Contemporary Engineering Sciences, Vol. 8, 2015, no. 1, 7 - 11
HIKARI Ltd, www.m-hikari.com
http://dx.doi.org/10.12988/ces.2015.411247

Time-Sensitivity Based Traffic Control System

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Abstract

This capstone project tries to develop a robust nighttime traffic surveillance system which reuses roadside cameras to capture scenes, automatically analyze the traffic and particularly focuses on nighttime surveillance problem. The system consists of a preprocessing module, responsible for offline configuration for each specific traffic scene and a traffic analyzing module, dealing with real-time detecting and tracking vehicles in the scene. The traffic information obtained from the system during the surveillance includes number of traffic lanes in the scenes, location of vehicles on the lanes and their travel status. The system has been tested on different nighttime scenarios and proven to provide robust performance in both accuracy and processing speed. The purpose of this project is to reduce the lead time of the commuters near signals to reach their destination sooner and also to avoid accidents by introducing TSS (Traffic Surveillance System) which monitors the density of the traffic by giving feedbacks to the signal system to change into the desired triggers(red or green) at variable timings. This system also includes the advanced techniques of night surveillance system which is useful for commuters in the night time, thereby help the passengers to have a safe trip.

Keywords: TSS, Robust Nighttime Traffic, Accident Avoidance

1. Introduction

During the peak hours in cities like Mumbai, Chennai, etc., the commuters get stuck at traffic signals, causing delay to reach their destination in time. The traffic signals used in Indian are fixed to certain timing (e.g. 60s, 120s, etc.). Due to this timing constrain, vehicles get exhausted before the signal turns to red and stays emptied till the allotted time, causing the other side of the commuters yet to move to be idle till next trigger. Sometimes the mindset of drivers makes them move when the signals are still in red, during which road accidents are caused. Taking

these instances into consideration, this project introduces a TSS (Traffic Surveillance System) which reduces the lead time of the commuters near signals to reach their destination sooner and also to avoid accidents. TSS monitors the density of the traffic and gives feedbacks to the signal system to change into the desired signal triggers at the variable timings, which also includes the advanced techniques of night surveillance to have a safe trip. The outcome of Nighttime Traffic Surveillance is integrated with an existing Daytime Traffic Analyzer creating a robust system for Traffic Surveillance for both day and night time.

2. Literature Survey

Yoshida and Shirmila (2002) proposed a vehicle classification system, which is based on local-feature configuration. They demonstrated vehicle recognition in outdoor environment. The algorithm is based on the Eigen-window method. This method has 3 advantages: (1) Occluded vehicles detection, (2) Detect even if vehicles are translated due to veering out of the lanes, (3) Does not require segmentation of vehicle areas from input images.

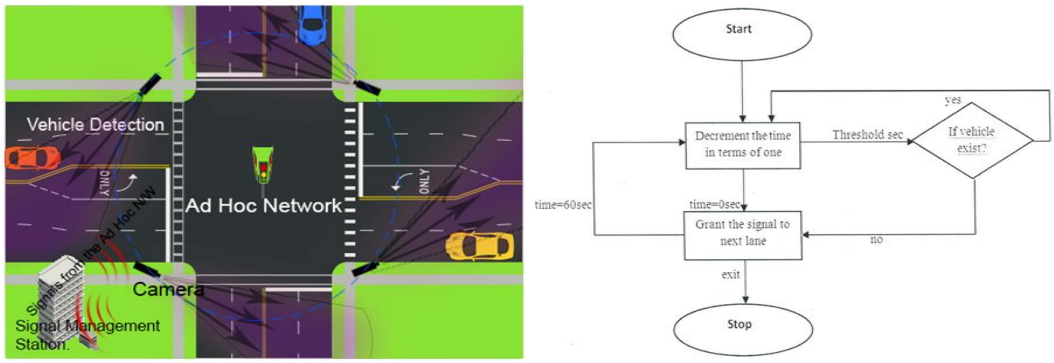
Manikandan and Srinivasan (2012) proposed an app which controls traffic signal remotely using Bluetooth enablement in a PC. Applications like emergency system and road map can also be used in it. The app is based on client-server management system making use of java technologies.

There was a study made by Mohan and Shobha (2007) in depth about the RFID technologies and its application, which incorporates the use of electromagnetic or electrostatic coupling in the radio frequency for identifying any object. They have stated even the benefits and an insight of the technology behind the RFID systems. A few applications based on RFID were proposed: Anu and Mala (2013) proposed an RFID based tracking system which carries out the following procedure: RFID data is generated from RFID tagged passports and the obtained data is queried using map reduce method from the data sent from different countries to the origin country. The info about migrants is then organized to reduction of complexity.

Another tracking system using RFID was proposed by Jeba and bevish (2010) were RFID is used to monitor sponsored vehicles, by eliminating the chance of user counterfeiting there usage. This eliminated factors like implementation of smart roads that is, roads free of traffic sign boards and speed limit boards by possibly making through In Vehicle Display Module (IVDM). The Tag Nodes are burned with necessary road safety information. Easy location of places is another application projected in this system, which helps visitors and tourists.

3. System Overview

The Traffic Surveillance System is divided into modules. By default the traffic signal timing is set to 60 seconds. An option for system user to vary those timing based on the density of the traffic is also provided. Once traffic signal timing is fixed, then the camera is connected. The overall architecture and Flow diagram of the system is shown in Figure 1 below:



1(a) 1(b)

Fig 1. (a) System Architecture; (b) System Flow Diagram

(1) Initially green signal is granted to north lane of the circle with 60sec.
(2) Thereafter precede clockwise manner.
(3) Traffic signal time starts decrementing by 1s.
(4) Calculate Threshold value for traffic signal timing simultaneously.

a. Using the Threshold value grant the 70% allotted traffic signal timing.
b. After 70% of the time, the system checks whether vehicles exist or not.
   i. If vehicles exist then allotted timing is untouched
   ii. Else the set time to 3sec, grant green signal to next lane and red to current

(5) When time reaches the threshold value, density of vehicles is checked.
(6) Objects motion is identified using frames collected from the video
   a. If no vehicles exist in current lane, it signals time and signal management module to set the traffic signal time and grant signal to next lane.

The Webcam is interfaced to the traffic surveillance system, allows fetching frames needed for motion detecting and provide Traffic police to capture the scene of the road when commuters violate the traffic rules using capture button. The UI designed for the system is shown in Figure 2 below:

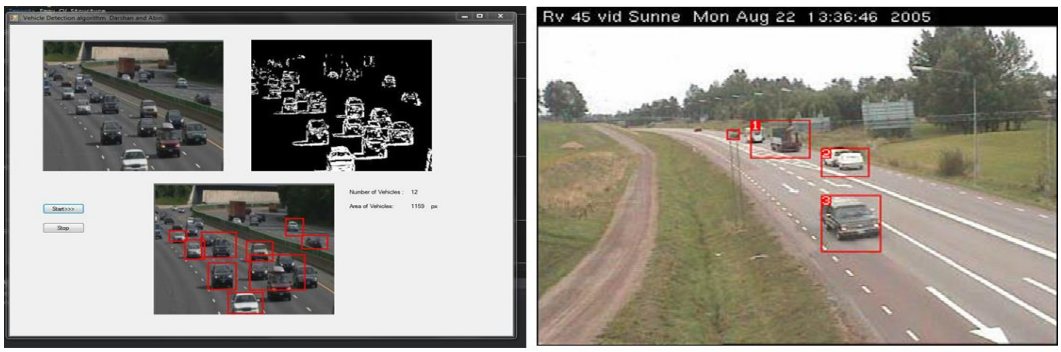


Fig. 2 Traffic Videos in UI

4. Output with Description

The output obtained consists of a form in which the videos snaps of the road are inserted which consists of textbox showing the number of vehicles and density of Traffic on each lane. Based on the density of the Traffic firstly green signal is granted for a particular lane. Once the traffic signal timing reaches the threshold timing, then the system has to check whether the vehicles exists or not which is done by motion detecting module.

Sequence	No. of Vehicles	Accuracy
Video 1	38	96.33%
Video 2	48	99.6%
Video 3	42	98.6%
Video 4	40	99.6%

Table 1. Performance Table

Scenario	Action	Result
Time Management	Switch signals appropriately	Signal Switching
Capturing Road Scene	Live capturing with camera	Display Road Status
Moving Objects Detection	Vehicle status check	Vehicle motion detected
Button Event	Capture and save Road Scene	Road scene snaps saved
System Snapshot	System Execution	Monitor vehicles & Switches Signal

Table 2. Experimental Results

5. Conclusion

In this System the Traffic signal timing will be changed based on the density of the traffic. The cameras capture the road scene at threshold by applying the algorithm on the frame, if no vehicles exists then the system grants the green signal to next lane of the circle, otherwise it doesn't. The system also provides option for Traffic Police to capture the commuters if traffic rules are violated, and could be proofed by pressing the capture button to take a snapshot.
The significance of TSS: (1) Saves time for about 30%, (2) No more waiting of vehicles in the lanes, (3) Prevents traffic jam effectively, (4) Time management is done based on traffic, (5) Synchronization of vehicles.

6. Future Enhancements

The following additional features could be imparted to the proposed system for future enhancement: (1) Automation in capturing snapshots of vehicles violating rules. (2) Detect vehicles in emergency and switch signals accordingly to favor them. (3) Night vision camera for Traffic Management Centre reduces accidents during nights. (4) Heat Recognition Thermal Sensitivity cameras would help in various ways. (5) High Resolution cameras for better view.

Acknowledgements. We thank Sathyabama University for providing us with various resources and an unconditional support for carrying out this work.

References

[1] Jeba Blessingson, W and Bevish Jinila, Y, Multi-utility/Tracing kit for vehicles using RFID technology, Recent Advances in Space Technology Services and Climate Change, RSTS and CC-2010.
http://dx.doi.org/10.1109/rstscc.2010.5712858

[2] Manikandan G. and Srinivasan S., Traffic Control by Bluetooth Enabled Mobile Phone, International Journal of Information Sciences and Computing, Vol. 6 No. 1 Jan 2012.

[3] Maria Anu, V. and Mala, G.S.A., Tracking international migration from RFID data using map reduce method, 5th International Conference on Advanced Computing, ICoAC 2013. http://dx.doi.org/10.1109/icoac.2013.6921998

[4] Mohan Kumar G and Shobha Reka, RFID and IT-2020, Journal of Information Science and Computing, Vol.1, No.1, Dec 2007.

[5] T. Yoshida and Shirmila Mohottala, Vehicle classification system with local-feature based Algorithm CG model images, IEICE Trans. Inf. Syst., vol. E85D, No.11, pp. 1745–1752, 2002.

Received: December 10, 2014; Published: January 6, 2015