International Journal of Engineering and Management Research
e-ISSN: 2250-0758 | p-ISSN: 2394-6962
https://ijemr.vandanapublications.com

Peer Reviewed & Refereed Journal
Volume-13, Issue-4 (August 2023)
https://doi.org/10.31033/ijemr.13.4.9

Robage BOT

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Received: 08-07-2023 Revised: 25-07-2023 Accepted: 09-08-2023

ABSTRACT

One of the biggest issues facing the entire globe today is waste management. Rapid population growth is a result of fast industrialisation, which also causes problems with waste management. It has been observed that there is a considerable likelihood that dumping light weight solid waste items may pollute public areas where the public congregates momentarily. There is no ideal method for keeping an eye on and maintaining these locations. It is possible to create a self-controlled robot application to solve these issues. Here machine can identify garbage and separate it into several categories, such as metallic and non-metallic waste.Implemented system uses IR sensors to detect garbage, metal proximity sensors to distinguish between metallic and non-metallic junk, and moisture sensors to further divide garbage into wet and dry waste. Here robot is controlled by an ESP32 microcontroller.

Keywords— ESP 32 Microcontroller, Moisture Sensor, Metal Sensor, Garbage Sorting

I. INTRODUCTION

An expanding population and economy result in more garbage being produced. Waste management needs to be properly executed in order to address this issue. This is accomplished using a variety of techniques, including hand picking and the use of huge machinery. One such area that calls for a lot of human power is cleaning public areas. Robotism can be seen as a positive contribution to society in order to replace the conventional methods of garbage collection and segregation. The future of garbage management and segregation is robotics and AI. A variety of techniques are used to gather the trash. One of the emerging technologies that is being explored and employed right now is garbage collection by autonomous robots. In accordance with this, we created the "ROBAGE BOT" initiative. The ROBAGE BOT has an IOT interface and may be controlled manually or automatically. Infrared sensors [1] are used to detect trash, and servomotors attached to the arm are used to gather it. Robotic arms are used to pick up the garbage. Metal sensors and soil moisture sensors are used to segregate the selected garbage into metallic and non-metallic (Wet/Dry) categories [4]. After robot-mounted dustbin which is partitioned in three section is filled with this separated trash. The corresponding products are suitable for cleaning plastic bottles, glass bottles, paper, metal and other public places in family gardens, parks, stations, and other public places. It has the characteristics of remotely and autonomous picking garbage at low cost and high efficiency. It helps in improving manual picking of garbage cleaning and has a good application prospect.

II. LITERATURE REVIEW

Abhimanyu Singh et al. proposes the idea of garbage detection using IR sensor. It is a IoT based product which collects garbage and monitors the level of garbage using IR sensor [1] It does not measure garbage with high accuracy. Renjith R et al. proposed the idea of garbage collection by using Raspberry Pi and cam module for garbage detection and used robotic arm to collect garbage [2] It can pick up only single garbage at a time. Prakash Kanade et al proposed the idea of smart dustbin ultrasonic sensors for monitoring the garbage level present in the dustbin and notify the user when the dustbin is full [3] It does not segregate the garbage. Ajay V P et al. developed garbage collection robot for segregation of garbage in metallic and non-metallic using Metal Proximity sensor and disposing the garbage in different bins [4] It does not segregate in wet and dry garbage. Analene Montesines et al. implemented autonomous robot in garbage collection using Arduino microcontroller, GSM monitoring and solar power for power supply [5]. Yuki Arai et al. implemented autonomous garbage collection robot containing deep learning algorithm for detection of garbage and it has a high accuracy about 95.6% [6]. Akanksha et al developed system by using YOLOv4 Object detection module which is trained by using 10,000 images for classifying the garbage in biodegradable and non-biodegradable [7].

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N.A.I Supasan et al. developed a garbage collection robot for collection of garbage using wide rotating wire brush in collecting arm, conveyer belt and a bin for garbage collection [8] It is unable to differentiate between garbage. Shobhit Khandare et al. developed a system for collecting garbage using ultrasonic sensor for detection of garbage and distance between the object and robot they used Raspberry Pi-3B controller and a camara for image acquisition [9] It is highly cost system.

Shihan Kong et al. developed a water surface cleaning robot for cleaning the floating garbage. They used YOLOv3 image processing model for garbage identification and grasper for collection of garbage floating on water [10].

N.Varuneshreddy and K. Nikhil developed a beach cleaning robot which can be controlled through Bluetooth and consist of solar cells for energy and collects plastic waste littered on beaches this robot is designed to carry heavy garbage up to 10-12 kg [11] It cannot lift garbage more than 10 Kg. Zhoulin Chang et al. developes a garbage collection robot based on visual recognition. The system composed of navigation unit, target identifying unit and garbage shorting unit [12] It has low accuracy.

III. METHODOLOGY

1. The block diagram provided describes the fundamental elements of the system, which include various input and output components, microcontrollers, motors, power supplies, etc.
2. The ESP 32 micro-controller receives input from the IR sensors, which are used to identify the existence of garbage and its proximity to the ROBOT, as soon as the system is turned on.
3. After processing the input, the microcontroller sends a pulse to the servo motor connected to the arm that will pick up the waste.
4. Using the metal sensors, this gathered trash is subsequently separated into metallic and non-metallic components.
5. The non-metallic waste is subsequently divided once more into wet and dry using the moisture sensors.
6. Once the sorting of trash is identified, it is disposed to the designated area of the dustbin.

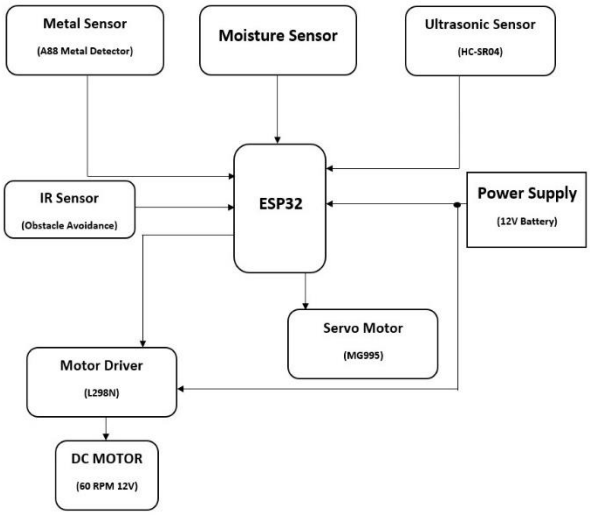

Figure 1: Block diagram

IV. SYSTEM DEVELOPMENT

4.1 Robotic Arm

The robotic arm basically has 2 actuators, one that is high torque 12V DC motor for the motion of the elbow in up and downward motion and two servomotors at left and right side of the arm for collecting garbage. As stated in introduction, the robot moves towards the object and IR Sensor is set at 35cm. When the distance is equal to 35 cm a signal is send to elbow motor to rotate clockwise. When it reaches to the ground a signal is send to servo motors which is attached to the arm to rotate 110 degrees. The arm on right side rotates in counter clockwise and the arm on left side rotates in clockwise direction. The garbage is collected in the bucket, which is attached at front of the elbow. After the garbage is collected the elbow motor rotates counter clockwise and the garbage is dumped in the bin attached to the ROBOT. Fig 2 shows the robotic arm mechanism.

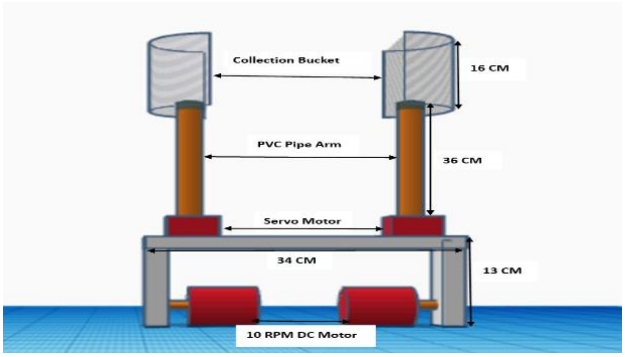

Figure 2: 3D Modelling Arm Design

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Figure 3: Robotic Arm Mechanism

4.2 Dustbin Monitoring

The proposed system utilizes ultrasonic sensor for measuring the level of garbage present in the section of dustbin [3]. The hight of dustbin is 30 CM and Ultrasonic sensor is placed at 40 CM hight from the base of the dustbin. The dustbin is divided in 3 levels of hight as Low-level (empty dustbin), Mid-level (half full dustbin), High-level (full dustbin). The level of garbage is shown to the user through Blynk app.

Figure 4: Top view of Dustbin

Figure 5: Front view of dustbin

4.3 Hardware Description

Here this section describes about the hardware architecture. The robot is powered by 12V-4A Li-ion Battery. The robot contains ESP32 microcontroller, L298N motor driver, IR sensors for garbage detection, Ultrasonic sensor for detecting the level of garbage in dustbin. High torque DC motor for motion of the elbow, servo motor for the movement of arms and metal sensor and moisture sensor at the arm for detection the type of garbage. Fig 5 shows the Hardware implementation of robot and fig 6 shows the circuit diagram.

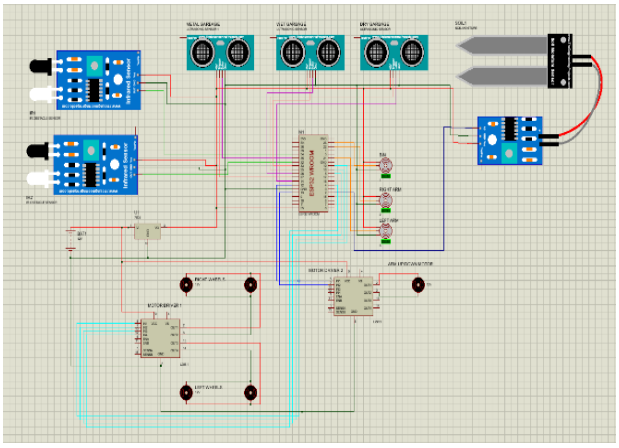

Figure 6: Circuit Diagram

V. SYSTEM ALGORITHM

5.1 Flow Chart

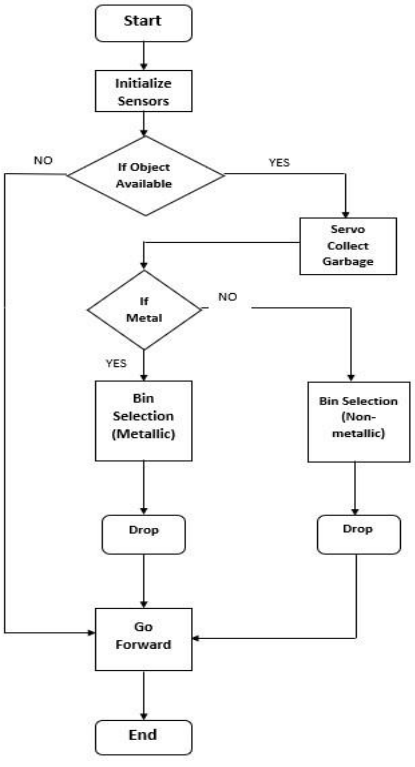

Figure 7: Flow Chart

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1. The system starts and the sensors are initialized.
2. The IR sensor provides input to the microcontroller as object detected.
3. Then garbage is collected by robotic arm using servo.
4. Collected garbage is then identified in metallic and non-metallic garbage using metal sensor.
5. If the metal sensor gives input as metal, then the bin selection is done and the metal garbage is dumped in metallic section.
6. If the metal sensor gives input as non-metal, then moisture sensor checks wet and dry, as per input bin selection is done and the garbage is dumped in Wet and Dry section of the bin.
7. If IR Sensor does not give any input as garbage detected then the robot moves forward.

5.2 3D Modelling

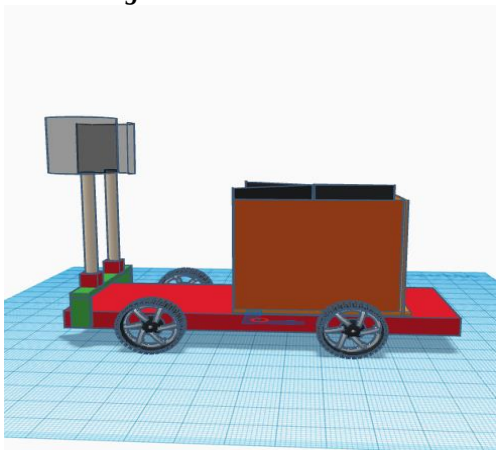

Figure 8: ROBAGE BOT Side View

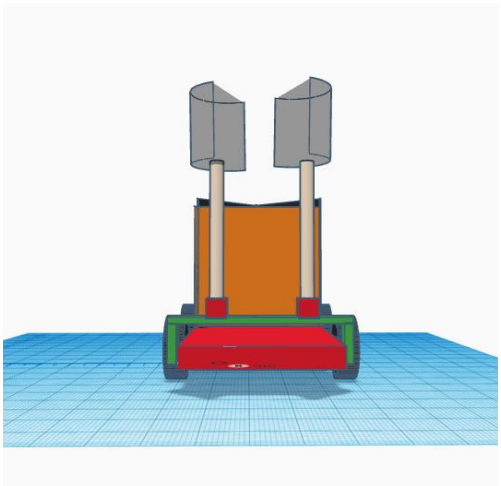

Figure 9: ROBAGE BOT Front View

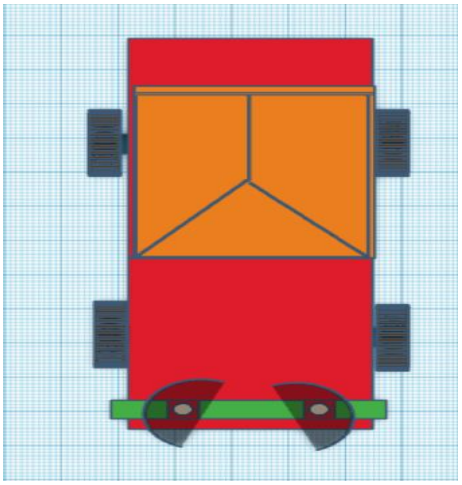

Figure 10: ROBAGE BOT Top View

VI. RESULT

The objective of this project is to identify and segregate the garbage. Implemented system helps easy to identify and pick up garbage that will help in recycling garbage. The feasibility of the system provides automatic garbage sorting which reduces the effort of sorting the garbage and contribute towards the environmental protection. Here system improves the accuracy of segregating garbage.

Garbage	Detected	Not Detected	Accuracy
Metal	90	10	90%
Wet	85	15	85%
Dry	94	6	94%

Table 1: Result

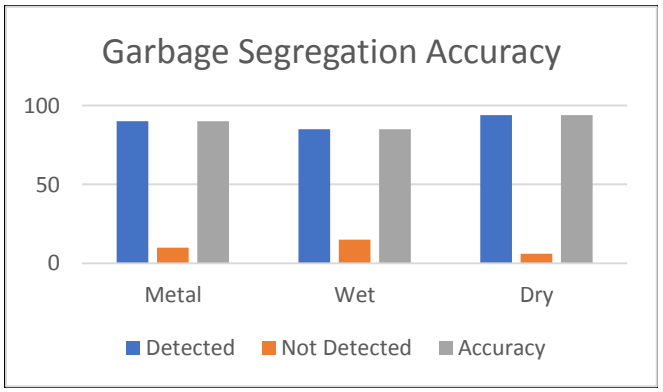

Figure 11: Graphical Result Plot

VII. CONCLUSION

Here paper presents an overall design scheme of Garbage Segregation Robot system. Through this project it becomes easy to identify and pick the garbage by using the mechanical arm and it is a user-friendly device which is easy to navigate and control. It provides with the

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feature of garbage segregation which is a tedious and required large man power this process takes time as well. Due to segregation of garbage, it becomes easy to recycle the garbage. Due to segregation the rate of recycling can be increased to a great extend especially in the developing countries like India where recycling rate is quite low as compare to other countries.

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