

# IOT Based Smart Trash Bin

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## ABSTRACT

In the present day scenario, due to increase of waste every day the dustbins or trash cans that are placed at public areas overflow, creating unhygienic situation for the residents and also creating foul smell around its surroundings leading to harmful diseases and other sickness. To control such situation of overflowing garbage, the system implemented a design of an IOT Smart Trash Can. In this system, the trash cans are placed around the city or a locality, where each trash can is built with a low cost embedded device that can check the level of the waste in the bins. Provided, these trash can also have different ID that enables the garbage collector to identify the location of the trash can which is full. Once the garbage level crosses its threshold limit, the status of the trash can is sent to the municipal authority. He/she then alerts the corresponding garbage collector through an SMS specifying the location of the dustbin. When the trash bin is filled with garbage it is automatically closed. The administrator can also manage the streetlight. Here admin can monitor the current status of streetlights, the light automatically work based on the climate. Admin can find the complaint on streetlight and inform to the municipality. Public can post complaints when the filled trash bins are not cleaned or when the streetlight is not working. Peoples can check the status of the complaint.

**Keywords:** Arduino Mega, Wi-Fi, Ultrasonic Sensor, Internet of things (IoT), Waste Management.

## I. INTRODUCTION

One of the major problems in developing countries is overflowing garbage bins. This is mainly due to the increase in population and improper waste management system. Untreated waste on open areas will lead to various diseases as insects breed on it. The generation and disposal of waste in large quantities has created a greater concern over time for the world which is adversely affecting the human lives and environmental conditions. [1]. Wastes are the one which grows with the growth of the country. People blame the municipal authorities for not taking proper action or their lack of interest in waste removal, but even after the removal of waste from an area, the next day it will still be a garbage dumping yard. The problem is that there is no proper systematic waste management. Uncollected garbage-pileup and stinking waste across both sides of national highways of various states in India is a normal scene today because of increase in population, lack of awareness and limited funding on waste management programs. Piling up of garbage leads to groundwater

contamination and facilitate breeding of flies, mosquitos, cockroaches, rats, and other pests. Possibility of frequent outbreaks of communicable diseases such as malaria, dengue fever, chickungunia etc. is enhanced. Also have negative impact on tourism industry. Generally, municipalities [5] pick up the trash on designated days on each and every trash cans of the locality whether or not the bins are full in order to keep the city clean. Thus wasting his time and number of trips he has to take for the garbage removal of all the dustbins. Since people have only limited time and attention, they are not very accurate when it is about capturing data about things in the real world. If computers were able to gather all these information without any human intervention, it would be easy to track everything and also reduce waste and cost. Internet has become an important part of today's lifestyle due to the tremendous demand and necessity leading to the beginning of Internet of Things (IOT). Internet of things is where the surrounding objects can be connected through a wired or wireless network without any human intervention. Few examples of an IOT based objects

are connected security system, electronic appliances, cars, alarm clocks, vending machines or any other objects that can be assigned with an IP address and also has the ability to send data over a network. Currently there is no system of segregation of dry, wet and metallic wastes at an industry. J.S. Bajaj [4] has suggested that a least cost, most appropriate technological option for safe management should be developed. The system prevents overflowing of garbage in the trash cans by alerting when the garbage level reaches its maximum. This reduces the time and effort of the garbage collectors and also the number of trips taken by the garbage collection vehicles. Therefore, Smart Trash Can makes waste management more efficient.

## II. BACKGROUND

### A. COMPONENTS

#### 1) Liquid Crystal Display (LCD)

Most common LCDs connected to the microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively. The standard is referred to as HD44780U, which refers to the controller chip which receives data from an external source (and communicates directly with the LCD).



*Fig 1: LCD*

#### 2) Ultrasonic Sensor

Ultrasonic sensors (also known as transceivers) work on a principle of a target by interpreting the echoes from radio or sound waves respectively. [2] Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor.



*Fig 2: Ultrasonic Sensor*

#### 3) WI-FI Module

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware. The ESP8266 module is an extremely cost effective board.



*Fig 3: Wi-fi Module*

#### 4) Arduino Mega board

The **Arduino Mega 2560** is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.[3] It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



*Fig 4: Arduino Mega*

## B. SOFTWARE TECHNOLOGY REVIEW

### 1) PHP

The PHP Hypertext Preprocessor (PHP) is a programming language that allows web developers to create dynamic content that interacts with databases. It is faster than other scripting language e.g. asp and jsp. It is integrated with a number of popular databases, including MySQL, PostgreSQL, Oracle, Sybase, Informix, and Microsoft SQL Server. The PHP code is enclosed in special start and end processing instructions `<?php` and `?>` that allows to jump into and out of "PHP mode". PHP performs system functions, i.e. from files on a system it can create, open, read, write, and close them.

### 2) Arduino Software

A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde. A minimal Arduino C/C++ sketch, as seen by the Arduino IDE programmer,[3] consists of only two functions: one is setup: this function is called once when a sketch starts after power up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch. Second is loop: after setup has been called, function loop is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

### 3) JavaScript

JavaScript is a scripting language. A scripting language is easy and fast to learn. A scripting language is interpreted in run-time. It is not compiled like other languages as C++, C sharp, VB.net etc. JavaScript is a client side language and it runs on a client browser. JavaScript can be used on all most known browsers. JavaScript code can be inserted directly in the HTML or you can place it in a separate file with the .js extension and link the webpage with the .js file.

### 4) AJAX

AJAX is a web development technique for creating interactive web applications. AJAX stands for Asynchronous JavaScript and XML. AJAX is a new technique for creating better, faster, and more interactive web applications with the help of XML, HTML, CSS, and JavaScript. Ajax uses XHTML for content, CSS for presentation, along with Document Object Model and JavaScript for dynamic content display.

### 5) jQuery

jQuery is a fast and concise JavaScript library created by John Resig in 2006. jQuery simplifies HTML document traversing, event handling, animating, and Ajax interactions for Rapid Web Development. jQuery is a JavaScript toolkit designed to simplify various tasks by writing less code.

### 6) HTML

HTML 4.01 was a major version of HTML and it was published in late 1999. Though HTML 4.01 version is widely used but currently we are having HTML5 version which is an extension to HTML 4.01, and this version was published in 2012. Originally, HTML was developed with the intent of defining the structure of documents like headings, paragraphs, lists, and so forth to facilitate the sharing of scientific information between researchers.

### 7) CSS

CSS is used to control the style of a web document in a simple and easy way. CSS is the acronym for "Cascading Style Sheet". CSS handles the look and feel part of a web page. Bootstrap makes use of certain HTML elements and CSS properties that require the use of the HTML5 doc type. Bootstrap includes a responsive, mobile first uid grid system that appropriately scales up to 12 columns as the device or viewport size increases.

## 8) MySQL

MySQL is the most popular Open Source Relational SQL database management system. A database is a separate application that stores a collection of data. Each database has one or more distinct APIs for creating, accessing, managing, searching and replicating the data it holds. The MySQL database is owned, developed and supported by Sun Microsystems, one of the world's largest contributors to open source software.

### III. PROPOSED SYSTEM

IOT Based Smart Trash consists of sensors, microcontroller and SMS module. The sensors detect the garbage level if the level reaches its average or maximum. The status of the trash can is then sending to the municipal authority. The municipal authority being the server can view all the trash cans that are controlled by this system. Municipal authority can also add new trash cans and view the status of all the trash cans. When the trash can is full, a SMS alert can be sent to the corresponding garbage collector. SMS alert will also contain the location of the dustbin that requires waste removal.

#### Module Description

##### a. Admin Module

1. Log in to the system by using his login ID and password
2. Manage the location
3. Add municipality
4. View the current status of the trash bins
5. View complaints and forward them to municipality
6. Add job vacancies
7. After performing all tasks admin can log out from the system

##### b. Municipality Module

1. Log in to the system by using his login ID and password
2. View the status of the trash bin
3. View the complaints post by public

4. After performing all tasks municipality can log out from the system

##### c. Public Module

1. Post the complaints on the official page
2. View job vacancies
3. Post comments

## IV. RESULTS

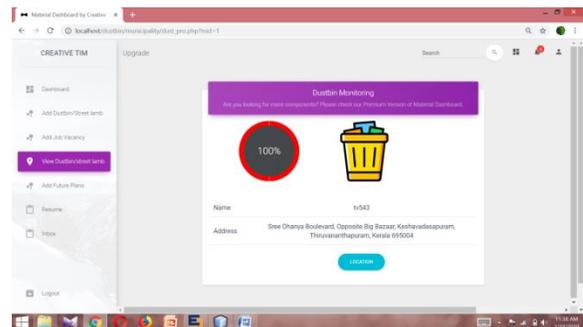


Fig 5: Dustbin status

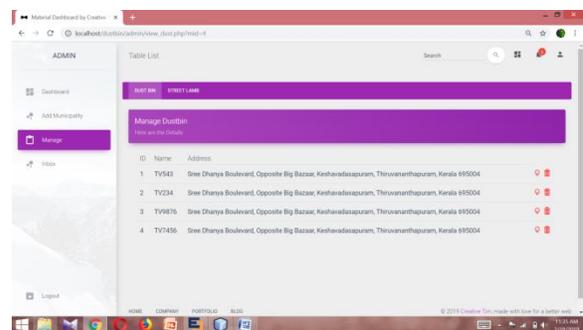


Fig 6: Manage dustbins

Status of dustbin is shown in the above figure i.e., the bin is full. The location of bins is shown in the next figure. The results are 100 percent accuracy.

## V. CONCLUSION

The smart city concept is still new in India. The prime need of a smart life style begins with cleanliness and cleanliness begins with dustbin. A society will get its waste dispatched properly

only if the dustbins are placed well and collected well. The main problem in the current waste management system in most of the Indian cities is the unhealthy status of dustbins. Various features such as durability, affordability, prevention against damage and maintenance issues are addressed when these smart dustbins are designed. This Smart Dustbin can contribute a lot towards clean and hygienic environment in building a smart city. The main advantage is that it control overflowing of trash cans in public areas and various localities, as smart trash cans ensures real time waste management. The time for filling and removing the trash of smart bin will also be minimized thus a clean environment and empty dustbins available to common people. The number of trips required by the garbage collection truck to clean the bin and the amount of fuel consumed by trucks can be minimized and thereby saving fuel and money by optimizing routes. Creating green environment by reducing fuel consumption in turn reduces pollution in the atmosphere. By detecting the waste level in the dustbin and through wireless transmission of information's to the concerned people, this system can prove to be a revolution for the whole urban waste management system of upcoming smart cities.

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