Rapid-Deployment Micro-Buoy System for Aquatic Environmental Monitoring

Parmar, Vedant (School: Academic Magnet High School)
Plante, Henry (School: Academic Magnet High School)
Lieberman, Avraham (School: Academic Magnet High School)

Continuous water quality monitoring is critical for safeguarding aquatic ecosystems, informing environmental management decisions, and supporting public health. However, conventional systems rely on costly instrumentation and limited sampling schedules, restricting temporal data resolution. This study presents the design and construction of a framework of a low-cost, modular, 3D-printed buoy system that integrates pH, temperature, TDS, and electrical conductivity for real-time aquatic monitoring. The system also focuses on low power consumption and wireless data transmission to a cloud-based application. The system's credibility was ensured by a structured comparison between the buoy measurements and calibrated handheld instruments under both controlled and field conditions. Statistical analysis was then conducted on the two datasets collected through P-Value test and T^2 tests. This project investigates whether an optimized low-cost buoy platform can generate measurements sufficiently accurate for localized monitoring and citizen science applications.

Awards Won: