CrossLink-NX QVGA MobileNet Human Counting Using VVML Board Demonstration

User Guide

FPGA-UG-02130-1.0

May 2021

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Contents

Figures

Acronyms in This Document

A list of acronyms used in this document.

Acronym	Definition
FPGA	Field-Programmable Gate Array
ML	Machine Learning
SD	Secure Digital
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
USB	Universal Serial Bus

1. Introduction

This document describes the Human Counting Demo using the CrossLink™-NX Voice and Vision platform. Human Counting is a subset of the generic Object Counting base design.

2. Functional Description

The Human Counting Demo is designed to utilize the Lattice Voice and Vision Machine Learning board. Figure 2.1 and Figure 2.2 show the top view and bottom view of the Voice and Vision board used in this demonstration.

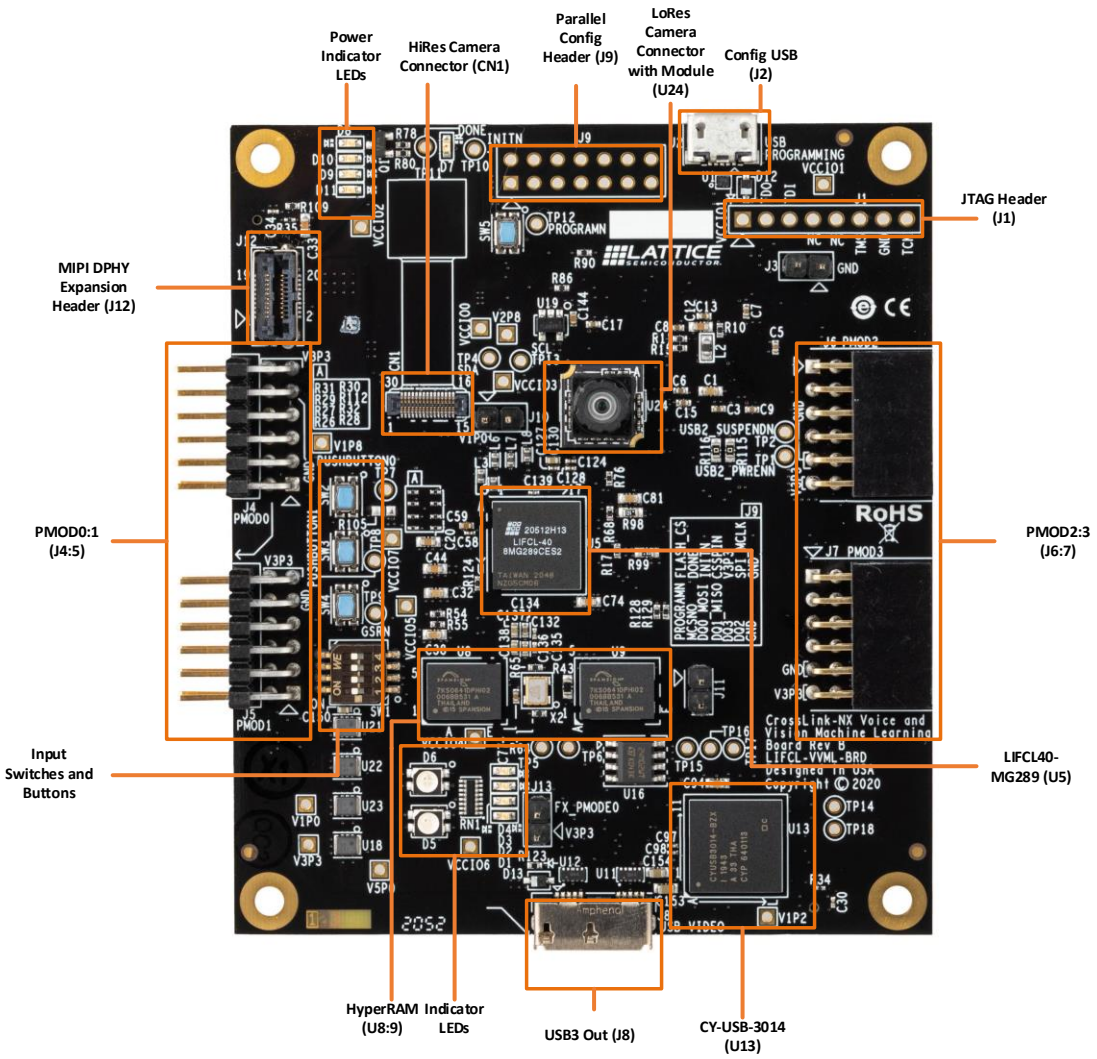

Figure 2.1. Top View of CrossLink-NX Voice and Vision Machine Learning Board

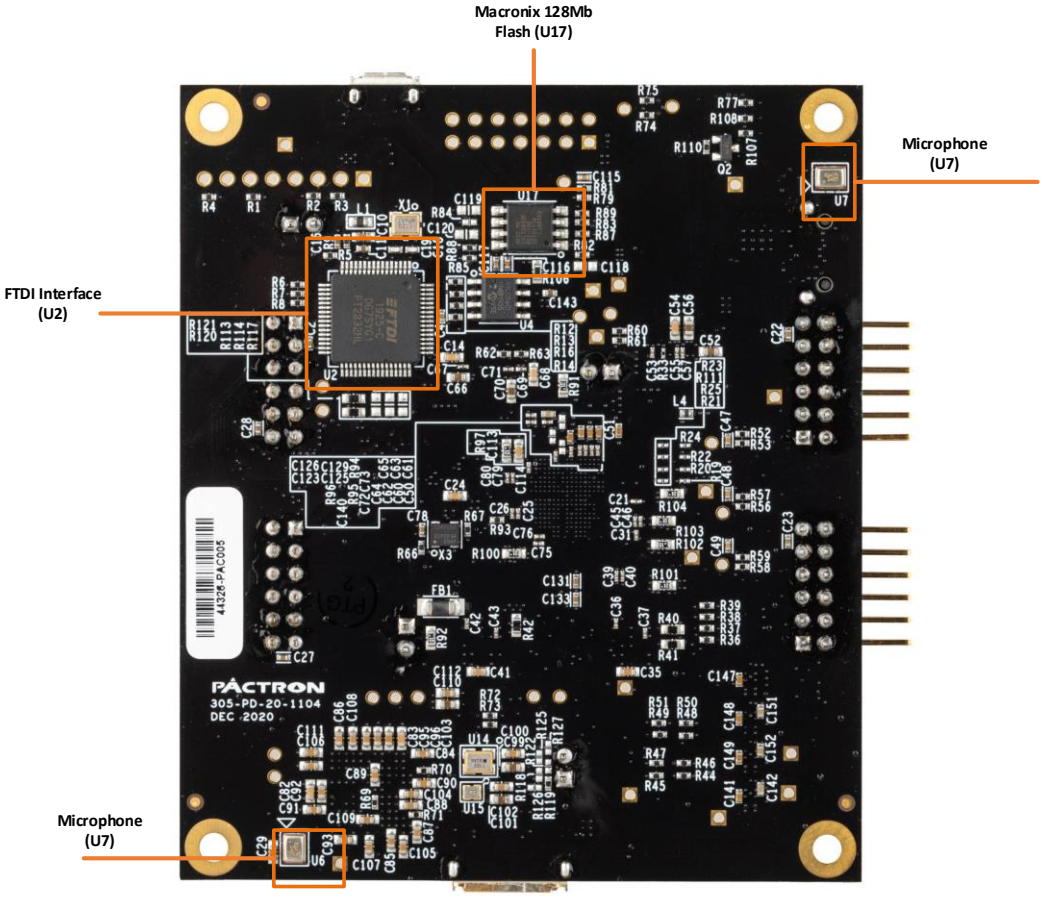

Figure 2.2. Bottom View of CrossLink-NX Voice and Vision Machine Learning Board

3. Demo Setup

This section describes the demo setup.

3.1. Hardware Requirements

- Crosslink-NX Voice and Vision Board

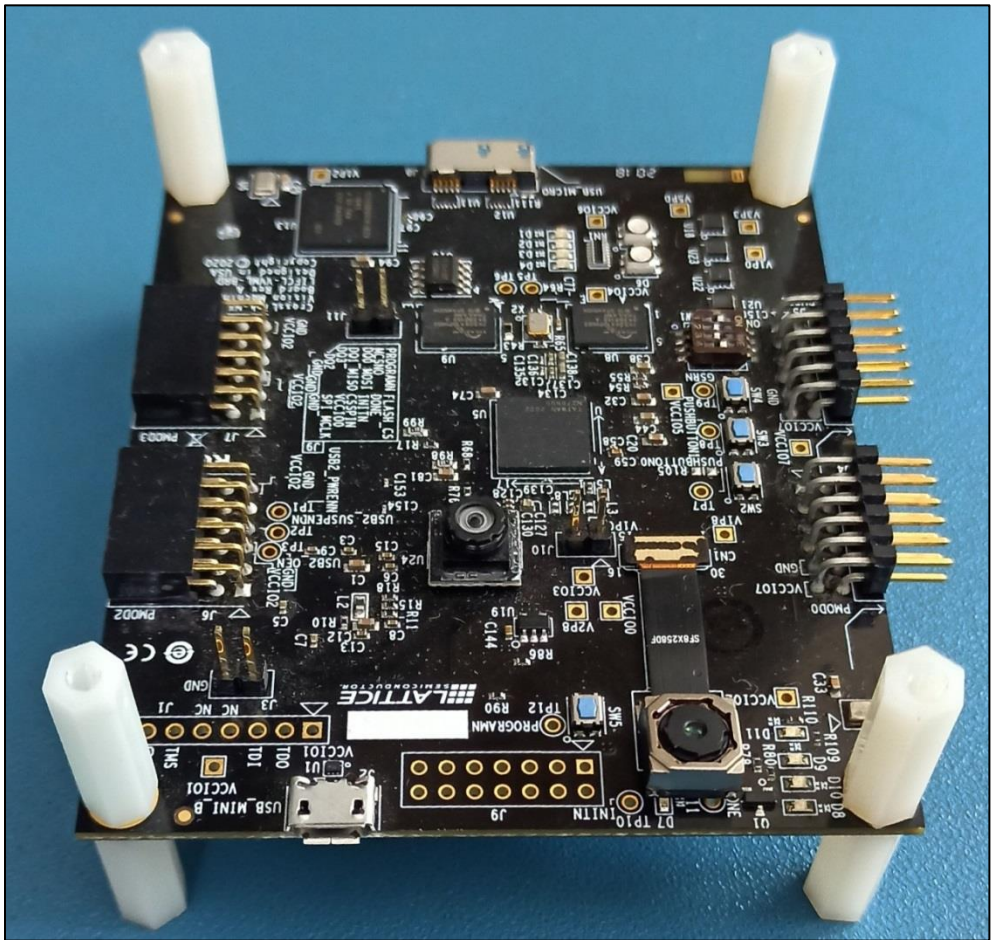

Figure 3.1. Lattice CrossLink-NX Voice and Vision Board

3.2. Software Requirements

- Lattice Radiant™ Programmer version 2.2 (Refer to http://www.latticesemi.com/programmer)

4. Programming the Demo

4.1. Load Firmware in FX3 I²C EEPROM

To load the firmware:

1. Connect the USB3 port of the CrossLink-NX Voice and Vision Machine Learning (Rev B) board to the display monitor using the USB3 cable.
2. Open the USB Control Centre application. Cypress FX3 SDK should also be installed.
3. Use the CrossLink-NX Voice and Vision Machine Learning (Rev B) board and put the jumper on **J13** to make the FX3 firmware programmable.
4. Connect the **FX3** cable to the display monitor.
5. Press the **Push** button **SW2** to reset the FX3 chip. Figure 4.1 shows the boot loader device screen.

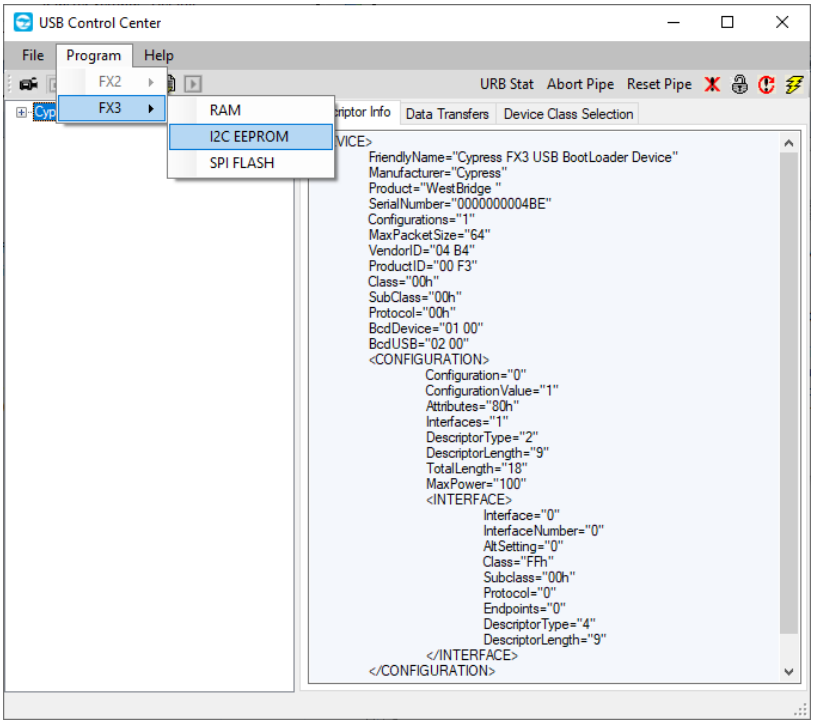

Figure 4.1. Selecting FX3 I²C EEPROM in USB Control Centre

6. Select **Cypress USB Bootloader**.
7. Go to **Program > FX3 > I2C E2PROM**.
8. Open and select the FX3 image file for the 640×480p60 16-bit configuration, and the firmware is programmed in the I²C E2PROM. Wait for the *Programming Successful* message to appear in the bottom taskbar.
9. After successfully programming the files, remove the J13 jumper.
10. Power off and power on the board to boot the FX3 from I²C E2PROM.

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

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

If the CrossLink-NX Voice and Vision device is already programmed (either directly, or loaded from SPI Flash), follow this procedure to first erase the CrossLink-NX Voice and Vision SRAM memory before re-programming the CrossLink-NX Voice and Vision's SPI Flash. If you are doing this, keep the board powered when re-programming the SPI Flash (so it does not reload on reboot).

To erase the CrossLink-NX Voice and Vision:

1. Start Lattice Radiant Programmer. In the Getting Started dialog box, select **Create a new blank project**.

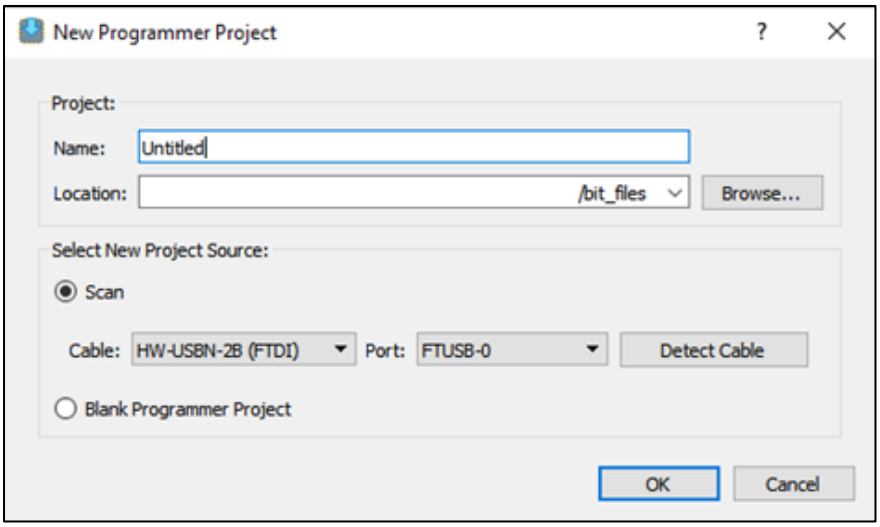

Figure 4.2. Radiant Programmer – Default Screen

2. Click **OK**.
3. Select **LIFCL** for **Device Family** and **LIFCL-40** for **Device** as shown in Figure 4.3.

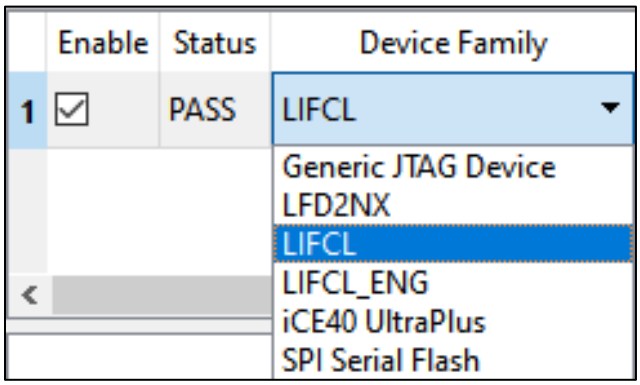

Figure 4.3. Radiant Programmer – Device Selection

4. Right-click and select **Device Properties**.
5. Select **JTAG** for **Port Interface**, **Direct Programming** for **Access Mode**, and **Erase Only** for **Operation** as shown in Figure 4.4.

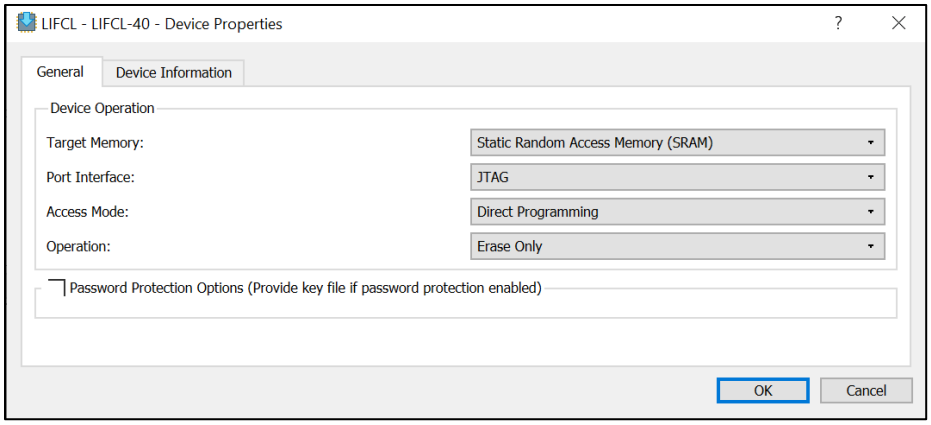

Figure 4.4. Radiant Programmer – Device Operation

6. Click **OK** to close the Device Properties dialog box.
7. Press the **SW5** push button switch. Click the **Program** button. Hold it until you see the *Successful message* in the Radiant log window.
8. In the Radiant Programmer main interface, click the **Program** button to start the erase operation.

4.2.2. 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**.
3. Apply the settings below:
   a. Under Device Operation, select the options below:
      - **Port Interface – JTAG2SPI**
      - **Target Memory – SPI FLASH**
      - **Access Mode – Direct Programming**
      - **Operation – Erase, Program, Verify**
   b. Under Programming Options, select the CrossLink-NX Voice and Vision bit file (*.bit) for the **Programming File**.
   c. For **SPI Flash Options**, make the selections as shown in Figure 4.5.

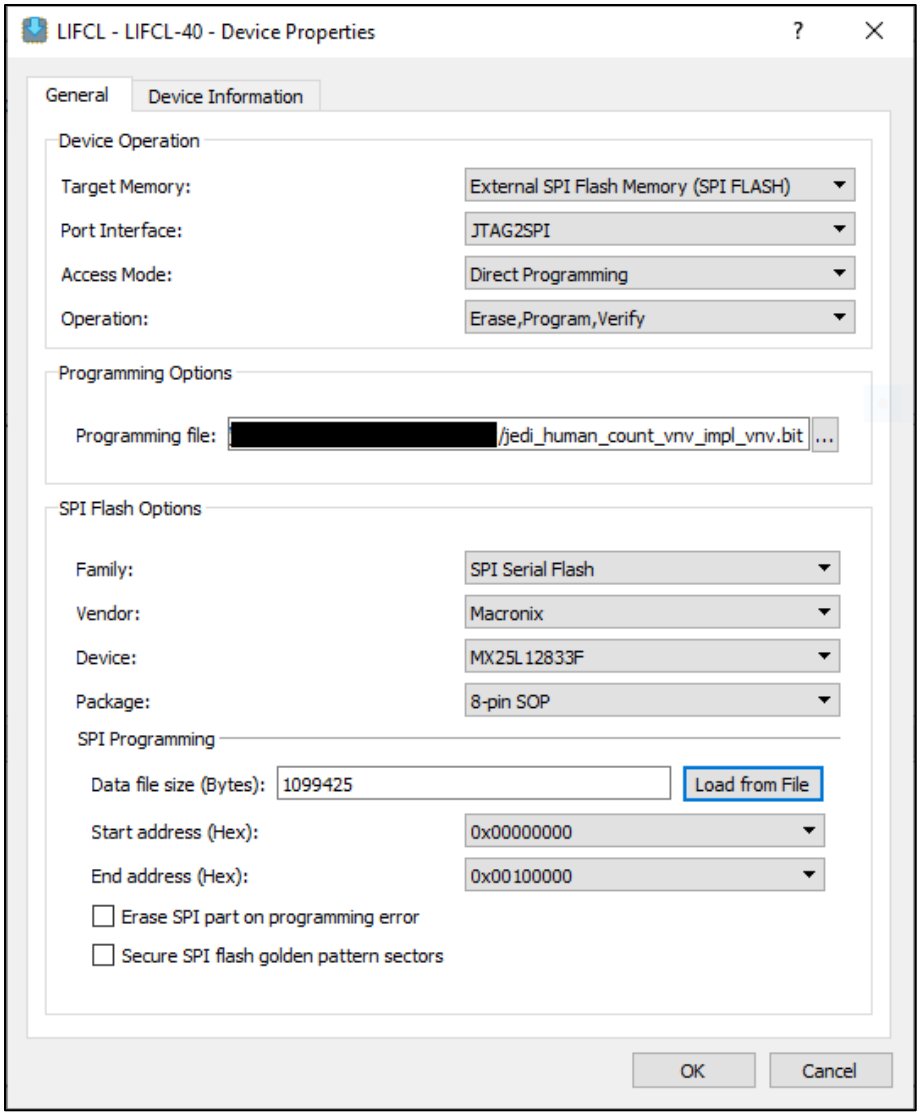

Figure 4.5. Radiant Programmer – Selecting Device Properties Options for CrossLink-NX Flashing

d. Click **Load from File** to update the data file size (Bytes) value.

e. Ensure that the following addresses are correct:

- **Start Address (Hex) – 0x00000000**
- **End Address (Hex) – 0x00100000**

4. Click **OK**.

5. Press the **SW5** push button switch before clicking **Program** button as shown in Figure 4.6. Hold it until you see the *Successful message* in the Radiant log window.

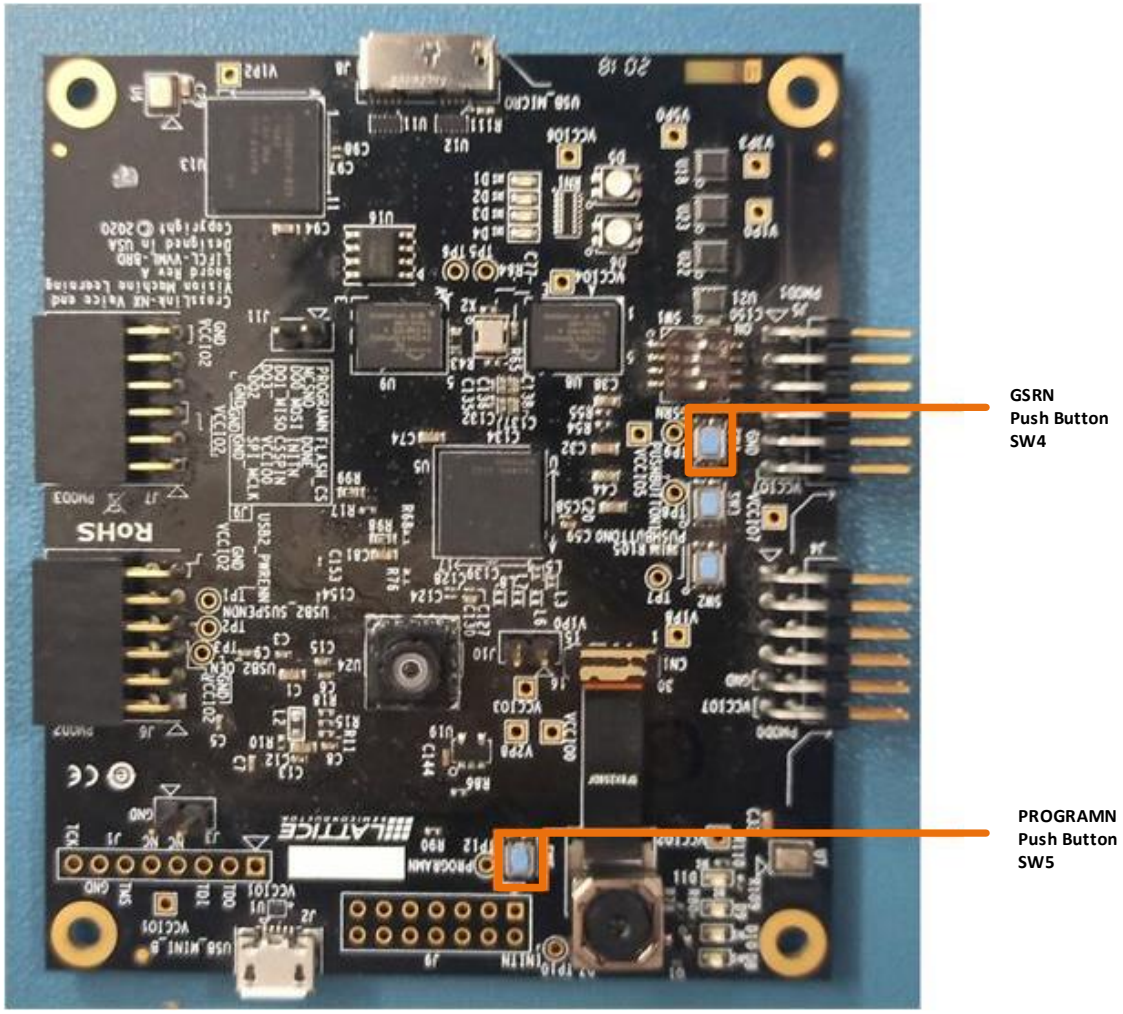

Figure 4.6. CrossLink-NX Voice and Vision Flashing Switch – SW5 Push Button

6. Click the **Program** button to start the programming operation.
7. After successful programming, the **Output** console displays the result as shown in Figure 4.7.

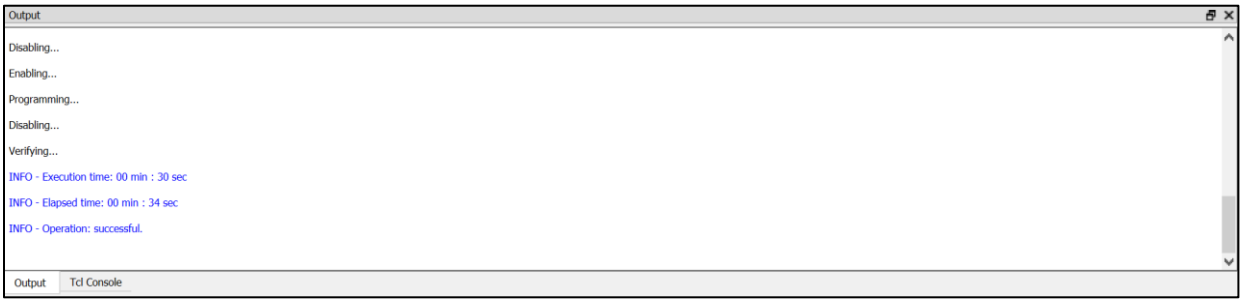

Figure 4.7. Radiant Programmer – Output Console

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

4.2.3.1. 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 before flashing the bitstream and the Lattice SensAI™ firmware binary.
2. In the Radiant Programmer main interface, right-click the CrossLink-NX row and select **Device Properties**.
3. Apply the settings below:
   a. Under Device Operation, select the options below:
      - **Port Interface – JTAG2SPI**
      - **Target Memory – SPI FLASH**
      - **Access Mode – Direct Programming**
      - **Operation – Erase, Program, Verify**
   b. Under Programming Options, select the CrossLink-NX SensAI firmware binary file after converting it to hex (*.mcs) for the **Programming File**.
   c. For **SPI Flash Options**, make the selections as shown in Figure 4.8.

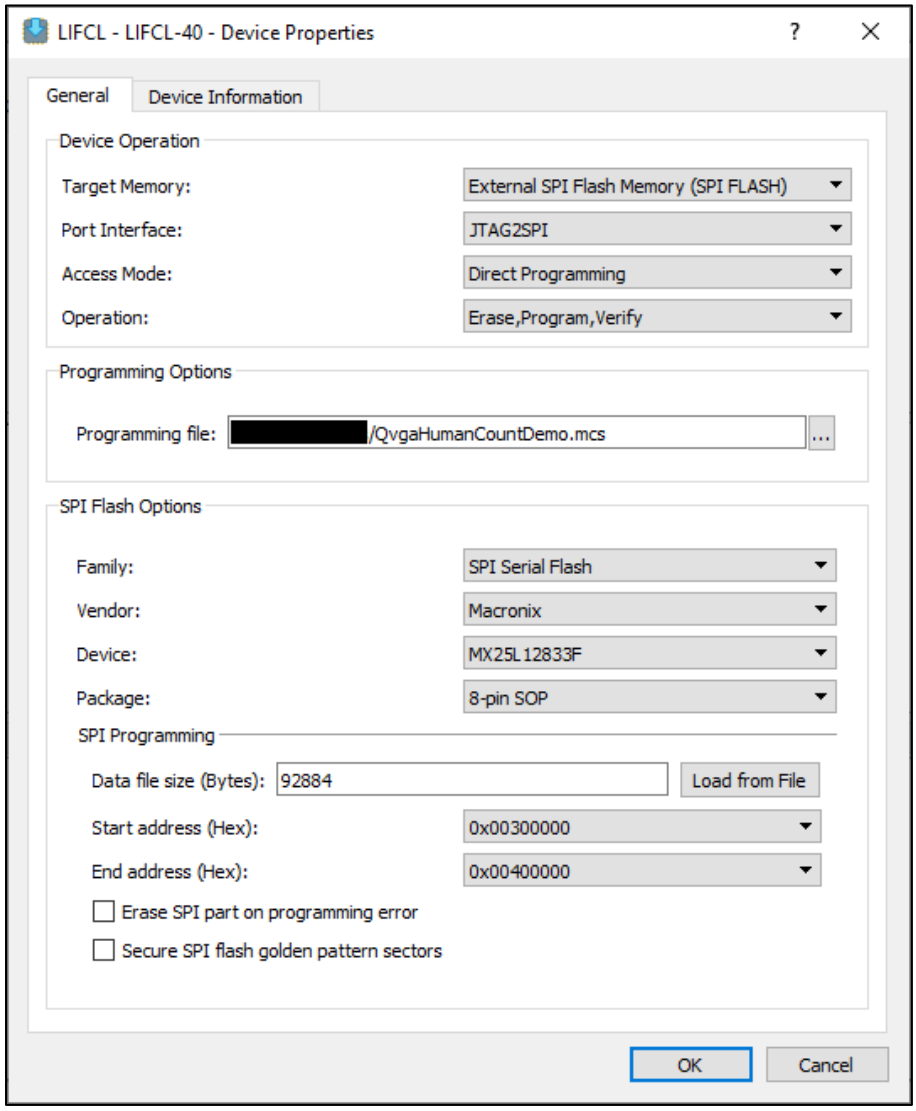

Figure 4.8. Radiant Programmer – Selecting Device Properties Options for CrossLink-NX Flashing

d. Click **Load from File** to update the data file size (bytes) value.

e. Ensure that the following addresses are correct:

- **Start Address (Hex) – 0x00300000**
- **End Address (Hex) – 0x00400000**

4. Click **OK**.
5. Press the **SW5** push button switch. Click the **Program** button and hold it until you see the *Successful* message in the Radiant log window.
6. Click the **Program** button to start the programming operation.
7. After successful programming, the **Output** console displays the result as shown in Figure 4.9.

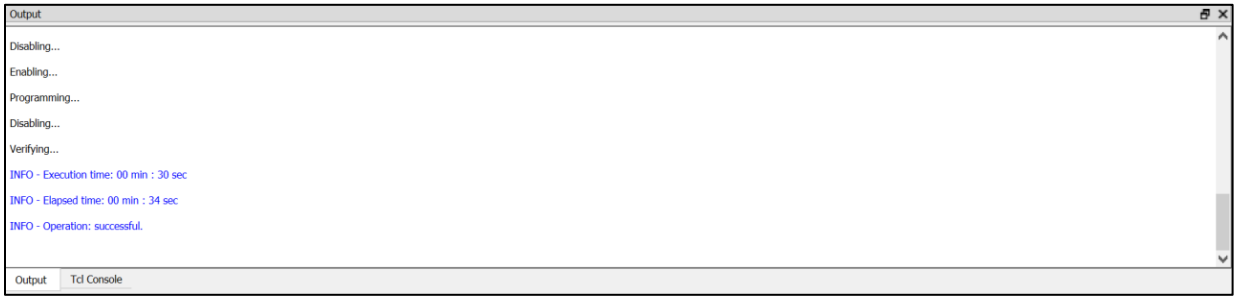

Figure 4.9. Radiant Programmer – Output Console

5. Running the Demo

To run the demo:

1. Power on the Voice and Vision board. Make sure the position of SWITCH0 is ON to boot the device from I^2C EEPROM.
2. Connect the Voice and Vision board to the display monitor through the board's USB3 port.
3. Open the AMCap or VLC application and select the FX3 device as source.
4. The camera image should be displayed on monitor as shown in Figure 5.1.

Figure 5.1. Running the Demo

5. The demo output contains the bounding boxes for detected humans in a given frame and it displays the total number of detected humans in a given frame on the display.

Technical Support Assistance

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

Revision History

Revision 1.0, May 2021

Section	Change Summary
All	Initial release

www.latticesemi.com