NEREID: Microplastic Detector Using Laser Microscopy and Image Processing Powered by the Raspberry Pi

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Microplastics are a rapidly emerging contaminant in water sources. California is in the process of adopting a standardized testing method to monitor microplastics in drinking water (Bill SB1422-California Safe Drinking Water Act: Microplastics). Existing technologies such as dynamic light scattering, the turbidity meter, and the SDI kit are not able to efficiently measure microscopic solid particles that are less than 1 um, especially in low concentrations. This project aims to develop a tool that can characterize microplastics in water. This detector can be used for industrial water quality control, homes with no access to filtration systems, and researching microplastic contamination. NEREID uses a 532 nm 5 milliwatt laser to illuminate solid particles in the water. A digital microscope perpendicular to the laser propagation direction records the scattered laser light. An image processing algorithm in Python analyzes the particle characteristics, such as a histogram of the particle size and particle count distribution. NEREID can detect particles as small as 5 nm. Using aspect ratio analysis, the particle shape can also be characterized when particles are bigger than 10 um. Using a 405 nm laser, the particle fluorescence emission can be analyzed using different color filter lenses, and different solid particle contaminants can be characterized. This is an advanced feature that can distinguish microplastics from other microscopic particles. Integrated with the Raspberry Pi, NEREID is compact, portable, and only costs $50 when purchasing individual parts.

Awards Won:

Third Award of $1,000