Location-Based Garbage Management System- An IoT Application

[1]Dr. M.S. Chaoudhari, [2]Ms. S. H. Chaflekar, [3]Shrutika Rajurkar, [3]Ankita Jarile,
[3]Juhi Chavhan, [3]Prajwal Wankhede, [3]Yash Patil
[1]Head of Department, Department of Information Technology, Priyadarshini Bhagwati College of Engineering,
Nagpur, Maharashtra, India
[2]Assistant Professor, Department of Information Technology, Priyadarshini Bhagwati College of Engineering,
Nagpur, Maharashtra, India
[3]UG Student, Department of Information Technology, Priyadarshini Bhagwati College of Engineering, Nagpur, Maharashtra, India

Abstract:- Ensuring a clean, pollution-free society means dealing with garbage properly. Incorrect disposal harms the environment and health. You might have seen bins overflowing in cities. IoT can help by checking bin status. We suggest a smart dustbin that works automatically using IoT and sensors. Regular bins need foot presses and tracking to avoid overflow. Our smart dustbin handles this alone. It detects the distance and opens without touching. It also uses an ultrasonic sensor to measure garbage levels and signals when it's getting full. The system then alerts the garbage collector online, so they know when to empty it. This keeps things clean and efficient through smart waste management.

Keywords:- Internet of Things (IoT), Arduino Uno Board, GSM Modem, GPS Module, Ultrasonic Sensor.

I. INTRODUCTION

A smart city is home to many people, and with a growing population, managing garbage has become a major challenge. Traditional garbage collection systems have failed to keepup with the increasing waste volume, leading to overflowing garbage bins and unhygienic conditions.

The system we suggest offers an information technology-driven approach to waste collection, enhancing accessibility, optimizing disposal planning, and concurrently gathering data on garbage generation. The nation is expanding, yet there's a lack of public knowledge about managing waste. In public areas, it's common to see overflowing garbage leading to pollution and disease due to breeding insects and mosquitoes. Garbage disposal is haphazard and inefficient, often causing bins to overflow.

Research shows that waste generation grows with the population. The cost of collecting solid waste is mostly wasted, around 80-95%. To create a Digital India, we must ensure a clean, healthy environment.

This paper addresses these concerns. Although IoT concepts are not new, their implementation is still emerging. Municipal waste seriously pollutes urban areas and affects people's health. Despite this, waste generation is unavoidable. Using advanced sensor design, communication protocols, and remote monitoring techniques, real-time monitoring of urban trash cans becomes feasible. The solution lies in IoT (Internet of Things), which connects devices to the internet, often controlled remotely.

Continuous garbage level monitoring provides an efficient waste management solution. When bins approach fullness, authorities receive alerts. This introduces dynamic scheduling and routing for garbage collection, an effective approach. Compared to traditional static methods, this dynamic strategy significantly reduces operational costs by minimizing waste.

II. LITERATURE SERVEY

Title of paper	Method/ Techniques used	Analysis and Observation
"IoT Based Automated Smart Waste Management System" *International Journal of Scientific Research in Science, Engineering and Technology* 2023*and Reviews,*2020.	IoT-based smart dustbin with automated lid opening via human clap detection, ultrasonic sensor for garbage level measurement, and GSM communication for remote monitoring and alerts	Proposed sensor-based smart dustbin for efficient, monitored garbage management.
"AZIGBEE GARBAGE BIN MONITORING SYSTEM WITH IoT" *E3S Web Conf. Volume 399, 2023 International Conference on Newer Engineering Concepts and Technology (ICONNECT-2023)*	The real-time monitoring system is used.	It contributes to improving operational efficiency, and a safer, cleaner, hygienic environment while lowering the management budget.
"Smart Garbage Management System" *International Journal of Scientific & Technology Research* 2022	Proposed the ultrasonic sensor for detection of garbage level.	This smart dustbin gives proper service to all without delay and reduces the time
"SMART DUSTBIN USING ARDUINO NANO*" NIET Journal of Engineering & Technology (NIETJET)* 2022	The proposed method for the smart dustbin is the use of a GSM module.	Detect the level of garbage, using sensors
"Smart Trash Bin*", International Journal of Scientific Research in Computer Science, Engineering and Information Technology,* 2021	Internet of Things (IoT) based smart trash bins for efficient waste management in urban areas.	Created IoT smart bins with sensors, improving waste management and real-time monitoring.
"IoT-based Smart Garbage Monitoring" *Journal of Computing Research and Innovation (JCRINN)* 2021	IoT-based system: Arduino, Blynk, ultrasonic sensors for real-time garbage level monitoring, email alerts, user testing	IoT system using Arduino, Blynk, and sensors optimizes university garbage collection by tracking bin levels and conditions
"IoT Based Smart Dustbin" *International Journal of Scientific & Technology Research* 2020	We are using Arduino Nano to execute the code to open the lid and wait while using an ultrasonic sensor for sensing.	Developed a software name Blynk to control the operation
"Smart dustbin based on IOT" *International Journal of Engineering & Technology* 2018	The ultrasonic sensors are used to identify the rubbish level in clean canister and dustbin level data.	Used multiple sensors to detect garbage level and display on led
"Garbage Management System for Smart City" *International Journal of Engineering Research & Technology (IJERT)* 2017	The ultrasonic sensors are used to identify the rubbish level in clean canister and dustbin level data.	Developed an application which updates the level of garbage and sends a notification to the garbage collector
"Garbage management of smart city using IoT" *International Journal of Research in Science & Engineering* 2017	IoT technology, ultrasonic sensors, and Wi-Fi modules for garbage level monitoring and notifying officials.	The sensors are used which monitor fake reports to reduce corruption.

III. PROPOSED METHODOLOGY

➢ Smart Bins: Smart bins equipped with IoT devices enable automatic detection of garbage volume and real-time monitoring of fill level, reducing garbage overflow and minimizing collection costs.

➢ Fleet Management System: The fleet management system helps track garbage trucks in real-time, allowing for optimizedroutes and reduced fuel consumption.

➢ Cloud-Based Software: The cloud-based software enables real-time monitoring and management. The software uses advanced algorithms and machine learning to enhance garbage collection efficiency and optimize the system's route and schedule.
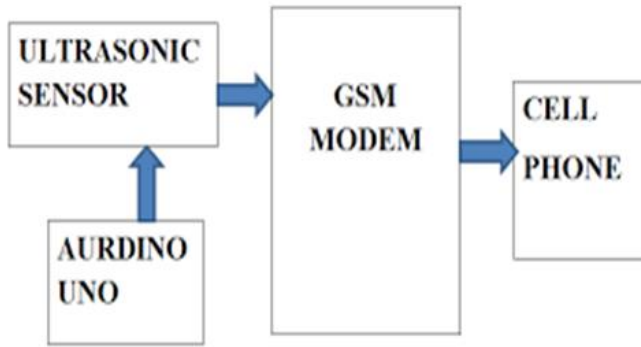
Fig 1. Block Diagram of Proposed System

Following are the Merits of proposed work:

- Reduced human labor is involved.
- It elevates the city's outlook.
- Contributes to pollution reduction.
- Effective surveillance.
- Municipalities can oversee and uphold smart city infrastructure.
- Cost-effective production.

A. Module Description:

A module refers to a component, both in terms of hardware and software or a segment within a program encompassing one or more routines.

➤ *Arduino Uno R3:*

The Arduino Uno R3 serves as a microcontroller board, relying on the ATmega328 as its core. It comes equipped with all the essential components to facilitate the operation of the microcontroller. To initiate its functionality, all that's required is a straightforward connection to a computer via a USB cable or powering it using an AC-to-DC adapter or battery.

Fig 2 Arduino Uno R

➤ *ULTRASONIC SENSOR:*

The HC-SR04 Ultrasonic Sensor is marketed as a Ranging Module as it can be accurately used for measuring distances in the range of 2cm to 400cm with an accuracy of 3mm. In order to send the 40 kHz Ultrasound, the TRIG Pin of the Ultrasonic Sensor must be held HIGH for a minimum duration of 10μS.

After this, the Ultrasonic Transmitter will transmit a burst of8 pulses of ultrasound at 40 KHz. Immediately, the control circuit in the sensor will change the state of the ECHO pin to HIGH. This bin stays HIGH until the ultrasound hits an object and returns to the Ultrasonic Receiver. Based on the time for which the Echo Pin stays HIGH, you can calculate the distance between the sensor and the object.

Fig 3. ULTRASONIC SENSORS

➤ *GPS Module:*

GPS module receivers find applications in smartphones, fleet management systems, and similar technologies to track locations or locate objects. The acronym GPS stands for Global Positioning System and is often referred to as Navigation System with Time and Ranging (NAVSTAR) GPS.

Fig 4. GPS Module

➤ *GSM Modem:*

A GSM module is a tool enabling electronic devices to exchange information with one another through the GSM network. GSM, a digital cellular communication standard, offers a framework for wireless communication among mobile devices. The GSM module functions as a specialized device, enabling the seamless transfer of data via the GSM network.

Fig 5. GSM Modem

B. Working of the Proposed System

- Monitor the dustbin's fill level to determine if it's full.
- Provide real-time status updates for each dustbin, allowing authorities to dispatch garbage collection vehicles promptly.
- Utilize an Ultrasonic sensor to gauge the waste level within the dustbins.
- Activate the red LED indicator when sensor readings surpass a specified threshold.
- Enable an Android device to identify the dustbin's location and its current status in the respective area.

IV. CONCLUSIONS

The system helps to monitor domestic wastage clearance at the proper time to avoid damage to public A web server has been established to provide authorities with information about the bins in their vicinity It uses sensors for sensing information from Bins and sending it to the workstation, which is situated at the municipal office to find the shortest path.

This project came in comfortably which is a worthy elucidation for maintaining a green environment. The proposed system is an attempt to improve the current waste collection system in India.

REFERENCES

[1]. Pavithra M, Alagu Esakkiammal N, Angel Melbha A, Aruleeswaran R, Balaji N "IoT Based Automated Smart Waste Management System" International Journal of Scientific Research in Science, Engineering and Technology 2023

[2]. Dr M Preetha1, Akshaya M, Arthima A, Mr. Akhilesh Kumar Pahade, Nusratova Khamida "AZIGBEE GARBAGE BIN MONITORING SYS- TEM WITH IoT" E3S Web Conf. Volume 399, 2023 International Conference on Newer Engineering Concepts and Technology (ICONNECT- 2023)

[3]. Parth Jajoo, Sushmit Mehta, Akshata Mishra, Vivek Solvande "Smart Garbage Management System" International Journal of Scientific and Technology Research 2022

[4]. Shudhanshu Ranjan, Shashank Singh, Dhananjay Singh, Anshuman Singh, Pavan Kumar Shukla, Vinod M. Kapse "SMART DUSTBIN US- ING ARDUINO NANO" NIET Journal of Engineering and Technology (NIETJET) 2022

[5]. Prathikshith Jain, Sowmya K, Ganesh Prasad Navada V, "Smart Trash Bin", International Journal of Scientific Research in Computer Science, Engineering and Information Technology,2021

[6]. Siti Sarah Md Ilyas1, Muhammad Amirul Rosyad Mohd Halim, Nadia Abdul Wahab, Norfiza Ibrahim "IoT-based Smart Garbage Monitoring" Journal of Computing Research and Innovation (JCRINN) 2021

[7]. Telugu Maddileti, Harish Kurakula "IoT Based Smart Dustbin", International Journal of Scientific and Technology Research 2020

[8]. L. Navya Teja, Md. Muthaharunnisa, K. Bharathi, P. Gopi Krishna "Smart dustbin based on IOT", International Journal of Engineering and Technology 2018

[9]. Asifa Indi, Nikitha Sukrithalal, Gayatri Babu, Jayshree Jha, "Garbage Management System for Smart City", International Journal of Engineering Research and Technology (IJERT) 2017

[10]. Ms. Ankita Khedikar, Ms. Monika Khobragade, Ms. Neha Sawarkar, Ms. Nikita Mahadule, Ms. Snehal Khasbage, Ms. Sonika Kolhatkar, Prof. Tikesh Harinkhede "Garbage management of smart city using IoT", International Journal of Research in Science and Engineering 2017