

# Open CV based Object tracking Robot using Image processing with Raspberry Pi

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**Abstract** –Computer Vision is the ability of computer to see. Open CV is a multiplatform software system and supports different programming language interfaces. Open CV based robots are intelligent robots that takes visual data, process on it and provide appropriate output. A Robot is based on open CV and designed on Raspberry Pi which is used for object detection and tracking depend on the object's color, size and shape. A robot can detect only one object a time. Robotic vision deals with image processing. In this project robot can detect the object and rotate as left/right direction and then moves forward and backwards depend on object's movement. We use Python coding to identify the object with Open CV and ultrasonic sensor to maintain the distance between object and robot to avoid an obstacle. Pi camera located on robot chassis is used to capture the image.

**Key Words:** Open CV, Raspberry Pi, Image processing, Ultrasonic sensor, Pi camera, Robot.

## 1. INTRODUCTION

### 1.1 Introduction

In recent days, Capturing images with high quality and good size is so easy because of rapid improvement in quality of capturing devices with less costly but superior technology. Object detection and tracking is one of the challenging tasks in computer vision. Mainly there are three basic steps in video analysis- Detection of the object of interest from moving object, tracking of that interested objects in consecutive frames and analysis of object tracks to understand their behavior. In order to detect the object first take the necessary and relevant steps together, information from the many computer vision applications. This project can be used for surveillance purpose in many security applications. Images or videos are continuously captured by Pi camera which is located on robot chassis and it is connected to raspberry pi with the help of this we can detect and track the specified object. The project code is written in Python language for object detection using Open CV library i.e. Open source computer vision is programming function mainly aimed at real time computer vision. The robot takes photos and it is able to process a constant stream of images of the surrounding area and searches for the objects and goes to the nearest one. The robot will keep searching for the objects while moving. The image processing job is to do the contrast between the floor color and color of the object and then the algorithm provides the location to move on. The project is

built with a Raspberry Pi/Raspbian platform running a Python program that uses the Open CV library to process images and parameters used to guide Robot. Pi camera provides high resolution images. When the object is detected among the number of the objects the motor will drive the Robot and moves leftward/rightward or forward/backward and goes near the object. While tracking object ultrasonic sensor maintains the constant distance between the object and the Robot and avoids the obstacle those comes in the way. As soon as the robot reaches near the object, a Buzzer beeps to indicate that object is detected then robot turns to the left direction and start searching the next object.

### 1.2 Existing System

In the existing system object detection is done with the help of sensors. Multiple object detector sensor was available but right sensor is difficult to identify because each having own features for object detection it can use proximity sensor, ultrasonic sensor, capacitive sensor, photo electric and inductive sensors. For tracking purpose proximity or image sensor. The sensor identification is not simple task for every kind of operation; individual sensor is used so selection of sensors is done by following conditions namely accuracy, resolution, range control interface, environmental conditions and cost. These are measure factors to be considered.

## 2. PROJECT DESCRIPTION

### 2.1 Hardware Design

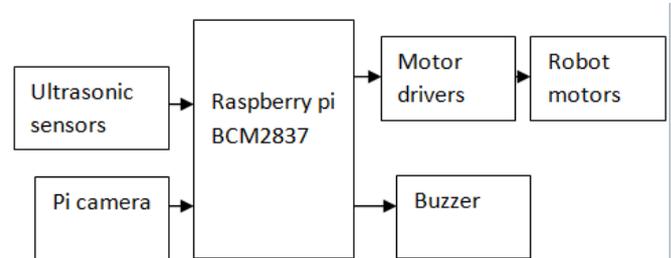


Fig 1. Block diagram

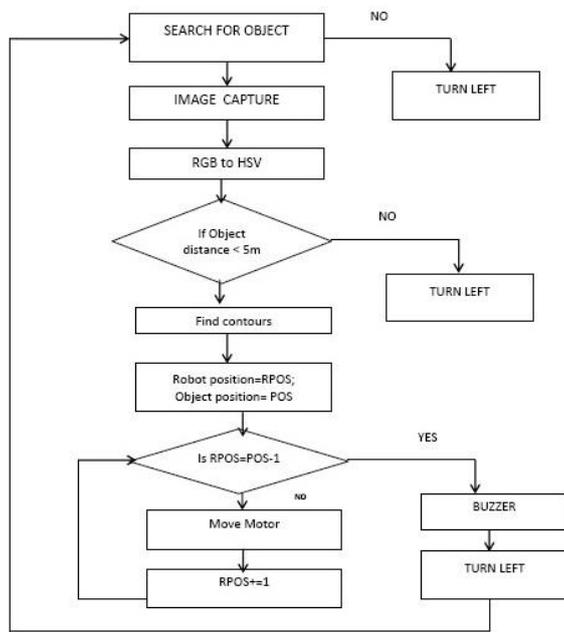
A chassis is used as a base on which raspberry pi kit, pi camera, motor driver which can control two motors, battery and power bank to provide power supply are mounted. We choose the raspberry pi as the main board for our project because it has enough processing power to deal with image

processing software's and deliver in real time results. It also has the advantage of the GPIO pins which can control the motors based on the result of the processing. Finally, it is a low power computer that can work for hours with a common battery.

The images or video are continuously captured by pi camera which is placed on the front side of the robot chassis and connected to raspberry pi with the help of RMC connector. The extracted image taken out from the pi camera sends to the raspberry pi kit and followed to execution of python coding. In the python coding the signals are generated, these signals coming from the execution of kit and sent to the robot. Robot follows and detect object effectively. Robot will detect the object of specific color or shape and then it tracks that object by moving left/right and forward/backward according to the object movement. It maintains the constant distance between the detected object and robot by using ultrasonic sensor HC-SR04 which consists of an ultrasonic transmitter, receiver and control circuit. The transmitter transmits short bursts which gets reflected from target and are picked up by the receiver. The time difference between transmission and reception by ultrasonic signals is calculated using the speed of sound and 'Speed = Distance/ Time' equation, the distance between the source and target can be easily calculated. Three ultrasonic sensors are used on front, left and right side. When robot reaches near to the object it beeps the buzzer and wait for a while. Then turn to left direction to find the next object.

## 2.2 Software Design

### Flowchart



The software flowchart for object detection and tracking is shown in fig.2. The steps involved in object detection are-

1. Capture video or image: The pi camera which is connected to raspberry pi captures the video which will be converted into frames.

2. Color conversion: The captured frame is RGB, to identify the object RGB image is converted into HSV color space. Where H means Hue (Color), S means Saturation (Greyness), V means Value (Brightness).
3. Thresholding: After color conversion the image is converted into binary image by selecting a proper threshold value.
4. Find Contours: Contours give good results with black background and white object using dilation and erosion. The dilation and erosion operation are very similar, the difference between them is that while the dilation computes the maximum pixel value during convolution, the erosion computes the minimum pixel value. The image is convolved with a kernel, which can be of any size or shape. The kernel has a specific anchor point usually at its center.
5. In a dilated operation, the bright region of the image will be dilated and dark reduced and in an eroded operation, the dark will be increased and bright eroded. The next function of the open CV used in this project is morphology EX. This function performs morphological transformations in the image and in this case applies two effects sequentially. First, the image goes through an erosion effect, removing small objects and possible artifacts. Second, the dilation effect which dilates the remaining pixels to enhance the size of real objects in the image. This combination of erode and dilate functions is called opening. In Range is used to detect if the robot is in front of any obstacles. Values of white and grey to the floor are defined and the percentage of non-white elements in the image is detected. If this value is almost 80% then this means that the robot might be in front of an obstacle and must turn around left direction.

## 3. CONCLUSION

The concept used in this project makes use of raspberry pi kit along with pi camera using image processing to track the color object effectively. The output response of the robot for different object movements was accurate and satisfactory. The application of object detection and tracking is in farming, military, civil, security and for commercial use, especially for surveillance purposes. Further modification we can do that is to develop a robotic pick and place arm which can detect objects with night vision cameras at low cost.

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