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Mushroom Kothi: An IoT-Enabled Climate Control Chamber for Precision Oyster Mushroom Cultivation

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INTRODUCTION & AIM

Oyster mushroom (*Pleurotus ostreatus*) is one of the most widely cultivated edible fungi globally, yet its productivity is highly sensitive to fluctuations in temperature, humidity, light, and CO_2 concentration. In India, traditional cultivation sheds often fail to maintain stable conditions during critical developmental stages such as primordia formation and fruiting, leading to irregular flushes, reduced biological efficiency, and poor uniformity. Climatic variations—especially rising temperatures, humidity dips, and inconsistent ventilation—further exacerbate yield losses. These limitations underscore the need for precision-controlled microclimate systems that can continuously regulate environmental parameters and respond dynamically to deviations. IoT-driven monitoring and automation offer a promising pathway for achieving consistent, year-round Oyster mushroom production with improved resource efficiency and reduced management burden.

Aim:

1. To evaluate whether an IoT-enabled, compact controlled-environment system (Mushroom Kothi) can enhance seasonal resilience, stabilize yield, and improve resource-use efficiency across diverse agro-climatic zones.
2. To assess water-use efficiency, energy consumption, crop loss reduction, and post-harvest quality under semi-controlled farm conditions.

METHOD

Experimental Setup

- **Sites:** 3 agro-climatic zones (North, Central, East India).
- **Seasons:** Monsoon & Winter
- **Replicates:** 30 Kothi chambers vs 30 conventional setups
- **Sensors:** Temp/RH (SHT31), CO_2 (MH-Z19B), light (BH1750), substrate moisture
- **Automation:** PID/hysteresis for RH–temperature, timed fresh-air exchange
- **Data Logging:** ESP32 cloud dashboard, 2-min interval logging

Measured Variables

- Total yield (g/kg substrate)
- Flush timing
- Fruit body uniformity (CV%)
- Water-use efficiency
- Time-to-harvest
- Microclimate deviation index (SD of T/RH)

RESULTS & DISCUSSION

- **Yield Increase:** 15–25% higher yield in Kothi chambers.
- **Water Savings:** 30–35% reduction in water use.
- **Uniformity:** Fruit body size variation reduced by >50%.
- **Faster Primordia:** Time-to-first harvest reduced by 1–3 days.
- **Microclimate Stability:**
  - Temperature maintained within 22–25°C (SD < 1.2°C)
  - Humidity maintained within 85–95% (SD < 3%)
- **Data Reliability:** Cloud sync success rate >95%.

Stable temperature–humidity regimes improved biological efficiency by reducing primordia abortion and promoting synchronized flush development.

CONCLUSION & DISCUSSION

The IoT-enabled Mushroom Kothi chamber demonstrates clear potential as a precision agriculture tool for Oyster mushroom farming. Its controlled environment enhances yield, uniformity, and resource efficiency, enabling farmers to move toward climate-resilient, data-driven production.

FUTURE WORK / REFERENCES

Future Work

- Integration of predictive analytics for flush scheduling
- Vision-based size estimation for automated harvesting alerts
- Large-scale validation with FPOs
- Design optimization for lower energy footprints

Key References

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