# Autonomous Garbage Collecting Robot Wall-E

**Mr. Rakshith Ranganath[1] Ms. Bhawna Sharma[2] Ms. Pooja AR[3] Mr. Rohan C Jadhav[4] Ms. Asha A[5]**
[1,2,3,4]U.G Student [5]Assistant Professor
[1,2,3,4,5]Department of Electronics and Communication Engineering
[1,2,3,4,5]VVIET, Mysuru, India

*Abstract*— Robots have always been an object of fascination in our society. They have been portrayed as humble servants of man as well as evil creations that rise to overthrow their masters. But where does this fascination come from? All robots share one thing in common at the root of their design and purpose they can perform tasks in place of humans. Life is filled with many repetitive tasks, and if robots are able to perform those tasks, they can help to ease an overarching burden. With that said, robots are optimal replacements for humans in a multitude of scenarios. As simple as it may seem, the primary action in many repetitive tasks is picking up objects and moving them to other locations. Be it picking up garbage from the floor, moving parts along an assembly line, or removing fallen debris, robots that can pick up and move objects will always be useful. This robot was designed as a fetching robot. It was to come with a set of objects (Garbage) that it was designed to detect and segregate into bio-degradable and non-biodegradable, and it would be able to collect these items from the environment when they were placed at random. Using an arm mechanism to lift the objects from the floor, it could then place the objects in a container.

***Key words:*** Robot, Wall-E

## I. INTRODUCTION

In recent times, garbage disposal has become a huge cause for concern in the world. A voluminous amount of waste that is generated is disposed by means which have an adverse effect on the environment. The common method of disposal of the waste is by unplanned and uncontrolled open dumping at the landfill sites. This method is injurious to human health, plant and animal life. This harmful method of waste disposal can generate liquid leachate which contaminate surface and ground waters; can harbour disease vectors which spread harmful diseases; can degrade aesthetic value of the natural environment and it is an unavailing use of land resources. The economic value of the waste generated is not realized unless it is recycled completely. Several advancements in technology has also allowed the refuse to be processed into useful entities such as Waste to Energy, where the waste can be used to generate synthetic gas made up of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam; Waste to Fuel, where the waste can be utilized to generate bio fuels. When the waste is segregated into basic streams such as degradable and non-degradable the waste has a higher potential of recovery, and consequently, recycled and reused. The wet waste fraction is often converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy. The metallic waste could be reused or recycled.

The specific design goals we hoped to accomplish were as follows:

1) The robot can detect target objects for collection.
2) The robot can pick up objects successfully, and hold at least 3 of them in its payload.
3) The robot can segregate waste into biodegradable and non-biodegradable.

## II. LITERATURE SURVEY

There are numerous methods that are used to make a garbage collecting robot. These methods provide the information about various techniques used for a garbage collecting robot. Some of these methods do have limitations which are proposed in this section.

In the first method, as a solution to manual primary waste disposal, a cost effective garbage cleaning robot is developed and that is named as "Thooyan"[1]. The system (road cleaning robot) consists of very simple but highly efficient mechanism. The main components consist of a rotating brush assembly (rake), a unique tilting wedge, a conveyor system and a garbage collection unit. Robot is programmed in a certain pattern so as to navigate automatically and detect obstacles to move in a free path. If encountered by a moving obstacle, the robot is programmed to pause for duration of 50 seconds and then sense again to move or it will take turn of 180º. A solar panel is provided for partial charging of the battery. Since this robot uses conveyor belt the cost of the whole system will be more which adds limitation to this method. But it gave an idea or advantage to use solar panels which in turn helps to reduce the power consumption. This robot is the small step to change the manual waste collection and ensures the safety of sanitary workers.

The second robot is about cleaning robot for the swimming pools, the house, the wall and the domestic stairs are interested and developed continually but the cleaning robot for the beach does not be much interested. Therefore, this paper presents the development of a prototype garbage collection robot on the beach[2] This robot uses the Bluetooth for communication between the user and the robot. The robot is built on the caterpillar wheels, and the power is supplied from 12V 30Ah battery which is connected to 40W solar cells. The user can control a robot via a program developed from Visual Basic 2005 application based on Window XP. The commands from user are sent via Bluetooth to PIC18F4550 for processing. In addition, it is also equipped with an IP camera with added pan/tilt capabilities which relays feedback information to the human operator via Ad-hoc system. The results of robot performances were found that the robot can move with an average speed of 0.5 meters per second on the sand via wireless communication and collect the big garbage with side 12.5 x 49 cm, for example, glass bottles, and plastic,

 

etc. From the experimental results, it can clearly indicate that the proposed robot is superior to handle tasking conveniently, control capability, and operate environmentally friendly. This robot is expected to overcome the garbage problem especially on the beach. However, this robot can still be improved to operate automatically and control from the more distance is the drawback of this.

The robot, called ROAR[3] is transported to the refuse collection site on the back of a refuse truck. An operator presses a button on the truck and this prompts a drone to be launched from its roof and begin scanning the surrounding area to locate bins. The locations of the bins are then relayed to the ground-based robot. ROAR navigates its way to each bin using a map of the area and the likely locations of bins, as well as the data provided by the drone. GPS and LiDAR are used to help it navigate and avoid obstacles. Inertial measurement unit (IMU) data, from accelerometer and gyroscope sensors, are used to help the robot keep track of its position. Once ROAR has arrived at the bin, it uses cameras and LiDAR to position itself, before extending its arms and lifting the bin onto its built-in platform. It then returns to the refuse truck and lifts the bin into position to be emptied. There is an automated emergency stop function built into ROAR in the event that it detects an obstacle and a camera on top of the truck to detect if something gets too close to the truck while a bin is being lifted and emptied. An emergency stop button can also be used to manually halt any activity and the operator is able to monitor the location of the robot from the cab of the truck. Manual intervention is needed which is the demerit.

## III. METHODOLOGY

The methodology involves two part. The first is the image processing part which is handled by Raspberry pi and second is the motor drive part which is done by Arduino Uno. The image processing part provides eyes to the machine to help and detect objects near it. In order to detect the object RGB color space is converted to HSV color space as RGB model is limited. In HSV, it is easier to represent a color than in RGB color-space. With RGB, a pixel is represented by 3 parameters, red, blue, and green. Each parameter usually has a value from 0 – 255. For example, a pure blue pixel on your computer screen would have a B value of 255, a G value of 0, and a R value of 0. With HSV, a pixel is also represented by 3 parameters, but it is instead Hue, Saturation and Value. The saturation is the intensity of the color. A saturation of 0 is white, and a saturation of 255 is maximum intensity. Another way to think about it is to imagine saturation as the colorfulness of a certain pixel. Value is the simplest of the three, as it is just how bright or dark the color is. HSV can be imagined like a three dimensional cylinder, as seen in the picture below.

The Arduino Uno acts as a slave to the raspberry pi as it only follows the commands and controlled from Python via a USB cable. The Raspberry pi sends commands to move the robot which are processed by the Arduino Uno.

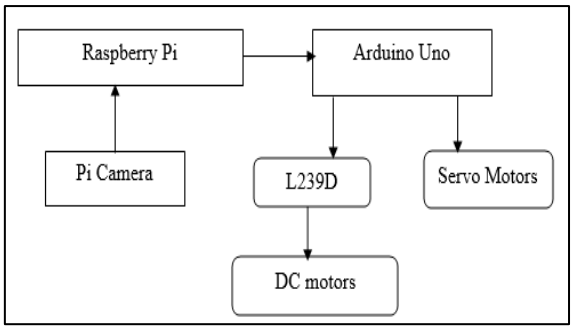


Fig. 3.1: Functional

### A. *Algorithm*

- Step1**:** Start and initialize the camera
- Step2**:** detection of object
- Step3**:** calculating the coordinates of object and setting the arm between 10 to 170 degrees
- Step4: object is picked and classified as bio-degradabe or non-bio-degradable.
- Step5: placed in the respective bin

### B. *Flow chart*

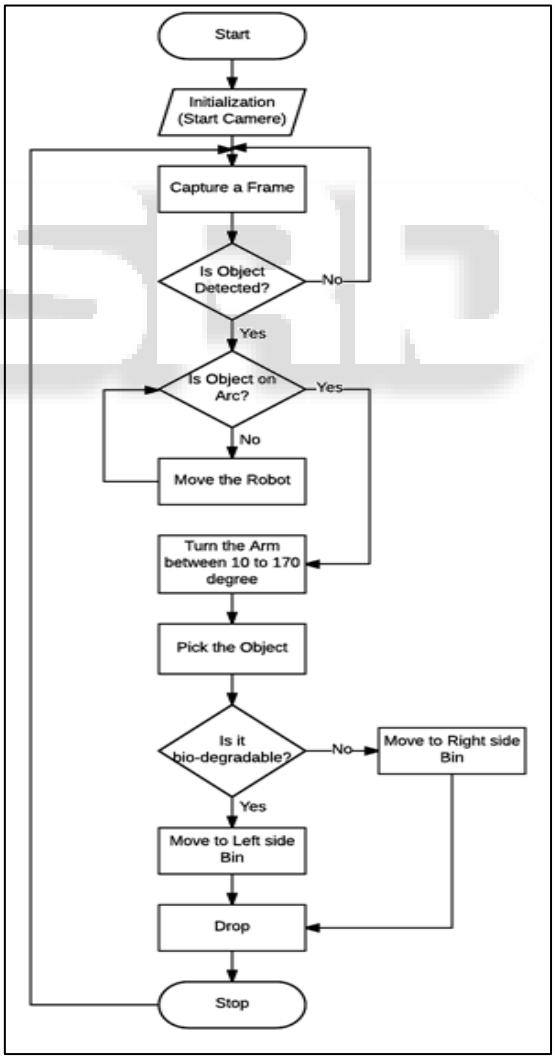


Fig. 3.2: Flowchart

## IV. RESULT ANALYSIS

Simulator output view of the initial positions of the node It can be seen in the fig 1.

 

Fig. 3.2: Input Image

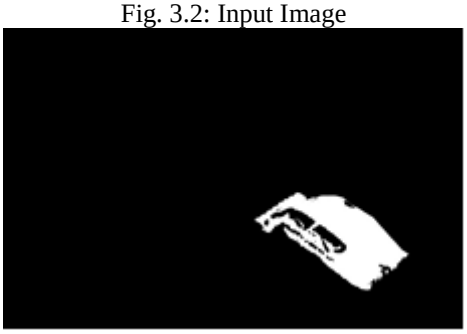

Fig. 3.3: Isolating the object from the background

Fig. 3.4: Encircling the detected object to get coordinates of the center of the object.

Fig. 4.1: Detecting and Picking the object

Fig. 4.2: Placing the object into respective bins

| Item | Expected Result | Action Result |
|---|---|---|
| **Center Fresh** | Pick and place in non-biodegradable bin | As expected |
| **Paper** | Pick and place in biodegradable bin. | As expected |
| **Center Fresh** | Pick and place in non-biodegradable bin | False detection |
| **Eraser** | Pick and place in biodegradable bin. | False detection |
| **Paper** | Pick and place in biodegradable bin. | As expected |

Table 4.1: Test cases

## V. CONCLUSION

The project works successfully and separates different objects or garbage using image processing technique into degradable and non-degradable. There are two main parts in the project motor drive part and image processing part.

Motor drive part includes robotic arm behaves as a slave to the master circuit which includes raspberry pi where image processing is program is executed and the instructions are sent serially from raspberry pi to arduino to control the operation of the robot.

- The Robot works under the random movement and if any garbage is detected by the robot, it stops and object is sensed using camera followed by image processing.
- After processing of the image, the robot can be able to analyze whether the object is degradable or non-degradable waste which is done by programming in the microprocessor.
- Then it is collected by robotic arms and there by separating the waste into two bins of one degradable and another non degradable which is kept at the trash container of the Robot.
- After the trash container fills up, it travels to the specified destination and dump the garbage over there.

The system has successfully performed handling station task, namely pick and place mechanism.Thus a cost effective Mechatronics system was designed using the simpl est concepts and efficient result was being observed. This system is a depicting the prototype of sorting systems which are used in industries.

## REFERENCES

[1] http://www.ijfcc.org/papers/329-CS3004.pdf
[2] http://www.citylab.com/tech/2016/03/the-robot-garbage-collectors-are-coming/471429/
[3] http://www.ipcbee.com/vol66/019-IEEA2014-A044.pdf
[4] http://contest.techbriefs.com/2013/entries/machinery-and-equipment/3240
[5] http://www.ijsrp.org/research-paper-0416/ijsrp-p5250.pdf.

 