Sanjay Ghodawat University Kolhapur

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Empowering Lives Globally !

Mini Project Report

On

"Traffic Analysis"

Under the guidance of

Mrs. Sophiya Shikalgar

Department of Artificial Intelligence & Machine Learning

Academic year: 2023 - 24

CERTIFICATE

This is to certify that the mini project report entitled

"Traffic Analysis"

Submitted by

Names of Student	Roll No.
Atharva P. Kangle	**48**
Atik A. Mulla	**49**
Ruturaj K. Kamble	**54**

In the partial fulfilment for the Semester VII of FinalYear .B. Tech of Artificial Intelligence & Machine Learning is a record of work carried out by the students mentioned above under the guidance and supervision of Mrs. Sophiya Shikalgar during the academic year 2023-24.

Place: SGU, Atigre

Date:

Ms. Sophiya Shikalgar	**Mr. Amrish Patil**	**Ms. Deepika Patil**
Mini Project Guide	**Program Co-ordinator**	**Head-SOCSE**

ACKNOWLEDGEMENT

We express our sincere thanks to **Mrs. Sophiya Shikalgar** and **Ms. Deepika Patil , Head-SOCSE** whose supervision, inspiration and valuable guidance , helped us a lot to complete our mini project work.

Their guidance proved to be the most valuable to overcome all the hurdles in the fulfilment of this mini project work.

Last but not the least, this acknowledgement would be incomplete without rendering our sincere gratitude to all those who have helped us in the completion of mini project work.

Sincerely,

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➢ ABSTRACT

Abstract—for smart city management, efficient handling of road traffic is one of the key aspects. Traffic congestion can be managed effectively, if the numbers of vehicles that are to pass through a crowded junction can be pre-estimated in time. The proposed method presents a framework, which has the capability to continuously convey the vehicle count and generate an alarm in case of large vehicle gathering to the controlling station in the Chandigarh or alike urban Indian cities. The number of vehicles passing through a location well before the required traffic junction can be estimated using the help of image processing techniques. Further, the monitoring details can be shared to a distant controlling centre situated anywhere in the city through internet usage. The performed experiments demonstrate the effectiveness of this Internet of Things (IoT) based technology.

➢ Introduction

Real time traffic density prediction and analysis have recently gained popularity as compared to traditional traffic density system using CCTVs. The popularity and need of traffic monitoring at public places, industrial sector, and residential areas have supported the widespread use of real time traffic monitoring. The motion of the vehicle is one of the basic parameter for identification of the flow of traffic on roads. The traffic flow on the roads can be basically categorized into heavy, medium and low traffic. Majorly thresholds that are used to correctly classify the traffic in any frame. Background subtraction, edge detection, optical flow estimation, BLOB(Binary Large Object) detection, magnetic loops, computer vision filtration techniques, closure operation are some techniques that are combined by various researchers and used to correctly classify the nature of vehicular traffic in a frame. However, the vehicular movement's nature is dynamic and unpredictable. For traditional techniques that are been used over years have a few challenges including the color of the road and obstacles such as shadow and illumination. The colors of majority of vehicles observed on roads are white, silver, and black. The roads also are cement based or tar-based those make them an obstacle in traditional systems. This paper presents a new blend of various studied techniques for Traffic Density Analysis.

➢ LITERATURE REVIEW

Traffic analysis using artificial intelligence (AI) techniques has gained significant attention in recent years due to its potential to improve network performance, security, and efficiency. This literature survey aims to provide an overview of key research papers and studies related to traffic analysis using AI. The survey covers various AI-based methodologies, techniques, applications, and challenges in the field of traffic analysis. It offers insights into the current state of research, highlighting the advancements and future directions in this domain.

1. Introduction:

- Overview of traffic analysis using AI and its significance in network management and security.
- Explanation of the goals and advantages of AI-based traffic analysis.

2. AI Techniques for Traffic Analysis:

- Machine Learning (ML) algorithms: Overview of ML algorithms such as decision trees, random forests, support vector machines, and neural networks used for traffic analysis.
- Deep Learning (DL) models: Discussion of deep learning architectures like convolutional neural networks (CNNs), recurrent neural networks (RNNs), and deep auto encoders applied to traffic analysis.
- Reinforcement Learning (RL): Exploration of RL techniques in optimizing network traffic and resource allocation.

3. Traffic Analysis Applications using AI:

- Network Intrusion Detection Systems (NIDS): AI-based models for identifying and mitigating network attacks, including anomaly detection and behavior analysis.

- Traffic Classification: ML and DL approaches for categorizing network traffic into applications or protocols.

- Quality of Service (QoS) Optimization: Using AI to optimize network traffic and improve QoS metrics.

- Traffic Prediction and Forecasting: AI models for predicting future traffic patterns and enabling proactive network management.

4. Challenges in Traffic Analysis using AI:

- Data scarcity and labeling: Addressing the challenges associated with limited labeled traffic datasets.

- Scalability: Developing AI models that can handle large-scale networks and process high-volume traffic data.

- Explain ability and Interpretability: Ensuring transparency and interpretability of AI models for traffic analysis.

- Adversarial attacks and evasion techniques: Handling attempts to manipulate or evade AI-based traffic analysis systems.

5. Evaluation and Performance Metrics:

- Discussion of evaluation methodologies and performance metrics used to assess the effectiveness of AI-based traffic analysis techniques.

6. Future Directions and Open Research Problems:

- Identification of emerging trends and challenges in traffic analysis using AI.

- Exploration of potential research directions, such as federated learning for distributed traffic analysis and explainable AI for traffic anomaly detection.

7. Conclusion:

- Summary of the key findings from the literature survey.

- Highlighting the potential of AI-based traffic analysis and the need for further research in this field.

This literature survey provides a comprehensive overview of AI-based methodologies, techniques, applications, and challenges in traffic analysis. It serves as a valuable resource for researchers, practitioners, and industry professionals interested in leveraging AI for enhancing network performance, security, and management through traffic analysis.

➢ Methodology

The automatic counting of vehicles passing through achosen destination was obtained by using image-processing techniques. A camera system was used to acquire the real time video footage of the traffic flow through road. After acquiring the video through camera, to image processing system was used to work on this data. Finally, after the average vehicle count per specified time interval has been found, the same processing system is used to communicate the same information to central control system.

- **Modules**
  - **Live Camera and Frame Capture :-**

    Detect camera and start camera to capture frame from camera.
  - **Image Processing :-**

    After capturing frame from camera process image to gray mode and after gray conversion, detect edge from frame and process next.
  - **Cascade Classifier to Detect Vehicle :-**

    It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect Vehicle in frame.
  - **Vehicle Count :-**

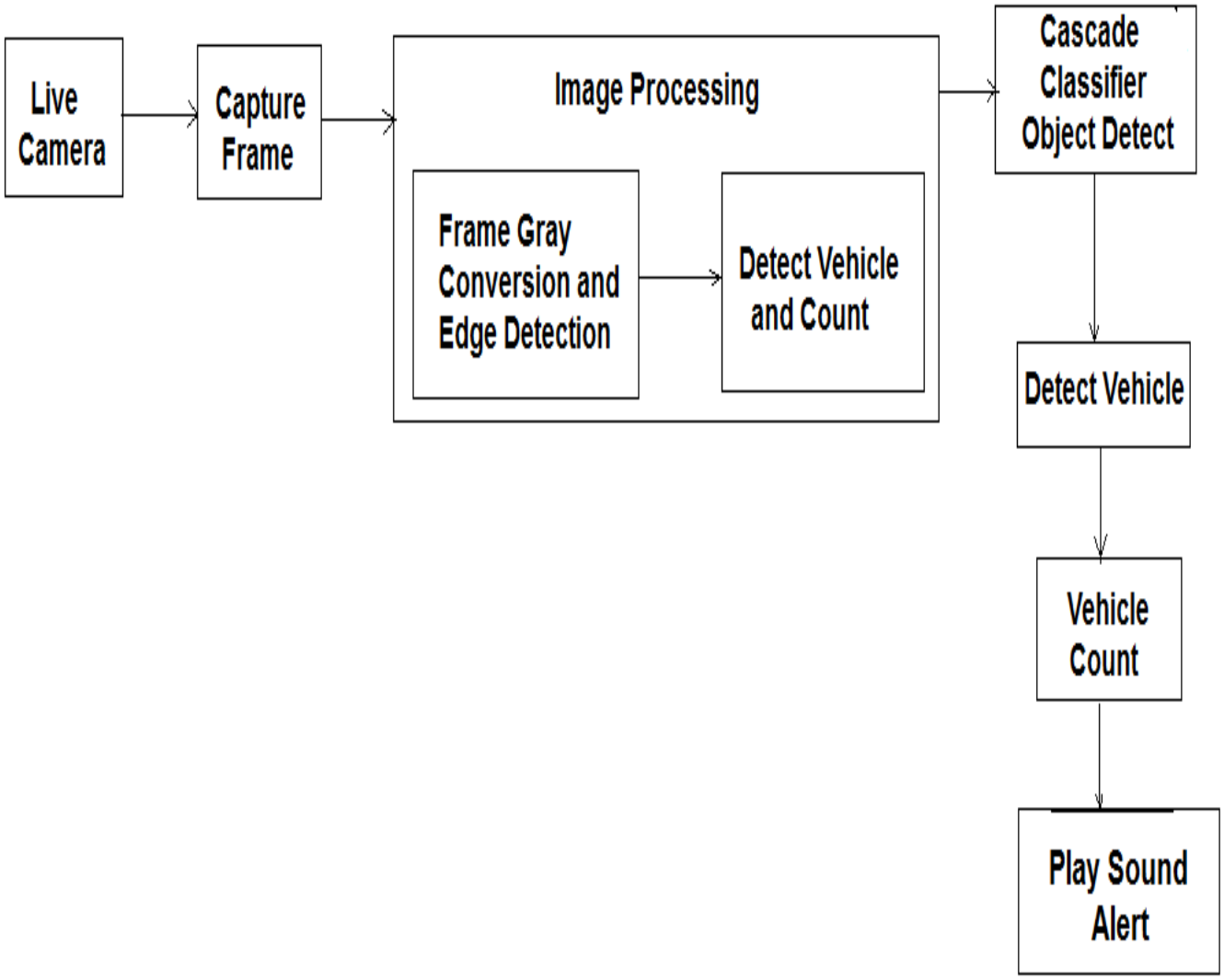
    Count detected Vehicle from capture frame
  - **Play Sound Alert :-**

    If Vehicle count increase than normal count value then play beep

➢ Functions and Packages used in project :-

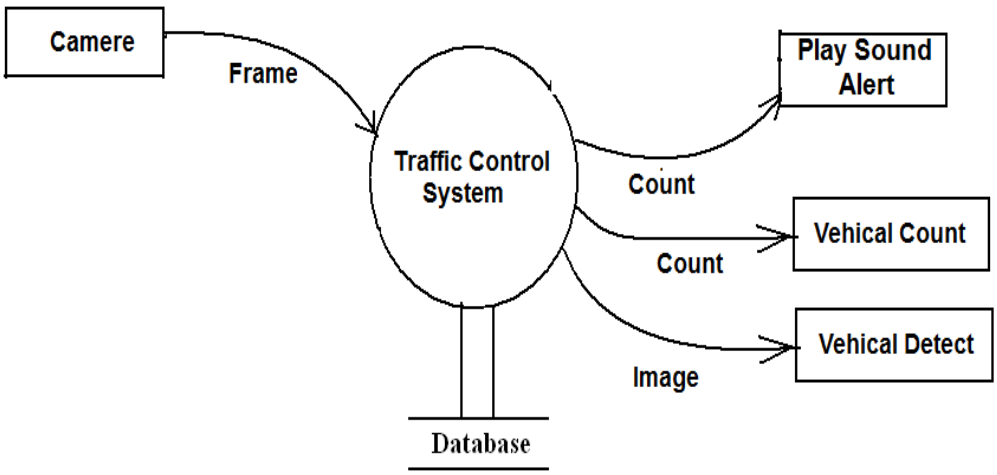
- **cv2 -** OpenCV is a huge open-source library for computer vision, machine learning, and image processing. It can process images and videos to identify objects, faces, or even the handwriting of a human.
- **Winsound -** The winsound module provides access to the basic sound-playing machinery provided by Windows platforms. It includes functions and several constants.
- **Numpy -** NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.
- **CascadeClassifier() -** It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.
- **detectMultiScale() -** detectMultiScale function is used to detect the faces. This function will return a rectangle with coordinates(x,y,w,h) around the detected face. It takes 3 common arguments — the input image, scaleFactor, and minNeighbours. scaleFactor specifies how much the image size is reduced with each scale
- **cv2.putText()** – Put Text on image
- **cv2.rectangle()** – Draw rectangle on image
- **winsound.Beep() -** winsound. Beep (frequency, duration) Beep the PC's speaker.

- **Architecture Diagram:-**

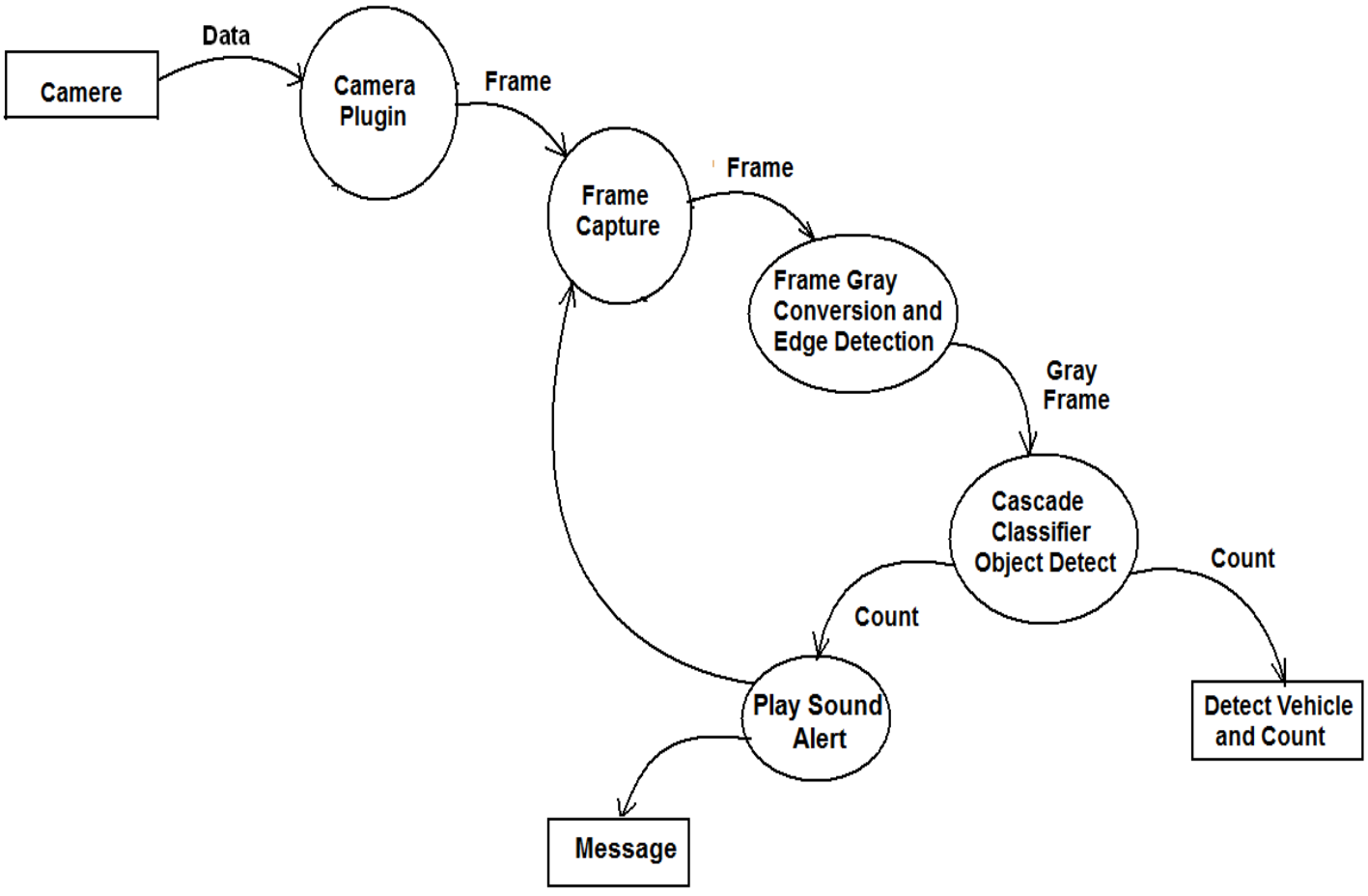


- **Flow diagram:-**

L-0



L-1



➢ System Requirements :-

❖ Software requirements:

- For allover coding, we will using Python programming language
- Visual Studio Code or Jupyter Notebook.
- Notepad++

❖ Hardware requirement:

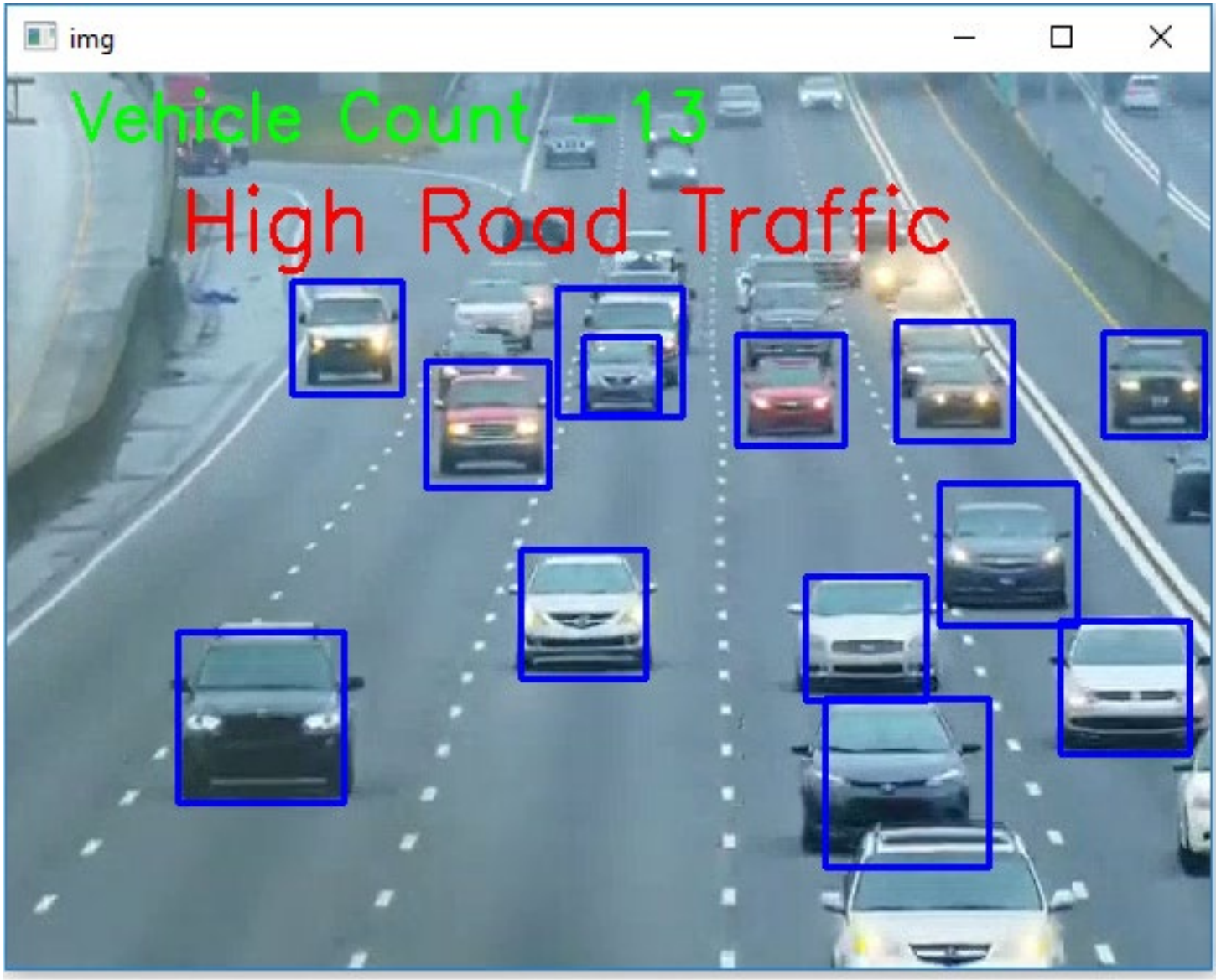
- Processor Intel i3/i5/i7
- RAM minimum 4 GB
- Hard disk minimum 100 GB

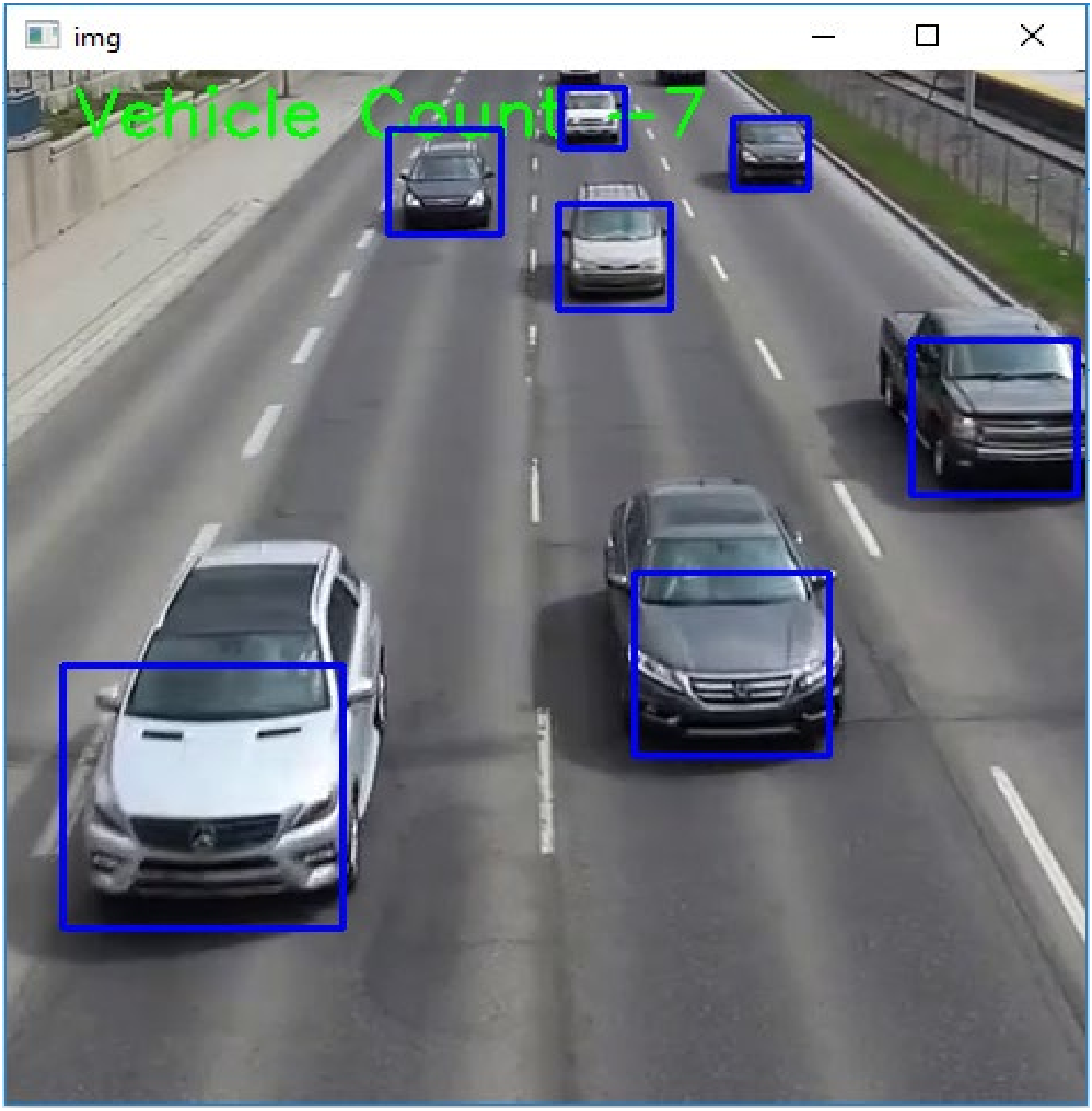
- **CODE:**

```
import numpy as np
import cv2
import winsound
face_cascade = cv2.CascadeClassifier('car2.xml')
#cap = cv2.VideoCapture(0)
cap = cv2.VideoCapture("Video5.mp4")


while 1:
    _, img = cap.read()
    gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
    faces = face_cascade.detectMultiScale(gray, 1.3, 5)


    Alarmdetect=0
    font=cv2.FONT_HERSHEY_SIMPLEX
    pos=(30,30)
    fontScale=1
    fontColor=(0,255,0)
    lineType=2


    cv2.putText(img,"Vehicle Count -"+str(len(faces)),pos,font,fontScale,fontColor,lineType)
```

```
for (x,y,w,h) in faces:
        cv2.rectangle(img,(x,y),(x+w,y+h),(255,0,0),2)


    if len(faces)>=10:
        Alarmdetect=1
        pos1=(80,80)
        fontColor1=(0,0,255)
        cv2.putText(img,str("High Road Traffic"),pos1,font,fontScale+0.3,fontColor1,lineType)



    if Alarmdetect==1:
        frequency = 1500  # Set Frequency To 2500 Hertz
        duration = 500  # Set Duration To 1000 ms == 1 second
        winsound.Beep(frequency, duration)

  if cv2.waitKey(100) & 0xFF == ord('q'):
                break
    cv2.imshow('img',img)

cap.release()
cv2.destroyAllWindows(
```

- **Result:**




img
Vehicle Count : 7

- **Challenging experiences encountered :-**

Implementing & Deploying python coding is itself a challenging experience although it allows us to find errors but also to resolve is it satisfies the requirements or not so it must be carried out professional to provide the proof of quality of services. As we do not have much of practical's in our courseso we learned the proper format for creating and accessing the python code aswell as the techniques to execute them therefore it take us about a week to learn all the things. Also, we were given task for implementing new codes by using python libraries which unfortunately did not get completed, but was a very challengingtask. As the carried on using the guidance of our Trainer we needed to learn about it. In this six weeks of training we faced 2 special challenging tasks like creating codes and run it, which helped us in improving our practical skills as well as enhancing our Technical knowledge.

➢ Conclusion :-

In conclusion, traffic analysis conducted using Python has demonstrated its effectiveness and versatility in various aspects of transportation studies. Python's extensive libraries, data processing capabilities, and machine learning functionalities make it a valuable tool for analyzing, modeling, simulating, and optimizing traffic data.

Overall, Python's flexibility, ease of use, and extensive library support make it a powerful tool for traffic analysis. The reviewed literature showcases its applications in traffic data processing and visualization, traffic flow modeling and simulation, machine learning in traffic analysis, intelligent transportation systems, and traffic signal optimization. As Python continues to evolve, we can anticipate further advancements and innovations in traffic analysis techniques, contributing to more efficient and sustainable transportation systems.

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