

# SMART GARBAGE MONITORING SYSTEM

Vishwas Dhanwani, Dhruval Ghandhi, Dishank Jani, Nehal Patel

Department of Information Technology, CSPIT  
CHARUSAT, Changa

**Abstract**— The idea of smart city is to have well developed things which make peoples work easier and are more efficient. Using IOT, we can make day to day objects smarter and our work simpler. The **Swachh Bharat Abhiyan** project, introduced by Government of India, aims for clean and hygienic environment for all living beings. As cities are getting developed financially, socially, etc., there has to be a better way of dumping waste in landfills. Smart Garbage Monitoring system helps the Department of Cleaning. In this paper, we proposed a system which checks the status of a dustbin and sends the data to concerned in-charge. By using this system, people don't need to check manually they will get notified. And garbage collecting truck also does not need to move all over city which saves a lot fuel. This system helps in creating a better way of collecting garbage and maintain clean environment.

**Keywords**- ESP8266, Blynk, Firebase, ThinkSpeak, IOT

In this system, We have chosen an Ultrasonic sensor which is used to measure distance of sensor from the element, thus this sensor would be connected on the top of the bin, and as the waste will be added the reading in the app decreases which indicates the amount of waste is increasing. When the bin will become full, a notification will be sent to the Municipal office using a mobile (Blynk app) or Web application. We have also used Location in our system. The message will be sent from dustbin to the authorized member using a WiFi-module (ESP 8266 or NodeMcu), thus the employees can get the status of the bin in certain area without actually being there, once the bin will be full then the employees can take further actions to empty the bin. This system will help in cleaning the city in a better way.

Apart from this an alternative website is also created to get data about user's dustbin which can also track the live status of the waste inside the bin with the ThinkSpeak plugins.

## I. INTRODUCTION

Today there many steps are taken for improving cleanliness in the country .Government are trying their best for Smart city project. We have also tried to support by building an IOT based **Smart Garbage Monitoring System** which will notify the Municipal members to empty the bin on time as it will get full. We will implement this system using the technology Internet of things (IOT). IOT can be linked to different devices using internet and try to convert old urban system into the smart city system by optimizing with modern techniques and different sensors.

## II. MOTIVATION OF THE STUDY

India generates 62 million tons of waste every year, of which less than 60% is collected and around 15% processed. With landfills ranking India is in 3<sup>rd</sup> in terms of greenhouse gas emission. As with growing population and industrial growth more and more waste is produced.

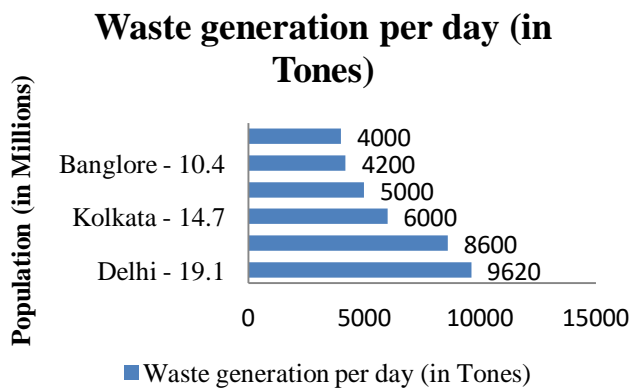
| Year    | Source   | Annual Generation (million tonnes) |
|---------|--|------------------------------------|
| 2017    | Our estimate 1<br>based on 450 gm per capita daily generation and urban population of 440 million* | 72                                 |
| 2017    | Our estimate 2<br>based on 400 gm per capita daily generation and urban population of 440 million* | 64                                 |
| 2014-15 | Central Pollution Control Board  | 52                                 |
| 2014-15 | Ministry of Urban Development  | 52                                 |
| 2013-14 | Task Force on Waste to Energy, Planning Commission   | 62                                 |

\*based on United Nations population estimate

**Fig.1 Annual waste generation [11]**

With so much amount of waste produced, there is a need of system where it is collected, when required. The collection should be done effectively, before it is overflowed and becomes home of many diseases. In this paper, we have tried to create a system which helps in proper collection of waste by concerned person (driver/garbage collector). The concerned person collects the waste only when it is about to full.

This system should be placed in cities like Delhi, Mumbai, etc., such cities with huge population generate a waste in huge tons. The below survey was done by State pollution Control Boards in year 2016. By which we can predict that current situation is worse and it needs to handle effectively with new technologies (like IOT).



**Fig.2 Major Waste Generating cities in India [12]**

| Sr. No. | Title of Papers  | Year | Sensor Used   | Technology Used  |
|---------|--|------|---|--|
| 1       | Promoting a Clean and Hygienic Environment [1]   | 2020 | Ultrasonic Sensor, Servo motor, Gas Sensor                                      | IOT, smart dustbins, Alert   |
| 2       | IOT based Smart Garbage Monitoring System using ZIGBEE [2]                               | 2019 | Ultrasonic Sensor   | Arduino mini, NodeMCU, Firebase, ZIGBEE                                  |
| 3       | Garbage Monitoring System using Internet of Things[3]                                    | 2019 | Ultrasonic Sensor   | NodeMCU, Geolocation API, IOT, IFTTT                                     |
| 4       | Automated Garbage Monitoring System using Arduino[4]                                     | 2018 | Ultrasonic Sensor, PIR Sensor   | IOT, GSM, Web, Buzzer, led   |
| 5       | Garbage Monitoring using IOT [5]   | 2017 | Ultrasonic Sensor   | Blynk, Arduino, ESP8266, Wi-Fi   |
| 6       | Smart Garbage Monitoring System Using Internet of Things[6]                              | 2017 | Ultrasonic Sensor   | Microcontroller, Wi-Fi modem, IoT, GSM,                                  |
| 7       | Smart garbage monitoring and clearance system using internet of things[7]                | 2017 | Ultrasonic Sensor, Force sensor   | Embedded, IoT, GSM, Microcontroller, Web server                          |
| 8       | Smart city technology based architecture for refuse disposal management [8]              | 2016 | Proximity, light, odor, force sensitive sensor                                  | Embedded, Arduino UNO microcontroller board, breadboard, GSM/GPRS, Wi-Fi |
| 9       | Smart Dustbin- An Efficient Garbage Monitoring System[9]                                 | 2016 | Ultrasonic sensor HC-SR04   | GSM, Arduino Uno   |
| 10      | Real time solid waste bin monitoring system framework using wireless sensor network [10] | 2014 | Accelerometer, hall effect, ultrasound, temperature, humidity, load cell sensor | ZigBee-PRO, GPRS, central server database                                |

**Table 1: Previous Research Papers**

### III. MATERIALS & TECHNOLOGY USED

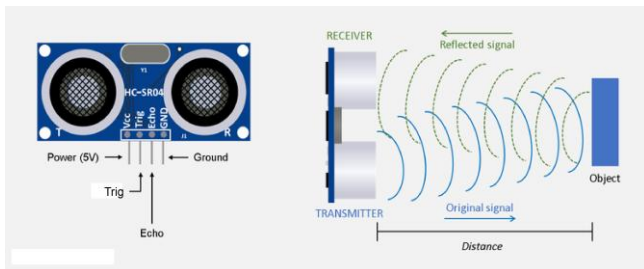
#### 1. ESP8266



**Fig.3 NODEMCU(ESP8266)**

ESP8266 is a very cheap microcontroller having its own WiFi Modulator. It runs on 3.3V power supply and if 5V is given then it may get damaged. It has 17 GPIO pins for input or output signals. It has ESP-12E chip which has 128kB internal RAM and 4MB external flash memory (for program and data storage), with this we can send web pages, JSON/XML data to the provided path.

#### 2. Ultrasonic Sensor



**Fig.4 Ultrasonic Sensor**

It senses how far is object present. It can also detect transparent objects. It can measure in range of 3cm to 3m.

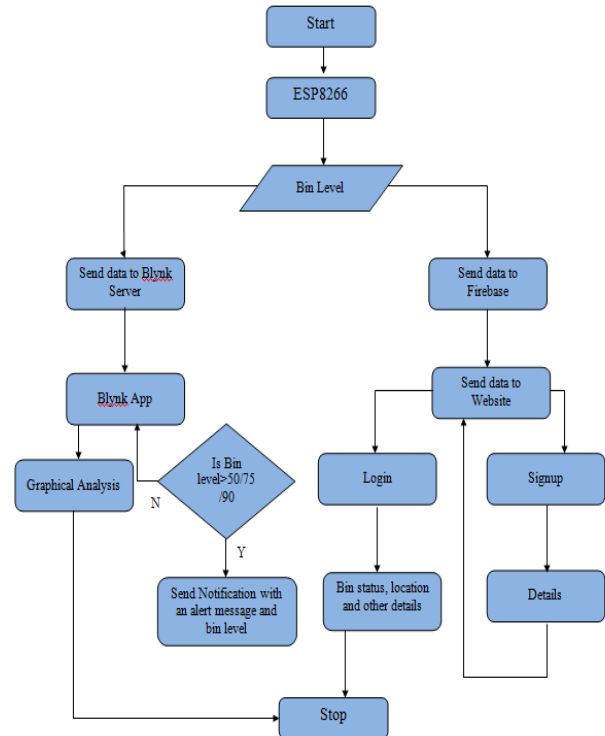
It emits ultrasonic waves and receive the reflect wave back from the object. It measures the distance using difference of time of emission & reception.

$$\text{Distance} = (0.5) * T * C$$

where T = Time between emission and reception,

C= ultrasonic wave speed

### IV. PROPOSED SYSTEM



**Fig.5 System Architecture**

The ESP8266 is connected with ultrasonic sensor and power supply. ESP8266 must have an internet connection and these details are in code .Ultrasonic sensor calculates distance. Then ESP8266 send this data to Blynk server and firebase.



**Fig.6 Circuit attached with dustbin**

The waste object level, present in dustbin, is measured using ultrasonic sensor and sends over to ThinkSpeak.

To view this data, we have created a website (for admins only). Website is using ThinkSpeak plugins. The bins data is stored on ThinkSpeaks server and using graph widget we can display it.

This data must be viewed by only authorized person. The authorized person can use the website and login using its unique id. If the account doesn't created then user can sign up using their employee id and fill up their details. After verification, it logs in. Now, all dustbin data (bin-level, location) is available and user can monitor it.

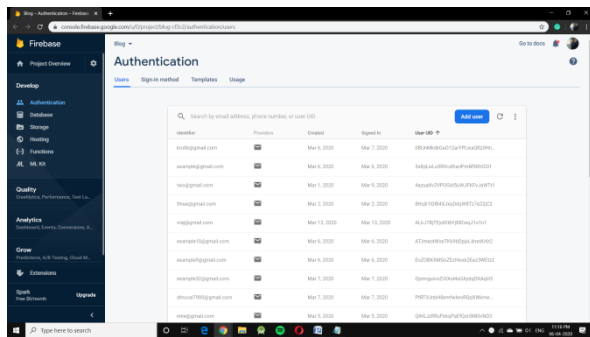


Fig.7 Authorized users allowed to access Firebase

The data is also send over Blynk server. So, that the responsible driver gets the information too. Using Blynk app, we can see how much dustbin is full? In app, we can see graphical view of dustbin level and also previous data is available. When the bin is more than 50% full, the user (driver) gets the notification.



Fig.8 Blynk App

The data is also stored on ThinkSpeak and admin can clearly analyze it using the website.

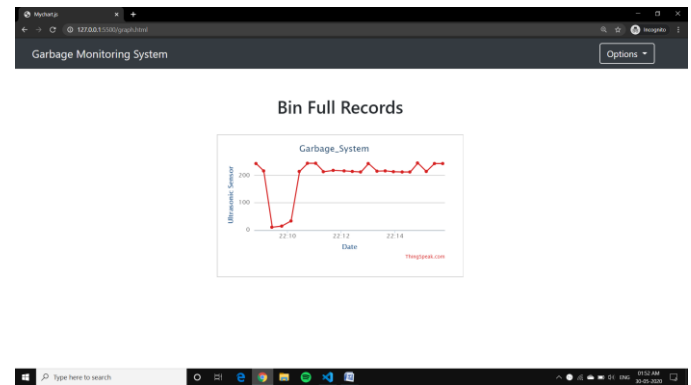


Fig.9 Graph

## V. RESULTS AND DISCUSSIONS

The dustbin was placed and garbage was put at different time. The current status of bin was transmitted and was viewed on Blynk app. As more and more garbage was put the graph was increasing. Also led display is placed to view the message and another display bar which shows bin-level.

| S.NO. | CONDITION      | MESSAGE                                | NOTIFIED PERSON |
|-------|----------------|--|-----------------|
| 1.    | Bin-level <50% | Bin is empty                           |                 |
| 2.    | Bin-level =50% | Bin is Half Full                       | Driver, Admin   |
| 3.    | Bin-level>75%  | Bin is almost full<br>Empty it today!! | Driver, Admin   |
| 4.    | Bin-level>90%  | Bin is full<br>Collect Now!!           | Driver, Admin   |

Table 2: Bin response in different conditions

## VI. CONCLUSION AND FUTURE ENHANCEMENT

The main objective of this system is to maintain the cleanliness and have an environment which is better for living. Using this system we can check status of garbage bin at any time. If the bin is almost full the responsible persons are notified and actions are taken according to it. Also as we know the status of garbage bin, the garbage truck doesn't need to move all over the city which ultimately saves the fuel.

In future, we can develop this system for a whole organization (or even a city), where every area has its own admin and that admin can view all garbage bins status (of its area only). We can also include checking the smell of the garbage (is it gone bad or not?).

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