Sashank Pawar
A.C Patil College of Engineering,
Navi Mumbai, India

Gaurav More
A.C Patil College of Engineering,
Navi Mumbai, India

Om Lohakare
A.C Patil College of Engineering,
Navi Mumbai, India

Sarvesh Dhawade
A.C Patil College of Engineering
Navi Mumbai, India

Prof.Yasmeen Attar
A.C Patil College of Engineering,
Navi Mumbai, India

ABSTRACT

With the growing population, it is imperative that the surroundings remain hygienic and clean. The overflowing trash cans in most cities are causing an unclean atmosphere. This will also cause an increase in various diseases. As a result, living standards will decline. An effective, intelligent waste management strategy must be created to get around these problems. The rate of urbanization has accelerated in recent decades, necessitating the development of affordable urban improvement plans. Currently, brilliant urban areas are being proposed globally, using new age innovation and vital approach. A smart city is insufficient without a strong system for managing waste. This paper describes how to handle waste accumulation management by using our "Smart Dustbin" model.

General Terms

IoT (Internet of things), Sensor Networks, Wireless Communication, Real-time Monitoring, Sensor Fusion

Keywords

Garbage level detection, Waste management, Ultra-sonic sensor, Arduino(uno).

1. INTRODUCTION

The rate at which waste is produced in society is exponentially increasing across all domains, posing an increasing threat to life. Waste management is a vital but frequently disregarded topic. It takes a lot of time and effort to manage the waste. We witness poor management of the garbage disposal system as a result of insufficient time and ineffective attempts. There are numerous locations where the trash cans are visible to be full. This overflow results in an unclean and unhygienic environment. The area surrounding a trash can also contributes to air pollution levels rising. Due to dustbin pollution, humans may be exposed to germs and viruses that can cause fatal illnesses. When there is a high enough level of trash deposits in the bins in a highly populated region, more caution is required. Solid waste management is a major issue in metropolitan areas, not just in India but in the majority of other nations as well. Therefore, a system that can completely eliminate this issue or at the very least drastically decrease it has to be built. One of the most effective methods for maintaining a clean and green environment is provided by the project. Although our current prime minister proposed the notion of creating 100 smart cities throughout India a few years ago, the smart city concept is still relatively new in India. Nowadays, there are a lot of obligations that must be met in light of the impending rise in smart cities. Trash has many ill-effects on the environment, direct as well as indirect. Direct effects cause physical harm on human beings and environment. The opinions and actions that we as a society have that contribute to the issue are influenced indirectly.
Mumbai Municipal Corporation [BMC] claims that Mumbai is one of the cities that is developing the quickest.
Approximately 9,700 metric tons of trash are produced daily in Mumbai. India produces between 133 and 770 tons of solid trash per day. Additionally, according to statistics, each individual produces about 0.17 kg of garbage per day in small towns and 0.62 kilogram per day in major cities. There are 200 million residences in the US alone, and since each home has two separate bins (one for conventional trash and one for recyclable trash), there are around 1.6 billion bins overall.

In many developing countries, solid waste management is an expensive urban service that takes up about 30% of the annual budget of the Municipal Corporation. In most places, trash has been a major issue. Pictures of waste overflow are frequently seen. The population in a certain location and consumption habits are two important characteristics that are typically used to calculate the amount of rubbish waste. Even though there are thousands of dumpsters in public areas, garbage still overflows from them since they are not mechanized. The person using the bin discards the trash and does not give the overflow any thought. When the problem of garbage overflowing dustbins is resolved, there will be less unpleasant odor surrounding the bin and people will be more at ease using it. As a result, managing and collecting rubbish is turning into a very difficult task for municipal corporations. So either the bins themselves should have the intelligent capability to handle the issues in order to fix the difficulties. Therefore, one of the main areas of concentration for all initiatives related to smart living and smart cities is the intelligent and effective management of trash.

The rest of the paper will be organized as follows. Section-II gives an overview of the papers referred for the proposed system. The detailed explanation of the objectives

is given in the section-III. The proposed work of the smart dustbin are discussed in the section-IV. The overall conclusion of the smart dustbin is given in the section-V.

2. LITERATURE SURVEY

This Section provides a brief survey on the existing dust monitoring systems proposed in the literature by the researchers in the past. For instance Ruhin Mary Saji has presented a smart garbage management system using IR sensor and web browser .While Hassan et al. have developed a smart solid waste monitoring and collection system using radio frequency (RF) Communication and GSM Communication . Moreover a Novel approach to Home Automation system using Bluetooth and Arduino is suggested for Arduino Uno board . A novel approach to Garbage management using Internet of things (IoT) and GSM Communication with GUI representation using MATlab is also suggested . Moreover an IoT based intelligent bin for smart cities using IR sensor, GSM, and Internet is developed . Other methodologies used for Waste bin monitoring system are based on Zixbee and GSM communication , PIC controller and GSM , WiFi module and IoT assisted RF module and web browser .

The idea of the waste management authorities employing the Internet of Things to continuously monitor the trash cans is put forth by Krishna Nirde et al. [1]. The trash cans are dispersed throughout the city at various points. The system provides weight sensing and waste level sensing as two remote real-time monitoring features. Waste management authorities have access to a website that displays the real-time status of every bin. This uses a radio frequency transmitter to transmit the level and weight data from the Programmable Interface controller to the radio frequency receiver. The information obtained at the RF receiver is subsequently processed by the Arduino board, which then uses the internet shield to update the website with the filled bins.

There isn't an automated system in place right now to manage waste disposal. Balamurugan S. et al. [2] provides an illustration of alerting authorities when the trash cans are full. The garbage level is detected by the ultrasonic sensors in this proposed system. Through Bluetooth, this sensor node communicates the data to the server node. After employing Arduino to process the data, the server node notifies the relevant authority. This project includes additional advancements in measuring the emission of harmful gases. This enables people to comprehend the types of gases that are released into their surroundings.

The Smart Alert System, as proposed by Dr. N. Sathish Kumar et al. [3] is a waste management solution for municipalities. It notifies the municipal web server of the amount of garbage present, guaranteeing prompt dustbin cleaning. It presents an e-monitoring system made up of web- based and embedded software integrated with radio-frequency identification and Internet of Things technologies. By automatically identifying trash that has been placed in the dustbin and notifying the server that the cleanup is complete, the use of radio frequency identification technology improves the system. A Wi-Fi module is used to receive notifications in an Android application. The waste monitoring authorities receive the alerts or notifications via the app. By using an Android application, workers can remotely monitor their cleaning process, eliminating the need for manual monitoring and verification**.** Additionally, GSM technology was used for communication and Near Infrared Reflectance (NIR) spectroscopy was used by Shubham Thakker and R. Narayanamoorthi [4] to identify any type of plastic garbage. Similarly, for bin monitoring and garbage collection in [5], writers used cloud computing [6], transportation models, Geographic Information Systems (GIS), Positioning Systems (GPS), and Radio Frequency Identification (RFID). These straightforward RFID or GPS-based monitoring systems are not a wise choice to deploy across the entire city because it is expensive and time-consuming to install a GPS chip in each dustbin and enable constant access to the dustbins via an RFID card.

3. PROPOSED WORK

Efficient Waste Management: The primary objective of implementing a smart dustbin using Arduino is to optimize waste management processes. By incorporating sensors and automation, the system aims to accurately detect the fill level of the dustbin and trigger appropriate actions, such as notifying waste collection authorities or scheduling collection routes.

Real-time Monitoring: Another objective is to enable real-time monitoring of the dustbin's fill level. Utilizing sensors like ultrasonic or infrared sensors, the system continuously measures the level of waste inside the bin. This real-time data allows for proactive management of waste collection schedules, preventing overflow and optimizing resource allocation.

Minimize Overflow and Littering: The smart dustbin aims to minimize overflow and littering by providing timely alerts when the bin approaches capacity. By automatically notifying authorities or waste management personnel when the dustbin is nearing full capacity, the system helps prevent waste overflow, thereby maintaining cleanliness and hygiene in public spaces.

User Convenience: The system also seeks to enhance user convenience by providing hands-free waste disposal. By automatically opening the lid when a user approaches with waste, the smart dustbin promotes a hygienic and hassle-free waste disposal experience, encouraging proper waste management practices among users.

Data-driven Insights: Additionally, a key objective is to gather data for analysis and insights into waste generation patterns. By collecting data on fill levels, collection frequency, and other relevant metrics, the system can provide valuable insights to optimize waste management strategies. Integration with IoT Ecosystem: Finally, the objective includes the integration of the smart dustbin into a broader IoT ecosystem. By connecting the dustbin to the internet and other IoT devices, such as centralized waste management platforms or smart city infrastructure, the system can leverage data exchange and interoperability to enhance overall urban sustainability efforts. Scalability: Designing the smart dustbin system to be scalable, allowing for easy deployment and integration into various urban environments with different waste management needs and infrastructure.

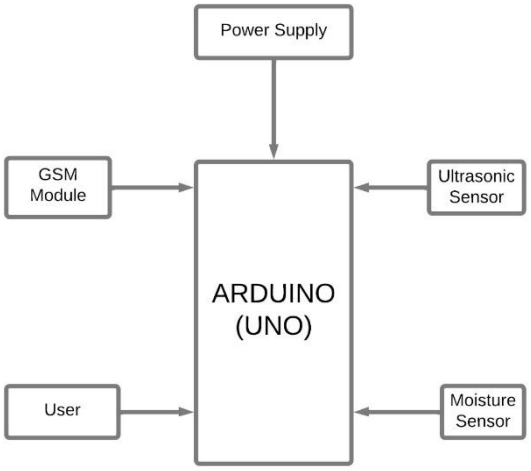
Cost-effectiveness: Striving to develop a cost-effective solution that utilizes affordable hardware components and open-source software platforms like Arduino, making it accessible for widespread adoption in both developed and developing regions.

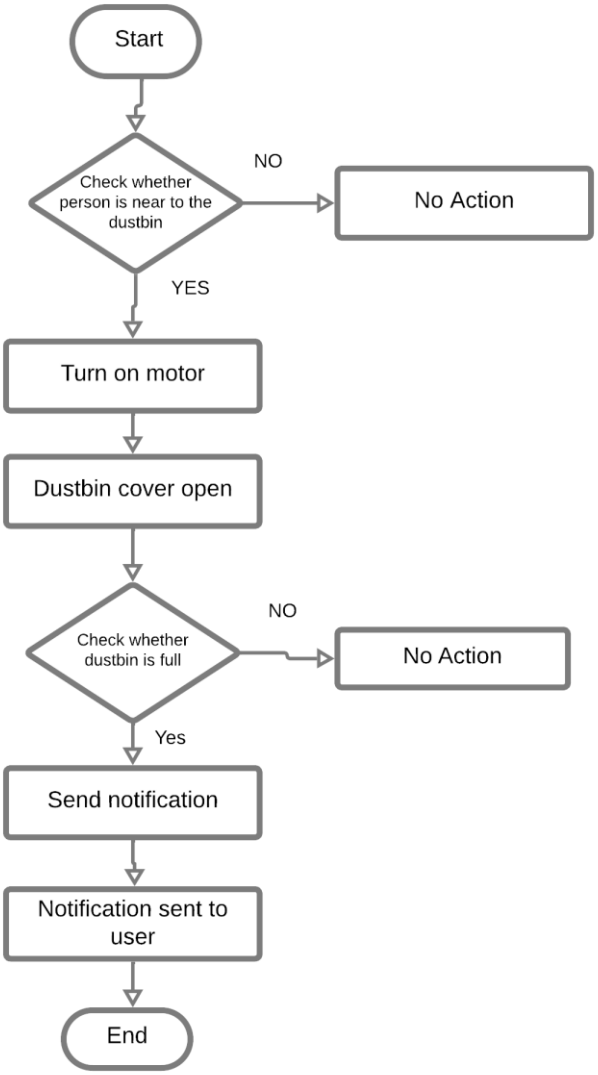
Community Engagement: Encouraging community engagement and participation in waste management efforts by incorporating features such as public feedback mechanisms, educational displays, or incentives for proper waste disposal. Environmental Sustainability: Promoting environmental sustainability by reducing the carbon footprint associated with waste collection through optimized routes and schedules, as well as encouraging recycling and composting practices Remote Monitoring and Management: Enabling remote monitoring and management capabilities, allowing waste management authorities or facility managers to access real-time data, configure settings, and receive alerts or reports from the smart dustbin system regardless of their physical location. Accessibility: Ensuring that the smart dustbin system is acces

sible to all members of the community, including individuals with disabilities, by incorporating features such as voice commands, tactile feedback, or adjustable height for ease. Data Security and Privacy: Implementing robust data security measures to protect sensitive information collected by the smart dustbin system, such as user data or operational metrics, and ensuring compliance with relevant privacy regulations . Continuous Improvement: Committing to ongoing research and development to continuously improve the functionality, reliability, and efficiency of the smart dustbin system through feedback from users, performance evaluations, and technological advancements.

4. BLOCK DIAGRAM

One sensor detects the amount of trash in the dust bin using an ultrasonic signal; if the level rises above a predetermined point, an Arduino program warns the relevant authorities. Another sensor detects any smells coming from the area surrounding the dust bin. As a result, a clean atmosphere is preserved. The user is alerted with the help of the GSM module.





The flowchart here shows us the basic work flow of the Smart Dustbin . If a person is near the dustbin within a certain distance the lid will be opened automatically otherwise it will remain closed . Then it also continuously checks whether the dustbin is full or not if the garbage in the dustbin reaches the specified level then it will notify the user that the dustbin is full and it requires to be emptied

.

5. CONCLUSION

In conclusion, the implementation of a smart dustbin using Arduino represents a significant stride towards revolutionizing traditional waste management systems. By seamlessly integrating sensors, microcontrollers, and communication modules, this innovative solution addresses various challenges associated with conventional waste disposal methods. The objectives outlined for the smart dustbin system highlight its potential to optimize waste management processes, promote sustainability, and enhance user experience.

The efficiency of the smart dustbin is evident in its real-time monitoring capabilities, which enable proactive waste management. The continuous measurement of fill levels not only prevents overflow and littering but also contributes to the overall cleanliness and hygiene of public spaces. Moreover, the system's hands-free waste disposal feature enhances user convenience, fostering positive waste management practices.

The data-driven insights provided by the smart dustbin, such as waste generation patterns and fill level analytics, offer valuable information for optimizing collection routes, reducing operational costs, and ultimately minimizing environmental impact. The scalability and cost-effectiveness of the system further position it as a viable solution for diverse urban environments, aligning with the broader goals of smart city initiatives.

Additionally, the commitment to energy efficiency, accessibility, and security ensures that the smart dustbin is not only environmentally conscious but also inclusive and protective of sensitive data. The integration of this system into the broader Internet of Things (IoT) ecosystem fosters interoperability and collaboration, contributing to the overarching vision of smarter, more connected cities.

As the smart dustbin using Arduino continues to evolve, embracing advancements in technology and incorporating user feedback, it stands as a testament to the potential of intelligent, data-driven solutions in redefining urban waste management. By marrying technological innovation with a commitment to sustainability and community well-being, the smart dustbin emerges as a promising cornerstone in the journey towards cleaner, more efficient cities.

6. REFERENCES

[1] Krishna Nirde, Prashant S. Mulay, Uttam M. Chaskar, “IoT Based Solid Waste Management System For Smart City” . ICICCS 2017

[2] Balamurugan S, Abhishek Ajith, Snehal Ratnakaran, S. Balaji, R. Marimuthu, “Design of Smart Waste Management System”. IEEE 2017.

[3] Dr. N. Sathish Kumar, B.Vijayalaksmi, R. Jenifer Prarthana, A. Shankar, “IOT based Smart Garbage alert system using Arduino UNO ”. IEEE 2016.

[4] S. Thakker and R. Narayanamoorthi, “Smart and wireless waste management,” 2015 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), Coimbatore, 2015, pp. 1-4.

[5] S. V. Kumar, T. S. Kumaran, A. K. Kumar and M. Mathapati, "Smart garbage monitoring and clearance system using internet of things," 2017 IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), Chennai, India, 2017, pp. 184-189, doi: 10.1109/ICSTM.2017.8089148.

[6] Jetendra Joshi, Akshay, Amrit Bagga, Rahul Aggarwal, Manash Deka, Urjit, and Abhinav. 2016. SmartGarbage Monitoring System. In Proceedings of the 7th International Conference on Computing Communication and Networking Technologies (ICCCNT '16). Association for Computing Machinery, New York, NY, USA, Article 7, 1–5. https://doi.org/10.1145/2967878.2967886.