Macquarie-Aarhus Joint PhD Project Opportunity

Title:
Reliable Communication in Body Area Networks

Research area and project description:
A Body Area network (BAN) consists of multiple tiny low-power intelligent wearable or implanted sensor nodes which are radio-enabled and can communicate wirelessly. The sensor nodes can collect various important physiological data for diagnosis or fast emergency response and as well as deliver various personalized therapeutic treatment related applications and services. BAN is a new emerging technology that is promising to enable pervasive monitoring or treatments. BAN is expected to enhance the patient health-care experience by providing independent living solutions for people that need constant health care. Furthermore, BAN can reduce the demand on the health-care infrastructure and medical staff in the hospitals.

This PhD project will conduct a research into reliable communications in Body Area Networks. As BAN is often required to deal with vital information, high reliable communication is a must. To achieve reliable communication, there are several challenges, e.g., interference, dynamic link quality, ultra-tiny form factor of sensor nodes, limited battery, limited memory and process power. Regarding interference, people can move around in public carrying their individual BANs. With the prevalence of BANs in the near future, it is very likely that multiple BANs co-exist within each other’s vicinity. In general, each BAN is independent and there has not been any coordination across the separate networks. Therefore, the interference among the BANs in each other’s proximity could deteriorate the communication link and cause a severe problem on the reliability in BAN. Additionally, interference can result in increased bit error rate, lower throughput and increased energy dissipation. Besides the inferences from co-existing BANs, there could be interference from other existing wireless networks (e.g., WiFi, Bluetooth, UWB, etc.). Although there is a variety of interference mitigation techniques proposed for the conventional wireless networks, they are not prioritized for energy efficiency and low complexity. So to achieve a reliable communication in BANs, it is worth looking into an energy-efficient and low complex interference mitigation for BANs. Furthermore, to achieve reliable communication with highly dynamic link quality due to body movements, an energy efficient retransmission scheme or adaptive error correction scheme is in needed. For severe link fading scenarios, there might be a need to employ relays to achieve reliable communication. Specially, it becomes more challenging to support heterogeneous medical sensor nodes with different data rates, duty cycles and requirements for the bit error rate and delay constraint.

Qualifications and specific competences:
Applicants to the PhD position must have achieved a Master’s degree in electrical engineering/computer science at First Class level or equivalent, or have submitted their Master’s thesis for assessment before the application deadline.

To be successful in this position, good experience in wireless communications as demonstrated by a combination of training, professional experience, and relevant publications or other peer-reviewed research activity will be advantageous.
Place of Employment and Place of Work:
Department of Electronic Engineering, Macquarie University, Australia
Department of Engineering, Aarhus University, Denmark

Contacts:
Macquarie University: Professor Eryk Dutkiewicz (eryk.dutkiewicz@mq.edu.au)
Aarhus University: Associate Professor Qi Zhang (qz@iha.dk)

Joint PhD application procedures:
A Joint PhD enables students to enrol in two universities simultaneously and spend research study periods at both institutions. Their research will be guided by supervisors from each university. One thesis will be submitted for joint examination, and upon meeting the criteria of both institutions, a single double-badged diploma will be awarded recognising the joint nature of the qualification. Scholarships are available to eligible candidates.

To undertake a Joint PhD, prospective students must apply and be admitted to both Macquarie University and Aarhus University. Procedures for each university are provided below.

Procedures for Macquarie University
Macquarie University offers a generous scholarship scheme to eligible Joint PhD students. Scholarships cover tuition fees at Macquarie University for the duration of the joint enrolment (maximum 3.5 years), and provide a living stipend while on campus at Macquarie (AUD$23,728 per year tax free – 2012 rate). In addition, one economy return airfare is provided for travel between the partner universities.

Prospective students will need to submit an application for admission and scholarship to the Higher Degree Research Office (http://hdr.mq.edu.au). Applications must be posted to the HDRO along with all supporting documentation by the application deadline. Two confidential referee reports must also be submitted directly by the applicant’s referees.

- Information on how to apply is available at http://hdr.mq.edu.au/information_about/research_degrees/applications.
- Information on scholarship requirements is available at http://hdr.mq.edu.au/information_about/scholarships/scholarship_requirements.
- Application and referee report forms may be downloaded from http://hdr.mq.edu.au/information_about/forms.

Please direct any application enquiries to hdrfuture@mq.edu.au.

Procedures for Aarhus University
PhD fellowships at Aarhus University are awarded when students are admitted on the basis of a master’s degree. The fellowship is granted for a period of up to three years, and is granted in accordance with the collective agreement between the Danish Ministry of Finance and the Danish Confederation of Professional Associations, and the amendment of 4 April 2003 regarding PhD scholars. The basic salary amounts to approx. DKK 25,000 per month before tax, including pension and holiday.

The applicant will need to submit an application for admission and PhD fellowship to the Graduate School of Science and Technology (GSST) at Aarhus University. Detail information about GSST is available here [http://talent.au.dk/phd/scienceandtechnology/](http://talent.au.dk/phd/scienceandtechnology/).

Applications for this specific project must be submitted here: [http://talent.au.dk/phd/scienceandtechnology/opencalls/](http://talent.au.dk/phd/scienceandtechnology/opencalls/)

Choose November 2012 Call with deadline 1 November 2012. Note: You will be directed to the call, and must choose the program 'Engineering' and When you fill out the information regarding Study: In the dropdown menu you must choose the project: "Reliable Communication in Body Area Networks".

The detailed application guide is available here: [http://talent.au.dk/phd/scienceandtechnology/application/application-guide/](http://talent.au.dk/phd/scienceandtechnology/application/application-guide/)

The Macquarie University PhD stipend and Aarhus University PhD fellowship are only paid while on campus at the respective institution.