The Differences and benefits of “LES” fingerprint sensor technology vs. Optical based FAP 45, FBI appendix “F” certified fingerprint sensors.

Integrated Biometrics LLC, from Spartanburg South Carolina, USA, is the first and only provider of non-optical FAP 45, appendix F fingerprint sensors. The industry changing advantages of this technology over conventional optical sensors is significant and will be the subject of this white paper.

Integrated Biometrics (IB) refers to their technology as “LES” or Light Emitting Sensor technology because the light used to create the fingerprint images which are captured is generated within the sensor from electroluminescent particles suspended in the film used for its platen.

The Benefits of LES vs. Optical sensors include the following

1. **Significantly smaller, lighter and thinner sensor package with reduced power requirements.**
2. **Highest Image quality certified by the FBI**
3. **Not affected by bright lights or direct sunlight**
4. **Collects dry fingers without moisturizers or silicon membranes**
5. **Not affected by latent prints or fingerprint oils left behind by previous users. This is a great advantage for high throughput enrollment applications. Does not need to be cleaned unless the film surface becomes “caked” with clearly visible contamination, (like peanut butter for example)**
6. **The TFT version of the sensor (Sherlock) can be made in a package ¼ in thick. The lens based LES sensor (Watson mini) is 1.1 in. thick, both compatible with mobile packaging requirements.**
7. **Spoof resistant, as the finger touching the film must be conductive. A silicon “Gummy” fake print will not be seen by the LES sensor and no image will be collected.**
   This is a major difference between LES and optical sensors. Optical sensors look at the surface topography of the finger (or fake finger) presented to it and collect the print image via TIR techniques. This makes Optical sensors susceptible to spoofing. The LES sensor required the friction ridge touching the film platen to act as a ground. Fake fingers will not work.

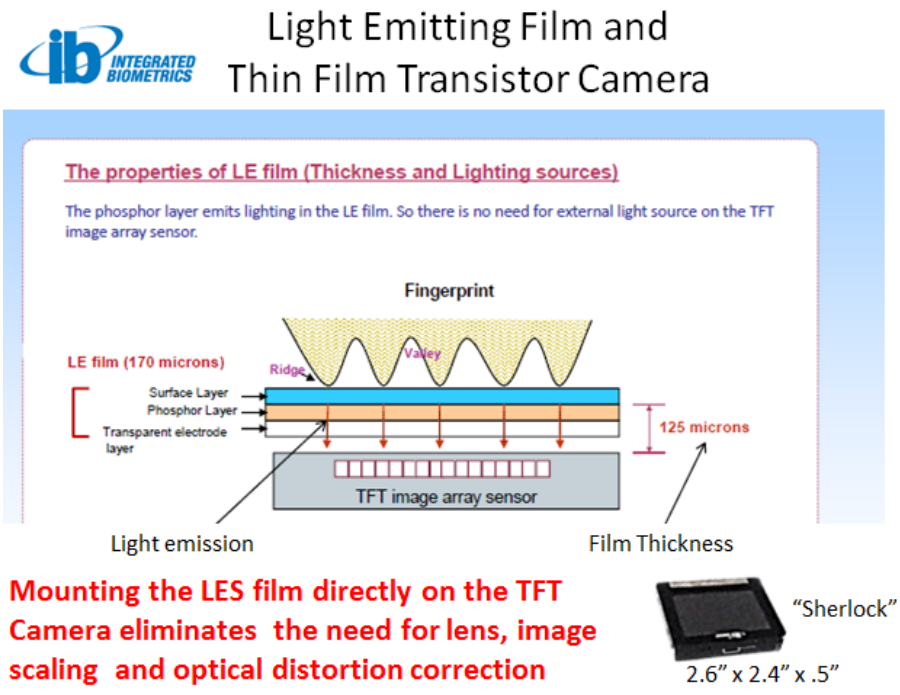
   Also, (see number 4 above) oils, latent prints or dirt left behind will not be seen by the LES sensor for the same reason.

   NOTE: IF a piece of paper is used to simulate dirt on the platen, the LES sensor will not see it. If this is used as a “test” to insure the sensor is capable of detecting a dirty platen in need of cleaning, it is not an appropriate test for the LES technology.

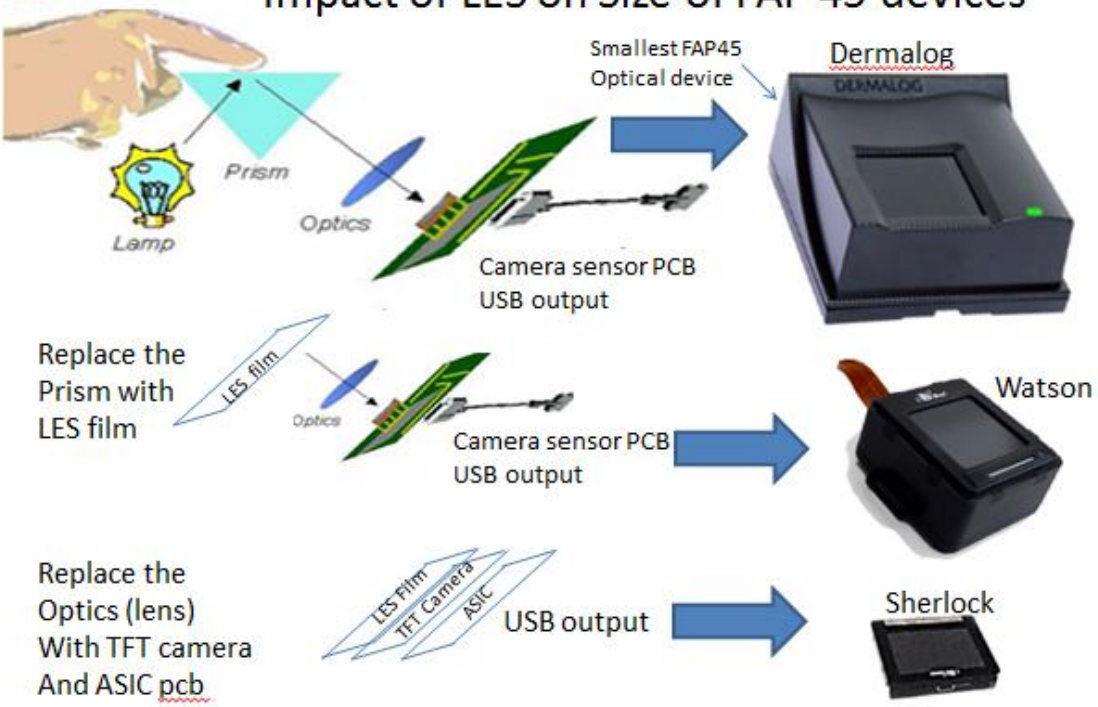
Brief description of how it works:

When an electric field is applied across the LES film, and a finger is placed on the film, the EL **particles suspended in the film glow beneath the finger resulting in a high resolution image of the** fingerprint. That image is in turn captured with conventional camera techniques, and then sent on via a USB 2.0 interface to the host PC, Tablet or Smartphone it is connected to.

In the Case of the Sherlock sensor, the film is laminated directly to a Thin Film Transister (TFT) Camera



Impact of LES on Size of FAP 45 devices



FAP45 Sizes, Weights & Power requirements

FBI Type	Style	W	L	D	Cu In.	Grams	**Full scan current drain**
FAP 45	Cross Match	2.60	6.81	3.82	68	620	~400ma
FAP 45	Suprema	3.31	6.73	2.48	55	540	~400ma
FAP 45	Dermalog	2.09	4.13	4.13	36	~410	~400ma
FAP 45	**IB - Watson**	**2.36**	**2.48**	**1.30**	**8**	**85**	**270ma**
FAP 45	**IB-Sherlock**	**2.57**	**2.33**	**.47**	**2.83**	**60**	**200ma**

Specifications taken from published literature

FAQ's

Q1: What are the key unmet needs in this product segment that LES sensors addresses?

Answer: The move to mobile devices and systems for biometric based personal identification and verification purposes requires a reduction in the size, weight, power requirements and profile of fingerprint sensors. Significant worldwide efforts are rapidly evolving for biometric based national ID programs requiring both "certified" devices for enrollment into nationwide data bases as well as hand held devices for identity verification. All this is to prevent fraud in benefits distribution, banking services, voting and other identity fraud areas. Todays "certified" fingerprint sensors, required for the level of accuracy necessary for these applications, are all optical based which makes them big, heavy, power hungry and incapable of the thin form factor necessary for integration into cell phone or mobile tablet packages.

Q2: How would you distinguish your product from those of competitors and/or in what respects is your product superior?

Answer; the fingerprint technology offered by Integrated Biometrics is the smallest, thinnest, lightest, most power efficient, highest quality and most forgiving "certified" fingerprint image capture technology in the world. It is the only technology that can meet the stringent image performance requirements of the FBI and international standards and be available in a "thin" form factor (less than ½ in. thick) compatible with mobile packaging requirements. Through its dynamic adaptive algorithms, it is able to capture quality images from moist to very dry fingers without the need for silicon membranes, moisturizers or constant cleaning of its platen.

Q3: What are some of the most important features/capabilities of your product that could influence end users to switch from competing products to your product?

Answer: In addition to the features mentioned above, it is especially well suited for inclusion in mobile devices used outdoors and on large numbers of individuals. Direct sunlight or bright light makes optical sensors unusable. To be used outdoors, optical sensors require the fingerprint capture platens be shaded from the sun or bright lights.
The sunlight has no effect on the Integrated Biometrics sensor. Also oils left behind by previous user enrollments have no effect on the image capture of the next individual. Oils left behind from previous users do not need to be cleaned away after each capture as is the case with all optical capture products. This allows for high throughput of high quality fingerprints suitable for large population enrollments or verifications.

Q4. What were the key product development challenges that needed to be addressed for developing this product, and what steps did you take so you were able to address these challenges? (In other words, what are some of the innovative best practices that were employed in developing this product, for example, new manufacturing or design process, collaboration with strategic partners, etc?

Answer: Adapting the IB (Integrated Biometrics) LES Film to meet the stringent image quality requirements of the FBI "appendix F" specification took significant research and development.

The film design and manufacture is a key IB intellectual property for us. Also our dynamic capture algorithm which makes possible the rapid capture of moist or dry finger prints with very high quality was also a significant challenge.

Criteria: Leverage of leading edge technologies

Q1: Which cutting-edge technology or combination of cutting-edge technologies has been implemented in your product, and how have they been implemented?

Answer: The IB fingerprint sensor uses a proprietary electroluminescent (LES) film to create the fingerprint image, a TFT (thin film transistor) based sensor which the film is laminated to which collects the image, pixel by pixel and a custom integrated circuit to "read" the rows and columns of the sensor to create the image which our IB image processing algorithm dynamically adjusts in order to deliver a highest quality fingerprint flat or "rolled" image that meets the FBI specification. The elegant combination of all these technologies by the IB engineering team has resulted in a technology that is truly a game changer for the "Mobile" biometric ID marketplace.

Q2: What industry verticals is your company targeting with this product? Could you provide a few case-studies on how a customer has leveraged the core technologies imbibed in your product?
OR Can you cite examples where end users have selected your product because of the specific technologies it runs on?

Answer: The IB fingerprint technology is specifically suited for mobile and hand held tablet markets requiring the collection of high quality, standards based, "certified" fingerprints for large scale programs such as national ID, Military , Public safety and Border Patrol applications. In this segment IB has no serious competition with comparable size, weight, low profile, power requirements of ease of use.

Criteria: Value added features/benefits

Q1: What are the new types of functionality or features that end users are requesting from your product segment and how does your product address such needs?

Answer: when designing hand held and mobile solutions, all our key attributes are required (size, weight, low profile, power requirements, ease of use, and ability to work with a wide distribution of young, old, moist and dry fingers)

Q2. Can you highlight or quantify the value addition provided by each of the specific features you cited (for example, speed, accuracy and ease of use or speedier deployment, etc)?

Answer: The use of our key enabling fingerprint capture technology gives a system integrator the benefits of the smallest, lightest, highest quality, easiest to use fingerprint collection solution for "certified" large scale applications in the world today.

Q3. What is your product strategy to continue to build upon and improve these features in the future?

Answer: We will continue to offer different size "certified" fingerprint capture technologies to meet the needs of all mobile ID applications currently characterized by the FBI and other international standards organizations.

Criteria: Increased customer value

Q1: How does your product innovation translate to cost effectiveness/ improved ROI and or operational benefits for your end-users?

Answer: For markets requiring certified mobile solutions, we may be the only technology suitable for the stringent need for pocket sized devices. In spite of our technological advantages, we remain price competitive with the older optical technologies.

Q2: Competition is all about value: creating it and capturing it. How do you plan to deliver a particular customer value proposition to this definable market?

Answer: See all comments above. WE believe the biometric identification market is rapidly emerging into the hand held and mobile space. Smart phones and tablets will become the OS for our sensors. Our form factor and performance is especially suitable for these emerging mobile applications.

Criteria: Customer acquisition/penetration potential

Q1: What are the fastest growing applications or markets for your product and what are the key elements of your business strategy to penetrate these applications or markets?

Answer: National ID, Military, Intelligence, public safety enrollments of good guys, bad guys and verification/identification thereof. Mobile devices will be demanded by all.

Q2: What do you think is the potential of this product innovation to become an industry standard. How do you think that this innovation would impact the product landscape?

Answer: WE believe our technology is THE Game changer for the market segment we have targeted. All viable integrators will want the advantages our technology represents.

Q3: What percentage of the existing markets for this product is your new product likely to replace?

Answer: My guess is 40% of the fixed market and 90% of the mobile market

Q4: How do you (your company) monitor customer behavior and spending patterns and how are you leveraging this information to penetrate new markets for your product and boost profitability?

Answer: WE monitor major US Gov and International initiatives and try to deal with all integrators bidding on those initiatives. This is where the majority of our market segment activity initiates.

Q5: Could you elaborate on the acceptance or adoption of your product in the marketplace and are there any positive client testimonials that can be shared with us?

Answer:

I cannot give details, but all viable integrators in our space are actively engaged with us.