TECHNICAL INSIGHTS

SENSOR

TECHNOLOGY ALERT

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1. SENSORS WITH HIGH-TECH BIO INKS

Blood glucose monitoring devices are used by both type 1 diabetics, who lack insulin, as well as type 2 diabetics, who have hyperglycemia (high blood sugar). Conventional methods of monitoring glucose levels require sticking the finger to obtain blood. The pain associated with the technique can deter patients from keeping regular track of their blood glucose levels. The University of California, San Diego, has developed temporary-tattoo-like sensors to monitor the glucose levels, but application of the device is limited to diabetes management. There is a need for a device that can be customized to perform different tasks or to detect different chemicals. In addition, the device should be easy to use and cost efficient.

To address the above challenge, researchers from the University of California, San Diego, have developed a new bio catalytic pen technology, based on novel enzymatic inks. The researchers have used ballpoint pens and filled them with high tech bio inks to draw the sensor on the skin or on different materials.

The researchers initially tested the bio ink by drawing a sensor directly on the skin to measure the glucose level. The enzymatic ink successfully reacted with the glucose and the electrode was used to record the measurements. The other ingredients used in the enzymatic ink are graphite powder for electrical conductivity, polyethylene glycol, which served as the binder, xylitol used to stabilize the ink, and chitosan helped the ink to stick to the surface. Depending on the chemical type, specific enzymes can be used in the ink to detect specific chemicals. The enzymatic ink can be used in a broad range of applications in the field and on site. With the help of enzymatic inks and ballpoint pens, anyone can draw a sensor easily, depending on the specific need; in addition, the device is cost efficient.

Post commercialization, the bio ink can be used on the skin to measure glucose. It is also expected to be employed for detecting pollutants and harmful chemicals. According to the researchers at the University of California, the pen contains enough ink to draw approximately 500 glucose sensor strips. With the help of the bio ink, anyone can make a customized sensor, depending on the need. It would be particularly useful for soldiers in the field, patients in their home and physician in the clinic. In the future the bio ink will be used on smartphones for personalized health monitoring and on the walls of buildings to monitor toxic gases. The researchers are currently working on identifying different applications for the bio ink.

The project was self-funded by the University of California, San Diego. At present, the researchers are using a potentiostat to read the sensor data. The researchers are currently working toward identifying different options to read sensor data effectively and accurately. In addition, they are also planning to connect the sensor wirelessly to investigate and monitor its abilities to perform in different conditions, such as extended exposure to sunlight and extreme temperatures.

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2. GAS SENSOR DEVELOPED USING MULTIPIXEL TECHNOLOGY

Indoor air quality plays a key role in the health of occupants in buildings. Airborne contaminants can be found inside rooms in colleges, offices, schools, movie theaters, auditoriums, and newly constructed sealed buildings. Volatile organic compounds, such as, carcinogens and compounds of carbon (excluding, for example, carbon monoxide) are found inside varied facilities. They cause health hazards such as eye irritation and headaches for older people, and particularly, children. There is a need for a device that can accurately monitor the indoor air quality in buildings and update occupants so that appropriate action can be taken to prevent health hazards. The system should be easy-to-use and cost effective.

To address the above challenge, a Switzerland-based company Sensirion has developed a gas sensor using multipixel technology.

Researchers from Sensirion have developed purportedly the smallest gas sensor with dimensions of 2.45 x 2.45 x 0.75 mm. The gas sensor is based on multipixel technology, which allows the sensor to perceive its surroundings using various receptors. In addition with the help of intelligent algorithms and state-of-the-art pattern recognition, the gas sensor is used to determine the concentration and different types of gases. It can also measure gases in one's breath. The sensors based on multipixel technology are high-performance sensors that can easily detect a complex mixture of gases in the near range. This sensor provides extremely reliable and accurate results with a high level of immunity even when environmental conditions vary greatly. The multipixel gas sensor can open up a broad range of applications; in smartphones, it will allow phones to act as alcohol breath analyzers and monitor air quality. The multipixel gas sensor can also be used in tablets and wearable devices.

The gas sensor can be deployed in homes, offices and other environments such as malls and theaters to monitor indoor air quality. The gas sensor will monitor the presence of gases, such as carbon monoxide and various volatile organic compounds. In addition, the gas sensor will also be used to determine the alcohol content in a person’s breath as well as different smells. In the future, the device can be used in different machines and in different places, such as hospitals. In addition, the researchers are also planning to expand its environmental sensing capabilities with the help of multipixel sensing technology.

The researchers at Sensirion are currently working on identifying different gases with the help of the multipixel gas sensor. The researchers are also identifying various places for deploying the gas sensors. The gas sensor, once commercially available, is expected to be commercialized by the end of the second quarter of 2015 and has opportunities to be well-received by manufacturers of smartphones, tablets, and wearables.

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3. MULTISENSORY CHIP FOR FUSING VOICE AND MOTION

Smartphones employ varied sensors to perform a number of operations, such as motion detection, scrolling, navigation, image sensing, and so on.. At present, a

major challenge facing the smartphone industry is drainage of the battery. Due to the number of chips involved, power drainage problems exist. There is a need for a multisensory chip which incorporates capabilities such as voice recognition and motion detection. In addition the device should consume less power, it should also be cost efficient, easy to use, and perform efficiently.

To address the above challenge, a North American company, Audience Inc., has developed the Audience N100 a multisensory processor that combines motion sensing and voice processing and recognition technology to provide a natural user experience to smartphone users.

The N100 multisensory processor is a combination of two different technologies from Audience. One of them is the VoiceQ technology for voice processing and recognition and the other is the MotionQ technology for motion sensing. The VoiceQ technology is a hands-free voice recognition technology that activates the device using a secure keyword and command the device for various operation processes using voice user interface. In low power mode, VoiceQ continuously listens to voice signals. Once the keyword is identified with the help of a voice detector, it enables the voice user interface to communicate with the user. The VoiceQ technology of N100 is designed to lower the false acceptance rates and preserve power. The MotionQ software is designed for outstanding context awareness with the help of advanced algorithms and power conscious architectures. In always-on mode, the N100 is designed to monitor the sensor continuously, deducing context from the mix sensor inputs. The N100 MotionQ is adjusted for the instruction set from the Audience with the aim of delivering best-in-class sensor fusion, sensor hub processing and auto-calibration.

The device will be used in smartphones as the additional chip or multisensory processor to take intelligent decisions based on the large amounts of sensor data as well as environmental conditions. The N100 multisensory processor will process the voice input and figure out real commands and false alarms to wake up smartphones. The N100 processor employs various intelligent technologies to save power. To wake up the smartphone, only the N100 chip and the microphone need to be awake to process voice inputs. The phone can be triggered with various voice inputs and the user can personalize the keywords to wake up their smartphones. Different sensors can be plugged into the platform to provide the new combination of smart sensors with better capabilities and contextual awareness. The developers will have access to the open source algorithm. Besides

smartphones, the N100 can be used in tablets, wearable fitness devices, smart and connected objects and the Internet-of-things.

The researchers are currently working on making the processor intelligent so that it can take decisions on its own; for instance, it can increase the volume of the phone if the user is standing in a noisy environment. In the future, the processor will go into the power saving or sleep mode when the phone is placed in the pocket of the user. This will be done with the help of an ambient light detector. The multisensory processor is expected to be commercialized with sample quantities in second quarter of 2015. Once the processor is successfully commercialized, it has opportunities to get a good response from smart phones manufacturers.

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4. RECENT PATENTS IN THE FIELD OF BIOMETRIC SENSORS

One of the most secure ways for user identity authentication is biometric identification. Biometric authentication systems are used to identify unique human behavioral and physiological characteristics, such as iris, vein, face, fingerprints and palm.

Authentication devices in consumer electronics, such as fingerprint identification, are enabling new business models, such as mobile commerce and pay as you go. The consumer should be assured about the security and authentication method of the device for mass adoption of mobile commerce. With the help of different biometric methods for secure and safe transactions, mobile commerce will achieve a high adoption rate.

Major consumer electronics market participants such as Google, Microsoft, and Apple, among those planning to integrate fingerprint authentication systems into mobile phones and tablets to prevent hacking. All the major mobile phone manufacturers are competing with each other to introduce devices with better authentication capabilities.

Biometrics has become an established technology, so the number of biometrics stakeholders is high. Stakeholders are rapidly identifying the emerging opportunities in consumer electronics and addressing the needs of customers.

A recent patent in biometric sensing, Display With Peripherally Configured Ultrasonic Biometric Sensor (WO/2014/197333), assigned to Qualcomm Incorporated, provides a pixelated display module that integrates ultrasonic fingerprint or biometric sensing capability.

The US has filed most of the patents in biometrics for the consumer electronics industries followed by Korea and Japan**.** In biometric identification, most of the patents are published in fingerprint sensing technology followed by voice recognition, face recognition and iris recognition technology. Biometric capabilities are poised to impact a wide array of industries, such as mobile phones, tablets, laptops, desktops, gaming and television. The smartphone industry is considered to particularly high potential and is expected to have a major share in biometrics for the consumer electronics market by 2015-17.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
Biometric Sensor Chip Having Distributed Sensor and Control Circuitry	11.12.2014; US20140361395	Apple Inc.	Bhagavat Milind S.	A sensor includes a sensor array formed on a first side of a substrate and at least one circuit operative to communicate with the sensor array formed on a second side of the substrate. At least one via extends through the substrate to electrically connect the sensor array to the at least one circuit. Placing the at least one circuit on the second side of the substrate allows the sensor array to occupy substantially all of the first side of the substrate.
DISPLAY WITH PERIPHERALLY CONFIGURED ULTRASONIC BIOMETRIC SENSOR	11.12.2014; WO/2014/197333	QUALCOMM INCORPORATED	DJORDJEV, Kostadin Dimitrov	Various techniques and apparatuses are disclosed that provide for pixelated display modules that integrate an ultrasonic fingerprint or biometric sensing capability. In some implementations, the ultrasonic fingerprint sensor and the display components of the display module may share a common backplane. In some implementations, the ultrasonic fingerprint sensor may share a flex cable with other components in the display module. In some implementations, the ultrasonic fingerprint sensor may leverage conductive traces on a cover glass used to provide for touch input to the display module.
SAFETY DEPOSIT COMPARTMENT WITH BIOMETRIC SENSOR	04.12.2014; US20140352580	Stradiota Julie	Stradiota Julie	A personally accessible storage unit includes a support structure, which is configured to house a safety deposit compartment slidably mounted within the support structure. The safety deposit compartment has a bottom surface and a plurality of surrounding side walls defining a storage area for a valuable article. A command panel is mounted on the exterior surface of the support structure and includes a biometric fingerprint scanner programmed to recognize the fingerprints of a user. A latch mechanism attached to the interior surface of the support structure is in communication with the

				fingerprint scanner and is engageable with the safety deposit compartment, based on input from the command panel. The unit also has means for providing electrical power to the command panel and the latch mechanism, which may include an electrical cord and plug and/or a battery. A storage unit having a hinged access panel is also provided.
IMAGING SENSOR AND METHOD FOR BIOMETRIC MAPPING OF FACIAL SKIN	27.11.2014; US20140347512	Toshiba America Electronic Components, Inc.	SETHI Rakesh	A diagnostic system for biometric mapping of facial skin includes a light filter a light sensor, a non-transient memory, a correlation processor, and an output unit. The light filter filters light reflected from an object to a filtered light signal. The light sensor receives the filtered light signal and generates a first electronic image signal representative of an image of the object in accordance with the filtered light signal. The memory stores a first electronic diagnostic signal representative of a predetermined mal-condition of the object. The processor determines a correlation between the first electronic image signal and the first electronic diagnostic signal, generates a correlation signal representative of a strength of the correlation, determines a diagnosis of the associated object based on the correlation signal, and generates a diagnosis signal in accordance with the diagnosis. The output unit generates a diagnosis result signal in accordance with the diagnosis signal.
MODULAR AUTHENTICATION DEVICE COMBINING BIOMETRIC AND RFID SENSORS	09.10.2014; US 20140304795			A modular identity authentication apparatus for a computer system includes at least two different authentication technologies, such as biometric fingerprint readers, NFC-RFID receivers, and BYOD sensors. Each modular apparatus provides multiple authentication sensors that are connected through a single port at a computer terminal location. System software permits terminal use when all module devices are authenticated, and shuts down the terminal whenever the module is disconnected.
FINGER BIOMETRIC SENSOR PROVIDING COARSE MATCHING OF RIDGE FLOW DATA USING HISTOGRAMS AND RELATED METHODS	18.09.2014; US 20140270420	APPLE INC.	BOSHRA MICHAEL	An electronic device may include a finger biometric sensor and a processor cooperating with the finger biometric sensor. The processor may be capable of determining enrollment finger ridge flow angles over an enrollment area for an enrolled finger, and determining match finger ridge flow angles over a match area for a to-be matched finger. The processor may also be capable of determining at least one likely match sub-area of the enrollment area by dividing the enrollment area into a plurality of regions and determining a respective enrollment ridge flow histogram for each region of the enrollment area, and determining whether the to-be matched finger matches the enrolled finger based upon the at least one likely match sub-area.

AGILE NON-CONTACT BIOMETRIC SENSOR	11.09.2014; US20140253711	ADVANCED OPTICAL SYSTEMS, INC.	Balch Michael Kevin	Exemplary embodiments include an agile non-contact biometric sensor apparatus, having a sensor that monitors a field of view for a user, an imaging system that captures one or more pieces of biometric information from the user, and a pan-tilt device that orients the imaging system to a location of the user in the field of view detected by the sensor.

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

Picture Credit: Frost & Sullivan

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