WALL-E

(Waterborne Autonomous Low Light Electrostereography)

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Background

Ostracods are tiny crustaceans that create luminous courtship displays. WALL-E is a submersible low-light camera that can be deployed to analyze these patterns using computer vision techniques.

Overview

WALL-E is a two-part project: the hardware setup to effectively capture footage, and the computer vision pipeline (shown below) to extract 3D points from ostracod footage.

Frame Synchronization
Fixing the offset between frames on left and right feed

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Stereo Rectification
Transforming the footage to fix fisheye distortion and level out the two feeds

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Pulse Matching
Identifying light pulses in the left and right feed that correspond to the same ostracod

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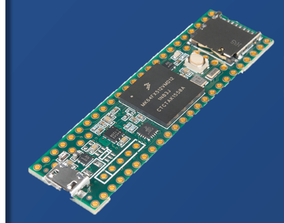
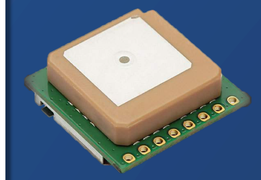
3D Mapping
Creating 3D models of ostracod pulses in time

Key Components



Teensy 3.6 Development Board
Microcontroller used to communicate with external modules

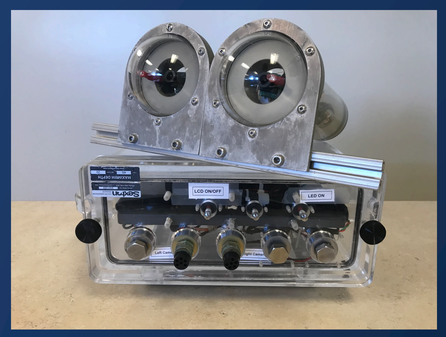


PAM-7Q-0 U-Blox GPS Module
GPS to initialize timestamp on videos and gather location data on deployments.

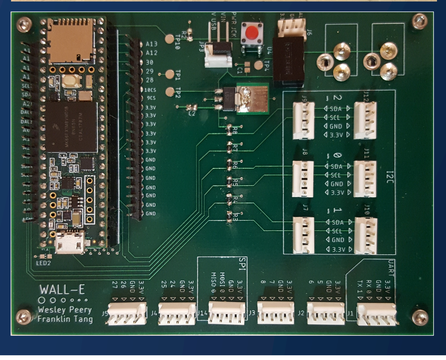
Watec WAT-910HX/RC 570TVL Camera
Low-light cameras that capture ostracod footage

Final Product

Cameras and External Hardware



Printed Circuit Board with Soldered Components

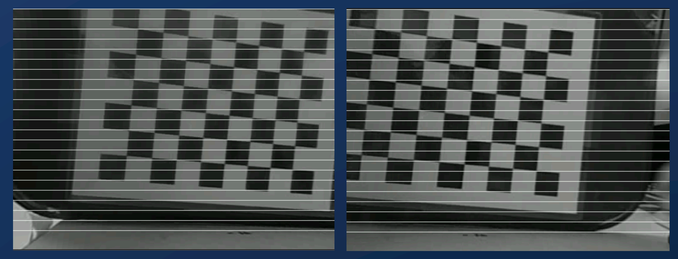


Frame Synchronization Results

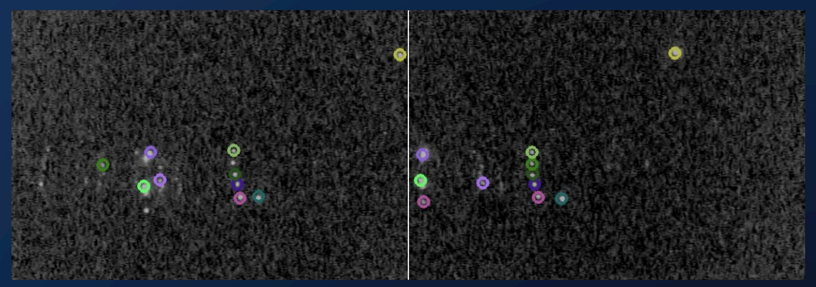
Original:

Synchronized:

Stereo Rectification Results



Pulse Matching Results



Like colored circles in left and right feed correspond to same ostracod

3D Mapping Results

Left: Sample ostracod pulse pattern

Right: Sample 3D mapped ostracod pulse pattern

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