

## TETAM Lab 8

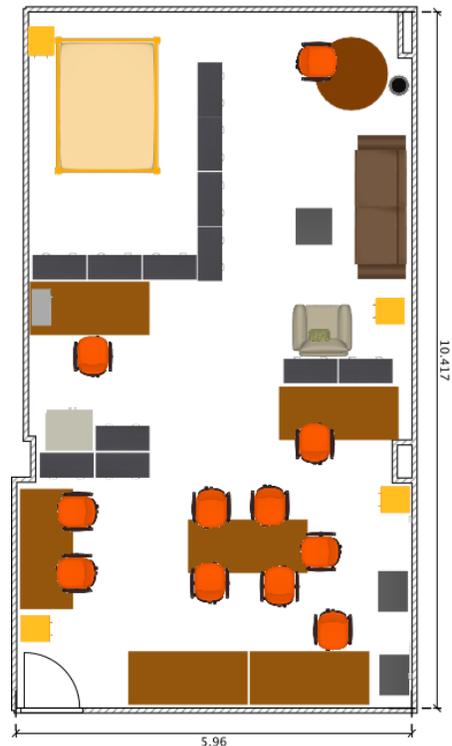
### Cem Ersoy Research Group Pervasive Healthcare / Activity Recognition and Ambient Sensing (ARAS)

#### Overall Motivation:

**Wireless Sensor Networks Research Group (Wi-Se)** with its 20 members, is involved in EU FP7, COST, State Planning Organization of Turkey, TUBITAK, Bogazici University Research Fund and private sector funded research activities focusing on cross layer algorithms for WSN, ubiquitous computing, applied information processing for ambient intelligence and pervasive healthcare applications, smart homes, smart cities, crowdsourcing, urban participatory sensing with smartphones, mobile cloud systems, network virtualization and software defined networks, green cellular networks and smart grid communications and intelligent transportation systems.

#### Current Research Projects:

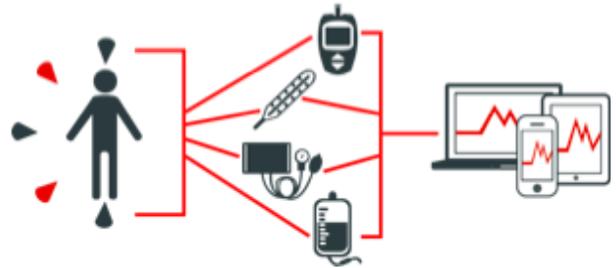
- **Activity Recognition and Ambient Sensing (ARAS):** Recognition of daily activities of one or multiple residents in a flat-like environment decorated with multiple Zigbee sensors. The research is focused on developing advanced machine learning techniques for activity recognition using sensory information, specifically with Hidden Markov Models and Nonnegative Matrix Factorization.
- **ARAS with batteryless sensors:** An extension to the former research with sensors using energy harvesting technology. With the wireless and batteryless sensors, the setup overhead and administration of the sensors are reduced drastically.
- **Fine Localization with Bluetooth Low Energy (BLE) Beacons:** Indoor position estimation with several BLE beacons using the Sequential Monte Carlo (SMC) methods on the previously collected fingerprint data. We designed a novel observation model to be used in the SMC methods.



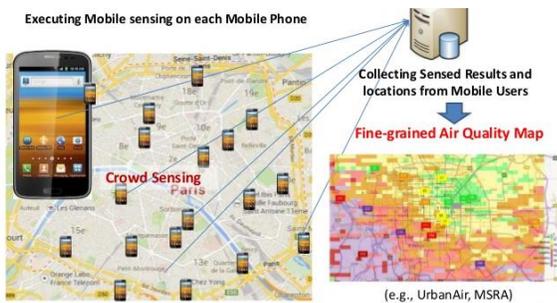
- **Lifelogging:** Collection of lifestyle and health related data with smart wearable devices on 3

continents and 8 countries. A system acquiring the nature of cities across cultures in terms of metrics such as walkability and happiness.

- e-Health:** Monitoring of patients with wearable and ambient devices such as smartwatches and phones in an obtrusive manner. A ubiquitous interface between the patients and medical doctors. Design of a system to notify the caregivers on change of critical health characteristics and symptoms,

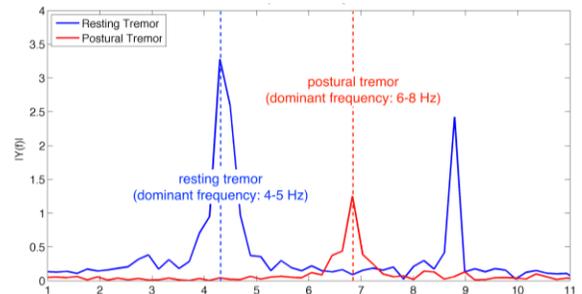


such as unusual high heart rate and falls.



- Crowdsensing:** Also known as urban and participant sensing, targeting the data collection on large scale, such as environmental monitoring, map construction. Working on optimization strategies such as sensor selections, data maximization. Research on developing incentive mechanisms for data collections with hundreds of participants.

- Monitoring and Analysis of Parkinson's Disease Symptoms using Wearable Sensors:** Aiming to aid the neurologists/clinicians to monitor their Parkinson's disease patients remotely, to accurately assess the state and the progression of the disease. The monitored symptoms include Parkinsonian tremors, gait characteristics and medication complications such as dyskinesias. Accurately detecting the existence and level of such symptoms potentially allows the physicians to formulate personalized treatments, primarily correct dosage of medication.



- Sleep Quality Assessment with Ambient and Mobile Sensing:** Monitoring the sleep statistics with ambient sensors such as light, temperature, humidity, atmospheric pressure, accelerometer and pressure mat sensors coupled with mobile phone applications to measure the environmental sound/light levels and to provide periodic surveys to the users. This study also aims to find correlations between the sleep quality and the style of daily living (i.e. analyzing the effects of social, cognitive and physical daily life actions on the quality of sleep.)