

# An Approach to Automatic Smart Dustbin

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**Abstract--** This proposed work is based on the idealization of the world with a safe, hygienic and green environment. This paper presents a cost-abating Automatic Smart Dustbin for small scale purpose like in Shopping Malls, Hospitals, Offices and in household. Due to the current pandemic situation it has become a necessity to keep cleanliness around. It gives an insight to a smart dustbin system based on Arduino and Ultrasonic sensor which monitors the fullness of the dustbin and sends signals using LEDs. It also includes a Servo motor with Ultrasonic Sensor which administers the cap of the dustbin. This is powered using lithium battery and bonnet is controlled by Servo motor. Lastly, the system is developed at an affordable and acceptable cost for the intended application and the performance was found satisfactory.

**Keywords :** Smart Dustbin, Arduino, Ultrasonic Sensor, Microcontroller

## I. Introduction

In our quotidian life, we usually behold a sight of waste inundated and encompassing the dustbins. This inappropriate waste dissipation can validate significant cause for genesis of various viruses and bacterias which also puts human life in jeopardy. The area around an improperly maintained dust bins can house disease spreading insects like mosquitoes, flies, bees and driver ants[1]. Additional care must be taken in a densely populated area where the waste deposits in the bins are sufficiently high [2][3]. The system is designed to decrease the improper use of valued human resources like human effort, time and cost and the need for smart waste collection and monitoring system[4]. The smart dustbin is an incipient conception of implementation which makes a mundane dustbin keenly intellectual utilizing ultrasonic sensors for garbage level detection[5].

Today in these times when Covid-19 Virus has expanded enormously and reached every corner of the globe with one of the preeminent reason that is physical contacts with the surfaces. This treacherous infection is tainting human lives and in worst cases causes death. Automatic Smart Dustbin substantiates imperceptible physical contact and may turn into very competent in places like Hospitals, Shopping Malls etc. The cost of applying such solutions is still relatively high [7].

This clause is followed by - Section 2 introduces blunt survey towards previous developments in smart garbage systems. Section 3 discusses the details about the model. Section 4 lists the hardware used in the proposed system. Model is presented in Section 5 and the observation result and conclusion is summarized in section 6. Section 7 is intended towards scope of future work regarding the work.

## II. Literature Review

In this section we have penned the development taken place with respect to Smart Dustbin. The most recent work is concluded by Dhawal Lad and his team on sensor and GSM based dustbin which includes Google Maps API. It sends a notification to the Local Municipality Office about the level and location of the dustbin[5].

Another work for instance is proposed by Kannapiran Selvaraj and his colleague which includes LAN server based Smart Dustbin.

Furthermore, Fady E. F. Samann developed a Smart Trash Bin which generates a sound when garbage reaches a certain level and it includes a Solar Panel which is connected to a battery that supplies power continuously to the system[6]. Shilan Abdullah Hassan and his colleagues proposed a project which sends a SMS to the Truck Driver to pick the waste[4].

Another related proposed project on wireless networks is done by T. Singh, Mahajan and Bagai. The bins are rigged with an accelerometer sensor which opens and closes the lid, measures humidity and temperature to analyse the organic waste present and fullness is observed by ultrasonic sensor[8]. Ruhi Mary Saji presented a smart garbage management system which uses IR sensors and Web Pages[9]. Moreover an IoT based intelligent bin for smart cities using IR sensor, GSM, and Internet is developed [10].

## III. Methodology

This clause delineates the basic operations and design of the project, block chart representation, then reveals the hardware used and later on describes the flowchart and circuit diagram.

Fig 1 explains the working of the Arduino based system that keeps track of the level of the garbage present inside the container and gives an alert using an LED attached at front.



Fig 1 Animated image of Dustbin with LED

. Fig 2 portrays the block diagram of the monitoring system. The fullness status of the bin is determined by calculating the distance between the lid of the bin and the trash by using a sensor.[6]. When garbage level reaches threshold, the ultrasonic sensor placed within transmits a signal to the Arduino microcontroller which in turn illuminates the LED.

Fig 3 describes another component of the project that automates the container and avoids human involvement. Whenever someone approaches the dustbin it automatically opens up.



Fig 2 Opening of lid as someone approaches

An Ultrasonic sensor placed in front senses the distance between individual and the bin and passes it to Arduino Controller which interprets the distance and dispatches a flag to Servo Motor which consequently opens the bin.

Fig 4 shows the flowchart of the working of the system for fullness of garbage level.

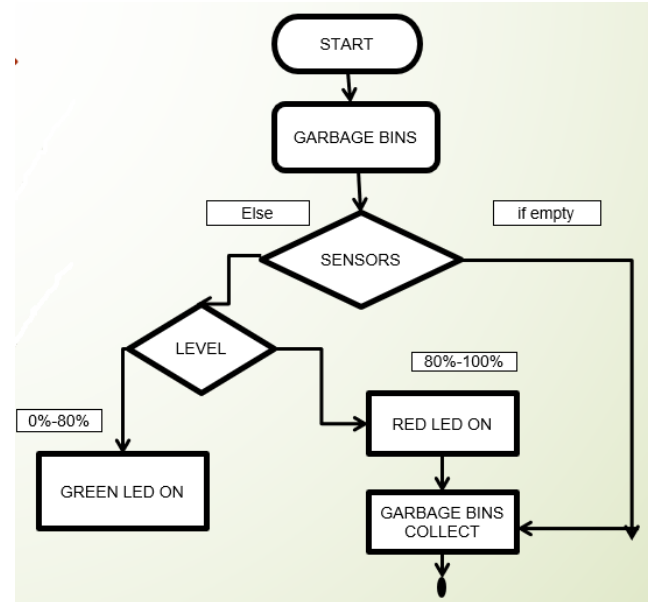


Fig 4 Flowchart for Monitoring System

Fig 5 exhibits a circuit diagram for the Automatic Lid Opener system and each hardware connects each other. Jump Wires are used to connect components with each other. Here, output of Trigger and Echo pins of sensor is linked with pin 5 and pin 6 of Arduino controller respectively. Servo motor is connected with pin 11 of Arduino.

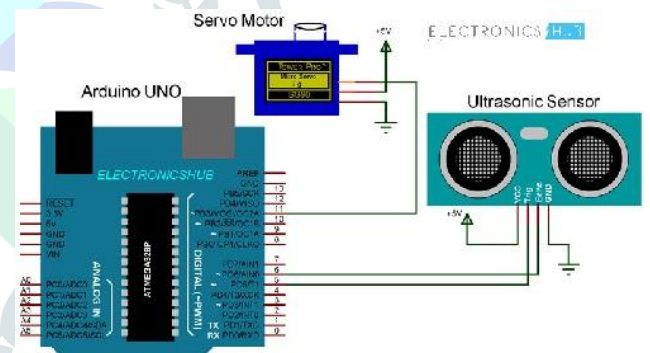


Fig 5 Circuit Diagram for Automatic Lid

Software used for programming for the controller is Arduino(version).Programming is accomplished using USB-Serial cable.

#### IV. Hardware Implementation

The hardware realization of the proposed Smart Dustbin using Arduino Controller and Ultrasonic server is detailed below[1].

##### A. Arduino Controller

An Arduino is an open source microcontroller board which is shown in Fig. 6 [1]. Various Arduino boards available in the marketplace are Uno, Mega, Nano, Yum, Pro, Mini, etc. We have used an Arduino Uno board which is based on ATmega328 microcontroller which consist of 6 analog inputs, 14 digital input/output pins, a 16 Mhz ceramic resonator, a USB Connection, a power-jack, an ICSP

header and a reset button. Potential operation is between 5-10 Volts and draws small amount of current.

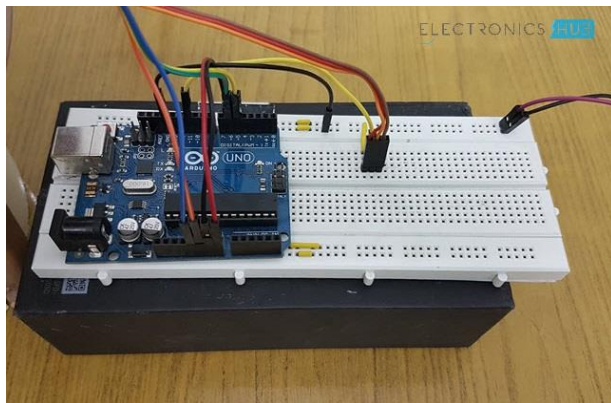


Fig 6 Arduino Uno Connected with Bread Board

### B. Bread Board

A Solderless full breadboard is used in the system to connect different components like Arduino, Sensor and

Wires easily. It is a solderless device used for temporary prototyping of electric circuits.

### C. Ultrasonic Sensor

Ultrasonic Sensor HC-SR04 is used in this system that measures the garbage level and distance between individuals and the dustbin using radio waves. It has a measuring range of 2cm-400cm with 3mm accuracy. 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[5]. It measures the level calculating the distance which is expressed in equation 1 taking velocity of sound as 343m/s.

$$\text{distance} = (\text{time} \times \text{speed of sound}) / 2$$

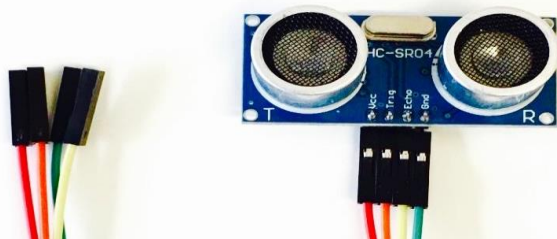


Fig 7 Ultrasonic sensor with Male-Male joint wires

### D. Servo Motor

SG90 Mini Servo Motor-180 degree rotation is applied to control the motion of dustbin lid which gets open when an individual approaches to a width as close as the ultrasonic sensor senses it. It has a feedback system which compares the output signal and reference input signals and controls the shaft. Motor is connected to 9W Lithium Battery for continuous power supply.



Fig 8 SG90 Mini Servo Motor with different shafts

## V. Implemented Model

Fig 9 shows the actual model of the project.



Fig 9 Real developed and implemented model

## VI. Conclusion

This smart dustbin initially tested successfully indoors with a 9W lithium battery which gave backup upto 5-6 hours. Later, it was placed at a shop during lockdown period with a power bank of 4500mAh which lasted for 10-12 hours. During the current scenario of Covid-19 pandemic it assured a safe option for intact disposal. A compelling advantage that it can be used in Hospitals, Railway Stations, Shopping Malls, etc where direct contact with bins is possible. This concept averts deluging flow of waste and evades even a little contact with dustbins. This developed system is reliable but is high maintenance with respect to power supply.

## VII. Future Work

In future this approach can be elongated to observing individuals and differentiating between animals and humans.

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