**Objectives**

- **Improve Health Care** through SMART, Convenient Wearable Sensors
- **Develop Human Energy Harvesting** towards a “fit and forget” and “no recharge” goal.
- **Target PREM: Patient Environment Monitor**
  - Role is to Intelligently Record and Compress
  - Compute HR and HRV and Record
  - 2.5mW to 3mW
  - 1.5mW to 3mW
- **Apply the technology in Real and Demanding Clinical Use cases**, ensuring fitness for purpose
  - Epilepsy in children, Alzheimer’s Disease in the elderly
  - Motion
- **Involve Industry** in multidisciplinary IT research

**Wearable ICT for Zero Power medical Application**

**Clinical Dimension**

**ALZHEIMER’S disease** (LREN, CHUV)

- Early DIAGNOSIS using accessible EEG is critical to drug treatment efficacy
- Novel attempt to use 124 electrodes over a longer period rather than 128 electrodes over short periods in hospital
- EEG Raw data compressed and recorded
- Algorithms applied to the data: multivariate and entropy analysis requiring networked high end machines
- Data from ECG and PEM used to improve prediction accuracy by fusing results, combining brain, emotional and environmental factor analysis

**EPILEPSY in children** (KISPI)

- EEG must be made more accessible to screen for epilepsy
- Todays manual methods must be enhanced with automatic brain wave aberration detection
- ECG and PEM are important to understand the context of an epileptic fit

**Evaluations**

- Trials will be conducted using the sensors on elderly with mild cognitive impairment and children already diagnosed with EP

**Wearable Sensors**

- **EEG Baseball Cap** (Brain Sensing)
  - 24 Electrodes at 512 to 1024 sample rates
  - Primarily Thermal/Solar
  - Role is to Intelligently Record and Compress
  - 1.5mW to 3mW
- **ECG Chest band** (Affect Sensing)
  - 3 Electrodes
  - Primarily Kinetic/Thermal
  - Compute HR and HRV and Record
  - 0.5mW to 1mW
- **PEM: Patient Environment Monitor** (Context Sensing)
  - A specific clinical requirement from partners
  - Used to replace self reporting which is ineffective in elderly persons with dementia and young children, provides clinicians with a hint to the context around the time of an incident recorded by the EEG and ECG sensor
- **Processing Systems**

  - UL POWER ASIC
  - MULTICORE DATA PROCESSING
  - USER INTERFACE HOMEPIC
  - CLINICAL OVERSIGHT

**Energy Harvesting**

- Will use a mix of Thermal Electric, Piezo-Kinetic, and Solar depending on user needs
  - **EEG Cap**. 24 electrodes include TEG sensors. With the head band provides 50 to 75 cm² harvesting area
  - **ECG Band**. 3 electrodes include TEG sensors. The chest band provides 1000 cm² kinetic harvesting area
  - **PEM**. 10 cm² solar harvesting area

**EEG**

- Clinical evaluation of ZPSense system based on newly developed EEG analysis tools

- Application of Entropy
  - Measures to evaluate EEG signals in AD and EP
  - which is similar to “gold standard” in AD – amyloid plaques distribution

- Integration of TEGs with optimized thermal interface for EEG

**EGG**

- Clinical evaluation of ZPSense system based on newly developed EEG analysis tools

- Application of Entropy
  - Measures to evaluate EEG signals in AD and EP
  - which is similar to “gold standard” in AD – amyloid plaques distribution

- Integration of TEGs with optimized thermal interface for EEG

**TEGs**

- Abnormal EEG synchronisation shows AD-specific pattern...
- ...or landscape of gray matter atrophy characteristic for AD

- Alzheimer’s disease
- Epilepsy in children
- Primarily Kinetic/Solar
- Compute HR and HRV and Record
- 0.5mW to 1mW