Vehicular Cloud Data Collection for Intelligent Transportation Systems

Abstract:

The Internet of Things (IoT) envisions to connect billions of sensors to the Internet, in order to provide new applications and services for smart cities. IoT will allow the evolution of the Internet of Vehicles (IoV) from existing Vehicular Ad hoc Networks (VANETs), in which the delivery of various services will be offered to drivers by integrating vehicles, sensors, and mobile devices into a global network. To serve VANET with computational resources, Vehicular Cloud Computing (VCC) is recently envisioned with the objective of providing traffic solutions to improve our daily driving. These solutions involve applications and services for the benefit of Intelligent Transportation Systems (ITS), which represent an important part of IoV. Data collection is an important aspect in ITS, which can effectively serve online travel systems with the aid of Vehicular Cloud (VC). In this paper, we involve the new paradigm of VCC to propose a data collection model for the benefit of ITS. We show via simulation results that the participation of low percentage of vehicles in a dynamic VC is sufficient to provide meaningful data collection.

Introduction:

The term ''Internet-of-Things'' (IoT) is used to refer to the global network interconnecting smart objects, along with the set of supporting technologies. IoT is anticipated to offer new applications and services for smart cities in several domains, by interconnecting billions of sensors to the Internet. IoT will allow the evolution of the Internet of Vehicles (IoV) from existing Vehicular Ad hoc Networks (VANETs). IoV features gathering, sharing, processing, computing, and secure release of information to enable the next generation of Intelligent Transportation Systems (ITS). These systems will offer the delivery of new applications and services to drivers by integrating vehicles, sensors, and mobile devices into the global network. Vehicular Cloud Computing (VCC) is a new paradigm which takes advantage of cloud computing to serve VANETs with several computational services, in order to improve our daily driving by minimizing accidents, travel time and traffic congestion. Ultimately, the goal of VCC is to provide on demand solutions for unpredictable traffic events, where applications can adapt according to the dynamic environmental changes with the aid of a Vehicular Cloud (VC). What distinguishes vehicles from standard nodes in a conventional cloud is autonomy and mobility. Despite the fact that broadband communications and wireless technologies can provide Internet connectivity to the public on the road through roadside access points (APs), the high mobility feature that characterizes vehicular environments limits the amount of data that a passing vehicle can download from an AP, where peer-to-peer connection can be an alternative approach . Congestion detection and avoidance applications can support drivers with efficient route planning based on the road condition. A centralized ITS will be slow to report eventual traffic problems and usually does not provide a mitigation solution. Alternatively, a VC can offer the most appropriate and effective applications that meet the requirements of ITS, by enabling vehicles to share their traffic experiences on demand. This way, vehicles can detect traffic congestion and accurately assess the traffic flow condition in city environments. Data collection is an important aspect in ITS, which can effectively serve online travel systems with the aid of a VC. In this work, we involve the new paradigm of VCC to propose a pull-based data collection model for the benefit of ITS. Moreover, we show via simulation results that the participation of low percentage of vehicles in a dynamic VC is sufficient to provide representative and meaningful data collection for ITS. Furthermore, we highlight existing challenges to be addressed by IoV data collection models and services. The remainder of this paper is organized as follows: in Section II, we provide a background on the topic and we review related work. In Section III, we describe our proposed model with design considerations highlighted, and we specify a service scenario based on the proposed model. In Section IV, we discuss issues and challenges to be addressed by data collection models and services. In Section V, we provide concluding remarks and suggestions for future work.