Sensor Technology (TechVision)

Biometric Sensors

Biometric Sensors Poised to Impact Consumer Electronics Domain

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FROST & SULLIVAN

Contents

Sensor Technology Innovations in Biometric Sensing

Large Area Fingerprint and Vein Sensor

FlexEnable and ISORG–Flexible fingerprint sensor for biometric authentication

Tech. Profile

Collaboration between FlexEnable and ISORG has led to the development of a large-area flexible fingerprint sensor. The researchers have employed an organic thin film transistor and deposited an organic printed photodetector on the substrate. The researchers were able to achieve an ultra-thin, lensless, robust and light sensor. Large area sensors help to reduce the false rejection rate and improve security.

Wide-scale Adoption

The thin and flexible large area fingerprint sensor can be deployed on any surface from wearable devices and consumer electronics to automotive and also in smart ATM cards. The large area fingerprint sensor is expected to be commercialized over the near-term.

Market Opportunity

The dominance of consumer electronics companies indicates the high potential of biometrics in consumer devices, such as smartphones and tablets. For example, the technology could enable a mobile device whose surface would know who is holding or touching it.

Competing Aspects

Compared to silicon area sensors, large area plastic fingerprint sensors are much more cost efficient and thin. In addition, the large area helps to extract the information of not only fingerprints, but also gain information about the veins configuration providing greater accuracy and security .

Technology Convergence

Biometric technologies, coupled with cloud computing, will open up new opportunities for growth. The biometric template database can be stored in the cloud, enabling low latency authentication programs.

Innovation Attributes

- ✓ 0.3mm thick
- ✓ Operates in visible and near infrared up to wavelength of 900 nm
- ✓ 1048576 pixel resolution

Market Entry Strategies

The companies are seeking collaboration with industry partners in consumer electronics. At present, the company's main focus is consumer electronics but it is also open to partnerships with automotive and banking and financial services companies.

Technology Readiness Level 1 2 3 4 5 6 7 8 **9**

Optical Fingerprint Sensor

Vkansee–Thinnest optical sensor for Biometric authentication

Tech. Profile

VKANSEE Technology Inc. has developed an ultra-thin optical fingerprint sensor that is less than 1.5 millimeters thick. 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 images in 2000 dpi (dots per inch) resolution and can capture 2,0000 pixels per inch.

Competing Aspects

The device captures an image with a third level of accuracy, which makes it difficult to hack it. 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.

Wide-scale Adoption

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.

Market Opportunity

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.

Technology Convergence

With ubiquitous access of mobile devices, and integration of sensor-based biometric technology and information and communication technology, new applications such as e-gate and pay-as-you-go business models are emerging.

Innovation Attributes

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, can enable more secure identification, prevent hacking, and make it difficult for the fraudster to spoof the fingerprint.

Market Entry Strategies

VKANSEE Technology is expected to use the licensing based business model for major OEMs. At the end of 2014, VKANSEE Technology secured funding of $7 million from Aviation Industry Corp. of China. The funding will be used to produce 1000 units of the fingerprint sensor.

Polysilicon- and Heat Transfer-Based Fingerprint Sensor

Next Biometrics–Flexible fingerprint sensor

NEXT BIOMETRICS

Tech Profile	Competing Aspects	Innovation Attributes	Market Entry Strategies
Next Biometrics has developed a flexible biometric sensor with the help of low-temperature polysilicon. In addition, the fingerprint sensors work on the active thermal sensing principle which measures the response when a heat pulse is applied to the sensor pixel over a short period of time.	○ Cost Efficient ○ Easy mass production ○ Large Area ○ Robust ○ High-performance analog signal processing ○ A large, different response for pixels near the finger's ridge or valley ○ Robust, uniform polysilicon	✓ Thin ✓ Flexible ✓ Application-Specific Integrated Circuit ✓ Compatible with large-area production processes, such as low-temperature polysilicon production ✓ Simplicity of pixel design	NEXT Biometrics is focusing on markets such as payment terminals, door locks, time, attendance and many more. The company is also focusing on the consumer electronics domain.

Technology Readiness Level 1 2 3 4 5 6 7 8 9

Impact & Opportunities

Wide-scale Adoption

Cost efficiency will help the company to get down to mass market acceptable price levels

Market Opportunity

Next Biometrics has an opportunity in the smart home and smart cards markets.

Technology Convergence

The technology can help drive trends toward more ubiquitous sensing, the quantified self, and Internet-of-Things connectivity.

Optical Coherence Tomography-based Fingerprint Sensor

The Langevin Institute, Paris, France–Internal imaging fingerprint sensor

Tech. Profile

- Researchers have developed a fingerprint sensor based on optical coherence tomography that provides 3D images.
- The device is able to penetrate deep inside the finger, to gather information about the finger and the layers of the skin.

Innovation Attributes

- The system can image sweat pores/ducts for
- additional information and authentication.
- Full field tomography does not require sophisticated
- data processing
- Less vulnerable to tampering or fooling
- New feature will block unwanted specular reflections

Technology Readiness Level

1 2 3
4 5 6
7 8 9

Competing Aspects

Offers accurate information by gathering internal, below-the-surface information about the finger and layers such as dermis, epidermis, root of nail, nail matrix, nail bed, distal phalanx, underlying flat bed, and the entire blood flow and bone structure.

Market Entry Strategies

This technology can be most readily applied to border patrol or law enforcement applications

Impact & Opportunities

Wide-scale Adoption

It is expected to be commercialized over the relative near-term.

Market Opportunity

The technology will, at least over the near term, be driven by security applications:

✓Border patrol

✓Law enforcement

Technology Convergence

Biometric sensors integrated with mobile devices, and portable biometric devices, dovetail with the increased mobility trend and offer on-the-spot authentication results, which is crucial in many applications.

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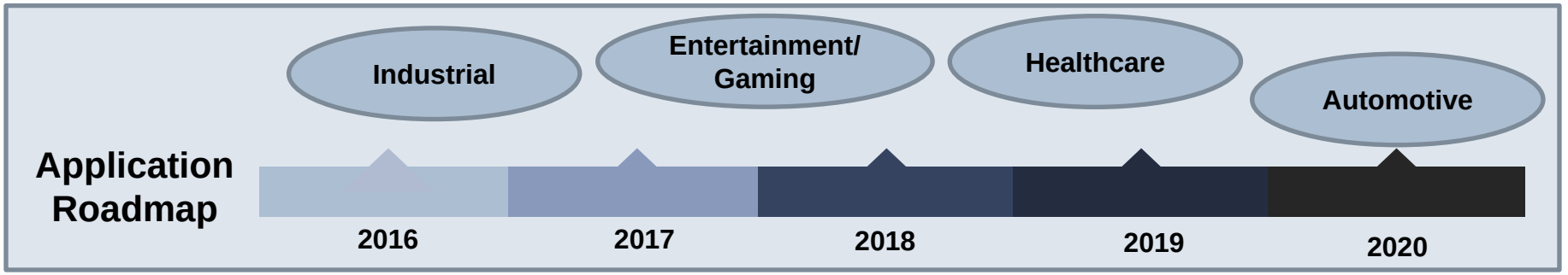
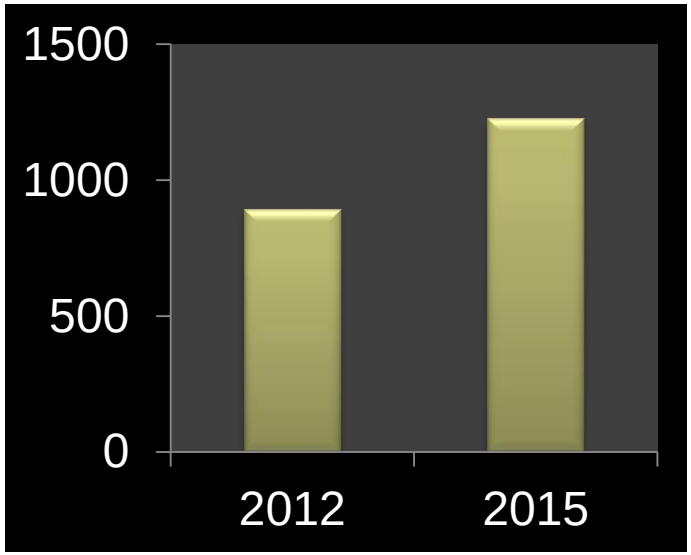
Strategic Insights

Strategic Insights



Intellectual Property (IP)



- Major companies that are own patent in biometric sensing are headquartered in APAC.
- The dominance of consumer electronics companies indicates the high potential of biometrics in consumer devices, such as, smartphones and tablets.
- In the last 4 years (2012 to 2015), the highest number of patents have been published in the United States.
- Most of the patents in fingerprint sensing have been published in Japan from 2004 onwards, but there has been a marked dip in patent applications in the last 4 years.
- Early adoption of biometrics happened in Japan, for applications such as banking, and now other countries are adopting the technology.

Strategic Insights

Drivers

- ✓ New product development
- ✓ Strong R&D efforts
- ✓ Better visualization
- ✓ Enhanced user experience
- ✓ High application scope
- ✓ Advancements in smart materials
- ✓ Technology advancements
- ✓ Environmental friendly solutions
- ✓ Increase in demand for products

Restraints

- Ẋ Higher System Cost
- Ẋ Technological challenges in capturing and processing of data can pose significant challenges in the short term. However, technological advancements are expected to reduce the impact in the long term.

Funding

- Government organizations are actively funding biometric projects, which have the potential to enhance national security, as well as the identification and tracking of individuals.
- EU invested about €4.4 million (about $4.8 million at the current exchange rate) in the Trusted Biometrics under Spoofing Attacks (TABULA RASA) project, which was used alongside a €1.6 million (about $1.75 million) investment by the consortium. The project, from 2010 to 2014, has aimed to address some issues of direct (spoofing) attacks on trusted biometric systems.
- The EU INGRESS project, from 2013 to October 2016, with a total cost of about €4.25 million (about $4.65 million at the current exchange rate).

Focus Areas

- Pay-as-you-go
- Analytics
- Image Sensors
- Information and Communication

The 2020 Scenario

- ❑ Despite several advantages, wide-scale adoption of biometric technologies for security applications, such as facial recognition and target detection, can only be facilitated by their ability to provide portable, timely, and highly accurate recognition of facial features or furtive targets in unpredictable or uncontrolled situations, and with greater speed. With significant cost reduction, biometrics can be implemented in passenger cars.
- ❑ The government and law enforcement sectors represent key end-user segments of biometric technologies. Law enforcement or defense/ military applications, such as criminal and forensic investigations, cross-border control, security surveillance, illegal immigrants, immigration services, and fundamental identification applications, such as national IDs or student IDs, passports, visas, and travel documents, are key biometric applications in the government sector.

Key Patents and Industry Interactions

Key Patents

No.	Patent No.	Publication Date	Title	Assignee
1	**EP2973362**	20.01.2016	METHOD FOR COLLECTING AND SECURING PHYSIOLOGICAL, BIOMETRIC AND OTHER DATA IN A PERSONAL DATABASE	ELLIPSON DATA LLC
	A computer based method includes collecting biometric, physiological and other local data from one or more sensors or medical devices, including physiological data and/or conditions of a person. Remote data is collected including treatment information provided by a physician, and data obtained from various data transmitting sources such as RFID fitted pill dispensers, medication dispensers, intra body devices, medical data sensors and medical apparatus. All the data is preferably obtained in real time and stored in an encrypted database which is either maintained in a local data storage device or in a remotely located secure database. Control and access to any or parts of the data collected is controlled by the person, preferably secured using biometric information, so each individual person can maintain control over the collected information, and prevent inadvertent disclosures to persons without a need to know.			
2	**US20160012217**	14.01.2016	MOBILE TERMINAL FOR CAPTURING BIOMETRIC DATA	BUNDESDRUCKEREI GmbH.
	The disclosure relates to a mobile terminal for capturing the biometric data (BD) of a user. The terminal comprises: a data storage unit having a credential (C); an authentication module; a sensor for capturing the bio-metric data of the user; a control unit that is configured to capture the bio-metric data (BD) of the user automatically or semi-automatically by means of a sensor only upon successful, reciprocal authentication of the user and the mobile terminal; a test unit for automatic testing of the authenticity of the biometric data captured. The control unit is configured to store the biometric data captured in the data storage unit in protected form only then, when the biometric data captured is authentic according to the test. The authentication module (**304**) is configured to authenticate an operator to the mobile terminal by means of additional authentication data (AD**3**) attributed to the operator. The control unit is configured to enable the readout of the biometric data that is stored in protected form for transmission of the biometric data read to a security document, only if the operator has been authenticated successfully.			

Key Patents (continued)

No.	Patent No.	Publication Date	Title	Assignee
3	**US20160012249**	14.01.2016	METHOD FOR COLLECTING AND SECURING PHYSIOLOGICAL, BIOMETRIC AND OTHER DATA IN A PERSONAL DATABASE	ELLIPSON DATA LLC
	A computer based method includes collecting biometric, physiological and other local data from one or more sensors or medical devices, including physiological data and/or conditions of a person. Remote data is collected including treatment information provided by a physician, and data obtained from various data transmitting sources such as RFID fitted pill dispensers, medication dispensers, intra body devices, medical data sensors and medical apparatus. All the data is preferably obtained in real time and stored in an encrypted database which is either maintained in a local data storage device or in a remotely located secure database. Control and access to any or parts of the data collected is controlled by the person, preferably secured using biometric information, so each individual person can maintain control over the collected information, and prevent inadvertent disclosures to persons without a need to know.			
4	**US20150379250**	31.12.2015	SECURE BIOMETRIC VERIFICATION OF IDENTITY	IVI HOLDINGS LTD.
	A high security identification card includes an on-board memory for stored biometric data and an on-board sensor for capturing live biometric data. An on-board processor on the card performs a matching operation to verify that the captured biometric data matches the locally stored biometric data. Only if there is a positive match is any data transmitted from the card for additional verification and/or further processing. Preferably, the card is ISO SmartCard compatible. In one embodiment, the ISO SmartCard functions as a firewall for protecting the security processor used for storing and processing the protected biometric data from malicious external attack via the ISO SmartCard interface. In another embodiment, the security processor is inserted between the ISO SmartCard Interface and an unmodified ISO SmartCard processor and blocks any external communications until the user's fingerprint has been matched with a previously registered fingerprint. Real-time feedback is provided while the user is manipulating his finger over the fingerprint sensor, thereby facilitating an optimal placement of the finger over the sensor. The card may be used to enable communication with a transactional network or to obtain physical access into a secure area.			

Industry Interactions

Jason Chaikin

CEO, VKANSEE Technology Inc., 110 Wall Street
New York, NY 10005.
Phone: +1-646-578-8858.
E-mail: jchaikin@vkansee.net
URL: http://vkansee.com/

Chuck Milligan

CEO, FlexEnable Limited, 34 Cambridge Science Park, CB4 0FX, UK.
Phone: +44-0-1223-707393.
E-mail: chuck.milligan@flexenable.com

Tore Etholm-Idsøe

CEO, NEXT Biometric, 1100 112th Ave NE,
Suite 340,
Bellevue, WA 98004.
Phone: +47-922-32-439.
E-mail: tore.idose@nextbiometrics.com
URL: http://nextbiometrics.com/

Arnaud Tourin

Director, The Langevin Institute, Paris, 1 rue Jussieu, 75238 Paris Cedex 05, France.
Phone: +33-0-1-80-96-30-63
E-mail: arnaud.tourin@espci.fr
URL: https://www.institut-langevin.espci.fr/home