WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Intelligent Waste Disposal Technology Powered by IOT

Dr. Ravindra M. Deshmukh

Dr. Rajendra Gode Institute of Technology & Research, Amravati
rmdeshmukh@gmail.com

ABSTRACT

Using an intelligent system that maintains the trash can and delivers real-time condition information is necessary for the construction of intelligent cities. Municipal authorities across India do not yet receive current data regarding garbage cans. In order to address this issue, we are putting in place an Internet of Things (IoT)-based system that can alert businesses about garbage overflowing and contamination levels. To oversee the information pertaining to the trash cans, an online platform has also been created. The module for GSM is used to send messages to cell phones, and the internet page updates with information on the state of the trash can. On this platform, residents may also file grievances about trash cans or waste disposal. In the suggested setup, the Arduino microcontroller serves as the connection for the GSM/GPRS modules and the sensors that are attached. A dustbin level with cytotoxicity is measured using an ultrasonic device and an air detector, accordingly.

Keywords: Management of waste, the Internet of Things, the toxicology straight, GSM/GPRS, air sensors, ultrasound sensors, Arduino, and controller

INTRODUCTION

One-sixth of the global population lives in India, which is among the globe's most populous nations. Due to the vast population, many homes and businesses create a lot of garbage. There are instances when trash decomposes and releases unsanitary gasses into the atmosphere [1] and [2]. The quantity of garbage generated by smart cities is enormous. Mumbai produces the most trash out of the 46 cities. Every day, 11,000 tonnes of garbage are produced [3]. Bins are positioned across the municipality to handle this garbage, but they frequently overflow and are left neglected. The city's administration does not get current data on trash can overflow [2] or [4].

Although we use dustbins to dispose of our garbage, there are still certain issues. For instance,

- garbage may occasionally be dumped outside the trash can. It is not watched over.
- Although there is no evidence, harmful gasses may have come from the trash can.
- Garbage cans do not get cleaned promptly and overflow.
- Although we can't halt the production of trash, we can manage and watch over it. The management of solid waste requires appropriate databases.

In India, there are bins everywhere on different roads. These trash cans are used by the public for garbage disposal, and the local government cleans them. However, occasionally trash cans overflow and are not promptly cleared. A sophisticated mechanism ought to be used to determine the garbage can's condition within a moment. [5]. Since technology is all around us in many ways, we should take advantage of it to track all of the trash cans in a certain region in real time. A notification should be delivered to the MC, who is in charge of cleaning the trash can, when the trash can is full. For later usage, the dustbin's whole data set is preserved.

LITERATURE REVIEW

Numerous studies on smart waste disposal methods are being conducted, but only a handful of these systems have an extremely good chance of solving these issues. P. Haribabu et al. created a trash can that was connected to the internet of things [2]. A GSM modem, an Arduino board, and an ultrasonic detector (HC-SR04) are all included in the dumpster. There was additionally a sounding device and a number of luminescent leds to indicate how much dust was in the garbage bin.

The undertaking "Cloud computing-oriented intelligent trash surveillance systems" put forth by Jetendra Joshi et al., the level of the bin is measured using an ultrasonic device. They additionally offer an app that shows the quickest route to the trash can.

The stack-based front-end technique [5] serves as the foundation for their strategy. Although S. Vinoth Kumar et al.'s "smart waste surveillance and clearance system using the Internet of Things (IoT)" was a nice idea, they were unable to foresee the dangerous gas released by the dumpster [6]. Another study on an "IoT-based municipal waste management approach for smart cities" was conducted by Krishna Nirde et al. They suggested the notion of real-time trash surveillance using two tracking structures: weight detection and garbage load detection. They were communicating whether or not the trash bin was full, although weight sense is not the best method for doing so [7]. Imteaj A. et al. created a smartphone app as part of their study on "Dissipation of Garbage Utilizing Interactive Observation and Unnerving Systems: The Smart City Applications." Users might use this programme to find local trashcan sites with paths on OpenStreetMap (OSM) [8]. In their planned "Smart City Initiative: Traffic and Waste Management," Ankitha S. et al. use intelligent trash cans that have unique ID. The system, which is connected to all garbage collection vehicles, receives a notice whenever the disposal container is filled [9].

In their IoT-based research, Trushali S. Vasagade et al. used multiple sensors in various locations to monitor various metrics. They employ a device beyond the receptacle that can identify trash thrown outside of it [10]. Bluetooth, Wi-Fi, Zigbee, and another module were employed in the "autonomous smart waste disposal systems" put out by Shujatullah Khan et al. Their intelligent trash can relies on infrared (IR) sensors to function. When the trash exceeds the threshold level, To send information to the required regulators, a GSM transmitting device, or the World System for Wireless Communications, is used. [11].Therefore, based on all of these studies, we can conclude that intelligent disposal of waste is a serious issue that we cannot ignore.

PROPOSED METHODOLOGY

In such a task, both the transmitter and the receiver are interfaced using a GSM/GPRS approach and an Internet of Things (IoT)-based technology [7].

Our "IoT-oriented smart garbage disposal structure: India perspective" offers the dustbin's real-time state. Both the degree of toxicity and the dustbin's percentage filling are measured. The web page receives information so that it may be observed later. Together with a dustbin's hazardous classification and amount of fill, it also keeps track of the duration and date within the database.When the trash can is full or the level of toxicity is excessive, a notice is sent to the concerned user. Figure 1 describes our entire system.

Ultrasonic and gas sensors that communicate information to the municipality via the GSM module are attached to an Arduino.

The process diagram in Figure 2 is another option to understand the proposed system.

1. A dustbin's level of fullness is detected by an ultrasonic sensor [4].

2. A gas detector determines the dustbin's degree of toxicity. Dustbins emit dangerous gasses when there is trash present, which makes them more poisonous.

3. When the depth is below ten centimetres or the gas's hazard is serious, a message is sent to the MC via a GSM unit.

4. After a predetermined amount of time, the trash can data is sent to the internet so that it can be stored there. The time and date are kept alongside the data.

5. If MC learns that the trash can has been filled, it will dispatch a truck driver to clear it. The trash cans are promptly cleaned in this manner.

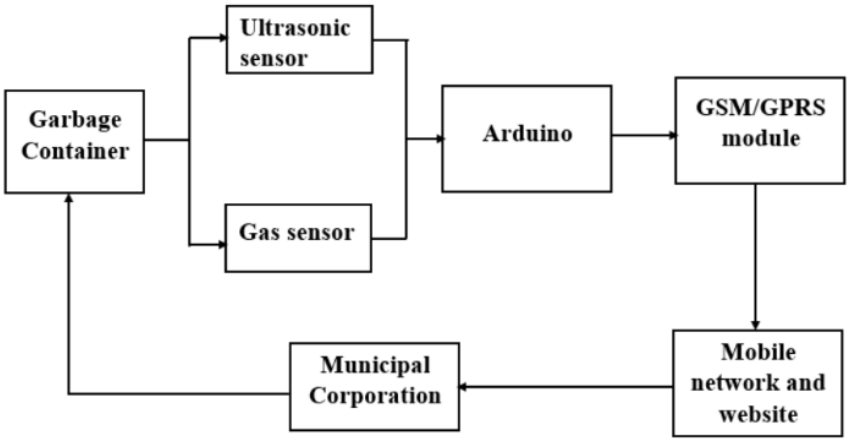

Fig.1 Block schematic of the proposed system,

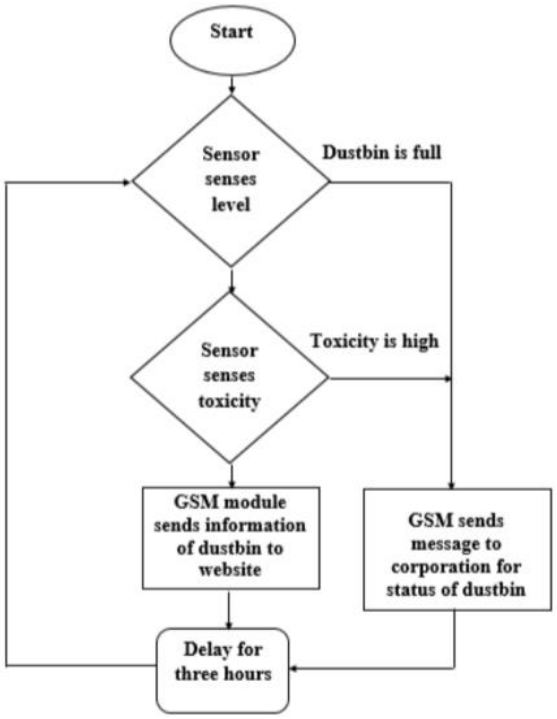

Fig.2: Flow chart of the system

The system as a whole is outlined in the sections that follow.

A. Systems Managing

Uno is employed as a controller in the system that is presented.

It connects to the GPRS module and sensors. It is a control device that can be programmed. Every device can be controlled by Arduino thanks to its programming in the Arduino IDE software. It utilizes a 5 volt power source. Both of the sensors need energy from the Arduino board. There are fourteen pins for digital inputs and outputs on it. Six of these outputs use pulsing of pulse width (PWM). Six analogue pins are also included. An ultrasonic detector connects to a digital pin, while a sensor for gas is attached to an analogue pin. The PWM pin connects to the GSM. In Fig. 3, Uno is depicted.

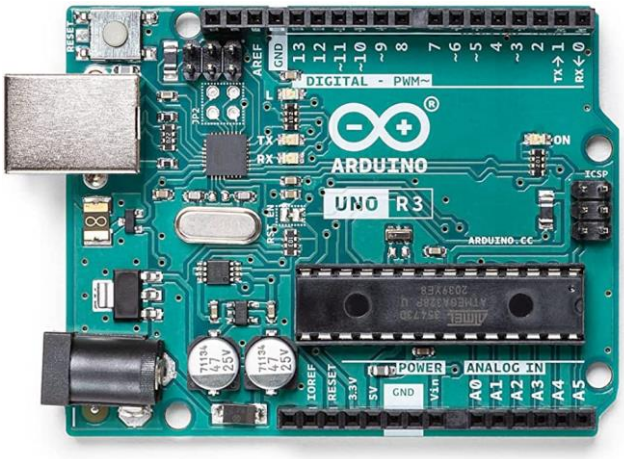

Figure 3: An Uno R3.

Table.1: Uno characteristics

Parameter	Specifications
Operating Voltage	5 Volt DC
Input Voltage	7-12 V
Clock Speed	16 MHz
DC current per I/O pin	40mA

B. To determine the level of the trash can

By gauging the distance between the thing in question and the impediment, we employ an ultrasonic sensor to determine the level [12]. We regard difficulties as trash. There are both transmitter and receiver components.

At certain times, a transmitter emits sound with high-frequency pulses. The rate at which the waves travel through the atmosphere is that of sound [1] [2] [10]. The waves are reflected back by the barrier, so their total length is computed. A sensor using ultrasound is shown in Figure 4.

To calculate the distance of the sensor from a barrier, apply the equation below:

(2) Distance = Speed * Time The precise details of the ultrasonic detector are shown in the tables that follow below. 2.

Table.2: Specifications of Ultrasonic Sensor

Parameter	Specifications
Operating Voltage	5 Volt DC
Operating Current	15 mA
Frequency of Operation	40 Hz
Range	2cm-400cm

C. To determine toxicology

A naturally occurring methanol gas detector (MQ4) is used in the system to keep an eye out for potentially harmful gases coming from garbage cans. This sensor is very effective at detecting methane gas. Decomposition garbage, including yolks, cadavers, and decaying vegetables, is the main source of these greenhouse gases [13]. A propane gas detector is shown in Figure 5, and the MQ4 gas detector's specifications are shown in Table 3.

Fig.4: Ultrasonic Sensor HC-SR04

Figure 5. Spontaneous methane is detected by the detector MQ4

Table.3 lists the MQ4 Gas Sensor's characteristics.

Parameter	Specifications
Operating Voltage	5 Volt DC
Heater Voltage	4.8V - 5.2V
Heater Resistance	28 ohm - 34 ohm
Load Resistance	20K ohm

D. Regarding communications

We are utilizing the Global System for Mobile Communication (GSM)-based approach to connect the infrastructure to a mobile network. GSM is an open digital medium used for digital data transmission. GSM transmits data at a 9.6 kbps rate. Both voice calls and messages can be sent. In India, it operates between the frequencies of 900 and 1800 MHz. In our system, when a trash can overflows, GSM transmits one communication. In this case, GSM also offers details regarding its website. The table displays the particular SIM900A values. FIG. 6 displays the SIM900A.

Table.4: Specifications of SIM900A

Parameter	Specifications
Operating Voltage	5V - 12V
Operating Current	2 Ampere
Frequency of operation	900/1800 MHz
Operation Temperature	-40^0 C to $+85^0$C

E. Sending data through the internet

The Internet of Things (IoT) is a network of physical objects like cars, appliances, and other household items that are integrated with electronics, software, sensors, and actuators that allow them to connect, gather data, and share information [5].

Our design proposal uses HTML code to create a webpage with reports and real-time data. The GSM/GPRS module is used to send all data [14–15]. Real-time data is saved by the website into a database and is accessible when needed. It will also be put to use in the future. We have developed a single website that saves time and money when a trash can is filled. Additionally, it features a complaint box where residents may file their grievances.

Bins will occasionally be cleansed thanks to this method. Admin can verify the state of the trashcan electronically if any complaints are made. We have an administrator login area on the site where a worried user may sign in as an administrator. He has access to all of the dustbins' data. There is another part of this page where the most recent news is shown. The website features the most recent news.

RESULT AND DISCUSSION

The global positioning system (GPS) module and microcontroller are fully connected. It is operational and sends SMS messages when it fills up or the level of toxicity rises. Every three hours, data is sent to the website.

Our concept was initially put into practise on Proteus, and subsequently it was simulated on a single board. The Arduino IDE is used for programming. The software is run on a PC with an AMD A4-3330MX APU running at 2.20 GHz and 2 GB of RAM. The necessary criteria are all met, and the outcome you want is obtained.

The message "Your trash can is full, situated at MLVTEC, Azad Nagar, Bhilwara No-001, or toxicity" is sent through SMS when a sound sensor identifies a distance of fewer than ten centimeters or a gas detector identifies an elevated level of poison.

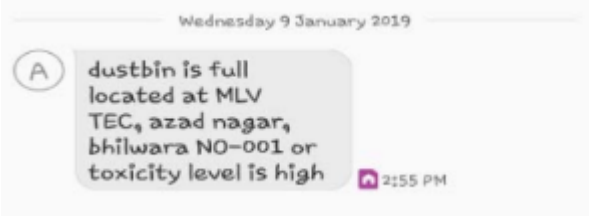

Figure 7. Snapshot of a received text

This site's development was centered on garbage can observation. It possesses a few specific qualities:

• Complaint counter

The news feed

• Login to Admin

• Details about dustbins using information via air and acoustic detectors as well as dates and times

• The administrator may see the grievances that include names or mobile phone details.

The website's home page is seen in Fig. 8:

On the website that admin has access to, there is data in the trash can. As shown in Fig. 9, this site offers the toxic level and proportion of trash filling, together with the time and hour. On the administrator's dashboard page, the admin may examine citizen grievances, containing currently, a period of time designation, and cell phone numbers, as shown in Fig. 10.

Fig.8: Homepage of website

The dustbins may also employ LED Signboards with Bio Enable gas sensors. The following features are relevant to multifunctional smart trash cans: -

1. Smart trash cans equipped with various sensors.

2. Informational signs on the street

3. An LED display system will be used for public information.

4. It may be used in train stations and uses a Wi-Fi module, so it uses little power.

5. Security Camera

6. Dustbin Tracking System, number six

7. In the future, Piezoelectric or solar panels will automatically provide the energy needed by sensors and gadgets to operate.

8. Rather than purchasing new waste containers, this device may be installed in currently used trash cans.

Fig.10 displays the dustbin as it now stands. In the table, a comparison of several projects is displayed.

Table.5: Comparison of Projects

S. No.	Name of the existence Project	Author name	Level Sensor	Toxicity Sensor	Web/ App support
1.	Implementing of Smart Waste management System Using IoT	P Haribabu et al. [2]	Present	Absent	Present
2.	Smart Garbage Monitoring and Clearance System	S. Vinoth Kumar et al. [4]	Present	Absent	Present
3.	IoT Based Solid Waste Management System for Smart City	Krishna Nirde et at. [5]	Present	Absent	Present
4.	Dissipation of Waste Using Dynamic Perception and alarming System	Imteaj A et al. [6]	Absent	Absent	Present
6.	Autonomous Smart Waste Collection System	Shujatullah Khan et al. [9]	Present	Absent	Present
7.	**(Our Proposed System)**	-----	**Present**	**Present**	**Present**

In fig.09, our suggested approach is displayed.

Fig.09: Smart Dustbin

This concept may be executed in many other locations, including parks, train stations, bus stops, and historical monuments, among others. Future train stations and bus stops will all have Wi-Fi access, making Wi-Fi hotspot capabilities available in place of GSM modules in smart trash cans.

We have one trash can; however, numerous trash cans can be used with various IDs, so they may be monitored easily from anywhere in the world. The message should be delivered to the appropriate person who is in charge of cleaning the trash can in accordance with the unique ID.

CONCLUSION

This approach makes it easier for residents and the municipal corporation to manage garbage and periodically check the trash can. Smart systems use messages to indicate when a trash can is full, saving the municipal corporation time, fuel, and money. Since there was an issue with verifying the dustbin's real-time state, it won't be cleaned for a while. Therefore, this issue is resolved in this project, and an appropriate database is administered online. The municipal corporation will operate effectively in this fashion. The public has a single complaint desk where they can file a grievance.

REFERENCES

[1] Jain A, Bagherwal R, "Design and implementation of a smart solid waste monitoring and collection system based on Internet of Things" in 8th International Conference on Computing, Communication and Networking Technologies (ICCCNT), 2017Jul 3 (pp. 1- 5), IEEE.

[2] Haribabu P, Kassa SR, Nagaraju J, Karthik R, Shirisha N, Anila M, "Implementation of a smart waste management system using IoT" in International Conference on Intelligent Sustainable System (ICISS) (pp. 1155-1156), IEEE.

[3]Ravale U, Khade A, Patel N, Chaure S. "Smart Trash: An Efficient Way for Monitoring Solid Waste Management"in2017 International Conference on Current Trends in Computer, Electrical, Electronics and Communication (CTCEEC) 2017 Sep 8 (pp. 1135-1137). IEEE.

[4] Joshi J, Reddy J, Reddy P, Agarwal A, Agarwal R, Bagga A, Bhargava, "Cloud computing based smart garbage monitoring system" in 3rd International Conference on Electronic Design (ICED), 2016 Aug 11 (pp. 70-75), IEEE.

[5] Kumar SV, Kumaran TS, Kumar AK, Mathapati M, "Smart garbage monitoring and clearance system using internet of things" in IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), 2017 Aug 2 (pp. 184-189), IEEE.

[7] Nirde K, Mulay PS, Chaskar UM, "IoT based solid waste management system for smart city" in International Conference on Intelligent Computing and Control Systems (ICICCS), 2017 Jun 15 (pp. 666-669), IEEE.

[8] Imteaj A, Chowdhury M, Mahamud MA, "Dissipation of waste using dynamic perception and alarming system: A smart city application" in International Conference on Electrical Engineering and Information Communication Technology (ICEEICT), 2015 May 21 (pp.1-5), IEEE.

[9] Ankitha S, Nayana KB, Shravya SR, Jain L, "Smart city initiative: Traffic and waste management" in 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2017 May 19 (pp. 1227-1231), IEEE.

[10] Vasagade TS, Tamboli SS, Shinde AD, "Dynamic solid waste collection and management system based on sensors, elevator and GSM", in Inventive Communication and Computational Technologies (ICICCT), 2017 Mar 10, (pp. 263- 267), IEEE.

[11] Khan S, Venkat S, Jayavel K. in IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI) on "Autonomous smart waste collection system using internet of things" 2017 Sep 21 (pp. 1181-1186). IEEE.

[12] Kolhatkar C, Joshi B, Choudhari P, Bhuva D. "Smart E- dustbin"in2018 International Conference on Smart City and Emerging Technology (ICSCET) 2018 Jan 5 (pp. 1-3). IEEE.

[13] Hayati AP, Emalya N, Munawar E, Schwarzböck T, Lederer J, Fellner J. "Analysis of the potential gas production of old municipal solid waste landfill as an alternative energy source: Preliminary results." inIOP Conference Series: Materials Science and Engineering 2018 Mar (Vol. 334, No. 1, p. 012031). IOP Publishing.

[14] Muruganandam S, Ganapathy V, Balaji R. "Efficient IOT Based Smart Bin for Clean Environment"in2018 International Conference on Communication and Signal Processing (ICCSP) 2018 Apr 3 (pp. 0715-0720). IEEE.

[15] Rohit GS, Chandra MB, Saha S, Das D. "Smart Dual Dustbin Model for Waste Management in Smart Cities"in2018 3rd International Conference for Convergence in Technology (I2CT) 2018 Apr 6 (pp. 1-5). IEEE.