

# Autonomous Waiter

## Project report

(Group No.- 02)

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## **Abstract**

We will make prototype of an Autonomous Bot using FIREBIRD V robot. This bot will receive order, perform image processing to detect if the order is ready, picks the object and drops it to the destination. This bot will move through the white path towards its destination automatically. Orders will consist of coloured objects. Overall, the bot moves to a defined location, turns, takes an image, checks if there is an object in the image. If yes, then it picks up the object, goes to the destination location and drops the object.

**Robotic arm** will be used to pick and place the orders. The orders will be kept to the left of the bot at a particular location. The bot should be able to correctly identify the presence of objects using image processing. (webcam required for image processing). The bot should be able to correctly go to the location specified, and drop the object at the correct place.

## 1. INTRODUCTION

Our autonomous waiter receives the signal from Matlab and moves to the object destination and sends back a signal to Matlab which means that the robot is in front of the object, if any, and the image can be taken. MATLAB takes an image from the webcam attached to the arm of the robot and performs the image processing.

MATLAB checks the amount of a particular colour present in the image taken. If there is more than the threshold, then it assumes that the object is present, and informs the bot. The bot holds the object in its arm and moves to the desired location, and drops the object (by releasing the arm)

## 2. SYSTEM ARCHITECTURE

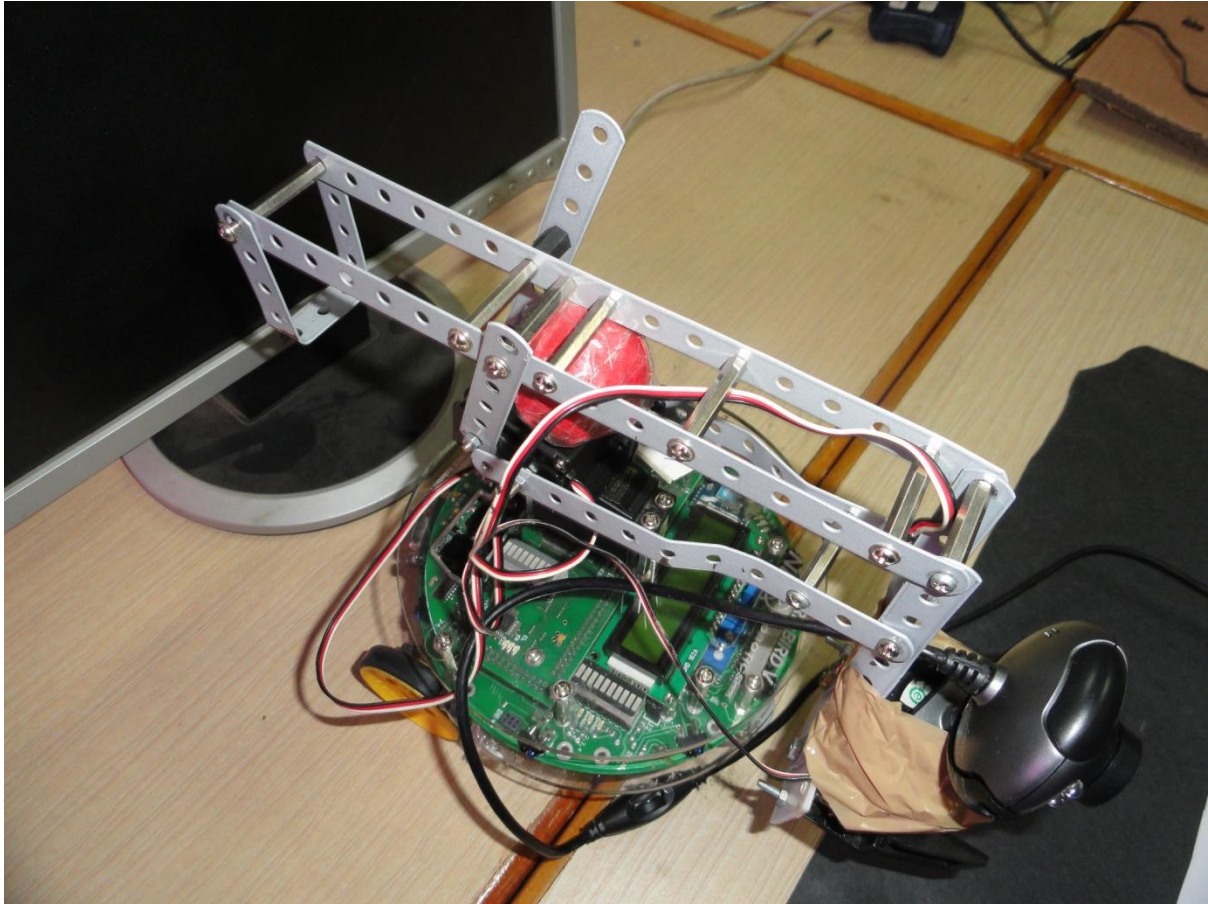
### 2.1 FireBird

In our prototype FireBird-V robot will be used as a waiter



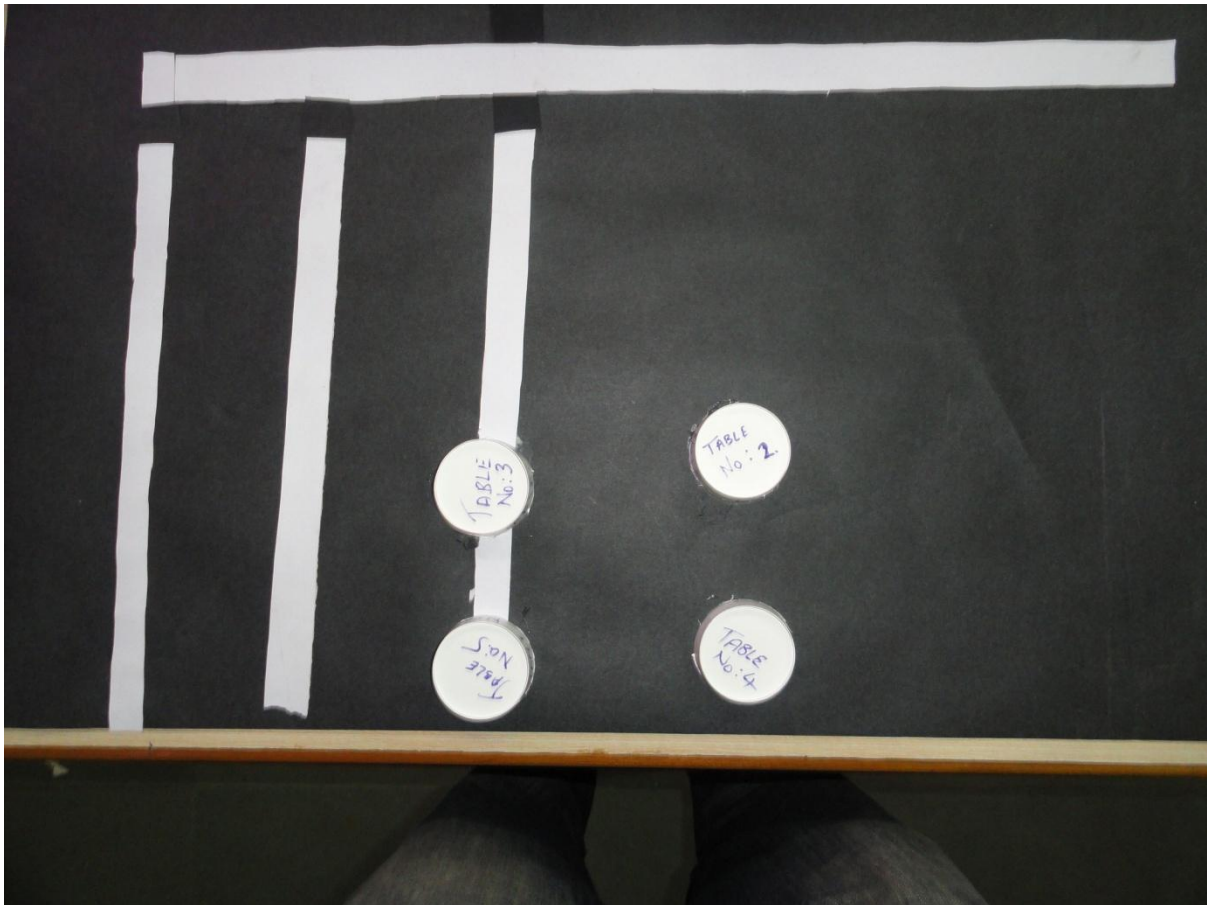
## 2.2 FireBird Waiter

With arms and camera enabled, it looks like this:



## 2.3 Restaurant Arena

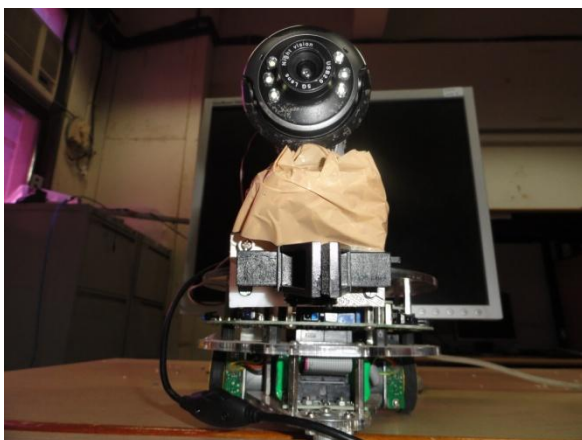
The arena is a rectangular place with tables and chairs. A white line is drawn from each table to the Kitchen. The bot will pick the object from the kitchen with the help of image processing and a camera and serve it to the table from where the order has been received following the white line.



Arena

## 2.4 Camera on waiter

A SLR camera has to be setup on the waiter to identify the objects. The orientation of camera should be proper so that the objects are in its view. We placed the objects to the left of the white line and camera is turned to left to view the objects.





## 2.5 Zigbee Module

Each waiter will have one in vehicle unit which is ZigBee enabled transreceiver module, which will communicate to the central server to receive the signals.



## 3. OVERALL DESCRIPTION

The main idea of this project is to use robots in place of human to reduce the human efforts and get some useful works done. It can be used as a waiter in restaurants or as a staff in hospitals or in an industry as a labor to pick objects and place it to its destination. The customer will place his order using the GUI at the main server. The robotic waiter receives the order using Xbee communication in the form of a signal from the Matlab at the main server. The bot moves to a defined location, turns to its left, takes an image, checks if there is an object in the image. If yes, then it picks up the object using the hand at the top of it, goes to the destination location following the white line and drops the object.

## 4. WORK DIVISION

Ashish Gupta: Image processing and ZigBee Communication

Ravinder Singh: Line Following and all the code burnt on bot

Saurabh Kumar Gupta: Image processing and working of arm

Kovid Kapoor: Matlab and all other codes

## 5. Testing plans

Test-1 : The bot was tested by checking if it could drop the object at the desired place after picking the correct object. Tested by making the bot drop the objects at various positions.

Test-2 : The bot should identify if the object to be picked is present. The robot reaches the first checkpoint and checks if the object is present. If yes, then it picks up the object (using the arm), and then goes ahead and drops the object at the correct place.

Both of these were successfully completed.

## 6. REQUIREMENTS

- Firebird Bot
- Robotic Arm to pick and place objects
- Camera placed on the bot to identify the correct item to be delivered
- Overhead Camera to identify the correct table where the order is needed
- Code base already provided for image processing
- Zigbee module for communication