Next Generation German e-Passport
Fingerprint Enrolment –
Quality vs. Time

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Overview

- Introduction
- Legislative framework
- Workflow for enrolment of biometric features in Germany
- Quality assurance of fingerprints
  - Quality requirements for sensor hardware
  - Quality requirements in the enrolment process
- Results of recent pilot testing
- Summary
Legislative Framework

Passport Law (PassG)

Regulation on Data Capture, Quality Assurance and Transmission of Passport Production Data (PassDEÜV)

Annex: Technical Guidelines on Data Capture, Quality Assurance and Transmission of Passport Production Data (TR-PDÜ)

- Annex .1: QA requirements for enrolment and transmission of Facial Image Data
- Soon available in English!

- Annex .2: QA requirements for enrolment and transmission of Fingerprint Images
- Soon available in English!


- Annex .4: Conformity Testing of certain components within this framework
For interoperability, the facial image (and later the fingerprints) have to comply to ISO and ICAO standards

A 3-phase Quality Assurance process is implemented in 5300 municipalities:
- new photo guidelines
- new photo template
- QA software for facial images and fingerprints
Preparations for large scale fingerprint enrolment
Overview fingerprint enrolment

• **Major differences compared to facial image enrolment**
  – in municipal offices, only digital enrolment is imaginable
  – visual inspection (i.e. QA of fingerprints) is not feasible
  – Fingerprint enrolment is completely new for citizens and officials alike
    → E.g., how to place a finger on a scanner?
  – Possibility of *Failure to Enroll* → regulations for exceptions have to be in place
  – electronic transmission only (no paper form fall-back)

• **Challenges**
  – no standard on high quality fingerprint enrolment available
  – certified hardware for 4-finger devices only
  – infrastructure needs, integration in local systems
Development of (national) quality requirements

• Motivation for the development of quality requirements for sensors
  – Only single finger fingerprint sensors for municipalities (cost, footprint)
  – Impossible to predict
    – the reference sensor at the time of verification nor
    – the reference matcher
  – therefore need to create highly interoperable images (for use at least throughout the European Union)

• Solution: apply existing and proven standard (EFTS/F) and adopt it to single finger fingerprint sensors

• Create national certification scheme for those sensors
Requirements for enrolment hardware

- Optical fingerprint scanner with 500 dpi or 1000 dpi (19794-5 Level 31/41)
- Compliance to the FBI’s Electronic Fingerprint Transmission Standard, App F (EFTS/F)
  - Acceptable deviations regarding sensor size for single finger scanners (at least 16mm x 20mm)
  - Compatible to BKA requirements for AFIS, VIS and Fast-ID
  - Conformity report of the vendor
  - Pre-tests at the BKA
  - BSI certified conformity (similar process to CC evaluation): independent testing by accredited testing lab
Enrolment process overview

- The standard process is the enrolment of two fingers, one from the right and one from the left hand.
- Fingers which are not available (e.g. due to injuries or handicaps) are not part of the standard process.
- If there is only one hand available, then only fingers from this hand will be enrolled.
- It is up to the official to decide if a finger is suited for enrolment or not.
- Pre-defined order: index finger → thumb → middle finger → ring finger
- Mandatory process: one has to try two fingers of one hand before the option to switch to the other hand is opened.
- From each hand, the best (according to our quality scoring) finger is selected for storage.
Enrolment of a single finger

- From each fingerprint, three separate images are captured (by placing the finger three times on the scanner).
- For each image, the quality score is calculated.
- The systems matches the three images against each other to avoid substitutions.
- The best image, according to match score, is selected for storage.
Live-Demo Fingerprint-Enrolment-Software 1/2
Live-Demo Fingerprint-Enrollment-Software 2/2

FAE-ANWENDUNG: Fingerabdrücke aufnehmen

Folgende Fingerabdrücke wurden ausgewählt
Auswahl: Erster Finger

Finger: RH / D
Qualität: 100
Matchwert: 249

Finger: LH / D
Qualität: 100
Matchwert: 413

Bitte wählen Sie 'Übernehmen' um die ausgewählten Fingerabdrücke zu akzeptieren.

Hilfe  Komplett zurücksetzen  Übernehmen  Abbrechen
Enrolment process: QA-software

1. The software has to model the control flow so that the fingers are taken in the correct order
2. Pre-qualification of single fingerprints by NIST NFIQ algorithm
3. There is always a series of 3 enrolled images per finger
4. Choose the image with the best Bozorth3 reference match score average

Why?
- Existing possibility of taking several images at enrolment (quality vs. time)
- When you have to choose between several similar images, NFIQ won’t help you (tests have shown that in most cases, all three fingerprints have the same NFIQ value)
- Solution derived from a set of about 70,000 fingerprints (from over 1,100 persons with 3 different sensors in autumn 2006)
Pilot Testing
Pilot testing: overview

- Final goal: functioning enrolment software, secure transmission, import into production systems, production of e-passports incl. FP for 5300 municipality offices
- Preliminary legislation in place for testing purposes (citizens in participating communities have to apply with fingerprints!)
- Participation of >28 municipality offices
- Cross section of all types of infrastructures (client/server, Citrix, PC, …) and all major software vendors
- Participants: MOI, BSI, BKA, Bundesdruckerei, vendors, offices
Timing considerations (1)

- Average time to **apply for an e-passport**: 8 min (based on 101 persons)
- Minimum: 3.4 min / Maximum: 24 min
• Average time to enrol two fingerprints: 2.3 min (based on 112 persons)
• Minimum: 42 sec / Maximum: 11 min
Fingers finally selected for e-passport storage

- In 90% of all cases, the index fingers were successfully enrolled
- Order during the test: index – thumb – middle – ring finger

100% = 20,235 data sets
Successful concept of capturing 3 individual images

• In almost 50% out of 38,000 fingerprint images, the third image was selected, an obvious learning effect
• Conclusion: it is useful to choose from 3 individual images
Distribution of NFIQ quality scores

- More than 80% of 112,000 fingerprints had NFIQ=1, highest quality.
- Approx. 2% had NFIQ=4 or NFIQ=5, lowest quality.
**Conclusions**

- Fingerprint enrolment creates so far **unknown challenges** for municipalities, citizens (…and the government).
- The German enrolment process is **quality centred** – only a few compromises for faster handling were accepted.
- Technically, a whole **new infrastructure** for the enrolment alone has to be installed/updated – not to mention the different PKI requirements.
- **Pilot Testing** is of outmost importance, for enrolment issues and technical processes.
- **Education, training and up to date information** of municipalities and citizens has to be organized.
- A **conformation testing** scheme will be implemented to check all important components of the process.
Thank you for your attention...

Questions?

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