Chapter 77
Web Services Description and Discovery for Mobile Crowdsensing:
Survey and Future Guidelines

Salma Bradai
University of Sfax, Tunisia

Sofien Khemakhem
University of Sfax, Tunisia

Mohamed Jmaiel
Digital Research Center of Sfax, Tunisia

ABSTRACT

The rapid growth of sensor-enabled smartphone is driven phenomena of common interest to be observed while leveraging people mobility and their sensory data collection. This paradigm known as mobile crowdsensing has demonstrated its efficiency in data collection over the last years, enabling the monitoring of traffic, pollution, people density and more. However, it stills pose interesting challenges, with particular regard to the management of collected data, dealing with their presentation and standardization in an interoperable infrastructure. Current visions of future crowdsensing systems share common goal of integrating those data into powerful real time web services accessible and discoverable via the web. In this paper the authors dig into this axis and define several criteria that allow succeeding it. They pay particular attention to semantic description and discovery techniques and evaluate proposed approaches by defining their strengths and shortcomings. The authors also propose guidelines for future researches.

INTRODUCTION

Fueled by the widespread adoption of smartphones as powerful measuring devices, a novel class of mobile Internet of Things applications fall under the category of mobile crowdsensing. By leveraging people mobility and smartphone integrated sensors (GPS, Velocity, Gyroscope, Air quality, Microphone, etc.), this new sensing paradigm allows to continuously monitoring phenomena. In fact, sensed and shared

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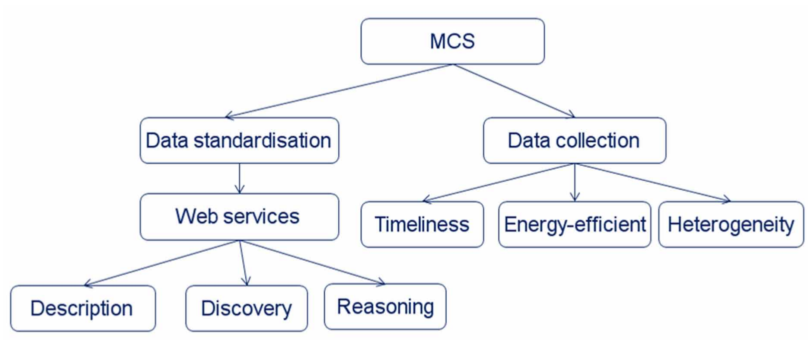
Figure 1. Mobile crowdsensing studied challenges



data between mobile and computing devices are processed by urban applications in order to deduce noise level, traffic information, people density and more.

Intrinsically, the mobile crowdsensing allows accessing information that are inherently out of the spatial and/or technological scoop. Information out of the spatial scoop are those related to specific regions or locations different from the consumer place. Citing the example of asthmatic people who would monitor air quality before moving to other places or city planners that would deduce noise level by leveraging smartphones' microphones and people mobility. Information out of the technological scoop are those that cannot be deduced alone due to technological problem such as smartphone capabilities limitation (e.g. lack of air quality sensor).

However, mobile crowdsensing collected data arise several challenges related to coverage quality, incentive mechanisms, data management and more. In this paper, we pay particular attention to collected data presentation standardization through Web services in an interoperable platform-independent infrastructure. In fact, Web services present an important direction to encapsulate widely detected data in order to be accessed through WebAPI (Sheng et al., 2013). Thus, as shown the Figure 1, we investigate mobile crowdsensing services description, discovery and reasoning techniques from one hand and their immediate provision from different and heterogeneous mobile devices in energy efficient manner from the other hand.

Especially in mobile crowdsensing, service discovery among the network is important for enabling devices cooperation. In fact, urban applications are exposed to a large pool of mobile services. Faced with this diversity, discovering services that best meet their requirements is a challenging task. Spatial/temporal correlation between consumers' requests and providers' data is needed in most scenarios; therefore not only the provided service data should be highly described but also the context surrounding it. This allows an easier and efficient service discovery required by urban application consumers. Then, faced with the large pool of discovered services, reasoning technique is a salient feature to compare query against offered services and to evaluate system performance in relation to user requirements.

However, as detection tasks and service provision can easily expose participants to a significant drain on intrinsically limited smartphone resources, a rigorous management of their energetic resources is desired and often enforced. This is a challenging task hindered by the intrinsic network heterogeneity. In fact, crowdsensing services delivery and discovery systems best demonstrate their values when integrating heterogeneous systems for exploiting their embedded capabilities regardless of how these systems were built (Mohamed & Wijesekera, 2012).

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