Master/Semester project: Weatherproof data logging system for honeybee colony metabolic investigation

Sections targeted: MT, GM, EL, SV, SIE or IN.
Master (30 ECTS) or Semester (10 ECTS) project, Spring semester 2025

Contact

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More info:
https://www.epfl.ch/labs/mobots/educati
on/student-projects/

1 Context

Honeybee colonies exhibit complex collective behaviours that are studied by researchers in special hives enabling visual characterisation of the colony (Figure 1). While these hives allow for increased insights onto behavioural patterns, they also affect behaviour by limiting cluster size and altering physical hive properties such as thermal insulation and mass.

Amongst others, researchers at MOBOTS are interested in studying the thermal collective behaviours of honeybees and the related metabolic activity. This is achieved through the deployment of robotic frames and additional CO_2 sensors within the hive space. Very little thermal and metabolic experimentation currently exists in box-hive environments, let alone their combination, and this despite the insight that cross-hive pattern comparison could provide on in-hive thermal management for colonies of varying sizes.
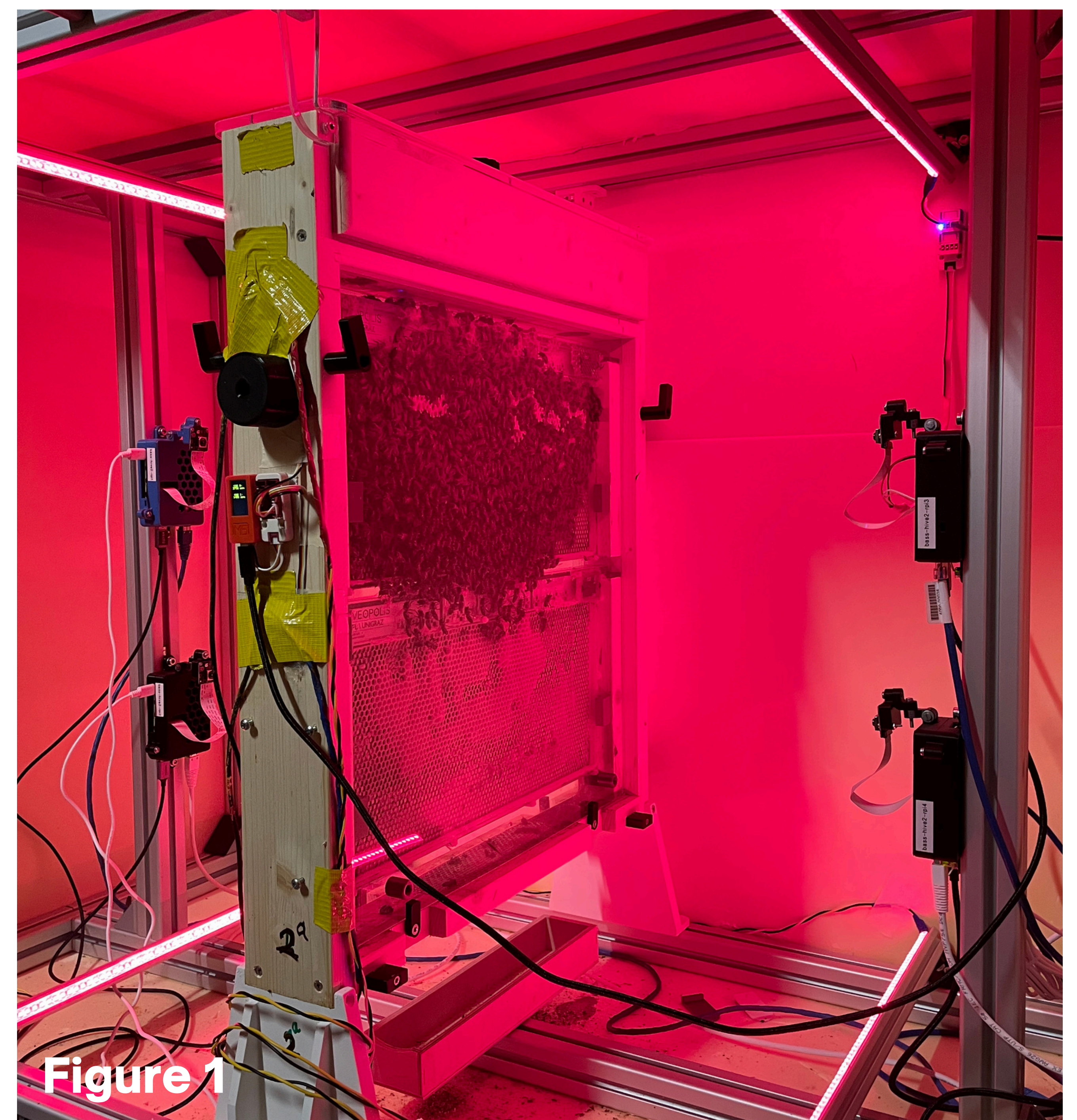

Figure 1

2 Objective

The aim of this project is to design and build a weatherproof data logging system that interfaces with robotic frames, an array of CO_2 sensors and a local weather station. To achieve this goal, a weather station and a bio-accepted CO_2 sensor array will be developed and installed in a real setting. *For PdM: with the setup, metabolic measurements will be compared with data from both empty and full observation hives.*

3 Methodology

A weatherproof electronics box will be used as the main building block for the system. Solar panels will be considered as the main electricity supply, and data logging will take place wirelessly.

Figure 2

4 Expected skills or interests

Interest in the subject is the main requirement. Through this project, you will use and develop your skills in mechanical prototyping, ESP32/Arduino programming and embedded linux development. *For PdM: the student would also make use of data analysis skills.*