Traffic Signs Size Estimation from GPS-tagged Images using a Smartphone-Based System

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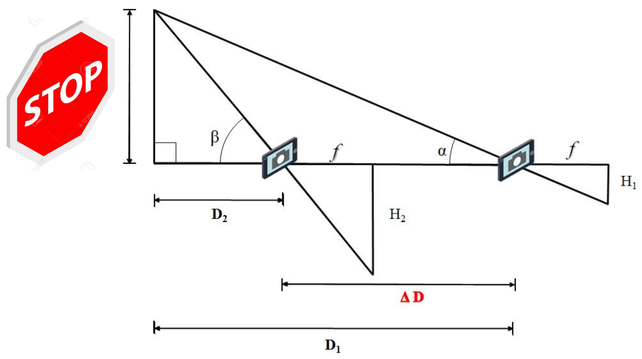
Motivation

- The DOT regulates traffic sign sizes to ensure general public's safety
- We present an alternative to tedious manual inspections, by estimating traffic sign sizes using monocular vision

Approach

1. Extract images from video within moving vehicle [1]
2. Find the distance between images taken
3. Estimate real world traffic sign size from images

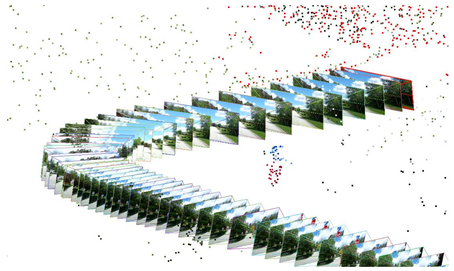


Daul-Image Pinhole Model

Methods

VisualSFM

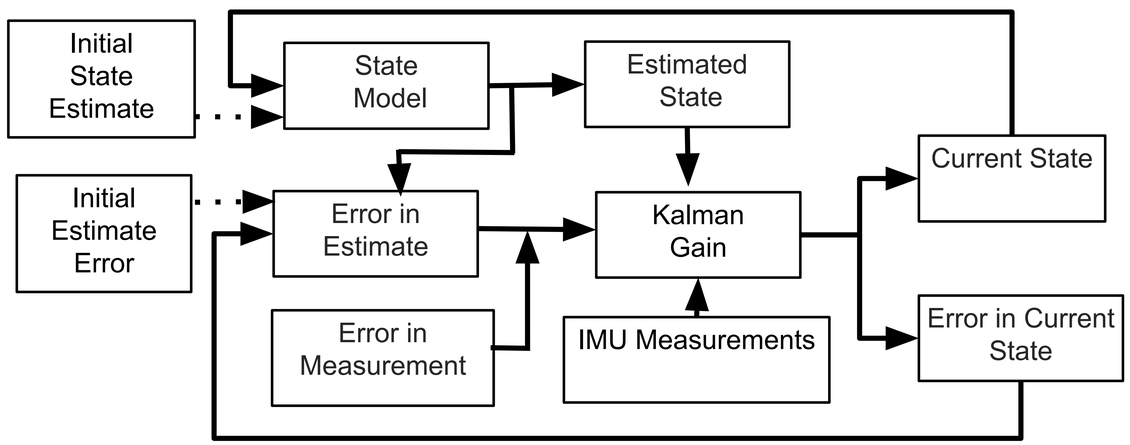
- 3D reconstruct scene using images



- VSFM uses an arbitrary scale coordinate system
- We translate this to meters using furthest GPS-tagged images
- Distances are not accurate enough for our model

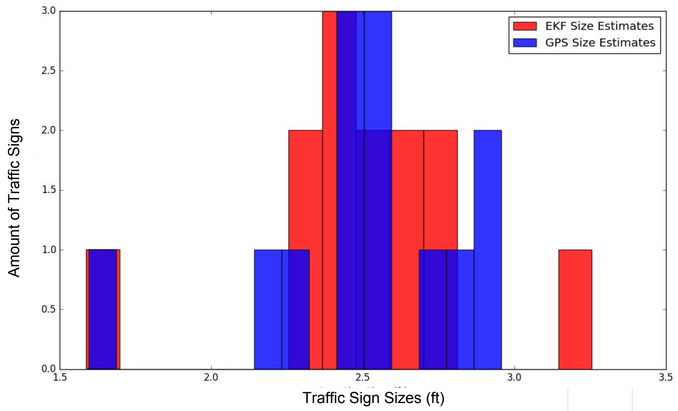
Sensor Fusion: Extended Kalman Filter

- Using IMU sensor data from our smartphone, we are able to calculate the path of the vehicle and obtain the distance between images [2]



Results

- The size of a 2.5 foot traffic sign was estimated using raw GPS and EKF calculated distance
- Anomalies in our data conclude there is a problem in our EKF
- This error in distance resultes in estimation inaccuracy



σ_{GPS} = .3347 σ_{EKF} = .3550

GPS Mean = 2.5049 EKF Mean = 2.518

Future Work

- Optimize Extended Kalman Filter
- Improve cropping software to accurately encapsulate traffic signs
- Compensate for rolling shutter effect
- Incorporate Visual Odometry data into the Kalman filter

References

[1]C. Mertz, S. Varadharajan, S. Jose, L. Wander and J. Wang, "City-Wide Road Distress Monitoring with Smartphones", *Proceedings of ITS World Congress*, 2014. [2] Kalman Filter code first written by Romuald Aufrere and later altered by me for our purpose

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Further Information

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