



# **A Review on Internet of Things based Garbage Management System**

**<sup>1</sup>G. Arunalatha, <sup>2</sup>R. Abiramy, <sup>3</sup>S Kavyavarshini,  
<sup>4</sup>C. Krishnakumar, <sup>5</sup>A Sushmmita,**

<sup>1</sup>Assistant Professor, Department of Computer Science and Engineering,

Perunthalaivar Kamarajar Institute of Engineering and Technology (PKIET), Karaikal. Puducherry

<sup>2,3,4,5</sup> B.Tech (CSE), Perunthalaivar Kamarajar Institute of Engineering and Technology (PKIET),

Karaikal. Puducherry, Email: vigneshgayu1121@gmail.com

## **ABSTRACT**

Smart city is an application of IoT to decrease the griminess, nastiness produced by the dustbins that will be controlled by using IOT garbage monitoring system to keep our city clean and neat. In many cities the dustbins were overloaded and it causes viral diseases. To avoid these, smart dustbins can be used in which GSM board send message by detecting the level of garbage with the help of Infrared Rays in the dustbin. The hungry stray animals for e.g. –dogs, cows, cats etc. will eat the overflowed garbage which contain plastic, toxic medicine etc. And it will cause harm to their health. The main purpose of the system is to reduce garbage, human efforts to make smart city.

**Keywords:** *Garbage, IoT, sensor, GSM, GPRS.*

## **INTRODUCTION**

Internet of things (IoT) is a communication technology where everyday life objects will be equipped with a microcontroller and communication protocol. One well-known product of IoT is the smart city, which can be defined as a city with smart technology, smart people, and smart collaboration. IoT shall transparently and seamlessly incorporate a large number of heterogeneous end systems while providing open access to select subsets of data for the development of a plethora of digital services. One major topic within the smart city is smart waste management. When it comes to waste management systems, the communication distance between the waste collection center and the waste collection point is a major factor in determining the system's effectiveness.

Waste management is a costly operation as it needs large number of resources and labor. The waste management systems can be improved by setting up the recyclable bin and launching the 3Rs method (recycle, reuse and reduce). A study on public awareness of recycling activities in Kota Bharu, Kelantan Malaysia shows that only 31.8% of the total of 384 participants were involved in recycling. This indicates that the methods taken previously were not effective and that a smart waste management system needs to be developed to replace the existing techniques.

The IoT can improve the existing waste management system. Sensors implementation in the waste bin together with IoT connectivity allow for real-time monitoring, which is absent in the existing waste management system. Data such as filling level, temperature, humidity, and any necessary data can be collected from the sensors. These data can then be transferred to the cloud for storage and processing. The processed data can then be used to study and access the limitation of the existing waste management system and therefore improve the system's efficiency as a whole. IoT application in the waste bin is one step towards a smart city.

In addition, deep learning has provided state-of-the-art solutions for comprehensively understanding human behaviors. With the development of deep learning and image processing algorithms, the classification of waste can be carried out with higher accuracy and in a shorter time. Classification of waste is a crucial step before the separation of waste can be performed. A deep learning method such as a convolutional neural network allows for the extraction of unique features from the image and then classifies them into each class with high accuracy. Challenges in achieving sustainable waste management. Insufficient technologies and facilities due to the increasing rate of waste generation have resulted in the failure to cope with landfilling. The lack of a recycling market has also hindered the effectiveness of waste recycling implementation. Waste minimization is a costly operation, the lack of funds among industry practitioners has resulted in a reluctance to apply proper waste management techniques

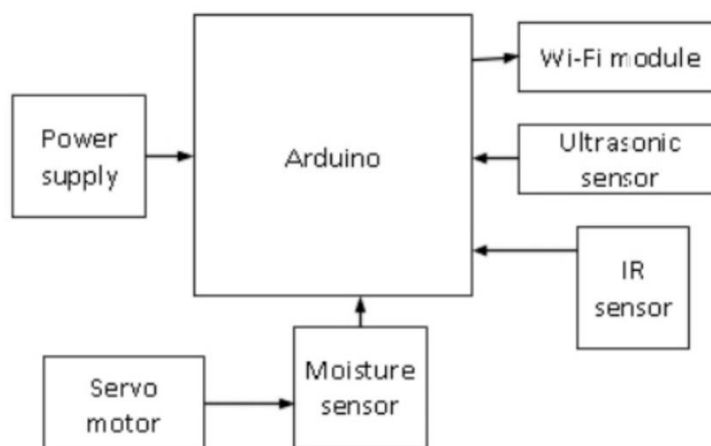


Fig.1 Block Diagram of Garbage Management System

### GARBAGE MANAGEMENT SYSTEM

Every smart bin is equipped with ultrasonic sensors which measure the level of dustbin being filled up. The container is divided into three levels of garbage being collected in it. With its continuous use the levels get filled up gradually with time. Every time the garbage crosses a level the sensors receives the data of the filled level. This data is sent to the garbage analyzer as instant alert message using GSM module. Every message received at the garbage analyzer is saved which is further used for the process of predictive modelling. The data received at real time is used by the application interface for checking the filled level. The data received is saved in the database keeping all its attributes. A history of data collected in months is used by the department of data analysis for prediction and report making. The application interface displays the real time level to the garbage



analyzer and it directs the garbage collector to collect the garbage to avoid overflow. The prediction model predicts the time in which the every level of container will be filled in future. This helps in saving resources and time of the waste management system and work is performed in more efficient manner.

The smart operating system enable two way communication between the dustbins deployed in the city and service operator. Therefore the focus is only on collection of route based fill level of the containers. The sensors installed in the containers provide real time information on the fill level. This information helps determine when and where to prioritise collection. In this way both service providers and citizens benefit from an optimized system which results in major cost savings and less urban pollution. Reduces the infrastructure (trucks, containers), operating (fuel) and maintenance costs of the service by upto 30%. Applying this technology to the city optimizes management, resources and costs, and makes it a “SMART CITY”. It keeps the surroundings clean and green, free from bad odour of wastes, emphasizes on healthy environment and keep cities more beautiful Reducing manpower required to handle the garbage collection.

### COMPONENTS

**Servo Motor:** A Servo motor is an electrical machine used to rotate or push an object with great precision. It is a simple motor that runs through the servo mechanism.

**Custom Made Moisture Sensor:** The moisture sensor uses capacitance which is used to measure dielectric permittivity of the surrounding medium. A voltage is created proportional to the dielectric permittivity by the sensor. The sensor calculates average water content over the entire length of the sensor.

**Infrared Sensor:** An Infrared sensor emits or detects infrared radiation to sense certain characteristics of its surroundings. Infrared sensors are also capable of measuring the heat being emitted by an object and object and detecting motion.

**GSM Modem:** GSM/GPRS module establishes communication between a computer and a GSMGPRS system. Global System for Mobile communication (GSM) is used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. It will send SMS to the person whose number has been saved in sim which is already inserted in GSM board.

### LITERATURE SURVEY

An efficient technique to separate the waste easily that has been designed [1]. This technology focuses on managing waste effectively. This will be helpful to the society at primary level for segregating waste initially as it will make the process easy and less time consuming.

The main issue in the waste management is that the garbage bin kept at public places gets overflowed well in advance before the starting of the next cleaning process. It in turn produces various hazards such as ugliness and bad odour to that place which may be the root cause for various diseases. To maintain public cleanliness and health a smart garbage system [2] is developed. This process is done by the ultrasonic sensor interfaced into the Arduino UNO to check the level of garbage filled in the dustbin and sends the alert message to the municipal web server if garbage is filled. After the dustbin is cleaned, the driver confirms the task of emptying the garbage with the use of RFID tag. The RFID is a technology used for verification process and it also enhances the smart



garbage alert system by providing automatic identification of garbage filled in the dustbin and sends the cleaning status to the server. The whole process is done by an embedded module embedded with RFID and IOT. By combining Internet of Things (IoT) and Artificial Intelligence (AI) [3], the waste management system can be replaced with smart sensors integrated into the system to perform real time monitoring for better waste management. A smart waste management system is developed using LoRa communication protocol and TensorFlow based on deep learning model. LoRa is used to send the sensor data and real time object detection and classification is done by TensorFlow. The bin contains several compartments to separate the waste materials including metal, paper, plastic and general waste compartment are controlled by the servo motors. Object detection and waste classification is performed by the TensorFlow framework. This object detection model is trained with images of waste to generate a frozen inference graph used for object detection which is done through a camera connected to the Raspberry Pi 3 Model B+ as the main processing unit. Ultrasonic sensor is integrated into each waste compartment to check the filling level of the waste. GPS module is embedded to monitor the location and real time of the bin using LoRa communication protocol. RFID module is used for the purpose of waste management personnel identification.

In [4], the garbage management system separates the waste into three types such as metallic, wet and dry waste. This system is cost effective and productive. The wastes are detected by the corresponding sensors and segregated into the bins. The PIC microcontroller is programmed with Embedded C.

In most of the cities, the overflowed garbage bins creates an unhygienic that will lead to the different types of unnamed diseases. This will degrade the standard of living. To avoid all such situations this paper gives a clear picture of IOT based garbage monitoring system to keep environment clean and safe. The IOT based Garbage monitoring system [5] is a innovative technique which help to keep the cities clean. This system monitors and checks the garbage bins and gives information about the level of garbage collected in the garbage bins through web page. It also indicates the status of toxic gas formation inside the garbage bin and the weight of the bin. For this, the system uses ultra-sonic sensor placed over the bins to detect the garbage level and compare it with the level of the garbage bin's depth. The system makes use of Advanced Virtual Reduced (AVR) Instruction Set microcontroller, Organic Light Emitting Diode (OLED) screen, Global system for mobile communication (GSM) modem for sending data and a buzzer. The system uses a solar cell and battery for power. The Organic Light Emitting Diode (OLED) screen is used to display the status of the level of the garbage collected in the bins and the web page shows the status to the user. The web page represents a graphical view of the bins. The display indicates the condition of the trash stage. The buzzer is ON when the level of garbage crossed the target.

Monitoring system [6] monitors the garbage bins using ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system uses Arduino family microcontroller, LCD screen, Wi Fi modem for sending data and a buzzer, GSM Ultrasonic Sensor. IOT Based Smart Garbage Monitoring System consists of dustbins that are interfaced with microcontroller based system embedded with Ultra sonic sensors with wireless systems. A network is established using wireless sensors, Sensors sends a alert message to the nearest vehicle driver if the level of garbage crossed the arget level. The model consists major three modules namely Sensor Module, Communication Module, and Analysis and Monitoring Module.



IOT Based Smart Garbage Monitoring and Air Pollution Control System[7], in which system monitors the garbage bins and informs about the level of garbage via a web page. It shows the block diagram of proposed system. In this system two ultrasonic and two gas sensors are used for level of garbage and harmful gases in the air respectively. Sensors are connected to the AVR family microcontroller (ATmega328) which is interfaced with LCD display which shows the status of bins and Wi-Fi module (ESP8266) is used to transmit data for webpage applications, which is a self-contained SOC with integrated TCP/IP protocol stack.

### CONCLUSION AND FUTURE WORK

Smart dustbin helps us to reduce the pollution. Many times garbage dustbin is overflow and many animals like dog or rat enters inside or near the dustbin and creates a bad scene. This garbage management system can avoid such situations by sending the alert message to the cleaning vehicle instead of the contractor's office. It helps to detect the waste level inside the garbage bins and transmit the information through the GSM modem by SMS. Real-time data transmission and access takes place and it avoids the overflows of garbage bins.

### REFERENCES

- [1] Balakrishnan, Kavya & Swathy, Rosmi & T D, Subha. (2016). Automatic Waste Segregator and Monitoring System. Journal of Microcontroller Engineering and Applications.
- [2] Razdan, Anuj & Alam, Mehtab & Khan, Ihtiram. (2021). Smart Garbage Monitoring System using IoT. SSRN Electronic Journal. 10.2139/ssrn.3902056.
- [3] Sheng, Teoh & Shahidul Islam, Mohammad & Misran, Norbahiah & Baharuddin, Mohd Hafiz & Arshad, Haslina & Islam, Md. Rashedul & Chowdhury, Muhammad & Rmili, Hatem & Islam, Mohammad. (2020). An Internet of Things Based Smart Waste Management System Using LoRa And Tensorflow Deep Learning Model. IEEE Access. PP. 1-1. 10.1109/ACCESS.2020.3016255.
- [4] V, Sowndharya & P, Savitha & S, Hebziba. (2019). Smart Waste Segregation and Monitoring System using IoT. International Research Journal of Multidisciplinary Technovation. 1. 1-10. 10.34256/irjmt1921.
- [5] Patole, Deepti & Panchal, Darshan & Sampat, Krishna & Nagare, Saurabh. (2018). IoT based Garbage Monitoring System. International Journal of Computer Applications. 182. 11-14. 10.5120/ijca2018917515
- [6] Monika K A, NikithaRao, Prapulla S B and Shobha G, Smart Dustbin-An Efficient Garbage Monitoring System, International Journal of Engineering Science and Computing, Volume 6 Issue No. 6, June 2016, 7113-7116.
- [7] Parkash and Prabu V, IoT Based Waste Management for Smart City, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 2, February 2016, 1267-1274.