TEAM

60

Solar-Powered Atmospheric Water Generator (AWG)

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Introduction & Problem Statement

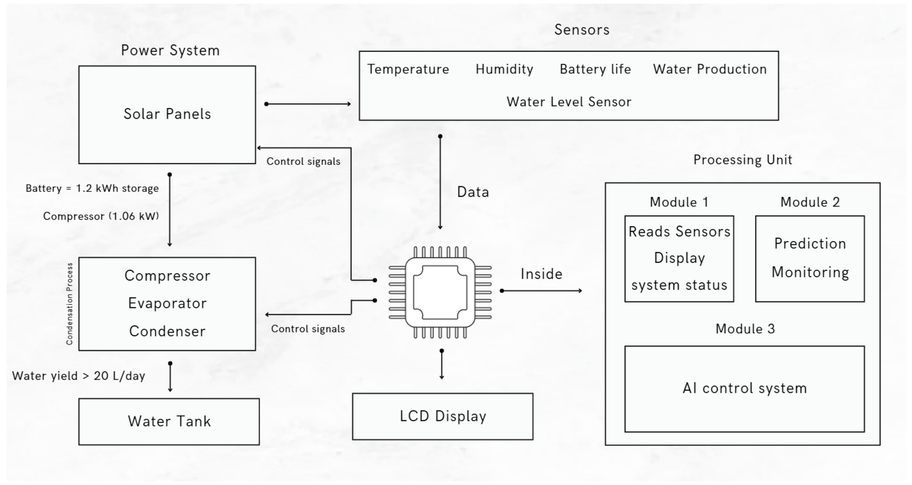
The Challenge: Farmers in humid, off-grid regions face high water costs due to saline groundwater or expensive trucking services.

The Solution: A portable, fully solar-powered Atmospheric Water Generator (AWG) designed to harvest fresh water from humidity. The system utilizes a novel variable-speed compressor and AI-driven control to optimize water production against limited solar energy.

Objectives & Novelty

- **Harvest Fresh Water:** Design a system to extract water from air in local climate conditions (10-49C, RH > 20).
- **Energy Independence:** Ensure continuous operation using Solar PV (9-12 kWh/day generation) and battery storage.
- **AI Yield Prediction & control** to predict water yield based on live weather data and then send control signals to the compressor. This improves Water-per-kWh by 10% compared to static systems.
- **Variable Cooling**: Utilizes a high-efficiency variable speed compressor to match power availability.

System Architecture & Methodology



Integrated schematics showing the Refrigeration Loop (Evaporator/Condenser), Power Distribution (Solar/Battery), and Control System (Raspberry Pi/Sensors)

Validation & Results

A. AI predictor (Random Forest Regressor) was trained on local weather data to forecast water yield.
   - R^2 Score: 0.8842
   - MAE: 0.0332 L/hour

B. Thermodynamic simulations and psychrometric-based scaling calculations validated the system design.Validation Result: With the upgraded hardware configuration, the system now achieves a theoretical yield of 20 L/day.

Specifications & Constraints

Specifications	Target Value
Water Production	> 20 L/day
Energy Consumption	0.6 kWh/Liter
Prediction Accuracy	Error 20%
AI control	improve L/kWh by 10%
Battery Storage	1.2 kWh
Total Weight	< 90
Constraints	**Limit**
Total Energy Use	< 15 kWh/day
Enclosure Rating	IP54
Data Storage	Store 7 days with <0.1% loss

Conclusion & Future Work

The system now achieves 20 L/day of water production with improved efficiency. Future work includes enhancing AI control, reducing weight, and increasing output.