Human Presence Detection on HM01B0 UPduino Shield Demonstration

User Guide

FPGA-UG-02077-2.1

October 2019

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Acronyms in This Document

A list of acronyms used in this document.

Acronym	Definition
CNN	Convolutional Neural Network
FPGA	Field-Programmable Gate Array
LED	Light-emitting diode
SOIC	Small Outline Integrated Circuit
SPI	Serial Peripheral Interface
USB	Universal Serial Bus

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1. Introduction

The Lattice Human Presence Detection on HM01B0 UPduino Shield Demonstration User Guide describes how to operate the Human Presence Detection demo on the Himax HM01B0 UPduino Shield board. This design features a Convolutional Neural Network (CNN) using the Compact CNN Accelerator soft IP, which is used in human presence detection.

2. Functional Description

In this demo, there are six LED lights with potential to turn on. From top to bottom, the top LED light represents a detected human in the upper left of the screen, second from the top represents upper right, third from the top represents lower left, fourth from the top represents lower right, fifth from the top represents the center of the camera, and bottom represents the full image.

Figure 2.1 shows the diagram of the Human Presence Detection demo. The camera captures the image data and sends it to the iCE40 UltraPlus™ device. iCE40 UltraPlus then uses the image data with the firmware file from the external SPI Flash to determine the outcomes.

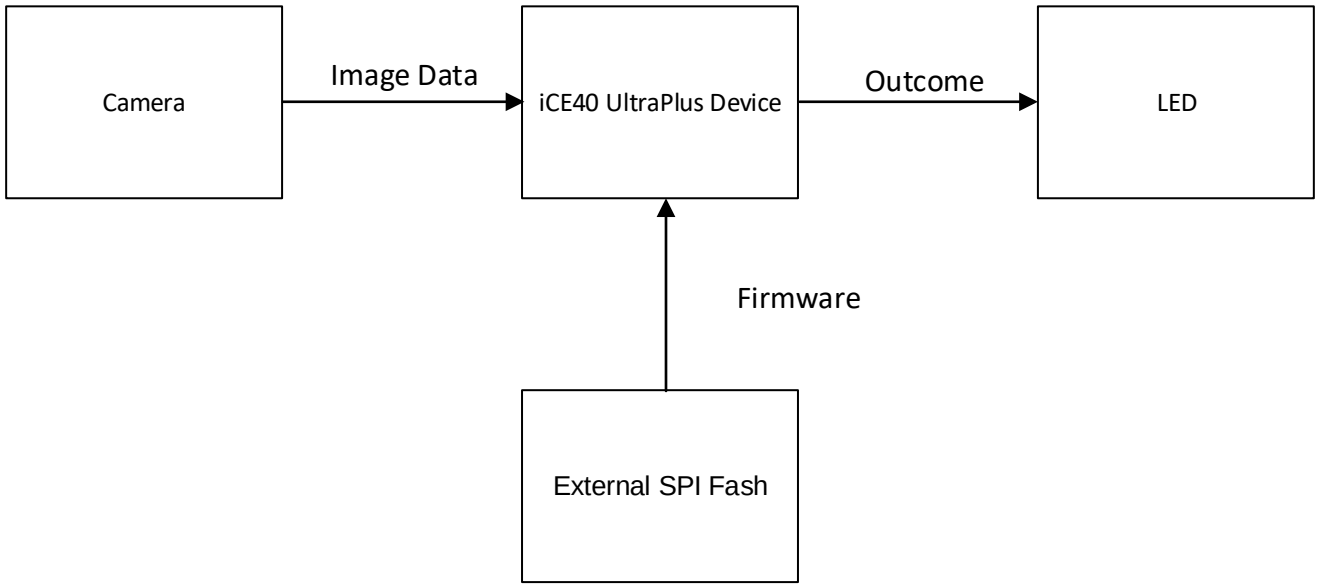

Figure 2.1. Human Presence Demo Diagram

3. Demo Setup

Before running the demo, make sure that the two boards are properly connected. A micro USB is required for programming and to turn on the board.

Important: Make sure that the protective film is removed from the camera sensor.

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4. Programming the Human Presence Detection Demo

This section provides the procedure for programming the SPI Flash on the Himax HM01B0 UPduino Shield Board.

Two different files should be programmed into the SPI Flash. These files are programmed to the same SPI Flash, but at different addresses:

- bitstream file
- firmware file

To program the SPI Flash in Radiant Programmer:

1. Connect the Himax HM01B0 UPduino Shield board to the PC using a micro USB cable.
2. Start Radiant Programmer. In the **Radiant Programmer - Getting Started** dialog box, select **Create a new blank project** as shown in Figure 4.1.
3. Click **OK**.

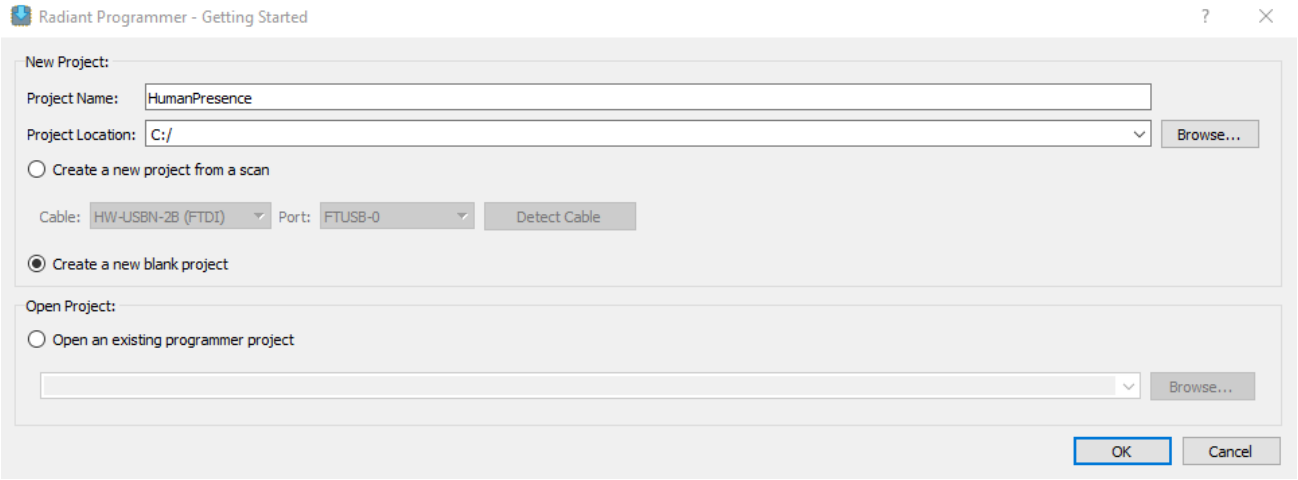

Figure 4.1. Create a New Blank Project

4. In the Radiant Programmer main interface, set **Device Family** to **iCE40 UltraPlus** and **Device** to **iCE40UP5K**.
5. Click the **iCE40 UltraPlus** row, and select **Edit > Device Properties**.
6. In the **Device Properties** dialog box, apply the settings below that are common to the two files to program.
   a. Under **Device Operation**, select the options below:
      - **Target Memory: External SPI Flash Memory**
      - **Port Interface: SPI**
      - **Access Mode: Direct Programming**
      - **Operation: Erase, Program, Verify**
   b. Under **SPI Flash Options**, select the options below:
      - **Family: SPI Serial Flash**
      - **Vendor: Winbond**
      - **Device: W25P32**
      - **Package: 16-pin SOIC**
7. To program the bitstream file, select the options below as shown in Figure 4.2.
   a. Under **Programming Options**, select the bitstream file **Humandet_2_1_bitstream_scanning_off.bin** in **Programming file**.
   b. Click **Load from File** to update the **Data file size (Bytes)** value.

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c. Ensure that the following addresses are correct:
   - **Start Address (Hex): 0x00000000**
   - **End Address (Hex): 0x00010000**

d. Click **OK**.

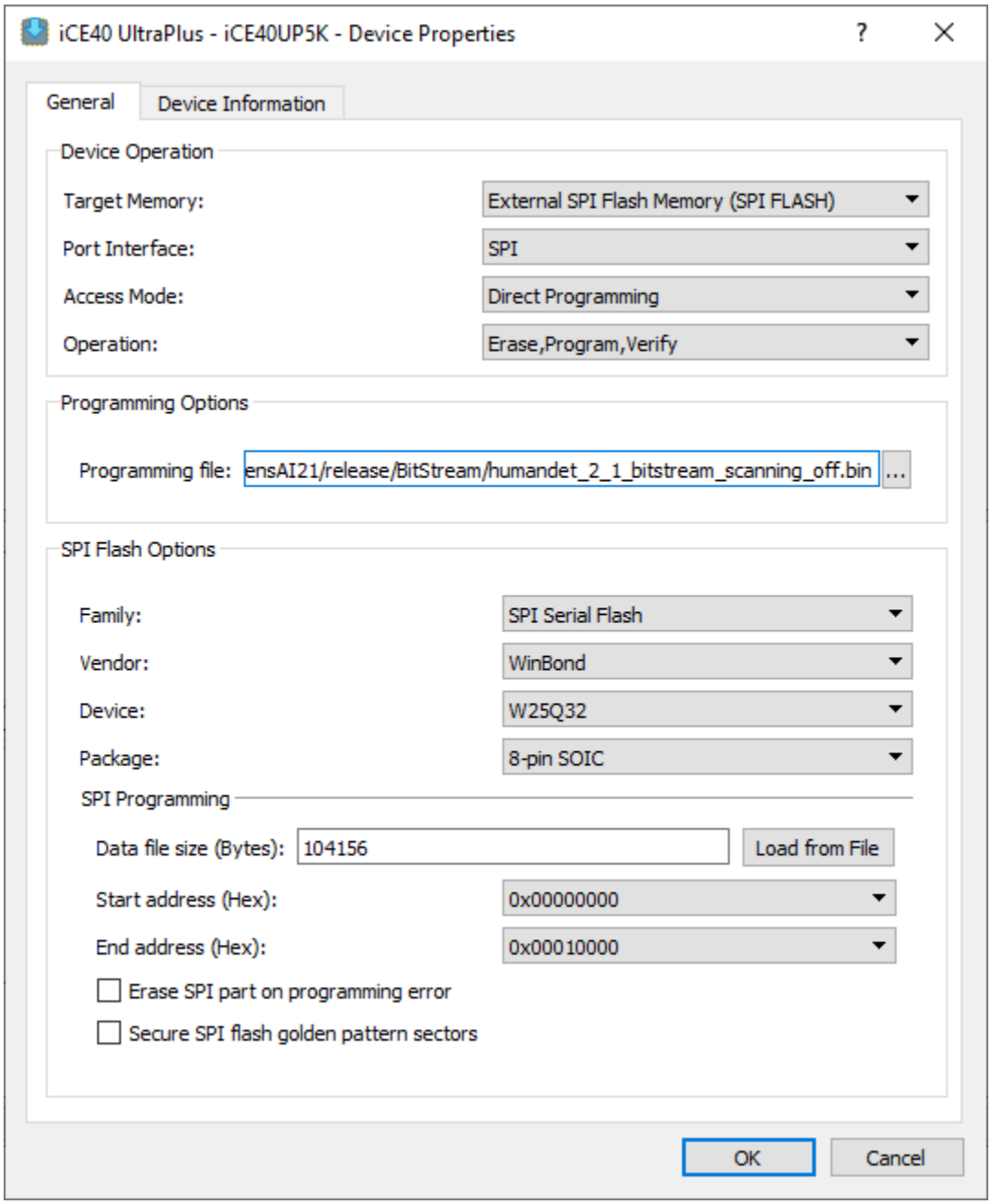

Figure 4.2. Bitstream File Settings

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8. In the main interface, click **Program Device** to program the bitstream file **HumanPresence_Bitstream.bin**.
9. To program the binary firmware file, select the options below as shown in Figure 4.3.
   a. Under **Programming Options**, select the binary file **Humandet2_1_FW.bin** in **Programming file**.
   b. Click **Load from File** to update the **Data file size (Bytes)** value. Change **Data file size** to **93368**.
   c. Ensure that the following addresses are correct:
      - **Start Address (Hex):** 0x00020000
      - **End Address (Hex):** 0x00030000
   d. Click **OK**.

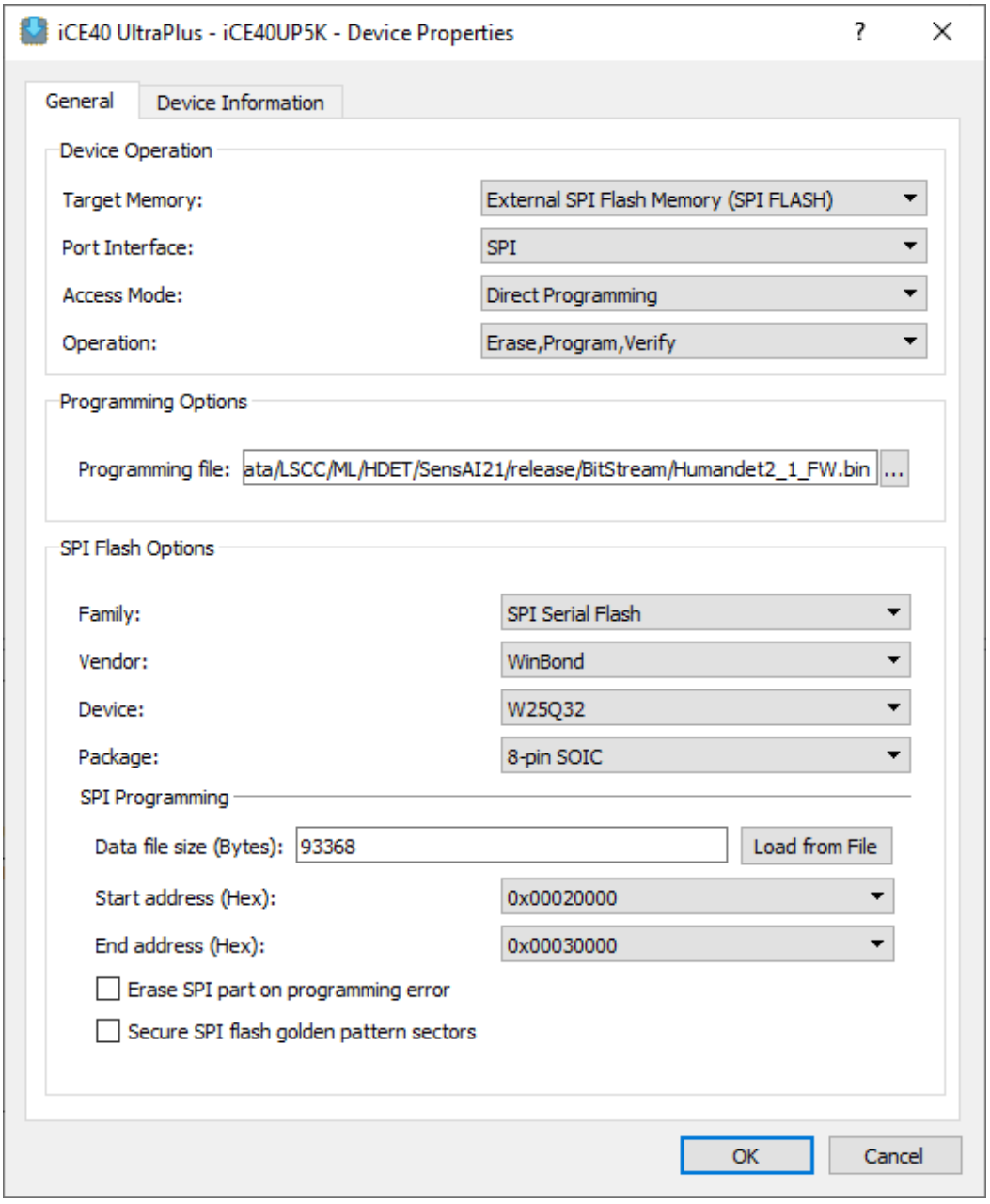

Figure 4.3. Binary Firmware File Settings

10. In the main interface, click **Program Device** to program the binary file **Humandet2_1_FW.bin**.
11. After programming the files, perform a power cycle to start observing the demo.

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5. Running the Human Presence Gesture Demo

To run the demo and observe results on the board:

1. Power ON the Himax HM01B0 UPduino Shield Board.
   Avoid any bright background.
2. Position a human in front of the camera. An LED light turns on if there is a human present in its section. Note that Upper Left is the camera's upper left. Refer to Figure 5.1 for the location of the camera and LED lights.

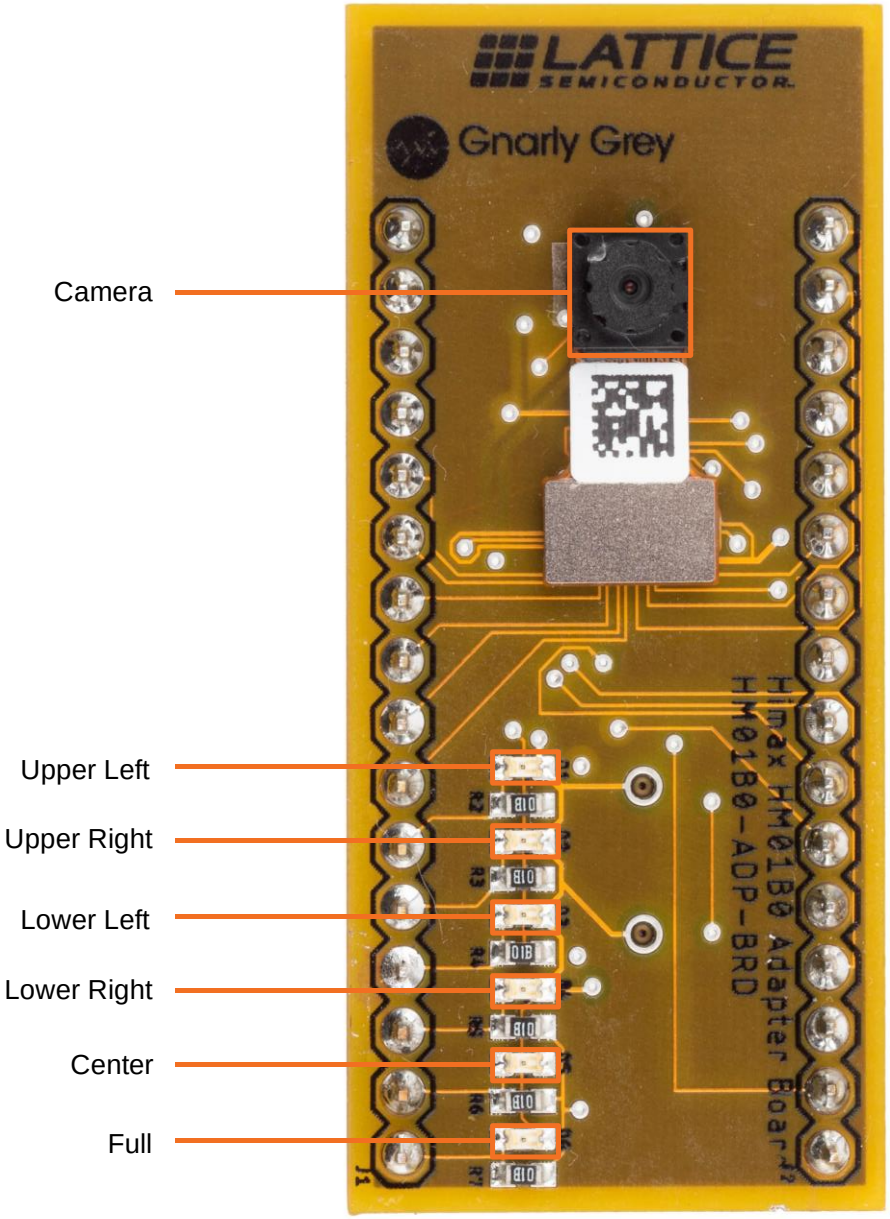

Figure 5.1. Camera and LED Location

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Technical Support

For assistance, submit a technical support case at www.latticesemi.com/techsupport.

Revision History

Revision 2.1, October 2019

Section	Change Summary
—	Changed document title to Human Presence Detection on HM01B0 UPduino Shield Demonstration.
Disclaimers	Added this section.
Programming the Human Presence Detection Demo	– Changed heading. – Updated files in procedure.
—	– Minor revisions in style. – Changed back cover.

Revision 1.0, October 2018

Section	Change Summary
All	Initial release.

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