Optimisation of Beamforming and Positioning for Aerial (Drone) Base Stations in 5G Emergency Scenarios

JOB DESCRIPTION

An aerial base station (ABS) is a flying base station (e.g. carried by a drone) which can be used to provide wireless connectivity from the sky and which itself is wirelessly connected to a donor (regular) base station. An ABS may be deployed flexibly and on demand, e.g. in emergency scenarios, in areas where the available network infrastructure is not able to provide sufficient coverage and performance (data rate, latency, reliability, etc.). For example, in (future) ambulance services, high-quality video images made by the paramedic on scene need to be streamed to a remote specialist for more effective assessment of the patient situation, e.g. to assess whether the patient should be brought to the hospital, or to advise on some immediate medical treatment by the paramedic. In many cases, e.g. in remote rural areas or due to building blockage, a mobile network may not able to provide sufficient uplink throughput required for the delivery of such video streaming. The deployment of an ABS nearby the scene is seen as an efficient candidate solution to this challenge.

When the ABS arrives on the scene, it may immediately start to provide service, while further optimising its beamforming configuration and physical 3D position to achieve the best overall performance and/or energy efficiency. This involves performance optimisation of both the access uplink (from the devices to the ABS) and the backhaul link (from the ABS to the donor base station). With regard to energy efficiency, not only the energy usage of the ABS for wireless transmission is of relevance, but also, and likely even more so, its energy usage for flying. The potential mobility of ambulance may also be taken into account.

The key objectives of the proposed graduation project are:

(i) To *define deployment scenarios* of ABS in ambulance services, where adaptive beamforming and dynamic optimisation of the ABS position are applicable. This includes the specification of ABS (e.g. energy constraints) and network (power profiles, radio propagation) parameters.

(ii) To *propose one or more algorithmic solutions for beamforming and position optimization*, which optimise overall energy efficiency of ABS while fulfilling the performance requirements of the ambulance services (e.g. for uplink delivery of video streaming) across both the access and backhaul links.

(iii) To conduct a simulation-based *quantitative assessment* of the proposed beamforming and position optimization algorithms. The assessment should include a mutual comparison and a benchmark against key state-of-the-art algorithms, as well as a sensitivity analysis w.r.t. key scenario aspects, in order to demonstrate attainable gains and identify the best candidate solution. This requires the specification of suitable and realistic scenarios in terms of system, propagation and traffic aspects and the development and application of a system-level simulator.

The graduation project is carried out as part of the European Horizon 2020 5G-HEART project (www.5gheart.eu). You will learn about the broader context of the overall project and will gain the necessary knowledge about mobile telecommunication technology in general and ABSs in particular.

REQUIREMENTS

You are a graduate student pursuing a Master's degree, preferably in the direction of Electrical Engineering or Computer Science. You have affinity with / interest in mobile networks,

computer simulations and programming experience. You have an enterprising, flexible and cooperative nature. You are also communicative, creative and innovative. Duration of the graduation project is about nine months.

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CONTACT US

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