ID Documents with On-Card Fingerprint Technology

System on Document – A new chance for the card industry
Agenda

1. MOTIVATION
2. SYSTEM ON DOCUMENT
3. APPLICATIONS
4. NEW ISO STANDARD
5. CONCLUSION
Motivation

- Imagine a world without PINs and passwords
- Mobile devices demonstrated, that biometry will provide added security and ease of use
- Let’s build ID documents with added value and a maximum degree of privacy and data protection

Chance for the card industry
The digital world requires new mechanisms.

Security token as a **Human Representative** in the digital world.
New applications require ...

... secure and interactive ID document systems with user-friendly interfaces.
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System on Document

- The ID document adopts new functions with multifunctional components
- Interactive and easy to use with a maximum degree of privacy protection
- Highly integrated system solution
- Strong requirements for hardware and software

ISO 14443 NFC

- Power Mgmt
- Output elements
- Crypto-processor
- Input elements
- LED Display
- Speaker
- PIN pad
- Touch
- Fingerprint
- Camera

Smart Packaging
# System on Document – Technology evolution for fingerprint authentication

<table>
<thead>
<tr>
<th>Biometrics</th>
<th>Template on Document</th>
<th>Match on Document</th>
<th>System on Document</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>External</td>
<td>Internal</td>
<td>External</td>
</tr>
<tr>
<td>Sensor and data capturing</td>
<td>✔️</td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td>Matching algorithm</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Storage of reference data</td>
<td></td>
<td>✔️</td>
<td></td>
</tr>
</tbody>
</table>

- **Template on Document**
  - **External**
  - **Internal**

- **Match on Document**
  - **External**
  - **Internal**

- **System on Document**
  - **External**
  - **Internal**

- **Strong requirements for interoperability**
- **e.g. ePassport**

- **Reference data never leaves the document**
- **Better protection of privacy**

- **Captured data and reference data never leaves the document**
- **Maximum protection of privacy**

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**Increasing complexity of the document and security**
**ID Go!** World’s first batteryless ID document with on-card fingerprint sensor and display

![ID Go! Image](image)

**FULL ID | GOVERNANCE**

- Intelligentes Workflow-Management
- Sicheres Berechtigungsmangement
- Effizientes Compliance-Management

[www.bundesdruckerei.de](http://www.bundesdruckerei.de)
Fast and secure verification of the ID document owner by simply touching the sensor.
ID document with on-card fingerprint sensor and display

### Specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>53.98 mm x 85.6 mm x 2.5 mm, ID-T format</td>
</tr>
<tr>
<td>Power</td>
<td>Contactless / Energy harvesting / No battery</td>
</tr>
<tr>
<td>Interface</td>
<td>ISO 14443 13.56MHz</td>
</tr>
<tr>
<td>Security IC</td>
<td>SMX</td>
</tr>
<tr>
<td>Card body</td>
<td>High quality monocoque architecture</td>
</tr>
<tr>
<td>Fingerprint sensor</td>
<td>Capacitive area sensor</td>
</tr>
<tr>
<td>Display</td>
<td>ePaper display / LED</td>
</tr>
<tr>
<td>Design</td>
<td>Full colour design/personalisation</td>
</tr>
</tbody>
</table>
Informational self-determination ensured at all times

High degree of data protection

- The sensitive biometric data never leaves the document. It is captured, safely stored and verified on a chip only
- “Verification on document" offers a high degree of data protection and ensures the user's informational self-determination at all times
- No personal biometric data is sent to a background system
Verification on document – Integration of a complex technology into a tiny smart card

- Biometric data capturing
- Image generation
- Classification
- Minutia detection
- Template
- Reference data
- Matching algorithm
- Result of probability calculation

System on Document – Challenge
System on Document - Future Challenges

**SYSTEM ON DOCUMENT**

Additional electronic components require more computing power and energy.

- **Computing power/Energy**
- **Complexity**
- **Energy Harvesting**
- **new components**
- **Crypto Chip**
- **Display**
- **Fingerprint**
- **Camera**

**Resources on document**

**Demand**

Energy Harvesting and **new components** are necessary.
Hardware and software challenges

**Reliable and secure operation with limited resources**

- New concepts for energy harvesting using power from reader terminals
- High performance and low power components required
- Efficient software algorithms and user friendly interfaces

<table>
<thead>
<tr>
<th></th>
<th>PC</th>
<th>Smartphone</th>
<th>Contactless Card</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td>1 kW</td>
<td>10 W</td>
<td>25 mW</td>
</tr>
<tr>
<td><strong>Computing power</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>4 GHz</td>
<td>2 GHz</td>
<td>150 MHz</td>
</tr>
<tr>
<td><strong>CPU core</strong></td>
<td>16</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>Bit</strong></td>
<td>64</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td><strong>Time for 1:1 Match</strong></td>
<td>10µs</td>
<td>10ms</td>
<td>100ms</td>
</tr>
</tbody>
</table>
Contactless energy harvesting - Energetic optimization

- Electromagnetic coupling at 13.56 MHz (ISO 14443 and NFC)
- Resonance condition is important for voltage gain and high coupling efficiency

Simulations caused optimization by 30%
Secure Identity – What can I do with it?

- Registering & Verification
- Authentication
- Authorization & Signature
- Encryption
Applications - Employee ID card for tomorrow

Intelligent Access
Single-Sign-On / Data Encryption
Machine Login
Process Approval
Virtual Private Network

Employee

Secure Transactions
Payment
Electronic Signature
Document Verification
Online Registration
Secure Access to Cross Company Applications (Cloud)
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New ISO/IEC standard for multifunctional smartcards

New international standard for multifunctional smartcards in preparation, including ID-T format.

DRAFT INTERNATIONAL STANDARD

ISO/DIS 18328-2:2014(E)

Information technology — ICC-managed devices —

Part 2: Physical characteristics and test methods for cards with devices

1 Scope

This International Standard defines physical characteristics and test methods for cards with devices, including but not limited to power supplying devices, displays, sensors, microphones, loudspeakers, buttons or keypads. This International Standard also covers aspects of coexistence of technologies of devices on the card and other machine readable card technologies.

Additional requirements related to biometric capture devices are defined in ISO/IEC 17839-2.
Main aspects of ISO/IEC 18328-2

- Definition of physical characteristics
- Definition of test methods
- Valid for devices on card
- Coexistence with other existing technologies

- Cards with devices, including but not limited to power supplying devices, displays, sensors, microphones, loudspeakers, buttons or keypads
- Additional requirements related to biometric capture devices are also defined in ISO/IEC 17839-2
- Annex: ID-T size card
  - Same length and width as normal ID-1 size card, but thicker
  - 85.60 mm (3.370 in) wide by 53.98 mm (2.125 in) high by 2.50 mm (0.098 in) thick
3D Printing technology – New possibilities

Eco-friendly and efficient production
- Simultaneously printing of plastics and conductors
- Smaller machine sizes and production facilities
- Reduction of waste disposal

Alternative form factors
- New form factors for ID token
- Material structures: new surface and behaviour
- Material grades: plastic blends for more elasticity and nano patterns

Production and machines
- Individual production concepts: Industrie 4.0
- Sophisticated printed machine parts
- Additive digital fabrication of complex components
Conclusion - Challenges

- Innovative and cost efficient components for mass production
  Sensors, displays, processors, card materials, software algorithms

- High performance and low power electronics

- Reliable integration and production technologies for ID-T format

- Novel operating system architecture

- Test methods and security evaluation

- New applications
1. Bright future for smart cards - On-card fingerprint technology enables new applications for secure identity

2. System on Document provides ease of use and highest degree of data and privacy protection.

3. System on Document is technology driven with highest demands on electronic components, materials and systems.
Does the biometric data has to be well protected?

Thank you for your attention!