

# Internship Proposal

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## **Project Title:**

Improvement of a continuous and non-invasive temperature and activity monitoring system for small mammals

## **Level:**

Master Student

## **Project Summary:**

We are looking for a Bioengineering, Medical Engineering or Electronic Engineering MSc student to carry out a dissertation project aimed at improving and testing a modular system based on RFID and ESP32-C6 technology, designed for continuous, remote and non-invasive monitoring of body temperature and activity in small mammals. The system uses multiple antennas connected to a central RFID reader capable of detecting miniaturised thermosensitive PIT tags implanted subcutaneously, allowing individual identification, temperature recording, and inference of activity and spatial behaviour.

The device also integrates environmental sensors (temperature, humidity and light) and operates autonomously, powered either by a powerbank or mains electricity. A functional prototype already exists, and one of the main objectives will be to optimise the modular antenna design, improve the electronic architecture, and integrate software for automated data acquisition, processing and remote transmission. The system has applications in biomedical research, ecology, conservation, veterinary medicine and animal welfare.

Funding for the student will be sought from international grant schemes (e.g. UFAW)

## **Work to be developed by the student:**

Expected student tasks

- Study of RFID principles, FDX-B (ISO 11784/85) standards, and thermosensitive PIT-tag reading.
- Optimisation of the modular antenna design (including three-dimensional arrangements).
- Integration of environmental sensors and development of the associated electronics.
- Programming of the ESP32-C6 module for continuous data acquisition, including local

storage and remote server transmission.

- Development of software for calibration, validation of readings, and automated analysis of temperature and activity.
- Laboratory testing using PIT-tagged animals or artificial heat/movement sources.
- Field or semi-natural setting trials to assess autonomy, reliability and robustness.
- Full documentation, data analysis and final performance reporting of the prototype.



### References:

C Miranda, L Oliveira, AM Carmo, IAS Olsson, NH Franco (2025) Contactless body temperature assessment for signalling humane endpoints in a mouse model of sepsis. *Animal Welfare* 34, e13

A Bartelik, M ater, ÖS Cevik, NH Franco, V Voikar (2024) Focus on novel approaches: Home-cage monitoring of laboratory mice. . *Scandinavian Journal of Laboratory Animal Science* 50 (1)

D Moutinho (2020) "Development of an RFID based monitoring system for group-housed mice and rats" (TESE/DISSERTAÇÃO)

NH Franco, A Gerós, L Oliveira, IAS Olsson, P Aguiar. (2019) ThermoLabAnimal–A high-throughput analysis software for non-invasive thermal assessment of laboratory mice. *Physiology & behavior* 207, 113-121