NBDK-2023-S2-VAIX-DB
Development Kit User's Guide

Version 1.2

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REVISION HISTORY

Version	Modified on	Modified by	Description of changes
1.0	2018-03-29	Radim Smat	Initial release
1.1	2018-04-06	Radim Smat	Updated section 4.2
1.2	2018-06-06	Radim Smat	Document name changed to NBDK-2023-S2-VAIX Development Kit User's Guide Added section 3.2 – SD card image Modified section 3.3 – eMMC

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ABBREVIATIONS

eMMC	embedded Multi Media Controller
DC	Direct Current
FFC	Flat Flexible Cable
GPIO	General Purpose Input Output
HD	High-Definition
HDMI	High-Definition Multimedia Interface
IC	Integrated Circuit
LDO	Low Drop Output
LS	Low Speed
OS	Operating System
OTG	On-The-Go
SDK	Software Development Kit
SPI	Serial Peripheral Interface
SD	Serial Data
USB	Universal Serial Bus

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1 INTRODUCTION

This document provides the user with technical information about the NEXT Biometrics NBDK-2023-S2-VAIX-DB Development Kit, its first-time setup and brief description of the example demo application.

The Development Kit consist of:

- NB-2023-S2 shield board with assembled NB-2023-S2-VAIX (SPI) fingerprint module, producing fingerprint development shield for DragonBoard 410c development board by Arrow Electronics.
- Software Development Kit (SDK), which can be downloaded from NEXT Biometrics Support Portal https://support.nextbiometrics.com/

It is primarily supposed that NB-2023-S2 shield board is put together with DragonBoard 410c development board and used as a one solid piece of hardware. Such a set allows to the user easy evaluation of the connected NB-2023-S2-VAIX fingerprint sensor module at ARM Cortex-A53 64-bit powered platform.

Please note that NBDK-2023-S2-VAIX-DB Development Kit is delivered without the DragonBoard 410c board. The can be purchased directly from Arrow Electronic: https://www.arrow.com/en/products/dragonboard410c/arrow-development-tools

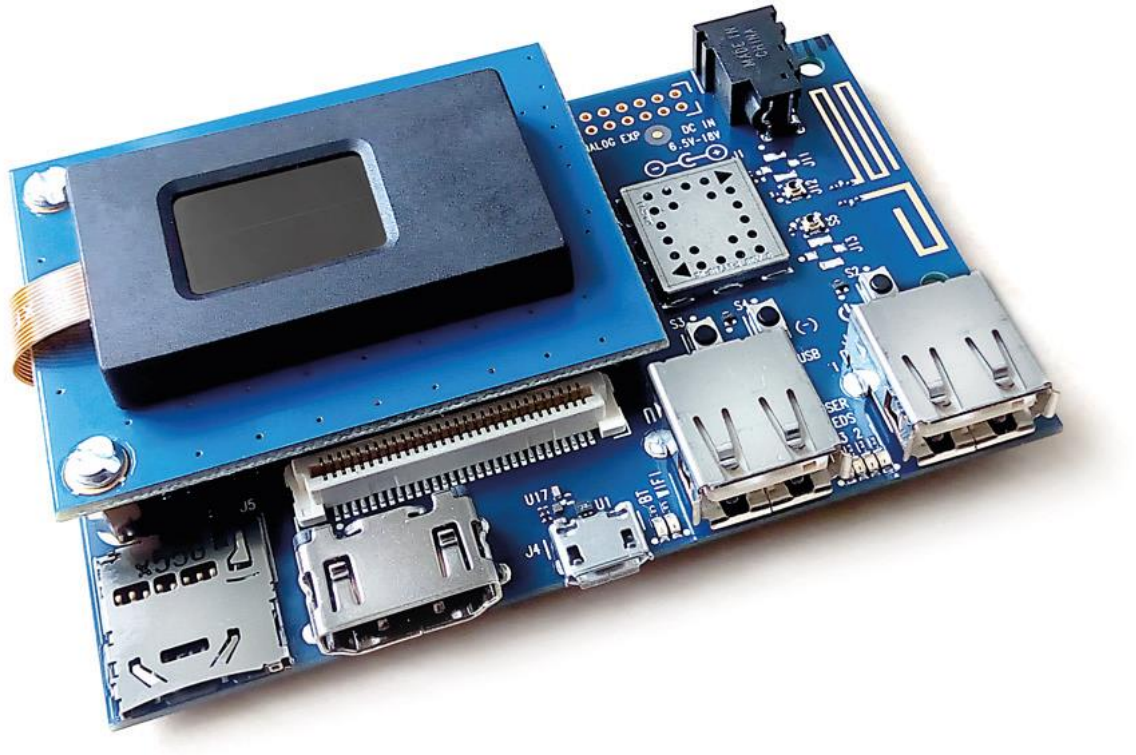

Figure 1: NB-2023-S2 shield board connected to DragonBoard 410c development board

2 HARDWARE

2.1 WHAT YOU WILL NEED

To start with NBDB-2023-S2-VAIX-DB kit, following material is needed

- NB-2023-S2 shield board with assembled NB-2023-S2-VAIX fingerprint module
- DragonBoard 410c development board from Arrow Electronics
- Power Supply adapter 12V / 2A
- USB keyboard and mouse
- Monitor and HDMI cable
- Micro SD card (recommended 8GB and bigger)

Micro SD card is optional. However, we recommend using SD card since it simplifies the installation of the operation system to the board.

2.2 NB-2023-S2 SHIELD BOARD

The NB-2023-S2 shield board provides an interface for connecting NB-2023-S2-VAIX fingerprint module to LS (low-speed) expansion connector on the DragonBoard 410c. The shield consists of two ICs.

- LDO providing 3.3V power supply for NB-2023-S2-VAIX module
- Level shifter translating electrical signals of different voltage levels between DragonBoard 410c (1.8V) and the fingerprint module (3.3V)

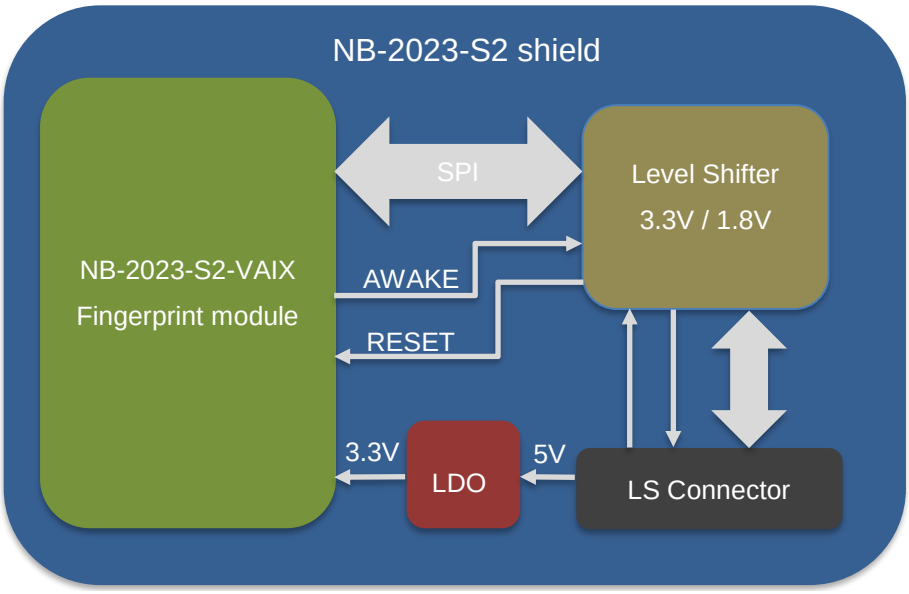

Figure 2: NB-2023-S2 shield board block diagram

NB-2023-S2-VAIX module is mounted in a POD (the black plastic housing) and connected to NB-2023-S2 shield board via FFC 12 pins flexible cable of 0.5 mm contact pitch.

2.3 PIN MAPPING

NB-2023-S2-VAIX fingerprint module utilizes SPI interface and two GPIO pins to communicate with the DragonBoard 410c.Table 1 shows the mapping of fingerprint module pins to LS expansion connector on the board.

Table 1: NB-2023-S2-VAIX pins maping to Dragonboard 410c

Pin	Name	LS connector pin	Function
1	MOSI	14 (APQ GPIO_16)	SPI Data – Slave In
2	MISO	10 (APQ GPIO_17)	SPI Data – Slave Out
3	GND	1, 2, 39, 40	Ground
4	SCLK	8 (APQ GPIO_19)	SPI Clock
5	GND	1, 2, 39, 40	Ground
6	nAWAKE	24 (APQ GPIO_69)	Finger Detect
7	nSS	12 (APQ GPIO_18)	SPI Slave Select
11	nReset	26 (APQ GPIO_12)	Reset

2.4 DRAGONBOARD 410C

The DragonBoard 410c development board a product of Arrow Electronics. It is based on Snapdragon410E (APQ8016E) quad core ARM Cortex A53 (64-bit) / 1.2 GHz processor by Qualcomm.

The board has built in 1GB SDRAM, 8GB eMMC (flash) memory, SD-Card slot, WLAN 802.11 b/g/n 2.4 GHz, Bluetooth 4.1 and GPS. An external monitor can be connected to HDMI supporting Full HD resolution. The board also offers 2 x USB 2.0 Host 1 x USB 2.0 OTG port.

Figure 3: Dragonboard 410c

DragonBoard 410c can be ordered directly from Arrow e-shop.
https://www.arrow.com/en/products/dragonboard410c/arrow-development-tools

2.5 POWER SUPPLY ADAPTER

12V / 2A DC supply is recommended. However, the board will accept any input voltage in range of 6.5V to 18V DC. The DC plug must have outer 4.75 mm and inner 1.75 mm diameter (EIAJ-3) to fit the board connector. Make sure the polarity of DC plug is center pin positive.

Arrow provides WM24P6-12-A-QL power supply worldwide. The adapter has a US plug, but supports 90-264V AC input and 12V/ 2A output.
https://www.arrow.com/en/products/wm24p6-12-a-ql/autec-power-systems

3 SOFTWARE

All needed software (and not only SW) for development with Dragonboard410c can be downloaded from developer community on NEXT Support Portal:

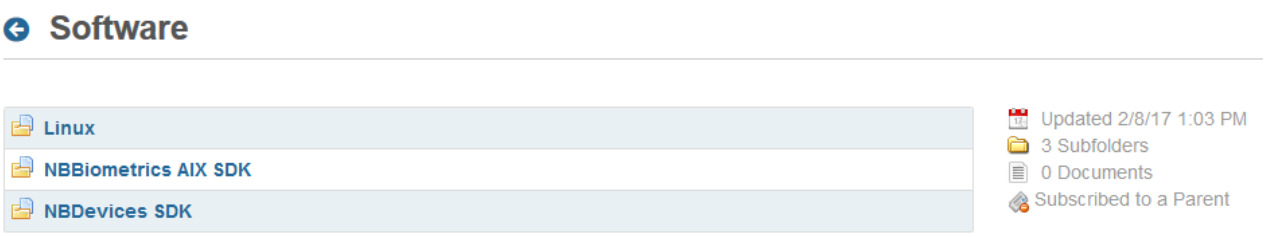

Figure 4: SW for NBDK-2023-S2-VAIX dev kit

3.1 NBBIOMETRICS AIX SDK

NBBiometrics AIX SDK offers complete biometric functionality. It supports template extraction, verification and identification. Besides biometrics operations, NBBiometrics provides all the functions included in NBDevices SDK for fingerprint image acquisition.

NBBiometrics AIX SDK can be downloaded here.

3.2 BOOTABLE SD CARD IMAGE FOR DRAGONBOARD 410C

For quick start with application development, SD card image with installed Linux operating system is available.

The main advantage of using SD card is that the system runs from the card. The OS in internal eMMC memory is not overwritten.

Compare to official SD Card image on www.96Boards.com, NEXT Biometrics image has already configured the environment and installed demo app. Any post-installation steps are not needed.

How to deploy SD card image:

1. Download NEXTBiometrics_DB410c.zip from here
2. Unzip the archive and flash the image to a SD card with minimum size of 4GB. (W32Diskimager utility can do that)
3. Plug the SD card and set S6 switch on bottom side to position 0100 (SD BOOT)
4. Plug SPI shield board with NB-2023-S2-VAIX module
5. Power on Dragonboard

The system will boot from SD. You can click on NEXT demo icon to launch the demo application. Demo application together with NBBiometrics AIX SDK is stored under */home/linaro/next* folder.

3.3 SYSTEM INSTALLATION ON EMMC

This section describes how to setup Dragonboard 410c in to boot and run the system from internal eMMC memory. This is an alternative to SD card solution described in the previous section.

If your Dragonbard doesn't not run Linux OS, you can download Linux distribution from 96Boards, link here. You will need to flash boot and rootfs image, look for "Fastboot files" section on the page.

This article describes how to install images and boot Dragonboard from eMMC.

The Official distribution has no SPI enabled by default, meaning that communication with NB-2023-S2-VAIX (SPI) fingerprint module doesn't work. To enable SPI, follow instructions in this article.

3.3.1 System update

Once your system is running Linux from internal eMMC and has enabled SPI, connect to a wifi network with Internet access, open a terminal (e.g XTerm) and update the system:

```
sudo apt-get update
sudo apt-get upgrade
```

NBBiometrics requires libusb-1.0 library, even only SPI module is used. Install libusb-1.0 package:

```
sudo apt-get install libusb-1.0
```

Congratulations! Your system is ready to use NB Biometrics AIX SDK and run SDK samples.

If you want to check out GUI demo application (which is not part of the SDK) then continue with reading.

4 DEMO APPLICATION

The demo is a simple Linux GUI application providing enrollment and identification operation with NB-2023-S2 shield board plugged to Dragonboard 410c. The application is based on NBBiometrics AIX SDK described in section 3.1

4.1 PERIPHERALS

NB-2023-S2-VAIX mounted on the shield board is connected via SPI interface and three GPIO pins. The access to peripherals and communication is managed by NBBiometrics library.

Table 2: Peripherals utilized by NB-2023-S2 shield board

Peripheral	Device driver	Description
SPI	/dev/spi0.0	SPI interface
GPIO	/sys/class/gpio/gpio18	SPI Slave select signal
GPIO	/sys/class/gpio/gpio69	Awake signal
GPIO	/sys/class/gpio/gpio12	Reset signal

4.2 BUILDING THE DEMO

The demo is written in QT application framework. Building the application requires QT5-default package. Open a terminal and install the package.

```
sudo apt-get install qt5-default
```

Download demo application package from NEXT Support Portal:

https://support.nextbiometrics.com/home?p_p_id=110_INSTANCE_YKal9iBkH91g&_110_INSTANCE_YKal9iBkH91g_struts_action=/document_library_display/view_file_entry&_110_INSTANCE_YKal9iBkH91g_fileEntryId=279088

Now extract the source code and build the demo:

```
unzip DB410c_Demo.zip
cd DB410c_Demo/src
qmake
make
```

When the build is finished executable file is stored in DB410c_Demo/bin folder.

4.3 LAUNCHING THE DEMO

Plug the NB-2023-S2 shield to Dragonboard and launch the demo application with **administrator privileges**.

```
sudo ./DB410C-demo
```

4.3.1 Sensor tab

Sensor tab shows basic information about connected sensor like model and firmware version.

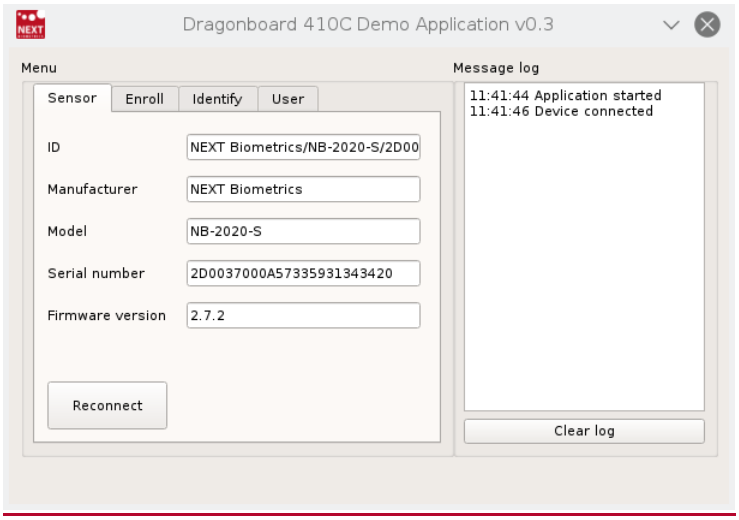

Figure 5: Demo app – sensor information

4.3.2 Enroll tab

Here you can enroll user fingerprints. Enter user name, select finger index and click Enroll. The application waits for finger attach. Finger detection timeout can be modified, the default value is 10 seconds. If needed, enroll operation can be canceled by clicking Cancel button. Once a finger is detected, user's fingerprint template is extracted and enrolled.

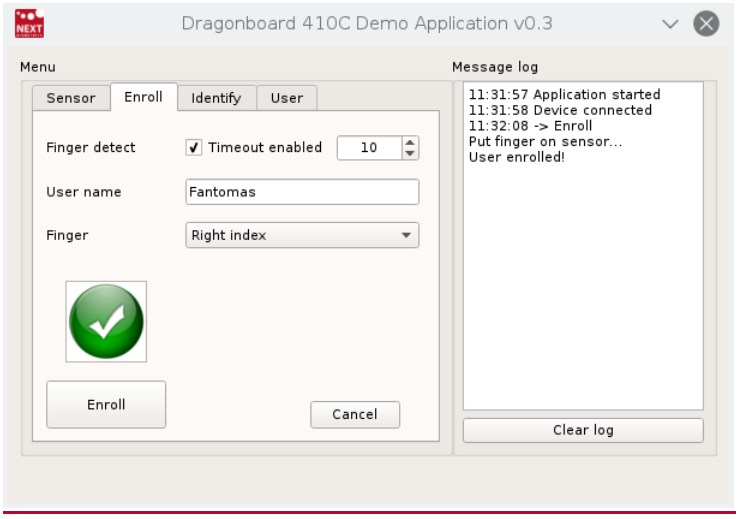

Figure 6: Demo app - enrollment

4.3.3 Identify tab

A fingerprint can be matched against enrolled template database. Click identify and put a finger at the sensor. If matching template is found the app returns user's name and finger index.

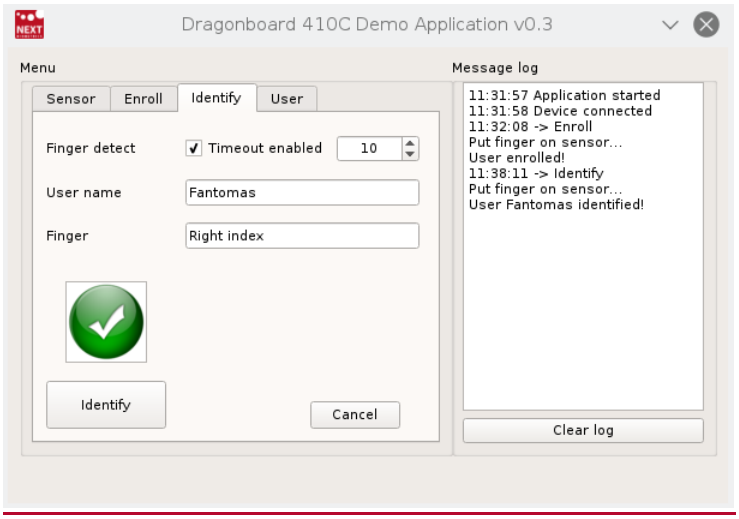

Figure 7: Demo app - identification

4.3.4 User tab

All enrolled users are listed under user tab. You can delete only one user or delete all users in the template database. This demo application uses SQLite v3 format. The database file can be changed via Select button. If database file is not found, the application will create a new database named FPDatabase.db.

NOTE: demo app stores enrolled fingerprints in local **database file which is not secured nor encrypted**.

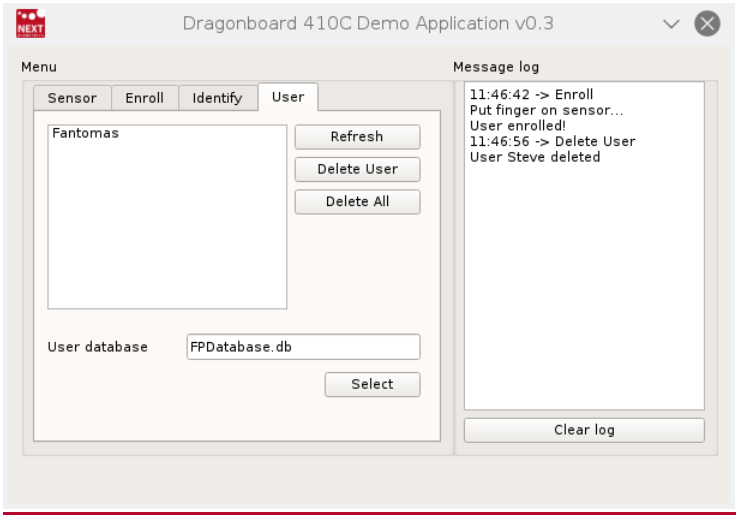

Figure 8: Demo app - user management

5 NEED HELP?

Contact us at https://www.nextbiometrics.com/company/contact/