# Development of an Experimental Devboard for a Frugal Smartphone

**Required Education Level:** Master's degree (or equivalent)
**Professional Experience:** No prior professional experience required.

## Position description

**Context.** The SmolPhone project is a research-action initiative in the field of frugal computing. Practically, it aims to design a type of low-tech smartphone with a one-week battery life. The goal is not to optimize a conventional smartphone but rather to reconsider usual design choices in mobile computing. The project aims to serve as a research ground for low-tech and frugal computing. For more information, see https://inria.hal.science/hal-04156447 and https://inria.hal.science/hal-04589322.

**Objective.** The objective by the end of the **24 month long contract** is to have an open and modifiable hardware devboard for a frugal smartphone built around a microcontroller and ultra-low-power peripherals for the screen, 4G modem, and Wi-Fi connectivity. A Cortex-A64 co-processor will occasionally handle compute-intensive tasks. To achieve this, the recruited individual will need to design several generations of PCBs to integrate the necessary components, starting with a test devboard and ideally concluding with a complete demonstrator.

The aim is not to design a marketable product but to create an experimental platform that will serve as a foundation for future research in frugal computing at the Inria institute, addressing some of the societal challenges expected in the coming years.

## Assigned Mission

The first year will be dedicated to the design of a 2000s-era smartphone centered around a microcontroller. The outcome should be open source and easy to tinker with: the pins of all components will be easily accessible to allow for potential hardware extensions, the board will offer all necessary measurement points like a classic *devboard* as well as self-diagnostic functions, and the whole system will be properly documented to be accessible to knowledgeable amateurs.

The second year will focus on hardware modularity and optimization. There are many 4G chipsets that are poorly documented. While a suitable reference might suffice for the first year, a more thorough comparative study will be necessary in the second year to find the most appropriate reference for our needs. Similarly, other microcontrollers will need to be evaluated once the software requirements are better understood. The PCB form factor should also be improved by the end of the contract if possible. The recruited individual will also participate in the writing of scientific articles presenting the developed platform in collaboration.

**Collaborations.** The candidate will work under the supervision of Martin Quinson (researcher in the MAGELLAN team, expert in distributed systems and frugal computing) and Simon Rokicki (researcher in the TARAN team, expert in micro-architecture and compilation), in a team with an engineer designing the software system to run on this hardware. They will also collaborate with Joseph Paturel and Mickaël Le Gentil (research engineers in the TARAN and GRANIT teams, experts in embedded systems).

## General information
- **Theme:** Frugal computing
- **Location/City:** Rennes
- **Inria center:** CRI Rennes - Bretagne Atlantique

## Recruiters (first.last@inria.fr)
- Martin Quinson (MAGELLAN Inria Team)
- Simon Rokicki (TARAN Inria Team)

## About Inria
Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, usually in collaboration with academic partners, involve over 3,500 scientists tackling digital challenges, often at the intersection of other disciplines. The institute draws on diverse talents across more than forty different professions. 900 support staff contribute to the emergence and growth of scientific and entrepreneurial projects that impact the world. Inria collaborates with numerous companies and has supported the creation of over 180 start-ups. The institute thus strives to address the challenges of the digital transformation of science, society, and the economy.

## Key to Success
This engineering position is aimed, among others, at engineers specialized in electronics or embedded software.
Feeling comfortable in an academic research environment, enjoying learning, exploring, interacting, and listening are essential qualities for succeeding in this role.

## Application Instructions
**Security Clearance:** This position may be assigned to a restricted zone (ZRR), as defined in decree no. 2011-1425 related to the protection of the nation's scientific and technical potential (PPST). Access authorization to such a zone is granted by the head of the establishment, following favorable ministerial advice, as defined in the decree of July 3, 2012, related to the PPST. A negative ministerial opinion for a position assigned to a ZRR would result in the cancellation of the recruitment.

**Recruitment Policy:** As part of its diversity policy, all Inria positions are open to people with disabilities.

**Note:** Application files (CV + cover letter) must be sent by email to the recruiters before **August 30, 2024**.

## Activities

**Main Activities.**
- Design and implementation in collaboration with project members.
- Develop the PCB (using KiCad) and oversee the manufacturing process.
- Test and modify until the design is validated.
- Write documentation for future contributors.
- Compare different components to integrate into the design (4G modem, screen, Wi-Fi connectivity, keyboard, application co-processor).
- Participate in technology watch related to this subject.
- Optimize the form factor and power supply.

**Additional Activities.**
- Write weekly progress reports.
- Participate in weekly group meetings.
- Contribute to the writing of scientific articles.

## Skills and Experience

The expected level of experience is that of a newly graduated engineer without specific professional experience.

**Technical Skills and Required Level.**
- Embedded systems design: good level
- PCB design with KiCad: good level
- Electronics practice (assembly, soldering, testing, modification): good level
- Familiarity with electronic lab tools is desired
- Participation in an open research environment: experience appreciated

**Languages.**
- French or English as the working language (candidate's choice).
- Written English for reading literature and writing documentation and scientific articles.

**Interpersonal Skills.**
- Autonomous, responsive and adaptable
- Good communication with colleagues to collaborate, seek help, and present project progress

## Benefits
- Subsidized meals
- Partial reimbursement of public transportation costs
- Leave: 7 weeks of annual leave + 10 days of RTT (based on full-time) + possibility of exceptional leave (e.g., sick children, moving)
- Possibility of telecommuting (after six months of service) and flexible working hours
- Professional equipment available (videoconferencing, loan of IT equipment, etc.)
- Social, cultural, and sports benefits (Inria Social Welfare Association)
- Access to professional training
- Health insurance