

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“Jnana Sangama”, Belgaum-590 014, Karnataka.



An Internship Report  
On

## ***“VEHICLE COUNTING SYSTEM USING OPENCV” - MACHINE LEARNING***

Submitted in the partial fulfillment of the requirements for the award of the Degree of

### **BACHELOR OF ENGINEERING IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE ENGINEERING**

*Submitted by*

**PURNIMA R**  
**(1EW21AD034)**

*Under the Guidance of*

**Mrs Trupti G N**

Asst Prof Dept. of ISE EWIT,  
Bangalore



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA  
SCIENCE ENGINEERING**

**EAST WEST INSTITUTE OF TECHNOLOGY**

BANGALORE - 560 091  
2023-2024

# EAST WEST INSTITUTE OF TECHNOLOGY

Sy. No.63, Off. Magadi Road, Vishwaneedam Post, Bangalore - 560 091  
(Affiliated To Visvesvaraya Technological University, Belgaum)

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE ENGINEERING



### CERTIFICATE

This is to certify that the Internship project work entitled “**VEHICLE COUNTING SYSTEM USING OPENCV**” presented by **PURNIMA.R (1EW21AD034)**, bonafide student of **EAST WEST INSTITUTE OF TECHNOLOGY**, Bangalore in partial fulfillment for the award of **Bachelor of Engineering in Artificial Intelligence and Data Science Engineering** of **Visvesvaraya Technological University**, Belgaum during the year **2023-2024**. It is certified that all corrections/suggestions indicated have been incorporated in the report. The internship work has been approved as it satisfies the academic requirements in respect of internship work prescribed for the said degree.

-----

Signature of Guide  
**Mrs. Tupti G N.**  
Asst Prof Dept. of ISE  
EWIT, Bangalore

-----

Signature of HOD  
**Dr. Suresh M B**  
Prof & Head, Dept. of ISE  
EWIT, Bangalore

-----

Signature of Principal  
**Dr. K Channakeshavalu**  
Principal  
EWIT, Bangalore

### External Viva

Name of the Examiners

Signature with date

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

# CERTIFICATE FROM THE ORGANIZATION

# Take It Smart (OPC) PVT LTD

*"Recognized by the Government of India's Startup India Initiative"*

Reg No. : 150027

ISO 9001 :2015

## Internship Certificate

This Certifies that

**PURNIMA R**

Student of EAST WEST INSTITUTE OF TECHNOLOGY

Has completed Internship in MACHINE LEARNING

From 25th OCTOBER 2023 TO 23rd NOVEMBER 2023

we found him/her sincere, Hardworking, Dedicated and Result oriented, She/he Worked well as Part of the team during his/her tenure. We take this opportunity to thank him / her And Wish him / her all the best for him / her future.



**Mallikarjun Kumbhar**  
Director



**#startupindia**

Vijayanagar, Bengaluru 8050104212 / 8792697647 takeitsmart.in

# EAST WEST INSTITUTE OF TECHNOLOGY

Sy. No.63, Off. Magadi Road, Vishwaneedam Post, Bangalore - 560 091  
(Affiliated To Visvesvaraya Technological University, Belgaum)

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE ENGINEERING



## DECLARATION

I, **PURNIMA.R**, Student of fifth Semester B.E ,in the Department of Information Science and Engineering, **East West Institute of Technology**, Bangalore hereby declare that the internship entitled "**VEHICLE COUNTING SYSTEM USING OPENCV**" **using MACHINE LEARNING** has been carried out by me and submitted in partial fulfillment of course requirements for the award of degree in **Bachelor of Engineering in Artificial Intelligence and Data Science** discipline of **Visvesvaraya Technological University**, Belgaum during the academic year **2023-2024**. Further, the matter embodied in internship report has not been submitted previously by anybody for the award of any degree or diploma to any other university.

**Place: Bangalore**

**NAME: PURNIMA.R**

**Date: 09-12-2023**

**USN: 1EW21AD034**

## **ABSTRACT**

Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class in digital images and videos. With the rapid development of intelligent video analysis, traffic monitoring has become a key technique for collecting information about traffic conditions. Using the traditional sensors such as loop detectors, ultrasonic sensors may cause damage to the road surface also sensors cost of work is high. Surveillance video cameras are commonly used sensors in the traffic monitoring, which can provide video stream for vehicle detection and counting. Vehicle detection and tracking finds its applications in traffic control, car tracking, creating parking sensors & so on. Vehicle counting process provides appropriate information about traffic flow, vehicle crash occurrences and traffic during the peak times in roadways by using the technique digital image processing methods. This addresses a video-based techniques for vehicle recognition and counting based on OpenCV technologies. Several OpenCV techniques, including of thresholding, the adaptive morphology operations and many more. This project describes the methodology used for image processing or video processing for traffic flow counting with real time videos using a programming language.

## ACKNOWLEDGEMENT

I am grateful to our institute **East West Institute of Technology** with its ideals and inspiration for having provided us with the facilities, which has made this project a success

I would like to express my gratitude to **Dr. K Channakeshavalu, Principal, EWIT** for providing us with all the facilities that helped me to carry out the work easily.

I express my sincere thanks to **Dr. Suresh M B, Professor and Head, Dept. of ISE, EWIT** for his valuable guidance and support.

I would like to express my sincere thanks to my internship guide **Mrs. Trupti. G N, Asst. Professor, Dept. of ISE, EWIT** for her valuable guidance, encouragement in carrying out the internship work.

I would like to express my sincere gratitude to my supervisor **Mr. Mallikarjun Kumbar** for providing his invaluable guidance, comments and suggestions throughout the course of the internship. During the period of my internship work. I have received generous help from many quarters, Without the help of them, it was impossible to finish my work.

Finally, I express sincere thanks to my parents. well-wishers and friends for their moral support, encouragement that help me in completing the internship work.

**PURNIMA.R**  
**(1EW21AD034)**

## **LIST OF CONTENTS**

	<b>PAGE NO</b>
<b>ABSTRACT</b>	<b>i</b>
<b>ACKNOWLEDGEMENT</b>	<b>ii</b>
<b>LIST OF FIGURES</b>	<b>vi</b>

## **CHAPTERS**

<b>CHAPTER: COMPANY PROFILE</b>	<b>1-3</b>
<b>1.1 AN OVERVIEW OF THE ORGANIZATION</b>	<b>1</b>
<b>1.2 OPERATIONS OF THE ORGANIZATION</b>	<b>2</b>
<b>1.3 OBJECTIVES OF THE ORGANIZATION</b>	<b>2</b>
<b>1.4 STRENGTHS AND STRATEGIES</b>	<b>2</b>
<b>1.5 PRODUCTS AND SERVICES OFFERED BY THE ORGANIZATION</b>	<b>3</b>
<b>1.6 BENEFITS</b>	<b>3</b>
<b>CHAPTER 2: INTRODUCTION</b>	<b>4</b>
<b>CHAPTER 3: SYSTEM ANALYSIS</b>	<b>5-7</b>
<b>3.1 NEED OF THE PROJECT</b>	<b>5</b>
<b>3.2 EXISTING SYSTEM</b>	<b>5</b>
<b>3.3 PROBLEM STATEMENT</b>	<b>5</b>

<b>3.4 PROPOSED SYSTEM</b>	<b>6</b>
<b>3.5 AIM OF THE PROJECT</b>	<b>6</b>
<b>3.6 ADVANTAGES</b>	<b>7</b>
<b>3.7 SIGNIFICANCE OF THE PROJECT</b>	<b>7</b>
<b>CHAPTER 4: SOFTWARE REQUIREMENT SPECIFICATION</b>	<b>8-13</b>
<b>4.1 INTRODUCTION</b>	<b>8</b>
<b>4.2 SYSTEM REQUIREMENTS</b>	<b>8-12</b>
<b>4.2.1 HARDWARE REQUIREMENTS :</b>	<b>8</b>
<b>4.2.2 SOFTWARE REQUIREMENTS :</b>	<b>9</b>
<b>4.2.2.1 MACHINE LEARNING</b>	<b>9-10</b>
<b>4.2.2.2 OPENCV</b>	<b>11</b>
<b>4.2.2.3 NUMPY</b>	<b>12</b>
<b>4.2.2.4 Pyttsx3</b>	<b>13</b>
<b>CHAPTER 5: METHODOLOGY</b>	<b>14-17</b>
<b>5.1 BACKGROUND EXTRACTION</b>	<b>14-15</b>
<b>5.1.1 BACKGROUND ESTIMATION</b>	<b>14</b>
<b>5.1.2 BACKGROUND SUBRACTION</b>	<b>15</b>
<b>5.2 FOREGROUND EXTRACTION:</b>	<b>15</b>



<b>5.3 PRE-PROCESSING</b>	<b>16-17</b>
<b>5.3.1 DILATION&amp;EROSION</b>	<b>16</b>
<b>5.3.2 GAUSSIAN BLUR</b>	<b>16</b>
<b>5.3.2 THRESHOLD</b>	<b>17</b>
<b>CHAPTER 6: IMPLEMENTATION</b>	<b>18-20</b>
<b>6.1 DETECTION OF VEHICLE</b>	<b>18</b>
<b>6.2 COUNTING A VEHICLE</b>	<b>19</b>
<b>6.2.1 CLASSIFICATION</b>	<b>19</b>
<b>6.3 PSEUDO CODE FOR VEHICILE COUNTING</b>	<b>19</b>
<b>6.3.1 FLOWCHART FOR VEHICLE COUNT</b>	<b>20</b>
<b>CHAPTER 7</b>	<b>21-22</b>
<b>7.1 SNAPSHOTS</b>	
<b>CONCLUSION</b>	
<b>FUTURE ENHANCEMENT</b>	
<b>REFERENCE</b>	

## **LIST OF FIGURES**

<b>Figure No</b>	<b>Title</b>	<b>Page No</b>
<b>FIG 3. 1:</b>	<b>PROPOSED SYSTEM OF VEHICLE COUNTING</b>	<b>6</b>
<b>FIG 4. 1:</b>	<b>TYPES OF MACHINE LEARNING</b>	<b>10</b>
<b>FIG 5. 1:</b>	<b>OBTAINING FRAMES FROM VIDEO</b>	<b>14</b>
<b>FIG 5. 2:</b>	<b>BACKGROUND SUBTRACTION</b>	<b>15</b>
<b>FIG 5. 3:</b>	<b>FOREGROUND EXTRACTION</b>	<b>15</b>
<b>FIG 5. 4:</b>	<b>DILATION &amp; EROSION</b>	<b>16</b>
<b>FIG 5. 5:</b>	<b>GAUSSIAN BLUR</b>	<b>17</b>
<b>FIG 5. 6:</b>	<b>THRESHOLD</b>	<b>17</b>
<b>FIG 6. 1:</b>	<b>DETECTION OF VEHICLE</b>	<b>18</b>
<b>FIG 7. 1:</b>	<b>OUTPUT IMAGES</b>	<b>21-22</b>

## **CHAPTER 1**

### **COMPANY PROFILE**

#### **1.1 AN OVERVIEW OF THE ORGANIZATION**

Take It Smart (OPC) PVT LTD is an Indian based engineering and software Company headquartered in Bangalore, Karnataka. Our teams have a unique blend of functional and operational knowledge, along with technical expertise and result-oriented management experience ranging from Application Development to end to end IT Implementation projects. Our organization derives its strength from its strong leadership team focused on inspiring an environment of entrepreneurial culture seeped in delivering exceptional value to the customers. Take it Smart Pvt ltd is a comprehensive information technology services and solutions platform that digitally transforms business operations, enhances one's individual engagement to progress skills and ideas.

It is both product and service oriented software company. All offices employ an experienced team of professionals with an outstanding track of handling complex web and app development projects. Our organization derives its strength from its strong leadership team focused on inspiring an environment of entrepreneurial culture seeped in delivering exceptional value to the customers.

#### **OUR VISION**

Our Vision is to empower individuals with technical expertise to overcome the industrial challenges in any dynamic field and enable them to excel in a rapidly advancing world.

#### **OUR MISSION**

- Provide pioneering programs pertaining to skill development based on industrial requirements.
- Equip individuals with necessary skill set to utilize opportunities and respond to challenges associated with ever-changing industrial demands.
- Promote a proactive approach to personal and professional development through skill-based learning.
- Maintain a level of excellence and standards in all programs offered at Take It Smart Pvt Ltd.

## **1.2 OPERATIONS OF THE ORGANIZATION**

The operation of the company is associated with providing managed services and software development. We offer a wide range of services to build a solution that is right our clients business needs. We provide internships for technical students in Bangalore with training, and report guidance. Take it Smart Pvt Ltd is best place for carrying out internships for all students. The Best internships are available on latest Technologies like Machine Learning.

## **1.3 OBJECTIVES OF THE ORGANIZATION**

- Performance measurement is standardized, so everyone contributes towards achieving the objectives.
- To sustain a leadership position and gain market share in our existing product or service offerings and continuously upgrading them by adapting to new technologies.
- Common objectives provide unity of action, vision, and goals among the entire workforce.
- Planning and implementation of essential processes is driven by the already set organizational objectives.
- Action plans, policies, programs, procedures are easier to define based on the company goals.

## **1.4 STRENGTHS AND STRATEGIES**

- A commitment to our core values has helped us build long – term,value centric relationship with customers.
- Continuously re-skilling, training and building the capabilities of our employees to be future-ready.
- “Future proofing” your business by making the required business model changes and building innovative alliances within an ecosystem of strategic part.

## **1.5 PRODUCTS AND SERVICES OFFERED BY THE ORGANIZATION**

- Embedded Applications development
- Web design and development
- IT Service
- Android app Development
- Web Bases Software Solutions
- Web Based ERP
- Web Based Ads Mobile Based Services: Mobile Web Apps a. Android Apps b. Windows Apps c. IOS Apps d. Cross Plate forms Apps
- Native Apps
- Hybrid apps Get trained for industry requirements while you pursuing degree The Different verticals that we operate in are: Internship & Software Training.

## **1.6 BENEFITS**

- Opportunity to learn under the professional and experienced programmers.
- Gain the ability and credentials required to score the best engineering related jobs in the industry.
- Get the confidence and knowledge to handle all kinds of challenges in a real-time work environment.
- The main benefit to the student is enhancing employ-ability and increasing the industry readiness for the IT industry.
- Take It Smart Pvt Ltd Internship offers students hands-on opportunity to work with the company in their desired field of expertise. They will be able to implement their theoretical knowledge gained from institutions in the real time projects and gain valuable experience that will make them a more eligible candidate for jobs.

## CHAPTER 2

### INTRODUCTION

In the traffic control and security management framework, Vehicle tracking methodology plays a vital role, which manages more responsibility for high security. The traffic issue is a significant issue occurring in numerous urban areas in the world. There are numerous significant reasons for the traffic issue. The quantity of individuals moving into a metropolitan region has developed generously, prompting an emotional expansion in the quantity of vehicles. This causes an irregularity between the quantities of vehicles and streets, bringing about street gridlock, particularly in enormous urban areas. Vehicle detecting and counting have a significant influence in numerous system that helps to regulate and control traffic in urban areas. The fundamental goal is to detect and count moving vehicles with clear accuracy and to have the option to do as such on streets, highways and in little paths, etc. OpenCV-analysis and understanding of images and videos taken by an advanced camera-has acquired more approval and been utilized in numerous fields including industry, medication, robotics, and so on.

For instance, a video sequence of streets can be handled and analyzed to identify and count vehicles. This may directly help in two kind of peoples. Street users and traffic organizations. In the event street users know the constant traffic data, they can utilize the data to pick the most ideal path for traveling and can keep away from congestion. Then again, traffic organizations can use the traffic data in their traffic control systems, bringing about better traffic to the board.

With the popular installation of traffic surveillance cameras, a vast database of traffic video footage has been obtained for analysis. Generally, at a high viewing angle, a more-distant road surface can be considered. The object size of the vehicle changes greatly at this viewing angle, and the detection accuracy of a small object far away from the road is low. In this study, we focus on the above issues to propose a viable solution, and we apply the vehicle detection results to multi-object tracking and vehicle counting.

## **CHAPTER 3**

### **SYSTEM ANALYSIS**

#### **3.1 NEED OF THE PROJECT**

Vehicle counting is a computer vision solution that automates the process of vehicle detection and classification. Vehicle counting software focuses on keeping track of the number and type of vehicles that enter and leave through a particular route for accurate monitoring of traffic. Vehicle detection, counting and finally classification has been an important aspect of traffic analysis specially on highways in many developed and developing nations. This has vitalized the monitoring of freeways and reduced the reliance on human traffic monitors specially in developed nations.

#### **3.2 EXISTING SYSTEM**

The system involves capturing of frames from the video to perform background subtraction to detect and count the vehicles using Gaussian models, background subtraction then classifies the vehicles by comparing the contour areas to the assumed values.

The principle of the system is to use already installed cameras in road networks without any additional calibration procedure. The vehicle counting project is mainly used-

1. For traffic management and planning
2. Parking Management
3. Congestion Control

#### **3.3 PROBLEM STATEMENT**

The trouble of getting the initial background there is the mistake of continuous background update and the trouble of controlling the update speed in moving vehicle location of traffic video The Vehicle detection is the key task in this area and counting of a vehicle plays a important role and this two are important applications.

The task of detecting and classifying objects in images and videos is suited well in ML since the task is a classification task.

### 3.4 PROPOSED SYSTEM

The method which is proposed used to detect, count different types of vehicles. This study aims to address an accurate and beneficial in moving vehicle recognition and counting technique that can be utilized in the perplexing traffic environment.

This proposed method, firstly, video files are taken from the static cameras installed in highways later utilize an adaptive background subtraction technology to recognize moving vehicle in a video. Besides, it played out a binarization interaction to obtained foreground area, followed by morphological activities to eliminate noise and shadow. To restrict from an over Segmentation issue, the forefront image got from the last step was incorporated with the edge picture of a similar frame. A head to applying a further process. At that point, vehicles were recognized and counted by utilizing a detector virtually positioned on the streets.

After vehicle contours are gotten, the virtual detection zone is utilized to count the number of a vehicles. The centroid of each forefront object is determined and tracked. At the point when the centroid of a vehicle is recognized the first time. The status is set to 0 (it is not yet counted). At that point, its position is tracked. On the off chance that it arrives at the virtual recognition, its status will be set to 1 (counted), showing that it has been counted as per sequential order.

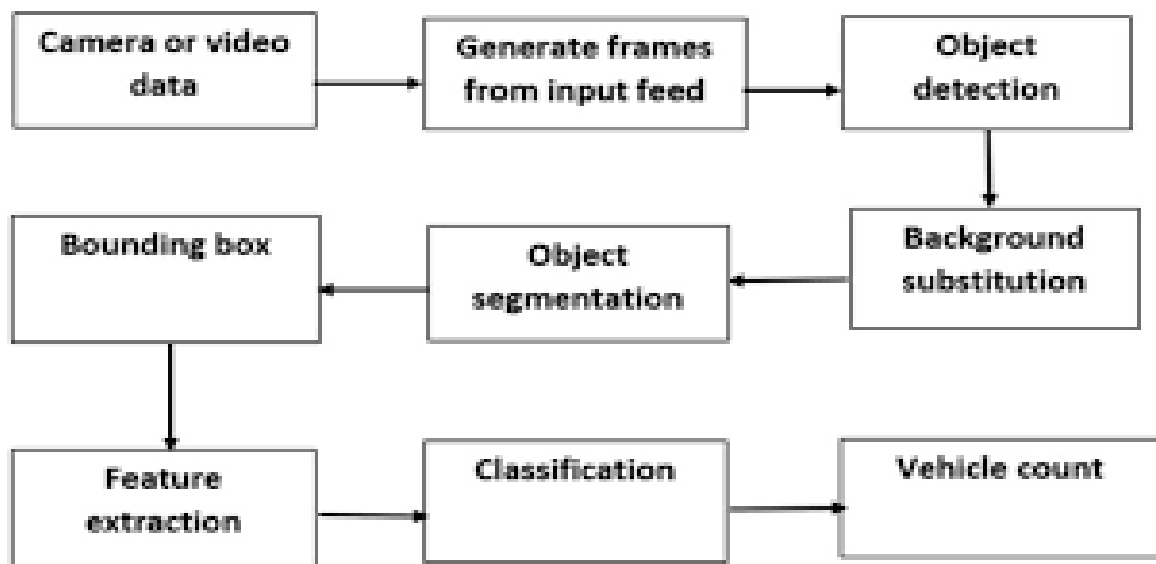


FIG 3. 1 PROPOSED SYSTEM OF VEHICLE COUNTING



### **3.5 AIM OF THE PROJECT**

Vehicle detection, counting and finally classification has been an important aspect of traffic analysis specially on highways in many developed and developing nations. This has vitalized the monitoring of freeways and reduced the reliance on human traffic monitors specially in developed nations.

### **3.6 ADVANTAGES**

- This vehicle counting method has several advantages over other automatic systems.
- It is cost-effective as it can count in many directions at once: only one camera is needed for several lanes or exits at a junction.
- It is easy to add or modify the zones through which vehicles are counted from a laptop computer.

### **3.7 SIGNIFICANCE OF THE PROJECT**

Since the industrial revolution, the number of cars increase day by day. One of the new challenges of the world is traffic. People in cities waste most of their time in traffic going somewhere in the city. Having a digitized traffic system that is functioning 24/7 and make the tasks so easy and efficient is crucial for all countries around the globe. Therefore by having a computerized traffic system cannot be handled without having an accurate vehicle tracking system. The vehicle detection and counting system, traffic information, and variable message signs are the essential elements in an ITS, all of which improve the efficiency and reliability of the transportation infrastructure.

## CHAPTER 4

# SOFTWARE REQUIREMENT SPECIFICATION

### 4.1 INTRODUCTION

This chapter describes about the requirements. It specifies the hardware and software are required in order to run the application properly. The Software Requirement Specification (SRS) is explained in detail, which includes overview of dissertation as well as the functional and non-functional requirement of this dissertation.

A SRS document describes all data, functional and behavioral requirements of the software under production or development. SRS is a fundamental document, which forms the foundation of the software development process. It is the complete description of the behavior of a system to be developed. Requirement Analysis discusses the conditions to be met for a new or altered product. Requirement Analysis is critical to the success to a development project. Requirement must be documented, measurable, testable, related to in identified business needs or opportunities, and defined to a level of detail sufficient for system design.

The SRS functions as a blueprint for completing a project. The goal of preparing the SRS document is to:

- ❖ Facilitate communication between the customer, analyst, system developers.
- ❖ To form a foundation for the design phase.
- ❖ Support system testing facilities.
- ❖ Controlling the evolution of the system.

### 4.2 SYSTEM REQUIREMENTS

#### 4.2.1 HARDWARE REQUIREMENTS:

OS (Operating System)-	Windows 10
Processor	- Intel I5 2.1 Ghz.
Storage	- 100 GB
RAM	- 4 GB

## 4.2.2 SOFTWARE REQUIREMENTS:

Programming Language	- Python
IDE (Integrated Development Environment)	- PyCharm IDE Community Edition 2021.2.3
APIs	- NumPy, gTTS/ pyttsx3, OpenCV
Technology use	- Machine Learning

### 4.2.2.1 MACHINE LEARNING

Machine learning (ML) is a field of study in artificial intelligence concerned with the development and study of statistical algorithms that can effectively generalize and thus perform tasks without explicit instructions. Recently, generative artificial neural networks have been able to surpass many previous approaches in performance.

Machine learning approaches have been applied to large language models, computer vision, speech recognition, email filtering, agriculture field and medicine, where it is too costly to develop algorithms to perform the needed tasks.

ML is known in its application across business problems under the name predictive analytics. Although not all machine learning is statistically based, computational statistics is an important source of the field's methods.

ML has 3 fundamental sorts they are as per the following:

- Supervised
- Unsupervised
- Reinforcement

#### • **Supervised Learning:**

Supervised learning is the types of machine learning in which machines are trained using well "labelled" training data, and on basis of that data, machines predict the output. The labelled data means some input data is already tagged with the correct output. The training data is processed, building a function that maps new data on expected output values. The most utilized managed algorithms are as per the following:

- Support Vector Machines (SVM),
- Logistic regression,
- Linear regression,
- Linear discriminant analysis,
- Decision trees, Neural Network.

- **Unsupervised Learning:**

Unsupervised algorithms not at all like supervised ones don't have the right answers. As it were, there is no output variable and a guide or instructor to address botches. The algorithms are attempting to comprehend the information features. They search for covered-up and concealed examples in the dataset to predict the output by simply having the input factors.

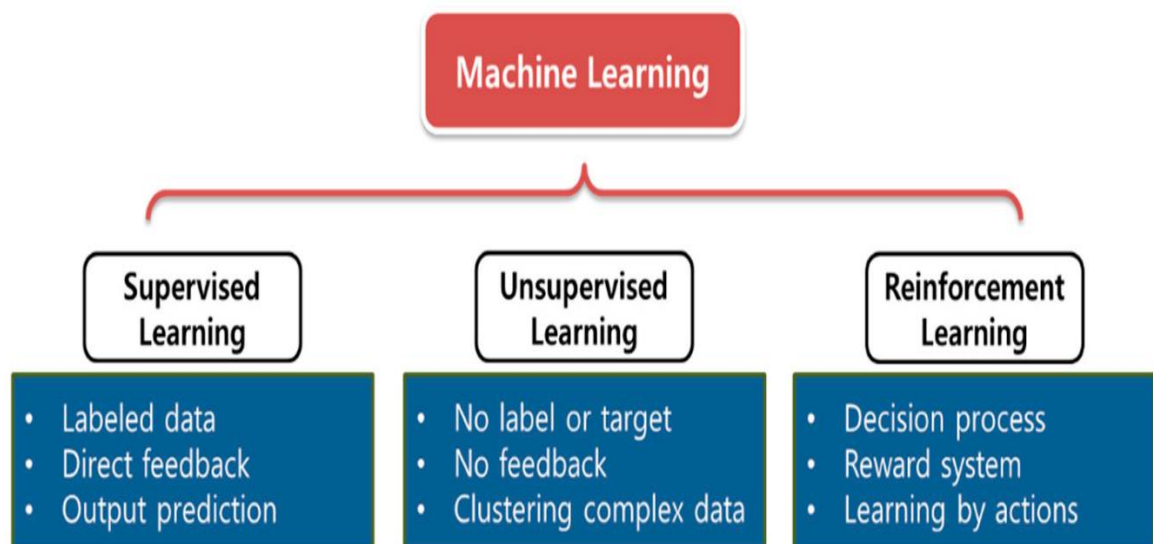
Unsupervised learnings are gathered in:

- Clustering- in this sort of task the information is partitioned into gatherings, for example, grouping clients by their purchasing behaviors.
- Association- algorithms are attempting to comprehend the standards that can elucidate the expansive bit of the data, for example, a client who purchases a shirt will in general purchase pants as well.

- **Reinforcement Learning:**

Reinforcement Learning (RL) is the science of decision making. It is about taking suitable action to maximize reward in a particular situation. Reinforcement.

learning differs from supervised learning in not needing labelled input/output pairs to be presented, and in not needing sub-optimal actions to be explicitly corrected.



**FIG 4. 2 TYPES OF MACHINE LEARNING**

#### **4.2.2.2 OPENCV**

OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. When it integrated with various libraries, such as NumPy, python is capable of processing OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features.

The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms.

These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 18 million. The library is used extensively in companies, research groups and by governmental bodies.

OpenCV is written in the programming language C++, as is its primary interface, but it still retains a less comprehensive though extensive older C interface. All newer developments and algorithms appear in the C++ interface. There are language bindings in Python, Java, C++ etc. The application programming interface (API) for these interfaces can be found in the online documentation.

#### **4.2.2.3 NUMPY**

NumPy is the fundamental package for scientific computing in Python. It is a Python library that provides a multidimensional array object, various derived objects (such as masked arrays and matrices), and an assortment of routines for fast operations on arrays, including mathematical, logical, shape manipulation, sorting, selecting, I/O, discrete Fourier transforms, basic linear algebra, basic statistical operations, random simulation and much more.

At the core of the NumPy package, is the nd-array object. This encapsulates n-dimensional arrays of homogeneous data types, with many operations being performed in compiled code for performance. There are several important differences between NumPy arrays and the standard Python sequences:

- NumPy arrays have a fixed size at creation, unlike Python lists (which can grow dynamically). Changing the size of nd-array will create a new array and delete the original.
- The elements in a NumPy array are all required to be of the same data type, and thus will be the same size in memory. The exception: one can have arrays of (Python, including NumPy) objects, thereby allowing for arrays of different sized elements.
- NumPy arrays facilitate advanced mathematical and other types of operations on large numbers of data. Typically, such operations are executed more efficiently and with less code than is possible using Python's built-in sequences.
- A growing plethora of scientific and mathematical Python-based packages are using NumPy arrays; though these typically support Python-sequence input, they convert such input to NumPy arrays prior to processing, and they often output NumPy arrays. In other words, in order to efficiently use much (perhaps even most) of today's scientific/mathematical Python-based software, just knowing how to use Python's built-in sequence types is insufficient - one also needs to know how to use NumPy arrays.

#### 4.2.2.4 pyttsx3

Text-to-speech (TTS) technology is a unique field that allows computers to convert written text into text/spoken words. One of such interfacing in python is **pyttsx3**.pyttsx3 is a text-to-speech conversion and one of most used popular library in Python. Unlike other online libraries such as gTTS, pyttsx3 is completely offline and works seamlessly and has multiple tts-engine support. It provides a simple interface for controlling speech output, including pitch, volume, and rate. It is a very easy to use tool which converts the entered text into speech. By leveraging pyttsx3, you can add speech synthesis capabilities to your Python applications and create engaging and interactive experiences.

An application invokes the `pyttsx3.init()` factory function to get a reference to a `pyttsx3` using Engine instance.

Install Pyttsx3 using pip, which is the most popular package manager for Python. Open a terminal or command prompt and type the following command: `pip install pyttsx3`

After importing the library, we need to create an object of the `pyttsx3.init()` class. This object will act as our text-to-speech engine. Create the object using the following command:  
`engine = pyttsx3.init()`.

Once we have created the engine object, we can use its `say()` method to convert our text into speech. The `say()` method takes a string as input, which is the text we want to convert into speech.

Later use the `runAndWait()` method of the engine object to play the speech. The `runAndWait()` method waits until the speech is complete before returning control to the program.

### **Feature of pyttsx3:**

- Customizing Voice Properties in Pyttsx3

Pyttsx3 provides the ability to customize various properties of the voice used for speech, such as the speaking rate, volume, and language. These properties can be set using the `setProperty()` method of the engine object.

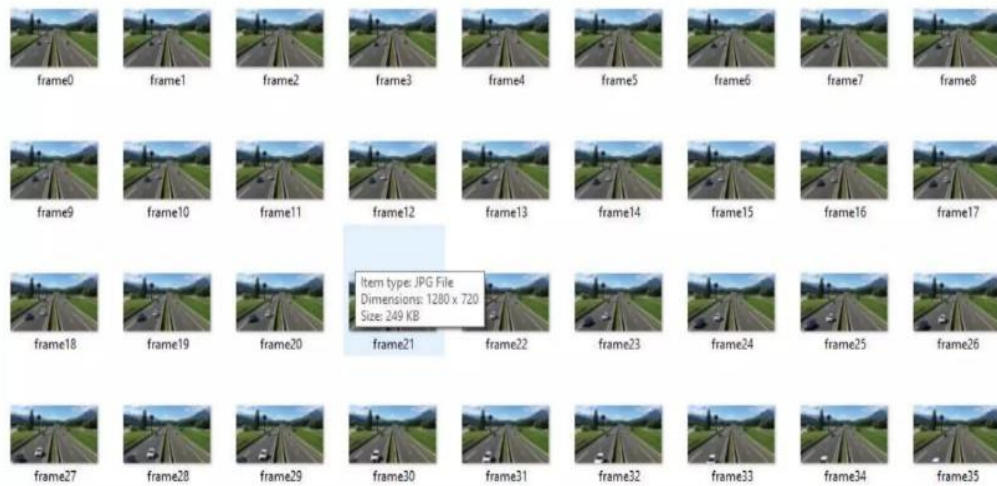
## CHAPTER 5

# METHODOLOGY

## 5.1 BACKGROUND EXTRACTION

### 5.1.1 BACKGROUND ESTIMATION

The video is taken as input and then frames are extracted from it, from which, the average of these frames is registered as a background.



**FIG 5. 7 OBTAINING FRAMES FROM VIDEO**

### 5.1.2 BACKGROUND SUBTRACTION

Background subtraction is an approach used to find the moving objects in video sequence to change it to foreground image. From the registered background, the other moving frames are subtracted which gives the moving object.

Specifically, a background image of the street contains no vehicle, and the present frame in the video is changed over from color (RGB) to gray-scale image. At that point, for every pixel (x, y), the gray intensity of a background image is deducted by that of a current frame. The absolutist outcome is put away into a similar position in another image, which is known as a different image. The detected moving vehicles using the Background Subtraction (BS) algorithm. The function `cv2.createBackgroundSubtractorMOG2()` is used that has some optional parameters like number of gaussian mixtures, detect shadows, thresholding etc.





**FIG 5. 8 BACKGROUND SUBTRACTION**

## 5.2 FOREGROUND EXTRACTION:

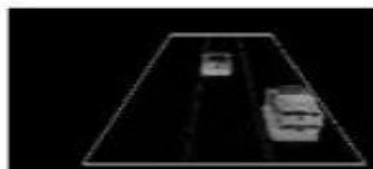
A particular image in figure (b) which has no vehicle on the road after the background subtraction on the video frame converted from color to gray scale image. For every pixel in the video frame the grey scale intensity of background image will be subtracted as shown in figure (b) by using hole editing, binary image and adaptive background subtraction. The total result will be stored in another image that image is called as difference image. Inside the loop of video, we will be using `Backgroundsubtractor.apply()` function to get the foreground objects.



**(a)**



**(b)**



**(c)**

**Figure (a) video frame (b) Fore ground mask (c) difference image**

**FIG 5. 9 FOREGROUND EXTRACTION**

## 5.3 PRE-PROCESSING

Morphological operations apply a structuring element to an input image and have a wide array of uses like removing noise from background, blurring an image, masking of images, isolation of individual elements and joining disparate elements in an image etc.

### 5.3.1 DILATION&EROSION

Dilation and Erosion are done to see the object clearly so that boundary regions of vehicles can be clearly seen. Then we will be taking the mask of the images for detecting and classifying vehicles based on their shape features.



FIG 5. 10 DILATION & EROSION

### 5.3.2 GAUSSIAN BLUR

Gaussian blur is the result of blurring an image by a Gaussian function. It is a widely used effect in graphics software, typically to reduce image noise and reduce detail. It is also used as a preprocessing stage before applying our machine learning or deep learning models. It is commonly used in reducing the size of an image. When down sampling an image, it is common to apply a low-pass filter to the image prior to re-sampling. The end result is that our image is less blurred, but more “naturally blurred,” than using the average blurring method. Furthermore, based on this weighting we will be able to preserve more of the edges in our image as compared to average smoothing.

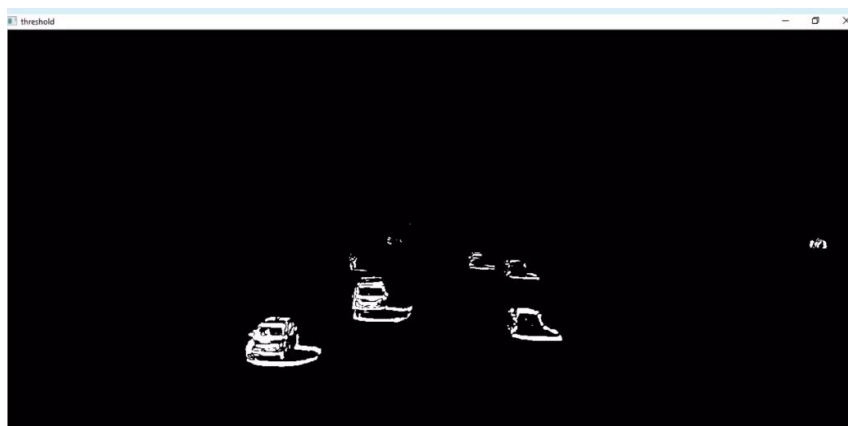


**FIG 5. 11 GAUSSIAN BLUR**

### **5.3.2 THRESHOLD**

Thresholding is a type of image segmentation, where we change the pixels of an image to make the image easier to analyze. In thresholding, we convert an image from color or grayscale into a binary image, i.e., one that is simply black and white.

Thresholding is generally applied to a transformation of the original image to determine the class.



**FIG 5. 12 THRESHOLD**

## CHAPTER 6

# IMPLEMENTATION

### 6.1 DETECTION OF VEHICLE

Vehicles are detected using bounding boxes around the vehicle. To achieve vehicle detection we have used virtual detector to detect the vehicles and threshold operations are applied on the difference image to separate the foreground image and background image. The morphological operations are applied on the images such as blurring erosion and dilations. Morphology is used to draw shapes and boundaries. We are using morphological operations so that we could get high accuracy results during extreme weather conditions or any illuminative issues like wind, rain, etc. By using the contours the size of square and rectangle sizes are fixed to calculate area of each vehicle. Firstly, each frame of the output image is compared with the corresponding image with the input image.

Dilation would add boundaries to the objects of the image and dilation add the extra boundaries in the image. The outcome after a thresholding operation, which is a binary image.. At that point, morphology operations are utilized to eliminate noise and some fail regions in the picture. Thus, various methods are utilized to eliminate noises and improve foreground objects. It is observed that the foreground objects set off smoother, clearer and more proper for recognition and counting measure.



**FIG 6. 1 DETECTION OF VEHICLE**

## **6.2 COUNTING A VEHICLE**

Firstly the line is drawn as a region of interest inside the frame. After detecting the moving vehicles, their position and centroid are detected. Whenever the centroid is crossed the line drawn at region of interest, counter is incremented by 1.

After vehicle contours are gotten, the virtual detection zone is utilized to count the number of a vehicles. The centroid of each forefront object is determined and tracked. At the point when the centroid of a vehicle is recognized the first time. The status is set to 0 (it's not yet counted). At that point, its position is tracked. On the off chance that it arrives at the virtual recognition, its status will be set to 1 (counted), showing that it has been counted and won't be counted in the resulting frames. When the vehicles are detected in these zones. It will be counted as per sequential order. After all these steps vehicles are classified and counted.

### **6.2.1 CLASSIFICATION**

Vehicles are classified by the ratio of height and ratio of width as the area. Height and width differ in car and truck. OpenCV library used for carrying all the image processing operations and for classification of the car and bus and haar-cascade classifier is used for detecting and counting the cars and buses.

## **6.3 PSEUDO CODE FOR VEHICLE COUNTING**

The process of vehicle counting can be combined to create a pseudo code:

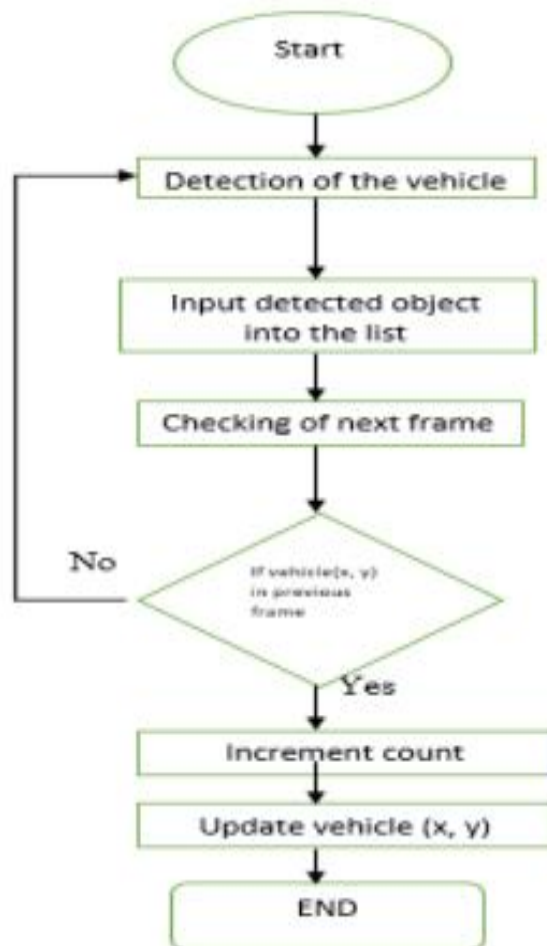
Step1: foreground extraction

Step2: Region of Interest/Detection field

Step3: detection of a vehicle

Step4: counting of a vehicle

### 6.3.1 FLOWCHART FOR VEHICLE COUNT:



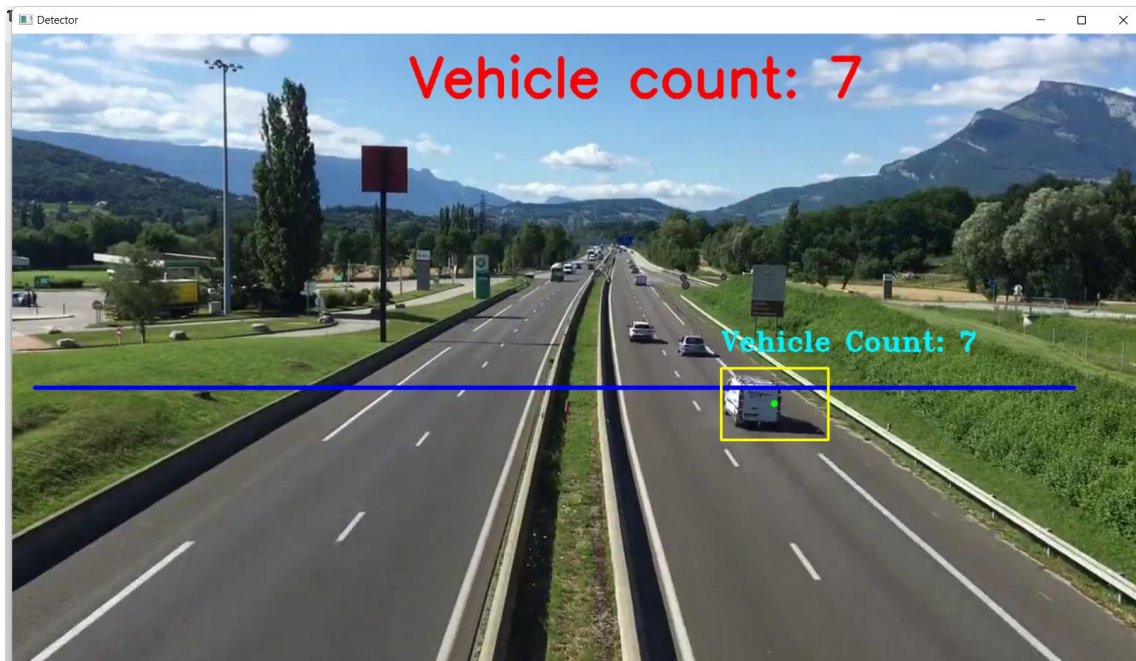
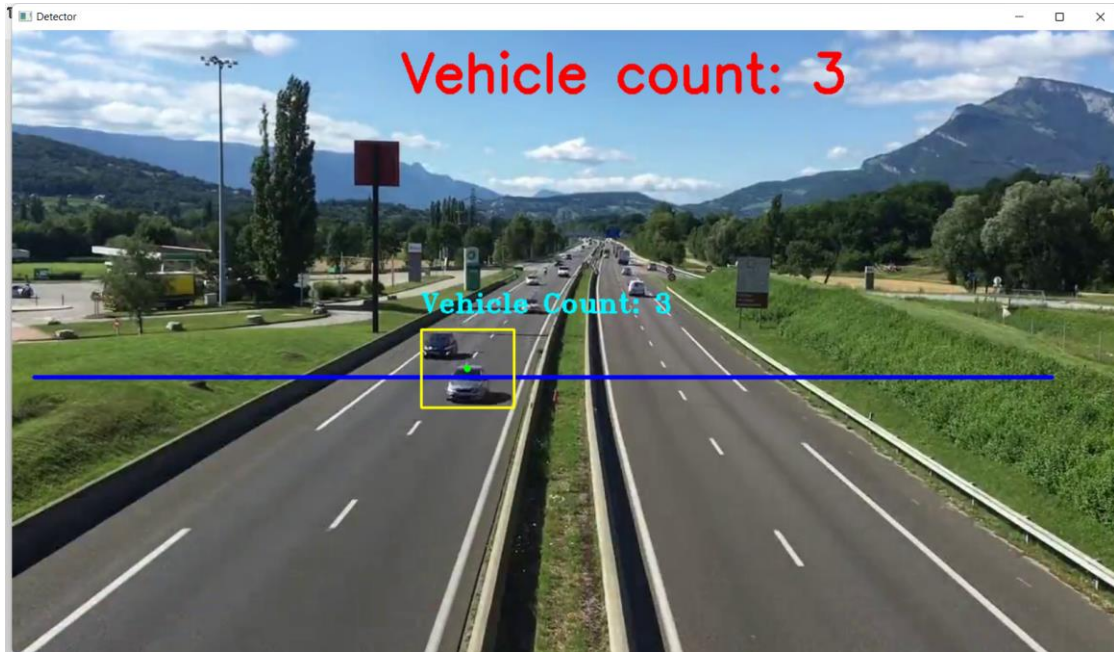
### 6. 1 VEHICLE COUNT FLOWCHART

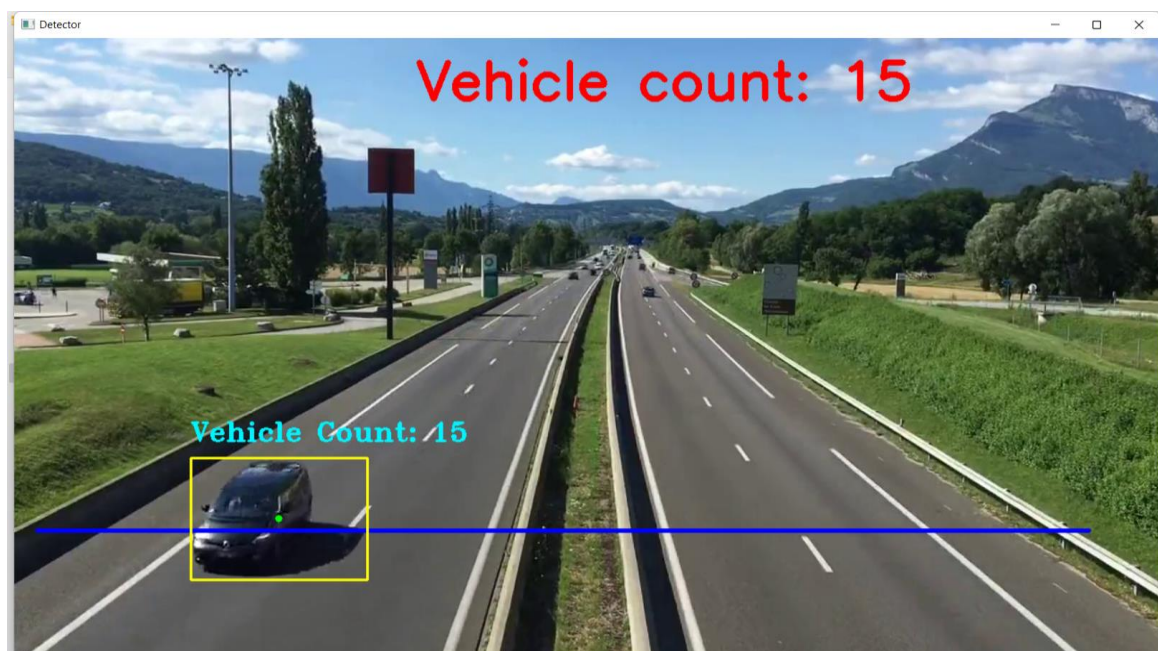
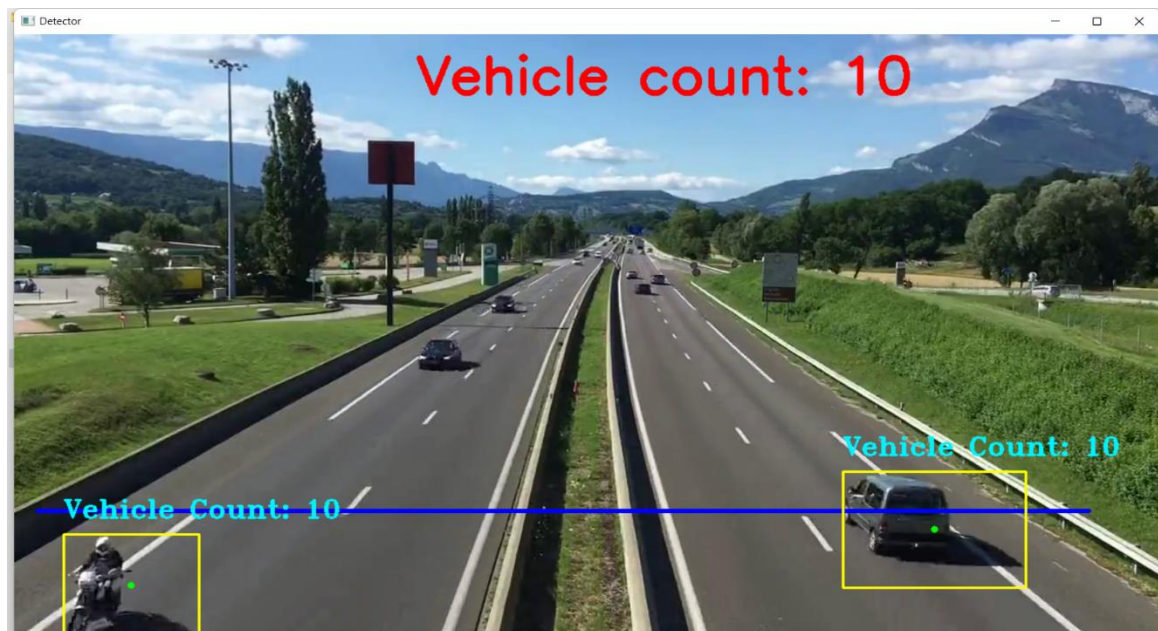
In this flowchart after detection of vehicle, vehicle is inputting to the list. Compares with the previous and current frame. If the vehicle is in the previous frames it will be set to 1 else 0. And after Increments the count and Updates vehicle (x, y).



## CHAPTER 7

### SNAPSHOTS





### 7.1 OUTPUT IMAGES



## CONCLUSION

This paper has clearly aimed to explain about the vehicle counting detection system to identify and counting the number of vehicles from the video sequence captured from static cameras. In this study, a methodology dependent on Python Language has been proposed. Computer vision techniques are utilized to detect the vehicle and counted the number of a vehicles that are passing on a particular street utilizing highway videos as input.

Vehicle detection and counting is implemented on python using OpenCV, it is used to improve the quality of intelligent transportation systems. A simple interface is developed for the users to choose the interested regions to analyze and then image processing techniques are applied to classify the vehicles and calculate their count. This solution can be used in parking area allocation, traffic monitoring, etc. This is an easy method to implement at cheap expenses. This system is not efficient at detection of occlusion of the vehicles which affects the accuracy of the classification as well as counting. This can be counted as one of the limitations of this system. At last, the vehicles were recognized and counted when they passed into the virtual detection zone. Experimented outcomes showed that a precision of the proposed vehicle counting system was 96%.

## **FUTURE ENHANCEMENT**

This vehicle detection and counting project can be extended to a variety of military applications in cross border areas, such as detecting people or vehicles crossing the border line and counting them. This vehicle detection and counting project can be extended to a variety of military applications in cross border areas, such as detecting people or vehicles crossing the border line and counting them. Vehicle detection should be done at night, and overspeed vehicles should be tallied. Detection should also be possible in inclement weather.

Looking back to the limitations of the study, there are tasks and options which can be added to this research or possibly to work on it separately. The topic is under the attention of researchers and improves day by day. Theoretical development is needed to be tracked and when any theoretical development is published and achieved, the researchers should utilize those concepts practically using algorithms to improve the accuracy level of the detection and tracking process. 38 Although, the dataset can be improved, future work can be testing these models using a better and larger dataset with a massive number of vehicle and non-vehicle images from different places, angles, cars, roads, cameras, distances, etc. Furthermore, other models can be added to the comparison list of models to make the comparison more reliable.

## REFERENCES

- [1] Vehicle Counting and Detection- Ravula Arun Kumar, D. Sai Tharun Kumar, K. Kalyan, B Rohan Ram Reddy. International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075 (Online), Volume-9 Issue-8, June 2020.
- [2] VEHICLE DETECTION AND COUNTING OF A VEHICLE USING OPENCV Karthik Srivathsa D S\*1, Dr. Kamalraj R\*2 @International Research Journal of Modernization in Engineering Technology and Science Volume:03/Issue:05/May-2021 [www.irjmets.com](http://www.irjmets.com).
- [3] Py-source “Count Vehicles on images with OpenCV and Python” July 30, 2021.
- [4] Dr. K. Suneetha , Mr. M. Sreekanth & Mr. K. Sankara – An Approach for Intelligent Traffic Signal Control System for Ambulance using IoT,SSRN Elsevier,Scopus Indexing, IADS International Conference on Computing, Communications & Data Engineering.
- [5] Birgi Tamersoy J.K. Aggarwal “Counting Vehicles in Highway Surveillance Videos” , 20th International Conference on Pattern Recognition, 23-26 August 2010.