



# IJRASET

International Journal For Research in  
Applied Science and Engineering Technology



---

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume: 9      Issue: VIII      Month of publication: August 2021**

**DOI: <https://doi.org/10.22214/ijraset.2021.37675>**

**[www.ijraset.com](http://www.ijraset.com)**

**Call:  08813907089**

**E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)**

# Smart Dustbin Utility System using IoT

Kaushiki Bhattacharya<sup>1</sup>, Mrinmay Hazra<sup>2</sup>, Debarghya Dutta<sup>3</sup>, Kaushik Roy<sup>4</sup>, Faiz Islam<sup>5</sup>, Surajit Basak<sup>6</sup>

<sup>1, 2, 3, 4, 5, 6</sup>Department of ECE, Guru Nanak Institute of Technology, Panihati, Kolkata-700114

**Abstract:** Several studies and reports of a smart dustbin are out there to reduce human efficiency and to make the city clean. Here, we will be using the idea of a smart dustbin using IoT and different sensors and work on it to make it even more effective. Each dustbin shall have the data of the distance and the filled percentage of all other dustbins, aligned to it, in its memory. When it'll be filled up to 75% or 90%, which we'll know by the Ultrasonic Sensor, it'll send a signal to the municipality about its content. When the dustbin shall be 100% filled, it'll send a signal to the municipality to empty it. The now brimmed dustbin shall display a message on the attached LCD of the nearest dustbin which is not full, along with the distance and the direction in which it resides. The dustbin calculates the closest distance from the data saved in the memory and at the same time checks if the other dustbins are filled completely or not. If both the conditions match, it displays the number and direction of that dustbin. This implementation is introduced so that people don't dump their trash in front of the filled dustbin, rather find a nearby one. This framework helps to make the city clean in an effective way.

**Keywords:** Ultrasonic Sensor; NodeMCU; Blynk; PHP; MySQL; IoT

## I. INTRODUCTION

Dustbins are the household necessity that is used to store the waste and garbage before disposing them off. Be it a residential place, industrial or commercial, dustbins are of utmost importance. The municipality or the responsible ones have to come and check the dustbins manually which is hectic for them, and even sometimes the dustbins gets filled but it remains just like that and are not emptied at regular intervals of time and may produce foul smells which is very unhygienic and even blocks the path and creates chaos [1]. Hence, the dustbins we use to prevent pollution and keep our society clean may sometime itself become the reason of polluting it. Due to lack of enough dustbins around and knowledge of whereabouts of nearby dustbins, one is forced to either throw the waste near the filled dustbin or try to force it into the same dustbin which is not at all healthy [2]. At some places the dustbins fill faster than other places due to the population of the respective localities. These dustbins also must be emptied at more regular intervals [3]. If we get information when the dustbins are going to fill then we might save a lot of labour and synchronously also keep the locality cleaner [4]. Now imagine a dustbin which is smart enough to indicate how much it is full at the very moment when you're just going to use it. Be it the filled percentage or the capacity, the dustbin will be smart enough to show it to the person standing in front of it. For this concern, we decided of making a smart dustbin system using Internet of Things concept which will assist the concerned ones in monitoring the dustbins at every instance from any desired location. Also, when someone approaches to put waste in a dustbin but the dustbin is already filled, it will direct him to another nearest dustbin which is still left to be filled. This will stop people from dumping wastes over filled dustbins and shall also create a healthy habitat gradually [5].

## II. SYSTEM MODEL

### A. Hardware design

This paper on Smart Dustbin Utility System using IoT proposes an IOT based dustbin management system which regularly checks the garbage level, calculates the filled percentage and if filled totally, directs the person in front to move towards the nearest dustbin which is not filled. The design and details have been explained with the help of a block diagram as shown below:



Fig.1: Block Diagram of the project

Here, we have proposed a system using the Ultrasonic Sensor only. The microcontroller board in use is Node MCU for the application of Internet of Things. It has an in- built capability of connecting with WIFI. We have devised a system which will print the filled percentage of the dustbin on the LCD attached to it [6]. The ultrasonic sensor detects the distance of the last garbage dumped. The filled percentage would be calculated by the formula mentioned below.

NodeMCU is a low-cost open source IoT platform. It is based on the eLua project and built on the Espressif Non- OS SDK for ESP8266. It uses many open-source projects, such as lua-cjson and SPIFFS. It can be programmed through USB port using Arduino IDE. It is a tool that is employed for Wi-Fi networking.

The specifications on a NodeMCU board are as follows: Microcontroller: ESP8266.

- 1) Operating voltage: 3to 3.3v
- 2) Input voltage: 4.5v to 10v
- 3) Digital I/O pins: 11
- 4) Analog input pins: 1
- 5) Flash memory: It has 128KB RAM and 4MB of Flash memory to store data and programs.
- 6) Frequency: 80MHZ

$$\text{Filled (\%)} = [(T-S)/T] \times 100$$

where, T represents the total capacity of the dustbin, which shall be stored in the database manually, S represents the last output of the sensor, which actually represents how much empty the dustbin is, so to calculate the filled amount we are incorporating the (T-S) factor, which tells us how much filled the dustbin is at that moment. This percentage shall be then sent back to the Node MCU and therefore, printed over the LCD screen. The Node MCU uses the Xampp server to connect to PHP for calculation of the nearest dustbin which is not filled, if the current dustbin is completely full. The PHP file first checks for a dustbin which is yet to be filled, then looks for the distance between the dustbins. The direction of the nearest dustbin is calculated by the process, if the ID number of the dustbin is less than the nearest one then it prints Left on the LCD screen, and if the ID number of the dustbin is more than the nearest one then it prints Right on the LCD screen [7]. Then finally it prints this data along with the filled percentage on the LCD screen.

### B. Hardware used

The project can be made by using minimum three model dustbins that has NodeMCU, Ultrasonic sensor and LCD for each

- 1) *Power Supply:* This is the primary requirement for the work. For our project we are using a DC 5V/1.5 A power bank. This supply can be used for the NodeMCU and also the ultrasonic sensor.

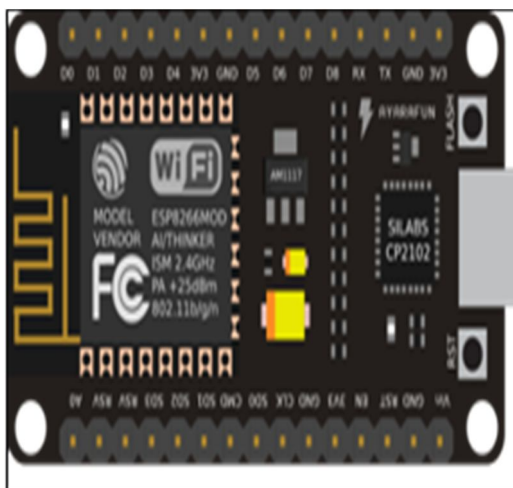


Fig.2: NodeMCU Board

- 2) *Ultrasonic Sensor:* An Ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e., the sound that humans can hear).

The sensor is small, easy to use in any robotics project and offers excellent non-contact range detection between 2 cm to 400 cm (that's about an inch to 13 feet) with an accuracy of 3mm.

- a) Operating voltage: 5 volts
- b) Input voltage:
- c) Digital pins: There are 2 digital pins Trig (signal output pin), Echo (signal input pin)
- d) Frequency: 25 to 50 kHz

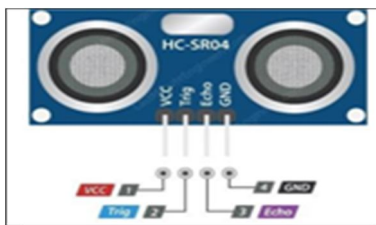


Fig.3: Ultrasonic Sensor HC-SR0

3) *LCD*: An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16x2 LCD display is a very basic module commonly used in DIYs and circuits. The 16x2 translates a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5x7-pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

- a) Operating voltage: 3.0v
- b) Operating temperatures: -20°C to +70°C
- c) Storage temperatures: -30°C to +80°C
- d) Digital pins: 8

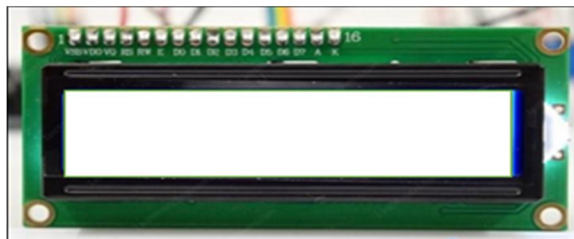


Fig.4: LCD Display

*C. Software used*

- 1) *Xampp*: It is a cross-platform for the local server Apache, the local database MySQL, and other software like PHP and Perl. It is used to dynamically store the Ultrasonic sensor data and analyses which bin would be nearest, at the same time not filled. It provides us with a database using phpMyAdmin, where we can store the data of different dustbins into different tables simultaneously. Also, we can store the distance between every two dustbins in a different table to access it whenever in need.
- 2) *Blynk*: It is an android application that allows the user to build a mobile output interface for monitoring hardware projects. Here, we have improvised the usage of Blynk to display the filled percentage of every dustbin to the nearest municipality or concerned one, so that they can monitor it time-to-time and always be alert when to empty one filled dustbin.

**III. PERFORMANCE AND ADVANTAGES**

*A. Operation*

This Smart Dustbin Utility System using IoT implements an IOT based dustbin management system which regularly checks the garbage level, calculates the filled percentage and if filled totally, directs the person in front to move towards the nearest dustbin which is not filled. Once the system detects the bin is completely filled, it also quickly sends alerts in intervals of time to empty it. Each dustbin is identified by a unique Id, so that the municipality or concerned one can detect the location of the dustbin without the use of GPS. The alert message would be delivered by Blynk Application. This system uses phpMyAdmin database, which is provided by Xampp, to dynamically store the data collected by the ultrasonic sensor for each respective dustbin [8]. The Node MCU would be connected with the local server using WIFI to calculate the filled percentage.

The process takes place using PHP, which all at once fetches data from the database and calculates the filled percentage. It also checks the nearest dustbin which is not filled, if the respective bin is already filled. This whole process takes place at the back end of the server. On the LCD screen, it displays the filled percentage of the dustbin, and if necessary, the direction in which the nearest dustbin is present.

#### B. Advantages

- 1) This project is very cost effective and even if it would be commercialized, it can be made in a budget friendly way as we are using very simple low-cost modules and sensors.
- 2) Manual checking of the dustbins can be reduced as the concerning authority will get notified through the Blynk application.
- 3) Air pollution can be controlled as we can optimize the foul smell as the dustbins shall be getting cleaned time to time.
- 4) The free internet facility provided in the metropolitan cities can be used for providing internet to the NodeMCU effectively.
- 5) The person approaching towards a filled dustbin will not be dumping over and scatter the garbage over the road. Rather he will be directed to the nearest dustbin.
- 6) This will inculcate a healthy hygienic practice to dump garbage properly and keep surroundings clean.

#### IV. CONCLUSION

The main objective of this project was to monitor every dustbin of our locality and maintain a healthy environment with the help of a smart interface. We also expect to create a healthy practice of dumping garbage into suitable dustbins and not throwing away it incautiously. The exact location as well as the dynamic distance between the dustbins at every instance can also be integrated by using a GSM Module. If the project gets commercialized the power supply can be changed to AC by using a rectifier in place of a DC Power Bank.

#### REFERENCES

- [1] Shyamala S, Sindhe K, Muddy V, Chitra C. "Smart waste management system". International Journal of Scientific Development and Research Vol. 1(9), pp.223-230, 2016.
- [2] M. Dhananjaya, Priyanka. K. E, Nidhi. R, Pooja. K., "Smart Garbage Monitoring System Using Node MCU". Int. Conf. on Signal, Image Processing Communication & Automation, ICSIPC, 2017.
- [3] N. M. Yusof, Mohd F. Zulkifli, Nor Y. A. Mohd Yusof, A. A. Azman, "Smart Waste Bin with Real-Time Monitoring System". International Journal of Engineering & Technology, 7, pp.725-729, 2018.
- [4] R.M. Saji, D. Gopakumar, H. Kumar, K.N. Mohammed Sayed, Lakshmi. "A Survey on Smart Garbage Management in Cities using IoT". International Journal Of Engineering And Computer Science, Vol. 5(11), 18749-18754, 2016.
- [5] S. Dhana S. Kanta, M. Narayanan. "Smart Garbage Monitoring System Using Sensors With Rfid Over Internet Of Things". Journal of Advanced Research in Dynamical and Control Systems, Vol. 9. Sp-6, 2017.
- [6] B. Tavli and W. Heinzelman, "Mobile Ad Hoc Networks, Energy-Efficient Real-Time Data Communications," 2011.
- [7] P.S. Dutta, S. Basak, K. Roy, "Cross-Layer Routing for Outage Minimization in Multihop Ad-Hoc Networks," IJRASET, Vol. 9(7), pp. 3130- 3134, 2021.
- [8] S. Joshi, U.K. Singh, S. Yadav, "Smart Dustbin using GPS Tracking," IRJET, Vol. 6(6), pp.165- 170, 2019.



10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)