Sensors & Medical Telemonitoring

Crédits ECTS
3 crédits

En bref

Langue de cours: Anglais

Présentation

Prérequis

- Basic understanding of signals and systems (desirable but not mandatory)
- Introductory knowledge of wireless communications (helpful)
- High School chemistry
- High School (molecular) biology: receptors, enzymes, hormones, antigens, antibodies, RNA, DNA, glucose, cell, virus

Objectifs d'apprentissage

This course introduces the fundamental concepts and technologies of digital healthcare, with a focus on analytical devices, point of care diagnostic biosensors, medical sensors, remote medical monitoring and medical data transmission. It covers sensor design and fabrication, signal transduction techniques, basic concepts to characterize sensor performances, notions on acquisition and digitization of physical signals, system architectures, communication technologies, and key challenges in designing reliable, efficient, and secure telemedicine solutions, from basic applications to advanced scenarios.

Description du programme

This course provides a comprehensive introduction to digital health technologies, including biosensors, eHealth, telehealth, telemedicine, and remote medical monitoring. It focuses on the principles and systems enabling continuous patient monitoring through body-worn medical sensors, such as wearable and WBAN devices, and the acquisition of physiological signals (e.g., ECG, SpO#, temperature) and the detection and quantification of biomolecules. The course also explores signal transduction approaches as well as common concepts about sensor capabilities, such as sensitivity, dynamic range, bandwith, and noises. It will then cover

the communication infrastructures required to transmit medical data reliably, covering both indoor environments (hospitals, homes) and outdoor scenarios using cellular, satellite, and IoT-based networks.

Based on these fundamental concepts, the course reviews key design challenges such as sensitivity, specificity, miniaturization, reliability, latency, energy efficiency, and data security. Through a range of use cases, spanning basic remote monitoring to advanced applications such as real-time telemedicine and telesurgery, students will gain insight into current technologies and emerging trends. The course also highlights the role of AI, interoperability, and next-generation networks in shaping the future of connected healthcare.

Beyond catalogueing existing technologies, the goal is to provide a clear unified picture of the entire conceptual chain: Physical quantity # transduction # signal conditioning # measurement # communication/inference.

Bibliographie

1. R. S. H. Istepanian, B. Woodward*: m-Health: Fundamentals and Applications*, Wiley-IEEE Press, 2016.

2. S. K. Manju, M.N.I. Sardar, *Artificial Intelligence-based Healthcare Systems*, Springer, 2023

3. N. Wickramasinghe et al., *Telemedicine Technologies: Information Technologies in Medicine and Digital Health*, Wiley, 2017

4. M. M. Ahmed et al. *Biosensing in Healthcare Applications. Studies in health technology and informatics*, [s. l.], v. 330, p. 393–416, 2025.

5. Hobbs P C D 2009 *Building electro-optical systems: making it all work* (Hoboken, N.J: Wiley)

6. Pallás-Areny R and Webster J G 2001 *Sensors and signal conditioning* (New York: Wiley)

Equipe pédagogique

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Total des heures		**24h**
CM	Cours Magistral	16h
TD	Travaux Dirigés	8h

Infos pratiques

Nom responsable UE

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