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GARBAGE COLLECTION ROBOT ON THE BEACH USING WIRELESS COMMUNICATION

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ABSTRACT __Current global advancement heavily relies on technology, particularly the Internet of Things (IoT), which facilitates device connectivity through cloud computing and web applications for enhanced operational efficiency. Smart cities are increasingly grappling with significant waste management challenges. This project introduces an innovative system designed to maintain cleanliness in urban environments. By employing a pick-and-place robot to collect litter from public spaces such as parks, streets, and parking lots, we aim to improve waste management efforts. Non-governmental organizations have made strides in cleaning public areas, but the initial step of gathering scattered garbage is crucial before effective segregation and disposal can occur. This paper presents a novel approach to developing a modular, scalable, and cost-effective garbage collection system. By leveraging IoT technology, we establish a constant connection between a central server and a network of autonomous waste-collecting robots. Our system aims to yield accurate results while significantly reducing operational costs, thereby minimizing the human effort required in waste collection. We propose a network of interconnected robots rather than focusing on a single unit, optimizing time, energy, and efficiency. The challenge lies in balancing accuracy, efficiency, and cost in the context of robotic garbage collection.

I. INTRODUCTION

To create greener, safer, and more efficient urban environments, the Internet of Things (IoT) plays a pivotal role. Implementing a robust waste management system is essential to

prevent the spread of diseases associated with improper waste disposal. This project proposes a smart mechanism for enhancing urban waste management practices. The IoT connects various devices, enabling remote control and monitoring. Waste generation is a pressing global issue that demands immediate attention. Inadequate waste management leads to significant problems, including health risks, transport safety hazards, wildlife endangerment, and visual pollution. Currently, waste collection primarily relies on manual labor, which presents various challenges, such as:

- Excessive land pollution and inconsistent availability of labor.
- Limited access to human resources in remote areas (e.g., along railway tracks).
- Safety risks for workers in hazardous environments.
- Insufficient resources for safely managing specialized waste, like nuclear materials.While the initial manufacturing costs of autonomous garbage collection systems may be high, their maintenance costs are minimal. Autonomous robots can efficiently handle tasks, improving safety and reaching areas that are difficult for

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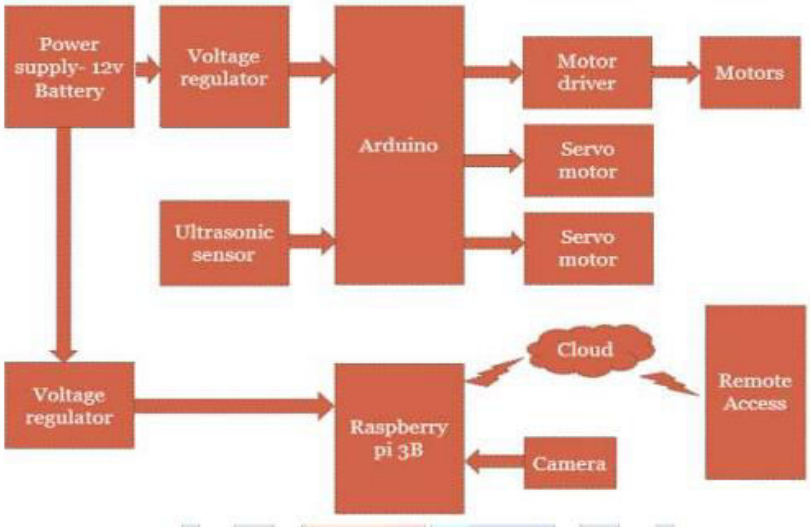
human workers. Although the production costs are a concern, our objective is to significantly reduce these expenses to facilitate widespread implementation, including integration by government agencies.

II.PROBLEM DEFINITION

As nations develop rapidly, they generate increasing amounts of waste, including electronics, plastics, and biodegradable materials. In many developing countries, waste management is a neglected issue that requires urgent attention. In metropolitan areas, the challenge of maintaining effective waste management systems is particularly daunting. This project aims to address these challenges through innovative solutions in automated waste collection.



III. LITERATURE SURVEY

1. Automatic BinBot - Garbage Collecting System using IoT

Bharathi V, Gayathri K, Jayashree S, Kiruthika D, Maheswari P

This study addresses the urgent garbage crisis exacerbated by rapid urbanization and poor governance. Traditional garbage collection relies on municipal solid waste workers (MSWWs), exposing them to health risks, including respiratory issues. To tackle these challenges, the BinBot, an automatic garbage-collecting robot, has been developed. This system autonomously collects waste from residential areas and notifies municipal authorities when full, supporting initiatives like “Swachh Bharat” (Clean India) by 2019.

2. Deep Learning Based Robot for Automatically Picking up Garbage on the Grass

Jinqiang Bai, Shiguo Lian, Zhaoxiang Liu, Kai Wang, Dijun Liu

This paper introduces a garbage pickup robot capable of detecting and collecting litter on grass using deep learning techniques for garbage recognition. The robot employs advanced navigation strategies to operate efficiently in parks and schools. Experimental results indicate a garbage recognition accuracy of 95%, and even in the absence of path planning, the robot performs comparably to traditional methods, effectively reducing the physical burden on human workers.

3. Automatic Bin Bot - Garbage Collecting System in Residential Areas and Enlightening Disposal Mechanism

Asst. Prof, J.J College of Engineering and Technology, Trichy

Similar to the first study, this research highlights the pressing garbage crisis linked to urban growth and systemic inefficiencies. The BinBot system autonomously collects waste in residential areas, communicating its status to municipalities through IoT, which enhances garbage collection efficiency and contributes to national cleanliness campaigns.

4. Garbage Collecting Robot Using IoT

Kavya C, Kokila C, Kowsalya M, Maha A, Mutharasu S

This paper discusses the necessity for robust waste management strategies amid rising population and littering issues. The authors propose a modular and scalable system for garbage collection that addresses the inefficiencies and high costs of existing methods. The focus is on the critical initial step of collecting unorganized waste, which is essential for effective waste management.

5. Waste Management by a Robot - A Smart and Autonomous Technique

Shikha Parashar, Pankaj Tomar

This research explores the challenges faced by municipal corporations in waste management. It presents the concept of a Smart Dustbin for environments like hospitals and schools, which integrates sensors and automated mechanisms for waste collection. Utilizing ultrasonic sensors to detect fill levels, the system updates a connected garbage collection vehicle, enhancing efficiency in waste management.

6. Autonomous Garbage Collector – RoboDumpster

Rama Prabha D, Sagar Mahindru, Akshat Srivastava, Nilalohita P

This study presents an infrared-based autonomous robotic arm designed for various applications, including garbage collection. The arm's capabilities allow it to navigate different environments effectively, measuring objects to either grasp or avoid them. This technology serves as a practical solution for autonomous waste collection in real-world scenarios.

BinBot Design and Operation

In this project, the design of the BinBot garbage-collecting robot employs a structured engineering approach. The initial phase involves identifying the necessary requirements, followed by analyzing these needs to determine specific components. The block diagram of these components is then integrated to achieve the desired functionality. The overall system is categorized into two main types:

1. IoT Control
2. Movement Control

Operation Categories

The BinBot's operations can be divided into two primary categories:

1. Live Video Streaming
2. Garbage Collection via Remote Access

Operational Stages

The operational process consists of the following stages:

1. Establishing an internet connection.

2. Initiating live video streaming.
3. Controlling the robot and the garbage collection mechanism remotely.

IV.CONCLUSION

This project introduces an integrated IoT-based, battery-operated system designed for efficient and cost-effective garbage collection. By analyzing existing IoT solutions, we aim to prevent the overflow of waste in public areas. The system's live video monitoring capability enhances the management and oversight of garbage collection processes. The employed technologies ensure a practical approach to monitoring and managing waste, contributing to a greener environment.

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