KOALA low-cost air quality monitoring network at a major sports event

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Introduction and Methods

The KOALA (***K**nowing **O**ur **A**mbient **L**ocal **A**ir **Q**uality*) is a low-cost stand-alone air quality monitor developed by the Queensland University of Technology, Brisbane, Australia (Fig 1). It consists of a Plantower PMS1003 particle sensor and an Alphalab CO-B4 carbon monoxide sensor and is powered by a solar panel and rechargeable battery so that it may be left in the field over long periods unattended. Sensing data is transmitted via the 3G network to cloud storage infrastructure which stores, processes and serves CSV files and interactive time series graphs. The current readings are available online with a mobile enabled map visualisation.

Fig 1

The city of Gold Coast, located on the eastern seaboard of Queensland, Australia, hosted the Commonwealth Games in April 2018. The event involved 6600 athletes and attracted over 670,000 visitors. As there was some concern about the impact on air quality, we installed a network of nine KOALAs in the vicinity of the athlete's village and games venues in the suburb of Southport in the Gold Coast. The devices operated successfully over the period of the Games with real time data obtained at 5 min intervals transmitted to the database every 30 min. Within this area was located an air quality monitoring station operated by the Queensland Department of the Environment and Science from which we were able to obtain standard $PM_{2.5}$ and CO concentration data as well as meteorological parameters such as wind speed and direction.

Fig 2 shows a typical visualisation chart made available on-line during the campaign. The vertical bars show the $PM_{2.5}$ concentrations reported by 8 of the 9 KOALAs located in the network across the suburb of Southport. The colour of a bar indicates the pollutant concentration at that location.

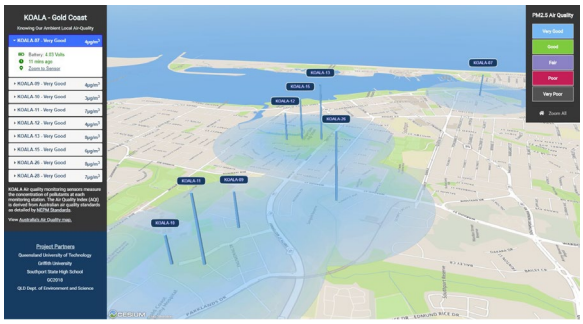

Fig 2: Typical visualisation map of the network

Results and Conclusions

The network of KOALAs showed a small but statistically significant decrease in $PM_{2.5}$ during the 2-week period of the Games (3.8 μg m^{-3}) when compared to the 2-weeks immediately prior to the Games (5.1 μg m^{-3}). We attribute this to a change in normal activity as well as the presence of offshore winds introducing cleaner marine air into the region. A decrease in relative humidity may also have played a role in this decrease (Jayaratne et al., 2018). The corresponding CO concentration did not show a significant change during the Games, suggesting that the decrease in $PM_{2.5}$ concentration was not directly a result of decreased motor traffic density. The concentrations reported by the KOALAs correlated well with each other and showed that there was no significant spatial variation across the network area. The data correlated well with the standard instruments, demonstrating that a network of low-cost sensors can be used reliably and effectively to derive information over a large area. One year on and a scaled down networks still operates, with $PM_{2.5}$, not showing signs of aging (http://www.sensors.net.au/).

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