Human Counting using Mobilenet on EVDK Demonstration

User Guide

FPGA-UG-02093-1.0

October 2019
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## Acronyms in This Document

A list of acronyms used in this document.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CKPT</td>
<td>Checkpoint</td>
</tr>
<tr>
<td>CNN</td>
<td>Convolutional Neural Network</td>
</tr>
<tr>
<td>EVDK</td>
<td>Embedded Vision Development Kit</td>
</tr>
<tr>
<td>FPGA</td>
<td>Field-Programmable Gate Array</td>
</tr>
<tr>
<td>LED</td>
<td>Light-emitting diode</td>
</tr>
<tr>
<td>ML</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>MLE</td>
<td>Machine Learning Engine</td>
</tr>
<tr>
<td>NN</td>
<td>Neural Network</td>
</tr>
<tr>
<td>NNC</td>
<td>Neural Network Compiler</td>
</tr>
<tr>
<td>SD</td>
<td>Secure Digital</td>
</tr>
<tr>
<td>SDHC</td>
<td>Secure Digital High Capacity</td>
</tr>
<tr>
<td>SDXC</td>
<td>Secure Digital eXtended Capacity</td>
</tr>
<tr>
<td>SPI</td>
<td>Serial Peripheral Interface</td>
</tr>
<tr>
<td>VIP</td>
<td>Video Interface Platform</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
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</table>
1. Introduction

This document provides technical information and instructions on setting up and running the EVDK Based Human Counting Demo.

Refer to the following documents for detailed information on Lattice development boards and kit:
- Lattice Embedded Vision Development Kit User Guide (FPGA-UG-02015)
- CrossLink VIP Input Bridge Board Evaluation Board User Guide (FPGA-EB-02002)
- ECP5 VIP Processor Board Evaluation Board User Guide (FPGA-EB-02001)
- HDMI VIP Output Bridge Board Evaluation Board User Guide (FPGA-EB-02003)

2. Functional Description

The EVDK Based Human Counting Demo is designed to utilize the Lattice Embedded Vision Development Kit with MicroSD card Adapter Board, as shown in Figure 2.1.

![Figure 2.1. Lattice EVDK with MicroSD Card Adapter](image-url)

The Lattice Embedded Vision Development Kit features a stackable modular architecture consisting of three boards:
- CrossLink Video Interface Platform (VIP) Input Bridge Board
- ECP5 VIP Processor Board
- HDMI VIP Output Bridge Board
3. **Demo Setup**

This section describes the demo setup.

3.1. **Hardware requirements**

- Lattice Embedded Vision Development Kit
  - Mini-USB Cable
  - 12 V Power Supply
- HDMI Cable
- HDMI Monitor (1080p30)
- Machine Learning Adapter Card (ML-EVN-ADP)
  - The microSD Card Adapter (MICROSD-ADP-EVN) has been replaced by the Machine Learning Adapter Card (ML-EVN-ADP). The Machine Learning Adapter card includes an optional microphone input, but is otherwise a 100% functional replacement for the microSD Card Adapter.
- MicroSD Card

3.2. **Software Requirements**

- Lattice Diamond Programmer (refer to [http://www.latticesemi.com/programmer](http://www.latticesemi.com/programmer))
- Win32 MicroSD Disk Imager (refer to [https://sourceforge.net/projects/win32diskimager/](https://sourceforge.net/projects/win32diskimager/))
4. Programming the Demo

Both the CrossLink VIP Input Bridge Board and the ECP5 VIP Processor Board must be configured and programmed. Also, the demo design firmware must be programmed onto the MicroSD card which is plugged into the MicroSD Card Adaptor Board.

4.1. Programming the CrossLink SPI Flash

4.1.1. Erasing the CrossLink SRAM Prior to Reprogramming

If the CrossLink is already programmed (either directly or loaded from SPI Flash), erase the CrossLink SRAM before reprogramming the CrossLink SPI Flash. Keep the board powered on to prevent reloading on reboot.

To erase CrossLink:

1. Launch Diamond Programmer with Create a new blank project.
2. Select LIFMD for Device Family and LIF-MD6000 for Device as shown in Figure 4.1.

   ![Figure 4.1. Select Device](image)

3. Right-click and select Device Properties.

   ![Figure 4.2. Device Operation](image)

5. Click OK to close the Device Properties window.
6. Click the Program button in Diamond Programmer to start the erase sequence.
4.1.2. Programming the SPI on the CrossLink VIP Input Bridge Board

To program the SPI on the CrossLink VIP Input Bridge board:

1. Ensure the CrossLink device is erased by performing Steps 1-6.
2. Right-click and select Device Properties.
3. Select SPI Flash Programming for Access mode and make the following selections:
   a. For Programming File, browse and select the CrossLink bit file (*.bit), Dual_Camera_to_Parallel_Crosslink.bit.
   b. For SPI Flash Options, refer to Table 4.1.

Table 4.1. SPI Flash Options Selection Guide

<table>
<thead>
<tr>
<th>Item</th>
<th>Rev B</th>
<th>Rev C – Option 1</th>
<th>Rev C – Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family</td>
<td>SPI Serial Flash</td>
<td>SPI Serial Flash (SPI Serial Flash Beta for Diamond 3.10 SP1 or earlier)</td>
<td>SPI Serial Flash (SPI Serial Flash Beta for Diamond 3.10 SP1 or earlier)</td>
</tr>
<tr>
<td>Vendor</td>
<td>Micron</td>
<td>Micron</td>
<td>Macronix</td>
</tr>
<tr>
<td>Device</td>
<td>SPI-M25PX16</td>
<td>SPI-N25Q128A</td>
<td>MX25L12835F</td>
</tr>
<tr>
<td>Package</td>
<td>8-pin S08W</td>
<td>8-pin SOP2</td>
<td>8-Land WSON</td>
</tr>
</tbody>
</table>

Figure 4.3. Device Properties
4. Click **OK** to close the **Device Properties** window.

5. Click the **Program** button in Diamond Programmer to start the programming sequence.

6. After successful programming, the **Output** console displays the results as shown in Figure 4.4.

![Output Console](image)

**Figure 4.4. Output Console**

### 4.2. ECP5 VIP Processor Board

#### 4.2.1. Erasing the ECP5 Prior to Reprogramming

If the ECP5 and CrossLink VIP Processor Boards are already configured and programmed, erase first the ECP5 SRAM memory, then program the ECP5’s SPI Flash in the next section. The demo design firmware must also be programmed onto the MicroSD card, which is plugged into the MicroSD Card Adaptor Board.

Keep the board powered when re-programming the SPI Flash in the next section.

To erase the ECP5:

1. Launch Diamond Programmer with **Create a new blank project**.
2. Select **ECP5UM** for **Device Family** and **LFESUM-85F** for **Device**.

![Selecting Device](image)

**Figure 4.5. Selecting Device**

3. Right-click and select **Device Properties**.
4. Select **JTAG 1532 Mode** for **Access Mode** and **Erase Only** for **Operation**.
5. Click OK to close the Device Properties window.

6. Click the Program button in Diamond Programmer to start the Erase sequence.

### 4.2.2. Programming the SPI on the ECP5 VIP Processor Board

To program the SPI:

1. Ensure the ECP5 device is erased by performing Steps 1-6.
2. Right-click and select Device Properties.
3. Select SPI Flash Background Programming for Access mode and make the following selections:
   a. For Programming file, browse and select the Human Counting Demo bit file (*.bit) `Human_count_mobilnet_bitstream.bit`.
   b. For SPI Flash Options, refer Table 4.2.
Table 4.2. SPI Flash Options Selection Guide

<table>
<thead>
<tr>
<th>Item</th>
<th>Rev B</th>
<th>Rev C</th>
</tr>
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<tr>
<td>Family</td>
<td>SPI Serial Flash</td>
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<tr>
<td>Vendor</td>
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<td>MX25L12835F</td>
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<tr>
<td>Package</td>
<td>8-pin SO8</td>
<td>8-Land WSON</td>
</tr>
</tbody>
</table>

Figure 4.7 Device Properties

4. Click **OK** to close the **Device Properties** window.

5. Click the **Program** button 🛠️ in Diamond Programmer to start the programming sequence.
6. After successful programming, the **Output** console displays the results as shown in **Figure 4.8**.

![Output Console](image)

**Figure 4.8 Output Console**

### 4.2.3. Programming the MicroSD Card Firmware

To write the image to the MicroSD Card:

1. Download and install the Win32diskimagr Image Writer software from the following link: [https://sourceforge.net/projects/win32diskimagr/](https://sourceforge.net/projects/win32diskimagr/).
2. Use Win32diskimagr to write the appropriate Flash image file to the SD memory card. Depending on your PC, you may need a separate adapter (not described in this document) to physically connect to the card.
3. In Win32 Disk Imager, select the **Image File** (*Humancount_mobilenet.bin*) and **Card Reader** as shown in **Figure 4.9**.

![Win32 Disk Imager](image)

**Figure 4.9 Win32 Disk Imager**

4. Click **Write**.
5. Running the Demo

To run the demo:

1. Insert the configured MicroSD Card into the MicroSD Card Adapter, and connect it to the Embedded Vision Development Kit.
2. Cycle the power on the Embedded Vision Development Kit to allow ECP5 and CrossLink to be reconfigured from Flash.
3. Connect the Embedded Vision Development Kit to the HDMI monitor. The camera image should be displayed on monitor as shown in Figure 5.1.

![Figure 5.1 Human Counting Demo Result](image-url)
Technical Support Assistance
Submit a technical support case through www.latticesemi.com/techsupport.
## Revision History

**Revision 1.0, October 2019**

<table>
<thead>
<tr>
<th>Section</th>
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<tbody>
<tr>
<td>All</td>
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