Ethentica and TactileSense™

A Breakthrough in Fingerprint Authentication

The explosion of on-line information, electronic transactions and remote communications has driven the need for secure and cost-effective user identification methods. While passwords and PINs (Personal Identification Numbers) are the standard gatekeepers for a wide variety of information, their inherent lack of security and rising administration costs make them an inadequate solution for widespread user identification.

The growth of the Internet as a foundation for communications has created an even greater need for user identification and authentication. High-value applications such as on-line banking, Internet-based transactions and remote access to sensitive enterprise information all create high security risks for users and organizations. The need to provide non-repudiated user identification that fits into today's evolving Internet infrastructure is critical for the success of on-line ventures.

Fingerprint security has emerged as a leading alternative to passwords and PINs. Fingerprint security has long been used to verify identity. However, current approaches are plagued by critical obstacles that keep this method a niche solution. Optical sensors are the most common method of fingerprint identification, but are also typically costly, large and unreliable. Silicon chip sensors are smaller and more accurate than optical sensors, but are prone to failure from environmental contaminants and long-term use. Additionally, their design architecture brings limitations in providing long-term cost efficiencies.

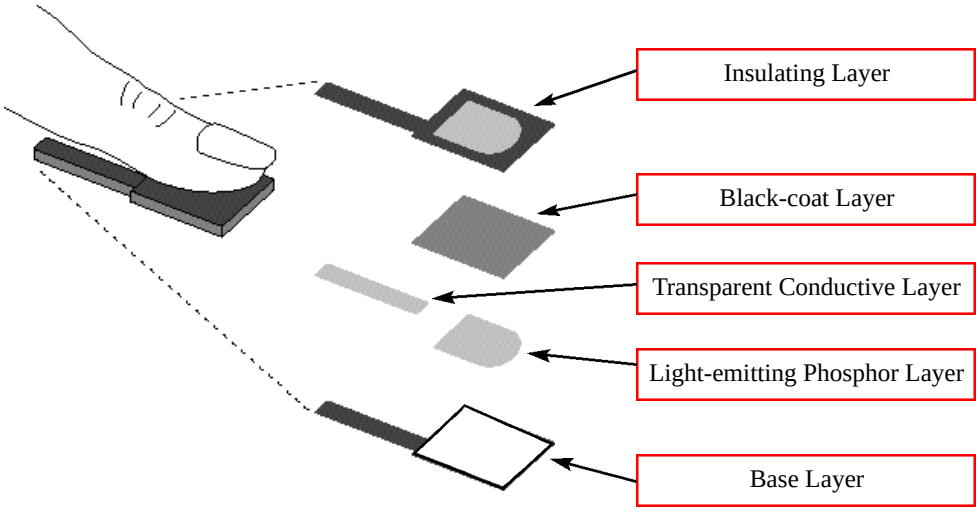
Ethentica's breakthrough technology overcomes the challenges facing previous fingerprint security systems. TactileSense™, a patented, light-emitting polymer, is the basis for Ethentica's suite of electro-optical devices that promises to deliver tremendous efficiencies in cost, size, reliability and accuracy. TactileSense delivers the next-generation sensing technology that will bring fingerprint security to mainstream applications.

Verified with TactileSense™

TactileSense™

TactileSense allows companies to integrate fingerprint-based security into existing products while opening up a range of new alternatives for personal security products. Without the need for a light source, the TactileSense polymer generates an image of the fingerprint patterns, identifying the unique characteristics that link it to an individual. TactileSense transforms the ridges, loops and whorls of a fingerprint into an optical image pattern. This pattern is captured as an image by a custom designed sensor, then transformed from an optical image into digital code.

The TactileSense polymer consists of several layers. First, an insulating layer protects the inner layers of the sensor from contaminates. The inner layers are comprised of a black-coat layer, a transparent conductive layer that supplies current, a light-emitting layer that acts as the illuminator and a base layer that allows TactileSense to adhere to another surface device.



TactileSense T-FPM

Partnership with Ethentica and Philips

The next generation of TactileSense products promises to provide even greater cost savings, size efficiencies and reliability. Ethentica has partnered with Philips FDS (Flat Display Systems), a division of Philips Corporation, to develop and market TactileSense T-FPM, a line of flat fingerprint sensors, embedded in glass, for portable computing and consumer electronics products.

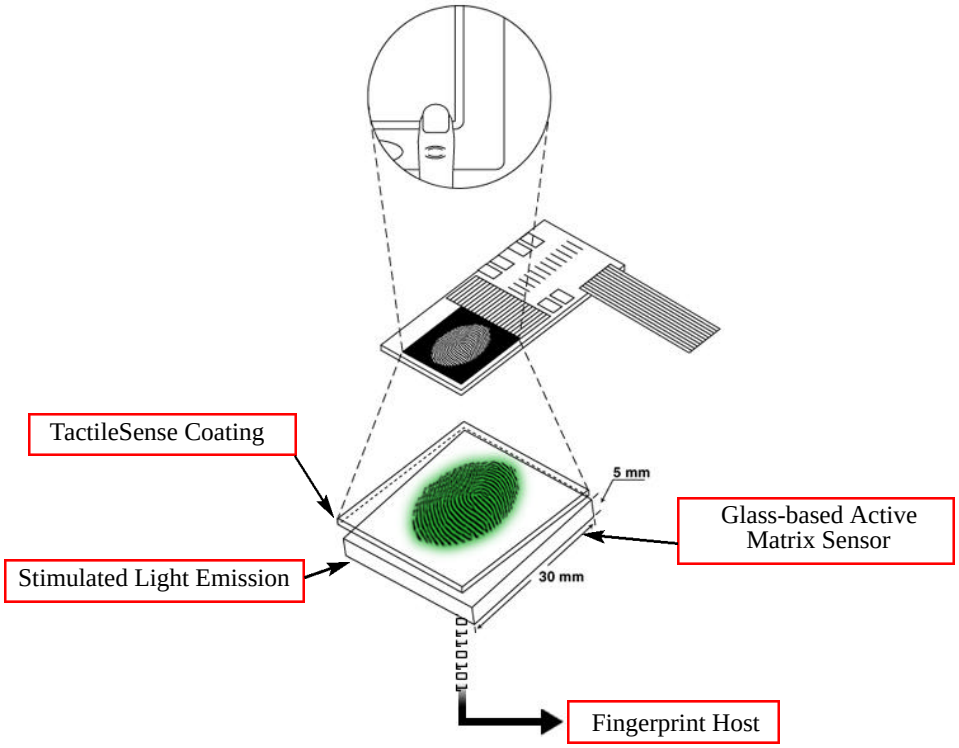
With TactileSense T-FPM, the TactileSense polymer is the touch surface layer between the glass and the user's finger. An amorphous silicon chip sensor is embedded in the glass. The sensor will be manufactured by Philips in a process that brings TactileSense together with flat panel display technology. This results in a slim profile (less than 1/8" thick), low-cost fingerprint sensor that can be integrated into displays on notebook computers, cell phones, handheld systems and other devices.

TactileSense T-FPM will provide even more effective fingerprint security and significant benefits over other approaches. The size of the touch area on the glass surface can be altered, allowing the manufacturer to determine the ideal size required for the fingerprint security application. Silicon-based alternatives have minimum size requirements based on the size of the chip design and requirements for a larger touch area would result in significantly higher costs, as the cost of the touch area is directly proportional to the size of entire chip surface.

Future products based on TactileSense will also be embedded into other products and materials (e.g., PC cards, mice, keyboards, joysticks, smart cards, etc). These products will provide low-cost, one-to-one fingerprint security methods for portable authentication.

TactileSense T-FPM (cont.)

TactileSense T-FPM consists of the following components:



Here's how it works:

- The finger contacts the thin, light-emitting TactileSense polymer.
- TactileSense creates an illuminated image.
- A photodiode array embedded in the glass detects the illumination.
- The image is translated into digital format by the electronics embedded into the glass.
- Image data is transmitted to the device hosting the fingerprint security application for enrollment or verification.

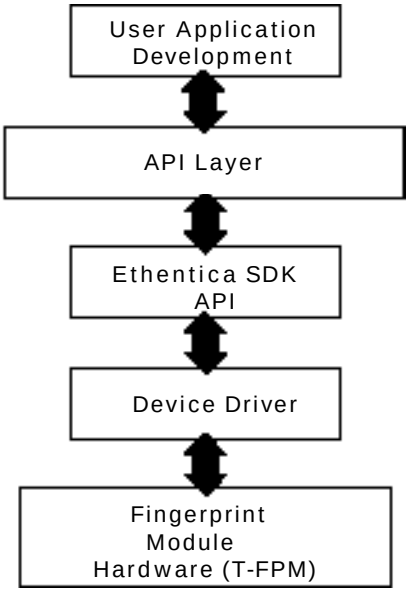
Software Architecture

The TactileSense software architecture provides a flexible framework to incorporate fingerprint security into new products or an existing environment. The Ethentica software architecture can be used to create a simple solution or a highly customized deployment of fingerprint security technology.

Ethentica has forged partnerships with key software vendors to provide a development environment that supports industry standard software platforms. In addition, Ethentica is at the forefront of establishing standard software protocols and APIs that will be the foundation for the fingerprint security industry. These standards will provide the basis for integrating fingerprint security into existing and new products.

The Ethentica software architecture consists of:

- **User Application Development** Gives customers the ability to write applications that will enroll and verify users
- **Application Programming Interface (API) Layer** Supports BIO API which includes HAAPI and BAAPI
- **Ethentica Software Development Kit (SDK)** Includes a Ethentica developed API as well as sample code
- **Device Driver** Software that acts as an interface between fingerprint module hardware and a specific operating system and communications channel

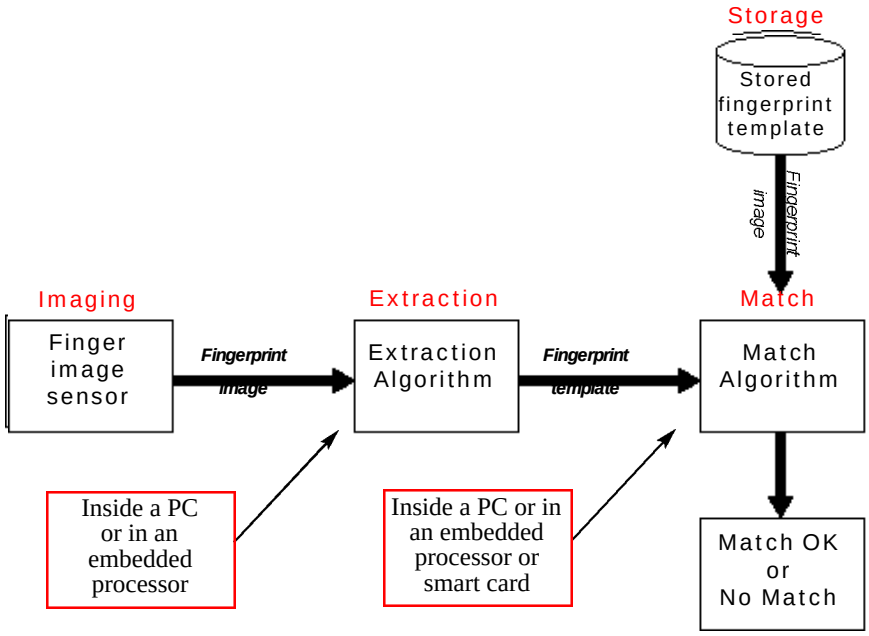


Software Architecture (cont.)

The first generation of the TactileSense software architecture supports enrollment, extraction, storage and verification of the fingerprints. First, the fingerprint sensor creates a fingerprint image. This image is translated into code by an extraction algorithm, and turned into a template for enrollment. The fingerprint template is stored locally on a PC, peripheral, smart card or other host device.

Subsequent fingerprints are extracted, and compared to the stored fingerprint template by a matching algorithm. A fingerprint match is indicated to the user.

This localized authentication process is a fundamental design direction for Ethentica and TactileSense. It provides a flexible design platform that can be applied across a whole range of devices and materials, and offers a less threatening fingerprint security option for end users to facilitate widespread consumer acceptance.



TactileSense Advantages

The TactileSense polymer, architecture and form factors benefit designers and users of fingerprint security products, as well as companies that deploy fingerprint security as an authentication method.

Reduced Size

TactileSense offers a dramatically reduced size for fingerprint security. The TactileSense polymer touch area can be the size of a postage stamp, or larger to accomodate a larger fingerprint. TactileSense T-FPM is less than 1/8" thick and will be integrated directly into flat active matrix glass. This reduced size provides a slim profile, making TactileSense easy to embed into other devices. Additionally, TactileSense products have low cycle time and storage requirements.

Design Flexibility

The smaller size and reduced complexity of components make TactileSense a more flexible platform to build into a wider variety of products. In addition, TactileSense includes development APIs such as BIO-API. TactileSense supports the standard parallel port host interface, as well as Windows 95, Windows 98, Windows NT and Windows 2000 operating system software.

Lower Power Consumption

TactileSense is self-illuminating and does not require an additional light source thereby reducing the amount of power required to perform the imaging operation. The TactileSense supporting components include a proprietary electrical circuit that typically control electrical current to about 75 mA. In addition, TactileSense products include a low power standby mode that can be powered-up on demand. This low power consumption makes TactileSense technology well suited for a variety of applications, from keyboards and monitors to battery-powered portable devices.

Lower Cost/Long-Term Cost Efficiencies

There are substantial material cost advantages and long-term efficiencies inherent in the TactileSense design. TactileSense uses fewer and lower cost components than optical devices. Ethentica is also investing in new designs that further streamline the TactileSense assemblies with more highly integrated components. Future products based on TactileSense will take advantage of these efficiencies.

TactileSense Advantages (cont.)

Reliability

Unlike FTIR sensors, TactileSense is not dependent on the oils in a individual's finger to create an image. This allows TactileSense to read a wide range of finger types, including users with dry or difficult-to-read fingers. In addition, the electro-optical assembly enables TactileSense to detect fake fingers.

Durability/Decreased Risk of Failure

The TactileSense polymer isolates the image sensor from the finger, making it tolerant to contaminants, scratching, puncture, and electrostatic charges while improving durability and performance. TactileSense has been tested to withstand more than one million fingerprint touches without wearing out.

TactileSense Development Tools

Ethentica provides both hardware and software tools for the developer and systems integrator.

Hardware

TactileSense T-FPM Fingerprint Sensor, Mechanical and Electrical Design Specifications

Platform Support

Windows 95, Windows 98, Windows NT and Windows 2000 Drivers

Tool Kit

Ethentica offers a software development kit which provides a platform for developing a customized user interface for any TactileSense installation. The software development kit includes an API that supports the Ethentica Fingerprint Module peripheral unit.

The software development kit includes tools for:

- Device initialization
- Raw fingerprint image data acquisition
- Verification/authentication of fingerprints

In addition, TactileSense includes a CD-ROM that contains:

- WhoUtility, which tests the functionality of the Fingerprint Module peripheral
- Application samples which provide HAAPI/BAPI compliant software that demonstrates the enrollment and verification or authentication of fingerprints.

Enrollment

Verification

Competition

TactileSense dominates competitive fingerprint security approaches in a variety of areas. First, TactileSense shows clear advantages over FTIR and silicon assemblies in integration and flexibility. Its slim profile, low power consumption and ability to be integrated into glass and small electronics makes it the most flexible option.

Further, TactileSense is an extremely durable alternative. It is the only sensor technology with a replaceable surface. Silicon, an expensive technology, can be costly to replace, while FTIR assemblies are highly complicated and rely on many components.

In addition, TactileSense is the most reliable fingerprint security approach in terms of accuracy and fault tolerance. Unlike FTIR, TactileSense can read a dry finger and detect a fake finger. And while silicon-based fingerprint devices can be unreliable due to their intolerance of static and contaminants, TactileSense manages static discharge and environmental factors by isolating the finger from the sensing processors.

Finally, TactileSense provides a high level of performance at a low price. Because it has a reduced number of components and low storage requirements, TactileSense is less expensive than either FTIR- or silicon-based fingerprint sensors. Long term, TactileSense provides cost efficiencies that continue through the life cycle of the host product.

	FTIR	Silicon	TactileSense™
Size/Integration Flexibility			
Small/thin profile		√	√
Small device integration		√	√
Glass integration			√
Low power consumption		√	√
Durability			
Wear resistant			√
Cost-effective replacement			√
Reliability			
Reads dry finger		√	√
Detects live finger		√	√
Manages static discharge	√	√	√
Easily cleaned	√		√
Opto-isolates finger from sensor	√		√
Price/Performance			
Component reduction		√	√
Small sw storage requirements		√	√
Long-term cost efficiencies			√

Market Evolution: The TactileSense Vision

Several critical factors must be addressed before fingerprint security becomes a mainstream application. First, current offerings must become smaller, more cost-effective, reliable and flexible. Second, fingerprint security must be a more integrated technology rather than simply offering adjunct or peripheral capabilites.

Ethentica is poised to address these market needs. In fact, TactileSense will evolve as an even smaller and more cost-effective technology. The inherent properties of the TactileSense polymer make it the most flexible fingerprint sensing alternative. The TactileSense polymer can be applied to a variety of materials–such as plastic–making it easy to incorporate into emerging technologies and products.

Further, fingerprint identification software and matching will move closer to the host processing device, making it an integral part in future products and portable security-equipped devices. This will enable users to be authenticated before starting up, logging on, or beginning a secure transaction.

TactileSense is poised to drive this integration of fingerprint security to the processor level, by taking advantage of new technologies such as smart cards and PCMCIA cards. These products are examples of new technologies that will integrate fingerprint security into mainstream applications for a wide variety of functions. The first product solution to incorporate TactileSense is the Ethenticator MS 3000 Touch Verification PC card from Ethentica. The product provides secure system and network access, a secure screen saver, and it also eliminates the need to remember passwords altogether.

Finally, the Internet provides the most immediate opportunity for fingerprint security devices. Ethentica will partner to work with Internet leaders to integrate fingerprint identification as an alternative to PIN/password access. TactileSense uses an open security infrastructure to incorporate the best in user identification and authentication technologies. Ethentica's goal is to grow with the on-line world, today and in the future.

TactileSense T-FPM *(Available August 2000)*

Technical Specifications

Components	1. Fingerprint Imaging Sensor 2. Windows 95/98 and Windows NTdrivers 3. API Developers Tool Kit w/ Sample Applications
Imaging Resolution	400 DPI
Fingerprint Imaging Area	0.76” x 0.56” (approx.)
Module Size	approx. 0.3 inch, 1/6 inch think
Systems Integration	Embedded
Weight	<25g
Recognition Speed	<=0.6 second on a Pentium 133
Touch Surface	Rugged Opaque Polymer, over 1M touches
Data Stream	Raw Fingerprint Images
Power	5mA sleep, 12mA snooze, 54mA ready, 211mA active
Host Platform	Windows 95/98, NT, 2000 and various embedded CPUs
Interface to Host	Parallel, USB, PCMCIA and various proprietary designs

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