COGNATE 3

PROJECT DOCUMENTATION

COGNATE 3

INNOVATIVE MUSHROOM FARMING:

Integrating IoT and AI for Enhanced Growth and Yield

INTRODUCTION

Our project focuses on **IoT-Enhanced Mushroom Greenhouse Cultivation**, where we explore the integration of Internet of Things (IoT) technology to optimize environmental conditions for mushroom growth. This topic is relevant as it addresses the growing need for sustainable, efficient farming methods that leverage technology to increase yields and reduce resource consumption. By automating processes such as temperature, humidity, and CO2 monitoring, this approach benefits both small-scale farmers and larger agricultural operations. In this content, you'll discover how IoT systems improve productivity, lower costs, and promote sustainable practices in mushroom cultivation.

ABOUT OUR PROJECT

About our project our goal is to grow oyster mushrooms while utilizing the Internet of Things. Our idea is to implement automated environmental controls, where we let IoT sensors to regulate temperature, humidity, CO2 levels to maintain the best conditions to the growth of mushroom. Integrating moisture and humidity sensors could trigger misting systems and adjust the airflow to ensure the perfect environment for our oyster mushrooms. Lastly, we are incorporating with cameras to monitor the mushrooms growth stages this will help the team to track progress, identify issues like fungal infections and predict the ideal harvesting time.

METHODOLOGY (SLDC)

SLDC

Title of the Project
Brief Background of the Project
Planning and Requirement of the Project
Defining
Designing
Building
Testing
Deployment

COGNATE 3

METHODOLOGY (SDLC)

COGNATE 3

INNOVATIVE MUSHROOM FARMING:

Integrating IoT and AI for Enhanced Growth and Yield

BRIEF BACKGROUND

In terms of agriculture, Mushroom farming has been growing due to its high nutritional value, economic potential, and has low environmental utilization. However, changes in humidity, temperature, lights, and CO2 (Carbon Dioxide) level has a significant impact on cultivating mushrooms. In traditional farming method for mushrooms optimal growing condition can be tough to maintain, which leads to inconsistent harvests and quality.

With the recent technological development, the integration of Internet of Things (IoT) and Artificial Intelligence (AI) creates a rare opportunity to optimize mushroom farming techniques. Utilizing IoT and AI, farmers are able to provide a consistent growing environment for the mushrooms by using a right sensor to monitor and control the growing environment of mushroom in real-time condition. With the help of AI algorithms, it can make an exact modification in the environment for the mushroom needs, it can also evaluate the data that has been gathered.

PLANNING & REQUIREMENT IDENTIFICATION

Environmental Scanning
Goals and Objectives
Scope / Limitation of the Project
Operations to be Improved

ENVIRONMENTAL SCANNING

For the Environmental scanning this defines how the current technology can enhance the current situation in farming a mushroom.

1. Current techniques to farm a mushroom - In traditional method to farm a mushroom, it is heavily relies on manual labor to monitor and maintain environment condition such as humidity, temperature, and CO2 levels.

2. Technological utilization - Currently, IoT and AI is growing in the industry, adoption to this technologies can improve precision in monitoring the environmental conditions and can optimize the crop quality and harvests.

3. If switching Traditional to Technological - In current situation, technological adoption is a challenge due to the cost and lack of understanding about IoT and AI setup for small farming.

4. Trends - the demand for organic and sustainable goods is becoming popular and it is increasing, there are also trends for innovating agricultural methods, especially for high-value crops such as mushroom.

GOALS AND OBJECTIVES

Our goal is to innovate mushroom farming system by integrating Internet of Things (IoT) and Artificial Intelligence (AI) to optimize environmental condition, increase harvests quality, and reduce the physical work.

Our Objectives Are:

1. To design a smart mushroom farming system with the use of IoT sensors to monitor and stabilize the crucial environment condition such as: humidity, temperature, light, and CO2.
2. To integrate AI managed system to evaluate data real-time and make automated changes to the farming environment.
3. To ensure that ideal growing conditions are continuously maintained to increase crop quantity and quality.
4. To provide a simple interface that enables farmers to monitor and manage their farms from a distance.

SCOPE / LIMITATION OF THE PROJECT

Scope of the Mushroom Farming:

1. The project is much more focused on developing automated mushroom farming with the use of IoT devices to monitor the environmental parameters need for the automated mushroom farm.
2. The AI will be used to analyze the collected data and providing real-time response to optimize growing conditions.
3. The web-based interface will be included in the system allowing remote management and monitoring to the mushroom farming system.
4. integration and utilization of; basic irrigation, lighting, airflow, humidity and temperature control system.

SCOPE / LIMITATION OF THE PROJECT

Limitation of the Mushroom Farming:

1. The project primary focus is, it will implemented indoor and may not be suitable for outdoor environment or large-scale business operation.
2. The initial expense for setting up AI and IoT device can be a challenge for the small-scale farmers.
3. The quantity and quality of data gathered throughout the cultivation phase will determine how effective the AI model is.
4. The mushroom farming system may be limited only for controlling basic environmental factor for the mushroom such as; irrigation, lighting, airflow, temperature, and humidity.

OPERATIONS TO BE IMPROVED

Operations to be improved on mushroom farming system:

1. Controlling and Monitoring the Environment - Real-time IoT sensors will take the position of manual environmental condition monitoring, lowering labor costs and human error.
2. Optimizing Harvests - with the mean of consistent environmental condition, it will lead to more reliable and high-quality harvest.
3. Resource Management - due to less management of resources in manual farming can lead to resource waste, replacing this with AI real-time data analyzation from IoT sensors can optimize resource usage, minimizing waste, and reducing the operational cost.
4. Predictive Measures - farmers on traditional techniques relies on guessing when to harvest, adding AI system to the farming system will utilize predictive analytics to present precise recommendations and enhancing harvest scheduling.

DEFINING

Coverage of the Project to be Developed

Stakeholders / Intended Users of the Project

Expected Project and Result

Expected Benefits and Improvements

Indentified Business Operational Importance

COVERAGE OF THE PROJECT TO BE DEVELOPED

The Coverage of our IoT-based Mushroom Greenhouse Project includes many main areas, each meant to maximize mushroom growth and production, improve ethical farming, and contribute to sustainable farming practices.

1. Environmental Monitoring and Control

- Real-time tracking of critical parameters such as temperature, light, humidity and CO2 levels using IoT sensors.
- Automated systems to regulate these conditions such as ventilation and misting based on sensor feedback

2. Data Collection and Analysis

- Collection of historical and real-time data on environmental conditions and mushroom growth stages.
- Analyzing the humidity, temperature, soil moisture, and CO2 readings.

COVERAGE OF THE PROJECT TO BE DEVELOPED

3. Automated Alerts and Notifications

- Set-up automated alerts for deviations from optimal growing conditions (e.g., if the temperature rises, humidity drops and if the mist is On/Off).
- Set-up alerts system for water level for refilling.

4. Resource Optimization

- Automation of resource inputs like in water (for misting), to ensure precise usage, minimizing waste.

5. Remote Management and Monitoring

- Remote access to greenhouse conditions through IoT-enabled devices, allowing operators to monitor and adjust settings from anywhere using a computer.

STAKEHOLDERS / INTENDED USERS OF THE PROJECT

The stakeholders or target users of our Mushroom Greenhouse Project are;

1. Farmers/Mushroom Growers: These are the major customers who will profit from automated monitoring and control systems to increase production, lower labor costs, and assure ideal growth conditions.
2. Agricultural Researchers: Professionals interested in investigating the effect of precise environmental control on mushroom growth and production, and who use IoT to collect real-time data for research and development.
3. Greenhouse Owners/Operators: Individuals or enterprises with bigger greenhouse operations looking to improve efficiency, scalability, and profitability by leveraging IoT technologies.
4. Technology Developers/IoT Providers: Businesses and developers that offer IoT solutions, sensors, and software suited for smart farming and greenhouses, allowing innovation and growth in the industry.

STAKEHOLDERS / INTENDED USERS OF THE PROJECT

The stakeholders or target users of our Mushroom Greenhouse Project are;

5. Environmentalists/Sustainability Advocates: Stakeholders that are interested in avoiding resource waste and supporting environmentally friendly agricultural methods in greenhouses by using energy-efficient technologies and using as little water possible.
6. Investors/Entrepreneurs: Those interested in funding or creating smart agricultural technology, seeing the potential for high profits and innovation in the agriculture industry.
7. Local communities/consumers: benefit from sustainable agricultural practices, which provide healthier, fresher product while also supporting local economies and improving food security.
8. Government/Policymakers: Entities that may provide funding for such developments through grants, subsidies, or policy changes that promote sustainable agricultural and technologically advanced farming solutions.

EXPECTED PROJECT AND RESULT

EXPECTED PROJECT OUTCOMES

1. Functional Automation System:

- Environmental Control (Temperature, Humidity, Light, Watering Level,...)
- Real-Time Monitoring (Environmental Parameters

2. User-Friendly Interface: Website that allows user to monitor environmental conditions, receive notifications or alerts.

3. System Reliability and Efficiency:

- Reduce Manual Intervention (Automation reduces the need for constant manual adjustments)
- Efficient use of resources such as water and electricity leading to cost savings and sustainability.

4. Scalability: A system that can be scaled up or adapted for different types of mushrooms.

EXPECTED PROJECT AND RESULT

EXPECTED RESULT

1. Improve Mushroom Yield:

- Consistent Growth Conditions (Stable and optimized environmental conditions)

2. Operational Efficiency: Minimizes the need for manual tasks, reducing labor costs. Efficient management use of energy and water for lower operational costs and environmental impact.

3. User Satisfaction and Ease of Use:

- A well-designed user interface ensures that operators can easily understand without extensive training.
- Reliable technical support and comprehensive documentation.

4. Long-Term Benefits: This project demonstrates the effectiveness of automation in agriculture, potentially leading to further innovations and improvements in the field.

EXPECTED BENEFITS AND IMPROVEMENTS

1. Increased Productivity and Yield

Optimized Growing Conditions: By maintaining ideal temperature, humidity, and CO2 levels through real-time monitoring, the growth cycle can be maximized, resulting in a higher yield of mushrooms per harvest.

Continuous Monitoring: IoT sensors work 24/7, ensuring that conditions are always optimal, leading to more consistent growth and improved overall productivity.

2. Reduced Labor Costs:

Automation of Processes: Automating tasks like misting, ventilation, and temperature regulation reduces the need for manual intervention, freeing up time for workers to focus on other important tasks.

Remote Management: Farmers and greenhouse operators can monitor and control the system remotely, reducing the need for on-site supervision and further lowering labor costs.

EXPECTED BENEFITS AND IMPROVEMENTS

3. Resource Efficiency

Minimized Water Use: Automated systems use resource on water only when needed, minimizing wastage. This is particularly important for sustainability, reducing the environmental footprint of mushroom farming.

4. Improved Quality Control:

Real-Time Adjustments: The ability to respond to environmental changes in real-time ensures that mushrooms grow in the best possible conditions, improving the quality of the final product.

Data-Driven Insights: Continuous data collection allows for better decision-making, helping farmers identify trends that lead to higher-quality mushrooms and fewer losses due to suboptimal conditions.

EXPECTED BENEFITS AND IMPROVEMENTS

5. Cost Savings:

Reduced Operational Costs: The combination of labor savings, efficient resource use, and predictive maintenance all contribute to lowering overall operational costs.

Higher Return on Investment: Over time, the initial investment in IoT technology is offset by increased yields, reduced resource consumption, and streamlined operations.

IDENTIFIED BUSINESS OPERATIONAL IMPORTANCE

Efficiency: IoT sensors and AI systems enhance the monitoring and control of environmental conditions, ensuring ideal growth settings with minimal manual input.

Yield Optimization: AI interprets data from IoT sensors to forecast and adjust conditions for maximum output, boosting productivity and profitability.

Resource Management: Automated systems precisely manage resources such as water, light, and nutrients, minimizing waste and cutting operational costs.

Real-time Monitoring: Continuous data collection and analysis offer real-time insights into farm conditions, enabling immediate adjustments and proactive solutions to potential issues.

IDENTIFIED BUSINESS OPERATIONAL IMPORTANCE

Scalability: The integration of IoT and AI facilitates the scaling of operations, as these technologies can process more data and control larger systems without a corresponding increase in labor.

Data-driven Decisions: AI generates actionable insights based on historical and real-time data, empowering farmers to make informed decisions that enhance farm management. Sustainability: More efficient use of resources and optimized growth conditions promote sustainable farming practices, reducing environmental impact.

Competitive Advantage: Adopting advanced technologies sets farms apart in the market, attracting customers drawn to innovative and sustainable practice.

DESIGNING

Development Concept
Operational Concept
Integration Concept
Organizational Benefit Concept
Improvement Concept

DEVELOPMENT CONCEPT

To develop an automated mushroom farming system that optimizes environmental conditions (humidity, temperature, and CO2 levels) for efficient mushroom growth using IoT devices and sensors.

Environmental Monitoring

- Use of IoT sensors to monitor critical environmental factors such as temperature, humidity, light, and CO2 levels.
- The data collected is transmitted to a central platform (cloud or local server), where it is analyzed in real-time.

Automated Climate Control

- Based on sensor readings, IoT devices can control fans, heaters, humidifiers, and ventilation systems.
- For instance, if the humidity drops below a set threshold, the humidifier will be automatically activated to maintain optimal conditions.

Data Analytics & Reporting

- Historical data from the sensors can be analyzed to track the growth cycle of mushrooms.

OPERATIONAL CONCEPT

The Smart Mushroom Farming System automates the critical aspects of mushroom cultivation, including climate control, irrigation, and monitoring, to optimize growth conditions and increase efficiency. It consists of IoT sensors, control systems, a central monitoring platform such as website for real-time management.

Initial Setup and Calibration

- Install IoT sensors in key areas of the mushroom growing facility to measure temperature, humidity, CO2 levels, and light.
- Program desired parameters (e.g., optimal temperature range: 18–22°C, humidity: 85–90%) for different stages of mushroom growth.
- Integrate control devices (fans, heaters, humidifiers, irrigation).
- Test the system to ensure all devices and sensors respond appropriately to real-time data.

OPERATIONAL CONCEPT

Automated Monitoring and Control

- **Continuous Data Collection:** Sensors collect real-time environmental data (temperature, humidity, etc.) and send it to the central monitoring platform (website).
- **Automated Adjustments:** When environmental conditions deviate from the preset parameters, control devices are triggered automatically:
  - If humidity drops below 85%, the humidifier turns on.
  - If temperature exceeds 22°C, fans or cooling systems activate to bring the temperature down.
  - If CO2 levels rise, the ventilation system increases airflow to maintain ideal gas exchange.

Data Analysis and Optimization

- **Data Analytics:** The system analyzes trends in environmental data, allowing farmers to review the conditions under which the mushrooms grow best. This information is logged and used for future growth cycles.
- **Predictive Maintenance:** Based on data from the sensors and devices, the system can alert the farmer when a piece of equipment is likely to require maintenance, ensuring minimal downtime.

INTEGRATION CONCEPT

1. Centralized Control System (Hub)

- **Core System**: At the heart of the operation is a centralized control hub that manages and integrates all farm systems. This could be cloud-based, allowing real-time data collection, processing, and decision-making.
- **Interconnected IoT Devices:** Sensors for temperature, humidity, CO2, and moisture are connected via the Internet of Things (IoT), feeding data into the hub. This hub oversees environmental adjustments, nutrient delivery, and growth monitoring in real-time.

2. Environmental and Irrigation System Integration

- **Unified Climate Control**: HVAC and misting systems are all linked to the central hub. Based on data inputs, the system will adjust parameters (e.g., increasing misting if humidity is low or adjusting light for optimal growth).
- **Integrated Water and Nutrient Systems:** Automated irrigation and nutrient delivery systems will be connected to soil and moisture sensors. When the soil moisture drops below a set threshold or when nutrient levels need replenishment, the central system will trigger precise watering or nutrient release.

INTEGRATION CONCEPT

3. Data and Analytics Integration

- **Farm-Wide Data Dashboard:** A centralized dashboard collects and displays all critical data (environment, water, nutrients, energy use, yield rates, etc.) in one place. The dashboard can be accessed via desktop or mobile devices, enabling remote farm management.
- **Cloud Storage & Analysis:** All farm data is stored in the cloud for easy access and analysis. Data analytics systems review historical data to provide insights into farm performance, predict future yields, and recommend process adjustments for improved efficiency.
- **Predictive Maintenance & Alerts:** The system can predict when equipment might fail (e.g., water pumps or ventilation systems) based on historical performance, triggering alerts for maintenance before an issue arises.

INTEGRATION CONCEPT

4. Modular System Integration

- **Interconnected Modular** Units: Each farming module (e.g., vertical farming racks or shipping containers) is equipped with sensors and systems that link to the central hub. This allows for easy expansion—new modules can be added to the system without disruption, and all modules will work harmoniously, ensuring uniform climate control and nutrient management.
- **Scalable Automation:** As the farm grows, the system automatically adjusts its operations to account for additional capacity (e.g., more lights, water, and energy requirements). The modular design means any size farm can be automated efficiently without needing a total redesign.

5. User Interfaces & Control

- **Web-Based Interface:** Farmers will have access to a user-friendly interface, either through desktop dashboards, where they can monitor farm conditions, make manual adjustments, or review performance analytics.
- **Alerts & Notifications:** The system will push notifications to users if any environmental parameter goes out of range or if any system requires maintenance. These alerts ensure timely intervention when needed.

INTEGRATION CONCEPT

6. Educational and Community Integration

- **Knowledge-Sharing Platform:** The farm can integrate with an online community or educational platform, sharing data and insights with other mushroom farmers or research institutions. This allows farmers to share best practices and improve their methods using real-world data from the farm.
- **Open API for Future Integration:** An open API allows for future integration with new technologies or third-party systems, such as weather forecasting tools, research databases, or marketplace platforms.

ORGANIZATIONAL BENEFIT CONCEPT

Increased Efficiency and Automation

- Automating tasks like monitoring and climate control reduces manual labor and human error, making operations smoother and faster.

Enhanced Yield and Consistency

- IoT sensors and AI optimize growing conditions, leading to higher yields and more consistent, high-quality mushrooms.

Cost Savings and Resource Optimization

- AI helps cut costs by using water, energy, and other resources more efficiently, while also reducing waste.

Data-Driven Insights and Improvements

- IoT data provides insights for improving processes, and AI can predict equipment issues, reducing downtime.

ORGANIZATIONAL BENEFIT CONCEPT

Market Differentiation and Competitive Advantage

- Consistently high-quality mushrooms and traceability through IoT can help the farm stand out and build consumer trust.

Sustainability and Environmental Impact

- Smart use of resources with IoT and AI lowers water, energy consumption, and waste, making the farm eco-friendly.

Scalability and Adaptability

- The system can easily expand as the farm grows, and AI allows quick adjustments to market or environmental changes.

IMPROVEMENT CONCEPT

Enhanced Environmental Control

- Upgrade to high-precision sensors with a broader range to capture more accurate and detailed environmental data.
- Use machine learning to predict and adapt to changing environmental conditions for mushroom growth.

User Interface and Experience

- User-centric design to enhance usability, for easy navigation for all users.
- Increase functionality of website to give users complete access to the system controls for monitoring.

Feedback and Continuous Improvement

- Conduct surveys and feedback session with users to gather insights into their experiences and areas for improvement.
- Prioritize feature enhancement and new developments based on the user needs and feedbacks.

BUILDING

Available Technology to be Used
Operational and Integration Plan
Cost Considerations

AVAILABLE TECHNOLOGY TO BE USED

For our project innovative mushroom farming we can consider the following:

Sensors:

- **DHT22:** Sensors for temperature and humidity.
- **CO2 sensor:** CO2 sensor for monitoring carbon dioxide levels.
- **Soil Moisture Sensors:** To ensure optimal substrate moisture for mushroom growth.

Camera:

- **Web camera:** The cameras will be used for visual monitoring of the mushroom growth.

Computer:

- **Raspberry Pi:** The Raspberry pi will be used as the data collection and processing hub for connecting all sensors (temperature, humidity, CO2, light, soil moisture) and controlling actuators (irrigation, fans, lights) in real-time.

OPERATIONAL AND INTEGRATION PLAN

System Set-up

- Installation of sensors DHT22, CO2 sensor, and soil sensor that will put in substrate, putting camera for visual monitoring and set up the Raspberry pi for the main component.

Integrating IoT Sensor

- Connecting the sensor into Raspberry pi to process the measures and the data,and save into database.

System Automations

- Set-up alert, notification, fans, irrigation that connected on the Raspberry pi for the automations process and ensuring of proper function.

Website user interface

- Developing a dashboard for real-time monitoring of environment condition and growth of mushroom with graphical or chart view and alert or notification icons. To ensure that the user will notify on the condition of the mushroom and greenhouse.

Evaluation

- Analyzing the collected data and make adjustments for the sensor and AI to be more effecient

COST CONSIDERATIONS

The project will cost of:

- **DHT22 sensor :** *₱195.00*
- **HC-SR04 sensor:** *₱69.00*
- **Humidifier:** *₱108.00*
- **5V Water Pump:** *₱115.00*
- **Sintra Board:** *₱680.00*
- **Plywood:** *₱151.00*
- **Cyno Glue:** *₱120.00*

TESTING

Test / Validation Procedure
Metric to be Used to Validate

TEST / VALIDATION PROCEDURE

1. Pre-Operational System Testing

- **Hardware**: Ensure all devices like sensors, actuators, and controls are properly installed and functioning. Each component should be tested individually to verify its responsiveness and accuracy.
- **Software**: Test the integration of all systems through simulated conditions to check if the software properly manages automation and data flow. It should respond swiftly to environmental changes and execute commands without errors.

2. Environmental Control Validation

- **Sensor Calibration:** Compare sensor readings with standard reference tools to ensure accuracy. Adjust calibration if necessary to maintain precise measurements of temperature, humidity, and other environmental factors.
- **Climate Simulation:** Simulate different growing conditions to ensure the system can maintain optimal levels. The system should adjust temperature, humidity, and light as needed, keeping all parameters within the required range.

TEST / VALIDATION PROCEDURE

3. Substrate & Irrigation Validation

- **Substrate Quality:** Test the substrate for proper moisture, pH levels, and absence of harmful pathogens. This ensures the medium supports healthy mushroom growth throughout the cultivation process.
- **Irrigation:** Validate the system's ability to deliver water and nutrients based on real-time moisture levels. It should provide even irrigation, preventing over- or under-watering.

4. Growth Cycle Testing

- **Mushroom Growth:** Conduct trials to monitor mushroom growth from spore inoculation to harvest under automated conditions. Observe for any abnormalities and compare to expected growth stages.
- **Harvest Timing:** Test the system's capability to detect the right time for harvesting based on size and maturity. Compare its accuracy with manual assessments to ensure it triggers harvesting at the optimal time.

TEST / VALIDATION PROCEDURE

5. Yield and Quality Assessment

- **Yield:** Measure the total yield of mushrooms grown using the automated system and compare it to traditional farming methods. The goal is to achieve higher or equivalent yields with greater consistency.
- **Quality:** Analyze the mushrooms for nutritional content, texture, and visual quality. They should meet market standards for size, appearance, and nutritional value, with minimal defects.

6. System Stress Testing

- **Load Testing:** Simulate maximum operational conditions, including full crop capacity and peak energy use. The system must maintain stable performance without failure under high load.
- **Backup Systems:** Test power backups and fail-safes in scenarios like power outages or sensor failures. The system should switch seamlessly to backups to prevent damage or crop loss.

7. Data Integrity and Traceability

- **Data Logging**: Ensure the system accurately records data from all sensors in real-time. This data must be reliable and available for analysis, helping managers make informed decisions.

TEST / VALIDATION PROCEDURE

- **Blockchain:** Verify that the blockchain logs all stages of the mushroom-growing process. Full traceability from planting to harvest should be maintained for transparency and compliance.

8. Customer & Market Validation

- **Market Testing:** Distribute mushroom samples to select customers or focus groups to gather feedback on taste, freshness, and quality. Positive responses will indicate that the product meets customer expectations.
- **Validation:** Feedback should confirm that the mushrooms are of high quality, meeting or exceeding current market standards for appearance, texture, and taste.

9. Continuous Improvement

- **System Optimization:** Regularly analyze real-time data and adjust system settings to improve efficiency. Each growth cycle should see improvements in yield, resource use, and crop quality.
- **Validation:** Track improvements over time to ensure that each subsequent cycle results in better outcomes, optimizing the system for peak performance.

METRIC TO BE USED TO VALIDATE

- The metric to be used for the validation is the consistency of environmental conditions, monitored through IoT sensors, and the correlation between these conditions and the quality of the mushroom yield.

DEPLOYMENT

Deployment Plan
User Training Plan
User Readiness Plan

DEPLOYMENT PLAN

- The deployment plan of this study is to set up on the location where it the environment is not very hot, because mushroom grows in cold area. Additionally, the site will be equipped with IoT sensors to monitor and maintain optimal temperature and humidity levels, ensuring the best conditions for mushroom growth.

USER TRAINING PLAN

For User Training Plan this is what we consider to include:

1. Introduction to the System:

- **Objective:** To familiarize users to the hardware and software components of the IoT based system.

Contents:

- Overview of the technology that is used in the project.
- Introduction to the website interface for monitoring and control.
- Discussion of environmental factors being monitored

2. Data Monitoring and Interpretation:

- Objective: To teach users how to understand the data provided by the system.

Contents:

- How to navigate the website the check real-time data.
- How to view images and insights provided by the camera and AI system.

USER TRAINING PLAN

3. System Control and Automation:
Objective: to enable users to operate automated features of the system.

Contents:

- How to adjust environmental settings.

4. **Basic Troubleshooting:**
   - Objective: To prepare users to solve issues in the system

Contents:

- Diagnosing sensors and other components

USER READINESS PLAN

For User Readiness Plan this is what we consider to include:

1. Pre-Training Preparation:

Objective: To ensure users are ready before the training starts.

Activities:

- **User Assessment:** This is to evaluate the technical proficiency of the users to identify if the user has a knowledge about technologies.
- **Resource Distribution:** Distributing reading materials and user manuals that outlines the system components, software features, and system overview.
- **System Access:** Make sure that the users have access to the website including system credentials and hardware components this will help the users to become familiar with the interface.

2. Introduction to the System

Objective: To familiarize the users with the IoT system.

Activities:

- **Overview Session:** Have a detailed presentation of the hardware and software components.
- **Live Demonstration:** The proponents will show to the users how the system operates in real time, how to navigate through the website and demonstrate how the mushrooms are monitored by the system.

USER READINESS PLAN

For User Readiness Plan this is what we consider to include:

3. Data Monitoring and Interpretation:

Objective: To let the users have the skills to monitor and interpret system data.

Activities:

- **Data Interpretation Workshop:** Teach users on how to read and understand system data that the system generates. The proponents will use case scenarios for more in depth knowledge.

4. System Control and Automation:

Objective: To enable users to control the system.

Activities:

- **Hands-on Control Practice:** Give the user a step by step guide on how to navigate through the website and give them guidance on how to adjust environmental settings.

5. Basic Troubleshooting:

Objective: To prepare users for basic troubleshooting and maintenance.

Activities:

- **Troubleshooting Simulation:** The proponents will give users a case about a common issue and the proponents will guide the users on how to deal with those issues.

COGNATE 3

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