Experimental Validation of a LabVIEW-Based SFCW Software-Defined Radar System

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Abstract Software-defined radar (SDR) provides a flexible and cost-effective platform for implementing and testing diverse radar techniques without hardware redesign. Among these techniques, Stepped-Frequency Continuous Wave (SFCW) radar has shown promise in addressing some of the limitations of Frequency Modulated Continuous Wave (FMCW). This paper presents the experimental validation of an SDR system based on the SFCW technique. The radar system was developed using a USRP N210 with a WBX daughterboard, fully controlled through LabVIEW for waveform generation, data acquisition, and signal processing. Experimental validation was conducted in a controlled indoor environment using a 30 × 30 cm metal target placed at distances from 0.7 m to 1.25 m. According to the data, this research has shown accurate detection at longer ranges, with error rates below 0.5%. However, the increasing inaccuracy at lower ranges highlighted issues in near-field measurements. The findings have confirmed the feasibility of SFCW-based SDR for compact, reconfigurable radar platforms and suggest opportunities for enhancing near-field accuracy through advanced signal processing and calibration.

Keywords **Author Keywords:** Software-Defined Radar (SDR); Stepped Frequency Continuous Wave (SFCW); USRP; LabVIEW; Range Detection

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