

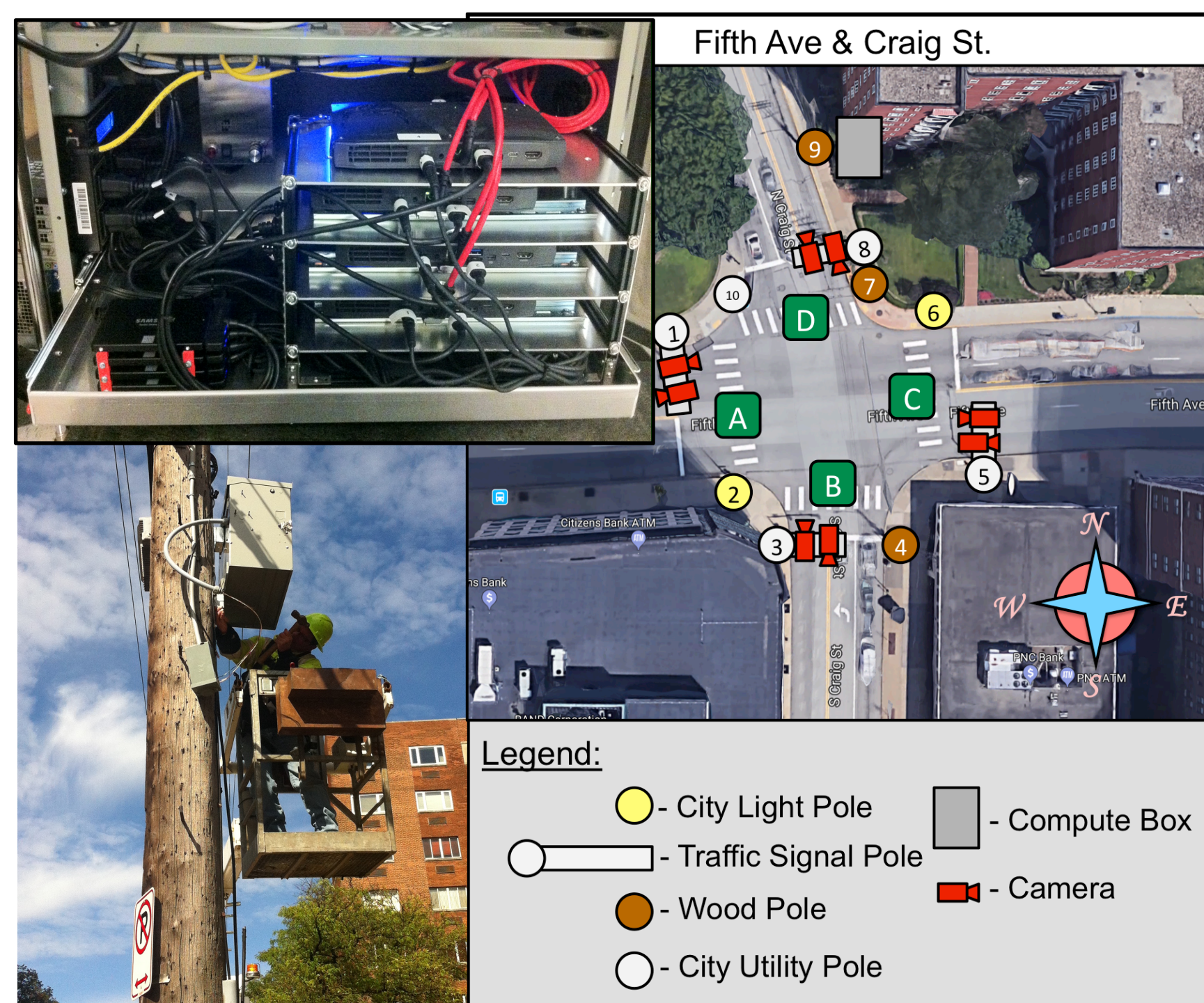
# Synergy: Anytime Visual Scene Understanding for Heterogenous and Distributed CPS

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## Challenge

- CPS systems share limited information
- V2V limited to sharing speed/position
- V2I limited by region and re-routing



**Connected Intersections** with instrumented cameras and edge computing will permit real-time analysis and V2X communication of sparse data.

## Solution and Scientific Impact

Vision-based architecture with:

- Integrated edge-cloud processing
- Hardware acceleration of anytime and coop. scene understanding methods
- Seamless communication of scene understanding (V2V and V2I)
- Managing security and privacy without impacting QoS



**Adaptive Automotive Headlights** can be programmed to react to the road environment in order to improve and enhance visibility for the driver. Awarded best research pitch at Three Rivers Venture Fair (2017).

## Broader Impact

- Crash fatalities increasing annually
- Synergy between computer vision, machine learning and cyber-physical systems will lead to a safer, cheaper and smarter transportation sector
- Co-advised students, co-taught multi-disciplinary courses, co-organized workshops, deployment on the road



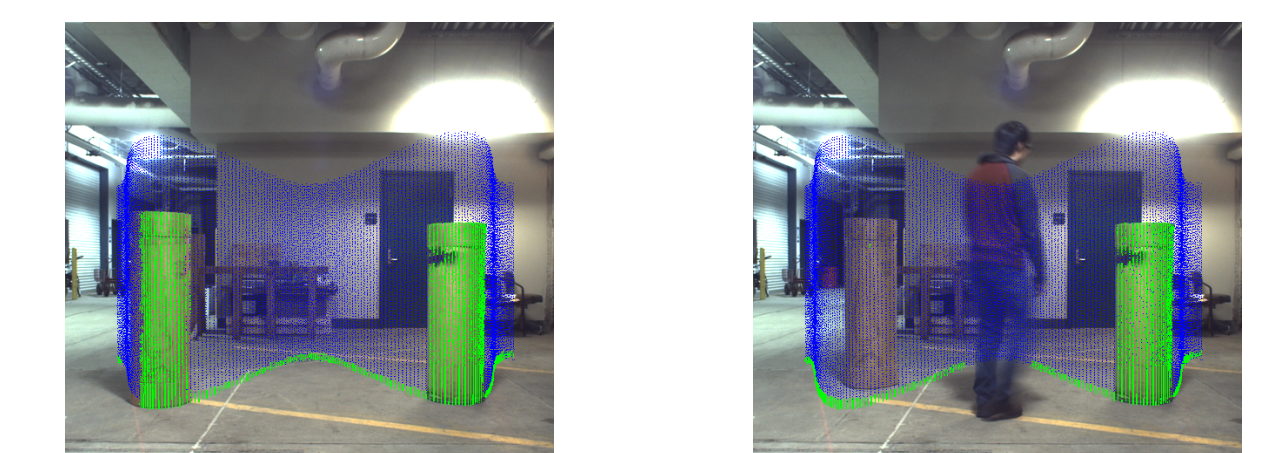
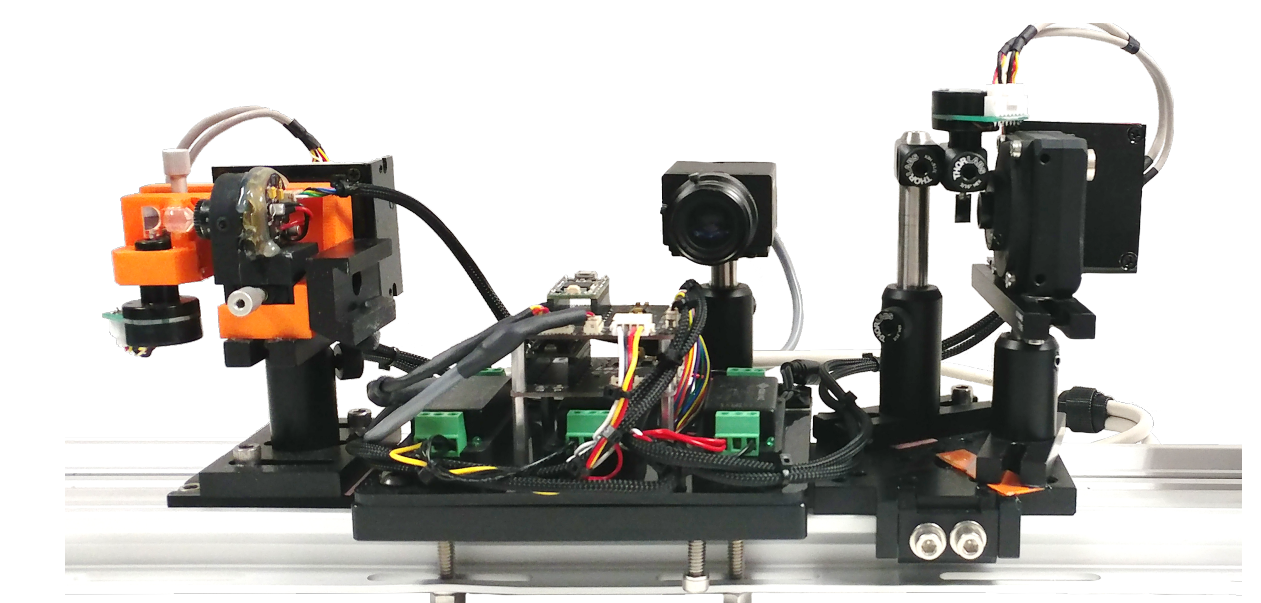
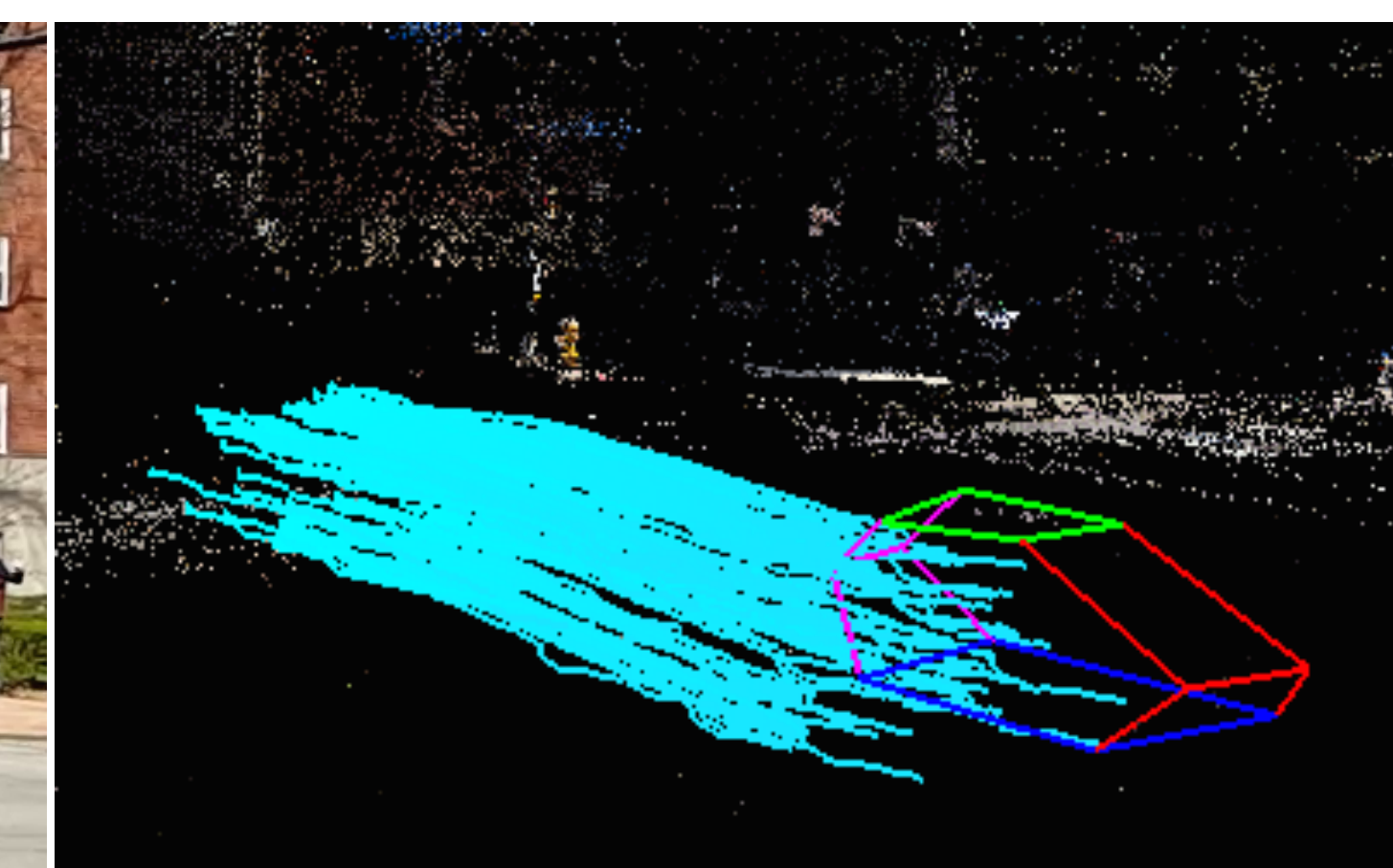
**Cross-Modal Stereo Matching** for the depth in the presence of challenging materials, e.g., glass, fabric, vegetation, lights, etc.



**Automated Road Surface Condition Assessment** from smartphone captured images and AI methods. Formed company RoadBotics to collect road data and perform analysis. Results provided to clients (e.g., all levels of government, planning organizations, and engineering/construction firms) as easy-to-ready color-coded maps on a web-based platform.



**3D Reconstruction** of vehicles and their spatiotemporal motion from multiple, unsynchronized cameras from different view points. Additionally, unsupervised keypoint localization for occluded vehicles.



**Object Detection** with a light curtain that is low cost, low computation, programmable, and works in bright light and through scattered media.