Low-Cost Replicable Open-Source Mangrove Monitoring System

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Although mangroves occupy less than 1% of the global coastal area, they are one of the strongest natural ecosystems to fight climate change as they sequester up to 22.8 tons of carbon annually. Additionally, mangroves preserve water quality, stabilize coastlines, serve as nurseries for many aquatic animals, and are home to many other species. Despite their benefits, mangroves have been disappearing rapidly at rates three to five times faster than those of other forests. Aquaculture and agriculture were identified as the major drivers of global mangrove deforestation, while the second major group of drivers was gradual climate variations, such as sea-level rise, temperature changes, salinity intrusion, and acidity at coasts, resulting in a loss of approximately 47% of global mangrove coverage. The purpose of this project is to develop the first scalable, low-cost, and replicable mangrove monitoring system that measures the physical parameters that directly affect the growth of mangroves. Furthermore, an open-source cloud-based system was implemented to provide real-time data of the environmental factors measured by the sensors that can be used for comparison with the best index parameters to allow a quick response to threats. The microprocessor used in the model is a low-cost ESP32 with Wi-Fi capability. The submerged sensors measured the water level, dissolved oxygen, temperature, and light intensity. Additionally, sensors were used attached to mangrove leaves to measure humidity, temperature, and light intensity. A system, website, and mobile application were developed using the MQTT protocol and through IoT Wi-Fi, data was uploaded every minute. Keywords: mangroves, monitoring systems, environmental sensors.

Awards Won:
Fourth Award of $500