

Ph.D. topic 2014

Continuous and unobtrusive vital signs monitoring with ballistocardiogram sensors for sleep awakening and apnea

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### Presentation of the Ph.D. topic

Unobtrusive monitoring of vital signs is an increasing requirement from the medical community, due to a number of reasons. First, there is a need to monitor vital signs continuously, under normal life conditions for days and weeks, which is not possible in the hospital. Second, there is an increasing number of nursing home residents and elderly living alone in their own homes, because of ageing population, giving rise to a need for self-monitoring and remote-monitoring of vital signs. Thirdly, there is an increasing burden on care-givers, to measure vital signs manually. Finally, there is the issue of rising healthcare costs all over the world.

In this research we are designing and developing sensors and software algorithms for remotely collecting vital signs unobtrusively from subjects in their beds. The main signal type is the ballistocardiogram signal, however other signal types such as the electrocardiogram will be used for the purpose of algorithm design and software validation. A prototype will be developed that measures the heart rate, breathing rate and other vital signs. It will involve development of combined piezo-capacitive sensor and piezo-resistive sensor mat. The system will be tested in the laboratory in Singapore using clinical level validation tools, and subsequently deployed in nursing homes in France for the purpose of studying nocturnal sleep, awakening patterns and sleep apnea.

### Expected deliverables

Design and development of combined piezo-capacitive and force sensitive resistor based pressure sensor mat will be the first deliverable. Data collection, calibration and performance tuning of the mat will be carried out as the next step, to improve the reliability and sensitivity of the mat, and its ability to pick up vital signs. Filters will be designed to produce clean signals under normal conditions. Lab testing and field testing will be done before data collection to study targeted clinical issues.

### Keywords

Cardiovascular and cardiopulmonary systems and associated vital signs, Continuous monitoring, Biomedical Signal Processing, MATLAB

### Applicant profile

- Master Degree or Engineer Student (last year of studies).
- Skills in programming, C++, Java, MATLAB.
- Familiarity with digital signal processing and analog signal data acquisition are appreciated
- Strong motivation towards this challenging project.
- Open to work with both French and Singaporean scientists
- Availability for starting second semester of 2014.

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