

Infrared for Estimation of Relative Feet Distance

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Aim: Infrared Proximity Sensor to improve estimation of foot positions in ForceShoes™ for ambulatory gait monitoring.

Existing Technology

ForceShoes™

- 2 Inertial Measurement Units
- 2 3DoF Force/Torque Sensors
- Ultrasound Range Estimation

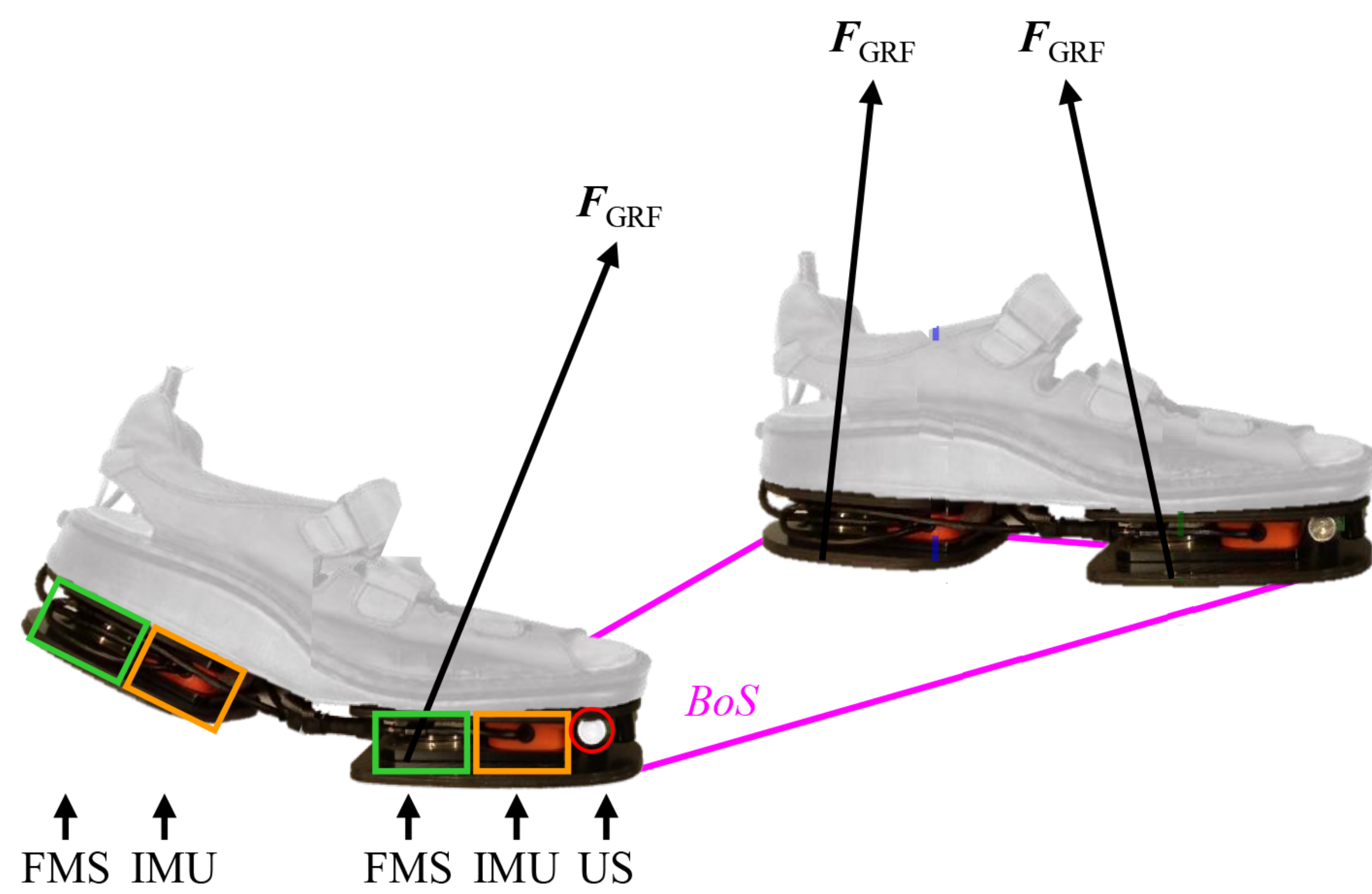


Fig1: ForceShoes with IMU, 3 DoF Force/Torque and Ultrasound [1]

Advantages of using Ultrasound Range Update

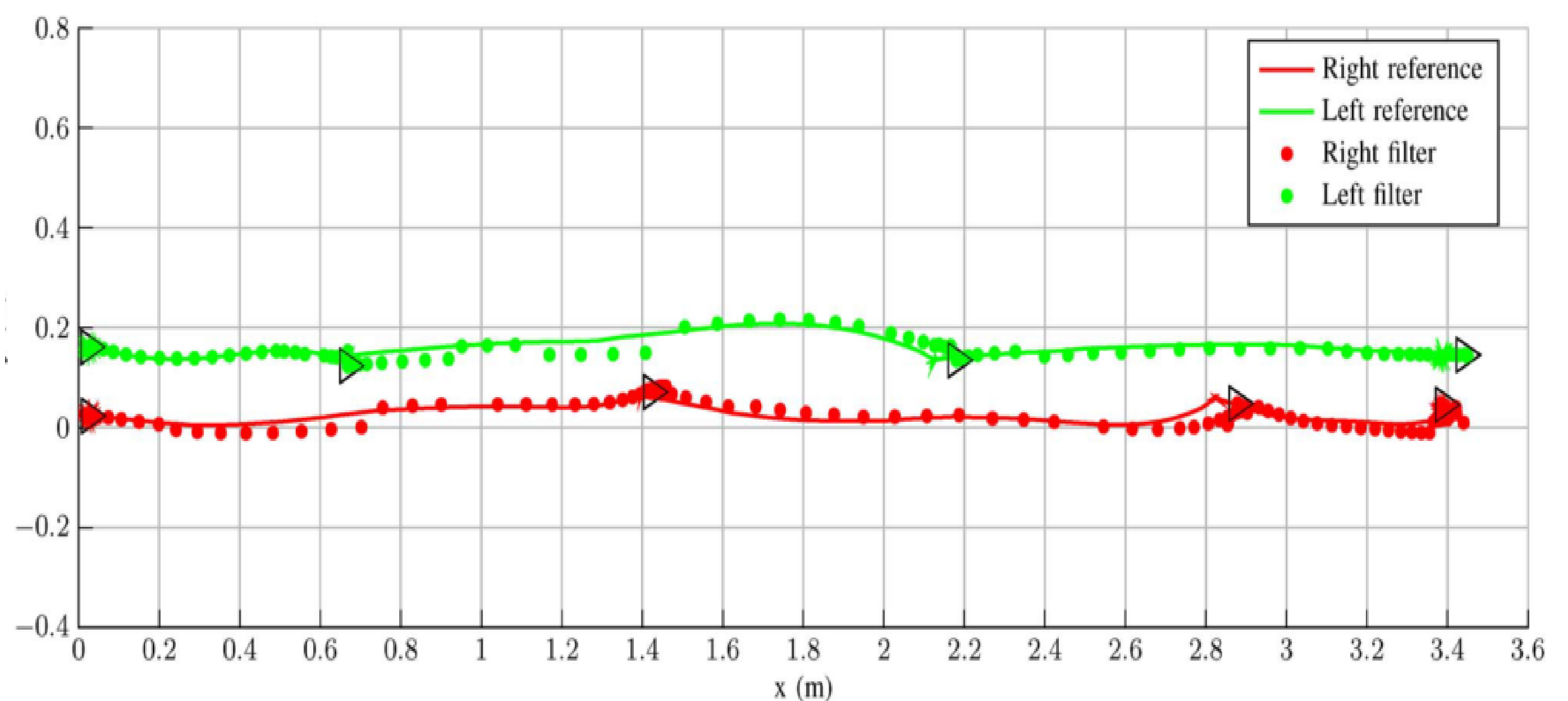


Fig3: Estimation of foot position over walking trial [2]

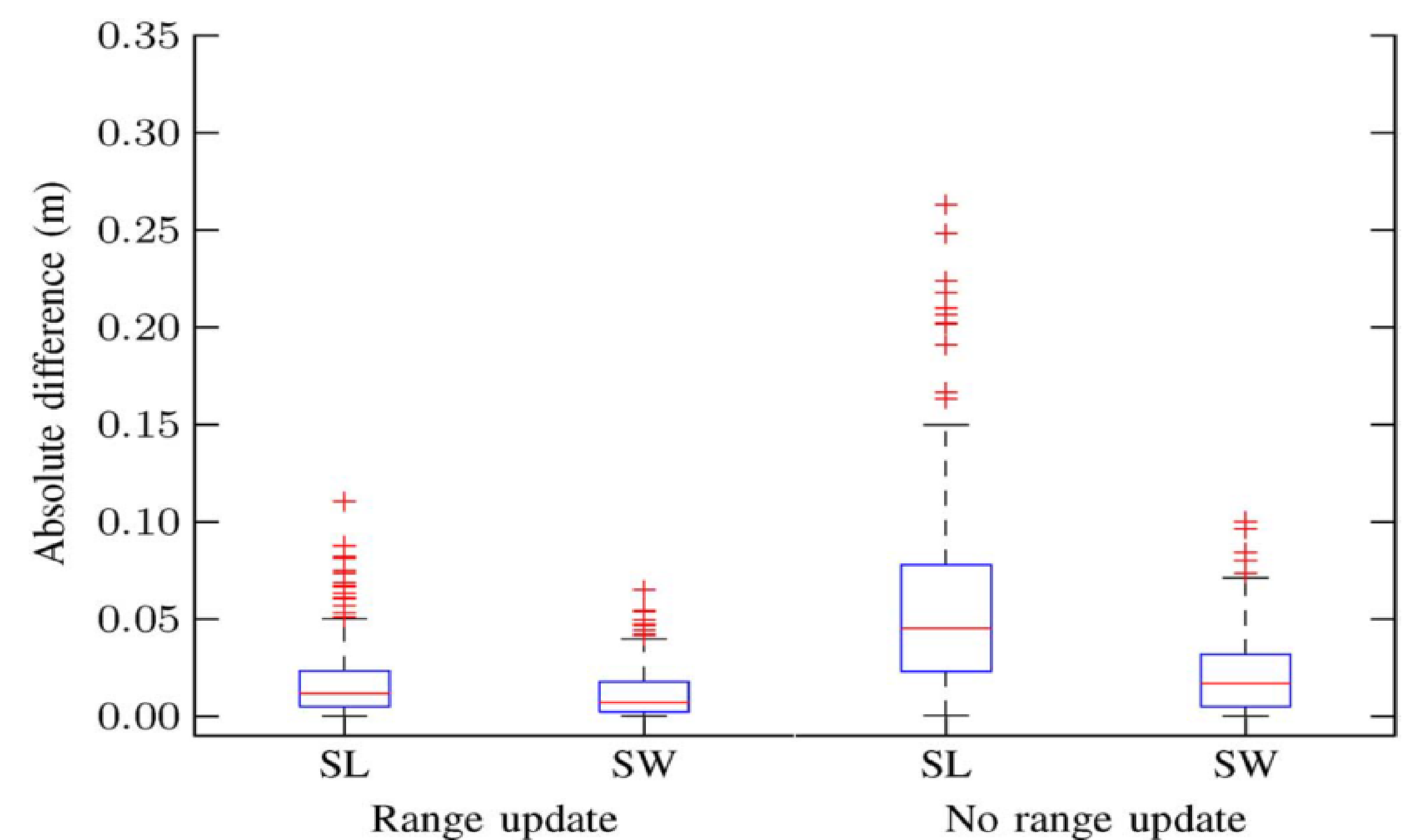


Fig4: Influence of Ultrasound range update on the Step Length and Width estimation [2]

Extended Kalman Filter (EKF)

- Sensor Fusion
- States: Position, Velocity, Orientation error, Gyroscope bias
- Ultrasound Range Updates

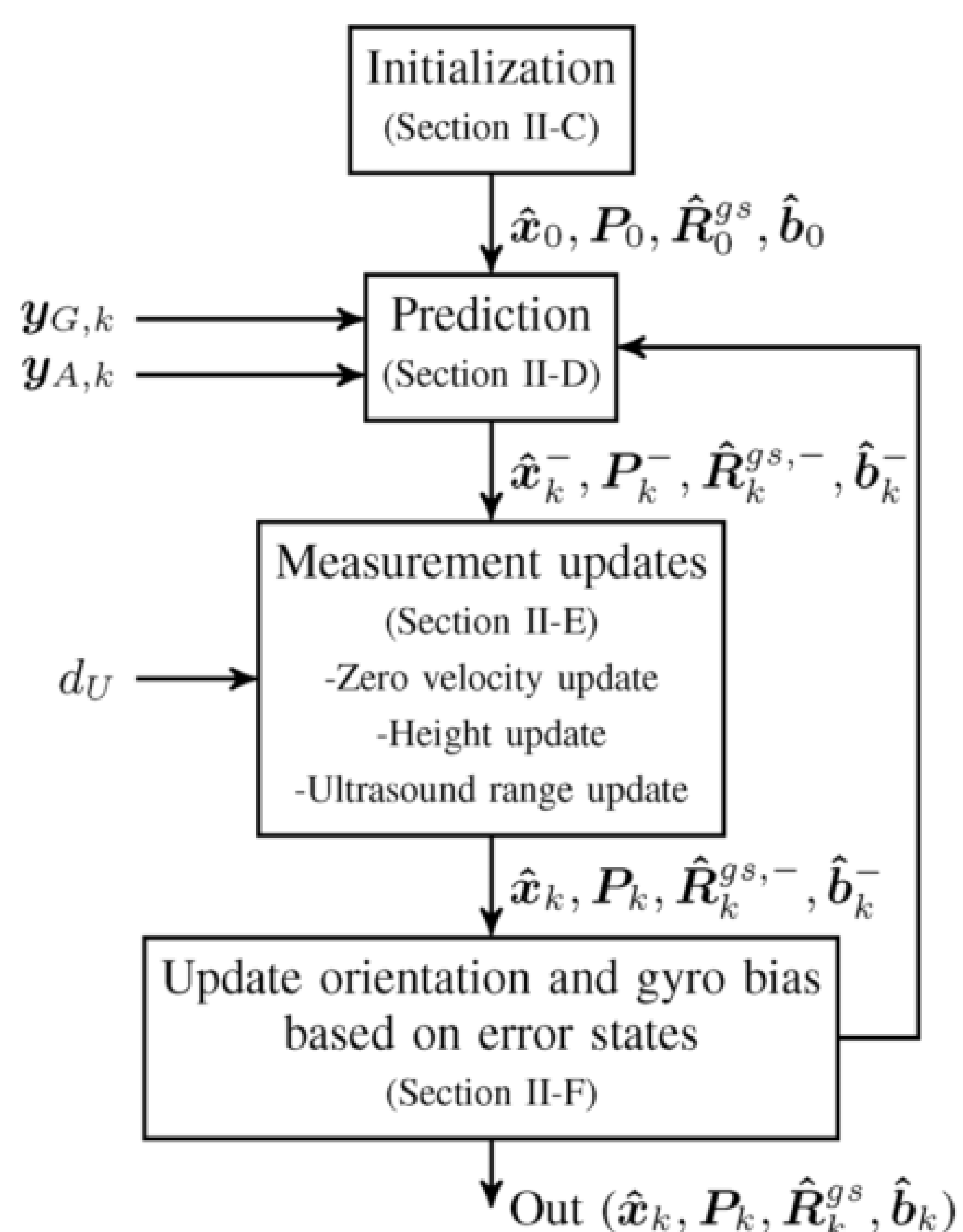


Fig2: Extended Kalman Filter to improve estimation [2]

Alternative to the Ultrasound System

Infrared Proximity Sensor

- Sparkfun ZX Distance Sensor
- 2D Proximity: distance and direction

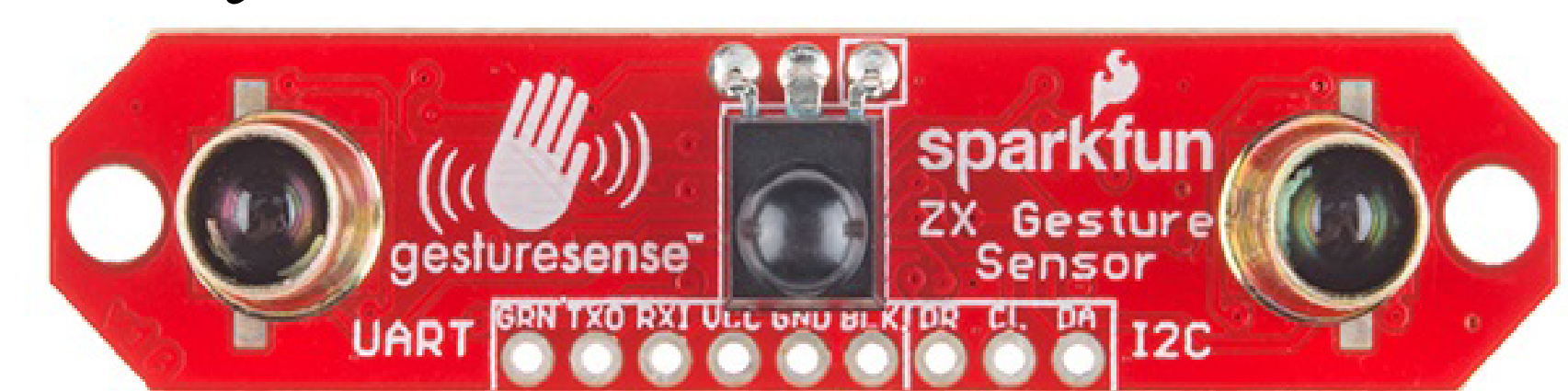


Fig4: SparkFun® ZX IR Distance Sensor

Implementation

- Identify points on the shoe for distance and direction estimation
- Infrared range updates to Extended Kalman Filter
- Compare Infrared and Ultrasound Range Update on foot position estimation [3]



Fig5: SparkFun® ZX Distance Sensor on the ForceShoes™