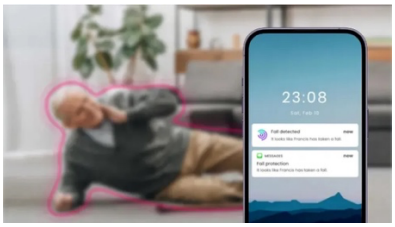
Wi-Fi sensing for health monitoring

Context:



Wi-Fi modems are continuously evolving to meet the ever-increasing expectations of the users in terms of communications rates. The last amendment of the 802.11 standard, the 11be amendment referred to as extremely high throughput (EHT), specifies the Wi-Fi communications at frequencies below 7 GHz on a 320 MHz-wide bandwidth and by using up to 16 spatial streams created by arrays of antennas. Communication rates up to 50 Gbps will be supported by your modem!

At the same time, the new amendment 11bf is also developed to support Wi-Fi sensing besides communications. The principle is to leverage the channel measurements already useful for the communications and characterizing the environment to offer new breakthrough applications aiming at improving the autonomy and the security at home. Wi-Fi sensing can be seen as a follow-up of the effort on the design of Wi-Fi based passive radars, i.e. radars working by observing the Wi-Fi communications signals of opportunity to sense the environment.

Objective:

Among the envisioned Wi-Fi sensing use cases, the monitoring of activities to assess the health state or the fast detection of specific events like a fall to quickly call emergency services may help developing the autonomous living of the elderly at home. This calls for the estimation of parameters like the walking speed and the deployment of classification algorithms to detect specific events. **The goal of this master thesis is to design a Wi-Fi based passive radar to track people indoors and extract micro-Doppler signatures useful to detect events like a fall or other activities when inputted to a classification algorithm.**

Methodology and tools:

- Design of Wi-Fi based radar system
    - People tracking indoors based on range/Doppler/angle estimations
    - Micro-Doppler signature extraction based on time-frequency analysis
- Settle hardware setup and acquire experimental data (USRP X310/X410)
- Conceive a Wi-Fi based health monitoring system
    - Physical parameter estimation to quantify level of activity (actimetry)
    - Classification algorithms for fall detection incl. feature extraction

Contact: francois.horlin@ulb.be