## ABSTRACT

The increasing demand for reliable surveillance systems for human tracking in outdoor environments has highlighted radar technology as a promising non visual alternative. One of its key roles is in crowd management, where realtime monitoring of mass movements is essential to support public safety and security. This research presents the development of a human tracking system based on Frequency Modulated Continuous Wave (FMCW) radar, utilizing the IWR6843ISK module. The system processes point cloud data using the Density Based Spatial Clustering of Applications with Noise (DBSCAN) algorithm for clustering, and the Extended Kalman Filter (EKF) for continuous position estimation and trajectory prediction. Implemented in realtime, the system is capable of detecting and tracking up to three individuals under various movement scenarios. Experimental results indicate that the lowest tracking RMSE of 0.2296 m is achieved for perpendicular trajectories relative to the radar, while the most accurate clustering performance is observed at a distance of 15-25 m with a minimum MSE of 0.0235. System performance declines beyond 40 m due to signal attenuation and decreased point cloud density. These findings confirm the potential of FMCW radar as a robust and adaptive solution for non-visual surveillance in diverse environmental conditions.



**Keywords**: FMCW radar, human tracking, surveillance system, DBSCAN, Extended Kalman Filter, point cloud, real-time