ASSISTANCE SYSTEM FOR DRIVERS USING IOT

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Abstract –

This project entitled as "Assistance System for drivers using IOT" consisting of three major sections

1. *Object Detection*
2. *Lane detection*
3. *IOT*

The evolution of Artificial Intelligence has served as the catalyst in the field of technology. We can now develop things which was once just imagination. This paper proposes a working model of assistance system which is capable of assisting drivers with a warning about possible obstacles and objects in front and the lane that the driver should follow. No matter how hard we try to create awareness regarding traffic rules and safety that has to be followed while driving, accidents are still occurring and aren't showing a sign to stop. Though human errors can never be eliminated, but accidents can definitely be stopped. And in this case technology has surely come to our rescue. A camera module is mounted over the top of the car along with Raspberry Pi sends the images from real world to the Convolutional Neural Network which then detects and tracks the objects in-front and display them along with the distance between them.

INTRODUCTION

we have created an assistive system for human drivers that tracks all the objects and lane in front of the car on the road by applying Computer Vision Techniques & convolutional neural network architectures on the frames generated through the live footage captured by the recording camera .Classifying images is straightforward, but the differences between object localization and object detection can be confusing, especially when all three are equally referred to as object recognition. Objects in images can be recognized by humans. Human vision is fast, accurate, and capable of identifying multiple objects and detecting obstacles with little conscious effort. We are now able to train computers with high precision to detect and classify multiple objects within an image with the availability of large data sets, faster GPUs, and better algorithms. We need to understand terms such as object detection, object localization, loss function for object detection and localization, and finally explore an object detection algorithm known as "You only look once" (YOLO).

As well as assigning a class label to an image, image classification also involves drawing a bounding box around one or more objects in an image. A more challenging part of object detection is combining these two tasks to draw a bounding box around each object of interest in the image and assign it a class label. Object recognition is the result of combining all of these problems. An object recognition algorithm identifies objects in digital photographs by combining several tasks. R-CNNs, or region-based convolutional neural networks, are a family of techniques for recognizing objects and localizing them. A technique called You Only Look Once, or YOLO, is the second in a series of techniques for object recognition that uses speed and real-time processing.

1.1 OBJECT DETECTION

Object detection is a critical vision task, but challenging at the same time. Image search, automatic annotation, scene interpretation, and object tracking are just a few applications that use it. Computer vision has focused a lot on tracking moving objects in video image sequences. In addition to smart video surveillance (Arun Hampapur 2005), artificial intelligence, guidance for military vehicles, safety detection, and robot navigation, and medical and biological applications, it has already been applied in many fields of computer vision. In recent years, there has been a number of successful single object tracking systems, however object detection becomes difficult when there are more than one object in the scene and when objects are occluded, their vision is obscured, which further complicates detection.

1.2 LANE DETECTION

Globally, intelligent transportation systems (ITS) are widely recognized since 1994. A series of advanced technologies (electronics, artificial intelligence, data communication, information technology, automatic control theory, computer technology, sensors, etc.) are applied to road transportation, vehicle manufacturing and service control by ITS. Through its application, vehicles, roads, and users are more effectively communicated with. By reducing road traffic accidents, reducing vehicle transportation costs, relieving congestion, decreasing vehicle environmental pollution, improving overall transportation efficiency and ensuring road traffic safety, it can improve the productivity of the transportation system.

1.3 IOT

There are currently two camera boards available for the Raspberry Pi: an 8MP model, or a high-quality (12MP) model. You can also get the 8MP device without an IR filter in NoIR form. Raspberry Pi is no longer making the original 5MP device.

A Raspberry Pi camera can take high-resolution photos along with 1080p video. The Raspberry Pi camera can be controlled fully programmatically. Using various software tools and scenarios are described on the web.

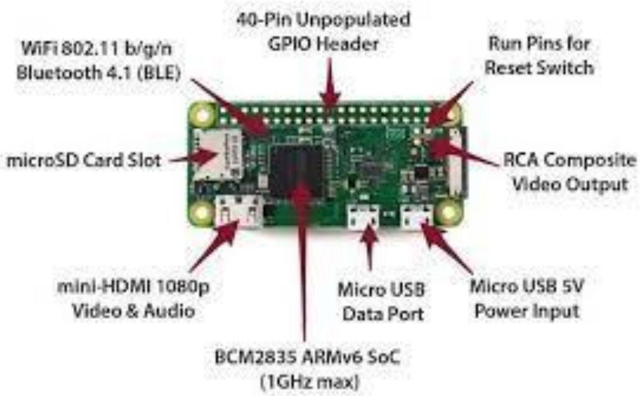
It is possible to use the cameras in a number of ways once they have been installed. Libcamera-still or raspberry Pi still are two of the provided camera applications, which make using one even simpler.

- **Camera connection**

On a Raspberry Pi, you need to insert the flex cable into the CAMERA connector located between Ethernet and HDMI. Make sure the silver contacts are facing the HDMI port when inserting the cable. You should pull the tabs on the top of the connector upward and towards the Ethernet port so that the connector will open. In addition to firmly inserting the flex cable into the connector, cable should also be taken not to bend the flex too accurately. While holding the cable in place, push the connector's top portion towards the HDMI port and downwards to close it.

Fig1: Raspberry Pi Camera Module

Fig 2:Rasberry Pi Zero



2. ALGORITHMS

1.Neural Network

- **Overview**

Neural networks are a set of algorithms, modelled loosely after the human brain, that are designed to recognize patterns. They interpret sensory data through a kind of machine perception, labelling or clustering raw input. The patterns they recognize are numerical, contained in vectors, into which all real-world data, be it images, sound, text or time series, must be translated. It is used in knowledge acquisition under noise and uncertainty, flexible knowledge representation, efficient knowledge processing, fault tolerance. It is a method of computing, based on the interaction of multiple connected processing elements and a powerful technique to solve many real world problems. It has the ability to learn from experience in order to improve their performance and to deal with incomplete information.

Diagram

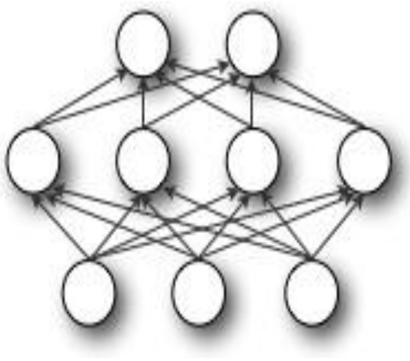


Fig.4 Neural Network

Advantages of Neural Network

- ✓ A neural network can perform tasks that a linear program cannot.
- ✓ When an element of the neural network fails, it can continue without any problem bytheir parallel nature.
- ✓ A neural network learns and does not need to be reprogrammed.
- ✓ It can be implemented in any application.
- ✓ It can be implemented without any problem.

Disadvantages of Neural Network

- ✓ The neural network needs training to operate.
- ✓ The architecture of a neural network is different from the architecture ofmicroprocessors therefore needs to be emulated.
- ✓ Requires high processing time for large neural networks.

2. YOLO Algorithm

- **Overview**

Real-time object detection is provided by Yolo through neural networks. Because Yolo is fast and accurate, this algorithm is popular. Different applications have benefited from its use, such as detecting traffic signals, parking meters and people.

YOLO is an acronym for the term 'You Only Look Once'. (In real-time) This algorithm detects and identifies various objects in a picture. The class probabilities of the detected images are provided by the YOLO object detection procedure as a regression problem.

YOLO algorithm detects objects in real time through convolutional neural networks. A neural network is only required to detect objects in one forward propagation of the algorithm as its name implies.

The whole image will be predicted in one algorithm run. Multiple class probabilities and bounding boxes are predicted using the CNN simultaneously.

There are several variants of the YOLO algorithm. YOLOv3 and tiny YOLO are common ones.

- **Methodology**

1. A grid is created by first dividing the image into cells. A bounding box is forecast for each grid cell along with its confidence score.

2. The probability values are used to identify the class of each object.
3. As a result of intersection over union, the objects' predicted bounding boxes match their real boxes.
4. This unique phenomenon eliminates the need for unnecessary bounding boxes when objects' characteristics (like height and width) meet the bounding boxes.
5. In the final detection, bounding boxes will be created that perfectly fit the objects.

- **Advantages of YOLO**
  - ✓ Speed: By predicting objects in real-time, this algorithm enhances the speed of detection.
  - ✓ High accuracy: YOLO predicts with an extremely low background error rate.
  - ✓ Learning capabilities: The algorithm is capable of learning the object representations and applying them to object detection.
- **Disadvantages of Bayesian Belief Network**
  - ✓ Comparatively low recall and more localization error compared to Faster R_CNN.
  - ✓ Struggles to detect close objects because each grid can propose only 2 bounding boxes.
  - ✓ Struggles to detect small objects.
- **Diagram**

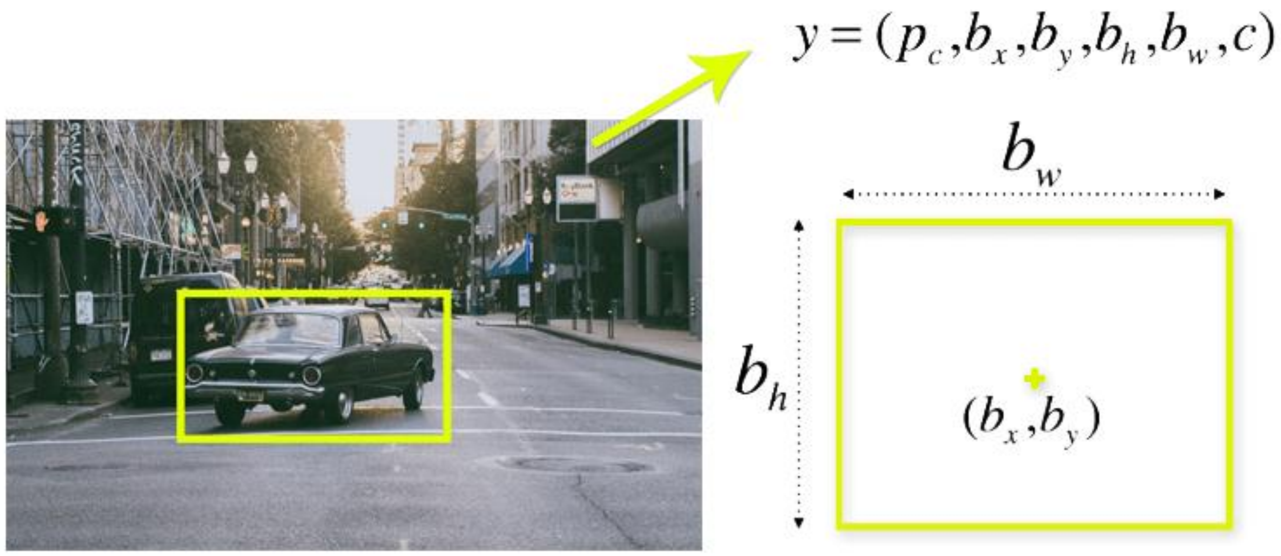


Fig.5 YOLO Algorithm prediction

3. Lane Detection Algorithm

- **Overview**

Lanes are typically designed to encourage orderliness as well as make vehicles easier to drive with consistent speed by keeping them straightforward. As a result, it may seem intuitive to first detect straight lines in the camera feed by detecting edges and extracting feature information. We will implement the computer vision algorithms using OpenCV, an open-source library. Below is a diagram of the pipeline.

Fig.6 Lane Detection Pipeline

- **Methodology**

  1. Convert to Grayscale.
  2. Apply Gaussian Blur.
  3. Apply Canny Edge Detection.
  4. Convolve Sobel Filters.
  5. Apply Hough Transformation.
  6. Transform perspective to Bird Eye
  7. Fit a PolyLine over the image
  8. Highlight the detected Lane.

3. COMPONENTS REQUIRED

Hardware Specifications

802.11 b/g/n wireless LAN

Bluetooth 4.1

Bluetooth Low Energy (BLE)

1GHz, single-core CPU

512MB RAM

Mini HDMI port and micro–USB On-The-Go (OTG) port

Micro USB power

HAT-compatible 40-pin header

Composite video and reset headers

CSI camera connector

Software Specifications

1. Operating System: Windows 10 64-bit ,Ubuntu
2. Software: Anaconda 3, Jupyter Notebook IDE

Programming Languages: PYTHON

4.PROPOSED SYSTEM

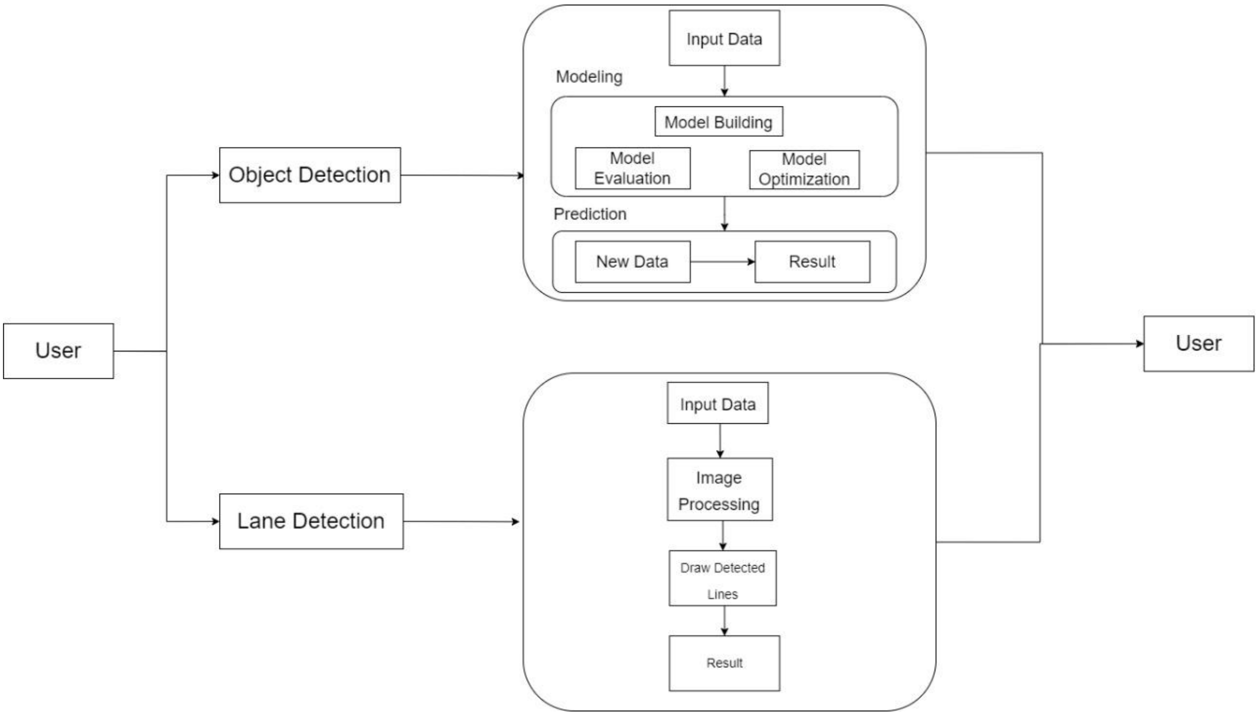


Fig . System Architecture Diagram

5. SCREENSHOTS OF EXECUTION

5.1 Hardware Connection

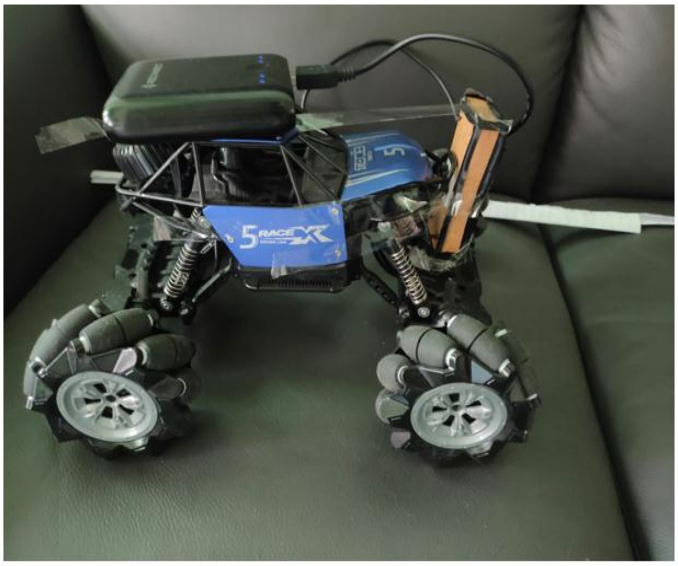


Fig. Vehicle

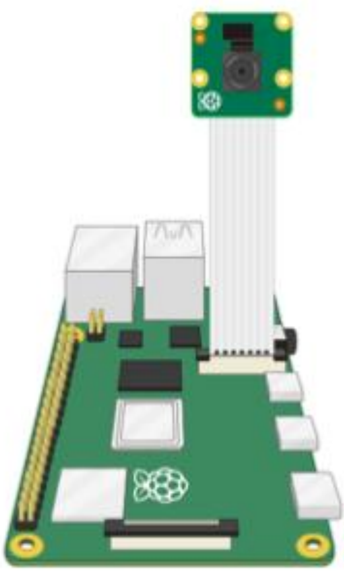
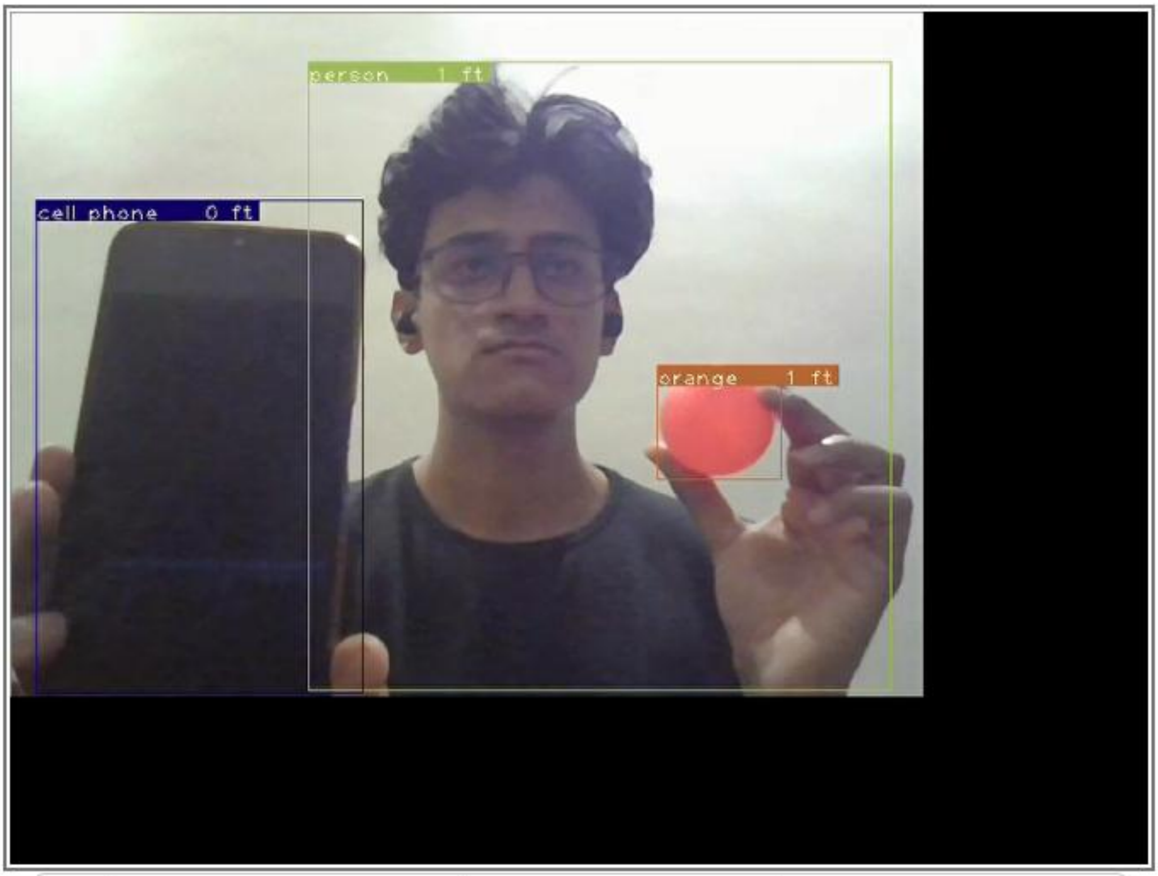


Fig. Raspberry Pi

5.2 Object detection



5.3 Lane Detection

5.4 Integration of Object Detection and Lane Detection

CONCLUSION

It concluded that Driver assistance system is used to solve the problems in Driving schools and human drivers. It provides greater accuracy in results, and we have successfully created an assistive system for human drivers that tracks all the objects and lanes in the front of the car on the road by applying Computer Vision Techniques & convolutional neural network architectures on the frames generated through the live footage captured by the recording camera.

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