

Towards Best Practices for Biometric Visa Enrolment

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Abstract:

Public sector applications - e.g. the process of application of a biometric visa - are connected to different kinds of technical, organisational, and legal requirements. But how can those requirements and recommendations be retrieved, analysed and described? The German federal government has taken part in the European pilot project BioDEV II in order to gain comprehensive experiences regarding the handling and processing of biometric visa. Furthermore, the Federal Office for Information Security (BSI) publishes technical guidelines that address different topics in information security. In this context, the Technical Guideline Biometrics for Public Sector (TR Biometrics) has been published in order to describe technical and organisational requirements and recommendations in the context of biometrics for electronic identity documents. In this paper the authors give an overview of the pilot project BioDEV II and show how the results have been introduced in the TR Biometrics.

1 Introduction

Based on the European Regulation No 767/2008 [EC-767-2008] a central Visa Information System (VIS) is prepared in Europe which will introduce a new generation of short-stay visas. The application for a visa will be connected with biometrics in particular the acquisition of fingerprints. Thereby, this biometric data is transmitted and stored in the central VIS which is connected to a Biometric Matching System (BMS). Hence, different processes have to be considered and established starting from the secure acquisition of the biometric data to the later verification of the biometric features at border control. Within the scope of verification and identification not only questions regarding the different requirements and the quality of the captured biometric data have arisen but it must also be answered how the usability can be realised in an adequate way. By taking part in the European pilot project BioDEV II the German federal government has gained comprehensive experiences regarding the complexity of the processes not only on the organisational level but also regarding technical aspects.

The results of the BioDEV II project as well as the experiences made in Germany with the introduction of the new ePassports starting in 2005 have been gathered and analysed in several projects. In this paper the approach of BioDEV II will be. Afterwards the concept of Technical Guidelines for governmental identity documents in Germany and in particular the Technical Guideline “Biometrics for Public Sector Applications” (TR Biometrics) published by the German Federal Office for Information Security (BSI) will be introduced briefly. It will be shown how the results of the BioDEV II project have found their way as requirements, recommendations and best practices for the course of actions into this technical guideline that shall be undertaken if the afore described processes are realised.

2 Pilot Project BioDEV II

With the pilot project BioDEV II (Biometric Data Experimented in Visas) the European Commission has offered the possibility to gain experience with handling of visa by representing the complete and comprehensive process chain for the issuance of visa and the adjacent usage. Eight member states of the Schengen area took part in this pilot project. Those were Austria, Belgium, France, Germany, Luxembourg, Portugal, United Kingdom and Spain. The acquisition of fingerprint data and the decision if the captured biometric data has adequate quality have to be performed based on consistent rules and conditions. These are beside other time, usability and quality assurance. Thereby, the interaction between the different components and the involved roles has to be considered. As a result, the foundation to check an identity at border control is enabled. In the pilot project - from October 2007 to August 2009 - in particular the interactions of the software and hardware components have been observed by logging the results of the different components. In order to perform these tests a national VIS was installed and hosted by the German Federal Office of Administration (BVA). This national VIS was designed in respect to the central VIS/BMS. During the evaluation the processes for visa enrolment and border control were tested and analysed.

For the enrolment process two consular posts one in Syria (Damascus) the other in Mongolia (Ulan Bator) have been selected and these offices were equipped with a basic enrolment client software from October 2007 to December 2008. The acquisition of fingerprints with this software provided basic quality assurance mechanisms and additionally allowed the operators to make decisions regarding the fingerprint quality. The logging results showed that the quality of the captured fingerprints led to high rejection rates up to 82%. Therefore, the deployment of an enhanced enrolment client was decided. In order to evaluate a greater amount of properties two solutions of enrolment clients were provided. The properties comprised besides other hardware auto-capture within the fingerprint scanner vs. auto-capture as part of the software. Furthermore, the acquisition of multiple slaps of fingerprints has been supported and thereby composite records have been generated. The decision which fingerprint had to be included in the final set has been made based on independent quality assurance mechanisms as well as based on the mechanism of cross-matching. If applicable, the repetition of fingerprint acquisition has been necessary. In doing so, the acquisition of multiple slaps has been considered as well as the approach of optional single-fingerprint acquisition. By taking several slaps the possibility to lift the fingerprints after each capture or to permanently apply the fingerprints to the fingerprint scanner has been observed, too. Appliance of an open quality assurance software (NIST QA) together with segmentation on the one hand and the use of vendor specific quality assurance software together with segmentation on the other hand have also been considered.

The mechanisms that were applied in the enhanced enrolment clients had a great influence to the rejection rates. Accordingly, the rejection rates based on the Sagem Kit 4 went down in Damascus from 69% (phase 1) to 25% (phase 2) while the results changed in Ulan Bator from 82% (phase 1) to 43% (phase 2). Additionally, improvements within the scope of the quality assurance algorithm of Sagem Kit 4 lead to even better rejection results down to 3%. Nevertheless, the better results in phase 2 of BioDEV II have only been possible for a trade: the processes took 1 ½ to 3 times longer time than before. This fact shall not be underestimated since usability has shown to be a key element within the complete process.

Besides technical mechanisms furthermore organisational safeguards have been introduced and their impacts have been observed. This included acquisition guides (i.e. posters) that visualise how the fingers shall be placed on the sensor as information for the operators and a separate information poster for the applicants during enrolment. The same is true for training videos. Additional tools to improve image quality e.g. if a person has dry fingers has been provided. The displaying of the captured fingerprints through feedback monitors has also been conducted.

After the performance of the enrolment process the analysis of the verification process at border control was necessary to complete the test system solution. Here, in accordance with the enrolment two different German airports were selected to collect analysis data. Those were the airports in Schoenefeld and Tegel both located in Berlin. Verification for travellers holding a biometric visa can be divided into two positions. In the first position the properties time and usability play an important role in order to allow high throughput. This means that the live captured fingerprint images are only matched against the biometric data that is stored in the VIS for this person (1:1 verification). The second position shall be entered by a traveller if the verification has failed at first position. This means that the comparison of the live captured fingerprint images of the visa holder did not match against the corresponding biometric data stored in the VIS whereas the connection is made over the visa sticker number. In this case 1:1 verification as well as 1:n identification are provided and can be executed on request. In the second position up to ten fingerprints may be captured (acquisition of slaps of the left and right hand as well as the thumbs). In any case, the border control process anticipates that at first the visa sticker is read and the according biometric features are captured. This data for verification is then coded and sent to the national VIS. The comparison result is sent as response from the VIS. Again, the BioDEV II project had the agenda to evaluate different properties. In particular the verification time and the use of different quality assurance algorithms were analysed and different fingerprint sensors types were applied.

3 Provision of a Technical Guideline for Biometrics

The Federal Office for Information Security (BSI) has published several technical guidelines in different application areas in order to describe adequate security requirements and/or safeguards. With the introduction of electronic Passports in Germany commencing on November 2005 the specification of new processes regarding the application, processing and transmission of electronic and biometric data became necessary. The normative requirements were described in the Technical Guideline “zur Produktionsdatenerfassung, -qualitätsprüfung und -übermittlung für Pässe” [TRPDÜ].

Very fast after the introduction of the ePassports it became clear that the experiences gained within this scope were important not only for other governmental electronic identity documents such as the national identity card or visa but also for different kind of public sector applications (i.e. application profiles) like application of a new document or verification and identification processes at border control. This is in particular true for the hardware and software components that were already put in operation at the municipalities and shall be used again for further applications or with other governmental documents. Therefore, several technical guidelines were published which can be traced back or connected to the TR PDÜ and represent different parts. Those are:

- TR PDÜ hD [TRPDÜ]
description of the business processes and the complete application process
- TR Biometrics [TRBIO]
encapsulation of requirements and recommendations regarding biometrics
- TR XhD [TRXhD]
XML representation for the exchange of application data
- TR SiSKo hD [TRSiSKohD]
requirements regarding secure communication processes for governmental documents.

3.1 Technical Guideline Biometrics for Public Sector Applications

The processing of visa or the new national identity cards will be connected to biometric data of the document holder as described in section 2 or as it is already applied for ePassports. Therefore, it has been proven advantageous to specify uniform quality requirements and recommendations as well as interoperability requirements in order to be able to use the same hardware and software components in different public sector applications and to establish uniform conditions.

As a consequence three parts of the TR Biometrics (TR-03121) have been published (compare [TRBIO]). In the first part (TR-03121-1) the framework and concept of the guideline and how to apply it are introduced and described. In part two (TR-03121-2) the software architecture and Application Profiles depending on the governmental document are specified. Thereby, the software architecture is based on the BioAPI concept [ISO06] which allows an easy and flexible way to integrate further biometric modalities or capture devices. The Application Profiles give more information about the processes in relation to the biometric feature, the target groups and the relevant documents that shall be referenced (e.g. regulations, standards, technical descriptions, etc.). The requirements, recommendations, and best practices that are valid for a specific Application Profile are encapsulated in so called Function Modules. This has the effect that it allows a specific target group to select only those Function Modules that are relevant for their business processes. E.g. a provider for quality assurance software is interested in the requirements regarding fingerprint comparison while a provider of hardware components (e.g. a fingerprint sensor) needs to know the specific requirements regarding acquisition and biometric image processing. Thus, a mapping table is part of every Application Profile so that an overview of all Function Modules (i.e. requirements and recommendations) is given from which an instance of the target groups can choose from. The actual Function Modules are listed and

specified in part three of the technical guideline (TR-03121-3) depending of the biometric feature (fingerprints or facial image).

The guideline is designed in a way that it is easily possible to add new Application Profiles and it's connected Function Modules for a governmental document. With the results of the BioDEV II project extensive experiences regarding the enrolment and later usage (i.e. border control) have been made. In the following section it will be shown how these results have found their way into the TR Biometrics.

3.2 New Application Profiles in the TR Biometrics for Biometric Visas

Two main processes have been analysed in the BioDEV II project and have been depicted in section 2 of this paper:

- Enrolment for biometric visa and
- Performance of border control with biometric visa.

In order to transform the results regarding biometrics of the pilot to requirements and recommendations for the TR Biometrics at first, new Application Profiles “Application for Biometric Visa”, “Basic Identity Check Biometric Visa”, and “Extended Identity Check Biometric Visa” have been added in part two. The first listed Application Profile starts with a short overview of the current situation of the Schengen Member States regarding biometric visa. Afterwards it is shown how the instances of the biometric visa application process correlate to each other. Biometric data for a new visa is captured in the visa application office and then sent to the National Central Authority (NCA) which forwards the data to the central VIS respectively the BMS. The BioDEV II project has shown that quality assurance is very important and has a large effect on the overall process. Significant results can only be provided if adequate logging information is available. Therefore, a description which information shall be logged needs to be given. Within the Application Profile this is highlighted by the Biometric Evaluation Authority (BEA) and furthermore described in part 3 in a separate Function Module (FM Coding and FM Logging). Furthermore a short process overview how the fingerprint images are captured and a facial image is obtained is given. While the process for fingerprint acquisition is based on the BioDEV II results the description how a facial image can be provided is based on the experiences made with the application of a German ePassport. Finally, the mapping table shows which Function Modules are important for this specific Application Profile. Thereby, Function Modules are “reused” from former defined Application Profiles if the requirements and recommendations are true for the situation in hand and additional (new) Function Modules are added if the requirements are specific to the Application Profile “Application for a Biometric Visa”.

The transformation of the requirements and recommendations - which are highlighted as Functions Modules in the afore mentioned mapping table - can be found in part 3 of the TR Biometrics. The Function Module Process (abbreviated with P-FP-VAPP) shows the balance that has been figured out between quality assurance and usability. Here as an example, the concept of composite records based on cross-matching has been adopted. Requirements for the acquisition hardware and software are chosen based on the requirements and recommendations that have been found in the context of the national identity card. Biometric image processing and thereby applying segmentation is based on the experiences made in BioDEV II. The Function Module

Coding (referenced with COD-FP-VAPP) describes the structure how the biometric data and the corresponding additional quality information are provided whereas the focus of the technical guideline is set on the quality values and logging information. While the purpose of logging is to collect specific data to understand the processes it is the objective of the evaluation to analyse the data based on specific evaluation methods. The requirements for evaluation are described in a separate Function Module (FM EVA-FP-VAPP). Safeguards for quality assurance have been tested with acquisition guides that visualise the correct positioning of the hands. This approach has been proven to be advantageous since it supports the official at the application counter. Therefore, these examples and the specification of the operation of devices and process requirements have been added besides further recommendations in the Function Module Operation (FM O-FP-VAA). The same is true for the user interface (FM UI-FP-APP).

The technical guideline containing the three named Application Profiles for biometric visa as well as the assigned Function Modules has been published in a developer version 2.1 on the web page of the Federal Office for Information Security.

4 Conclusions

The afore described derivation of requirements and recommendations from the pilot project BioDEV II into the Technical Guideline Biometrics for Public Sector Applications has shown that not only technical but also organisational safeguards have to be taken into account. Thereby, the different properties which are possible had to be evaluated against each other in order to describe processes that show the best balance between high quality and usability. Here, in particular the time factor is very important because high quality is connected to a longer enrolment time while a good usability requires fast and easy usage. But an adequate decision can only be made if comprehensive logging data is available that allows evaluation of the situation also in the case that errors might occur.

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