Master thesis proposal (2022/2023)

Vertical farming device and automated system to operate it

**Anticipated students’ specialities:** M (“Mechanical engineering”) and Z (“Automation and mechatronics engineering”)

**Background**
Norbite is a Swedish start-up that upcycles plastic waste into sustainable goods by means of an insect-based biorefinery.

Our solution is both inspired by nature and scientifically proven, it is based on one specific insect, *Galleria mellonella*, and we have developed a process that enables the insects to digest more than 90% of commonly used plastics.

Moreover, by the end of the transformation we obtain high quality insect-based proteins for human and livestock consumption, and biofertilizers and biocontrol agents for organic farming, covering thus various aspects of healthy food production.

The proof of concept of the technology is done, and this project is part of its pilot scale up, that will lead to the building of a demonstration unit in 2023 and of a commercial facility in 2025. The commercial facility will transform 60 000 t/y of plastic and save 120 000 t/y of CO₂e.

Through this transformation process, Norbite contributes to several of the sustainable development goals.

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**Project summary**
One of the main difficulties that the emerging insect industry is facing today, is the development of an economically viable and fully automated vertical farming operational system. At Norbite, we have developed a disruptive concept of a breeding device and its inclusion in the whole operational system, a first “dirty” prototype was made last year. Now, we are looking forward to the realization and adjustment of 1:1 scale prototype.
The key parts of the project are: **Building of breeding device.** This activity comprises a detailed design of the 2 key elements – rearing and sorting plates, testing of the device with the insect-like filling, such as wood or plastic spheres, to check its maneuverability and compliance with the basic requirements; then, if possible, with actual insects. The final realization should consist of at least 2 rearing plates and 1 sorting plate to implement them into the automatically operated system. **Arrangement of the devices into automatic breeding system.** This activity consists of the combination of different rearing and sorting plates and of the establishment of the necessary connections, and engines to move those devices as a future automated breeding system, which is supposed to take care of growing of the insects, their feeding, cleaning (removal of dejections, leftovers, etc.) and recovery. Also, the cleaning-in-place systems for the devices is to be added (or at least its addition to foreseen) and incorporated in the whole handling of the system at this stage, to ensure the decontamination in the future facility. The system may first be validated through empty rounds, then with insect-like filling and finally, if possible, with alive insects. The final realization should also foresee the integration of the system into the industrial facility, e.g. communication between the different engines, the remote control of the whole system, the handling of the raw material supply, leftovers removal, and larvae transfer as well as different on-line controls, such as NIR, temperature/humidity checks etc.

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