

RADAR APPLICATION NOTE

SURVEILLANCE OF TAXIWAY CROSSING AT AIRPORT COLOGNE/BONN



IMST GmbH and the Fraunhofer Institute for Communication, Information Processing and Ergonomics (FKIE) made a radar/video test campaign at the airport Cologne/Bonn. The system controls airport supply vehicle traffic that must cross the aircraft taxiway. If the sensors detect any objects (e.g. suitcases or other goods in transit), persons or vehicles, the intersection will remain closed to aircrafts until the areas has been cleared.

The 24GHz radar module sR-1200 and a high resolution video camera were installed on a mobile lift platform in a height of 6.5m with view to the crossing area. Both sensors are able to detect objects independently from each other. The advantage of radar is that a precise position of objects can be measured even in darkness and at bad weather conditions. Distances are measured with the FMCW mode while angles are determined from phase difference measurements of the two receive antennas within the radar module. Video processing algorithms even allow the detection of small and lightweight objects like board trolleys or cardboard boxes, which are hardly visible for radio waves. Both sensors types had an excellent detection rate for

persons and vehicles moving inside in the crossing area. Through the fusion of both sensor types a very high confidence level can be achieved. The benefits of both sensors are merged, while the drawbacks of the individual sensor are eliminated.

Radar measurements and video streams are transferred to a small industrial computer for data fusion and evaluation of the traffic scenario. The test software allows marking the detected objects from both sensors within the video. A red signal area turns on and indicates that the intersection is closed for aircrafts. The signal automatically turns to green, when the area has been cleared.

Real tests were made during four different periods. The first one was carried out in the early afternoon at daylight and sunny weather. Both sensors worked well. The second period was running from daylight to dawn. The system was able to detect all objects that were considered as potential threads for the traffic safety by the airport. These objects were vehicles, person, hand luggage, cardboard boxes and cylinders.



For the last field trial an airport fire truck was summoned to wet the intersection asphalt. Several hundred liters of water were splashed from the roof cannon. A large puddle spreads over the ground and caused strong reflections from the morning sun. The tests with different objects were repeated for the last time. The radar/video surveillance system succeeded this difficult situation as well. The software of both sensors allows adaptations of numerous parameters. These settings can be optimized for different scenarios and environmental conditions.

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RADAR PROPERTIES IN A NUTSHELL	VIDEO PROCESSING IN A NUTSHELL
24 GHz FMCW and Doppler mode 1 ms ramp time 250 MHz bandwidth 100mW radiated power Signal processing in module Adaptive background adjustment Object distance measurement: 10 – 50m Object angle measurement: -35° – +35°	Full-HD video processing Automatic illumination adaption for day/night Supports multiple sensors Adaptive background estimation Full automatic processing Estimating object size and position Sensor fusion with radar Single Camera field of view: 90°x70°



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