iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VIII **Month of publication:** August 2021

DOI: https://doi.org/10.22214/ijraset.2021.37630

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

Road Traffic Analysis Using Computer Vision

Needhi U. Gaonkar[1], Melina Afonso[2]
[1]*PG student Computer Science and Engineering, Department of Computer Engineering,Goa College of Engineering, Farmagudi, Goa University*
[2]*Asst. Professor, Department of Computer Engineering, Goa College of Engineering, Farmagudi, Goa University*

Abstract: ***Traffic analysis plays an important role in a transportation system for traffic management. Traffic analysis system using computer vision project paper proposes the video based data for vehicle detection and counting systems based on the computer vision. In most Transportation Systems cameras are installed in fixed locations. Vehicle detection is the most important requirement in traffic analysis part. Vehicle detection, tracking, classification and counting is very useful for people and government for traffic flow, highway monitoring, traffic planning. Vehicle analysis will supply with information about traffic flow, traffic summit times on road. The motivation of visual object detection is to track the vehicle position and then tracking in successive frames is to detect and connect target vehicles for frames. Recognising vehicles in an ongoing video is useful for traffic analysis. Recognizing what kind of vehicle in an ongoing video is helpful for traffic analysing. this system can classify the vehicle into bicycle, bus, truck, car and motorcycle. In this system I have used a video-based vehicle counting method in a highway traffic video capture using cctv camera. Project presents the analysis of tracking-by-detection approach which includes detection by YOLO(You Only Look Once) and tracking by SORT(simple online and realtime tracking) algorithm.***
Keywords: Vehicle detection, Vehicle tracking, Vehicle counting, YOLO, SORT, Analysis, Kalman filter, Hungarian algorithm.

I. INTRODUCTION

In today's world where technology has gone beyond all barriers it's now becoming easy to resolve most human related problems. Traffic related problems are increasing over the recent years and have negative impacts on accidents, road rage, pollution, unwanted delays and wastage of fuel.1n thickly populated urban cities there arises traffic-related problems. Since there's a rise within the number of vehicles, vehicular traffic control has become a necessary part of the transport system. Many researchers are acting on traffic management applications supporting image and video processing approaches. The most important mode of transportation are roads. Expressways, highways and roads are becoming overcrowded because of a rise within the number of vehicles[1].People choose their private vehicles or transport for daily travelling. Since the bulk of people have the habit of using their private vehicles, it's caused a rise within the number of vehicles on the road and also together with the increase in industrialization and urbanisation result in problems with traffic.

Vehicle detection and statistics about detection in highway road of video data are of considerable significance to intelligent traffic management. With the assistance of installations of CCTV cameras, for analysis a database of traffic video footage can be obtained a more-distant paved surface is often obtained for analysis at a high distinct angle. The possible solutions to create traffic flow more efficiently or to scale back it, authorities can develop initiatives to scale back the traffic related problem by not welcoming the polluting vehicles, using public transportation then on as per the need of the control. Addition to those, traffic engineers analyses the traffic flow in cities taking into consideration the opposite factors just like the effect of traffic lights , street directions so as to cut back travel times

The process of recognizing an object/objects within the images and video is understood as visual perception. The pc vision technique enables the autonomous vehicles to classify and detect objects in real-timeAnalyzing and interpreting images and videos captured by a camera can be done by computer vision which have gained lots of popularity and are even employed in many fields including industry, robotics, medicine, etc. With the assistance of which we are able to do analyses of the traffic flow during various times of each day, on weekends or on any particular time of the year. For tracking vehicles and other real word objects, video surveillance may be a dynamic environment.[2]In this system a video sequence of roads is processed and analysis is meted out to detect,track and count the vehicles. Here it directly benefits two groups of people i.e. road users and traffic administrations. The most effective way for traveling and to avoid traffic jams can be decided by road users if they know the real-time traffic information. On the other hand,if traffic administration knows about the information then traffic administrations can utilize the traffic information in their control systems, leading to better traffic management.

We predict the classes and bounding boxes of the full image at one run of the algorithm and detect multiple objects employing a single neural network.[3]Object tracking is identifying trajectory or path; object takes within the concurrent frames. Image obtained from the dataset is a collection of frames Across an object with Intersection over union > 0.5 a bounding box can be created which is tracked using Multi Object Tracking (MOT)[2] in concurrent frames.

II. LITERATURE

A traffic inspection always plays a vital role in a very smart facility.After a few years of research now traffic engineering literature is sort of broad and extensive. Solutions have emerged that depend on mobile devices to observe the traffic in real time. Such reasonable information is used for administering different purposes, as an example, to visually analyse the traffic conditions. Seongmoon Kim , Mark. E. Lewis, and Cheslsea. C. White III says it will be useful to optimize the routes taken by vehicles [4]. Using computer vision technology, a vehicle detection and counting method. Traffic management conducted by Nilakorn Seenouvong, Ukrit Watchareeruetai and Chaiwat Nuthong, Khamphong Khongsomboon for their experiment to find accuracy of auto detection. The tactic proposed uses background subtraction technique to search out foreground objects during a video sequence. Techniques like hole filling ,adaptive morphology and thresholding are applied to detect moving vehicles more accurately. The quantity of vehicles detected by the proposed method would be shown and be compared with those obtained by a manual counting and was implemented in C++ language, when an input video was fed into the proposed method. Hold up caused by ineffective traffic management systems which are outdated and work on a predefined countdown are targeted by Smart Traffic Management System with Real Time Analysis. These traditional systems allot timings no matter the particular density in traffic on a selected road thereby causing large red light delays[5]. The system proposed by Sheena Mariam Jacob, Shobha Rekh, Manoj G, J John Paul ensures traffic lights reply to real time values of traffic and so allowing proper management of resources and time .Initially the calculation of the density of combination of ultrasonic sensors and image processing techniques initially decides the calculation of density of traffic Raspberry pi process the available information controls spotlight. System which is able to assign time to every road supported the number of traffic. The load of traffic in one lane is classified into three level i.e. low, medium and high. The ultrasonic sensors and camera gives raspberry pi supported input from which these levels are determined. The output from ultrasonic sensors determines the levels for raspberry pi supported the extent of the density of traffic supported earlier periodic analysis can be predicted by cloud having values, if a case rises where the sensor system fails. System which is able to assign time to every road supported the number of traffic. The amount of traffic on one lane is classed under three levels: low, medium and high. The ultrasonic sensors and camera gives raspberry pi supported input from which these levels are determined. The output from ultrasonic sensors determines the levels for raspberry pi supported the extent of changes to the red green and yellow indication and allotting time for lane is then done by Raspberry pi[6].Recognition is predicated on a sequence of frames taken by one calibrated camera. vehicles were observed on a straight street, in a study conducted by Dongjin Han, Matthew J. Leotta, David B. Cooper,J oseph L. Mund The system was designed to acknowledge vehicles randomly in situations and distances. The more the features observed on the vehicle, the more reliable was the classification. With the employment of correlation curves of 3D ridges on the outer surface of the vehicle a vehicle class recognizer is designed, and also the vehicles are divided into three categories i.e. cars, SUVs, and minibus[7]. Jia-Ping Lin and Min-Te Sun" A YOLO-based Traffic Counting System" 2018 Conference on Technologies and Applications of Artificial Intelligence have comprehend the function of auto counting, it's a necessity to identify the link of vehicles in several frames, i.e., Whether or not they represent the identical vehicle Although the vehicle counting is commonly achieved by using the tracking algorithm, a fast period of recognition failure may cause wrong tracking, which can cause incorrect traffic counting. System here proposes a utilization of the YOLO framework for traffic flow counting[8]. Nilesh J Uke Ravindra Thool worked on highway counting process background is developed by subtraction image filtering, image binary and segmentation methods. Counting of moving vehicles from pre-recorded videos is done by the system. A proposed system accepts the traffic flow video out of camera which converts videos into frames, extracts background and also performs detection of moving objects. For effective detection and counting of vehicles running on roads, the proposed System has a vision based system. Camera records continuous stream of knowledge and sends to the system for analysis Background Subtraction where a gaggle of frames are taken into focus and on successive analysis and operations background subtraction takes place. All the moving vehicles/objects are tracked and counted by using the subtracted background image, during Vehicle Detection[9].Yingqian YANG, Fuqiang LIU , Ping WANG, Pingting LUO, Xiaofeng LIU worked on moving and static vehicles which can be recognized correctly using their system. .They have used feature points of the images extracted in each frame and are matched between two adjacent frames in the background, moving vehicles with forward direction and moving vehicles with backward direction in the event of moving vehicles. For static vehicles, the road region is correctly extracted by the supported edge detection algorithm[10]

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

III. PROPOSED SYSTEM

First the input video is given to the system. The video gets converted to frames. For each frame detect types of vehicles. Track the vehicles. Create data file from the video data. Based on data find different analysis.

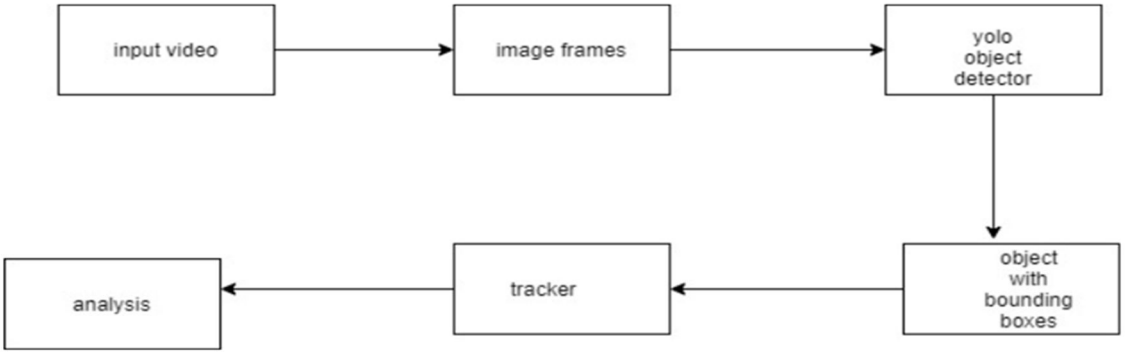


Fig 1: Flow chart of proposed system

The Fig. 1 shows the flow graph of the road traffic analysis system. Visual object detection and object tracking is done using YOLO and SORT respectively. The input given to the system is video data. input video file is passed through the system. The video data is coveted to frames. The frames are then processed. First the vehicles have to be detected in every frame in order to get tracked and then get count.

For detection the YOLO (You Only Look Once) real-time object detection algorithm is used. It is convolutional neural network (CNN).It is object detection algorithms that encircle many of the most innovative ideas coming out of the computer vision research community.

The yolo is trained on coco dataset the dataset have 80 classes. The algorithm applies a single neural network to the whole image, and then draws a bounding boxes around vehicles the different five class that have been used for traffic analysis are bicycle, bus, car, motorcycle, truck. YOLO detects the vehicles in every frame. The vehicles get the bounding box around it. Each vehicle gets its identity number. The vehicles have to be tracked in successive frames. For tracking, a SORT algorithm is used.

SORT is a tracker which works on the principle of tracking by detection. SORT tracks each detection by assigning a unique id to each bounding box.

For all the successive frames, the current object ID is attempted to be carried forward. If the object moves away from the image, the ID will be removed. If a new vehicle appears in the particular, then a new fresh ID will be given to that vehicleA combination of Kalman Filter and Hungarian algorithm is used for tracking. Here, Kalman filtering is performed in image space while Hungarian technique facilitates frame-by-frame data association using an association metric that computes bounding box overlap. The Hungarian algorithm also known as kuhn-munkres algorithm.

A Kalman Filter is an algorithm that can predict future positions based on current position. A Kalman Filter is used on every bounding box, so it comes after a box has been matched. The idea of a Kalman filter is to use the possible detections and previous predicted values to arrive at a best guess of the current state, while keeping the possibility of errors in the process. The best part of the Kalman filter is that it is recursive , meaning we take current readings, to predict the current state, then use the measurements and update our predictions .

The are case to be considered for tracking by detection. Initially only the some detections can be seen which don't any any matching detections. Next case, when for the same detection is observed in next frame and its matches with the earlier detection Next case when the detection goes missing for some frames or when moves out of frames and they are to be considered as unmatched tracks,if for ten more than ten frames no matching track appears then those are basically lost objects and are ids are removed from tracker. The pixel position is found inorder to calculate speed. Speed calculated here is instantaneous parameter which means it varies as position of vehicle in every frame. All the details about vehicles are then saved in csv file which is then used to find analysis on the data.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

IV. ANALYSIS AND RESULT

The analysis is carried out on the data that is obtained after processing the video dataset. In Fig. 2 screenshot of detection and prediction is shown which is showing the bounding boxes around detected vehicles. It classifies the different types of vehicles. Initially a blue bounding box is given which says some detections can be seen which don't have any matching detections earlier, so it is to be considered as unmatched detection. Some bounding boxes are green in color which says some detection is observed in frame and it has matches in the earlier detection so it is considered to be matched detection and it gets tracked. When the detection goes missing for some frames bounding box appears red and they are to be considered as unmatched tracks.

In Fig.3 graph shows the date v/s count of vehicles for days between 11/3/2021 to 17/3/2021 for the time from 8 am to 9am. It is observed that the count of motorcycle is always the high and the count of bicycle is low for the time period from 2021-3-11 to 2021-3-17.The bicycles are almost having consistent count but it can be observed that the minimum count of bicycle is on 2021-3-12 and maximum on 2021-3-16.The count of bus is higher than bicycles and it can be observed that the minimum count of bus is on 2021-3-14 and maximum on 2021-3-17.The count of car is higher than truck and it can be observed that the minimum count of car is on 2021-3-14 and maximum on 2021-3-16.The count of truck is higher than the bus and it can be observed that the minimum count of truck is on 2021-3-11 and maximum is on 2021-3-15.The count of motorcycle is higher than any other vehicle type, it is observed that the minimum count of motorcycle is on 2021-3-14 and maximum is on 2021-3-16.Considering the truck and buses as heavy vehicle, the maximum count of heavy vehicle can be observed on 2021-3-15 and the minimum can be observed on 2021-3-14.

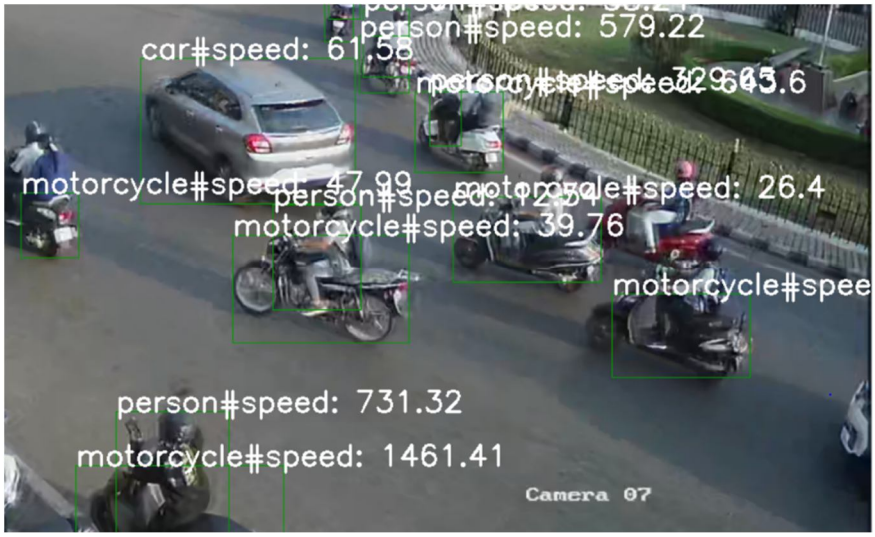


Fig 2 : Screenshot showing vehicle detection and tracking

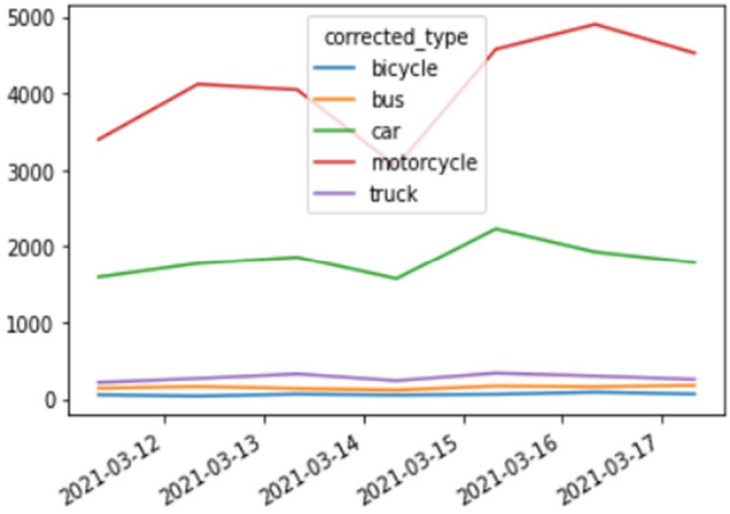


Fig 3: Count of different types of vehicles

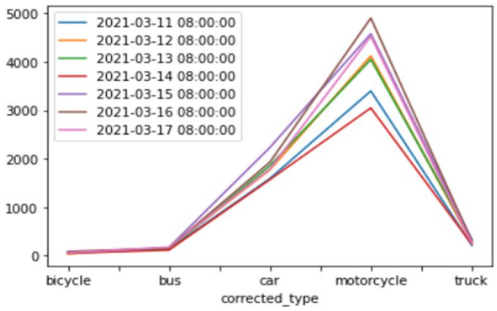


Fig 4:Plot showing pattern of vehicles for week

The Fig 4 graph shows the traffic pattern for type of vehicles against count of vehicles for days between 2021-3-11 and 2021-3-17 for the time from 8 am to 9am.Based on graph it can be observed that the maximum traffic was on 2021-3-16 and the minimum was on 2021-3-14.

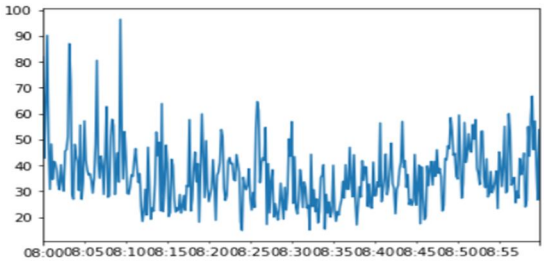


Fig 5:Speed pattern

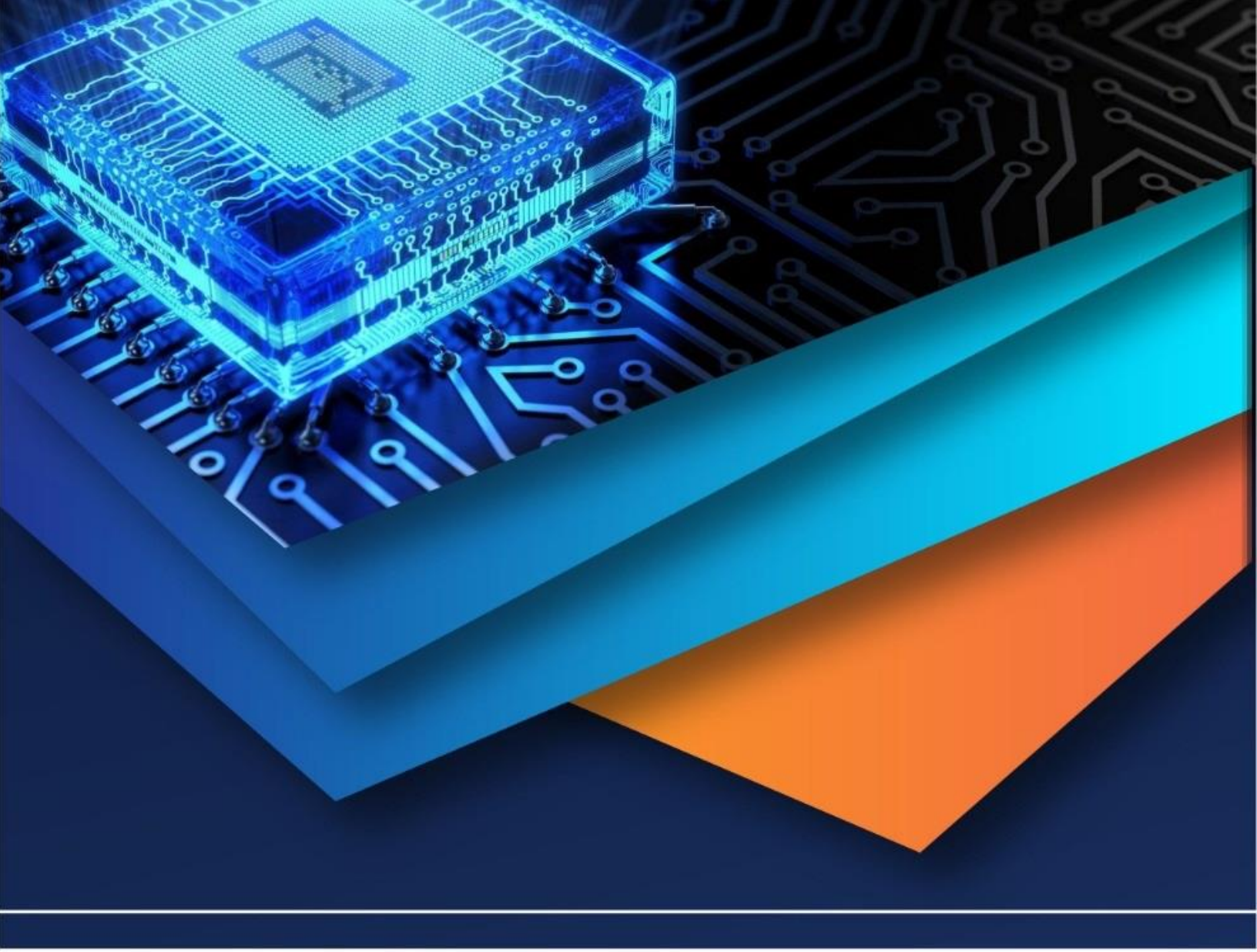
The Fig 5 graph shows a speed pattern for average speed between 8am to 9am.It can be observed that on the road section which have been used for finding analysis, the speed of most of the vehicles ranges from 20 KpH to 50 KpH. Out of which maximum vehicles have speed range between 30 KpH to 40 KpH

V. CONCLUSION

If the people know if road have high traffic after 8:30am and if they are in hurry, and as per their calculation they might reach that road around that time then they might not take that route, or they can try to reach the location little early. If the authority finds the road have too much of traffic then they can find some alternative route for that particular road. The use of real-time information in decision-making has significant implications, as it might be also used as a tool to guide drivers to make choices for the benefit of the city, thus creating a more optimal traffic configuration.

REFERENCES

[1] Da Li,Bodong Liang,Weigang Zhang"Real-time Moving Vehicle Detection, Tracking, and Counting System Implemented with OpenCV " International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8, Issue-3S, February 2019
[2] Mohana,HV Ravish Aradhya"Object Detection and Tracking using Deep Learning and Artificial Intelligence for Video Surveillance Applications"(IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 10, No. 12, 2019
[3] Geethapriya. S, N. Duraimurugan, S.P. Chokkalingam "Real-Time Object Detection with Yolo"International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8, Issue-3S, February 2019
[4] Seongmoon Kim , Mark. E. Lewis, and Cheslsea. C. White III, "Optimal vehicle routing with real-time traffic information," IEEE Transactions on Intelligent Transportation Systems, vol. 6, no. 2, pp. 178–188, 2005.
[5] Nilakorn Seenouvong, Ukrit Watchareeruetai and Chaiwat Nuthong,Khamphong Khongsomboon" A Computer Vision Based Vehicle Detection and Counting System" Computer Science 2016 8th International Conference on Knowledge and Smart Technology (KST)
[6] Sheena Mariam Jacob, Shobha Rekh, Manoj G, J John Paul" Smart Traffic Management System with Real Time Analysis"
[7] Dongjin Han,Matthew J. Leotta, David B. Cooper,Joseph L. Mundy"Vehicle Class Recognition from Video-Based on 3D Curve Probes"proceedings 2nd Joint IEEE International Workshop on VS-PETS, Beijing, October 15-16, 2005
[8] Jia-Ping Lin and Min-Te Sun" A YOLO-based Traffic Counting System" 2018 Conference on Technologies and Applications of Artificial Intelligence
[9] Nilesh J Uke Ravindra Thool" Moving Vehicle Detection for Measuring Traffic Count Using OpenCV"4th International Conference on Conference on Electronics Computer Technology (ICECT 2012)
[10] Yingqian YANG, Fuqiang LIU , Ping WANG, Pingting LUO, Xiaofeng LIU" Vehicle detection methods from an unmanned aerial vehicle platform" 2012 IEEE International Conference on Vehicular Electronics and Safety July 24-27, 2012. Istanbul, Turkey



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY