

## **R&D internship in IoT/WSN in Inria 2024-2025**

Inria is the French national research institute for digital science and technology. In 220 project teams, most of which are shared with major research universities, more than 3,900 researchers and engineers explore new paths, often in an interdisciplinary manner and in collaboration with industrial partners to meet ambitious challenges.

FUN (Future Ubiquitous Networks) project team is based in Inria center at Université de Lille in Villeneuve d'Ascq. FUN members imagine self-organization solutions for future wireless sensor, actuator and RFID networks to allow those kinds of networks to self-deploy, to every entity to discover, to communicate, to know when to sleep, when to transmit, etc. Solutions are validated through experiments.

**FUN project team is recruiting a research and development intern in IoT/WSN. The candidate should be preparing for a Master 2 or an engineering degree (5<sup>th</sup> year) in the field of computer science.**

### **Subject: An adaptative and dynamic approach for managing smart edge-enhanced IoT devices in mission-critical applications**

**Tutor:** Carol HABIB, Postdoc researcher at FUN, carol.habib@inria.fr

#### **Internship conditions:**

- **Duration:** 6 months
- **Location:** 40 Avenue Halley, 59650, Villeneuve d'Ascq, France
- **Project team:** FUN

**Keywords:** IoT, wireless sensor networks, constrained devices, post-disaster use case, edge-enhanced devices

#### **Context:**

The integration of the Internet of Things (IoT) with cloud computing has enabled a multitude of applications in various domains. Yet, this centralized architecture is not suited for all use cases. For example, mission-critical applications cannot tolerate delays, downtime or failure. Therefore, edge computing emerged as a paradigm allowing close-to-the-source processing. Particularly, in post-disaster management, where the network is scarce and access to the Internet might not be possible, edge servers can be embarked on the robots that are exploring the disaster area. When needed, these robots can run energy-consuming tasks and provide local decision-making to the wireless sensor network that they are deploying during the mission. However, these robots are battery-powered and some network and application requirements must be ensured in order not to compromise the mission. Therefore, these computation resources must be properly managed.

#### **Objectives:**

The aim of this internship is to first study the state-of-the-art of multi-access edge computing in IoT. Then, to propose an algorithm allowing edge-enhanced devices in post-disaster management to decide in real-time how to manage their resources. The algorithm must be adapted to constrained devices

and take into account the constraints of the network and the requirements of the application. Simulations must be conducted to evaluate the performance of the proposed approach.

**Profile:**

**Preparing for a Master 2, an engineering degree (5<sup>th</sup> year) or equivalent in the field of computer science, the candidate should:**

- Have good programming skills in C/C++ and Python.
- Show a strong interest in experimentation and have a practical sense, especially in the field of IoT.
- Have a good level of English (reading/writing).
- Have good organizational, relational, listening, and receptive skills.

**Please send your CV+motivation letter at [carol.habib@inria.fr](mailto:carol.habib@inria.fr)**

**References:**

Militano, L., Arteaga, A., Toffetti, G. and Mitton, N., 2023. The Cloud-to-Edge-to-IoT Continuum as an Enabler for Search and Rescue Operations. *Future Internet*, 15(2), p.55.

N. Santi and N. Mitton, "A resource management survey for mission critical and time critical applications in multi access edge computing," *ITU Journal on Future and Evolving Technologies*, vol. 2, no. 2, 2021.

N. Zenasni, C. Habib, and J. Nassar, "A fuzzy logic based offloading system for distributed deep learning in wireless sensor networks," in *2022 International Joint Conference on Neural Networks (IJCNN)*. IEEE, 2022, pp. 1–8.