Lab 2: Interfacing a camera and implementing image processing algorithms with the DE1-SoC board

Objectives:

- Understand the procedure involved in interfacing peripherals to an embedded system

- Understand the process of capturing image through a camera

- Learn to develop C programs for the ARM hard core processor using the Altera Monitor Program

- Understand basic image processing concepts

- Understand how images are displayed on a monitor

Information to help get started with the Lab 2:

1. Go through the Altera Monitor program tutorial provided on the website. It is important that you understand the capabilities of the software to make use of its capabilities. Go through the main features such as creating a project, compiling and loading the programs, running the programs.

2. Go through the Terasic D5M camera user manual. Also, Altera provides a document explaining how the Video IP cores work, I would suggest you to go through that to understand the underlying components in the QSYS system given to you. It is critical that you go through this document as it has the necessary details to implement most of the tasks in this lab.

3. Download the folder Lab2_ECE354_2017 from course website. This folder has the complete HW/SW requirements for this project. The QSYS system required for the design is complete and does not require any modification. Open the capture_image project from the files given to you. Understand the files in the project and get an overall broad view of the project by running the design QSYS system, since the same system will be carried on for our work in upcoming labs.

4. Run the DE1SoC_With_D5M.amps project provided with the VGA connector and camera connected to your board. This project demonstrates the use of the D5M camera with the DE1-SoC Board. The starter C code in the project implements the following - (a) Capture one frame of video when any key is pressed and (b) Display the captured frame.

5. It is also recommended that you go through the DE1-SoC computer system tutorial. The document has many examples which illustrate how to access the peripherals, use interrupts, display graphics on the monitor etc. This along with the sample codes provided in the University Program should provide sufficient information to complete the lab successfully.

6. Modify the starter code to perform the following three forms of image processing:
   a. Add a timestamp to the image
   b. Counter to keep track of number of pictures taken
   c. Rotate, mirror, invert image