DEVELOPMENT AND FABRICATION OF SMART WASTE SEGREGATOR BOT

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Abstract— . Dynamic raise in the quantity of waste and contemptible dumping of waste has turn out to be a matter of worry, because of the threat it causes the big damage to environment. There comes the essential role of an automated waste segregate system which avoids these troubles and also reduces the complexity of recycling. The significance and the financial importance of waste is realized only when it is segregated. Currently there are no such systems for auto segregation. As the world is in a stage of upgradation, there is one stinking problem we have to deal with and that is Garbage! In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out. This leads to the number of diseases as large number of insects and mosquitoes breed on it. A big challenge in the urban cities is solid waste management not only in India but for most of the countries in the world. Hence, such a system has to be build which can eradicate this problem or at least reduce it to the minimum level. Our project provides one of the most efficient ways to keep our environment clean and green here our aim is to build a waste segregation robot which has the ability to detect using wireless camera, pick and separate different kind of waste and dump them into the respective dustbins which will be very easy for to be recycled and keep our surroundings clean.

Keywords—*Waste collector, Robotic Arm, DustBINS, Arduino Uno , Smartphone Function etc.*

I. INTRODUCTION

Waste segregation and recycling are effective ways of reducing dumped trash. Unfortunately, these practices are not widely implemented in the country. People have been negligent when it comes to proper waste disposal, ignoring labels and throwing recyclables that can still be reused. Most of the people are unaware or ignore the fact the waste segregation and recycling can reduce cost, reduce drain in our resources, and lessen the waste being produced. Typical composition of garbage people throw in are 5.8% metals, 3.5% glass, 1.6% plastic,12.9% papers, 1.8% textiles and 53.7% biodegradables which means only the remaining 20.7% of the wastes should really be going to our landfills. In our country, recycling centers do manual process of sorting wastes so it increases human interface. For this we implement a system which minimizes human interference in the waste collecting and segregation process.

Waste management generally includes all those activities required to manage waste from its collection to its disposal. It deals with all types of waste including industrial, biological, and household. Waste management is intended to reduce the adverse effects of waste on human health, the environment, or the aesthetic. Waste segregation is done at the source level it will help smoothen the recycling process. India is in a critical condition with regard to waste generation by the increasing urban population. This degrades the pollution as well as is a threat to the health

of humans and animals living around. So it's crucial for Indians to bring a system to collect, transport, treat, and dispose of waste adequately. The opportunities to recover from such a situation are as significant as the current barriers being faced. Despite significant development in social, economic, and environmental areas, the waste management systems in India have remained relatively unchanged.

II. PROBLEM STATEMENT

• Garbage generation poses a significant global challenge that demands urgent attention. Improper waste management leads to various issues, including threats to public health and hygiene, transportation hazards, wildlife endangerment, and environmental degradation. Currently, waste cleanup is predominantly reliant on manual labor.

• However, as industries increasingly embrace automation, it is imperative to apply efficient waste management solutions. While manual labor provides employment opportunities, it also presents several challenges:

• Excessive land pollution due to inadequate waste management infrastructure and a shortage of available labor.

• Difficulty in accessing sufficient manual labor, particularly in remote areas such as railway tracks or rugged terrains.

• Safety concerns for workers in hazardous environments, including exposure to toxic substances or accidents during waste collection.

III. OBJECTIVES

The main purpose of this project is to contribute to the society by reducing the human intervention. The overall Objective is to categorize waste materials into different partitions for the disposal consideration, to take proper measures for waste handling and to promote prevention, preparing for reuse, recycling, other recovery and disposal. It mainly focuses on various options available for the disposal of waste for a brighter and more sustainable future.

• To design and fabricate a wireless waste collector robot.
• To implement waste segregation system.
• To use wireless control system using Bluetooth technology.
• To develop wireless camera monitoring system.
• To develop robotic arm based waste collector bot/vehicle system.

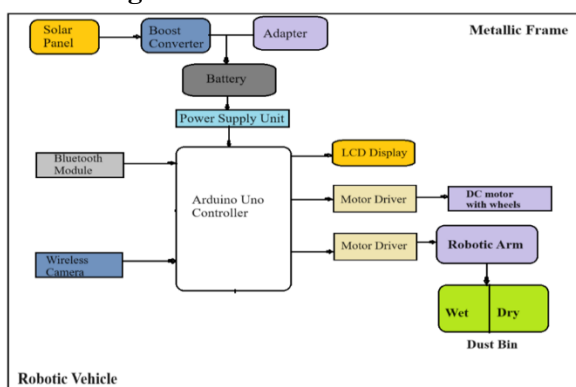## IV. PROJECT METHODOLOGY

Block Diagram

Fig. 1. Block Diagram

V. WORKING

- A waste collector robotic arm integrated with robotic vehicles and equipped with cameras represents a cutting-edge solution to address the challenges of waste management in various environments. This innovative system combines robotic technology, mobility, and visual monitoring capabilities to enhance the efficiency and effectiveness of waste collection processes.
- The waste collector robotic arm serves as the primary mechanism for collecting and sorting waste materials. It is equipped with sensors and actuators that enable it to identify, grasp, and manipulate different types of waste with precision and dexterity. The robotic arm can be mounted on a stationary platform or integrated into a mobile robotic vehicle for increased flexibility and adaptability.
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- Robotic vehicles are deployed to transport the waste collector robotic arm to different locations, such as city streets, parks, or industrial sites, where waste collection is required. These vehicles are equipped with autonomous navigation systems that allow them to navigate through complex environments safely and efficiently. They can also communicate with the waste collector robotic arm and other vehicles to coordinate their activities and optimize waste collection routes.
- The integration of cameras into the system provides real-time visual monitoring of the waste collection process. Cameras mounted on the waste collector robotic arm and robotic vehicles capture images and videos of the surrounding environment, allowing operators to remotely monitor operations and identify potential obstacles or hazards. Additionally, computer vision algorithms can be used to analyze the captured images and detect objects of interest, such as litter or debris, enabling autonomous decision-making and action by the robotic system.
- Overall, the waste collector robotic arm with robotic vehicles and cameras offers a comprehensive solution for waste management, combining advanced robotics, mobility, and visual monitoring capabilities to streamline waste collection processes, improve operational efficiency, and enhance environmental sustainability. By leveraging this technology, municipalities, businesses, and organizations can optimize their waste management operations and contribute to a cleaner and healthier environment.

VI. COMPONENTS USED

There are number of components are used for the working of the robot. These system make the motion and functioning of system possible. Different component perform different operation like actuation, transmission, control, motion etc. To perform these function following component are used which is explain in subsection.

- Adapter
- Battery
- Bluetooth module
- Arduino Uno
- Motor Driver
- DC Motor
- Robotic Arm
- Wheels
- Frame
- LCD display
- Wireless camera
- Others.

VII. RESULTS AND DISCUSSION

The implementation of Waste Collector Robotic Arm with Robotic Vehicles controlled using Bluetooth module demonstrates promising results in enhancing waste collection efficiency and automating waste management processes. The system's performance and effectiveness are discussed below:

Table 1 : Result of Waste Collection

SI. NO	TYPE OF DRY WASTE	DISCARDED OR NOT
1	PAPER	YES
2	SMALL BOTTLES	YES
3	HEAVY CARTONS	NO
4	MILK COVER	YES
5	DRY LEAVES	YES
6	CLOTHES	YES
7	TETRA PACK	NO

- Improved Efficiency:
- The integration of robotic arms and vehicles equipped with Bluetooth control allows for remote operation and monitoring of waste collection activities.
- Operators can wirelessly control the movement and functions of robotic vehicles, such as navigation, waste collection, and compaction, from a distance, reducing the need for manual intervention and increasing operational efficiency.
- Enhanced Accuracy:
- Bluetooth communication provides a reliable and responsive connection between the operator's control device and the robotic vehicles, ensuring precise control over their movements and actions.
- Real-time feedback and telemetry data transmitted via Bluetooth enable operators to monitor the status and performance of the robotic vehicles accurately, facilitating timely adjustments and optimizations as needed.
- Versatility and Adaptability:
- The Bluetooth-controlled waste collection system offers flexibility in deployment and operation, allowing it to be easily adapted to different environments and waste management scenarios.
- Operators can customize control commands and parameters to suit specific collection requirements and environmental conditions, maximizing the system's adaptability and effectiveness.
- Remote Monitoring and Management:
- Bluetooth-enabled remote control capabilities enable operators to monitor waste collection activities and vehicle status remotely, providing valuable insights into operational performance and efficiency.
- Real-time data transmission via Bluetooth facilitates proactive decision-making and intervention, allowing operators to address issues or obstacles promptly and optimize workflow processes.
- Challenges and Future Improvements:
- While the Bluetooth-controlled waste collection system offers significant advantages in terms of efficiency and flexibility, it may face challenges related to signal range limitations and potential interference in densely populated or complex environments.
- Future improvements could focus on integrating advanced communication technologies, such as Wi-Fi or cellular connectivity, to overcome these limitations and enhance system reliability and performance further.
- The Waste Collector Robotic Arm with Robotic Vehicles controlled using Bluetooth module demonstrates promising results in optimizing waste collection processes, improving operational efficiency, and advancing towards automated and intelligent waste management solutions. Continued research and development efforts are essential to address challenges and further enhance the system's capabilities for sustainable and effective waste management.

VIII. CONCLUSION

Research has uncovered several shortcomings in the current practices of municipal solid waste management, including insufficient segregation systems and low public awareness. To address these deficiencies, there is a need to emphasize machinery-based segregation and design innovative devices for this purpose. The waste sorting machine, capable of segregating wastes into lightweight and heavy materials, achieves an average overall efficiency of 55.60%. This approach has the potential to boost recycling rates and reduce the volume of waste sent to landfills. Simple in design, such waste sorting machines could provide a viable solution for municipalities grappling with waste management challenges nationwide.

At the societal level, an Automated Waste Segregator can be implemented to separate waste into dry and wet categories, handling one type of garbage at a time, including metal, wet, and dry waste. This method offers benefits such as cost reduction and resource optimization, making it a valuable solution for municipalities striving to enhance waste management practices throughout the country.

Waste management is all those activities, actions and works required to manage waste from its production to its final disposal. This project is designed such a way that a system which collects from different positions and segregates the wastes. The timing and movement of the Robotic arm are controlled by the peripheral interface controller (Arduino microcontroller and Bluetooth technology via application.

The integration of Waste Collector Robotic Arm with Robotic Vehicles controlled using Bluetooth module represents a significant advancement in waste management technology. By automating the waste collection process and providing remote control capabilities, this system offers numerous benefits including increased efficiency, reduced manual labor, and enhanced safety.

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