

# IOT Based Smart Garbage Monitoring System

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## Abstract:

The increase in population, has led to huge degradation in the position of hygiene with respect to waste management system. The major issue of world is waste management. The main problem in managing the waste is that the garbage bin at public places gets overflowed well in advance before the the next cleaning process, which result in various issues such as bad odor & ugliness to that place which result in different diseases. To reduce all dangers scenario and maintain public cleanliness and health this project is designed on a smart garbage system. The spillover of waste in areas generates the polluted condition in the neighboring areas. For eliminating the garbage's and maintains the cleanness, it requires 'smartness based waste management system. This paper is proposed IOT based smart alert waste clean management system which checks the waste level over the dustbins by using Sensor and clear it by giving an alarm to the municipal web server for instant cleaning of dustbin. This project is designed with the help of ultrasonic sensor which is interfaced with Arduino UNO to check the level of garbage filled in the dustbin and sends the alarm to the municipal web server once the garbage is filled . The real time status of waste collection is being monitored and followed up by the municipality authority with the aid. An Android application is developed and linked to a web server to intimate the alerts from the Arduino UNO to the municipality and to monitor the cleaning process, done by the labour, thereby reducing the human efforts in process of monitoring and verification. The notifications are sent to the Android application. This project is designed to greenish the environment and to support swachh bharat.

**Keywords**—Garbage bin, Power Supply, Arduino UNO, Ultrasonic Sensor Android Application.

## I. INTRODUCTION

In metropolitan or city areas, the clearance of waste management is one of the challenging tasks for the majority of the country all over the world. There is need of a well- organized waste clearance system is mandatory by keeping green environment. There are many mechanism are available for monitoring as well as managing waste. But, there is lacking for gathering information is a major challenging task. This miscommunication will affect the fast national growth rate in dense area. This is a major challenging in waste management system to create a prototype because the lack of coordination among government, people and local authority for shipping and processing waste. Currently the waste gathering is conventional which acquire a lot of labors and is time overwhelming process. By using Internet of Things surrounding objects are connected through wired and wireless networks without user. In the case of IOT, the objects

communicate and exchange information to provide advanced services to user with advances in mobile devices equipped with various sensors and communication modules, together with the communication network technologiess. Term Internet of Things was introduced by Kevin Ashton; he was the director of the Auto-ID Center of MIT. The initial technical realization of IOT was achieved by utilizing RFID technology for the identification and tracking of devices and storing devices information. The current IOT performs many operations such as sensing, actuating, data gathering, storing, and processing by connecting physical or virtual devices to the internet. The characteristics and advantages of IOT services, waste management is major issue in academia, industry, and government as major IOT application fields. An illegal discharge of waste, an absence of waste disposal and management systems, and inefficient waste management policies have caused serious environmental problems and have incurred considerable costs for waste disposal. To handle this situation, investigation on waste management using on IOT technology have been conducted, from studies on RFID technology to studies on waste management platforms and systems .But still, there is lack of research on waste management by using IOT technology. This paper proposes IOT-based smart garbage system (SGS) composed of a number of smart garbage bins (SGBs), routers, and servers. Each SGB, which plays a role in collecting food waste, is battery operated for mobility and, considering the convenience to residents, performs since August 2012 onwards, as two dumpsites in the suburbs of the urban were close by villagers against weakening the ecological and health situation. The municipality came to be idle as huge kind of garbage put down spotted on lane and open plot cross urban. The crisis condition pressed the Bruhat Bengaluru Mahanagara Palike (BBMP) to make amend in route near sustainable devastate organization exercise. The BBMP determined to impose waste parting and distribute waste processing to redirect squander left from the landfills and endeavour. During which BBMP initiated and gave emphasis on many programs such as Information Education and Communication (IEC) campaign and Wake-Up Clean-Up Campaign. IEC campaign was established to endorse waste isolation at basis.

In Bangalore kind of city affected a cruel garbage crisis various techniques through wireless communication. The "KasaMuktha" ward program was started by BBMO for wide opportunity in learning and communication to extend the knowledge about waste isolation from the starting place then pass on message to the people about the innovative technology about the garbage gathering and clearance from their area. The government had made a public awareness through daily and electronic media for cleanness program. This project was the conjectural demonstration about the waste management by bringing in

cooperation all the people including administration authority, mass producer, business place, NGOs and ecological association, firm squander specialist, service contributor.

## **II. Literature Survey:**

The literature surveyed some different papers to get information about the existing work which have been done SauroLonghi, DavideMarzioni, EmanueleAlidor, Gianluca Di Bu` o, Mario Prist, Massimo Grisostomi and MatteoPirro[2] proposed, garbage collector supported by using sensor motes which is providing information and status about the bin and also sending the retrieved data through DTN (Data Transfer Nodes). This bin has a custom prototype instead of basic installation of sensor nodes. The whole system is designed for allowing heterogeneous sensor for communication. A wireless sensor network is helped for controlling bin by gathering data from motes. The limitation here is that the information about the bin is not directly transferred to the server or to the client; it needs to be sent through the Data Transfer Nodes.

ShubhamThakker, R.Narayanamoorthi, in this paper [3], using the Near Infrared Reflectance (NIR) spectroscopy we can identify the type of plastic. The alienated dissipate equipment from MSW (municipal solid waste) can be place in a needy area. By Using an dissenter materials which can be mix into a uniform material. The entire process is repeated every hour.. The fermentation mechanism took place in a sealed atmosphere, where bacteria converted into undividable enzymes which results in biogas.

Andrei Borozdukhin, Olga Dolinina and Vitaly Pechenkin, [4] this proposed system consists of two parts: software and special signaling equipment. The equipment is placed on the side walls of the bin which consists of two parts: one is the receiver-transmitter and sensor. Sensor is used to indicate the level of the bin which is connected to the transmitter that transmits a signal of fullness of the bin to the receiver at the server host. A manager is appointed at the server side whose job is to find the shortest route and intimate it to the truck driver to collect it in a short interval of time.

Thompson A.F, Afolayan A.H, Ibidunmoye E.O projected work about the internet-based platform for the organization and monitoring of waste collection, discarding and carrying etc. This is comprised of the client, server and storage. The client is the device which can access the pages and forms used by web application e.g. PDAs, phones, laptops etc. the desktop is a program that launches the application and makes it performs over the internet. In this, the back-end system is the web server and database management system that supervise the data used by the function to monitor the movement of data between user and system. The limitation of this paper is that it only shows the location of the bin in the web page.

Solid Waste Monitoring and Management using RFID, GIS and GSM: Balamurugan S, Abhishek Ajith, Snehal Ratnakaran, S. Balaji, R. Marimuthu. This paper gives information about solid waste monitoring and management system using radio frequency identification (RFID) associate with intelligent systems.

The system consists of RFID system, mobile communication like GSM and geographical information system (GIS) for tracking vehicle position. This system is able to monitor the solid waste collection process and manages the overall collection process.

The technology which is used in the proposed system are good enough to ensure the solid waste monitoring and management for green environment.

Design of Smart Waste Management System: Balamurugan S, Abhishek Ajith, Snehal Ratnakaran, S. Balaji, R. Marimuthu. In this paper we have developed a low price, low power consumption waste management system which will be applicable in regions which are not economically sound. This system enables us to collect the trash as and when the can is full or when the trash inside is decomposed compared to daily collection. The system is designed by an Arduino Uno board incorporating additional modules such as a GSM module to send messages.

Volunteer GIS (VGIS) Based Waste Management: S M Labib This Waste management is a major issue for rapidly growing megacities in developing countries. Unorganized and improper management system results in negative environmental impact, and lowering livability of these cities. However, there is freedom for integrating general people in the waste management to improve overall performance. In such cases, the purpose of this study is to design and detail, a volunteer GIS based smart waste management system for Dhaka city; in order to involvement of the citizens in resolving solid waste management conditions. The study focused on developing a Geoweb (Web 2.0) design for collecting waste related problems from the citizens. VGIS concept is developed using web-server and VGIS interface, with JavaScript and Google Maps APIs. The developed Geo-web would allow reporting waste related problems (e.g., illegal waste dumping) by the citizens using geo-tagged marker over a customized Google Map. The website can also be used to disseminate waste collection schedule, contact information of the waste collectors for different wards in the city. The system provides a habitual platform for every resident for active participation in waste management, and also helps bridge the gap between citizens and local government. Successful implementation of the system helps in reducing solid waste management problems and creates awareness among the citizens regarding waste management and use of internet in improving their surroundings.

Real Time Solid Waste Bin Monitoring System Using Wireless Sensor Network: Md. Abdulla Al Mamun, M. A. Hannan, Aini Hussain. This paper represents new idea that enables the remote monitoring of dustbins in real time. The system is developed to monitor the status of the bin.

A Review of Solid Waste Management Techniques using GIS and Other Technologies: Priyanka Shrivastava1, Shivangi Mishra, Solid waste management has been a leading concern for all the developing countries. It effects environment, health and economic cascade. There has to be apt planning for proper waste management by analyzing the area and its waste situation. This paper deals with, how Geographical Information System and other technologies like RFID, GPS etc. can be used as a decision support tool for proper planning of solid waste management. This paper aims to review and compare various GIS models suggested for solid waste management. The study would upgrade the solid waste management reform; boost its management and efficiency to ensure the practical solutions for solid waste collection process, monitoring and management for green environment.

Dynamic Solid Waste Collection and Management System Based on Sensors, Elevator and GSM: Trushali S. Vasagade, Solid waste management is one of major aspect which has been considered in terms of making urban area environment healthier.

The dustbins placed by the municipal corporation in public places results in health, environmental and social problems. Various side effects are there like improper system of collecting waste by City Corporation, and specifically people are not aware enough to use dustbins in right way. It results in increasing serious problems such as, an unhygienic condition, air pollution, and unhealthy environment.

The research has been carried out by developing a Software Applications for indicating dustbin level. Considering all these major factors, a smart waste management system is designed that continuously monitor status and give alert of dustbin level and system has also feature to literate people to use dustbins in right way and to automatically sense and clean garbage present outside the dustbin.

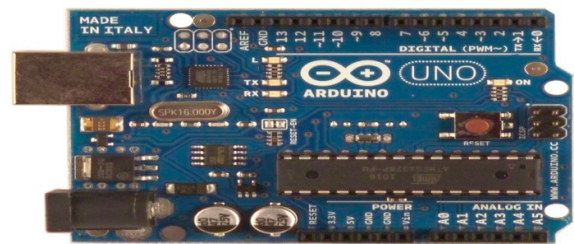
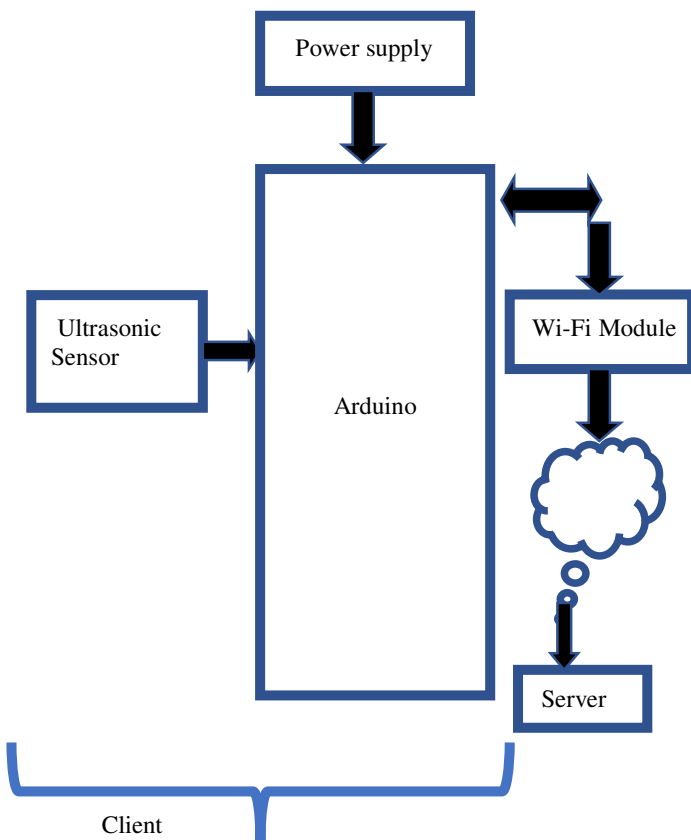
This gives solution to achieve waste management satisfying goal of making Indian clean, healthy and hygienic.

The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to measure the distance.



**Controller (Arduino)** -Arduino Uno is a microcontroller board based on the ATmega328P. It is having 14 digital input/output pins from which 6 can be used as PWM outputs, 6 analog inputs, and a 16 MHz quartz crystal.

### III. Block Diagram:

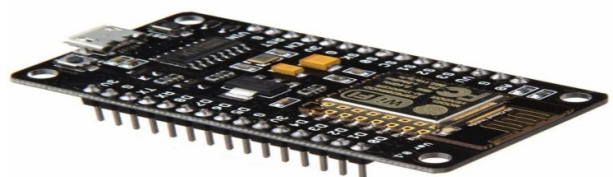


**Server**-It will keep the record of all dustbins and also if it gets complain from citizen and send the same to client.

**Client**- It will get the commands from server. One the work is done it will again report to the server.

**Power Supply**- It provides supply to the circuit. We use 12v power supply in our project. It is used to provide DC voltage to the components on board. 3.3V for lpc2138 and 4.2v for Wi-Fi module is apply from power supply. 5V is required for relay applied from power supply.

**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. Each ESP8266 module comes pre-programmed with AT commands. This module has a powerful enough onboard processing and storage capability that allows it to be integrated with the sensors and other application specific devices through it.



**Ultrasonic Sensor**- It will measure the distance by using ultrasonic waves. The sensor generates an ultrasonic wave and receives the reflected wave. In our project Ultrasonic Sensors check the level between garbage. When dustbin will be full then data will be updated on web server through IOT module. The Ultrasonic Sensor sends out a high-frequency sound pulse and the echo signals get reflected. The sensor has 2 openings on its front. The speed of sound is approximately 341 meters which is 1100 feet per second in air.

The idea struck us when we observed that the garbage is collected twice a day. Although this system was thorough it was very inefficient. Let's consider street A is a busy street and the garbage fills up really fast whereas maybe street B even after two days the bin isn't even half full.

This will help us generate the percentage of trash in the trashcan. We have used two conditions which need to be satisfied to indicate that the particular bin needs to be emptied:

The amount of trash, in other words let's say if your bin contain 50% garbage then there is no need to empty it.

The maximum amount that we permit is 75% of the bin. (You could change the threshold according to your preference).

If supposing a particular trashcan fills up 20% and then for a week doesn't change, it comes into our second criteria, time. With time even the little amount of garbage results smelly surrounding.

To avoid that our tolerance level is 2 days, so if a trashcan is less than 75% but it is two days old it then will also need to be emptied. An ultrasonic sensor is placed on the inner side of the lid, the one facing the solid waste. As waste level increases, the distance between the ultrasonic and the waste decreases. This live data will be sent to our micro-controller.

Our micro- controller then processes the data and through the help of Wi-Fi sends it to an app. What the app does it visually represents the amount of trash in the bin with a small animation. This process will indicate all the bins which need immediate attention.

In this project, an integrated system of Wi-Fi modem, IOT, GSM, Ultrasonic Sensor is introduced for efficient and economic garbage collection. The developed system provides improved garbage collection and waste monitoring at each location. By implementing this project we will avoid over flowing of garbage from the container in residential area which is previously either loaded manually or with the help of loaders in traditional trucks.

It continuously checks the garbage level & sends the information to Cooperation. The technology used in the proposed system is allowable to certify the practical and perfect for solid garbage collection process monitoring and management for green environment.

In this system, there are number of dustbins are located at different places of a city or a campus, these dustbins are provided with low cost embedded device which helps in chase the quantity of the garbage bins. The bins are assigned with a unique ID which is use to differentiate the dustbins with each other to identify which garbage bin is fill.

When the level crosses its threshold limit, the device will transmit the level along with the unique ID. These details are access by the authorities with the help of internet and an immediate action is taken to clean the dustbins.

## **V.CONCLUSION:**

We are implementing garbage management system by using smart dustbins to check the level of smart dustbins whether the dustbin is full or not. In this system when garbage is full the information is sent to the authorized person. By implementing this proposed system, we can develop the smart city concept and cost is reduced. By the effective usage of smart dustbins can the resource is optimized. This system reduces the traffic in the smart city, so that environment will be cleaned. The existed system will inform the status of the garbage in each and every dust bin, so that the concerned authority can sent the garbage collection vehicle only when the dustbin is full. It will also indicate alarm or notification on android module and it will automatically clean when the trash can is empty.

In proposed system we also implement an android module for notification regarding dustbin, garbage or waste on road outside of building related complaint through citizen.

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