

# IOT Based Smart Waste Monitoring System

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**Abstract** - Waste disposal and monitoring are some of the major problems facing the world, regardless of their economic or social status. This mainly occurs when garbage cans in crowded cities and villages are full of waste which might lead to an unhealthy environment and maybe a reason for the spread of diseases. To avoid this condition and maintain public health and cleanliness. This paper proposes an idea that can interpret the real-time status of all bins situated in various parts of the city by sending an alert signal to the municipal workers for immediate cleaning of a dustbin with proper verification based on the level of garbage filling, moisture, and temperature. Reduce manual monitoring and verification process

**Keywords-** Internet of Things (IoT), Ultrasonic Sensor, Arduino Uno, GPRS Module.

## I- INTRODUCTION

India belongs to the category of developing countries. Waste separation is critical to the proper disposal of the huge amount of waste that is produced in our daily lives from various sources. People are used to throwing things away and never realizing the consequences of their actions, as seen in Figure 1. Problems such as health, environmental pollution can pose a danger to an adequate management system. Urban areas with emerging economies are experiencing poor garbage collection services and failing to pick up garbage, exacerbating the problem.

The method of waste collection introduced in many countries is a problem, and most of them are hampered by lax regulations and rapid urbanization. At present, the volume of municipal solid waste is increasing dramatically due to population growth, economic recovery, industrial development, changing consumer habits and many other factors in the lifestyle of the urban population.

The management company of the area that needs to be visited is alerted to select an overflow or bin that is nearing the saturation level so that the assigned cleaner can get there in time to clear it.



Fig.1: Dustbins in the locality

The Internet of Things (IoT) concept is something where surrounding things are connected using wired or wireless communication without manual intervention. The Internet of Things as a technology performs the detection, activation, compilation, storage and processing of data connecting devices to the Internet. The purpose of this document is to devise a practical solution to the problem that most economies face today. The monitoring system allows the period in which the basket will be filled. Ultrasonic sensors measure the distance between the lids and inform the server, which can also be viewed through mobile applications.

## II- PROPOSED TOPOLOGY

The proposed waste management is based on a set of sensors and controllers. The ultrasonic sensor senses the height of the dumpster. If the dumpster is about to fill up, they are notified accordingly. Wet and dry waste is separated and collected in various containers.

This is done using the moisture sensor and the IR sensor, where the moisture sensor detects the moisture in the waste only when the wet container is opened. Once the garbage container is full in a certain area, the garbage collector can locate the full garbage container and collect the waste. Two of the important features included are checking the volume that the recycle bin can hold and the other is interpreting the data and sending it to the cloud system for monitoring. The waste is mainly classified as recyclable waste, industrial waste, hospital waste, commercial waste, green waste, electronic waste, nuclear waste and organic waste, depending on the source of where the waste is produced. The current trend is where people play lixio anywhere without segregation.

This leads to poor hygiene around the source of the vectors. This is when the cleaners need to be most careful. Therefore, the proposed system will benefit scavengers and process monitoring personnel.

## III - MATERIALS AND METHODOLOGY

To solve the problem, a smart bin has been designed to monitor garbage cans 24x7. The whole assembly includes the Arduino UNO which is the first controller of a large part of the process connected to the Internet which works on the principles of the Internet of Things. Along with this, an ultrasonic sensor, humidity sensor, and temperature sensor are connected together with a servo motor. The administrator establishes a connection with the cloud and depending on the activity the administrator from different devices can manage in the cloud and by mobile as shown in Fig.2 and the example for the same in Fig.3

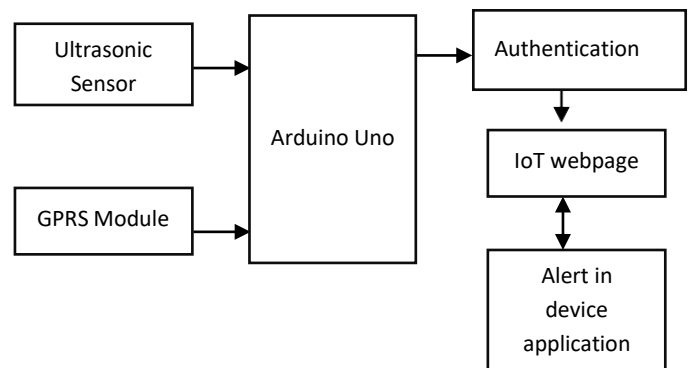


Fig.2: Block Diagram of Waste Monitoring

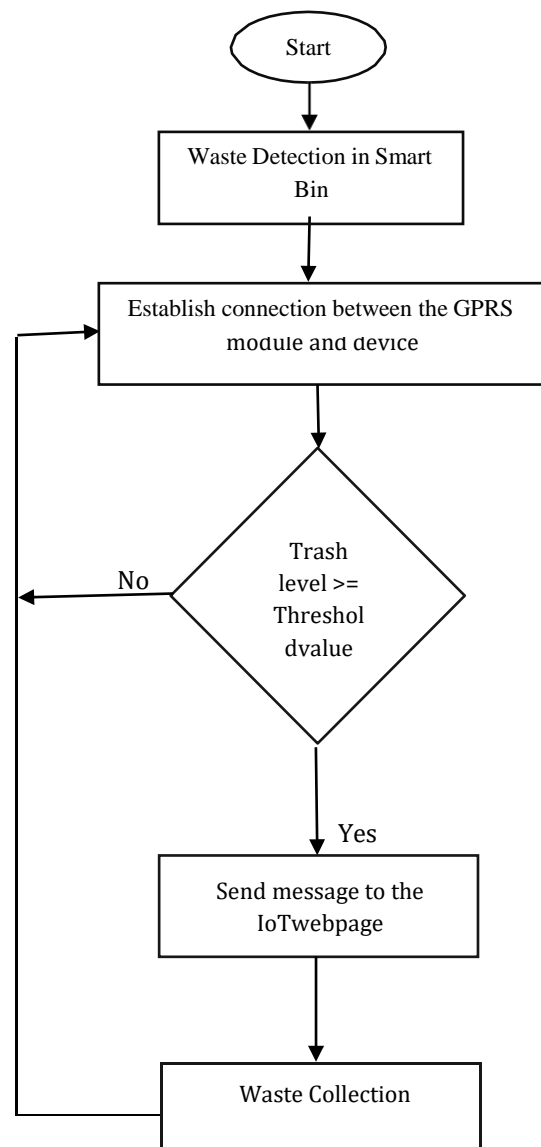


Fig.3: Flowchart of waste monitoring

### III - PROPOSED ALGORITHM

(laptop/mobile) are connected to each other. The ultrasonic sensor detects the level of the waste bin and 4 LEDs connected to the waste bin indicate the level of empty, low, medium and full respectively. A connection is established by the Arduino Uno with the IoT web page. When the bin level is above the threshold level, an alert is sent to the concerned authorities through the mobile/laptop application. If the debris or temperature does not exceed the threshold level, the process is repeated. Then, the GPRS module sends the location to the IoT web page and displays the output on the LCD screen. As soon as the IoT web page is updated, it displays the Google location and bucket level on the screen. The SIM card connected in the GPRS module sends a message about the waste level to the main authority. It is an application based project for the real world and a solution project for problem statement

### V- Experimental Prototype

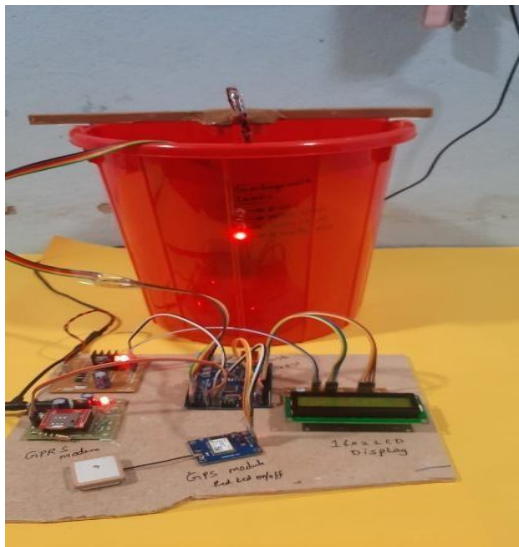


Fig.4: Experimental prototype of Smart wastemanagement

The hardware kit consists of a bin, ultrasonic sensor, LEDs, power supply, Arduino UNO, GPRS Modem, GPS module and LCD. An Android application is developed to have remote control and track the level of various trash cans that need to be evacuated. Here the android application is used to monitor the level of the garbage bins. The mobile application is enabled two-way communication between the IoT. The table of the hardware components with the ratings is given in Fig.5.

Table.1: Hardware Components of the experimental circuit

Sr. No	Component	Rating
1	Ultrasonic Sensor	40 kHz, 5V, 20 mA
2	Arduino UNO	16 Mhz, 6-20v, 20 mA
3	GPRS Modem	SIM900A, 5V
4	GPS Module	5-10 Hz, 3.3 V, 30 mA
5	LCD Display	4.7 to 5.3 V, 1 Ma

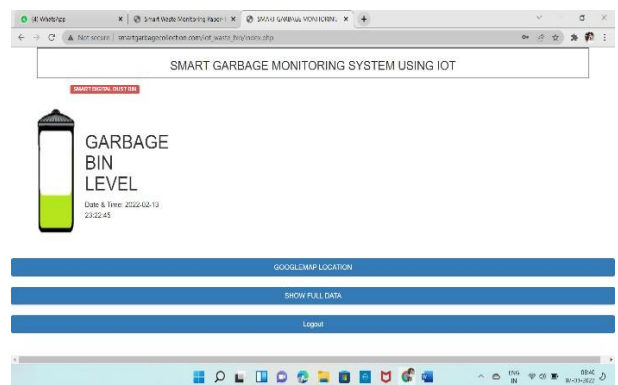


Fig.5: IoT webpage created for waste monitoring

The above Fig.6 shows the level of the garbage bin on the webpage created. Also, the status of our bin and the location can be seen in Fig.7 and Fig.8. This IoT webpage is created using embedded C in Arduino compiler as our main microcontroller is Arduino UNO. This application can be opened on any device like mobile/laptop which is connected with the GPRS modem of our kit. Also, the latitude and longitude value of our location is displayed on the screen.

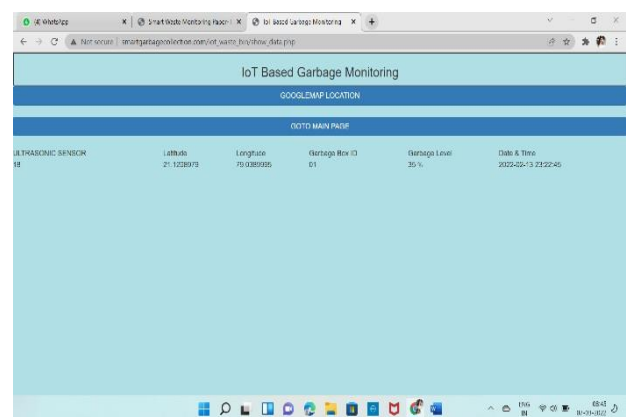


Fig.6: Present Status of the bin

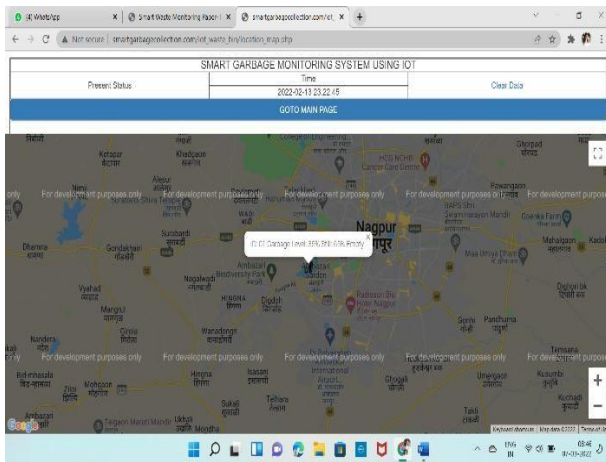


Fig.7: Google location of the bin

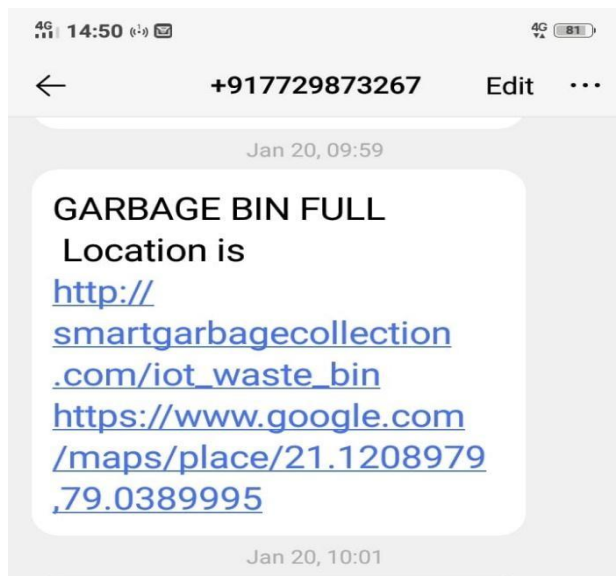


Fig.8: Message sent to the device

A warning message is sent to the caller, as shown in Fig. 9. The controller sends various information about the bin based on its distance, if it exceeds the threshold value, it will display "WASTE BIN FULL".

The action from the mobile phone that motivates the staff has reached its maximum limit and needs to be done quickly. The mobile device sends information to communicate in IoT through the establishment of two-way communication between devices. The database stores all the information about the phone at some point, the system is designed in a way to update the web page of the IoT with the Arduino Uno and its efficient use for ten times as possible. It also reduces maintenance during the year. Necessary.

It shows garbage on the created web page. Also, the situation and location of our seat in figure 7 and 8 can be seen. This page on the Internet of Things is created using C made in the Arduino compiler because our real microcontroller is the Arduino UNO. This program can be opened on any device such as a mobile/laptop connected to a GPRS modem. Also, the length and latitude of your location are displayed on the page. Get an ultrasonic cleaner and remove the dirt and touch. He doesn't want to do the work as he doesn't have an Arduino Uno and he will put the sensor as the voice of action and take me to search for IoT or GPS GPS.

The model is developed under standard conditions for testing purposes. In our city, many garbage cans can be considered overloaded. This creates an unsanitary condition in the place and leads to the spread of many diseases. It is proposed to develop an IoT-based smart waste management system that effectively checks whether the trash cans are full or not. Thanks to the implementation of this system, it is possible to ensure cleanliness of the area and avoid the spread of diseases, as well as reduce the costs associated with garbage collection. Various sensors have been used for the real-time implementation.

#### IV - CONCLUSION

This whole system monitors the level of garbage in the dumpster. It is intended to assist the local corporation with its waste management system, which involves monitoring household and waste waste at regular intervals to provide a solution for public and waste water, which also minimizes the entire journey of the garbage truck, which ultimately reduces emissions. In the future, it will be possible to connect different types of sensors for precise output. By reducing manual labor and downtime, this system is a user-friendly product.

This proposed product is an attempt to improve the current waste collection system in India and pave way for a green environment. This proposed system ensures the maintenance of the garbage containers as and when the garbage level reaches the saturation level. This minimizes frequent checking of garbage collection. Ultimately, it aims to maintain the cleanliness and productivity of society. Therefore, the waste monitoring and management system makes garbage collection more effective and efficient.



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