Technik & Architektur
HSLU Lucerne University of Applied Sciences and Arts

MyceliumTent

Project Context 1

Final Report

$My_{celium}Tent$

The biodegradable tent

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Contents

1 Introduction

2 Background

3 Development of concept

This chapter describes the development of the concept of My$_{\text{celium}}$Tent. The user scenario is presented at the beginning. From it, a catalogue of requirements is made, and the result of this chapter is the concept for the final product.

3.1 User scenario

This sub-section explains the primary use case of My$_{\text{celium}}$Tent and what describes the problem it is going to solve.

3.1.1 Problem

Many festival-goers buy cheap, disposable tents with the intent to use them only once. These tents are often left behind after the event, as they are difficult to carry back, especially if they are damaged. Because festivals can be rough on tents, people are reluctant to bring high-quality ones and instead opt for cheap alternatives. As a result, thousands of plastic and nylon tents are abandoned after major festivals, creating an environmental issue with large amounts of non-biodegradable waste.

3.1.2 Objective

The My$_{\text{celium}}$Tent is a biodegradable and recyclable tent made from mushroom roots, designed as an eco-friendly alternative to single-use plastic tents often abandoned at festivals and outdoor events. Lightweight, easy to carry, and affordable, it provides a durable yet temporary shelter that helps reduce plastic waste and minimize environmental impact, offering festival-goers a sustainable way to enjoy their experience without contributing to pollution.

3.2 Requirements catalogue

Based on the final user scenario and the feedback of potential customers, the requirements have been defined in the catalogue of requirements (Table 1).

Table 1: Catalogue of requirements

Nr.	Mandatory / Optional	Category	Topic, questions	Requirement
Functional requirements				
1	M	Main function	What is the primary application of the product from the customer point of view?	To keep the customer and the customers belongings dry and clean during a festival.
2	M	Actors	Who buys the product? Who uses the product?	Buyers B2C: Festival-goers Users: Festival-goers, typically between the ages of 18 and 35.
3	O 3	Actors	What other potential customers are conceivable?	B2B: Corporation with Festival-organizers (Tent-Inclusive offer)
4	O 5	Start process	How to set up or start up the installation?	Self-explanatory set-up
5	M	Dimensions	What is the maximum/minimum dimensions of the product?	Max. length: 60 cm Max. diameter: 20 cm
6	M	Weight	What is the maximum weight of the product?	Max. 5 kg.
7	M	Sustainability	How big is the environmental impact of the tent?	80 % by mass of the tent is recyclable.
Non-functional requirements				
8	M	Costs	What should the product cost from the user's perspective?	30 to max. 80 CHF
9	O 4	Durability / quality	How long should the product last when used properly? How susceptible to faults should the product be at most? What stresses can the product withstand?	The product should last for 5 days, the duration of a long festival. The tent should be able to withstand a wind force of 50 km/h. (Beaufort scale 6)
10	O 4	Design	Color? Shape?	The Design should be puristic, simple and should be offered in a variety of bright colors.
11	M	Operability	Simple handling	Easy to set up (within 10 min)
12	M	Safety	Special safety measures	The Tent must be fully fireproof and have a minimum hydrostatic head of 1500 mm.
13	M	Legal norms / standards	e.g., road-safety laws, CE-Norm	DIN EN ISO 5912 (Waterproofness, tear resistance) DIN 4102 B1 (flame retardant)

3.3 Morphological box

This chapter describes the process of developing three design variants for a biodegradable festival tent using the morphological box method. The product was divided into key subproblems, such as shape, size, structure support, lifespan, and material processing. For each subproblem, a range of possible solutions was researched, resulting in the initial morphological box (see Appendix, Table xy).

To streamline the process, less critical subfunctions, like color design and biodegradation duration, were excluded, and unsuitable materials, such as unprocessed Mycelium-Based Composites (MBCs) and plastic, were removed. The refined morphological box (see Appendix, Table xy) formed the foundation for selecting three promising design variants, which are detailed in Table 2 and the following section.

Table 2: Morphological box with three solution variants

Sub-Functions / Problems	Solution 1	Solution 2	Solution 3	Solution 4
Shape	Right triangular prism	Dome	Tunnel	Instant-tent (Decathlon-Style)
Size (People)	Max. 1 p.	Max. 2 p.	Max. 3 p.	Max. 4 p.
Structure support	Mycelium-poles	Aluminum	Bamboo	
Lifespan	Single use	5 months	1 - 3 years	
Quality	Low	Medium	High	
Processing Method	Mycelium-based Leather MBL		Kombucha leather	

3.3.1 Description of the three solution variants

Variant 1: Dome tent (Single use, Fully biodegradable)
The first variant is a dome-shaped tent, constructed entirely from biodegradable materials, including mycelium poles and Mycelium-Based Leather (MBL). This variant is designed for single-use and aims to provide the highest possible grade of biodegradability. It is produced with a focus on low-cost and low-quality materials, suitable for short-term use at festivals.

Variant 2: Tunner tent (Four-person, Long-lasting)
The second variant is a tunnel tent, chosen for its optimal space-to-weight ratio, making it suitable for accommodating four people—the largest capacity in this selection. It is designed with higher-quality materials for a lifespan of one to three years, supported by an aluminum structure for enhanced durability and stability.

Variant 3: Triangular prism tent (Two-person, Medium-lasting)
The third variant is a right triangular prism-shaped tent, designed for two people. This option combines features from both the high-quality tunnel tent and the single-use dome tent. It uses bamboo poles, which provide greater longevity than mycelium but are less durable than aluminum, while still maintaining biodegradability.

The final selection between these three variants will be made in the following chapter.

3.4 Value-Benefit analysis

Table 3 presents the Value-Benefit analysis of the three previously described tent variants. In alignment with our primary objective of addressing plastic waste at festivals, biodegradability is assigned the highest priority. The affordability of each variant is also crucial, as it must remain competitive with existing products that contribute to the plastic waste problem. Given that the target market is festival-goers seeking short-term, disposable solutions, the overall quality and lifespan of the tents are less critical, as we do not aim to compete in the high-quality tent market.

The analysis includes a row for “Weather Resistance”, which evaluates the tent’s ability to endure adverse weather conditions, such as heavy winds. This aspect is particularly relevant as different shapes provide varying levels of structural resilience.

3.4.1 Justified choice

Based on the weighted ratings derived from the Value-Benefit analysis Table 3, the Dome Tent variant emerges as the most suitable option, achieving a total score of 680 points, the highest among all variants. This reflects its strong alignment with customer requirements, such as affordability, ease of use, and reduced environmental impact, making it particularly appealing to festival- goers. Its features address the key customer demand for a sustainable, temporary shelter while effectively contributing to the goal of reducing plastic waste in festival environments.

Table 3: Value-Benefit analysis

Criteria	Weighting	Dome		Tunnel		Prism	
		Score	Weighted score	Score	Weighted score	Score	Weighted score
Price	25	8	200	2	50	6	150
Biodegradability	25	9	225	5	125	7	175
Handling	15	6	90	5	75	6	90
Lifespan	10	3	30	8	80	6	60
Quality	10	3	30	8	80	6	60
Weather resistance	15	7	105	7	105	5	75
TOTAL Score			**680**		**515**		**610**

4 Final concept

4.1 Product concept

4.2 Technical specifications

4.3 Construction plans

4.4 Mock-up

The mock-up presentation is a key part of the project, allowing users to visualize and understand the tent's design. The tent's features, including the removable cap and door operation with the respective materials used to create the mock-up, will be shown below.

4.4.1 Concept of mock-up

The $\text{My}_{\text{celium}}$Tent features a fully enclosed body with an upper ventilation opening, protected by a mosquito net and rain cover (Figure **??**).
External poles ensure airflow and prevent water ingress. The entry is secured with a loop-and-toggle system, and the overlapping door design blocks rain.

Made from mycelium (Figure **??**), a natural material grown from mushrooms, it is fully recyclable and, in the worst case, mostly biodegradable. Even if abandoned, the $\text{My}_{\text{celium}}$Tent minimizes environmental impact.

4.4.2 Final mock-up

Figure 1: Final mock-up

Figure 2: Compact mycelium

4.4.3 Technical drawing

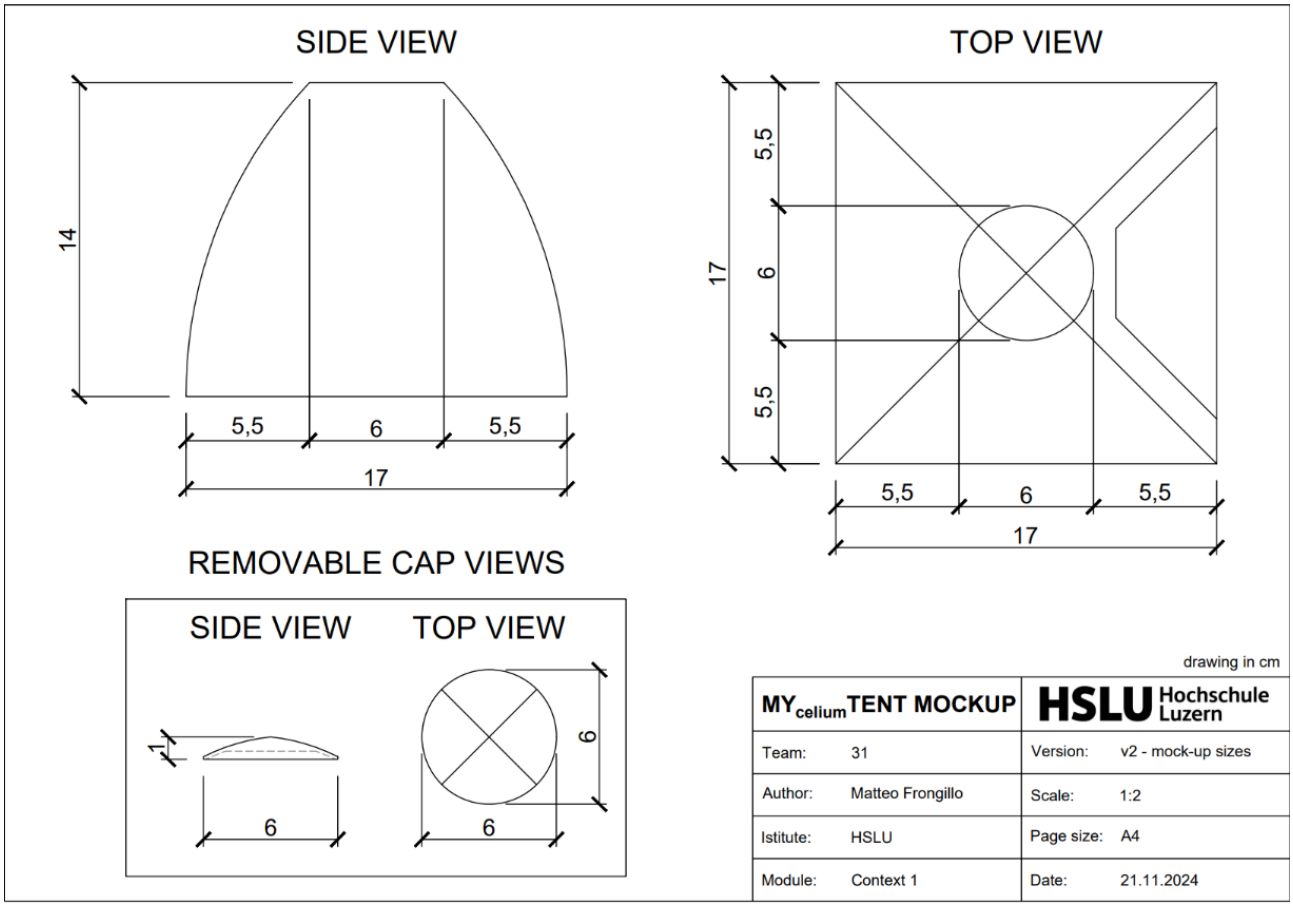

Figure 3: Technical drawing of the mock-up

5 Testing

This chapter examines the testing phase, which is critical to ensuring that the product meets technical specifications and fulfils customer requirements. The expected results are then evaluated in order to give clarification, if further tests or development is necessary.

5.1 Tests

The testing process is divided into two principal areas: Verification and Validation. For each area, three different tests will be conducted.

5.1.1 Verification

This subchapter discusses the verification process during the testing phase. The purpose of this process is to ensure that the product has been developed correctly and meets the predefined requirements. Three of the most significant tests are outlined in Table 4, with the numbers in brackets indicating the corresponding links to the requirements catalogue, which can be found in the appendix.

Table 4: Verification tests

Function	**Requirement**	**Test procedure**	**Expected Result**
Hydrostatic head (1 / 12)	The tent should have a minimum hydrostatic head of 1500 mm	The hydrostatic head is determined by a water pressure test. The material is subjected to increasing water pressure. This continues until the material allows water to pass through. When the third drop has penetrated to the inside, the test ends.	The height of the water column at the point of water passage is above 1500 mm. ⇒*Fulfilled*
Wind resistance (9)	The tent should be able to withstand a wind force of 50 km/h (Beaufort scale 6).	The tent is set up on a meadow and tested with a wind generator simulating a wind speed of 50 km/h for 30 minutes. Inside, it contains a sleeping bag, sleeping mat, and backpack with a total weight of 8 kg. The meadow has a minimum soil moisture of 40%, reflecting conditions after rainfall. This worst-case scenario eliminates the need for additional tests, as drier conditions improve results.	The tent remains in place for half an hour. ⇒*Fulfilled*
Air circulation (1)	It is not only the waterproofness that determines whether it stays dry inside the tent. The geometry of the tent must allow the humidity to be transported outside.	A humidifier is placed in the tent and switched on for 8 hours. It is set to release 50 ml of water per hour, which is roughly equivalent to a human being breathing. At the same time, the wind generator is set to 20 km/h to simulate a realistic wind situation on a large field.	No water collects on the tent floor after 8 hours: ⇒*Fulfilled*

5.1.2 Validation

5.2 Discussion

Regarding the verification tests, the primary source of uncertainty lies in the water resistance of the material, particularly its water column. Existing materials with adequate water resistance, such as alternatives to rubber seals, demonstrate that it is feasible to produce a mycelium-based material with similar properties. However, further testing is required to determine whether the material maintains its water resistance at very thin wall thicknesses, which is crucial for meeting weight specifications.

Wind resistance is unlikely to pose a significant challenge due to the aerodynamic, wind-slip shape of the tent. However, the ability to effectively manage moisture inside the tent remains a concern. As this is a single-wall

design, the construction and shape of the tent play a critical role in facilitating ventilation. To address this, the ventilation opening has been enlarged relative to the tent's total surface area. The effectiveness of this design will only become clear during prototype testing.

Like the wind resistance, the validated operability and sustainability are unlikely to cause later complications. This is due to the facts that the tent not only has a simple structure and a construction manual as an available aid for the set-up process but is also made predominantly out of a recyclable and biodegradable material. The overall durability of the tent during a festival on the other hand could lead to further concern. Additional tests during extended festivals with varying weather conditions will need to be performed to clarify how well the tent can withstand longer and more challenging conditions.

6 Conclusion

The $\text{My}_{\text{celium}}$Tent project sought to address the critical environmental issue of waste accumulation at festivals by developing a tent composed of a fully sustainable and recyclable material. Mycelium, characterized by its high recyclability and cost-efficient cultivation, has shown promise as a potential solution. However, a key challenge remains the evaluation of its suitability as a tent material. Addressing this challenge requires extensive research and development, which falls beyond the scope of this project.

Despite these challenges, the concept has demonstrated substantial potential. It addresses an urgent environmental problem and offers a compelling business opportunity, particularly as a B2B solution for festival operators. Collaborations with such stakeholders could significantly enhance the project's impact and feasibility.

Future work should prioritize comprehensive research into the material properties of Mycelium, followed by the production and evaluation of prototypes under realistic conditions. This iterative development process will enable the refinement of the product to ensure its functionality and durability. Given the significance of the problem and the potential of the proposed solution, continuation of this project is strongly recommended.

7 List of tables and figures

List of Tables

List of Figures

8 Declarations on the use of AI tools

- *DeepL* and *ChatGPT 4o* have been used as a spell-checker;
  https://www.deepl.com/
  https://www.chatgpt.com/

9 Appendix