



Object Following Robot Using Raspberry Pi And Open Cv – Python

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Abstract: Object detection and tracking are important and challenging tasks in computer vision applications such as surveillance, vehicle navigation and autonomous robot navigation. Object detection involves locating objects in the frame of a video sequence. There are three key steps in video analysis, detection interesting moving objects, tracking of such objects from each and every frame, and analysis of object tracks to recognize their behavior. This project mainly focuses on Raspberry Pi ARM-11 based processor utilization, image processing. Here the webcam is interfaced to it using the USB ports available on board. Images captured by the webcam are sent to the Raspberry pi board where the processing of the image will be done. After this, the code gets executed and the dc motors are rotated in accordance to the written code and rotate as left, right, forward and backwards depends upon the object movement. It maintains the constant distance between the object and the robot. This robot can be used in both military and commercial applications like in hostage situations which can reduce risk of damage to human life.

Keywords: Image Capturing, Raspberry Pi, Camera, Python, Open CV

1. INTRODUCTION

The aim of this project will be design and development of a real time system to detect and track objects in video streams used in traffic surveillance, security cameras, etc. The goal of object detection is to detect all instances of objects from a known class, such as people, cars or faces in an image. This is wireless gesture controlled robot. This provides an easy, user friendly way to interact with robots and its systems using simple gestures. This can be achieved by detecting the gestures of the object or the human using some sensors. Because the work of the sensor is to sense the information from the external environment. The information given by the sensor to the system is processed to detect the type of the gesture. Later this gestures are used to decide the movement of the robot. The movement of the robot is controlled by another microcontroller. In this way the robot follows the gesture of the object or human. In this

project we are using the Raspberry pi kit for effective interaction of the user with robot.

2. LITERATURE SURVEY

a. “Accelerometer Based Gesture Controlled Robot with Robotic Arm” paper published in IJIRST –International Journal for Innovative Research in Science & Technology ISSN (online): 2349-6010

The concept behind our project is controlling a robot by detecting the gestures from an object. There are different methods to detect the gestures. This paper uses accelerometer sensor stick to the object to detect the gesture. But this method is not accurate instead we used image processing to detect gestures from an object.

b. “Image Processing and Object Detection” paper published in International Journal of Applied Research 2015; 1(9): 396-399

The detection of object gesture is done by using the Open Computer Vision library files. This is an image processing technique in this project we have used this to detect the colour specified. The concept of colour detection using Open CV library is grabbed from this paper. We used this concept to detect yellow colour.

c. “Interactive Interface for DC Motor using GUI with Raspberry Pi Controller” paper is published in International Journal of Innovative Research in Computer and Communication Engineering Vol. 5, Issue 6, June 2017

This project is simple only if we use raspberry pi kit because raspberry pi supports OS installation and Read Only Memory. This project requires Open CV libraries along with python language. The files required to run the Open CV and python are installed in the OS

d. “Remote Access of Raspberry Pi Robot via Internet” paper published in International

journal of innovative research in electrical, electronics, instrumentation and control engineering Vol. 4, Issue 4, and April 2016.

To make the robot wireless we connect to the raspberry pi using Virtual Network Connection through Wi-Fi and control the robot. It can also be called as Remote desktop Connection.

3. Hardware Design

a. List of hardware and software:

- Raspberry pi
- Camera
- IC L293D
- DC Motor
- Open CV
- Python
- Raspbian OS
- VNC viewer

b. Hardware Description

Raspberry pi: The raspberry pi is nothing but a minicomputer. It consists of 1GB Ram but it does not have inbuilt Read only



Fig 1: Raspberry Pi

Memory. We can provide memory externally up to 32GB. The version of the raspberry pi which is being used is Pi 3 model B. It is built with Bluetooth and Wi-Fi. It requires installation of Linux Operating System.

Camera: The HD web cam can be used for video streaming. The camera used is Logitech C270 streams the real time scenario to the raspberry pi through an USB cable.

IC L293D: The Raspberry pi itself cannot drive the 5V DC motor because of the less output current. As raspberry pi contains 40 pins the voltage across every pin is same but the current divides. The input current to the Raspberry pi is maximum 1Ampere. This current is divided across each and every component and at GPIO pin current is about 16Milli Ampere. We use L293D IC to amplify this small output current and provide sufficient power to run the DC Motor.

DC Motor: DC motor is an electrical machine which converts Direct current into mechanical energy through the interaction of two magnetic fields. One field is produced by a permanent magnet assembly, the other field is produced by an electrical current flowing in the motor windings.

c. Software Description:

Open CV: The Open Source Computer vision library files are used in the project for colour detection. Open CV-python interface software is installed in the raspberry pi and the python program written in this software controls the DC motor.

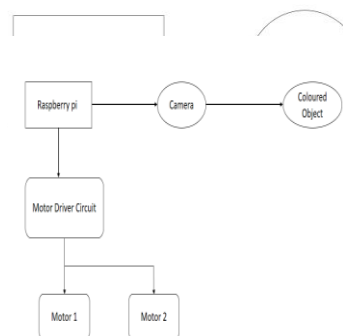
Raspbian OS: As the Raspberry requires an OS the manufacturing company provides a software called Raspbian OS. This includes the many built in applications including Virtual Network Connection.

VNC viewer: It is software which installed in other laptop to connect control the raspberry. This software access the device in the same network through an IP address given to the same device. The Internet Protocol (IP) Address is used to identify the electronic devices over the network.

4. Previous Method:

The Previous method consists of gesture detection based on the accelerometer reading. The attached to the object continuously monitor its position. These reading are sent to the Arduino wirelessly. Based on reading of the accelerometer the gesture is detected. These gestures decides the movement of robot.

Fig 2: Block diagram of previous method



5. Block diagram

Fig 3: Block diagram of present method

7. Working:

The accelerometer used in the previous method is replaced by the camera. The coloured object is monitored by camera. This block diagram consists of Raspberry pi, Motor driver circuit and two DC motors.

6. Flow Chart

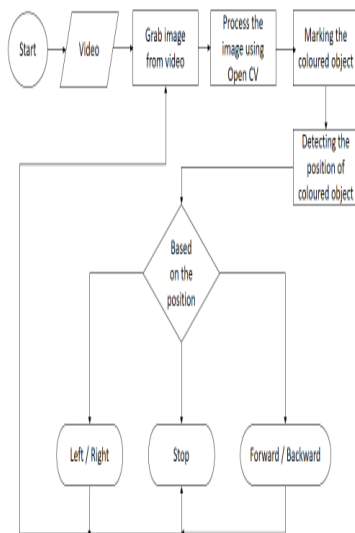


Fig 4: Flow Chart

As shown in flow chart each time the image is grabbed from video and takes the decision in controlling robot. This loop is an infinite loop.

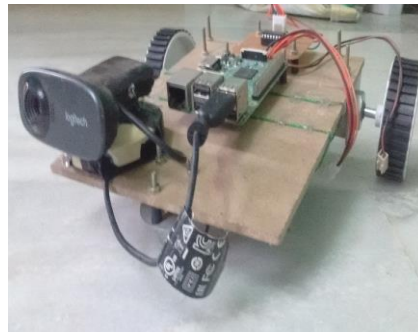


Fig 5: Project Photo

The camera sends the real-time scenarios to raspberry pi. This raspberry pi grabs each and every frame from video to analyse it for specified colour. The image is nothing but the group of intensity levels. This each intensity level is called pixel. Number of pixels depends on the image resolution. By default image resolution is very high so it is necessary to reduce the resolution which reduces processing time. So in the first step the image resolution is shrunk. Then using Hue Saturation and Value (HSV) readings. For every colour there is a range of HSV. Each and every pixel of the shrunk image is analysed for the specified HSV Range. If the HSV of the pixel which is analysed is within the range then it highlights the pixel otherwise removes it. After analysing whole image the result is displayed with highlighting the specified colour and removing Background. In this way the loop is repeated continuously.

8. Conclusion: Hence, it is possible to use the artificial vision for a robot to interact with the external environment, using a feature such as shape, color or texture. This characteristic is used as a metric to determine the movement of the entire robot.

9. Future scope:

- This concept can be used for tracking various objects continuously and security purpose in boarder areas and used for continues monitoring of objects and improved the processing speed and response.
- Tracking of Multiple Object



10. References:

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