Himax HM01B0 UPduino Shield Based Hand Gesture Detection Demo

User Guide

FPGA-UG-02076 Version 1.0

October 2018

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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 Himax HM01B0 UPduino Shield Based Hand Gesture Detection Demo User Guide describes how to operate the Hand Gesture 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 hand gesture.

2. Functional Description

In this demo, there are three LED lights with potential to turn on. The bottom LED represents a detected open hand, middle LED represents a detected closed hand, and top LED represents everything else.

Figure 2.1 shows the diagram of the Hand Gesture 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 three outcomes.

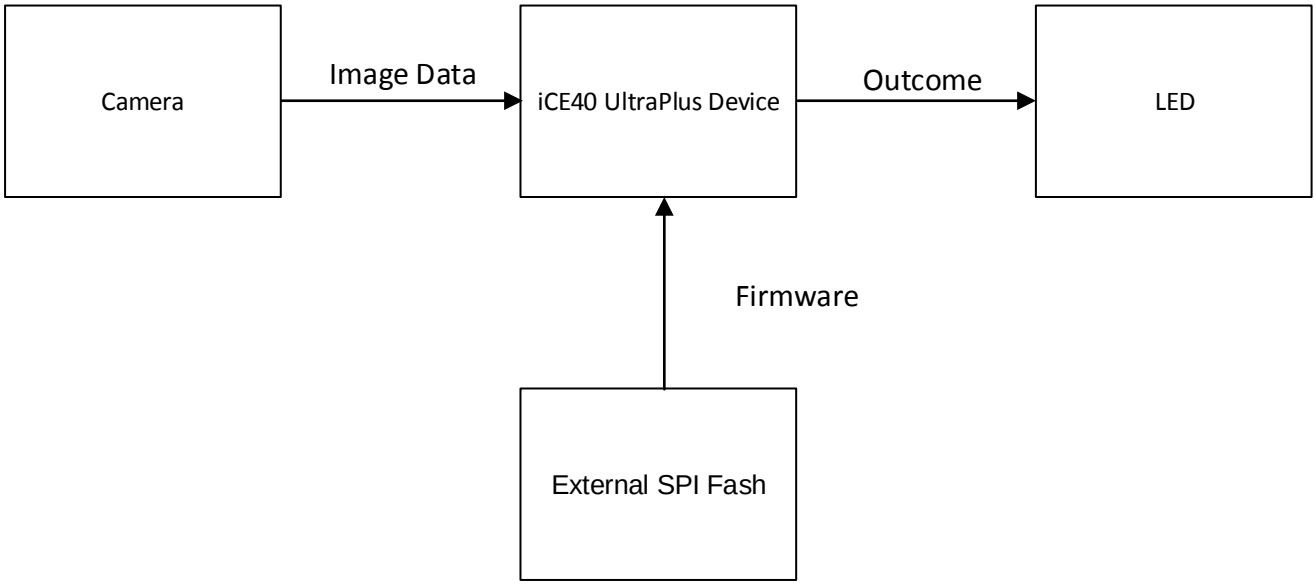

Figure 2.1. Hand Gesture Demo Diagram

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 Hand Gesture 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**.

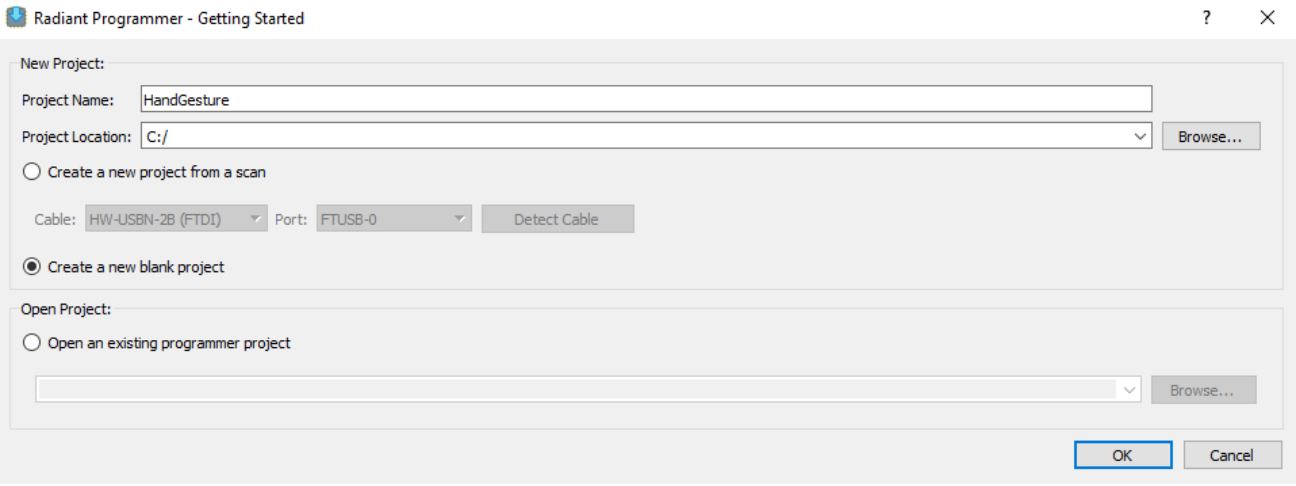

Figure 4.1. Create a New Blank Project

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 **Hand_Gesture_bitstream.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**.

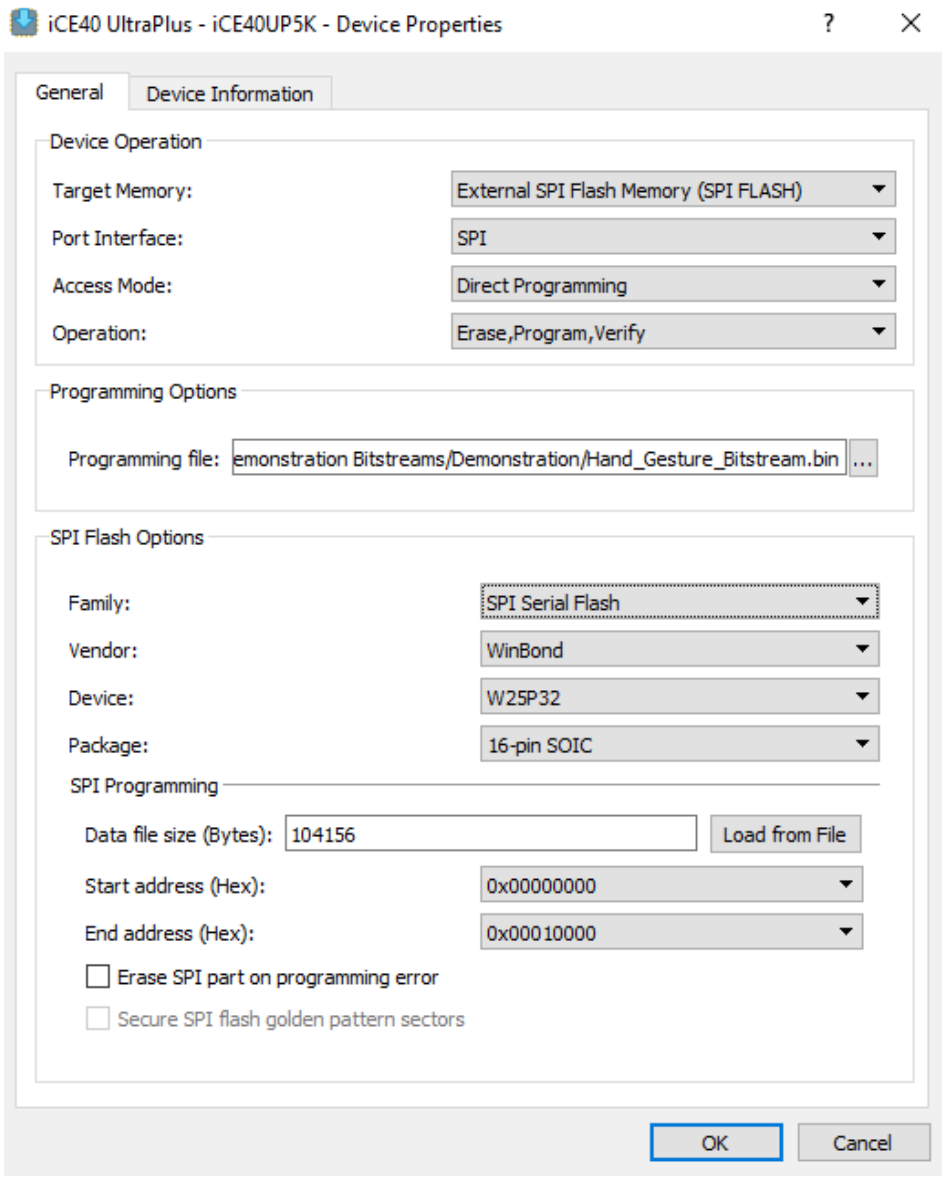

Figure 4.2. Bitstream File Settings

8. In the main interface, click **Program Device** to program the bitstream file **Hand_Gesture_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 **Hand_Gesture_firmware.bin** in Programming file.
   b. Click **Load from File** to update the Data file size (Bytes) value. Change Data file size to **64376**.
   c. Ensure that the following addresses are correct:
      - Start Address (Hex): **0x00020000**
      - End Address (Hex): **0x00030000**
   d. Click **OK**.

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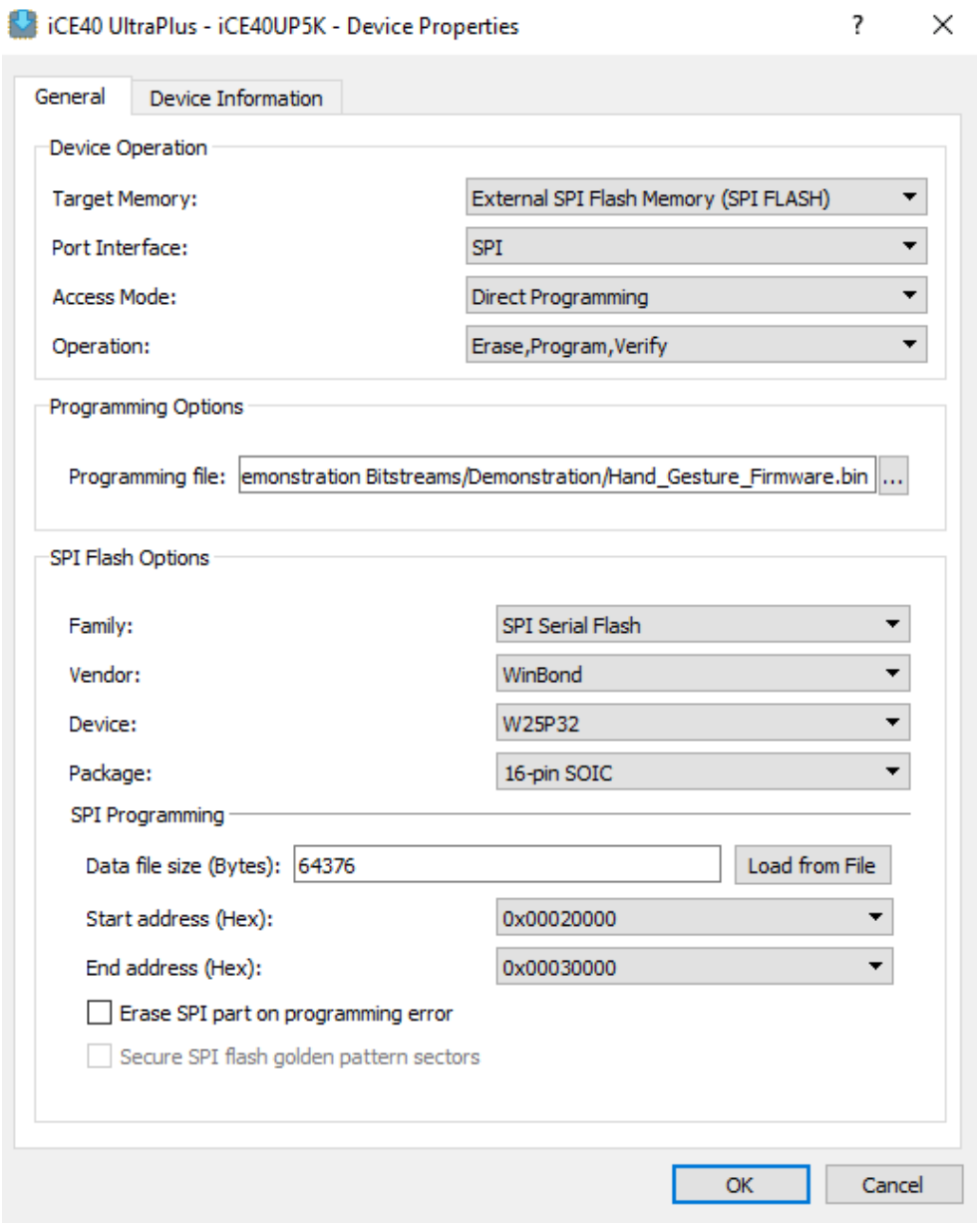

Figure 4.3. Binary Firmware File Settings

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

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5. Running the Hand Gesture Demo

To run the demo and observe results on the board:

1. Power ON the Himax HM01B0 UPduino Shield Board.
2. Avoid any bright background.
3. Simply place a closed hand, open hand, or nothing at all to see the LED light toggle. Refer to Figure 5.1 for the location of the Camera and LED lights.
4. Optional: use UART tool to align hand to camera
   a. Open *Uart_display* application under, **Himax HM01B0 UPduino Shield Based Hand Gesture Detection Demonstration Bitstreams\Demonstration\uart_display\uart_display\uart_display\bin\Release**.
   b. Select the UART port used to connect to the board.
   c. Click the **Uart get gray** button.
   d. Align your hand to the camera. Refer to Figure 5.2 for an example.

   Note: Repower the board after programming to allow the UART tool to access the board. If you still see a gray box, recheck your COM port.

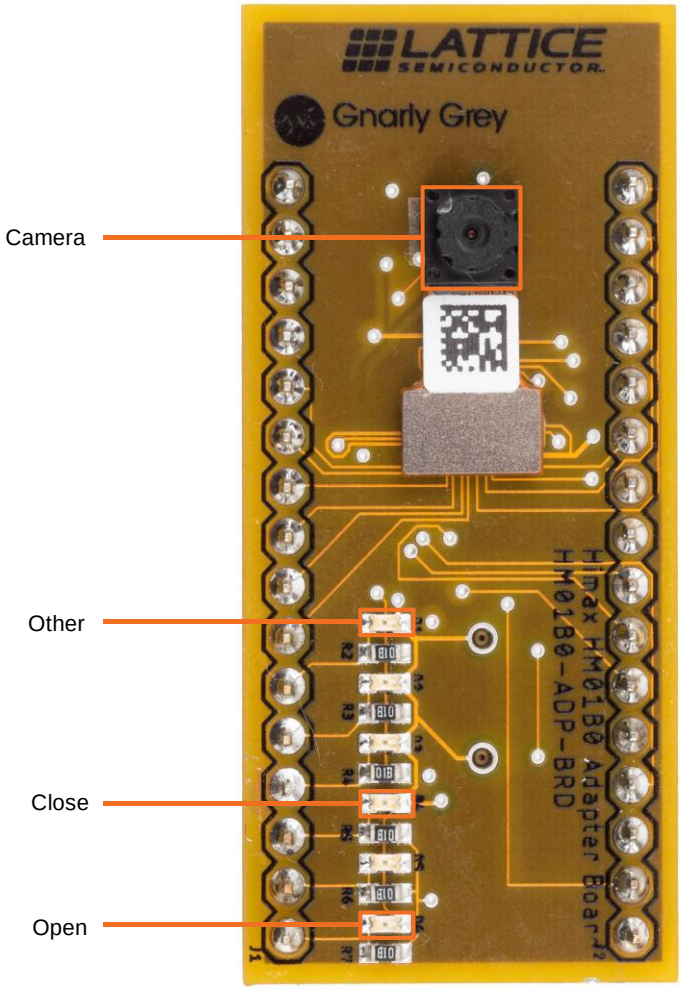

Figure 5.1. Camera and LED Location

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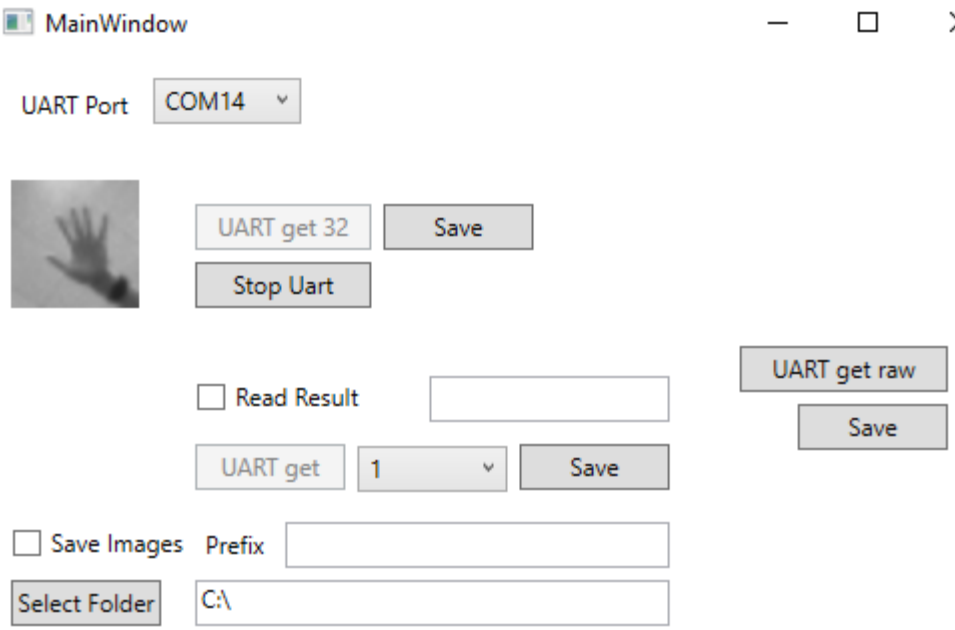

Figure 5.2. Uart Example of Open Hand

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Technical Support

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

Revision History

Revision 1.0, October 2018

Section	Change Summary
All	Initial release.

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