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Embedded and mobile fingerprint identification technology

FingerCell EDK

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The FingerCell technology, developed on the VeriFinger basis, is designed for embedded biometric systems developers. FingerCell algorithm is compact, sensor-independent and cross-platform. It offers decent reliability and identification speed for various mobile or embedded devices

FingerCell is available for integrators as Embedded Development Kits (EDK) with FingerCell library or source code for developing a fast and reliable system on embedded or mobile platform.

- Reliability proven at FVC2004
- Multiple fingerprint sensors support
- Cross platform algorithm with compact portable source code.
- Low speed processors supported.
- Reasonable prices, flexible licensing and free customer support.

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FingerCell Algorithm Features and Capabilities

FingerCell offers decent reliability and identification speed for various mobile or embedded devices. The FingerCell algorithm is similar to the VeriFinger algorithm and includes these proprietary solutions:

- **Fast image processing.** Fingerprint image processing time is **less than 1 second on 200 MHz ARM** processor, which is acceptable for embedded systems.
- **Low speed processors are supported.** The template extraction and matching is adapted for low speed embedded processors. For example, fingerprint verification is performed in **about 2 seconds on a 75 MHz ARM7** processor when FingerCell algorithm is used.
- **Features generalization mode.** This fingerprint enrollent mode generates a collection of the generalized fingerprint features from a collection of fingerprints of the same finger. Each fingerprint image is processed and features are extracted. Then the collection of features is analyzed and combined into a single generalized features collection which is written to the database. This way, enrolled minutiae are more reliable and the fingerprint recognition quality considerably increases using this enrollment mode.
- **Identification ability.** As FingerCell is developed on the VeriFinger basis, it is suitable not only for fingerprint verification (1-to-1 matching), but also for identification (1-to-many matching).
- **Tolerance to fingerprint translation, rotation and deformation.** Such tolerance is achieved by FingerCell proprietary fingerprint matching algorithm. The algorithm is able to identify fingerprints even if they are rotated, translated and deformed, and matches about 150 fingerprints per second in 1-to-many mode on a 200 MHz ARM family processor.
- **Faster matching using pre-sorted database entries.** *For some identification tasks* FingerCell effective matching speed can be increased up to **700 fingerprints per second** (on a 200 MHz ARM family processor) by pre-sorting database entries using certain global features. Fingerprint matching is performed first with the database entries having global features most similar to those of the test fingerprint. If matching within this group yields no positive result, then the next record with most similar global features is selected, and so on, until the matching is successful or the end of the database is reached. In most cases there is a fairly good chance that the correct match will be found at the beginning of the search. As a result, the number of comparisons required to achieve fingerprint identification decreases drastically, and correspondingly, the matching speed increases.
- **Compact portable software.** FingerCell is designed for easy implementation into very various and specific applications. The algorithm's **ANSI C source code** is sensor independent; therefore it can be ported to various platforms and hardware. Compiled code and internal data arrays require only **400 KB of memory** and therefore can be implemented in low memory microchips, thus reducing hardware costs.

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FingerCell Embedded Development Kits

FingerCell Embedded Development Kit (EDK) is based on the FingerCell embedded fingerprint recognition algorithm that is especially designed to be used in embedded low-power and comparably low-CPU-power applications. FingerCell EDK includes libraries for ARM Linux and ARM Windows CE embedded platforms, as well as support modules for embedded sensors and source codes for sample applications.

Customers who want to use another platform can obtain the FingerCell ANSI C source code package and port the software to the required platform.

The following types of FingerCell 2.1 EDK are available

- **FingerCell 2.1 Library EDK – is** intended for biometric system projects using hardware based on ARM processors. Includes FingerCell library, programming samples and documentation for Windows CE and Linux.
- **FingerCell 2.1 source code EDK –** is intended for large biometric system projects using third party or custom hardware. Includes FingerCell source code, samples and documentation for MS Windows CE and Linux.

The table below compares different types of FingerCell EDK:

	Library EDK	Source code EDK
Supported platforms		
• ARM, Windows CE	+	+
• ARM, Linux	+	+
FingerCell algorithm components		
• FingerCell 2.1 algorithm	+	+
• FingerCell 2.1 algorithm source code		+
Scanner support modules (for Linux)		
• Tacoma CMOS scanner support module	+	+
• Startek FM200 scanner support module	+	+
• Biometri-CS CS-Pass sensor support module	+	+
• Zvetco Verifi P4000 scanner support module	+	+
• AuthenTec AF-S2 sensor support module	+	+
• AuthenTec AES4000 sensor support module	+	+
• Fujitsu MBF200 scanner support module	+	+
FingerCell programming samples		
• FingerCell EDK sample application	+	+
Documentation		
• FingerCell EDK documentation	+	+
• FingerCell source code documentation		+

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FingerCell 2.1 Library EDK

FingerCell 2.1 Library EDK includes the FingerCell 2.1 library for developing custom products. The developed product can run on ARM-based platform under Linux or Microsoft Windows CE.

FingerCell 2.1 Library EDK contains the following components:

- MS Windows CE components:
  - FingerCell 2.1 library (for Microsoft Visual Studio 2005 with SP1)
  - Source code of FingerCell library usage sample application in Visual C++ 2005 SP1
- ARM Linux components:
  - FingerCell 2.1 library (for Arm-Linux GCC C compiler)
  - Source code of sample embedded application in ANSI C (project for Arm-Linux GCC C compiler)
  - User-space drivers for image input from Tacoma CMOS, Startek FM200, Biometri-CS CS-Pass, Zvetco Verifi P4000, AuthenTec AF-S2, AuthenTec AES4000 and Fujitsu MBF200 fingerprint sensors via USB port
- FingerCell 2.1 EDK documentation.

FingerCell 2.1 source code EDK

FingerCell 2.1 source code EDK is intended for developers who are going to integrate fingerprint identification technology into a custom embedded device.

FingerCell 2.1 source code EDK contains the following components:

- 10,000 FingerCell 2.1 installation licenses
- FingerCell 2.1 source code:
  - Project for GCC compiler (ARM-Linux platform)
  - Project for MS Visual Studio 2005 (Pocket PC 2003 platform)
- FingerCell 2.1 Algorithm and Source Code Description
- Sample applications:
  - Project for GCC compiler (ARM-Linux platform)
  - Project for MS Visual Studio 2005 (Pocket PC 2003 platform)
- Linux user-space drivers' source codes for Tacoma CMOS, Startek FM200, Biometri-CS CS-Pass, Zvetco Verifi P4000, AuthenTec AF-S2, AuthenTec AES4000 and Fujitsu MBF200 fingerprint sensors connected via USB port
- FingerCell 2.1 EDK developers' guide

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System requirements

- ARM-based processor:
  - **Minimum** requirement: ARM7 processor running at 75 MHz for fingerprint verification in about 2 seconds.
  - **Recommended:** ARM-based processor with 200 MHz CPU clock rate for fingerprint enrollment in less than 1 second (ARM processor core families: ARM9, ARM10, ARM11, StrongArm, XScale).
- At least **400 KB** of memory for FingerCell code and data arrays (the recommended amount could be different, as it depends on fingerprint image size)
- Fingerprint sensor that has a support module included in FingerCell EDK or a driver is available from scanner manufacturer or other sources
- **ARM Linux** (glibc 2.3.4 or later) or Microsoft **Windows Mobile 2003** (or later) operating system

Please note that FingerCell 2.1 source code EDK can be easily **ported** to most other platforms and processors using **ANSI C compiler**.

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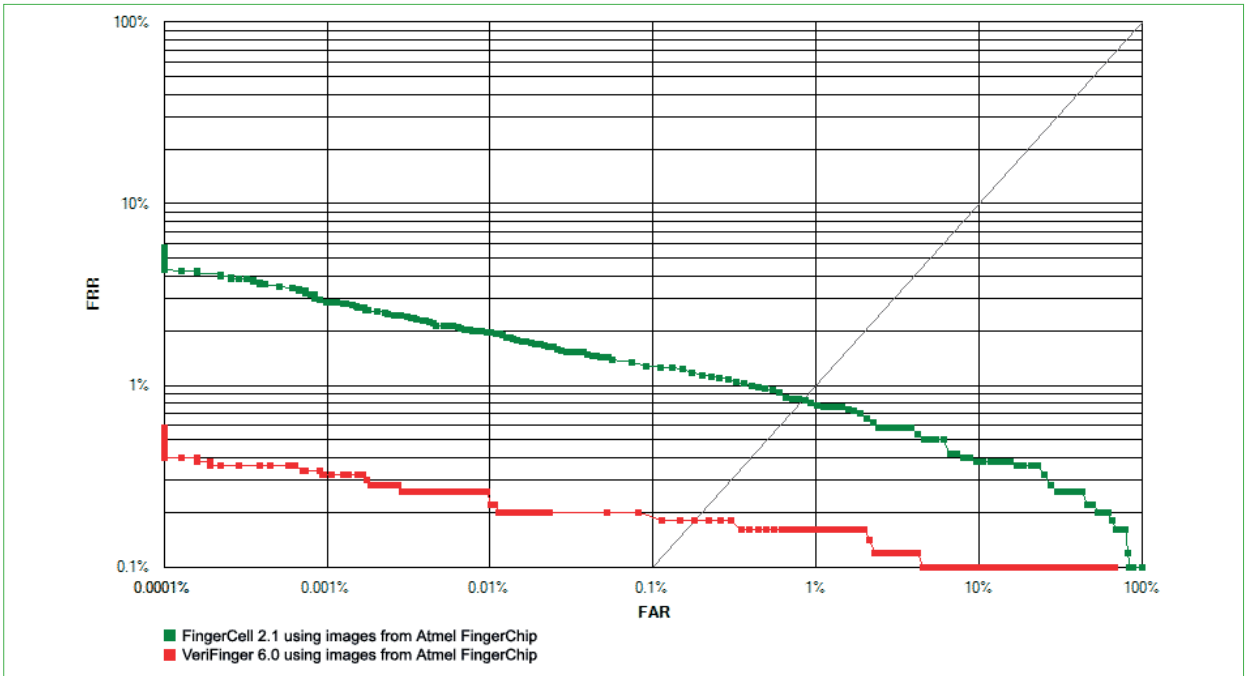
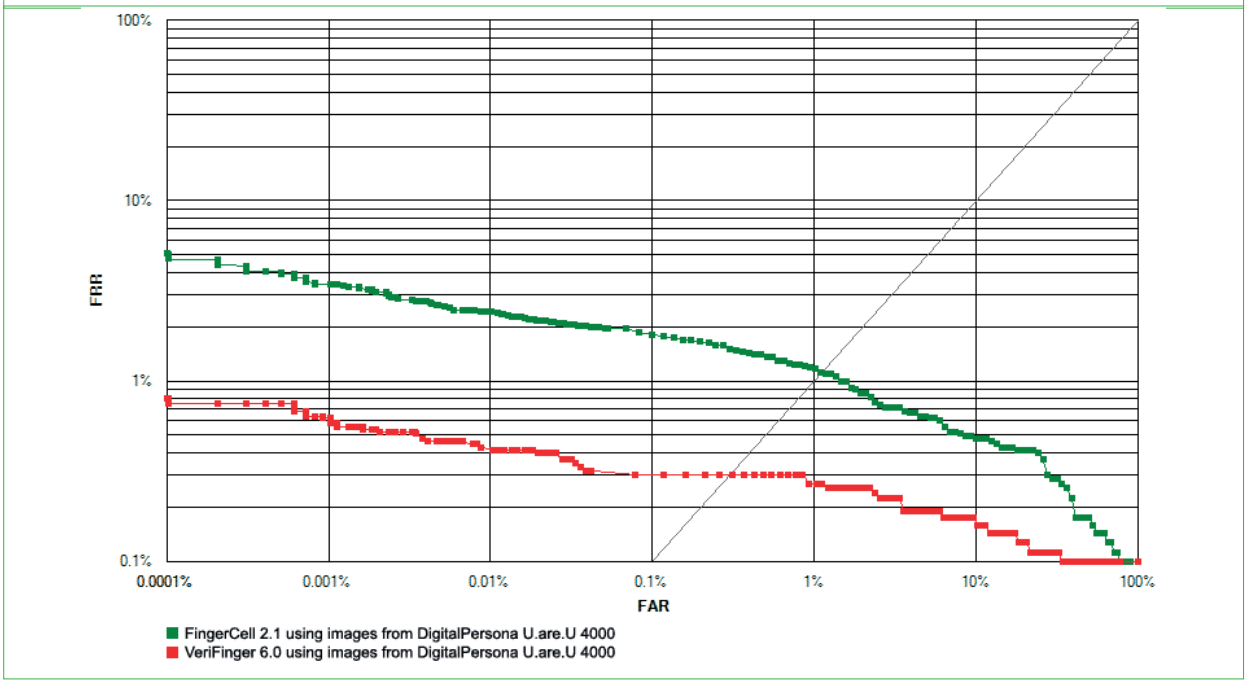
Reliability Testing Results and Technical Specifications

As FingerCell is intended for embedded devices, it uses a faster and less powerful fingerprint noise filtration algorithm with a slightly higher False Rejection Rate than a PC running the VeriFinger algorithm. However, the FingerCell algorithm still produces a decent level of recognition reliability, which is acceptable for embedded devices. Receiver operation characteristic (ROC) curves obtained in testing with two scanner databases compare FingerCell 2.1 (green) and VeriFinger 6.0 (red) reliability under the same conditions





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Please note, that these specifications were determined on a device with 200 MHz ARM family processor.

All fingerprint templates should be loaded into RAM before identification, thus the maximum fingerprint templates database size is limited by the amount of available RAM.

FingerCell 2.1 algorithm technical specifications	
Enrollment time	< 1 second
Enrollment time in features generalization mode	< 3 seconds
Verification time	0.5 seconds
Matching speed	up to 700 fingerprints/second
Template size	300 - 600 bytes
Memory required for code and data arrays	400 kilobytes

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FingerCell Demo, EDK Trial and Related Products

FingerCell demo applications allow to evaluate the FingerCell 2.1 algorithm. The demo applications can be downloaded at ***www.neurotechnology.com/download.*** Demo applications for these platforms and devices are available:

- HP iPAQ **hx2700** series, with Microsoft Windows Mobile. Reading from integrated fingerprint scanner is supported.
- HP iPAQ **H5500** series, with Microsoft Windows Mobile. Reading from integrated fingerprint scanner is supported.
- Other devices with Microsoft Windows Mobile. No fingerprint scanners supported; fingerprints can be loaded from image files.
- PC, with Microsoft Windows 2000/XP/2003/Vista. List of supported scanners is the same as in VeriFinger SDK.

FingerCell EDK 30-day trial can be also downloaded at ***www.neurotechnology.com/download***

These products are related to FingerCell EDK:

- Biometric Standards Support add-on – allows developers to integrate support for fingerprint template and image format standards and additional image formats with existing biometric systems based on FingerCell EDK. See next section for add-on description.
- VeriFinger SDK– intended for development of PC-based fingerprint identification systems; See “VeriFinger SDK” brochure for more information.

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Biometric Standards Support Add-on For FingerCell EDK

Neurotechnology offers Biometric Standards Support (BSS) Add-on For FingerCell EDK. The BSS Add-on allows to integrate support for fingerprint template and image format standards with existing biometric systems based on FingerCell EDK.

These biometric standards are supported:

- **ISO/IEC 19794-2:2005** (Finger Minutiae Data)
- **ISO/IEC 19794-4:2005** (Finger Image Data)
- **ANSI/INCITS 378-2004** (Finger Minutiae Format for Data Interchange)
- **ANSI/INCITS 381-2004** (Finger Image-Based Data Interchange Format)
- **ANSI/NIST-ITL 1-2000** (Data Format for the Interchange of Fingerprint, Facial, & Scar Mark & Tattoo (SMT) Information)

The BSS Add-on allows **conversion** between FingerCell templates, ISO/IEC 19794-2:2005, ANSI/INCITS 378-2004 and ANSI/NIST-ITL 1-2000 templates.

Add-on Structure

The BSS Add-on for FingerCell includes:

- A component that supports all mentioned biometric standards and performs template conversion
- Documentation

Supported Platforms and System Requirements

The included components can be used from C/C++ applications. The add-on supports platforms based on **ARM** processor architecture. Libraries for **Windows CE** and **ARM Linux** operating systems are provided.

General system requirements for the BSS Add-on are the same as the system requirements for FingerCell EDK.

Licensing and Ordering Information

The add-on can be used on any device that has FingerCell installation license.

The BSS Add-on for FingerCell EDK costs **EUR 700** and can be ordered by existing FingerCell EDK customers.

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Licensing FingerCell EDK

To develop a product based on FingerCell technology, an integrator should obtain FingerCell 2.1 Library EDK (EUR 4,900) or FingerCell 2.1 source code EDK (EUR 17,190). The integrator can develop only an **end-user** product using FingerCell 2.1 EDK and sell/install the product to the end-users*. FingerCell 2.1 EDK customers can obtain additional FingerCell 2.1 licenses for their product installation or development at any time.

FingerCell 2.1 Library EDK

Customers should **sign** the FingerCell 2.1 Library EDK Software Licensing Agreement before purchasing FingerCell 2.1 Library EDK.

1,500 FingerCell 2.1 installation licenses are already included with the FingerCell 2.1 Library EDK license. Additional FingerCell 2.1 installation licenses may be purchased anytime.

FingerCell 2.1 source code EDK

Customers should **sign** the FingerCell 2.1 source code EDK Software Licensing Agreement before purchasing FingerCell 2.1 source code EDK.

10,000 FingerCell 2.1 installation licenses are already included with the FingerCell 2.1 source code EDK license. Additional FingerCell 2.1 installation licenses may be purchased anytime.

Please, contact us for more information about FingerCell 2.1 source code licensing.

** If the integrator wants to develop and sell a FingerCell based development tool (with API, programming possibilities, programming samples, etc.), he/she will need permission from Neurotechnology and shall sign a special VAR agreement.*

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Prices for FingerCell Products

- The prices are **effective from January 29, 2009**. The prices may change in the future, so please **download and review the latest version** of the brochure before making an order.
- Quantity discounts do not accumulate over time.
- The prices do not include any local import duties or taxes.
- Product shipping cost depends on delivery country
- Our customers can gain a discount for our products by getting the Solution Partner status.

FingerCell 2.1 Embedded Development Kit (licensing model)

FingerCell 2.1 Library EDK (1,500 FingerCell 2.1 installation licenses are included)	€ 4,900.00
FingerCell 2.1 source code EDK (10,000 FingerCell 2.1 installation licenses are included)	€ 17,190.00

FingerCell 2.1 installation licenses for embedded devices (prices per license)

Quantity	Price
50-99	€ 6.00
100-199	€ 5.00
200-499	€ 4.00
500-999	€ 3.00
1000-1999	€ 2.30
2000-3999	€ 1.90
4000-7999	€ 1.50
8000-15999	€ 1.20
16000-31999	€ 0.90
32000-63999	€ 0.70
64000-127999	€ 0.50
128000-255999	€ 0.37
256000-511999	€ 0.28
512000 and more	Please contact us for more information

Additional products

Biometric Standards Support Add-on For FingerCell	€ 700.00

FingerCell products can be ordered:

- online, at ***www.neurotechnology.com/cgi-bin/order.cgi***
- via a local Neurotechnology distributor; the list of distributors is available at ***www.neurotechnology.com/distributors.html***

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