A Ruggedized, Portable Triple Quadrupole Mass Spectrometer for Mobile Detection of Chemical Threats in Urban Environments

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The DARPA SIGMA+ program is developing novel sensors, algorithms, and architectures to provide early warning and detection of chemical, biological, and explosive (CBE) threats in urban environments. A custom-designed, miniature, laboratory-grade Triple Quadrupole Mass Spectrometer (TQMS) functions as a chemical referee system, providing mobile, real-time measurements of the urban chemical environment. Targeted Multiple-Reaction Monitoring provides continuous monitoring of 20+ compounds in less than one second resolution. Instrumentation can switch between positive and negative ion polarity with a 50 ms settling time between modes. Initial sensitivity of the instrument through laboratory-based testing demonstrates a limit of detection in the part-per-trillion (ppt) range depending on chemical ionization potential. The TQMS is portable (50 kg, 75 L) and is configured for vehicle installation for mobile deployment applications. This Mass Spectrometer has been deployed in Boston and Indianapolis, mapping over 6000 miles in more than 500 operational hours. Data collected during these urban chemical background measurement campaigns refined sensor requirements and generated data that is being used to optimize detection algorithms and deployment strategies.

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