Group no.15

AI-BASED GARBAGE PICKING ROBOT

Presented by-

Rohitashva Kumawat-51
Shreya Mantri-54
Anuja Ghagre-70
Parth Bhongade-74

TABLE OF CONTENTS

INTRODUCTION

Our project introduces an Autonomous AI-Based Garbage-Picking Robot to tackle the pressing challenge of waste management. In a world where efficient waste handling is critical for environmental sustainability, our solution aims to redefine the standards. Join us as we unveil the future of waste management through innovation and technology.

PROBLEM STATEMENT

To design and develop an autonomous object-picking robot, capable of classifying objects into garbage and others, and effectively cleaning its surroundings and also for environmental cleanliness, efficiency in waste management, labor-saving in cleaning tasks.

PROPOSAL SURVEY

Paper 1

C. Mayorga et al., "GABOT: Garbage Autonomous Collector for Indoors at Low Cost," 2019 International Conference on Mechatronics, Electronics and Automotive Engineering (ICMEAE), Cuernavaca, Mexico, 2019,

(In this work we propose a proof of concept of a mechatronic system that can detect and pick up garbage on a zone using a camera and sensors.)

Paper 2

S. S. Chandra, M. Kulshreshtha and P. Randhawa, "Garbage Detection and Path-Planning in Autonomous Robots," 2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), Noida, India, 2021

This paper provides an in-depth review of such Robots and their prototypes that were developed to achieve a motive of detecting and picking trash.

Paper 3

G. Yang et al., "Garbage Classification System with YOLOV5 Based on Image Recognition," 2021 IEEE 6th International Conference on Signal and Image Processing (ICSIP), Nanjing, China, 2021

ollecting various types of garbage pictures and building detection data sets, we adopt the garbage identification and detection algorithm based on YOLO-V5 and use data enhancement to improve the robustness of the mode

METHODOLOGY

1

Process 01

This robot trash collector employs a two-pronged approach for autonomous operation. First, it leverages the power of machine learning. By connecting to Hugging Face, the robot downloads and utilizes a pre-trained visual transformer model for real-time image classification. The robot's camera captures its surroundings, and the image is fed to the model, which identifies objects as "Trash," "Plastic," "Paper," or "Not Trash."

2

Process 02

Second, the robot uses an ultrasonic sensor to measure distance. When trash is detected, the distance sensor determines if the robot is close enough for pickup (e.g., within 5 cm). If so, the grabbing mechanism is activated to collect the trash. Otherwise, the robot continues moving forward. This cycle of image capture, classification, distance measurement, and movement control allows the robot to navigate its environment, identify and collect trash, and avoid obstacles (using optional additional sensors).

WORKFLOW:

Start

1. **Load Model:**
    - Connects to Hugging Face ([Hugging Face])
    - Downloads and loads the pre-trained visual transformer model for trash classification

2. **Capture Image:**
    - Activates robot camera
    - Captures a still image of the environment

3. **Image Preprocessing (Optional):**
    - Resize image (if necessary for model input)
    - Convert image format (if necessary for model input)

4. **Trash Classification:**
    - Feed the preprocessed image to the loaded visual transformer model
    - Receive the model's output: "Trash," "Plastic," "Paper," or "Not Trash"

5. **Decision:**
    - Trash Detected:If output is "Trash," "Plastic," or "Paper":
        - Proceed to Step 6 (Distance Measurement)
    - Trash Not Detected:If output is "Not Trash":
        - Proceed to Step 8 (Move Forward)

6. **Distance Measurement:**
    - Activates ultrasonic sensor
    - Measures the distance between the robot and the detected trash

7. **Pick Up Trash (if close):**
    - If distance is less than 5 cm:
        - Activates robot's grabbing mechanism
        - Picks up the trash
        - Else (if not close enough):Proceed to Step 8 (Move Forward)

8. **Movement Control:**
    - Move the robot forward in a straight line

9. **Obstacle Detection :**
    - If obstacle detected:Implement obstacle avoidance strategy (e.g., turn left or right)
    - Else (no obstacle):Continue moving forward

10. **Repeat:**
    - Return to Step 2 (Capture Image) to continuously scan the environment for trash

End

HARDWARE COMPONENTS

- **Cam module**

A camera module used for capturing images or video footage.

- **Rasberrypi 3b+**

a single-board computer used as the main controller for the robot, providing processing power and interfacing capabilities.

- **4 Motor DC**

Direct current motors used for propulsion, typically driving the wheels of the robot.

- **L298n motor circuit driver**

An integrated circuit used to control the speed and direction of DC motors, typically used with the Raspberry Pi.

- **Ultrasonic sensor**

A sensor used for distance measurement using ultrasonic sound waves.

- **Car Chasis**

An infrared sensor used for proximity sensing or object detection.

- **3-3.7V lithium-ion battery**

Rechargeable batteries supplying power to the system, typically operating within the voltage range of 3 to 3.7 volts.

- **2 Servo motors**

A motor used for precise angular control, typically used for rotating the camera.

- **9V battery**

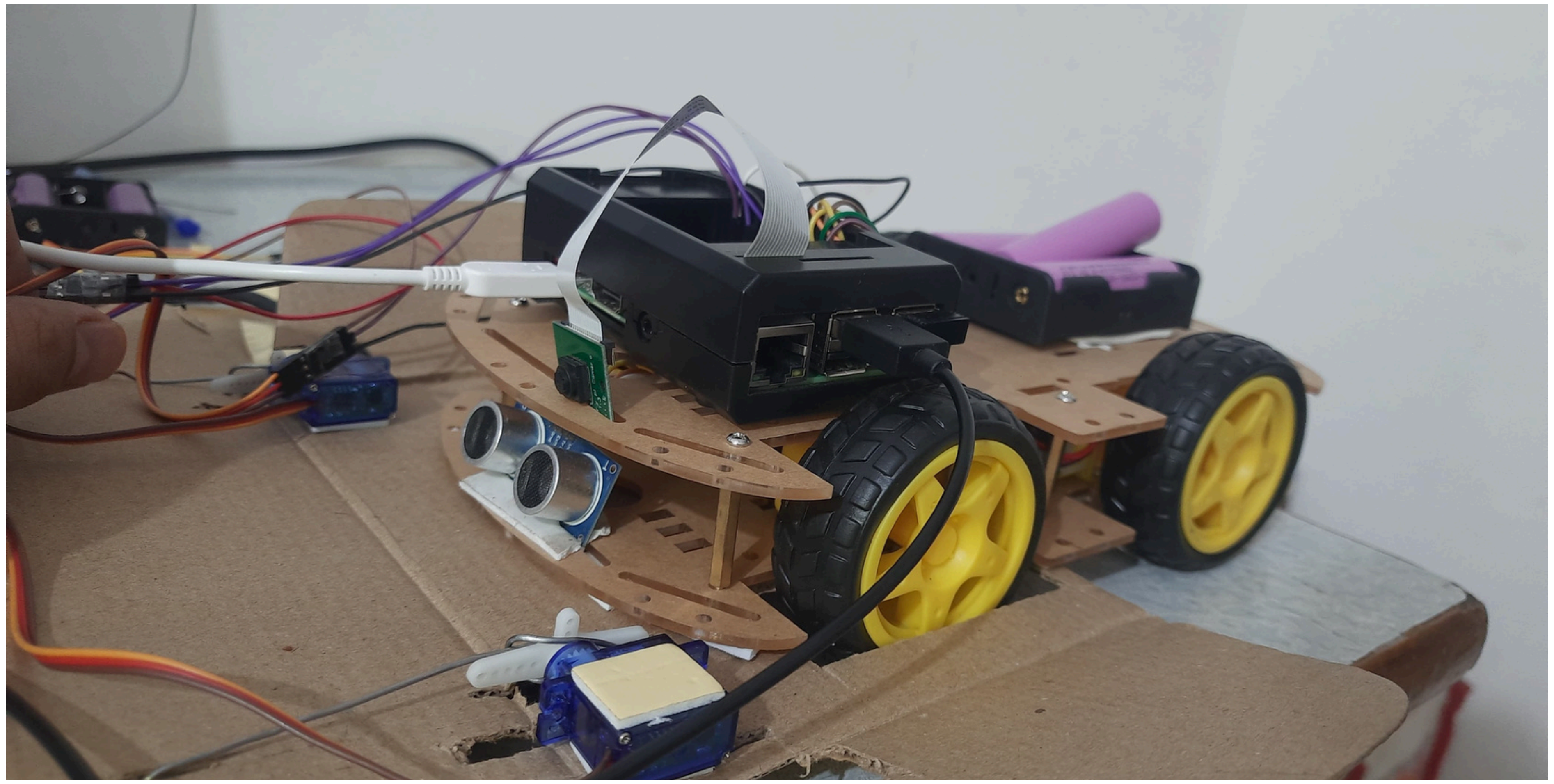
A battery providing power to specific components or subsystems within the robot.

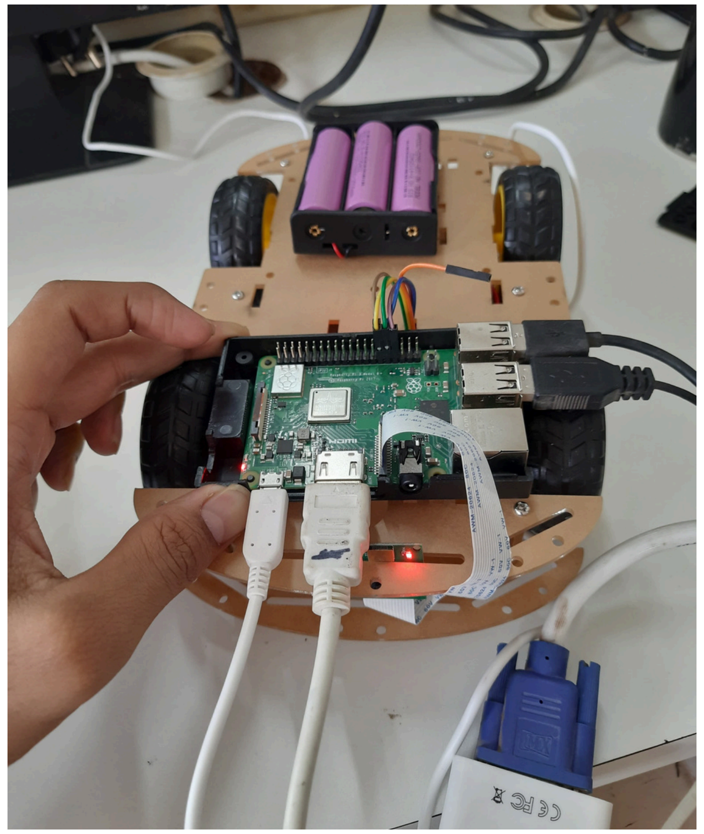
- **Buck Converter**

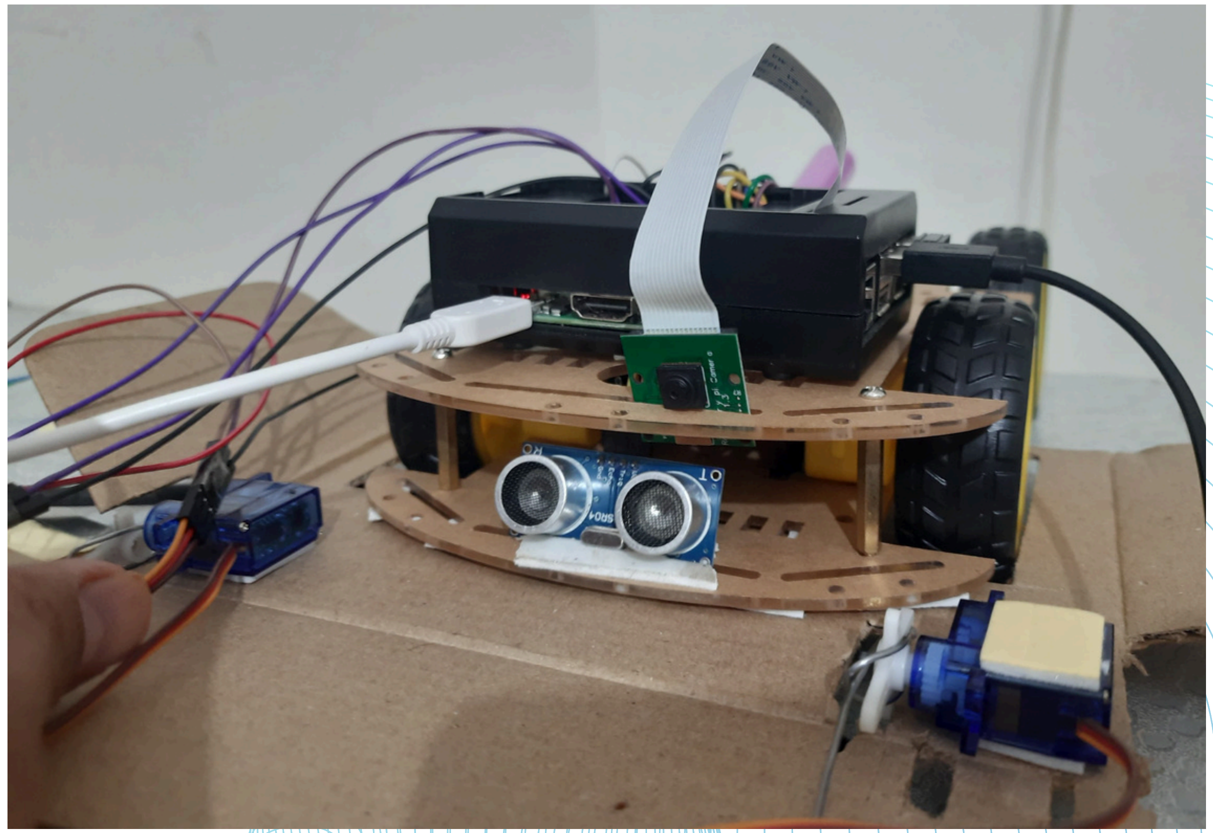
An electronic circuit used to step down voltage levels efficiently, often employed to regulate the voltage supplied to various components within the robot.

RESULTS

These results would demonstrate the effectiveness and benefits of integrating AI technology into waste management processes, paving the way for more innovative and sustainable solutions in the future.







LIMITATIONS & FUTURE SCOPE

- **01 Obstacle Detection and Avoidance:**

Implementing advanced obstacle detection and avoidance algorithms, such as LiDAR or advanced computer vision techniques, can enhance the robot's ability to navigate safely in complex environments.

- **02 Shortest Path Optimization:**

Introducing algorithms for finding the shortest path can significantly improve the robot's efficiency in reaching its destination, reducing cleaning time and energy consumption.

- **03Frontend Development:**

Developing a user-friendly frontend interface with features like live video streaming, task scheduling, and remote control capabilities can enhance user experience and facilitate seamless integration into existing waste management systems.

By addressing these limitations and exploring the suggested future scope, the autonomous garbage-picking robot can evolve into a more efficient, versatile, and user-friendly solution for waste management challenges.

CONCLUSION

Our AI-Based Garbage-Picking Robot represents a pioneering approach to waste management, driven by innovation and technology. As we unveil this solution, we are inspired by its potential to redefine the standards of efficient waste handling and contribute to environmental sustainability. With a focus on continuous improvement and collaboration, we are poised to shape a future where waste management is smarter, cleaner, and more effective. Together, let's embark on this journey towards a greener tomorrow.

THANK YOU!