Chapter 5

A Secured Dynamic Privacy Preserving Scheme for Vehicular Cloud Computing

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ABSTRACT

There are rapid technological advancements in the field of transportation. Vehicles cooperate among themselves and establish an intelligent transportation system to fulfill the needs on traffic management. To make this possible, the vehicles are equipped with on board unit which shares information regarding the condition of roads, traffic, and management. Such information is stored in cloud server to be accessed by the vehicles at any time. During the message communication, the origin of the message is checked for its authenticity by the receiver. During signature verification, to preserve the privacy of the user, it is required that the ID of the vehicle should not be revealed. Security and privacy of the information stored in the cloud is a challenging task. The privacy of the vehicle user and the information should be secured from the threats. The solutions in the existing literature do not fulfill the requirements of security and privacy. In this chapter, a secured and dynamic privacy preserving scheme is proposed for vehicular cloud computing. Analysis on the proposed privacy scheme is done based on anonymity and un-linkability. The analysis shows that the proposed dynamic scheme provides better privacy compared to static schemes.

1. INTRODUCTION

A great development in vehicular industry has enhanced the vehicle capacity. The recent vehicles are equipped with varied resources namely the computing power and storage. In certain cases, the vehicles resources are not utilized properly and many vehicle resources are kept idle for a long time without use. To incorporate such issues Vehicular Networking is introduced. It is an emerging field due to its DOI: 10.4018/978-1-5225-3981-0.ch005
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unique features and applications like traffic management, road safety and infotainment. In a vehicular network, each vehicle communicates with other vehicles and the Road Side Unit (RSU). The vehicles carry on board computing facilities, storage and sensors. Several methods have evolved to make an efficient vehicular communication and effective utilization of resources. One such solution is Vehicular Cloud Computing (VCC) where all the information can be deployed in cloud and can be accessed when required. It is the incorporation of VANET and cloud computing. Each vehicle in VCC can communicate to the other vehicles or the network infrastructures by using the vehicle to vehicle or the vehicle to infrastructure network communication. The computing, sensing, communication and the storage resources of the vehicles are coordinated by VCC to balance the limitation of hardware and service requirements.

The National Institute of Standards and Technology (NIST) has provided a formal definition of cloud computing as:

*Cloud computing is a model for enabling convenient and on demand network access to a shared pool of configurable computing resources that can be rapidly utilized and released with minimal management effort or service provider interaction (Mell & Grace, 2011).*

The VCC architecture relies on three layers namely in-vehicle, communication and cloud. The first layer in-vehicle is responsible for collecting the information by the usage of sensors namely environment sensors, smartphone sensors, navigation sensors, temperature sensors and pressure sensors which is equipped in the On Board Unit (OBU) of the vehicle. The second layer is the communication layer which comprises of two different parts of communication namely Vehicle to Infrastructure (V-I) and Vehicle to Vehicle (V-V) communication.

The potential value of an intelligent transport system is to take as an example the study by Cintra (conducted at Harvard University in 2008), which showed that the traffic congestion cost in the city of Sao Paulo was approximately 33.5 billion reais per annum. Eighty-five percent of this cost is due to time lost in traffic, 13% is caused by fuel consumption, and 2% is due to increased air pollution. These traffic jams can be aggravated when the city hosts a major event like World Youth Day or the FIFA World Cup. The time lost in congestion is greater during city events and causes particular harm to the vehicular traffic required for emergency services such as ambulances, police cars, and fire engines as it means they take longer to arrive at these places. In addition, it can discourage visitors from attending these events. The cost of traffic congestion can be reduced by means of VANETs which provide updated and dynamic information about the conditions of road traffic. In addition, VANETs can reduce the number of road accidents while providing drivers and passengers with applications for comfortable driving, such as location services, streaming, multimedia, local news, tourist information, and warning messages about conditions on the highway and in the streets of the city.

Zingirian (2012) suggested that the vehicles can collect, transmit, and interpret information through a wide range of sensors, cameras, computers, and communication resources, and this can assist in the acquisition of data and help the drivers to make decisions to take appropriate actions. With enough sensing capacity and the ability to act in an environment, vehicles can become an important tool for smart cities, not only in vehicle traffic management but also for picking up useful real-time information that can be used in resource management.
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