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AI HYBRID AGRI DRYER

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Proposed Solution

In Nigeria, post-harvest losses affect up to 40% of crops, including cassava and pepper. These losses are primarily due to pests, contamination, and inefficient drying methods, and the lack of access to reliable electricity or affordable mechanical dryers traps farmers in a cycle of food insecurity and income loss. Our AI Hybrid Agri Dryer addresses this challenge by combining biomass and solar energy with AI and IoT technologies to optimize drying conditions for various crops. Designed for off-grid communities, the system offers a modular, low-cost, and intelligent solution that reduces spoilage, enhances food quality, and increases farmer income ensuring better crop preservation while empowering rural communities.

Technical Design

- **Dual-Chamber Dryer**: High-temperature for tubers, low-temperature for grains/pepper.
- **Energy Source**: Hybrid system using a charcoal-fed biomass heater and solar panels for continuous off-grid operation.
- **Sensors**: DHT22 (Temperature & Humidity), LM35 (Temperature), MQ-2 (Gas & Smoke).
- **Control System**: Arduino Uno microcontroller integrated with ESP8266 Wi-Fi module.
- **AI Engine**: Recommends drying parameters such as time, airflow, and energy mix tailored to each crop type.
- **Output Monitoring**: Mobile dashboard for real-time monitoring with SD card data logging for offline access and analysis.
- **Structure**: Built from locally sourced materials incorporating RG133 blower and FFB0924EHE extractor fans for efficient airflow.

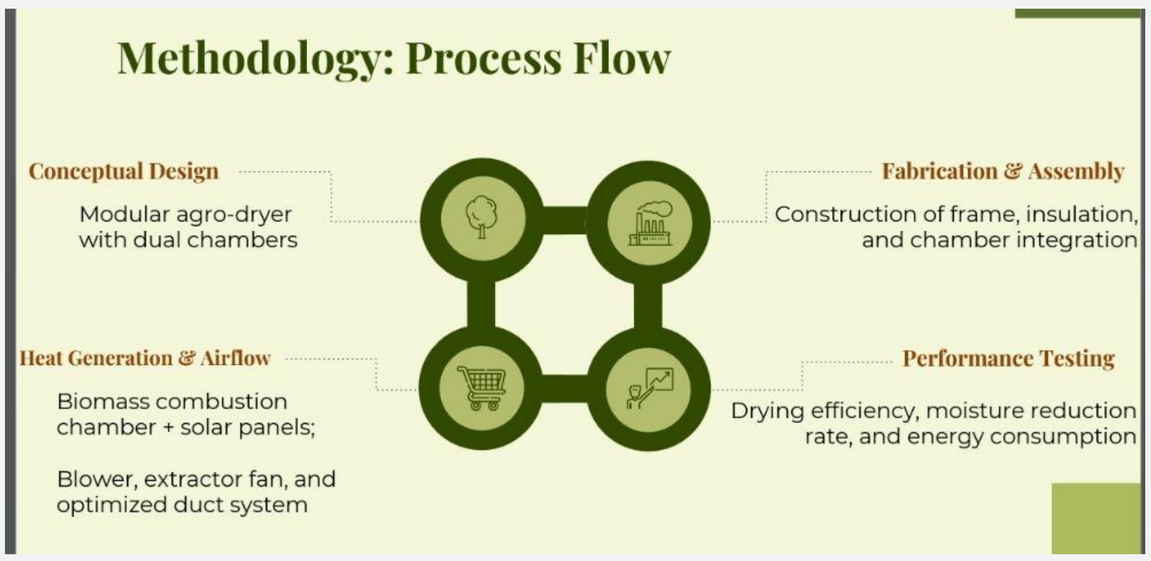

Fig. 1: Methodology Process Flow for Modular Agri Dryer Development

Economic Feasibility

Costs between **₦250,000** and **₦300,000** in pilot, achieves **30–50%** faster drying compared to traditional methods, offers **20–30%** energy savings over conventional dryers, and can extend crop shelf-life by up to **two times**.

The Agri Dryer is designed using locally sourced materials and powered by renewable energy, the system supports job creation in fabrication, IoT maintenance, and AI support services. It is tailored for use by farmer groups, cooperatives, and rural SMEs, with flexible deployment models including direct sales, rental options, and partnerships to ensure affordability and scalability.

Business Model

- **B2C**: Lease-to-own for farmers (₦5,000/month for 12–18 months)
- **B2B**: Bulk sales to cooperatives & Agricultural extension agents
- **Support Services**: Sensor replacement, AI updates, field training
- **Scaling Strategy**: Rural hubs for fabrication, maintenance, and data services.

Timeline (Prototype to Pilot)

By leveraging readily available materials and open-source technology, we can move swiftly from design to field implementation. This structured approach ensures the solution can be validated, refined, and scaled efficiently within rural contexts once funding is secured.

PHASE	DURATION
Design & CAD	2 Weeks
Fabrication & Assembly	3 Weeks
IoT & AI Integration	2 Weeks
Field Testing & Feedback	1 - 2 Weeks
Pilot Deployment	1 - 2 Months (after funding)

Target Market

- Smallholder farmers (cassava, pepper, maize, etc.)
- Rural agricultural cooperatives
- Women-led farming groups
- Agritech SMEs
- Post-harvest processing hubs in Nigeria's North-East, Middle Belt

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