A proposal for designing and building a prototype of an autonomous robot project.

Computer Science & Engineering

University of Rajshahi

Submitted by

Student name: Arif Ikbal Tarik

Student ID: 2111076140

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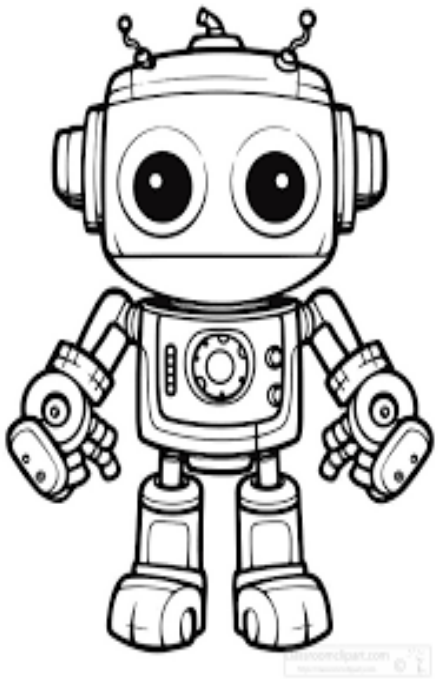

Project Advisor

Prof. Dr. Bimal Kumar Pramanik

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ABSTRACT

The proposal robot will come out from the seminar library then it will go into rooms no 120 and 122. It will walk through the room and collect waste material (like pieces of paper, unused pens, pencils, erasers, etc.). If it finds any, it will take way this put it in the bins kept outside of the room. After completing the task, it will enter the library again and stay there for the next day.

The robot's mission is to autonomously detect and gather these waste items, contributing to a cleaner and more organized environment. Upon collection, it will transport the waste materials to designated bins placed outside the rooms, promoting efficient waste disposal and recycling.

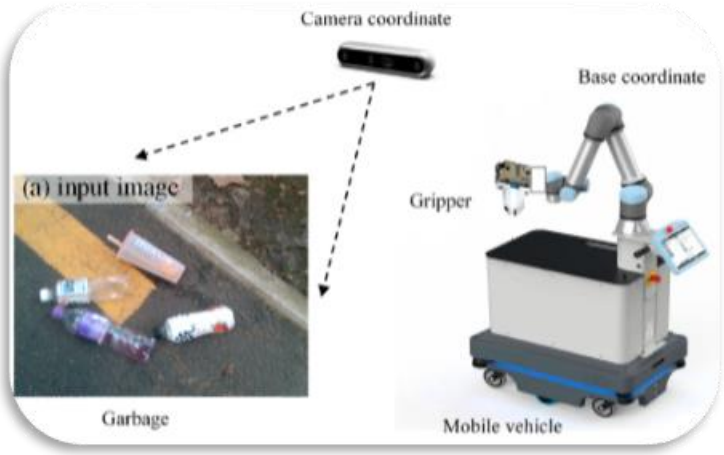


Figure 1: collecting waste.

This project embodies the potential of robotics and automation to address pressing environmental concerns while also showcasing the application of advanced technology in waste management. The robotic system will not only serve as an efficient waste collector but also stand as a testament to the capabilities of modern automation technology in enhancing our daily lives.

The robot's interaction with the librarian, where it rests and prepares for the next day's tasks, demonstrates its seamless integration into the library's operational workflow. This project signifies a significant step toward creating a cleaner, more organized, and technologically advanced workspace [1].

1.INTRODUCTION

1.1. General Description of robot

This project aims to design and build a groundbreaking autonomous robot prototype, leveraging cutting-edge technology in robotics and artificial intelligence. The goal is to create a versatile robot capable of independent navigation and intelligent task execution. Equipped with advanced sensors and machine learning algorithms, the prototype will operate safely and efficiently in various environments. The modular design ensures adaptability, with potential applications spanning industries from manufacturing to healthcare. This project represents a significant step forward in the evolution of autonomous systems, promising innovation, and efficiency across diverse sectors [2].

1.2. Literature Review/ Background Study of robotics

This project is built upon a comprehensive review of current autonomous robot systems and waste management practices. The review underscores the need for technological interventions to improve efficiency and sustainability in waste collection [2]. The project draws insights from existing robotic technologies, sensor systems, and waste management practices to inform the design and implementation of the proposed robot.

2.METHODOLOGY

2.1 Requirement Analysis

Conduct a comprehensive analysis to identify the specific tasks and challenges the autonomous robot will address. Define the operational environment, performance criteria, and user requirements to guide the design process [3].

a) **Power source:**

Batteries or power supply to provide energy for the robot's operation.

A power supply is a device or system that provides electrical energy to an output load or device. Its primary function is to convert electrical power from one form to another, ensuring that the supplied power meets the requirements of the connected devices. Power supplies are essential components in various electronic systems and are used in a wide range of applications, from powering small electronic devices to large industrial equipment.

b) **sensor:**

A sensor is a device or an instrument that detects and measures physical properties, environmental conditions, or changes in the surroundings and converts this information into signals or data that can be interpreted, displayed, or used for various purposes. Sensors are essential components in a wide range of applications, providing crucial input for monitoring, control, and automation systems.

Figure 3. Sensor

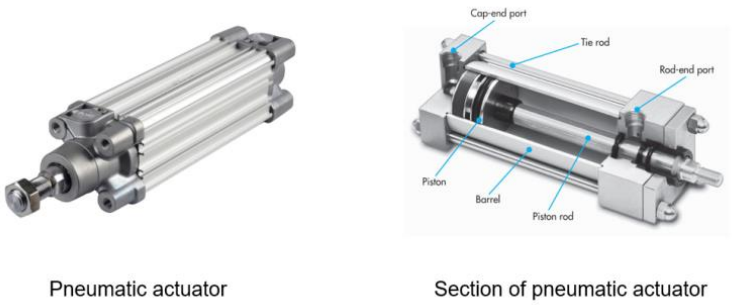
Figure 2. Power source

c) Actuator:

Motors, servos, or other devices that enable the robot to move its limbs, wheels, or other parts. Actuators can also be used for tasks like gripping objects.

d) Controller/Microcontroller:

The brain of the robot processes information from sensors and sends commands to actuators. Microcontrollers like Arduino or Raspberry Pi is commonly used.



Pneumatic actuator

Section of pneumatic actuator

Figure 4. Actuator

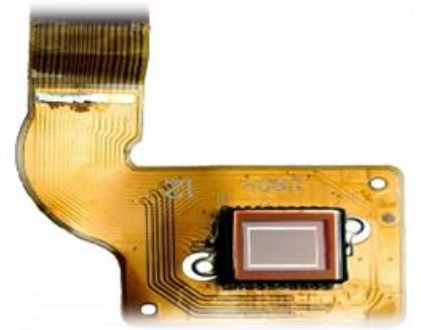


Figure 5. Controller

e) Power Distribution:

Circuitry to distribute power from the source to various components.

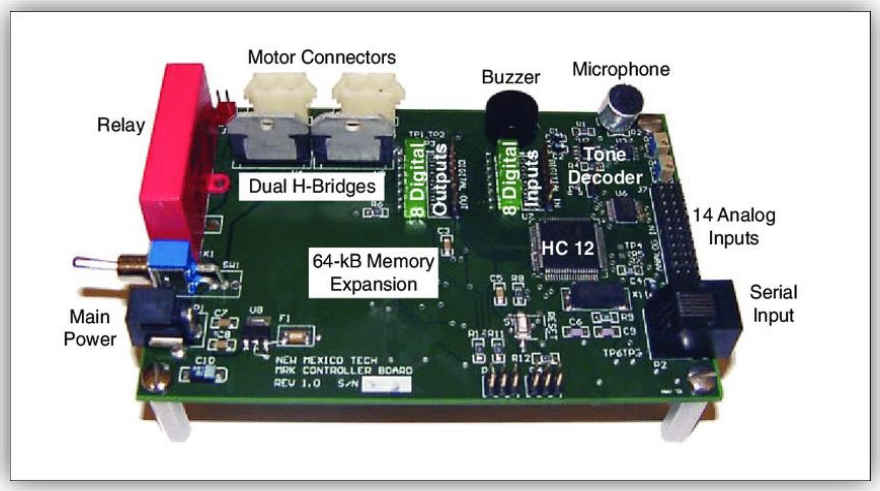


Figure 6. Control system

f) Frame/Chassis:

The physical structure that holds all the components together. This can range from a simple frame to a more complex humanoid or wheeled chassis.

g) End Effectors:

Tools or attachments at the end of robotic limbs, such as grippers, welding tools, or other devices depending on the robot's purpose.

Figure 7. End effector

2.2 Machine Learning Algorithms

Develop and train machine learning algorithms to enable the robot to learn and adapt to different scenarios. This includes object recognition, path planning, and decision-making processes to enhance the robot's autonomy and responsiveness.

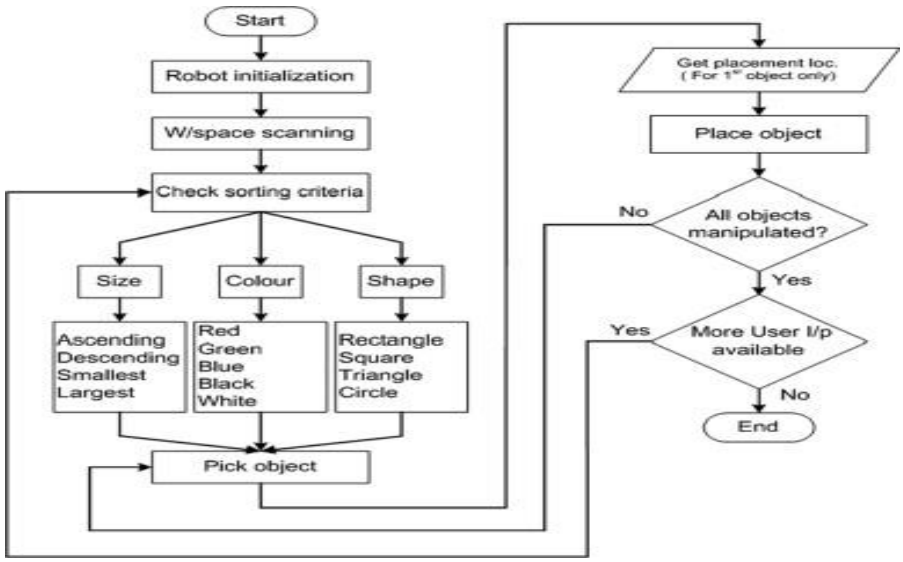


Figure 8: algorithms

2.3 Control System Design

Implement a robust control system that governs the robot's movements and actions. This system should be capable of real-time adjustments based on sensor inputs and machine learning outcomes, ensuring smooth and precise operation.

2.4 Safety Protocols

Integrate fail-safe mechanisms and obstacle avoidance algorithms to prioritize safety. Implement emergency stop features and collision detection systems to prevent accidents and ensure the robot's responsible interaction with its environment.

2.5 Modular Hardware Design

Develop a modular hardware design that allows for easy upgrades and customization. This enables adaptability to various applications and facilitates future enhancements to keep the robot technologically relevant.

2.6 Testing and Iteration

Conduct rigorous testing in controlled environments to validate the robot's functionality, safety, and performance. Iteratively refine the design based on test results, user feedback, and emerging technological advancements.

2.7 User Interface Development

Create a user-friendly interface for easy interaction and programming. This could include a web-based control panel or a mobile application, enabling users to define tasks, monitor the robot's status, and receive alerts.

3. FUNCTION OF SENSOR

A sensor is a device or an instrument that detects and measures physical properties, environmental conditions, or changes in the surroundings and converts this information into signals or data that can be interpreted, displayed, or used for various purposes. Sensors are essential components in a wide range of applications, providing crucial input for monitoring, control, and automation systems. Here are some common types of sensors and their uses [4]:

3.1 Temperature Sensor

I. Use: Measures the temperature of the environment.
II. Applications: Climate control systems, weather monitoring, industrial processes, health monitoring.

3.2 Pressure Sensor

I. Use: Measures the force applied on a surface per unit area.
II. Applications: Barometers, altimeters, industrial process control, monitoring tire pressure in automobiles.

3.3 Light Sensor (Photodetector)

I. Use: Detects the intensity of light in the environment.
II. Applications: Automatic lighting control, camera exposure control, solar panels.

3.4 Motion Sensor

I. Use: Detects movement or changes in position.
II. Applications: Security systems, gaming consoles, automatic doors, energy-efficient lighting.

3.5 Magnetic Sensor:

I. Use: Measures the strength and direction of a magnetic field.
II. Applications: Compasses, navigation systems, automotive applications.

3.6 Sound Sensor (Microphone)

I. Use: Converts sound waves into electrical signals.
II. Applications: Audio recording, voice recognition, noise monitoring.

3.7 Image Sensor (Camera)

I. Use: Captures visual information in the form of images or video.
II. Applications: Photography, surveillance, facial recognition, autonomous vehicles.

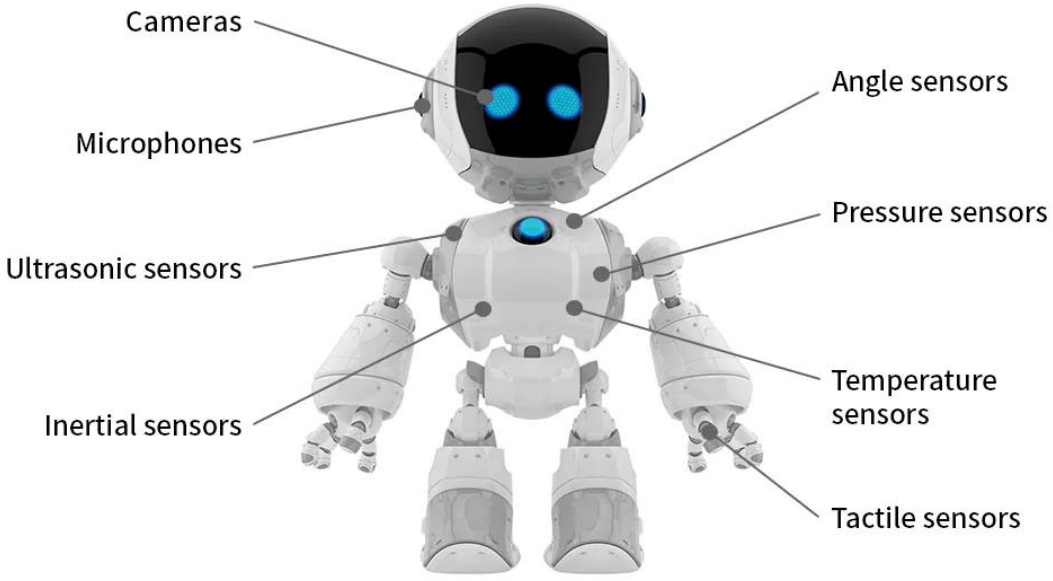


Figure 9. Sensors

4. WHY THIS ROBOT IS MORE USEFUL AND EFFECTIVE

This autonomous waste collection robot system surpasses traditional waste management practices and other robotic systems due to several key factors [5]:

- **Efficiency:** Advanced sensors and algorithms enhance waste identification and collection efficiency.
- **Adaptability:** The robot can navigate through various environments within educational institutions.
- **Positive Aspects of Building This Robot:** The development of this robot offers several benefits.
- **Reduced Manual Labor** & **cost-Effective**: Minimizes the need for manual involvement in routine waste collection. Promises long-term cost savings through efficient waste management practices.
- **Enhanced Cleanliness:** Contributes to a cleaner educational environment, fostering a positive learning atmosphere.
- **Technological Innovation:** Showcases the institution's commitment to technological advancements and sustainability.

5. THE NEED FOR THIS ROBOT

Creating this autonomous waste collection robot is essential for several reasons [6]:

- **Sustainability Goals:** Aligns with the institution's sustainability goals and environmental responsibilities.
- **Promoting Technological Advancements:** Demonstrates the institution's commitment to embracing and implementing innovative technologies.
- **Safety:** Waste collection can be hazardous due to sharp objects, toxic substances, or heavy loads. Robots can be designed to handle such materials without risking human health and safety.
- **Public Awareness and Expectations:** There is a growing awareness of environmental issues, and communities expect more sustainable and efficient waste management practices.
- **Technological Advancements:** Advances in robotics, artificial intelligence, and sensor technologies have made it more feasible to develop robots capable of autonomously navigating complex environments and performing tasks like waste collection.

6.TIME SCHEDULE

It takes a lot of time to fulfil the project. Our team has worked well for this project. The time consuming for this project are given bellow:

Table-1: Time (week)-2023

Activity	W1	W2	W3	W4	W5	W6	W7	W8	W9
Project Initiation									
Design Phase									
Implementation									
Safety and Testing									
Hardware Finalization and Optimization									
Documentation and Training									
Pilot Deployment									
Finalization and Optimization									
Project Review									
Conclusion									

7.COST ESTIMATION

Table-2: Total cost table

Name of cost	Unit	Unit price	Total (taka)
Sensor	3	5000	15000
Camera	2	2500	5000
Microcontroller	1	5000	5000
Processor	1	5000	5000
Batteries	4	2000	8000
Power system	1	5000	5000
Simulation software	1	3000	3000
Framework & tools	1	5000	5000
Testing equipment	1	6000	6000
Pilot deployment	1	10000	10000
Personal cost	1	90000	90000
Total cost			150000

8.CONCLUSION

The proposed autonomous waste collection robot system offers an innovative and effective solution for enhancing waste management in educational institutions. Through its advanced sensor technologies, robotic arms, and intelligent algorithms, the system aims to reduce manual labor, promote sustainability, and contribute to a cleaner and technologically advanced learning environment [7]. In conclusion, robotics represents a rapidly evolving field that has transformative implications for numerous aspects of our lives. The integration of advanced technologies, such as artificial intelligence, machine learning, and sophisticated sensors, has

propelled robotics into a realm where machines can perceive, adapt, and interact with the world in ways that were once relegated to the realm of science fiction.

9. REFERENCE

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