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ECE | Florida
Electrical & Computer Engineering

FoveaCam++: Systems-Level Advances for Long Range Multi-object High-Resolution Tracking

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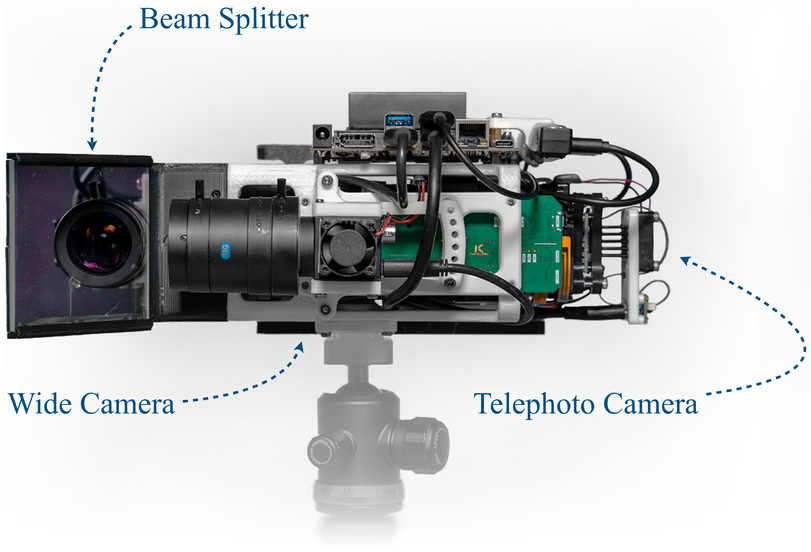
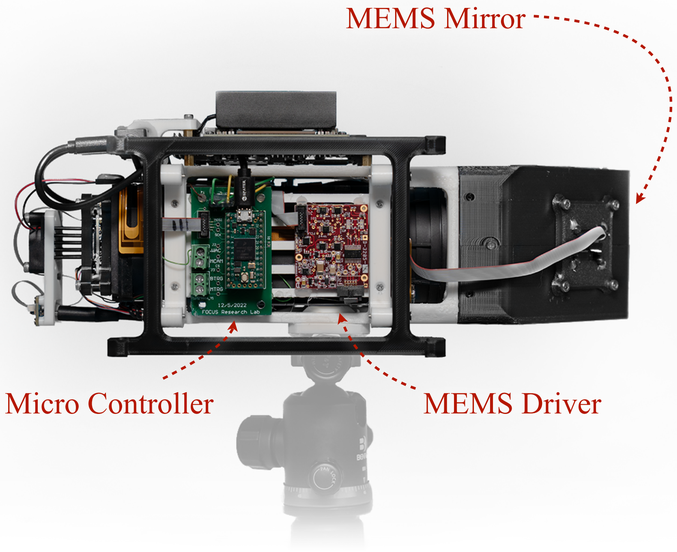
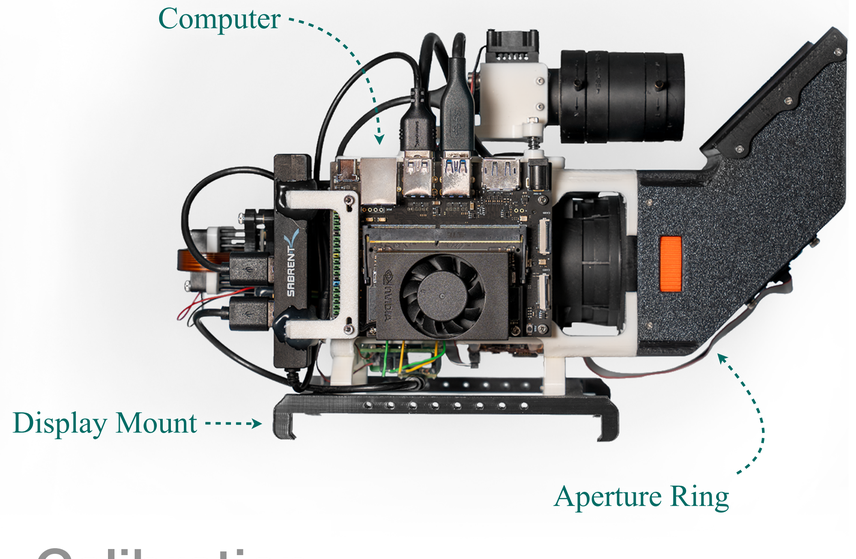


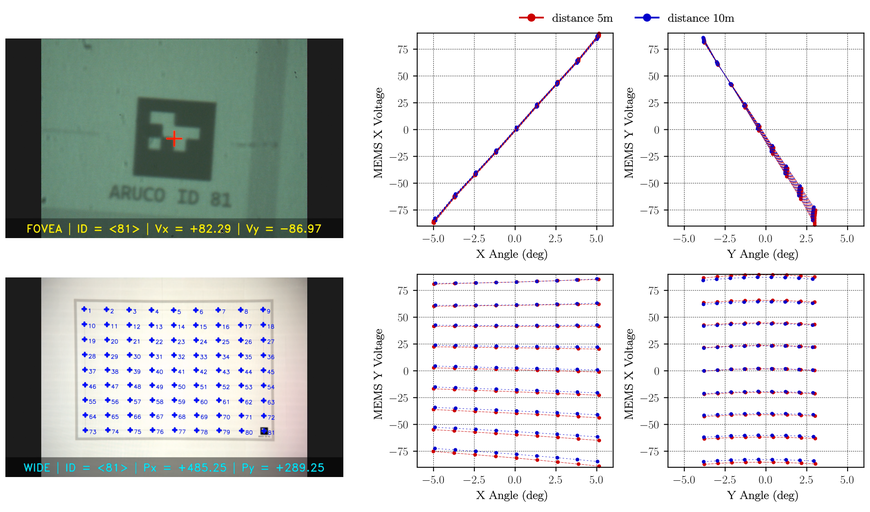




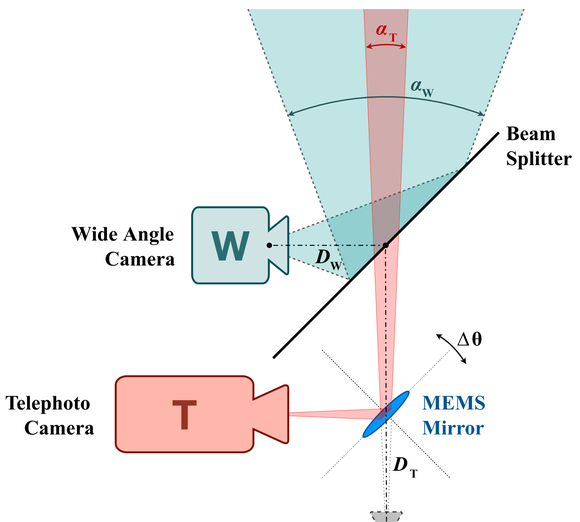
ABSTRACT

UAVs and other fast moving robots needs to keep track of distant objects. Conventional zoom cameras commit to a particular viewpoint, and carrying multiple zoom cameras for multi-object tracking is not feasible for power limited robotic systems. We present a dual camera setup that allows tracking of multiple targets at nearly 1km distance with high-resolution. Our setup includes a wide angle camera (WAC) providing a conventional resolution view and a MEMS driven zoom camera that can query a specific region within the WAC. We built and calibrated the two-camera system and implemented a real- time image fusion pipeline. We show multi-object tracking and stabilization in real world scenarios.

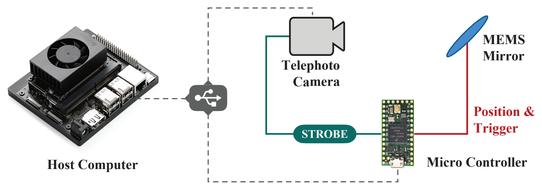
Calibration

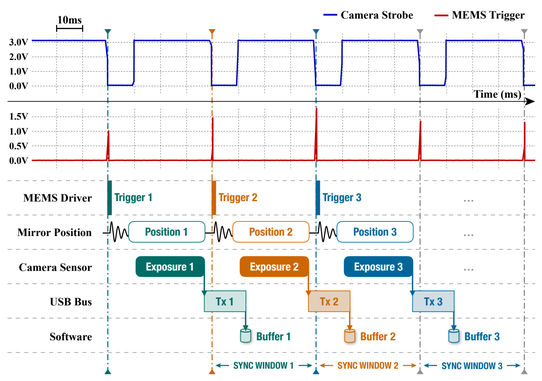


Optical Diagram

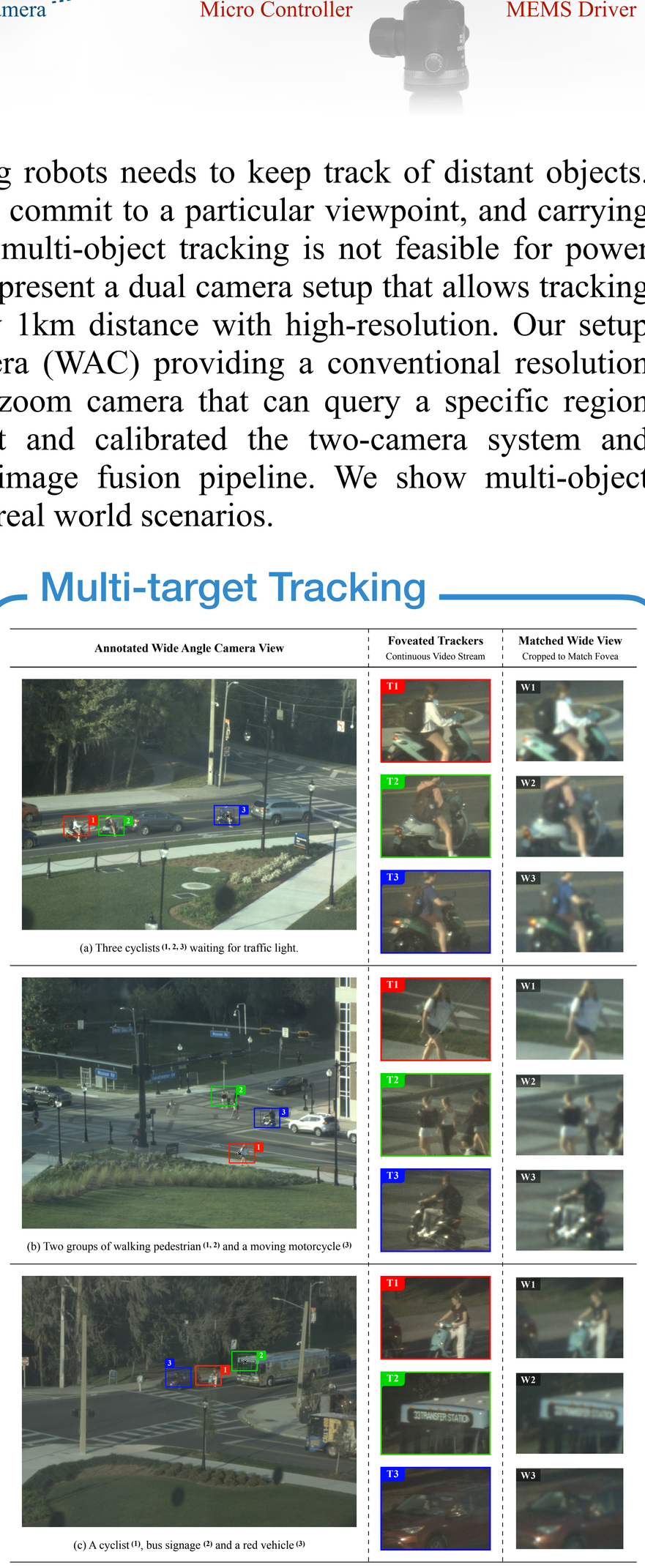


Synchronization





Multi-target Tracking

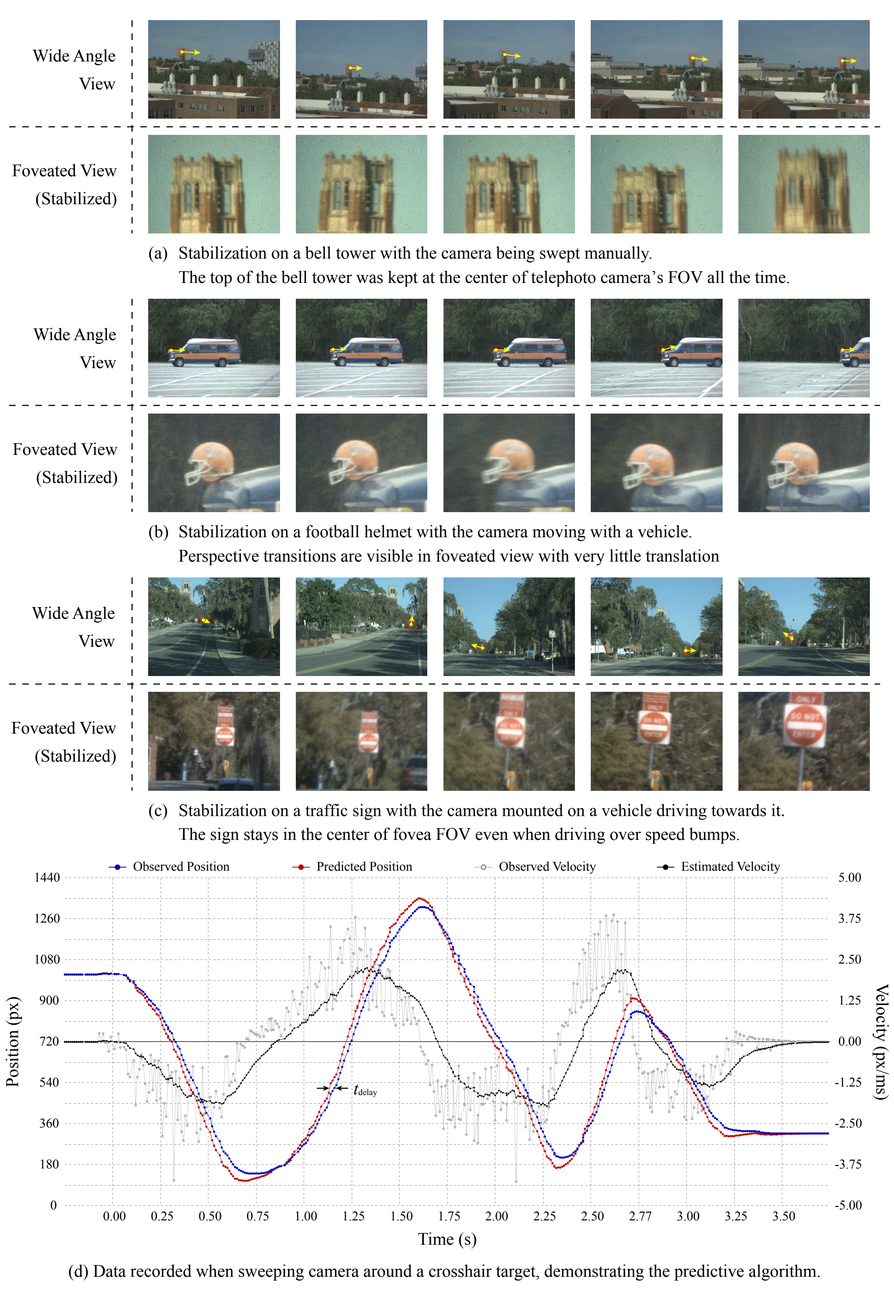


(a) Three cyclists [1, 2, 3] waiting for traffic light.

(b) Two groups of walking pedestrian [1, 2] and a moving motorcycle [3]

(c) A cyclist [1], bus signage [2] and a red vehicle [3]

Camera Stabilization



(a) Stabilization on a bell tower with the camera being swept manually. The top of the bell tower was kept at the center of telephoto camera's FOV all the time.

(b) Stabilization on a football helmet with the camera moving with a vehicle. Perspective transitions are visible in foveated view with very little translation

(c) Stabilization on a traffic sign with the camera mounted on a vehicle driving towards it. The sign stays in the center of fovea FOV even when driving over speed bumps.

(d) Data recorded when sweeping camera around a crosshair target, demonstrating the predictive algorithm.