Security at mass events – support from the air

28 March 2011

Aerial view of the entrance to the Allianz Arena in Munich: red lines mark detected groups of persons with estimated head counts.

Image: DLR.

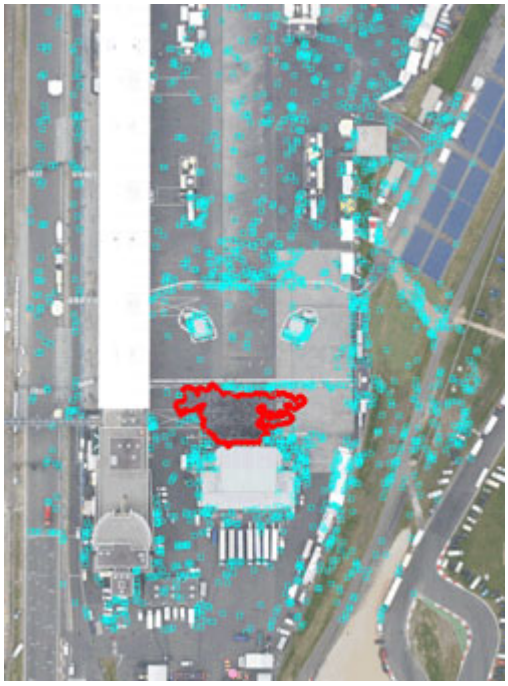
Every year, the Oktoberfest in Munich attracts around six million people. Should anything unforeseen happen, the visitors' safety may be acutely threatened. A technology developed by DLR's Applied Remote Sensing Cluster permits authorities to analyse groups of persons and their direction of movement on the basis of current aerial photographs.

Mass events like the Oktoberfest, the Love Parade, or demonstrations are often attended by people in their hundreds of thousands. In most cases, more or less dense crowds keep moving steadily in a particular direction towards their target. If something unforeseen occurs, the risk of a runaway panic is great. Such a mass reaction may be triggered by fires, detonations, or - as in the case of the Duisburg Love Parade in 2010 – simply by an extremely dense agglomeration of people.

Mass panic prevention

Therefore, authorities and organisations responsible for security at mass events need to know approximately how many people are assembled in any specific location on the premises, the direction in which they are moving, and the density of each group. If a panic is imminent, it is also necessary to know how much space visitors have for evading and escaping from a threat.

In most cases, however, only rough estimates of the total number of visitors can be had from the police or the organisers. Frequently, such data differ widely, and they contain no information about local density anomalies. While surveillance cameras do show pictures of the situation on the spot, they do not deliver quantitative information about the number and density of persons in a large area.



Aerial view of the premises of the 'Rock am Ring' open air concert: blue squares mark detected individuals; red lines mark dense crowds of people in front of the stage.

Image: DLR.

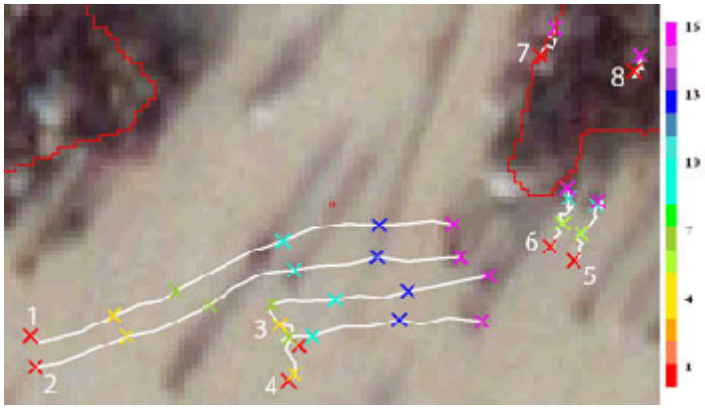
Quantitative estimates

Developed by the DLR Applied Remote Sensing Cluster, the 3K airborne camera system is capable of photographing an area measuring 3 x 5km within one minute. Its high spatial resolution (c. 15x15cm per pixel) permits head counts of individuals as well as of dense groups of persons. In addition, its temporal resolution of up to five images per second facilitates analysing movement patterns. Data are evaluated on board and transmitted to a ground station without delay.

The automated detection of persons greatly depends on the capability to distinguish individuals from their background and from areas of shadow. Based on a self-teaching approach, the software distinguishes between persons and other objects in the first step and categorises them as individuals or as part of a group in the second. The total number of persons in a group, and thus its density, is estimated on the basis of local variations in brightness and colour.

One idea for the future is to expand the method beyond the detection of persons to include the interpretation of movement patterns so that suspicious situations can be recognised. In the context of terrorist attacks, authorities and organisers alike may find this helpful in identifying individuals or groups that behave conspicuously.

Scientists from three of DLR's main research areas, astronautics, aeronautics, and transport, are involved in this project, which at the same time forms part of DLR's security research, a cross departmental programme under which defence and security-related research and development activities are being planned and controlled.



Interpreting of situations: persons 3 and 4 are waiting for persons 1 and 2, leaving with them afterwards. The scale on the right shows the number of frames processed.

Image: DLR.

The VABENE project

The above research activities originated from DLR's VABENE project (traffic management for major events and disasters) under which an interdisciplinary team of transport engineers, IT specialists, mathematicians, geographers, physicists, and surveying engineers from seven DLR institutes is working on the development of a system that will provide relevant information in real time to mission controllers and traffic managers. This will improve the coordination of decisions and the objectiveness of impact assessments. For the same purpose, DLR is developing suitable communication methods and user interfaces for integration into mobile ground stations. Examples include the EmerT web portal and the Disaster Management Tool (DMT).

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