TRAFFIC LIGHT MANAGEMENT SYSTEM USING AI

B.Tech. Project

By

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- **SIMAR JYOT SINGH NARANG (**Team Leader)

  Vehicle Count and Traffic Light synchronization

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  Object Detection using OpenCV and Vehicle Count

- **VANSH SINGH BISHT (**Technical Lead)

  PyGame Vehicle Simulation Demo

- **ANSH OHRI (**Content Writer)

  Research Work and Simulation Demo

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Abstract

Increasing traffic congestion at signalized junctions is a matter of great concern for creating and maintaining sustainable cities. Traffic jams in addition to adding to drivers' delays and stress levels, traffic bottlenecks significantly increase fuel usage and pollution. The main reason behind this is the way of controlling traffic at such junctions. Semi-automated and conventional traffic management has reached it's saturation point and can no longer handle the high density of traffic flow with complex patterns. In this paper, we discuss and draw comparisons of previous research and works done to solve this problem. Our focus would be on techniques using Machine Learning, such as Computer Vision and Deep Neural Networks.

Chapter 1

Introduction

Numerous road networks are experiencing issues due to the decline in road capacity and the accompanying Level of Service as a result of the rise in automobiles in metropolitan areas. As an example, in Delhi itself the number of vehicles have increased or nearly doubled up from 317 per thousand people in 2005-06 to 643 per thousand in 2019-20. There was a 3.03 percent year on year increase in the number of vehicles in 2021-22. On an average a commuter in a metro city like Delhi would spend an extra 20 minutes on the road during rush hours in the morning and evening.

The bottleneck for these high vehicular flow are the conventional traffic management system used in these cities. There are two ways to tackle traffic flow currently in implementation : semi-automatic traffic lights with fixed timings or traffic police stationed at junctions to control the flow manually. The problem with use of traffic lights is that they use a fixed time for each side of the cross road, irrespective of the density of vehicles on those roads. Ideally, the road with higher density of vehicles should be given extra time to pass the junction, as that will lead to lower waiting time on average for all of the vehicles. Depending on manual control of traffic at junctions with manpower is inefficient, as a human cannot process all of the information at live with great accuracy for a longer time[1].

Despite the fact that computer vision is today a highly developed field, capabilities for recognition and classification are not frequently used in day-to-day activities. Therefore, in this paper we would be working on findings and research done on this aspect using Machine Vision and what all advancements have been made till now. We would also come across some new methodology and techniques in analysis and decision making for traffic lights using live cameras installed at junctions.

Figure 1.1. Traffic Light with a timer (left) and traffic congestion(right)

Chapter 2

Review of Past Work and Problem Formulation

Literature Review

A. Smart Control of Traffic Light Using Artificial Intelligence (2020)

Mihir M. Gandhi,[1] in this paper uses image processing and object detection to calculate real-time traffic density from images captured by CCTV cameras placed at traffic intersections. The vehicle detection algorithm receives the image and employs YOLO. The number of each type of vehicle, including cars, bicycles, buses, and trucks, is counted in order to determine the traffic density. This density, along with a few other variables, is used by the signal switching algorithm to change the light at traffic lights signals. To prevent a certain lane from going hungry a high and low value is added to the system.

B. ***Intelligent Traffic Lights Control By Fuzzy Logic(1997)***

Rubiyah Yusof,[2] in this study, used fuzzy logic techniques to address the issue of traffic congestion. In essence, this research study has developed a fuzzy controller system for a single four-way junction. Although this system as a whole is considerably different from ours, it almost has the same solution. The primary distinction is that we take into account other junctions that are directly connected to the specific junction while they focus on a single junction. By this, we have knowledge of the a bigger area and can calculate timings according to that.

C. ***Vision Based Intelligent Traffic Management System (2011)***

Muhammad Hassam Malhi,[3] in this paper uses a dynamic background subtraction method for better vehicle detection on roads on live basis using the cameras at junction. While the density of vehicle are determined using a proper method called here as 'region of interest'. By comparing the difference between the pre-processed video frame and the dynamically changing background, background removal is performed. For better detection, the constantly changed background is employed for each video frame.

D. ***Improving Traffic Light Control by Means of Fuzzy Logic (2018)***

A system [4] based on the Arduino-UNO is intended to lessen traffic and wait times. Through the camera, this system captures photos, which are then processed in MATLAB to remove saturation and colors and transform the image to a threshold image from which the traffic density is estimated. The simulation packages are preconfigured, and USB is used to connect MATLAB and Arduino. The Arduino determines each lane's green light time based on traffic volume and density. But there are a number of problems with this approach. It is challenging to accurately count the number of vehicles on the road since the cars frequently overlap.

E. *Intelligent traffic management system for cross section of roads using computer vision (2017)*

The design and implementation of an automated, intelligent traffic control system[5] that makes use of computer vision and image processing methods is done in this work. In addition to traditional computer vision approaches, this study introduces two brand-new, low-processing-cost methods. One of the approaches was built with hardware assistance, whilst the other was developed without it. This comprehensive traffic management system has proved successful in easing congestion and backups in simulated environments. The system counts the number of vehicles on each road and determines the optimal amount of time for both red and green lights.

F. Data-Driven Intersection Management Solutions for Mixed Traffic of Human-Driven and Connected and Automated Vehicles

Bashiri[12] here proposes two answers for metropolitan traffic light within the sight of associated and robotized vehicles. Initial a concentrated company-based regulator is proposed for the helpful crossing point the board issue that exploits the platooning frameworks and V2I correspondence to produce quick and smooth traffic stream at a solitary convergence. Second, an information driven approach is proposed for versatile sign control within the sight of associated vehicles. The proposed framework depends on an information driven technique for ideal sign timing and an information driven heuristic strategy for assessing directing choices. It requires no extra sensors to be introduced at the crossing point, decreasing the establishment costs contrasted with run of the mill settings of condition of-the-practice versatile sign regulators. The proposed traffic regulator contains an ideal sign timing module and a traffic state assessor. Recreations showed that the proposed traffic regulator beats Highway Capacity Manual's technique and given appropriate disconnected boundary tuning, it can diminish normal vehicular deferral by up to 25%.

G. *DRLE Decentralized Reinforcement Learning at the Edge for Traffic Light Control in the IoV*

In this Exploration Paper, Zhou [15] and his group proposed another model called Decentralized Reinforcement Learning at the Edge for traffic light control in the IoV (DRLE). DRLE takes advantage of the universality of the IoV to speed up the assortment of traffic information and its understanding towards reducing clog and giving better traffic signal control. DRLE works inside the inclusion of the edge servers and utilizations collected information from adjoining edge servers to give city-scale traffic signal control. DRLE decays the profoundly intricate issue of enormous region control. into a decentralized multi-specialist issue.

H. *HOG, LBP and SVM based Traffic Density Estimation at Intersection*

In this examination paper, Prasad [13] et al a productive method for assessing the traffic thickness on crossing point involving picture handling and AI procedures continuously. The proposed procedure takes pictures of traffic at intersection to assess the traffic thickness. The strategies utilized are Histogram of Oriented Gradients (HOG), Local Binary Patterns (LBP) and Support Vector Machine (SVM) based approach for traffic density estimation. The system is computationally cheap and can run productively on raspberry pi board.

I. *Simulation Pipeline for Traffic Evacuation in Urban Areas and Emergency Traffic Management Policy Improvements through Case Studies*

In this Exploration Paper,Yu Chen [11] and his group utilized SUMO Reproductions and OpenStreetMaps to reenact genuine point by point streets and convergences to assess departure plans ahead of time for these uncommon occasions, including recognizing traffic stream bottlenecks, further developing traffic the executives approaches, and understanding the vigor of the traffic the board strategy are basic for crisis the executives and gave an Exact assessment of clearing time, ID of the bottlenecks, and testing existing and proposed departure traffic the board arrangements and their strength.

J. *T-GCN A Temporal Graph Convolutional Network for Traffic Prediction*

In the going with assessment paper, Zhao[14] and his gathering propose a clever brain network-based traffic estimating strategy, the temporal graph convolutional network (T-GCN) model, which is in mix with the graph convolutional network (GCN) and gated recurrent unit (GRU). In particular, the GCN is utilized to learn complex topological designs to catch spatial reliance and the gated repetitive unit is utilized to learn dynamic changes of traffic information to catch transient reliance. Then, the T-GCN model is utilized to traffic estimating in light of the metropolitan street organization. At the point when assessed on two certifiable traffic datasets and contrasted and the HA model, the ARIMA model, the SVR model, the GCN model, and the GRU model, the T-GCN model accomplishes the best expectation results under various forecast horizons.

K. A Fully-distributed Traffic Management System to Improve the Overall Traffic Efficiency

The number of automobiles has risen more quickly recently than the infrastructure that is in place. As a result, traffic congestion has developed into a daily issue that has an impact on many facets of contemporary society, including regional economic development. In order to increase traffic efficiency and reduce congestion issues, traffic management systems (TMS) have been developed. One building block to develop an efficient TMS is the Vehicular Ad hoc Network (VANET). It considers vehicles as mobile nodes with embedded sensors, processing units, and wireless communication interfaces [6, 8, 7]. These systems focus on collecting information about traffic in one location to pinpoint congestion and recommend detours.

L. A Survey on Urban Traffic Management System Using Wireless Sensor Networks

The number of vehicles in use today has grown rapidly, but the fundamental capabilities of roadways and transportation networks have not kept pace in order to effectively handle the volume of vehicles using them. As a result, there are more traffic-related pollution and traffic jams, which has a negative social and economic impact on various markets around the world. Due to traffic congestion, a static control system could obstruct emergency vehicles. In order to monitor traffic and minimize gridlock on the roads, wireless sensor networks (WSNs) are receiving more and more attention. The wireless communication has numerous technologies and standards, including Zig Bee, Bluetooth, GPRS, GSM,Wi-Fi and Wi-MAX [9] WSNs are greatly in-demand due to their quick information transfer, simple setup, low maintenance requirements, small design, and lower cost when compared to alternative network solutions. Significant research has been done on Traffic Management Systems that use WSNs to reduce Average Waiting Time (AWT) of vehicles at intersections, prevent congestion, and guarantee priority for emergency vehicles.

M. An Intelligent V2I-Based Traffic Management System

There are currently automobiles on the market with sophisticated accident-avoidance technologies like lane-keeping assistance (LKA) or collision warning systems (CWSs). Adaptive cruise control (ACC) based on radar technology [10] and traffic warning signals using artificial vision [11]. The next stage in minimizing traffic accidents is to plan ahead for such vehicles to operate in order to prevent collisions and enhance traffic flow. To effectively control traffic conditions, vehicle-to-infrastructure (V2I) connections are crucial. This article outlines the AUTOPIA strategy for a V2I-based intelligent traffic management system. In order to avoid collisions and improve traffic flow, a fuzzy-based control system that considers each vehicle's safe and comfortable distance and speed adjustment has been developed. An analysis of communications based on IEEE-802.11p verified the suggested solution. When tested in real-world circumstances, first using computer simulation and later with actual automobiles, the complete system performed well.

N. Applications of Artificial Intelligence Paradigms to Decision Support in Real-Time Traffic Management

Intelligent transportation systems' success depends on decision support for real-time traffic management. Theoretically, traffic management methods can be assessed in real time using microscopic simulation models before a course of action is suggested. For example simulation models such as VISSIM(12), DYNASMART(13), and DynaMI(14) can evaluate traffic conditions under the diversion strategy and for a control scenario that involves no diversion

O. Traffic Management System Using IoT Technology

The number of automobiles on the road will only increase due to cities' constantly growing populations and manufacturers' ongoing production of all different types of vehicles. Increased traffic congestion is a natural result of this, especially in major cities and during rush hour. This situation continuously puts pressure on academics, government representatives, and urban planners to develop safer and more cost-effective traffic management strategies. Numerous studies have been carried out in attempt to solve this ongoing issue, and the results have led to some important improvements, such as special lanes for emergency vehicles in urban areas. Nevertheless, even with these lanes, the optimum target times for emergency vehicles to arrive

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A table of comparison of different research paper on this topic :

Table 2.1. Sample table. Description of styles used in this document

Author	Title	Methodology	Findings
Tousif Osman, Shahreen Shahjahan Psyche, J. M. Shafi Ferdous, Hasan U. Zaman	Intelligent Traffic Management System for Cross Section of Roads Using Computer Vision	Light intensity varying Image detection algorithm,	More car passage with lesser waiting time was registered.
Mihir M. Gandhi, Devansh S. Solanki, Rutwij S. Daptardar, Nirmala Shinde Baloorkar	Smart Control of Traffic Light Using Artificial Intelligence	YOLO (You only look once), CNN (convolutional neural network), OpenCV, DarkNet	Lower time stopage and more movement of vehicular traffic was recorded at junctions. A total of 23% improvement was noticed.
Alan Vogel, Izidor Oremovi´c, Robert ˇSimi´c, Edouard Ivanjko	Improving Traffic Light Control by Means of Fuzzy Logic	Fuzzy Logic, Microscopic simulation,	Improvement in average and maximum queue lengths for both primary and secondary driveways
Tan Kok Khiang, Marzuki Khalid, and Rubiyah Yusof	Intelligent Traffic Lights Control By Fuzzy Logic	Fuzzy Logic, Aurdion-UNO	The fuzzy logic traffic lights controller performed better than the fixed-time controller or even vehicle actuated

			controllers due to its flexibility
Muhammad Hassam Malhi, Muhammad Hassan Aslam, Faisal Saeed, Owais Javed, Muhammad Fraz	Vision Based Intelligent Traffic Management System	Dynamic Background Subtraction Method	Promising real time performance, occlusion and shadow overlapping exist in this algorithm
Muhammad Hassam Malhi, Muhammad Hassan Aslam, Faisal Saeed, Owais Javed, Muhammad Fraz	A Fully-distributed Traffic Management System to Improve the Overall Traffic Efficiency	Dynamic Background Subtraction Method	Promising real time performance, occlusion and shadow overlapping exist in this algorithm
Allan M. de Souza and Leandro A. Villas	A Fully-distributed Traffic Management System to Improve the Overall Traffic Efficiency	V2V communication	In FASTER, every car communicates with its neighbors so that each one can learn more about the state of the traffic. Every vehicle also imparts its local knowledge to other cars.

Kapileswar Nellore and Gerhard P. Hancke	A Survey on Urban Traffic Management System Using Wireless Sensor Networks	Dynamic traffic monitoring using vehicular networks (DTMon), V2V and V2R communication	There is no way to ensure a real-time traffic control system. To overcome the real-time difficulties, it is necessary to construct an intelligent traffic cloud using cloud computing.
Vicente Milanés, Jorge Villagrá, Jorge Godoy, Javier Simó, Joshué Pérez, and Enrique Onieva	An Intelligent V2I-Based Traffic Management System	V2I communications, Fuzzy Logic	The two goals of the proposed V2I-based traffic control system are: In the first place, our strategy suggests a solution to the issue of controlling traffic flow in metropolitan environments.
Vicente Milanés, Jorge Villagrá, Jorge Godoy, Javier Simó, Joshué Pérez, and Enrique Onieva	Applications of Artificial Intelligence Paradigms to Decision Support in Real-Time Traffic Management	SVM , SVR, CBR	SVR performance appears to be better than that of the CBR. The results of an additional statistical test revealed that SVR prediction errors were lower than CBR mistakes.

RFID readers and tags, Green Wave Systems, smart phones and wireless communication with Big DTta center	Traffic Management System Using IoT Technology	RFID readers and tags, Green Wave Systems, smart phones and wireless communication with Big Data center	This report reviewed a number of intelligent traffic management technologies. These included using smart phones, Green Wave Systems, RFID readers and tags, and wireless connectivity with Big Data centers.
Simone Baldi , Iakovos Michailidis, Vasiliki Ntampasi, Elias B. Kosmatopoulos , Ioannis Papamichail and Markos Papageorgiou ,	Simulation-based Synthesis for Approximately Optimal Urban Traffic Light Management	Convergence to minimum of a function.	Average speeds of car in the city were increased.
Usha Mittal, Priyanka Chawla	Neuro – Fuzzy Based Adaptive Traffic Light Management system	CNN (convolutional neural network), fuzzy logic, Grid partition	Better management of traffic considering multi lane roads and negligible wait time for priority vehicles.
Amita Jain ,Sudesh Yadav, Sonakshi Vij, Yogesh Kumar, Devendra Kumar Tayal	A Novel Self-Organizing Approach to Automatic Traffic Light Management System for Road Traffic Network	RFID, arithematic mean theorem	Improvement in wait time of each individual vehicle.
R G Putra, W Pribadi , I Yuwono , D E J Sudirman , B Winarno	Adaptive Traffic Light Controller Based on Congestion Detection Using Computer Vision	YOLOv3, COCO	A true positive value of 100% was received for HV and 93% for

			LV.
Luiz Fernando Pinto de Oliveira, Leandro Tiago Manera and Paulo Denis Garcez da Luz	Development of a Smart Traffic Light Control System with Real-Time Monitoring	Xmesh, RF Module	Average cycle time of a red light was minimized to avoid traffic congestion

Problem Statement

To build a self adaptive traffic light control system based on YOLO. Disproportionate and diverse traffic in different lanes leads to inefficient utilization of same time slot for each of them characterized by slower speeds, longer trip times, and increased vehicular queuing.To create a system which enable the traffic management system to take time allocation decisions for a particular lane according to the traffic density on other different lanes with the help of cameras, image processing modules.

Chapter 3

Methodology

The solution can be explained in four simple steps:

1. Get a real time image of each lane.
2. Scan and determine traffic density.
3. Input this data to the Time Allocation module.
4. The output will be the time slots for each lane, accordingly.

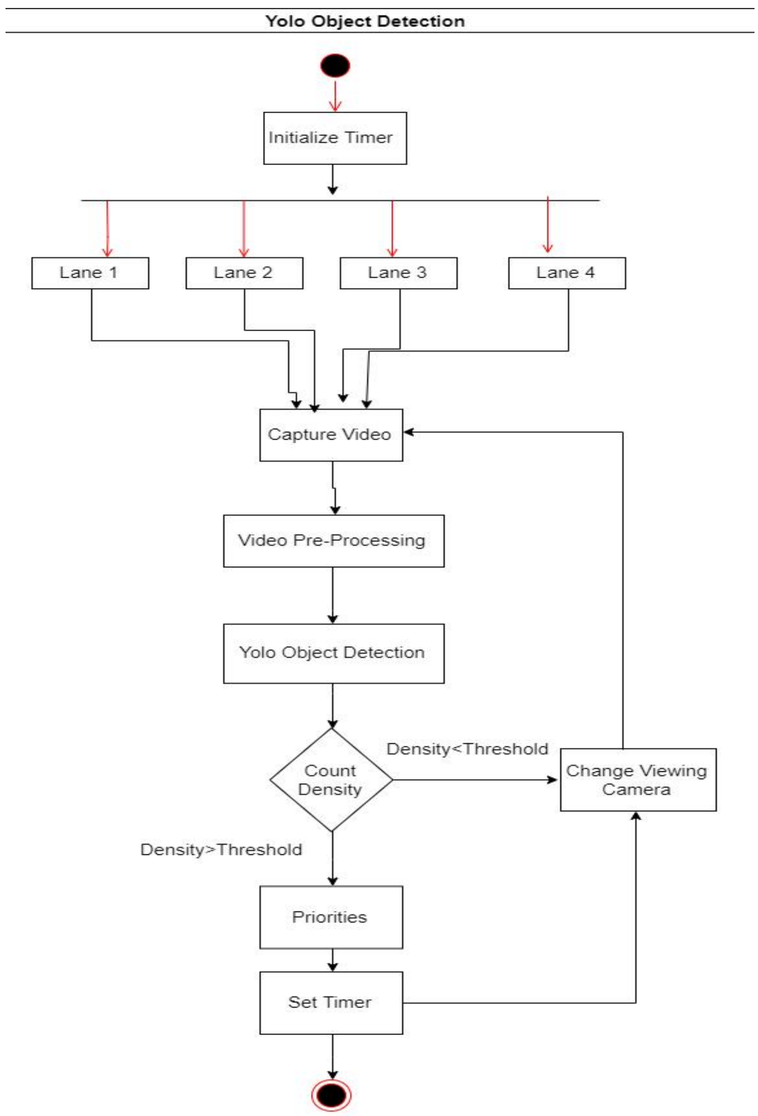

Figure 3.1 : Working Module of YOLO Framework

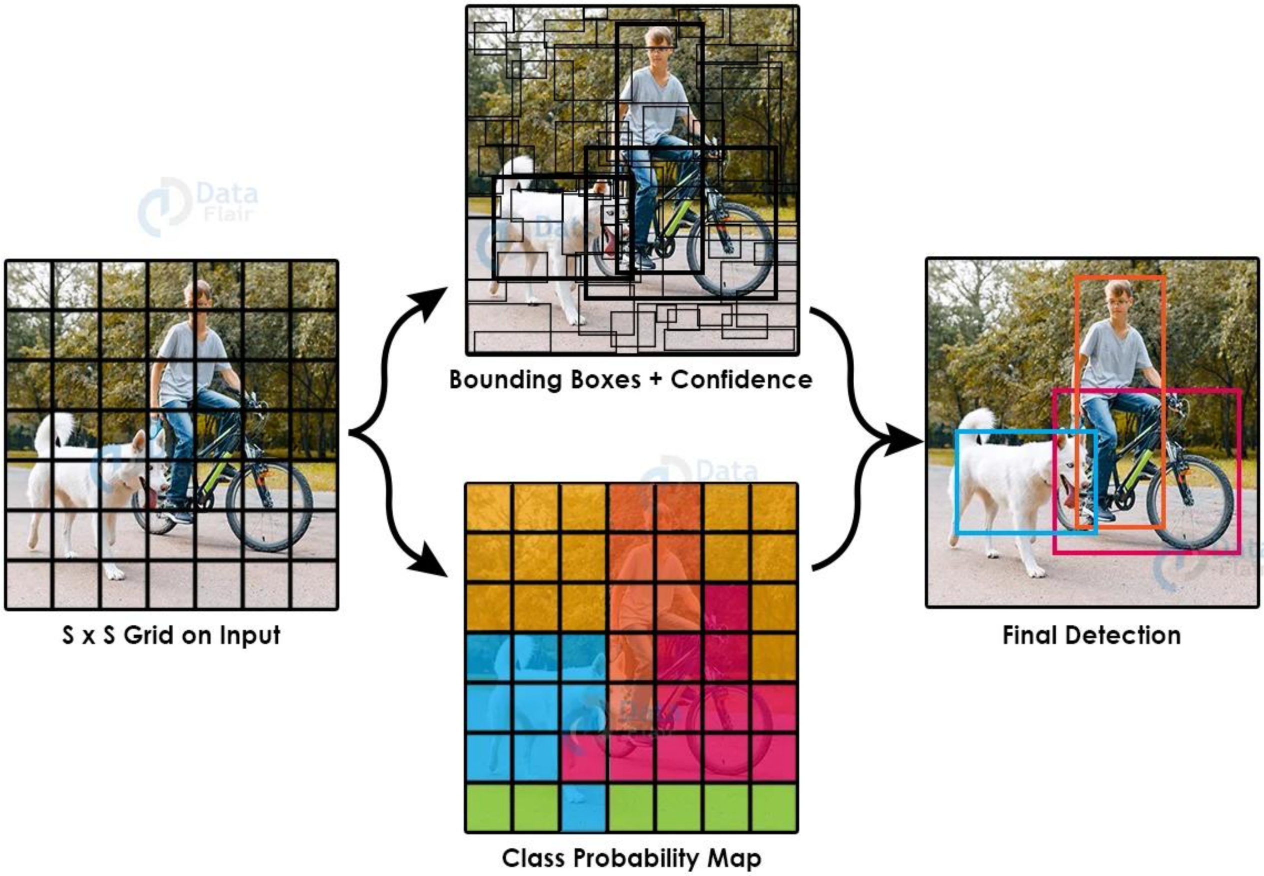

Figure 3.2 : Bounding Boxes of YOLO on an Image

Chapter 4

Results and Discussions

The result for the project could be divided in two divisions :

1. Evaluation of Vehicle Detection Model

The vehicle detection module was tested with a variety of test images containing varying amounts of vehicles, and the accuracy of detection was found to be in the range of 75-80%. Some test results are shown above in Fig. 3. This is satisfactory, but not optimum. The primary reason for low accuracy is the lack of a proper dataset. To improve upon this, real-life footage from traffic cameras can be used to train the model, so that accuracy of the system can be improved.

2. Evaluation of the Proposed Adaptive System

For the pupose of evaluation of the system, the traffic movement simulation for both the system was run for 5 minutes a total of 15 times, using which the total time spent at the traffic stop and the time taken by a single vehicle to cross the junction can also be inferred.

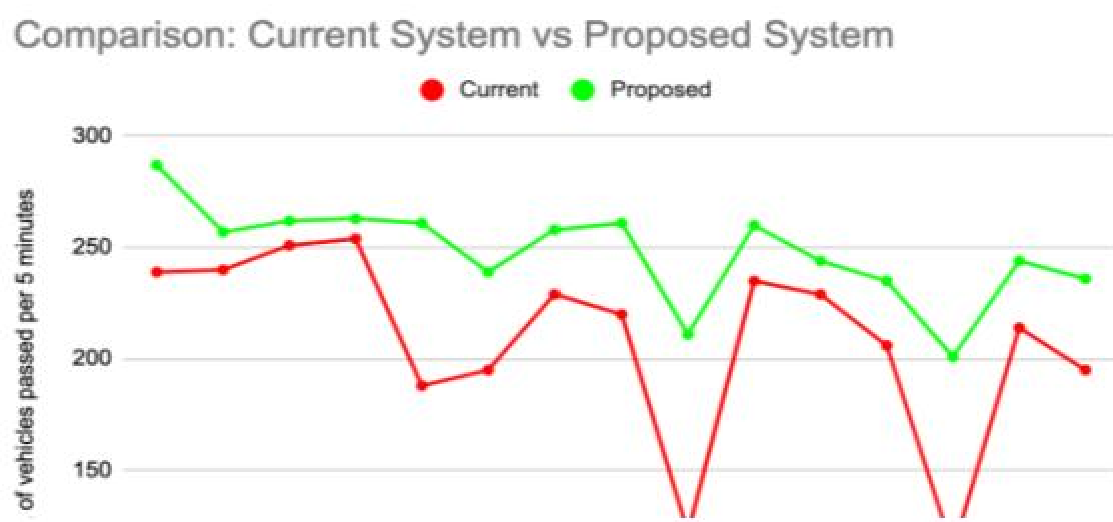

Figure 4.1 : Comparison of current static system and proposed adaptive system

We have used the images from the live feed camera installed at the traffic junctions or at normal traffic spots around the city or on the outskirts. These videos or live feeds were used to feed the model based on YOLO and OpenCV, where we detected the vehicle and there movement as in downwards or upwards, i.e., towards the traffic signal or away from it. We were also successful in defining what type of vehicle is it.

Figure 4.2 : Traffic Vehicle Movement from live feed

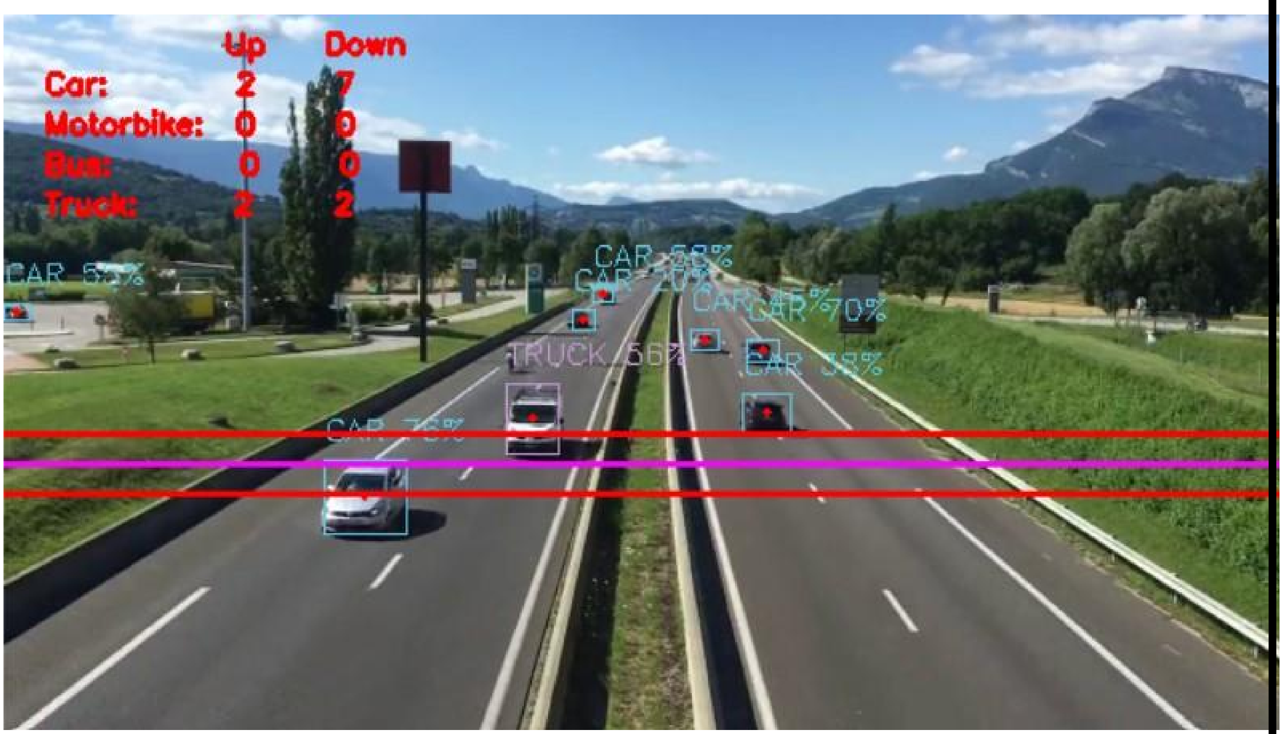

Figure 4.3 : Detection of Vehicle using OpenCV and YOLO

We were also succesfull in implementing the derived traffic density from the detection module to the model for finding the optimum timings for each traffic lane to pass the vehicles. This was done on the principle of giving more priority or giving more time to the lane with higher traffic density and lesser to the ones with relatively uncrowded lane, while not creating bottlenecks or congestion in any one lane. For the same purpose, we created a simple simulation using PyGame.

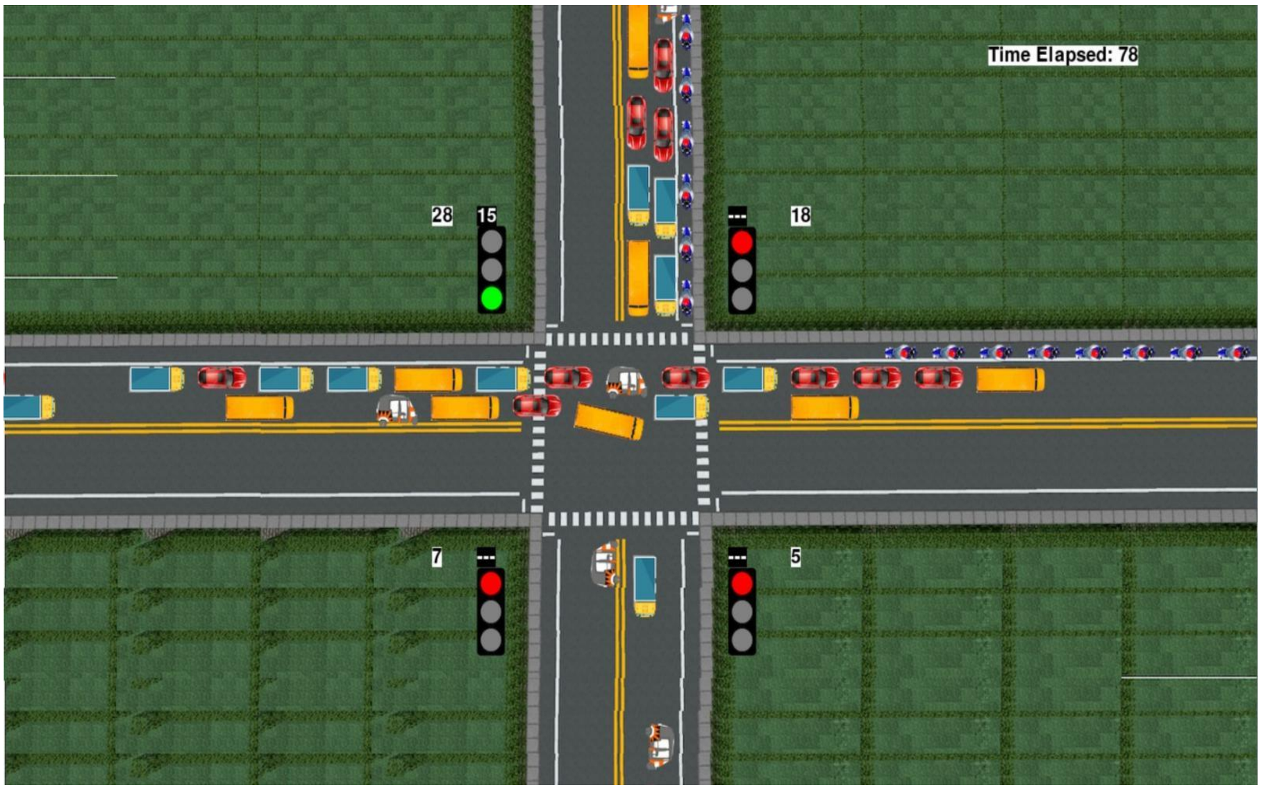

Figure 4.4 : Traffic Light Simulation based on Vehicle Density on PyGame

Chapter 5

Conclusions and Future Work

After different analyses and comparisons, it was found out that the YOLO model was providing us with the highest accuracy.

Developing an efficient traffic management system is the need of the hour and with no generalized form is a troublesome task and requires a lot of research. The unavailability of a dataset in any Indian language and having no algorithm that can work upon any language other than English was a big constraint that may be worked upon in the future. As traffic rules and regulation and how cars behave on the street is different in different, its a challenge to make a generalized model that works for all. A different approach for the data could be taken so that different categorizations can be done for the same and can work upon the early Traffic management system. In further research aggregation method and ensemble could be implemented in a much better way to attain higher accuracy.

REFERENCES

[1] M. M. Gandhi, D. S. Solanki, R. S. Daptardar and N. S. Baloorkar, "Smart Control of Traffic Light Using Artificial Intelligence," 2020 5th IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE), 2020, pp. 1-6, doi: 10.1109/ICRAIE51050.2020.9358334.

[2] Khiang, Kok & Khalid, Marzuki & Yusof, Rubiyah. (1997). Intelligent Traffic Lights Control By Fuzzy Logic. Malaysian Journal of Computer Science. 9. 29-35.

[3] M. H. Malhi, M. H. Aslam, F. Saeed, O. Javed and M. Fraz, "Vision Based Intelligent Traffic Management System," 2011 Frontiers of Information Technology, 2011, pp. 137-141, doi: 10.1109/FIT.2011.33.

[4] A. Vogel, I. Oremović, R. Šimić and E. Ivanjko, "Improving Traffic Light Control by Means of Fuzzy Logic," 2018 International Symposium ELMAR, 2018, pp. 51-56, doi: 10.23919/ELMAR.2018.8534692.

[5] T. Osman, S. S. Psyche, J. M. Shafi Ferdous and H. U. Zaman, "Intelligent traffic management system for cross section of roads using computer vision," 2017 IEEE 7th Annual Computing and Communication Workshop and Conference (CCWC), 2017, pp. 1-7, doi: 10.1109/CCWC.2017.7868350.

[6] G. Karagiannis, O. Altintas, E. Ekici, G. Heijenk, B. Jarupan, K. Lin, and T. Weil. Vehicular networking: A survey and tutorial on requirements, architectures, challenges, standards and solutions. Communications Surveys Tutorials, IEEE, 13(4):584–616, 2011.

[7] L. Villas, A. Boukerche, R. Araujo, A. Loureiro, and J. Ueyama. Network partition-aware geographical data dissemination. In Communications (ICC), 2013 IEEE International Conference on, pages 1439–1443, 2013.

[8] A. M. Souza, G. Maia, and L. A. Villas. Add: A data dissemination solution for highly dynamic highway environments. In Network Computing and Applications (NCA), 2014 IEEE 13th International Symposium on, pages 17–23, Aug 2014.

[9] Albaladejo, C.; Sánchez, P.; Iborra, A.; Soto, F.; López, J.A.; Torres, R. Wireless Sensor Networks for Oceanographic Monitoring: A Systematic Review. Sens. 2010, 10, 6948–6968. [CrossRef] [PubMed]

[10] A. Vahidi and A. Eskandarian, “Research advances in intelligent collision avoidance and adaptive cruise control,” IEEE Trans. Intell. Transp. Syst., vol. 4, no. 3, pp. 143–153, Sep. 2003.

[11] A. Gonzalez, M. A. Garrido, D. F. Llorca, M. Gavilan, J. P. Fernandez, P. F. Alcantarilla, I. Parra, F. Herranz, L. M. Bergasa, M. A. Sotelo, and P. Revenga de Toro, “Automatic traffic signs and panels inspection system using computer vision,” IEEE Trans. Intell. Transp. Syst., vol. 12, no. 2, pp. 485–499, Jun. 2011.

[12] VISSIM Microscopic Traffic and Transit Simulation User Manual, V.3.70. PTV-AG, Karlsruhe, Germany, 2004.

[13] Mahmassani, H. S., S. Peeta, T. Hu, and A. Ziliaskopoulos. Dynamic Traffic Assignment with Multiple-User Classes for Real-Time ATIS/ATMS Applications. In Proc., Advanced Traffic Management Conference, St. Petersburg, Fla., 1993.

[14] User’s Guide, DynaMIT & DynaMIT-P, Version 0.9: Development of a Deployable Real-Time Dynamic Traffic Assignment System. Massachusetts Institute of Technology, Cambridge, 2000.

[15] Saad, A. A., El Zouka, H. A., & Al-Soufi, S. A. (2016, March). Secure and Intelligent Road Traffic Management System Based on RFID Technology. In Computer Applications & Research (WSCAR), 2016 World Symposium on (pp. 41-46). IEEE.