International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 05 | May - 2023 Impact Factor: 8.176 ISSN: 2582-3930

Object Detection Using Raspberry Pi and TensorFlow

[1] **Ms. Poonam Rakibe**, Assitant Professor, Information Technology Engineering Department,
Progressive Education Society's Modern College of Engineering, Pune - 411 005 (Maharashtra)(India)

[2]Student VIII Semester B.E(Information Technology),
Abhijeet Bhosale[1], Amogh Devarshi[2], Pradip Gawali[3], Vishal Gaikwad[4]

Progressive Education Society's Modern College of Engineering, Pune - 411 005 (Maharashtra)(India)

Abstract - Real-time object detection is considered a vast, vibrant, and complex area of computer vision. When an image has a single object to be detected, it is known as Image Localization, while multiple objects in an image is referred to as Object Detection.[1] The semantic objects of a class in digital images and videos are detected through this process. Various applications of real-time object detection include object tracking, video surveillance, pedestrian detection, people counting, self-driving cars, face detection, ball tracking in sports, and more. The SSD MobilenetV2 FPN model, which is a representative tool of deep learning to detect objects, can be used with TensorFlow or OpenCV, an open-source computer vision library of programming functions primarily focused on real-time computer vision.[2]

***Key Words*: Deep learning, Object Detection, TensorFlow,**
Raspberry Pi4, Web Camera, Detection Technique, Training Model, SSD-Mobilenet.

1.INTRODUCTION

In recent year 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. And human face detection for blind person.[3] In object detection the main challenge is track the image with the help of calculating mathematical expression Designing a comprehensive Machine Learning Model that is capable of identifying multiple objects in one image is a challenging task in computer vision. However, with the latest advances in deep learning and object recognition systems,[4]it is easier to develop this multiple object recognition system. Here we will use TensorFlow and OpenCV with Raspberry Pi to build object detection models The advancement of technology has created many optional new development environments for software developers. Some reasons why the Raspberry Pi is preferred are that almost everything a computer can do with its operating system can be done and it can be carried anywhere because it is small enough to fit in many places.

1.1 TensorFlow

It is an open source programming library for first class numerical calculation. Its versatile engineering premits basic sending of calculation over a variety of stages (CPUs, GPUs, TPUs), and from work territories to gatherings of servers to adaptable and edge gadgets. At first made by examiners and designers from the Google Brain aggregate inside Google's AI affiliation, it goes with strong help for machine learning and significant learning and the versatile numerical count focus is used transversely finished various other sensible spaces.

1.2 Raspberry Pi

Minicomputer that working on free software, has the power to play 1080p videos easily. This computer is portable board thanks to its small size, which carries the operating system on the micro-SD card. Raspberry Pi, which works silently because it has no cooling fan or moving parts, meets most of the features expected from a personal computer. The Raspberry Pi can be used as a computer or as a developer platform using the pins on it It is a development of negligible single-board PCs made in the United Kingdom by the Raspberry Pi Foundation to drive the instructing of essential programming working in schools and in making countries. The primary model wound up significantly more inescapable than foreseen, offering outside its objective exhibit for uses, for example

mechanical couple of embellishments have been combined into two or three official and easygoing gatherings. A couple of times of Raspberry Pi's have been released. All models feature a Broadcom structure on a chip (SoC) with an organized ARM great central getting ready unit (CPU) and on-chip plans taking care of unit (GPU).[5]

2. LITERATURE SURVEY

These days, the main objective in video surveillance applications is object recognition from a video In order to locate necessary objects in video sequences and group their pixels together, object detection technology is performed In many applications, especially those used for video surveillance, the detection of an item in a video sequence is crucial Processes including pre- processing, segmentation, foreground and background extraction, and feature extraction can be used to recognize objects in a video stream. Humans are able to quickly recognize and locate things in an image. With minimal conscious effort, the human visual system can complete complicated tasks like recognizing several objects. It is quick and accurate We can now readily train machines using vast amounts of data, faster GPUs, and improved algorithm

3. METHODOLOGY

Finding and identifying instances of real-world objects, like animals, cars, bikes, TVs, flowers, touchable objects, and people, in photos or videos is a process known as object detection. An object detection technique enables the identification, localization, and detection of numerous things inside an image, allowing you to comprehend the specifics of an image or video. Applications including image retrieval, security, surveillance, object detection, face detection, and advanced driver assistance systems commonly make use of it (ADAS).

Implementation process for the windows10:

- TensorFlow installation.
- Import all necessary libraries.
- Testing the Installation.
- Compile all the models (in order to support the all platforms)
- Install jupyter note book.
- Initialize the database into notebook for training ,testing and the validation purposes.
- Run the source code in jupyter notebook.
- Using cv2 we can detect the all objects.

Whereas for the implementation on Raspberry Pi:

- Upgrade Raspberry Pi
- Mount swap memory (USB drive).
- Install TensorFlow.
- Install cv2 and other dependent packages.
- Interface Pi camera.
- Compile the all models (In order to support the all platforms).
- Compile jupyter note book.
- Run the models (database) through jupyter note book.
- Run the source code using Python IDLE

4. PREPARING AND TRAINING DATASET

We have collected and added all the different types of animals in the database for training the system. Following is the proposed procedure for training and testing of the data for animal detection:

- Collect all the images of animals in data folder
- These images are labelled by using labelling software
- Generate annotations and XML file of each image
- Converting the Dataset images into train, test, and validate and TensorFlow record.
- Training dataset with Sequential model on the TensorFlow and detect the object for the Input image.
- Alarming the driver with real time detection with approximate distance with 5-meter range
  By using ultrasonic sensor

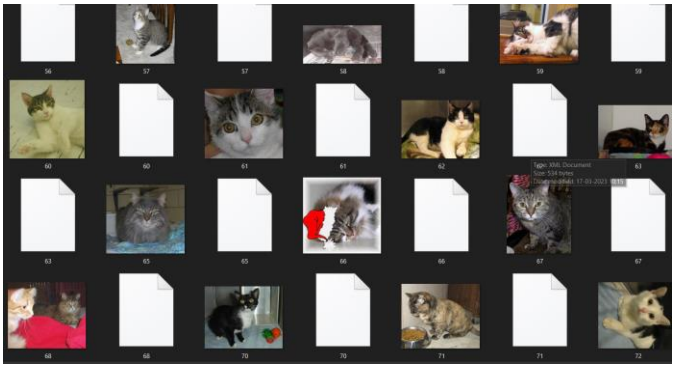

Fig-1: Image Dataset

```
<annotation>
    <folder>cat</folder>
    <filename>106.jpg</filename>
    <path>D:\OBJECT Det\images\cat\106.jpg</path>
    <source>
        <database>Unknown</database>
    </source>
    <size>
        <width>499</width>
        <height>375</height>
        <depth>3</depth>
    </size>
    <segmented>0</segmented>
    <object>
        <name>cat</name>
        <pose>Unspecified</pose>
        <truncated>0</truncated>
        <difficult>0</difficult>
        <bndbox>
            <xmin>13</xmin>
            <ymin>27</ymin>
            <xmax>490</xmax>
            <ymax>362</ymax>
        </bndbox>
    </object>
</annotation>
```

Fig-2: Annotation(XML) File

5. WORKING PRINCIPLE

- Using the raspberry pi terminal and installing labelling software making labels for the storage of the images for the purpose of training.
- Upload the images of various entities as per the labels associated.
- Open jupyter and Upload the folder into it.
- Exporting tensor flow library for designing the model which is capable of comparing the input images to the trained data.
- Export the model into raspberry pi operating System
- Capture the image through Camera and predict the label name .
- Determine the distance from car and alert the user

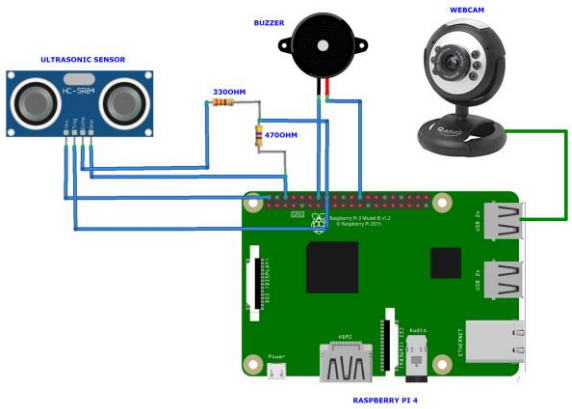

Fig -3: Circuit Diagram

Fig-4: Hardware Device

5. Model

we are using the MobileNetV2 SSD FPN-Lite 320x320 pre-trained model. The model has been trained on the dataset with images scaled to 320x320 resolution. Here, we are using the MobileNetV2 SSD FPN-Lite 320x320 pre-trained model. The model has been trained on the dataset with images scaled to 320x320 resolution.

5.1 Feature Pyramid Network:

Detecting objects in different scales is challenging in particular for small objects. Feature Pyramid Network (FPN) is a feature extractor designed with feature pyramid concept to improve accuracy and speed.

6. RESULT

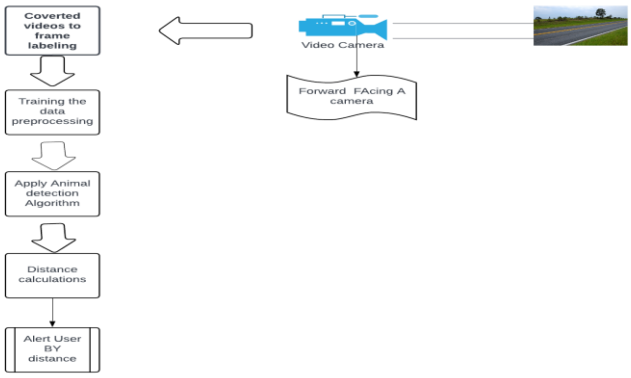

Fig-5: Flow Diagram

An efficient automatic animal detection and a warning system can help drivers in reducing the number of collisions occurring between the animal and the vehicle on roads and highways. In this paper, we discussed the necessity of automatic animal detection system and our algorithm for animal detection based on. The algorithm can detect an animal in different conditions on highways. The proposed system achieves an accuracy of almost 95% regarding animal detection.

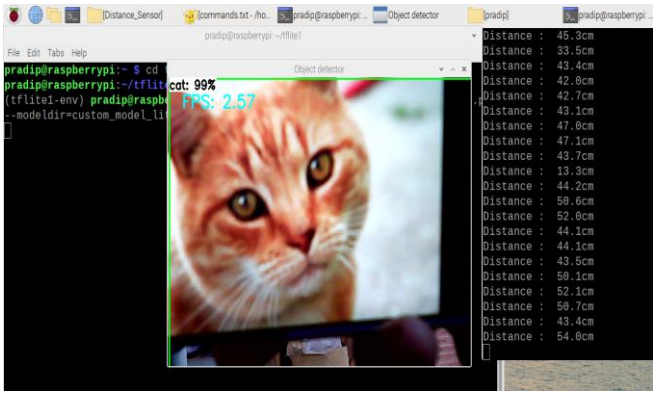

Fig-6: Detection - Result 1

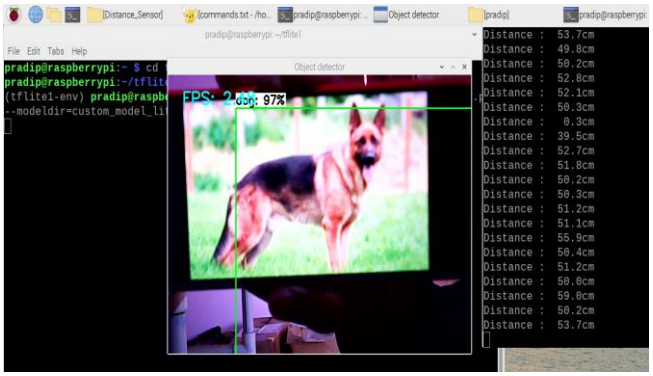

Fig-7: Detection- Result 2

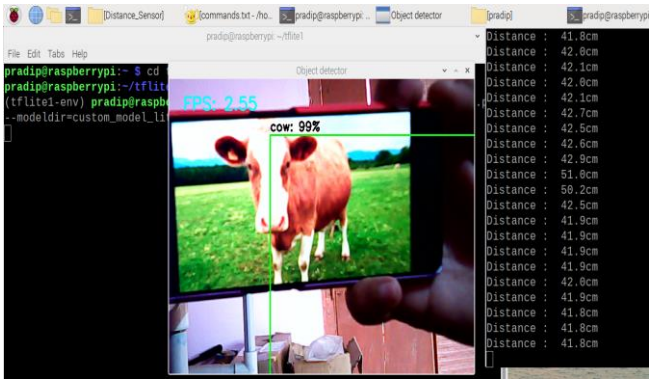

Fig-8: Detection- Result 3

7. CONCLUSIONS

Images of objects from a particular class are highly variable. One source of variation is the actual imaging process. The challenges like the on motion object can be fatal as their fixed position can't be determined but many of them can have their lives saved.

ACKNOWLEDGEMENT (Optional)

Live object detection using TensorFlow on Raspberry pi module is done for the object detection of the live video stream, on the small and specific board. It will be used in the real time application. It will be the one of the main application of the embedded systems. The latest version of the technology artificial intelligence used in the TensorFlow. This system will be applicable for the artificial intelligence too that can be implemented or utilized in many industries.

REFERENCES

[1] Felzenszwalb P. Huttenlocher D.. Pictorial structures for object recognition. International Journal of Computer Vision61(1) 55–79

[2] Dr. Sunitha M.R. Dr Famika Khan(2019) Object Detection and Human Identification using Raspberry Pi 2019 1st International Conference on Advances in Information Technology

[3] Koraqi Tetovo University, Florim Idrizi(2020) Detection, identification and tracking of objects during the motion" International conference for object detection for blinds

[4] Amit, . 2d Object Detection and Recognition: Models, Algorithms and Networks. MIT Press, Cambridge, MA.

[5] Ross Girshick, Je Donahue, Trevor Darrell, and Jitendra Malik. Rich feature hierarchies for accurate object detection and semantic segmentation. In The IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2014

[6] Ross Girshick. Fast R-CNN. In International Conference on Computer Vision (ICCV), 2015.