TECHNICAL INSIGHTS

SENSOR

TECHNOLOGY ALERT

22nd August 2014

1. BREATH ANALYSIS OF BLOOD GLUCOSE

At present, diabetics typically monitor blood sugar levels using devices that break the skin to obtain a blood sample. Driven by needs to reduce the discomfort, inconvenience, and time involved in glucose sensing for diabetics, considerable attention has been focused on achieving reliable, accurate, rapid non-invasive blood glucose monitoring of diabetes. The ability to effectively monitor blood glucose non-invasively has been a goal of, and valued by, diabetics. The development of effective non-invasive, inexpensive, easy-to-use breath analysis devices could advance and create new opportunities in self-monitoring of diabetes.

Furthermore, detection of volatile compounds in breath can be suitable for identification of diseases (such as diabetes, cancer, infectious diseases, food intolerance) at an early stage; although a breath sample can be difficult to analyze due to the complexity of volatile organic compounds (VOCs) in exhaled breath,

The breath of diabetics can include abnormal concentrations of acetone, with the concentrations rising gradually in accordance with an individual’s blood glucose level. The breath acetone of diabetics can have a "fruity" odor that can significantly increase with high glucose levels.

Moreover, the concentration of acetone in breath has been found to be a suitable marker of fat-burning during physical activity. The concentration of acetone in a person's breath turns out to be a good indicator of the rate of fat-burning while keeping the body healthy.

Reflecting ongoing opportunities in breath analysis for applications such as glucose monitoring of diabetes, US-based A&B Sensor Technologies, founded in 2009 by Anastasios Angelopoulos, associate professor, department of biomedical, chemical, and environmental engineering, University of Cincinnati, and Jonathan Bernstein, MD, professor of medicine, University of Cincinnati,

have achieved key progress in the development of a catalyst-based , non-invasive optical sensing device for non-invasive breath analysis of blood glucose in diabetics.

A&B Sensor Technologies aims to enable its inexpensive, portable detection device for detecting gaseous biomarkers and hazards to achieve instant, real-time results. The researchers, along with Adam Worrall, a Ph.D. engineering student at the University of Cincinnati, created a method for detecting low concentrations of harmful volatile organic compounds in the body. The approach uses perfluorosulfonic acid (PSA) polymer membranes as a catalyst, which shows color-coded chemical results, termed chemselective colorimetric reactions.

Such results could be highly suitable for home use as they are simple to comprehend. The lower the blood glucose level,, the less intense the color. As the blood glucose level rises and becomes elevated, the color intensity becomes greater. The company aims to create a color intensity chart for users to identify their specific levels of blood glucose in accordance with the catalyzed color.

PSA ionomers can be effective in the detection of acetone, formaldehyde and various anhydrides in the presence of resorcinol. Via visible light spectroscopy, the researchers can selectively detect unique products formed by the reactions, enabling them to determine how much exposure an individual has experienced. The researchers have been especially interested in detection of acetone in human breath as the basis for a blood glucose monitor.

The researchers had encountered obstacles, notably the presence of water. Water, the largest single compound in human breath, interferes with acetone measurement, as it absorbs into the PSA polymer membrane catalyst. The absorption can induce swelling and can interfere with the optically sensitive results. The researchers addressed this issue through the use of an additive that eliminates the effects of humidity on the reaction.

The researchers have developed an array of membrane sensing devices that can have application for non-invasive monitoring of diabetes and for assessing real-time environmental conditions impacting workplace or home safety. They have built a prototype and collected preliminary clinical data that demonstrates excellent blood glucose correlations in diabetics. Commercialization of the team’s handheld portable glucose monitor would

require addressing US Food and Drug Administration (FDA) clinical testing requirements.

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2. BIOMETRIC SENSORS TO ENABLE SAFER; EMPATHETIC VEHICLES

Automakers are increasingly interested in equipping vehicles with biometric sensors that can track a driver's biological responses, vital signs and determine a driver's stress, drowsiness, fatigue level, or distraction. Monitoring key biometric responses of the driver, such as blood pressure, respiration, heart rate, skin conductance (for example, sweaty palms), the driver's eyes (pupil) or other facial characteristics or head movement, can enable improved driver performance, reduce distraction and stress, and facilitate vehicle safety. It can also allow identification of particular areas of a highway or roadway that lead to increased driver stress. Information from such sensors can allow for initiating actions to reduce the driver's stress level, such as listening to relaxing music, reducing the temperature inside the vehicle, disabling the driver's cell phone, and so on.

Interest in sensors that enable empathic vehicles which are more attuned to the physical or emotional state of the driver is being driven by factors such as the increasing population of elderly or distracted drivers as well as advancements in mobile biometric sensing technology.

Combining and integrating information from the in-vehicle biometric sensors with information from other vehicle systems, such as driver assistance, steering, braking, collision avoidance, or vehicle speed, can help determine the driver's overall stress level.

It is vital that in-vehicle biometric sensors are accurate and immune to issuing false positives. Furthermore, such sensors should be able to be readily integrated with existing, associated vehicle systems, such as those mentioned above. Such sensors also should have a fairly rapid response time; be discreet and non-invasive so as not to further distract the driver; be adaptable to changes in the driver's attire, position, or driving style; be able to work with different drivers of the same car; and be relatively inexpensive.

An example of the key research and development activities for sensor-enabled empathic vehicles capable of detecting the onset of driver stress or anger is AutoEmotive, a research initiative from the Affective Computing group at US-based Massachusetts Institute of Technology's (MIT) Media Lab. The project's Audi test vehicle has used biosensors in door handles and the steering wheel to detect forceful grasping, sweat, and heart rate. With microphones that can detect pitch and volume changes in the driver's voice and strong touch interactions with the satellite-navigation system, the system can determine the stress levels of the driver. The biosensors can also help predict when the driver is close to a moment of rage and warn the driver by changing the color of lights around the dashboard. There has also been interest in conjunction with the project in the development of thermo-chromatic color-changing paint so a car could warn other drivers of an increasing stress level or distressed condition.

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3. GOLD COATING ENHANCES INFRARED GAS SENSORS

Infrared (IR) gas sensors or detectors operate based on absorption of infrared electromagnetic radiation (the infrared range covers electromagnetic radiation that is longer than the visible range but shorter than millimeter waves).

In IR gas sensors, an infrared source illuminates a volume of gas inside a sample chamber. The target gas absorbs some of the IR wavelengths as light passes through it. The concentration of the gas is measured by an optical detector; and the amount of IR absorption is related to the gas concentration.

In a passive infrared sensor, the sensor detects infrared radiation from an object in its field of view. Passive infrared sensing devices do not emit or radiate any energy for detection, but detect the IR energy by other objects. The active infrared sensor emits a beam of IR light (which for night vision applications can be in the near infrared spectral region) and gathers the reflected light waves. The active IR sensor requires an active signature to be received.

Active infrared sends out a beam of infrared light and gathers the reflected waves, whereas thermal devices record the current signatures of the devices based on their current heat pattern.

The sensitivity of an IR gas sensor is boosted by increasing the optical reflectivity of the sensor (the reflectivity of incident radiation), via, for example, increasing the reflectivity of the sensor's gas tube.

US-based Epner Technology, Inc., a high-tech engineering and specification plating company, with excellent proprietary optical coating technology, combines innovative plating techniques to significantly enhance the sensitivity and performance of passive or active IR gas sensors or IR gas analyzers, and yttrium aluminum garnet (YAG) lasers.

The process for IR gas sensors involves growing the gas cell around a highly polished mandrel (a tool or metal shaping form). First, a thin layer of proprietary, ultra-high reflective gold (98 at 800 nanometers and 99 at 2 micrometers) is electroplated onto the mandrel via Epner's proprietary Laser Gold® plating process. The electroplating of the first, gold layer is followed by a somewhat thicker, heavier layer of pure nickel plating, which provides the gas cell with structural strength. Then, the mandrel is removed, resulting in a stand-alone cylinder or cell lined with an efficient IR reflective surface.

The Laser Gold process provides a pure, hard, electrochemically-deposited gold coating, which combines the theoretical reflectivity and emissivity of gold with a surface that can be physically cleaned. The Laser Gold process has reportedly been the sole and single NIST (US-based National Institute of Standards and Technology) standard (#2011) for infrared reflective material, and has been specified on some of the US's most advanced military and space programs.

Epner's gold plating process enables IR gas sensors to achieve higher reflectivity, higher sensitivity, repeatability, and consistency of performance.

IR gas sensors using the Laser Gold process are used for measuring carbon monoxide or carbon dioxide, mainly for commercial applications.

The gold plating process is used in IR gas sensors or analyzers that are manufactured by various companies in the UK (including Servomex) and in the US (including Li-Cor). The gold plating process has also been used in infrared thermopile sensor-based ear thermometers.

Epner Technology, founded in 1910 and under third-generation family management, has deep and significant experience in high-tech plating and in infrared applications. Moreover, the company's gold-plating technique has been used on lamp-pumped neodymium-doped (ND) YAG lasers and can be used on diode-pumped YAG lasers.

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4. RECENT PATENTS IN THE FIELD OF BIOMETRIC SENSORS

According to the European Central Bank, in 2012, total fraudulent transactions using cards reached €1.33 billion (about $1.75 billion at the current exchange rate). In 2006, the United Kingdom reported that more than 290,000 passports were lost or stolen. This situation ultimately leads to identity theft. Biometric recognition systems are being used in airports to detect identity fraud; but sometimes because of the human error or machine error, the fraud gets unnoticed. With an increase in the number of frauds, it is very crucial for airport authorities and various organizations, such as banks to implement a device which can raise an alarm once the threat is detected.

From 1922, approximately 10,526 patents have been classified under alarm technologies, such as burglar alarms and fire alarms. Approximately 33,588 patents have been registered in the field of biometric sensing from 1976. From 2004, 37 patents have been purely focused on data authentication and theft detection using biometric sensing.

Biometric sensors are also being incorporated in various other devices, such as mobile phones for authenticating the user via fingerprints. Numerous companies are offering different types of biometric sensors that can be used for a wide range of applications. Apple has deployed a fingerprint sensor for the IPhone device. IDEX a Norway-based company is offering a film fingerprint sensor for smart cards, which can be used for withdrawing money from ATM machines.

A recent patent in biometric sensing (US20140210622) is for a portable theft prevention device that inlcudes sensors for movement detection and a biometric sensor and generates am alarm in response to the detection. Recent trends in biometric sensing suggest that both investors and inventors are focusing on applying the brakes to debit card fraud and identifying theft. In the future, fingerprint sensors are expected to be deployed in numerous smart cards used to withdraw money. They are also expected to be deployed in mobile devices for user authentication and in varied types of organizations to keep track of employees through a key fob which is used to enter and exit the building. Biometric sensing has garnered significant interest across various sectors and is expected to be a huge market in the future.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
PORTABLE THEFT PREVENTION DEVICE	31.07.2014; US20140210622	BAILEY LARRY	BAILEY LARRY	The present invention is directed to a portable theft prevention device that includes an outer shell/main body for housing a processor that is conventionally connected to an internal memory, one or more movement detection sensors, an alarm consisting of one or both of a speaker and an alarm light, an input unit, a biometric sensor, and a power source. The device functioning to detect movement and generate an alarm in response to the detection.
TECHNIQUES FOR BIOMETRIC AUTHENTICATION OF USER OF MOBILE DEVICE	12.06.2014; WO/2014/089576	CHAMTECH TECHNOLOGIES INCORPORATED	SCULLY-POWER, Paul	A method for biometric authentication of a user of a mobile device (110), and a case (100) for performing the method is provided. The method includes, by the case (100), coupling (300) the mobile device (110) to the case (100), receiving (310) from the mobile device (110) biometric data of the user of the mobile device (110) that was captured (306) by the mobile device (110), storing (312) the biometric data, receiving.(408) a request from the mobile device (11 0) for authenticating the user of the mobile device (110), the request including biometric data captured by the mobile device (110).
VEHICLE ACCESS AND SECURITY BASED ON BIOMETRICS	05.06.2014; US20140152422	Intelligent Technologies International, Inc.	Breed David S.	Method for interacting with a vehicle includes controlling interaction with the vehicle based on receipt of a signal by a component on the vehicle, and generating the signal based on biometric data entered via a portable communications device proximate the vehicle. The entered biometric data may be verified as biometric data of a driver of the vehicle prior to generating the signal. The biometric data may be a fingerprint, a palm print, a hand print, a facial image, and/or a voiceprint, all of which may be obtained using the communications device, e.g., a smartphone. The controlled interaction with the vehicle may be maintaining a brake lockout mechanism coupled to at least one brake of the vehicle in a locked state until the signal is received and/or maintaining at least one door of the vehicle in a locked state until the signal is received.
UNIVERSAL SECURE REGISTRY	29.05.2014; US20140149295	Weiss Kenneth P.	Weiss Kenneth P.	In one embodiment, a user device is configured to allow a user to select any one of a plurality of accounts associated with the user to employ in a financial transaction. In one embodiment, the user device includes a biometric sensor configured to receive a biometric input provided by the user, a user interface configured to receive a user input including secret information known to the user and identifying information concerning an account selected by the user from the plurality of accounts. In a further embodiment, the user device includes a communication link configured to communicate with a secure registry, and a processor coupled to the biometric sensor to receive information concerning the biometric input, the user interface, and the communication link. According to one embodiment, the processor is configured to generate a non-predictable value and to generate encrypted authentication information from the non-predictable value, the identifying information, and at least one of the information concerning the biometric input and the secret information, and to communicate the encrypted authentication information via the communication link to the secure registry.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
SYSTEM AND METHOD OF A SMARTCARD TRANSACTION WITH BIOMETRIC SCAN RECOGNITION	23.03.2014; US20140081857	Company, Inc. American Express Travel Related Services	Bonalle David S.	A method for facilitating biometric security in a smartcard-reader transaction system is provided. The method includes determining if a transaction violates an established rule, such as a preset spending limit. The method also includes notifying a user to proffer a biometric sample in order to verify the identity of said user, and detecting a proffered biometric at a sensor to obtain a proffered biometric sample. The method additionally comprises verifying the proffered biometric sample and authorizing a transaction to continue upon verification of the proffered biometric sample.
SISYSTEM AND METHOD FOR FRAUD PREVENTION	31.01.2014; WO/2014/015386	CHERRY, Peter	CHERRY, Peter	The present invention is directed to a data card. The data card includes a biometric sensor, at least one processor wherein the at least one processor is operable on contact by a user with said biometric sensor whereon said processor is adapted to obtain a reading from the biometric sensor to verify that the user is an authorised user and prohibit further card usage in the event that the user is not an authorised user.
System for biometric security using a fob	04.02.2010; US20100030633	Xatra Fund MX, LLC	Beenau Blayn W	The present invention discloses a system and methods for biometric security using biometrics in a transponder-reader system. The biometric security system also includes a biometric sensor that detects biometric samples and a device for verifying biometric samples. In one embodiment, the biometric security system includes a transponder configured with a biometric sensor. In another embodiment, the system includes a reader configured with a biometric sensor. The device for verifying samples compares the biometric samples with information stored on databases.

Exhibit 1 lists some of the patents related to biometric sensing.

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