A novel markov model-based traffic density estimation Technique for intelligent transportation system

ABSTRACT

An intelligent transportation system (ITS) aims to improve traffic efficiency by integrating innovative sensing, control, and communications technologies. The industrial Internet of things (IIoT) and Industrial Revolution 4.0 recently merged to design the industrial Internet of things–intelligent transportation system (IIoT-ITS). IIoT sensing technologies play a significant role in acquiring raw data. The application continuously performs the complex task of managing traffic flows effectively based on several parameters, including the number of vehicles in the system, their location, and time. Traffic density estimation (TDE) is another important derived parameter desirable to keep track of the dynamic state of traffic volume. The expanding number of vehicles based on wireless connectivity provides new potential to predict traffic density more accurately and in real time as previously used methodologies. We explore the topic of assessing traffic density by using only a few simple metrics, such as the number of surrounding vehicles and disseminating beacons to roadside units and vice versa. This research paper investigates TDE techniques and presents a novel Markov model-based TDE technique for ITS. Finally, an OMNET++-based approach with an implementation of a significant modification of a traffic model combined with mathematical modeling of the Markov model is presented. It is intended for the study of real-world traffic traces, the identification of model parameters, and the development of simulated traffic.