TECHNICAL INSIGHTS

SENSOR

TECHNOLOGY ALERT

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1. ULTRA-THIN OPTICAL BIOMETRIC SENSOR

A major problem in biometric-enabled smart phones is that they can potentially be hacked by copying the fingerprints. Commonly, biometric sensors in smartphones do not use high resolution to authenticate the fingerprint. This sensor just uses the first layer of the skin to authenticate the person's identity. The first layer of the skin can be easily copied, allowing the fraudster to gain access to the device; this will further compromise banking and mobile commerce applications. In 2012, according to a European Central Bank report, the total false trades using cards reached €1.33 billion (about $1.53 billion at the current exchange rate). There is a need for a device that can detect fraudulent transactions without any errors and provide accurate, reliable, and authentic results.

To address the above challenge, a Beijing-based company, VKANSEE Technology Inc. has developed an ultra-thin optical fingerprint sensor. According to sources at VKANSEE Technology, the firm has filed more than 10 patents in the unique pinhole imaging method. The firm's expertise in pin hole imaging, which is used to develop fingerprint sensors, will enable more secure identification, prevent hacking, and make it difficult for the fraudster to spoof the fingerprint.

The ultra-thin fingerprint sensors developed by VKANSEE Technology employs a thin optical sensor that is less than 1.5 millimeters. The device uses the pin-hole imaging technique to enhance the resolution of the fingerprint sensor. The surface of the device is made of glass. To detect and recognize biometric information; the device captures 2000 pixel per inch (PPI) images. This technique of capturing an image provides a third level of accuracy, which makes it difficult to hack the device. The device gathers the information about the finger and layers of the skin, such as epidermis and dermis. The high-resolution imaging technique of the device provides accurate authentication.

The ultra-thin fingerprint sensor is expected to be first deployed in smartphones and tablets. The technology can be further applied in various smart devices, such

as smart cards for authenticating bank transactions. It can also be expected to be deployed in the PIN entry of various banks, which will authenticate the user before initiating the transaction. The sensor can be easily deployed in existing security solutions. It can be used in large organizations to restrict or grant access to employees in highly secure areas. The biometric information of an employee or account holder in the bank will be stored in the device, which will make it more secure. The device is very fast and authenticates the user with a high level of efficiency.

The fingerprint sensor was self-funded by the company. To achieve brand awareness and visibility, VKANSEE Technology demonstrated the product at CES 2015. The company's next step is to provide potential prospects with the samples of their fingerprint sensor for their internal evaluation. VKANSEE Technology is expected to use the licensing based business model for major OEMs'. Recently, VKANSEE Technology has secured funding of $7 million from Aviation Industry Corp. of China. The funding will be used to produce 1000 units of the finger print sensor. The ultra-thin fingerprint sensor is expected to be commercialized or can be seen integrated in the smart devices in one years' time. Once the sensor is successfully commercialized, it will find application in consumer electronic products due to its capability for high authentication accuracy.

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2. LOW-COST ROBOTIC HAND

Robotic hands are gaining strong traction in the prosthetics industry. However, the robotic hands available in the market are high priced and beyond the reach of many. In addition, these hands are also heavy, making it difficult for users to utilize them for long periods of time. There is a need for a new type of robotic hand that is easy to use, and compatible with the wearer. In addition, the robotic hand should be cost efficient with low weight.

To address the above challenge, a UK-based firm called Open Bionics have developed a low cost and lightweight robotic arm. The robotic arm is comprised of flex sensors and silicon sheets as the elastomer material.

Researchers at Open Bionics have employed 3D printing to print the fingers of the robotic hand. Flex sensors are employed to determine joint movement or placement. In addition, silicon sheets are used in the lower part of the finger as the elastomer, while low-friction tubes with rigid phalanges are deployed for the

tender routing in the upper part of the finger. In addition, the researchers have also developed a disk-shaped differential mechanism to connect independent fingers. The fingers are connected together with the help of cables and servo motors. The differential mechanism will allow the finger in the robotic hand to work alone or in a group. A combination of low-thickness rubber and sponge-like material is deployed on the fingertips to provide high friction coefficient. For cables the Dyneema fishing line is used to handle high forces. The use of 3D printing has brought down the total cost of manufacture of the robotic hand. According to the researchers at Open Bionics the total ownership cost of the robotic hand will be approximately £1000, which is very low compared to the robotic prosthetic hands available in the market.

The low-cost robotic hand will be used for everyday applications such as affordable myoelectric prostheses or humanoid robots. It can be used as prostheses by amputees suffering from partial hand amputations. Various types of interfaces can be considered, depending on the different types of amputations, such as total number of fingers missing. One of the possibilities is a synergistic interface based on a flex sensor, which is used to record the motion of the fingers and predict the motion of the prosthesis. The electromyography (EMG) interface based on EMG sensors is used to control the robot fingers by using the EMG signals from the human forearm muscles.

The initial development of the robotic hand started with the project called Open Hand Project. The project was funded by National Instruments. The Open Hand Project also achieved the initial stages of the funding through the crowd funding campaign. A total of £44,328 was generated through crowd funding. Open Bionics recently grabbed the second place in the Intel Wearable Technology competition which helped them to secure funding amounting to $200,000. The project is now supported by Yale University USA, Cornell University USA, and National Technical University of Athens, Greece. Researchers at the firm are currently identifying different applications that can be enabled with the help of the robotic hand. The robotic hand is expected to be commercialized in one to two years' time. It is expected to be well received in the healthcare industry due to its cost efficiency and reliability.

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3. FLEXIBLE MAGNETIC SENSORS FOR VARIED APPLICATIONS

In the robotics, consumer electronics, and healthcare domains, there is a need to continuously develop advanced, cost-effective technologies that can enhance human machine interfaces while conforming to the size limitations of today's devices.

Researchers from the Leibniz-Institute for Solid State and Materials Research have developed a new ultra-thin, low cost, and lightweight magnetic sensor for a range of applications from robotics to healthcare. The technology equips humans with magnetic sense, enabling researchers to make use of flexible materials and printing technology to develop a new magnetic sensor, which is able to perceive the presence of dynamic and static magnetic fields.

Researchers from the Leibniz-Institute have developed a magnetic sensor on 1.4-micrometer-thick polyethylene terephthalate (PET) substrate. The researchers have fabricated the substrate using the lithography printing process, which is compatible with the substrate. The conductive silver paste without any heat treatment is used to develop the electrical pads on the substrate. The magnetic sensor developed by the researchers is less than two micrometers thick with a weight of only three grams per square meter. Without sacrificing performance and sensitivity, the sensor can withstand bending with radii of less than three micrometers. The magnetic sensor is ultra-thin and lightweight, allowing it to float on water.

The sensor is expected to be deployed as a touchless human-machine interaction platform for motion and displacement sensing which can be further utilized for functional medical implants or soft robots or for magnetic functionalities for on skin electronics. The ultra-thin robust magnetic sensor might also be used wearable**.** In addition, the magnetic sensor will also be used in consumer electronics, safety, and healthcare monitoring.

The project was self-funded by the Leibniz-Institute for Solid State and Materials Research. The research was supported by the University of Tokyo and Osaka University in Japan. The researchers are currently working on identifying the different applications where these magnetic sensors can be deployed. The project is expected to be commercialized in one to years' time. Once the project is successfully commercialized, it is expected to be used in robotics applications. The magnetic sensor is expected to be well received in the market due to its flexibility and thickness.

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4. RECENT PATENTS IN THE FIELD OF BIOMETRIC SENSORS

Biometric technologies identify, detect, and fight fraudulent activities. In the banking and financial services sectors, biometric technologies have witnessed enormous growth, helping to simplify the banking experience and enabling enhanced safety and security. The government and law enforcement sectors represent the key end-user segments for biometric technologies. Fundamental identification applications, such as passports, visas, and travel documents are key biometric applications in the government sector.

The different types of biometric authentication processes are fingerprint recognition, face recognition, iris recognition, voice recognition, and palm print recognition. Optical, capacitive, thermal, ultrasound, and 3D are the key sensors employed in different types of biometric recognition. Charged coupled device based palm print scanners, digital cameras, digital scanners, and video cameras are used to collect palm print images.

The biometric sensor market has been experiencing strong demand from the government, financial, retail, and IT sectors. With the growing threat of terrorist attacks and the need for efficient identification, biometric technologies are evolving, especially in security and surveillance applications. With the ubiquitous access of mobile devices, and integration of sensor-based biometric technologies and information and communication technologies, new applications such as e-gate and pay-as-you-go business models are emerging. Biometric sensors integrated with mobile devices, and increased mobility will offer on-the-spot authentication results in many applications.

The smartphones market is continuously evolving and smartphones will be used for E-commerce and bank transactions. There is a need for enhanced security to detect attempts at hacking of devices or gaining access to mobile phones by spoofing identity. With the Iphone 5s, Apple has integrated a fingerprint reader with the motive of enhancing security and improving usability. It is expected that with smartphones, biometrics will become a part of the daily lives of the global population.

A recent patent in biometric sensing powered by an array of sensors formed on both sides of the substrate (US20140361395) is assigned to Apple Inc. which has been classified under devices consisting of a plurality of semiconductor or other

solid-state components formed in or on a common substrate including semiconductor components sensitive to infra-red radiation, light, electromagnetic radiation of shorter wavelength or corpuscular radiation and specially adapted either for the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation.

In 2015, approximately 38 patents had been registered under biometric sensing. In total, approximately 30031 patents have been registered under biometric sensing. In which approximately 144 patents were registered in Africa which includes Egypt, Kenya, Morocco, and South Africa; approximately 20332 patents were registered by America which includes USA and Canada; approximately 4585 patents were registered by Asia-Europe which includes Bahrain, China, Eurasian Patent office, Estonia, European Patent office, Israel, Japan, Jordan, Portugal, Russian Federation, Singapore, Spain, Republic of Korea, Vietnam and United Arab Emirates. Many more patents have been registered under biometric sensing from different parts of the world.

Some of the participants investing in biometric sensing R&D include Samsung Electronics Co., Ltd., Apple Inc., LG Electronics INC, Intel Corporation, Qualcomm Incorporated, Synaptics Incorporated, Toshiba America Electronic Components Inc., Fitbit Inc., Korea Electrotechnology Research Institute, Sonavation Inc., STMicroelectronics (Research & Development) Limited, Sony Ericsson Mobile Communications AB, and Motorola Inc.

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	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.
DISPLAY WITH PERIPHERALLY CONFIGURED ULTRASONIC BIOMETRIC SENSOR	04.12.2014; US20140354596	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.

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.
BIOMETRIC MONITORING DEVICE HAVING A BODY WEIGHT SENSOR, AND METHODS OF OPERATING SAME	20.11.2014; US20140343443	Fitbit, Inc.	Yuen Shelten Gee Jao	A system comprising a biometric monitoring device including a housing including a platform to receive at least one foot of the user, a body weight sensor to generate body weight data, processing circuitry to calculate user weight data which corresponds to the user's weight, using the body weight data, and communication circuitry to: (a) receive user identification data which identifies the user or a portable activity monitoring device, and (b) transmit the user weight data to data storage associated with the user identification data. The system further includes the portable activity monitoring device including a housing having a physical size and shape that is adapted to couple to the user's body, a sensor to generate sensor data, and communication circuitry to receive physiologic data which is based on the user weight data, and processing circuitry to calculate activity data using the sensor data and physiologic data.
Multiple charge-coupled biometric sensor array	25.09.2014; US20140286547	Kim Moon J.	Kim Moon J.	Embodiments of the present invention relate to fingerprint scanning. Specifically, the present invention relates to a multi-sided fingerprint scanning device on a card (e.g., credit card, smart card, etc.), an associated energy-efficient method for attaining accurate fingerprint information using a multiple charge-coupled biometric sensor array. In a typical embodiment, a scanning device will be provided that includes a scanning area comprised of a set (e.g., at least one) of imaging pixel electrodes (e.g., arranged adjacent to one another in a grid-like or other fashion). As a user presses his/her finger against the scanning area, a portion of the finger will contact a plurality of electrodes. When this occurs, a voltage source of the device will apply a first voltage to each of the plurality of electrodes. A meter of the device will take a first electrical measurement (e.g., resistance and/or charged skin voltage) of the plurality of

				electrodes. The voltage source of the device will apply a second voltage to the plurality of electrodes. The meter of the device will take a second electrical measurement (e.g., resistance and/or charged skin voltage) of the plurality of electrodes. The voltage level difference between the first electrical measurement and second electrical measurement is calculated. The voltage level difference provides accurate fingerprint information.

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

Picture Credit: Frost & Sullivan

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