

Student:	Name:	
	Student ID:	Departement:
	University: EPFL	
Thesis:	Title: Mycelium-wood hybrid composites for eco-monitoring transient robotics	
	Kind of Thesis:	Semester: SS or FS 2026
Supervisor:	Prof. Dr. Mirko Kovac	
Advisor:	Dr. Kyung-Sub Kim	
Co-Advisor:		

Start of the Project:	01.03.2026
Deadline delivery final report:	31.08.2026

Introduction

The adoption of biodegradable materials in electronics and robotics can help mitigate the ecological footprint caused by the multidisciplinary applications of intelligent devices. In this context, transient robotics composed of biodegradable materials has attracted increasing attention, offering potential applications in various fields such as medical robotics, environmental exploration, and agriculture. [1] Exploratory transient robots can float on water [2], crawl through soil [3], or fly into dense forests [4], and after completing their missions, they can decompose into non-toxic byproducts in the natural environment. These robots have been fabricated using biodegradable polymers such as gelatin, lignin, PLA, and cellulose, which are degraded into short polymer chains by esterases produced by soil microorganisms.

However, the environmental conditions to which devices are exposed at their end-of-life stage, such as temperature, humidity, pH, and microbial activity, are not constant. As a result, the degradation rate of the devices cannot be guaranteed within a predictable range, and the pathways of their return to the natural environment remain uncertain. By employing **bio-hybrid composites containing living mycelium**, it becomes possible to **pre-program their life cycle** by controlling the species and concentration of the mycelium. Furthermore, using wood chips as fillers in mycelium composites can simplify the fabrication process and reduce material and processing costs. Beyond this, properties such as **self-healing capability, environmental adaptability, and the ability to generate electrical signals in response to environmental stimuli** make mycelium-based materials highly promising for expansion into robotic applications such as robotic skin [5] and controllers [6].

Although mycelium–woodchip composites are highly promising, systematic material studies on their mechanical and electrical properties, as well as their biodegradation kinetics depending on different combinations of mycelium and wood chips, are still lacking. Moreover, in the implementation of robotic structures, biologically driven fabrication methodologies remain a missing piece. Therefore, **this project focuses on fundamental material, mechanical, and biological studies of mycelium–wood composites for the realization of eco-monitoring transient robotics.**

Objectives

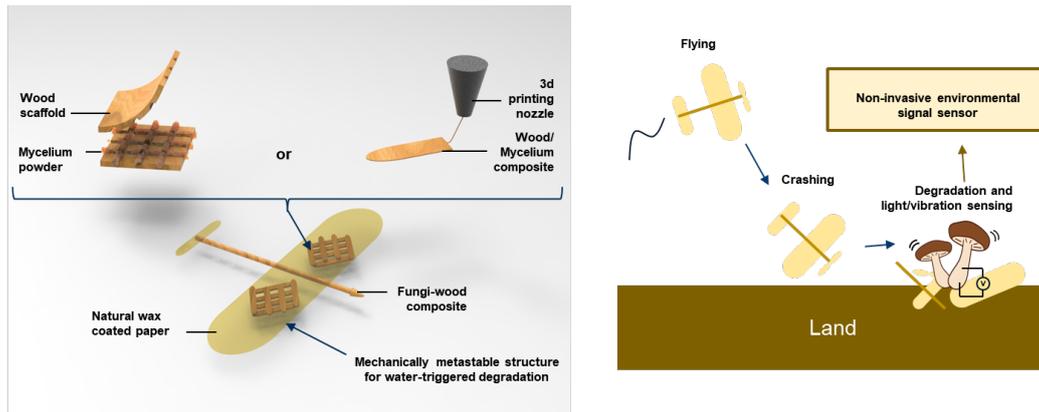


Figure 1. Targeting fabrication methods (left) and overall working scenario (right) of the mycelium-wood hybrid transient drone.

The ultimate goal of this project is to develop a transient drone for environmental monitoring based on a mycelium–woodchip composite. As a primary objective, we will focus **on fabricating composites using various combinations of mycelium and wood chips, as well as on their characterization and process optimization.** Depending on the progress of the project, we will further develop structural designs for the transient drone and establish methodologies to measure electrical signals within the mycelium in response to external stimuli. The work packages are listed below.

Work breakdown

The work will be subdivided in the following tasks:

Surveying of literature:

The student will initially study the types of mycelium-hybrid composites. Subsequently, the student will study the mycelium cultivation methods and required equipment. Finally, the student will study the evaluation methods for morphological changes and mechanical properties of mycelium-wood composites.

Fabrication:

The student will develop and optimize mycelium cultivation on woodchips (Fig. 2).

The student will modify the material by selecting and blending additives to enhance its mechanical properties.

The student may also participate in the development of printable inks for 3D printing of the composite.



Figure 2. Spawn representing the final structural form (left) and the equipment required for structural fabrication (right).

Characterization:

The student will evaluate the mechanical properties of the composite using a universal testing machine. The student will assess mycelium propagation and the degree of wood degradation using SEM images. The student may also measure electrical signals generated in the fruiting body.

Integration:

The student will assemble glider wings produced using molds to conduct a conceptual drone demonstration.

The work location will be the Laboratory of Sustainability Robotics at EPFL (Lausanne) and will be conducted in collaboration with Empa (Dübendorf, Zurich). The formal supervision will be performed by Prof. Mirko Kovac. The project starting day would be discussed with Kyung-Sub Kim.

Requirements

The student belongs to EPFL ENAC or STI.

The student is motivated to work on an interdisciplinary research topic encompassing material/electrical/environmental/mechanical science & engineering.

Bibliography

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Lausanne, 29/01/2026

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