

Android GNSS Measurements under Spoofing and Interference

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ABSTRACT

This laboratory exercise examines how consumer smartphones process raw GNSS measurements under both stationary and motion conditions, and evaluates the impact of imposed spoofed location inputs and timing delays on computed navigation solutions. Leveraging open-source filtering and weighted least-squares estimation, we measure deviations in reported fixes and identify key factors—geometry shifts, signal strength fluctuations, and clock behavior—that influence accuracy. Our findings underscore strategies for detecting anomalous GNSS outputs on mobile devices.

1 INTRODUCTION

Global Navigation Satellite Systems (GNSS) provide critical positioning services for a wide range of consumer and industrial applications. However, GNSS signals are inherently vulnerable to spoofing attacks, in which counterfeit signal parameters are supplied to the receiver, potentially leading to incorrect location or time estimates. Understanding how smartphone GNSS observables respond under legitimate and spoofed inputs is essential for developing reliable detection mechanisms.

This laboratory exercise captures raw GNSS measurements from an Android handset in two scenarios: a static rooftop deployment and a tram-based kinematic test. Each dataset is processed twice with a weighted least-squares estimator—once to establish baseline performance and again with an overridden reference location and controlled timing delays. By comparing these runs, we isolate the effects of satellite geometry, signal quality, and receiver clock behavior on output integrity.

The remainder of this report is organized as follows. Section 2 describes the experimental setup, including device configuration, data collection procedures, and the processing pipeline. Section 3 presents results and discussion, contrasting static versus dynamic performance, examining spoofed-location impacts, and analyzing delay effects. Finally, Section ?? summarizes the key findings and outlines directions for future work.

2 METHODS

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*The authors collaborated closely in developing this project.

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3 RESULTS AND DISCUSSIONS

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3.1 Baseline Performance: Static vs. Dynamic

3.2 Impact of Spoofed Position

3.3 Effects of Timing Delays

3.4 (Optional) Interference Effects

4 CONCLUSIONS

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