

SURVILLANCE ROBOT

Technical Answers to real world problems

ECE3999

Under Guidance of

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Table of Contents

1.	Introduction
2.	Software Description
3.	Hardware description
4.	Block Diagram
5.	Algorithm
6.	Program
7.	Applications
8.	Acknowledgement
9.	Conclusion and results
10.	References

Introduction

Object tracking in real time is one of the most important topics in the field of computer Vision. Detection and tracking of moving objects in the video scenes is the first relevant step in the information extraction in many computer vision applications. This idea can be used for the surveillance purpose, video annotation, traffic monitoring, human-computer interaction, intelligent transportation, and robotics and also in the field of medical.

The robot is designed to track objects by spinning left and right to keep the object in sight and driving forward and backward to maintain a constant distance between the robot and the object. Images are acquired through the camera of an ARM11 Raspberry Pi device which is attached to the robot. The camera is attached to servos on the robot which allow the camera to pan and tilt. Several image processing techniques are used to detect the location of the object being tracked in the images

Here, the object is detected which follows adaptive color filtering method to identify the features that belongs to the moving object for tracking. This can be used in industrial process monitoring and automation. Most of the work done on object tracking robots makes use of sensors such as infra-red sensor, photo diodes, and colour sensors to detect the objects .

. Each pixel is then assigned as “0” or “1” depending on whether it is less than or greater than the threshold limit which is called as background and foreground pixels respectively. This results in a black and white image. An automated robot is developed which can follow colored objects .

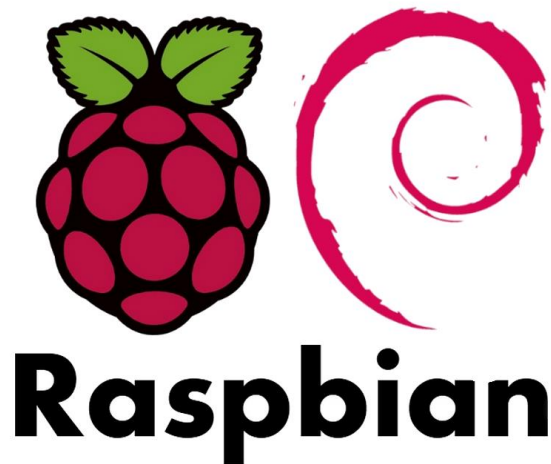
The object is detected with image processing techniques by using open cv. The snapshots or frames are continuously passed through a mask where the color thresholding is performed to detect the required object. Then the noises are eliminated to detect the required region of the object by various filter techniques.

Software Description

Linux Raspbian

The **Raspberry** is a Debian based Linux distribution created for the **Raspberry Pi**. It is worth to mention that the Raspberry is designed to only function with the raspberry,

Raspbian Os is easy to maintain as it is to use. The commands are quite easy and whenever you need to install software, the repository will always provide an updated version of the same. The repository boasts also of plenty of software all that encompasses most of which that you will need.

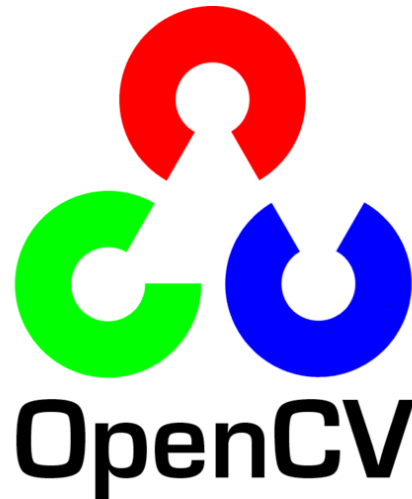


On the downside, you are not likely to encounter Raspberry as strong in performance as some other Pi distros like pidora. This means a pidora will run quite fast however what really puts Raspbian on the top is its level of usability which to honestly say Raspbian is way beyond the rest. Another alternative that you are likely to encounter is the arch which is also fun to use but a little more difficult for beginners. But if you are pretty okay with the learning curve you may opt for it. I recommend you to go for Raspbian. It's fun and pretty easy to use.

Open CV Python

Computer Vision is the ability of a computer to see. Open CV is a versatile software system and supports a variety of programming languages. CV-based robots are smart robots that take visual data, work on it and provide the right result.

The Robot is based on an open CV and designed for the Raspberry Pi used for object detection and tracking depending on the item's color, size and shape. A robot can only have one thing at a time. Robotic vision handles image processing.



In this project the robot can see the object rotate as a left / right direction and then move back and forth depending on the movement of the object.

We use Python encoding to identify an object with an Open CV and an ultrasonic sensor to maintain the distance between an object and a robot to avoid an obstacle. The Pi camera found on the robot chassis is used for photography.

Hardware's Used

A chassis is used as a base on which following hardware components are fit:

- Raspberry Pi for GPU and CPU computations.
- Inbuilt Wi-Fi to connect to Pi remotely.
- Motor driver which can control two motors
- Batteries to provide power.
- Jumper wires to connect individual components.
- Web camera.
- Servo motor to control the arm of the robot.

Hardware Description

Raspberry Pi

The Raspberry Pi is a very cheap computer that runs Linux. It provides a set of GPIO (general purpose input/output) pins that allows us to control electronic components for physical computing and explore the Internet of Things (IoT).

The original Pi had a single-core 700MHz CPU and just 256MB RAM, and the latest model has a quad-core 1.4GHz CPU with 1GB RAM.

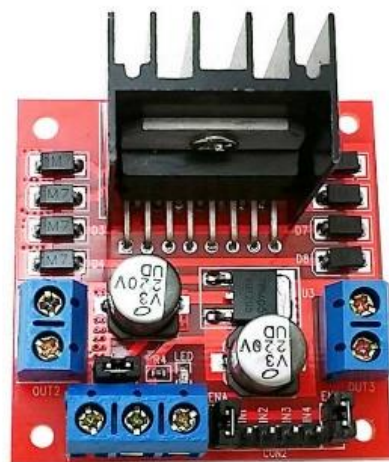
Raspberry Pi is used to learn programming skills, build hardware projects, do home automation, and even use them in industrial



Motor Driver (L298N)

L 298 is a dual full bridge driver that has a capability to bear high voltage as well as high current. It receives basic TTL (Transistor Transistor Logic) logic levels and is able to operate the different loads such as DC motors, stepper motors, relays etc.

L-298 has two enable input to control any device by enabling or disabling it. L 298 IC is most commonly used to make motor drivers or motor controllers.



These motor controllers can be controlled by any micro controller e.g Arduino, PIC, Raspberry Pi etc.

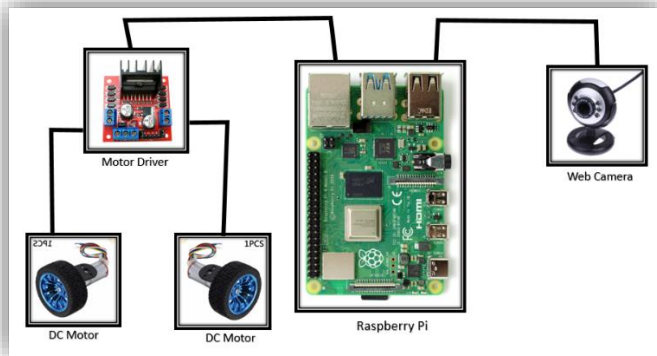
They receives input from micro controllers and operate the load attached to their output terminals correspondingly. L-298 motor driver (H-Bridge) is able to control two different DC motors simultaneously. While it can control a single stepper motor as well. L 298 has two Pulse Width Modulation (PWM) pins.

PWM pins are used to control the speed of the motor. By changing the voltage signal's polarity at its input we can rotate the motor in either clockwise or counter clockwise direction. It has a lot of real life applications e.g robotics, doors lock systems, CNC machines etc.

Web Camera

A webcam is a video camera that feeds or streams its image in real time to or through a raspberry pi. The quality and configurability of the camera module is highly superior to a standard USB webcam.

Hardware Design



Block diagram Explanation:

This method was implemented in Open CV for windows and experimentation has been performed on the robot that uses a Raspberry Pi and camera to record and process the frames. The robot can track any fully colour object using the colour based tracking algorithm at an average frame rate of 25 frames per second, which is sufficient for real-time applications. Figure 1 shows a sequence of frames while the robot is tracking a green ball. Figure 2 shows a sequence of frames while the robot is tracking a blue ball.

Program Algorithm:

In this program the image taken by the camera is divided into fragments. Every object have a different colour and have its own RGB Intensity. The exact RGB Intensity object is assigned to the bot.

When Target Intensity is located in the image. The program records its coordinates. And for the entire target finds the centre of the object.

And then accordingly if the centre coordinates is at left it commands the high voltage to right wheel or else if centre coordinates are in right it commands high voltage to the right wheel. Making the bot in right position.

Complete Program Link:

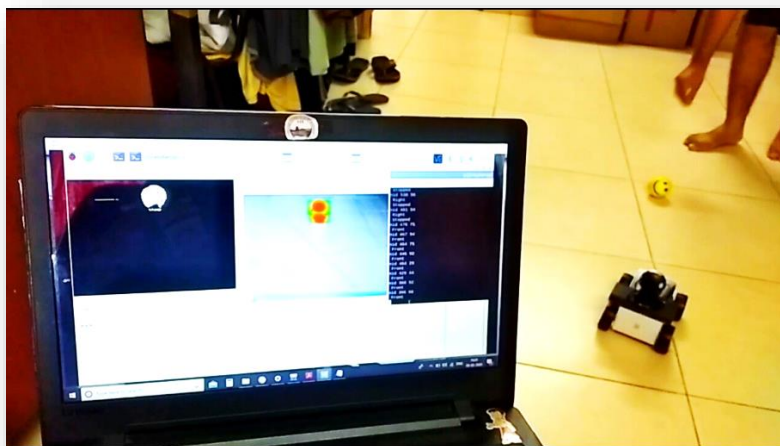
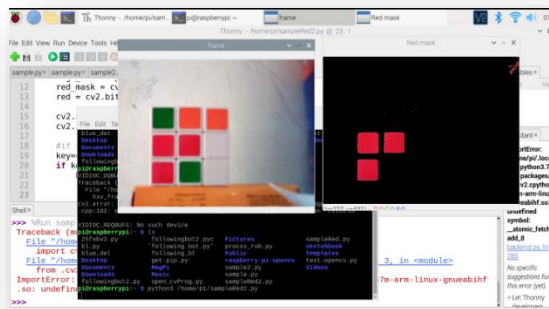
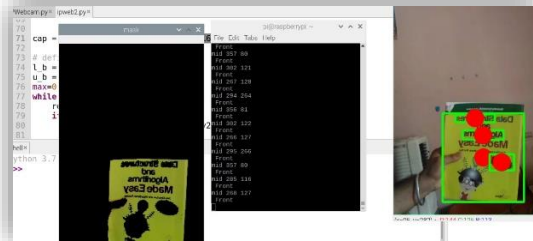
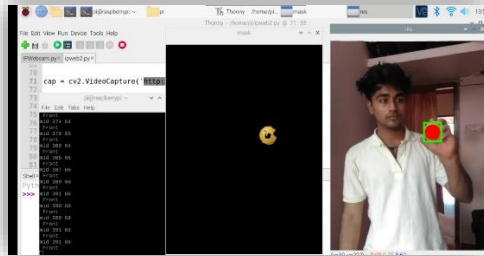
<https://drive.google.com/file/d/1O66AsjCKVepcSZMy0gJqVP4mevKcds0c/view?usp=sharing>

Procedure

- Installation of open cv python in Rpi
 - Give access to camera and connect it to Rpi
 - Testing of camera module
 - Testing different colours.
 - pointing out the boundary line of given colour.
 - Divide the frame into matrix . and assign coordinates.
 - Fixing the centre point of the target
 - Taking down the coordinate of centre of the target
 - Import GPIO Rpi library to program
-
- Assign the output ports and connect it to motors.
 - Now if the centre of target moves right assign high voltage left motors
 - Vice versa if centre of target moves left , assign high voltage to right motors.
 - If area of target reduces, assign high voltage to both left and right motors.
 - If area of target increases, reduce the voltage of both left and right motors till area reaches the max limit and stop.
 - If area extends the max limit, assign rev high voltage to both left and right motors to make backward movement.

Working Video Link:

https://drive.google.com/file/d/13t9hIAWM6VSbG6Fb_G606HFnBdhyb5Vj/view?usp=sharing



Applications

Object tracking can be used in applications such as video surveillance, human-computer interaction, robot navigation, activity recognition, anomaly detection, virtual reality, object navigation, and path detection.

Application of Object Detection and Tracking Techniques for Unmanned ... tracking and hand gesture recognition for human-robot interaction

The application of object detection and tracking is in farming,

Military (Tracking target)

Civil, security and for commercial use

Sports (tracking movements of ball or players)

Existing System

Wireless camera and several sensors are used to trace the object and tracking.

Disadvantages

This type of tracking system is difficult to handle when the target objects change their appearance and shading conditions

Proposed System

Our proposed approach for object detection and tracking is based on colours of the object with the help of camera alone.

Advantages

This method is used for tracking the various objects which have different shapes, sizes and colours.

Avoiding technology employed several infrared rays' sensors and supersonic waves' sensors together and measures the range in real time between the objects and the robot.

Future Enhancements

Tracking of multiple objects.

Position of container can be autonomous.

Area of coverage can be expanded.

Four wheeler to Drone Setup Bot

Acknowledgement

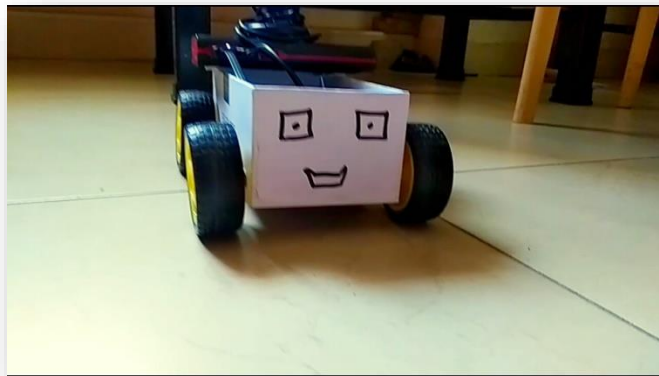
We would like to express our special thanks to our Professor Om Prakash Sahu Sir whose valuable guidance has been ones that helped us in making our project successful. His Suggestions and his instructions has served as the major contributor towards the completion of the project. This project has helped us in doing a lot of research and we get to know about so many new things.

We are really grateful because we managed to complete our Project. This project could not have completed without the effort and cooperation of our group members.

Conclusion and Result

The concept used in this project makes use of raspberry pi kit along with pi camera using image processing to track the colour object effectively. The output response of robot for different object movement was accurate and satisfactory.

The application of object detection and tracking is in farming, military, civil, security and for commercial use specially for surveillance purpose. Further modification we can do that is to develop robotic pick and place arm which can detect object with night vision camera at low cost.



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