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Smart Trash Can

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Abstract

Technology is advancing day by day. This promotes ease in the life of humans and allows us to carry out mundane tasks with comfort. In this paper we present a working model of a smart trash can which is equipped with 3 vital components they are ultrasonic sensor, moisture sensor and a Bluetooth module. Each performing different functions to carry out waste segregation and waste management efficiently, by promoting the goals of green computing, e-governance and upcycling. The smart trash can is equipped with Arduino Uno which controls all the parts of the trash can.

Keywords: Arduino Uno, HC-SR04 Ultrasonic Sensor, Moisture Sensor, HC-05 Bluetooth module.

Introduction

Most of the waste management problems could be solved if the waste is segregated properly at the source. One of the main objective of our model is to promote waste segregation and to prevent overflowing of waste bins. The Smart Trash can consists of a microcontroller i.e. Arduino Uno which controls all the parts of the can. The ultrasonic sensor informs the municipality people about the level of the waste being filled in the can so that they can empty the can when it is full. The moisture sensor alerts people when they try to discard a wet waste in a dry bin. There is an inbuilt led which blinks to alert the people. The smart trash can is also equipped with a Bluetooth module which transmits the serial data online so that the municipality people can keep a watch and act accordingly.

WORKING

Component: Ultrasonic Sensor

Ultrasonic sensors are based on the measurement of the properties of acoustic waves with frequencies above human audible range. The properties of received echo pulses are evaluated based on:

The time of flight- Ultrasonic transmitter emits a short burst of sound in a particular direction, the pulse bounces of a trash level and returns to the receiver after a time interval t the receiver records the time interval which is monitored in the terminal and hence helps in calculating the level filled in the smart trash can.

$$r = c \times t^2$$

Doppler Shift-when a wave reflects of a moving object its frequency is shifted by an amount proportional to the velocity of the object.

$$f_e - f_r = 2 \times f_e (v/c) \cos A$$

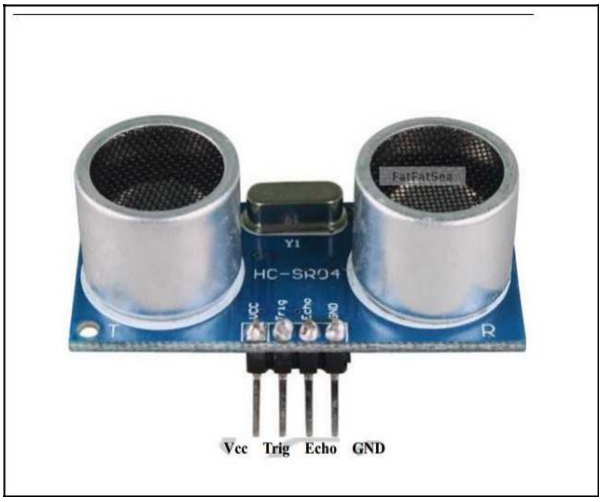
These properties make sure that the measurements are accurate and there are no chances of failure occurring. When the required exceeds its threshold value of 95% it alarms the municipality with the status and location of the trash can for the replacement. Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work: Using IO trigger for at least 10us high level signal. The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back, if the signal back, through high level time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time×velocity of sound (340M/S) / 2

with AFH(Adaptive Frequency Hopping) feature. It has the footprint as small as 12.7 mm 27mm.It

simplifies overall design/development cycle.

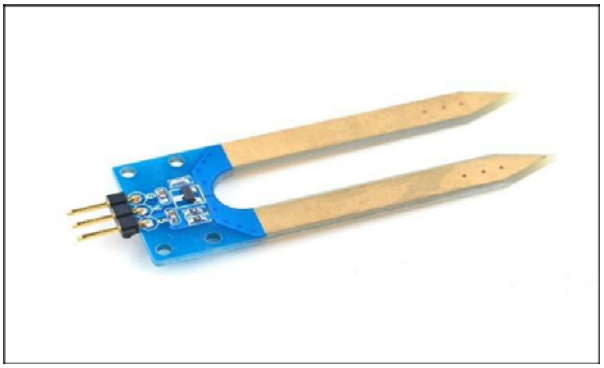
Ultrasonic Sensor



Component: Moisture Sensor

Another major section is the moisture detection sensor which is used to measure the volumetric water content of an input object. It returns the value of moisture content relative to the threshold value, if it exceeds the threshold the system alarms the person that it is a wet waste.

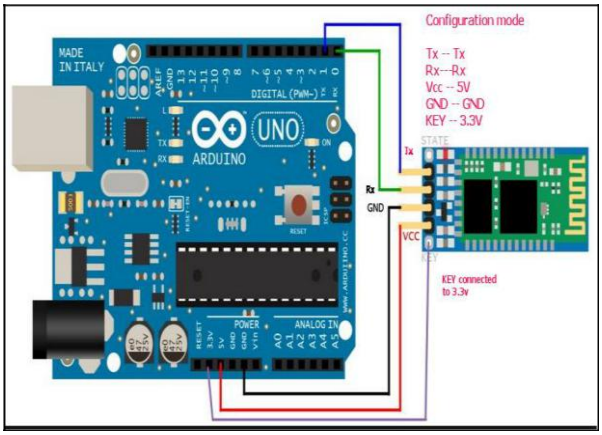
Specification: Range:0-65% of volumetric water content, Accuracy:$\pm 4\%$ typical, Typical resolution:0.1%, Operating temperature:-40$^{\circ}C$ to +60$^{\circ}C$. The large variation in operating temperature ensures that the reading is accurate.



Moisture Sensor

Component: Bluetooth module

HC-05 module is an easy to use Bluetooth SPP(serial port protocol)module, designed for transparent wireless serialconnection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR(Enhanced Data Rate) 3Mbps modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and



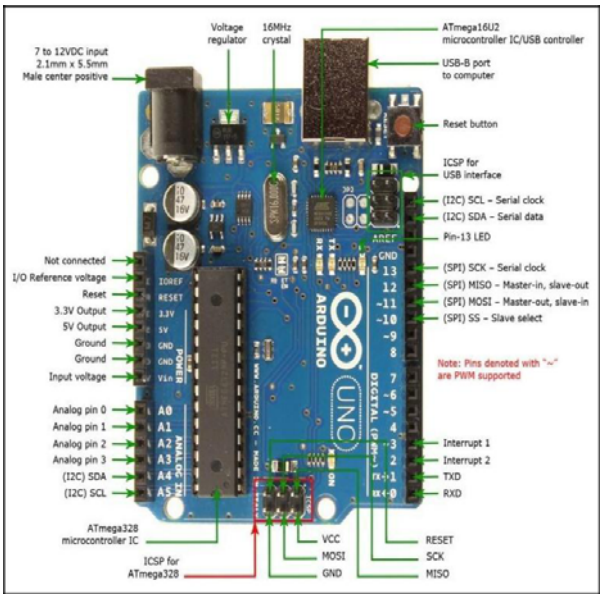
Integrated Bluetooth Module

Specification of hardware features: Typical - 80dBm sensitivity, Up to +4dBm RF transmit power, Low Power 1.8V Operation,1.8 to 3.6 V I/O, PIO control, UART interface with programmable baud rate, With integrated antenna, With edge connector

Component: Arduino Uno

Arduino Uno is a microcontroller board based on the Atmega328P(datasheet).Since it is a microcontroller a program input on it once fed need not be reinstalled again and again.

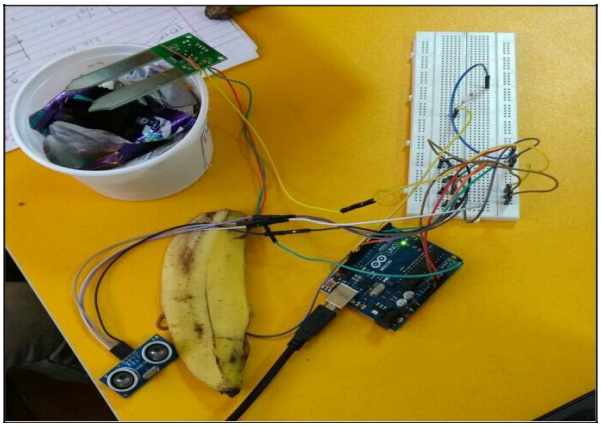
Specification: 14 digital input output pins, 16 mega quartz crystal, USB connection, Power Jack, ICSP header, Reset Button, USB cable with an AC/DC adapter.



Schematic of Arduino Uno

Implementation

The Digital India vision of the government seeks to empower every citizen with the benefits of technology by enabling digital transformation. Smart Trash Can is focussing on fulfilling this culture and creating an ecosystem of innovation by implementing a smart city with good hygiene and sophistication.



This paper describes intelligent ecologic system which identifies the waste produced individually using sensors embedded in the trash cans. While depositing waste the individual is alerted if it is the right kind of waste discarded or not along with this the information about the trash can i.e. the location through the Bluetooth module, the type of waste through the moisture sensor and the level of trash through the ultrasonic sensor reaches the server system and is recorded in the database of the respective municipalities this makes the waste disposal easier to manage and maintain in a affordable price. The serial port analyses the results of the moisture content, percentage of trash and gives an indication if the waste is wet or dry relative to the threshold value. These values are sent and recorded in the database to analyse the status of the can and hence the required replacement. The code below illustrates the working of the serial port analysis.

```
#define trigPin 9
#define echoPin 10
#define led 13
int sensorValue = 0;  // variable to store the value coming from the sensor
int sensorPin=0;
void setup() {
  Serial.begin (9600);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(led, OUTPUT);
 }
void loop() {
long duration,distance;
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = (duration/2) / 29.1;
  if (distance <= 3) {
    digitalWrite(led, HIGH);
    Serial.println("dustbin full");
    }
  else {
    digitalWrite(led,LOW);
  }
   Serial.print(distance);
    Serial.println(" cm");
```

Acknowledgements

The needs for effective waste management was the keyfactor which motivated us to prepare the prototype of smart trash can.Further improvements and implementation of the same can bring about revolutionary changes in waste management.

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