SMART INDIA HACKATHON 2025

- **Problem Statement ID -** 25053
- **Problem Statement Title -** Improved Onion storage technology for enhancing shelf life of onions
- **Theme -** Agriculture, FoodTech & Rural Development
- **PS Category-** Hardware
- **Team ID -** AgriStackAi
- **Team Name -** AgriStackAi

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Controlled Climate Storage Solutions

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Problem

- Traditional "Kandha Chawl" structures can lead to 40-42% losses
- Annual losses in India are estimated at approximately **11000** crore due to improper storage.
- The Rabi season, which accounts for 65% of production, is particularly vulnerable.
- Storage duration 6-7 months
- Maintaining temperature, humidity and Air Circulation
- Pre and post harvest care

Traditional Onion Storage

Solution

- Our IoT-based solution directly addresses the primary causes of spoilage, which are uncontrolled temperature, humidity, and gas levels.
- Making Controlled Environment (Loss decreased by **20-25%**)
- Realtime Data of Temperature, Humidity and Gas Sensor(calibrated to detect rotten onion smell)
- Batch Based Storage
- A app/website to See Realtime Climate fluctuation in Warehouse
- Automation for Temperature and Humidity Control
- Timeline for Pre-Post Harvest Care
- Upgradation in Design of Warehouse
  Making ventilation more effective

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TECHNICAL APPROACH

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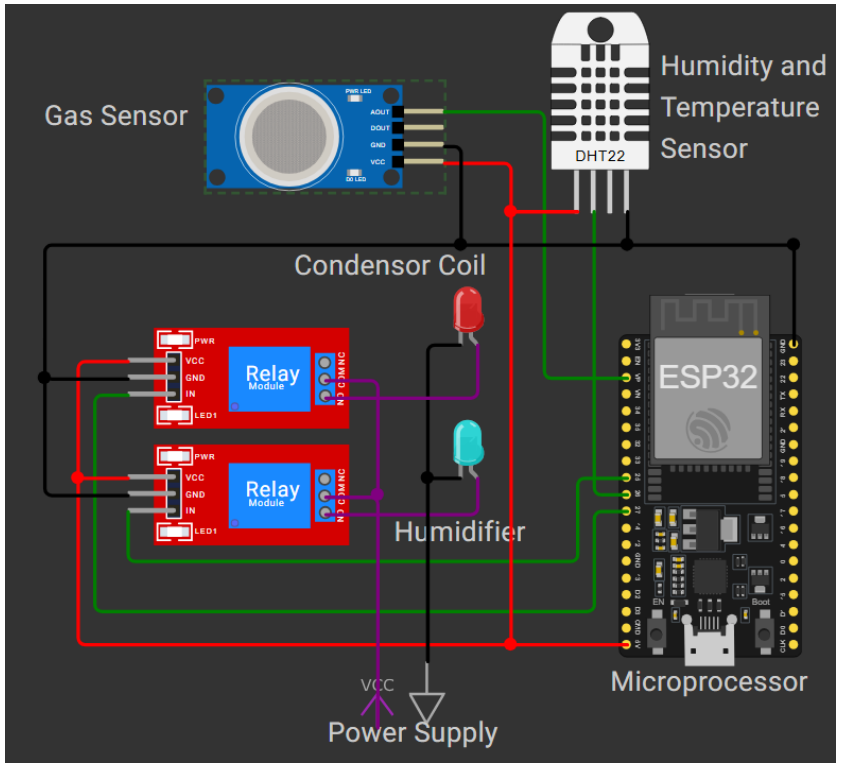
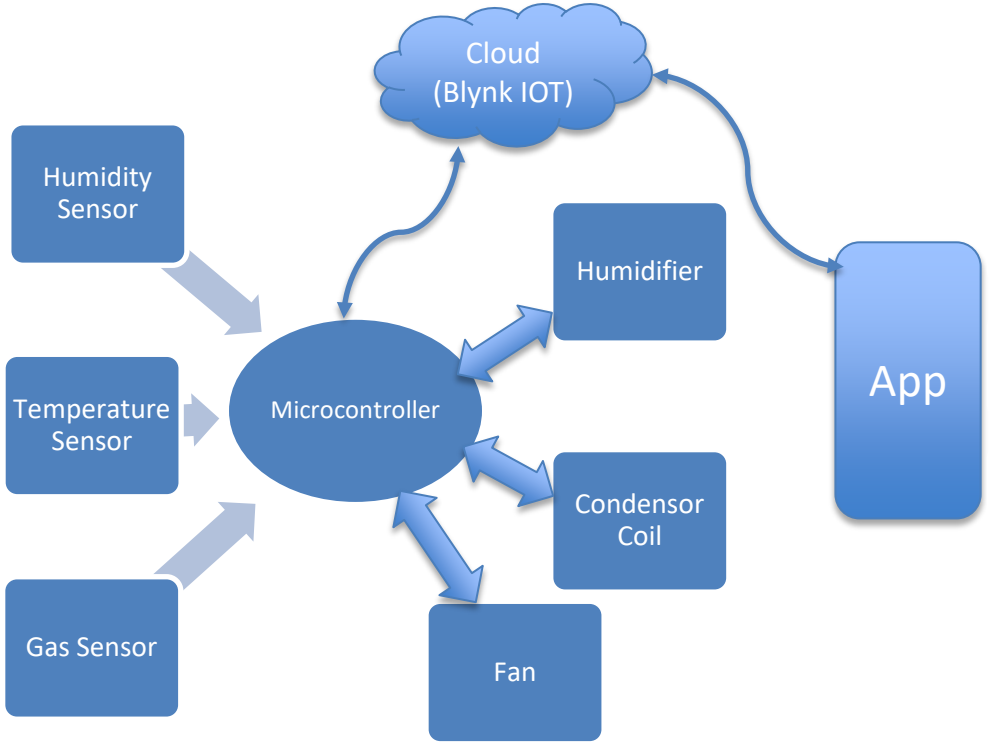


Micro-Climate Controller

Hardware: ESP32, Temperature/Humidity Sensor (DHT22), Gas Sensor (MQ135)
Embedded Programming: C++.
Cloud Infrastructure: Blynk IoT platform for data ingestion and real-time communication.
Frontend: Blynk Mobile App for the user interface



System Architecture

- Temperature Range (25-28) °C
- Humidity Range (55-65)%
- Gas Sensor Range (Base Value+350Adc)
- Indrustial fans for Ventilation
- **Irradiation** can be done before Storing onions
- User Friendly App Dashboard Based on Realtime Monitoring

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FEASIBILITY AND VIABILITY

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FEASIBILITY

- Uses commercially available IoT tech, avoiding complex cold-storage infrastructure.
- Much cheaper than traditional cold storage (>₹10 lakh per 20 tons).
- Technically sound, minimal custom hardware needed.
- Cuts spoilage from ~40–42 % to 20–25 %, saving farmers/traders millions.
- **Strong ROI**- Clear ROI with measurable savings.
- Price per **kg gets 3times** from May to November. Making the gross income 3x

Possible Problems

- **Maintenance need:** Requires technical expertise for setup/repairs
- **Adoption barrier:** Farmers hesitant to move from low-cost traditional storage.
- **Connectivity issues:** Internet in rural areas may be unreliable.
- **Hardware risks:** Single sensor/relay failure can impact storage.

Possible Solution

- **Tiered pricing & demos:** Low-cost entry model, show ROI with on-site demonstrations.
- **Hybrid connectivity:** Wi-Fi for app + GSM module for SMS alerts when internet fails.
- **Easy maintenance:** Plug-and-play design, visual manuals, dedicated support, optional annual service contract.
- **Redundancy & reliability:** Backup sensors/components, industrial-grade parts, self-diagnostics.
- **Power & site safety:** Offer UPS/solar backup to handle power cuts.

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IMPACT AND BENEFITS

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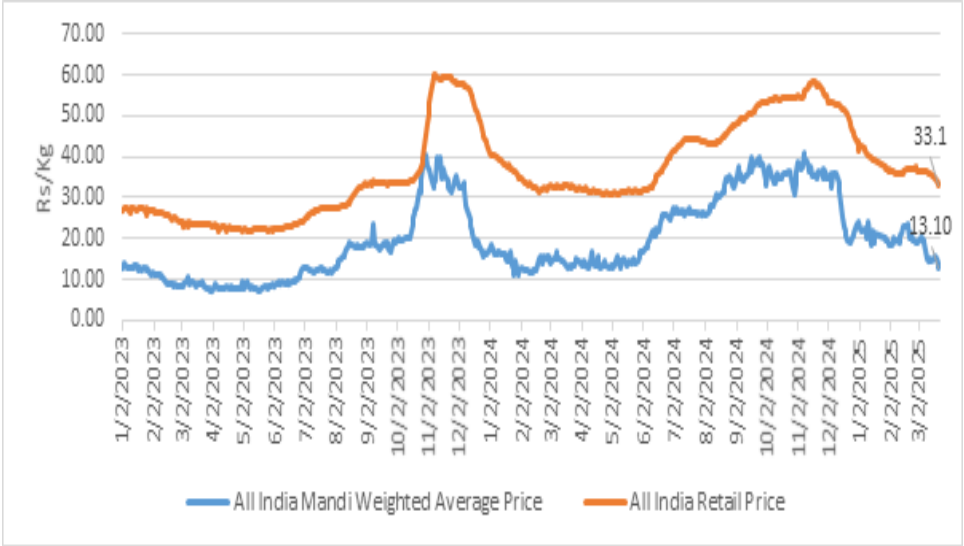
Potential Impact on Farmers

- **Financial Security:** Drastically reduces financial losses for farmers and traders by minimizing spoilage and saving over **8300 thousand metric tonnes**
- **Market Power:** Allows farmers to hold their produce for longer, giving them the ability to sell when market prices are favorable, rather than immediately after harvest at low rates.
- **Increased Efficiency:** Saves time and labor by automating the monitoring and control of storage conditions, freeing up farmers to focus on other tasks.



Onion Prices from January 2023-March 2025
(price hikes in November)

Benefits of the Solution

Economic: Increases farmer income and stabilizes supply chains, benefiting both producers and consumers.(20% losses reduced)

Environmental: By minimizing onion waste, the solution contributes to a more sustainable agricultural ecosystem.

Social: A small farmer can also install a kit whereas, government can make storage warehouse for storing onion to avoid price hikes in month of Sept-Nov

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RESEARCH AND REFERENCES

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