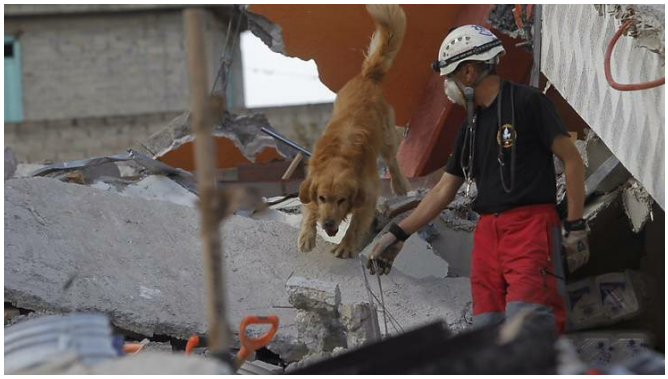
FORSCHUNG

Elektronische Spürnase findet Verschüttete über Ausdünstung

sda • 16.5.2018 um 11:52 Uhr



Spürhunde sind verlässliche Katastrophenhelfer. Doch sie brauchen Pausen und sind nicht immer so schnell verfügbar wie nötig. In Zukunft könnten sie Unterstützung von elektronischen Spürnasen erhalten, die die ETH-Zürich entwickelt hat. (Symbolbild)
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Wissenschaftler der ETH Zürich haben eine winzige Apparatur entwickelt, die wie ein elektronischer Spürhund funktioniert: Mit Gassensoren kann sie verschüttete Menschen über deren ausgeatmete und ausgedünstete Stoffwechselprodukte ausfindig machen.

Die Gassensoren erkennen Azeton, Ammoniak und Isopren, wie die ETH Zürich am Mittwoch mitteilte. Diese Stoffwechselprodukte werden vom Menschen in geringen Mengen ausgeatmet oder ausgedünstet. Die Forscher um Sotiris Pratsinis, Professor für Verfahrenstechnik an der ETH Zürich, kombinierten Gassensoren in einem Gerät mit zwei kommerziellen Sensoren für CO2 und Feuchtigkeit.

"Die Kombination von Sensoren für unterschiedliche chemische Verbindungen ist wichtig, weil die einzelnen Stoffe auch andere Quellen als den Menschen haben können", lässt sich Andreas Güntner, Postdoktorand in Pratsinis Gruppe, in der Mitteilung zitieren. CO2 zum Beispiel könne von einem Menschen oder auch von einem Brandherd stammen.

Dank der Kombination der Sensoren erhalten Wissenschaftler zuverlässige Hinweise darauf, dass sich im Suchgebiet Menschen befinden. Güntner ist Erstautor der in der Fachzeitschrift "Analytical Chemistry" veröffentlichten Studie.

Auf Nachfrage der Nachrichtenagentur SDA sagte er, dass es vom Prinzip her auch möglich sei, Verstorbene zu finden, da die einzelnen Stoffe weiterhin feststellbar seien. Getestet wurden die Sensoren allerdings nur mit lebenden Personen.

Tests nur mit lebenden Versuchspersonen

Dafür setzten sich Versuchspersonen einzeln während zwei Stunden mit Atemmasken in eine als Verschüttungssimulator entwickelte Versuchskammer am Institut für Atemgasanalytik der Universität Innsbruck in Dornbirn. An den Labortest waren auch österreichische und zyprische Wissenschaftler beteiligt.

"Azeton und Isopren sind typische Stoffe, die wir grösstenteils ausatmen. Ammoniak hingegen dünsten wir vor allem über die Haut aus", erläutert Pratsinis in der Mitteilung. Deshalb wurde im ersten Versuch die von den Testpersonen ausgeatmete Luft direkt aus der Kammer geleitet, im zweiten Teil bliebt die ausgeatmete Luft drin. So haben die Wissenschaftler ein Atemluft- und ein Ausdünstungsprofil erstellt.

Kaum grösser als Nadelkopf

Die ETH möchte als nächstes unter realen Bedingungen testen, ob sich die Apparatur für den Sucheinsatz nach Erdbeben oder Lawinenniedergängen eignet. Für solche Fälle gibt es bereits Suchgeräte. Diese funktionieren gemäss Mitteilung jedoch mit Mikrofonen und Kameras. Man kann daher nur Verschüttete finden, welche sich akustisch bemerkbar machen können oder die unter Trümmern sichtbar sind.

Die Idee der ETH-Wissenschaftler ist es daher, diese Suchgeräte mit den Sensoren zu ergänzen. Gemäss einem Bild der ETH Zürich sind die Sensoren nicht viel grösser als ein Stecknadelknopf. Dennoch sind sie gemäss der Mitteilung etwa gleich empfindlich wie die meisten Ionenmobilitäts-Spektrometer.

Auch Drohnen oder Roboter lassen sich laut der Mitteilung mit den Gassensoren ausrüsten. So könnten auch Gebiete abgesucht werden, welche zu Fuss nicht oder nur schwer zugänglich seien. Als weitere mögliche Anwendungen listet die Mitteilung das Aufspüren von blinden Passagieren oder das Aufdecken von Menschenschmuggel auf.

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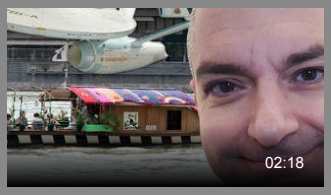

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Elektronische Spürnase findet Verschüttete über Ausdünstung

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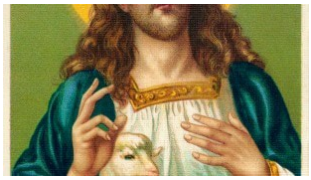

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Scientists have developed a measuring device with small and extremely sensitive gas sensors that can find people trapped under debris, just like trained rescue dogs.

The sensors developed by researchers at ETH Zurich in Switzerland can detect acetone, ammonia, and isoprene - all metabolic products that we emit in low concentrations via our breath or skin.

These were combined with two commercial sensors for CO2 and moisture, to create a device useful when searching for entrapped people.

To test the device, researchers used a test chamber at the University of Innsbruck in the UK as an entrapment simulator. Volunteers each remained in this chamber for two hours.

"The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO2, for example, could come from either a buried person or a fire source," said Andreas Guntner, lead author of the study published in the journal Analytical Chemistry.

The combination of sensors provides the scientists with reliable indicators of the presence of people.

Researchers also showed that there are differences between the compounds emitted via our breath and skin.

"Acetone and isoprene are typical substances that we mostly breathe out. Ammonia, however, is usually emitted through the skin," said Sotiris Pratsinis, professor at ETH Zurich who led the study.

In the experiments in the entrapment simulator, the participants wore a breathing mask. In the first part of the experiment, the exhaled air was channelled directly out of the chamber; in the second part, it remained inside. This allowed the scientists to create separate breath and skin emission profiles.

The gas sensors are the size of a small computer chip.

"Our easy-to-handle sensor combination is by far the smallest and cheapest device that is sufficiently sensitive to detect entrapped people. In a next step, we would like to test it during real conditions, to see whether it is suited for use in searches after earthquakes or avalanches," he said.

While electronic devices are already in use during searches after earthquakes, these work with microphones and cameras. These only help to locate entrapped people who are capable of making themselves heard or are visible beneath ruins.

The ETH scientists' idea is to complement these resources with the chemical sensors. They are currently looking for industry partners or investors to support the construction of a prototype.

Drones and robots could also be equipped with the gas sensors, allowing difficult-to-reach or inaccessible areas to also be searched. Further potential applications could include detecting stowaways and exposing human trafficking.

(This story has not been edited by Business Standard staff and is auto-generated from a syndicated feed.)

First Published: Thu, May 17 2018. 15:40 IST

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An electronic rescue dog

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An electronic rescue dog

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Trained rescue canines are nonetheless the perfect catastrophe staff — their delicate noses assist them to trace down folks buried by earthquakes or avalanches. Like all dwelling creatures, nonetheless, canines must take breaks each from time to time. They are additionally usually not instantly accessible in catastrophe areas, and dog groups need to journey from additional afield.

A brand new measuring system from researchers at ETH Zurich led by Sotiris Pratsinis, Professor of Process Engineering, nonetheless, is at all times prepared to be used. The scientists had beforehand developed small and very delicate gasoline sensors for acetone, ammonia, and isoprene — all metabolic merchandise that we emit in low concentrations through our breath or pores and skin. The researchers have now mixed these sensors in a tool with two business sensors for CO2 and moisture.

Chemical "fingerprint"

As proven by laboratory assessments in collaboration with Austrian and Cypriot scientists, this sensor mixture might be fairly helpful when trying to find entrapped folks. The researchers used a check chamber on the University of Innsbruck's Institute for Breath Research in Dornbirn as an entrapment simulator. Volunteers every remained on this chamber for 2 hours.

"The mixture of sensors for varied chemical compounds is vital, as a result of the person substances may come from sources apart from people. CO2, for instance, may come from both a buried particular person or a hearth supply," explains Andreas Güntner, a postdoc in Pratsinis' group and lead creator of the research, revealed within the journal *Analytical Chemistry*. The mixture of sensors gives the scientists with dependable indicators of the presence of individuals.

Suitable for inaccessible areas

The researchers additionally confirmed that there are variations between the compounds emitted through our breath and pores and skin. "Acetone and isoprene are typical substances that we mostly breathe out. Ammonia, however, is usually emitted through the skin," explains ETH professor Pratsinis. In the experiments within the entrapment simulator, the contributors wore a respiration masks. In the primary a part of the experiment, the exhaled air was channelled instantly out of the chamber; within the second half, it remained inside. This allowed the scientists to create separate breath and pores and skin emission profiles.

The ETH scientists' gasoline sensors are the scale of a small pc chip. "They are about as sensitive as most ion mobility spectrometers, which cost thousands of Swiss francs and are the size of a suitcase," says Pratsinis. "Our easy-to-handle sensor combination is by far the smallest and cheapest device that is sufficiently sensitive to detect entrapped people. In a next step, we would like to test it during real conditions, to see whether it is suited for use in searches after earthquakes or avalanches."

While electronic gadgets are already in use throughout searches after earthquakes, these work with microphones and cameras. These solely assist to find entrapped people who find themselves able to making themselves heard or are seen beneath ruins. The ETH scientists' thought is to enrich these sources with the chemical sensors. They are at the moment searching for business companions or buyers to help the development of a prototype. Drones and robots is also geared up with the gasoline sensors, permitting difficult-to-reach or inaccessible areas to even be searched. Further potential purposes may embrace detecting stowaways and exposing human trafficking.

Story Source:

Materials offered by **ETH Zurich**. *Note: Content could also be edited for type and size.*

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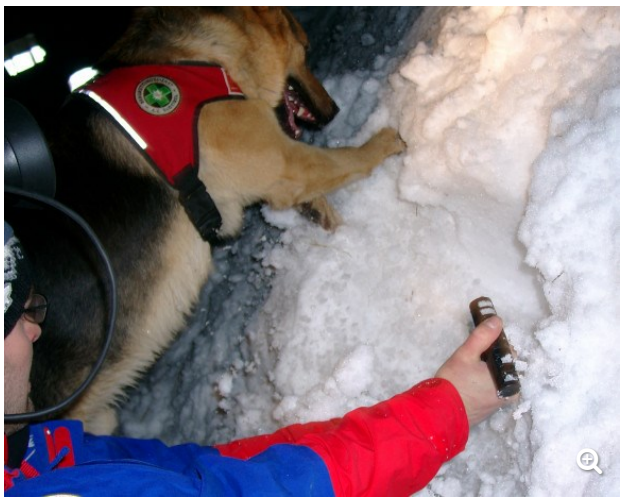
Digitale Spürnase 17.05.2018, 06:05 Uhr

ETH entwickelt elektronischen Rettungshund

ETH-Wissenschaftler entwickelten die mit Abstand kleinste und günstigste Apparatur, mit der Menschen am Geruch detektiert werden können. Sie eignet sich für die Suche nach Personen, die bei einem Erdbeben oder von einer Lawine verschüttet worden sind.



Nach Lawinenkatastrophen kommen Spürhunde zum Einsatz, weil sie mit ihrer empfindlichen Nase Menschen auffinden können.
(Quelle: Gerhard Huber / Wikipedia)

Trainierte Rettungshunde sind noch immer die besten Katastrophenhelfer. Dank ihrer empfindlichen Nase können sie Menschen aufspüren, die bei einem Erdbeben oder von einer Lawine verschüttet worden sind. Wie alle Lebewesen brauchen Hunde allerdings ab und an Erholungspausen. Ausserdem sind sie oft nicht sofort in Katastrophengebieten verfügbar, und Hundestaffeln müssen von weit her anreisen.

Pausenlos einsatzbereit ist hingegen eine neue Messapparatur von Forschern um Sotiris Pratsinis, Professor für Verfahrenstechnik an der ETH Zürich. In den vergangenen Jahren entwickelten die Wissenschaftler kleine und äusserst empfindliche Gassensoren für Azeton, Ammoniak und Isopren – alles Stoffwechselprodukte unseres Körpers, die wir in geringen Konzentrationen ausatmen und ausdünsten. Die Forschenden kombinierten diese Sensoren nun in einem Gerät mit zwei kommerziellen Sensoren für CO2 und Feuchtigkeit.

Chemischer «Fingerabdruck»

Wie Labortests in Zusammenarbeit mit österreichischen und zyprischen Wissenschaftlern ergaben, lassen sich mit dieser Sensorkombination sehr gut verschüttete Personen aufspüren. Die Forschenden nutzten eine als Verschüttungssimulator entwickelte Versuchskammer am Institut für Atemgasanalytik der Universität Innsbruck in Dornbirn, in welcher freiwillige Versuchspersonen einzeln während zwei Stunden ausharrten.

«Die Kombination von Sensoren für unterschiedliche chemische Verbindungen ist wichtig, weil die einzelnen Stoffe auch andere Quellen als den Menschen haben können. CO2 zum Beispiel kann sowohl von einer verschütteten Person als auch von einem Brandherd stammen», erklärt Andreas Güntner, Postdoktorand in Pratsinis Gruppe und Erstautor der in der Fachzeitschrift Analytical Chemistry veröffentlichten Studie. Dank der Kombination der Sensoren erhalten die Wissenschaftler zuverlässige Hinweise auf die Anwesenheit von Menschen.

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Sensors

ETH Zurich scientists have developed the smallest and cheapest ever equipment for detecting people by smell. It could be used in the search for people buried by an earthquake or avalanche.

Trained rescue dogs are still the best disaster workers — their sensitive noses help them to track down people buried by earthquakes or avalanches. Like all living creatures, however, dogs need to take breaks every now and again. They are also often not immediately available in disaster areas, and dog teams have to travel from further afield.

A new measuring device from researchers at ETH Zurich led by Sotiris Pratsinis, Professor of Process Engineering, however, is always ready for use. The scientists had previously developed small and extremely sensitive gas sensors for acetone, ammonia, and isoprene — all metabolic products that we emit in low concentrations via our breath or skin. The researchers have now combined these sensors in a device with two commercial sensors for CO_2 and moisture.

As shown by laboratory tests in collaboration with Austrian and Cypriot scientists, this sensor combination can be quite useful when searching for entrapped people. The researchers used a test chamber at the University of Innsbruck's Institute for Breath Research in Dornbirn as an entrapment simulator. Volunteers each remained in this chamber for two hours.

"The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO_2, for example, could come from either a buried person or a fire source," explains Andreas Güntner, a postdoc in Pratsinis' group and lead author of the study, published in the journal Analytical Chemistry. The combination of sensors provides the scientists with reliable indicators of the presence of people.

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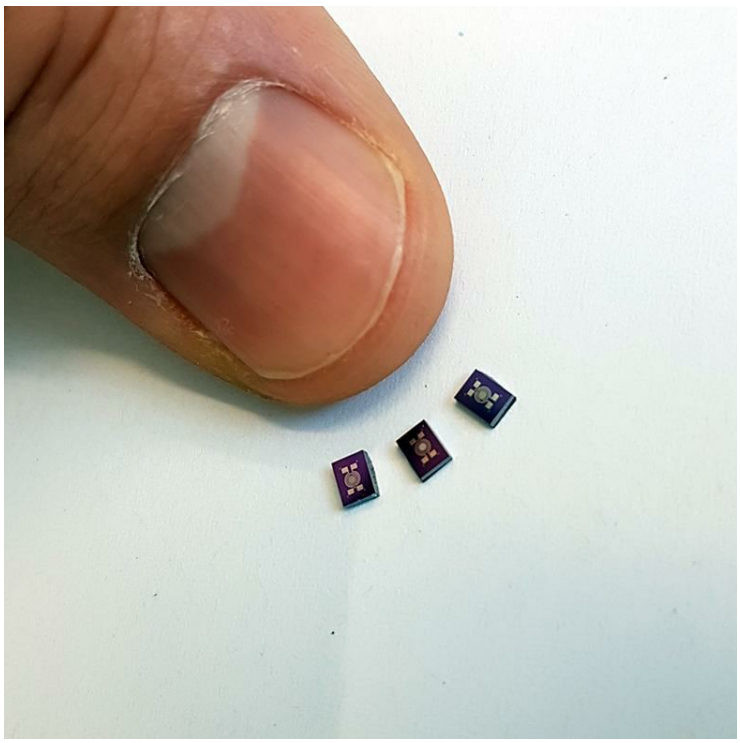

The three gas sensors developed at ETH Zurich. Image: ETH Zurich/Andreas Güntner

The ETH scientists' gas sensors are the size of a small computer chip. "They are about as sensitive as most ion mobility spectrometers, which cost thousands of Swiss francs and are the size of a suitcase," says Pratsinis. "Our easy-to-handle sensor combination is by far the smallest and cheapest device that is sufficiently sensitive to detect entrapped people. In a next step, we would like to test it during real conditions, to see whether it is suited for use in searches after earthquakes or avalanches."

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Source: ETH Zurich

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Measuring device behaves like an electronic rescue dog

17th May 2018 **Source:** ETH Zurich

Posted By : Enaie Azambuja

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Trained rescue dogs are still the best disaster workers – their sensitive noses help them to track down people buried by earthquakes or avalanches. Like all living creatures, however, dogs need to take breaks every now and again. They are also often not immediately available in disaster areas, and dog teams have to travel from further afield. A new measuring device from researchers at ETH Zurich led by Sotiris Pratsinis, Professor of Process Engineering, however, is always ready for use.

The scientists had previously developed small and extremely sensitive gas sensors for acetone, ammonia, and isoprene – all metabolic products that we emit in low concentrations via our breath or skin. The researchers have now combined these sensors in a device with two commercial sensors for CO2 and moisture.

As shown by laboratory tests in collaboration with Austrian and Cypriot scientists, this sensor combination can be quite useful when searching for entrapped people. The researchers used a test chamber at the University of Innsbruck's Institute for Breath Research in Dornbirn as an entrapment simulator. Volunteers each remained in this chamber for two hours.

"The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO2, for example, could come from either a buried person or a fire source," explains Andreas Güntner, a postdoc in Pratsinis' group and lead author of the study, published in the journal *Analytical Chemistry*. The combination of sensors provides the scientists with reliable indicators of the presence of people.

The researchers also showed that there are differences between the compounds emitted via our breath and skin. "Acetone and isoprene are typical substances that we mostly breathe out. Ammonia, however, is usually emitted through the skin," explains ETH professor Pratsinis.

In the experiments in the entrapment simulator, the participants wore a breathing mask. In the first part of the experiment, the exhaled air was channelled directly out of the chamber; in the second part, it remained inside. This allowed the scientists to create separate breath and skin emission profiles.

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Image credit: ETH Zurich.

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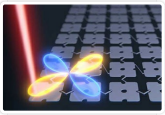

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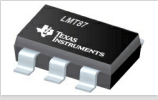

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An electronic rescue dog

ETH ZURICH

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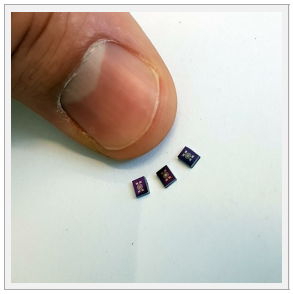

IMAGE: THIS IS AN IMAGE OF THE THREE GAS SENSORS DEVELOPED AT ETH ZURICH. view more ›

CREDIT: ETH ZURICH / ANDREAS GÜNTNER

A new measuring device from researchers at ETH Zurich led by Sotiris Pratsinis, Professor of Process Engineering, however, is always ready for use. The scientists had previously developed small and extremely sensitive gas sensors for acetone, ammonia, and isoprene - all metabolic products that we emit in low concentrations via our breath or skin. The researchers have now combined these sensors in a device with two commercial sensors for CO2 and moisture.

Chemical "fingerprint"

As shown by laboratory tests in collaboration with Austrian and Cypriot scientists, this sensor combination can be quite useful when searching for entrapped people. The researchers used a test chamber at the University of Innsbruck's Institute for Breath Research in Dornbirn as an entrapment simulator. Volunteers each remained in this chamber for two hours.

"The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO2, for example, could come from either a buried person or a fire source," explains Andreas Güntner, a postdoc in Pratsinis' group and lead author of the study, published in the journal *Analytical Chemistry* [http://dx.doi.org/10.1021/acs.analchem.8b00237]. The combination of sensors provides the scientists with reliable indicators of the presence of people.

Suitable for inaccessible areas

The researchers also showed that there are differences between the compounds emitted via our breath and skin. "Acetone and isoprene are typical substances that we mostly breathe out. Ammonia, however, is usually emitted through the skin," explains ETH professor Pratsinis. In the experiments in the entrapment simulator, the participants wore a breathing mask. In the first part of the experiment, the exhaled air was channelled directly out of the chamber; in the second part, it remained inside. This allowed the scientists to create separate breath and skin emission profiles.

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###

Reference

Güntner AT, Pineau NJ, Mochalski P, Wiesenhofer H, Agapiou A, Mayhew CA, Pratsinis SE: Sniffing Entrapped Humans with Sensor Arrays. *Analytical Chemistry*, doi: 10.1021/acs.analchem.8b00237 [http://dx.doi.org/10.1021/acs.analchem.8b00237]

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Gas Sensors
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Rescue workers search for victims at a collapsed building on February 7, 2016 in Tainan, Taiwan after a magnitude 6.4 earthquake. (Credit: Lam Yik Fei/Getty Images)

NATURAL DISASTERS | ETH ZURICH

Gas sensors are like tiny electronic rescue dogs

Posted by Fabio Bergamin-ETH Zurich | May 16th, 2018

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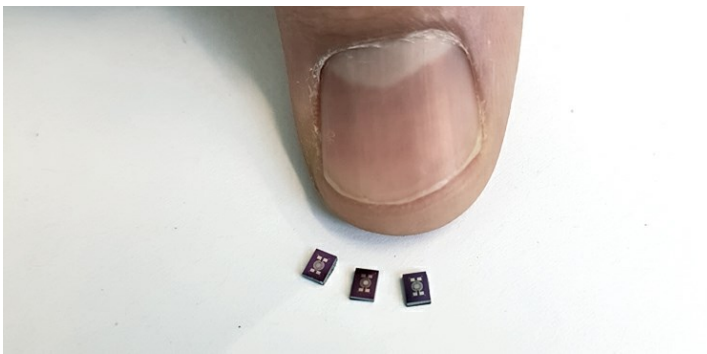
A new device is the smallest and cheapest yet for detecting people by smell, which could be useful in the aftermath of an earthquake or avalanche, for example. And although rescue dogs need to take breaks, an electronic alternative would always be ready.

The team at ETH Zurich had previously developed small and extremely sensitive gas sensors for acetone, ammonia, and isoprene—all metabolic products that we emit in low concentrations via our breath or skin. The researchers, led by Sotiris Pratsinis, professor of process engineering, have now combined these sensors in a device with two commercial sensors for CO_2 and moisture.



The three gas sensors. (Credit: Andreas Güntner/ETH Zurich)

Laboratory tests show that the sensor combination can be quite useful when searching for entrapped people. The researchers used a test chamber at the University of Innsbruck's Institute for Breath Research in Dornbirn as an entrapment simulator. Volunteers each remained in this chamber for two hours.

"The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO_2, for example, could come from either a buried person or a fire source," explains Andreas Güntner, a postdoc in Pratsinis' group and lead author of the study in *Analytical Chemistry*. The combination of sensors provides the scientists with reliable indicators of the presence of people.

> "In a next step, we would like to test it during real conditions, to see whether it is suited for use in searches after earthquakes or avalanches."

The researchers also showed that there are differences between the compounds emitted via our breath and skin. "Acetone and isoprene are typical substances that we mostly breathe out. Ammonia, however, is usually emitted through the skin," explains Pratsinis.

In the experiments in the entrapment simulator, the participants wore a breathing mask. In the first part of the experiment, the exhaled air traveled directly out of the chamber; in the second part, it remained inside. This allowed the scientists to create separate breath and skin emission profiles.

The gas sensors are the size of a small computer chip. "They are about as sensitive as most ion mobility spectrometers, which cost thousands of Swiss

francs and are the size of a suitcase," says Pratsinis. "Our easy-to-handle sensor combination is by far the smallest and cheapest device that is sufficiently sensitive to detect entrapped people.

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Related: Laser sensor sniffs out 'fingerprint' traces of chemicals

While electronic devices are already in use during searches after earthquakes, they work with microphones and cameras. They also only help to locate entrapped people who are capable of making themselves heard or are visible beneath ruins. The ETH scientists' idea is to complement these resources with the chemical sensors.

They are currently looking for industry partners or investors to support the construction of a prototype. Drones and robots could also carry the gas sensors, allowing them to search difficult-to-reach or inaccessible areas. Further potential applications could include detecting stowaways and exposing human trafficking.

Source: ETH Zurich

Original Study DOI: 0.1021/acs.analchem.8b00237

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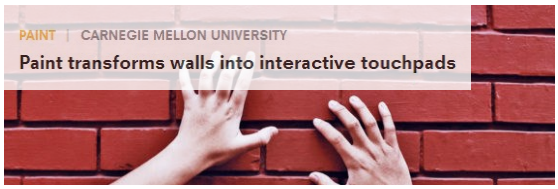

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Scientists develop electronic rescue dog

05/16/2018

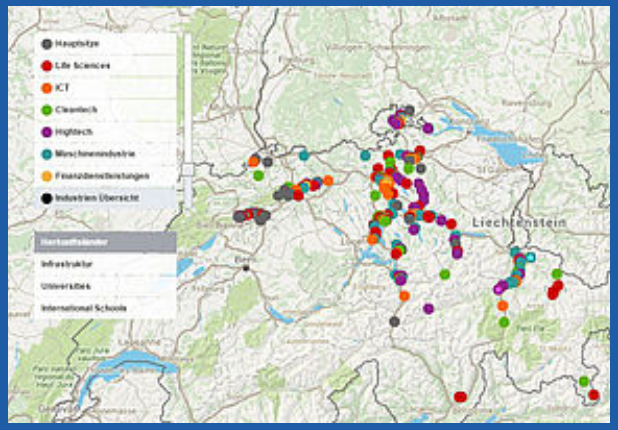
Zurich – Researchers at the Swiss Federal Institute of Technology in Zurich have developed equipment that could be used to detect people by smell after an earthquake. It is the smallest and cheapest equipment of this kind ever made.

Trained rescue dogs are still the best disaster workers because of their sensitive noses, the Swiss Federal Institute of Technology in Zurich (**ETH**) writes in a **press release**. However, dogs are often not immediately available and need to take breaks every now and again. Researchers led by ETH Professor Sotiris Pratsinis have now developed a device that can detect buried people by smell.

The scientists have combined previously developed gas sensors for acetone, ammonia, and isoprene with two commercial sensors for CO_2 and moisture. “The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO_2, for example, could come from either a buried person or a fire source,” explains Andreas Güntner, a post-doctoral researcher.

The sensors applied by the ETH scientists are the size of a small computer chip. The device they have created is “is by far the smallest and cheapest device that is sufficiently sensitive to detect entrapped people,” comments Professor Pratsinis. Laboratory tests have shown that this sensor combination can be quite useful when searching for entrapped people. The next step is to test it in real conditions. The researchers are currently seeking industry partners or investors to support the construction of a prototype.

Interactive Industry Map



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In future, they hope this device could not only be operated by people, but also by drones and robots. This would allow difficult-to-reach or inaccessible areas to also be searched. Further potential applications could include detecting stowaways and exposing human trafficking.

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16.05.2018 08:16

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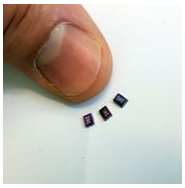

Die drei an der ETH Zürich entwickelten Gassensoren
ETH Zürich / Andreas Güntner

Wissenschaftler der ETH Zürich entwickelten die mit Abstand kleinste und günstigste Apparatur, mit der Menschen am Geruch detektiert werden können. Sie eignet sich für die Suche nach Personen, die bei einem Erdbeben oder von einer Lawine verschüttet worden sind.

Trainierte Rettungshunde sind noch immer die besten Katastrophenhelfer. Dank ihrer empfindlichen Nase können sie Menschen aufspüren, die bei einem Erdbeben oder von einer Lawine verschüttet worden sind. Wie alle Lebewesen brauchen Hunde allerdings ab und an Erholungspausen. Ausserdem sind sie oft nicht sofort in Katastrophengebieten verfügbar, und Hundestaffeln müssen von weit her anreisen.

Pausenlos einsatzbereit ist hingegen eine neue Messapparatur von Forschern um Sotiris Pratsinis, Professor für Verfahrenstechnik an der ETH Zürich. In den vergangenen Jahren entwickelten die Wissenschaftler kleine und äusserst empfindliche Gassensoren für Azeton, Ammoniak und Isopren – alles Stoffwechselprodukte unseres Körpers, die wir in geringen Konzentrationen ausatmen und ausdünsten. Die Forschenden kombinierten diese Sensoren nun in einem Gerät mit zwei kommerziellen Sensoren für CO2 und Feuchtigkeit.

Chemischer «Fingerabdruck»

Wie Labortests in Zusammenarbeit mit österreichischen und zyprischen Wissenschaftlern ergaben, lassen sich mit dieser Sensorkombination sehr gut verschüttete Personen aufspüren. Die Forschenden nutzten eine als Verschüttungssimulator entwickelte Versuchskammer am Institut für Atemgasanalytik der Universität Innsbruck in Dornbirn, in welcher freiwillige Versuchspersonen einzeln während zwei Stunden ausharrten.

«Die Kombination von Sensoren für unterschiedliche chemische Verbindungen ist wichtig, weil die einzelnen Stoffe auch andere Quellen als den Menschen haben können. CO2 zum Beispiel kann sowohl von einer verschütteten Person als auch von einem Brandherd stammen», erklärt Andreas Güntner, Postdoktorand in Pratsinis Gruppe und Erstautor der in der Fachzeitschrift Analytical Chemistry [http://dx.doi.org/10.1021/acs.analchem.8b00237] veröffentlichten Studie. Dank der Kombination der Sensoren erhalten die Wissenschaftler zuverlässige Hinweise auf die Anwesenheit von Menschen.

Auch für unzugängliche Katastrophengebiete

Wie die Forschenden ausserdem zeigten, unterscheiden sich die ausgeatmeten von den ausgedünsteten Verbindungen. «Aceton und Isopren sind typische Stoffe, die wir grösstenteils ausatmen. Ammoniak hingegen dünsten wir vor allem über die Haut aus», erklärt ETH-Professor Pratsinis. In den Experimenten im Verschüttungssimulator trugen die Versuchspersonen eine Atemmaske. Im ersten Teil des Versuchs wurde die von den Teilnehmern ausgeatmete Luft direkt aus der Kammer geleitet, im zweiten Teil blieb die ausgeatmete Luft darin. So konnten die Wissenschaftler ein Atemluft- und ein Ausdünstungsprofil erstellen.

Die verwendeten Gassensoren der ETH-Wissenschaftler haben die Grösse eines kleinen Computerchips. «Sie sind etwa gleich empfindlich wie die meisten Ionenmobilitäts-Spektrometer, die mehrere tausend Franken kosten und die Grösse eines Koffers haben», sagt Pratsinis. «Unsere handliche Sensorkombination ist mit Abstand das kleinste und günstigste Gerät, das ausreichend empfindlich ist, um verschüttete Personen zu erkennen. In einem nächsten Schritt möchten wir unter Realbedingungen testen, ob es sich für den Sucheinsatz nach Erdbeben oder Lawinenniedergängen eignet.»

Für die Suche nach Verschütteten gibt es zwar bereits elektronische Geräte, diese arbeiten jedoch mit Mikrofonen und Kameras. Mit ihnen lassen sich nur Verschüttete finden, die sich akustisch bemerkbar machen können oder unter Trümmern sichtbar sind. Die Idee der ETH-Wissenschaftler ist, solche Hilfsmittel mit den chemischen Sensoren zu ergänzen. Derzeit suchen die Forschenden Industriepartner oder Investoren, die den Bau eines Prototypen unterstützen. Auch Drohnen oder Roboter liessen sich mit den Gassensoren ausrüsten. So könnte man auch Gebiete absuchen, die zu Fuss nicht oder nur schwer zugänglich sind. Weitere mögliche Anwendungen wären das Aufspüren von blinden Passagieren oder das Aufdecken von Menschenschmuggel.

Literaturhinweis

Güntner AT, Pineau NJ, Mochalski P, Wiesenhofer H, Agapiou A, Mayhew CA, Pratsinis SE: Sniffing Entrapped Humans with Sensor Arrays. Analytical Chemistry, doi: 10.1021/acs.analchem.8b00237 [http://dx.doi.org/10.1021/acs.analchem.8b00237]

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> Επιστήμη

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Χιμένεθ και Αραουχο»

17:34 Τραγικός θάνατος για 38χρονο: Εξερράγη το ηλεκτρονικό τσιγάρο

17:30 Smoothie με τρία υλικά που θα λατρέψουν όλα τα παιδιά

17:29 Πέρασε άνετα στον τελικό ο Ολυμπιακός, σκούπισε τον Υδραϊκό

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σκύλου διάσωσης». Διευκρινίζουν ότι οι εκπαιδευμένοι σκύλοι διάσωσης εξακολουθούν να είναι οι πλέον αποτελεσματικοί, συχνά όμως δεν είναι άμεσα διαθέσιμοι.

Η συσκευή αποτελείται από έναν συνδυασμό αισθητήρων που μπορούν να ανιχνεύσουν ακετόνη, αμμωνία, ισοπρένιο, διοξείδιο του άνθρακα και υγρασία. Αυτά τα μεταβολικά προϊόντα αποβάλλονται σε χαμηλές συγκεντρώσεις μέσω της αναπνοής ή του δέρματος του ανθρώπου. Μεμονωμένα αυτές οι ουσίες θα μπορούσαν να προέρχονται από άλλες πηγές εκτός από τον άνθρωπο, όπως από μια πυρκαγιά για παράδειγμα. Ωστόσο ο συνδυασμός των αισθητήρων «παρέχει στους επιστήμονες έναν αξιόπιστο δείκτη για την παρουσία ανθρώπων». Επί του παρόντος οι αισθητήρες έχουν δοκιμαστεί μόνο σε εργαστηριακές συνθήκες, σε συνεργασία με Αυστριακούς και Κύπριους επιστήμονες.

Η ερευνητική ομάδα με επικεφαλής τον Σωτήρη Πρατσίνη, καθηγητή Μηχανικής Τεκμηρίωσης στο Ομοσπονδιακό Ινστιτούτο Τεχνολογίας της Ζυρίχης, επιδιώκει τώρα να δοκιμάσει τη μικροσκοπική συσκευή σε πραγματικές συνθήκες για να ελέγξει την καταλληλότητά της σε αποστολές έρευνας και διάσωσης.

Οι ηλεκτρονικές συσκευές που χρησιμοποιούνται μέχρι τώρα στις έρευνες έπειτα από σεισμούς, βασίζονται σε μικρόφωνα και κάμερες που μπορούν να εντοπίσουν παγιδευμένους ανθρώπους κάτω από τα ερείπια μόνο εάν τους δουν στην κάμερα ή τους ακούσουν.

Επιπλέον, τα drones και τα ρομπότ θα μπορούσαν να εξοπλισθούν με τη μικροσκοπική συσκευή ώστε να διευκολύνεται ο εντοπισμός επιζώντων σε δυσπρόσιτες και απομακρυσμένες περιοχές. Επίσης, περαιτέρω πιθανές εφαρμογές της συσκευής θα μπορούσαν να περιλαμβάνουν τον εντοπισμό λαθρεπιβατών και εμπορίας ανθρώπων.

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Miniatur-Gassensoren

Katastrophenhelfer: Elektronischer Rettungshund erschnüffelt Menschen

17.05.18 | Autor / Redakteur: Fabio Bergamin* / Dr. Ilka Ottleben

Nach Lawinenkatastrophen kommen regelmäßig Spürhunde zum Einsatz, weil sie mit ihrer empfindlichen Nase Menschen auffinden können. (Bild: Eric Diederen Fotografie)

Züricher Forscher haben die nach eigenen Angaben mit Abstand kleinste und günstigste Apparatur, mit der Menschen am Geruch detektiert werden können, entwickelt. Sie kombiniert Miniatur-Gassensoren in einem Gerät mit kommerziellen Sensoren für CO_2 und Feuchtigkeit und eignet sich für die Suche nach Personen, die bei einem Erdbeben oder von einer Lawine verschüttet worden sind.

Zürich/Schweiz – Trainierte Rettungshunde sind noch immer die besten Katastrophenhelfer. Dank ihrer empfindlichen Nase können sie Menschen aufspüren, die bei einem Erdbeben oder von einer Lawine verschüttet worden sind. Wie alle Lebewesen brauchen Hunde allerdings ab und an Erholungspausen. Außerdem sind sie oft nicht sofort in Katastrophengebieten verfügbar, und Hundestaffeln müssen von weit her anreisen.

Pausenlos einsatzbereit ist hingegen eine neue Messapparatur von Forschern um Sotiris Pratsinis, Professor für Verfahrenstechnik an der ETH Zürich. In den vergangenen Jahren entwickelten die Wissenschaftler kleine und äußerst empfindliche Gassensoren für Azeton, Ammoniak und Isopren – alles Stoffwechselprodukte unseres Körpers, die wir in geringen Konzentrationen ausatmen und ausdünsten. Die Forschenden kombinierten diese Sensoren nun in einem Gerät mit zwei kommerziellen Sensoren für CO_2 und Feuchtigkeit.

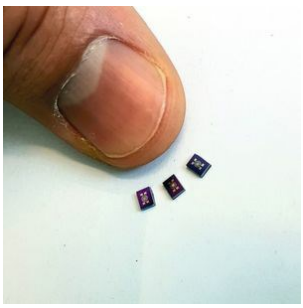
Chemischer Fingerabdruck verschütteter Menschen

Wie Labortests in Zusammenarbeit mit österreichischen und zyprischen Wissenschaftlern ergaben, lassen sich mit dieser Sensorkombination sehr gut verschüttete Personen aufspüren. Die Forschenden nutzten eine als Verschüttungssimulator entwickelte Versuchskammer am Institut für Atemgasanalytik der Universität Innsbruck in Dornbirn, in welcher freiwillige Versuchspersonen einzeln während zwei Stunden ausharrten.

„Die Kombination von Sensoren für unterschiedliche chemische Verbindungen ist wichtig, weil die einzelnen Stoffe auch andere Quellen als den Menschen haben können. CO_2 zum Beispiel kann sowohl von einer verschütteten Person als auch von einem Brandherd stammen“, erklärt Andreas Güntner, Postdoktorand in Pratsinis Gruppe und Erstautor der Studie. Dank der Kombination der Sensoren erhalten die Wissenschaftler zuverlässige Hinweise auf die Anwesenheit von Menschen.

Auch für unzugängliche Katastrophengebiete

Wie die Forschenden außerdem zeigten, unterscheiden sich die ausgeatmeten von den ausgedünsteten Verbindungen. „Aceton und Isopren sind typische Stoffe, die wir größtenteils ausatmen. Ammoniak hingegen dünsten wir vor allem über die Haut aus“, erklärt ETH-Professor Pratsinis. In den Experimenten im Verschüttungssimulator trugen die Versuchspersonen eine Atemmaske. Im ersten Teil des Versuchs wurde die von den Teilnehmern ausgeatmete Luft direkt aus der Kammer geleitet, im zweiten Teil blieb die ausgeatmete Luft darin. So konnten die Wissenschaftler ein Atemluft- und ein Ausdünstungsprofil erstellen.



Die drei an der ETH Zürich entwickelten Gassensoren. (Bild: ETH Zürich / Andreas Güntner)

Die verwendeten Gassensoren der ETH-Wissenschaftler haben die Größe eines kleinen Computerchips. „Sie sind etwa gleich empfindlich wie die meisten Ionenmobilitäts-Spektrometer, die mehrere tausend Franken kosten und die Größe eines Koffers haben“, sagt Pratsinis. „Unsere handliche Sensorkombination ist mit Abstand das kleinste und günstigste Gerät, das ausreichend empfindlich ist, um verschüttete Personen zu erkennen. In einem nächsten Schritt möchten wir unter Realbedingungen testen, ob es sich für den Sucheinsatz nach Erdbeben oder Lawinenniedergängen eignet.“

Für die Suche nach Verschütteten gibt es zwar bereits elektronische Geräte, diese arbeiten jedoch mit Mikrofonen und Kameras. Mit ihnen lassen sich nur Verschüttete finden, die sich akustisch bemerkbar machen können oder unter Trümmern sichtbar sind. Die Idee der ETH-Wissenschaftler ist, solche Hilfsmittel mit den chemischen Sensoren zu ergänzen. Derzeit suchen die Forschenden Industriepartner oder Investoren, die den Bau eines Prototypen unterstützen. Auch Drohnen oder Roboter ließen sich mit den Gassensoren ausrüsten. So könnte man auch Gebiete absuchen, die zu Fuß nicht oder nur schwer zugänglich sind. Weitere mögliche Anwendungen wären das Aufspüren von blinden Passagieren oder das Aufdecken von Menschenschmuggel.

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An electronic rescue dog

ScienceDaily | 5/16/2018 | Staff

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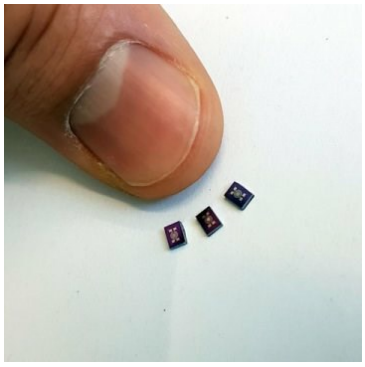

A new measuring device from researchers at ETH Zurich led by Sotiris Pratsinis, Professor of Process Engineering, however, is always ready for use. The scientists had previously developed small and extremely sensitive gas sensors for acetone, ammonia, and isoprene -- all metabolic products that we emit in low concentrations via our breath or skin. The researchers have now combined these sensors in a device with two commercial sensors for CO2 and moisture.

Chemical "fingerprint"

Laboratory - Tests - Collaboration - Cypriot - Scientists

As shown by laboratory tests in collaboration with Austrian and Cypriot scientists, this sensor combination can be quite useful when searching for entrapped people. The researchers used a test chamber at the University of Innsbruck's Institute for Breath Research in Dornbirn as an entrapment simulator. Volunteers each remained in this chamber for two hours.

"The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO2, for example, could come from either a buried person or a fire source," explains Andreas Güntner, a postdoc in Pratsinis' group and lead author of the study, published in the journal Analytical Chemistry. The combination of sensors provides the scientists with reliable indicators of the presence of people.

Researchers - Differences - Compounds - Breath - Skin

The researchers also showed that there are differences between the compounds emitted via our breath and skin. "Acetone and isoprene are typical substances that we mostly breathe out. Ammonia, however, is usually emitted through the skin," explains...

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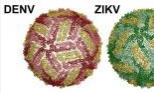

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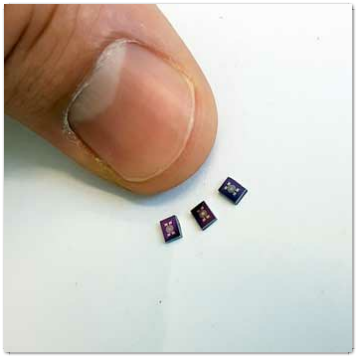
An electronic rescue dog

(*Nanowerk News*) Trained rescue dogs are still the best disaster workers - their sensitive noses help them to track down people buried by earthquakes or avalanches. Like all living creatures, however, dogs need to take breaks every now and again. They are also often not immediately available in disaster areas, and dog teams have to travel from further afield.

A new measuring device from researchers at ETH Zurich led by Sotiris Pratsinis, Professor of Process Engineering, however, is always ready for use. The scientists had previously developed small and extremely sensitive gas sensors for acetone, ammonia, and isoprene - all metabolic products that we emit in low concentrations via our breath or skin. The researchers have now combined these sensors in a device with two commercial sensors for CO_2 and moisture.



This is an image of the three gas sensors developed at ETH Zurich. (Image: ETH Zurich / Andreas Güntner)

Chemical "fingerprint"

As shown by laboratory tests in collaboration with Austrian and Cypriot scientists, this sensor combination can be quite useful when searching for entrapped people. The researchers used a test chamber at the University of Innsbruck's Institute for Breath Research in Dornbirn as an entrapment simulator. Volunteers each remained in this chamber for two hours.

"The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO_2, for example, could come from either a buried person or a fire source," explains Andreas Güntner, a postdoc in Pratsinis' group and lead author of the study, published in the journal *Analytical Chemistry* ("Sniffing Entrapped Humans with Sensor Arrays"). The combination of sensors provides the scientists with reliable indicators of the presence of people.

Suitable for inaccessible areas

The researchers also showed that there are differences between the compounds emitted via our breath and skin. "Acetone and isoprene are typical substances that we mostly breathe out. Ammonia, however, is usually emitted through the skin," explains ETH professor Pratsinis. In the experiments in the entrapment simulator, the participants wore a breathing mask. In the first part of the experiment, the exhaled air was channelled directly out of the chamber; in the second part, it remained inside. This allowed the scientists to create separate breath and skin emission profiles.

The ETH scientists' gas sensors are the size of a small computer chip. "They are about as sensitive as most ion mobility spectrometers, which cost thousands of Swiss francs and are the size of a suitcase," says Pratsinis. "Our easy-to-handle sensor combination is by far the smallest and cheapest device that is sufficiently sensitive to detect entrapped people. In a next step, we would like to test it during real conditions, to see whether it is suited for use in searches after earthquakes or avalanches."

While electronic devices are already in use during searches after earthquakes, these work with microphones and cameras. These only help to locate entrapped people who are capable of making themselves heard or are visible beneath ruins. The ETH scientists' idea is to complement these resources with the chemical sensors.

They are currently looking for industry partners or investors to support the construction of a prototype. Drones and robots could also be equipped with the gas sensors, allowing difficult-to-reach or inaccessible areas to also be searched. Further potential applications could include detecting stowaways and exposing human trafficking.

Source: ETH Zurich

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Elektronische Spürnase soll Verschüttete über Ausdünstung finden

Nach Erdbeben setzen Rettungsteams Hunde, Kameras und Mikrofone ein, um verschüttete Personen zu bergen. Geräte, die vom Körper abgegebene Stoffwechselprodukte erkennen, könnten die Suche weiter verbessern.

16.5.2018, 14:15 Uhr

Rettungskräfte bergen eine Überlebende nach einem Erdbeben in Istanbul in der Türkei. (Bild: Imago)

MEISTGELESEN IM RESSORT

Ein Arzt spricht Klartext
Alan Niederer / 18.5.2018, 05:30 Uhr

Gehirne intelligenter Menschen sind weniger vernetzt
Lena Stallmach / 16.5.2018, 15:00 Uhr

Wenn der Magen nach oben rutscht
Bruno Kesseli / 16.10.2016, 05:26 Uhr

(sda) · Wissenschafter der ETH Zürich haben eine winzige Apparatur entwickelt, die wie ein elektronischer Spürhund funktioniert: Mit Gassensoren kann sie Menschen über deren ausgeatmete und ausgedünstete Stoffwechselprodukte erkennen.

Die Gassensoren erkennen Azeton, Ammoniak und Isopren, wie die ETH am Mittwoch mitteilte. Diese Stoffwechselprodukte werden vom Menschen in geringen Mengen ausgeatmet oder ausgedünstet. Die Forscher um Sotiris Pratsinis, Professor für Verfahrenstechnik, kombinierten Gassensoren in einem Gerät mit zwei kommerziellen Sensoren für CO_2 und Feuchtigkeit.

«Die Kombination von Sensoren für unterschiedliche chemische Verbindungen ist wichtig, weil die einzelnen Stoffe auch andere Quellen als den Menschen haben können», lässt sich Andreas Güntner, Postdoktorand in Pratsinis Gruppe, in der Mitteilung zitieren. CO_2 zum Beispiel könne von einem Menschen oder auch von einem Brandherd stammen.

Dank der Kombination der Sensoren erhalten Wissenschafter zuverlässige Hinweise darauf, dass sich im Suchgebiet Menschen befinden. Güntner ist Erstautor der in der Fachzeitschrift «Analytical Chemistry» veröffentlichten Studie.

Tests nur mit lebenden Versuchspersonen

Auf Nachfrage sagte er, dass es vom Prinzip her auch möglich sei, Verstorbene zu finden, da die einzelnen Stoffe weiterhin feststellbar seien. Getestet wurden die Sensoren allerdings nur mit lebenden Personen.

Dafür setzten sich Versuchspersonen einzeln während zwei Stunden mit Atemmasken in eine als Verschüttungssimulator entwickelte Versuchskammer am Institut für Atemgasanalytik der Universität Innsbruck in Dornbirn.

«Azeton und Isopren sind typische Stoffe, die wir grösstenteils ausatmen. Ammoniak hingegen dünsten wir vor allem über die Haut aus», erläutert Pratsinis in der Mitteilung. Deshalb wurde im ersten Versuch die von den Testpersonen ausgeatmete Luft direkt aus der Kammer geleitet, im zweiten Teil blieb die ausgeatmete Luft drin. So haben die Wissenschafter ein Atemluft- und ein Ausdünstungsprofil erstellt.

So gross wie ein Stecknadelkopf

Die ETH möchte als Nächstes unter realen Bedingungen testen, ob sich die Apparatur für den Sucheinsatz nach Erdbeben oder Lawinenniedergängen eignet. Für solche Fälle gibt es bereits Suchgeräte. Diese funktionieren gemäss der Mitteilung jedoch mit Mikrofonen und Kameras. Man kann daher nur Verschüttete finden, die sich akustisch bemerkbar machen können oder die unter Trümmern sichtbar sind.

Die Idee der ETH-Wissenschafter ist es, diese Suchgeräte mit den Sensoren zu ergänzen. Gemäss der Hochschule sind die Sensoren nicht viel grösser als ein Stecknadelkopf. Dennoch seien sie ähnlich empfindlich wie die meisten Ionenmobilitätsspektrometer.

Auch Drohnen oder Roboter lassen sich laut der Mitteilung mit den Gassensoren ausrüsten. So könnten auch Gebiete abgesucht werden, die zu Fuss nicht oder nur schwer zugänglich seien. Als weitere mögliche Anwendungen listet die Mitteilung das Aufspüren von blinden Passagieren oder das Aufdecken von Menschenschmuggel auf.

Elektronische Spürnase hilft dem Chirurgen, zwischen Tumor und gesundem Gewebe zu unterscheiden

Bei Krebsoperationen ist es wichtig, alle Tumorzellen zu erwischen. Deshalb werden feste Geschwülste mit etwas gesundem Gewebe darum herum herausgeschnitten. Mit einem neuartigen Skalpell könnte dieser Sicherheitsrand wegfallen.

Hermann Feldmeier / 24.9.2013, 18:00

Erdbeben in der Schweiz – eine Übersicht

Wo in der Schweiz Erdbeben am häufigsten auftreten. Warum es oft zu Häufungen in kurzer Zeit kommt. Und welches die stärksten Beben der vergangenen 1000 Jahre waren.

Marie-José Kolly / 1.9.2017, 15:29

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TECHNOLOGY

Robotic noses could be the future of disaster rescue—if they can outsniff search dogs

If researchers can crack the chemistry, the applications are numerous.

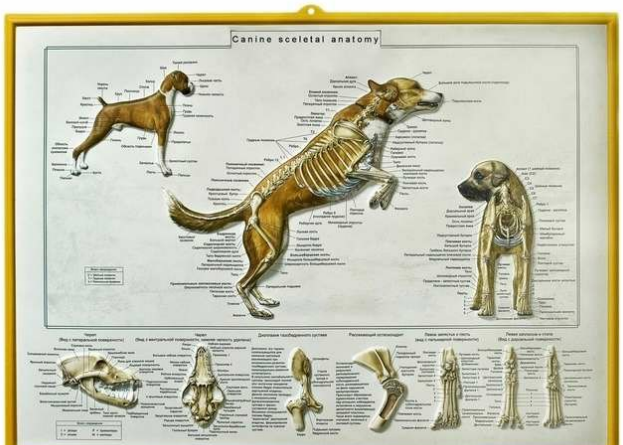
By Eleanor Cummins May 18, 2018

The most adorable device around.
Deposit Photos

As Hurricane Harvey ripped through Texas and neighboring gulf states in August 2017, leaving a record-breaking 30 million gallons of quickly-dirtied water in its wake, the Federal Emergency Management Agency, more commonly known as FEMA, moved into position. Among the personnel from federal agencies as varied as the Department of Health and Human Services and the Coast Guard were numerous Urban Search and Rescue teams—experts in finding people in the midst of a large-scale crisis, whether they're stranded on a roof, or trapped deep beneath the rubble.

For all their expertise, these responders aren't going it alone. They're equipped with listening devices, heat detection equipment, and, most importantly, some loyal sniffers. "We use the dogs [as] locating tools," says Scott Mateyaschuk of the New York Police Department's K9 unit. "The dogs will locate live human scent under structural collapse." In his work for FEMA, which is fundamentally a constellation of emergency response experts who mobilize in a crisis, Mateyaschuk also helps to train and deploy disaster dogs across the country.

While canine units are a tried and fairly true method for identifying people trapped in the wreckage of a disaster, analytical chemists have for years been working in the lab to create a robotic alternative. A synthetic sniffer, they argue, could potentially prove to be just as or even more reliable than a dog, more resilient in the face of external pressures like heat and humidity, and infinitely more portable. (As of this writing, you can't hoist a dog with a drone.) But for all the excitement in academia, those on the ground remain skeptical.



Anatomy of a super-smeller.
Deposit Photos

Man's best friend—and tool

Humans have utilized canine noses since at least the Middle Ages. Police dogs originated with medieval parish constables who, in addition to maintaining the palace, used bloodhounds, called "slough dogs" or "sleuths", to hunt down outlaws. Seventeenth century monks living in Switzerland's Great St. Bernard Pass used dogs to find pilgrims lost in the snow. The life-saving dogs have since been bred with other canines, leading to a heavier, jowlier descendant, the St. Bernard. By the turn of the 19th century, more scientific efforts to train canine units were underway. Ghent, Belgium established what is considered the first police dog training school in 1889. By World War I, the military began to train dogs to locate wounded soldiers.

A thousand years later, the basic technology—that is, the dogs—remains much the same. Dogs have incredible olfactory abilities, with 100 times greater density of smelling cells in their nostrils than in the meager human nose. While humans breathe and smell through the same system, when a dog breathes in or out, the air travels through two different pathways, one for breathing, the other solely for smelling. They have another secret, too: a pheromone-detecting apparatus humans seem to lack altogether. Taken together, this specialized snout allows dogs to perceive odors in parts per trillion—an infinitesimal amount that comes in handy when their human handlers need them to identify the smallest whiff of a lost person.

That means the key difference between search dogs of yesteryear and now is training. Taking all of the regional groups together, Mateyaschuk says, FEMA's total canine headcount numbers around 285 "live find" canines, which are trained to bark when they discover a living person, and 85 cadaver dogs, expert in identifying the deceased. The dogs are from a variety of breeds: About 60 percent are Labrador Retrievers. The next most popular are Belgian Malinois, which constitute about 14 percent of FEMA-affiliated dogs. Other agencies have their own dogs: the Transportation Security Administration, or TSA, has 1,000 dogs for deployment in airports across the country, for example. Dogs are also trained to track down invasive species and preliminary research is assessing their ability to detect cancer.

Urban rescue dogs vetted by FEMA must complete a lengthy training course and have to pass a post-graduation verification process before they can go out in the field. The whole process sometimes takes as long as two years to complete—and that's assuming they even get a shot at all. These days, prospective canines are aggressively vetted (pun intended). "Post-9/11, we've really dialed into testing the dogs prior to going into these different programs," Mateyaschuk says. They look, first and foremost, for what he calls a "hunt drive," which could also be described as a pathological need to please. While any dog could stand to learn something from urban search training, the basic drive to find something—anything—in exchange for a reward can't be taught.

Measuring the true success of these elite urban rescue K9s remains difficult, as the only way to know if a dog successfully identified every endangered person is through an entrapment simulation. In a real-life scenario like Hurricane Harvey or the Boston Marathon Bombing, dogs can only really be measured by the number of people they do find; the number of people they *don't* find may never be known.

However, research that has been conducted on urban rescue simulations is heartening. One 2015 study, published in the journal *Wilderness and Environmental Medicine,* analyzed 25 experiments over four months with 10 dog and trainer pairs in England. The researchers found a 76.4 percent success rate among dogs in a simulated search and rescue environment, though they noted that some of the success was undercut by a high false positive rate—the dogs sometimes barked at the wrong thing, which, in theory, could delay them from identifying the right thing. Other experimental research of dogs in simulated search environments has found success rates as high as 95 percent.

"What's very unique about the canines is their ability to cover a large area of collapse in a very short period of time," says Mateyaschuk. "There really has been no technology—yet—that can do that."

A noble beast.
Deposit Photos

Can old dogs teach humans new tricks?

While Mateyaschuk and the rest of the canine handlers associated with FEMA are satisfied with—even proud of—the work their dogs do, some scientists think search and rescue robots might one day provide a faster and more effective way of identifying victims in disasters. Assuming they can get the nose right.

Sotiris Pratsinis is a professor of process engineering and material science at ETH Zurich, a science and technology university in Switzerland, about 3 hours north of the Great St. Bernard Pass. In a recent study in the journal *Analytical Chemistry,* Pratsinis and his colleagues shared the results of a preliminary study on a portable device that sniffs out humans in entrapment situations.

Less like a robotic search and rescue dog than a metal box with an array of sensors, the system Pratsinis helped to develop detects chemicals common in human breath and skin, like acetone, ammonia, isoprene, and CO_2. It also detects shifts in relative humidity as the human mouth is typically much more moist than the surrounding environment. In theory, if one or more of these chemicals were identified in a concentration higher than background rates, a search and rescue team would know a human being was in the vicinity, even if they were trapped far below.

"In an earthquake, you have a significant area to cover," Pratsinis says. "You have an hour to save people, because after that, the survival rate become [smaller and smaller]." He imagines a day where the sensor array is made portable. That way, a first responder could hold it in their hand as they comb the disaster site, or they could suspend the device from a drone—a relatively recent addition to the FEMA toolkit—for even faster deployment. While dogs need rest and water in the midst of a search, Pratsinis notes his metal box will never tire.

For now, though, the device is confined to the laboratory. In this initial study, participants were placed in a sterile plexiglass box for observation. Researchers looked first at chemicals released from their lungs, then at chemicals emitted from their skin, and finally at all of the chemicals released from both skin and lungs. The researchers found that, in particular, their sensors detected parts per billion of acetone, ammonia, and isoprene "with high accuracies… and precision, unprecedented by portable sensors."

Pratsinis is hopeful that with more research—and more research dollars—a portable sensor device like this could eventually be brought to market. Other researchers are working on similar projects, including mimicking canine respiration patterns, as documented in a 2013 *PopSci* feature by Josh Dean. But how long it will take before we see these technologies in the field is anyone's guess. "We would love to make big claims," he says, but, right now, "the sample size is too small." The same is true for similar human chemical detection efforts, like other analytical chemistry research aimed at one day identifying human trafficking victims on ships in port with a similar sensor array.

But agencies like FEMA, which would ostensibly be the main users of such a device, aren't certain it's necessary, or feasible. The fact that search and rescue teams are stationed around the country, typically coming together only in times of crisis, means standardization is important. Everyone must be trained the same way with the same device, which means the agency is methodical—perhaps even slow—in incorporating new equipment. That's especially true given FEMA doesn't really have its own research and development arm. Instead, it relies on external exploration committees, and regularly partners with another federal group, the National Institute of Standards and Technology, to review new technologies.

What's more, Mateyaschuk believes in the efficacy of FEMA's existing noses: the search dogs. "Over the last 13 years that I'm involved with this system, there's been different things that have come along that have not been able to capture the unique olfactory experience that the dog has," Mateyaschuk says. "Something to be said about the dogs is, if it's not broke, don't fix it." And while Pratsinis is invested in the future of smelling devices, he acknowledges canines still have a competitive edge. "I wish we knew what the dogs were picking up," he says. "The dogs don't tell us."

tags: canines, dog, dogs, olfaction, chemistry, sensor technology, sensors, search and rescue, technology

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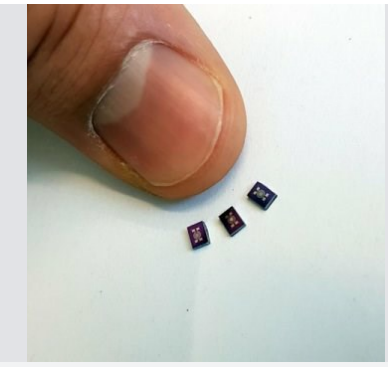
An electronic rescue dog

Date: May 16, 2018

Source: ETH Zurich

Summary: Scientists have developed the smallest and cheapest ever equipment for detecting people by smell. It could be used in the search for people buried by an earthquake or avalanche.

FULL STORY



This is an image of the three gas sensors developed at ETH Zurich.

Credit: ETH Zurich / Andreas Güntner

Trained rescue dogs are still the best disaster workers -- their sensitive noses help them to track down people buried by earthquakes or avalanches. Like all living creatures, however, dogs need to take breaks every now and again. They are also often not immediately available in disaster areas, and dog teams have to travel from further afield.

A new measuring device from researchers at ETH Zurich led by Sotiris Pratsinis, Professor of Process Engineering, however, is always ready for use. The scientists had previously developed small and extremely sensitive gas sensors for acetone, ammonia, and isoprene -- all metabolic products that we emit in low concentrations via our breath or skin. The researchers have now combined these sensors in a device with two commercial sensors for CO_2 and moisture.

Chemical "fingerprint"

As shown by laboratory tests in collaboration with Austrian and Cypriot scientists, this sensor combination can be quite useful when searching for entrapped people. The researchers used a test chamber at the University of Innsbruck's Institute for Breath Research in Dornbirn as an entrapment simulator. Volunteers each remained in this chamber for two hours.

"The combination of sensors for various chemical compounds is important, because the individual substances could come from sources other than humans. CO_2, for example, could come from either a buried person or a fire source," explains Andreas Güntner, a postdoc in Pratsinis' group and lead author of the study, published in the journal *Analytical Chemistry*. The combination of sensors provides the scientists with reliable indicators of the presence of people.

Suitable for inaccessible areas

The researchers also showed that there are differences between the compounds emitted via our breath and skin. "Acetone and isoprene are typical substances that we mostly breathe out. Ammonia, however, is usually emitted through the skin," explains ETH professor Pratsinis. In the experiments in the entrapment simulator, the participants wore a breathing mask. In the first part of the experiment, the exhaled air was channelled directly out of the chamber; in the second part, it remained inside. This allowed the scientists to create separate breath and skin emission profiles.

The ETH scientists' gas sensors are the size of a small computer chip. "They are about as sensitive as most ion mobility spectrometers, which cost thousands of Swiss francs and are the size of a suitcase," says Pratsinis. "Our easy-to-handle sensor combination is by far the smallest and cheapest device that is sufficiently sensitive to detect entrapped people. In a next step, we would like to test it during real conditions, to see whether it is suited for use in searches after earthquakes or avalanches."

While electronic devices are already in use during searches after earthquakes, these work with microphones and cameras. These

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only help to locate entrapped people who are capable of making themselves heard or are visible beneath ruins. The ETH scientists' idea is to complement these resources with the chemical sensors. They are currently looking for industry partners or investors to support the construction of a prototype. Drones and robots could also be equipped with the gas sensors, allowing difficult-to-reach or inaccessible areas to also be searched. Further potential applications could include detecting stowaways and exposing human trafficking.

Story Source:

Materials provided by **ETH Zurich**. *Note: Content may be edited for style and length.*

Journal Reference:

1. Andreas T. Güntner, Nicolay J. Pineau, Paweł Mochalski, Helmut Wiesenhofer, Agapios Agapiou, Christopher A. Mayhew, Sotiris E. Pratsinis. **Sniffing Entrapped Humans with Sensor Arrays**. *Analytical Chemistry*, 2018; 90 (8): 4940 DOI: 10.1021/acs.analchem.8b00237

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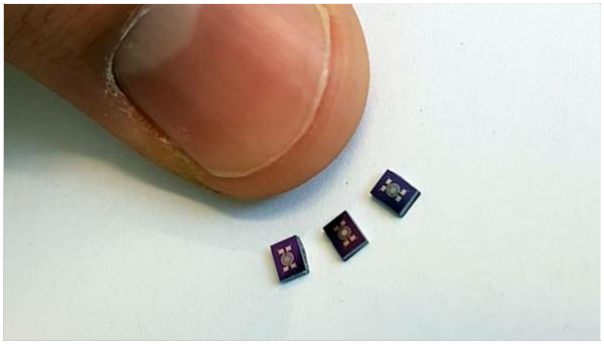
An Electronic Rescue Dog

Published: May 16, 2018.
Released by ETH Zurich



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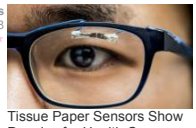
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A Swiss dog rescue team look for survivors in West Sumatra after a powerful earthquake struck the region in 2009. "Trained rescue dogs are still the best disaster workers, but they are often not immediately available" wrote the scientists.

(Keystone)

Researchers from the Federal Institute of Technology Zurich (ETH) have developed a kind of electronic rescue dog – a tiny sensor which can detect humans by smell. The equipment could be used to search for people buried by an earthquake or avalanche.

The device consists of a combination of sensors which can detect acetone, ammonia, isoprene, CO2 and moisture, announced the ETH in a statement on Wednesday.

These metabolic products are emitted in low concentrations via a person's breath or skin. Individually, these substances could come from sources other than humans, such as a fire, for example, but the combination of sensors "provides the scientists with a reliable indicator of the presence of people", the ETH wrote.

Real life applications

The sensors have so far only been tested in laboratory conditions, in collaboration with Austrian and Cypriot scientists. The research team led by Sotiris Pratsinis, Professor of Process Engineering at ETH Zurich, would now like to test the pin-sized device in real life conditions to test its suitability for search and rescue missions.

"Trained rescue dogs are still the best disaster workers, but they are often not immediately available and dog teams have to travel from further afield," wrote the scientists.

+ Learn more about avalanche detection in the digital age

While electronic devices are already being used during searches after earthquakes, they rely on microphones and cameras which can only locate entrapped people who are capable of making themselves either seen or heard beneath the rubble.

Fine tuning equipment

The ETH scientists would like to supplement this existing equipment with their newly developed sensors. In addition, drones and robots could also be equipped with the device, thus allowing inaccessible and remote areas to be searched for survivors.

Further potential applications of the device could include detecting stowaways and combatting human trafficking and people smuggling.

On the trail of the Alps' four-legged heroes

By Jessica Dacey

It is absolutely silent inside the man-made dugout in the snow but gradually the sound

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Swiss scientists develop new 'electronic rescue dog'

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No, this dog is not electronic. File photo: AFP

Researchers at Zurich's ETH university have developed a tiny device for detecting people by smell which could provide essential assistance in the search for people buried by avalanches and earthquakes.

The device, which is the size of a small computer chip, contains extremely sensitive gas sensors for acetone, ammonia, and isoprene – metabolic products that we emit in low concentrations via our breath or skin– as well as sensors for carbon dioxide and moisture.

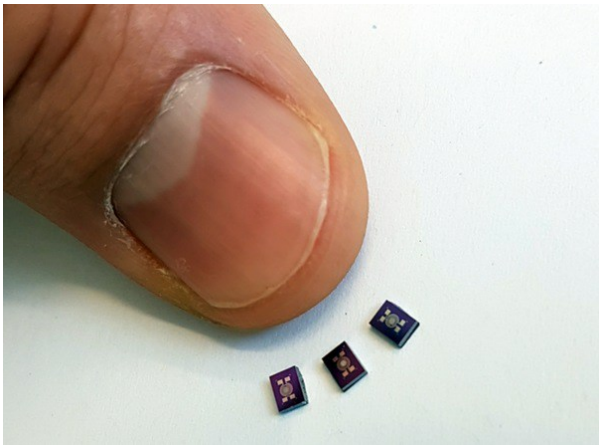

Photo: ETH/Andreas Güntner

The device can therefore detect a "chemical footprint" indicating the presence of humans, ETH said in a statement.

This means it has potential rescue applications as an alternative to rescue dogs which need to rest and which are not always available in emergency situations.

The ETH researchers, who are seeking industry partners or investors to develop a prototype, now want to test the device in real-life situations.

They say theirs is the smallest and cheapest device of its kind and could be an ideal compliment to current rescue devices which feature microphones and cameras but only work if people are able to communicate that their presence.

The ETH device could also be fitted to drones for use in difficult-to-access locations, the team said.

"The devices are about as sensitive as most ion mobility spectrometers, which cost thousands of Swiss francs and are the size of a suitcase," said Sotiris Pratsinis, ETH Professor of Process Engineering, who headed up the development team.

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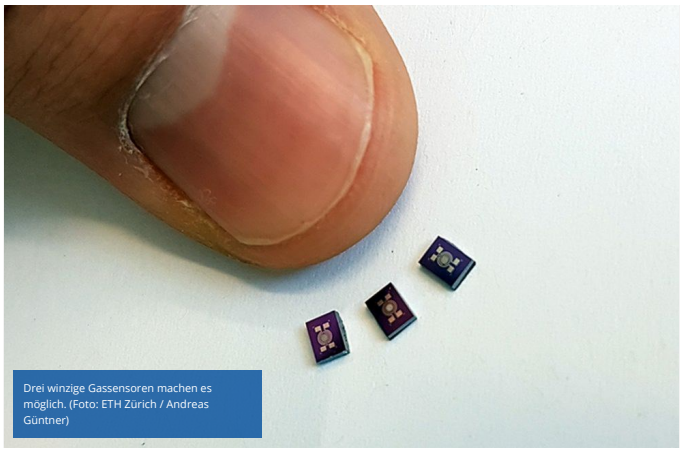

Drei winzige Gassensoren machen es möglich. (Foto: ETH Zürich / Andreas Güntner)

Wo stecken Menschen unter dem Erdbebenschutt oder dem Lawinenschnee? Rettungshunde haben dafür buchstäblich eine feine Nase – ihre Leistungen als Katastrophenhelfer sind legendär. Doch nicht immer und überall ist der Einsatz der tierischen Rettungshelfer möglich. Nun berichten Forscher über die Entwicklung einer raffinierten technischen Alternative zur Hundenase: Ihre praktische Apparatur kann menschlichen Geruch aufspüren, zeigen Tests an einem Verschüttungssimulator.

Das Original schlägt so schnell keiner – die Natur hat Hunde bekanntlich mit einer extrem feinen Sensorik ausgerüstet. Doch die Vierbeiner haben als Rettungshelfer nicht nur ideale Aspekte: Sie müssen trainiert werden, brauchen Pflege, Erholungspausen und sind in gefährlichem Gelände nur beschränkt einsetzbar. Außerdem sind Hundestaffeln in Katastrophengebieten in der Regel nicht sofort verfügbar – sie müssen oft erst von weit her anreisen.

Somit sind technische Alternativen gefragt. Bisher gibt es allerdings nur elektronische Geräte, die mit Mikrofonen und Kameras ausgerüstet sind. Mit ihnen lassen sich somit nur Verschüttete finden, die sich akustisch bemerkbar machen können oder durch Hohlräume in Trümmern sichtbar sind. Die Forscher von der Eidgenössischen Technischen Hochschule Zürich arbeiten hingegen bereits seit einiger Zeit an „schnüffelnden" Rettungshelfern. Wie sie berichten, hat ihre Arbeit nun zur Entwicklung eines Systems für den Handgebrauch geführt.

Winzige Gassensoren

Sie kombinierten im neuen Gerät die von ihnen in den letzten Jahren entwickelten Gassensoren für Aceton, Ammoniak und Isopren. Dabei handelt es sich Stoffwechselprodukte unseres Körpers, die wir in geringen Konzentrationen ausatmen und ausdünsten. Die verwendeten Gassensoren haben die Größe eines kleinen Computerchips. „Sie sind etwa gleich empfindlich wie die meisten Ionenmobilitäts-Spektrometer, die teuer sind und die Größe eines Koffers haben", sagt Co-Autor Sotiris Pratsinis. „Unsere handliche Sensorkombination ist mit Abstand das kleinste und günstigste Gerät, das ausreichend empfindlich ist, um verschüttete Personen zu erkennen", so der Wissenschaftler.

Anzeige

Für das Gerät kombinierten die Forscher ihre Sensoren mit zwei kommerziell verfügbaren Fühlern für Kohlendioxid und Feuchtigkeit. „Die Kombination von Sensoren für unterschiedliche chemische Verbindungen ist wichtig, weil die einzelnen Stoffe auch andere Quellen als den Menschen haben können. Kohlendioxid kann zum Beispiel sowohl von einer verschütteten Person als auch von einem Brandherd stammen", erklärt Co-Autor Andreas Güntner.

Konzept mit Potenzial

Für Tests ihres Systems nutzten die Forscher eine zum Verschüttungssimulator umfunktionierte Versuchskammer am Institut für Atemgasanalytik der Universität Innsbruck. Darin saßen einzelne Versuchspersonen, die eine Atemmaske trugen. Im ersten Teil der Untersuchungen wurde die von den Teilnehmern ausgeatmete Luft direkt aus der Kammer geleitet, im zweiten Teil blieb die ausgeatmete Luft im Raum. So konnten die Wissenschaftler ein Atemluft- und ein Ausdünstungsprofil erstellen. „Aceton und Isopren sind typische Stoffe, die wir ausatmen", sagt Pratsinis. „Ammoniak hingegen dünsten wir vor allem über die Haut aus". Letztlich entsteht aus der Kombination eine Art chemischer Fingerabdruck des Geruchs von Menschen, der sich detektieren lässt, erklären die Forscher.

Die Ergebnisse legen ihnen zufolge nahe, dass sich mit ihrem Konzept auch unter realen Bedingungen verschüttete Personen aufspüren lassen könnten. „In einem nächsten Schritt möchten wir testen, ob es sich für den Sucheinsatz nach Erdbeben oder Lawinenniedergängen eignet", sagt Pratsinis. Die Forscher suchen nun nach Industriepartner oder Investoren, die den Bau eines Prototypen unterstützen. Es zeichnet sich ihnen zufolge auch erweitertes Potenzial für das Konzept ab: Um schwer zugängliche Gebiete zu untersuchen, könnte man etwa Drohnen oder Roboter mit

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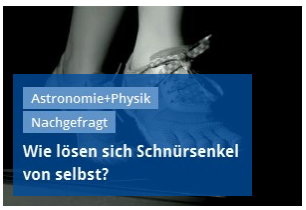

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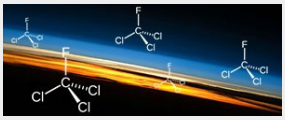

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New Portable Sensor Could Aid First Responders in Search and Rescue Operations

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Published on April 20, 2018 at 9:58 AM

Written by AZoSensors Apr 19 2018

When buildings collapse from bombings, earthquakes, or other disasters, the foremost step is to rescue people who may be trapped in the debris. However, it can be difficult to find entrapped people among the huge rubble. Now, researchers have developed a low-cost, selective sensor that is portable and lightweight enough to be held by first responders and can be carried by drones during search and rescue operations. The study has been reported in the ACS journal, Analytical Chemistry.

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A new sensor could aid first responders in their search for survivors after buildings collapse. (Image credit: Linda Macpherson/Shutterstock.com)

In the wake of a destruction-causing incident, the survival rate of humans trapped in the ruins drops quickly, which means it is important to reach there fast. In existing methods, human-sniffing dogs and acoustic probes that are capable of detecting cries for help are traditionally used. However, these approaches have certain disadvantages, for example, the silence of unconscious victims and the limited availability of canines.

A human chemical signature contains molecules that waft off the skin or that are exhaled. Devices that are capable of detecting such chemical signature shows immense potential, but so far, these products are too costly and bulky and thus impractical for wide implementation. In addition, they can overlook signals that are present at very low concentrations. Therefore, Sotiris E. Pratsinis and team wanted to develop a compact, low-cost sensor array that can detect even the faintest signs of life.

The scientists used three existing gas sensors to build their palm-sized sensor array, with each sensor customized to detect a particular emitted by skin or breath: isoprene, ammonia or acetone. For detecting CO_2 and humidity, the researchers also included two commercially available sensors. In a simulation of human entrapment, the sensors quickly detected trace amounts of these chemicals down to three parts per billion—levels that are unparalleled for portable detectors. Now, the next step is to test the palm-sized sensor array in the field under similar conditions as those predicted in the wake of a disaster.

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Handheld Device to Sniff Out Humans Trapped in Collapsed Buildings

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Earthquakes are lethal natural disasters frequently burying people alive under collapsed buildings. Tracking entrapped humans from their unique volatile chemical signature with hand-held devices would accelerate urban search and rescue (USaR) effortsThe first step after buildings collapse from an earthquake, bombing or other disaster is to rescue people who could be trapped in the rubble. But finding entrapped humans among the ruins can be challenging.

Scientists now report in the ACS journal Analytical Chemistry the development of an inexpensive, selective sensor that is light and portable enough for first responders to hold in their hands or for drones to carry on a search for survivors.

A new sensor could aid first responders in their search for survivors after buildings collapse.

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In the hours following a destruction-causing event, the survival rate of people stuck in the rubble rapidly drops, so it’s critical to get in there fast. Current approaches include the use of human-sniffing dogs and acoustic probes that can detect cries for help. But these methods have drawbacks, such as the limited availability of canines and the silence of unconscious victims.

Devices that detect a human chemical signature, which includes molecules that are exhaled or that waft off the skin, are promising. But so far, these devices are too bulky and expensive for wide implementation, and they can miss signals that are present at low concentrations. So, Sotiris E. Pratsinis and colleagues wanted to develop an affordable, compact sensor array to detect even the most faint signs of life.

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The authors acknowledge funding from the Swiss National Science Foundation, the European Union's Horizon 2020 research and innovation program and the Austrian Research Promotion Agency.

Contacts and sources:
Katie Cottingham, Ph.D.
The American Chemical Society

Citation: "Sniffing Entrapped Humans with Sensor Arrays"
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Novel portable device can sniff out' trapped humans

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Scientists have developed a light and portable sensor that can detect even the faintest signs of life, and could be used to rescue people trapped in rubble after an earthquake or bombing.

The first step after buildings collapse due to a disaster is to rescue people who could be trapped in the rubble. However, finding entrapped humans among the ruins can be challenging.

Scientists from ETH Zurich in Switzerland and University of Innsbruck in Austria developed an inexpensive, selective sensor that is light and portable enough for first responders to hold in their hands or for drones to carry on a search for survivors.

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So far these devices are too bulky and expensive for wide implementation, and they can miss signals that are present at low concentrations, researchers said.

They wanted to develop an affordable, compact sensor array to detect even the most faint signs of life, according to a study published in the journal Analytical Chemistry.

The researchers built the palm-sized sensor array from three existing gas sensors, each tailored to detect a specific chemical emitted by breath or skin: acetone, ammonia or isoprene.

They also included two commercially available sensors for detecting humidity and CO2.

In a human entrapment simulation, the sensors rapidly detected tiny amounts of these chemicals, at levels unprecedented for portable detectors - down to three parts per billion.

The next step is to test the sensor array in the field under conditions similar to those expected in the aftermath of a calamity, researchers said.

(This story has not been edited by Business Standard staff and is auto-generated from a syndicated feed.)

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A new sensor could aid first responders in their search for survivors after buildings collapse.

Portable device to sniff out trapped humans

By American Chemical Society —— Bio and Archives--*April 23, 2018*

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"Sniffing Entrapped Humans with Sensor Arrays"

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EMERGING TECH

A lightweight sensor can help sniff out survivors in disaster zones

By **Luke Dormehl** — Posted on April 23, 2018 - 11:28AM

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American Chemical Society

There are a number of different ways that search and rescue teams look for survivors in the aftermath of disasters, such as earthquakes or bombings. A team of researchers from Austria, Switzerland, and Cyprus may have added a powerful new technology to the toolkit, however, in the form of an inexpensive sensor which can be used to help find people trapped in rubble.

The sensor is both light and portable enough that it can be carried by first responders or easily mounted onto a drone. It could help discover survivors in the all-important period of time immediately following an incident, which could mean the difference between life and death.

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“In the aftermath of an earthquake, many victims are entrapped under collapsed structures and need rapid help, because survival rates drop dramatically within the first hours,” Sotiris Pratsinis, Professor of Process Engineering at ETH Zurich in Switzerland, told Digital Trends. “Currently indispensable for urban search and rescue are dogs with their superior ability to sniff entrapped humans from their scent. However, their availability and operational time are limited and they are rather stress-sensitive. Here, we built a palm-sized and inexpensive sensor array that can detect humans by sniffing their chemical signature as well.”

The team’s diminutive device consists of five sensors in all. Two of these are commercially available sensors for detecting humidity and carbon dioxide. There are also three tailor-made sensors, able to detect the specific breath and skin-emitted chemicals acetone, ammonia or isoprene at even tiny, trace-level concentrations. This is significantly better than the current bulky, expensive sensors currently used for this task, which can miss signals if they are not present at high enough concentrations.

“[We’ve so far] tested our sensors in a human entrapment simulation,” Pratsinis

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continued. “Volunteers were enclosed in a gas-tight chamber to accumulate their breath and skin emissions. The sensors rapidly detected human presence by sensing tiny amounts of these chemicals, at levels unprecedented for portable detectors — down to three parts per billion. The next step is to test the sensor array in the field with first responders under conditions similar to those expected in the aftermath of a calamity.”

A paper describing the project, “Sniffing Entrapped Humans with Sensor Arrays,” was recently published in the American Chemical Society journal Analytical Chemistry.

Editors' Recommendations

- Today, A.I. helps detect tiny earthquakes. Tomorrow, it might predict the big one
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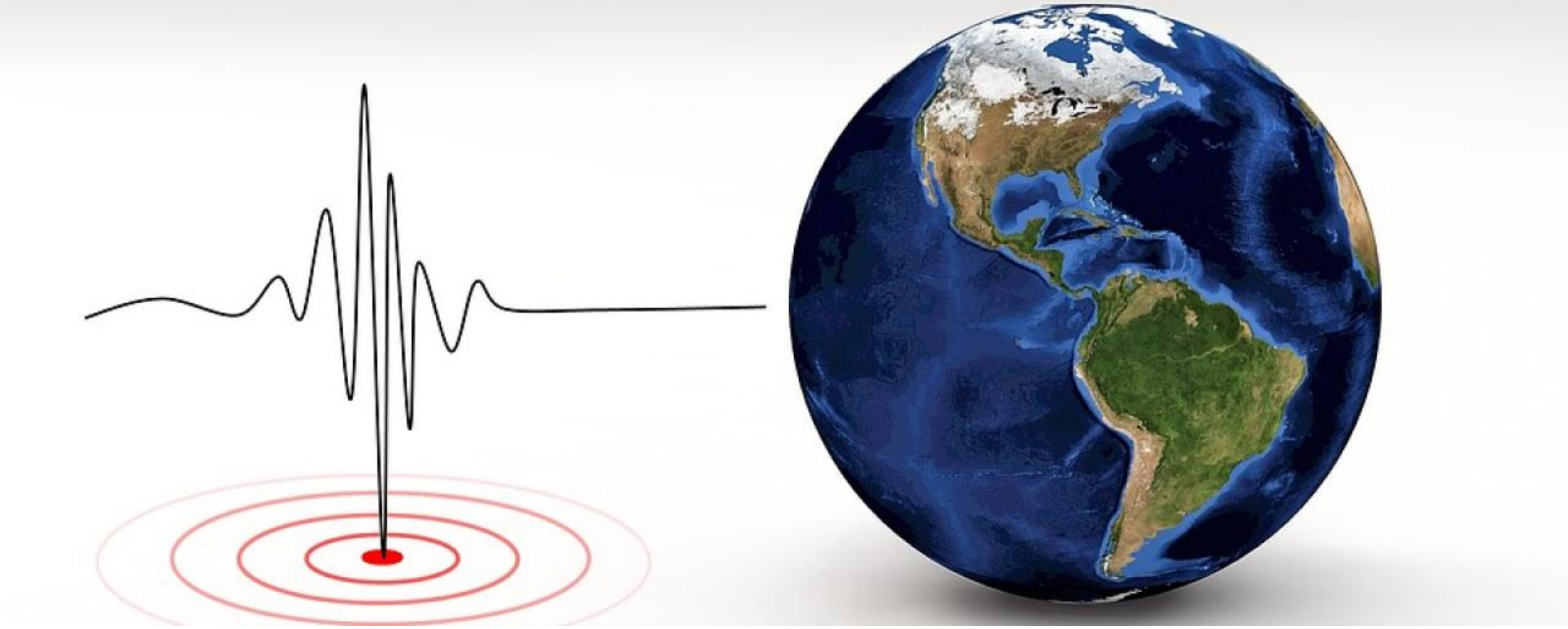

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Portable Device Can Save Lives After Natural Disasters

04/24/2018 - 10:28am

by Jennifer DeLaOsa

Sensors

After a natural disaster, finding trapped or missing people is no easy task. To help first responders or unmanned drones efficiently locate those in need, scientists have developed an inexpensive and portable sensor.

The study uses "compact and orthogonal sensor arrays to detect the breath- and skin-emitted metabolic tracers, such as acetone, ammonia, isoprene, CO_2, and relative humidity (RH), all together serving as sign of life."

Current method of detection include human-sniffing dogs and acoustic probes, but each has their

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downside. Oftentimes, canine units have limited availability, and acoustic signatures miss the silence of unconscious victims.

Chemical-sensing devices are promising, however, present gadgets are bulky, expensive, and can miss weak signatures. The new, palm-sized sensor array aims to fill that gap, and hopefully provide people with a fast and efficient avenue toward safety.

According to the research, the device "consists of three nanostructured metal-oxide sensors (Si-doped WO_3, Si-doped MoO_3, and Ti-doped ZnO), each specifically tailored at the nanoscale for highly sensitive and selective tracer detection along with commercial CO_2 and humidity sensors."

During human entrapment trials, the invention was able to detect small amounts of chemical signatures with high accuracy and precision at levels "unprecedented by portable sensors."

The next phase of development consists of more field tests, mimicking similar aftermath conditions following a disaster.

To learn more about this potentially life-saving design, read "Sniffing Entrapped Humans with Sensor Arrays," published in *Analytical Chemistry*.

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Homeland Security News Wire

Search & rescue

Portable device to sniff out trapped humans

Published 19 April 2018 Share |

The first step after buildings collapse from an earthquake, bombing or other disaster is to rescue people who could be trapped in the rubble. But finding entrapped humans among the ruins can be challenging. A new, inexpensive sensor is light and portable enough for first responders to hold in their hands or for drones to carry on a search for survivors.

The first step after buildings collapse from an earthquake, bombing or other disaster is to rescue people who could be trapped in the rubble. But finding entrapped humans among the ruins can be challenging. Scientists now report in the ACS journal *Analytical Chemistry* the development of an inexpensive, selective sensor that is light and portable enough for first responders to hold in their hands or for drones to carry on a search for survivors.

In the hours following a destruction-causing event, the survival rate of people stuck in the rubble rapidly drops, so it's critical to get in there fast. Current approaches include the use of human-sniffing dogs and

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acoustic probes that can detect cries for help. But these methods have drawbacks, such as the limited availability of canines and the silence of unconscious victims. Devices that detect a human chemical signature, which includes molecules that are exhaled or that waft off the skin, are promising. But so far, these devices are too bulky and expensive for wide implementation, and they can miss signals that are present at low concentrations. So, Sotiris E. Pratsinis and colleagues wanted to develop an affordable, compact sensor array to detect even the most faint signs of life.

ACS says that the researchers built their palm-sized sensor array from three existing gas sensors, each tailored to detect a specific chemical emitted by breath or skin: acetone, ammonia or isoprene. They also included two commercially available sensors for detecting humidity and CO_2. In a human entrapment simulation, the sensors rapidly detected tiny amounts of these chemicals, at levels unprecedented for portable detectors—down to three parts per billion. The next step is to test the sensor array in the field under conditions similar to those expected in the aftermath of a calamity.

— Read more in Andreas T. Güntner et al., "Sniffing Entrapped Humans with Sensor Arrays," *Analytical Chemistry* 90, no. 8 (30 March 2018) (DOI: 10.1021/acs.analchem.8b00237)

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Ideas, Inventions And Innovations

Tuesday, April 24, 2018

Handheld Device to Sniff Out Humans Trapped in Collapsed Buildings

Earthquakes are lethal natural disasters frequently burying people alive under collapsed buildings. Tracking entrapped humans from their unique volatile chemical signature with hand-held devices would accelerate urban search and rescue (USaR) efforts

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A new sensor could aid first responders in their search for survivors after buildings collapse.

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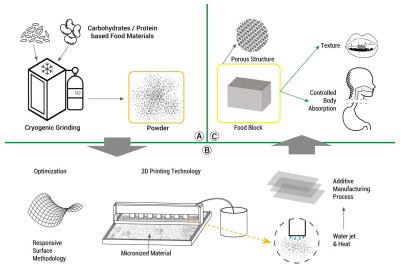

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The researchers built their palm-sized sensor array from three existing gas sensors, each tailored to detect a specific chemical emitted by breath or skin: acetone, ammonia or isoprene. They also included two commercially available sensors for detecting humidity and CO2. In a human entrapment simulation, the sensors rapidly detected tiny amounts of these chemicals, at levels unprecedented for portable detectors--down to three parts per billion. The next step is to test the sensor array in the field under conditions similar to those expected in the aftermath of a calamity.

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Contacts and sources:
Katie Cottingham, Ph.D.
The American Chemical Society

Citation: "Sniffing Entrapped Humans with Sensor Arrays"

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Opinion

Novel portable device can sniff out trapped human beings

Agencies | 2018-04-23 17:25:38.0

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London: Scientists have developed a light and portable sensor that can detect even the faintest signs of life, and could be used to rescue people trapped in rubble after an earthquake or bombing.

The first step after buildings collapse due to a disaster is to rescue people who could be trapped in the rubble. However, finding entrapped humans among the ruins can be challenging.

Scientists from ETH Zurich in Switzerland and

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University of Innsbruck in Austria developed an inexpensive, selective sensor that is light and portable enough for first responders to hold in their hands or for drones to carry on a search for survivors. In the hours following a destruction-causing event, the survival rate of people stuck in the rubble rapidly drops, so it is critical to get in there fast.

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Portable sensor array to detect trapped humans after a calamity

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April 18, 2018

The first step after buildings collapse from an earthquake, bombing or other disaster is to rescue people who could be trapped in the rubble. But finding entrapped humans among the ruins can be challenging. Scientists now report in the ACS journal *Analytical Chemistry* the development of an inexpensive, selective sensor that is light and portable enough for first responders to hold in their

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This Device Can Sniff Out Trapped Humans During Rescue

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Scientists have developed a light and portable sensor that can detect even the faintest signs of life, and could be used to rescue people trapped in rubble after an earthquake or bombing.

The first step after buildings collapse due to a disaster is to rescue people

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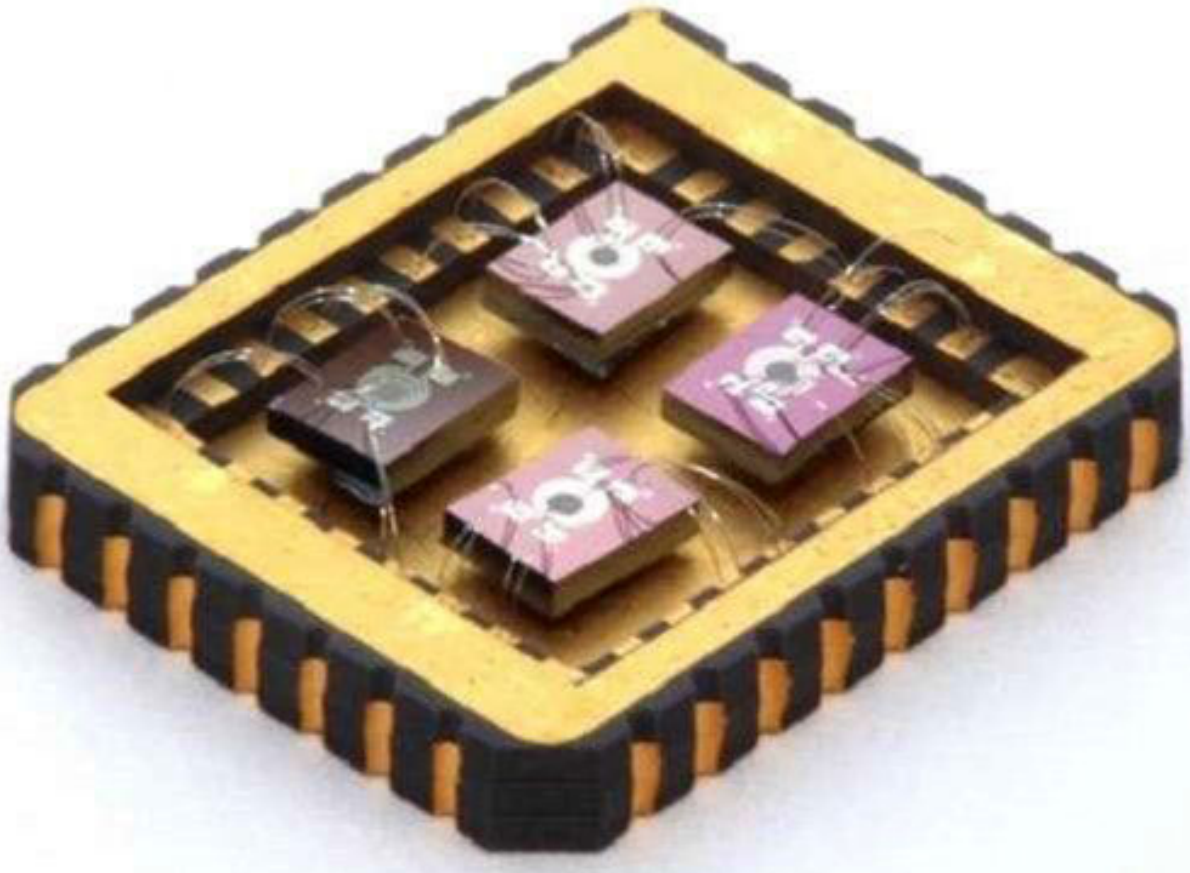
who could be trapped in the rubble. However, finding entrapped humans among the ruins can be challenging.



Scientists from ETH Zurich in Switzerland and the University of Innsbruck in Austria developed an inexpensive, selective sensor that is light and portable enough for first responders to hold in their hands or for drones to carry on a

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search for survivors. In the hours following a destruction-causing event, the survival rate of people stuck in the rubble rapidly drops, so it is critical to get in there fast.

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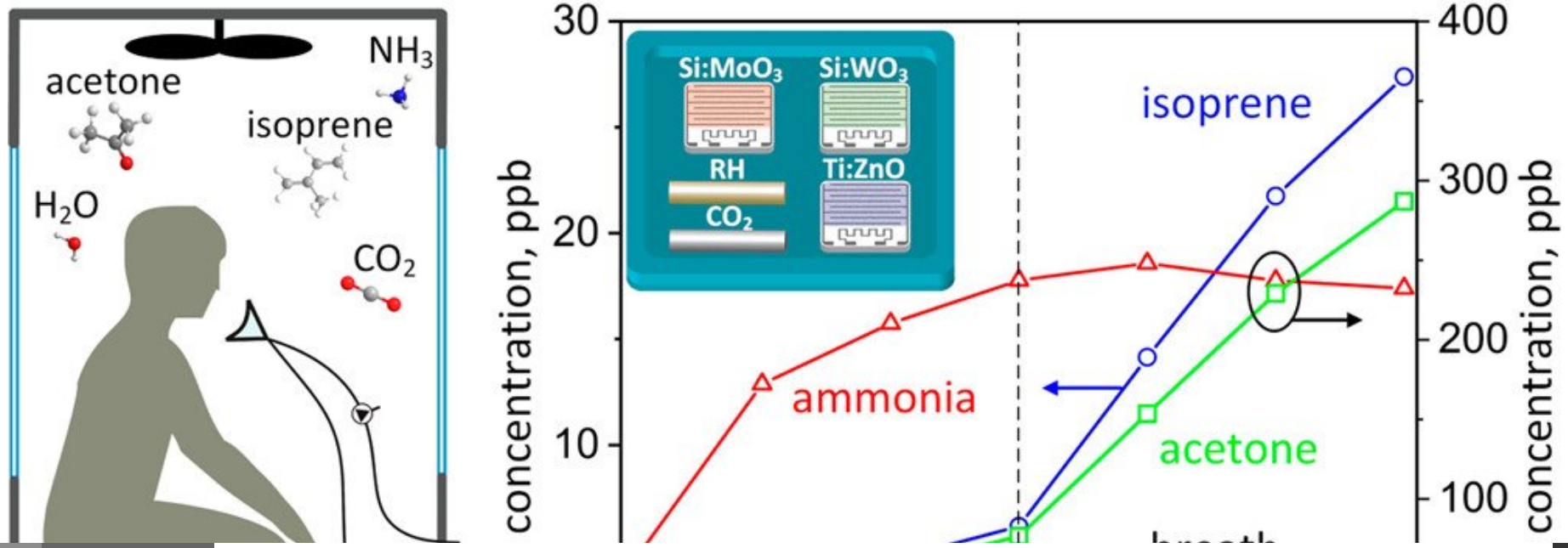

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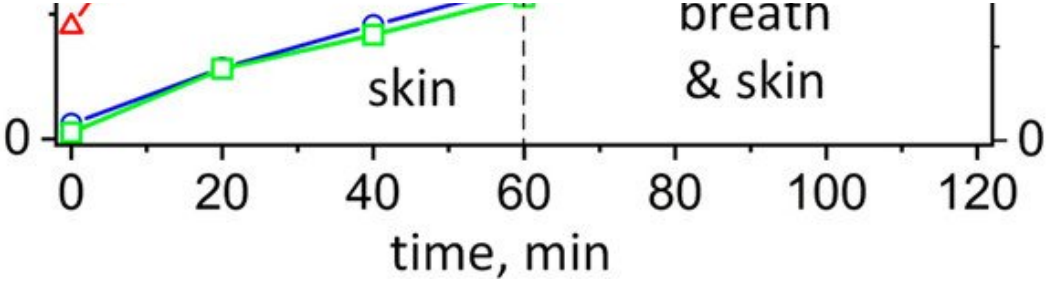

So far these devices are too bulky and expensive for wide implementation, and they can miss signals that are present at low concentrations, researchers said. They wanted to develop an affordable, compact sensor array to detect even the faintest signs of life, according to a study published in the journal Analytical Chemistry.

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the field under conditions similar to those expected in the aftermath of a calamity, researchers said.

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Sniffing Entrapped Humans With Sensor Arrays

05/01/2018 - 9:00am by Analytical Chemistry

Materials

The first step after buildings collapse from an earthquake, bombing or other disaster is to rescue people who could be trapped in the rubble. But finding entrapped humans among the ruins can be challenging. Scientists now report in the ACS journal *Analytical Chemistry* the development of an inexpensive, selective sensor that is light and portable enough for first responders to hold in their hands or for

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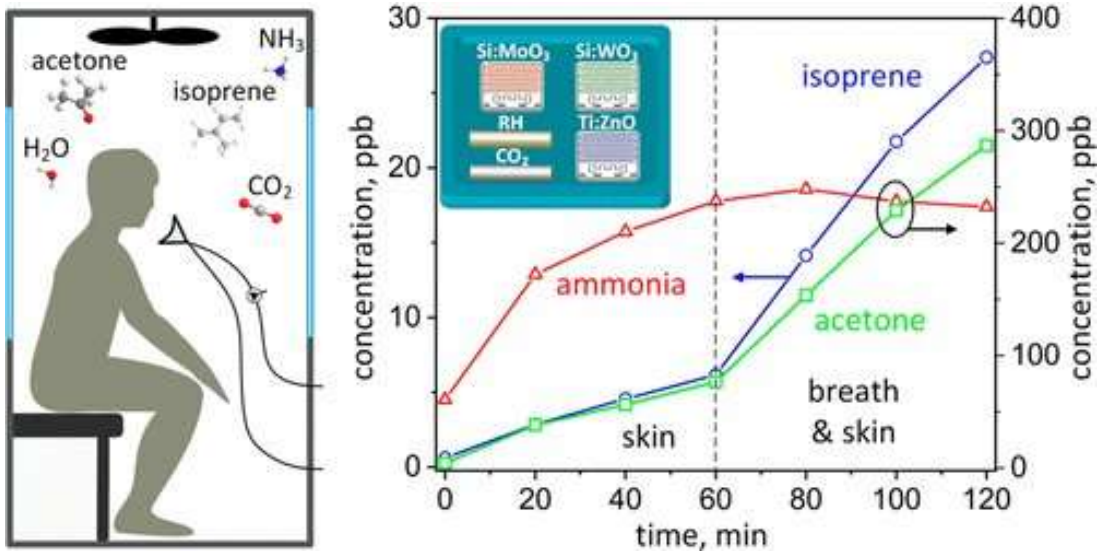
Portable device to sniff out trapped humans

April 18, 2018, American Chemical Society



Credit: American Chemical Society

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More information: Andreas T. Güntner et al. Sniffing Entrapped Humans with Sensor Arrays, *Analytical Chemistry* (2018). **DOI: 10.1021/acs.analchem.8b00237**

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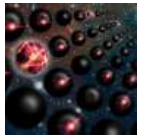
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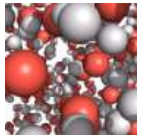
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Abstract

Earthquakes are lethal natural disasters frequently burying people alive under collapsed buildings. Tracking entrapped humans from their unique volatile chemical signature with hand-held devices would accelerate urban search and rescue (USaR) efforts. Here, a pilot study is presented with compact and orthogonal sensor arrays to detect the breath- and skin-emitted metabolic tracers acetone, ammonia, isoprene, CO2, and relative humidity (RH), all together serving as sign of life. It consists of three nanostructured metal-oxide sensors (Si-doped WO3, Si-doped MoO3, and Ti-doped ZnO), each specifically tailored at the nanoscale for highly sensitive and selective tracer detection along with commercial CO2 and humidity sensors. When tested on humans enclosed in plethysmography chambers to simulate entrapment, this sensor array rapidly detected sub-ppm acetone, ammonia, and isoprene concentrations with high accuracies (19, 21, and 3 ppb, respectively) and precision, unprecedented by portable sensors but required for USaR. These results were in good agreement (Pearson's correlation coefficients ≥0.9) with benchtop selective reagent ionization time-of-flight mass spectrometry (SRI-TOF-MS). As a result, an inexpensive sensor array is presented that can be integrated readily into hand-held or even drone-carried detectors for first responders to rapidly screen affected terrain.

Journal reference: Analytical Chemistry

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Portable Device to Aid Rescue Workers in Searching for Humans Trapped under Rubble

Posted **April 23, 2018**

The obvious first step after the collapse of buildings from an earthquake, bombing or other disaster is to rescue people trapped under the rubble. Doing so, however, can be quite complicated due to logistic and technological reasons.

As a contribution to solving the issues faced by rescue workers, a paper out in the American Chemical Society (ACS) journal *Analytical Chemistry* introduces an inexpensive, selective sensor which is light enough to be held in the palm of a hand or flown over the territory by a drone.

Given the rapidly dwindling survival rate of victims trapped under blocks of concrete and other debris, first responders currently use dogs to sniff out the scent of victims and acoustic devices capable of picking up on muffled cries for help.

Effective as they are, such methods leave much to be desired – the availability of rescue canines can be quite limited, and acoustic devices do not register victims who had been rendered unconscious.

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While devices attuned to the chemical signature of humans, such as the variety of molecules which leave our bodies during normal exhalation, hold significant promise in the future, they are typically too bulky, expensive, and lack the sensitivity to pick up on the relevant compounds at low concentrations.

To remedy the situation, Sotiris E. Pratsinis of the ACS developed a palm-sized sensor array from three existing gas sensors, each tailored to detect a specific chemical emitted by breath or skin: acetone, ammonia or isoprene.

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Provided field tests are successful, first responders could soon be saving a potentially grater number of human lives thanks to a light-weight, portable sensor capable of detecting an array of chemical compounds characteristic of the human body. Image credit: Chuck Simmins via Wikimedia.org, CC BY 2.0.

Improving the device further, Pratsinis and his team also equipped it with commercially available sensors for detecting humidity and CO_2.

During tests which simulate human entrapment scenarios, the system was found to work at a snappy pace and was able to detect the aforesaid chemicals even at levels (down to three parts per billion) virtually imperceptible to pretty much all other portable detectors.

With the proof of concept work completed, the team hopes to bring the array out of the lab and into the field to make sure its functionality is not reduced under real-world conditions following the aftermath of an urban disaster.

Source: acs.org.

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Portable Device to Sniff Out Trapped People

NEWS Apr 19, 2018 | Original Story from the American Chemical Society.

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Credit: Pixabay.

The first step after buildings collapse from an earthquake, bombing or other disaster is to rescue people who could be trapped in the rubble. But finding entrapped humans among the ruins can be challenging. Scientists now report in the ACS journal Analytical Chemistry the development of an inexpensive, selective sensor that is light and portable enough for first responders to hold in their hands or for drones to carry on a search for survivors.

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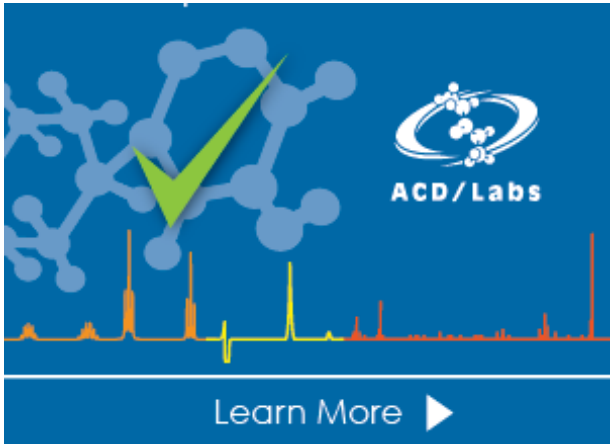
Reference

Sniffing Entrapped Humans with Sensor Arrays. Andreas T. Güntner, Nicolay J. Pineau, Paweł Mochalski, Helmut Wiesenhofer, Agapios Agapiou, Christopher A. Mayhew, and Sotiris E. Pratsinis. Anal. Chem., 2018, 90 (8), pp 4940–4945, DOI: 10.1021/acs.analchem.8b00237.



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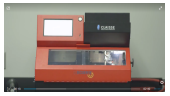

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DISASTER MANAGEMENT

Portable device to sniff out trapped humans

by Staff Writers
Washington DC (SPX) Apr 19, 2018

The first step after buildings collapse from an earthquake, bombing or other disaster is to rescue people who could be trapped in the rubble. But finding entrapped humans among the ruins can be challenging.

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Portable device can 'sniff out' humans trapped after quakes

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Finding survivors: A file photo of policemen looking for survivors after a building collapse in Kathmandu. | Photo Credit: Manish Swarup

Sensor detects chemical signatures like molecules exhaled or the waft off the skin

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