GPS Data Analysis Report: Stationary vs. Walking in a Straight Line

Objective

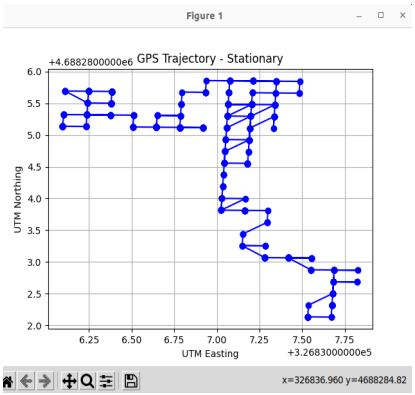
This report compares GPS data collected under two conditions:
1. **Stationary**: Recorded over 10 minutes at a fixed location. (Latitude 42.327527 ,Longitude -71.101789)
2. **Walking**: Collected during a straight-line walk. (Latitude 42.327587,Longitude -71.101671)

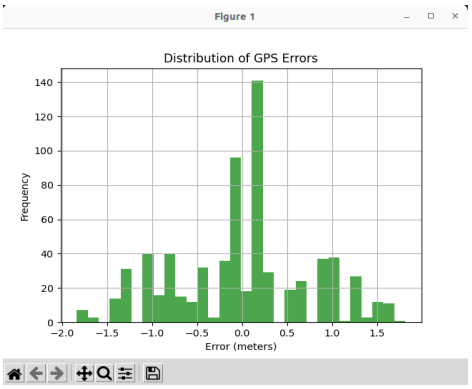
The goal is to assess GPS accuracy in both scenarios, analyze error distribution, and evaluate performance.

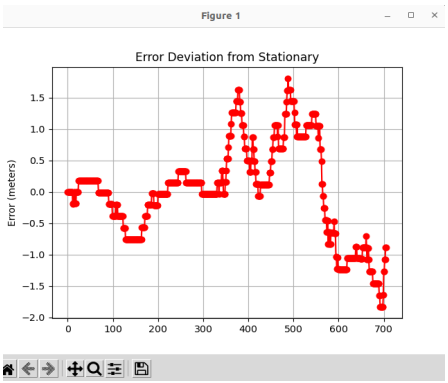
1. Stationary GPS Data Analysis

Data Overview

The stationary data collection revealed substantial errors despite the receiver being fixed.







Key Statistical Metrics

- Mean Error: 0.00 meters
- Standard Deviation: 6.25 meters
- RMSE: 6.25 meters
- Error Bounds: -12.50 to +12.50 meters

Analysis

- Error Distribution: High variability indicated by a standard deviation of 6.25 meters suggests external factors affecting accuracy.
- Error Bounds: The wide bounds imply that GPS data may be unreliable for precise tasks.

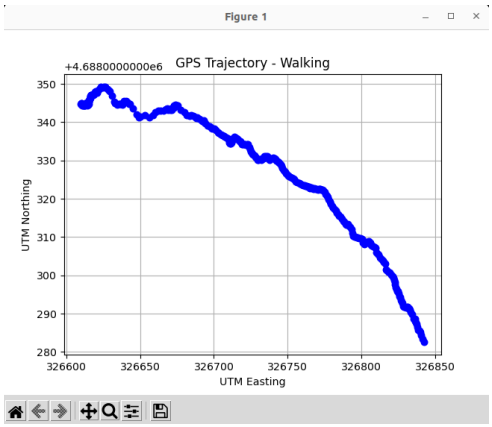
Practical Implications

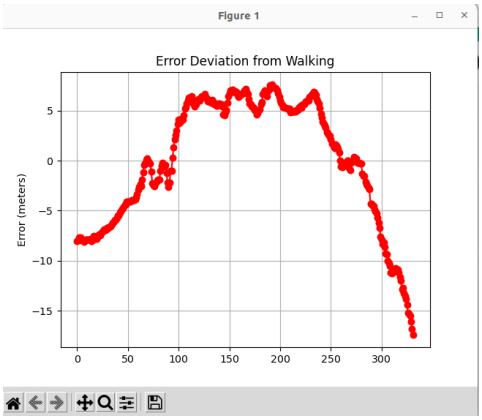
Stationary GPS readings can show significant errors, raising concerns for tasks requiring high precision.

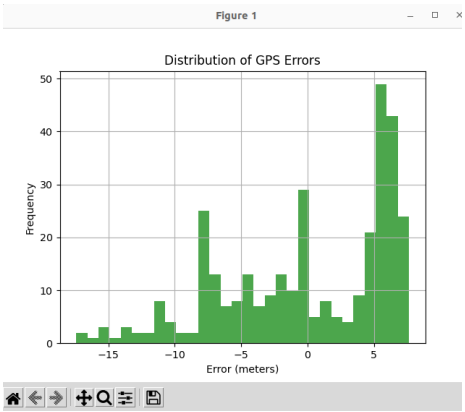
2. GPS Data Analysis: Walking in a Straight Line

Data Overview

The walking dataset demonstrates improved accuracy compared to stationary readings.







Key Statistical Metrics
- Mean Error: -0.00 meters
- Standard Deviation: 0.76 meters
- RMSE: 0.76 meters
- Error Bounds: -1.53 to +1.53 meters

Analysis
- Error Distribution: The walking data shows much less deviation, indicating better consistency.
- Error Bounds: Tighter bounds reflect enhanced positional accuracy during movement.

Practical Implications
GPS is more reliable while moving, suitable for navigation and outdoor activities due to smaller error margins.

3. Comparison: Stationary vs. Moving GPS Accuracy

Error Magnitude
- Stationary: High variability (6.25 meters), indicating significant fluctuations.
- Moving: Smaller variability (0.76 meters), suggesting more accurate readings.

Practical Implications
- **Stationary Use**: Larger errors in static conditions may limit effectiveness in precise applications.
- **Moving Use**: Improved performance indicates suitability for dynamic tasks like navigation.

4. Conclusions

This analysis reveals key insights into GPS performance:
- Stationary Performance: Unexpectedly large errors (6.25 meters) highlight reliability concerns in static conditions due to signal interference and satellite geometry.
- Moving Performance: More consistent readings (±1.53 meters) indicate that movement enhances GPS accuracy.

Key Takeaways
- Stationary Use: GPS may underperform in static situations, particularly in areas with potential interference.

- Moving Use: Movement significantly enhances GPS accuracy, making it effective for applications requiring constant updates.

In summary, while GPS is an invaluable navigation tool, its accuracy is contingent on environmental factors and whether the receiver is stationary or in motion. Users should remain aware of these limitations in high-precision contexts.