

# IoT based Smart Garbage Management System

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## ABSTRACT

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Garbage management is an important role in our day-by-day life. If the Garbage is not managed with a proper way, it will spread diseases and pollution. To manage and handle garbage's we have developed a Smart Garbage Management System. This research work is about an Internet of Things (IoT) based, Smart Garbage Management System to solve the issue and to manage the garbage properly in a timely manner. We aim to create smart garbage management system to help the garbage collection team members as well as all uplift the people in their lifestyle. We have identified the components requirements, analyzing it and found the possible way to smart based solution to identify garbage levels in the bin and proper management to reduce air pollution using IoT.

Keywords – Arduino UNO, Garbage Management, Internet of Things (IoT), Node MCU, Blynk.

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## I. INTRODUCTION

In the big cities, as the population is increased the garbage is also increased. It is not easy to monitor the garbage level of bins manually because it needs more time, cost and more human efforts. Moreover, if no one disposes of the garbage's from the bins at the right time, it will affect the health of the human as well as the environment. Moreover, now most of the countries concentrates to make the life of their citizens easy and based on the IoT solutions. In addition; the countries which have a clean environment will attract tourists resulting in an increase in the country's economy. So, the smart garbage system will give a real time indicator of the garbage level in a dust bin at any given time. Moreover, it will isolate the different types of trash like (paper and metal) in different dust bins.

### 1.1 Aim of the research work

The aims of this smart garbage management system are:

1. To optimize garbage collection routes.
2. To reduce fuel consumption during the garbage collection.
3. To reduce the time and the effort of the workers who collect the trashes

### 1.2 Objective of the research work

To analyze various methodologies of the Garbage Management System.

- To identify or measure the level of the Garbage collection basket and produce indication of the level of the Garbage collection basket.
- To identify, which dust bin for paper and which dust bin for metal by using LCD Screen.
- To notify the garbage collection team about the level of the garbage in bins by using Blynk application software through their mobile devices.
- To produce the notification to the Garbage collection team member through mobile phone

## II. LITERATURE SURVEY / DATA COLLECTION

In this paper, the idea of Dhana Shree K, Janani B, Reenadevi R and Rajesh R is to make a smart garbage monitoring system which is used in smart bins to monitor the level of garbage in the waste bins automatically. This system is implemented by using IoT devices, cloud to store the data and Wi-Fi module. So, the whole analysis is export in the mobile application and web pages. The researcher was used thermal sensor and servo motor so the lid of bins will be always closed and it will open only when there is a person near to it so this will help in rainy or winter session to avoid additional water in the bins. Because if the rain water is entered inside the bins which will track the mosquitoes and other diseases. Also, researches used, ultrasonic sensor to monitor the level of the garbage on dust bins and then a message will be sent to the corporation when the garbage reach to a specific limit. Moreover, there is a gas sensor which help to find and monitor the toxic gases inside the bin and it can be observe by municipality to save the people who collect the waste [1].

This research work is done by Norfadzlia Mohd Yusof1, Aiman Zakwan Jidin1 and Muhammad Izzat Rahim. The researchers developed a smart garbage monitoring system that measures the level of rubbish in the trash bin to alert the city through SMS messages. The system contains an ultrasonic sensor that measures the level of garbage and also a GSM unit is used to send SMS messages and an Arduino UNO that controls the operation of the system. The idea of the research work, it consists of ultrasonic sensors, Arduino UNO, and a GSM module. An ultrasonic sensor works to know the level of garbage for each trash bin. After that, the information will be sent to the microcontroller, Arduino UNO. In the event that one of the dust bin is full, a message will be sent to the garbage collection team members through SMS messages. Also, the system is connected to several LEDs, in green or red colors, which enables to alert

residents about the status of trash. In this system there are two levels for trash: the first at 70% of the height of the trash, and second at 90% of the height of the trash. If the rubbish exceeds the first level, a SMS message will be sent to the officials and the green LEDs will also turn on, but if the rubbish exceeds the second level, a SMS message will be sent to the officials and the red LEDs will turn on [2].

In the third research work, the idea of Ms. Priya A Jadhao, Ms. Sonal D Sakhare, Ms. Kajal G. Bhaladane, Prof. Abhishek P. Narkhede and Prof. Vaibhav S. Girnale is to make a system that will monitor the trash in the bins and then inform the work station about the level of trash in the bins. They used in their system the infrared (IR) sensor, Moisture sensor, Global System for Mobile (GSM) system and a WIFI module. The IR sensor is used to detect the level of trash in the bins and if it reaches 80%, the work station will be informed with the help of GSM and with the use of the call. The Microcontroller is used to interface the IR sensor (sensor system) with GSM system. Where the Moisture sensor is used to detect or sense the moisture in the bins. So, if it senses that the garbage or the trash is wet then, the door of bins will open automatically and for 30 seconds to ventilate the bins and avoid the bad smells. Also, the researchers used the Blynk application as another way to inform the workers of Municipal about the level of trash in the bins [3].

This paper describes the idea of Vikrant Bhor, Pankaj Morajkar, Maheshwar Gurav, and Dishant Pandya to make an intelligent garbage management system using the IR sensor, Arduino and GSM module. Also, use weight sensor, that it gives the weight of the garbage in the trash. But it does not provide any information of the level of garbage in the trash, it used Infrared (IR) sensor to detect level of garbage [4].

In this paper, Mustafa M.R and Ku Azir K.N.F are used four ultrasonic sensors in four garbage bins. The first one for paper, the second bin for plastic, the third bin for glass and the last bin will be for domestic wastages. The four sensors are connected to the " ARM microcontroller" which is used to monitor the level of trash or garbage in each and every bin. Moreover, they also connect those four sensors that is in the bins to the "ESP8266 WI-FI" module which is used when the sensors detect the level of garbage in the bins, the data will be send to the "ThingSpeak" through "ESP8266 WI-FI module". The purpose of ThingSpeak is that it will display the data (the level of garbage in each bin) in real time so the data can be monitored by the people who work to manage the waste and then they will tell the collector to collect the garbage from the bin which is full. Another point, the researchers also used the LCD which will display the level of garbage in each bin so the people can know about the level of trash inside the bins without opening it [5].

This project is done by K. Maheshwaran1, P. S. Alexpandian, A. Anton, V. Subramaniyan and S. Sathesh Kumar, and implemented an automatic smart garbage monitoring system. They are used ultrasonic sensor connected with Arduino UNO to check the level of garbage and then send alert to the web server. After finish removing the garbage, the collection team confirms the task of emptying the garbage with the help of RFID tag (radio frequency identification: system that uses to order to identify items). RFID is used to verification process and it also works to provide automatic identification of the trash

filled in the garbage and send an alert to the workers. Also, they used an application and link this application with a web server for alerts from microcontrollers to office and for remote monitoring of the cleaning process. [6].

### 2.1 Contributions of Proposed research work

- To improve the existing research work [1], in this research we used a box or container that will contain all components so it will not have affected by the water and then it will stop to work.
- To improve the research work [2], we planned to use application to detect the level of rubbish, instead of using text messages because maybe many messages are arriving at one time.
- To improve the previous system [3], instead of operating by the use of battery it is much better to use solar panels so the whole components will have the energy from the solar energy.
- To improve this method [4], can use ultrasonic to detect the level of trash in garbage, instead of using IR because maybe the results inaccurate when using IR.
- To improve the system in paper [5], it is better to use different sensor for each material like use capacitive proximity sensor in metal bin so it will detect only the metal and if another material (for example paper) is thrown in that bin an alarm will operate to notify the people that this bin is only for metal.
- To improve this work [6], can use many garbage for different materials example one garbage for plastic and other for metal.

### III. SMART GARBAGE SYSTEM DIAGRAMS - PHYSICAL AND LOGICAL DIAGRAMS

In the physical design, used two bins inside the bin there will be an ultrasonic sensor, which serves to find the level of garbage in the garbage bin and by connecting it with the Blynk application, the result (the level of the garbage) will appear in the application.

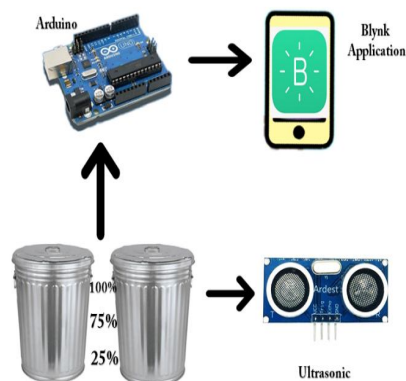
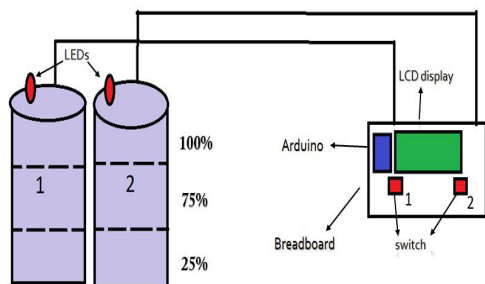


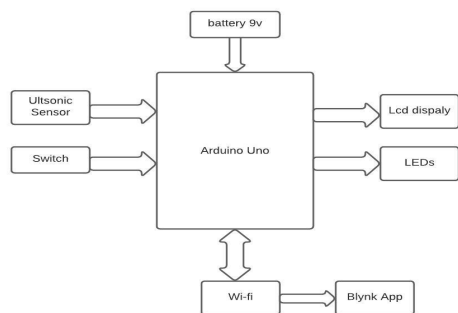
Figure 1: Smart Garbage System – Physical Diagram.



**Figure 2: Smart Garbage System – Logical Diagram.**

In the Logical design, we used two bins one for paper and the other for metal. Then, by the using of LCD display, the switch that connects with the Arduino UNO micro controller and the LED which is on the dust bin; the people will identify which dust bin for paper and which dust bin is for metal. Moreover, the ultrasonic sensor which is inside the garbage basket will indicate the level of the garbage and it will send the notification to mobile device through the Blynk application.

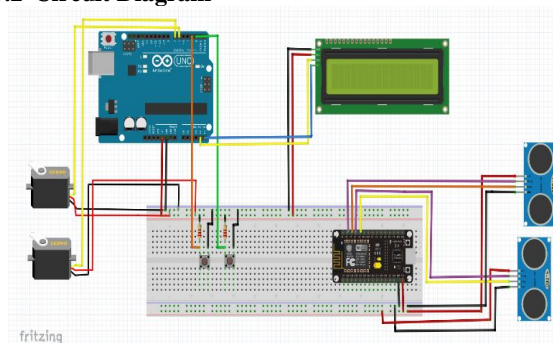
**3.1 Block Diagram of the research work**



**Figure 3: Block Diagram of Smart Garbage System**

In the block diagram, the battery, ultrasonic sensor and the switch are the input for the Arduino Uno in the research project. The power supply can pass to the microcontroller, Arduino UNO from the 9 voltage battery or solar panel and Arduino microcontroller will pass the power to the LCD screen to display the messages. If the user pressed the button in the breadboard, then LED blink either paper dust bin or metal dust bin in the garbage bin and display the level of the garbage in the screen. Also, by connecting the switch, the LEDs which is on the top of the garbage will turn on. Then, ultrasonic sensor identifies the level of the garbage in the dust bin and send to the microcontroller Arduino UNO. Also, Wi-fi module supports to connect the microcontroller to the remote end user mobile devices using Blynk application.

**3.2 Circuit Diagram**

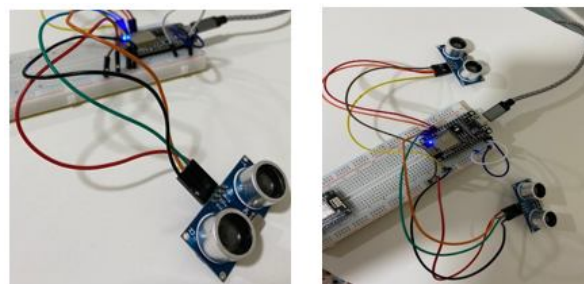


**Figure 4: Smart Garbage System – Circuit Diagram**

The circuit diagram is used to showcase the graphical circuit of the research work and developed the diagram by using Fritzing software. Also, the researchers utilized various components such as Arduino UNO, Node MCU ESP8266, LCD display, breadboard, Ultrasonic sensors, servomotors, switch, resistor and jumper wires. Initially connected the Node MCU ESP8266 with Ultrasonic sensor in the breadboard. and connected the Arduino Uno with an LCD display. Also, connected servomotors as well as the switch with resistor. Finally, connected the node MCU ESP8266 with the Ultrasonic sensors and it performed to send the level of garbage to the remote team members through Blynk application.

**IV. RESULT AND DISCUSSION**

**4.1 Ultrasonic Sensor working process**



**Figure 5: Ultrasonic Sensor connection with Node MCU**

Ultrasonic Sensor is used to measure the distance of the object using Ultrasonic Sound Waves.

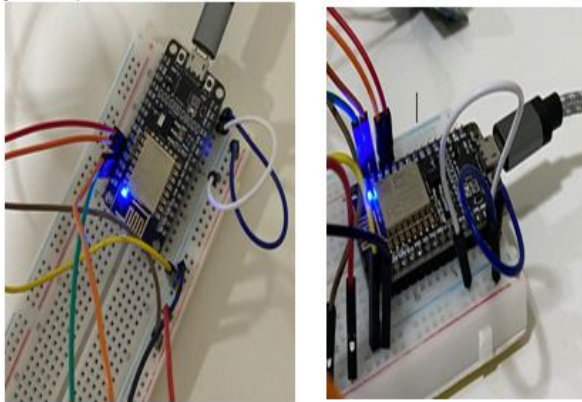
This research work gives the result as follows

- If the garbage < 25%, the green LED in the Blynk application will turn on.
- If the garbage < 65%, the orange LED in the Blynk application will turn on.
- if the garbage =100%, the red LED in the Blynk application will turn on.

**4.2 Node MCU ESP8266 model and working process**

Node MCU is a Wi-Fi module, it helps to connect the mobile devices in the garbage management system.

The MCU module is connected using bread board and jumper wires.



**Figure 6: Node MCU ESP8266 working process**

### 4.3 LCD Display and Result Display

It is used to display the result in the screen. This device helps to display the dust bin details whether paper based or metal based garbage bin. In this research work Bin – 1 for paper and bin-2 for metal.

Result:

- 1) Bin for paper.
- 2) Bin for Metal



**Figure 7: Working model of Smart Garbage Management System**

## V. CONCLUSION

In conclusion the environment is an important aspect for all people. Collecting garbage is one of the problems in the city. Also, modern cities are planning to manage in a smart way using IoT. It provides easy way to manage the garbage and helps peoples to prevent from the diseases. The smart garbage monitoring system gives a real time indicator of the garbage level in a wastebasket at any given time. Moreover, it isolates the different types of trash like (paper and metal) in the different dust bins. It helps to solve the different problems such as:

- The time consume of the garbage collection team

members.

- To reduce the efforts of the effort of the garbage collection people.
- It reduces the pollution and diseases spread.
- It protects the human health from different diseases.

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### Authors Biography



Dr. Jehan Murugadhas has over 23 years of experience in teaching and research, working as a Teaching Faculty of IT Department, University of Technology and Applied Sciences-Nizwa. He served in D. J. Academy for Managerial Excellence as an Associate Professor of Computer Science Department at D. J. Academy for Managerial Excellence, Coimbatore, India from 2007 to 2014. He received his Ph.D (Computer Science) from Dr.G.R.Damodaran College of Science, Coimbatore under Bharathiar University, India in 2015. He completed his B.Sc degree in Computer Science from Manonmaniam Sundaranar University in 1998 and the M.Sc degree in Computer Science from Bharathidasan University, Tiruchirappalli, India in 2000. He completed him M.Phil degree under Manonmaniam Sundaranar University, Tirunelveli, India in 2003. He has published more number of papers in International Journals and Conferences. His research interests are IoT, Wireless Networks, Congestion Control and Ad hoc Networks.