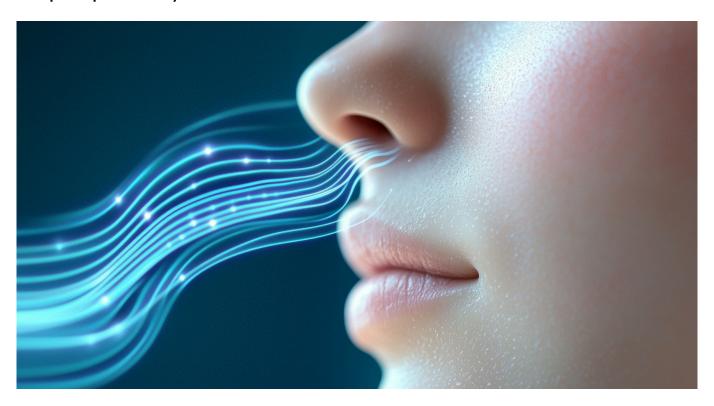**TECH OFFER**

Compact Spectrometry-Based Electronic Nose for Odour Detection

KEY INFORMATION

TECHNOLOGY CATEGORY:

Electronics - Sensors & Instrumentation
Environment, Clean Air & Water - Sensor, Network, Monitoring & Quality Control Systems
Green Building - Indoor Environment Quality
Infocomm - Smart Cities

TECHNOLOGY READINESS LEVEL (TRL): **TRL7**
COUNTRY: **SINGAPORE**
ID NUMBER: **TO175322**

OVERVIEW

With increasing discoveries of new pollutants being detrimental to human health and the environment, there have been an increasing scrutiny of air pollution, industrial emission and air quality through tighter government regulations. With the increasing importance to detect different combination of analyte concentrations within an area, there is a growing demand for electronic olfactory system. Laboratory multi-analyte analysis method, like gas chromatography and mass spectrometry (GC/MS), provide high accuracy and selectivity but is time consuming, complex and not portable. Comparatively, industrial gas sensors, like micro-electromechanical systems (MEMS), are portable and simple but lack the selectivity of chemical substances and do not operate in real-time.

The technology owner has leveraged on Field Asymmetric Ion Mobility Spectrometry (FAIMS) with a proprietary odour analysis

system built on extensive experimental data to develop a compact, lightweight spectrometer for real-time multi-analyte analysis. While this system may not fully match the performance of laboratory-grade mass spectrometry, it offers higher accuracy and selectivity than industrial gas sensors, enabling continuous, non-invasive analysis on the go. Notably, it excels in ammonia detection by achieving highly sensitive measurements ranging from sub-ppb to several hundred ppb.

The technology owner is currently seeking industrial collaborators looking to explore digital olfaction devices for multi-analyte analysis application, particularly for ammonia-based detection, which leverages on the technology's high selectivity and sensitivity.

TECHNOLOGY FEATURES & SPECIFICATIONS

The device solution utilises FAIMS (Field Asymmetric Ion Mobility Spectrometry), which separate individual gas molecules via ionisation and specialised electric field and identifies them via electrical signals. Previously limited to only specialised environments, the technology owner has leveraged on proprietary algorithm of data analysis to develop a deployable device for broader usability. The key features include:

- High sensitivity and selectivity
- Battery powered for portability to deploy device (as an IoT) on site
- Compact formfactor (~3kg) with current prototype being 120mm (H) × 220mm (W) × 160mm (D)
- User friendly with no in-depth technical expertise required
- Real-time multi-gas analysis for quick and actionable insights, such as pattern recognition, early hazard detection and predictive maintenance
- Continuous, non-invasive sample delivery design using integrated pump design for contactless analysis
- Provision of cloud data transmission, computing and visualisation for horizontal usage across various application
- Easier maintenance due to fewer consumables and ease of replacement

POTENTIAL APPLICATIONS

With the capability of deployable laboratory multi-analyte detection and analysis, the technology solution is designed to enable various odour-centric application across different industries such as:

- **Environmental Monitoring for Safety and Health**: Monitoring and mapping of ambient air pollutants, fire hazard monitoring and prediction, cleanroom contamination and visualisation, and odour monitoring in confined environments (e.g. cabin air, tunnel)
- **Gas/Solvent-based Industrial & Manufacturing Processing:** Monitoring, leak detection and mapping (e.g. for ammonia energy source), odour detection and control, and solvent analysis and contamination evaluation
- **Food & Beverages:** Maintenance of food hygiene, freshness evaluation and control, authenticity assessment of products, and contamination detection and mapping
- **Logistics:** Monitoring of perishables, and packaging defect detection
- **Healthcare and Wellness:** Non-invasive bio-gas analysis for disease diagnostics, management of chronic conditions, and effectiveness testing
- **Agriculture:** Quality assessment of produce, and predictive maintenance of optimal growth conditions

MARKET TRENDS & OPPORTUNITIES

The global electronic nose (e-nose) market is expected to be valued at US$972 million in 2024 and is projected to reach

US$1,617 million by 2029, exhibiting a CAGR of 10.7% during the forecast period.

Across application segments within the global e-nose market, medical application is projected to be the largest market share in 2029 of US$665 million while environmental monitoring application is expected to exhibit the largest CAGR of 12.1% during the forecast period of 2024 to 2029.

UNIQUE VALUE PROPOSITION

The technology solution is designed to leverage the advantages of FAIMS and MEMS technology to develop the odour sensor system capable of high sensitivity and selectivity while being compact, portable and user friendly. With the continuous real-time multi-gas analysis on site, the system has the capability to provide AI based analytics, such as odour profiling and predictive maintenance, for quick insightful decision-making. This technology will provide the future integration to a non-invasive IoT device across various use-cases, from potentially detecting new hazardous odours for public safety to disease diagnostics via breath analysis.