



Real Time Object Detection and Tracking using Raspberry Pi

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Abstract:

Detection and tracking of moving object is a challenging task. In this paper algorithm for real time detection and tracking of object is proposed. The system consists of camera and Raspberry pi and the PC. Camera continuously captures the video. It is send to Raspberry pi for further processing. Blob detection analysis is performed in which objects gets detected based on their shapes. Bounding box algorithm is applied which continuously tracks the object based on information from the boundary pixels by using horizontal and vertical scan from left to right and top to the bottom to locate the boundary points. These boundary points are used to track the object through boundary box.

Keywords: Object Tracking ;Raspberry Pi; Camera Module;Image Processing; Bounding Box.

I. INTRODUCTION

Video surveillance is an important research area in computer vision which tries to detect and track objects over a sequence of images. Object detection and tracking are important and in various computer vision applications such as vehicle navigation, surveillance and autonomous robot navigation. In object detection we locate objects in the input image frames of the video. Object tracking is the process of locating an object or multiple objects over time using a camera. The availability of high quality and inexpensive cameras and their increased need for automated video analysis has created a great interest in object tracking algorithms. There are three phases involved in the analysis of any video which are detection of interesting moving objects, tracking of these objects from each input image frame, and analysis of these detected and tracked objects to identify their behavior [1]. For moving object detection various background subtraction techniques are available. Background subtraction means the absolute difference between the reference background and the current image frame. A good background subtraction algorithm can avoid the problems due to background clutter varying illumination condition, bootstrapping, shadows, camouflage, and for we have to do segmentation of foreground object at the same time. In the presence of variability illumination condition and background motion object tracking is a very challenging issue.

Tracking objects can be complex due to:

- Loss of information caused by projection of the 3D world on a 2D image,
- Noise in images,
- complex object motion,
- non rigid or articulated nature of objects,
- partial and full object occlusions,
- complex object shapes,
- scene illumination changes, and
- Real-time processing requirement.

In any object detection and tracking system we have to follow above steps. During data acquisition stage

camera continuously captures the video. Then captured input image frames are preprocessed. Segmentation means, separating out the objects from the background. The aim of image segmentation algorithms is to partition the image in to perceptually similar regions. Different segmentation methods are Mixture of Gaussian based on moving object detection method, Frame differencing method to detect objects and Background subtraction method to detect foreground objects. Next step is to select a proper feature in tracking. Feature is mainly related with the object representation. Object is represented with many features like color, is used as a feature for histogram based appearance representations. For contour-based representation, edge is usually used as feature. Combinations of these features are used for easy tracking of the object. Then based on the features selected object tracking will be done. This paper discusses about the object detection and tracking system and software design flow in section II Hardware components and system implementation is given in section III Results of the system are given in section IV Applications of the object tracking system are given in section V Finally the work is concluded in section VI.

II. PROPOSED SYSTEM

A. Block Diagram of the system:

Proposed system consists of Raspberry pi, camera module and the PC with MATLAB. Camera continuously captures the video and its input frames are sending to raspberry pi. On raspberry various operations are performed on the image. Image is preprocessed and blob detection algorithm is applied to detect objects and then bounding box algorithm is applied which tracks the objects. Whole algorithm of the object tracking is implemented on raspberry pi. Data from raspberry is send to PC end for display.

Steps in the proposed system for object detection and tracking:

1. Camera: Continuously record video.
2. Read Image: Read frames of the image.
3. Gray scale conversion: It converts the colour image into a gray image. This method is based on different color

transformation. According to the R, G, B value in the image, it calculates first gray value, and obtains the gray image at the same time.

4. Image Binarization: Gray scale image is converted into black and white image.
5. Blob Analysis: Blob analysis is performing on the binary image in order to get vehicle count in SIMULINK. In blob analysis we find area of the object. Remove Small objects in the image. Convert that image into logical image in Simulink.
6. Bounding box to the object: It finds boundary pixel information to set bounding to the different objects for tracking.

B. Software Design

1. MATLAB with Simulink Support

MATLAB is a high-performance language whose basic data element is an array that does not require dimensioning. A matrix and vector formulation allows us to solve many technical computing problems. It integrates programming visualization and computation which gives easy-to-use

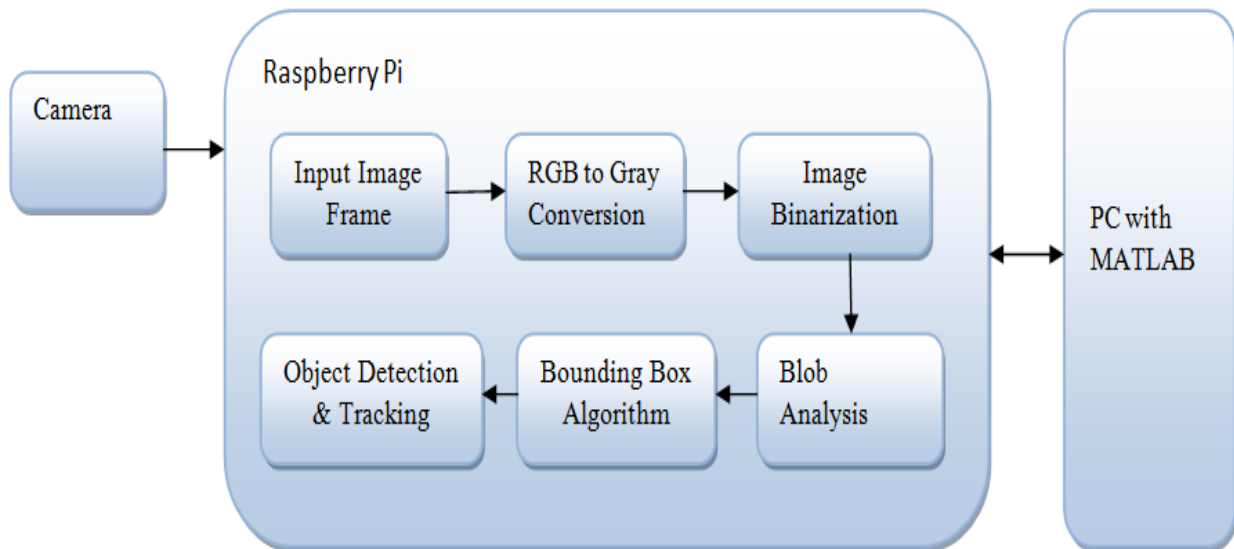
environment where problems and solutions are expressed in the mathematical notation. Areas in which MATLAB toolboxes are available include control systems, simulation, signal processing, neural networks, wavelets, fuzzy logic, and many others. Simulink is developed by Matlab tool, it is graphical programming environment for simulation, modeling and analyzing multiple domain dynamic systems. It has a customizable set of block libraries and a graphical block diagramming tool.

III. IMPLEMENTATION

A. Hardware Implementation and its components

1. Raspberry Pi

All models of raspberry pi consists of Broadcom system on chip (SoC), which includes an ARM compatible central processing unit (CPU) and an on-chip GPU (Graphics Processing Unit) Most boards have between HDMI composite video output, 3.5 mm phone jack for audio, 1 and 4 for USB slots. CPU speed ranges between 700 MHz to 1.2 GHz Pi 3 and on board memory range from 256 MB to 1 GB.



In raspberry pi, operating system is stored in SD cards. Low level output is provided through no. of GPIO pins which support protocols like I²C. Pi 3 and Pi Zero We have on board Bluetooth and Wi-Fi 802.11 In the B-models has an 8P8C Ethernet port.

Raspbian OS is available for Raspberry Pi, Raspbian comes out on top as being the most user-friendly, best looking, has the best range of default software and optimized for the Raspberry Pi hardware. Raspbian is a free operating system based on Debian (LINUX), which is available for free from the Raspberry Pi website.

Raspbian is a free operating system which is based on Debian and optimized for the Raspberry Pi hardware. It is the set of basic programs and utilities that runs Raspberry Pi. It comes with over 35,000 packages, pre-compiled software bundled in format for the easy installation of raspbian operating system on Raspberry Pi.

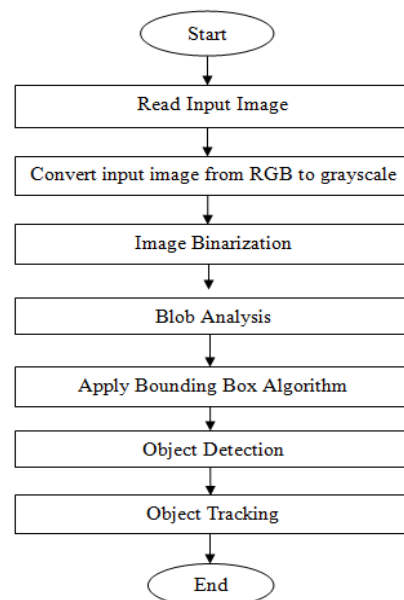


Figure.1. Proposed System Flow

V. APPLICATIONS

Applications of object tracking are:

1. Automated video surveillance system:

In this application system is designed to monitor the movements in a given area, identifies the moving objects and report if there is any doubtful situation.

2. Robot vision technique:

In robot navigations the steering system identifies different obstacles in the path of the robot and tries to avoid the collision. If the obstacles are other moving objects then it is calls for a real-time object tracking.

3. Traffic monitoring system:

Traffic congestion problems are increasing so adaptive traffic control is necessary. We need to do real time vehicle tracking in order to control traffic light.

4. In Animation System:

Object tracking algorithm can also be extensive for animation.

VI. CONCLUSION

This paper discusses the object tracking system based on raspberry pi. Bounding box algorithm is implemented for detecting and tracking objects using MATLAB with the Simulink support. Results shows that method is suitable the tracking of objects and it can be used in various future applications.

VII. REFERENCES

- [1].Ravi D. Simaria, Prof. D. S. Pipalia, "Real Time Object Detection & Tracking System (locally and remotely) with Rotating Camera", International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 3 Issue: 5 3058 – 3063.
- [2].Pradeep Kumar.G.H , "Object Tracking Robot on Raspberry Pi using Opencv", In ternational Journal of Engineering Trends and Technology (IJETT) – Volume 35 Number 4- May 2016.
- [3].M. Karthikeyan, M.Kudalingam, P.Natrajan, K.Palaniappan and A.Madhan Prabhu , " Object Tracking Robot by Using Raspberry PI with open Computer Vision (CV)", International Journal of Trend in Research and Development, Volume 3(3), ISSN: 2394-9333.
- [4].Kalpesh R Jadav, Prof.M.A.Lokhandwala, Prof.A.P.Gharge, "Vision based moving object detection and tracking", National Conference on Recent Trends in Engineering & Technology, 13-14 May 2011.
- [5].M.R.Sunitha,H.S.Jayanna,Ramegowda,"Automtic Object Tracking using Background Subtraction and Horizontal and Vertical Scanning Technique",International Conference on emerging research in computing information ,communication and application,Elseveir Publication,2013.
- [6].Ms Jyoti J. Jadhav , "Moving Object Detection and Tracking for Video Surveillance", International Journal of Engineering Research and General Science Volume 2, Issue 4, June-July, 2014 ISSN 2091-2730.

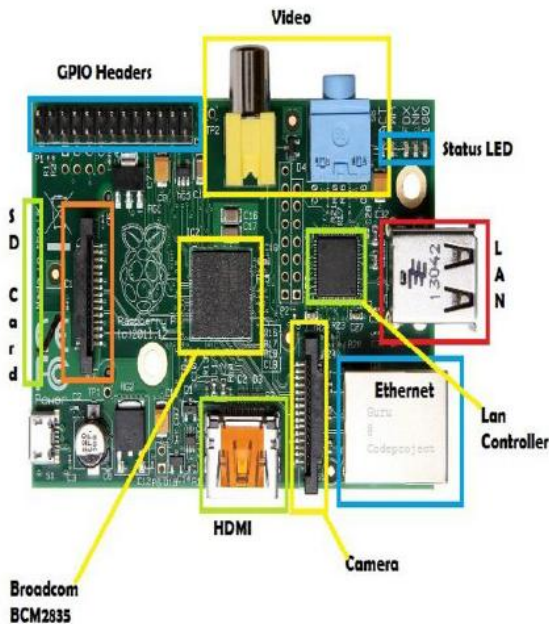


Figure. 2 Raspberry Pi kit structure

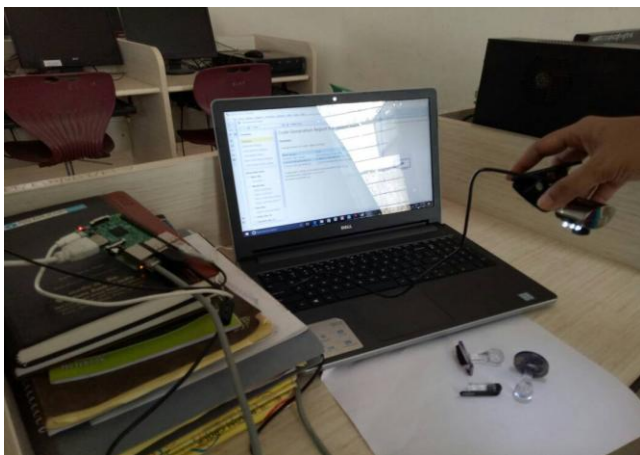


Figure.3. Implemented Model

IV. IMPLEMENTATION RESULTS

A. Object Detection and Tracking Results

Objects detected and tracked in the input video sequence are shown in the figure 6. Tracking is done using boundary box detection. In figure different boundary boxes are shown according to the boundaries and shape of the objects in the input image frame.



Figure.6. Results of object detection and tracking

- [7].Aswin C. Sankaranarayanan, Ashok Veeraraghavan ,“Object Detection, Tracking and Recognition for Multiple Smart Cameras”, Proceedings of the IEEE | Vol. 96, No. 10, October 2008.
- [8].Isaac Cohen , G’erard Medioni ,“Detecting and Tracking Moving Objects for Video Surveillance”, IEEE Proc. Computer Vision and Pattern Recognition Jun. 23-25, 1999. Fort Collins CO.
- [9].Samar D. Gajbhiye¹ , Pooja P. Gundewar ,“Object Tracking Using Embedded Platform for Video Surveillance”, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Issue 7, July 2015.
- [10].Vijayalaxmi¹ , K.Anjali² ,B.Srujana³ , P.Rohith Kumar, “object detection and tracking using image processing”, Global Journal of Advanced Engineering Technologies,2014.
- [11].Onkar R. Kirpan , Pooja I. Baviskar , Shivani D. Khawase , Anjali S. Mankar , Karishma A. Ramteke, “Object Detection on Raspberry Pi”, Research Article Volume 7 Issue No.3.,2017.
- [12].K.Shiva Prasad, M.Shirisha ,“Human Face Detection and Tracking Using Raspberry PI Processor”, International Journal & Magazine of Engineering, Technology, Management and Research, Volume No: 2, Issue No: 8, 2015.
- [13].Geda.Karthik, Kumar and S.Kayalvizhi “Real Time Industrial Colour Shape And Size Detection System Using Single Board”, International Journal of Science, Engineering and Technology Research (IJSETR) Volume 4, Issue 3, March 2015.