

A Survey of Smart Control of Traffic Light System using Artificial Intelligence

Ajith Kumar B P¹, Harsha Patel², Ompreeth D R³, Prathvik Raikar⁴

Professor, Department of Information Science & Engineering¹

Students, Department of Information Science & Engineering^{2,3,4}

Canara Engineering College, Mangalore, Karnataka, India

Abstract: *With a population increase and automobiles in cities, traffic congestion has become one of the most important concerns. Heavy traffic not only adds stress and delay to vehicles, but also rises energy pollution and consumption. Megacities are the most affected, despite the fact that it seems to be present everywhere. Because of this, real-time traffic density calculations are required for improved signal control and efficient traffic management. The traffic controller is one of the key elements affecting traffic flow. As a result, improving traffic management is required to better meet this rising demand. Our suggested system will employ artificial intelligence and image processing to determine traffic density using real-time images from traffic junction cameras. Additionally, it focuses on the algorithm for changing traffic signals based on vehicle density in order to lessen congestion, improve travel times for passengers, and cut emissions.*

Keywords: Image Processing, Traffic Density, Traffic Controller.

I. INTRODUCTION

To determine traffic volume using YOLO object recognition and set the signal countdowns appropriately, this dynamic signal timing timer uses live images from vehicle intersection camera systems. As a result, there is less traffic on the roads, people can travel faster, and less fuel is used. With enormous increase in population, traffic congestion is becoming highlighting issue of today's era. Congestion on Pakistan roadways are never been really worse, and with increasing traffic accidents our roads are life threat of everyday routine.

The key to this solution is to suggest a traffic signal that can detect areas of high traffic and highlight a schedule of which lane is congested and at what times. The next step will be to analyse the data and determine a logical and practical schedule for applying intelligence. Traffic lights can communicate once we have a proper congestion schedule. Congestion can be lessened by this communication.

People frequently end up in life-threatening situations because they lack traffic sense and do not obey the rules of the road (Cohen 2014). We waste tens of thousands of hours each day driving around and honking at people. Future generations will be gasping for a breath of fresh air as a result of the threat getting worse every year.

Congestion can be lessened by this communication. Imagine a signal in the middle of an intersection where traffic is flowing from four different roads at once. Therefore, we will propose a traffic signal that can act in accordance with provided data and adjust themselves to display red, yellow, and green lights in order to ease congestion.

With the massive growth in population, traffic congestion is now one of the most prominent problems facing modern society. Roadway congestion in Pakistan has never been significantly worse, and daily life is endangered by the rising number of traffic accidents.

II. LITERATURE SURVEY

The approach put forth in paper [1] proposes a system for image-processing-based control of traffic lights. Instead of using electronic sensors, the method recognizes vehicles using pictures. A camera would be installed near the traffic signal. Image sequences would be managed to capture. Image processing is an improved technique for controlling the traffic light's transient state. It shows that because it uses actual traffic images, it is more reliable in evaluating motorised vehicles and can reduce congestion issues and time lost by a green light on an empty road.

In contrast to the current detection system, the method proposed in the paper [2] Vehicle travel should be straightened out to reduce carbon dioxide emissions by lowering stop-and-go times. Plan to smooth vehicle travels in two ways to



achieve the goal of reducing vehicle CO2 emissions: first, control traffic signals to allow vehicles to cross through intersections with little waiting time, reducing CO2 emissions during the idling period; and second, strongly suggest vehicles an appropriate speed before they actually try to enter the intersection, reducing CO2 emissions during the running period.

The method proposed in the paper [3] describes the design and improvement of an intelligent traffic management system that utilizes vehicular actuated sensing to dynamically enforce a controlled allocation of time duration. The goal is to reduce the amount of time that vehicles have to wait at intersections, which will lower overall emissions.

The approach recommended in the paper [4] involves using a smart traffic diversion system to lessen the incredibly heavy traffic and road congestion. By using sensing devices to measure weight and transmit the results to a traffic light PLC, which controls the traffic diversion, this would operate. The following are a few of the difficulties encountered in this area. Emergency Vehicle Is Immobilized Reduce Traffic Data on four Way Junctions in Congestion, Central Server Location, Human-Free Smart Traffic System.

The paper [5] Make the case that the main objective of this effort is to show the Traffic Department how to collect data in the field in real time. After that, analytics as well as outcome can be newly introduced traffic police and interacts with software through a Graphical User Interface (GUI).

The technology used as an optimization model in paper [6] was formulated as a multi-dimensional search problem with the aim of obtaining the smallest product of variance in travel time per unit distance of transportation and cumulative travel time associated with urban street network. A genetic algorithm was used to arrive at the model's solution. A simulation control protocol that is integrated into the PARAMICS software tool and is capable of conducting an area-wide micro simulation is used to design the logic frame and function module of the area-wide traffic signal control system.

The strategy outlined in the paper [7] It was believed that the Field Programmable Gate Array controller, which is based on the Neuro-Fuzzy system, would offer a practical Congestion Control solution. It has the potential to lessen the drawbacks of conventional traffic control because of the accuracy of the provided variation in green cycle referencing on the heavily congested loads that changed at every line of traffic in a four-legged intersection.

A cellular crowd sensing technology had also been described in the research [8], particularly focused on accurate lane detection various approaches and adaptive traffic control techniques to enhance drivers' route planning decisions to avoid traffic. One of the greatest possibilities for India's adaptive traffic control system is recommended crowd sourcing.

This "elimination pairing system" used to represent the future research directions in the study " Technology for signal timing sequence design in overpopulated areas [9]. Vehicle delay and stop-start statistics were created as an object function. The object function has been utilized to determine the total estimated value. The results obtained were compared with intersection control software and the standard traffic signal timing conceptual design, Webster. Webster produces very spectacular outcomes, but Elimination Pairing Systems generated more accurate ones. As a result of that study, the elimination pairing system may be created to lengthen the duration of traffic signals.

Its aspects relevant in the research [10], which is based on a generalized probability sampling rule. There exists a dynamic inclusiveness that is produced, but there has been using a modification of the reflection theory to demonstrate both the existence and, in the specific instance of perpendicular phases, the originality of constant solution. In order to demonstrate stability, the generalized proportional allocation controllers are then assessed as coefficients of a specific entropy-like function and applied as a nonlinear system for the isolated circuit.

S1 no	Title	Existing System	Methodology/ Algorithm	Drawback
1	Traffic Control Using Digital Image Processing	The vehicles are detected by the system through images instead of using electronic sensors.	Edge detection/ image processing technique	Traffic congestion, red light delays, wasting of time.
2	An Open Traffic Light Control Model for Reducing Vehicles' CO2 Emissions Based on ETC Vehicles	To reduce vehicle's CO2 emissions, vehicles' travel should be smoothed by reducing the stop-and-go times.	A branch-and-bound based real-time traffic algorithm	The influence brought by the different ETC penetrations and the communication failed considered.



3	Intelligent Traffic Light System for Green Traffic Management	development of an intelligent traffic control system that dynamically implements a controlled allocation of green time using vehicular actuated signaling.	Novel algorithm	If no islands are available, pedestrians find it difficult to cross the junction
4	Smart Traffic Light System by Using Artificial Intelligence	For this method of reducing the heavy traffic and congestion from road we are using smart traffic diversion system.	PLC Algorithm	Excessive delays, diversion of signals to inadequate of alternate roads
5	Traffic Cop Android Application for Management of Traffic Violations	In current system whenever vehicle driver breaks any rule then police officer catch him and ask for his license.	Global Positioning System (GPS).	Internet connectivity or wireless network is compulsory to transmit the data.
6	Area-wide traffic signal timing optimization under user equilibrium traffic	The optimization model was formulated as a multi-dimensional search problem aimed to achieve minimized product of the total travel time associated with urban street network and the variance of travel time for unit distance of travel	Multidimensional search problem	More time consume for the red light
7	Traffic control system based on Field Programmable Gate Array	Field Programmable Gate Array controller based on Neuro-Fuzzy system thought provided effective solution for Traffic Control	Neuro-Fuzzy system	Reconfigurable computing, high speed
8	Adaptive traffic control systems with VANET	Focused on reliable traffic prediction approaches and various types of adaptive traffic control algorithms also proposed a mobile crowd sensing technology to support dynamic route choices for drivers to avoid congestion	Adaptive traffic control algorithms	It has trouble to unknown processes or arbitrary disturbances.
9	Traffic signal timing at oversaturated intersections was expressed as the elimination pairing system	An object function with vehicle delay and stop-start numbers has been generated. Total cost value has been calculated according to the object function.	The elimination pairing system	vehicle delay
10	Dynamic feedback traffic signal control policies	This based on a generalized proportional allocation rule. There results in a differential inclusion for which there prove existence and, in the special case of orthogonal phases, uniqueness of continuous solutions via a generalization of the reflection principle.	A generalization of the reflection principle	The rear end collisions are common in very highly populated cities

Figure 1: Analysis Table

III. PROPOSED SYSTEM

The primary goal of the paper is to develop an artificial intelligence-based traffic light controller that can adjust to the current traffic conditions. This system aims to use live CCTV video feed from intersections to determine the traffic density and adjust the green signal timing. The traffic density will be calculated by the scheduling algorithm

IV. FINAL ANALYSIS

The goal of this systematic review is to develop a self-adaptive algorithm to control road traffic that is based on artificial intelligence to enhance the traffic management system. At intersections, improving traffic flow and cutting CO2 emissions, this new system reduces congestion. Image processing is being used in this method of assessing traffic systems. When using pictures from a tape or carriage, this is avoided, and pictures taken while recording are combined into a series of pictures.

REFERENCES

- [1]. Chandrasekhar. M, Saikrishna. C, Chakradhar. B, Phaneendra Kumar. P & Sasanka. C “ Traffic Control Using Digital Image Processing” by Department of Electronics and Communications Engineering, Students of KL University, Greenfields, Vaddeswaram, Guntur District, A.P, India.
- [2]. Chunxiao, Shigeru Shimamoto an Open Traffic Light Control Model for Reducing Vehicles’ CO2 Emissions Based on ETC Vehicles by IEEE Transaction on vehicular technology in Jan 2021.
- [3]. Habibu Raibu, Hassan Bashir Intelligent Traffic Light System for Green Traffic Management 1st International Conference on Green Engineering for Sustainable Development, IC-GESD 2015 at Bayero University, Kano.
- [4]. L.F.P. Oliveira, L.T. Manera, P. D. G.Luz Smart Traffic Light System by Using Artificial Intelligence, Dept of semiconductor, Instrumentation and photonic, University of Campinas, Brazil.
- [5]. Ms. Deshna Patil, Ms. Nikita Dhankute, Ms. Shubhangi Gedam, Prof. Ashish Palandurkar Traffic Cop Android Application for Management of Traffic Violations Department of Computer Science and Engineering, Nagpur Institute of Technology Nagpur, Maharashtra, India.
- [6]. Jianhua Guo, Ye Kong, Zongzhi Li, Wei Huang, Jinde Cao, Yun Weid Area-wide traffic signal timing optimization under user equilibrium traffic Intelligent Transportation System Research Center, Southeast University, Nanjing, China, Illinois Institute of Technology, IL, USA.
- [7]. M. F. M. Sabri, M. H. Husin, W.A.W.Z.Abidin, K.M.Tay, H.M.Basri Traffic control system based on Field Programmable Gate Array International Journal of Advanced Research in Artificial Intelligence, Vol. 1, No. 3, 2012
- [8]. Pavan Kumar and Dr. M. Kamala kumara “Adaptive traffic control systems with VANET ”Continent Transportation Research Symposium, Ames, Iowa, Iowa State University, August 2005.
- [9]. Ekinhan Eriskin “Traffic signal timing at oversaturated intersections was expressed as the elimination pairing system” 10th International Scientific Conference Transbaltica 2017: Transportation and Technology.