Density Based Traffic Control System and Green Light Transition Time Estimation using Image Processing

G. Venkateshwaran[1,*], J. Surya[2], A. Mohan Rajan[3], and Dr. C.Sujatha[4]
[1,2,3] Department of ECE, SSM Institute of Engineering and Technology, Dindigul, Tamilnadu-624002 India
[4]Associate Professor, Department of ECE, SSM Institute of Engineering and Technology, Dindigul, Tamilnadu-624002 India

I.

Abstract

Traditionally, equal weightage has been given to the traffic signals to undergo transitions at each side of the junction. In metropolitan cities, this system would give rise to tremendous delay effect which is discomfort to the commuters. Traffic congestion affects the daily routine of passengers and in the long run there will be a declination in productivity if such situation is not addressed effectively. If an Ambulance, unfortunately got stuck in the middle of congested road, any further delay can endanger the life of the patient and many such cases require intelligent, powerful and reliable traffic control system. With the emerging technology such as advanced version of Microcontrollers, Sensors, etc., the smooth functioning of traffic signal system can be attained. For instance, in the density based traffic control system, the interface between IR Sensors and Microcontrollers System on Chip (SoCs) keeps track of vehicle's density across the lane. The microcontroller in response to sensor's output generates the control signals to alter the traffic signals accordingly. During each transition phase, the Voice Recognition (VR) modules installed on different lanes sense the emergency vehicle's siren and thus temporarily allow passage to such vehicles by turning the signal "green" for the corresponding lane, while others being remained at "red".

Using Image Processing analysis, the exact count of vehicles can be visualized in the GUI Tool (created using MATLAB®) and the green light timings for the "consecutive turns" can also be estimated. Due to globalization, the vehicle density is increasing year-by-year, hence we took the motives to propose an improvement in the existing system. We have included larger number of sensors for accuracy as well. In future, we will interface the Image Processing result and the embedded part (the one with separate program running on micro-controller) to get accurate timings to switch to different lanes and circumvent delay issues.

Keywords - *ATmega2560, Infra-Red (IR) Sensors, Edge detection (Image Processing), GUI (Graphical User Interface).*

II. I. INTRODUCTION

Vehicle density [1] at any traffic junction is a probabilistic event [2], hence it becomes complex to monitor their counts at a given time. However, the objective of traffic research is to regulate or smoothen out the flow of traffic in order to suppress the unintentional delays and deliver comfort experience to commuters. Though there are many existing models/methods available to control the traffic signals using IR sensors and the micro-controller, but we felt "incorporating/*embedding* the so-called "density [3] mode" into the "normal/traditional mode" will surely change the way the traffic control [4] system operates." In this research, we have tried to emphasize this effect, and the algorithm used can be made compatible to multiple junctions by modifying (manually) just one section of code (say a control function). Secondly, the VR module installed on each and every junction can handle the emergency situations by diverting the normal transitions of traffic signals into "emergency-mode". For convenience, the setup of the proposed system is shown in Fig 1.

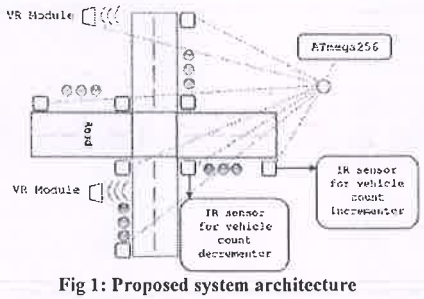

Fig 1: Proposed system architecture

Using image processing [5], the misinterpretation issues in vehicle's count can be addressed effectively. The Image Processing part offers parameters such as percentage match, vehicles count and green light timings, as discussed in design and development section. In future, the correlated version of embedded and image processing part will surely provide "All-in-One" support for traffic research. Notice the position of IR sensors, the one at the extreme end of the road counts the vehicle entry and the other near the traffic post decrements the vehicle's count. Though the logic can be achieved using single sensor but for accuracy