

# IOT Based Garbage Monitoring System For Smart City

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*A B S T R A C T* - We are living in an age where tasks and systems are fusing together with the power of IOT to have a more efficient system of working and to execute jobs quickly! With all the power at our finger tips this is what we have come up with.

In this paper, garbage monitoring system is implemented with IoT. This system monitors all the dustbins located throughout the city and compare it with the garbage bins depth. The ultrasonic sensors are used for detection of the dustbins status. When the level of the dustbin reaches the threshold limit, the device will transmit the level along with the unique ID provided to that dustbin. These details can be accessed by the concern authorities from their place with the help of internet and an immediate action can be made to clean the dustbins.

This is our solution, a method in which waste management is automated. This project IoT Garbage Monitoring system is a very innovative system which will help to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. This web page also send all information to garbage collection vehicles.

*Index Terms* : WI-FI MODEM, NODEMCU/ESP8266-12E WIFI MODULE, GPS, ULTRASONIC SENSOR, THINGER.IO IOT PLATFORM

## I. INTRODUCTION

The foremost aim of technology has been to increase efficiency and decrease effort. With the advent of 'Internet of Things' in the last decade, we have been pushing for ubiquitous computing in all spheres of life.

One of the main concerns with our environment has been solid waste management which in addition to disturbing the balance of the environment also has adverse effects on the health of the society. The detection, monitoring and management of wastes is one of the primary problems of the present era. The traditional way of manually monitoring the wastes in waste bins is a

complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present day technologies in any way.

Nowadays the population is increasing rapidly throughout the entire world, which causes in lack of health awareness in public and results in people investing less money in programs related to the waste management in society. This creates huge issues over people's health all over the world. Proper management of waste materials urban and rural areas is very important to maintain hygienic and healthy living environment to live. The Government of India has been struggling from many years to find a cost efficient and effective way to manage the country's increasing amount of garbage.

Majority of infections are spread because of bacteria and viruses in unhygienic and polluted environment. The technology sources are needed for safeguarding the environment at present. Majority of the environment in the public and residential areas are being polluted with the waste materials in public, residential and industrial areas.

The IoT based garbage monitoring system is a very innovative system which will help to keep the environment and cities clean. This system monitors the garbage bins throughout the city and informs about the level of garbage collected in the garbage bins to a person in the administrative department.

For number of times we have seen that the dustbins are being over flown with the waste materials and the concern person don't have any information about it within the time, due to which unsanitary conditions are formed in the surroundings environment and living area. Bad smell is spread out due to waste in dustbin at the same time. Also the bad look of the city which leads to air and environmental pollution and to some harmful infections and diseases around the locality which is spreadable easily.

The traditional system has some major issues like unhygienic environment and look of the city. One of the most common issues in the over populated and residential urban areas are garbage

bins overflowing on to the streets and footpaths causing environmental pollution and unhygienic living conditions in surroundings. This is mainly due to the routines for cleaning the dustbins by the government municipal corporation, without taking the waste disposal rate of the areas. There are number of unwanted manual checks of garbage bin's level by municipal corporations which is less effective and time consuming. Trucks are sent to empty the dustbins whether they are full or not. And the trucks need fuel which is costly. The bad smell is spread and which may cause illness to living beings in the surroundings.

This paper has tried to overcome the above mentioned problems. Presented section is divided into sections. The introduction of the presented system is described in the first section of paper. This is our IoT Garbage Monitoring system, an innovative way that will help to keep the cities clean and healthy. Follow on to see how you could make an impact to help clean your community, home or even surroundings, taking us a step closer to a better way of living.

## II. PROPOSED SYSTEM

### A. PRESENT SCENARIO

In Our Cities like Mumbai, Navi Mumbai & Thane has a population of close to 1.75 Cr. In which Mumbai produces 9500+ ton of mixed waste daily. Navi Mumbai & Thane produces about 650 tons each of mixed waste. There are total of 6\7 landfills in all three cities and all are totally overflowing. They is no space for new landfills to decompose this waste. As per *World Health Organization (WHO)*, Mumbai is the 5th most polluted megacity of the world. Rivers like Dahisar, Mithi, Oshiwara, Poisar are chocked and converted to Nallahs/Sewages. There were total 18 Coast line (beaches) which are dirty. Municipal Corporation of Greater Mumbai, spend 1400 Crores on Waste Transport.

So in order to decrease this spending and its problems related to garbage, we proposed this system.

### B. PROPOSED SYSTEM WITH BLOCK DIAGRAM

The IOT Garbage Monitoring system is a very innovative system which will help to keep the cities clean.

This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. For this the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system makes use of NodeMCU or ESP8266-12e wifi

module, LCD screen, Wi-Fi modem for sending data and a mail. The system is powered by a 12V transformer. The LCD screen is used to display the status of the level of garbage collected in the bins.

Whereas a web page is built to show the status to the user monitoring it. The web page gives a graphical view of the garbage bins and highlights the garbage collected in colour in order to show the level of garbage collected. The LCD screen shows the status of the garbage level. The system puts on the mail when the level of garbage collected crosses the set limit. Thus this system helps to keep the city clean by informing about the garbage levels of the bins by providing graphical image of the bins via a web page.

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 preprogrammed with an AT command set firmware. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

In this we are also go to use a Ublox 6m GPS module and an OLED display to the NodeMCU or ESP8266-12e wifi module to display your current GPS location and other info.

Implementation of real time waste management system by using smart dustbins to check the level filled of smart dustbins and to check whether the dustbins are full or not. In this system the information of all smart dustbins can be accessed from anywhere and anytime by the authenticated person and authenticated person can take a decision accordingly. By implementing this system the cost reduction, resource optimization, effective usage of smart dustbins can be done. By reducing unnecessary rounds for garbage collection this system indirectly reduces traffic in the city. In urban cities the garbage collection vehicle visit a particular area's everyday twice or thrice depends on the population of the particular area and sometimes these dustbins may not be full. This system will inform the status of each and every dust bin in real time located throughout the city, so that the concerned authority can dispatch the garbage collection vehicle only when the dustbin is completely full or is about to full.

The traditional garbage collection system is changed into a smart and intelligent system. The integrated IoT system is very useful to remotely monitor the garbage levels in dustbins in

cities. This system reduces cost and saves huge time. This system

also reduces human efforts and t is user- friendly system.

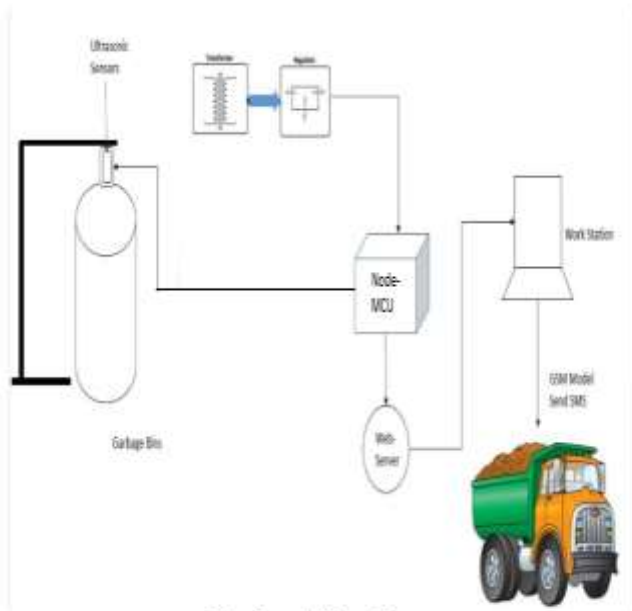


Figure: System Architecture Diagram

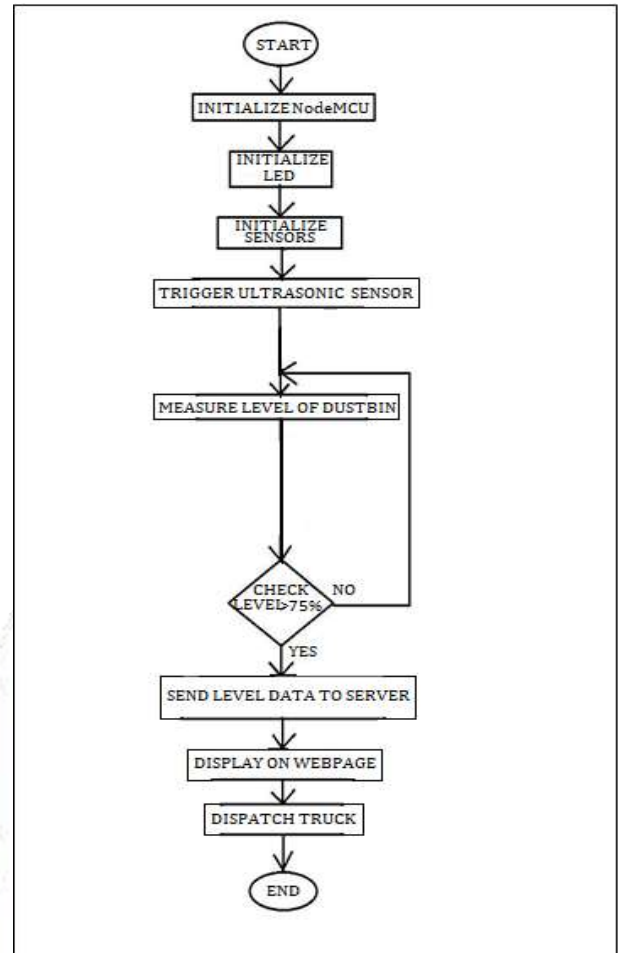


Fig. 2 Flowchart

Fig.1 Block Diagram

**C. EXISTING TECHNOLOGIES/METHODOLOGIES USED**

**1. ESP8266 / NODEMCU**

The ESP8266 chip from Espressif was the new generation of low-cost WiFi chips after the TI CC3000/CC3200. This small chip not only integrates the whole WiFi features, but also a powerful programmable MCU. Depending on the board layout (ESP-01, ESP-03, ESP-07, ESP12, etc) it is attached to a programmable flash, ranging from 512K to 4M. This increases the available user code pspace, and make possible other cool features like a small file system, or OTA updates.

**2. THINGER.IO IOT PLATFORM**

It is an open source Platform for Internet of Things (IOT). This documentation is related with the Arduino client library version

of the Thingier.io platform. With this library you will be able to connect almost any Arduino board using Ethernet, Wi-Fi, GSM, or other supported boards like ESP8266, NodeMCU, and TI CC3200.

The client library allows connecting your IoT devices to the Thingier.io cloud platform. This is a library specifically designed for the Arduino IDE, so you can easily program your devices and connect them within minutes.

It supports multiple network interfaces and boards, like Ethernet Shield, Wi-Fi Shield, and GSM. It also supports other boards like ESP8266 (or NodeMCU), Texas Instruments CC3200 Launchpad, and Adafruit CC3000 board. It requires a modern Arduino IDE version, starting at 1.6.3.

The thingier.io platform is designed to support almost any microcontroller or device with communication capabilities. No matter if it has Ethernet, Wifi, GSM, or the chip is from some vendor or not. Almost any device can be integrated in the cloud. So you can choose the hardware you want to connect, as this

platform does not force you to purchase some compatible vendor hardware. This is a crucial when designing your IoT projects. Here you are free to choose the hardware you want!

### III. CONCLUSION

- This system assures the cleaning of dustbins soon when the garbage level reaches its maximum. If the dustbin is not cleaned in specific time, then the record is sent to the higher authority who can take appropriate action against the concerned contractor.
- This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection.
- Therefore, the smart garbage management system makes the garbage collection more efficient.
- The cost & effort are less in this system.
- The entire operation is automated and once the process is started, no human intervention is required.
- Human Errors are reduced.
- It can reduce the human workload due to the automation process which ultimately increases the efficiency of the system.

### IV. FUTURE SCOPE

There are several future works and improvements for the proposed system,

1. Having a case study or data analytics on the type and times the waste is collected on the type of days or season making the bin filling predictable and removing the dependency on electronic components and fixing the coordinates.
2. Improving graphical interfaces for the Server and complete Android applications has possibility of extending the system adding other use cases and applications for smart cities.
3. Moreover, the proposed solution is flexible and decoupled with respect to the determination of optimal number of bins and vehicles or to the algorithm that define the best route for vehicles.

Therefore, future works can be made in the study of models that offer the best results in terms of decision-making.

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