

## 18 Intelligent Garbage Collection

### 18.1 Introduction

Intelligent garbage collection is one of the real-time applications of mobile robots, it utilizes the robot's motion, its gripper, as well as its vision systems. The objective of this program is to collect a given set of colored boxes and bring them to one place. The color of the box is not a restriction, and is set during the run time of the program. This is an interesting program, where the robot collects the objects having definite visual characteristics.

First the color of the box is selected and the images are obtained. Each image is checked pixel by pixel with respect to the color of the box. If the pixel value lies in a particular range (the range being set by the user) then that pixel is made black otherwise white. In this way the whole image is mapped into another image, where we have black dots resembling the color of the box. After this the image is divided into 12 blocks ( $3 \times 4$ ). The number of dots in each block is counted and the block having the highest number is found. If this value exceeds the preset value (the preset value is set so that noise is not taken as the object) then that particular block is selected. The robot moves to the object for grabbing. If the surface plane of the object is not parallel to the gripper arm, then it may not be possible for the robot to grab in the first attempt and some more trials are required.

### 18.2 Algorithms and Source Code for Garbage Collection

The client-server algorithms are given in Listings 18.1 and 18.2 and their programs written in C++ and Java are given in Listings 18.3 and 18.4 respectively at the website of the book. The garbage collection program output with program log session is depicted in Fig. 18.1.

**Listing 18.1.** Server algorithm

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Step 1: Open the server socket and wait for the client to join.  
Step 2: Send the image and wait for the next instruction.  
Step 3: If next instruction = IMAGE  
Then go to Step – 2.  
Else go to Step – 4.  
Step 4: If next instruction = STOP  
Then stop the robot.  
Go to Step – 2.  
Else go to Step – 5.  
Step 5: If next instruction = EXIT  
Then go to Step – 11.  
Else go to Step – 6.  
Step 6: If next instruction = GO  
Then go to Step – 7.  
Else go to Step – 2.  
Step 7: Send Image and get angle and instruction.  
Step 8: If angle = 45  
Then turn by angle. Go to Step – 9.  
Else turn by angle.  
Move 250 mm.  
Goto Step – 9.  
Step 9: If Beam break state = true  
Then close the gripper.  
Turn towards origin and move to origin.  
Drop the object there and return to initial position.  
Step 10: If instruction = IMAGE  
Go to Step – 7.  
Else If instruction = STOP Go to Step – 2.  
Else Go to Step – 11.  
Step 11: If Client connected.  
Then Go to Step – 7.  
Else Go to Step – 12.  
Step 12: Stop.

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