This project has received funding from the European Union's Horizon 2020 FET Open programme under grant agreement No [899261]

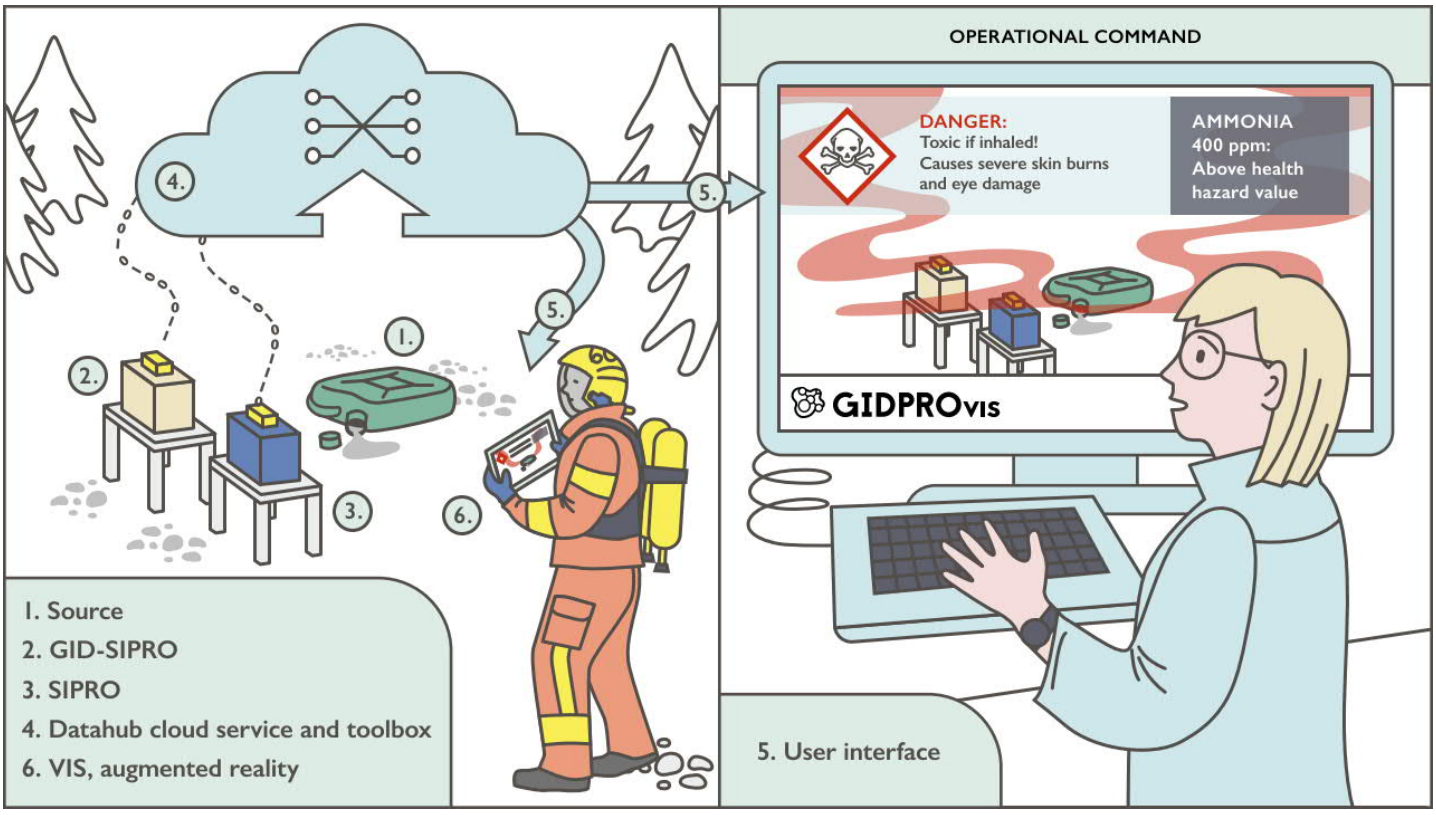
GIDPROVIS

Gas Ion Distillation and Sequential Ion Processing Technologies for Identification and Visualization of Chemicals in Airborne Vapours

Project director Paula Vanninen, VERIFIN, University of Helsinki

Scientific director Gary Eiceman, VERIFIN, University of Helsinki, New Mexico Stae University, USA

Coordinator Hanna Hakulinen, VERIFIN, University of Helsinki



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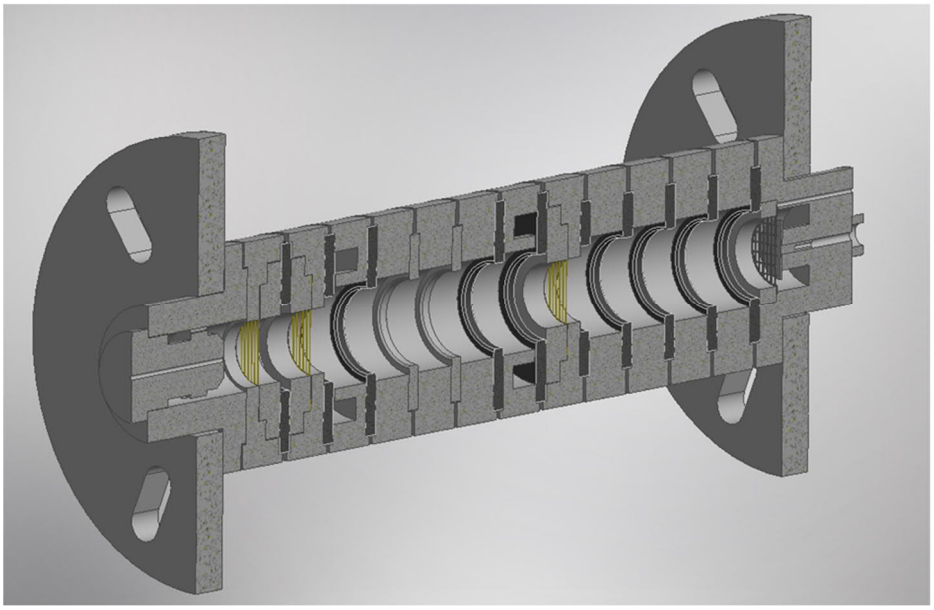
GIDPROVIS

GAS ION DISTILLATION (GID) UNIT



Cut-off view of GID-IMS.

Three GID-IMS units

Achievements of GIDPRO$_{vis}$

GID

Technology:	GID, Gas Ion Distillation
Partner:	University of Helsinki (UH)
Desired operational effect:	Sensitivity and specificity increase of analytical instruments (MS or drift-IMS) with GID pre-separation

Why is this technology helpful?

Atmospheric ionization is limited by the abundance of reactant ions and therefore the most reactive compound can supress the ionization of other compounds resulting to incomplete understanding of the sample content. GID is an atmospheric pressure ionization modifier, which improves sensitivity and selectivity of an analytical instrument such as MS or drift-IMS.

What does this technology do?

GID is a front end method to separate ionized gas phase sample based on the reactivity of the sample compounds. Reactivity is defined as a product of concentration and reaction coefficient.

How does this technology work?

Gas sample is confined into the reaction space which is fed with reactant ions (typically hydrated protons) by electric field. Hydrated protons collide with neutrals resulting to product ions. The product ions are washed away from the reaction space with electric field. As long as product ions remain in the reaction space, they collide with neutrals, with remaining reactant ions, and other product ions. The balance of this process moves continuously towards the most stabile product ions. In an arrangement where the residence time of the product ions is long, in range of seconds, the product ions washed from the reaction space represent the most prominent species at the specific temporal moment. This is seen as kinetic based temporal separation of ions.

Future development

TRL of GID is 3 to 4. Further development is needed for flow control and sample introduction, adjustment of reaction times by geometry and electric fields and introduction of reactant ions. These are both engineering and research topics.

Achievements of GIDPRO$_{vis}$

GID

GENERAL

Company Details:

University of Helsinki, VERIFIN - Finnish Institute for Verification of the Chemical Weapons Convention

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Portability Laboratory level equipment.

Unit Cost Not defined

Status Patent pending, Patent application 20235661 “GAS ION DISTILLATION

TRL 3-4

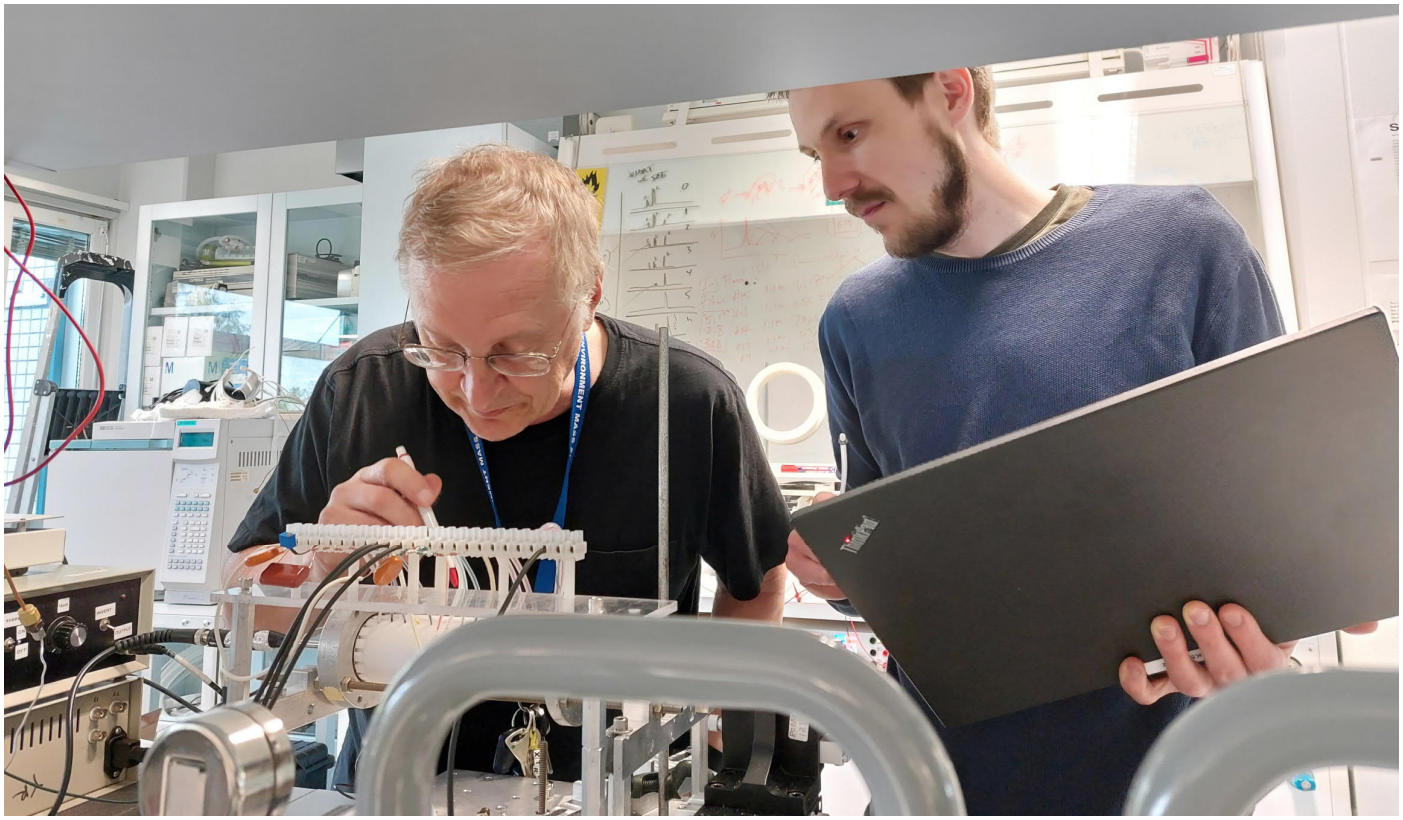
Technology Hardware

Description Gas Ion Distillation unit, GID

Current Use Analytical instrumentation (IMS, MS)

Future developments Optimization via engineering and research

Anticipated TRL 5 (2025), 9 (2030)



GID Science

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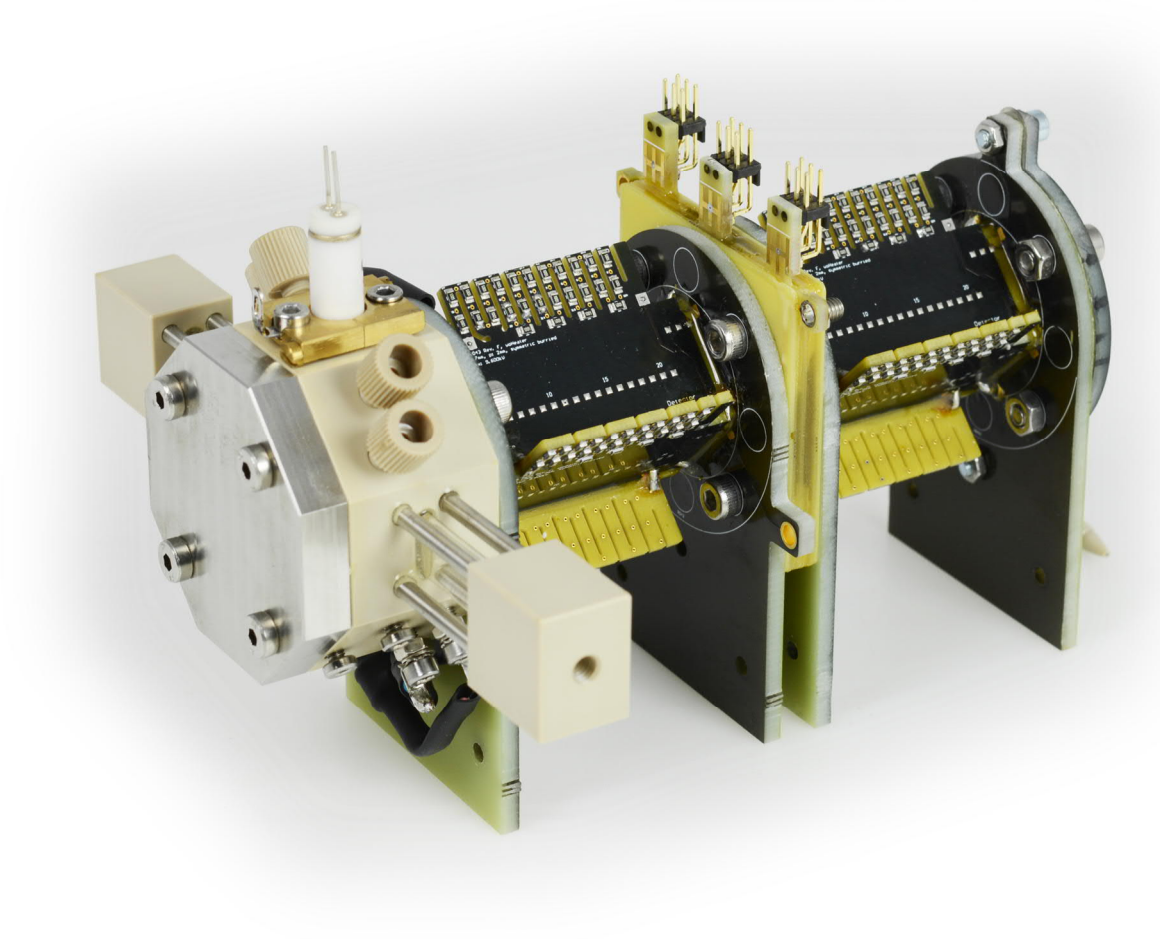
GIDPROVIS

SIPRO - SEQUENTIAL ION PROCESSING



PCB-SIPRO consisting of X-ray source and drift tubes with integrated high-field region

Achievements of GIDPRO$_{vis}$

SIPRO - Sequential Ion Processing

Technology:	SIPRO is an ion mobility spectrometer (IMS) with built-in high-field region for ion manipulation
Partner:	Leibniz University Hannover (LUH)
Desired operational effect:	Fast detection of compounds at pptv-levels by IMS with integrated high-field region revealing additional compound features for reliable compound identification

Why is this technology helpful?

Ion Mobility Spectrometry (IMS) is used for fast and reliable detection of trace chemicals in ambient air due to the superior sensitivity with detection limits in the pptv range. The accuracy of chemical identification in mixtures is frequently a challenge for IMS, and this challenge is exacerbated by the miniaturization of the spectrometer. However, the inclusion of a high-field region in the SIPRO enables the generation of additional molecular information. This added capability contributes to the reduction of false alarms, addressing a persistent issue in IMS-based chemical detection.

What does this technology do?

The SIPRO system is composed of three key components: a first drift tube, a high-field region, and a second drift tube. The ions are separated based on their K_0 values in the first drift tube. Subsequently, a selected ion species is trapped within the high-field region where it encounters strong electric fields of up to 120 Td at ambient pressure. The strong electric fields can lead to field-induced dissociation (FID). Thereafter, the resulting fragments are separated in the second drift tube based on their individual K_0 values.

How does this technology work?

The high-field region resembles Field Asymmetric Ion Mobility Spectrometry (FAIMS) with high electric fields strength up to 120 Td. The high-field region separates the first and the second drift tube . The device can be used either for conventional IMS or as a IMS-FAIMS-IMS. In the high-field region, ions gain energy from the strong electric fields, increasing their temperature and causing FID. Typically, sinusoidal or bisinusoidal waveforms are employed for fragmentation to simplify electronics. However, this limits energy transfer to ions as the maximum field strength is applied briefly. In contrast, SIPRO uses rectangular waveforms with an arbitrary number of repetitions, yielding significantly higher fragmentation efficiencies.

Future development

Enhancements in fragmentation performance will be pursued through the implementation of novel heating concepts and grid configurations. Moreover, there is a commitment to reducing both size and production expenses. Progressing from TRL4 to TRL9 requires additional advancements in electrical engineering, specifically in minimizing the potential for electrical discharges.

Achievements of GIDPRO$_{vis}$

SIPRO - Sequential Ion Processing

GENERAL

Company Details:

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Phone +49 511 762 4672

URL www.geml.uni-hannover.de/en/

Portability Yes

Technology IMS with built-in high-field region

Unit Cost n/a

Description Detection of chemicals in complex mixtures

Status Demonstrator

Current Users n/a

TRL 4

Future developments Reduce size and weight

Anticipated TRL 7 (2025), 9 (2027)

OPERATIONAL PARAMETERS

Detection Trace chemicals in ambient air

Detection State n/a

Start up Time < 10 min

Alarms Yes, user programmable

Response Time < 1 s

Selectivity Resolving Power R_P = 100

Detection Limits 50...100 pptv

PHYSICAL PARAMETERS

Size n/a

Weight n/a

Power Requirements n/a

LOGISTICAL PARAMETERS

Durability n/a

Environmental Considerations n/a

Shelf Life n/a

Consumables n/a

Calibration Requirements n/a

Repairs n/a

Repair Options n/a

Maintenance Costs n/a

SPECIAL REQUIREMENTS

Operator Skills Basic skills

Training Required Yes

Training Available Yes, by retailer

Manuals Available n/a

Support Equipment n/a

Communication Capability Local Area Network (LAN)

Tamper Resistance n/a

Warranty Not for demonstrator

Testing Information n/a

Applicable Regulations None

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GIDPROvis

TECHNOLOGY INTRODUCTION: GIDPROvis USER ENGAGEMENT

GIDPROvis graphical user interface development discussions

Achievements of GIDPRO$_{vis}$

GIDPROvis User engagement

Aim:	GIDPROvis graphical user interface including Toolbox was developed based on user interviews and feedback discussions.
Partners:	University of Helsinki (UH), National Technical University of Athens (NTUA), ATOS, Airsense Analytics GmbH (Airsense), Leibniz University Hannover (LUH)
Desired operational effect:	Firefighters and first responders get real-time chemical information with warnings and guidelines for action in a meaningful way with appropriate interpretation in augmented reality.

Why is this technology helpful?

GIDPROvis air monitoring device helps firefighters and first responders in chemical hazard situations to gain real-time data on chemical concentration levels, risks, and guidelines for action.

What does this technology do?

GIDPROvis graphical user interface (GUI) help users in chemical risk perception through different communication layers (data, information, knowledge).

How were users involved in the development of the GIDPROvis graphical user interface?

The development of GIDPROvis graphical user interface is based on interviews that focused on a) comprehension of chemical hazards and risks, b) responses to chemical hazards and risks, and c) communication of chemical hazards and risks. In total, 74 laymen and 30 experts in chemical safety were interviewed in Finland, Germany, and Greece. User feedback discussions were conducted in three different phases and focused on a) information in screens including content and presentation, b) Toolbox including content and presentation, and c) applicability of the GIDPROvis user application.

Future development

GIDPROvis graphical user interface will be further refined for firefighters and first responders based on test user feedback, usability research in the context of chemical hazards, and state-of-art augmented reality (AR). Additionally, a different type of graphical interface can be developed for the general public for chemical education or recreation purposes.

Contact details

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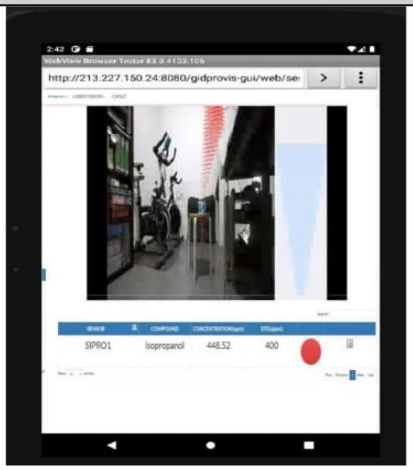
Achievements of GIDPRO$_{vis}$

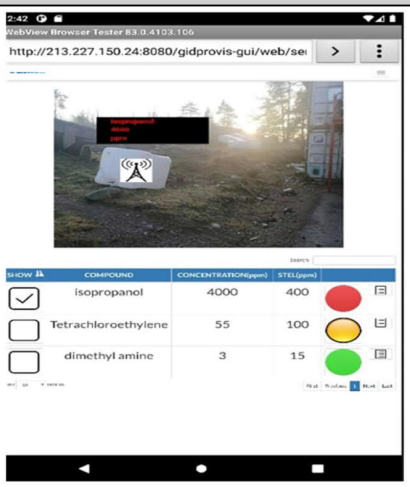
GIDPROvis User engagement

Evolution of the graphical user interface (GUI) concept of GIDPROvis

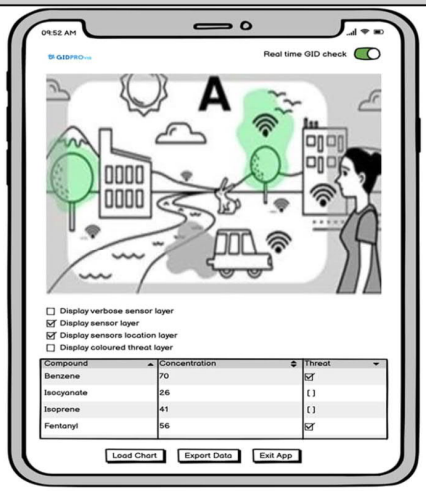
March 2023	**Application screenshots**	May 2023
	Fourth phase	

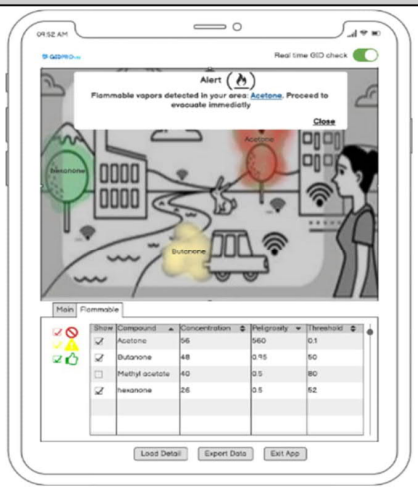


May 2021	**Technical but fake mock-ups**	August 2022
	Third phase	

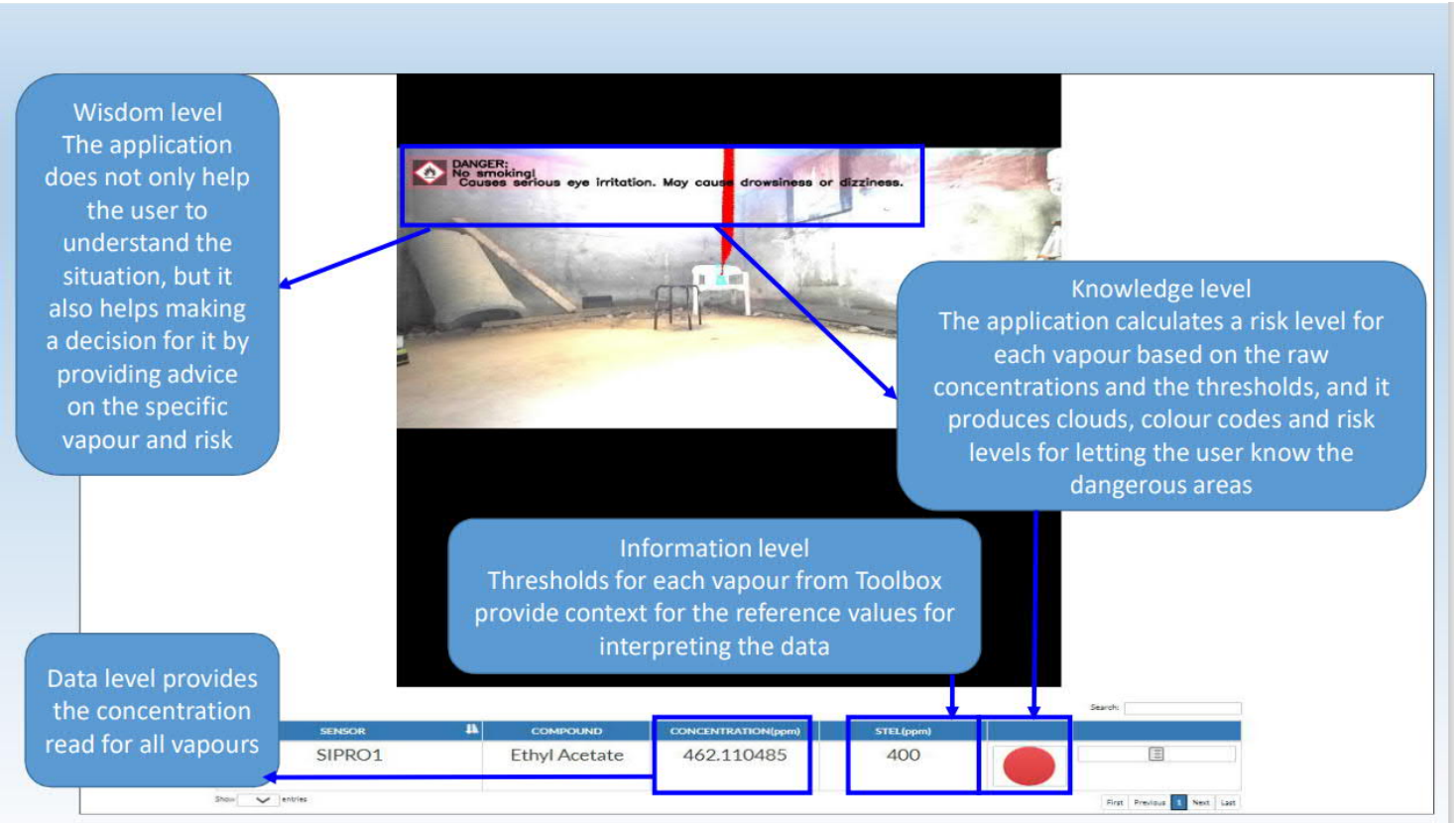


Sept 2020	**Conceptual mock-ups**	Jan 2021
	First phase	**Second phase**





Communication levels in AR prototype



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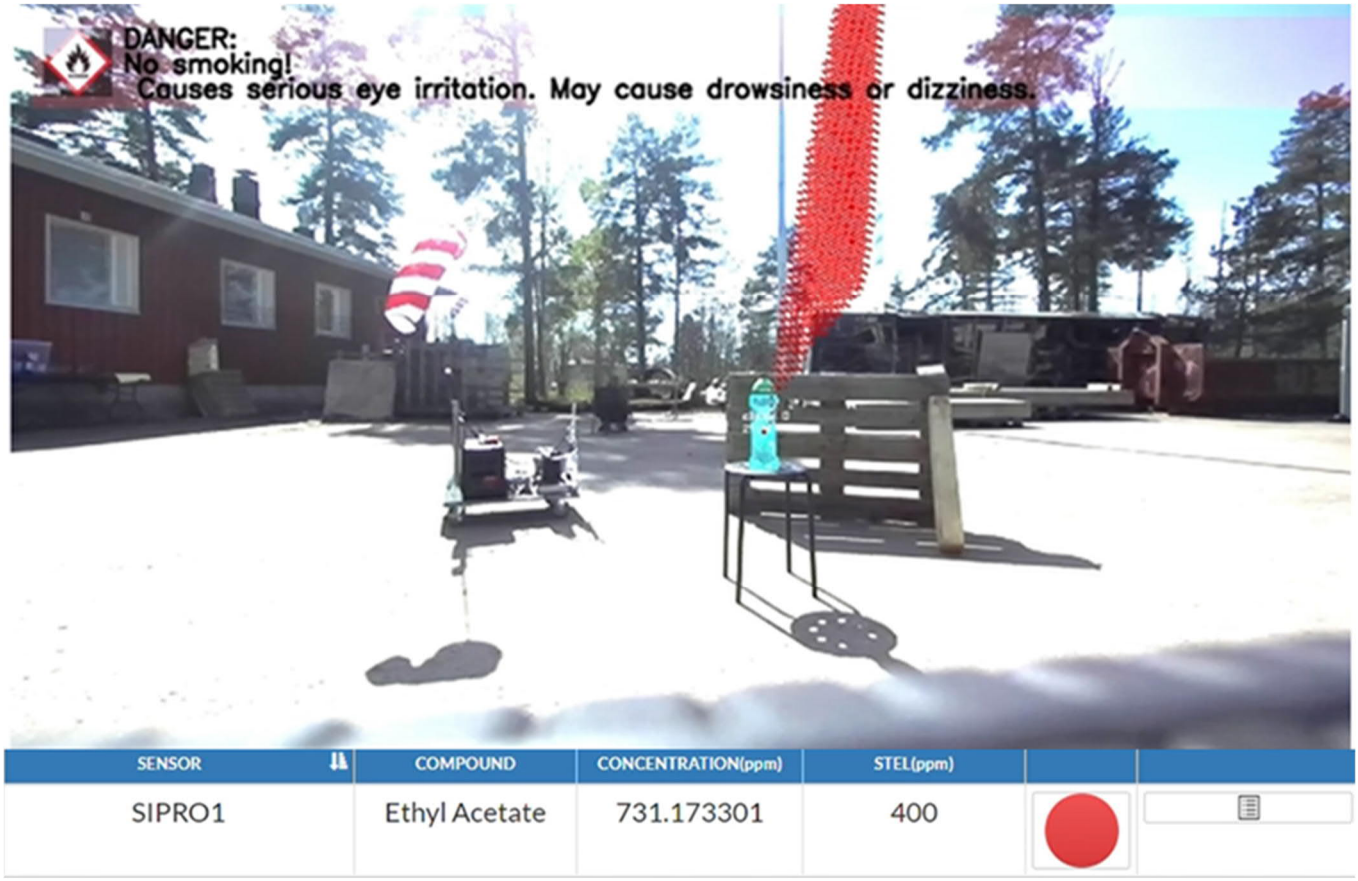
AUGMENTED VOC DISPLAY



GIDPROvis project's visualisation

Achievements of GIDPRO$_{vis}$

Augmented VOC display

Technology:	Augmented VOC display is a web-based augmented reality software that allows combining live video of a scene with the data retrieved from sensors and a live calculation of VOCs from the data provided by SIPRO and the possible sources for those VOCs identi-
Partner:	ATOS
Desired operational effect:	Users will be able to see a live representation of an estimation of the spread of the detected VOCs over the scene

Why is this technology helpful?

Though there are other technologies that allow providing a live representation of a vapour colour dispersion for controlled scenarios, those technology are slower than GIDPROvis and can only work on predefined scenarios.

What does this technology do?

It detects the possible sources for all measured chemicals in the scene and creates an approximate representation of the dispersion of the measured chemicals from the possible detected sources for those VOCs. Additionally, it also provides warning an alarm VOCs, based on their corresponding concentrations and chemical characteristics.

How does this technology work?

The technology uses computer vision to locate any objects that could be a possible source for the detected chemicals. It filters the detected object by choosing those ones that are reported from the Toolbox to be able to generate the detected chemical. Once the possibles sources are found it creates a dispersion model to represent the dispersion of the chemicals based on the location of the identified sources and the emission rate of those sources, which is calculated from the measurements reported by the sensors.

Future development

Support for chemical density and pressure.

Support for the detection of multiple sources.

Achievements of GIDPRO$_{vis}$

Augmented VOC display

GENERAL

Company Details:

ATOS Spain S.A.

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28034 Madrid

Spain

Contact Details: Darío Ruiz López, Project Director

Email Dario.ruiz@atos.net

URL eviden.com

Portability Portable, needs computer or hand-held device and a stereoscopic camera, which may be supplied either embedded in the device or separately

Unit Cost Not defined

Status pending integration in ATOS portfolio

TRL 6

Technology Augmented VOC Display

Description Augmented reality displaying live representation of VOCs based on 3D camera feed

Current Users under development

Future developments Integration on ATOS commercial portfolio

Anticipated TRL 7 (2025), 9 (2030)

OPERATIONAL PARAMETERS

Detection Able to integrate with SOS-compliant sensing systems, including SIPRO

Start up Time n/a

Response Time live data

Sensitivity n/a

Detection State n/a

Alarms Alarms and warning for threatening VOCs

Selectivity n/a

PHYSICAL PARAMETERS

Size At least 10"" for the screen of the tablet, but the larger the better

Operating system Android

Camera Works with stereoscopic cameras

Web compatibility Works with Chrome

LOGISTICAL PARAMETERS

Calibration Requirements The application automatically calibrates the camera

Environmental Considerations harsh conditions are supported only with ruggedised devices

SPECIAL REQUIREMENTS

Operator Skills Basic android and web navigation skills for tablet users.

Training Available No

Training Required No

Manuals Available Deliverable 2.7

Communication Capability Needs a connection to the Internet

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GIDPROVIS DATABASE— OPERATIONAL GUIDANCE TOOL FOR END USERS

Contents of CBRN Toolbox

Achievements of GIDPRO$_{vis}$

GIDPROvis DATABASE

Technology:	GIDPROvis Database is a software and database for CBRN compound detection and dealing with them.
Partner:	University of Helsinki (UH)
Desired operational effect:	User to get practical information of compounds. Meant for first responders as well as for laypeople.

Why is this technology helpful?

The GIDPROvis database is meant for use of First Responders and laypeople in CBRN incidents.
Software is also helpful at command levels, medical hospitals (e.g. first aid) and off-site analytical laboratories. It contains data of CBRN agents, detection/monitoring, protection, triage and medical aspects. It also includes training material for sampling and using of personal protective equipments (PPEs). It includes guidelines in visual form easy to access.

What does this technology do?

Technology helps to identify CBRN compound and help people to react appropriately.

How does this technology work?

This software will work with a regular browser (e.g., Mozilla Firefox and Google Chrome).

Software itself is in the WWW-server, concluding database which contains data of

- CBRN agents; detection/monitoring e.g. manuals and guidelines for devices; protection including cordon, PPE and decontamination of personal and equipment;
- triage of casualties including ethical aspects; and medical aspects including symptoms and treatment guidelines.
- Most recently, health hazard values, spectra, links to external webpages and warning text for other software has been added to the database.

Data in the database can be searched against certain criteria's, e.g. colour, physical state. GIDPROvis database is has some training material and material is easy to print for training purposes and for field manoeuvres.

Future development

The GIDPROvis database needs to be upgraded according to comments from GIDPROvis field trial.
(e.g., chemicals in the list in alphabetical order, colour of icons showing same colour as in the text, synonyms of chemicals)

Achievements of GIDPRO$_{vis}$

GIDPROvis DATABASE

GENERAL

Company Details:

University of Helsinki, VERIFIN - Finnish Institute for Verification of the Chemical Weapons Convention

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FI-00014 University of Helsinki, FINLAND

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Email matti.kuula@helsinki.fi

Phone +358 2941 50447

URL www.verifin.helsinki.fi

Portability Portable, needs computer or hand-held device

Unit Cost Not defined

Status not commercial product (e.g., patent pending) / commercially available

TRL 7 (1-9)

Technology Software and database

Description GIDPROvis database

Current Users under development

Future developments here something

Anticipated TRL 8 (2025), 9 (2030)

OPERATIONAL PARAMETERS

Operational parameters are related to the device which uses the GIDPROvis database

PHYSICAL PARAMETERS

Physical parameters are related to the device which uses the GIDPROvis database

LOGISTICAL PARAMETERS

Logistical parameters are related to the device which uses the GIDPROvis database

SPECIAL REQUIREMENTS

Operator Skills Basic computer skills

Training Available No

Training Required No

Manuals Available Deliverable 4.4

Communication Capability Same as host device

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T4I SAMPLING MODULATION SEPARATION (T4I SMS)

Achievements of GIDPRO$_{vis}$

T4I SMS

Technology:	The technology for T4i SMS is based on well-proven principles of fast pneumatic periodic sampling . The system is controlled via Symbiotic Engine software.
Partner:	T4i Engineering
Desired operational effect:	T4i SMS is a miniaturized device that integrates ultra-fast pneumatic sampling with LTM fast chromatography that allows fast separation of vapour mixtures. On integration with IMS, it provides protection against saturation and high-performance hyphenation.

Why is this technology helpful?

T4i SMS operates with very fast alternations between sampling and non-sampling periods resulting in repetitive sampling and analysis pereiods and providing real-time monitoring capability. The device allows fast separation ranging from few seconds to few minutes. Combined with its portability and seamless integration with analytical detection devices such as IMS, PID, FTIR, T4i SMS stands as an optimal solution, providing 2D chemical identification and thus, reducing pseudo-alarms and increasing reliability.

What does this technology do?

T4i SMS (Sample Modulation Separation), a miniaturized, sampling and separation system, is based on pneumatic periodic injections as short as 100 ms of air/vapor samples. The separation system is based on Low Thermal Mass Gas Chromatography (LTM-GC). SMS is a quite robust system with the flexibility of using all types of commercially available GC columns in the range 0.3-15 m. When the detector is in motion for example on board UAV or a vehicle, the iso-kinetic sampling is achieved. No pressurized gas cylinder is required for use as carrier gas. An advantage for field use of T4i SMS is that the air is being cleaned and utilized as carrier gas, using well-engineered air scrubbers. T4i SMS is self-cleaned and that prevents the contamination that may cause memory effects or ghost peaks.

The device is operated with a specially developed software; Symbiotic Engine Software. It controls the operation of T4i SMS through the GUI with simple, clear commands that configure parameters such as analysis time, sampling time, temperature and other.

How does this technology work?

SMS unit consists of two tiny tubes and one COTS capillary column located inside the inner tube. By utilizing miniature valves and pumps, the unit can pneumatically allow or prevent the capillary column from sampling. The capillary column acts as a transfer line by retaining all specifications of the hyphenated detector . However it can act as a fast GC by providing analytical-scale gas chromatographic separation.

The SMS unit operation is supported by the pneumatics board where the sample modulation and GC control takes place by combining heating elements, miniature pumps, valves and flow sensors. An on-board microcontroller with specially designed firmware allows the user to define sampling times as short as 100ms and pre-program the alternation between sampling and non-sampling modes in a fully customizable manner.

Future development

- T4i SMS can be used either as a dynamic sampler to GID-IMS or in combination with a fast GC as a front-end of GID-IMS solution
- Upgrade T4i SMS to allow higher heating temperatures T> 100 °C
- T4i SMS to be further miniaturized with drastically reduction of seize, weight and assembly cost

Achievements of GIDPRO$_{vis}$

T4i SMS

GENERAL

Company Details:

T4i Engineering

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Phone +302109940383

URL https://www.t4ieng.com/

Portability : Designed to be used as a handheld device

Unit Cost : Not defined

TRL 6

Technology :Well-proven principles of fast pneumatic periodic sampling and Symbiotic Engine software

Description : T4i SMS as a miniaturized fast, low thermal mas GC which can operate hyphenated to IMS system

Anticipated TRL: 7

OPERATIONAL PARAMETERS

Start up Time Ready to be used in 5 min

Response Time A few seconds

Selectivity: Depends on the COTS GC column installed. Broad range of options

PHYSICAL PARAMETERS

Size 36.5x 10.5x 8.6cm (LxWxH)

Weight : less than 2kg

Power Requirements: 12VDC 2A max, 220V with AC/DC converter

LOGISTICAL PARAMETERS

Calibration Requirements: Built- in diagnostics and calibration

Repair Options: On-site

Environmental Considerations 0°C—45°C

Consumables: Molecular sieves trap for air purification (20gr)

Repairs : Infrequent

SPECIAL REQUIREMENTS

Operator Skills Basic computer skills

Training Available: yes

Support Equipment: Not required

Tamper Resistance : High

Testing Information : Results from tests sessions and Test Arena available in Deliverable 5.2

Training Required No

Manuals Available Deliverable 5.2

Communication Capability: USB

Warranty: No

Applicable Regulations : EMC

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MOBILE PLATFORM VAPOUR GENERATOR (MPVG) FOR AMBIENT GAS-PHASE MEASUREMENTS

KARSA MPVG

Achievements of GIDPRO$_{vis}$

Mobile platform Vapour Generator

Technology:	Mobile Platform Vapour Generator (MPVG)
Partner:	Karsa Ltd. (Karsa)
Desired operational effect:	Movable point source. Produces adjustable concentration vapour to ambient air, to be measured by tested measurement technology.

Why is this technology helpful?

For testing purposes, it is necessary to measure known chemicals. This technology provides the capability to produce controlled test vapours in basically any environment. Mobile platform with on-board power supply, is not limited to set locations or lengths of power cables.

What does this technology do?

It produces a continuous chemical vapour devoid of particles from a chosen liquid sample.

How does this technology work?

The technology is based on a liquid atomizer, which uses pressurised air to create vapour and small droplets from bulk sample. The biggest droplets are impacted to the liquid container wall from the gas stream and the smaller droplets are vaporized with a sequential heated flow line.

Initial concentration of the sample can be set by diluting the liquid sample. Further control of the output concentration can be tuned with a bypass flow, which controls the ratio between clean air and the vapour concentrated flow from the atomiser. In an operational state, the vapour concentration seen by the tested instrument can be changed without touching the controls of the generator, rather moving the generator closer and further away from it.

The generator is housed on a moving platform with a in-built portable power supply and a pressurised air compressor, which provides the needed flows for the atomizer and dilution.

Future development

Development of adjustability of the atomizer geometry could have an effect on the initial droplet distribution, which then will enhance the dynamic concentration range for different chemicals. Currently the system is intended for dispersing relatively highly volatile chemicals in reasonable concentrations.

Achievements of GIDPRO$_{vis}$

Mobile platform Vapour Generator

GENERAL

Company Details:

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FI-00560 Helsinki, FINLAND

Contact Details: HJ Jost, CEO

Email HJ.Jost@karsa.fi

Phone +358 45 699 5005

URL www.karsa.fi

Portability Portable, 2 degrees of freedom (not liftable)

Unit Cost 15k€

Status not commercial product

TRL 7

Technology Hardware and control electronics

Description A mobile vapour generator

Current Users GIDPROvis project consortium

Future developments Packaging and commercialisation

Anticipated TRL 8 (2024), 9 (2025)

OPERATIONAL PARAMETERS

Detection n/a

Start up Time 5 min

Response Time seconds

Sensitivity n/a

Detection State n/a

Alarms Battery level, overheating

Selectivity n/a

PHYSICAL PARAMETERS

Size 1m x 0.5m x 0.5m

Power Requirements 230V 50Hz AC charging (~12 A)

Weight ~ 15 kg

LOGISTICAL PARAMETERS

Durability Robust

Shelf Life years

Calibration Requirements if operated for quantitative measurements

Repair Options off the shelf replacement parts

Environmental Considerations depended on battery chemistry

Consumables dispersed chemical solutions

Repairs regular maintenance of the pump, atomizer cleaning, ex-changing lines after regular intervals

Maintenance Costs ~100€ per year / depending on use

SPECIAL REQUIREMENTS

Operator Skills Basic chemistry knowhow, laborant level skills

Training Available Yes

Support Equipment Typical available tools (wrench, allen keys etc.)

Tamper Resistance not applicaple

Testing Information On request

Training Required No

Manuals Available Upon first sale

Communication Capability Not currently

Warranty Not currently

Applicable Regulations Portable power supply related, heated volatile chemical related

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PERSONAL GAS DETECTOR ARRAY (GDA-P) FOR DETECTION OF CHEMICAL THREATS

Achievements of GIDPRO$_{vis}$

Personal gas detector

Technology:	Personal Gas Detector Array (GDA-P) Ion Mobility Spectrometer
Partner:	Airsense Analytics GmbH (AIR)
Desired operational effect:	A small, hand held chemical detector permits first responders knowledge of the presence, location, and amounts of toxic vapours and gases while at the scene of a CBRN incident

Why is this technology helpful?

Those entering rescue at the site of a CBRN incident may have knowledge of the presence of a chemical agent or toxic substance, however, detailed understanding of distribution of the agent or amounts on a casualty of the incident can be determined using the GDA-P. Rapid, convenient and sensitive measurements of air and vapours are essential to health and safety of first responders and timely decisions on decontamination.

During the GIDPROvis project the GDA-P was used as a reference instrument.

What does this technology do?

The GDA-P provides personnel involved in rescue at a CBRN incident the technology to determine the presence and location of chemical agents and toxic substances by sampling air near an object or person. Since the GDA-P is fast with automated analysis of measurements, users have real-time information on chemical agents on surfaces (clothing, skin, buildings, vehicles, and other objects) and toxic gases in a specific location. Multiple GDA-P analyzers in a zone can together establish a detailed measure of the distribution of agents throughout the zone. Response in the GDA-P is dynamic and findings from the analyzers will show changes in agent concentration or distribution throughout the duration of a rescue event.

How does this technology work?

The GDA-P is an ion mobility spectrometer with time of flight design combined with an additional sensor to improve the selectivity and to increase the number of detectable compounds. This could be an photoionisation detector (PID) or an electro chemical cell. In this instrument, ambient air or vapours from near a person or object are drawn into the analyzer for a measurement. Chemicals or toxic gases are ionized by reactions with ions generated in a weak beta emitter. In a next step, ions derived from samples are introduced into a weak electric field where ions are characterized in under 10 milliseconds speed or mobility which are distinctive of individual chemicals. After passing through the electric field, ions collide on a plate, generating a current flow and producing an ion mobility spectrum. The spectrum can be matched to libraries to interpret the chemical identity and measure concentrations of the agent in the air. All processes are continuous and automated providing users knowledge of chemicals in seconds with high sensitivity (low ppb detection limits).

Achievements of GIDPRO$_{vis}$

Personal gas detector

GENERAL

Company Details:

AIRSENSE Analytics GmbH
Hagenower Str. 73
19 061 Schwerin
Germany

Contact Details:

Email info@airsense.com

Phone +49 385/3993-280

URL www.airsense.com

Portability Portable hand held device

Unit Cost on request

Status commercially available

TRL 9

Technology Personal Gas Detector Array (GDA-P) Ion Mobility Spectrometer + PID/EC

Description hand held chemical detector for toxic industry chemicals and warfare agents

Current Users

Future developments here something

Anticipated TRL 8 (2025), 9 (2030)

OPERATIONAL PARAMETERS

Detection toxic industry chemicals and warfare agents

Start up Time n/a

Response Time n/a

Sensitivity detection range ppb to ppm

Detection State name and concentration depending on current threat

Alarms optical and acoustic alarm

Selectivity high resolution IMS plus PID or EC to increase selectivity

PHYSICAL PARAMETERS

Size detection range ppb to ppm

Weight 1.3 kg

Power Requirements 11-20VDC, 8 Watt
rechargeble battery (8 hrs) or standard AA battery *14pcs (8 hrs)

LOGISTICAL PARAMETERS

Durability n/a

Shelf Life n/a

Calibration Requirements no calibration needed

Repair Options n/a

Environmental Considerations n/a

Consumables n/a

Repairs n/a

Maintenance Costs n/a

SPECIAL REQUIREMENTS

Operator Skills no skills

Training Available

Support Equipment

Tamper Resistance

Testing Information

Training Required No

Manuals Available

Communication Capability Serial RS-232 and Bluetooth

Warranty 12 months

Applicable Regulations

Achievements of GIDPRO$_{vis}$

Summary of Technologies: Publications

“Parametric Sensitivity in a Generalized Model for Atmospheric Pressure Chemical Ionization Reactions”, Elie Lattouf, Osmo Anttalainen, Tapio Kotiaho, Hanna Hakulinen, Paula Vanninen, and Gary Eiceman, J. Am. Soc. Mass Spectrom. 2021, 32, 8, 2218–2226, https://doi.org/10.1021/jasms.1c00158

"Ion density of positive and negative ions at ambient pressure in air at 12–136 mm from 4.9 kV soft x-ray source", Osmo Anttalainen, Elie Lattouf, Tapio Kotiaho, and Gary Eiceman, Rev. Sci. Instrum. 92, 054104 (2021) https://doi.org/10.1063/5.0050669

“Quantitative Distributions of Product Ions and Reaction Times with a Binary Mixture of VOCs in Ambient Pressure Chemical”, Elie Lattouf, Osmo Anttalainen, Oliver Hecht, Bert Ungethuem, Tapio Kotiaho, Hanna Hakulinen, Paula Vanninen, and Gary Eiceman, J. Am. Soc. Mass Spectrom. 2023, 34, 8, 1768–1777, https://doi.org/10.1021/jasms.3c00189

“Resistive High-Voltage Probe with Frequency Compensation by Planar Compensation Electrode Integrated in Printed Circuit Board Design”, Jonas Winkelholz, Moritz Hitzemann, Alexander Nitschke, Anne Zygmanowski and Stefan Zimmermann, Electronics 2022, 11, 3446, https://doi.org/10.3390/ electronics11213446

“A Highly Efficient Ion Manipulator for Tandem Ion Mobility Spectrometry – Exploring a Versatile Technique by a Study of Primary Alcohols”, Alexander Bohnhorst, Anne Zygmanowski, Yu Yin, Ansgar T. Kirk, and Stefan Zimmermann, Anal. Chem. 2023, 95, 18, 7158–7169, https://doi.org/10.1021/acs.analchem.2c05483

“Computational Analysis of an Electrostatic Separator Design for Removal of Volatile Organic Compounds from Indoor Air", Osmo Anttalainen, Elie Lattouf, Paula Vanninen, Hanna Hakulinen, Tapio Kotiaho, and Gary Eiceman, J. Air Waste Manag. Assoc., Accepted, 2023, https://doi.org/10.1080/ 10962247.2023.2265329

“Safe City: A Study of Channels for Public Warnings for Emergency Communication in Finland, Germany and Greece”, Sari Yli-Kauhaluoma, Milt Statheropoulos, Anne Zygmanowski, Osmo Anttalainen, Hanna Hakulinen, Maria Theodora Kontogianni, Matti Kuula, Johannes Pernaa, and Paula Vanninen, Multimodal Technologies and Interaction, 7, 94 (2023), https://doi.org/10.3390/mti7100094

“Conditional rate constants for gas phase reactions between Volatile Organic Compounds and Hydrated Protons”, Oliver Hecht et al., In preparation (2023)

“*Reaction Region with Stop Flow Confined Volume Ion Mobility Spectrometer* ”, Osmo Anttalainen et al., In preparation (2023)

“The Ionization Source Term Determination from the Experimental Results of Evaluation of Several X-ray Sources”, Oliver Hecht et al., In preparation (2023)

Consortium Partners

UNIVERSITY OF HELSINKI
VERIFIN FINNISH INSTITUTE FOR VERIFICATION OF THE CHEMICAL WEAPONS CONVENTION

AIRSENSE ANALYTICS

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Department of Sensors + Measurement Technology

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