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VEHICLE SPEED ESTIMATION

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Abstract
For accurate vehicle speed estimation, an approach combing the wheel speed and the GPS-BD information is firstly put forward to compensate for the impact of road gradient on the output horizontal velocity of the GPS-BD module, and the longitudinal acceleration of the IMU. Then, a multi-sensor fusion-based longitudinal vehicle speed estimator is synthesized by employing three virtual sensors which generate three longitudinal vehicle speed tracks based on multiple sensor signals. Finally, the accuracy and reliability of the proposed longitudinal vehicle speed estimator are examined under a diverse range of driving conditions through hardware-in-the-loop tests. The speed is calculated by mathematical formulation based on the distance traversed by vehicle. The error in the speed estimation is observed to be 9 %.
The rapid recent advancements in the computation ability of everyday computers have made it possible to widely apply deep learning methods to the analysis of traffic surveillance videos. Traffic flow prediction, anomaly detection, vehicle re-identification, and vehicle tracking are basic components in traffic analysis. Among these applications, traffic flow prediction, or vehicle speed estimation, is one of the most important research topics of recent years. Good solutions to this problem could prevent traffic collisions and help improve road planning by better estimating transit demand we combine modern deep learning models with classic computer vision approaches to propose an efficient way to predict vehicle speed. In this paper, we introduce some state-of-the-art approaches in vehicle speed estimation, vehicle detection, and object tracking.

Keywords:GPS-BD, Traffic flow prediction, Prevent traffic collisions, vehicle speed estimation, vehicle detection, Anti-lock braking systems.

I. INTRODUCTION
Four-wheel-independently-actuated electric vehicles, also known as FWIA EVs, are receiving a lot of attention because of the potential for flexible layout design, as well as improved vehicle handling performance and safety. This attention is due to the fact that FWIA EVs have the potential to improve vehicle handling performance and safety. Direct propulsion is provided by four in-wheel motors that are controlled individually in FWIA electric vehicles. The over-actuation feature offers a vast array of potential applications for active control systems (ACS), which include anti-lock braking systems (ABS), acceleration slip regulation (ASR), and advanced driver assistance systems (ADAS), amongst others (ADAS). Because the longitudinal vehicle speed is not a parameter that can be measured when using conventional low-cost sensors, this presents a challenge that is not at all easy to solve. On the other hand, there is a way out of this predicament. In order for these ACSs to be able to perform their functions in an efficient manner, it is necessary for them to acquire the longitudinal speed of the vehicle in a manner that is accurate, reliable, and in real time. Since FWIA electric vehicles do not have any driven wheels, it is not possible to derive the speed of the vehicle by directly integrating the rotational wheel speed. This is because the speed of the driven wheels would be directly proportional to the speed of the vehicle. This occurs as a result of the direct proportional relationship between the speed of the driven wheels and the overall speed of the vehicle. These techniques do not require the utilisation of tyre models, and the kinematic models that underpin them are not only straightforward but also simple and easy to understand. It was suggested as a method for estimating the longitudinal

speed of a vehicle to use an algorithm that would determine the status of the vehicle based on the rotational wheel speed and the longitudinal acceleration of the vehicle. This algorithm would determine the status of the vehicle based on the rotational wheel speed and the longitudinal acceleration of the vehicle. A vehicle's longitudinal speed can be estimated with the help of this algorithm, which was developed for that purpose. In addition to this, it would be possible to estimate the speed using multiple different methods. On the other hand, dynamics-based approaches make use of vehicle dynamics and tyre models in order to determine the state of the vehicle by employing specialised state estimators. This is done by inferring the state of the vehicle from the dynamics of the vehicle and its tyres. This is done in order to establish whether or not the vehicle is moving forward at this time. The acquisition of the parameters of the tyre model in real time and with a high level of accuracy is the primary challenge for methods that are based on dynamics. This challenge also applies to the acquisition of the friction coefficient of the road. This is something that needs to be done in a wide range of different operational conditions. Some of the researchers worked toward the goal of developing complex estimation strategies that were effective even without prior knowledge of the adhesion conditions of the road. This was one of their goals. According to the findings of other studies, the structure of the dual estimator makes it possible to use a variety of estimation methods and tyre models interchangeably. This ability is attributed to the fact that it is possible to use a variety of estimation models interchangeably. Because of the dual nature of the structure, this is made possible. The use of techniques that involve the fusion of data from multiple sensors is becoming an increasingly popular option as a means of overcoming the drawbacks of methods that are based on kinematics and dynamics. This is one way to overcome the drawbacks of methods that are based on kinematics and dynamics. They are able to achieve accurate and reliable vehicle speed estimation by making full use of kinematics and dynamics models, information on motor states, and signals from IMUs and GPS devices. This allows them to achieve their goal of accurate and reliable vehicle speed estimation. They are able to accomplish their objective of achieving accurate and reliable vehicle speed estimation as a result of this.

II. LITERATURE REVIEW

[1] A. Boukerche, A. J. Siddiqui, and A. Mammeri, (2017), "Automated vehicle detection and classification: Models, methods, and techniques,". Increased security concerns in ICT have prompted academics to focus on automated vehicle classification (AVC) using visual sensors. Based on the granularity of classification, we suggest three distinct types of AVC research: Vehicle Type Recognition, Vehicle Make Recognition, and Vehicle Make and Model Recognition. We provide a detailed analysis and comparison of features extraction, global representation, and classification methods across all AVC system types. Additionally, we offer the performance measures associated with accuracy and speed and explore how they may be used to compare and assess various AVC works. Also discussed are the many datasets offered throughout time for AVC and the difficulties they reflect or do not represent in the actual world. Each kind of AVC system's most significant difficulties are discussed, drawing attention to research gaps in this field. We wrap off by outlining where we think this field of study should go next, paving the path for effective AVC systems at scale. The goal of this study is to provide researchers with a framework for analysing the existing body of work in the field of AVC, specifically the methodologies presented for each module, and for developing plans to advance the current state of the art.

[2]S. Girisha, M. M. Pai, U. Verma, and R. M. Pai, (2019), "Performance analysis of semantic segmentation algorithms for finely annotated new uav aerial video dataset(manipaluavid),". When movies are semantically segmented, it aids in scene interpretation, which in turn aids other automated video processing methods like anomaly identification, object recognition, event detection, etc. Semantic segmentation of UAV-captured films, however, has received less attention since no standardised dataset exists to test various approaches. In this work, we introduce ManipalUAVid, a new dataset of UAV aerial videos for semantic segmentation. Fine annotation is supplied for four backdrop classes including buildings, vegetation, roads, and bodies of water. All of the footage was gathered on a secure university campus. In addition, the results of Conditional Random Field (CRF), U-Net, Fully Convolutional Network (FCN), and DeepLabV3+, four semantic segmentation methods,

are evaluated on the ManipalUAVid dataset. When applied to the UAV aerial video dataset, these methods show competitive performance, with mean squared error (mIoU) values of 0.86, 0.86, 0.83, and 0.83, respectively.

[3] S. Girisha, M. Pai, U. Verma, and R. Pai, (2019), "Semantic segmentation of uav aerial videos using convolutional neural networks,". Complex aerial movies may be better understood with the help of semantic segmentation. As a result, systems using automated methods of video processing, such as anomaly detection, object identification, and event detection, perform better. Unfortunately, the lack of an adequate dataset has hindered research into semantic segmentation in aerial movies. To solve this problem, a DJI Phantom 3 professional drone is used to film and manually annotate an aerial video dataset. The proposed study also examines the effectiveness of semantic segmentation algorithms for aerial films utilising Fully Convolution Networks (FCN) and U-net designs. For the purposes of semantic segmentation, this research focuses on two categories: vegetation and transportation. On Unmanned Aerial Vehicle (UAV) aerial films, it is shown that both designs perform comparably, with a pixel accuracy of 89.7 and 87.31% respectively.

[4]J. Zhu, K. Sun, S. Jia, Q. Li, X. Hou, W. Lin, B. Liu, and G. Qiu, (2018), "Urban traffic density estimation based on ultrahigh-resolution uav video and deep neural network,". Using state-of-the-art deep learning methods, this research proposes a methodology for accurately estimating urban traffic densities by processing ultrahigh-resolution traffic recordings captured by an unmanned aerial vehicle (UAV). Before anything else, we fly a UAV during rush hour in a contemporary megacity and acquire almost an hour of ultrahigh-resolution traffic footage at five congested road crossings. To create the dataset used in this article, we randomly picked over 17,000 512 x 512 pixel picture patches from the video frames and manually annotated over 64,000 cars. This dataset will be made publicly accessible to the scientific community. Vehicle identification and localisation, type (car, bus, and truck) recognition, tracking, and vehicle counting over time are all a part of our state-of-the-art deep neural network (DNN) based urban traffics analysis system. For our answer to be fully understood, we shall give substantial experimental findings. We'll demonstrate that deep learning approaches are more successful than standard computer vision techniques in traffic video analysis, and that our enhanced single shot multibox detector (Enhanced-SSD) is the best of its kind. We'll also demonstrate how ultrahigh-resolution video can be used to accurately identify and recognise vehicles, but lower quality contents can only do so with limited accuracy. This research not only highlights the benefits of employing state-of-the-art technology (ultrahigh-resolution video and UAV), but also proposes a cutting-edge DNN-based method for capitalising on these innovations in the estimate of urban traffic density.

III. METHODOLOGY

To begin, an input in the form of a video is provided to the system. In the beginning, the requirements are applied to the given input video and then it is preprocessed. When applied to the processed video sample, the filters allow for the detection of the vehicle. After that, the vehicle in question is followed and analysed so that its speed can be calculated. In order to obtain video from a live stream, a Video Capture object must first be created. The title of this discussion could be either the report on the apparatus or the name of a video record. In the event that it is extremely low, the video will be canny, and in the event that it is extremely high, the video will be moderate (Well, that is the course by which you can demonstrate accounts in moderate movement). The number of subcomponents that are used to apply various enhancements or corrections to an image that is being read in. The corrected image can be operated on by the subcomponents whenever one or more of the preprocessing options are turned on. After the data for each pixel has been gathered by this model framework, a technique known as DBSCAN (Density-based spatial social affair of organisations with tumult) is used to gather information about portions of the frontal area focuses.

SYSTEM REQUIREMENTS:

HARDWARE:

- OS- WINDOWS 7,8,10(32 OR 64 BIT)
- RAM-4GB–2 or 64 bit) RAM – 4GB

SOFTWARE:

- PYTHON IDLE
- ANACONDA NAVIGATOR

DEPLOYMENT ENVIRONMENT

The vast majority of Python implementations, including CPython, contain a read-eval-print loop (REPL), which enables them to carry out the duties of a command line interpreter. CPython is one of these implementations. The user feeds in statements in a predetermined sequence, and the interpreter returns results almost immediately after processing them.

Other shells, such as IDLE and IPython, have additional capabilities added to them, such as auto-completion, session state retention, and syntax highlighting, amongst other things. These new capabilities are available to users.

Python Anywhere is an integrated development environment (IDE) and hosting environment that runs entirely within a web browser. Canopy IDE is a Python integrated development environment (IDE) that is commercially available and focuses on scientific computing. Sage Math, which is designed for developing Python programmes related to science and mathematics, as well as Canopy IDE, are both examples of integrated development environments (IDEs) that are available in addition to the standard desktop IDEs and IDEs that are accessible via web browsers.

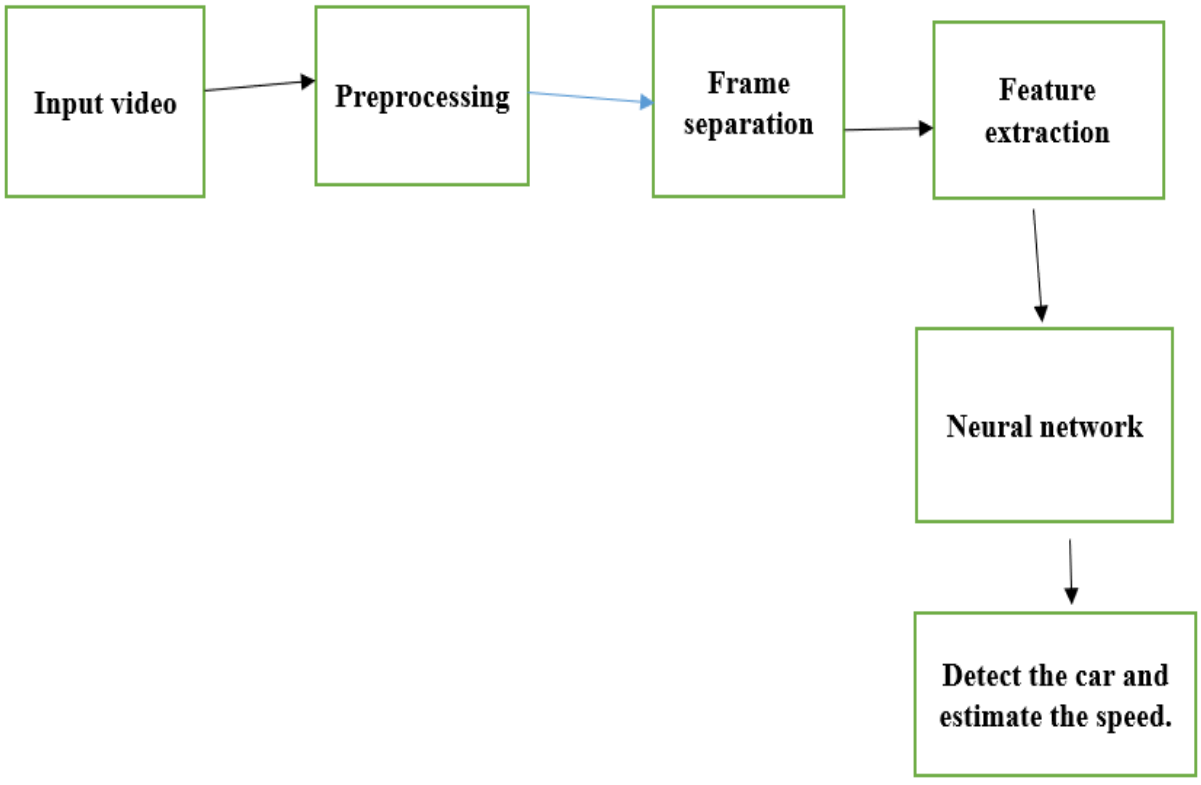

Figure 1: Proposed block diagram

PREPROCESSING:

Digital Image Processing. Digital image processing deals with manipulation of digital images through a digital computer. It is a subfield of signals and systems but focus particularly on images. DIP focuses on developing a computer system that is able to perform processing on an image. The input of that system is a digital image and the system process that image using efficient algorithm.

It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and distortion during processing.

1. Importing the image via image acquisition tools.

2. Analysing and manipulating the image.
3. Output in which result can be altered image.

Image Pre-processing is a common name for operations with images at the lowest level of abstraction. Its input and output are intensity images.o The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing.

DIGITAL IMAGE PROCESSINGCLASSIFICATION OF IMAGES

There are 3 kinds of pix applied in Digital Image Processing. They are

1. Binary Image
2. Gray Scale Image
3. Colour Image

Advantages

- Efficient functionality.
- Low accuracy.
- These methods have no requirement of tire models, and the underlying kinematic models are also straight forward and easy to understand.

Binary picture

A binary photograph is a virtual photo that has most effective viable values for every pixel. Typically the two colorings used for a binary image are black and white despite the truth that any colours may be used. The colour used for the item(s) in the photograph is the foreground colour while the rest of the picture is the historic past coloration.

Binary pix are also called bi-stage or -stage. This approach that every pixel is stored as a single bit (zero or 1).This name black and white, monochrome or monochromatic are regularly used for this idea, however may also additionally designate any pics that have best one pattern in keeping with pixel, together with grayscale photos

Binary pics often upward push up in virtual image processing as masks or because the result of positive operations collectively with segmentation, thresholding, and dithering. Some input/output gadgets, which include laser printers, fax machines, and bi-level laptop shows, can most effective manage bi-degree pix.

Gray scale images

A grayscale Image is virtual photo is an picture in which the price of every pixel is a single sample, this is, it consists of satisfactory depth information. Images of this type, also referred to as black-and-white, are composed solely of sun shades of gray(0-255), various from black(0) on the weakest depth to white(255) at the maximum effective.

Grayscale snap shots are extremely good from one-bit black-and-white pix, which in the context of laptop imaging are pix with only the 2 sun sunglasses, black, and white (additionally known as bi-diploma or binary photos). Grayscale snap shots have many sunshades of grey in among. Grayscale photos are also referred to as monochromatic, denoting the absence of any chromatic version.

Grayscale pix are frequently the quit end result of measuring the intensity of moderate at every pixel in a single band of the electromagnetic spectrum (e.G. Infrared, seen mild, ultraviolet, and lots of others.), and in such instances they will be monochromatic proper at the same time as simplest a given frequency is captured. But moreover, they may be synthesized from a whole colour picture; see the phase approximately changing to grayscale.

Colour picture

A (digital) colour image is a virtual photograph that includes shade records for every pixel. Each pixel has a specific rate which determines its appearing shade. This fee is certified by means of manner of 3 numbers giving the decomposition of the color inside the 3 number one sunshades Red, Green and

Blue. Any shade seen to human eye may be represented this manner. The decomposition of a colour inside the 3 number one hues is quantified through some of amongst 0 and 255. For instance, white may be coded as R = 255, G = 255, B = 255; black can be referred to as (R, G,B) = (0,0,0); and say, amazing pink may be : (255,0,255).

In great phrases, an photo is an intensive -dimensional array of colour values, pixels, each of them coded on three bytes, representing the 3 primary shades. This allows the image to encompass a complete of 256x256x256 = 16. Eight million particular shades. This approach is likewise referred to as RGB encoding and is particularly tailor-made to human imaginative and prescient.

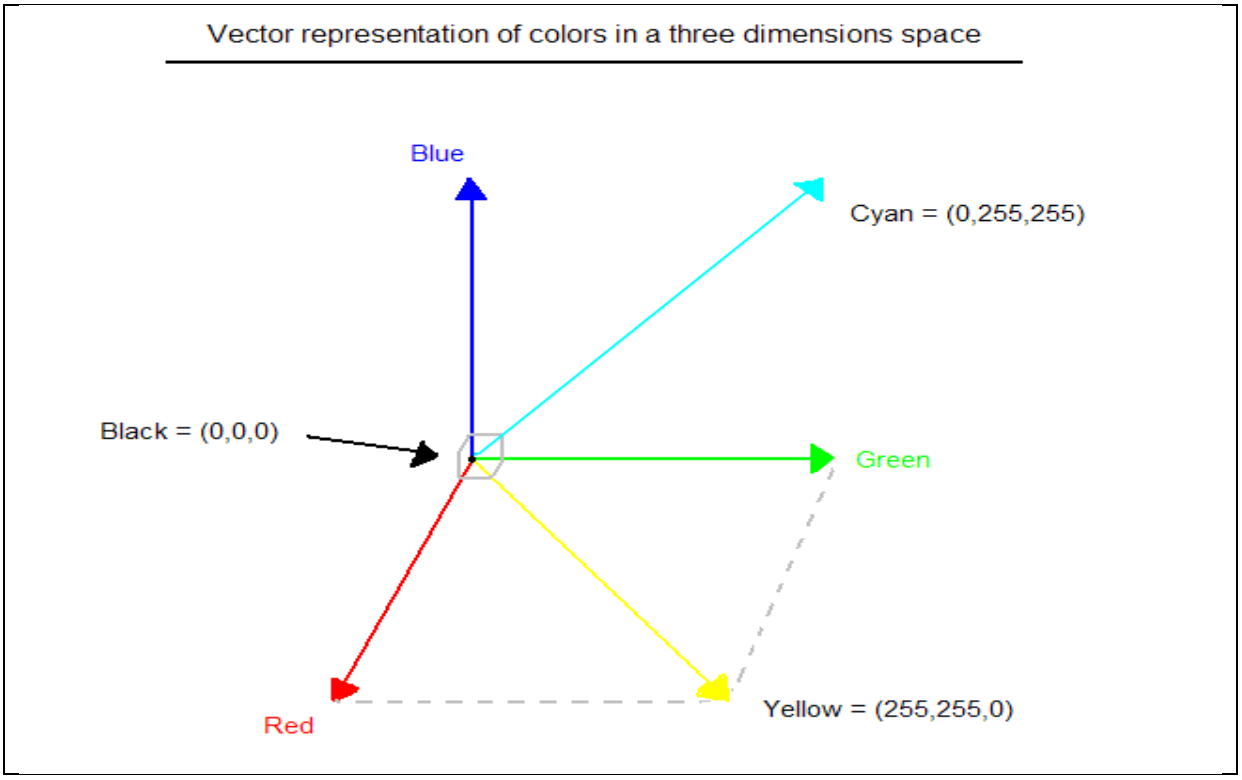

Figure 2: Hue Saturation Process of RGB SCALE Image

From the above determine, sunshades are coded on 3 bytes representing their decomposition on the 3 primary colourings. It sounds obvious to a mathematician to right away interpret colours as vectors in a three-size area in which every axis stands for one of the number one hues. Therefore, we are able to gain of maximum of the geometric mathematical requirements to cope with our colours, which consist of norms, scalar product, projection, rotation or distance.

The identification of devices in an picture and this method may additionally possibly begin with photograph processing techniques collectively with noise removal, observed via the usage of (low-diploma) feature extraction to find out lines, areas and probable regions with sure textures.

The smart bit is to interpret collections of those shapes as single devices, e.G. Vehicles on a avenue, boxes on a conveyor belt or cancerous cells on a microscope slide. One motive this is an AI problem is that an item can seem very one-of-a-type while viewed from unique angles or underneath amazing lighting. Another problem is finding out what skills belong to what item and which can be information or shadows and so on. The human visible device plays these responsibilities specifically unconsciously however a laptop calls for skilful programming and masses of processing strength to method human commonplace overall performance. Manipulation of records inside the shape of an photograph through severa viable strategies. An image is generally interpreted as a -dimensional array of brightness values, and is maximum familiarly represented via way of such patterns as the ones of a

photographic print, slide, tv display, or movie show display. An image may be processed optically or digitally with a laptop.

IV. RESULTS AND DISCUSSIONS

Results:

In this modern age, where there has been a rapid reduction in the number of accidents, the number of people who use vehicles has also increased dramatically. The heavy volume of traffic is to blame for this. It is recommended that we flow new communication methods in order to circumvent this issue. One example of this would be an image processing-based vehicle speed estimation and monitoring system that makes use of OPENCV. By employing this method, we will be able to obtain the specifics regarding the information about vehicles that is located at particular intersections through the use of internet access. This is more helpful in the event of travelling during an emergency.

Python Code:

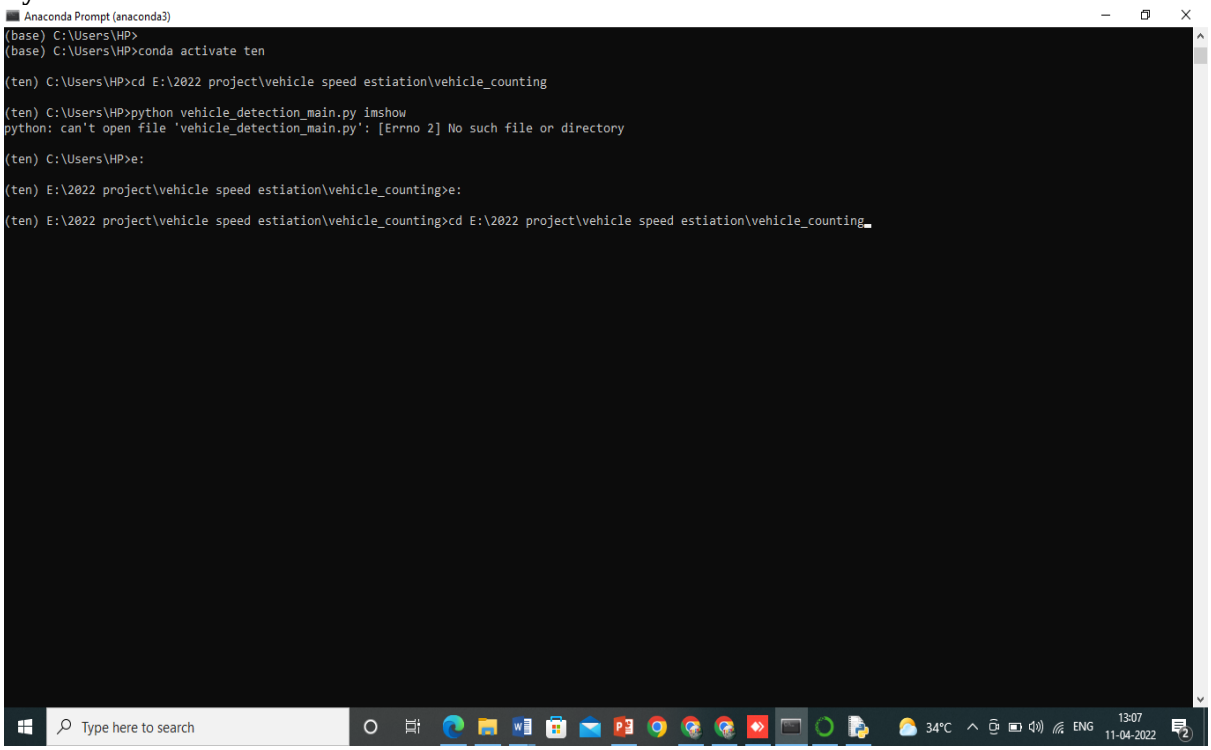

Figure 3: Input python program

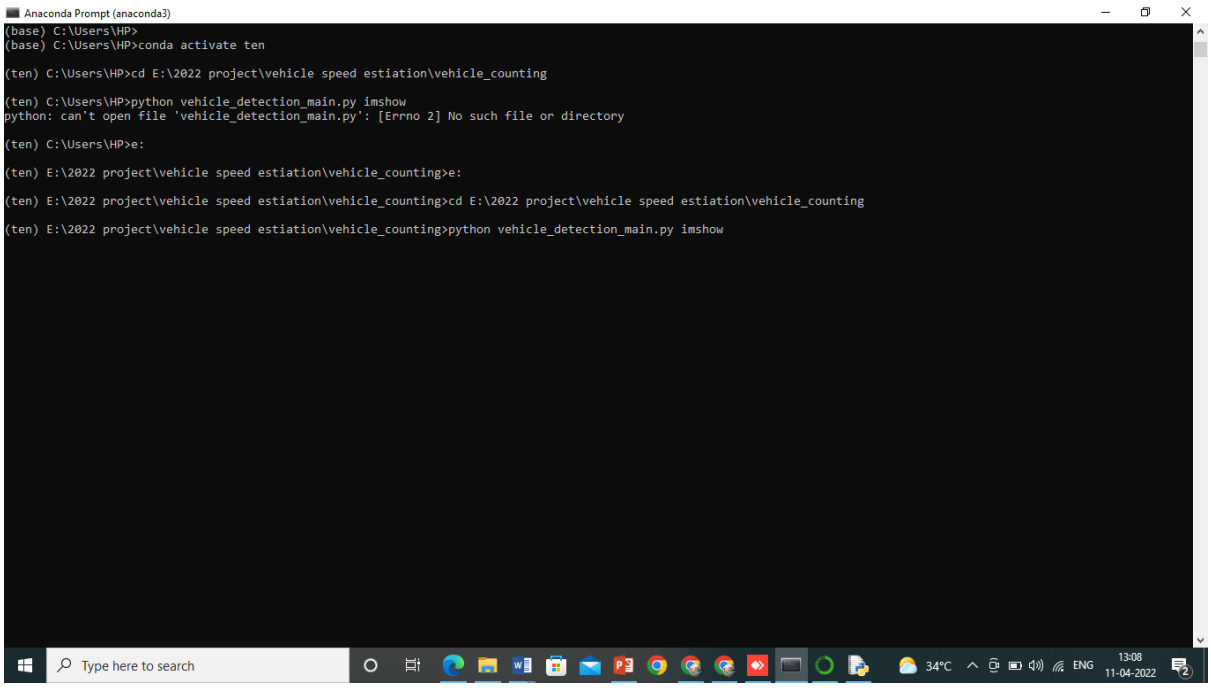

Figure 4: Input python program

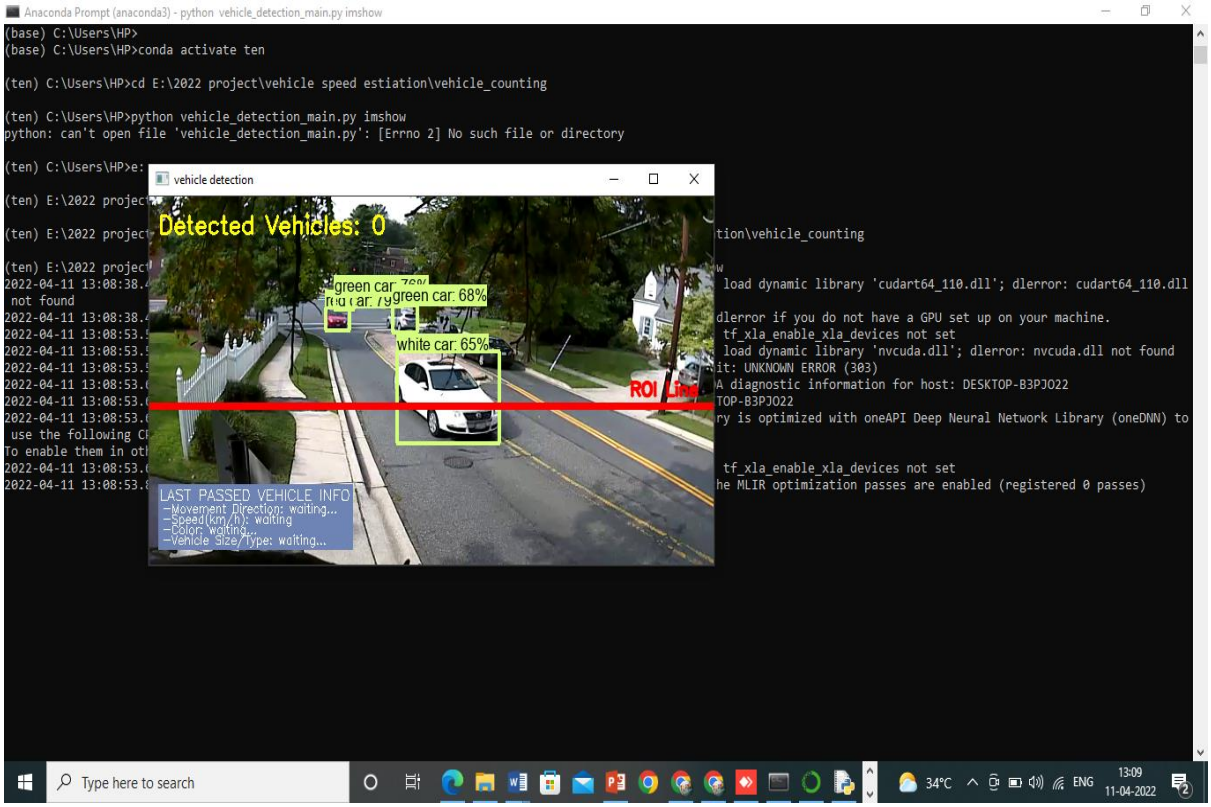

Figure 5: Detected vehicle 0

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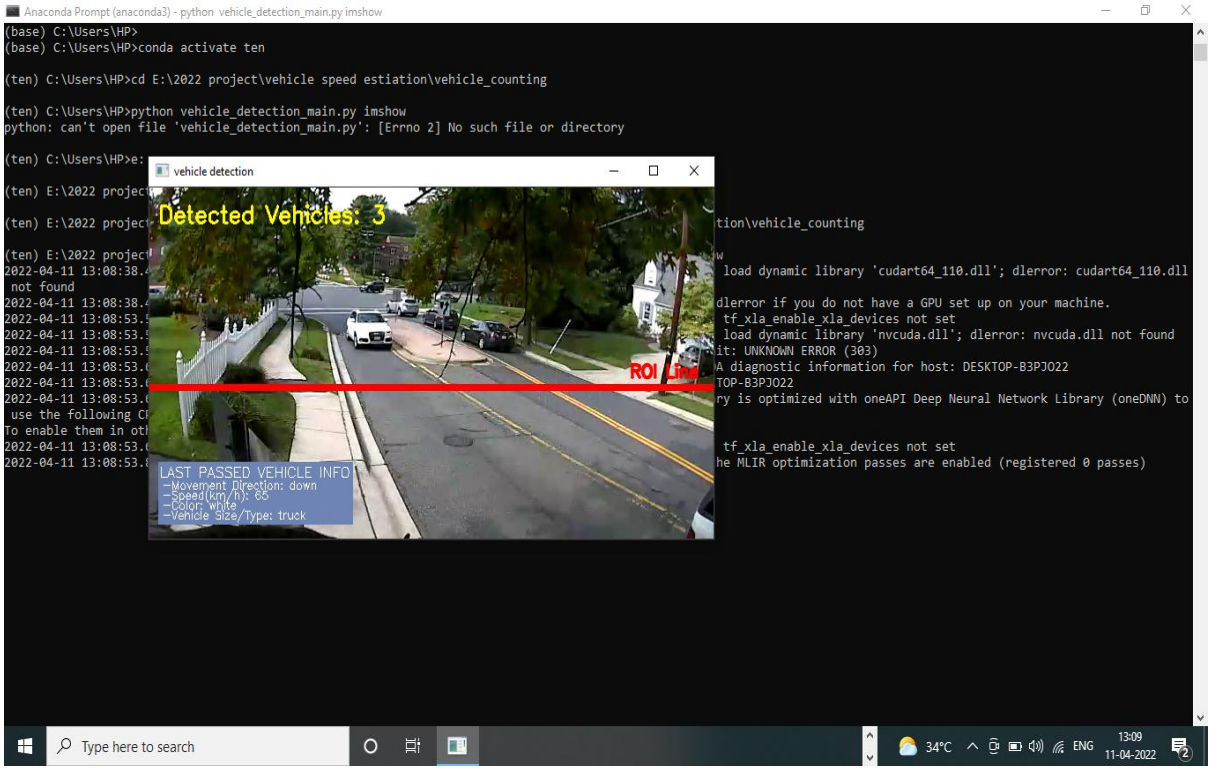

Figure 6: Detected vehicle 3

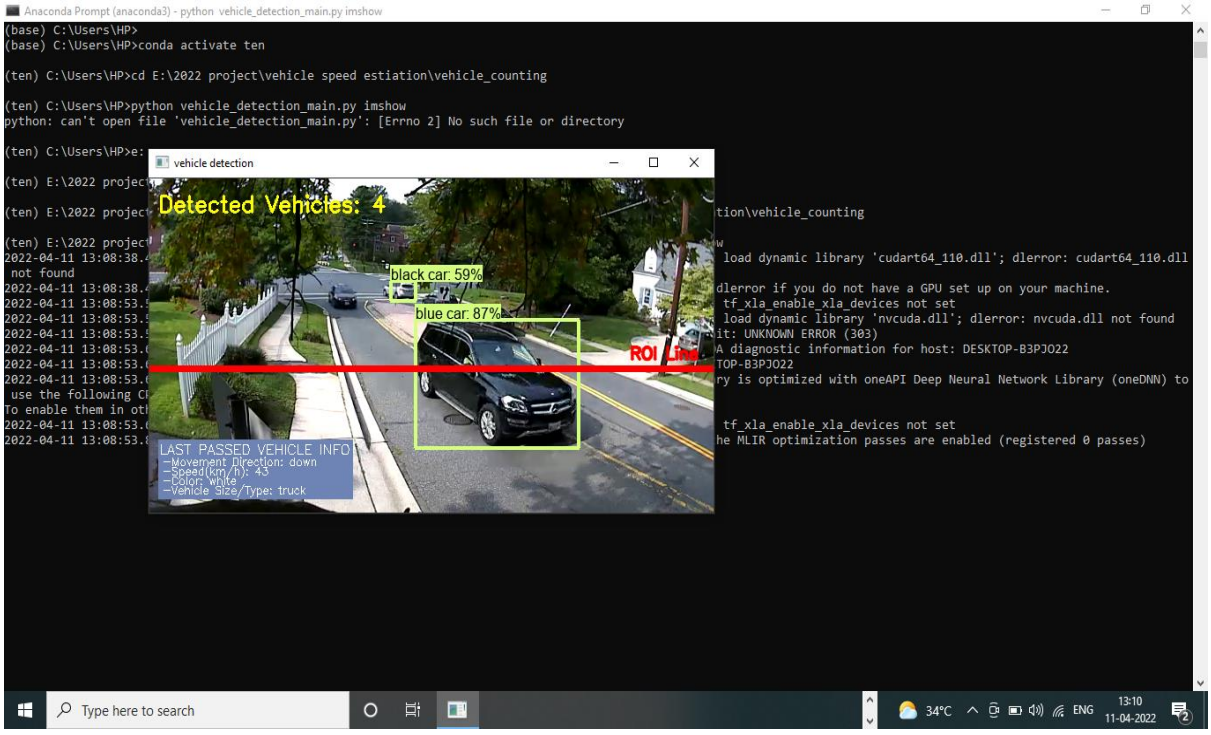

Figure 7: Detected vehicle 4

V. CONCLUSIONS

The number of people who use automobiles has skyrocketed in this day and age, despite the fact that there has been a significant drop in the overall number of accidents. This is a direct result of the high volume of the surrounding traffic. It has been suggested that we establish new channels of

communication as a means of getting around this problem. One illustration of this would be a monitoring and estimating system for vehicle speeds that is based on image processing and makes use of OPENCV. By utilizing this strategy, we will be able to acquire the particulars regarding the information about vehicles that is located at specific intersections by making use of internet access as our primary resource. This will be of greater assistance in the event that you are travelling during an emergency.

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