



Review Paper ON "Smart AI Based Traffic Control"

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Abstract: Real-time tracking is possible with the car tracking service. Our car detecting system is open-source. The emergency vehicle regularly updates the GPS server with its latitude, longitude, and speed. Fire engines, police cars, and ambulances must get at their destination as soon as possible. With more people living in cities and more cars on the road, traffic congestion is turning into one of the major issues. Unnecessary path delays may eventually result in hazardous situations. It could harm people or property. The time it takes for emergency vehicles to go from their starting point to their final destination is one of the most significant delays.

The findings imply that the suggested strategy is the best way to reduce the wait times that emergency vehicles encounter while traveling their routes. The goal of our suggested method is to compute traffic density using AI and image processing using real-time footage from intersection cameras. In order to ease traffic congestion, speed up travel, and cut down on pollution, it also relies on algorithms that change traffic signals according to vehicle density.

Keywords: traffic light system, traffic control, traffic management, intelligent transport system, smart surveillance, computer vision, machine learning, object detections

I. INTRODUCTION

The prompt arrival of emergency services can significantly impact lifesaving in today's hectic metropolitan settings. By putting into practice a cutting-edge AI-powered traffic light control system, this initiative seeks to address this issue. Our system can precisely track the location of emergency vehicles in real time by incorporating GPS-based pre-emption technology. Artificial intelligence algorithms then process this data, enabling the system to dynamically modify the timing of traffic lights in the path of the vehicle. As a result, traffic moves more smoothly and effectively, giving emergency personnel clear routes.

The importance of emergency vehicles in saving lives might be the first point in your AI-powered Traffic Light Control with GPS-Based Pre-emption for Emergency Vehicles project's introduction. Stress how crucial effective traffic control is to ensuring these trucks can move quickly. Present the idea of GPS-based pre-emption as a remedy that maximizes traffic light regulation by utilizing artificial intelligence. Your audience could be interested if you emphasized the possible effects on response times and the general effectiveness of emergency services.

Traffic control systems are being revolutionized by Intelligent Traffic Management (ITM). When combined with GPS-based pre-emption for emergency vehicles, AI integration in traffic light control improves overall efficiency. By dynamically modifying traffic signals in response to real-time GPS data, this system gives priority to emergency vehicles, guaranteeing quick and secure travel in emergency situations.

II. LITERATURE REVIEW

This suggests a system based on Arduino and UNO with the goal of lowering waiting times and traffic congestion. This system uses a camera to capture photos, which are then processed in MATLAB to determine traffic density and create a threshold image by eliminating saturation and hues. The preinstalled simulation packages and USB are used to link MATLAB and Arduino. The Arduino determines how long each lane's green light will last based on traffic density and volume. Yet, this approach has a number of shortcomings [1].

In Paper Kwon, Rober Betts, Sangho Kim, and Eil discuss combining a sequential dynamic pre-emption strategy with an online route selection module to minimize delays caused by needless pre-emption and clear traffic queues at intersections on a specific emergency route ahead of time for an emergency vehicle. A microscopic Simulation model, calibrated with the emergency vehicle trip time data gathered from the Sample network, was used to simulate this specific method in real traffic [2].

In the first stage, we use convolutional neural networks to detect cars; in this case, we used the net You Only Look Once (YOLO); in the second stage, we use a tracker to focus each car; and in the final stage, we use a Support Vector Machine (SVM) and the Violent Flow (ViF) descriptor for each car to detect car crashes [3]. Kushi presented "Smart control of traffic light system using image processing" at the 2017 International Conference on Current Trends in Computer, Electrical, Electronics, and Communication (CTCEEC) [4].

Traffic congestion is becoming a significant issue in the modern period due to the increasing number of motor vehicles brought about by the busy urban lifestyle and population growth (Carley and Christie, 2017) [5]. Yuvaraj, N. V. B. Prakash, and D. Venkatraj, the paper's authors, clarify that it has to do with controlling automated traffic signals in a way that prevents regular signal operation and allows for life-saving vehicles (2017). It can be thought of as a hybrid of differential GPS and pervasive computing [6].

With this approach, you can anticipate quantifying traffic by calculating the number of vehicles in each lane and their weight, after which you can diverge them similarly (Soh et al., 2010) [7].

III. PROBLEM DEFINITION

The inefficiency and lack of optimization in the traffic light control system, especially in urban areas, is the stated problem. Traffic jams, lengthier travel times, and challenges for emergency vehicles to manoeuvre through the city during emergencies are all consequences of inefficiency. Thus, efficiently controlling urban traffic flow and guaranteeing prompt emergency response in densely populated areas are the main issues.

In order to overcome these obstacles and enhance overall traffic flow and emergency response effectiveness, it recognizes the need for a system that combines AI-powered traffic signal control with GPS-based pre-emption for emergency vehicles.

- Emergency vehicles' GPS locations are automatically updated
- Designing and implementing an AI-powered traffic light control system with GPS-Based Pre-emption for emergency vehicles is the main goal. • Turn traffic signals green when emergency vehicles approach them.
- To identify the automobiles.
- By utilizing real-time GPS data, this system seeks to dynamically improve traffic light timings, giving priority to emergency vehicles.
- Create algorithms that can dynamically modify traffic signal timings in response to emergency vehicles' incoming GPS data.
- Put policies in place to effectively handle emergency vehicle movements while reducing interference with normal traffic patterns.

V. METHODOLOGY

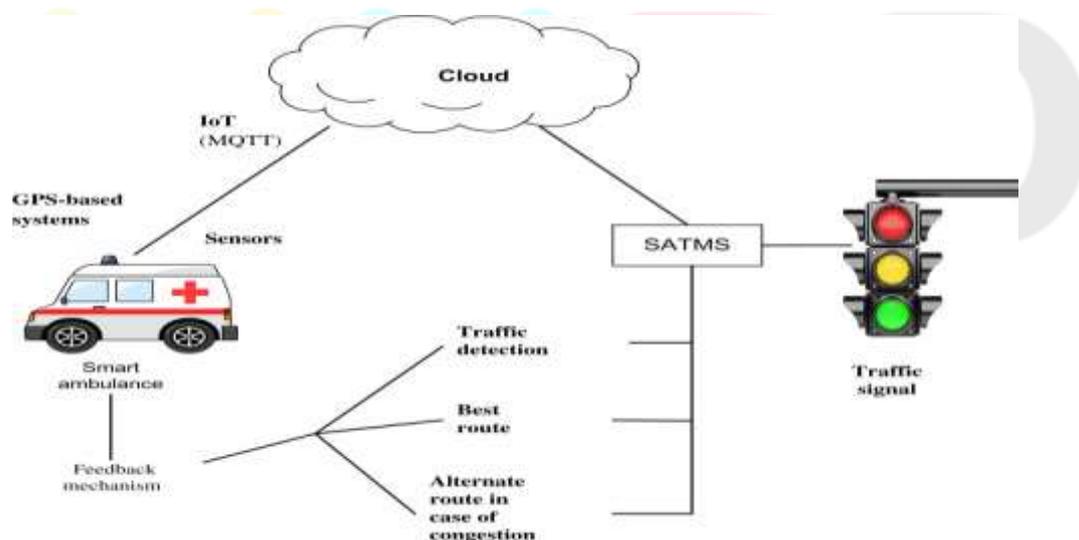


Figure 1. AI Based Pre-emption for EV

When an emergency occurs, the driver of an emergency vehicle (EV) activates the pre-emption system. The system uses input data to determine the E.V.'s current position, and the driver enters the destination's location on a map. The map provides the system with longitude and latitude information, such as the street name, house number, school, station, etc. The system is being designed by breaking it up into two main components:

A. Side of an emergency vehicle.

B. Side of the traffic light.

A. Side of an emergency vehicle

The string sent by the National Marine Electronics Association (NMEA 0183) protocol is first read at the vehicle unit via a communication link to the GPS receiver [7]. The vehicle's longitude, latitude, and speed are all contained in the retrieved data as a string of characters.

When the pre-emption system is first started, the traffic light position is only delivered once. Until the pre-emption system is stopped, the vehicle position is sent on a regular basis. Position information is supplied to the traffic light controller via SMS using a GSM model with a chosen SIM card number that serves as the traffic light identity.

B. Side of the traffic light.

The purpose of this unit is to receive position data and respond appropriately. It is equipped with a microcontroller and a GSM modem that are connected to the traffic light.

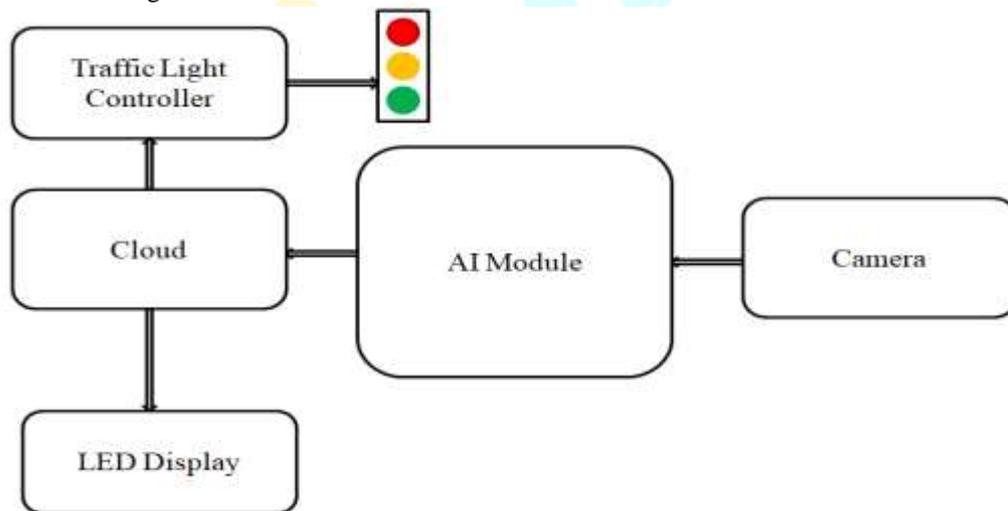


Figure 2. AI Traffic Light Control System

For managing traffic congestion in large cities, our suggested approach offers a special and ideal answer. The camera module in this traffic control system records the video. The camera sensor converts the movies into images, which are then processed using a variety of algorithms before the computer outputs the visual count of vehicles.

Traffic lights are changed and a timer is shown on the LED display based on the final output.

YOLO ALGORITHM

Because of its accuracy and speed, the YOLO (You Only Look Once) algorithm has become a popular real-time object detection system. YOLO uses a neural network to process the entire image in a single forward pass, directly predicting bounding boxes and class probabilities for items that are discovered.

SIGNAL SWITCHING ALGORITHM

All signals' red, green, and yellow times are improved using this technique. The number of cars in each class, as determined by the vehicle detection module, as well as numerous other variables including the number of lanes and the average speed of each class of vehicles, are the basis for setting these times.

VII. CONCLUSION

To sum up, the suggested AI-powered traffic signal control system with GPS-based emergency vehicle pre-emption is a major step forward in tackling the problems associated with emergency response and urban traffic management. The system provides a dynamic, flexible, and data-driven method for optimizing traffic flow and giving priority to emergency vehicles by utilizing AI and GPS technologies. It seeks to improve overall urban mobility, decrease emergency vehicle response times, and smooth out traffic flow by utilizing AI algorithms and GPS. The project attempts to offer concrete answers for enhancing public safety and urban mobility through the creation of complex AI algorithms and the use of GPS-based pre-emption. The goal includes reducing emergency response times, improving traffic flow efficiency, and generally contributing to a more intelligent and adaptable urban infrastructure. The expected advantages, which include better traffic flow, quicker reaction times, and more efficient use of resources, highlight how this approach

could have a good effect on cities. The success of the system will be further confirmed by simulation and testing in the real world, which will also give policymakers and urban planners useful information. As time goes on, it becomes increasingly necessary to include cutting-edge technologies into urban design. The research's conclusions not only add to the current discussion on intelligent traffic management, but they also set the stage for an urban environment that is more responsive, robust, and efficient. A step toward more responsive and intelligent urban infrastructure is represented by this system.

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