International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

RECYCLING SEGREGATION ROBOT

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Abstract - *Abstract in this paper, we present a robotic system which can be used for collecting stray used bottles, form the places like malls, railway stations, bus stands, and stadiums without any human interaction independent of size, shape, color, and position of bottle in the surrounding, and collect these bottles at proposed area for further processing. System consist of raspberry pi 3 model B+ which is main processing and controlling unit. Pi camera module attached to the system detects bottle in the surrounding and gives appropriate signal to driving system to follow the bottle. After reaching at close distance to bottle its gripping section locks the bottle inside its gripping angles then system brings that bottle to proposed collection area.*

***Key words**: robot, bottle collecting robot, objects detection, object avoidance, object classification, haar cascade, and ultrasonic, raspberry pi.*

1. INTRODUCTION

A bottle is a container used to store liquids. It can be made up of different types of materials and comes in different shapes and sizes. Around 41 million tourists visit India every year and our own 132 crore population also uses bottles of various forms and of different material for so many different purposes. Most of the time bottles are thrown away after its first use. Bottles made from plastic takes around 400 years to degrade and reuse of such used plastic bottle can be hazardous. Similarly broken glass bottles can harm humans as well as animals in the surrounding. A million bottles are bought around the world every minute and the number will jump another 20% by 2021 creating an environmental crisis. According to new published in Guardian Newspaper, this high usage of bottes can have serious impact on climate change. The demand, equivalent to about 20,000 bottles being bought every second, is driven by an apparently increasing desire for packaged drinking water and spread of western urbanized "on the go" culture. Fewer than half of the bottles bought in 2016 were collected for recycling and just 7% of those collected were turned into new bottles. Instead most plastic bottles produced end up in landfill or in the ocean.

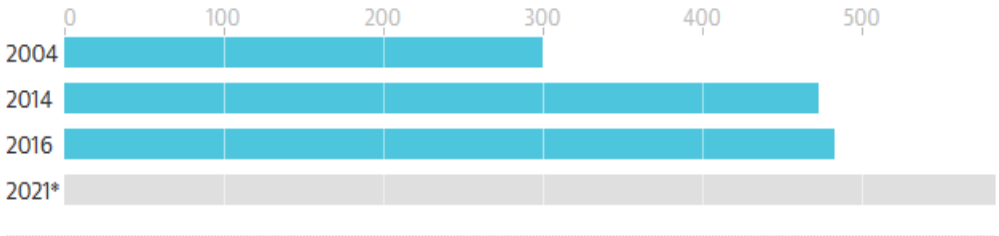

Fig. 1 Stats of global plastic bottle production

In India, there are various ways in which bottles reach the main waste stream for recycling. Team of workers from Municipal Corporation collects these bottles by hand and dumps them in the truck. Municipal solid waste is one main (MSW) source of collected bottle. All types of bottles are separated from MSW and preceded to the recycling center. Street bottle collectors also go directly to the sources (railway stations, airport, restaurants, and hotels) and collect these bottles and sold it to the flea. Over the decade there are so many solutions proposed for this problem. One of them is use of robotics.

Over the past decade robots have helped humans in practical tasks, services, entertainment, and play, so on. Further in recent several years' intervention of robots will be more. Nowadays so many governments are also

investing in development of autonomous robots for various purposes, from military applications to municipal work.

1.1. OBJECTIVES

The aim of the project is to develop and implement a four wheel robot with following objectives.

- To design a circuit which can detect a bottle in the surrounding environment independent of the shape, size, color, material used and internal liquid level.
- To design a circuit which can lead robot body to follow the bottle.
- To design a robotic structure which can collect bottles detected irrespective of its size, shape and position.
- To study and understand the concepts of image processing, object detection and Haar cascade method.
- To develop software part that can keep the count of collected bottles and use the data for further analysis.

2. SYSTEM DESIGN AND IMPLEMENTATION

2.1. SYSTEM ARCHITECTURE:

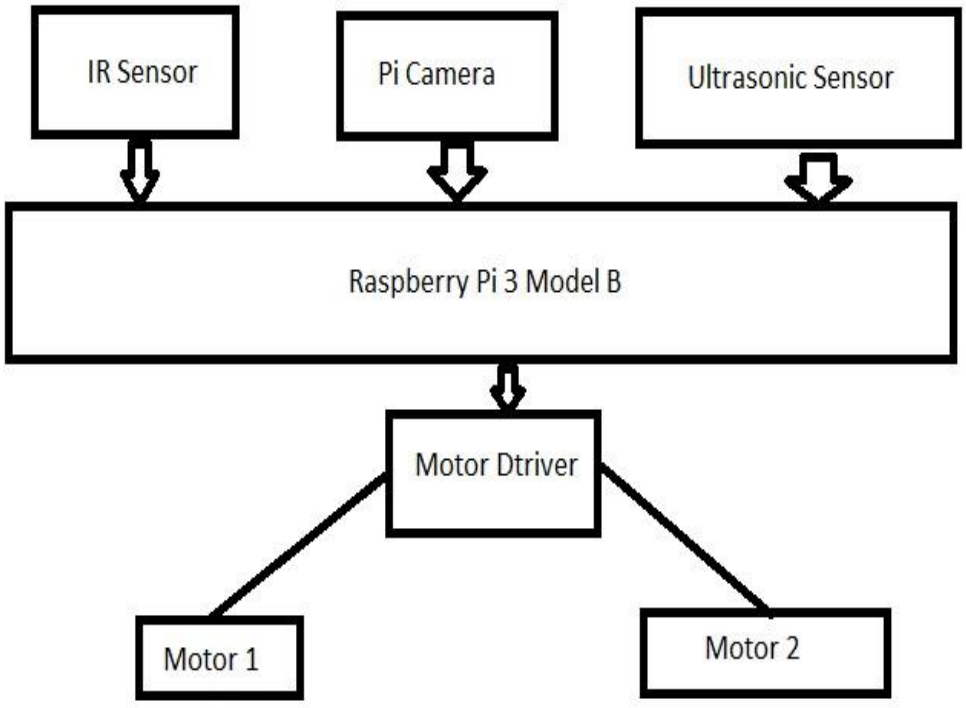

Fig 1. System Architecture

Fig.1 illustrates the block diagram of the proposed system. The major blocks involved are raspberry pi, pi camera module, IR sensors, ultrasonic sensor, motor driver IC, and motors

2.2 HARDWARE IMPLEMENTATION

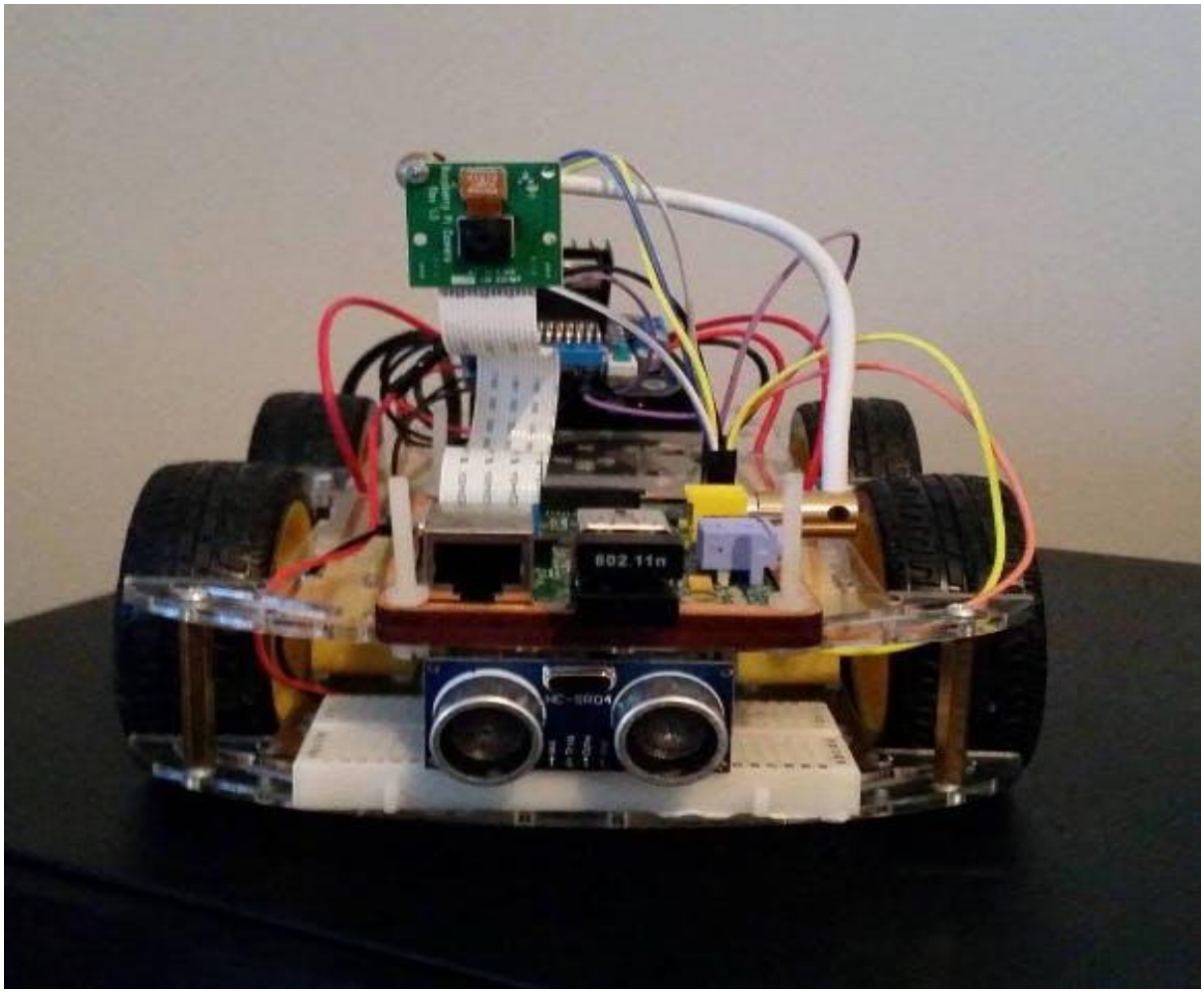

Fig 2. Hardware Implementation

2.3. METHODOLOGY

Existing System:
As we know currently the recyclable bottles are collected manually by people and then these bottles were sent for the process of recycling. Sometimes due to lack of manpower the disposal of bottles could be tough. This could be hazardous for human health as the improper disposal of waste can be harmful to the human health.

Proposed System:
We are proposing this system to make automation in collecting the recycling bottles. The desired system collects the recycling bottle and dumps it to the dumping area. We are particularly segregating the recycling bottles from the other waste. These collected bottles then sent for the recycling purpose.

2.4. RESULTS

The following figure sows the detection of bottle.

Fig 3. Detection of bottle

3. CONCLUSION

In this project we successfully developed a system which can detect bottles in the environment independent of its size, shape, color, and position without any human interaction and collect the bottle at proposed dumping area, also bottle can avoid obstacles.

System works with one bottle at a time more reliably.

4. FUTURE WORK

1. Some advanced image classification algorithms such as YOLO object detection can be used for faster processing.
2. In the future, the segregation of other recycling objects can also be added to this system.
3. Bottle collecting statistics can be recorded to the cloud for analysis of generation and recycling rate of bottles.

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