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Automatic Trash Collector

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Abstract

This paper represents the solution for collecting the wastes contained in the dustbin in the companies. The prototype contains a rover which is connected to a container which holds the waste, a robotic arm is used to hold the dustbin and a camera is used to detect the dustbin. The robot is controlled automatically via programs developed in LabVIEW. NI-myRIO is the controller used to interface with all the motors and usb camera connected to it. The dustbin is detected using image processing technique in sequence the gripper which is connected to the robotic arm is used to hold the dustbin and transfers all the wastes into the container.

Keywords: NI-myRIO, LabVIEW, Image Processing, Robot, Robotic Arm

Subject classification: Robotics, Image processing and Automation

1. Introduction

In today's world everyone is searching for an option to do things with fewer efforts, it is hard to keep time for things such as cleaning and maintaining a healthy environment. It is really a difficult task to keep a particular area clean. Garbage consists of unwanted materials left over from the educational Institutions, Business organizations, etc., The office waste which gets accumulated in the garbage bin are collected at a particular time of day when it is filled. The disposal of waste by humans is not fruitful as it may lead to infections and diseases. But whatever may be the problems it is our duty to maintain a clean and healthy environment. Now a days many diseases are caused due to the place we sit which does not have a healthy clean ambience. Even it is needed to have a clean office environment. Owing to wide increase in industrial sector it is difficult to clean each place by a human. With respect to human health and hygiene, the effectiveness of garbage disposal is very important. In the fast moving world

everyone wants to do work with fewer efforts. In this modern era it is possible to design and use this technology for the purpose mentioned above. Thus taking all these considerations we have designed a robot that will automatically detect the dustbin and transfers all the wastes to the container mounted in the robot.

Although the most common ways of disposing wastes are trash cans and bags, these methods are implemented manually. This Automatic Trash Collector (ATC). The ATC is a prototype robot that can automatically trace the black line. The dustbin is identified using Image processing technique which is programmed in LabVIEW. Then, the robotic arm with the help of the gripper holds the dustbin and transfers all the wastes to the container.

2. Literature Review

The below description explains related to automatic collection of garbage by using various technology.

John et al. [11] owned a patent for their project which is used to collect garbage in streets. They designed a front-loading, refuse collecting vehicle which is modularly provided with a combination of a low profile, front-loadable waste bin (intermediate container) and one or more, side-loading robotic arms. The designed vehicle was not an automatic one, it was operated purely by mechanical means.

Ruide et al. [7] proposed a project for collecting the waste automatically. They designed a prototype for automated garbage collection robot that uses visual information ie. image processing to navigate and a robot arm to collect and deposit cans. This robot was planned for domestic purpose.

Apoorva et al. [8] have designed an Autonomous Garbage collector Robot to dispose the garbage. It is built in such a way that when it is started it will move on the path defined in the Arduino program. When it encounters any obstacle, depending upon the conditions applied in the program the robot makes further motion and picks the garbage. It is designed to collect garbage in foot path, public places(Parks, schools, colleges), mostly cemented paths and beach.

Samrudhi et al. [10] designed a garbage collecting robot using raspberry pi. The detection of dustbin is done by computer vision that is by camera and opto couplers. The collection is done by Vacuum unit where it takes all the garbage and cleans the area. Once the dustbin is full, the level sensor in the bin will sense the level of the garbage and send it to the nearest garbage collector truck.

We have designed a robot to eliminate the initial level problems. The robot automatically tracks the path and detects the garbage and then will pick it up. Thus for the detection of dustbin whether it is dustbin or not we have used edge detection method as it provides (a) Good detection (b) Good localisation (c) Minimal response. The controller used for interfacing the hardware is NI-myRIO. The NI- myRIO is used because it is a reconfigurable and reusable tool. Initially we worked on the chassis and robotic arm with gripper. The motors used are dc motor for the movement of the robot and gripper and servo motor for the robotic arm.

3. Methodology

The following sections deals with the components used for automatic trash collector. The operation of the robot is classified into three main categories. They are Movement of the robot, Image processing and Garbage collection using Robotic arm.

3.1. Movement of the robot

The robot can travel in a pre-programmed path by the combination of motors, motor driver module and IR sensors. The chassis consists of 4 dc motors of 100rpm each, L293D motor driver module and three IR sensors. The IR sensor acts as the input to the myRIO. The motors are connected to the output of the myRIO through L293D module. The IR signals are emitted to the maximum in black surface and the dc motors are made to rotate based on the labVIEW program interfaced with myRIO.

3.2. Image Processing

The USB camera of 10mega pixel is connected to the myRIO. The following steps to be performed to detect the dustbin.

- (a) The camera contrast is optimized and the representative image of the dustbin is acquired for calibration.
- (b) The vision script is imported into the LabVIEW Vision Assistant Express VI.
- (c) A point –distance calibration step is created in NI Vision Assistant and measure length in real-world units.
- (d) Vision script is developed in the stand-alone version of Vision Assistant to measure and report the dimensions in pixels and in real world units.
- (e) The input and output devices are added respectively for further process.

Garbage collection:

The robotic arm consists of servo motor mounted on the arms for the elbow movement. This setup will operate only for predetermined set of conditions programmed in LabVIEW. The wastes into the container. This setup is mounted at the left side of the chassis. Once the dustbin is detected, the arm makes a movement to hold the dustbin with the help of the gripper and transfers the wastes to the container which is placed behind the robotic arm. Figure 1 shows the block diagram of our entire work.

The controller used in this project work is NI-myRIO. It is an embedded device with reconfigurable microprocessor architecture used to “do real world engineering”. It is a reconfigurable and reusable device which is used to design control, robotics and mechatronics systems.

In our project work all the inputs are connected to the NI-myRIO. The myRIO is loaded with LabVIEW program to perform desired operations.

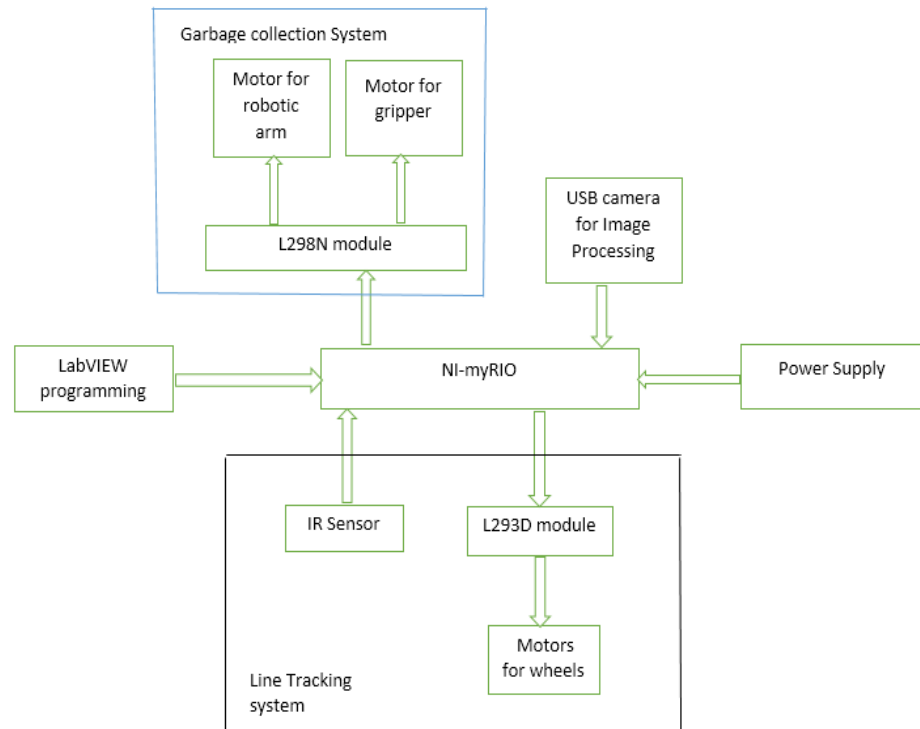


Fig.1. Block Diagram of Automatic Trash Collector

4. Working Model



Fig.2. Working model for Automatic trash collector

Figure 2 represents the Working model of our project work. The robot is started to move by tracing the black line using IR sensor. The camera is allowed continuously to take pictures. The dustbin is detected by comparing the image taken by the camera with the default image. If the dustbin is detected the robot stops moving and the robotic arm with the help of gripper picks up the dustbin and transfers the wastes automatically into the container. The process is repeated till the black line ends. Once the black line ends the robot stops moving further.

4.1. LabVIEW program Execution

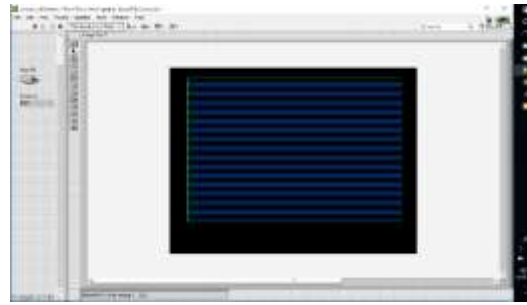


Fig.3. Front panel Execution of Automatic Trash Collector

Figure 3 represents the front panel of the project. In LabVIEW, block diagram panel contains the graphical source code to control the entire process. It contains one or more icons present in it which is been developed to perform various operations in which the required set of functions is been performed with the help of data flow principle, which means the required set of operations will be taking place as per our design. In the following representation of the program we have combined the action of rover as well as the robotic arm, image processing into a sub VI in order to reduce the complexity and make it more simple and easy to understand.

5. Results

The movement of the robot has been tested with L293D module with 3 IR sensors, which follows the black line. The edges are detected and compared with the default image using vision assistant tool. The dustbin is detected by edge detection technique in Image processing. The garbage collection system has been tested with L298N module. The arm rotates and lifts the dustbin with the help of the gripper. Thus the prototype was tested and found to deliver satisfactory outcome, in making the above mentioned operations automatically.

6. Conclusion

The purpose of this work is to design a robot which automatically moves, detects, lifts the dustbin and collects the wastes in the dustbin. It paves way for smart garbage system in companies. It ensures safety and does not consumes time and also safety for humans preventing from allergic and other diseases. It prevents from being theft. Thus it is capable of disposing of waste which is present in garbage economically.

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