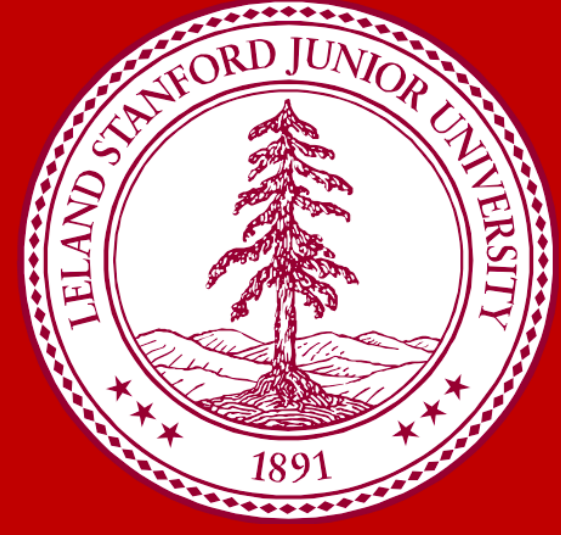# Comparison of Extended Kalman Filter and Complementary Filter for IMU Orientation Tracking
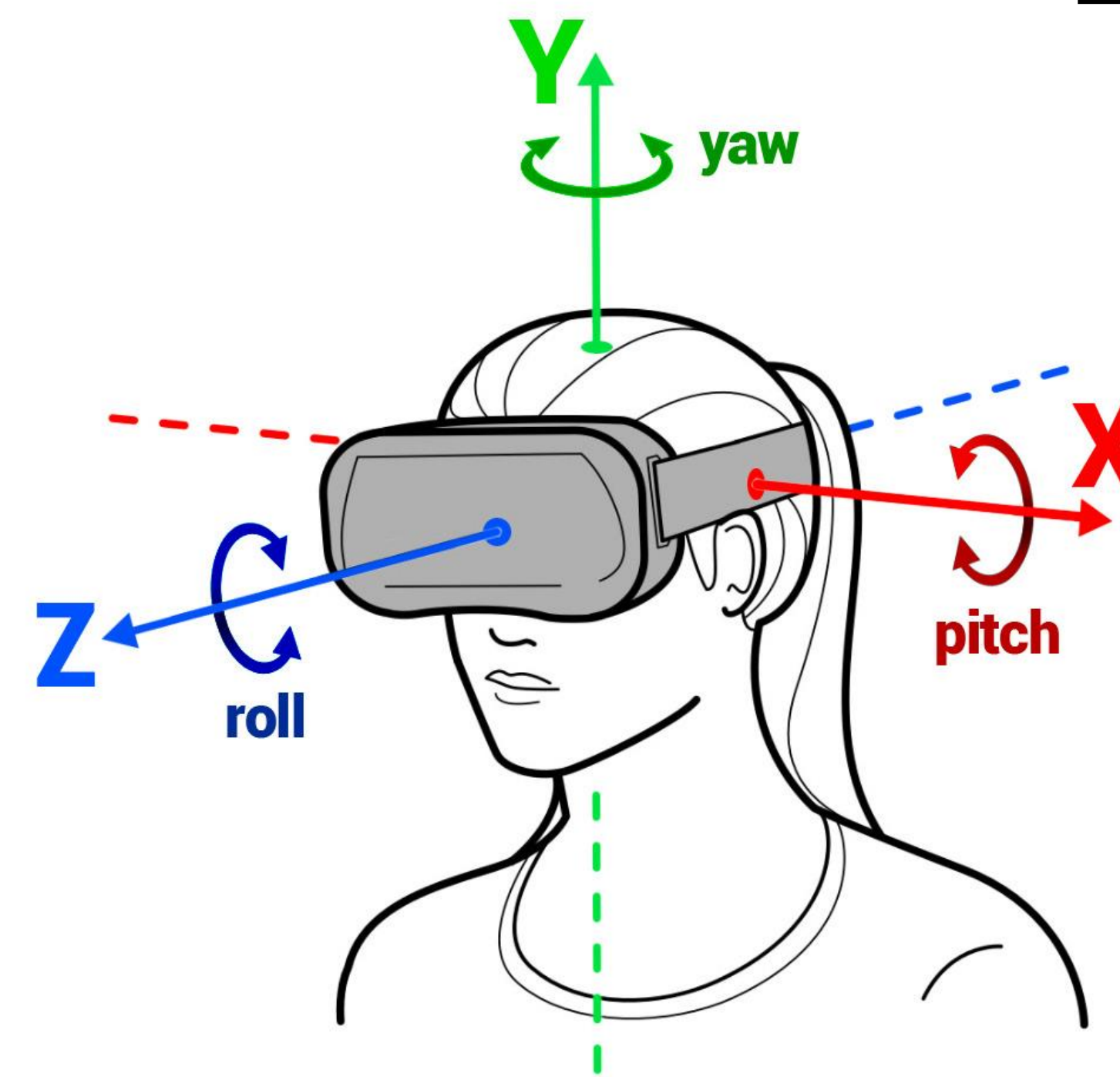
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Motivation

- Enhance the IMU orientation tracking used to create immersive virtual environments

- Comparison of complementary filter and Kalman filter for 6-DOF sensor fusion for real-time orientation tracking.

Experimental Design

MATLAB Simulation

- Accuracy
- Noise Reduction
- Latency

Arduino Implementation

- Visual noise evaluation
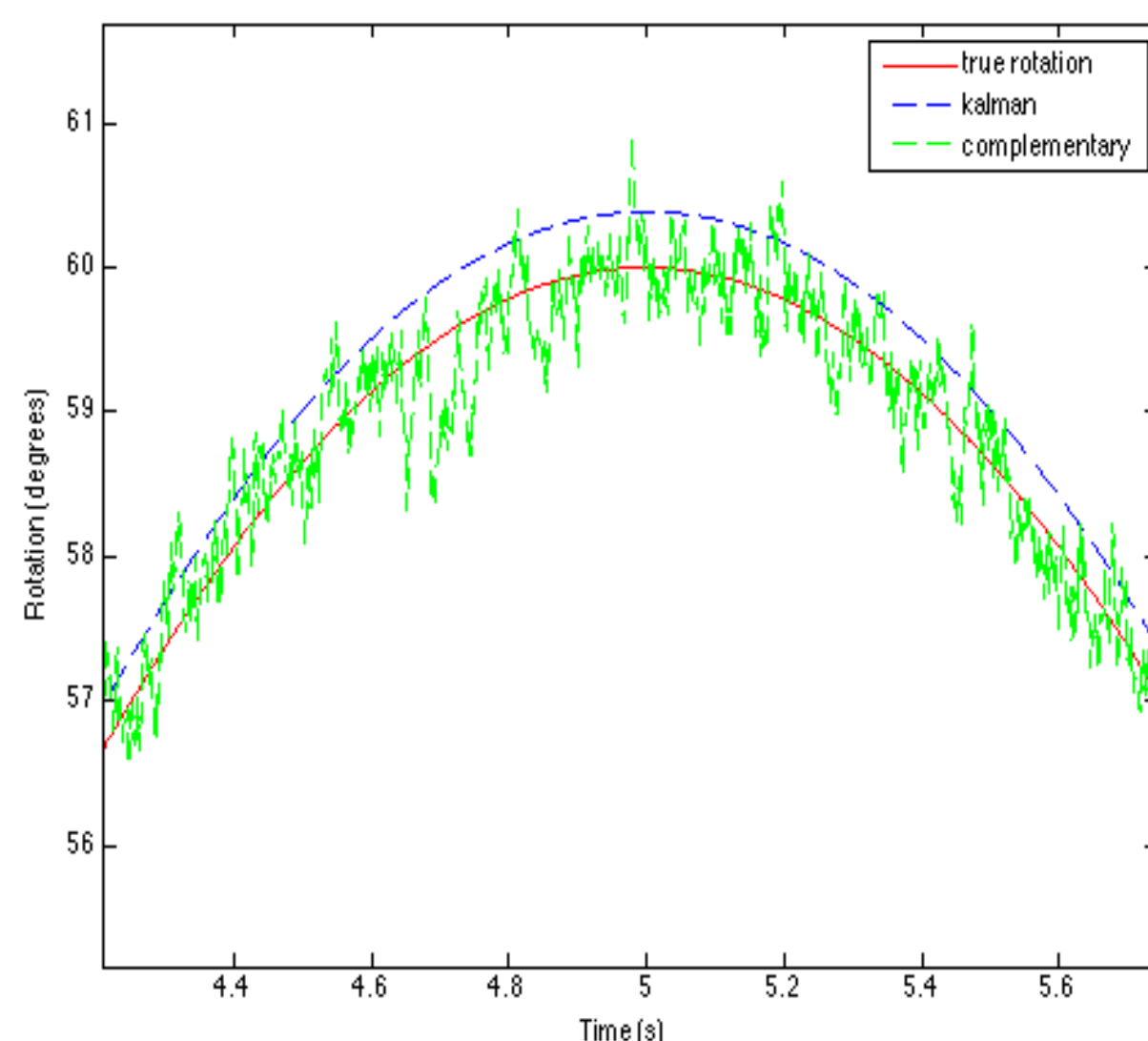- User experience with HMD

Experimental Results

Figure 1: Simulation results from curved true-rotation of Kalman and complementary filter. Kalman filter returned lower RMS error and higher SNR.
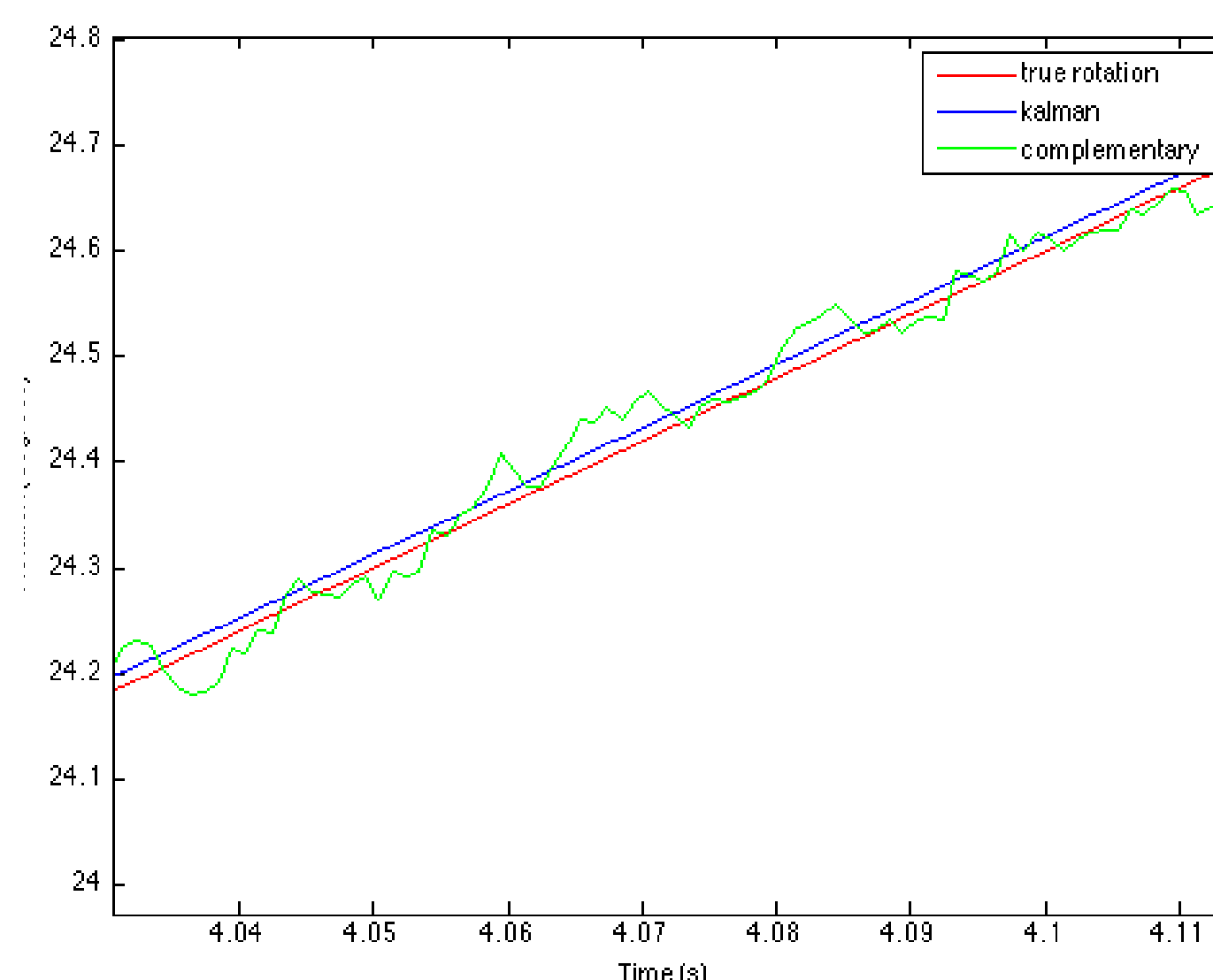

Figure 2: Simulation results from linear true-rotation of Kalman and complementary filter.
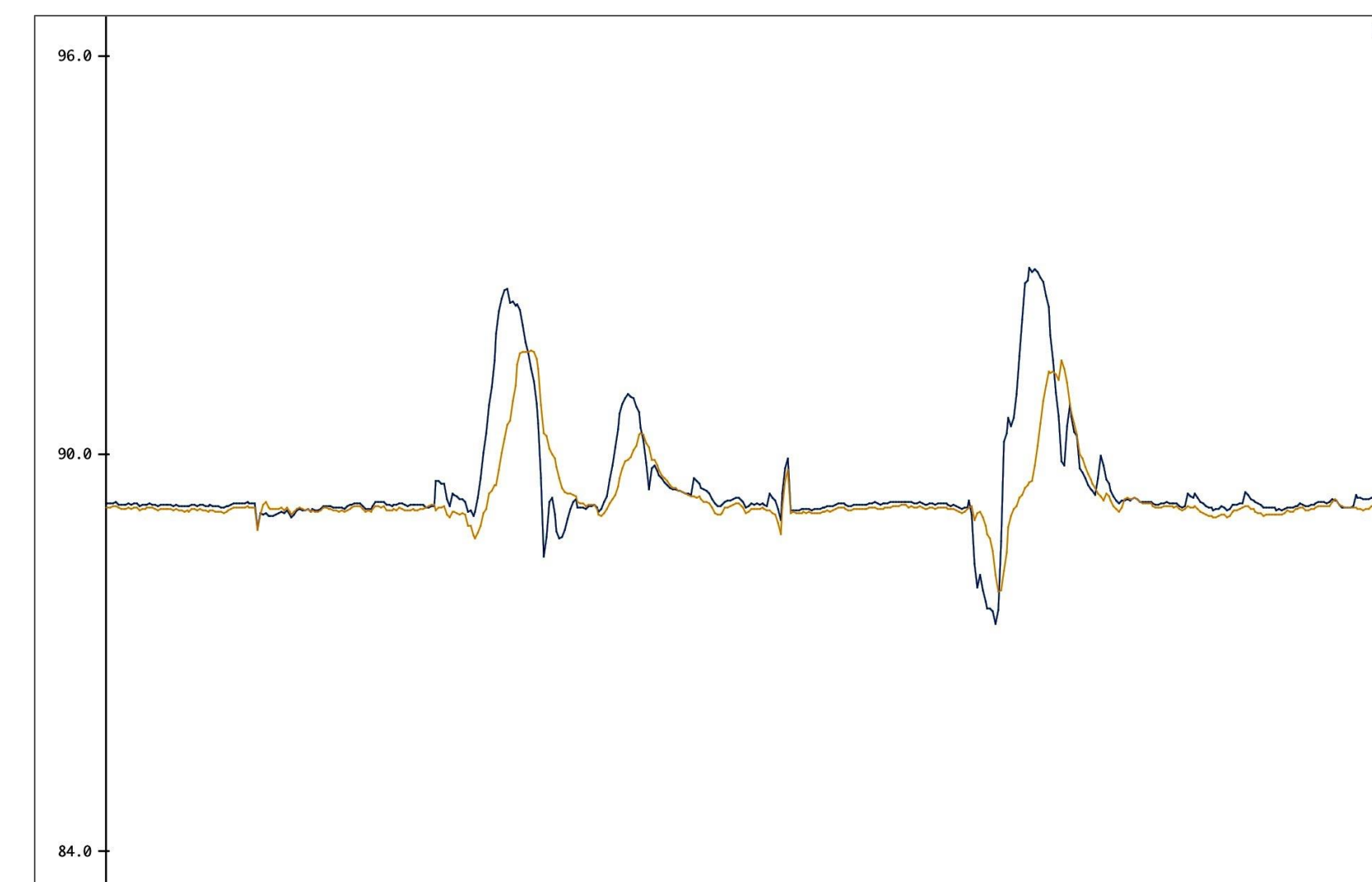

Figure 3: Results from Arduino implementation. Blue line is the complementary filter and yellow is Kalman filter. Latency was 2x greater using Kalman (6ms vs 3ms).

Related Work

- E. Kraft "A Quaternion-based Unscented Kalman Filter for Orientation Tracking", IEEE Proc. Information Fusion, 2003
- Madgwick, S., "An efficient orientation filter for inertial and inertial/magnetic sensor arrays" April 30, 2010
- St-Pierre, M., and D. Gingras. "Comparison between the Unscented Kalman Filter and the Extended Kalman Filter for the Position Estimation Module of an Integrated Navigation Information System." IEEE Intelligent Vehicles Symposium