Call for a PhD Position: Optimized strategies for an adaptive drones mobility control in the context of 5G networks.

Short description:
In recent years, the geographic coverage of mobile networks has gradually expanded, to the point of virtually being able to provide ubiquitous access to any user around the world. However, these observations cannot obscure the challenges posed by the need to significantly improve the possibilities of mobile terminals to access to the network infrastructures in multiple bad or unconnected zones. This is of course the case for fixed and mobile terminals, but also for all new types of equipment whose access to mobile networks could offer the networks operator's a new economical growth. This is particularly the case for the access of civil and commercial drones (also known as unmanned aerial vehicles, or UAVs) to 4G and 5G mobile networks, for which important market prospects is already identified. However, it is also necessary to note that these prospects are currently severely limited by the fact that terrestrial mobile networks are not yet intrinsically designed and deployed to maintain communication links with vehicles evolving a few tens or hundreds of meters away. As a result, there are many network coverage imperfections for this type of access, even in areas with good connectivity to traditional terrestrial terminals [1]. Ground-to-air communications are thus likely to be regularly disturbed. In fact, the significant ambitions of cellular terrestrial mobile network operators regarding the resources and network services offered to UAVs [8] will be affected by these disturbances. In this PhD thesis, we will focus on the application context of coverage extension of cellular terrestrial networks, by means of a swarm of UAVs.
In this thesis, we will focus on the mobility control techniques of a fleet of drones, with the objective of designing an optimized strategy for the extension of coverage of the terrestrial cellular network. The drones will be judiciously positioned using D2D mechanisms [4], so that each node of the fleet can maintain a route to neighboring base stations and UAVs. In this context, we will use optimization techniques to achieve a powerful, autonomous and real-time mobility control. The idea is to propose a solution able to take into account several metrics, in the context of 5G network coverage extension, in order to achieve an autonomous mobility control of a fleet of UAVs in a reasonable time and by means of a realistic computing capacity.
If you want more information about the PhD, do not hesitate to contact the persons mentioned below.

PhD contract: CDD-FR (CIFRE Convention envisaged).

PhD location: This PhD will take place in the premises of Orange Labs in Lannion (Brittany, France), in cooperation with the University of Burgundy (Nevers, France).

Expected starting date: October/November 2018.

Contacts:
Industrial supervisor: Laurent Reynaud, Orange Labs, Lannion,
Academic supervisor: Sidi Mohammed Senouci, University of Burgundy, Nevers.

Expected Profile:
Candidates should own a Master (M.Sc.) or Engineer (B.Sc.) degree in Computer science or Telecoms. Good mathematical background and networking protocols as well as practical skills with programming languages and software tools (e.g., Matlab, NS-3, OMNET++, Cplex, Gazeboo) and fluent English (written and spoken) are required. Above all, the applicants must be motivated to learn quickly and work effectively on challenging research problems.

How to Apply:
Application process (deadline **may 2018**)
The following documents are required:
- CV,
- motivation letter,
- statement of research experience and interests,
- transcripts of University transcripts and
- (at least) two reference letters

as attachments of an email, whose subject will be "Application for PhD position at Orange Labs", which must be addressed to Laurent Reynaud (laurent.reynaud@orange.com) and Sidi Mohammed Senouci (sidi-mohammed.senouci@u-bourgogne.fr).
Web links of research articles authored by the applicant or the internship report are welcome to be included, too.

Some references:

[1] Signals Ahead, A benchmark Study of how LTE Networks Enable the Command and Control of Drones, May 2017.

[2] K. Fall, “A delay-tolerant network architecture for challenged internets,” Proceedings of the 2003 conference on Applications, technologies, architectures, and protocols for computer communications - SIGCOMM ’03, p. 27, 2003

[3] I. Bekmezci, O. K. Sahingoz, and S. Temel, “Flying Ad-Hoc Networks (FANETs) : A survey,” Ad Hoc Networks, vol. 11, no. 3, pp. 1254–1270, 2013.

[4] M. Mozaffari; W. Saad; M. Bennis and M. Debbah, “Unmanned Aerial Vehicle With Underlaid Device-to-Device Communications: Performance and Tradeoffs,” IEEE Transactions on Wireless Communications, 2016.

[5] Adrian Carrio, Carlos Sampedro, Alejandro Rodriguez-Ramos, and Pascual Campoy, “A Review of Deep Learning Methods and Applications for Unmanned Aerial Vehicles,” Journal of Sensors, vol. 2017, Article ID 3296874, 13 pages, 2017. doi:10.1155/2017/3296874

[6] Tai, L., Liu, M.: Deep-learning in mobile robotics-from perception to control systems: a survey on why and why not. arXiv preprint arXiv:1612.07139 (2016)

[7] Dong Ki Kim, Tsuhan Chen, “Deep Neural Network for Real-Time Autonomous Indoor Navigation”, arXiv preprint arXiv:1511.04668 (2015)

[8] GSMA Regulatory Position on Drones, Position Paper, 2017, https://www.gsma.com/iot/wp-content/uploads/2017/08/GSMA-Regulatory-Position-on-Drones-Approved-August-2017-FINAL.pdf