Autonomous Color Tracking Robot Using Raspberry Pi

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Abstract **-** Autonomous vision-based robots are intelligent robots which take visual data and provide the appropriate output. In this paper, we have presented color tracking technique for embedded system. Many techniques have been proposed for color tracking object. The proposed system aims to develop autonomous color tracking robot using a raspberry pi. We have compared various priors and color tracking technique. Color tracking is most important part in the field of computer vision. Detection and tracking of moving object in the video scenes is the first relevant step in the information extraction in many computer vision applications. The robot is designed to detect and track the predefined color object. The overall objectives to evaluate techniques for color tracking object and other popular techniques for efficiency.

Keywords— color tracking, Object detection, Object tracking, etc

I. INTRODUCTION

Ball tracking plays an important or eventful role in most of the applications, such as video surveillance, human-computer interface, vehicle navigation, and robot control. It is generally defined as a problem of estimating the position of an object over a sequence of images. The basic objective of this paper eliminates the background disturbances accumulated during video structure analysis of a particular colored 3-D dynamic ball which in turn makes robot mobility according to directional movement of the ball .

Image Processing has been the talk of e-world for some years. Its varied applications have found its uses in almost every field. Vision deals with Computer Vision also image processing.The Raspberry Pi, sometimes referred to as the Pi, is a small, low-cost computer invented in the U.K. by the Raspberry Pi Foundation. It provides an easy-to-use tool to help you learn to code in Python (the Pi part of its name came from the focus on using it to code in Python). About the size of a deck of cards, it isn't as powerful as a laptop or desktop computer; its computing power is more similar to that of a smart phone. But what it lacks in processing power, it makes up for in its many features:

- Its readiness for programming in Python
- The many ways you can use it
- Its small size and cost

1. HARDWARE DESIGN

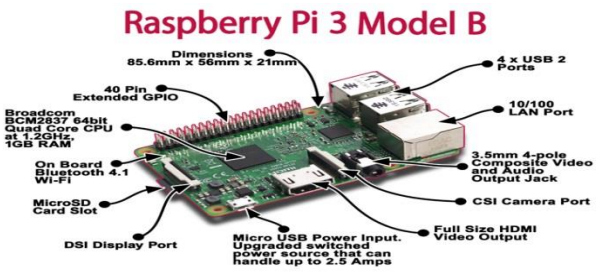
1.1 List of Hardware

• Raspberry Pi (model B) and CPU computations.
• Motor driver
• Jumper wires
• Web camera
• Servo motor

2.2 Hardware and Software Description

1.1.1 Raspberry Pi

The Raspberry Pi is a tiny and affordable that you can use to learn programming to fun ,practical projects. The Pi, with its companion memory card, is preloaded with all the software you need to jump into programming in Python. Type in commands, and see what happens. Enter a program you find on the internet or in a magazine, run it, and see how it works. The Pi is made for you to learn to code by playing with it, using it, and interacting with it. The Raspberry Pi 2 Model B has four USB ports. They're on the board in two sets of two, side by side. The USB ports are useful for connecting a keyboard and mouse to your Pi.A USB hub can also be plugged in to allow for even more peripherals.



1.1.2 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 configure ability of the camera module are highly chief to a standard USB webcam.

1.1.3 Raspbian OS

Raspbian uses PIXEL, **P**i **I**mproved **X**windows **E**nvironment, **L**ightweight as its main desktop environment as of the latest update. It is composed of a modified LXDE desktop environment and the Openbox stacking window manager with a new theme and few other changes.

1.1.4 Python

Python's creator, Guido van Rossum, said that code is read more often than its written.2 Readability is an extremely important part of programmingnand is a guiding principle in the style of Python programs. Comments are an important way to keep your code easy to read and understand. Comments are your new friend, and they will make your code easy to read. You'll keep using them to add notes to your code as you collect information from your game player (or user) and create a silly sentence.

1.1.5OpenCV

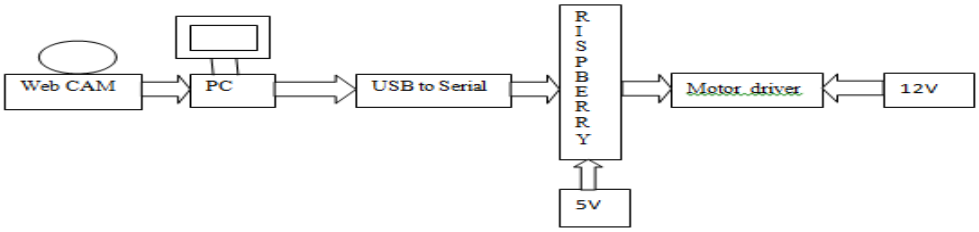
OpenCV grew out of an Intel Research initiative to advance CPU-intensive applications. Toward this end, Intel launched many projects including real-time ray tracing and 3D display walls. One of the authors (Gary) working for Intel at that time was visiting universities and noticed that some top university groups, such as the MIT Media Lab, had well-developed and internally open computer vision infrastructures code that was passed from student to student and that gave each new student a valuable head start in developing his or her own vision application.

1.1.6 Servo Motor

Servomotors are not a fixed class of motor. Servo Motor are also called Control motors. They are used in feedback control systems as output actuators and does not use for continuous energy conversion. The principle of the Servomotor is similar to that of the other electromagnetic motor, but the construction and the operation are different. Their power rating varies from a fraction of a watt to a few hundred watts.

I. Methodology

The proposed system will have camera mounted robot with raspberry pi.With help of camera images will be captured. The captured images will be processed to identify predefined colors object. Till the color is detected the robot will be searching the color by moving around it.The algorithm wriiten on raspberry pi will control robot motors and camera mount to identify the same, once the color detected robot will be tracking the color by control of motor. The robot is controlled by PC using USB-VCOM. In PC the software to control robot car will be installed while the webcam tracks the colored object and sends a command to robot via COM port, raspberry pi receives data from PC and controls the two DC motors using motor driver IC's. The body of the robot is moving by three wheels using two gear motors, PC COM-USB Interface, and motor driver circuit. Based on the variation in the input of the raspberry pi and the program that is flashed into it, the uC will cause movement of the motors by giving its output to the input of the motor driver IC which enables the movement of the motor. The uC helps in the collecting the serial data from the rxd port and accordingly giving commands to various output ports The motor driver is required to provide the motors with 12V power supply while the uC works on 5V. Five directions of the motors are tracked, namely, i) moving forward, ii) moving backward, iii) turning right, iv) turning left and v) stop. The major parameters of the project are the resolution of the camera.The color detection is done based on a range of values above and below the actual value so that there is no hindrance in the working of the project due to external environmental changes (brightness or dark) and the object can still be detected.More importantly, the distance of the object doesn't matter as long as it is in the camera resolution frame.



Block diagram: color tracking robot using raspberry pi.

II. Result and discussion

Same angle same distance

Sr.	Distance between robot and ball	Angle between camera and ball	Time required to track
1.	5ft	0°C	10sec.
2.	5ft	45° C	15.5sec.
3.	5ft	90° C	20.5sec.
4.	5ft	135° C	27.7sec.
5.	5ft	180° C	not detected
6.	5ft	225° C	28sec.
7.	5ft	270° C	not detected
8.	5ft	285° C	not detected
9.	5ft	315°C	not detected

Same angle different distance

Sr.	Angle between camera and ball	Distance between robot and ball	Time required to track
1.	0°C	1ft	not detected
2.	0°C	2ft	3.5sec.
3.	0°C	3ft	8.3sec.
4.	0°C	4ft	10.4sec.
5.	0°C	5ft	15sec
6.	0°C	6ft	not detected

Constant angle different distance

Sr.	Angle between camera and ball	Distance between robot and ball	Time required to track
1.	45°C	1ft	not detected
2.	45°C	2ft	3.5sec.
3.	45°C	2.5ft	10.3sec.
4.	45°C	3ft	10.4sec.
5.	45°C	3.7ft	13.9sec
6.	45°C	4ft	30.4sec
7.	45°C	4.5ft	not detected
8.	45°C	5ft	not detected

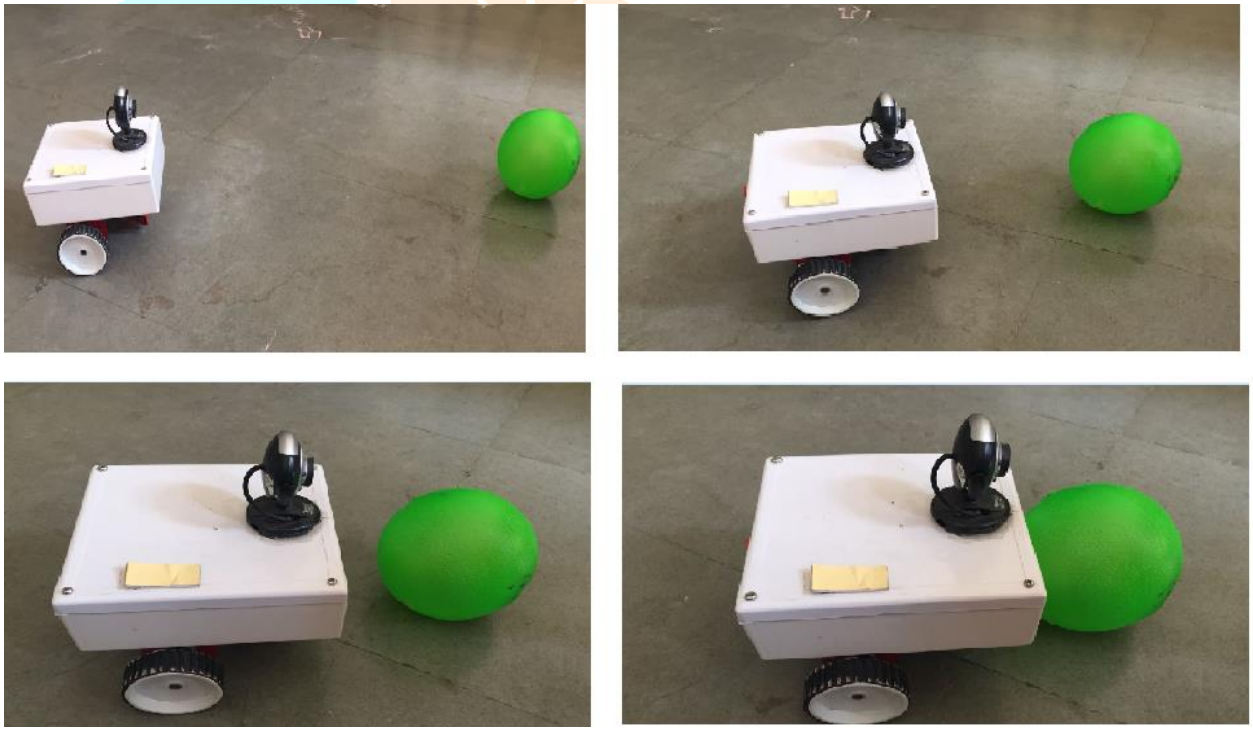


Figure: Snapshot taken during ball tracking

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IV. CONCLUSION

In this paper a webcam to track the color object effectively with the raspberry pi kit. The robot movement here used along dc motor for accurate measurements. It is not only used for color object because operating system we used here in the kit to access all facilities which were we use in computer like games, music, video etc., further modification we can do that use of raspberry pi remote to operate the manual supply like tv, so wired system can be reduced.

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