OBJECT DETECTION AND TRACKING USING IMAGE PROCESSING

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Abstract: The project mainly focuses on the basis to implement the object detection and tracking based on its colour, which is a visual based project i.e., the input to the project will be the video/image data which is continuously captured with the help of a webcam which is interfaced to the Raspberry Pi. It will detect the object and it tracks that object by moving the camera in the direction of the detected object. The visual data captured by the webcam is processed in the Raspberry Pi and the object is detected based on the colour or shape and if the object is detected, the servo motor is rotated in such a way that wherever the object moves, the camera will be pointing to that object. Here, the servos are controlled by the help of a Microcontroller board called Arduino board through its PWM pins. We can control the angle of servo rotations by the arduino board i.e., by varying the pulse widths.

Keywords: Object, Raspberry PI, Colour.

I. INTRODUCTION
The aim of this project is to present a method for object detection and tracking based on its colour. By using this method, one can easily detect and track any object which may be a ball or book or even an enemy aircraft’s missiles i.e., this method can be used even in many security applications.

This model gives an overview of Raspberry Pi Arm-11 based processor board. The main features of Raspberry Pi are Broadcom BCM2835 Arm-11 processor (700 MHz), 512MB RAM, on board USB 2.0 ports. Providing a wide range of processors based on a common architecture that delivers high performance and cost efficiency.[1]

To control the movement of servos, the controller is used. Since Arduino has more number of PWM pins and it supports open source hardware, it is preferred to use. Arduino has a 32-bit Atmel ARM processor.

A) Overview
The objective is to detect an object based on colour and the make use of open source hardware, hence Raspberry Pi processor board is the best option for an individual interested in low cost Arm processor. It has many inbuilt features and many ports which makes the used to experience the power of using a processor. The board comes with USB ports to which Camera, keyboard and mouse, Wi-Fi dongle can be connected which gives the feeling of working on a system.

The Arduino board is also a good choice in respect to cost, performance and user friendly when it compared to other microcontrollers. The Arduino integrated development environment (IDE) is free of cost and the programming language is very simple and it comes with so many examples to learn.

The rest of the paper is organized as Section 2 discusses project description; Section 3 gives the specifications, Section 4 deals with Block diagram, section 5 discusses software flow chart and last two sections discusses results and conclusions.

II. PROJECT DESCRIPTION
The project mainly focuses on the basis to implement the object detection and tracking based on its colour, which is a visual based project i.e. the input to the project will be the video/image data which is continuously captured with the help of a webcam which is interfaced to the Raspberry Pi. It will detect the object and it tracks that object by moving the camera in the direction of the detected object.

First of all the Linux O.S is installed into the Raspberry Pi board via Micro SD card and appropriate code is written in Python language for the object detection using the Open CV libraries and is dumped in the board. The visual data captured by the webcam is processed in the Raspberry Pi and the object is detected based on the colour and once if the object is detected, the servo motor is rotated in such a way that wherever the object moves, the camera will be pointing to that object. We can control the angle of servo rotations by the arduino board through its PWM pins i.e., by varying the pulse widths.

The main Hardware/Software used is
- Wheezy Raspbian
- Raspberry Pi
- Servo motors
- Image Processing
- Open CV
- Python
- Arduino

III. SPECIFICATIONS

A) Project specifications
The project is mainly divided into three parts:
- Capturing images/video and sending them to Raspberry Pi.
• Processing the images/video and detecting the object using Raspberry Pi by writing appropriate code.
• Enabling the servo motors through the Arduino board according to the processed image data.

**B) Hardware requirements**
- Raspberry Pi
- Servo motors
- Webcam
- Arduino board
- Acrylic sheet DMI cable
- Monitor

**C) Software requirements**
- Ubuntu 12.04
- Python
- Open CV
- Geany
- Xming
- Putty

**IV. BLOCK DIAGRAM**
The block diagram of complete object detection and tracking is shown in Figure 1:

![Figure 1: Block Diagram](image)

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**V. SOFTWARE FLOW CHART**
The software flow chart for object detection and tracking is shown in Figure 2. The steps involved in object detection are:

**A) Capture Video:** The camera which is connected to Raspberry PI USB captures the video which will be converted to frames.

**B) Colour Conversion:** The captured frame is RGB, to identify the object the RGB image is converted into HSV colour space. ‘H’ stands for Hue, ‘S’ stands for Saturation and ‘V’ stands for Value.

![Figure 2: Flow Chart](image)

**C) Thresholding:** After colour conversion, the image is converted into binary image by selecting a proper threshold value.
D) Find Contours: Contours are similar to connected component in MATLAB which is used to find the object. Contours give good results with black background and white object. If the contours are <= 300, than servo is tilted to right otherwise the servo is rotated to left.

VI. RESULTS
Below figure shows the snapshots of the Object detection and tracked developed and tested in the real environment.

VII. CONCLUSION
The objective is to build a model that can detect the object of specified colour and that works on the basis of visual data captured from a typical webcam which has a fair clarity. The algorithm is tested in the laboratory live and the success rate is 100%. The algorithm works well under all conditions and the time taken to detect and track the object is <10ms. The future scope of this work is to develop a robotic arm which detects and tracks the object based on colour and shape.

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