NXP Semiconductors
User's Guide

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MCU VIZN Solution User's Guide

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1 Introduction

NXP's MCU-based SLN-VIZN-IOT development kit provides OEMs with a fully integrated, self-contained, software and hardware solution. This includes the i.MX RT106F run-time library and pre-integrated machine learning face recognition algorithms, as well as all required drivers for peripherals, such as camera and memories.

This cost-effective, easy-to-use face recognition implementation facilitates the demand for a face-based Friction Free Interface that can be embedded in a variety of products across home, commercial and industrial applications, thus eliminating the need to use hard to learn and time-consuming mechanisms to identify users.

TARGET APPLICATIONS

- **Safety/Security/Alarm devices:** E-locks, Alarm panels, remote sensors, and automated access
- **Smart appliances:** Washing machines, dryers, ovens, refrigerators, stoves, and dishwashers
- **Home comfort devices**: Thermostats, remote temperature sensors, and lighting
- **Counter-top appliances:** Microwaves, coffee machines, rice cookers, and blenders
- **Smart industrial devices:** Power tools, ergonomic stations, machine access and authorization

1.1 RT106F VISION CROSSOVER PROCESSOR OVERVIEW

The i.MX RT106F is an EdgeReady member of the i.MX RT1060 family of crossover processors, targeting low cost embedded face recognition applications. It features NXPs advanced implementation of the Arm® Cortex®-M7 core, which operates at speeds up to 600 MHz to provide high CPU performance and best real-time responses. This i.MX RT106F based solution enables system designers to easily and inexpensively add face recognition capabilities to a wide variety of smart appliances, smart homes, FRICTION FREE INTERFACE VISION HARDWARE and smart industrial devices. The i.MX RT106F processor is licensed to run NXPs i.MX RT run-time library for face recognition which may include:

- Camera drivers
- Image capture
- Image pre-processing
- Face alignment
- Face tracking
- Face detection
- Face recognition
- Emotion recognition

1.2 Additional Peripherals

In addition to the i.MX RT106F, included in the kit are many additional peripherals essential to experiencing everything the SLN-VIZN-IOT kit has to offer. Many of these peripherals are shown in the figure below.

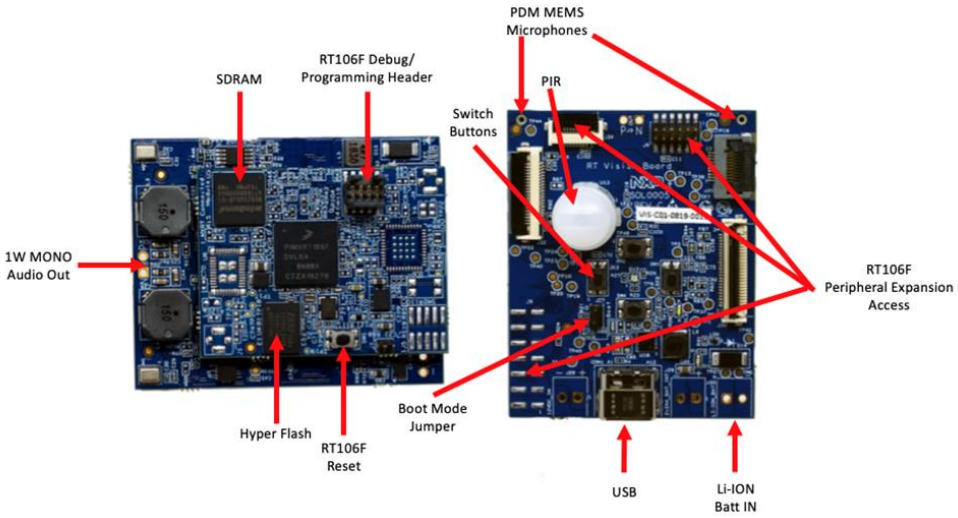

Figure 1: SLN-VIZN-IOT Additional Peripherals

Recommended Computer Configuration

The MCU SLN-VIZN-IOT SDK requires an up-to-date computer which runs the MCUXpresso IDE 11.1 version. It also requires a terminal program to communicate with the device via USB.

https://www.nxp.com/support/developer-resources/software-development-tools/mcuxpresso-software-and-tools/mcuxpresso-integrated-development-environment-ide:MCUXpresso-IDE

Computer type	OS version	Terminal
Apple	Mac OS	PuTTY
PC	Windows 7 / 10	PuTTY/Tera Term
PC	Linux	PuTTY

Table 1: Supported Computer Configurations

Usage Condition

The following information is provided per Article 10.8 of the Radio Equipment Directive 2014/53/EU:

(a) Frequency bands in which the equipment operates.

(b) The maximum RF power transmitted.

PN	RF Technology	(a) Freq Range	(b) Max Transmitted Power
SLN-VIZN-IOT	Wi-Fi	2412MHz-2472MHz	17.9dBm

Table 2: Wi-Fi Frequency & Power

EUROPEAN DECLARATION OF CONFORMITY (Simplified DoC per Article 10.9 of the Radio Equipment Directive 2014/53/EU)

This apparatus, namely SLN-VIZN-IOT, conforms to the Radio Equipment Directive 2014/53/EU. The full EU Declaration of Conformity for this apparatus can be found at this location: https://www.nxp.com/

2 Get Started with SLN-VIZN-IOT

2.1 Box Contents

The SLN-VIZN-IOT kit arrives in a box as shown below. Inside the box, you will find the SLN-VIZN-IOT kit alongside a printed Quick Start Guide and a USB-C Cable.

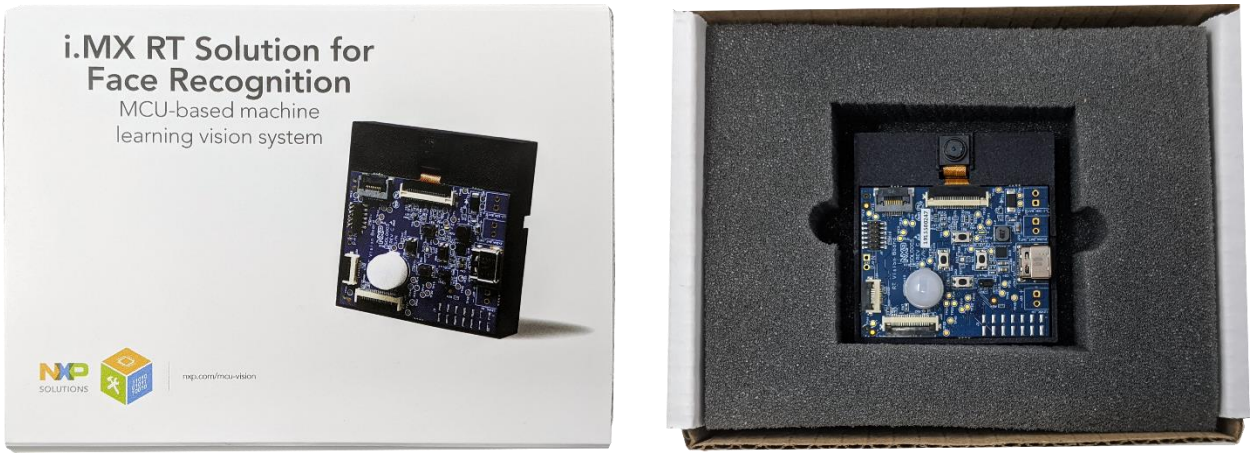

Figure 2: SLN-VIZN-IOT Box Contents

Please check your kit for damage or marks, and, if seen, please contact your NXP representative.

2.2 Running the Demo

To get started, take the USB-C cable provided inside the kit and plug the USB-A end into your computer and the USB-C end into your kit.

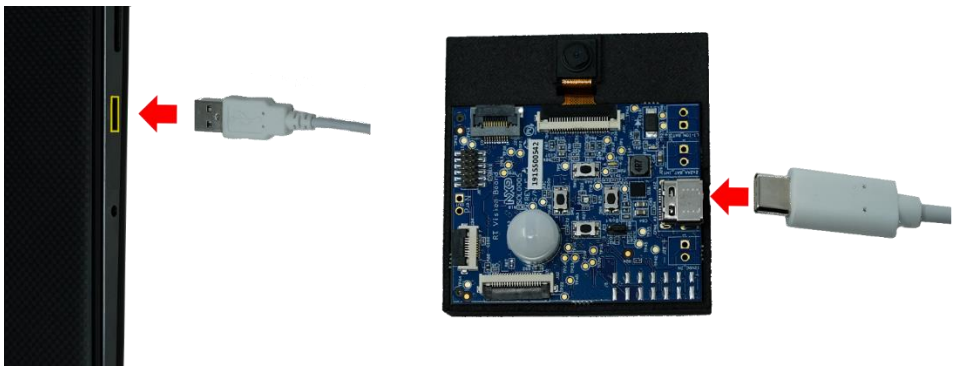

Figure 3: Plugging in SLN-VIZN-IOT Kit

Once connected, the RGB LED's (D13) on the front of the kit will blink rapidly for a moment. This blinking pattern is a status indicator for the various stages of the boot process and the chip cycles from internal ROM, to bootstrap, to bootloader, to application. Additionally, a green LED (D1) will light up to indicate the kit is powered on.

2.2.1 Access the Camera

Camera enumeration is currently supported on Windows and Ubuntu.

With the kit powered on and connected to your computer, the SLN-VIZN-IOT kit will automatically enumerate as both a serial device and USB camera device. To access the kit's camera, open **Camera** if using Windows, or **Cheese**, if using Ubuntu. In this guide, we'll be using Windows and the Windows camera app.

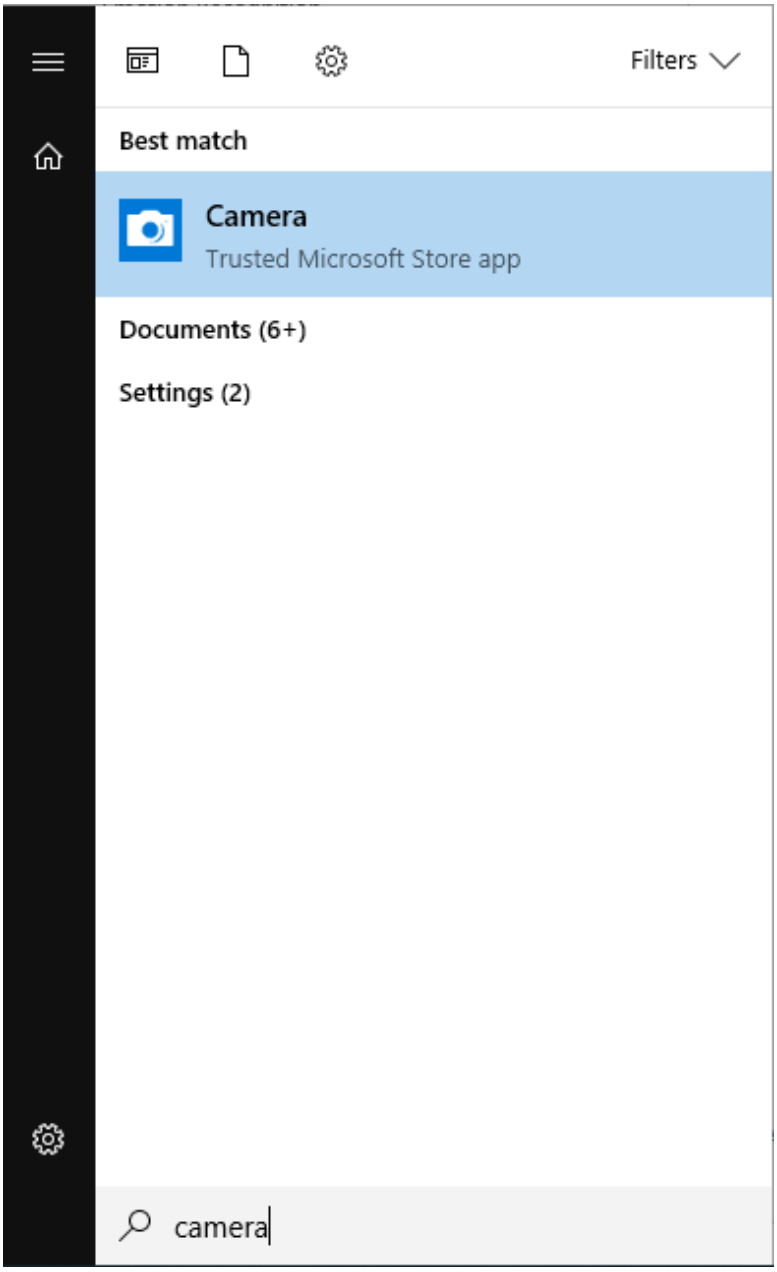

Figure 4: Windows Camera App

After opening the camera app, video will be shown in the camera app directly from the kit:

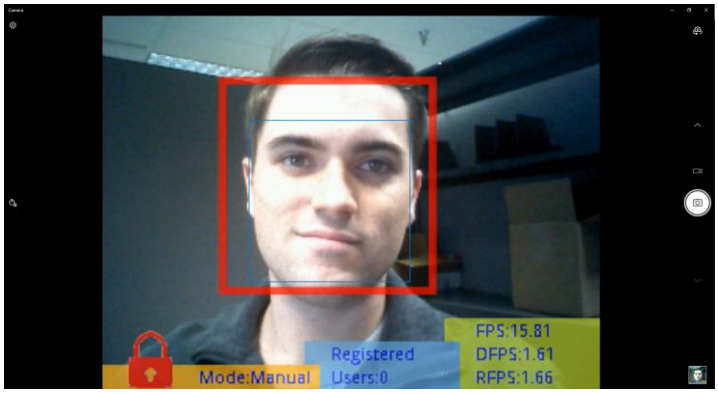

Figure 5: SLN-VIZN-IOT Camera Output in Camera App

If the camera picture looks blurry, try adjusting the focus of the camera by twisting the lens using the lens' grooved edges.

Note: If there is no picture coming from the board whatsoever, ensure that the "base" board and "expansion" board are properly connected inside of the enclosure.

If you have multiple cameras connected to your computer, you may need switch the camera being shown. In Windows, use the "Switch Camera" button located in the top right-hand corner of the app.

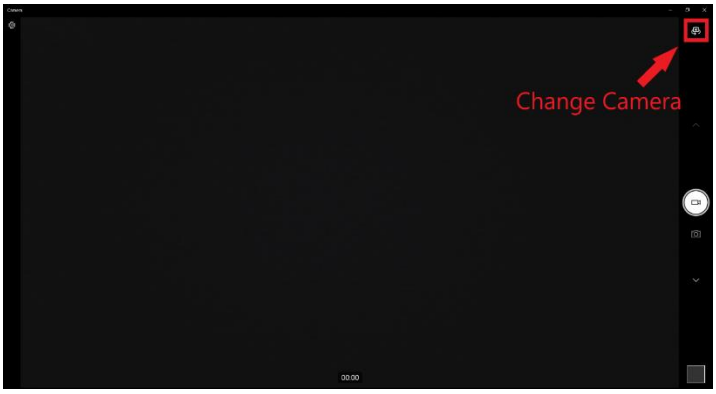

Figure 6: Change Camera Button in Windows Camera App

2.2.2 Register a Face

The kit will automatically detect faces. An unregistered face will be indicated by a red LED on the kit, and a red bounding box around the user's face.

If powering on for the first time, there will be no registered faces in the internal database.

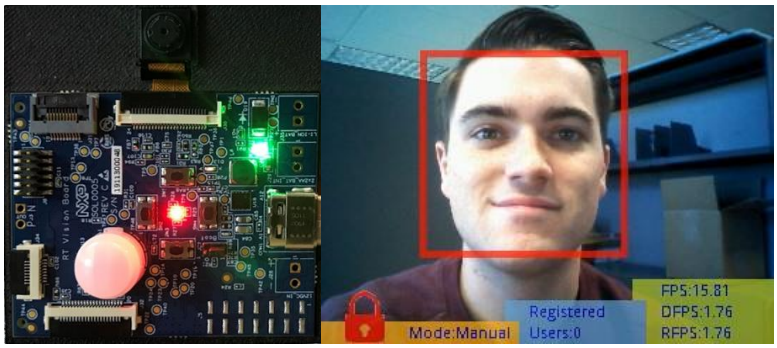

Figure 7:Face Detected

To begin registering a new face, press the **Manual Registration** button on the kit (SW4).

Figure 8: SLN-VIZN-IOT Manual Registration Button

Once pressed, a message indicating registration is taking place will pop up at the top of the screen.

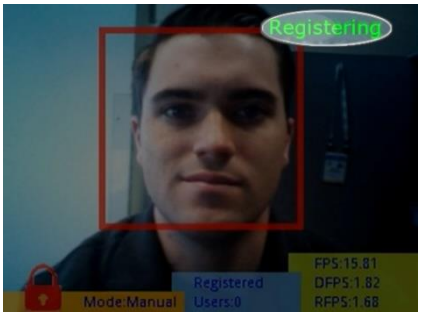

Figure 9: Registration in Progress

NOTE: If pressing the button does not produce a 'Registering' message, ensure that the "base" board and "expansion" board are properly connected inside of the enclosure.

To register your face, stare straight-on at the camera and wait for the box around your face to turn from red to green. When registering a face via the buttons on the kit, a generic username will be assigned to the newly registered face.

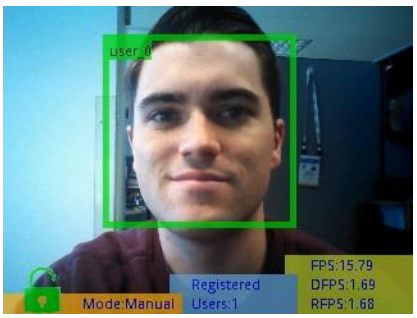

Figure 10: Successful Registration

Your face is now registered into the system. Follow the same procedure to add additional faces into the system.

2.2.3 Connect to Serial Interface

Using serial commands will give users access to the full suite of features the SLN-VIZN-IOT has to offer. Issuing serial commands can be done using a serial terminal emulator like PuTTY or Tera Term.

To connect to the serial interface of the kit, identify the **COM** port associated with the kit and connect using the [115200, 8, 1, N, XON/XOFF] serial settings shown below.

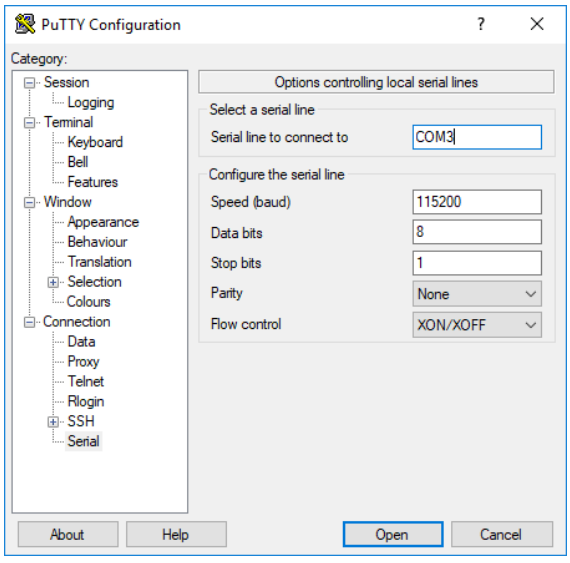

Figure 11: Serial Connection Settings

After connecting, you will encounter a blank terminal screen that echoes any characters that you type. Use the "**help"** command to display a list of all the available serial commands and their usage.

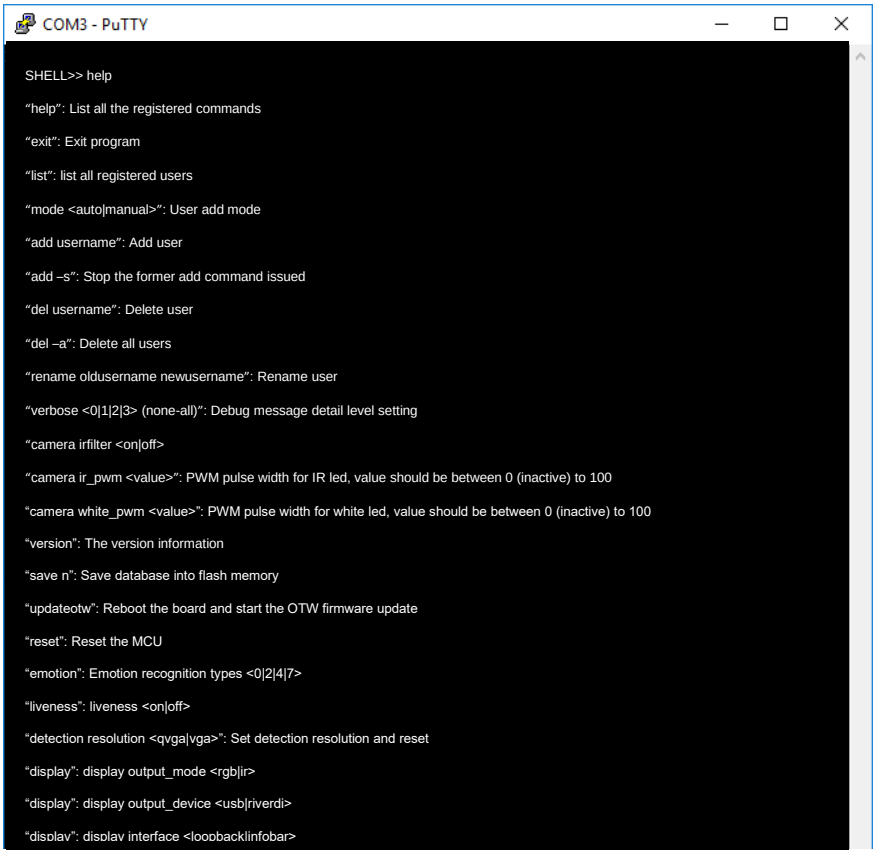

Figure 12: Serial Commands "Help" Menu

We will be discussing a few of these commands in the upcoming section.

2.2.4 Save Registered Face

By default, faces that are registered will not persist through resets. A terminal application like **PuTTY** will be needed to communicate with the kit and save the registered face into flash.

The **save** command is used to persist all/individual face "embeddings" into flash depending on whether an entry id is provided. Issue a "**save**" command to persist every face registered since power up.

Upon successful completion of the command, you will receive an output message in the terminal indicating that the command was successful.

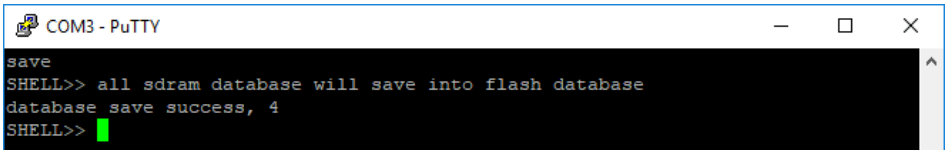

Figure 13: Face Successfully Saved

Power cycle the device and confirm that the registered face is still recognized.

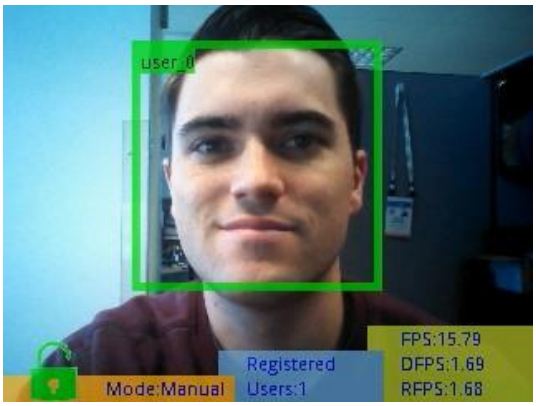

Figure 14: Face Save Successful

2.2.5 Enable Emotion Recognition

The SLN-VIZN-IOT kit also supports emotion recognition in addition to face recognition. This feature comes disabled by default and needs to be enabled via serial commands.

Once connected to the kit via serial, use the command **“emotion 0”, “emotion 2”, “emotion 4”,** or **“emotion 7.”**

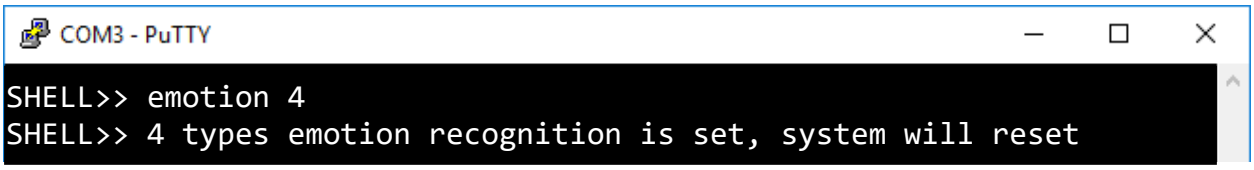

Figure 15: "emotion 4" Command Success Output

Running the **“emotion”** command will enable the recognition of the emotions shown in the table below.

Emotion	“emotion 2”	“emotion 4”	“emotion 7”
Neutral	X	X	X
Happy	X	X	X
Angry		X	X
Surprised		X	X
Sad			X
Fear			X
Disgust			X
Accuracy	92%	81%	62%

Table 3: Emotion Recognition Configuration Table

When a user’s emotion is recognized, the kit will display a message which will indicate the detected emotion. If a user smiles, the text “Happy” will be shown in the upper right-hand corner of the bounding box.

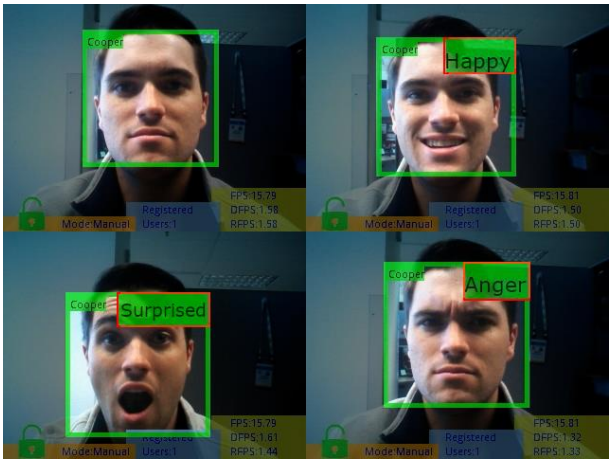

Figure 16: "emotion 4"

The more emotions that are being actively recognized, the lower the emotion accuracy. For this reason, we recommend using two or four emotions.

*Please note the "**Neutral**" emotion is a standard state and is not displayed.*

2.2.6 Enable Verbose Mode

The SLN-VIZN-IOT kit supports verbose debug message logging which provides important inference performance information, for example, the time it took to detect a user. Serial debug messages are disabled by default but can be enabled via a serial command.

To enable debug output on the SLN-VIZN-IOT, type the serial command **"verbose 0"**, **"verbose 1"**, **"verbose 2"**, or **"verbose 3."**

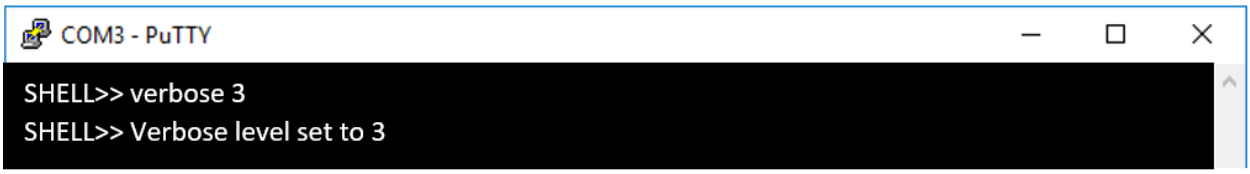

Figure 17: "verbose 0"

Using the verbose command will enable logging of the debug information indicated in the table below.

Message Type	*Importance*	*"verbose 0"*	*"verbose 1"*	*"verbose 2"*	*"verbose 3"*
Critical	*High*		*X*	*X*	*X*
Detailed	*Medium*			*X*	*X*
Misc.	Low				X

Table 4: Verbose Mode Configuration Table

The following is an example of a debug message a user might receive after a face detection and recognition event.

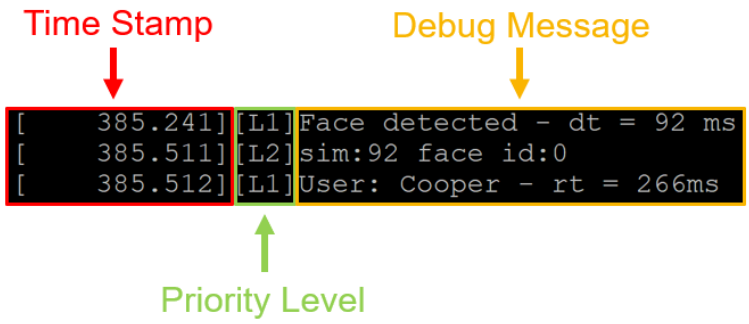

Figure 18: Example Verbose Mode Debug Message

The following table describes the different messages and the associated descriptions.

Abbreviation	Definition
dt	Time taken to detect face
rt	Time taken to recognize face
sim	Predictive accuracy/confidence value of face rec
face_id	Internal face database identifier

Table 5: Verbose Mode Abbreviation Table

2.2.7 Configure Detection Resolution

The SLN-VIZN-IOT kit comes with both VGA and QVGA detection resolution settings. By default, the kit runs in QVGA mode. Although VGA takes more processing power which can slightly affect inference times, the higher resolution provided by VGA mode also allows for further detection/recognition range than when using QVGA.

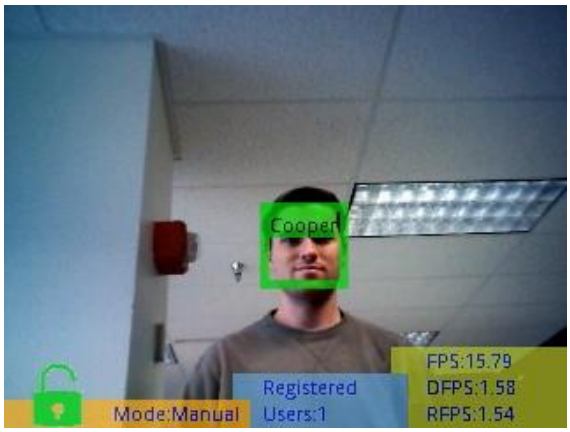

Figure 19: VGA Detection Resolution Max Range

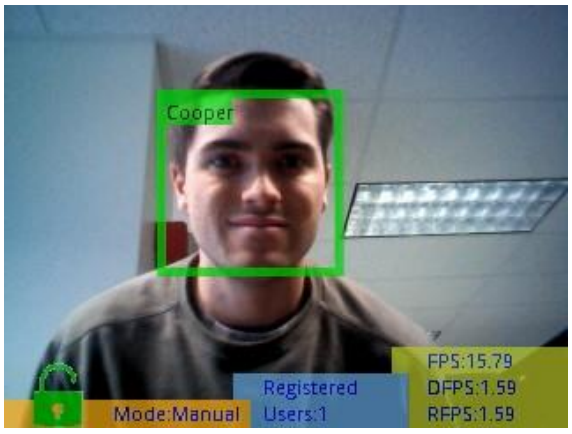

Figure 20: QVGA Detection Resolution Max Range

In order to switch between the two modes, the command "**detection resolution <VGA|QVGA>**" can be used to enable VGA or QVGA detection resolution mode. For the

command to take effect, the board will automatically restart itself, so make sure to have any faces you want to retain saved in flash (see **Saving Users Through Resets)**.

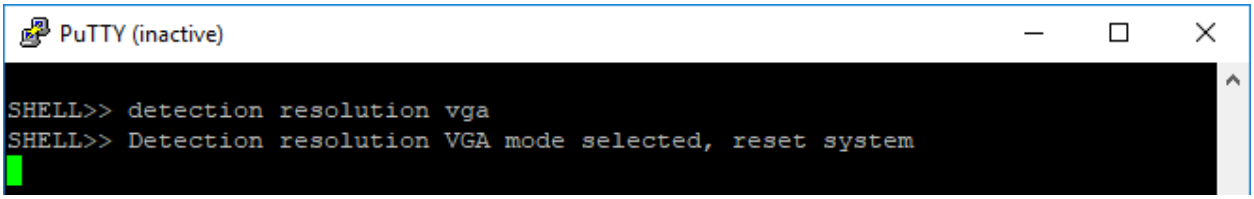

Figure 21: "detection resolution vga" Command

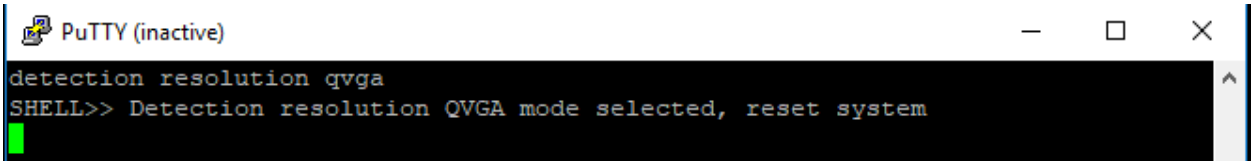

Figure 22: "detection resolution qvga" Command

NOTE: As the name would suggest, changing the detection resolution does not affect the resolution of the video output, just the resolution of the image the inference engine sees.

3 Additional Functionality

This section will discuss in more detail some of the extra features included in the kit that may not have been discussed in the previous sections. Included in this feature discussion are the **Push Buttons** and their functionality, as well as many of the **Serial Commands** and how to use them.

3.1 Push Buttons

The SLN-VIZN-IOT kit makes use of on-board push buttons in order to give users easy access to some of the kit's most useful features, like face registering and deregistering, and the ability to change between manual and automatic enrollment mode.

In this section, we will discuss these buttons and their functions in more depth.

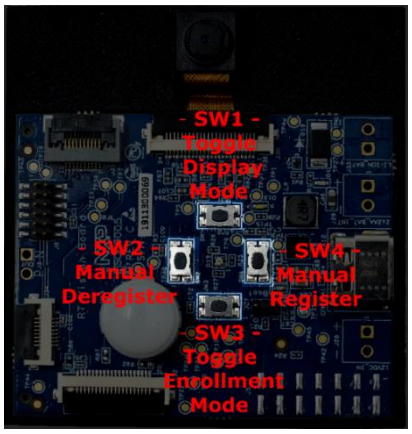

Figure 23: Button Functions:

Button	Function	Description
SW1	Toggle Display Mode	*Switches between Live/Camera view and Info Only view*
SW2	Manual Deregister	*Triggers the deletion of the next registered face encountered by the kit*
SW3	Toggle Enrollment Mode	*Switches between Manual and Automatic registration mode*
SW4	Manual Register	*Triggers the registration of the next face encountered by the kit*

Table 6: Button Function Table

3.1.1 SW4 – Manual Registration

Figure 24: SW4

As mentioned previously, SW4 can be used while the demo is running in manual registration mode to tell the application to begin seeking a new face to register in the kit's internal face database.

When SW4 is pressed, the board will begin the registration process, and an indicator message will be shown near the top of the display. *This behavior is identical to what would display if you had triggered a manual registration using UART.*

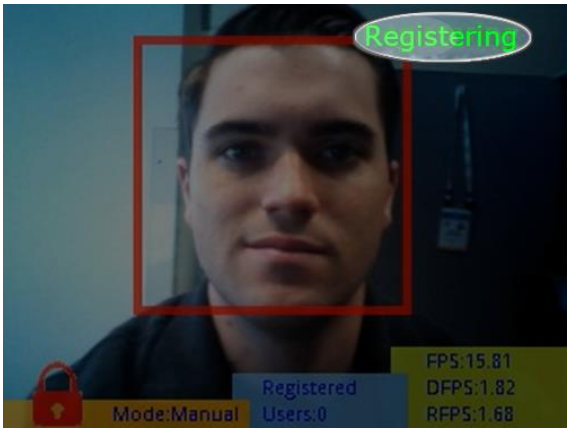

Figure 25: Registration in Progress

To register a face, simply hold it in front of the camera and stare straight-on for 1-3 seconds until the box around the face turns from red to green. Additionally, the number of registered users will be incremented by one.

To cancel a registration command, simply press SW4 again and the process will be cancelled.

3.1.2 SW2 – Manual Deregistration

Figure 26: SW2

Working similarly to SW4, pressing SW2 will trigger a manual “deregistration” command, which will remove the next recognized face from the kit’s internal face database.

When this button is pressed, an indicator message will be displayed at the top of the screen which lets the user know that the process of deregistering a face is taking place.

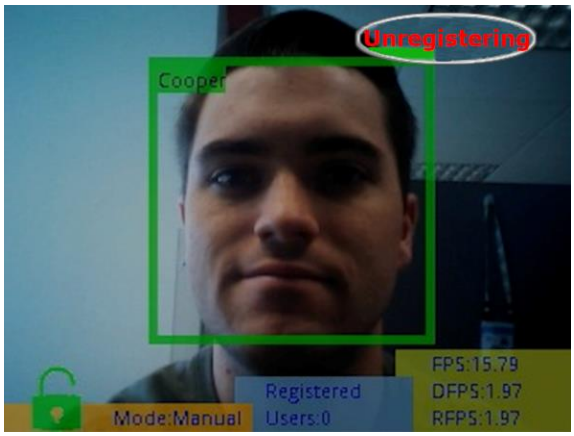

Figure 27: Deregistration in Progress

To deregister a face, simply stare straight-on at the camera for 1-3 seconds and wait for the box around the face to change from green to red. Additionally, the number of registered users will be decremented by one.

To cancel a deregister command, simply press SW2 again and the process will be cancelled.

3.1.3 SW3 – Change Face Enrollment Mode

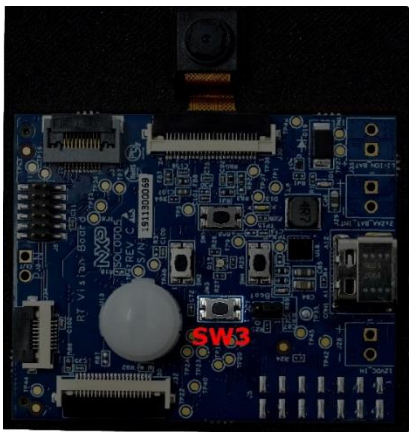

Figure 28: SW3

As mentioned in the overview, the SLN-VIZN-IOT has both a manual and an auto registration mode. The demo's current registration mode can be toggled by the use of SW3. Pressing the "bottom" button on the board will change the active registration mode, which will be reflected by the "Mode" text found in the overlay.

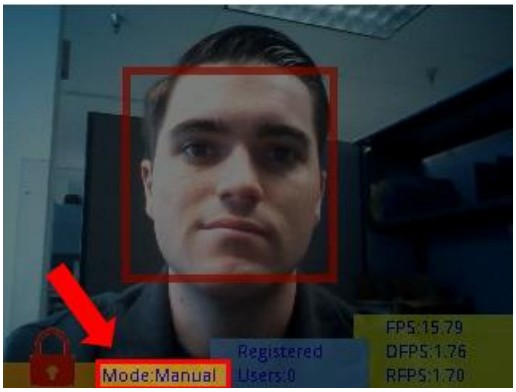

Figure 29: Manual Registration Mode

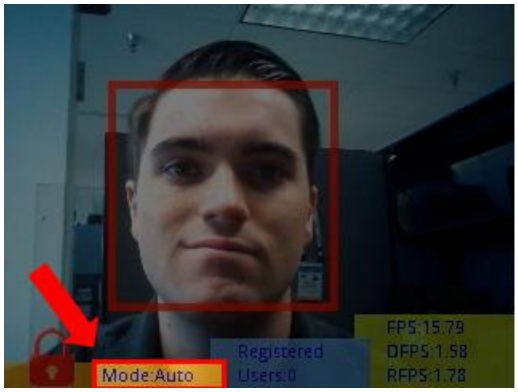

Figure 30: Automatic Registration Mode

3.1.4 SW1 – Toggle GUI

Figure 31: SW1

The SW1 push button toggles whether the GUI display is active or not. When deactivated, the only information that will be shown is the bounding box around the face of the user in frame. The behavior of this button is identical to the **"display interface"** serial command.

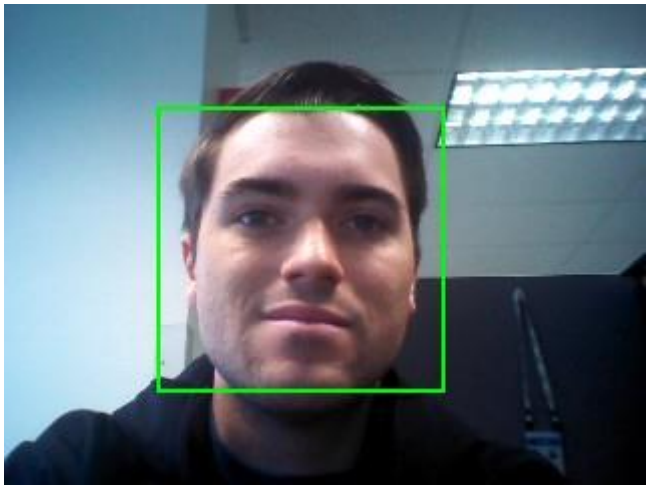

Figure 32: GUI Toggled Off

3.2 Serial Commands

In order to access the full suite of features that the SLN-VIZN-IOT has to offer, communication via serial is needed. Using serial, users can be added and deleted, the camera's detection resolution can be configured, as well as several additional capabilities.

In this section, we will show a full list of available serial commands and them in-depth.

3.2.1 List Available Commands

To display a list of all available commands you can run, type the command "**help**."

The following table show all the available commands the kit has to offer:

Command	Arguments	Description
help	n/a	*Display a list of all available serial commands along with a brief description of their function*
exit		*Exit program; closes serial terminal until reset*
list		*List all registered users*
mode	< auto | manual >	*List current registration mode when supplied no arguments; Change registration mode to mode specified by arguments*
add	USERNAME	*Add new user with specified username*
add	-s	*Stops attempting to add a new user*
del	USERNAME	*Deletes specified user*
del	-a	*Deletes all registered users*
rename	Old new	*Renames face associated with **old** name to **new** name*
verbose	< 0 | 1 | 2 | 3 >	*Configures verbose mode debug logging with the specified verbosity*
version		*Displays version information regarding inference engine*
save		*Saves face database in flash memory*
updateotw		*Reboots the board and sets up OTW firmware update mode*
reset		*Reset the MCU*
emotion	< 0 | 2 | 4 | 7 >	*Configures emotion recognition to use the specified mode (0, 2, 4, or 7 emotion recognition mode)*
detection resolution	< qvga | vga >	*Configures the detection resolution to use the resolution specified and resets the board*
display output_device	< usb | riverdi >	*Configures the display output device to use either video over USB or the Riverdi display. (Requires Riverdi display)*
display interface	< loopback | infobar >	*Configures whether the info bar/GUI is displayed or not*

Table 7: Serial Command Table

3.2.2 List All Registered Users

Using the “**list**” command will list all the users currently registered into the system.

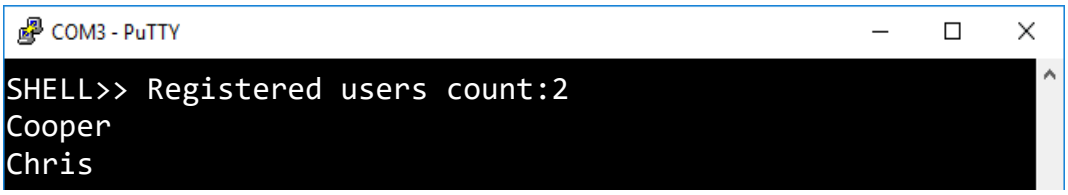

Figure 33: "list" Command

3.2.3 Change Face Enrollment Mode

By default, the demo application runs in “manual” mode. This means that a face will not be registered unless explicitly told to do using either **SW4** or serial commands. Alternatively, the demo is able to run in “auto” mode, meaning that any time the application encounters a face that is has never seen before, it will attempt to register that face as a new user using a generic name like “user_0”, “user_1”, etc.

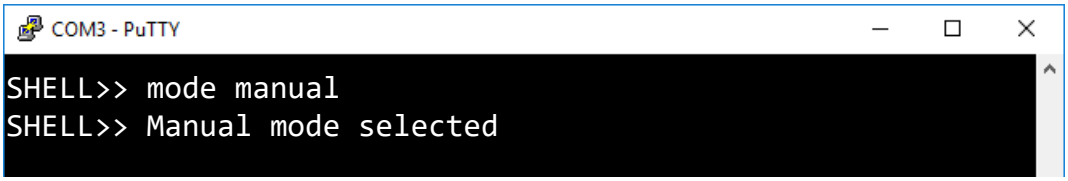

Figure 34: "mode manual" Command

Should you desire to change the currently running mode, simply use the command “**mode auto**” or “**mode manual**” to change to either auto or manual mode, respectively.

3.2.4 Manually Add Users

While running in manual mode, in order to register a new face, use the command “**add USER_NAME**.” After a few seconds, should the demo find a face, it will begin recording and saving a face, with success indicated by a green border around the newly registered face.

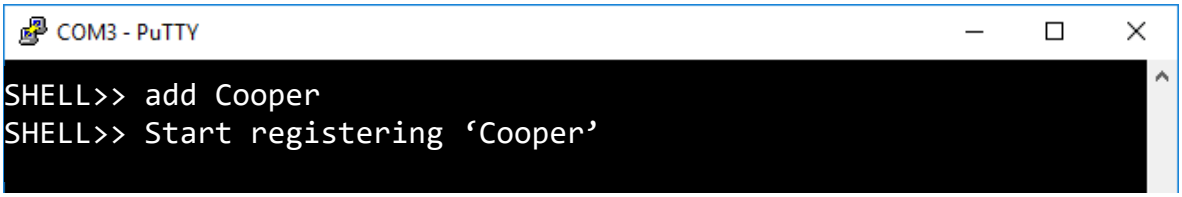

Figure 35: "add Cooper" Command

This command can even be used to assign a specific name to the next registered face while running in **auto** mode.

To cancel an “**add”** command issued via serial or the SW4 push button, issue an **“add”** command with the “**-s**” argument.

Figure 36: "add -s" Command

3.2.5 Manually Delete Users

In cases where you want to delete a previously registered user, running the command “**del USER_NAME**” will delete the specified user.

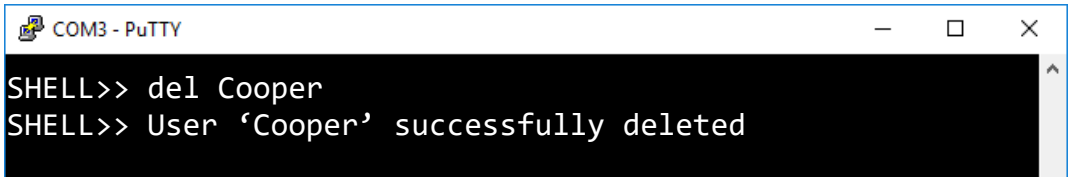

Figure 37: "del Cooper" Command

Alternatively, running the command “**del -a**” will delete all users from the database.

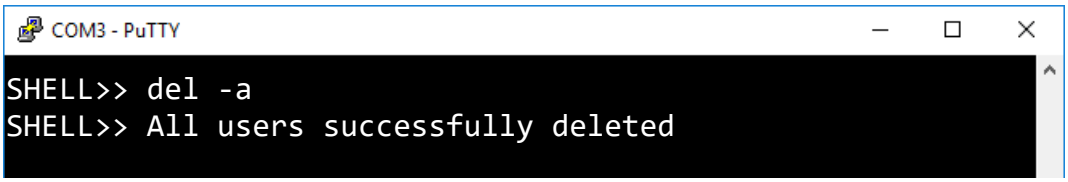

Figure 38: "del -a" Command

3.2.6 Rename Users

The **“rename”** command can be used to rename a user who is currently registered into the database. To do so, simply use the command **“rename oldusername newusername.”** Below is an example of the command being used.

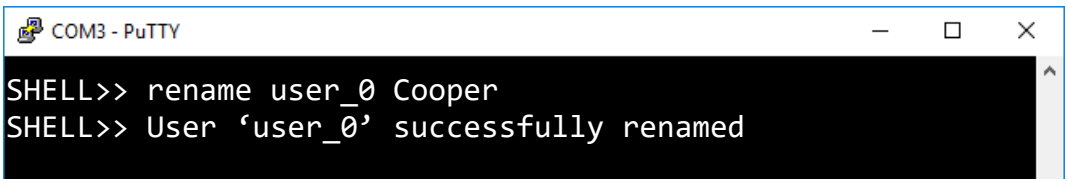

Figure 39: "rename user_0 Cooper" Command

3.2.7 Verbose Mode

The SLN-VIZN-IOT kit supports verbose debug message logging which provides important inference performance information, for example, the time it took to detect a user. Serial debug messages are disabled by default but can be enabled via a serial command.

To enable debug output on the SLN-VIZN-IOT, type the serial command **“verbose 0”**, **“verbose 1”**, **“verbose 2”**, or **“verbose 3.”**

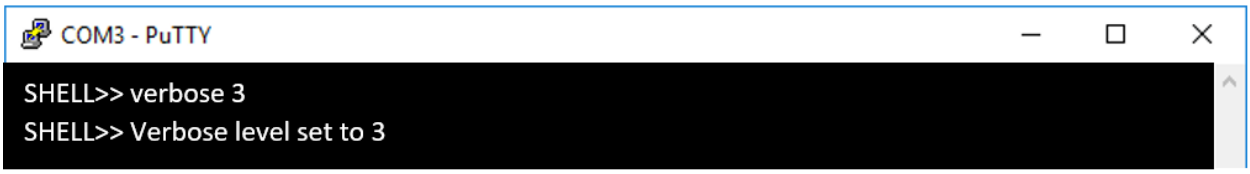

Figure 40: "verbose 0" Command

Using the verbose command will enable logging of the debug information indicated in the table below.

Message Type	*Importance*	*“verbose 0”*	*“verbose 1”*	*“verbose 2”*	*“verbose 3”*
Critical	*High*		*X*	*X*	*X*
Detailed	*Medium*			*X*	*X*
Misc.	Low				X

Table 8: Verbose Mode Configuration Table

The following is an example of a debug message a user might receive after a face detection and recognition event.

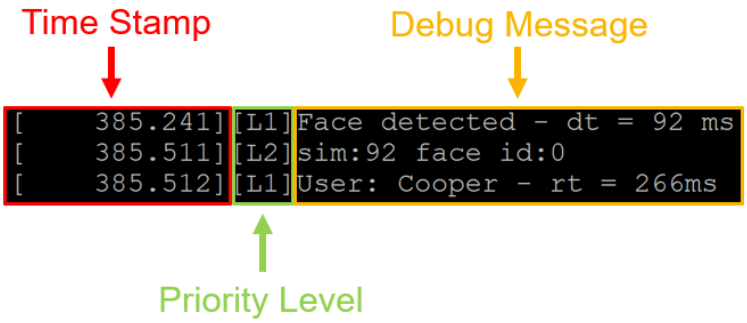

Figure 41: Example Verbose Mode Debug Message

The following table describes the different messages and the associated descriptions.

Abbreviation	Definition
dt	Time taken to detect face
rt	Time taken to recognize face
sim	Predictive accuracy/confidence value of face rec
face_id	Internal face database identifier

Table 9: Verbose Mode Abbreviation Table

3.2.8 Print Version Information

It can be useful to know which version of the SLN-VIZN-IOT inference engine is being run in order to know which features are currently supported. To determine the version number of the Oasis Lite inference engine being used by your kit, use the **"version"** command.

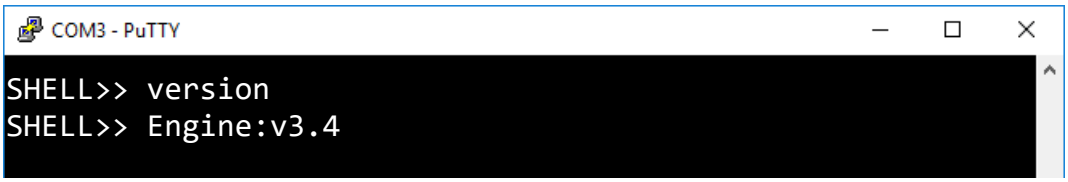

Figure 42: "version" Command

3.2.9 Save Users Through Resets

By default, faces are not saved into flash, meaning that when the board is reset, any registered faces not explicitly saved into flash will be removed. To save a face into flash, use the command "**save N**", where "N" is the number of users you want to save. Users are saved in the order that they were added, so if the command "save 3" was used, the first 3 users registered into the database would be saved.

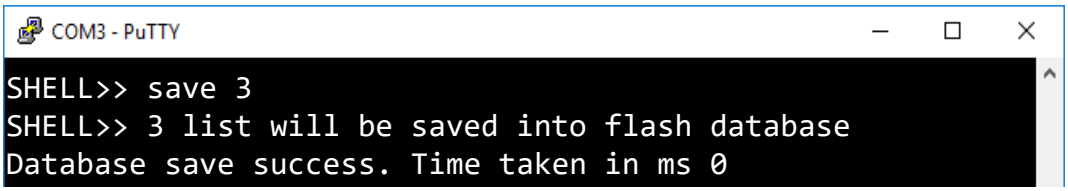

Figure 43: "save 3" Command

Alternatively, the command "**save**" with no arguments will save all registered users into flash.

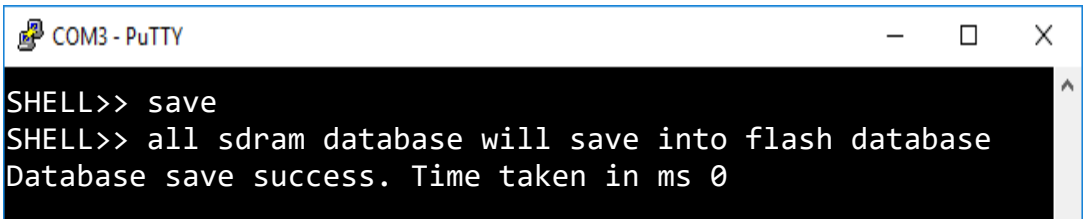

Figure 44: "save" Command

The **"save"** command returns a success message along with the time taken in milliseconds to save all the faces into flash.

3.2.10 Enable OTW (Over-the-Wire) Update Mode

OTW updates and enabling OTW Update Mode are discussed in the SLN-VIZN-IOT Developer's Guide.

3.2.11 Reset the SLN-VIZN-IOT

Situations can arise in which it is useful to reset the kit without needing to physically power cycle anything. This can be done through use of the **"reset"** command. This command performs a soft reset of the kit, going through the entire bootstrapping and bootloading process again.

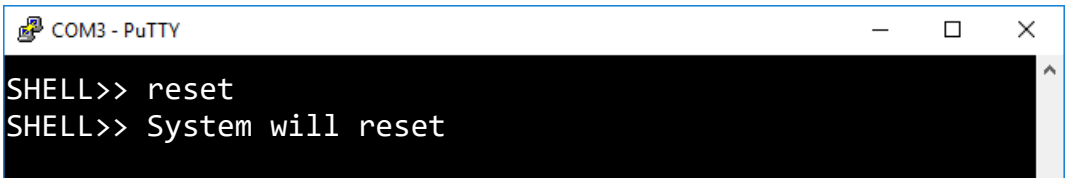

Figure 45: "reset" Command

As with any reset of the kit, serial communication will need to be reestablished to begin issuing serial commands to the board again.

3.2.12 Configure Emotion Recognition

The SLN-VIZN-IOT kit also supports emotion recognition in addition to face recognition. This feature comes disabled by default and needs to be enabled via serial commands.

Once connected to the kit via serial, use the command **"emotion 0", "emotion 2", "emotion 4",** or **"emotion 7."**

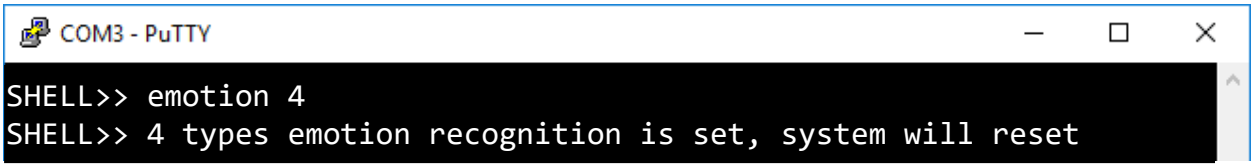

Figure 46: "emotion 4" Command Success Output

Running the **“emotion”** command will enable the recognition of the emotions shown in the table below.

Emotion	“emotion 2”	“emotion 4”	“emotion 7”
Neutral	X	X	X
Happy	X	X	X
Angry		X	X
Surprised		X	X
Sad			X
Fear			X
Disgust			X
Accuracy	92%	81%	62%

Table 10: Emotion Recognition Configuration Table

When a user’s emotion is recognized, the kit will display a message which will indicate the detected emotion. If a user smiles, the text “Happy” will be shown in the upper right-hand corner of the bounding box.

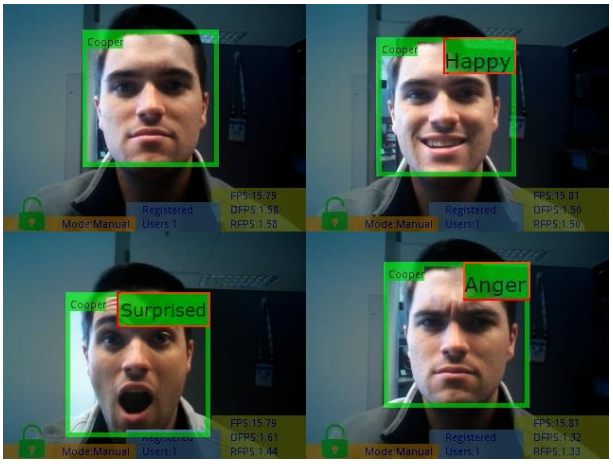

Figure 47: "emotion 4"

The more emotions that are being actively recognized, the lower the emotion accuracy. For this reason, we recommend using two or four emotions.

*Please note the “**Neutral**” emotion is a standard state and is not displayed.*

3.2.13 Configure Detection Resolution

The SLN-VIZN-IOT kit comes with both VGA and QVGA detection resolution settings. By default, the kit runs in QVGA mode. Although VGA takes more processing power which can slightly affect inference times, the higher resolution provided by VGA mode also allows for further detection/recognition range than when using QVGA.

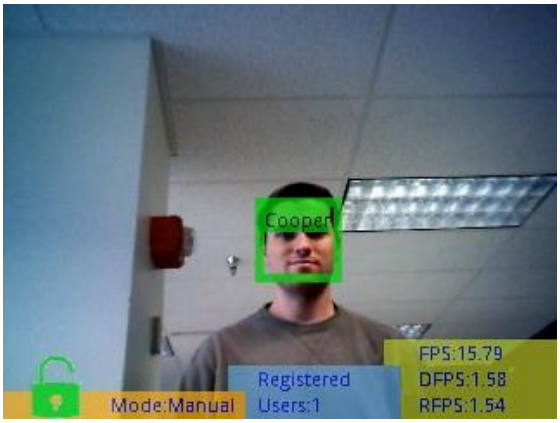

Figure 48: VGA Detection Resolution Max Range

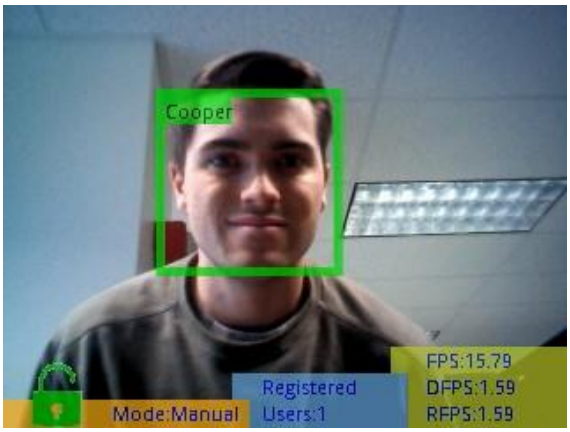

Figure 49: QVGA Detection Resolution Max Range

In order to switch between the two modes, the command "**detection resolution <VGA|QVGA>**" can be used to enable VGA or QVGA detection resolution mode. For the command to take effect, the board will automatically restart itself, so make sure to have any faces you want to retain saved in flash (see **Saving Users Through Resets)**.

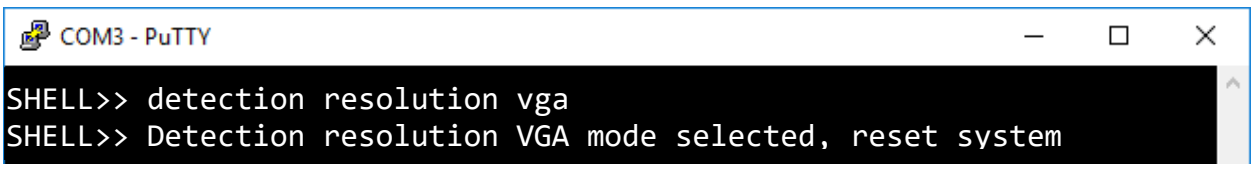

Figure 50: "detection resolution vga" Command

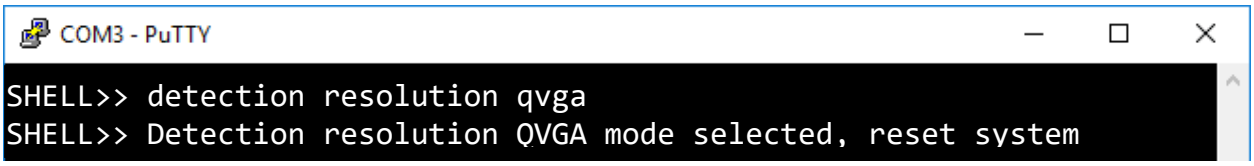

Figure 51: "detection resolution qvga" Command

NOTE: As the name would suggest, changing the detection resolution does not affect the resolution of the video output, just the resolution of the image the inference engine sees.

3.2.14 (Requires Riverdi Display) Configure Display Output Device

Kits enable with a Riverdi display like that shown below can use the **"display output_device <usb|riverdi>"** command to configure whether video will be output through USB to a computer or through the Riverdi display connected to the kit.

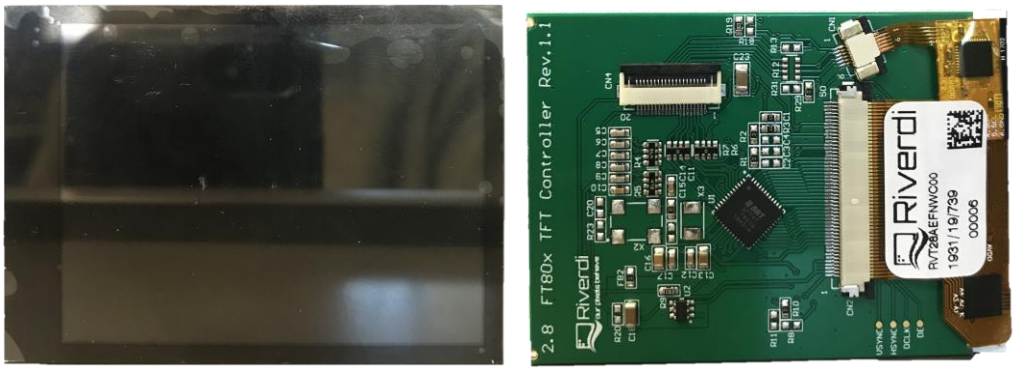

Figure 52: Riverdi Display

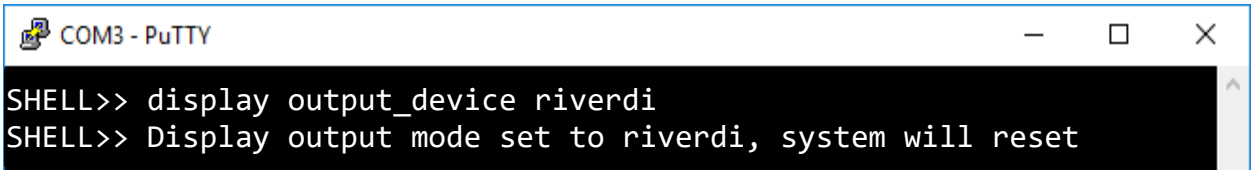

Figure 53: "display output_device riverdi" Command

Attempting to use a configuration that is not supported with your current hardware configuration will result in a message like the following:

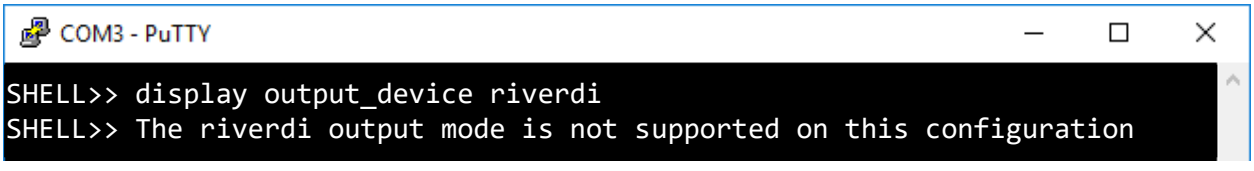

Figure 54: "Display Output Mode Not Supported" Message

3.2.15 Toggle GUI

Similar to the SW1 push button, the **"display interface <loopback|infobar>"** command can be used to toggle the GUI on or off, leaving only the face bounding box.

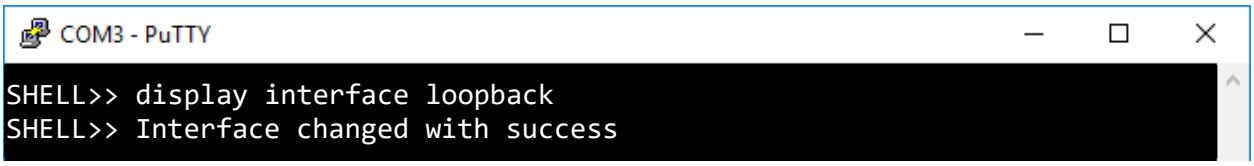

Figure 55: "display interface loopback" Command

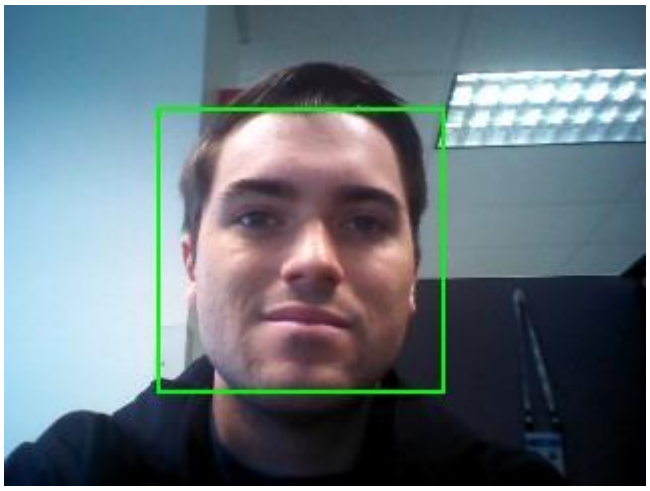

Figure 56: GUI Toggled Off

4 Document Details

4.1 References

The following references are available to supplement this document:

Document/Link	Remark
http://www.nxp.com/MCUXpresso	MCUXpresso IDE Download
https://www.nxp.com/docs/en/user-guide/MCUXpresso_IDE_User_Guide.pdf	MCUXpresso IDE User Guide
	SLN-VIZN-IOT Developer Guide
https://www.nxp.com/mcu-vision	SLN-VIZN-IOT Home Page
	SLN-VIZN-IOT Power Reference

Table 11: Reference Documents

4.2 Acronyms, Abbreviations, & Definitions

Acronym	Meaning	(Definition)
FTDI	Future Technology Devices International	
GUI	Graphic User Interface	
IOT	Internet of Things	
IVT	Instruction Vector Table	
JTAG	Joint Test Action Group	
MANF	Manufacturer	
MCU	Microcontroller Unit	
MEMS	Micro-Electro-Mechanical System	
MSD	Mass Storage Device	
OEM	Original Equipment Manufacturer	
OTW	Over the Wire	
OTP	One Time Programmable	
ROM	Read Only Memory	
RTOS	Real-Time Operating System	
SDK	Software Development Kit	
UART	Universal asynchronous receiver-transmitter	

Table 12: Abbreviations and Definitions

4.3 Revision History

Date	Version	Details of Change	Author	Reviewers
4/21/20	Production 1.1	Removed mention of the dual camera and foxlink	Cooper Carnahan	NXP
2/11/20	Production 1.0	Complete revamp; split UG into UG + DG	Cooper Carnahan	NXP
19 December	Release 0.5	Added Manufacturing tools/security info	Cooper Carnahan	NXP
12 November	Release 0.4	Revision	Cooper Carnahan	NXP
30-September	Draft 0.1	Initial Draft	Cooper Carnahan	NXP

Table 13: Revision History

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