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Study of IoT Based Garbage collection Using Smart Dustbins

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Abstract
Waste management has emerged as a significant issue in today's world. Improper waste disposal and mismanagement have led to environmental contamination, directly impacting human well-being. The task of separating garbage is also challenging for workers, and the lack of awareness among people often results in garbage piling up in public areas.
To encourage individuals to dispose of waste properly, this paper proposes a concept that provides a scientific and user-friendly platform. In this system, users will be rewarded in a cashless manner, utilizing digital payments and free coupons, as an incentive for their participation.The system incorporates sensors to detect the nature
(wet or dry) and weight of the garbage deposited. Based on this information, the waste will be automatically segregated into two sections. Users will receive rewards based on the weight of the garbage they dispose of. The operations of the system will be programmed using Arduino Uno micro-controller, sensors, and GSM technology.
Implementing this system will centralize waste collection and segregation, fostering effective recycling practices and mitigating environmental pollution. Additionally, this initiative aligns with the Swachh Bharat Abhiyaan scheme initiated by the government of India, allowing individuals to actively contribute to the nation's cleanliness and sanitation goals.

Keywords
Metal detector sensor, astemanagement,garbagesegerationandaccumulation,DigitalPayments,Arduino Uno ,Micro-Controller, Swachh Bharat Abhiyaan.

Introduction
Today, one of the major pollution issues we face is garbage overflow. It not only creates unhygienic conditions but also spreads a foul smell in the surroundings, leading to the spread of diseases and human illnesses. To address this problem, we propose the implementation of a project called "IoT Based Waste Management Using Smart Dustbins."

This research utilizes the concept of the Internet of Things (IoT), where objects in the environment are interconnected through wired and wireless networks, enabling them to communicate and exchange information seamlessly. Multiple smart dustbins are placed throughout the city or campus, each equipped with sensors to track the level and weight of the garbage inside. Additionally, each dustbin is assigned a unique ID for easy identification.
Garbage collection is a critical process in waste management that involves the collection, transportation, and disposal of waste materials to maintain cleanliness, hygiene, and environmental sustainability. It plays a vital role in maintaining public health, preventing pollution, and preserving natural resources.
The primary objective of garbage collection is to efficiently and effectively remove waste from residential, commercial, and industrial areas. Garbage collectors, often known as sanitation workers or waste management professionals, are responsible for collecting various types of waste, including household trash, recyclables, organic waste, and hazardous materials.

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Traditionally, garbage collection has involved manual labour, where workers physically collect and load waste into collection trucks. However, with technological advancements, modern garbage collection systems now employ advanced techniques and technologies such as automation, sensor-based monitoring, and the Internet of Things (IoT).
Efficient garbage collection processes are essential to maintaining a clean and healthy environment. Proper waste disposal minimises the risk of disease transmission, prevents contamination of water sources and soil, and reduces the impact on ecosystems. Additionally, effective waste management helps conserve resources by promoting recycling and resource recovery, thereby reducing the need for raw materials.
Despite the importance of garbage collection, it poses various challenges. These challenges include ensuring worker safety, managing increasing waste volumes, optimising collection routes, addressing environmental concerns, and adopting sustainable waste management practises.
To address these challenges, ongoing research and innovation focus on integrating emerging technologies into garbage collection systems. IoT-enabled sensors and smart waste management systems provide real-time data on waste levels, enabling optimised collection routes, reduced fuel consumption, and improved operational efficiency. Additionally, advanced sorting and recycling technologies aim to increase the recycling rate and minimise waste sent to landfills.
Understanding the practises, challenges, and advancements in garbage collection is crucial for improving waste management strategies, enhancing sustainability, and safeguarding public health. Through research and innovation, we can develop more efficient, cost-effective, and environmentally friendly approaches to garbage collection, ultimately leading to cleaner and healthier communities.

Problem Statement

Waste management is a growing concern in our society today. Improper disposal and mismanagement of waste have led to environmental contamination, directly affecting people's health and well-being. The task of separating garbage is difficult for workers, and many people are unaware of the consequences of improper waste disposal, leading to garbage piling up in public places.

Gastrointestinal infections: Improperly disposed garbage, especially food waste, attracts pests and creates unsanitary conditions. Consumption of contaminated food or water, contaminated by contact with garbage, can lead to gastrointestinal infections such as diarrhea, cholera, and dysentery.

Skin infections: Direct contact with contaminated garbage waste can lead to skin infections and wounds. Sharp objects or contaminated materials in the garbage can cause cuts, abrasions, or puncture wounds, increasing the risk of infections such as tetanus and cellulitis.

Allergies and respiratory sensitization: Decomposing organic waste produces mold, fungi, and other allergens that can trigger allergies and respiratory sensitization in individuals who are susceptible. These conditions can lead to allergic rhinitis, asthma attacks, and other respiratory allergies.

Objective

1. Designing and building an IoT-based garbage collection and segregation machine that provides immediate rewards based on the weight of the disposed garbage.
2. Creating an innovative system using Arduino programming to centralize garbage collection and discourage improper waste disposal.
3. Developing a mechanism to separate dry waste from biological waste.
4. Designing and manufacturing a tilting mechanism with a load cell to accurately separate and weigh the waste.
5. Implementing a user-friendly interface for easy interaction and input.
6. Integrating sensors to detect and handle different types of waste effectively.

7. Incorporating a communication system to send notifications and updates to the users and concerned authorities.
8. Ensuring the system promotes hygiene and reduces the risk of diseases by incorporating features like automatic sanitization.
9. Providing a reliable and efficient garbage management solution for public spaces, communities, or campuses.
10. Contributing to the larger goal of promoting sustainable waste management practices and environmental conservation.

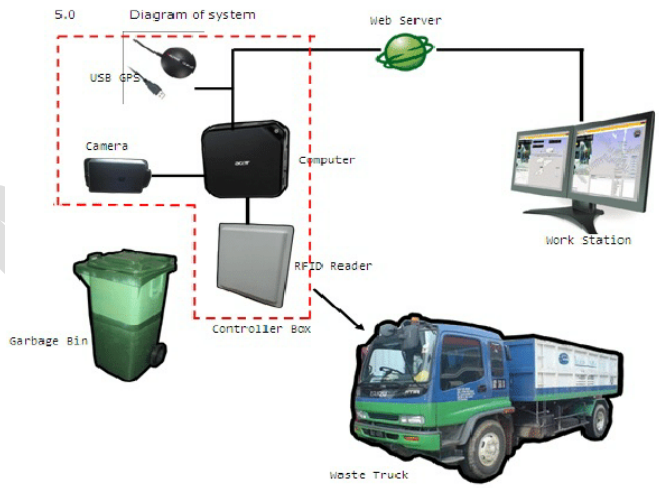
Garbage Collector

The Garbage Collector system uses an Arduino UNO microcontroller to automate the entire machine and facilitate communication between the sensors and user input. To begin the process, the user enters their mobile number using a keypad. The machine's window opens with the help of a motor, allowing the user to drop the waste inside. The garbage is directed to the central area of a tilting mechanism, which includes a weight sensor to accurately measure the weight of the garbage.

To determine the type of garbage, a soil moisture sensor and an infrared (IR) sensor are used. The moisture sensor detects any wet garbage, causing the mechanism to tilt towards the wet garbage side. The IR sensor helps cross-check the type of garbage. The tilting mechanism is mounted on a motor to facilitate the dumping of the waste into the respective wet or dry bin.
Once the garbage is disposed of, the machine sends an SMS to the user, providing them with reward points that can be redeemed. Additionally, an automatic sanitizer dispenser is available for the user to maintain hygiene. The entire process can be tracked on an LCD display.
In terms of design, the garbage collector's parts, such as the garbage bin with an inclined base, the body design with an overhead compartment for electric components, and the tilting mechanism,

Garbage Collector

are modeled using CATIA Design software. The inclined base prevents garbage from stacking up in one place, and a rectangular slot is provided to fit a roll bar handle.



Overall, the Garbage Collector system simplifies waste disposal by automating the process and providing rewards to users while promoting hygiene and proper waste management.
When a dustbin reaches its threshold limit in terms of level and weight, the sensor sends the readings along with the assigned unique ID. To tackle the issue of decaying smell, a harmless chemical sprinkler is incorporated. It activates as soon as the smell sensors detect a decaying odor, effectively neutralizing the smell.

Once a dustbin becomes full, it will no longer be accessible to users. The status of the dustbins can be monitored by the relevant authorities through an IoT-based mobile application. Upon receiving alerts about overflowing bins, the authorities can take immediate action by replacing them with empty bins.

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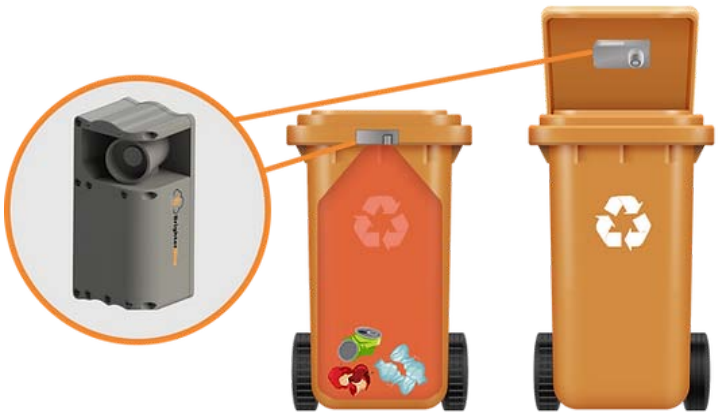

fig1. 2Alert Alarm

To enhance the functionality of the system, an alarm system can be integrated to alert nearby individuals when a dustbin is about to reach its full capacity. Additionally, a garbage metal detector can be installed to identify and segregate metallic waste from the regular garbage, facilitating recycling processes.

By implementing this IoT-based waste management system, we can effectively address the problem of garbage overflow, improve hygiene conditions, and prevent the spread of diseases. The real-time monitoring and prompt action taken by authorities contribute to maintaining a clean and healthy environment for everyone

fig1.3 Metal Detector

The information sent by the smart bin is kept in the cloud and may be accessed from any location via the internet. Garbage collection truck drivers and waste management authorities such as municipalities, corporations, etc. can both use the continually sensed data from the trash cans that is kept on a cloud server.
With the locations of the filled smart bins, the Google Maps package for Dynamic Routing is used to create a navigational map using the Shortest Path Algorithm. The truck drivers can plan a strategy to remove the rubbish from the bins using this navigation map.

2. Related Work

In the traditional waste management system (Figure 1), the corporation and the people are involved in the manual collection of waste, its dissemination, and its recycling.

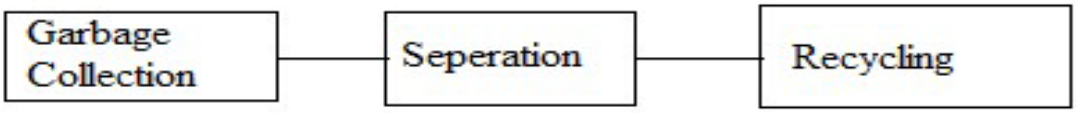

Figure 1: Traditional Waste Management System
Then slowly, they started to use technology for monitoring and collecting the waste in an efficient way. Mahajan and Chitode [4] have proposed a Zig-Bee-based waste bin monitoring system. The sensors placed in the garbage bins sense the level of garbage in the bin, and the status of the garbage bin is communicated to the garbage collection truck driver using a short messaging service. A similar approach is proposed by Gupta and Kumar [5]. They have utilised RFID and GSM technology for communicating the status of garbage bins. In the system proposed by Bhor [6], the extent of garbage in the bins is spotted with the help of sensor systems and communicated to the authorised control room through a GSM system. To monitor the required information related to garbage bins at different locations, a GUI was also developed. This will increase the efficiency of garbage collection and

management. The concept of smart bins for waste collection management for the entire city is proposed in [7]. In the SmartBin [2] model, the bin segregates the waste into dry and wet waste, and once the bin is filled, it will notify the user for clearance. Sangita and Varsaha [3] proposed the Solid Waste Collection as a Service Model, in which IoT-enabled devices are used for monitoring the garbage bins and communicate with the cloud server to notify their location.

Working 3.3

Plug the IOT board into the power source and turn on the circuit once we have our hardware and code ready. An ultrasonic sensor will signal "GARBAGE IS FULL" once a specific level of garbage has been added. after theWeight sensor alerts that the "DUSTBIN IS OVERLOADED" when the trash can is loaded with more than 40 KG. We have maintained memes that signify the 'FALL DOWN' in order to prevent situations where animals or people push the trash can down and allow trash to leak out. Therefore, these data are updated collectively via IOT in the corporate office website so that employees can dispose of it as soon as possible.

Survey Of Garbage Collector

1. Prior to designing our garbage segregator machine, we conducted a market survey to understand the existing machines available in the market. We analyzed the differences between our machine and the ones already available. Here are some key points from our survey:
2. Unique Design: Our garbage collector machine incorporates a unique design that includes an inclined base to prevent garbage from stacking in one place. This feature helps in efficient waste management and prevents overflow.
3. IoT-based Automation: Unlike some existing machines, our garbage collector is equipped with IoT technology. This allows for automated processes, such as user input through a mobile number, communication via GSM module, and SMS notifications to users. This automation simplifies the user experience and enhances convenience.
4. Weight and Moisture Detection: Our machine utilizes a tilting mechanism with a weight sensor and moisture sensor. This enables accurate segregation of waste based on its weight and moisture content. The inclusion of these sensors enhances the efficiency of waste segregation.
5. User-Friendly Interface: We have designed our machine to have a user-friendly interface. It features a 4x4 keypad for user input and a 16x2 LCD display to provide real-time information and tracking. This simplicity and ease of use make it accessible to a wide range of users.
6. Sanitization Feature: Our machine includes an automatic sanitizer dispenser, which helps prevent the spread of contagious diseases like the novel coronavirus. This feature promotes hygiene and contributes to the overall well-being of users.
7. By incorporating these unique features, our garbage segregator machine aims to address the limitations of existing machines and provide a more efficient and user-friendly waste management solution.

Conclusion

By successful implementation from design to lean manufacturing of our project, garbage will be collected at a particular place rather than being dumped in public places. Further, due to the feature of instant reward, more and more people will utilize the machine which will ultimately reducethe accumulation of garbage on roads and create awarenessamongstpeopleregarding“SwachhBharatAbhiyaan”.Efficientandeffectivesolidwastemanagementwilltakeplace and the biological waste from the machine can be used as manure by the farmers or also in landfills.

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