Mushroom Cultivation System

(Mushroom++)

mpp

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1. Background Description

Every type of mushroom requires different conditions for optimal growth. While plants produce energy by absorbing sunlight, mushrooms get all their energy and nutrients from their growth medium through a biochemical decomposition process. Mushrooms require specific humidity levels of around 95-100% and substrate moisture levels of 50 to 75% which can be a challenge to maintain using traditional methods of cultivation. (Chang and Miles, 2004)

Mushrooms can be cultivated indoors or outdoors but the most common method is by far indoors because of the control and consistency it provides. Indoors mushroom is regulated by spawning cycles (Beyer, Fleischer and Wuest, 1999) and is typically accomplished in trays situated in windowless buildings made with commercial mass production in mind. This type of cultivation provides the advantage of scalability and ease of harvesting. While cultivating mushrooms indoors there is a lot of attention put on the tight control over growing substrate composition and growing conditions which results in a constant and predictable yield for the producer.

Mushroom cultivation usually consists of these six steps (Beyer, 2003): composting, fertilizing, spawning, casing, pinning, and cropping. The pinning step is regarded as the most difficult for a grower to accomplish because mushrooms are triggered towards fruiting by a very precise combination of carbon dioxide (CO2) concentration, temperature, light, and humidity. (Chang and Miles, 2004) Another important factor that might prohibit mushroom growth is cross-contamination.

Mushroom production in private households has proven to be rather hard due to these environmental conditions. And without the aid of industrial solutions, monitoring and ensuring these kinds of properties, mushroom cultivation remains a difficult task. To this day, commercially available nonindustrial hardware and or software, tackling problems concerning mushroom cultivation are nonexistent (Sauciunas, 2021).

Taking into consideration that this is a complex problem, there are already communities out there who are dealing with these kinds of issues. But these communities can be described as a group of people sharing experience and information, rather than an organized group, methodically tackling the obstacles.

Private growers have limited access to such non-industrialized products and features, including but not limited to the following:

- Hardware directly assisting with the monitoring and regulation of environmental properties.
- Communal, unified data collection from hardware for analysis.
- Remote management and monitoring of hardware.
- Freely available results of data analysis for performance boost.

2. Problem Statement

Individuals and small businesses interested in mushroom cultivation have limited options to monitor their cultivation life cycle, compromising spores and harvests.

- How could a person maintain an ideal growing condition for different mushrooms?
- How could a mushroom grower know if something went wrong with his farm?
- How could a mushroom grower keep track of the environmental changes and its effects on mushrooms all the time?
- How can a mushroom grower keep track of deadlines and important milestones while cultivating their farm?
- How could a mushroom grower know the optimal environmental properties to cultivate mushrooms?

3. Definition of purpose

The purpose is to help mushroom farmers monitor and manage the environmental factors which influence and often limit the practice of fungiculture.

4. Delimitation

The delimitations of our project are:

- We will not include system support for outdoor fungiculture.
- We will not provide automatic climate management for all the relevant external factors.

5. Methodology

Agile Unified Process (AUP) and Scrum framework will be used during this project. Unified Process consists of four phases: Inception, Elaboration, Construction and Transition. In the Inception phase, the team will define the base tenets of the project, and establish the business requirements of the project, including feasibility, targeted customers, and project schedules.

During the Elaboration phase, the team will establish a solid foundation for the software to be developed. During this phase, common risk factors will be addressed, and the general architecture will be constructed. During this phase, a working proof of concept will also be developed.

During the Elaboration phase’s second half and in all further phases, Scrum will be used as a day-to-day development methodology. This is due to the advantages of Scrum in such a context, such as the streamlined management capabilities and enhanced cooperative efficiency.

For Scrum, Levente Nagy will serve as Product Owner and Kristóf Lénárd will serve as Scrum Master. All other team members will serve as members of the development team, organized into smaller departments led by the technical leads of said department. Scrum itself will be organized in the classical Scrum format, with sprints planned, during an appropriate meeting, with daily meetings, both in-group and in-department, and with sprint review and sprint retrospective meetings at the end of it. Other elements of Scrum (e.g., backlog refinement) will be done on an ongoing basis.

Next, during the Construction phase, the penultimate version will be developed. The goal here is to create the actual system that meets the requirements, and to develop the supplementary materials so that they also meet the technical standards of the group.

Finally, the project will reach Transition phase, during which user acceptance testing will be conducted, and provided a pass, the final version will be uploaded, and all supplementary material will be finalized. The development after this will consist of minor updates and bugfixes, without new features or significant changes.

6. Time schedule

The following section provides a preliminary schedule set for the SEP4 project period. The schedule includes the four UP phases: Inception, Elaboration, Construction, and Transition.

17th February – SEP4 Kick-off
22nd February – Idea hand-in
24th February – Feedback: Idea, beginning of Inception phase
15th March – Inception hand-in
17th March – Inception feedback, beginning of Elaboration
26th March – Specialization hand-in
27th March – 5th April – Easter break
7th April – Hardware handout
26th April – Elaboration deadline
28th April – Feedback: Elaboration
17th May – Construction hand-in deadline
19th May – Feedback: Construction
21st May – 4th June – Project period
3rd June – 4th June – Transition phase
4th June – Final hand-in

Scrum sprints:
7th April – 26th April – Sprint 1 (Elaboration phase)
28th April – 14th May – Sprint 2 (1st Construction)
19th May – 25th May – Sprint 3 (2nd Construction)
26th May – 28th May – Sprint 4 (3rd Construction)
31st May – 2nd June – Sprint 5 (4th Construction)

7. Risk assessment

Risks	Likelihood Scale: 1-5 5 = high risk	Severity Scale: 1-5 5 = high risk	Product of likelihood and severity	Risk mitigation e.g., Preventive- & Responsive actions	Identifiers	Responsible
Delay when receiving alerts.	3	4	12	Optimization, delay measurements, connection distance decreasing	Significant difference between timestamps, non-accessible device	Kristof Lenard
Significant errors in measurements	2	4	8	Sensor calibration/replace,	Unrealistic measurements, inconsistencies	Daria Maria Popa
Errors when transmitting messages from app to sensors	2	4	8	Delivery confirmation,	Actuator cannot be accessed by the app	Kristof Lenard

8. Sources of Information

Note: Use the standard reference method: Harvard Anglia. A very good reference tool is Mendeley (Mendeley.com 2016), ask VIA Library if you need help. You may include sources that you have not used yet but expect to use.

Chang, S. and Miles, P., 2004. Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact. 2nd ed. London: CRC Press.

Beyer, D., Fleischer, S. and Wuest, P., 1999. Crop Profiles. [online] North Carolina State University, Center for Pest Management. Available at: <https://web.archive.org/web/20071227150738/http://cipm.ncsu.edu/cropprofiles/docs/pamushrooms.html> [Accessed 3 March 2021].

Beyer, D., 2003. Basic Procedures for Agaricus Mushroom Growing. [online] Pennsylvania State University. Available at: <https://web.archive.org/web/20070921154907/http://www.americanmushroom.org/agaricus.pdf> [Accessed 3 March 2021].

Sauciunas, A., 2021. *Report based on the research concerning mushroom cultivators.*

Appendices

- Group Contract
- Preliminary Requirements