

Chapter 4

Significance of Real-Time Systems in Intelligent Transportation Systems

Manipriya Sankaranarayanan

 <https://orcid.org/0000-0002-0973-2131>

National Institute of Technology, Tiruchirappalli, India

Mala C.

National Institute of Technology, Tiruchirappalli, India

Samson Mathew

National Institute of Technology, Tiruchirappalli, India

ABSTRACT

The advancements of several real-time system applications enable us to provide better solutions to day-to-day problems. One such real-time systems that has significantly enhanced its efficiency in aiding travelers to make commutation pleasant is the intelligent transportation system (ITS). There are several aspects of an ITS application that make it efficient and resourceful, but the major significant factor is its capability to provide services within a time constraint. This chapter aims to provide the basic concepts, background, and importance of dependability on distributed real-time systems in ITS using two applications for efficient traffic management. A novel automated traffic signal (ATS) is proposed that manages traffic flow by enumerating vehicle density of road segments using image processing techniques. The other proposed work involves the estimation of congestion rate (CONGRA) for given target area using the proposed hybrid vehicular ad hoc network (VANET). The details of the modules, implementation, and result analysis of the applications are discussed and presented.

INTRODUCTION

The technological advancements in the field of computer science and communications network have become extremely immense in order to make a stress free living. These advancements and improvements are focused on developing applications that are easy to use in real-time with co-ordinated system (Sumit Mallik 2014). Today, such applications are innumerable and developed in every field possible. One such highly developing application is in the field of road traffic management. Applications and services that are managed in real time in the field of transportation to provide a smart, safe and co-ordinated use of transport networks are the Intelligent Transportation Systems (ITS). It is a broad area of research which combines information and technologies to solve day to day transportation related problems. The developments in this field have been drastically significant over the past decade. Initially, only few countries such as United States and European Union had proposed and implemented ITS concept (Alam Muhammad et al., 2016). However now, they have raised up against various issues which have subdued its success, such as systems not having enough expertise, not being properly integrated, not establishing appropriate master plan, or importantly, financial restrictions. The most common issues, that have been experience so far, are the compatibility and integration of the applications and concepts across nations due the difference in the environmental impacts, data acquisition, traffic rules and regulations etc. (Mashrur Chowdhury et al., 2017).

Several applications and innovations are developed in field of ITS to make hindrance free travelling experience to commuters (Fayaz, Danish 2018). The need to work effectively in real time must be addressed by these applications. The future of ITS and the way forward in the future have become a hot topic of research (Agachai Sumalee et al., 2018, A. B. Nkoro et al., 2018). In this chapter, two ITS applications that work efficiently in real time are explained in detailed way. Each application is an example from diverse area of implementation and technology. Both the applications work towards providing solution to traffic management.

The first application involves traffic management through traffic signal. In developing countries at present, the traffic signal works as per fixed phase time and time requires manual labor to operate it. Therefore, there is a need to develop a traffic control system by evaluating all the criteria necessary to properly manage traffic imitating experts in the field of transportation. This work proposes a unique algorithm for automated traffic signals using surveillance camera feed for controlling traffic in intersection. Such applications are already existing using image processing. (Prakash et al., 2018, Akoum Al., 2017, Prashant Jadhav et al., 2016). All the existing work proposes a new infrastructure to fit into their proposed work and provide solution specific to a location or scenario. The major uniqueness of the work is utilizing existing infrastructure, robust method of detection of vehicles and the algorithm proposed for Green phase of traffic signal. This chapter explains how the traffic signal function can be made fruitful by using real time information of exiting vehicle density to control traffic efficiently. The details of the work are discussed in the subsequent section.

The other application is aimed as future technology of a real time application involving the estimation of congestion information of roads using smart vehicles. Seamless transportation is a necessity for our societal and economic sustainability. The congestion occurs due to two major problems: one is due to the limited capacity of the road and the other is lack of traffic assistance information to travellers. In order to resolve this congestion problem, new facilities and infrastructure needs to be developed to provide travelers prior traffic information about the route. Therefore, it is important to detect where the congestion occurs and to estimate the CONGestion Rate (CONGRA). A common solution to this is to

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