**Literature Review & Thesis Writing**

**(IN 5910)**

**Assignment**

D.N.H Senevirathna

139180A

Faculty of Information Technology

University of Moratuwa

**Different Types of Vehicle tracking systems**

In their study, Benjamin Coifman, David Beymer, and coworkers have proposed a real time computer vision system for vehicle tracking and traffic surveillance under challenging conditions (Coifman et al., 1998). Their work is based on an algorithm to differentiate vehicles from shadows by Chao and coworkers (Chao et al., 1996). According to the study by Benjamin Coifman, David Beymer, and coworkers, the existing systems for vehicle tracking and traffic surveillance have problems with accurately tracking vehicles under conditions like congestion, occlusion, lighting transitions between night/day and day/night, camera vibration due to wind, and long shadows linking vehicles together. Therefore, in this system, they have proposed to track vehicle features instead of tracking entire vehicles, making the system robust and the system less sensitive to the problem raised in these challenging conditions. In their work, they have developed an algorithm and by tracking in daylight and nighttime conditions, the system itself allowed to choose the most appropriate features for the given conditions. The resulting vehicle trajectories from this system can be used to provide traditional traffic parameters as well as new metrics such as lane changes. This vehicle tracking system is suited both for permanent surveillance installations and for short term traffic studies. However this system has not been tested under all challenging conditions mentioned here due to space constrains. Furthermore they have detected some errors in flow and density primarily due to missed or over segmented vehicles by the system (Coifman et al., 1998).

A similar study has done by Dailey and his coworkers to extract vehicular speed information from a given sequence of real-time traffic images (Dailey et al., 2000). This work is based on two preliminary researches done on pixel speed estimation in images. First research they have based their work on is analysis of road image sequences for vehicle counting by Soh and coworkers (Soh et al., 1995). The other work they have refereed as the basis of their method is a study on tracking and segmentation of moving objects in a scene by Picton (Picton, 1989). In the work by Dailey and coworkers, a new approach is presented for extracting vehicular speed information from a given sequence of real-time traffic images. They have developed an algorithm to extract moving edges and process the resulting edge information to obtain quantitative geometric measurements of vehicles. They have stated that their approach differs from existing approaches because a simple geometric relations obtained directly from the image is used instead of using reference objects to perform camera calibrations. Furthermore they have mentioned this proposed method does not require an explicit camera calibration. The results presented in this report demonstrates the validity of their approach and shows that neither direct camera control nor placement of a calibration object in the environment is required. Even though this proposed approach is straightforward to extend to other related traffic applications, still there are some problems remain to be solved. In this system they have not addressed the effect of shadows and occlusion of vehicles which is a very common scenario in traffic surveillance applications (Dailey et al., 2000).

Noppadol Chadil and his coworkers, have proposed an open source GPS tracking system named as Goo-Tracking system using hardware and open source software (Chadil et al., 2008). The system is based on Global Positioning System (GPS) (Kaplan, 1996), General Packet Radio System (GPRS) (Bates, 2001), and Google Earth software (Google Inc, n.d.). The proposed system by Noppadol Chadil and coworkers includes a module based on Global Positioning System to locate vehicle, and a module based on General Packet Radio Service for message transmission. Multi Media Card (MMC) to temporary store location information, and an 8-bit AVR microcontroller. Their system is claimed to have shown great stability when it was tested, and by using the robust message transfer protocol most of locations were accurately acquired and transmitted to the server in real-time. They have proposed the Goo-tracking system to be used in fleet management in the future, and as a further enhancement, they have proposed it to be used for lost vehicle tracking by integrating with a car alarm system. The sensors are to report vehicle status information to the server, which will be useful for information processing and for intelligent tracking management[18].

By comparing two different approaches on vehicle tracking, the second approach based on GPS/GPRS appears to be simpler and feasible to implement with minimum effort and cost.

The above study shows certain limitations of both approaches on vehicle tracking.

Research Limitation

Real time computer vision system for vehicle tracking (Coifman et al., 1998) One major limitation of this system is the cost related with implementing

GPS tracking system (Goo-Tracking system) (Chadil et al., 2008)

A limitation of this system in practical usage is, it requires a GPS module to be implemented inside the vehicle. Therefore this method will not be suitable in applications like public traffic management.

Dileepa Jayakody, Mananu Gunawardana and coworkers have proposed an intelligent train tracking and management system to be implemented in Sri Lanka for the purpose of improving the existing railway transportation system. According to their study, the proposed system is a combination of technologies like Global System for Mobile Communication (GSM), Geographical Information System (GIS), Global Positioning System (GPS) and a custom software. The train location is to be identified using the Global Positioning System (GPS) technology, and for this purpose a GPS module is proposed to be installed inside the train. Furthermore, the obtained train location using the installed GPS module inside the train is proposed to be transferred to a central system using the Global System for Mobile Communication (GSM) technology. Once the data of train’s current location is received, the data is proposed to be processed using the custom software, and provide a visual positioning of train on maps using Geographical Information System (GIS) technology. In their study, they have mentioned that with the availability of this information, the administrative staff of Railway Department, like train controllers would be able to obtain more accurate details about train location and hence take more accurate decisions. At the same time, due to the availability of accurate, real time information including speeds of trains, the administrative staff is to be able to identify and address safety issues more effectively which occur in railway transportation system in a considerable frequency in Sri Lanka. Their study also shows that the collected data using the proposed system could be used for accurate scheduling considering the train arrival time and departure time at each station(Jayakody et al., 2011).

This system can be considered as a comprehensive solution for the current issues observed in the train transportation system. It is proposed to facilitate the real time train tracking, and to provide collected data to the railway administration to enhance the efficiency and safety of their service. But it mainly focuses on train administrative staff rather than the passengers, and also the cost of implementation and infrastructure cost will be considerably large. Furthermore, this system should be implemented within the railway department itself.

**GPS based tracking system for trains in Sri Lanka**(Gunasekara, 2006)

Gunasekara, N.S has proposed a system named “trianTracker” to function as an auxiliary system inside the control center of Railway Department of Sri Lanka, for the use of internal technical staff. The system is proposed to monitor the train movements electronically using Global Positioning System (GPS) technology. In his study, he has pointed out the importance of having the exact location of a train, especially during disastrous situations. In the proposed “trianTracker” system, the locations of trains are to be displayed on a digital map, for the reference of staff inside the train control center in of Railway Department of Sri Lanka. For this purpose, the retrieved location of a train using Global Positioning System (GPS) technology, is to be transferred using the Short Message Service (SMS) service of the wireless telecommunications service provider(Gunasekara, 2006).

The main disadvantage of the proposed system here is, it is available for the train control staff only. In this work, the train passengers have not been taken in to consideration. In contrast, the main objective of the CBTLS is to provide train location information to the general public.

References:-

Bates, R.., 2001. GPRS: General Packet Radio Service, 1st Edition. ed. McGraw-Hill Professional.

Chadil, N., Russameesawang, A., Keeratiwintakorn, P., 2008. Real-time tracking management system using GPS, GPRS and Google earth. IEEE, pp. 393–396. doi:10.1109/ECTICON.2008.4600454

Chao, T.-H., Lau, B., Park, Y., 1996. Vehicle detection and classiffication in shadowy traffic images using wavelets and neural networks, in: SPIE Proc. Presented at the Transportation Sensors and Controls: Collision Avoidance, Traffic Management, and ITS, Boston, MA, pp. 136–147.

Coifman, B., Beymer, D., McLauchlan, P., Malik, J., 1998. A real-time computer vision system for vehicle tracking and traffic surveillance. Transp. Res. Part C Emerg. Technol. 6, 271–288.

Dailey, D.J., Li, L., Northwest, T., others, 2000. Video image processing to create a speed sensor. Washington State Department of Transportation.

Google Inc, n.d. Google Earth. Google Earth Software. URL http://www.google.com/earth/ (accessed 2.1.08).

Gunasekara, N.S., 2006. GPS based tracking system for trains in Sri Lanka.

Jayakody, D., Gunawardana, M., Surendra, N.W., Jayasekara, D.G., Upendra, C., De Silva, R., 2011. GPS/GSM based train tracking system – utilizing mobile networks to support public transportation. Phanindhra Nath.

Kaplan, E.D., 1996. Understanding GPS: Principles and Applications. Artech House Publishers.

Picton, P.D., 1989. Tracking and segmentation of moving objects in a scene, in: Image Processing and Its Applications, 1989., Third International Conference on. pp. 389–393.

Soh, J., Chun, B.T., Wang, M., 1995. Analysis of road image sequences for vehicle counting, in: Systems, Man and Cybernetics, 1995. Intelligent Systems for the 21st Century., IEEE International Conference on. pp. 679–683 vol.1. doi:10.1109/ICSMC.1995.537842