CrossLink-NX Background Segmentation Using VVML Board Demonstration

User Guide

FPGA-UG-02161-1.0

June 2022

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Acronyms in This Document

A list of acronyms used in this document.

Acronym	Definition
CNN	Convolutional Neural Network
EVDK	Embedded Vision Development Kit
FPGA	Field-Programmable Gate Array
LED	Light-emitting diode
MLE	Machine Learning Engine
NN	Neural Network
NNC	Neural Network Compiler
SD	Secure Digital
SDHC	Secure Digital High Capacity
SDXC	Secure Digital extended Capacity
SPI	Serial Peripheral Interface
VIP	Video Interface Platform
USB	Universal Serial Bus
VVML	Voice & Vision Machine Learning Board

1. Introduction

This document describes the Semantic Segmentation Demo running process using the Crosslink-NX™ Voice and Vision Machine Learning platform.

2. Functional Description

Figure 2.1 shows the top view of the VVML board used in this demonstration.

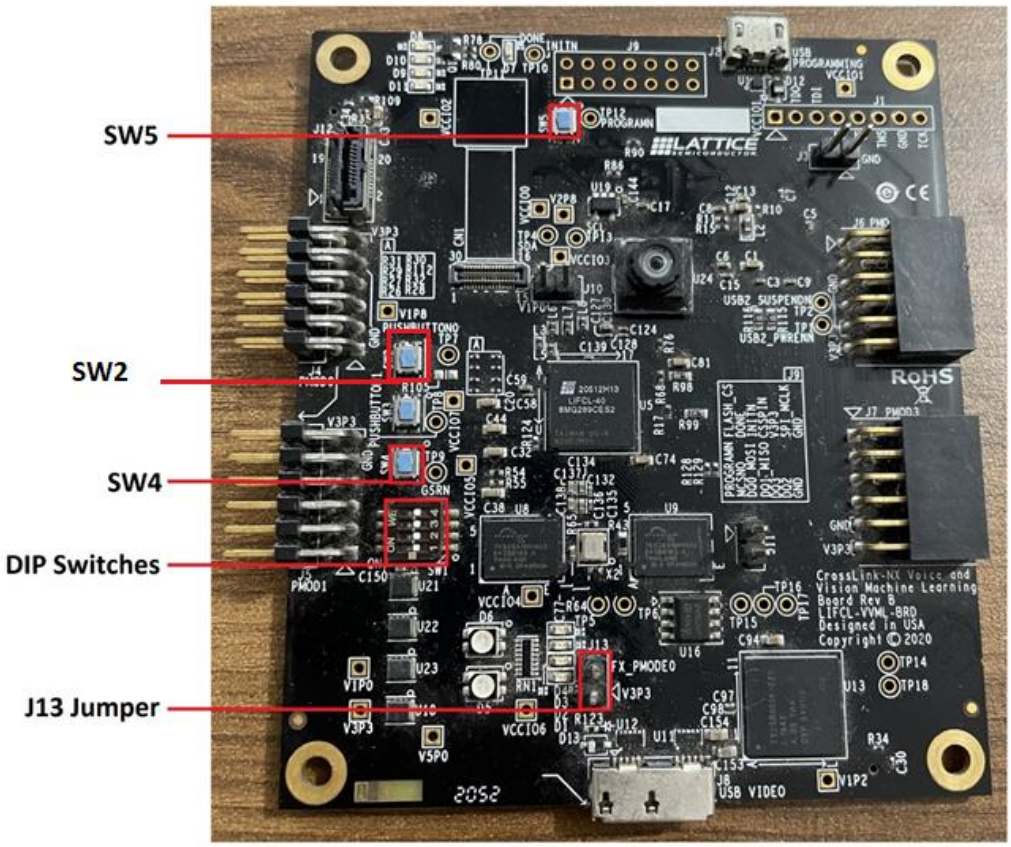

Figure 2.1. VVML Rev-B board - Top View

3. Demo Setup

This section describes the demo setup.

3.1. Hardware Requirements

- CrossLink-NX Voice and Vision Machine Learning Board, Rev. B
- USB 3.0 A to Micro B cable (To load firmware in FX3 and to run demo using video visualizing tool), USB 2.0 A to Micro B cable (to program Crosslink-NX VVML board)
- Personal computer

3.2. Software Requirements

- Lattice Radiant™ Programmer version 3 (Refer to http://www.latticesemi.com/programmer)
- Cypress - EZ-USB FX3 Software Development Kit (Refer to https://www.cypress.com/documentation/software-and-drivers/ez-usb-fx3-software-development-kit)
- Video visualizing tool to see output, user can use one of below tool:

1. VLC Media Player: https://www.videolan.org/vlc/download-windows.html
2. Windows Camera APP: To use windows camera app user must change default webcam if other camera device is connected to system. For more info user can follow steps mentioned in link: https://answers.microsoft.com/en-us/windows/forum/all/how-to-change-default-webcam-in-windows-10/1e8377c8-4fd5-4e9c-8ab6-67913c5c8e0c.
3. AMCap: http://noeld.com/programs.asp?cat=video.

4. Programming the Demo

This chapter describes the Semantic Segmentation Demo running process using the Crosslink-NX Voice and Vision platform.

To Run the demo user will need prebuilt '.mcs' and '.bit' file to program the Crosslink-NX VVML board.

4.1. Package folder structure

Figure 4.1 shows the demo directory structure.

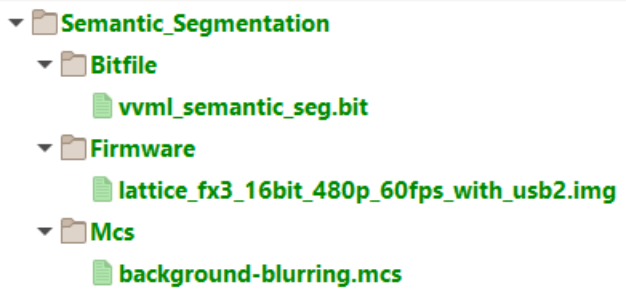

Figure 4.1. Demo Package Folder Structure

4.2. Load Firmware in FX3 I2C EEPROM

4. Connect the USB3 port of the CrossLink-NX Voice and Vision Machine Learning (VVML) Board, Rev B to PC using USB3 cable and Open the USB Control Centre application (Cypress FX3 SDK needs to be installed for same).
5. Use CrossLink-NX Voice and Vision Machine Learning (VVML) Board, Rev B board and put jumper on J13 to make it FX3 firmware programmable and connect FX3 cable to PC.
6. Press the Push button switch SW2 on the board to reset the FX3 chip
7. Screen will show the boot loader device as shown in below Figure 4.2. Cypress USB Bootloader – Default ScreenFigure 4.2.

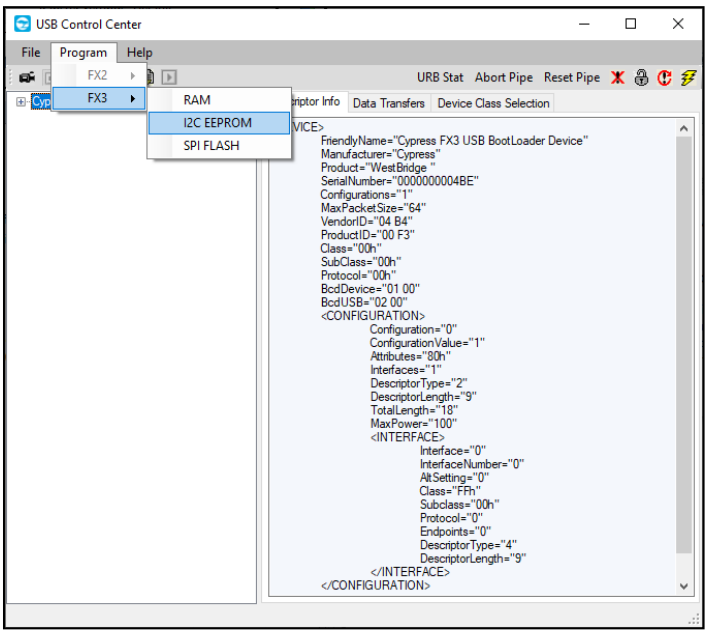

Figure 4.2. Cypress USB Bootloader – Default Screen

8. Select Cypress USB Bootloader
9. In Menu Bar: Select Program -> FX3 -> I2C E2PROM Browse and Select the FX3 image file for the 640x480p60 16bit configuration and Firmware will be programmed in the I2C E2PROM
10. Wait for the programming successful message in bottom taskbar
11. After successfully programming the files, remove jumper J13.
12. Power off and power on the board, now FX3 will boot from I2C E2PROM

4.3. Programming the CrossLink-NX Voice and Vision SPI Flash

4.3.1. Erasing the CrossLink-NX Voice and Vision SRAM Prior to Reprogramming

Note: Erase the board if board is already programmed with different demo.

To erase CrossLink-NX Voice and Vision:

1. Launch Lattice Radiant Programmer with Create a new blank project.

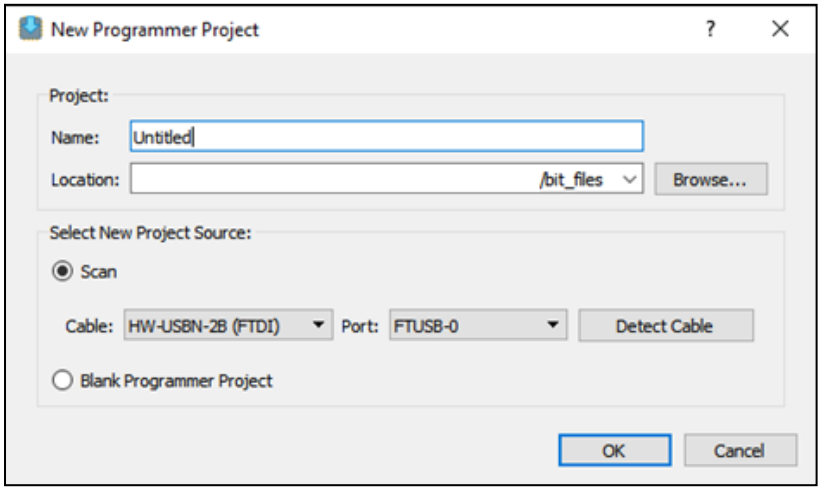

Figure 4.3. Radiant Programmer – Default Screen

2. Select LIFCL for Device Family and LIFCL-40 for Device as shown in below image.

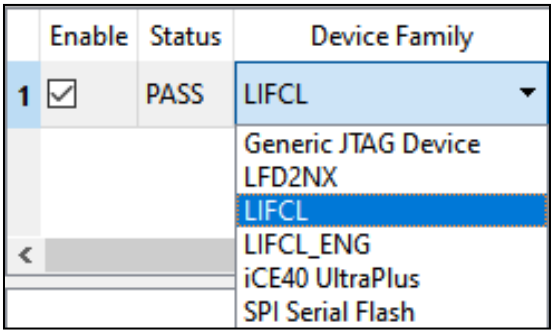

Figure 4.4. Radiant Programmer – Device Selection

3. Right-click and select Device Properties.
4. Select JTAG for Port Interface, Direct Programming for Access Mode and Erase Only for Operation as shown in Figure 4.5.

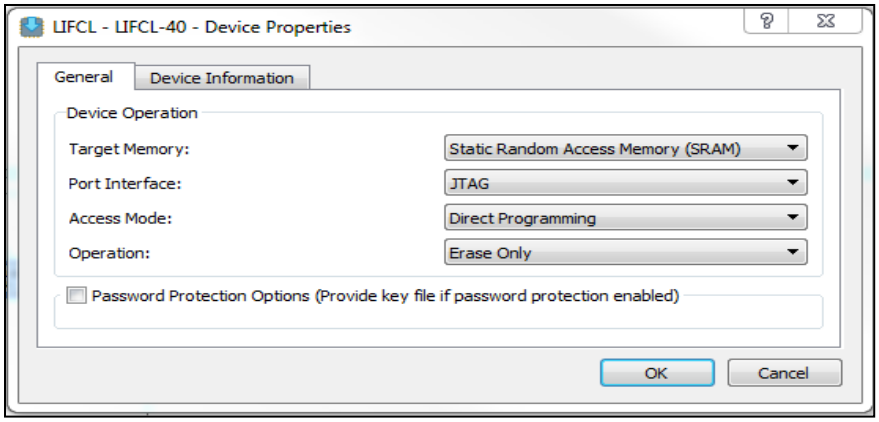

Figure 4.5. Radiant Programmer – Device Operation

5. Click OK to close the Device Properties dialog box.
6. Now press SW5 push button switch before clicking program button in below step and keep it pressed till you see Successful message in Radiant log window.
7. In the Radiant Programmer main interface, click the Program button to start the erase operation.

4.3.2. Programming the CrossLink-NX Voice and Vision Board

To program the CrossLink-NX Voice and Vision SPI flash:

1. Ensure that the CrossLink-NX Voice and Vision device SRAM is erased by performing the steps in Erasing the CrossLink-NX Voice and Vision SRAM Prior to Reprogramming.
2. In the Radiant Programmer main interface, right click the CrossLink-NX Voice and Vision row and select Device Properties to open the Device Properties dialog boxes as shown in Figure 4.6.
3. Select SPI FLASH for Access mode, JTAG2SPI for Port Interface, and Direct Programming for Access Mode.
4. For Programming File, browse and select the CrossLink-NX Voice and Vision bitfile (*.bit).
5. For SPI Flash Options, make the selections in Figure 4.6 to select the Macronix 25L12833F device.

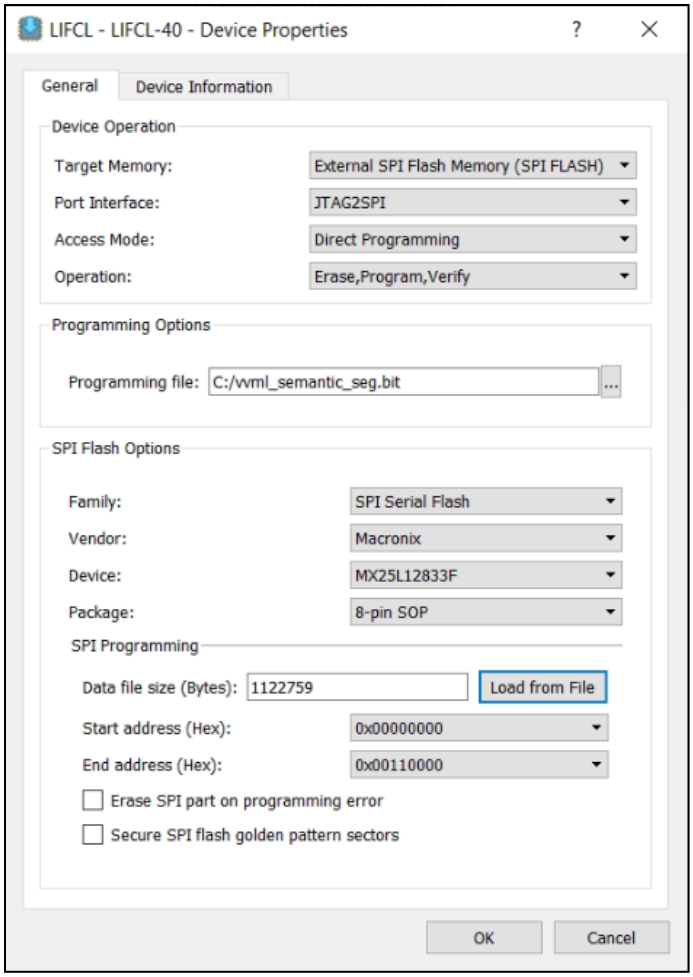

Figure 4.6. Radiant Programmer – Selecting Device Properties Options for CrossLink-NX Flashing

6. Click Load from File to update the Data file size (Bytes) value.
7. Ensure that the following addresses are correct:

- Start Address (Hex): 0x00000000
- End Address (Hex): 0x00110000

8. Click OK.
9. Now press SW5 push button switch before clicking program button in below step and keep it pressed till you see Successful message in Radiant log window.

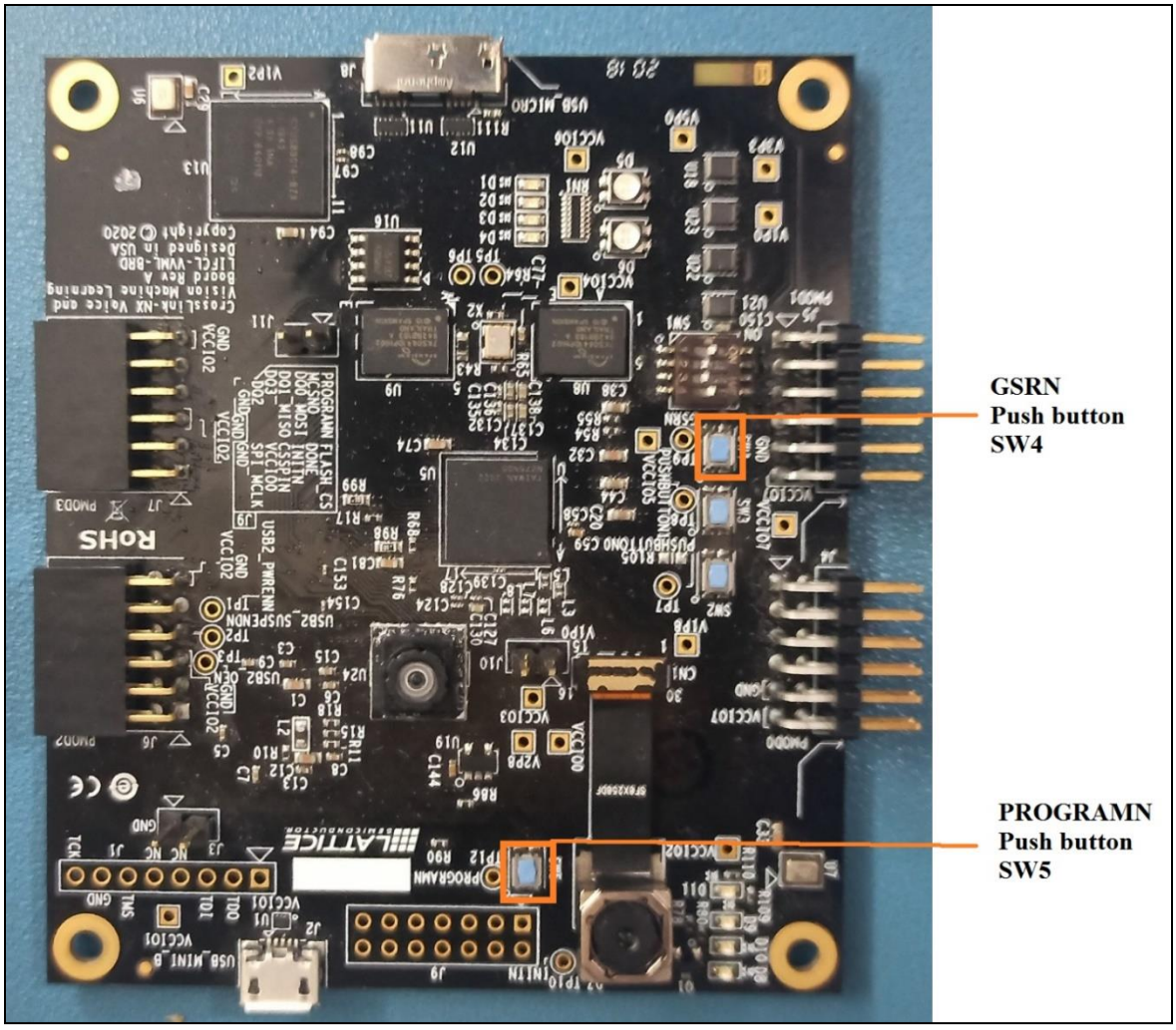

Figure 4.7. CrossLink-NX Voice and Vision Flashing Switch – SW5 Push Button

10. In the Radiant Programmer main interface, click the Program button to start the programming operation.

11. Successful programming is displayed in the Radiant Programmer Output console as shown in Figure 4.8.

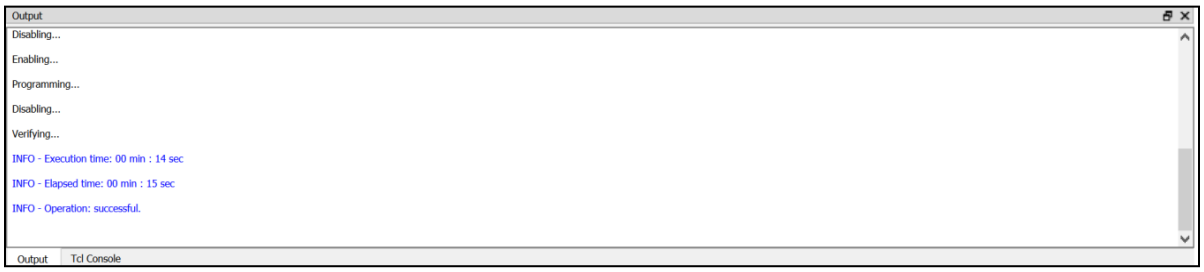

Figure 4.8. Radiant Programmer – Output Console

4.3.3. Programming SensAI Firmware Binary to the CrossLink-NX Voice and Vision SPI Flash

4.3.3.1. Flash SensAI Firmware Hex to Crosslink-NX SPI Flash

To program the CrossLink-NX SPI flash:

1. Ensure that the CrossLink-NX device SRAM is erased by performing the steps in Erasing the CrossLink-NX Voice and Vision SRAM Prior to Reprogramming once before flashing bitstream & SensAI firmware binary.
2. In the Radiant Programmer main interface, right click the CrossLink-NX row and select Device Properties to open the Device Properties dialog boxes as shown in Figure 4.9.
3. Select SPI FLASH for Target Memory, JTAG2SPI for Port Interface, and Direct Programming for Access Mode.
4. For Programming File, browse and select the CrossLink-NX SensAI firmware binary file after converting it to hex (*.mcs).
5. For SPI Flash Options, make the selections in Figure 4.9 above to select the Macronix 25L12833F device.

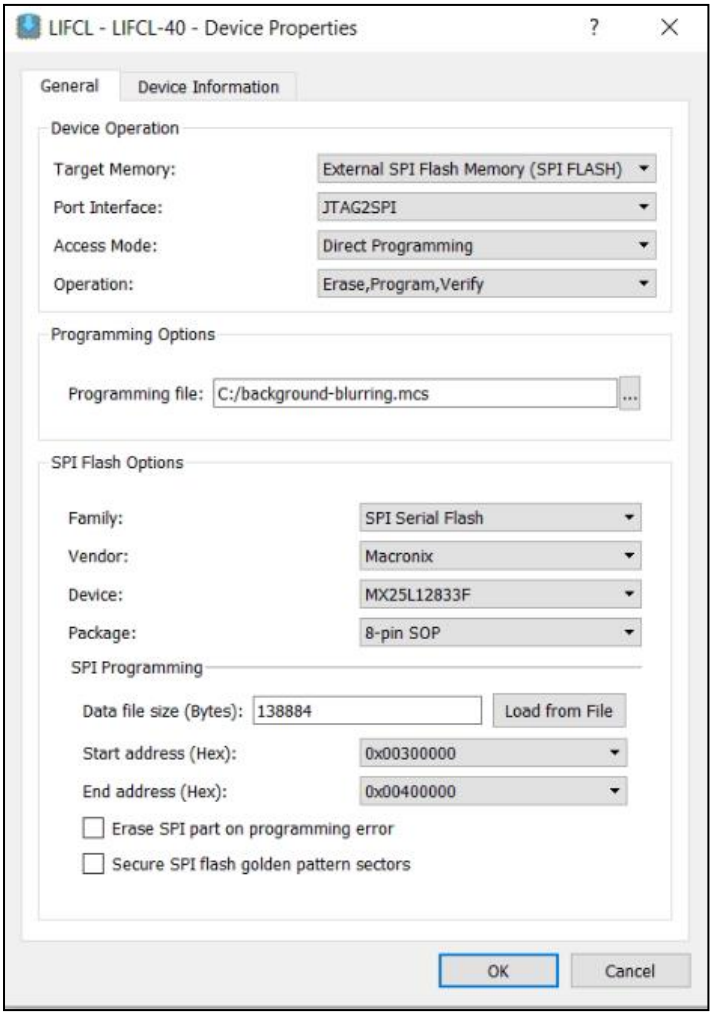

Figure 4.9. Radiant Programmer – Selecting Device Properties Options for CrossLink-NX Flashing

6. Click Load from File to update the Data file size (Bytes) value.
7. Ensure that the following addresses are correct:

- Start Address (Hex): 0x00300000
- End Address (Hex): 0x00400000

8. Click OK.

9. Now press SW5 push button switch before clicking program button in below step and keep it pressed till you see Successful message in Radiant log window.
10. In the Radiant Programmer main interface, click the Program button to start the programming operation.
11. Successful programming is displayed in the Diamond Programmer Output console as shown below.

Figure 4.10. Radiant Programmer – Output Console

5. Running the Demo

5.1. Run Demo

To run the demo:

1. Power on Voice and Vision Board.
2. Connect the Voice and Vision board to the PC via board's USB3 port
3. Open the Windows utility and select the FX3 Device as source and usb port to maximum number port available.
4. The camera image should be displayed on monitors shown in below figure Figure 5.1.

Figure 5.1. Running the Demo

5.2. Ideal Conditions for testing the demo

- Distance: Users should be in range up to 3 feet distance.
- Decent light is needed to run demo. Too low and direct light from light source may reduce the performance of demo.

Technical Support Assistance

Submit a technical support case through www.latticesemi.com/techsupport.

Revision History

Revision 1.0, June 2022

Section	Change Summary
All	Initial release.

www.latticesemi.com