IoT BASED WASTE SEGREGATION SYSTEM AND LOCATION TRACKING

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ABSTRACT

With the growing population rate, the amount of waste being produced is also increasing at a very faster rate. It is also posing a very serios problem at the municipal level to manage the wastes being dumped everywhere as landfill waste. To ensure the minimal risk to the environment and human health, it is necessary to take meticulous measures when segregating and transporting waste. Segregation of waste in proper manner brings to the limelight actual economical value of the waste. The traditional method used for segregation of waste in India is through rag pickers which are time-consuming and can have adverse effects on the health of the people. Here we proposed the IoT BASED WASTE COLLECTOR AND LOCATION TRACKING which is cheap and easy solution for segregation of household waste, it is designed to segregation of household waste. It is designed to segregate the waste into four categories viz. metallic, dry and wet waste. After detection, arms are used to push the waste into respective bins. Combining GPS and shortest path to the moving garbage collecting trucks is novel. The advantage of this system is, a person need not to wait at the road side to drop his garbage bag to the truck since the end user can install the application in his smart device and observe or track the garbage collecting truck's drive path. Thought if a person misses the truck's then this application will guide the shortest path to drop the wastes to any other trucks among the group of trucks which are going around to collect garbage in a particular geographical area. In fact, public as end user to this app can be benefited with cheaper in cost and managing time in parallel.

KEYWORDS: *Waste management, IoT, waste segregation, garbage collection, environmental sustainability, route optimization, GPS tracking, mobile application, waste disposal, efficiency.*

I.INTRODUCTION

Waste management is a critical aspect of modern society, as our consumption patterns continue to grow and the impact on the environment becomes increasingly evident. Proper waste segregation is a fundamental step towards mitigating these environmental challenges. In this project, we will delve into the essential practice of waste segregation, focusing on three distinct categories: bio waste, non-bio waste, and metallic waste.

1. Bio Waste: Bio waste, also known as organic waste, encompasses materials that are biodegradable and originate from living organisms. This category includes food scraps, yard waste, and other organic matter. Effective management of bio waste is crucial not only to reduce landfill usage but also to harness its potential for composting and biogas production, which can contribute to sustainable energy generation.

2. Non-Bio Waste: Non-bio waste, often referred to as inorganic waste, comprises materials that do not biodegrade naturally. This category encompasses a wide range of items, including plastics, glass, paper, and various types of packaging. Non-bio waste poses significant challenges due to its persistence in the environment and potential for pollution. Proper segregation and recycling of non-bio waste can help conserve resources and reduce the strain on landfills.

3. Metallic Waste: Metallic waste is a subset of non-bio waste that includes all items primarily composed of metal. This category involves materials such as aluminum cans, steel containers, and discarded electronic devices. Recycling metallic waste is essential not only for conserving valuable resources but also for reducing energy consumption during the manufacturing of new metal products.

In this project, we will explore the importance of segregating these waste categories and the benefits it offers. Effective waste segregation not only minimizes the environmental impact but also creates opportunities for resource recovery and sustainable practices. By studying these waste categories in detail, we aim to raise awareness about the critical role each of us plays in reducing waste and promoting a more environmentally responsible future.

II.LITERATURE SURVEY

Palanisamy & Krishnamoorthy. Proposed a system that laid the foundation for IoT-based waste management systems. It introduced the concept of smart bins equipped with sensors and real-time data monitoring to optimize waste collection routes.

Ali et al., This author focuses on a specific application of IoT-based waste management for food waste. It presents a system that uses sensors to monitor food waste levels, reducing food waste and facilitating efficient collection.

Abo-Zahhad., This review article by Abo-Zahhad et al. provides an in-depth analysis of IoT-based waste management systems. It discusses the challenges, opportunities, and future prospects, emphasizing the importance of sustainability and environmental impact reduction.

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Sharma et al., Real-Time Waste Bin Monitoring and Collection Optimization Using IoT" (2022)., Explores real-time waste bin monitoring and collection optimization using IoT technology. The study focuses on reducing collection costs and improving service quality.

III. SYSTEM ANALYSIS AND DESIGN

Existing System:

The existing waste management systems vary across different regions and municipalities. Traditionally, waste collection has been carried out based on predetermined schedules or on-demand requests. Waste bins are typically emptied on a fixed schedule, regardless of their fill levels, leading to inefficiencies and potential overflow issues. In some areas, manual inspections are conducted to estimate the fill levels of waste bins, which can be time-consuming and prone to errors. This approach often results in either unnecessary collections or bins being left unemptied, leading to dissatisfaction among residents and inefficient use of collection resources. Furthermore, the tracking and monitoring of waste collection vehicles are often limited or nonexistent in many existing systems. This lack of visibility makes it challenging to optimize collection routes, respond to urgent requests, or monitor vehicle performance and maintenance needs.

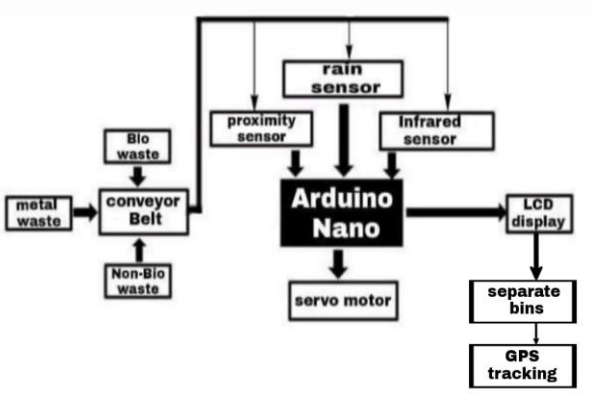

Fig 1: Block diagram of existing system

Working flow of the Existing System:
The existing waste management systems generally lack real-time data insights, efficient resource allocation, and optimized collection routes, leading to inefficiencies, increased costs, and suboptimal environmental outcomes. The proposed IoT-Based Waste Collector and Location Tracking System aims to overcome these limitations by introducing sensors to monitor fill levels, integrating GPS tracking for vehicles, and providing a centralized monitoring platform.

Advantages of the existing system:

- The Waste segregation reduces the amount of mixed waste sent to landfills, which helps extend landfill life and minimizes the environmental impact of landfilling.
- Proper waste segregation can lower the overall cost of waste management by reducing the volume of waste that needs disposal and the associated transportation costs.
- The Waste segregation projects can raise public awareness about the importance of responsible waste management and sustainable living practices.

Disadvantages of the existing system:

- Increased Infrastructure Costs: Implementing a waste segregation system requires the establishment of separate collection bins or containers for each waste category.
- Even with the best efforts, waste streams can still become contaminated. For example, non-bio waste might end up in the bio waste stream or vice versa, reducing the effectiveness of the segregation process
- Regulations and compliance requirements for waste segregation can vary by region and may change over time. Staying compliant with these regulations can be a complex and ongoing challenge.

Initialisation:
Our groundbreaking system tackles these issues head-on by utilizing cutting-edge technology to automate waste segregation and optimize collection routes. By categorizing waste into metallic, dry, and wet categories, it minimizes landfill waste and maximizes recycling potential. Additionally, the integration of GPS technology ensures efficient truck routing, reducing fuel consumption and operational costs.

Working flow:
The proposed IoT-Based Waste Collector and Location Tracking System aims to revolutionize waste management processes by leveraging IoT technology. The system comprises several components and functionalities
Smart Waste Bins: Equipped with sensors, the waste bins can detect their fill levels in real-time. This data is transmitted wirelessly to the monitoring platform.

Sensor Integration: Sensors installed in the waste bins accurately measure the fill levels and provide continuous monitoring. This eliminates the need for manual inspections and enables data-driven decision-making.

Centralized Monitoring Platform: A user-friendly interface allows waste management authorities to monitor the status of waste bins, track collection vehicles, and access real-time data analysis. The platform offers comprehensive insights, reports, and data visualization to facilitate efficient waste management.

GPS Tracking: Waste collection vehicles are equipped with GPS devices that transmit their location data to the monitoring platform. This enables route optimization, efficient dispatching, and timely responses to collection requests.

Optimization Algorithms: Advanced algorithms analyze the collected data to determine the optimal time for waste collection. This minimizes unnecessary trips, reduces costs, and ensures efficient resource allocation

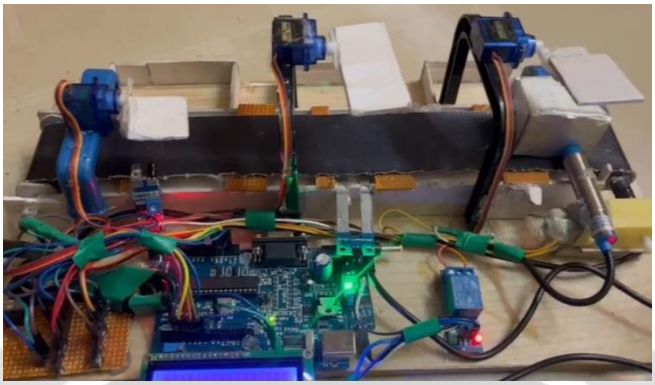

Fig 2: Hardware setup of the proposed system

Advantages of the proposed system:

- Sensors can accurately identify and sort different types of waste materials based on predefined criteria. This reduces the chances of human error in waste segregation.
- Sensors can help identify valuable materials in the waste stream, enabling better resource recovery
- Sensors maintain a consistent level of accuracy and performance, ensuring that waste segregation remains reliable over time.

Disadvantages of proposed system:

- The complexity of waste segregation systems can lead to confusion among workers or project participants, resulting in improper sorting and disposal.
- If waste is not segregated properly or if individuals are not adequately trained, there is a risk of contamination.

IV. CONCLUSION

The IoT-based Waste Collector and Location Tracking system presents an innovative and efficient approach to waste management. It streamlines waste segregation, optimizes collection routes, and enhances user convenience through real-time tracking. By reducing landfill waste, promoting recycling, and lowering operational costs, it contributes to environmental sustainability. This system not only addresses the challenges posed by increasing waste generation but also aligns with global sustainability goals. It represents a cost-effective, eco-conscious solution for municipalities and communities worldwide, ushering in a cleaner, smarter, and more responsible era of waste management..

V. FUTURE SCOPE

Advanced Analytics and AI: Future developments may involve leveraging advanced analytics and artificial intelligence algorithms to extract deeper insights and optimize waste management operations.
Integration with Smart City Initiatives: The system can be integrated into broader smart city initiatives, enabling seamless coordination with other smart systems for enhanced resource allocation and overall city operations.
Sustainability Metrics and Reporting: Future iterations can include features for tracking and reporting sustainability metrics, helping organizations monitor their environmental impact and comply with reporting requirements. Expansion of IoT Integration: The system can expand its capabilities by incorporating a wider range of IoT devices and sensors, such as temperature sensors or air quality sensors, to gather more comprehensive data for decision-making and optimization.

REFERENCE

1. Amrutha Chandramohan, Joyal Mendonca, Nikhil Ravi Shankar &Nikhil U. Baheti, "Automated Waste Segregator", Texas Instruments India Educator's Conference, 2014,IEEE publication. pp. 1-6

2. Muhammed Rafeeq, Ateequ Rahman,Mikdad, SanjarAlam."Automation of Plastic, Metal and Glass Waste materials Segregation Using Aurdino in Scrap Industry" IEEE publication, pp.1-5

3. Narendan Sivakumar, Adithyan Raj Kunwar, Sandeep Kumar Patel,Santhosh Kumar,Pushpa Mala S, "Design and Development of an Automatic Clustered Assorted Trash Segregation System,"IEEE International conference on Recent Trends In Electronics Information Communication Technology,May 20-21,2016 ,pp.1-5

4 Priya B K,T Lavanya,V samyukta Reddy,"Bin That Think's", The International Journal Of Science And Technoledge,pp.1-6

5. M.K Pushpa, Aayushi Gupta, Shariq Mohammed Shaikh, Stuti Jha, Suchithra V, "Microcontroller Based Automatic Waste Segregator" International Journal of Innovative Research in Electrical ,Electronics, Instrumentation and control engineering, Volume 3,2015

.

6. S.M Dudhal,B.S Jonwal,"Waste Segregation Using Programmable Logic Controller", International Journal for Technological Research in Engineering ,Volume 1,2016.

8. Bhuvaneshwari "Raspberry Pi-based Safety System for Women Security using IoT" , International Journal of Science and Research (IJSR), Volume 9 Issue 7, July 2020.
9. Smart Women Safety Device using IoT, International Journal of Engineering Research & Technology (IJERT), Volume 9, Issue 12.

10. Naeemul Islam, Md. Anisuzzaman , Sikder, Mohammed Rabiul "Design and Implementation of Women Auspice System by Utilizing GPS and GSM". 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE), 7-9 February, 2019

11.Prof. R.A. Jain, Aditya Patil, Prasenjit Nikam, Shubham More, Saurabh Totewar," Women's safety using IOT ". Vol: 04 Issue: 05| May2017
12. Navya R Sogi, Priya Chatterjee, Nethra U, Suma V, "SMARISA: A Raspberry Pi based Smart Ring for Women Safety using IoT", Proceedings of the International Conference on Inventive Research in Computing Applications (ICIRCA 2018), pp. 451- 454

13. G. Toney, F. Jabeen, and Puneeth S, "Design and implementation of safety armband for women and children using ARM7," in 2015 International Conference on Power and Advanced Control Engineering (ICPACE), 2015, pp. 300–303.

14. Mahajan, M., Reddy, K. T. V., & Rajput, M. (2016, March). Design and implementation of a rescue system for the safety of women. In Wireless Communications, Signal Processing and Networking (WiSPNET), International Conference on (pp. 1955-1959). IEEE.

15. N. Viswanath, N. V. Pakyala, and G. Muneeswari, "Smart foot device for women safety," in 2016 IEEE Region 10 Symposium (TENSYMP), 2016, pp. 130–134