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Mushroom Management System

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Abstract: ***Mushroom cultivation faces significant challenges due to the absence of direct market access, limited real-time environmental monitoring, and inadequate technical guidance for small-scale farmers. This research presents the design and development of a digital platform that directly connects mushroom farmers with buyers, ensuring transparent pricing and reducing dependence on intermediaries. The proposed platform integrates a buy–sell marketplace along with real-time cultivation support, including temperature, humidity, CO_2, and light condition monitoring through sensor-based alerts. When environmental parameters deviate from optimal ranges, farmers receive instant notifications, enabling timely corrective actions to safeguard crop yield. Additionally, the system provides scientific guidance on cultivation practices, disease identification, harvesting schedules, soil composition, and spawn quality through advisory and training modules. User-friendly dashboards and standardized data entry templates are incorporated to simplify farm management for both farmers and traders. The platform also facilitates the sale of mushroom seeds, ensuring access to quality inputs. By addressing issues of scalability, sustainability, and knowledge gaps, the proposed solution empowers mushroom farmers to adopt technology-driven practices, improve productivity, and expand market reach effectively.***

Keywords: Mushroom cultivation, Digital marketplace, Smart agriculture, IoT-based monitoring, Direct farmer- to-buyer platform, Environmental sensing, Precision farming, Agricultural advisory system.

I. INTRODUCTION

Mushroom cultivation is an important segment of agriculture, offering significant economic and nutritional value. However, smallscale mushroom farmers often face numerous challenges, including limited access to buyers, dependence on intermediaries, and insufficient knowledge of optimal cultivation practices. Environmental factors such as temperature, humidity, CO_2 levels, and light conditions play a critical role in mushroom growth, but farmers frequently lack the tools to monitor and control these parameters in real-time. Consequently, crop losses, reduced yields, and income instability are common problems in mushroom farming. Existing solutions, such as traditional markets or manual monitoring, fail to provide timely guidance or direct market access, and while some IoT-based agricultural tools exist, they often focus solely on monitoring environmental conditions without integrating marketplace functionalities or advisory support. To address these gaps, this research proposes a comprehensive digital platform that connects mushroom farmers directly with buyers, ensures transparent pricing, and provides real-time cultivation support. The platform integrates sensor based environmental monitoring, disease detection tips, harvesting schedules, and scientific guidance on soil composition and spawn quality. User-friendly dashboards and standardized templates simplify data entry and farm management, while the system also facilitates the sale of high-quality mushroom seeds, empowering farmers to adopt technology-driven practices, improve productivity, and expand their market reach

A. Problem Statement

Small-scale mushroom farmers often struggle with low productivity and income instability due to the lack of direct access to buyers, reliance on intermediaries, and limited knowledge of optimal cultivation practices. Environmental factors such as temperature, humidity, CO_2 levels, and light conditions critically affect mushroom growth, yet farmers frequently lack the tools for real-time monitoring and timely corrective action. Existing solutions either focus solely on environmental monitoring or traditional marketplaces, failing to provide an integrated platform that combines direct market access, precision cultivation support, and advisory guidance. This gap results in reduced crop yields, economic losses, and difficulty in adopting technologydriven practices, highlighting the need for a comprehensive digital solution that addresses both market connectivity and smart cultivation management.

II. METHODOLOGY

The methodology of this research is designed to develop an integrated digital platform for mushroom cultivation that combines a direct marketplace with real-time IoT-based monitoring and advisory support. The research is conducted in the following phases:

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A. Requirement Analysis

The project begins with a detailed analysis of farmer challenges, market needs, and gaps in existing solutions. Surveys and interviews with small-scale mushroom farmers are conducted to understand issues related to environmental monitoring, market access, and cultivation practices. Customer needs and preferences are also evaluated to define the functional requirements of the platform.

B. System Design

Based on the requirements, the system is designed with modular architecture, including a buy–sell marketplace, farmer guidance modules, and IoT-based monitoring functionalities. The platform architecture includes frontend and backend design, database management, and integration of sensors for temperature, humidity, CO_2, soil moisture, and light. Userfriendly dashboards and standardized templates are included for simplified farm management, data entry, and monitoring.

C. Implementation

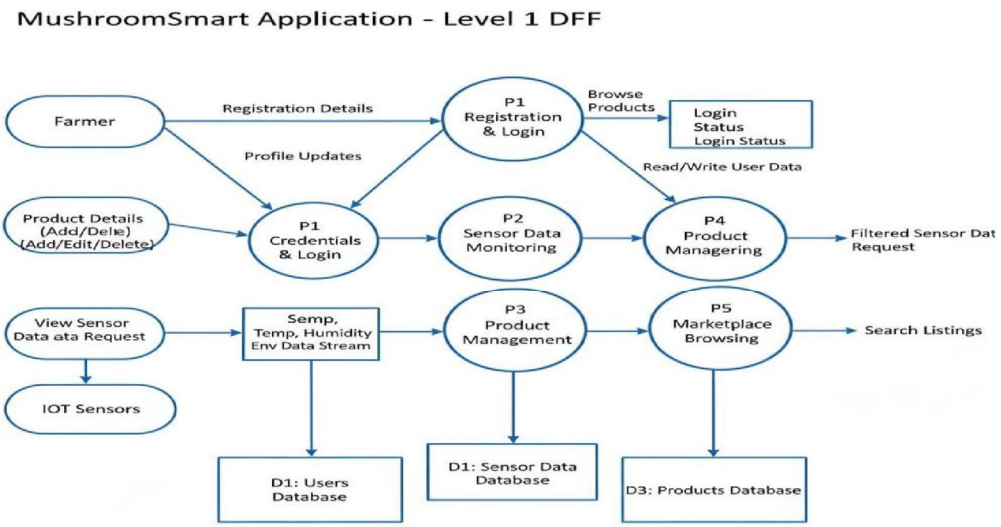
The platform is developed using modern frontend and backend technologies. HTML, CSS, and JavaScript are used to design the user interface, while Python handles backend logic. Databases such as MySQL and MongoDB store farmer, buyer, and sensor data efficiently. IoT sensors installed on mushroom farms continuously capture environmental parameters and provide real-time alerts. The system also integrates advisory modules to provide guidance on cultivation methods, spawn quality, disease identification, and harvesting schedules.

D. Testing and Deployment

The platform undergoes rigorous testing to ensure functionality, usability, and reliability. Both farmers and buyers participate in user acceptance testing to validate features such as order management, environmental monitoring, and advisory support. Feedback from testing is incorporated to refine the system before full-scale deployment.

E. Scope and Execution

1) The Buy–Sell Module allows farmers to list mushroom produce and seeds for direct sale, manage orders, update listings in real-time, and receive customer feedback.
2) The Farmer Guidance Module provides step-by-step tutorials, seasonal advice, and disease management tips to improve yield and quality.
3) IoT sensors continuously monitor environmental factors, providing instant alerts to maintain optimal growing conditions.
4) The platform supports scalability and sustainability by enabling technology adoption and improved farm management practices.



Flow-Diagram of ' 'Mushroom Management'1

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III. LITERATURE REVIEW

The literature survey reviews existing research and technologies related to mushroom cultivation, monitoring, post-harvest management, and market systems. It helps in understanding current solutions, their benefits, and limitations, which form the base for the proposed Mushroom Management System.

A. Mushroom Cultivation and Environmental Monitoring

1) Mushroom cultivation is highly sensitive to environmental parameters such as temperature, humidity, carbon dioxide (CO_2) concentration, and light intensity. Several studies highlight that improper control of these factors leads to reduced yield and poor-quality mushrooms. Traditional farming methods depend on manual observation, which is time-consuming and errorprone.

2) Recent research emphasizes the use of IoT-based monitoring systems using sensors to continuously track environmental conditions. Sensors for temperature, humidity, CO_2, and light provide real-time data to farmers. Automated alert systems help farmers take timely actions, reducing crop failure. These systems have shown improvements in yield, consistency, and resource optimization. However, most existing systems are costly and lack easy-to-use interfaces for small-scale farmers.

B. Post-Harvest Handling and Storage of Mushrooms

1) Mushrooms are highly perishable and typically have a shelf life of only 2–3 days under normal conditions. Studies indicate that poor post-harvest handling leads to significant losses during transportation and storage. Factors such as moisture loss, microbial growth, and oxidation affect mushroom quality.

2) Research suggests that cold storage and Modified Atmosphere Packaging (MAP) can extend the shelf life of mushrooms up to 10–14 days. These techniques help maintain freshness and nutritional value. However, small farmers often lack access to cold storage facilities and proper packaging knowledge, highlighting the need for awareness and guidance systems integrated with farm management platforms.

C. AI and Computer Vision in Mushroom Farming

1) Recent advancements in Artificial Intelligence (AI) and Computer Vision have been applied to agriculture, including mushroom farming. Studies show that machine learning models can be used to detect diseases, identify contamination, grade mushroom quality, and predict harvest time using image processing techniques.

2) Computer vision systems help in early disease detection, reducing losses and improving productivity. Yield estimation models assist farmers in planning harvest and supply. However, existing research indicates that such systems require large datasets and technical expertise, making them less accessible to small and medium-scale farmers. There is a need for simplified, farmer-friendly AI-based solutions.

D. Market and Supply Chain Challenges

1) Literature related to agricultural marketing highlights that farmers often depend on middlemen, resulting in unfair pricing and reduced profit margins. Mushroom farmers face price fluctuations and lack direct access to buyers such as restaurants, wholesalers, and consumers.

2) Research strongly recommends direct digital marketplaces that connect farmers and buyers. Such platforms ensure transparent pricing, better income for farmers, and fresh produce for consumers. Existing agricultural e-commerce platforms focus mainly on crops and grains, with limited support for mushroom-specific needs such as quality grading, freshness, and rapid delivery.

E. Research Gap Identified

1) From the literature review, it is observed that:

2) IoT monitoring systems exist but are not fully integrated with market platforms.

3) AI-based disease detection systems are complex and not farmer-friendly.

4) Market solutions lack specialization for mushroom farming.

5) There is no single platform that combines cultivation guidance, monitoring, and direct buy-sell functionality.

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IV. SIGNIFICANCE OF THE SYSTEM

The proposed system plays a crucial role in addressing the key challenges associated with small-scale mushroom cultivation by integrating technology, market access, and scientific guidance into a unified digital platform. By combining IoT-based environmental monitoring with a direct buy–sell marketplace and advisory services, the system aims to enhance productivity, profitability, and sustainability in mushroom farming. The significance of the system is summarized as follows:

1) The proposed system enables direct farmer-to-buyer interaction, ensuring transparent pricing, reducing dependency on intermediaries, and improving income stability for mushroom farmers.
2) It integrates IoT-based real-time monitoring of critical environmental parameters such as temperature, humidity, CO_2 concentration, soil moisture, and light, which are essential for maintaining optimal mushroom growth conditions.
3) The system provides instant alerts and notifications when environmental conditions deviate from recommended ranges, allowing farmers to take timely corrective actions and significantly reduce crop losses.
4) By offering scientific cultivation guidance, disease identification support, harvesting schedules, and advisory services, the platform effectively bridges the knowledge gap among mushroom farmers.
5) Access to high-quality mushroom seeds and spawn through the platform ensures consistency in production, improved yield quality, and sustainable cultivation practices.
6) User-friendly dashboards and standardized data templates simplify farm management, order handling, and monitoring activities, improving operational efficiency for both farmers and buyers.
7) The integrated approach promotes precision farming and smart agriculture, enabling data-driven decision-making and long-term sustainability.

Overall, the system enhances productivity, profitability, and scalability of small-scale mushroom farming while encouraging technology adoption and economic empowerment in rural agricultural communities.

V. FUTURE WORK

In future, the proposed system can be enhanced by integrating additional IoT sensors to monitor advanced environmental parameters such as ammonia levels and detailed air quality indicators that influence mushroom growth. Automated environmental control mechanisms, including smart ventilation, humidifiers, and temperature and CO_2 regulators, can also be incorporated to enable automatic corrective actions based on real-time sensor data, further improving cultivation efficiency and yield quality.

The farmer advisory module can be expanded by including expert consultation services, region-specific cultivation recommendations, and multilingual support to improve accessibility for farmers from diverse backgrounds. Development of a mobile application would allow farmers to remotely monitor environmental conditions, receive alerts, and manage marketplace activities, increasing usability and adoption of the platform. Future enhancements to the buy–sell marketplace may include the integration of secure digital payment gateways, logistics and delivery tracking systems, and buyer–seller rating mechanisms to improve transparency and trust. Additionally, the platform can be scaled to support multiple mushroom varieties and expanded to different geographical regions, enabling broader adoption and longterm sustainability of the system.

VI. ACKNOWLEDGEMENTS

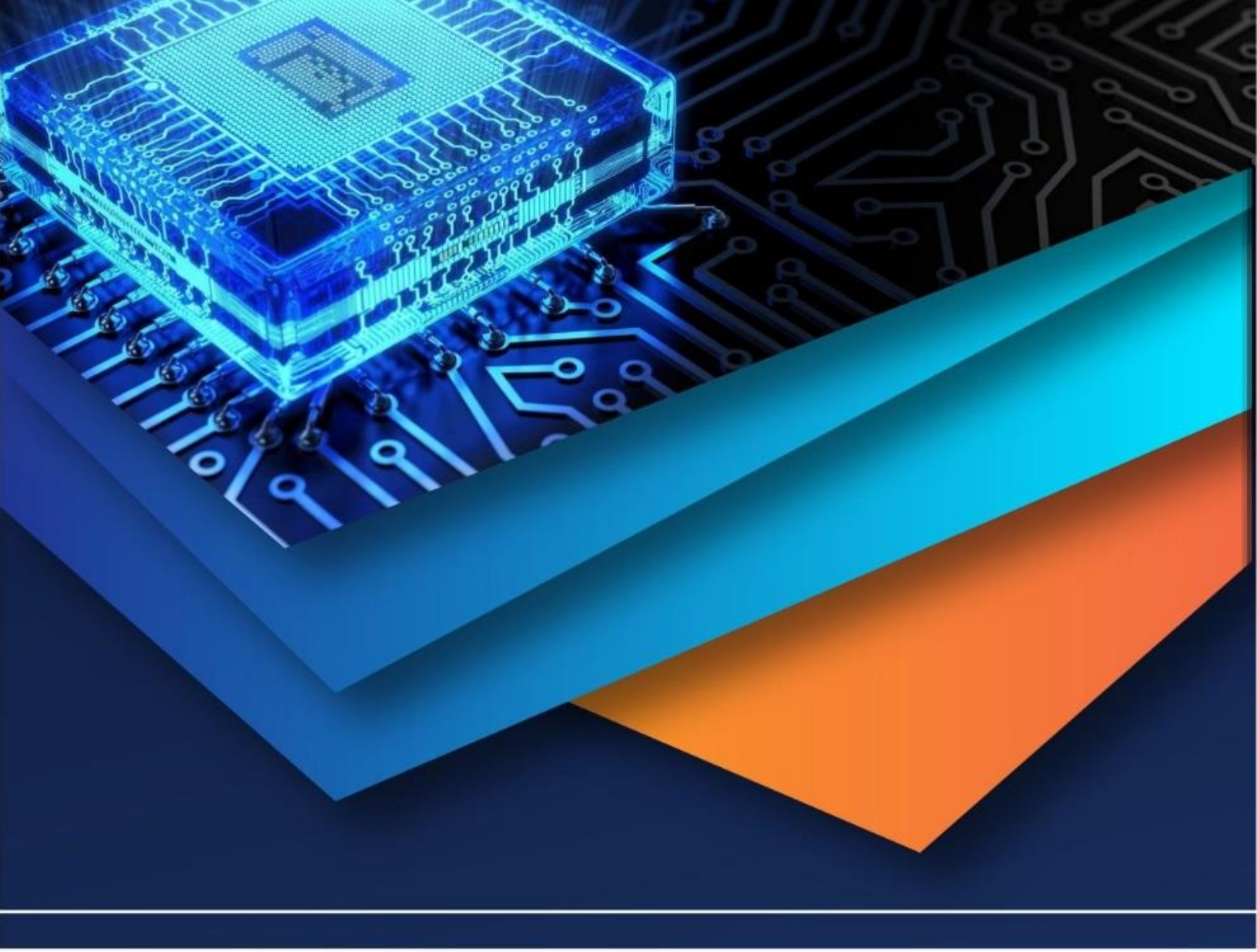
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