

STAND4ALL Evaluation Case Study

Now that you have completed the STAND4ALL training, we would like to ascertain whether or not you feel you can apply your learning in future standards development processes. So we have devised a short case study to help you to demonstrate your competence at using Guide 6 to deal with disability and accessibility issues when you are working with a committee to develop a new standard or revise an existing standard.

The task

You have been asked to work with a group of experts and disabled people to scope out a standard for a biometric capture system for identity verification for a building security system. The scope of the standard only covers the actual capture of the biometrics from building users and visitors, it does not cover the specification of the security system that will be used thereafter. So the scope of the standard is as follows:

- What biometrics will be captured?
- How will they be captured?
- How will the process of capture be managed including setting up capture locations, getting people there to record biometrics, the process of capture
- What training will staff need to do the biometric capture?
- How will confidentiality, data protection and privacy issues be dealt with?
- End process verification – ensuring the biometrics captured can be used successfully for verification of identity.

Stage 1

Using Guide 6, firstly set out below which tables you think are relevant to this proposed standard and why you think they are relevant:

Stage 2

Go back over each table and look back to the scope of the standard, what do you think the accessibility and disability issues are for each element?

Stage 3

What solutions could you suggest to solve these issues?

Answers

(This section to be used by STAND4ALL consortium member to establish how good the responses are).

Stage 1

Relevant table	Reason(s)
Table 1 - information	<ul style="list-style-type: none">a. Information will need to be provided about how and where the biometric capture will take place including any access issues such as booking accessible parking spaces, BSL interpreters to support Deaf people, appointment systemsb. Any information provided to people before or on the day will also need to be fully accessible. E.g. instructions on what the process will be, any queuing procedure etc will all need to be accessible.
Table 3 - Materials	This is not an easy one to think about, but it could be relevant in terms of what the biometric capture system parts are made of, e.g. the way that the physical capture system is constructed.
Table 5 – user interface	Very relevant, for example if

	<p>the biometric capture is in a booth, is this accessible to wheelchair users, if the system is automated by voice command this will need to be accessible to Deaf people and sight impaired people where the auto instruction will need to be well designed. Also what role will staff assisting people take, will they have disability equality training, and will they be able to appropriately assist disabled people?</p>
<p>Table 7 – built environment</p>	<p>This could be a catch all for everything that isn't related to people, the premises used for capture, the way that the capture system works, and the way that the end product is provided to people.</p>

Stage 2

There will be other issues that people may identify either under tables or separately. A summary of the key issues for various groups is as follows:

Visually impaired people

- Absence of iris caused by genetic problems or possibly same effects from people who have had laser eye surgery
- Blind people can have problems due to their natural difficulty to align their eyes with the camera
- Nystagmus (tremor of the eyes)
- People that have been operated on for cataracts may need to be re-enrolled

Hearing impaired-Deaf people

- Speech may be affected due to loss of hearing resulting in difficulty in using voice recognition systems
- Inability to hear instructions for example from the camera of face and iris recognition systems or from staff assisting people to register

Physically impaired people

- Conditions such as arthritis may affect usability (it may be difficult to position the finger and/or hand correctly)
- Skin conditions such as eczema may cause blistering on the fingertips
- Any kind of surgery that significantly changes the structure of the face, will require an individual to re-enroll
- Cuts, bruises and swelling can have a temporary affect on face or hand images
- Inability to use hand or finger based systems due to loss of limbs and or digits
- Crutches may make it difficult to stand steadily
- Drooping eyelids
- Wheelchair users can face usability barriers due to the usual location of cameras and insufficient height variation possibilities
- Changes in medical condition can be faster than normal ageing affects so need to re-enroll more regularly
- Those with cerebral palsy, multiple sclerosis, muscular dystrophy, motor neurone disease etc, may have little control of their muscle movement and may find it very difficult to hold their head or fingers still long enough for a facial, iris or fingerprint recognition device. Similarly they may be unable to record a digital signature or a consistent digital signature.

People with cognitive impairments

- Dyslexia, language, learning or knowledge retention difficulties may make it difficult to reliably and consistently provide a biometric sample or otherwise navigate through an automated process
- May need additional support and explanation from staff about how to register including information in easy words and pictures.

Older people

- Biometrics usually have higher failure rates with the very old. As people get older, ageing processes tend to degrade biometrics. For instance the ridges of their fingerprints wear down and cataracts are more prevalent.
- In addition to visual impairments, many older people have a combination of impairments (cognitive impairments such as dementia, physical impairments such as arthritis and Parkinson's disease etc). Also multi-tasking becomes less easy. The effect of all these factors is that many older people may have problems in using a biometric terminal at the same speed as their younger counterparts if at all

Accessibility problems for non-disabled people

Accessibility problems may not be restricted to disabled people. Other groups of people may be affected, for example, people carrying out construction and manual work. People working with cement and chemicals may result in the wearing down of fingerprints.

The wearing of veils due to religious reasons may result in some people being unwilling to use certain biometric technologies such as face and iris recognition systems.

People who have had cosmetic surgery (e.g. botox) may have problems with face recognition systems, in particular at the

authentication stage if they have had the procedure after the enrolment stage.

Cold weather may affect people using fingerprint and signature recognition systems especially if the authentication terminals are outside.

If the instructions of how to use an unmanned enrolment or authentication terminal are not clear then this will affect everybody in using all systems.

Stage 3

Some solutions should be about process design and some should be about 'physical accessibility'. If people suggest that they will seek advice before putting forward solutions that's a good thing as long as they make it clear they will seek advice from experts but will also develop solutions with disabled people's involvement.

Background information that may be useful

Relevant standards

ISO/IEC 19795 - Biometric Performance Testing & Reporting
ISO/IEC 19792 - Framework for Security Evaluation of Biometric Systems

Section 5.4.38 Biometric Characteristics of the draft European standard [EN 1332-4 Identification Card Systems - Man-Machine Interface - Part 4: Coding of user requirements for people with special needs](#) relates to a multimodal tag.

Best Practices in Testing & Reporting Biometric Device Performance

www.cesg.gov.uk/site/ast/biometrics/media/BestPractice.pdf

Standard under development

A draft ISO standard is under development that will highlight the needs of disabled and older people and suggest practical ways of addressing their needs:

1. Systems using a biometric should be designed so that as many potential subjects as is reasonably possible can use the system effectively and with the minimum of discomfort.
2. In the design of such new systems or services, the needs of disabled subjects should be considered from the outset.
3. Before systems are deployed, they should be thoroughly tested with subjects who represent the widest range of abilities (that is, in respect of visual, auditory, physical, cognitive and behavioural ability).

4. For subjects with a disability, adequate training in the use of the system should be offered.
5. Wherever practicable, the subject should have a choice of biometric systems, and should not be discriminated against if their disability prevents them from using a specific biometric.
6. Where no alternative biometric is available and where the disability prevents the use of this biometric, subjects should be permitted to use an alternative method. Wherever practicable, the use of such an alternative should not result in an inferior level of service or functionality to the subject.
7. If the subject can no longer use a verification system reliably, the subject should be provided wherever feasible with the opportunity to repeat the registration process.
8. Staff operating systems using a system with biometrics should be trained in how to process disabled subjects.
9. A system using a biometric should not store details of a subject's disabilities without their informed consent.
10. The rights of privacy of a disabled subject should be the same as those of a non-disabled subject.

Biometrics

What are biometrics?

A biometric is a **physical** or **behavioural** feature or attribute that can be measured. It can be used as a means of proving that you are who you claim to be, or as a means of proving without revealing your identity that you have a certain right.

Biometrics which are commonly used to confirm identity include:

- Fingerprint recognition
- Iris recognition
- Face recognition
- Hand geometry recognition
- Vein recognition
- Voice recognition
- Dynamic signature recognition

What is a biometric system?

A biometric system is essentially a pattern recognition system that operates by acquiring biometric data from an individual, extracting a feature set from the acquired data, and comparing this feature set against the template set in the database.

If you would like further background information on biometrics please click on the following link: [An introduction to biometrics](#)

Some physiological and medical factors can affect the usability and efficiency of biometrics:

Advantages of biometrics for people with disabilities

The obvious advantage of biometric systems is that the user no longer has to remember PINs (personal identification numbers) and keep this number secret. People with a cognitive impairment will find most biometric systems much easier to use and provide a greater level of security.

People who have limited or no use at all of arms or hands will find using face and iris recognition systems an advantage as they will not have to swipe a card or type in a name or PIN number.

Enrolment Terminals

To register a biometric for public use (e.g. for a passport), the subject will usually have to go to a centre where specialist staff take the biometric and check other relevant documentation. Ideally these staff should be trained to work with people with disabilities. For private use (e.g. replacement for a password on a personal device such as a laptop computer), the subject is expected to follow instructions on the screen or in a printed manual to register the biometric.

The environment of the enrolment centre needs to meet the general accessibility for [public access terminals](#). However specific biometrics will require special consideration (see details in the sections related to the various biometrics).

Authentication Terminals

These may be fully supervised, partially supervised or un-supervised; this is likely to be significant for occasional users and for some people with disabilities. In general, a consistent user interface will benefit all users and may be of particular importance for some people with disabilities. With un-supervised terminals it would be beneficial for there to be a standardised set of icons, symbols and pictograms for the operation of the terminal.

It is essential that the authentication terminal is comfortable to use. For instance, enrolment of fingerprints will normally be done with the subject sitting down. However the authentication may be done with subject standing. It is important that the height and angle of the fingerprint reader is comfortable for both a tall person and someone in a wheelchair. If it is not viable to make the reader variable height (or on a flexible lead), it might be helpful if it was tiltable to allow a comfortable angle for the wrist. A wrist rest might be beneficial for a subject with hand tremor.

Like all input devices on public terminals, it is important that the device gives both auditory and visual feedback of the current status (e.g. still processing, accepted, rejected). It is also important that error messages are helpful and give guidance on what the subject should do differently.

Ability to update biometric

The biometric information can be stored in a central database or on a smart card. Users are likely to prefer the information to be stored on their card rather than on a remote database. However, it is easier to regularly update the database with revised biometric data as the user's characteristics change.

Using multimodality to enhance the usability of systems

Two (or more) modalities could be combined in parallel to produce a system that would allow more flexible use. For example biometric systems built for both fingerprint and face recognition, could allow the use of only the facial image for verification when users have problems enrolling their fingerprints and vice-versa. Moreover, this procedure could prove extremely useful to those users who have temporarily lost the ability to provide one of their biometric traits (for example, a temporary eye problem that rules out an iris scan). The same could apply in cases where people refuse to use a specific modality (for religious or health purposes, for instance). A multimodal system therefore allows enhanced flexibility by providing alternatives for the identification process. As such, it also has the potential to be more socially inclusive.

Providing instructions in an accessible format

- If the terminal is unmanned, or an assistant is not always available to help the user, audio instructions should be provided, taking the user step-by-step through the enrolment and authentication process.

- Instructions should be provided, explaining any progress made.

For example, if a fingerprint scan is successful: "This scan was successful, please remove your finger and place it on the reader again."

- Any further instructions explaining what the user is doing wrong would also be very helpful.

For example, if an iris scan is not successful: "This scan was not successful, please turn your head slightly to the right."

or

if a fingerprint scan is not successful: "This scan was not successful, please hold your finger still on the reader."

- There should be a clear sound to indicate a success and a failure. A success should be signified by a higher more pleasant sound (e.g. chimes ringing), a failure by a lower less pleasant sound (e.g. buzz).
- The user should be told, before the scanning process starts, if it is necessary for more than one scan to be taken for registration.
- When the first scan has been taken there should be an audible acknowledgement (such as a chime sound) followed by a spoken instruction: "The first scan has been successfully recorded. Please place your finger on the fingerprint reader for the second scan." And so on.
- There should be a clear indication when the registration process is complete. For example an audio message "Your iris pattern has been successfully registered."
- If the terminal is awaiting further information, the instruction should say this. If not, it should indicate that the user has reached the end of the process. For example "The registration process is now complete. Thank you."

- If registration fails, there should be a clear indication that the process will restart. For example "The registration has failed because the four images did not match. The process will now restart."

Informing the user that the reader is waiting for him/her to take action

- The reader should be lit when it is awaiting input from the user.
- The reader should only light up when it is ready to enroll a biometric. When the process is complete the light should turn off.
- A spoken message to inform users that the biometric reader is awaiting input would help users who have insufficient vision to see the visual signal.
- A timeout feature on the terminal should not be excessively short, as the user may need an extended period of time to find the reader and to complete the required actions.
- If the user is taking an unusually long period of time to respond to an instruction the instruction should be repeated at least once before the terminal times out.

Catering for users who do not require audio instructions (e.g. those who have good vision, or those who are familiar with the process)

- An option to bypass the audio instructions should be provided. This could simply be that the audio comment is skipped or cuts out if the user provides the correct input.

Reference: [Identification of Accessibility Issues for Visually Impaired Users of Biometric Technologies: Fingerprint Readers](#)

Research

In the United States of America, the [Biometric Standards, Performance and Assurance Laboratory](#) of Purdue University,

focuses on the data collection of "extreme populations". Two examples are the elderly and those that have illnesses that can affect a biometric either through the illness or the treatment:

- [Image quality and the elderly](#): an initial study examined how fingerprint image quality was affected by age
- [Extreme populations](#): focuses on data collection of "extreme populations". Two examples are the elderly and those that have illnesses that can affect a biometric either through the illness or the treatment

The primary aim of the Social and Environmental Special Interest Group of the [European Biometrics Forum](#) is to investigate and report on issues and concerns which might arise from the mass implementation of biometric systems across the European Community, from the end user perspective.

These include issues and concerns relating to:

- Physically disabled and people with learning difficulties

The [Biometric Foundation](#) is dedicated to a systematic program of research and education to reduce impediments to wide adoption and use of all biometric technologies. The Foundation will address technical, societal, and legal aspects of biometric technologies and their applications. Accordingly, the Foundation's agenda will include studies of public attitudes toward uses of biometrics; demonstration and evaluation of alternative biometric technologies; inquiry into biometric standards issues; development of formal educational curricula that encourage students to enter the field of biometrics as a professional career choice; and conferences and seminars about the most effective uses of biometrics in key applications.

[UK Passport Service \(UKPS\) Biometrics Enrolment Trial \(PDF\)](#)

The goal of the UKPS Biometrics Enrolment Trial was to test the

processes and record customer experience and attitude during the recording and verification of facial, iris and fingerprint biometrics, rather than test or develop the biometric technology itself. One of the 3 sample groups recruited were a disabled participant sample of 750.

According to the UKPS, the trial results highlighted several issues that require further investigation or work. Among other things, further trials are needed, specifically targeted towards those disabled groups that have experienced enrolment difficulties due to environment design, biometric device design, or to specific group problems - for example, black participants and participants aged over 59 had lower iris enrolment success rates.

Further information

- Ashbourne, J, Ethnicity in Relation to Biometric Identity Verification, March 2004
- Ashbourne, J, [The Social Implications of the Wide Scale Implementation of Biometric and Related Technologies](#), (PDF) , January 2005
- [Biometrics: Designing for People \(PDF\)](#)
- [Biometrics: Usability & User Acceptance \(PDF\)](#)
- [European Biometrics Forum](#)
- Fennell, A, Dr. [Identification of Accessibility Issues for Visually Impaired Users of Biometric Technologies: Fingerprint Readers](#)
- [International Biometric Group](#)
- Maghiros, I, Punie, Y, Delaitre, S, Lignos, E, Rodríguez, C, Ulbrich, M, Cabrera, M, Clements, B, Beslay, L, Van Bavel, R. [Biometrics at the Frontiers: Assessing the Impact on Society \(PDF\)](#), EUR No: EUR 21585 EN, February 2005
- [Proceedings of Conference on Accessible Biometrics](#), 18th May 2005, London
- [Resources Related to Biometrics and People with Disabilities](#)
- [UK Passport Service \(UKPS\) Biometrics Enrolment Trial \(PDF\)](#)

- [Using speech: Designing Biometric Devices](#)

Acknowledgements

The information contained in this section was collected from the following sources:

- Maghiros, I, Punie, Y, Delaitre, S, Lignos, E, Rodríguez, C, Ulbrich, M, Cabrera, M, Clements, B, Beslay, L, Van Bavel, R. [Biometrics at the Frontiers: Assessing the Impact on Society \(PDF\)](#), EUR No: EUR 21585 EN, February 2005
- Marek Rejman-Greene, Home Office
- Anil K. Jain, Arun Ross and Salil Prabhakar, [An Introduction to Biometric Recognition \(PDF\)](#), Appeared in IEEE Transactions on Circuits and Systems for Video Technology, Special Issue on Image- and Video-Based Biometrics, Vol. 14, No. 1, January 2004. (Section 8. Multimodal Biometric Systems)