MushHubApp: Integrated Mushroom Management System through Training, Collaboration and Analytics

Proponents:_____

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INTRODUCTION

Mushroom cultivation, despite its contribution and benefits to the economy, faces several management challenges worldwide. Although there are over 14,000 species of mushrooms, only a small percentage are commercially cultivated due to certain difficulties such as lack of modern technology and infrastructure designed for mushroom cultivation, and limited market support. As stated in a blog on Krishi Bazaar, most mushroom-growing farmers are poor and cannot afford the pasteurization room. As a result, these farmers suffer a loss not only in yield but in profit from their crops as well. Thus, a common pasteurization chamber facility should be provided by the government and non-governmental organizations (NGOs). These issues are identified in many developing countries where mushroom farming has the potential to be a stable source of income for rural communities but is inhibited by a lack of technology, adequate training, and weak environmental protection systems.

In countries like Nepal and Nigeria, farmers struggle with a lack of irrigation, high costs, and limited training, resulting in low yields and incomes(Tijani. 2019 . Acharya, K., & Dhungel, B. 2021). In the Philippines, regardless of the growth potential of the mushroom industry due to the abundant agro-waste substrate, production continues to decrease due to a lack of support and market access(Chang et, al 2014). These challenges suggest the need for an integrated technological solution in mushroom management that will improve skills, collaboration, and efficiency across the sector.

Dr. Lolita D. Viyar, led the initiatives at Laguna State Polytechnic University (LSPU) and has contributed to the growth of mushroom industry. Her STRAW Project, which focuses on reprocessing agricultural waste for sustainable mushroom cultivation, marks an outstanding accomplishment in the Mushroom Research and Production Center (MRPC) journey at LSPU. From hands-on training to educational seminars, the center has been made to encourage people to understand and expertise in mushroom cultivation within the community.

The LSPU Mushroom Center takes part in offering students hands-on experience and focusing on research and innovation. The program at the Mushroom Center aims to reach local communities, sharing knowledge and skills that benefit farmers and entrepreneurs. The challenges they face include the lack of technological infrastructure, such as an effective website and management system for handling inquiries, scheduling, and product information distribution. These challenges led to coordination issues, causing unclear conversations with interested parties.

Based on various studies, there are several challenges encountered by farmers on agripreneurs in the Philippines, including digital poverty due to a lack of ICT infrastructure and skills, as well as limited access to mentorship programs and government facilities for marketing in different agricultural products (Raissa, Fabregas, 2022; De Mesa et al., 2022). Despite the lack of physical access and ability to new technologies and limitations of the public sector, the Department of Agriculture of the Philippines uses e-government to support the development of agriculture and the lives of farmers. (Panganiban, 2018).

Dr. Lolita D. Viyar's research at LSPU further highlighted the limited production and supply of oyster mushrooms in the local market (Andam & Dulay, 2018). These findings collectively underscore the complex array of obstacles facing the agricultural sector in the Philippines, from technological barriers to market access and biodiversity assessment. Additionally, the importance of mushrooms in the country for their nutrition and income production was emphasized despite the need for a thorough checklist of natural mushroom species (Dulay et al., 2023).

Information and communication technologies (ICT) are important to agricultural development, especially through mobile apps, internet access, and e-commerce platforms that provide timely information and direct markets for farmers (Wanglin et al., 2023; Kauffman & Riggins, 2012). Precision agriculture tools such as GPS mapping and soil sensors help in more accurate farm management (Doong & Ho, 2012). Moreover, digital financial services platforms provide access to banking and insurance services, which improves farmers' financial management (Kauffman & Riggins, 2012).

The study's overall goal is to develop a MushHubApp, which is a web-based system that can be used to simplify the process of requesting training schedules and facilities for mushroom cultivation especially on MRPC, that provide a community forum for knowledge sharing, and even geo-map the locations of mushroom stores/centers. By leveraging ICTs, this portal seeks to overcome barriers to access and facilitate knowledge exchange within the community, enabling easy access to facility information and engaging in knowledge sharing with the help of the MushHub platform.

General Objectives

This study aims to create a website platform entitled “MushHubApp: Integrated Mushroom Management System through Training, Collaboration and Analytics”.

Specific Objectives:

1. To develop a web portal for Mushroom Center to extend its services to the community with the following features:

    1.1 Training Scheduling

    1.2 Requesting of Facilities

1.3 FAQs for Inquiries

1.4 Evaluation with Data Analytics

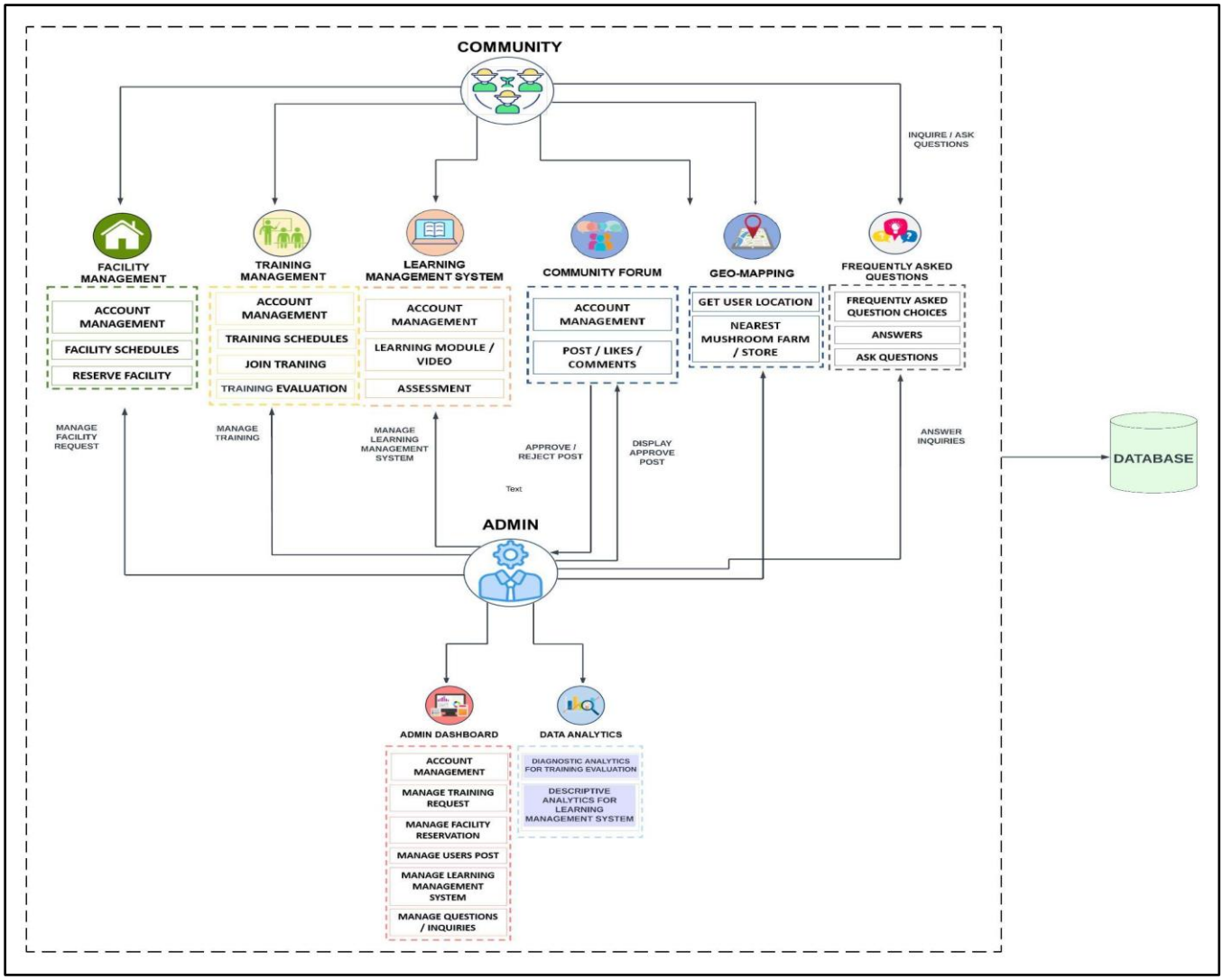
2. To create an online community for collaboration on different trainings and products.

3. To integrate geo-mapping to locate the different available mushroom stores or livelihood centers.

4. Develop an integrated LMS within the web-based platform to provide comprehensive learning resources and tools for individuals interested in mushroom cultivation.

5. Test and evaluate the system in terms of usability and level of user's acceptability.

Conceptual Framework



The diagram illustrates the proposed system's conceptual framework, consisting of six main subsystems for the community and two subsystems for administrators. For the community the subsystems are Facility Management, Training Management, Learning Management System, Community Forum, Geo-Mapping, and Frequently Asked Questions (FAQs). For administrators the subsystems are Dashboard and Data Analytics.

In the Facility Management subsystem, the ADMINISTRATOR can add and oversee facilities within the system, while the COMMUNITY can register to access the website, check calendar dates, and reserve for use of Mushroom Center Facilities, with requests forwarded to the administrator for approval or rejection. The Training Management subsystem is designed for individuals and groups interested in the Mushroom Research and Production Center training. Farmers, communities, or other groups can join available training, and monitor events via event calendars. Mushroom Research and Production Center will conduct the training, and users will answer training evaluations afterward.

The Learning Management System, the third subsystem, will offer learning materials on mushrooms, including modules or videos. The user can enroll in a certain course and take an assessment based on their chosen course.

The Community Forum will allow users or farmers within the community to post something like tips, referrals for the training or some questions, Community Forum will allow users to interact with other people in the community by posting, liking and commenting on other people's posts. When a user posts something, the post will be passed to the administrator for approval before displaying it publicly.

The fifth subsystem will be the Geo-Mapping which offers the users to locate or see nearest mushroom farm or store based on their current location, it will get the users location and display a map to serve as guide to reach the nearest mushroom farm or store .

The sixth subsystem comprises a chatbot for FAQs, enabling users to inquire about the portal's offerings and obtain assistance, particularly beneficial for new users seeking information about the portal's functionalities. Users can also ask questions related to mushrooms to the admin and admin can reply to those questions.

The administrator module will be the Dashboard that serves as a page for managing users' posts, training request, facility request, learning management system content and can manage or answer users questions and inquiries.

Lastly, the Data Analytics module can allow the see which courses have high or low completion rate. Diagnostic Analytics is for Training evaluation, through the evaluation of the users after the training, the admin can see where they lack in training such as; materials quality, content quality and speaker evaluation. Through diagnostic analytics, they can improve what they lack in the next training.

Scope and Limitation of the Study

MushHubApp is a website for Mushroom Research and Production Center. MushHubApp has features such as Training Scheduling where users can join available training based on calendar, it also comes with the evaluation feature where users who join training can evaluate the speaker. Requesting of Facilities where users can reserve available facilities. MushHubApp also has a Learning Management System feature where users can view and join courses about mushroom, users can learn and take assessments after reading the module. There are also Frequently Asked Questions for users who want to learn how to use the website and for users who want to inquire. Users can also post in the community page, they can downvote or upvote and comment on other users' posts. There is also geo-mapping for users to locate and see directions of nearby mushroom farms or mushroom stores.

MushHubApp is a website for Mushroom Research and Production Center (MRPC), by providing a comprehensive online platform for the mushroom-related activities in community engagement and for education. The primary users of MushHub are the mushroom farmers, researchers, and community members. This development and implantation are phases of the MushHub platform from MAY 2024 to the end date.The platform site exclusively supports mushroom-related content and does not provide the other types of plants or agricultural activities. The platform functionalities and support services they can see other mushroom farms nearby in the area .Posts by users and participants in the platform are submitted to administrative filtering, which is may delay the display of new content and restrict the flow of information. Other limitations include potential technical issue, such as server downtime, and the availability of resources for maintaining and updating the platform. In the Geo-Mapping feature, the user can’t see the 3d view of the map, they can only view, zoom in, and zoom out the map. Additionally, there is no borrowing system integrated into the platform, meaning tools and facilities cannot be borrowed through the system. This feature is not catered by the web-based platform. The information and FAQs found on the platform are also limited to mushroom-related topics.

Literature Review

Training Scheduling

In the study, "Impact of oyster mushroom training programme on farm women of Bastar", it shows that training in mushroom production has expanded the knowledge of women farmers and has had a positive impact on their livelihoods through the development of their own businesses. (Ritika et al., 2020) It is also stated in a study of Tijani (2019) regarding on how lack of training affects the efficiency of mushroom production that mushroom farmers in Oyo State need high level of training in mushroom production, especially in infection prevention and chemical preservation, in order to increase their production and avoid limitations such as low sales. Proving that training has an effect and is important to the efficiency of mushroom production, the study of Pandey et al. (2018) shows that training at Krishi Vigyan Kendra for mushroom production was effective in increasing the knowledge and skills of the participants. In addition, most participants were satisfied with the aspects of training and with the skills they have adopted that can help improve their livelihood. To reach a larger population of new mushroom grower who needs training, online training can be considered as one of the best options nowadays. And according to the study of Elang et al. (2022), Mobile Training Units (MTU) are an effective solution to expand the reach of training to youth who have difficulty reaching educational centers, especially in the field of mushroom production training.

Planning the training of new employees presents a major challenge to many organizations due to its complexity and resource demands. Pandey et al. (2019) addressed the challenge of scheduling training efficiently through project utilization. This project resolves scheduling conflicts and optimizes resource allocation, including time, rooms, and trainers, based on predefined constraints, thereby improving the overall effectiveness of training programs. In the study by Qingyang et al. (2023), they emphasize the importance of effective scheduling, especially in technical fields such as deep learning, where a transport layer scheduler can speed up training distribution by improving computation communication. Similarly, Shahraki et al. (2022) emphasized the role of Decision-Support Systems in modernizing training scheduling, ensuring the fair distribution of work, and aligning schedules with the trainees' preferences. On the other hand, Yang & Zhu (2023), apply the use of GRA model, which offers way to improve work task efficiency and optimize resource utilization by including time as one of the critical parameters. These authors describe different approaches to the better practice of planning that focuses on the improvement of efficiency and resource management.

Learning Management System

In educational and organizational situations, the effective utilization of Learning Management Systems (LMS) remains crucial for managing online courses and educational materials. Amutha & Prasath (2023) highlight the development of an LMS Php project aimed at enhancing interactive learning experiences. This initiative addresses the ongoing challenge of promoting engaging educational environments through advanced web-based platforms. For study of Rosário & Dias (2022) emphasize the analytic role of LMS systems in educational contexts, emphasizing the need to align system features with various user needs to ensure ideal educational

delivery and student record management. Furthermore, on innovations such as those discussed by Bae & Shin (2020) highlight the evolution of LMS capabilities, including features for comparative analysis of student performance. These advancements aim to motivate continuous improvement and eventually enhance educational outcomes by utilizing comprehensive data.

Teachers perceptions and acceptance of Learning Management Systems (LMS) are influenced by various factors, as highlighted by Asif, Nosheen, & Shaista (2021). These factors include social influence, recognizing ease of use, and distinguish usefulness, which play a crucial roles in form attitudes toward LMS adoption. The study emphasize the importance of actual system usage and content quality as critical factor affecting how educators perceive and utilize LMS tools. In higher education, platforms like Moodle are crucial in enhancing educational practices by improving access, flexibility, and cost-effectiveness (Chaubey & Bhattacharya, 2015). Ana, Paula, & Lopes (2014) in importance the functionalities of LMSs, such as communication tools, management features, and assessment capabilities, which empower educators to organize tasks efficiently, provide timely feedback, and support students in both synchronous and asynchronous learning settings.

Data Analytics

Data analytics plays crucial role in organization operations by transforming raw data into actionable insights critical for informed decision-making and improving products and services (Li, 2022). Ensuring the reliability of research outcomes connected on maintaining data accuracy, employing suitable analytical methodologies, and interpreting results effectively (Thompson, 2022). A range of analytical approaches, spanning quantitative, qualitative, and integrated methods, are may employed with the aid of specialized software tools. Over time, data analytics has evolved significantly since the dot-com bubble, integrating advanced techniques such as data mining to extract valuable insights from vast datasets (Rahmad, 2022).

Integration on data analytics tools and methodologies, emphasized by Glenn et al. (2013), within a parallel computing infrastructure facilitates the development of strong data models and analytics applications. This approach addresses the need for advanced statistical, spatial, graphical, pattern mining, clustering, and machine learning models to tackle complex data challenges effectively. Lee (2021) emphasize the pivotal role of data analytics in technological forecasting, employing a process-focused morphological matrix to provide actionable insights for future research directions. Furthermore, Ghasemaghaei, Ebrahimi, & Hassanein (2018). They highlight that competency in data analytics enhances decision quality in organizations, the sheer volume of data alone does not necessarily lead to improved decision efficiency. The collective study mark the critical importance of leveraging data analytics to address specific challenges in decision-making processes, forecasting, and optimizing data-driven strategies.

Mushroom Cultivation Platforms

The mushroom cultivation industry faces significant challenges in effectively monitoring and controlling crucial environmental parameters essential for optimal growth. Rong-Yuan et al. (2022) introduce an autonomous mobile platform designed to alleviate labor shortages in manual inspection tasks at mushroom farms, highlighting the need for improved environmental monitoring. This study aims to develop an automatic irrigation system for growing oyster mushrooms using a DHT22 sensor for monitoring temperature and humidity (J., Habibuddin.,

Taufik, Muchtar., Muhammad, Azis, 2023) . Although the system is effective in maintaining the right level of humidity, it still has the potential to improve the integration of other technologies such as the use of various sensors for more comprehensive environmental control. Laurentius et al. (2023) address this challenge with an system focused on monitoring temperature and humidity in mushroom breeding rooms,

Technological advancements, play a crucial role in revolutionizing mushroom cultivation practices. Chong et al. (2023) emphasize potential in managing and monitoring cultivation environments, demonstrating its transformative impact on industry practices. Jou et al. (2022) expand on this by employing an autonomous mobile platform equipped with smart sensors and for real-time data collection in mushroom plantations, enhancing precision in environmental monitoring and management. Hendinata & Fikri (2023) further contribute to this field with an system for monitoring temperature and humidity in mushroom growing rooms, emphasizing practical solutions for improving cultivation efficiency and yield management.

Community Engagement

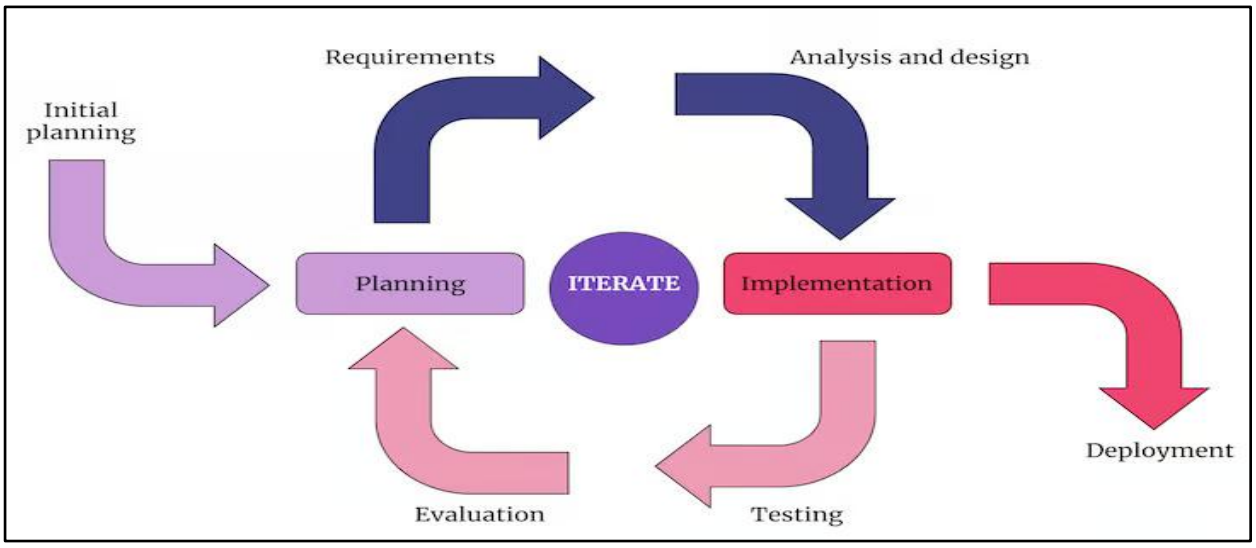
The importance of community participation extends across various domains, including the online sharing economy and agricultural practices. Yunwei & Byung-Ryul (2023) explore how factors like community identity and relationship commitment influence participation in online sharing economy communities. This match with Dicky et al. (2023) Community participation are important in the development of tourism activities, from planning to implementation, and plays a major role in the success of tourism in Cibodas Village, Bandung, Indonesia. Although there are challenges in the development of agrotourism, the participation of farmers in its development has significantly increased (Dicky et al., 2023). Additionally, Obach & Tobin (2014) they highlight higher levels of volunteerism and political participation among participants in civic agriculture, emphasizing the link between community engagement in agricultural activities and broader civic involvement. These studies collectively underscore between community participation, agricultural practices, and socio-ecological relationships, illustrating how fostering community bonds through activities like mushroom farming can positively impact both local ecosystems and civic engagement.

The benefits of community farming initiatives are evident across various studies. Liu et al. (2016) demonstrated their potential in England and China, highlighting alternatives to industrialized food systems and promoting long-term health and well-being benefits for participants. Poulsen (2017) explored urban farming in Baltimore, different participation in farming's community-focused approach with another farm emphasizing job creation and financial sustainability. Both initiatives address community needs and foster participation in the food system. Samoggia et al. (2019) furthered this perspective by studying Community Supported Agriculture (CSA) farmers in the United States and Hungary, revealing shared positive perceptions regarding food quality, environmental benefits, and community engagement, despite differing views on economic and management aspects. These studies collectively determine the diverse yet impact roles of community farming initiatives in enhancing local food systems and community well-being globally.

METHODOLOGY

The proponents utilized the Iterative and Incremental model in developing the website. The Iterative and Incremental development model consists of the following steps: Planning, Requirements, Analysis and Design, Implementation, Testing, Deployment and Evaluation. Iterative Incremental development is important for modern websites and applications because it helps to create tests that can effectively find issues and ensure website development quality, it can also facilitate feedback and flexibility to accommodate some changes in the project (Bew, G. 2013).

Software Development Model



The proponents implement the Iterative and Incremental Software Development Model for MushHubApp to guide the creation of the website. By using this model, the development becomes flexible and allows the proponents to continuously develop and improve MushHubApp by incorporating changes and adjusting its features based on suggestions and comments from the Mushroom Research and Production Center Head and their adviser. The Iterative and Incremental approach ensures MushHubApp meets the expectations of the Mushroom Research and Production Center and the adviser.

Planning

Before gathering the requirements and creating the website, the proponents plan how to collect the necessary data. They coordinate with their adviser for guidance before heading to the Mushroom Research and Production Center. Together, the proponents and their adviser set up a meeting with the head of the Mushroom Research and Production Center to schedule an interview for requirement gathering. This includes collecting data for the Learning Management System, deciding the system's color palette, and gathering pictures or videos for the landing page. They also outline the development process, including the sequence of feature development.

Requirements

After planning, the proponents discuss the website plan and features with the head of the Mushroom Research and Production Center. They then proceed to gather the necessary data, such as Learning Management System materials like PDFs and videos about growing mushrooms, and Geo-Mapping locations of mushroom farmers. Once the discussion and interviews regarding the website and data are completed, the head of the Mushroom Research and Production Center approves the features and data needed. The proponents also ask about the types of mushrooms grown at the center, including Oyster, Milky, and Volvalleria mushrooms, to incorporate these into the website. Additionally, they take and download pictures and videos from the Mushroom Research and Production Center to include on MushHubApp's landing page.

Analysis and Design

After collecting some of the data and requirements, the proponents inquire with the head of the Mushroom Research and Production Center about the preferred color palette for the website. Using the provided data, such as the color palette, pictures, and videos, the proponents conceptualize how to integrate these elements into the website's landing page. They also design the layout, determining the placement of buttons and content to ensure the website is easy to navigate. After brainstorming, the proponents use Figma to create a storyboard and prototype, utilizing it as a guide for design and content creation. They prioritize designs for features like the community section, admin dashboard, facility and training requests, and the Learning Management System before working on other elements such as login, signup, and FAQs.

Implementation

After completing the storyboard, the proponents proceed to implementation or development using various tools. They use Visual Studio Code as the main Integrated Development Environment (IDE) because of its flexibility in website development and compatibility with various programming languages.

For the front-end development of the website, the proponents utilize HTML, Tailwind CSS, and React JS. HTML serves as the skeleton for MushHubApp, while Tailwind CSS is used for website design, enabling easier and faster development by applying design classes without needing a separate CSS page. React JS, a JavaScript library, is employed to make development more efficient, especially for page routing. The proponents also use React JS libraries like React-PDF for implementing PDF features in the Learning Management System.

For cloud storage, the proponents utilize Firebase, which offers cloud database services. Firebase is used to store Learning Management data, such as video learning materials, and for Google Authentication, leveraging its built-in authentication features.

Testing

Once the website is developed, the proponents test its functionality, responsiveness, accessibility, and usability. They use the Visual Studio Code extension Thunder Client to test MushHubApp's API, ensuring all API requests and responses run smoothly. During testing, the proponents identify potential errors and address them promptly. They also allow the Mushroom Research and Production Center staff and the adviser to test the website, gathering feedback and resolving any issues identified. The proponents thoroughly check and test each feature to ensure consistency and address any issues before proceeding with usability and acceptability evaluations. They also perform cross-browser and device compatibility testing to ensure MushHubApp works seamlessly across different devices.