Traffic management system with vehicle detection and counting.

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APPROVAL

This Project titled "**Traffic management system with vehicle detection and counting.**", submitted by Fahima Siddika ID: 181-15-1976 and Md, Taskinmostofa Azam ID: 181-15-1790 and Shahriar Hossain ID: 181-15-1964 to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 25 October, 2021.

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We thus declare that we completed this project under the supervision of **Mr. Ohidujjaman (Senior Lecturer)** of Daffodil International University's Department of CSE.

We further certify that no component of this project, or any part of it, has been submitted to any other institution for the award of a degree or diploma!

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ABSTRACT

"Traffic Management System with vehicle detection and counting" is a research-based initiative with the primary purpose of detecting, tracking, and classifying automobiles, but it can also be applied to driver behavior detection, lane recognition, and other applications. This framework can be used in a variety of domains, including public safety, accident detection, vehicle detection, theft detection, parking lots, and human identification.

It can also be used to locate criminals on the road and traffic rule violators so that traffic controllers can take swift action. People are expanding in number, and vehicles are increasing in number as well. Due to a growth in the number of automobiles, highways and roadways are becoming overcrowded. As a result, the frequency of accidents and violations of traffic laws has skyrocketed. For traffic managers, vehicle detection and counting become essential. As a result, we suggested a traffic management system framework.

Our work is mostly based on a video-based technique for vehicle recognition and counting that employs the Python programming language OpenCV.

Visual Studio Code was used to create and implement the framework for this article. To achieve real-time automatic vehicle detection and counting, software was combined with Intel's OpenCV video stream processing system.

This framework can quickly recognize and track automobiles, as well as assist in the counting of objects.

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INTRODUCTION

1.1 Introduction

We all know that the traffic problem is a big problem in big cities. There are many reasons for this. Urbanization, the increase in population, and the increase in the number of vehicles are the factors causing traffic problems in cities. For this reason, quantity of vehicles also increasing. However, the street limit has become generally lethargic and get lacking. This causes an irregularity between the quantities of vehicles and streets, bringing about street gridlock, particularly in enormous cite areas. An insufficiency of public transportation frameworks likewise causes a similar issue.

The primary goal is to detect and count moving vehicles with correct efficiency and to have the option to do as such on streets, highways and in little paths, etc.

Because of advances in storage capacity, computational power, and video encryption methods, OpenCV analysis and recognition systems are becoming less expensive and more effective [9].Humans typically evaluate the videos stored by these surveillance devices, which is a time-consuming task.

A more comprehensive, automatic video-based solution is necessary to address this problem. Hardware and software are commonly found in a traffic management system. The hardware component of the system is a roadside camera that captures video feeds, while the software component deals with processing and analysis.

These systems might be portable, with a microcontroller attached to the camera for real-time processing and analysis, or they could simply be cameras that send the video stream to a centralized computer for processin

1.2 Motivation

As the world has been going through an information age, there is an increase in the number of crimes committed.

This causes we have to protect our society. We will use our System and caught the traffic breaker vehicles. Our motto is “We obey our traffic system”. We also believe that the system will put pressure upon the criminal psyche and deter them from their activities.

1.3 Objective:

• To keep an eye on the flow of traffic.

• To estimate the vehicle's speed or assess the traffic situation.

• To detect and count unusual occurrences, such as rising alerts in the event of a road collision or stopped vehicles.

• To the detection of car theft.

• The suggested system's usefulness is demonstrated by experimental findings on real image sequences.

1.4Research Questions

- What methodology do we use?
- What framework will we use?
- How to solve traffic jam problem?
- How to solve parking management problem?
- How do we do identify the accident?
- What are the challenge?

1.5 Final Outcome

In our project we want to show that, sometime we always fall in a big traffic jam. if we know that in which road there are more vehicle. If we know we can avoid the road and free from jam. Also, if any occurrence occurred in road, we can also find the victim and find the criminal also. So that the court has punished the criminal.

Our moto is no one can break the traffic signal. If our society obey our traffic rule then no one can trouble & have a safe journey.

1.6 Report Layout

In the beginning of the report discussions, we discuss about traffic problem and importance of traffic management system. After that we proposed a framework on vehicle detection and counting system for traffic management. There are also described the motivation and objective of this paper. Then we discuss about application and implementation with the help of graph, chart and figure and give a proper discussion of our proposed framework. In the last part of report discussion, we discuss about future scope of it and in last section we describe about how can we improve our framework in future. Lastly, we also added some reference in the paper.

CHAPTER 2

BACKGROUND

2.1 Introduction

In our system we are using the subtractor algorithm. For which we done our project. We use in our system on video base. So we need to some tools for is. We work with color method, creation vehicle shapes. After that we prepared the background image. At 1st we blur our background using color method & image processing. Then we use to the display that can detect the object. We all detect the vehicle.

At finishing our system count all the vehicle and result is display on top of the screen.

2.2 Related Works

Computer vision research has recently focused on the tracking of moving cars in video streams. The information contained in photos and videos can be understood and modified using computer vision. Its basic goal is to comprehend objects and then offer the necessary information. Many studies have been conducted on traffic management systems that include vehicle detection and counting. Some of the relevant studies mentioned in this publication are:

[1]Nilesh J. Uke and Ravindra C. Tool developed, built, and implemented a real-time autonomous vehicle detection and counting system using Visual C++ software and Intel's OpenCV video stream processing technology. The system is built with OpenCV image development kits, and real-time video from a single camera is used to demonstrate the findings. This system was tested on a laptop with a 1.83 GHz Intel Core Duo processor and 2GB RAM. Background subtraction, image filtering, image binary, and segmentation

approaches were employed to construct this highway traffic counting process. This device can also count moving cars using pre-recorded data from video.

Dr. Kamalraj R and Karthik Srivathsa D S suggested a Python-based technique in [2].Using highway recordings as input, computer vision techniques are used to recognize the vehicle and count the number of vehicles passing on a certain roadway. Finally, when the vehicles entered the virtual detection zone, they were recognized and counted. Experiments revealed that the proposed vehicle counting system has a precision of 96 percent.

In [3,] Sowmya Kini Ma, Rekha Bhandarkar, and K Praveen Shenoy suggested a system that uses the computer vision platform and is implemented in Python. The recordings were gathered from traffic camcorders with a variety of sources for analysis. All of the recordings can be regarded pre-recorded videos that can be obtained for research purposes from the traffic department. The basic approach is created to select the relevant location to be broken down, and then picture preparation strategies are used to calculate vehicle tally. We used two ways to assess the algorithms' accuracy while tracking the vehicles. As a result, it may be argued that blob-based tracking outperforms the other approach.

D Agustiani, S Wardani, and A Riyadi proposed a method for processing picture data using computer vision and machine learning in [4]. The goal of this paper is to keep track of every car that enters the parking lot. Every vehicle entering the parking lot will be photographed by a camera stationed at the entrance. The approach for classifying and counting it when it passes through the parking gate is the same as for classifying and counting it on the road. The video sample for this study is a video of automobiles flowing on the road at varying speeds with various vehicle kinds.

Sania Bhatti, Liaquat A. Thebo, Mir Muhammad B. Talpur, and Mohsin A. Memon suggested in [5] a system that could be used to detect, recognize, and track cars in video frames, as well as classify the identified vehicles into three sizes based on their size.

As illustrated in fig. 1, the proposed system is made up of three modules: background learning, foreground extraction, and vehicle categorization. Background subtraction is a common technique for obtaining the foreground image, or detecting moving objects.

2.3 Research Summary

We discovered that when our traffic system is totally damage then we come to take a new idea. Our system helps all of them who connect transport system. Our project based on machine learning. We also use deep learning on our system.
The goal of our project is to develop our traffic system. In our city our society fall in a big trouble like transport. So, in our system it also helps the transport authority also saving the valuable time.

2.4 Challenges

Installation: Installing all the software and packages were time consuming. First of all we didn’t know that what was the right software. We installed Microsoft Visual Studio at first but we had to install Visual Studio Code. Then installing Python was another challenge for us. It took almost 3 to 4 days to complete the installation process. To install

OpenCV for Python we installed CMAKE software and customize many things that was irrelevant. We thought YOLO V3 will be easy for us to install and make the project done but it was another wrong process for us. Actually, it was right but we couldn’t do it properly. We had gone so far with YOLO V3 but in the end it doesn’t even matter.

Understand: Understanding the hole process of making the project was so tough for us. It took almost 1 month that how we will make the project. We couldn’t get any clear concept from google, youtube or anyone.

Time: Understanding the project and implementation was too much time consuming for us. It took almost 1 month to finally run the code successfully.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

As our research goal is to detect the vehicle, count it, reduce traffic, control it, manage traffic, planning clear and safe road, parking management, we have to use deep learning in order to solve the system.

3.2 Proposed System

A Methodology is defined by this system. These are the steps of a proposed method, which are outlined below. In the steps that follow, we'll go through each step in depth. The system can detect, recognize, and count automobiles in video frames. Background learning and vehicle counting are two components that make up the proposed system.

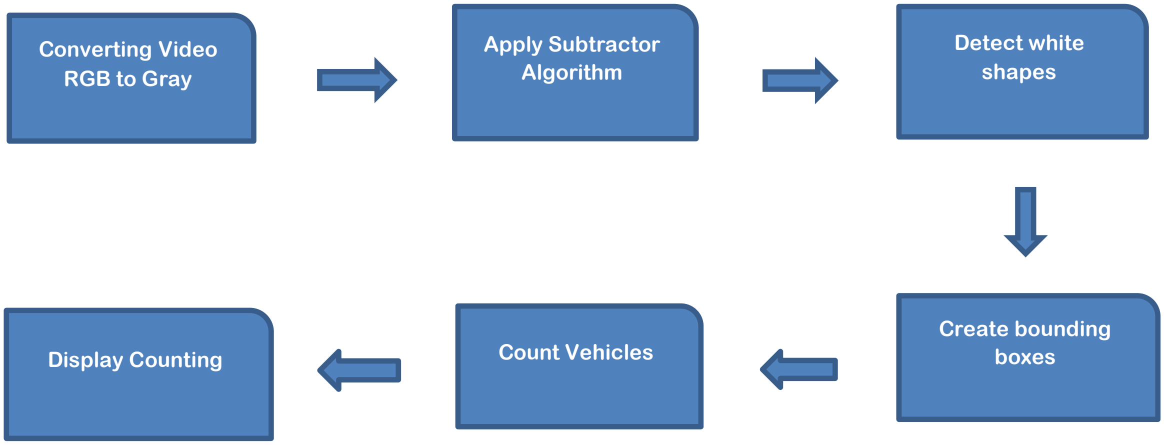

Fig-1: Block diagram of proposed vehicle detection and counting

Our proposed system based on a video. When the video footage input our system, it read the video. Before applying SubtractorMOG algorithm it converts the video into gray color from RGB color and by Gaussian Blur method it converts the moving vehicles into white dots. Then the Subtractor algorithm will be applied on each frame of the video. By getstructuringElement it will give a structures to those elements. Here some methods will be applied. FindContors() method will find out the contour area to detect the vehicles. Bounding boxes will appear on the screen to show that the vehicle is detected. Some mathematical terms will be applied to define the middle point of those different types of bounding boxes. When the middle point will touch the counter line it will start counting vehicles and display the total number of counted vehicles on the top.

3.3 System Overview

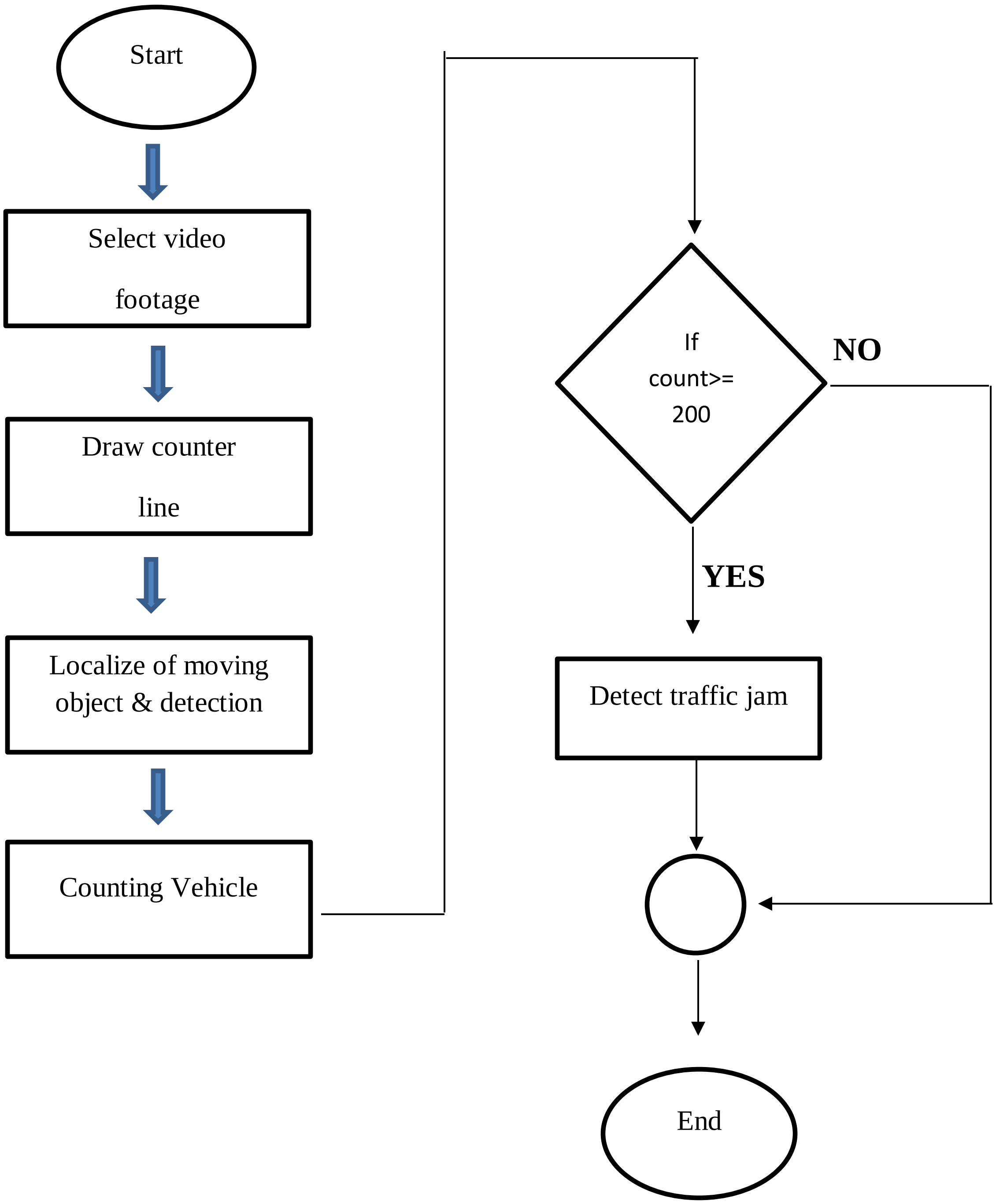

Fig 2: Flow diagram of traffic system

In our system overview we will describe how our system work in.

In this system it builds with two components.

1. **Vehicle detection Model**
2. **User interface**

In very first the video footage from the road side is import the system. All of the vehicle are detecting from the footage. Then the system counting the number of vehicle & if there are much traffic on the road System will give the signal. Then the authority see the frame in which road so much traffic.

The user interface makes the system very interactive for the authority for use. Authority can monitor the traffic footage and find the traffic jam. In this system when vehicle are counting system call the number of vehicle.

At the end of the overview video footage analysis is a big factor, because when we put multiple videos in our system user can analysis the video and get the result very fast. Multiple videos when imported it encoded our system. When encode finish system will detect the image and count.

For user it is very simple to use our system. In this system we build some method and apply Subtract MOG algorithm.

3.4 Implementation Procedure

A. Computer Vision

OpenCV is an open source computer vision and machine learning software library that was utilized for image processing in this project.

Subtraction MOG algorithm is using for our project to detect And R-CNN is classify the categorize of our vehicle.

Initially, the administrator must open a video to begin using the project film created with the item 'Open' that can be found under the thesis file. The Authority can open any video footage from the bellow storage file.

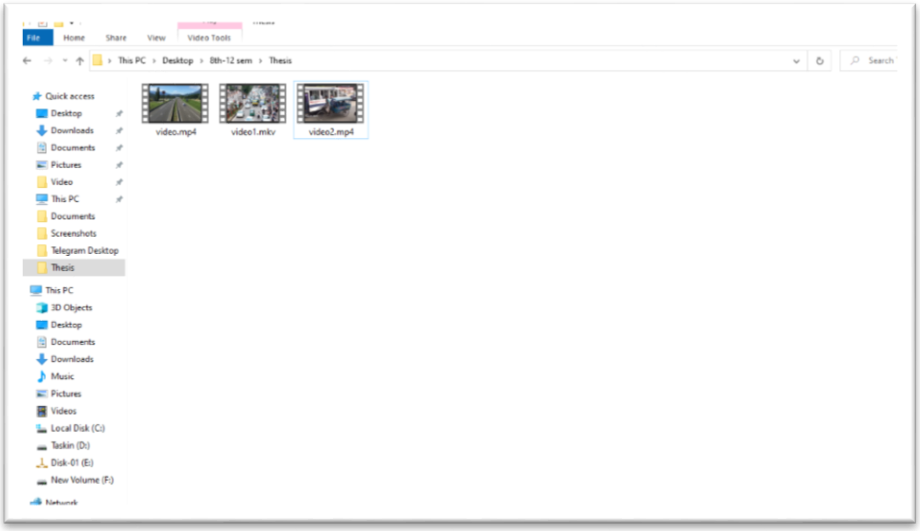

Fig 3: Open a video footage form storage

The system will obtain a preview of the video clip after it is opened from storage. A frame from the provided video clip appears in the preview. The preview is used to locate roads and to create a traffic line across them. The administrator's traffic line will be used as a traffic line. Select the 'Region of interest' item from the 'Analyze' option to enable the line drawing capability. After that, the administrator must choose two spots from which to draw a line that denotes a traffic gridlock.

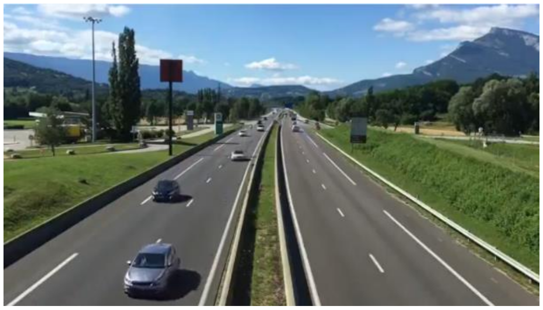

Fig 4: Region of Interest (ROI)

When you select a region of interest, the traffic detection system will begin to run. The coordinates of the drawn line will be displayed on the console. After the line is drawn, the object detection system will begin instantly. The weights will be loaded first. The system will then detect objects and look for traffic. The output will be displayed frame by frame on the screen.

B. Background SubtractorMOG Algorithm: Background subtraction is a common technique for obtaining the foreground image, or detecting moving objects. Background Subtractor MOG2 is the algorithm employed in the implementation of the proposed system. Most essential part of this algorithm is that an automated way to pick an appropriate number of Gaussian mixtures for the pixel when the number of distributions for the background model

are defined. From given video in the code segment, at first, we make a while loop to read the video infinitely and then show it. To Subtract the background images, we use the Subtractor Algorithm. Before applying the algorithm, we converted the video from RGB to GRAY and then blur the moving objects. Thus, the video has to convert into so many single images or frames we had to apply

Subtractor algorithm on each frame. Dilate method points the moving blur objects and combines all the neighborhoods pixels to give them a structure. By getStructuringElement method all the shapes of the combined pixels have taken to the Subtractor algorithm. Morph_Ellips method combines those shapes into ellipse and morphologyEx method gives shapes all the multichannel images. FindContors function accepts all the binary images and explains their algorithm. Then we show the black and white images which is shown in

Fig: 5

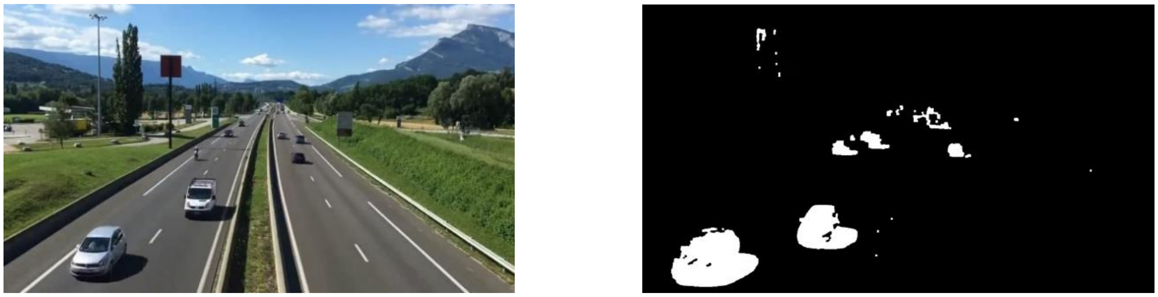

Fig 5: Using subtractor Algorithm

C. Counter Line: Basically, Contours are the shape's boundaries where are employed in object detection and recognition. The procedure of locating the contours can be extremely precise. Contours is a function provided by OpenCV () a method for locating the contour. When we ready our counter line we have to create to position. Then we insert the value of this position line. After insert the value we declared the color of the frame and thickness. After creating the counter line, we create bounding box for vehicle.

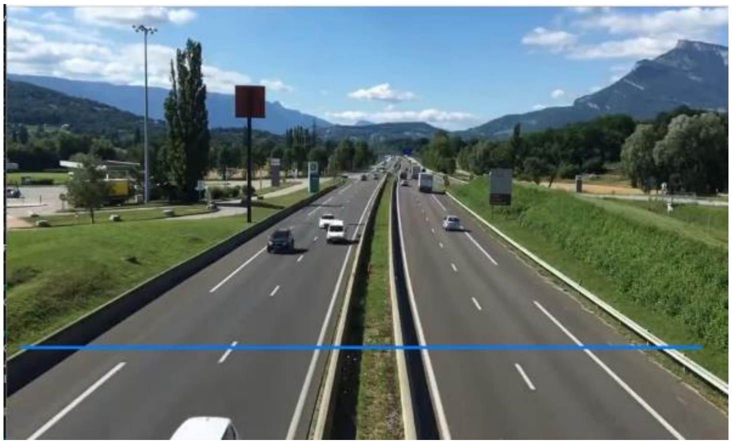

Fig-6: Counter line creating on the display

D. Object detection: In preview of counter line now we want to detect the vehicle. when we detect the object, we have to apply algorithm in the bounding box, 1st we create counter shapes, then we declare the height and weight for the bounding box. When vehicle coming towards the line algorithm identify the rectangle shape with their height and weight. After the vehicle come to the frame then they are identifying their own frame and pixels. Then we create a bounding box around each object (red box). The bject detector computes every frame in the video. We can detect our vehicle by this way.

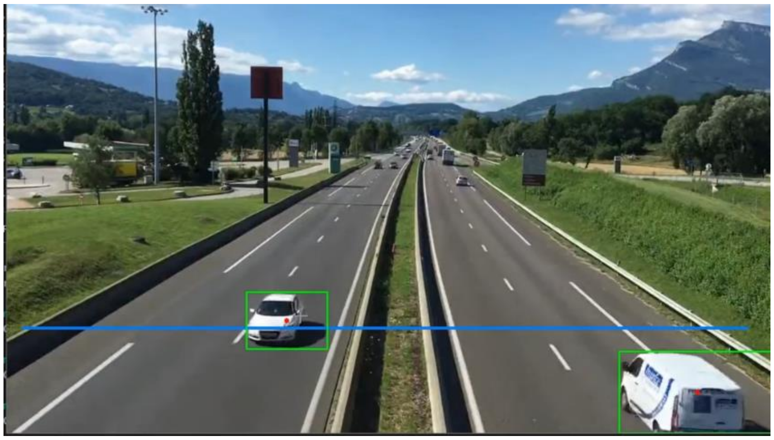

Fig-7: Bounding box and rectangle Creating

E. Counting Vehicle: Our project final part is vehicle counting, so when the vehicle count? Actually, we have to define the center points for all the bounding box. When the center point touches the counter line it starts counting. We put all the values of the counter in to the detect array. Then we will display vehicle counter on top of the display and show how many vehicles detects. Last of all we will display Vehicle with counter on top of every bounding box. We can count every vehicle on the road and maintain traffic on busy read. This is the essential part of our proposed framework. We can find a good way to handle traffic by this way.

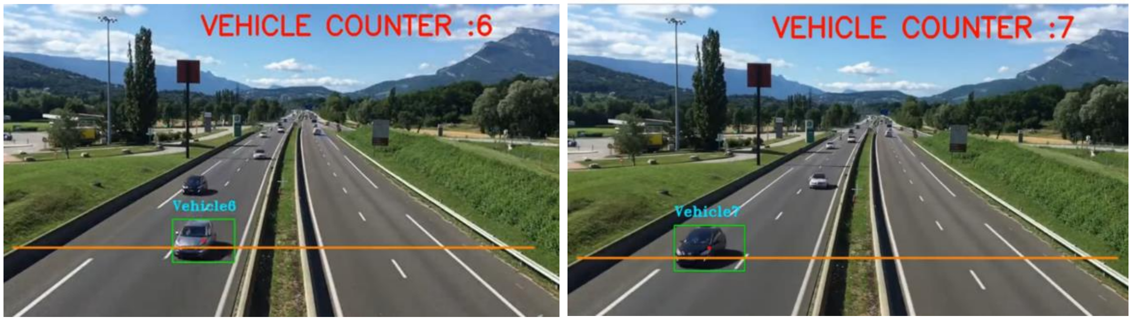

Fig-8: vehicle detection and counting

F. Classification: In the system's implementation, the categorization is done utilizing two alternative methods, which are (1) Classification using CC (2) BoF and SVM method.

1) Contour Comparisons for Classification:

FindContors() method extracts the contour elements and the area of the contour such as solidity and compares them to the values which were previously established to determine whether the vehicle is Bus, Car or Motorcycle. This method gives structure to the returned elements. It accepts the binary images from the algorithm and analyses the algorithm. Contours are made up of all the pixels in a picture that are connected to one another. Outlines of foreground objects are obtained after doing background removal and recognizing foreground elements. A minimum width and height constraint on the contours is provided, allowing for the option of bigger contours. Following the selection of these contours, a number of their properties are collected, which may then be used to categorize the automobiles. These include features like as area, solidity, aspect ratio, and others. Particular emphasis is made to contour regions that are compared to the predicted values of the vehicle.

First, a bounding box is generated over the contour and its centroid is computed, which identifies the automobiles and initiates the classification algorithm to identify the vehicles when it intersects with the imaginary line. Presumptively, the following values are assumed:

If the area is between 700 and 9000 square kilometers, the vehicle is classified as Motorcycle or Cycle.

The categorizing of Car and Bus/Truck is a two-step process:

1. Depending on the height, the vehicle might be an Car or an Truck if the size is between 600 and 134000 square feet.

2. A vehicle is classed as Car if its height is equal to or more than its width (width-30 to width+30); otherwise, it is classified as Truck.

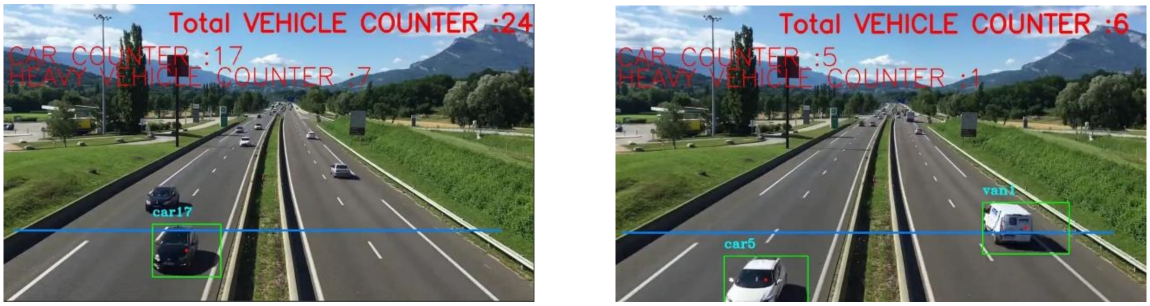

Fig-9: vehicle detection, counting & classification

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CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Implementation

We made this project to manage our traffic system, parking area. It will count every vehicle that will cross an imaginary or certain spot. Suppose in a road, there are so many vehicles are gathering. The road is getting overloaded by vehicles. Traffic jam would occur anytime. Now what will we do? We will have to predict the maximum number of vehicles that can enter into that specific area, road or block. Our program will count the total number of vehicles that entered into to area. If it crosses the maximum number of vehicles,
It will block the area or alert the user or management to turn off the road. Then the traffic police will guide the drivers into another road.

Similarly, in parking management system, our project can detect and count the total number of vehicles that entered into the parking spot. It can block the area if the maximum number of vehicles are already entered into the area. When we will add the classification part of the project it will be able to classify whether it is car only or microbus. If the parking management don’t allow bus, truck to park, it will block the gate.

4.2 Experiment environment

In Fig. 8, the total cars counted by both CC and BFF and SM methods are compared to real values using three sample movies of diverse traffic scenarios.

In bellow Bar chart we implement 3 methods. When we analysis our video then we need data from the video through the method. As our project is video base we need to import multiple video for testing that can we came good accuracy. When the number of multiple video import in our system then R-CNN analysis the data from video. Then Video is analysis for the multiple outcome. In these 3 method we are implement in the bar chart it taka the data from bar chart then classify the number of vehicle.

After classify the vehicle system give the final output in which road how many vehicles in the road. The number of vehicle are classifying by it method. After classify it count how many car heavy vehicle bike covert van are passing through the road. So classify the number of vehicle system is working the categorize. Because if we do not categorize the vehicle we do not define the classification of multiple vehicle. After categorize final bar chart is ready for analysis.

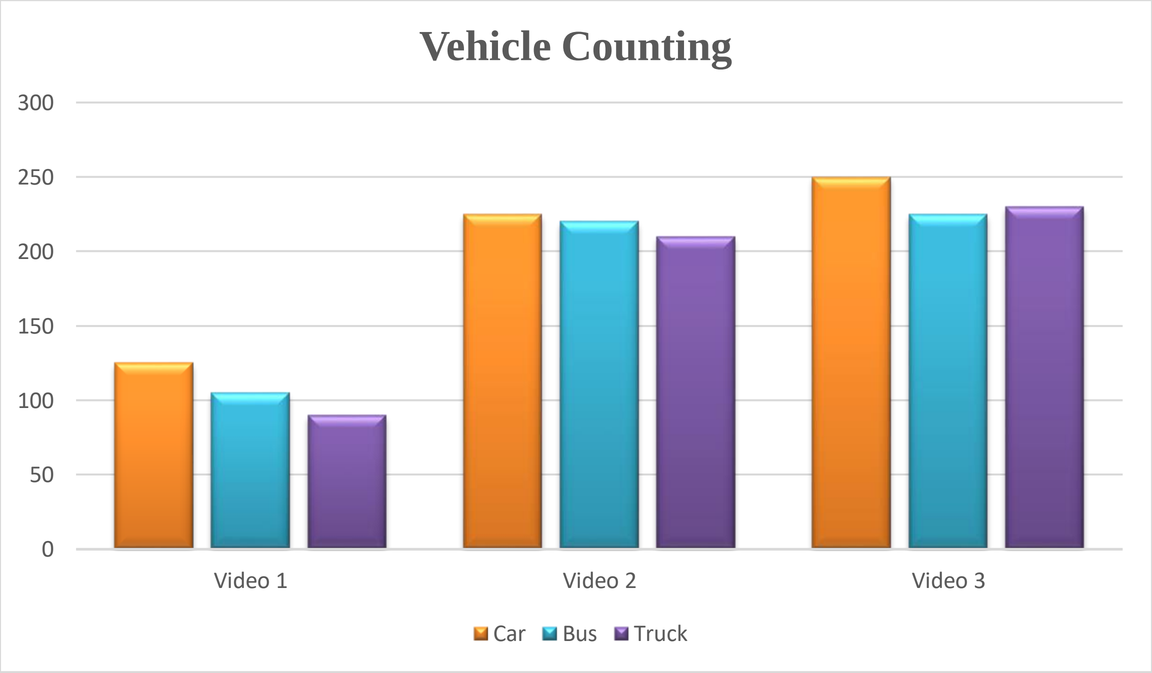

Fig-10: Ber char of import video.

We import all of the video for comparison of original count for the videos.

From video-1

We get the number of vehicle 125 Cars. Then 105 bus form the video. And

we get 90 trucks.

From Video-2

We get the number of vehicles 225 is car. Then we get 220 bus. And

we get 210 trucks.

From Video-3

We get the number of vehicles 250 is car. Then we get 225 buses. And

we get 230 trucks.

Now we get all of the result from this comparison. Now we analysis all the video for simulation result.

After simulation we get the result in which road there are more traffic and which is free from traffic.

4.3 Pie chart of the traffic video

We insert 3 videos on our system.

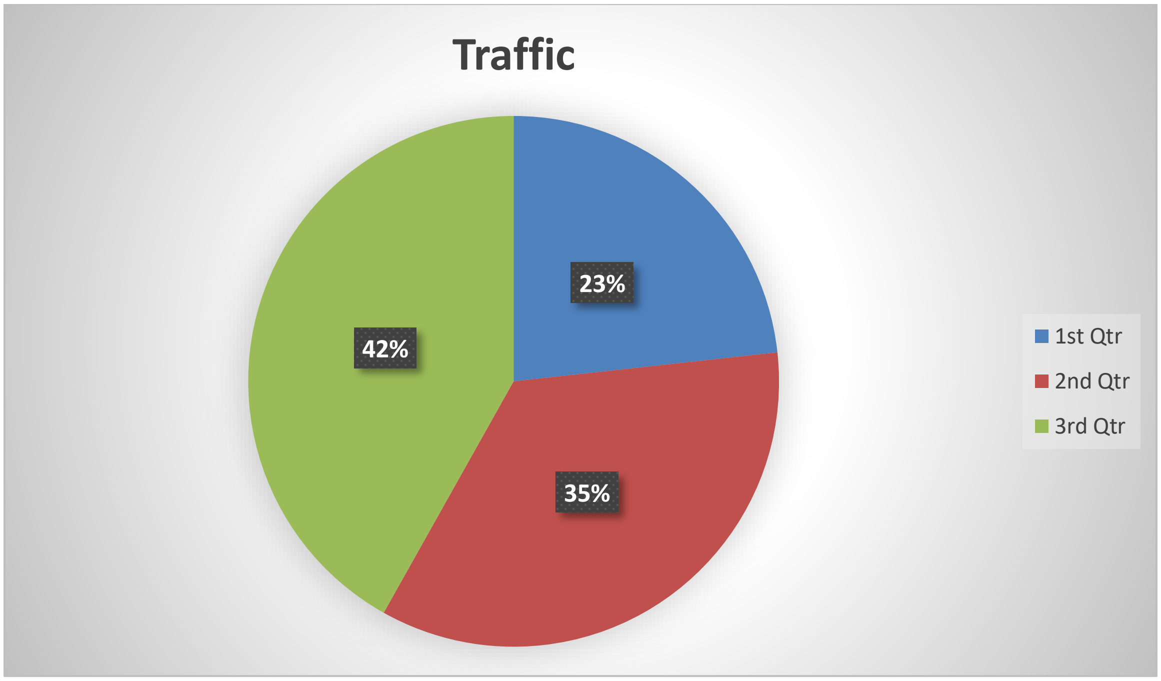

Fig 11: Pie chart of import video.

1. **Video -1:** In video 1 there are passing 195 vehicle and there are 42% traffic count and the result is in this 1st video specify this road is much busy, because 42% vehicle is passing through the road.

2. **Video -2:** In video 2 there are passing 150 vehicle and there are 35% traffic count and the result is in this 2nd video specify this road is more than free rather than 1st video because 35% vehicle is passing through the road.

3. **Video -3:** In video 3 there are passing 130 vehicle and there are 23% traffic count and the result is in this 3rd video specify this road is much free because 23% vehicle is passing through the road.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 Conclusion

We implemented our project on Python using the OpenCV bindings. Traffic camera footages will be used to implement the process. Our project mainly works with image processing from the given video footage. It removes the background images and detect the moving objects and then calculate it. It can be used in traffic management system, parking management system, traffic control, reducing traffic jams, identifying criminal activities etc.

Moreover, our project will be use in big cites where traffic is much huge. In case of Our project, we try our best to solve the traffic system.

5.2 Future work

In our current model, we don’t have any software or web app for our users to easily use the project. In the future, we have to design a user interface for our user to navigate and use our project easily. We need to classify our project whether it is car, bus or motorcycle etc. The suggested system currently works with previously recorded videos, but it can be expanded to process live video feeds by adding microcontrollers. To identify automobiles at night, we may incorporate night vision into our project.

We will try to get 100% accuracy to our project. As there some limitation of our system it Tough for us. But when we will research more then we will get full accuracy on our system. The system could also be improved for better accuracy using segmentation of multiple objects.

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