Mitigating Information Falsification in Participatory Vehicular Cyber-Physical Systems: A Data-driven Approach

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Abstract

The tight coupling and closed interaction of both, the physical world (vehicles, roads) and cyber components (computers, networks) in vehicular traffic domain, form a new paradigm of the technological innovation named as Vehicular Cyber-Physical Systems (*VCPS*). Besides cyber-agents like vehicular nodes, human-agents using cyber-media, like smartphones, also form the participating components of *VCPS*. The simultaneous involvement of a large number of independent contributory participants, not always improve the quality of available information, very often also resulted in contradictory information. The sources of contradictory information affect the informed-decision making process in an adverse manner at both individual as well as community level. This contradictory information sharing in participatory *VCPS* is called as *Information Falsification* problem.

The information falsification problem may arise due to faulty sensing units, compromised nodes, man-in-the-middle attack, perception difference of the human participants or even due to their malicious intents. Irrespective of the reasons, the information falsification problem in participatory *VCPS* poses a number of practical issues to the stakeholders. Handling the information falsification problem in participatory *VCPS* needs near real-time decision making in constrained situations and thus poses non-trivial challenges for the research community.

This research studies the information falsification problem and its nature through in-depth analysis of real dataset in participatory *VCPS*. First, a computational model for the participation pattern of the *VCPS* participants has been devised in terms of information sharing frequency and spatiotemporal distribution of the participation. The insight obtained from the data analysis of the real-dataset used to develop a simulation platform for the generation of realistic participatory sensing *VCPS* dataset. The concept of reputation and mobile security agent are leveraged to conduct the participants' profiling. Further, the algorithms and schemes are proposed to handle the information falsification problems in the near real-time constrained environment from two different perspectives i.e., central authority level as well distributed node level. Extensive simulation-based experiments with real dataset in realistic environments reveal that the proposed methods can provide relatively better and more effective tools to handle information falsification problems in both the human and artificial societies.

Keywords: Vehicular Cyber-Physical Systems (*VCPS*); Participatory Sensing; Information Falsification; Reliability; Quality of Information.