Smart Dog House: A Self-Sustaining, Automated Habitat for a Dog's Well-Being

Salomon Gonzalez, Betzabe (School: Acadiana Renaissance Charter Academy)

Outdoor pets face risks from sudden flooding and extreme heat when owners are away. This project addresses engineering problem of designing an off-grid shelter that monitors and maintains a safe environment that actively changes its elevation to avoid flood exposure while maintaining structural stability. A self-sustaining prototype was designed and built as an off-grid smart doghouse whose primary innovation is an elevating system that converts the enclosure into a dynamic structure. Using statics and dynamics principles, the lift architecture distributes load through the supports to maintain stability under real use cases, including off-center loading entry. Dual water-contact flood sensors trigger automatic elevation and a Raspberry Pi 5 executes a safety-critical state machine. Motion interlocks “Thread Shield” prevent conflicting commands during movement, and an emergency-stop flag mitigates risk during transient events, such as system start/stop and potential jamming. Lift height is tracked as 0–100% “memory elevation” variable with 100 internal steps, configured for approximately a 10-second full-lift cycle enabling repeatable positioning and real-time verification. System data—including temperature, humidity, house status, and lift position—stream to a Flask web app with live video. Supporting subsystems feature closed-loop climate control sensing with ±1°C hysteresis, servo-based feeding, electro-valve watering with bowl-level feedback and timeout protection. A global-shutter camera utilizing YOLOv8 confirms pet presence, incorporating performance tuning to reduce latency. Results demonstrate that actuator-based elevation provides a practical, repeatable flood-mitigation method integrated with autonomous care and monitoring in a single prototype.

Awards Won:

Society Alumni Special Award: Excellence in Science Communication