Blazing Trails in the 21st Century

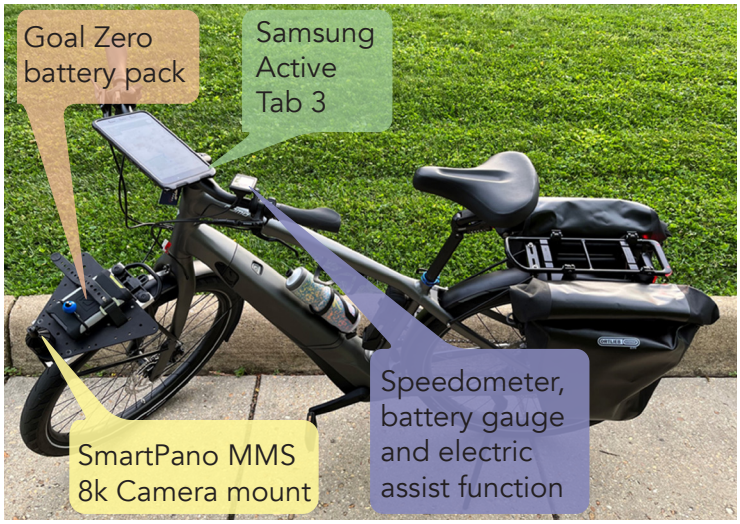
Using Electric Bikes to Map Trail Conditions in National Parks and Beyond

The National Park Service (NPS) is piloting an innovative trail condition assessment and mapping methodology.

WHAT: Efficiently collect high-quality, objective trail condition data using electric bicycles (eBikes) equipped with a cameracand sensor system.

HOW: Captured photographic, accelerometer, and annotative data, is mapped and organized in a geodatabase, and used to inform trail maintenance and management decisions.

WHY: The "Trailblazer" eBikes present a cost-effective and easily transferable method for other federal, state, and local organizations to assess the condition of their trail networks.



Camera and Sensor Collections

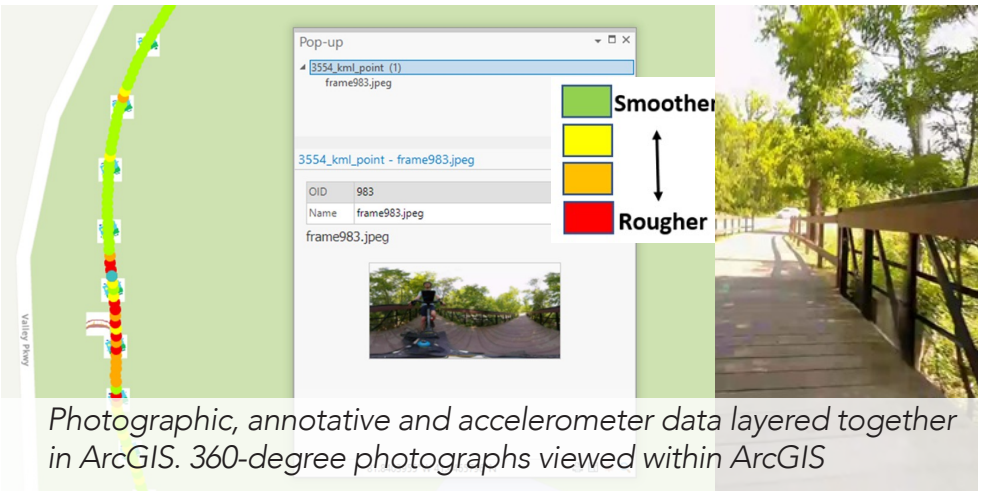
- 360-degree 4k geolocated photographs captured every second
- Accelerometer records trail 'roughness', collecting 200x readings per second
- Processed accelerometer data provides geolocated maximum z-axis values per meter

Tablet Interface

- Camera interface streams directly to a tablet
- Custom buttons allow recording of features at current location

Annotation Examples

1. Bridge
2. Congestion
3. Crosswalk
4. Hazard
5. Trail Surface Material Change
6. Milepost
7. Slow/Stop
8. Vegetation



Photographic, annotative and accelerometer data layered together in ArcGIS. 360-degree photographs viewed within ArcGIS

Utility

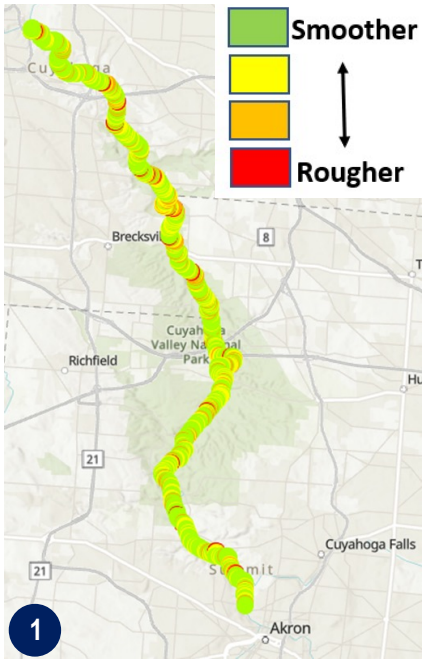
- Identifies trail segments in greatest need of attention and maintenance; helps trail managers prioritize focus areas
- Causes of poor condition like potholes

or

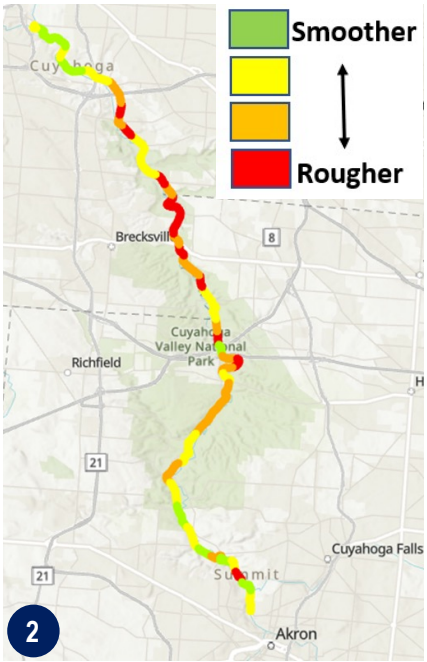
- rutting can be pinpointed with 360 photos in GIS
- Annotations pinpoint hazards, infrastructure, and user patterns of interest to trail managers

Potential Applications

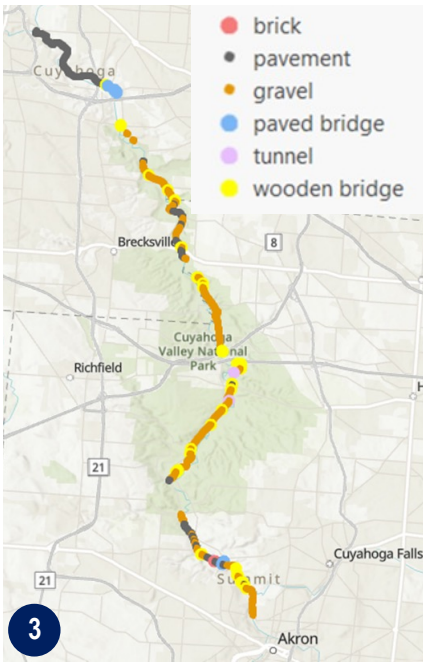
- Expand for NPS service-wide use and/or partner use
- Cyclic assessments can track trail condition changes over time
- Trail signage, access points, and infrastructure inventories
- Post-storm or flood damage survey tool for trails
- Virtual tours of trails in Google Streetview style



Maximum z-axis accelerometer value per meter (roughness)



Roughness averaged by half mile



Trail surface material

Annotative data

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