In-network collaborative crowd-Xing

Mots clés :

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- Unité de recherche : INRIA-Paris
- École doctorale : École Doctorale Informatique, Télécommunications, Électronique de Paris
- Domaine scientifique principal : Sciences de l’information et de la communication

Résumé du projet de recherche (Langue 1)

Sensor and actuator networks, possibly wireless, have drastically evolved over the last few years, with rich sensors being embedded in most devices and deployed everywhere, as highlighted by the Internet of Things vision. However, in spite of significant advances, the key challenges of these systems arise from largely the same attributes as those of early-envisioned mobile systems: relative resource-poverty in terms of computation and communication, variable and unreliable connectivity, and limitations imposed by a finite energy source. These remain true even though modern mobile devices are significantly more powerful compared to their ancestors; the work we expect them to do has increased and will keep increasing, and the computation and storage abilities available through fixed infrastructure such as the cloud are larger by order of magnitudes than any single mobile device. Following, the design of algorithms and protocols to efficiently coordinate the sensing, processing, and actuation capabilities of the large number of mobile devices in future systems is a core area of MiMove's research. The focus of MiMove's research interests then lies mostly in the systems resulting from the increased popularity of sensor-equipped smart devices that are carried by people, which has led to the promising field of mobile phone sensing or mobile crowd-sensing. The paradigm is powerful, as it allows overcoming the inherent limitation of traditional sensing techniques that require the deployment of dedicated fixed sensors. In this context, we are specifically interested in the challenges rising from the potentially very large scale of mobile crowd-sensing, combined with the openness, heterogeneity and dynamicity of the related sensing and actuation environment. Our target is to raise mobile crowd-sensing to a reliable means of sensing world phenomena, with a special focus on urban phenomena as part of the development of digital cities. We believe that the right way to achieve this is by enabling scalable and quality data collection, i.e., maximizing the effectiveness of collective sensing, rather than gathering massive raw data that require costly post-processing for producing meaningful knowledge. To this end, we focus on data and control coordination among the sensing actors.

Résumé du projet de recherche (Langue 2)

In the above context, the purpose of the PhD is to investigate distributed protocols for the “effective” collection of urban data, based on the coordination of services distributed over the related heterogeneous Internet of Things devices. The solution is expected to be cross-layer in that it will introduce a supporting middleware closely integrated with the underlying urban network for the sake of resource-efficiency. In order to reduce the network’s load, the solution will in particular promote in-network processing, which will be informed by the specifics of the upper-layer application. Typically, data processing and filtering of data on the devices themselves will be applied as far as possible, and build upon approaches like the one proposed in the Dioptase middleware that was developed within MiMove. The candidate will more specifically focus on protocols supporting urban-scale noise crowdsensing. We will leverage numerical models for urban noise, which are investigated by the CLIME Inria team, close collaborator of MiMove in the smart city research effort. In addition, there is a need for devising novel data gathering that enhances data quality while ensuring availability and recovering from sensing inaccuracy. In particular, it is crucial to support opportunistic correlation and configuration/calibration, while devising effective aggregation of the resulting sensed data at a community scale. The PhD is also about investigating data collection at multiple scales, contributing to both personalized and global sensing with a tradeoff between cost and performance. Finally, a prototype will be developed and performance evaluation will be performed. References Billet and V. Issarny: “Dioptase: A distributed data streaming middleware for the future web of things”, Journal of Internet Services and Applications, 2014. Hachem, A. Pathak, V. Issarny: “Service-oriented middleware for large-scale mobile participatory sensing”. Pervasive and Mobile Computing 10, 66-82 (2014). Sara Hachem, Vivien Mallet, Raphael Ventura, Animesh Pathak, Valérie Issarny, Pierre-Guillaume Raverdy, Rajiv Bhatia: “Monitoring Noise Pollution Using the Urban Civics Middleware”. Proceedings of IEEE Big Data Service 2015. Valérie Issarny, Vivien Mallet, Kinh Nguyen, Pierre-Guillaume Raverdy, Fadwa Rebhi, Raphael Ventura: “Dos and Don'ts in Mobile Phone Sensing Middleware: Learning from a Large-Scale Experiment”. Proceedings of Middleware 2016.

Informations complémentaires (Langue 2)
The applicant should have a Master degree (or equivalent) in computer science with background in the distributed systems and wireless networking domains. Prior internships with R&D expertise in these areas will be a plus. Contact: Valérie Issarny - Valerie.issarny@inria.fr - https://mimove.inria.fr/members/valerie-issarny/ Francoise Sailhan – Francoise.Sailhan@inria.fr - http://cedric.cnam.fr/~sailhanf/index.html