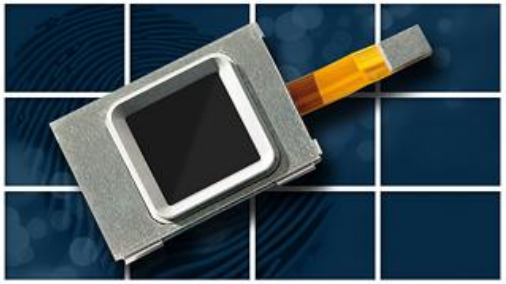

A comparative analysis of size and quality in fingerprint sensors – study by Carlos III University of Madrid Summary of results 2015-05-15

“THE MADRID REPORT”

A comparative analysis of size and quality in fingerprint sensors

The TCS1 integrated in the Eicon Touch 510

The NB-1010 integrated in the NB-3010

The FPC-1011F3 integrated in the FPC-ASD

THE “MADRID REPORT” - UNIVERSIDAD CARLOS III de MADRID **MAY 2015**

PROF. RAUL SANCHEZ-REILLO
- Highly respected biometric industry resource
- Member of multiple biometric industry ISO-committees

THE STUDIES
- The largest, commercial fingerprint sensor test ever done
- Analysis of image quality, biometric performance and effect of small sensors
- ISO best practices methodology applied
- 589 persons participated over a period of 4 months
- Origin of sensors kept confidential to operators and subject
- Sequence of sensors randomized
- All test subjects made 2 visits separated by at least 2 weeks
- Small sensors simulated by cropping full-sized images
- FRR/FAR and FNMR/FMR are synonymous for one trial.

Universidad Carlos III de Madrid

IN TOTAL …

- 180 000 PRINTS COLLECTED (roughly 60 000 from each sensor)
- OVER 300 MILLON COMPARISON TRANSACTIONS ANALYZED

FRR PERFORMANCE AT 0,01% FAR..

High security setting – Targeting payments, corporate access, governmental appl.

	Images from full size sensors	Images cropped at 12*12 mm 144 mm²	Images cropped at 10*10 mm 100 mm²	Images cropped at 8*8 mm 64 mm²
THE TCS-1 13*18 mm **230 mm²** 500 dpi Capacitive Principle	AVERAGE FRR 0,42%	AVERAGE FRR 1,58%	AVERAGE FRR 6,72%	AVERAGE FRR 8,31%
THE NB-1010-U 12*17 mm **201 mm²** 385 dpi Active Thermal Principle	AVERAGE FRR 0,63%	AVERAGE FRR 3,17%	AVERAGE FRR 5,89%	AVERAGE FRR 11,43%
THE FPC-1011-F3 10.4*14 mm **148 mm²** 363 dpi Capacitive Principle	AVERAGE FRR 1,54%	AVERAGE FRR 3,95% *	AVERAGE FRR 4,75% *	AVERAGE FRR 27,03% *

Average FRRs under 1% are considered robust .

1%-2,5% (ok - application dependent)

At above 2,5% averages a significant %-age of the users will not be able or willing to use the system.

KEY "MADRID" CONCLUSIONS :

1) The Active Thermal principle performs in line with significantly more expensive - same sized - capacitive sensors
2) Sensor size is the dominant factor determining sensor system performance
3) At acceptable FAR levels, reduced size comes with a dramatic effect on FRR levels (false rejection of genuine user)

* FPC 12x12 cropped is actually 10.6x12 because original image is only 10.6x14. Therefore also little difference between 12x12 and 10x10. The pre-processed FPC images seem not to work well below a critical size and result in a significant drop in accuracy for 8x8.

FRR PERFORMANCE AT 1% FAR..

Low security setting – Targeting convenience focused applications

	Images from full size sensors	Images cropped at 12*12 mm 144 mm²	Images cropped at 10*10 mm 100 mm²	Images cropped at 8*8 mm 64 mm²
THE TCS-1 13*18 mm **230 mm²** 500 dpi Capacitive Principle	AVERAGE FRR **< 0,01%**	AVERAGE FRR **0,86%**	AVERAGE FRR **4,06%**	AVERAGE FRR **5,10%**
THE NB-1010-U 12*17 mm **201 mm²** 385 dpi Active Thermal Principle	AVERAGE FRR **< 0,01%**	AVERAGE FRR **1,51%**	AVERAGE FRR **3,15%**	AVERAGE FRR **6,91%**
THE FPC-1011-F3 10.4*14 mm **148 mm²** 363 dpi Capacitive Principle	AVERAGE FRR **< 0,01%**	AVERAGE FRR **2,04% ***	AVERAGE FRR **2,97% ***	AVERAGE FRR **19,53% ***

Average FRRs under 1% are considered robust .

1%-2,5% (ok - application dependent)

At above 2,5% averages a significant %-age of the users will not be able or willing to use the system.

KEY "MADRID" CONCLUSIONS :

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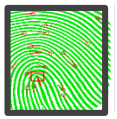
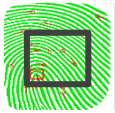
FURTHER ON THE TOPIC of “SIZE”…

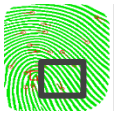
Unprecedented size test – a mass market realistic comparative analysis



A large sensor will capture a large amount of data



A medium sensor will capture a medium amount of data



A small sensor will capture a small amount of data

I

The MADRID STUDIES were performed in an indoor environment.

In a outdoor environment variables like wet, dry, dirty and skewed placement fingers will often render parts of sensors useless.

Such variables further increases dependency of sensor size.

II

The MADRID STUDIES were performed with a world leading algorithm (Neurotechnology a top level performer in international comparative tests) using a combination of minutiae points and proprietary image pattern data.

Such larger, unique features are mass market proven and recognized as robust and long term constant features.

III

SMALL SENSORS capture small areas.

Many people will have only a few unique features in such small areas.

The use of stitching during enrollment or evaluating “microfeatures” such as sweat pores and ridge shape can only moderately compensate the lack of real estate = active area

IV

SMALL SENSORS are, even though the cost is low, never implemented by system integrators selling systems that need to work securely and conveniently for a high %-age of a population.

Smaller sensors (< 100 mm2) will only work conveniently for a modest %-age of a population. Further reduced sizes comes with additional sacrifice of security level.