

Connected Objects



Component
École Nationale
Supérieure
d'Électrotechnique
d'Électronique

In brief

- > **Ametys Code:** N6EE05A
- > **Open to exchange students:** Yes

Presentation

Objectives

Design amplification, filtering, and analog/digital processing chains.

Understand the principle of analog-to-digital conversion.

Understanding the principle of QAM data transmission/reception

Knowing how to analyze data

Learning to work in a group (knowing how to listen to others and actively participate in group work, feeling responsible for everyone's learning)

Learning to manage a project from design to completion

Learning to write a design report

Description

Nowadays, there is a growing demand for the development of sensors to record, quantify, and analyze health status using various criteria. This demand reflects a

sense of poor well-being linked to stress, poor eating habits, and lack of physical exercise. The most common sensors are those related to measuring physical activity via speed, distance traveled, heart rate (using smartphones, smartwatches, etc.). Knowing how much energy we have expended should enable us to better adapt our dietary needs and modify our behavior. Here, we are particularly interested in monitoring heart rate. Until now, this has mainly been measured and obtained by ECG using a chest strap, which was not very comfortable (or using electrodes). In recent years, another more suitable method of measurement has emerged

based on measuring the light absorbed by blood flow: photoplethysmography (PPG) [1]. In addition, it is now also possible to obtain other relevant information about the patient's state of health, such as oximetry [2] [3] and blood pressure [1] [4] [5].

The operating principle is based on a device capable of emitting light within a certain wavelength spectrum (infrared, red, or green) and quantifying the light that is either reflected or absorbed after passing through tissue. It is the variation in blood volume in the blood vessels that modulates the amount of light detected. In general, the most commonly used part of the body is the finger, but it is not limited to this. It can also be the earlobe, the temple, etc.

During this project, students are asked to design the analog/digital part that collects, amplifies, filters, and digitizes the signal from the sensor. It is then transmitted in QAM modulation and processed by signal processing algorithms to bring out the key parameters contained in the signal.

Pre-requisites

Circuit Basics

Logic System Design

Operational Amplifiers and Compensation

Semiconductor Physics and PN Junctions

Signal Transistors and Power Components

Transistor Amplifier Circuits

Digital Signal Processing

Signal Processing