

## **Master's thesis – LTSI INSERM 1099**

### **Development of an Embedded System for the Acquisition of Cardiac and Respiratory Signals**

#### **Context**

The LTSI (Laboratory for Signal and Image Processing) is a research laboratory of the University of Rennes and INSERM, at the interface of information science and health technologies.

#### **Subject**

This internship will take place within the SEPIA team at LTSI. The SEPIA team's research focuses on the development and evaluation of new patient-specific diagnostic and therapeutic methods to improve the care of patients suffering from cardiovascular and cardiorespiratory diseases. The proposed internship will be linked with two ongoing projects of the team.

The first project aims at developing a new treatment for sleep apnea. This treatment is based on the real-time detection of sleep apnea events from respiratory signals. A PhD student from the team is developing sleep apnea detection models using artificial intelligence algorithms. These models are currently available only on computers and are in the process of being implemented on an embedded system, such as a Raspberry Pi. The intern's goal will be to develop a Bluetooth Low Energy (BLE) communication interface between the Raspberry Pi module (dedicated to signal processing) and a real-time acquisition system of respiratory, electrocardiographic, movement, and position signals (using an accelerometer). The BLE interface will also be used to activate a kinesthetic stimulator to treat the apnea events when they are detected.

The second project follows-up on research currently conducted by the team to design, calibrate, and use an acquisition system dedicated to the measure of mechanical, electrical, phonographic, and echographic signals produced by the human heart. In this context, the intern will focus on acquiring cardiac signals from various sensors connected to a Raspberry Pi. To ensure the real-time acquisition requirements of the project, the intern will be trained in programming methods using both "multiprocessing" and "multithreading" in Python. Depending on the progress of the work, the intern may also receive training in the development of lightweight machine learning algorithms for embedded systems, as well as basic echographic signal acquisition.

This internship lies at the intersection of analog electronics (schematics and component sizing, PCB design and soldering, etc.), digital electronics (embedded systems, real-time programming with Python), and signal processing (mathematics, machine learning). It is worth noting that the skills developed during this internship are highly sought-after in the field of electronics and embedded systems applied to healthcare.

**Profile**

The selected candidate should have solid skills in analog and digital electronics. Knowledge of Python programming is also desired. An interest in biomedical engineering will be considered in the application, although no prior knowledge of anatomy or physiology is required.

**Location / Start date / Duration**

Rennes, Campus de Beaulieu / 2025 / 6 months

**Application**

In France, an internship is remunerated 4.35 euros per hour. The working duration of this internship is of 35 hours per week.

**Application**

Please provide a CV, a cover letter, as well as your transcripts from your last 3 years of study.

**Contacts**

Jérémy Beaumont Assistant professor <a href="mailto:jeremy.beaumont@univ-rennes.fr">jeremy.beaumont@univ-rennes.fr</a>	Alfredo I. Hernandez. INSERM Research director <a href="mailto:alfredo.hernandez@univ-rennes.fr">alfredo.hernandez@univ-rennes.fr</a>
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