CROSSMATCH®

U.are.U® SDK v3

Platform Guide for Android

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Contents

Introduction

THIS CHAPTER PROVIDES AN OVERVIEW OF THE CHAPTERS IN THE U.ARE.U SDK PLATFORM GUIDE FOR ANDROID-BASED PLATFORMS.

This manual describes how to use the U.are.U SDK to develop applications that will run on the Android platform. The U.are.U SDK is available for multiple platforms and this document describes information specific to developing applications that will run on Android-based platforms.

This SDK is available in two editions: the *U.are.U SDK for Android* (supporting optical readers only) and the *U.are.U SDK for Android with TouchChip Support* (for use with both optical and silicon readers). The material in this document applies to both editions unless otherwise noted.

Introduction (this chapter) describes how to get the latest version of this documentation.

Installation provides instructions for installing on your development system.

Developing Applications with C/C++ lists system requirements for developing and running applications in C/C++ and describes the sample application.

Developing Applications with Java lists system requirements for developing and running applications using Java, provides additional installation instructions and describes the Java sample application.

For a detailed description of the SDK, consult the U.are.U SDK Developer Guide.

Getting Updated Documentation

If you are viewing this guide from the download package for the U.are.U SDK, you may want to check online at our website for an updated version of this document at

http://www.crossmatch.com/Support/Reference-Material/SDK-Reference-Material/

Installation

Except as noted in the platform/language-specific chapters, the installation process is the same for all Android development.

There are two steps to the installation:

- Installing on the development system
- Installing on the device (the target hardware)

These steps are described below.

Installing on the Development System

To install the SDK on an Intel-based Linux development system:

1. Unpack CM-UareU-3.0-<date.build>.tar.gz into a directory.
2. Go to the directory where you unpacked the files.
3. Run setup.
4. Follow the prompts as they appear.

The installer copies all necessary files to the selected folder. The files installed on the developer's machine are located in the following folders within the main product folder:

Folder	Contents
Include	Header files for C/C++ API.
Android/docs	End user license agreement (EULA) plus documentation: ■ SDK Developer Guide - describes all APIs ■ Platform Guide for Android - Android-specific details ■ C_API - Doxygen for C/C++ API ■ Java_API - Javadoc for Java API
Android/bin/android-14/arch-arm	Drivers for U.are.U fingerprint readers Runtime files for: ■ arm - C/C++ development for ARM processors ■ java - Java JAR file
Android/Samples	Source files for sample applications: ■ UareUSample - C/C++ sample ■ UareUCaptureOnly - C/C++ sample that demonstrates only capture ■ UareUSampleJava - Java sample

Folder	Contents
Android/Samples/bin	Executables for sample applications: ■ `UareUSample` - C/C++ sample ■ `UareUCaptureOnly` - C/C++ sample that demonstrates only capture ■ `UareUSampleJava` - Java sample
Android/bin/android-14/arch-arm - and - Android/Samples/UareUSampleJava/libs/armeabi	TouchChip device support `libdpfpdd_tcd58.so` Installed only with the U.are.U SDK for Android - TouchChip Support Edition.

Installing on the Target Hardware

C/C++ application	See *Building the Sample Applications on page 7*.
Java application	See *Installing on the Target Hardware on page 20*.

Developing Applications with C/C++

THIS CHAPTER PROVIDES INFORMATION NECESSARY FOR DEVELOPING ANDROID APPLICATIONS IN C/C++ WITH THE U.ARE.U SDK.

Pre-Requisites

This chapter assumes that you have a working knowledge of C/C++ and that you know how to develop for applications that will run on Linux platforms and devices.

System Requirements

Development System

The development system can be any Intel-based Linux system. The Android Native Development Kit (NDK) is required to develop native (C/C++) applications and libraries.

Target Hardware (Android-Based Device)

The Android-based device must have Android 4.4 or better installed and the UVC (also known as Video4Linux) kernel driver enabled. You must have root privileges on the Android device in order to develop and run C/C++ applications and samples. A USB port in host mode is required.

The file sizes are (in Kb):

	Android API Level 14
Capture runtime (drivers + SDK layer)	580
Fingerprint recognition runtime	460

In addition, the device must have 16 MB free memory.

The SDK works on a variety of hardware and is intended to have a small footprint so that it can run even on minimal hardware. Less capable hardware will work, but response time may not be optimal.

The Sample Applications

U.are.U SDK includes sample applications to demonstrate the features of the SDK. The sample applications are located in subfolders of the `/urusdk-android/Android/Samples` folder:

- The `UareUCaptureOnly` subdirectory contains the sources of the sample application that demonstrates fingerprint capture. This application does not have any dependencies on the FingerJet engine libraries.
- The UareUSample subdirectory contains the source for the sample application that demonstrates the full functionality of the SDK: fingerprint capture, feature extraction and verification, identification and enrollment of fingerprints. This application has dependencies on the capture and FingerJet Engine libraries.

Building the Sample Applications

`UareUSample` and `UareUCaptureOnly` are built in the same way. The makefile relies on the following environment variables: `NDK` and `TOOLCHAIN`. The default values are set assuming that the Android NDK is installed in the `$HOME/Android/android-ndk-r8d` directory and the development system is Linux-x86. Modify the makefile or set the environment variables according to the actual locations of the NDK directory and the toolchain directory. Once those are set, you can build the sample application with the `make` command.

Running the UareUSample Application

The `UareUSample` application demonstrates the Capture API and the FingerJet Engine API. It is a console application - it does not require any graphic libraries. However it requires root privileges in order to access `/dev/videoX` devices, and it requires the `adb` shell or an `ssh` connection to run.

In addition, the Gallery app (installed by default on most Android devices) must be disabled to avoid interruption of the sample. To disable the Gallery app, navigate on your device's display to Settings->Apps->Gallery App and click the **Disable** button.

To run the `UareUSample` application:

1. Establish the adb shell connection with the device:
   - `adb shell`
2. Type `su` to grant permission to the device
3. Create the directory where the libraries and application executable will be copied:
   - `mkdir /data/dpsample`
4. Exit the root
   - `exit`
5. Exit the shell and copy the libraries and executable to the created directory:
   - `exit`
   - `adb push <UareU SDK folder>/urusdk-android/Android/bin/android-14/arch-arm/ /data/dpsample`
   - `adb push <UareU SDKfolder>/urusdk-android/Android/Samples/bin/UareUSample /data/dpsample`
   - `adb push <UareU SDKfolder>/urusdk-android/Android/Samples/bin/UareUCaptureOnly /data/dpsample`
6. Reestablish adb shell connection with the device and change access permissions on the reader device.
7. Make sure that LD_LIBRARY_PATH points to the directory with SDK libraries:
   - `adb shell`
   - `cd /data/dpsample`
   - `LD_LIBRARY_PATH=/data/dpsample ./UareUSample`

When you launch the application you will see the main menu, as shown below:

```
shell@grouper:/data/dpsample $ LD_LIBRARY_PATH=/data/dpsample ./UareUSample

UareU SDK 3.x sample application (verification, identification, enrollment)

    1: Select new reader (not selected)
    2: Run verification
    3: Run identification
    4: Run enrollment
    5: Select Engine

Enter 1 - 5, or 'E' to exit: █
```

First, select a fingerprint reader device to use with the application. After you press **1** and Enter to select the reader, the application will search for any fingerprint readers and display a list of the readers it finds, as shown below.

Choose the desired reader and press **Enter** to continue.

```
shell@grouper:/data/dpsample $ LD_LIBRARY_PATH=/data/dpsample ./UareUSample

UareU SDK 3.x sample application (verification, identification, enrollment)

   1: Select new reader (not selected)
   2: Run verification
   3: Run identification
   4: Run enrollment
   5: Select Engine

Enter 1 - 5, or 'E' to exit: 1


Available readers:
   video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0}



Reader selection

   1: Select video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0}
   2: Refresh reader list

Enter 1, 2, or 'B' to go back: 
```

Once a reader is selected, you will see a screen that shows information about the reader and its capabilities, as shown below.

```
Selected reader:   video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0}
Vendor name:       DigitalPersona, Inc.
Product name:      U.are.U 5100
Serial number:     {65a90dec-0bfa-4485-87d6-675c3f5dafb0}
USB VID:           05ba
USB PID:           000b
USB BCD revision:  0001
HW version:        0.0.0
FW version:        0.0.0

can capture image:       1
can stream image:        1
can extract features:    0
can match:               0
can identify:             0
has fingerprint storage: 0
indicator type:          29
has power management:    0
has calibration:         0
PIV compliant:           1
resolution:              500 dpi


UareU SDK 3.x sample application (verification, identification, enrollment)

   1: Select new reader (selected: video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0})
   2: Run verification
   3: Run identification
   4: Run enrollment
   5: Select Engine

Enter 1 - 5, or 'E' to exit: 
```

To test verification, press **2** and press **Enter**.

Follow the prompts on the screen as shown below and place your finger on the reader. You will see that the program extracts the fingerprint features. Touch the reader again and the sample application will extract the features of the second fingerprint and determine whether the fingerprints match or not.

```
UareU SDK 3.x sample application (verification, identification, enrollment)

   1: Select new reader (selected: video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0})
   2: Run verification
   3: Run identification
   4: Run enrollment
   5: Select Engine

Enter 1 - 5, or 'E' to exit: 2
Verification started

Put any finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

Put the same or any other finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

Fingerprints matched.


dissimilarity score: 0x0.
false match rate: 0.000000e+00.


Verification started

Put any finger on the reader, or press Ctrl-C to cancel...  ▯
```

Touch your index finger as the first fingerprint and your middle finger as the second fingerprint and note that they do not match.

Press Ctrl-C to return to the main menu.

To test identification, press **3** and **Enter** to start.

Remember that identification matches a single fingerprint against a set of fingerprints. You will be prompted to place each of your fingers on the reader in turn, as shown below. When you have entered all of your fingerprints, you will be prompted to place any finger on the reader. Place one of your fingers on the reader to ensure that the fingerprint matches. Touch the reader with a finger from your other hand and ensure that it does NOT match.

```
UareU SDK 3.x sample application (verification, identification, enrollment)

    1: Select new reader (selected: video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0})
    2: Run verification
    3: Run identification
    4: Run enrollment
    5: Select Engine

Enter 1 - 5, or 'E' to exit: 3
Identification started

Put your thumb on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

Put your index finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

Put your middle finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

Put your ring finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

Put any finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

Fingerprint identified, your ring finger
dissimilarity score: 0x0.
false match rate: 0.000000e+00.
```

Press Ctrl-C to return to the main menu.

To test enrollment, press **4** and **Enter** to start.

The enrollment test is to enroll a single finger. Follow the prompts on the screen (as shown below) and place your finger on the reader when prompted. Then when prompted, place the same finger on the reader again. It typically takes four scans to get a good enrollment. If you place a different finger on the reader during enrollment, or if a scan is of poor quality, that scan will be dropped and the application will request additional finger scans in order to do a complete enrollment.

```
UareU SDK 3.x sample application (verification, identification, enrollment)

   1: Select new reader (selected: video0{288050a3-b298-4a21-b4b7-cb72291e1d1
   2: Run verification
   3: Run identification
   4: Run enrollment
   5: Select Engine

Enter 1 - 5, or 'E' to exit: 4
Enrollment started

1
Put any finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

2
Put the same finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

3
Put the same finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

4
Put the same finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured,
    features extracted.

Enrollment template created, size: 440


Enrollment started

1
Put any finger on the reader, or press Ctrl-C to cancel... []
```

To test the Select Engine feature, select 5 and press Enter.

The SDK includes two versions of the FingerJet matching engine, versions 6 and 7.

Version 6 has a feature extractor certified by the National Institute of Standards and Technology's Minex program (*http://www.nist.gov/itl/iad/ig/minex.cfm*), as interoperable with other Minex-certified feature extractors and matchers.

Version 7 has both the feature extractor and matcher certified by the Minex program. However, the Minex-certified matcher is slower than the non-certified matcher in the version 6 FingerJet engine.

For customers who do not have a requirement to use a Minex-certified matcher, we recommend using the version 6 FingerJet engine. Specifically, for customers who use DigitalPersona legacy template formats, the version 7 FingerJet engine does not provide any improvements in matching performance over version 6.

```
UareU SDK 3.x sample application (verification, identification, enrollment)

  1: Select new reader (selected: video0{288050a3-b298-4a21-b4b7-cb72291e1d12})
  2: Run verification
  3: Run identification
  4: Run enrollment
  5: Select Engine

Enter 1 - 5, or 'E' to exit: 5



Engine selection

  1: Select DPFR engine 6
  2: Select DPFR engine 7

Enter 1, 2, or 'B' to go back: 1        or press Ctrl-C to cancel...

Now running DPFR engine 6
```

This completes the demonstration of the `UareUSample` application. Press **E** to exit from the main menu.

Running the UareUCaptureOnly Application

The `UareUCaptureOnly` application demonstrates the Capture API alone (no dependencies on the FingerJet Engine library). It is a console application - it does not require any graphic libraries. However it requires root privileges in order to access `/dev/videoX` devices, and it requires `adb` shell or an `ssh` connection to run.

To run the `UareUCaptureOnly` application:

1. Establish an `adb` shell connection with the device:
   - `adb shell`

2. Type `su` to grant permission to the device

3. Create the directory where the libraries and application executable will be copied:
   - `mkdir /data/dpsample`

4. Exit root:
   - `exit`

5. Exit the shell and copy the libraries and executable to the created directory:
   - `exit`
   - `adb push <UareU SDK folder>/urusdk-android/Android/bin/android-14/arch-arm/ libdpfpdd5000.so /data/dpsample`
   - `adb push <UareU SDK folder>/urusdk-android/Android/bin/android-14/arch-arm/ libdpfpdd.so /data/dpsample`
   - `adb push <UareU SDK folder>/urusdk-android/Android/bin/android-14/arch-arm/ libdpuvc.so /data/dpsample`
   - `adb push <UareU SDKfolder>/urusdk-android/Android/Samples/bin/UareUCaptureOnly / data/dpsample`

6. Reestablish the `adb` shell connection with the device and change access permissions on the reader device.

7. Make sure that LD_LIBRARY_PATH points to the directory with the SDK libraries:
   - `adb shell`
   - `cd /data/dpsample`
   - `LD_LIBRARY_PATH=/data/dpsample ./UareUCaptureOnly`

When you launch the application you will see the main menu, as shown below:

```
shell@android:/data/dpsample $ LD_LIBRARY_PATH=/data/dpsample ./UareUCaptureOnly


UareU SDK 3.x sample application (capture)

    1: Select new reader (not selected)
    2: Capture fingerprints
    3: Stream fingerprints
    4: Asynchronous Capture

Enter 1 - 4, or 'E' to exit: 
```

Select a reader

You must begin by selecting a fingerprint reader device to use with the application. After you press **1** to select the reader, the application will search for any readers and will display a list of any readers it finds, as shown below. Choose the desired reader and press Enter to continue.

```
UareU SDK 3.x sample application (capture)

  1: Select new reader (not selected)
  2: Capture fingerprints
  3: Stream fingerprints
  4: Asynchronous Capture

Enter 1 - 4, or 'E' to exit: 1


Available readers:
  video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0}



Reader selection

  1: Select video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0}
  2: Refresh reader list

Enter 1, 2, or 'B' to go back: ▯
```

Once a reader is selected, you will see a screen that shows information about the reader and its capabilities, as shown below.

```
Enter 1, 2, or 'B' to go back: 1

Selected reader:    video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0}
Vendor name:        DigitalPersona, Inc.
Product name:       U.are.U 5100
Serial number:      {65a90dec-0bfa-4485-87d6-675c3f5dafb0}
USB VID:            05ba
USB PID:            000b
USB BCD revision:   0001
HW version:         0.0.0
FW version:         0.0.0

can capture image:      1
can stream image:       1
can extract features:   0
can match:              0
can identify:            0
has fingerprint storage: 0
indicator type:         29
has power management:   0
has calibration:        0
PIV compliant:          1
resolution:             500 dpi



UareU SDK 3.x sample application (capture)

  1: Select new reader (selected: video0{65a90dec-0bfa-4485-87d6-675c3f5dafb0})
  2: Capture fingerprints
  3: Stream fingerprints
  4: Asynchronous Capture

Enter 1 - 4, or 'E' to exit: ☐
```

Capture fingerprints

Select **2** and press Enter to test the capture function of the sample application.

The capture function simply puts the reader into fingerprint capture mode and waits until a fingerprint is detected, as shown in the picture below.

```
UareU SDK 3.x sample application (capture)

   1: Select new reader (selected: video0{288050a3-b298-4a21-b4b7-cb72291e1d12})
   2: Capture fingerprints
   3: Stream fingerprints
   4: Asynchronous Capture

Enter 1 - 4, or 'E' to exit: 2
1
Put your finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured
    width: 400, height: 500

2
Put your finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured
    width: 400, height: 500

3
Put your finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured
    width: 400, height: 500

4
Put your finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured
    width: 400, height: 500
```

Once you have finished testing the capture feature of the sample application, press Ctrl-C to return to the main menu.

Stream fingerprints

To test the streaming feature (not available on all fingerprint readers), select **3** and press Enter. The streaming function simply puts the reader into fingerprint stream mode and waits until a fingerprint is detected, as shown in the picture below.

```
UareU SDK 3.x sample application (capture)

    1: Select new reader (selected: video0{288050a3-b298-4a21-b4b7-cb72291e1d12})
    2: Capture fingerprints
    3: Stream fingerprints
    4: Asynchronous Capture

Enter 1 - 4, or 'E' to exit: 3
    1 image captured, score: 63
    2 image captured, score: 74
    3 image captured, score: 71
    4 image captured, score: 72
    5 image captured, score: 69
    6 image captured, score: 69
    7 image captured, score: 72
    8 image captured, score: 74
    9 image captured, score: 75
    10 image captured, score: 77
    11 image captured, score: 78
    12 image captured, score: 80
    13 image captured, score: 82
    14 image captured, score: 83
    15 image captured, score: 78
    16 image captured, score: 18
    17 image captured, score: 59
    18 image captured, score: 83
```

As you place your finger on the reader, images will be captured and their quality score displayed. Press E to exit streaming mode.

Asynchronous Capture

To test the Asynchronous Capture feature, select 4 and press Enter. This feature starts asynchronous capture on the opened reader device. It signals the device that a fingerprint is expected and then exits.

```
UareU SDK 3.x sample application (capture)

    1: Select new reader (selected: video0{288050a3-b298-4a21-b4b7-cb72291e1d12})
    2: Capture fingerprints
    3: Stream fingerprints
    4: Asynchronous Capture

Enter 1 - 4, or 'E' to exit: 4
1
Put your finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured
    width: 400, height: 500

2
Put your finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured
    width: 400, height: 500

3
Put your finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured
    width: 400, height: 500

4
Put your finger on the reader, or press Ctrl-C to cancel...
    fingerprint captured
    width: 400, height: 500
```

This completes the demonstration of the `UareUCaptureOnly` application. Press **E** to exit from the main menu.

Developing Applications with Java

THIS CHAPTER PROVIDES INFORMATION NECESSARY FOR DEVELOPING ANDROID APPLICATIONS IN JAVA WITH THE U.ARE.U SDK.

Pre-Requisites

This chapter assumes that you have a working knowledge of Java and that you know how to develop for Linux readers.

System Requirements

Development System

The development system may be a Windows or Linux system. The Android SDK is required to develop for Android. We also recommend that you download and use the Eclipse version that is included with the Android SDK.

Target Hardware (Android-Based Device)

The Android-based device must have Android 4.4 or better installed and the UVC (also known as Video4Linux) kernel driver enabled. A USB port in host mode is required. You don't have to have root privileges on the Android device.

The SDK works on a variety of hardware and is intended to have a small footprint so that it can run even on minimal hardware. Less capable hardware will work, but response time may not be optimal.

Installing on the Target Hardware

To install the run-time environment on the target hardware platform:

Note: If you are installing the U.are.U SDK for Android with TouchChip Support on a device where the edition without TouchChip Support was previously installed, remove the Java sample (DigitalPersona U are U SDK Sample) from the device before the new installation.

1. Enable USB debugging mode by navigating on your device's display to Settings->DeveloperOptions->Enable USB debugging.
2. Connect the target hardware platform to the development system.
3. Establish an `adb` connection with the device.

- `adb install <UareU SDK folder>/urusdk-android/Android/Samples/bin/ UareUSampleJava.apk`

Installing the .apk file will install the following into its own application zone:

- Driver and engine libraries
- Java SDK wrapper
- Java Sample Application

If you install any of those components elsewhere on the target, you will have duplicate files installed. The intended architecture of Android is for all applications to have all dependencies secured within their own application zones. All dependencies, UIs and services are installed and started automatically.

The Java Sample Application

U.are.U SDK includes a sample application to demonstrate the features of the SDK when using the Java API. The sample application is located in the `Samples` folder.

The application demonstrates the features of the SDK. When you launch the application, you see the main screen as shown below.
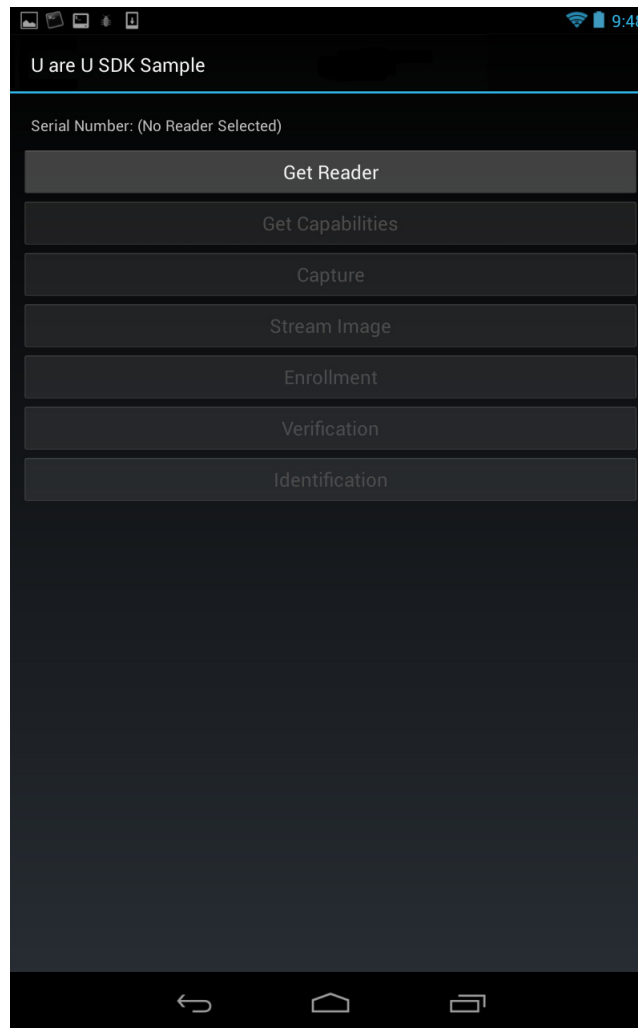

The sample program demonstrates:

- How to enroll a finger
- How to identify a fingerprint
- How to verify a fingerprint
- The built-in control for enrollment
- The built-in control for identification
- How to use the streaming feature to display live fingerprint data on the screen

Selecting a Reader

To choose the reader, click on the **Get Reader** button. If there is only one reader attached, that reader will be selected automatically. If there are multiple readers, you will see a list of available readers and you can choose the desired device, as shown below. Click on the desired device and click on the **Back** button.
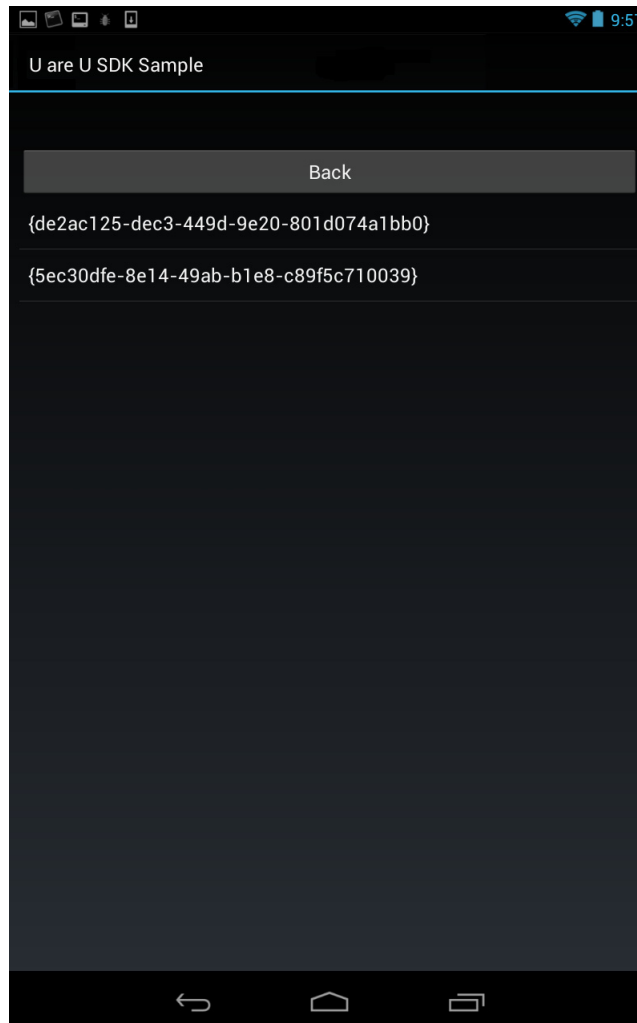
To see the reader capabilities, click on the **Get reader capabilities** button.
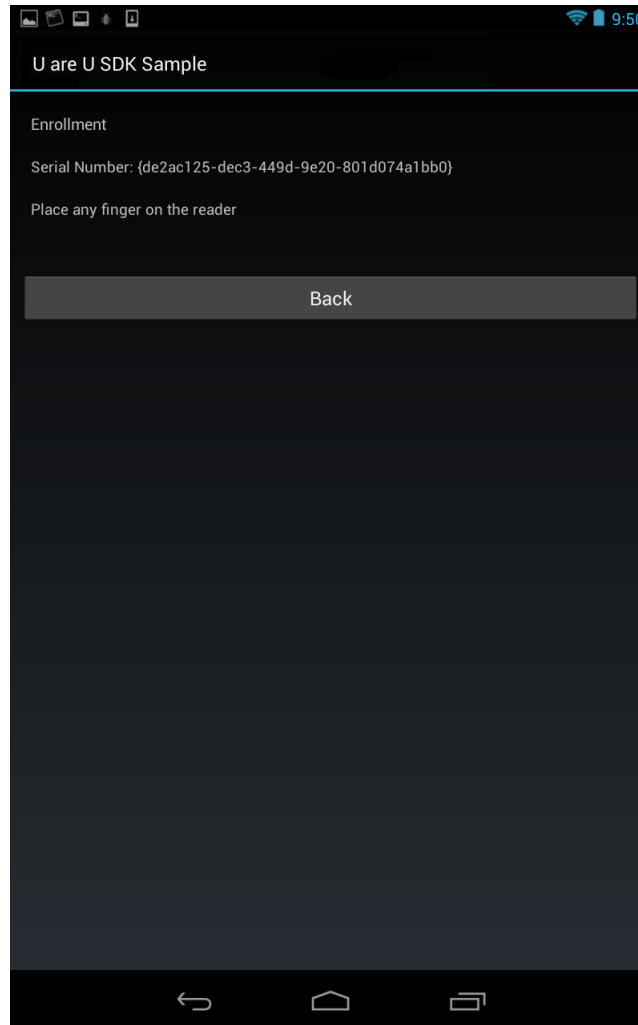
The capabilities will be displayed, as shown in the image below.
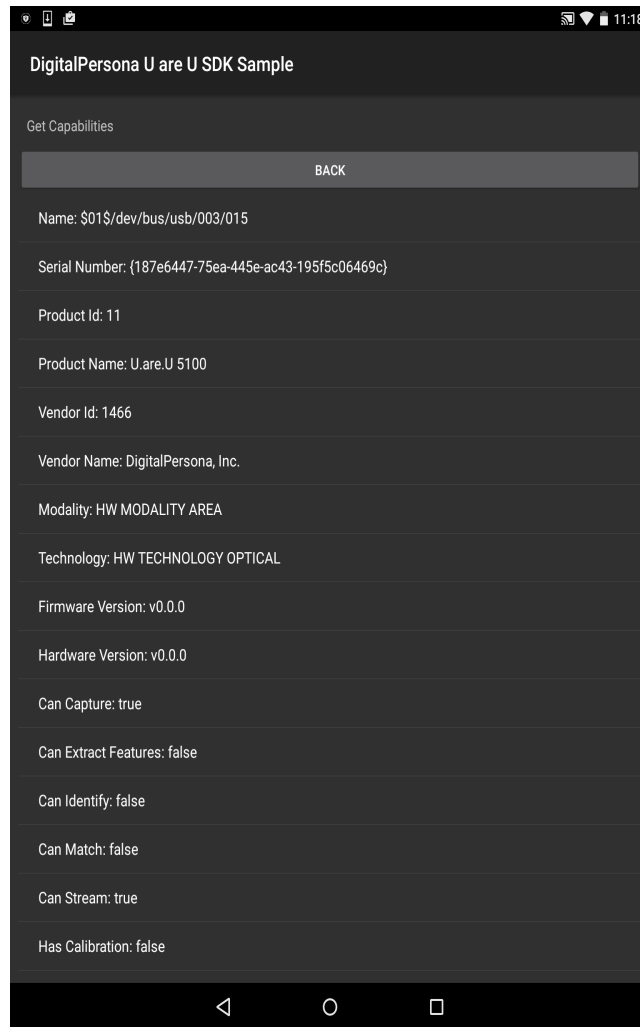
Click on the **Back** button to return to the main screen.

Enrolling a Finger

Click on **Enrollment** to begin enrolling a test subject.

You will see a series of prompts to scan fingers for enrollment, as shown below.

After the first finger is successfully scanned, you will be prompted to scan additional fingers until a sufficient number of high quality scans are complete. The number of fingers requested will vary depending on the image scans - the enrollment function will continue to request scans until an acceptable enrollment record has been created.
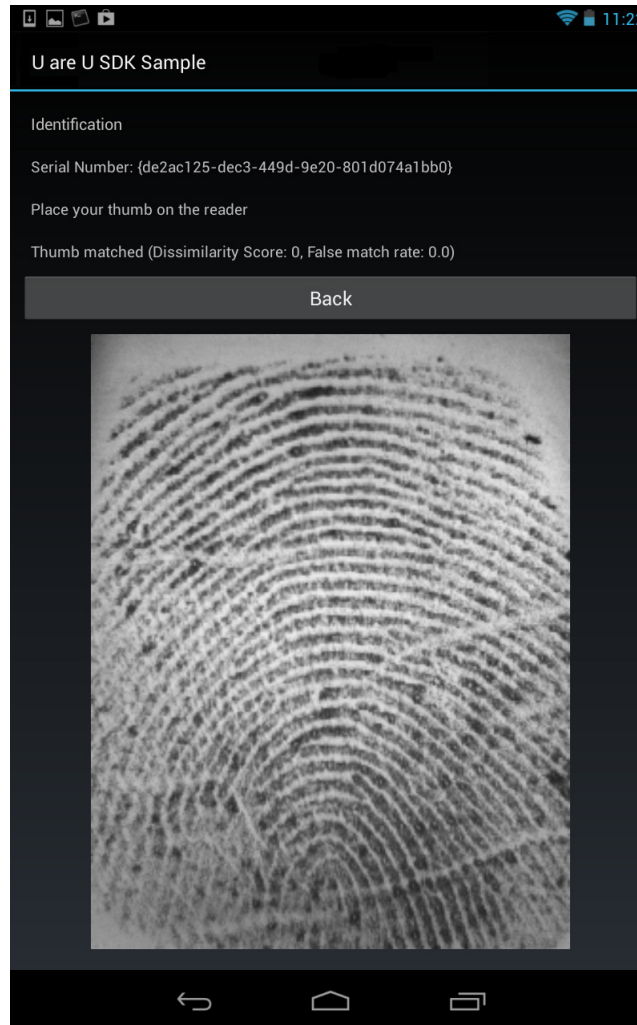
When enrollment is complete, click **Back** to return to the main screen.

Identifying a Fingerprint

To test the identification feature, click on the **Identification** button. Recall that identification is a 1-to-many comparison where the application searches through all of the enrolled fingers to find a match. For this example, we do not have a stored database, so the sample application first prompts you to place your finger on the reader so that it can create a FMD. After a FMD is created, you will be prompted to place any finger on the reader to identify against the FMD that was just created.

When you click the **Identification** button, you will be prompted to place your fingers on the reader. If you place an enrolled finger on the reader, you will see that a match was found. In the screen image below, we successfully identified a user.

To exit identification mode, click on the **Back** button.

Verifying a Fingerprint

To test the verification feature, click on the **Verification** button. Recall that verification is a 1-to-1 comparison where the application matches against a specified fingerprint. When you click the **Verification** button, you will be prompted to place your finger on the reader. As with the identification example above, in the screen below, we have successfully verified a user.
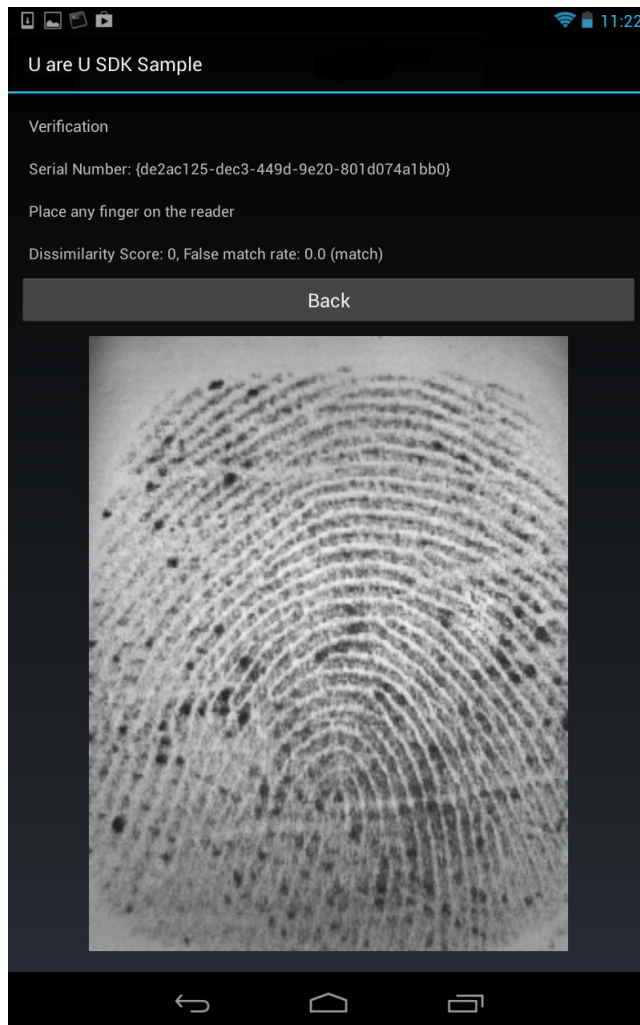

To exit verification mode, click on the **Back** button.

Using the Capture and Streaming Feature

The sample application also demonstrates the streaming feature (on fingerprint readers that support that feature). To test capturing or streaming, from the main window, click on the **Capture** or **Stream Image** button.

This puts the reader into capture/streaming mode and immediately the results are displayed in the window. For streaming mode, the window then becomes like a live window on the reader as it streams results. Placing a finger on the reader displays the streamed fingerprint, as shown below.
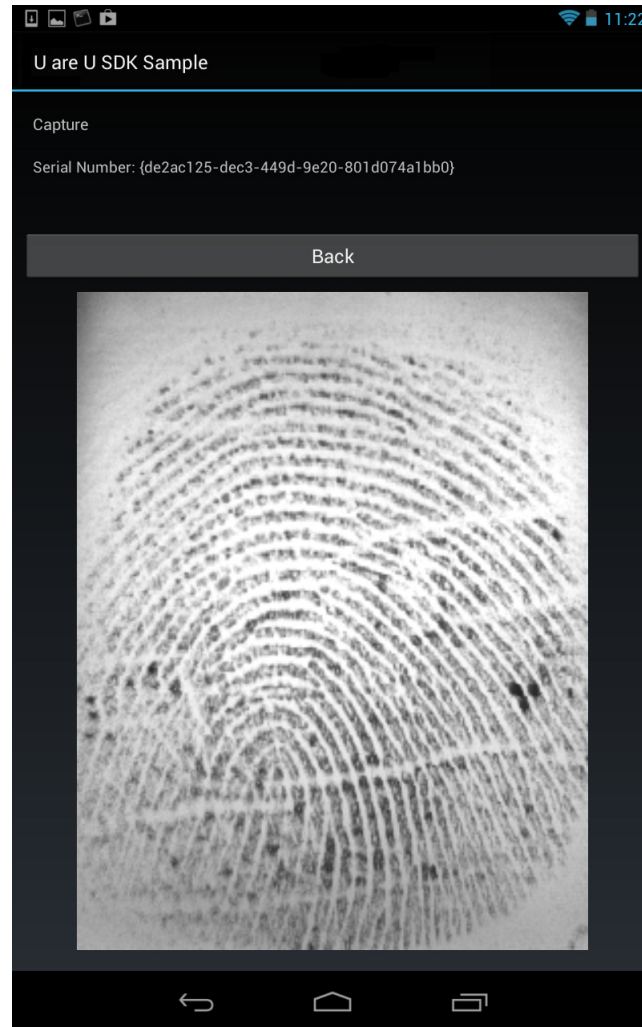
For streaming, removing the finger shows a blank stream.

To exit capture / streaming mode, click on **Back**.

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