Simplifying the rolled fingerprint capture process

INTRODUCTION

Compared to flat fingerprints, capturing rolled fingerprints is a complex process. Today, electronic fingerprint scanners have replaced the manual ink-and-paper capture process in many places. Although electronic scanners have improved over the years, the capture process still requires continuous practice and training. One of the key elements to support the officer during the capture process is to provide real-time, on-device feedback. Having dynamic feedback on the position and speed of the rolled finger on the scanner itself rather than on a separate screen, helps to simplify the capture process and make it more secure for the officer.

CHALLENGES WHEN CAPTURING A ROLLED FINGERPRINT

From a physical point of view capturing a rolled fingerprint, whether with ink-on-paper or by a livescanner, means converting a dynamic 3-D-object into a 2-D-image. When the finger is pressed onto the surface, it is continuously deformed.

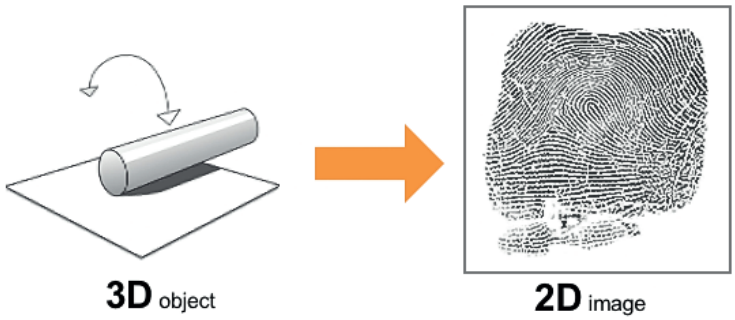

Figure 1: Rolled fingerprint - Conversion from 3D to 2D

In contrast to the ink-and-paper process, where the image is continuously is formed by ink, with live-scanners this image forming process is much more complicated. To have a perfect representation of the rolled fingerprint, discrete images of the rolled finger need to be captured.

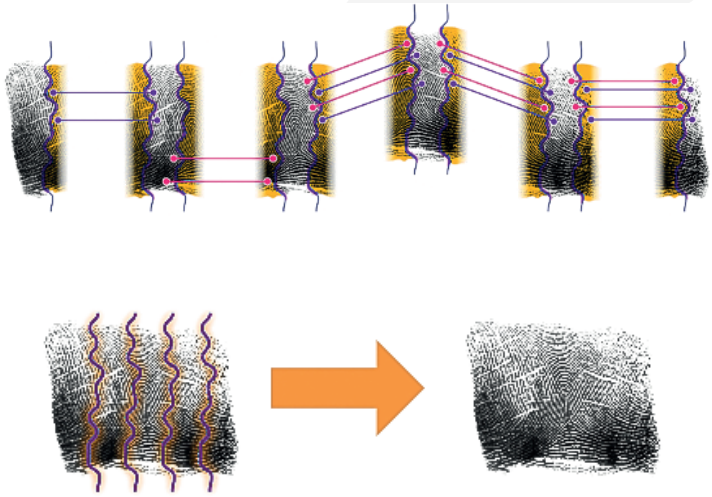

Figure 2: Single images are stitched together to form a rolled fingerprint

Although there are various rolled finger algorithms, the basic principle is always similar: Single images are captured that have an overlapping area with the previous and succeeding image. Next, an intersection is generated based on local similarities in the overlapping areas of two adjacent images. Finally, the single images are stitched together using these similarities to form a rolled fingerprint image as shown in Figure 2.

PARAMETERS THAT DETERMINE ROLLED FINGERPRINT QUALITY

Speed

It is obvious that speed has an essential impact on the rolled fingerprint quality. In order to capture single images that contain as much as possible information, the finger should not be rolled too slow or too fast. Rolling too fast, risks the loss of single images (the finger is rolled faster than the integration time of the sensor), which leads to finger slippage and motion blur. Rolling with a very slow roll speed often leads to the capture of only one position.

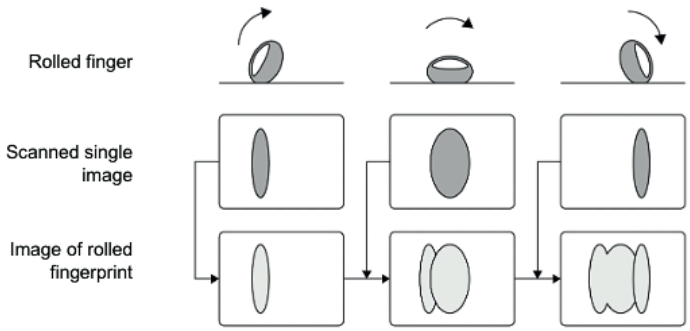

Figure 3: Moving and turning the rolled finger simultaneously over the capture surface

Movement

Fingers needs to be rolled continuously over the capture area and shall not be rolled on one position only. The latter will cause overlapping fingerprint ridges and an unusable fingerprint image.

Consistent pressure

As there is a continuous deformation of the finger it is important to keep this deformation at the same level during the rolling process. Only in this case, the fingerprint ridges and valleys will be shown and the true width and minutia can be identified.

Position of the fingerprint scanner and the user

In order to consider all the above described parameters, the setup of the fingerprint scanner is a critical point to consider. If the scanner is placed too high, fingers are often lifted, i. e. the upper part of the finger is not pressed onto the surface correctly. If the scanner is placed too low, too much pressure is applied to the fingertip. The applicant should be positioned straight to the fingerprint scanner to simplify the capture process.

TYPICAL ROLL ERRORS

The most typical issues with rolled fingerprint images are caused by shifting and lifting. Figure 5 shows typical rolled fingerprint problems that are caused by incorrect roll speed, inappropriate setup of the scanner, incorrect position of the applicant or varying pressure on the finger. Whereas shifting problems cause misalignments or blurry fingerprint ridges, lifting of the finger will cause missing parts of the rolled fingerprint.

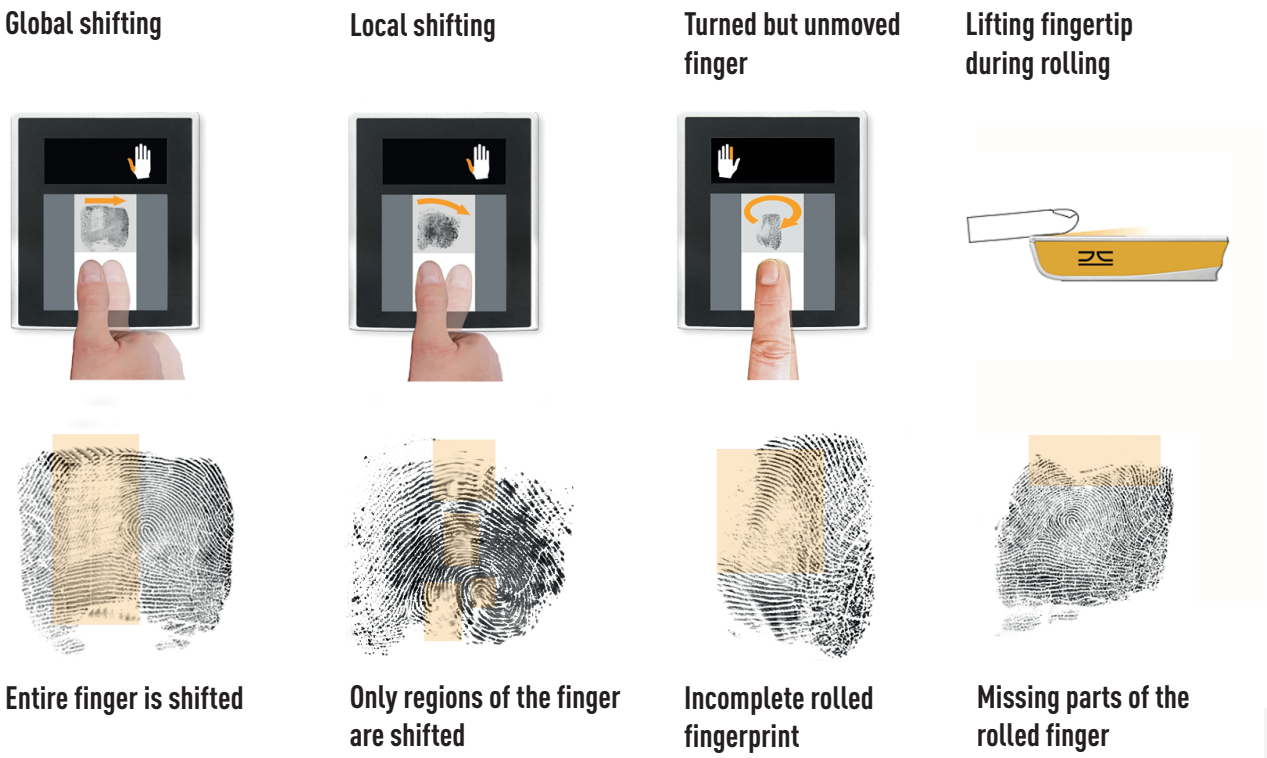

Figure 5: Typical rolled fingerprint problems

SIMPLIFYING THE ROLLED FINGERPRINT PROCESS

With the introduction of new TFT-based fingerprint technologies, the acquisition of rolled fingerprints has been simplified to a large degree. The ability to have a user guidance and feedback area directly underneath the capture area supports the user to generate rolled fingerprint images with consistent high quality.

Focus on the scanner only

Having a user guidance directly within the scanner does not require the office to switch between the scanning process and the computer screen. The officer can fully concentrate on the scanner without checking the position and rolling process of the finger on a separate screen. This improvement not only increases the security of the officer during booking but also facilitates the capture process.

Figure 6: Guidance for rolled fingerprint capture on a separate screen or directly at the scanner

Find the capture area immediately

Rolled fingerprints are recorded in the defined height and width. The larger the scanning area, the more difficult it is to find this position without risking that the fingerprints are captured outside the detection area. A display under the sensor clearly marks the detection area and helps to start the rolling process immediately and not to roll the finger outside the defined area.

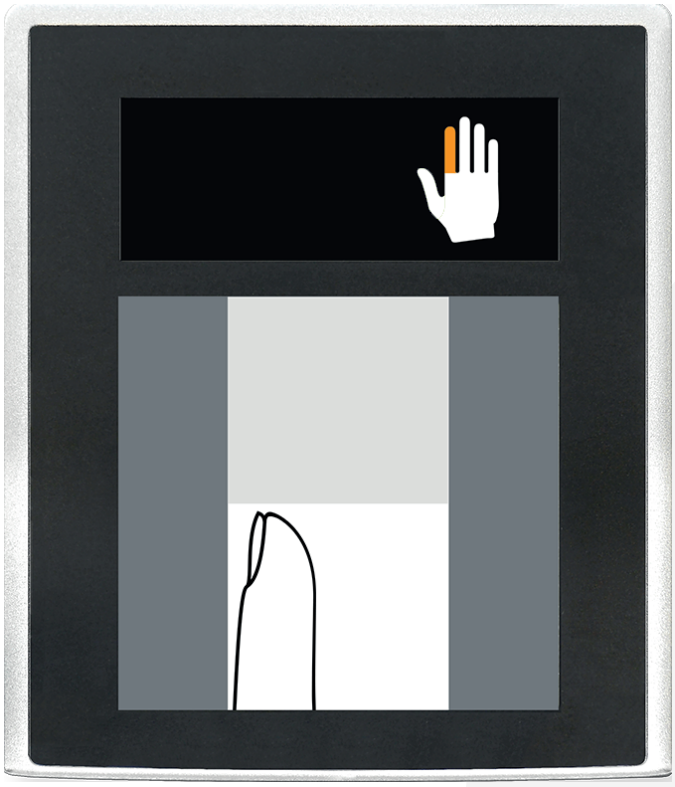

Figure 7: Example for the integration of user guidance and feedback area directly above the capture area

Move the finger with consistent speed

As soon as the capture process has started, two lines guide the officer to move the finger with consistent speed over the roll area. Poor images caused by rolling too fast, too slow or only in one position are significantly avoided.

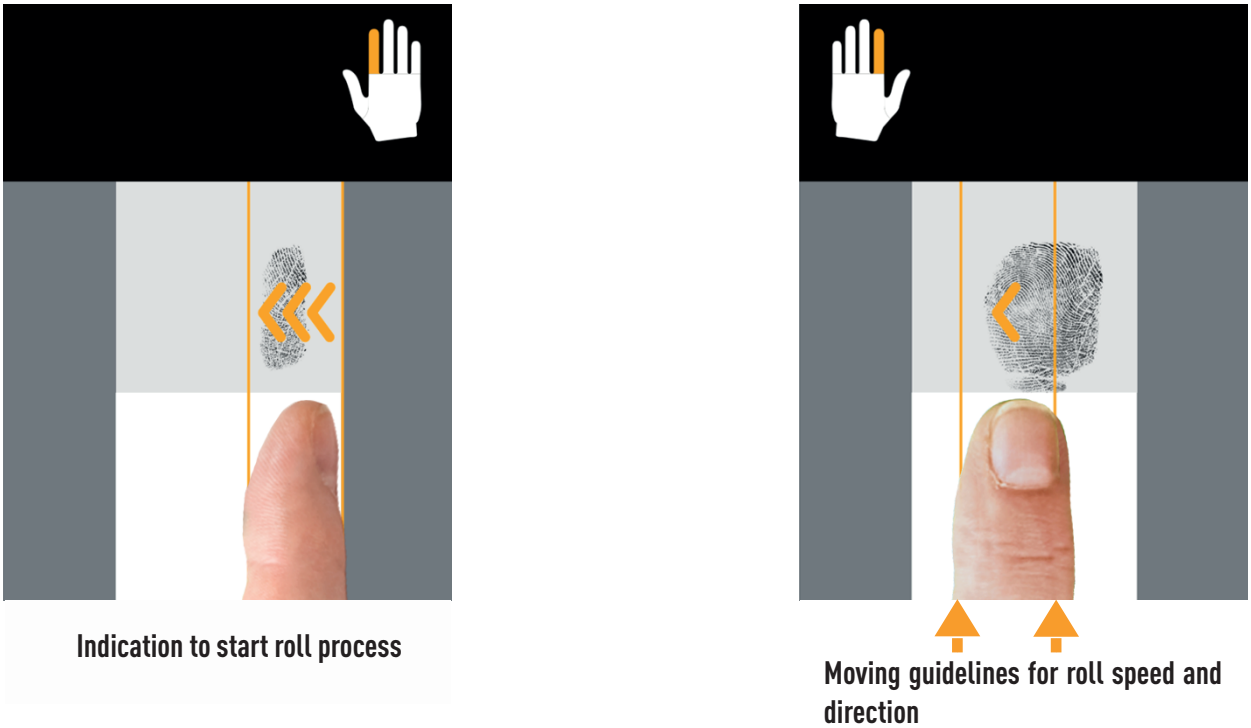

Figure 8: Guiding through the rolling process

Simulating the ink-and-paper process

Rolling with ink on paper is intuitive as there is direct feedback to the officer about the roll progress. This real-time feedback can now also be provided directly at the scanner and help the officer to monitor the roll progress.

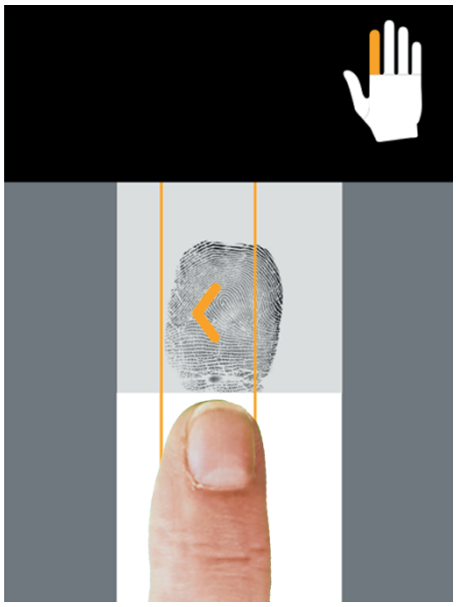

Figure 9: Real-time feedback at the scanner during the rolling process

On-device messages and workflow control

Feedback on typical roll errors is given directly at the unit. The touch sensitive area is pre-defined or customized buttons can be used (also with gloves) to control the workflow, e.g. repeat, stop, continue etc.).

Touch-sensitive area for workflow control using soft buttons

Live feedback

Pre-defined and customizable error messages

Figure 10: Feedback on roll error at the scanner

SUMMARY

Modern fingerprint technology now allows for the combination of display and sensors into one unit. This combination enables a much more intuitive rolled fingerprint capture process by providing live image feedback directly on the scanner. Not only will this ensure consistent image quality but also increase the security of the officer by allowing them to concentrate solely on the scanner during the capture process.