

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020

## A Review of Machine Vision System Beginning Artificial Intelligence with Raspberry PI

V.Saravanan<sup>1</sup>, K.Sathiya Muges<sup>1</sup>, K.Selvaganesan<sup>1</sup>, K.Ravikumar<sup>1</sup>

S. Sasikumar<sup>2</sup>, K.Robinston Jeyasingh<sup>2</sup>

Final year students, Department of Mechanical Engineering, Francis Xavier Engineering College, Tirunelveli,  
Tamil Nadu, India<sup>1</sup>

Professor, Department of Mechanical Engineering, Francis Xavier Engineering College, Tirunelveli,  
Tamil Nadu, India<sup>2</sup>

**ABSTRACT:** With the recent advancement of deep learning, the performance of object detection techniques has greatly increased in both speed and accuracy. This has made it possible to run highly accurate object detection with real time speed on modern desktop computer systems. Recently, there has been a growing interest in developing smaller and faster deep neural network architectures suited for embedded devices. This thesis explores the suitability of running object detection on the Raspberry Pi 4, a popular embedded computer board. This project focused at developing a Machine Vision system using a combination of low-cost camera hardware and computer to enable robots to process visual data from the world. The goal is to construct a model that can recognize and indicate the shading that make utilization of open source materials and catches visual information caught from an ordinary camera (webcams, Picams, etc).

**KEYWORDS:** Raspberry pi, Machine vision, OpenCV, TensorFlow, Python.

### I. INTRODUCTION

Machine vision (MV) is the technology and methods used to provide imaging-based automatic inspection and analysis for object detection and tracking are key features in many computer vision applications, with uses in autonomous cars, medical diagnostics, surveillance, and industry automation, amongst others. It is a research area which has had a lot of progress in recent years. The main goal of this project is to develop an object detection and tracking framework that is able to run on the Raspberry Pi 4 in real-time. A user-friendly visualization of the detection and tracking in images should also be given.

#### Raspberry Pi

- ❖ Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- ❖ 1GB, 2GB or 4GB LPDDR4-3200 SDRAM (depending on model)
- ❖ 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE, Gigabit Ethernet
- ❖ 2 USB 3.0 ports; 2 USB 2.0 ports.
- ❖ Raspberry Pi standard 40 pin GPIO header
- ❖ 2 × micro-HDMI ports (up to 4kp60 supported)
- ❖ 2-lane MIPI DSI display port
- ❖ 2-lane MIPI CSI camera port
- ❖ 4-pole stereo audio and composite video port
- ❖ H.265 (4kp60 decode), H264 (1080p60 decode, 1080p30 encode)
- ❖ OpenGL ES 3.0 graphics
- ❖ Micro-SD card slot for loading operating system and data storage

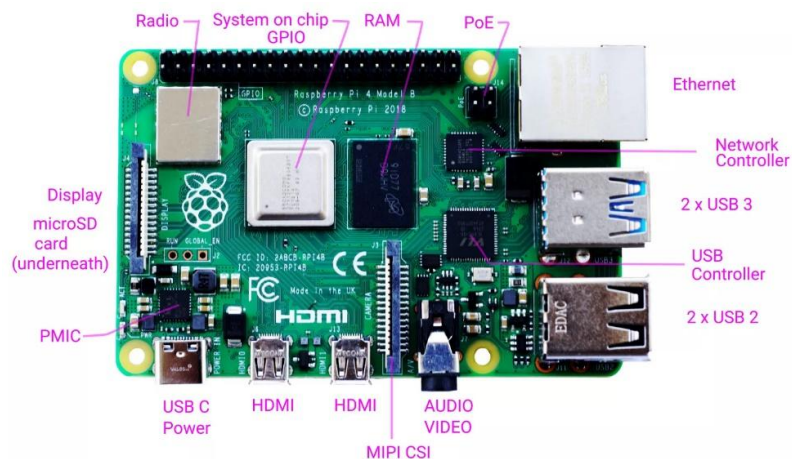
# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020

- ❖ Dimensions: 88mm x 58mm x 19.5mm, 46g.



The Raspberry Pi 4 Model B

## II. RELATED WORK

There has been a lot of work in object detection using traditional computer vision techniques. Cameras and Devices with processors with very high speed are used that use technologies like CNN, ANN, etc. Object Detection is being used in every field of work like optical character recognition, Self-Driving Cars, Tracing Objects, Face Detection, Object extraction, activity recognition and many more things. For industrial machine vision we need powerful processors with essential GPU. The process and working methodology may differs from the deep learning approach.

### APPLICATIONS

- ❖ **Autonomous vehicles**

Machine vision is necessary to enable self-driving cars. Manufacturers use multiple cameras, lidar, radar, and ultrasonic sensors to acquire images from the environment so that their self-driving cars can detect objects, lane markings, signs and traffic signals to safely drive.

- ❖ **Google Translate app**

By using optical character recognition to see the image and augmented reality to overlay an accurate translation, this is a convenient tool that uses machine vision.

- ❖ **Facial recognition**

Facial recognition for police work, payment portals, security checkpoints at the airport.

- ❖ **Healthcare**

90 percent of all medical data is image based there is a plethora of uses for machine vision (or) computer vision in medicine. From enabling new medical diagnostic methods to analyze X-rays, mammography and other scans to monitoring patients to identify problems earlier and assist with surgery, expect that our medical institutions and professionals and patients will benefit from machine vision today and even more in the future as it rolled out in healthcare.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020

## ❖ Real-time sports tracking

Machine vision is also helping play and strategy analysis, player performance and ratings, as well as to track the brand sponsorship visibility in sports broadcasts.

## ❖ Agriculture

Artificial intelligence and machine vision to analyze grain quality as it gets harvested and to find the optimal route through the crops. There's also great potential for machine vision to identify weeds so that herbicides can be sprayed directly on them instead of on the crops.

## ❖ Manufacturing

In Predictive maintenance the equipment is monitored with machine vision to intervene before a breakdown would cause expensive downtime. Packaging and product quality are monitored, and defective products are also reduced with machine vision.

Various studies on machine learning to increase the accuracy of object detection and fps of recognition time have been carried out theoretically and experimentally. The work done by previous researchers in machine vision is work carried out.

### ARKO DJAJADI et al (2010)

Image processing in today's world grabs massive attentions as it leads to possibilities of broaden application in many fields of high technology. The real challenge is how to improve existing sorting system in the Modular Processing System (MPS) laboratory which consists of four integrated stations of distribution, testing, processing and handling with a new image processing feature. Existing sorting method uses a set of inductive, capacitive and optical sensors to differentiate object color. This paper presents a mechatronics color sorting system solution with the application of image processing. Supported by OpenCV, image processing procedure senses the circular objects in an image captured in real time by a webcam and then extracts color and position information out of it. This information is passed as a sequence of sorting commands to the manipulator (Mitsubishi Move master RV-M1) that does pick-and-place mechanism. Extensive testing proves that this color based object sorting system works 100% accurate under ideal condition in term of adequate illumination, circular objects' shape and color. The circular objects tested for sorting are silver, red and black. For non-ideal condition, such as unspecified color the accuracy reduces to 80%.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020

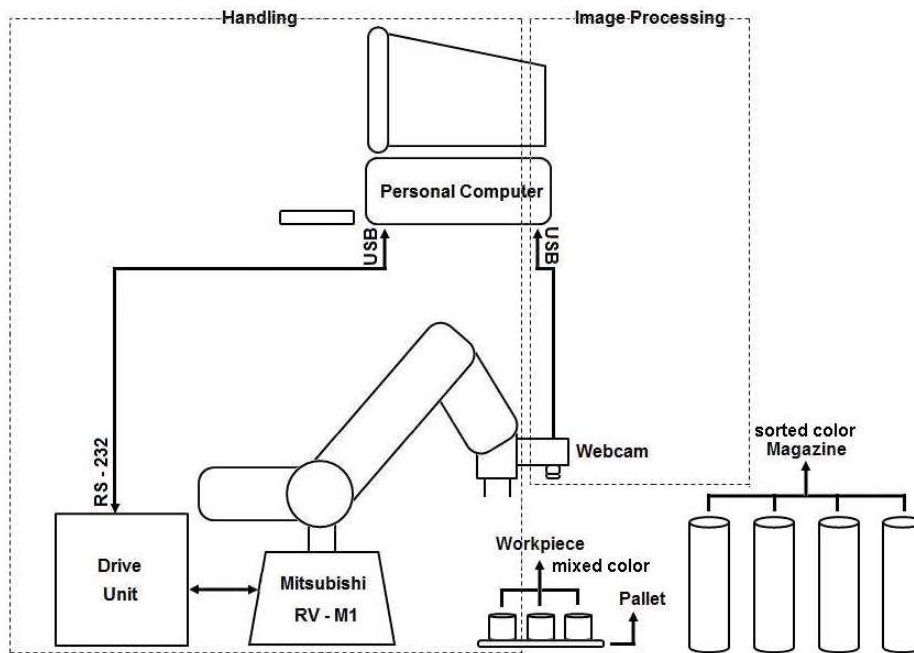


Fig 1 System design overview

## KIRTAN B. PATEL et al (2013)

The machine vision has been used in the industrial machine designing by using the intelligent character recognition. Due to its increased use, it makes the significant contribution to ensure the competitiveness in modern development. The state of art in machine vision inspection and a critical overview of applications in various industries are presented in this paper. In its restricted sense it is also known as the computer vision or the robot vision. This paper gives the overview of Machine Vision Technology in the first section, followed by various industrial application and the future trends in Machine Vision.

## GURJASHAN SINGH PANNU et al (2015)

The project aims to build a monocular vision autonomous car prototype using Raspberry Pi as a processing chip. An HD camera along with an ultrasonic sensor is used to provide necessary data from the real world to the car. The car is capable of reaching the given destination safely and intelligently thus avoiding the risk of human errors. Many existing algorithms like lane detection, obstacle detection is combined together to provide the necessary control to the car.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020



Fig 2 Original road with region of interest (ROI)

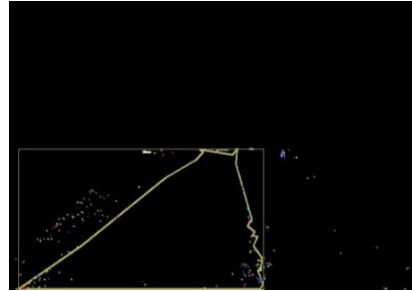


Fig 3 The contour around the road



Fig 4 Detected road edges in different parts of ROI

## ABHIJEET SURYATALI et al (2015)

This paper presents a brief review of toll collection systems present in India, their advantages and disadvantages and also aims to design and develop a new efficient toll collection system which will be a good low-cost alternative among all other systems. The system is based on Computer Vision vehicle detection using OpenCV library in Embedded Linux platform. The system is designed using Embedded Linux development kit (Raspberry pi). In this system, a camera captures images of vehicles passing through toll booth thus a vehicle is detected through camera. Depending on the area occupied by the vehicle, classification of vehicles as light and heavy is done. Further this information is passed to the Raspberry pi which is having web server set up on it. When raspberry pi comes to know the vehicle, then it accesses the web server information and according to the type of the vehicle, appropriate toll is charged. This system can also made to count moving vehicles from pre-recorded videos or stored videos by using the same algorithm and procedure that we follow in this paper.

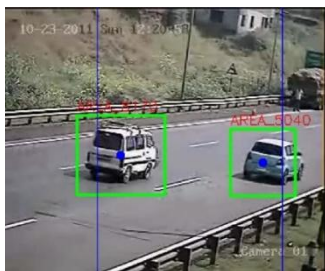


Fig 5 Screenshot of Detected Vehicles

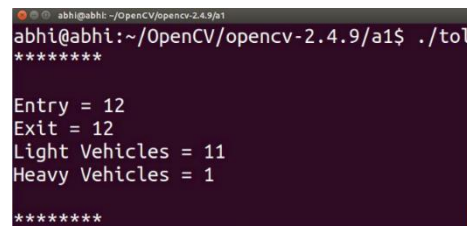


Fig 6 Screenshot of Printing Summary after classification of Detected vehicles



# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020

LOHIT UJJAINIYA et al (2015)

Highway obstacle detection is one of the most challenging tasks in real time for autonomous vehicle navigation system. The basic idea is to design an effective system for real time environment, which detects the presence of obstacles in the track of the vehicle. In the proposed work Raspberry Pi Camera module is employed for object detection and image acquisition. A thorough investigation is performed on a test image in order to validate the best algorithm suitable for edge detection of images. Sufficient analysis is performed to consolidate the results.



Fig 7 Canny edge detection

SANDEEP KUMAR et al (2017)

Object Recognition is a technology in the field of computer vision. It is considered to be one of the difficult and challenging tasks in computer vision. Many approaches have been proposed in the past, and a model with a new approach which is not only fast but also reliable. Easynet model has been compared with various other models as well. Easynet model looks at the whole image at test time so its predictions are informed by global context. At the prediction time, our model generates scores for the presence of the object in a particular category. It makes predictions with a Single network evaluation. Here object detection is a regression problem to spatially separated bounding boxes and associated class probabilities.



Fig 8 Dataset PASCAL VOC 2007

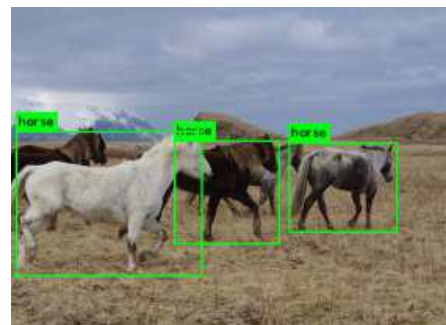


Fig 9 Output of image horse.jpg

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020

SHAKTHI MURUGAN.K.H et al (2017)

In recent times we tend to use a number of surveillance systems for monitoring the targeted area. This requires an enormous amount of storage space along with a lot of human power in order to implement and monitor the area under surveillance. This is supposed to be costly and not a reliable process. In this paper we propose an intelligent surveillance system that continuously monitors the targeted area and detects motion in each and every frame. If the system detects motion in the targeted area then a notification is automatically sent to the user by SMS and the video starts getting recorded till the motion is stopped. Using this method, the required memory space for storing the video is reduced since it doesn't store the entire video but stores the video only when a motion is detected. This is achieved by using real time video processing using open CV (computer vision / machine vision) technology and raspberry pi system.

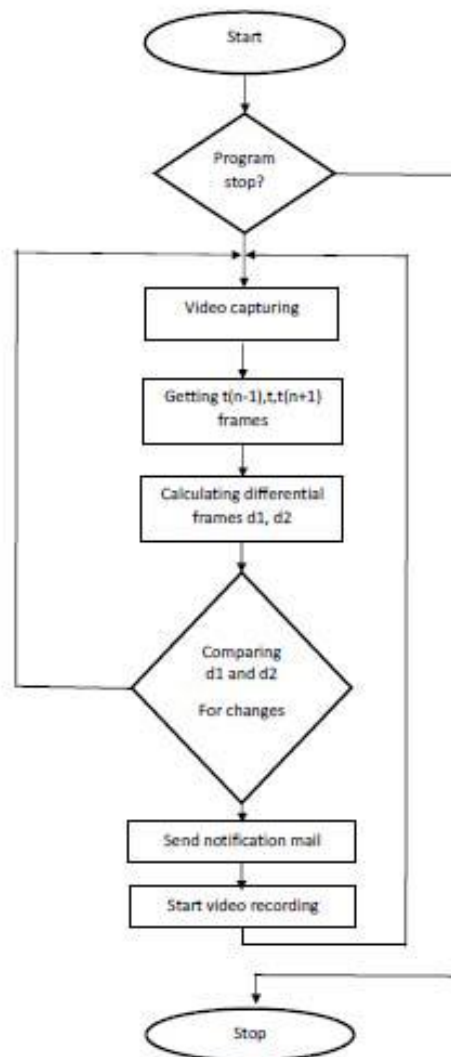


Fig 10 Flow chart of complete process

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020

AKSHAY R. SHINDE et al (2019)

The aim of this is to explore different methods for helping computers interpret the real world visually, investigate solutions to those methods offered by the open source computer vision library, OpenCV, and implement some of these in a Raspberry pi-based application for detecting and keeping track of objects. The main focus rests on the practical side of the project. The result of this thesis is a GNU/Linux based C/C++ application that is able to detect and keep track of object by reading the pixel value of frame captured by the Raspberry Pi camera module. The application also transmits some useful information, such as coordinates and size, to other computers on the network that send appropriate query.



Fig 11 Block Diagram of System

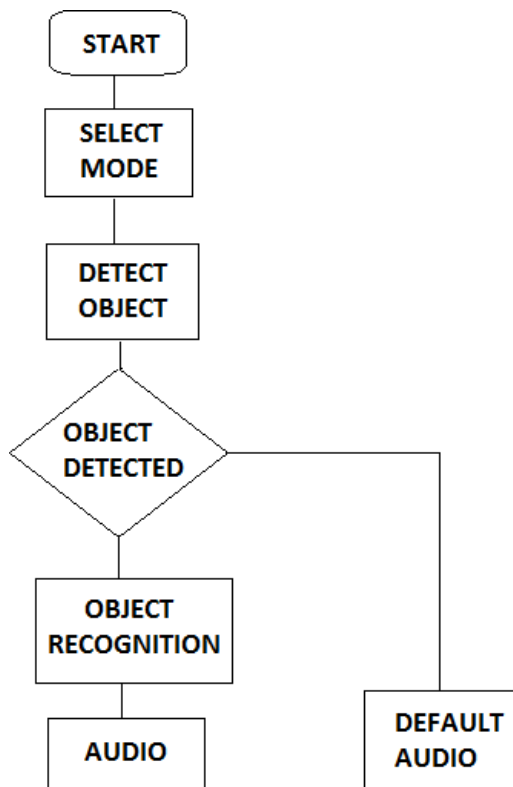


Fig 12 Flowchart



# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020

SHAILESH SACHAN (2019)

Object Detection and following are essential and testing undertakings in numerous PC vision applications, for example reconnaissance, self-driven cars, vehicle route, self-sufficient robots and various security purposes. Object Detection includes finding objects in the casing of the video succession. For instance, measure of a planet in astronomy, distinguishing diseases in mammography scan in medicine, controlling into an obstacle in robotics, identifying persons eye shade or hair color in security. The goal is to construct a model that can recognize and indicate the shading that make utilization of open source materials and catches visual information caught from an ordinary camera(webcams, Picams, etc).On a live video at first the class of object is detected and tracks the length by creating a four sided polygon (square or a rectangle) around the object. I have executed it through OpenCV on Linux foundation.

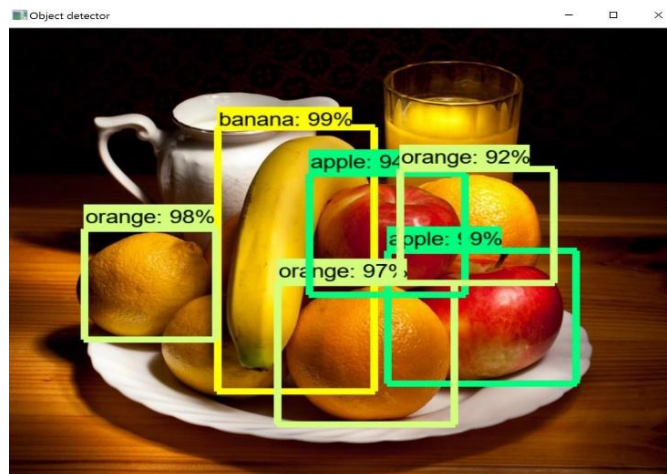


Fig 13 Output of the system

AJAY TALELE et al (2019)

Detecting and recognizing objects in unstructured as well as structured environments is one of the most challenging tasks in computer vision and artificial intelligence research. This paper introduces a new computer vision-based obstacle detection method for mobile technology and its applications. Each individual image pixel is classified as belonging either to an obstacle based on its appearance. The method uses a single lens webcam camera that performs in real-time, and also provides a binary obstacle image at high resolution. In the adaptive mode, the system keeps learning the appearance of the obstacle during operation. The system has been tested successfully in a variety of environments, indoors as well as outdoors, making it suitable for all kinds of hurdles. It also tells us the type of obstacle which has been detected by the system.

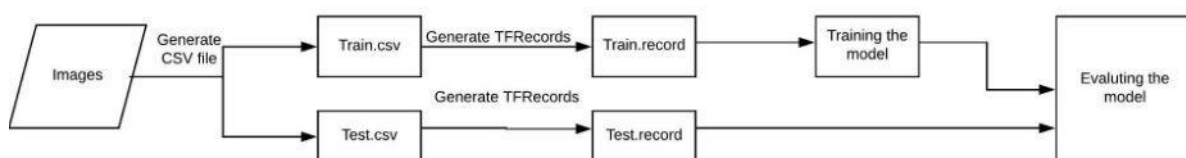


Fig 14 Block Diagram of training the model

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 2, February 2020



Fig 15 Output of the system

### III. CONCLUSION

The above investigation presents a clear view of machine vision in different types of deep learning approaches with different techniques. This section summarizes and presents the investigations carried out:

1. TensorFlow's Object Detection API is a powerful tool which enables everyone to create their own powerful Image Classifiers.
2. OpenCV is a library of programming functions mainly aimed at real-time computer vision. it is library used for Image Processing.
3. YOLO is the convolutional neural network approach has both great results and high speed, allowing for the first-time real-time object detection.

### REFERENCES

1. Arko Djajadi, Fiona Laoda, Rusman Rusyadi, Tutuko Prajogo, Maralo Sinaga. A Model Vision of Sorting System Application Using Robotic Manipulator. TELKOMNIKA Vol. 8 No. 2 Augustus 2010.
2. Kirtan B. Patel, M.B. Zalte, S. R. Panchal, Machine vision and its Applications, IOSR Journal of Electronics and Communication Engineering, Volume 7, Issue (Sep. - Oct. 2013), PP 72-77.
3. Gurjashan Singh Pannu, Mohammad Dawud Ansari, Pritha Gupta, Design and Implementation of Autonomous Car using Raspberry Pi, International Journal of Computer Applications, Volume 113 – No. 9, March 2015.
4. Abhijeet Suryatali, Computer Vision Based Vehicle Detection for Toll Collection System Using Embedded Linux, Institute of Electrical and Electronics Engineers-2015.
5. Lohit Ujjainiya, M. Kalyan Chakravarthi, Raspberry-Pi Based Cost Effective Vehicle Collision Avoidance System Using Image Processing, ARPN Journal of Engineering and Applied Sciences, VOL. 10, NO. 7, APRIL 2015.
6. Sandeep Kumar, Aman Balyan, Manvi Chawla, Object Detection and Recognition in Images, IJEDR-2017 | Volume 5, Issue 4 | ISSN: 2321-9939.
7. Shakthi Murugan.K.H, V. Jacintha, S. Agnes Shifani, Security System Using Raspberry Pi, Institute of Electrical and Electronics Engineers-2017.
8. Akshay R. Shinde, Pratik P. Bhagat, Sairaj R. Dhobale, Object Detection and recognition for Blind Assistance, EasyChair Preprint-Nov-2019.
9. Shailesh Sachan, Object Detection using Raspberry Pi, Cikitusi Journal for Multidisciplinary Research-Volume 6, Issue 10, Oct 2019.
10. Ajay Talele, Aseem Patil, Bhushan Barse, Detection of Real Time Objects Using TensorFlow and OpenCV, Asian Journal of Convergence in Technology, Volume V Issue I-ISSN NO: 2350-1146, 2019.