Using Drones to Collect Speed Data: A Novel Approach

Presented by Alyssa Ryan

Research by Dr. Cole Fitzpatrick, Dr. Chengbo Ai, Alyssa Ryan, and Dr. Michael Knodler
Introduction and Motivation

› Speed and volume data are important for many transportation studies

› Collecting this data can be costly using traditional methods such as LiDAR, pneumatic tubes, and manual TMCs

› Small Unmanned Aerial Systems (sUAS) are already being used for civil engineering applications such as bridge inspections

› sUAS have the potential to reduce the hours required to collect speed and volume data
Background

SPEED LIMIT SETTING

› The speed limit setting process in Massachusetts requires large amounts of data to be collected (MassDOT, 2017)

› 100 speed observations at each location every 0.25 miles in the proposed zone (MassDOT, 2017)

› This can be costly and time-intensive in the field
Background

AERIAL IMAGE PROCESSING

Volume Study

A

- Chose intersection and collect video

Phantom 3 Pro

- Data collected from 7am to 8am
- Drone's camera has FOV of 94 degrees
Volume Study

Vehicle Tracking

- Kalman filter was used to predict motion
- Based on the closeness of predicted location and observed, the detection will merge to vehicle track
Volume Study

Accuracy

- Recall and precision both averaged 93%
- Accuracy was worse from 7:00am to 7:20am due to lighting

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- Analyze time-cost and accuracy of technique
Speed Study

A

- Chose location and collect data

- To track specific vehicle, an “X” was placed on top
- Drone flew at 100 meters (328 feet)
- Probe vehicle speeds were tracked using both speedometer and smartphone app

Route 9, Amherst, MA
Speed Study

- Automated speed processing

Same technique was used as volume study, plus:
- Camera Calibration
- Speed Computation

Camera Calibration
- Transformed image coordinate system to world coordinate system

Speed Computation
- Computed the vehicle speed for all vehicle trajectories
- Computed speed based on distance measured in world coordinate system divided by time
Speed Study

Camera Calibration

- Transformed image coordinate system to world coordinate system

Speed Computation

- Computed the vehicle speed for all vehicle trajectories
- Computed speed based on distance measured in world coordinate system divided by time

Example of median smoothing scheme on derived speed in drive
Speed Study

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<td><strong>Average:</strong></td>
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- Analyze time-cost and accuracy of technique
Conclusions

› Our method of UAS and video processing for volume data collection had an **accuracy of 93%**

› Speed data collection has an **average relative error of 6.6%**

› UAS data collection is able to collect all vehicles passing through an area, unlike LiDAR and RADAR sensors

› UAS have the potential to reduce the hours required to collect speed and volume data, especially on multi-lane medium to high volume roads compared to traditional methods
Future Studies

› Specific studies related to:
  – turning movement counts
  – conflict-event studies
  – intersection delay measurement
  – parking utilization tracking
  – queue studies

› Exploring the optimal vehicle tracking method using UAS to gain the most accurate results
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