ABSTRACT

Overcrowding in public spaces is a common issue that can occur in areas that serve as focal points for various aspects of community life. If not properly managed, this can lead to more serious problems, such as crowd crush incidents resulting in fatalities. Various solutions have been implemented to control crowds, ranging from non-technical measures like regulations to using cameras for monitoring. However, several challenges remain, including the subjectivity of human assessments, system inflexibility, detection accuracy, and potential privacy violations due to unauthorized image capture of individuals.

To address these issues, a Public Space Visitor Counting and Tracking System has been developed using frequency-modulated continuous wave (FMCW) radar, which can count the number of people entering and exiting public spaces without capturing images of visitors. Additionally, a website is provided for public space managers to access real-time visitor data.

Testing data indicates that the system demonstrates high accuracy in certain scenarios. In the first specification, the system achieved relatively high accuracy in the first and second trials (89.53% and 92.75%, respectively), but lower accuracy in the third trial (67.29%). Under the second specification, the results showed high accuracy, reaching 98.3% for 30 samples. For the third specification, the data transmission accuracy from the application to the website was 96.35% in the first trial, 96.07% in the second trial, and 100% in the third trial. However, some aspects of the system could still be improved, such as the decrease in accuracy when there is a high density of visitors entering or exiting with very close proximity, and the delay in data transmission from the application to the website. Therefore, further development is needed to enhance accuracy, ensuring the system can adapt to various conditions and situations, providing more consistent and reliable results in different usage environments.

Keywords: Overcrowding, radar, accuracy, mmWave