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WHO Collaborating Centre on Mass Gatherings and High Visibility/ High Consequence Events, Public Health England

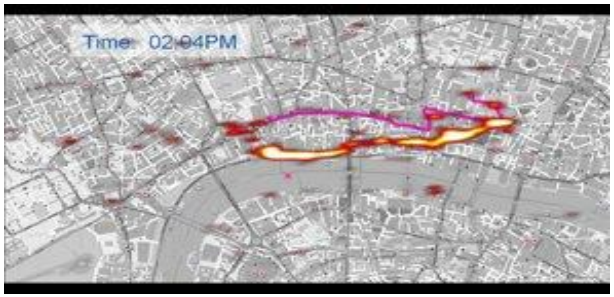
The problem

Mass gathering events have an enormous potential to place a severe strain on the local health care system. Event organisers, medical resource planners and emergency services, including local hospital emergency departments face many challenges in order to provide a safe event[1].

As evidenced by the crowd disaster at the 2010 Love Parade in Duisberg Germany, there are two kinds of fatalities of over crowding within an area: trampling and crushing. Despite venue capacities being completely full, further crowd members attended and still tried to gain access, which unfortunately resulted in several deaths and many more injuries. Planners must have a thorough understanding of crowd behaviour and the relevant safety systems. The combination of high crowd density and difficult access points is a major risk factor for a catastrophic stampede or trample disaster and resulting crush injuries[2].

The science

The behaviour of crowds at a mass gathering event can be highly unpredictable, which highlights the need for emerging critical crowd situations to be detected at an early stage in order to reduce the risk of evolving in to a mass casualty incident. The advent of new smart-phone technology has the potential to highlight crowd density (the number of people per unit area) and can therefore be used as an important measure to assess the risk of potential overcrowding and stampede.



1:[Crowd Density at the Lord Mayors Show London (2011) – Source: Martin Wirz[3]]

Different modalities such as Bluetooth sensing or app-based GPS localization have been used to capture collective dynamics such as flocking, crowd turbulence or mobility patterns during large-scale events. In particular, individual location data can analyse to estimate safety-relevant characteristics such as crowd movement velocity, density, turbulence or crowd pressure.

The application to policy and practice

Wirz et al (2013) used a scientific model to turn mass gathering participants' smartphones in to a reliable sensing tool for measuring crowd density during the Lord Mayor's Show in London 2011. Attendees downloaded a smart-phone App to record the user's location at regular intervals. To motivate as many attendees as possible to download the App and share their locations, the App offered a set of features including an interactive program of the event and maps of the venue as an incentive to all[3]. The application was used to successfully track crowd movement and monitor high density areas during the mass gathering event. (Figure 1 & 2)

2: High Crowd Density areas (red) at the Lord Mayor's Show (2011) – Source: Martin Wirz[3]]

In practice the use of smartphone technology has three major advantages[4].

1) Data can be captured and transmitted in real time to a central command centre to visualize crowd characteristics
2) Crowd safety personnel can send notifications, warnings of potential high crowd density areas and guide the attendees to an appropriate exit in the event of an emergency situation
3) Crowd data once collected can be used to analyse the mass-gathering event and reveal critical factors that can be addressed in future events.

The Application has real potential if participants to the mass gathering event are informed appropriately such as reassuring attendees of their right to privacy and associating the tracking device itself with an application for the event promoted. The application can also provide extra information regarding exits, medical centres, shelter, food and beverage stations as well as what to look out for in the event of an emergency.

Did it make a difference?

The use of smartphone technology has the potential to make a real difference in crowd monitoring and crowd dynamics at mass gathering events. It can alert organisers to high density areas and potential overcrowding, and can even inform participants that have downloaded an 'event application' of safety measures. Monitoring of crowd density can also have the far reaching implication of informing medical services of participant numbers and to ensure adequate healthcare can be provided to cope with the size of the crowd attending. This sort of technology has already been tested successfully several times; In 2011 at the Maltese Freenight-Festival "Notte Bianca", in 2012 at the London musical festival "West End live" and the London Olympics as well as at the "Vienna City Marathon", among others. Further research is required in this exciting field, but the potential is certainly there.[5]

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