

# A Vision Based Approach for Optimal Real Time Road Traffic Control Application

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## Abstract:

*A non-linear increase in the vehicle density is causing severe pollution problems and accidents in metropolitan cities. At the same time, there are no proportional enhancements in transport infrastructure, due to space and cost constraints, leading to road traffic congestion raising a main concern for pollution. This paper proposes a vision based approach using vehicle density measurement method which a closed loop imposing statistical control strategy for optimal traffic controls.*

**Keywords :** road traffic congestion, vehicle density measurement method, closed loop, statistical control, real time traffic control, optimal traffic control

## I. Introduction

Road traffic congestion is a recurring problem worldwide. Non-optimal traffic controls, non-favorable road conditions and undisciplined traffic are the major contributing factors for such traffic congestions. Road traffic congestion results in long waiting time, wastage of fuel, increased air pollution and carbon dioxide emissions, stressed and frustrated motorists, road accidents etc. Therefore it is necessary to have a fast efficient road traffic control system. Intelligent traffic management will help to avoid the road traffic congestion issues to a certain extent [1]. To solve the problem of road traffic congestion at traffic signal, government has to find new methods to monitor and control the traffic. One way to solve the problem of traffic congestion is to give an efficient, real time control strategy that will control the traffic based on vehicle flow measurement/ density for the smooth flow of traffic. The paper proposes a vision based approach for road traffic control. The

main emphasis is given to maintain the equal traffic density in all the directions of traffic signal and avoid the traffic congestion. By using image processing the vehicle flow is measured and the traffic signal is controlled in real time.

## II. Related Work

Generally to control the traffic at traffic signals, traditional methods like, "Traffic police at traffic signal" and "Automatic traffic management system" are used. During the past 20 years, however the emphasis has shifted from traditional techniques to some advanced techniques. But all these are open loop control systems. In most vehicle detection methods in the literature, only the detection of vehicles in frames of the given video is emphasized. However, further analysis is needed in order to obtain the useful information for traffic management such as real time traffic density. In this section, various solutions to the traffic congestion problems suggested in the literature are presented:

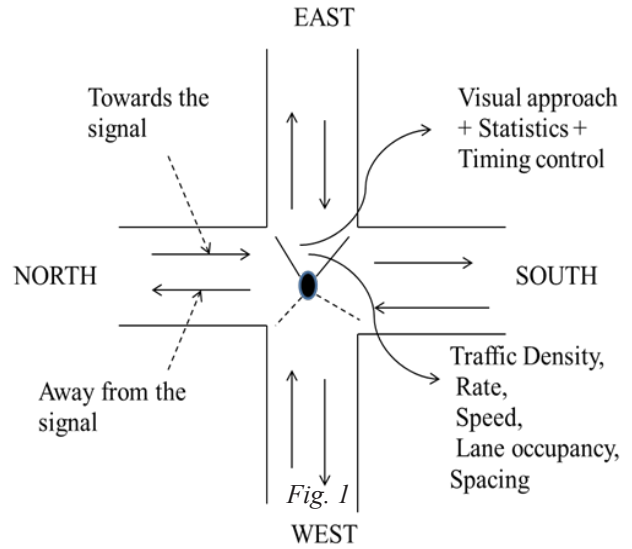
- A. Embedded System: The author Zhang Yuye et.al.[2] system use AT89C51 and CAN BUS controller which leads to complicated design and cost of the system more because of CAN BUS controller. Intelligent Traffic Signal Control System by Dinesh Rotake and Prof. Swapnili Karmore [3]. Here system uses IR sensors, AVR-32 microcontroller with programmable flash memory and built in 8-channels ADC. Here IR sensors are used, due to various climate conditions present in India, IR sensors may need to keep in safe place or a strong box.
- B. Wireless Sensor Network: Priority Based Traffic Lights Controller Using Wireless Sensor Networks by Shruthi K R and Vinodha K [4].

System uses fuzzy logic to define direction of emergency vehicle. Communication in Wireless Sensor Network is still a research field. Data exchange in between Sensor is not reliable and as specified before Sensors need to become robust in order to survive in Indian weather.

- C. Active RFID & GSM technology: Road Traffic Congestion Monitoring and Measurement using Active RFID and GSM Technology by Koushik Mandal, Arindam Sen, Abhijnan Chakraborty and Siuli Roy[5]. Involvement of various communication devices makes implementation costly.
- D. Image processing: Image Processing Based Intelligent Traffic Controller by Vikramaditya Dangi, Amol Parab, Kshitij Pawar and S.S Rathod [6]. Images extracted from the video are analyzed to detect and count vehicles. Then depending on the signal cycle, time is allotted to each lane. The system also takes into account the emergency vehicles at the intersection. If such a vehicle is detected, the lane is given priority over the others. Camera used, have to be robust. When ambulances arrive from more than one lane system fails, it gives green light to all lanes. The author Promila Sinhmar et.al. [7] the system use Image processing to traffic light control and monitoring system. The System is connected to a computer through a serial communication cable, so hardware cost is more.

### III. A Vision Based Approach

In contrast to above mentioned techniques, video-based systems offer many advantages. They provide more traffic information, combine both surveillance and traffic control technologies, are easily installed, and are scalable with progress in image processing techniques. Traffic flow can be observed from a centre and statistics can be made [8]. It is shown in the Fig. 1.



*Visual approach and Statistics used to control a signal*

If the traffic light timers are showing correct time to regulate the traffic, then the time wasted on unwanted green signals (green signal, when there is no traffic) will be saved. Timer for every lane is the simplest way to control traffic. If those timers are predicting exact time then automatically the system will be more efficient. Traffic systems design and urban planning can be very efficient by basing them on the statistics taken from computer aided traffic systems. We are using computer aided image processing to attain optimal support. To manage the traffic at traffic signal we will install CCTV cameras on the pole of traffic signal which will capture the image sequences, these sequences are analyzed by using image processing, system will count the traffic density by counting the number of vehicles and accordingly the traffic light will be controlled so that the traffic density in all the directions will remain the same. This will avoid the traffic congestion at traffic signal.

### IV. Control Strategy and Data Analysis

System architecture for the optimal road traffic based on image processing is shown in the Fig. 2. Development of statistical and mathematical model will involve modeling the techniques for traffic measurements and analysis, developing the computer simulation models for devising the optimization algorithms, and converting the same or real time applications.

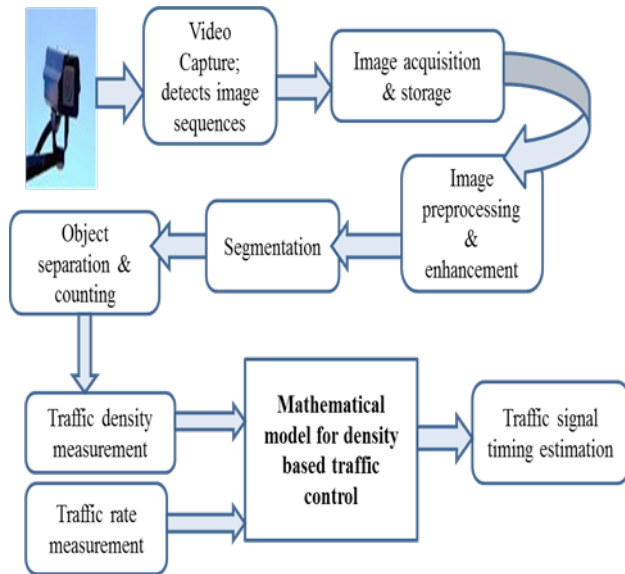


Fig. 2  
System Architecture

The collected data will be tabulated and processed by employing suitable statistical tools. Simulation is performed using MATLAB Software. It is a tool used for formulating solutions to many technical computing problems, especially those involving matrix representations. This tool emphasizes a lot of importance on comprehensive prototyping environment in the solution of digital image processing. Vision is most advanced of our senses, hence images play an important role in humans' perception, and MATLAB is a very efficient tool for image processing

## V. Future Work

After surveying various traffic management schemes, we can conclude that traffic management using Image Processing is suitable for implementation. Though there are some drawbacks which can be overcome by adding some features from other technologies. Whereas other techniques are costly and not suitable in Indian conditions, so there is lot of research going in use of Image Processing for traffic management. One can use Audio processing technique in order to decide whether ambulance is in emergency or not. Also, speed of vehicles can be detected and eventually it can help the traffic management system and the police to get better control over the traffic flow of the particular location.

## VI. Conclusion

The above paper presents the method of traffic light control through image processing. The earlier techniques had a drawback that, these techniques are not dependent on the real time traffic. Our implemented system avoids this problem. We have successfully implemented real time image processing based traffic light controller as a pilot project.

This paper illustrates that image processing is the best way to control traffic when it comes to real time feedback. The key feature of this paper is that it removes the need of hardware sensors such as infrared sensors and RFID tags and it visualizes the reality so it functions much better than those systems that rely on the detection of vehicles metal content.

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