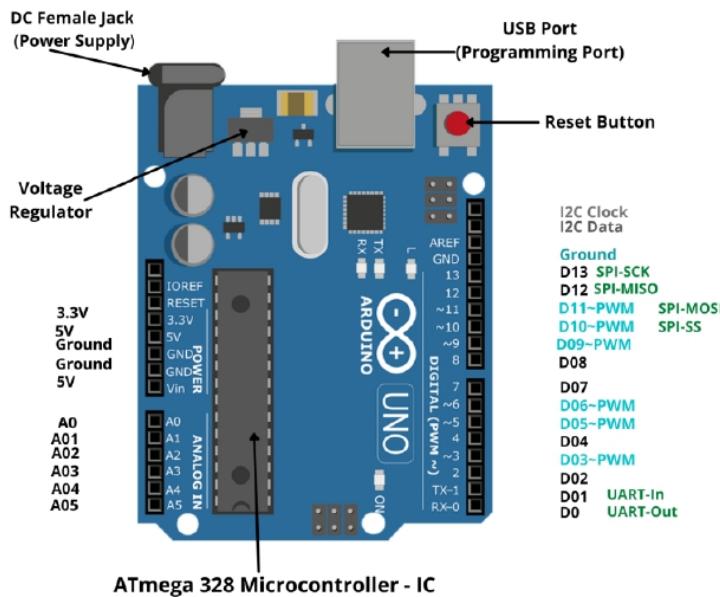
Trigger Pulse Width: - 10 s

Dimension: - 43x20x15 mm

• ARDUINO

ARDUINO is an open-source physical computing device based on simple I/O operations and used to implement the program written in **ARDUINO IDE**. The open-source IDE can be downloaded for free to write a program to implement a project. It has 14 digital IO pins with 6 PWM pin multiplexed on it, 6 analog inputs, a 16 MHz quartz crystal oscillator to provide clock to microcontroller, a USB connection, a power jack for power supply and a reset button and operates on 5V 1A supply. It's simply a trainer learning kit, with open source software.

Arduino Uno R3



FEATURES:

<u>Microcontroller</u>	ATmega328
<u>Operating Voltage</u>	5V
<u>Input Voltage</u>	7-9V
<u>Input Voltage (limits)</u>	6-20V
<u>Digital I/O Pins</u>	14 (6 provide PWM output)
<u>Analog Input Pins</u>	6
<u>DC Current per I/O Pin</u>	40 mA
<u>DC Current for 3.3V Pin</u>	50 mA
<u>Flash Memory</u>	32 KB (ATmega328) (0.5 KB used by bootloader)
<u>SRAM</u>	2 KB (ATmega328)
<u>EEPROM</u>	1 KB (ATmega328)
<u>Clock Speed</u>	16 MHz

•SERVO MOTOR

Servo Motor helps in opening the lid of the dustbin. The Arduino is programmed in such a way that after detecting the waste using ultrasonic sensor the lid should open automatically and this is done using this servo motor.



TowerPro SG-90 FEATURES:

Operating Voltage is +5V typically

Torque: 2.5kg/cm

Operating speed is 0.1s/60°

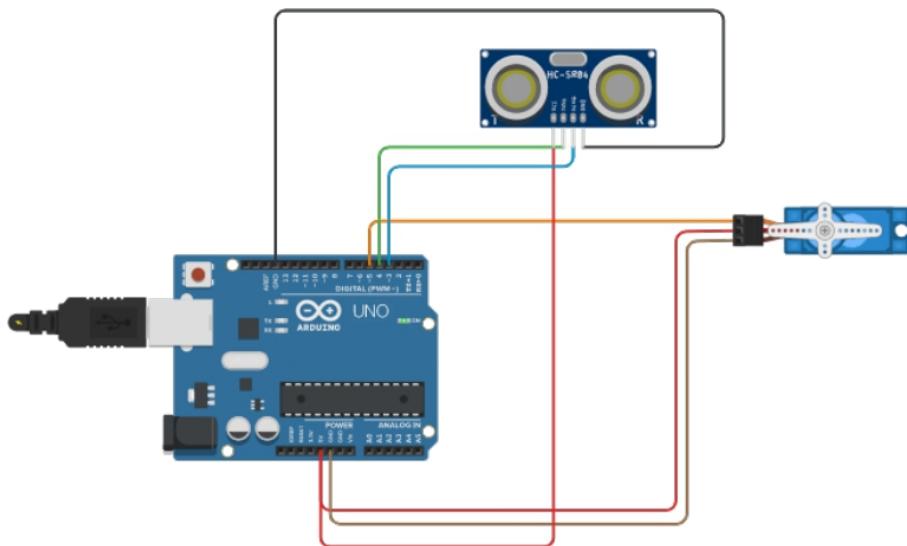
Gear Type: Plastic

Rotation : 0°-180°

Weight of motor : 9gm

Package includes gear horns and screws

HARDWARE DESIGNING



Connection Diagram



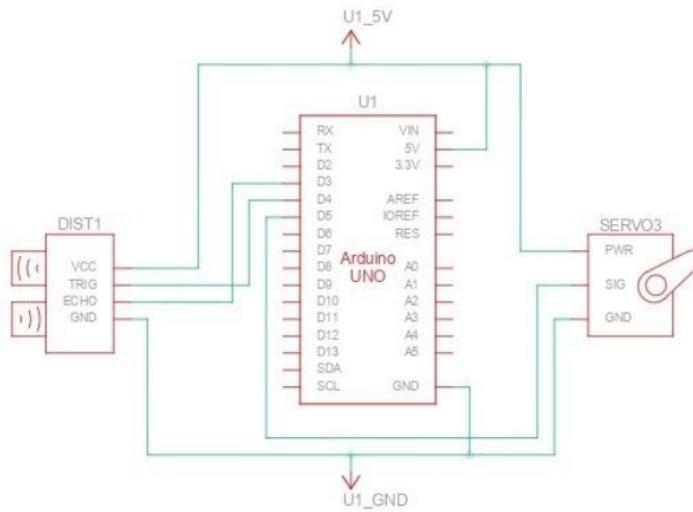
AUTODESK®
TINKERCAD®

Simulation

<https://www.tinkercad.com/things/308A9lerCT0>



CIRCUIT DIAGRAM



WORKING

After wiring and attaching all the devices and setting up to the Smart Dustbin, now observe all the important setup whether they are well connected or something missed.

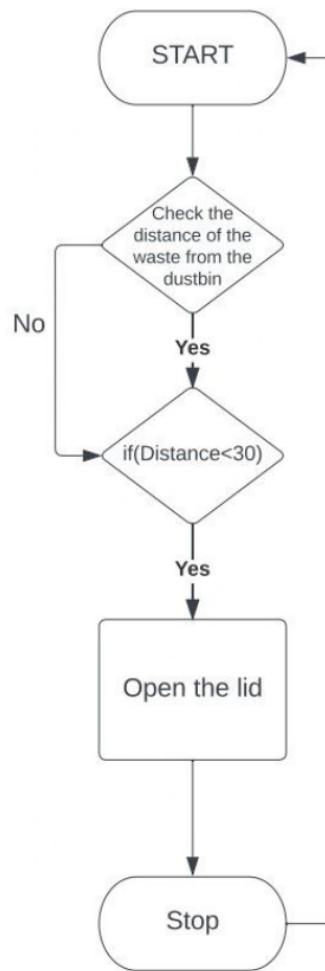
After connection set up now next step is to submit/upload code in Arduino and supply power to the circuit.

When system is powered ON, Arduino keeps monitoring for any things that come near the sensor at given range.

When Ultrasonic sensor detect any object for example like hand or others, here Arduino calculates its distance and if it less than a certain predefines value than servo motor get activate first and with the support of the extended arm of the lid.

Lid will open for a given time than it will automatically close.

FLOW CHART



The waste is first placed in front of the ultrasonic sensor. The sensor detects the waste and makes the lid of the dustbin to open and the waste is disposed inside the dustbin. This process repeats and goes on like a cycle.

5/3/22, 10:44 AM Smart-Dustbin-for-Smart-Cities/Code.ino at 672d75138fda5e9daf15b26e21e8a36c23cddea6 · sanjeetmeenia/Smar... [Code](#)

sanjeetmeenia / Smart-Dustbin-for-Smart-Cities Public PROGRAM CODE

[Code](#) [Issues](#) [Pull requests](#) [Actions](#) [Projects](#) [Wiki](#) [Security](#) [Insights](#) [Settings](#)

[672d75138f](#) [...](#)

Smart-Dustbin-for-Smart-Cities / Code.ino

 **sanjeetmeenia** Code: Smart Dustbins for Smart Cities [...](#) [🕒](#)

1 contributor

36 lines (33 sloc) | 671 Bytes [...](#)

```

1 #include <Servo.h>
2 Servo servoMain; // Define our Servo
3 int trigpin = 4;
4 int echopin = 3;
5 int distance;
6 float duration;
7 float cm;
8
9 void setup()
10 {
11     servoMain.attach(5); // servo on digital pin 10
12     pinMode(trigpin, OUTPUT);
13     pinMode(echopin, INPUT);
14 }
15
16 void loop()
17 {
18     digitalWrite(trigpin, LOW);
19     delay(2);
20     digitalWrite(trigpin, HIGH);
21     delayMicroseconds(10);
22     digitalWrite(trigpin, LOW);
23     duration = pulseIn(echopin, HIGH);
24     cm = (duration/58.82);
25     distance = cm;
26
27 if(distance<30)
28 {
29     servoMain.write(180); // Turn Servo back to center position (90 degrees)
30     delay(3000);
31 }
32 else{

```

<https://github.com/sanjeetmeenia/Smart-Dustbin-for-Smart-Cities/blab/672d75138fda5e9daf15b26e21e8a36c23cddea6/Code.ino> 1/2

5/3/22, 10:44 AM Smart-Dustbin-for-Smart-Cities/Code.ino at 672d75138fda5e9daf15b26e21e8a36c23cddea6 · sanjeetmeenia/Smart-Dustbin-...

```
33     servoMain.write(0);
34     delay(50);
35 }
36 }
```



<https://github.com/sanjeetmeenia/Smart-Dustbin-for-Smart-Cities>

ADVANTAGES

Following are the advantages of using Smart dustbin:

- A reduction in the number of waste collections needed by up to 80%, resulting in less manpower, emissions, fuel use and traffic congestion.
- A reduction in the number of waste bins needed.
- Maintain environment hygiene (i.e. no overflowing of waste and less unpleasant odor).
- It will help in bringing evolution by technology in term of cleanliness.

APPLICATION

- 1) To collect dustbins placed at public places in city.**
- 2) Automatic open-close lid for ease of use.**
- 3) There is no contact touch between dustbin and Person so, prevention from germs and diseases.**
- 4) Warning message indication when a Smart Trash Bin is nearly full. Also send SMS to garbage collector in particular area.**
- 5) Healthy Environment maintained in particular area.**
- 6) Smart Trash Bin can be used in Colleges/University Campus, Shopping malls,Railway stations (We can use Wi-Fi modules for sending SMS to garbage collector).**

Advantages:

- Efficient cleaning of garbage.
- Helpful for the municipality.
- On time collection of garbage.
- No bad odour around the bin.

FUTURE ENHANCEMENT

The above method is just a stepping stone for implantation of IOT.

There can be many enhancements done for this prototype which can be a revolutionary change in maintaining our environment clean and healthy.

The few enhancements can be done are:

The implementation of more collective bins placed side by side where it automatically detects the type and waste and places in the correct bin color which is assigned for that type.

These dustbins can be placed with a GPS tracker where the dustbins in a particular locality can be located easily and the waste can be emptied.

This method can lead to Smart Waste Monitoring System.

CONCLUSION AND SUGGESTION

Here,I am going to make an evolution changes toward cleanliness. The combination of intelligent waste monitoring and trash compaction technologies, smart dustbins are better and shoulders above traditional garbage dustbin.

It is equipped with smart devices like sensor, Arduino,etc.Lid of the dustbin will automatically open when an object comes near to the dustbin and after certain time period it will close the lid.

For social it will help toward health and hygiene, for business i try to make it affordable to many as many possible. So that normal people to rich people can take benefit from it. Believe this will bring something changes in term of cleanliness as well technology.So our next work will be adding one more sensor which will sense whether our dustbin is full or not. And there will be a display will be added so that user can notify that dustbin is full or not.

REFERENCES

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- [2]. <https://www.instructables.com/id/Smart-Home-Arduino-Trash-Indicator-With-BLE/>
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- [4]. S.S. Navghane, M.S. Killedar, Dr.V.M. Rohokale,|| IoT Based Garbage and Waste Collection Bin||, May 2016.
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- [6]. Guerrero, L.A., Maas, G., Hogland, W.: Solid waste management challenges for cities in developing countries. *Journal of Waste Management*.
- [7]. <https://www.elprocus.com/smart-dustbin-using-iot/>
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- [9]. <https://www.youtube.com/watch?v=e9D5XSDnVWo>

TOTAL COSTING



Clean91 Smart Dustbin(Mini)

Capacity: 7L



Item	Quantity	Rate	Amount
Arduino UNO	1	₹230.00	₹230.00
Servo Motor	1	₹55.00	₹55.00
Ultrasonic Sensor	1	₹50.00	₹50.00
Jumper Wires	20	₹0.80	₹16.00
Dustbin	1	₹99.00	₹99.00
Adaptor	1	₹49.00	₹49.00

Notes:

Any inquiry please contact at :
Email - missionclean91@gmail.com

Terms:

Only online payment accepted



Subtotal:	₹499.00
Tax (18%):	₹89.82
Shipping:	₹49.00
Total:	₹637.82



LOGO_Clean91_Smart_Dustbin