

Real time object detection using Image Processing

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Abstract—*Object detection plays an important role in real time applications. It is used in many applications such as surveillance monitoring, human machine interaction, army base etc. The main aim of this paper is to detect the object and to detect the colour of the object using Image processing technique. Pi camera. Raspberry pi 11 kit interfaced with pi camera is used for detection of object. Raspbian os with python coding is used for object detection and colour recognition.*

Keywords—*Raspberry Pi, Pi camera, Raspbian os, object detection, colour recognition, Image processing.*

1. INTRODUCTION

Image processing is widely used in many applications. It is defined as the process of converting the image into digital form. Enhancement of image can be done to obtain the special features of the image. Generally, the input of the image may be video frame or a photograph and the output of it may be image or image attributes. Generally, importing the image by means of optical scanner, analyzing and enhancing the image and obtaining the resultant image are the three main steps of image processing. Image processing is used in various applications such as robotics, remote sensing etc.

Object detection and colour recognition is widely used in real time applications. Object detection is used in detecting the multiple objects within an image. It is used in many applications such as security, face recognition etc.

Colour recognition is used to identify the object of particular morphological features. Tracking the multiple objects of same colour can be done using this technique.

2. LITERATURE SURVEY

Pallavi V. Saraikar and Prof K.S. Ingle designed on Raspberry Pi which is used for object detection and tracking depend on the object's colour, size and shape. backwards depend on object movement.

Prof V.B. Raskar, Nilesh Hargude and Sabale Viswanath designed a robotic hand which is used for many applications such as contour detection and contour extraction.

Vijayalaxmi, K. Anjali, P. Rohit Kumar, B. Srujana designed a robot which mainly tracks the colour of the object using Image Processing technique.

Ravi D. Simaria, Prof D.S. Pipalia designed an embedded system which detects an object first and then tracks it as long as it is in the line of sight of the camera. As the object moves, the embedded system rotates the camera which is mounted on a stepper motor according to the path of the moving object. The

embedded system also sends data to an end user via a Wi-Fi server so that the end user can monitor the activity of the object of interest.

Himanshu Borse, Amol Dumbare, Rohil Gaikwad, Nikhil Lende designed an embedded system which tracks a moving object. By utilizing a mobile robot with sensors and image processing, robot detection and then obstacle avoidance can be done in real time applications.

D. Schulz, W. Burgard, D. Fox, A.B. Cremers designed a mobile robot which track multiple moving objects by means of Bayesian filtering technique.

3. BLOCK DIAGRAM

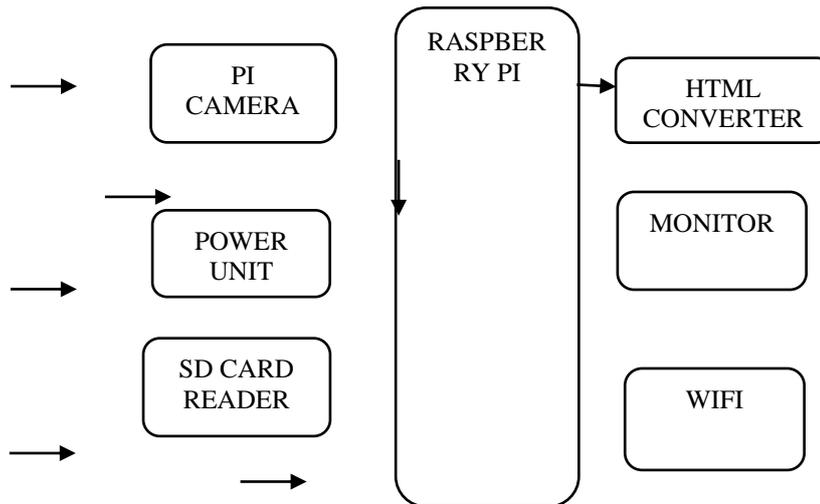


Fig. 1 Block diagram

4. COMPONENTS DESCRIPTION

The hardware requirements for this project are

- Raspberry Pi
- Pi camera
- HTML converter
- Adapter for power supply connection

The software requirements for this project are

- Python
- Raspbian os
- Tensor flow

A. Raspberry Pi

The Raspberry Pi is a fully-fledged minicomputer, capable of doing whatever you might do with the computer. It comes with 4x USB, HDMI, LAN, built-in Bluetooth/Wi-Fi support, 1GB RAM, 1.2GHz quad-core ARM CPU, 40 GPIO (General Purpose Input Output) pins, audio and composite video output, and more.

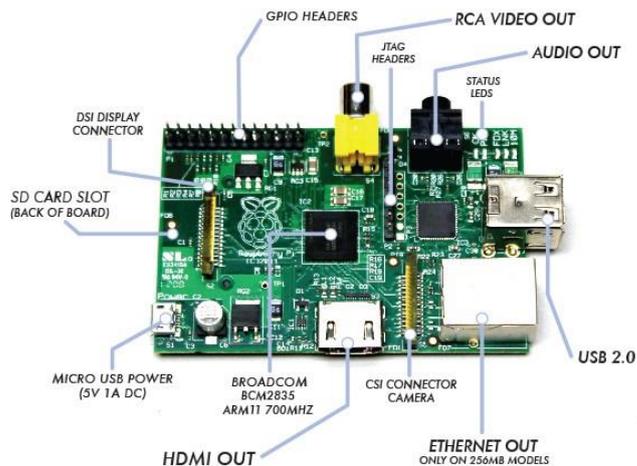


Fig 2 Raspberry Pi kit

B. Pi camera

The pi camera is interfaced with the Raspberry Pi kit for capturing video frames and photographs of the desired objects.

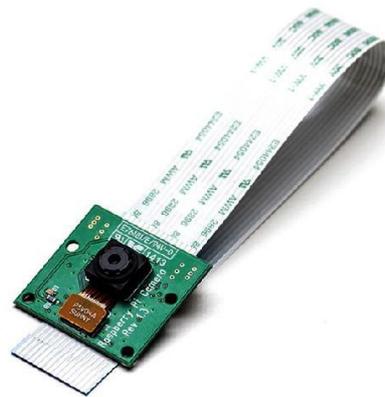


Fig 3 Pi Camera

C.HTML converter

The HTML converter is used for connecting the monitor with the HTML port of the raspberry pi kit.

D. Power Supply

The adapter is connected to power supply port of Raspberry Pi kit. It is necessary to ensure that the power supply should be in range of 4-5v

E. Raspbian os

Raspbian OS is one of the official Operating systems available for use. The system is based on Debian Linux and is optimized to work efficiently with the Raspberry Pi computer. We are using Raspbian os with python coding for object detection and colour recognition purpose.

F. TensorFlow

TensorFlow is an open source machine learning framework for all developers. It is used for implementing machine learning and deep learning applications. TensorFlow is designed in Python programming language, hence it is considered an easy to understand framework. TensorFlow is well-documented and includes plenty of machine learning platform.

G. Keras

Keras is an open-source neural-network library written in Python which is capable of running on top of TensorFlow.

5. WORKING

The working consists of the following phases.

A. Installation of software's

This includes the

- Installation of python
- Installation of pip version
- Installation of numpy version
- Installation of Raspbian os
- Installation of tensor flow

B. Interfacing pi camera with Raspberry Pi Kit

The steps required to interface pi camera with Raspberry Pi kit are mentioned below.

- For enabling camera in Raspberry Pi, open raspberry pi configuration using following command, `sudo raspi-config`.
- Then select Interfacing Options in which select camera option to enable its functionality.
- Reboot Raspberry Pi.
- Now we can access camera on Raspberry Pi.

C. Dumping of code into Raspberry Pi kit

- Create colour detection and object detection algorithm.
- The steps involved in colour detection algorithm are
 1. Image Acquisition
 2. Image Enhancement
 3. Image Restoration
 4. Colour recognition

- Thresholding
- Background Subtraction

a) Image acquisition

It is the primary step in image processing. Objects which are needed to be detected are to initially captured by means of image sensors. It helps in collecting more information about the object. One of the forms of image acquisition in image processing is known as real-time image acquisition. This usually involves retrieving images from a source that is automatically capturing images

b) Image enhancement

Image enhancement is among the simplest and most appealing areas of digital image processing. The image which is collected in the previous stage is enhanced to highlight the certain features of the image such as brightness, contrast.

c) Image restoration

Image restoration is an area that also deals with improving the appearance of an image. However, unlike enhancement, which is subjective, image restoration is objective, in the sense that restoration techniques tend to be based on mathematical or probabilistic models of image degradation.

d) Colour detection

The two algorithms used are Thresholding and Background subtraction.

Thresholding is a process of converting a grayscale input image to a binary image by using an optimal threshold. The purpose of thresholding is to extract those pixels from some image which represent an object. Though the information is binary the pixels represent a range of intensities. The main objective of binarization is to mark pixels that belong to true foreground regions with a single intensity and background regions with different intensities.

Background subtraction is a way of eliminating the background from image. To achieve this, we extract the moving foreground from the static background. Background Subtraction has several use cases in everyday life, it is being used for object segmentation, security enhancement, pedestrian tracking, counting the number of visitors, number of vehicles in traffic etc. It is able to learn and identify the foreground mask. The area of the image is set to 1 while the background area is set to be zero.

- The steps involved in object detection are

- a) Image Acquisition
- b) Image Enhancement
- c) Image Restoration
- d) Object detection

a) Image acquisition

It helps in collecting more information about the object. One of the forms of image acquisition in image processing is known as real-time image acquisition. This usually involves retrieving images from a source that is automatically capturing images.

b) Image enhancement

It is a subjective process. This process involves highlighting certain features of the image like brightness, contrast etc.

c)Image restoration

It is the process of restoring certain features of image. Resizing of image is possible without affecting features of original image.

d)Object detection

It is the process of finding instances of objects in images. In the case of deep learning, object detection is a subset of object recognition, where the object is not only identified but also located in an image. This allows for multiple objects to be identified and located within the same image.

There are two approaches to performing object recognition using deep learning. They are training a model from scratch using a pretrained deep learning model.

D)Construction

- Initially take the Raspberry Pi kit.
- Connect the keyboard and mouse to the USB ports of Raspberry Pi.
- Connect the monitor to HDMI port
- Use the power supply port for power supply connection

E) Working

- After the kit connection, switch on the power supply. Note that supply should be in the range of 4-5v.
- A Raspbian os environment is visualized on the monitor.
- Select the terminal option in it.

Object detection

- For object detection type `cd object detection` and press enter.
- Then type `python3 objectdetection.py` which is nothing but a file in python which has list of objects to be detected.
- Click enter. A pi camera screen is visible.
- Wait for 2-3 minutes till the pi camera screen minimization.
- The terminal and pi camera screen are visible now in minimised version.
- Now use pi camera for capturing the image of the object.
- Then the object is detected on monitor.
- The monitor will finally display the object identity.

Colour detection

- For object detection type `cd tf1.py` which is nothing but a file in python which has colour spaces and properties.
- Click enter. A pi camera screen is visible.
- Wait for 2-3 minutes till the pi camera screen minimization.
- Now use pi camera for capturing the image of the object.
- The monitor will finally display the colour of the object.

6. CONCLUSIONS AND FUTURE WORK

Conclusions

Object and colour detection play an important role in real time applications. They are used in various fields like

- Mining, Industrial applications and Surveillance monitoring.
- They are also used in capturing live images of the object. Thus, building a model that can detect the colour of the object and identify the object is done. Objects of same morphological features can be detected easily. Background subtraction helps us to eliminate the background thereby avoiding shadowing problems.

Future Work

Our proposed method can only detect the colour of the object and identify the object. It can't track the moving object. Static objects are alone tracked. Our future work is to track the object based upon its morphological features like colour and size and to track the objects in motion.

7. OUTPUT

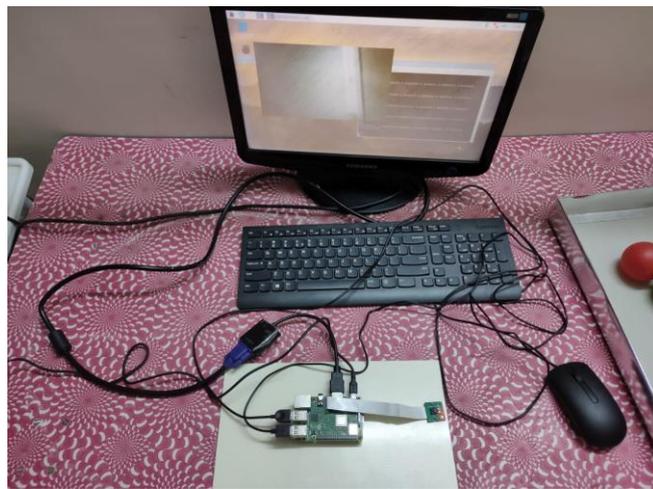


Fig 4 Real time set up



Fig 5 Kit and Pi camera connection



Fig 6 Detecting scissor

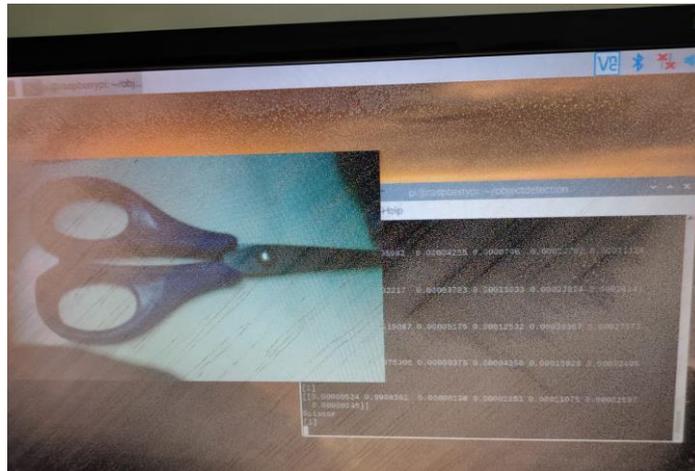


Fig 8 Detected output scissors



Fig 7 Scissor and Pi camera

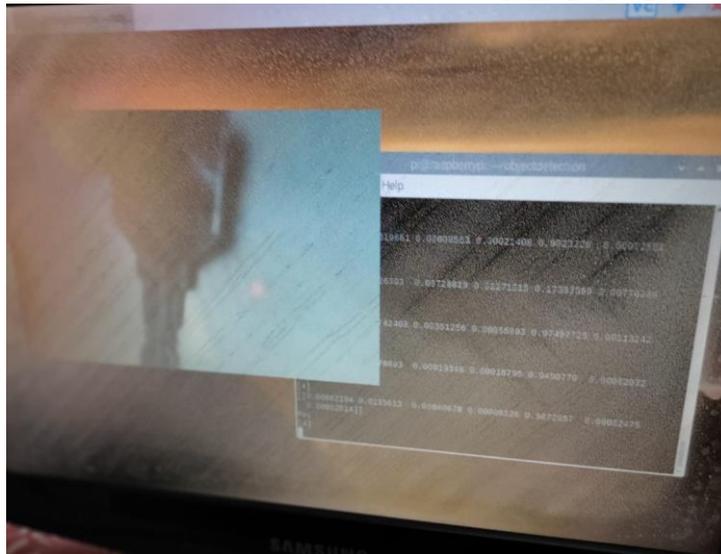


Fig.7 Detected Output key

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