An Engineered Hub & Spoke System to Seek & Destroy HABs (Year 4)

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HABs have plagued waterways causing significant losses to Florida's economy. Currently, algal bloom data collection is reactionary and inadequate, following regional fish kills. Algal mitigation efforts are minimal and centered around fertilizer usage. Hence, there is a need for a "smart" solution aimed at preemptive detection and mitigation of impending blooms. The goal is to engineer an integrated Hub & Spoke (H&S) algae mitigation system for remote algal measurements, analytics, and mitigation. The system had three Spokes and a Hub. Spoke-1 (1st Mover), includes an aerial drone surveillance system, multispectral imagery, and post processing using software. Spoke-2 (Verifier), an engineered floatation device for real-time algal measurements with a microcontroller and six sensors (pH, DO2, TDS, Photoresistor, Color Intensity, and Temperature). Spoke-3 (Destroyer), a proactive mitigation system with algal suppression agents and a camera. Lastly, a centralized Hub to observe descriptive analytics visually in a cloud dashboard 24/7. H&S engineered prototype tests were successful. 1st Mover visuals were converted as orthomosaic images and differentiated "green" zones from others. Verifier passed leak checks, sensor-microcontroller interactions were seamless, measured data and transmitted to the Hub continuously. Destroyer pump dispersed mitigation agents via remote on/off switch from the Hub dashboard. Per lab testing, a physicochemical agent (Alum-Bentonite combo) suppressed C.vulgaris algae by flocculation and sedimentation. TDS, pH, and DO2 declined dramatically signifying the suppression. A 4th order polynomial ML model predicted TDS with 84% accuracy. This solution can be applied in the real-world to mitigate HABs, saving our coastlines.

Awards Won:
Third Award of $1,000