Video Capture : Full Guide

I. Introduction

This document gives an overview of capturing video of an exercise being performed on the simulated surgical setup. Video capture consists of three major steps:

1) Preparation. Setting up the signal generator, opening the software application, setting the video file name, capturing the background, and telling the software application to start capture

2) Frame Acquisition. Video frame acquisition begins when the trigger signal from the signal generator is enabled. Disabling the trigger stops frame acquisition. All frames captured between enabling and disabling the trigger will be saved. The subject should instructed to start the exercise after enabling the trigger. When the subject completes the exercise the trigger should be disabled.

3) Saving Video File Data. After all frames have been acquired the software application will save the frames to a video file to be used in later analysis.

First an overview of the hardware involved in the capture process is given. Setup and use of the signal generator for triggering frame acquisition is described. Next, the software interface is described. Finally, the video capture process using the software application is described.

II. Hardware

a. Capture Hardware Overview

Figure 1 is a schematic of the hardware used to capture video. A PC runs the software application, vidCaptureGUI, which controls and acquires data from the cameras. Section **Software Interface** describes how to use the application. The PC is connected to a Power over Ethernet (PoE) switch via an Ethernet cable. The two cameras are also connected to the PoE switch. This forms a network that is used to control the cameras and send video data from the cameras to the PC. In order to synchronize video acquisition, a trigger signal is sent simultaneously to the two cameras. A signal generator is used for this. During data collection, the output of the generator must be manually enabled and disabled in order to begin and end frame acquisition. This is explained in the proceeding subsection. A BNC cable connects the signal generator to a custom signal splitter box. This box buffers the trigger signal to the two cameras. A custom cable is connected between the signal splitter and each camera. Each cable consists of BNC connector, two conductor cable, and a DIN connector. The connection at the signal splitter is BNC and the connection at the camera is DIN.
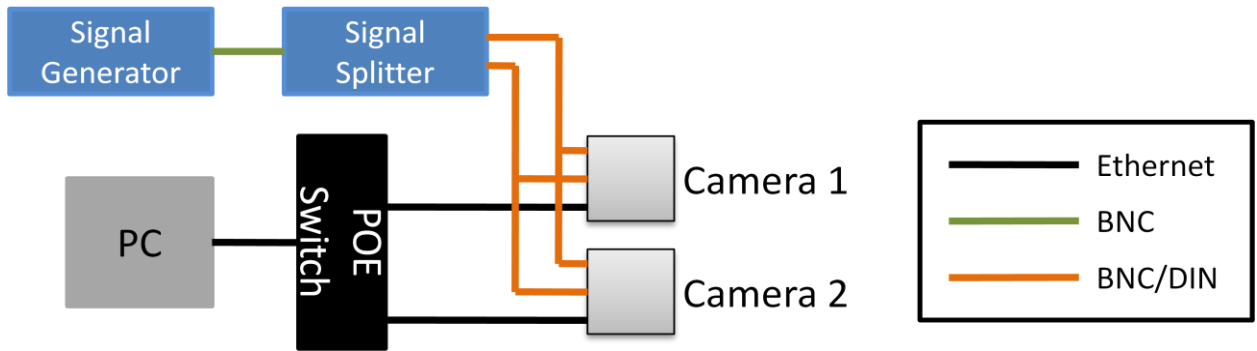
Figure 1 : Video Capture Hardware Schematic
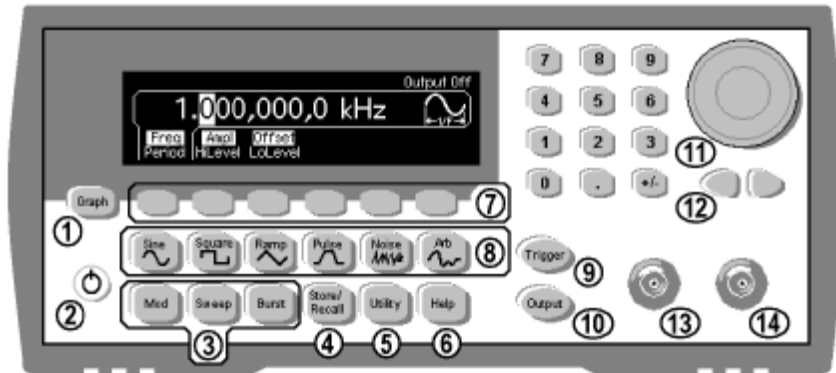
b. Signal Generator

Besides the PC, the only hardware component that should be interacted with during video capture is the signal generator. An illustration of the signal generator's front panel is seen in **Figure 2**. Prior to performing video capture, the generator must be configured to send the correct trigger signal to the cameras. These settings can be set manually or recalled from the memory of the signal generator. The preferred method is to simply recall the settings. Below are instructions on how to do this:

1) Power on the signal generator. A circular button (2) with a circular green symbol is located on the left hand side of the signal generator's front panel. After pressing this, the screen of the generator will turn on.
2) Enter the store/recall menu. One of the white square buttons (4) is labeled "Store/Recall". Press this button.
3) Enter recall state menu. Press the blue button beneath the text "Recall State" on the display panel.
4) Select STATE_1. Press the blue button beneath the text "State 1" on the display panel. Then press the blue button under the text "RECALL STATE". At this point the signal generator is properly configured for video capture.

Alternatively the signal generator can be set manually. A table of the settings used for video capture as of 11/05/2011 is given in **Table 1**.

A button labeled "output" on the right hand side of the signal generator's front panel is seen in **Figure 2**. This button is used to enable and disable the trigger signal. When the trigger is enabled the button will light up green. When the trigger is disabled the light will not be present. Prior to performing a video capture trial the trigger signal should be disabled. After video capture has been initiated in the software application, manually pressing the output button will start the acquisition of video frames. Disabling the trigger signal by pressing the output button will signal the software application to stop

acquiring video (no new frames will be acquired). The remainder of the capture process consists of waiting for the PC application to save the video data.

1 Graph Mode/Local Key
2 On/Off Switch
3 Modulation/Sweep/Burst Keys
4 State Storage Menu Key
5 Utility Menu Key
6 Help Menu Key
7 Menu Operation Softkeys
8 Waveform Selection Keys

9 Manual Trigger Key (*used for Sweep and Burst only*)
10 Output Enable/Disable Key
11 Knob
12 Cursor Keys
13 Sync Connector
14 Output Connector

Figure 2: Signal Generator Front Panel

| Signal Type	Square
Vpp	3.3 V
Offset	0 V
Frequency	30 Hz
Duty Cycle	50 %
Output Termination	High Z

Table 1 : Video Capture Signal Generator Settings

III. Software Interface Overview

Video capture is controlled by the application vidCaptureGUI. **Figure 3** shows the windows that are opened when the application is started. The large window contains two display panels. These panels are live displays of the two cameras from which video is captured. There are useful for properly positioning the cameras, positioning components of the simulated setup, and for verifying appropriate lighting.
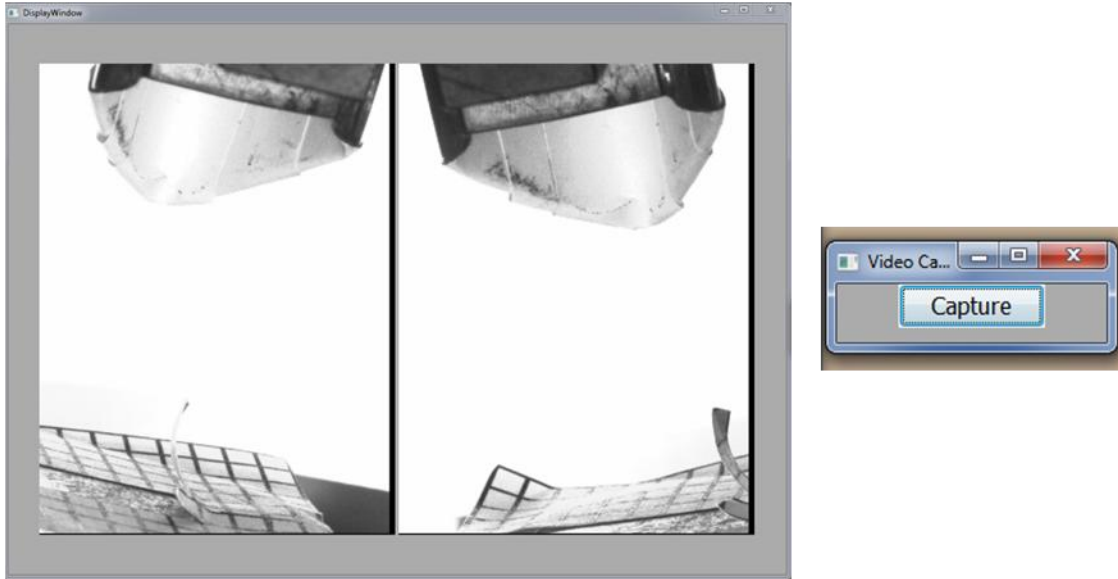
Figure 3 : Application Opening Windows

The small window contains a button labeled capture. This button opens the dialog seen in **Figure 4**. Video capture is controlled using this dialog. Note, the live displays do not update when this dialog is open.
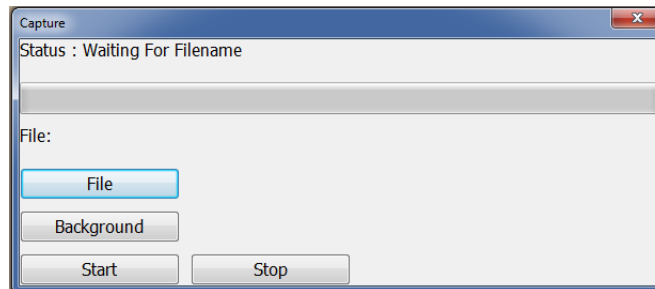
Figure 4 : Capture Dialog

A text indicator at the top of the dialog describes the status of the capture process. A progress bar below this is used for indicating file save progress after frames have been acquired. The "File" button is used to set the name of the video files captured. The "Background" button is used to save a background video used by the tracking algorithm. The "Start" button initiates video capture. The stop button is used to initiate the stop of video acquisition. Note the stop button is not the preferred method of stopping frame acquisition. Disabling the trigger as explained in the next section should be used.

a. Software Related Issues

It is possible that no windows will open when the vidCaptureGUI application is started. This generally indicates a communication problem between the PC and the cameras. To get around this

issue, disconnect and reconnect the PoE switch power source. This will restart the cameras. Wait 30 seconds then try to open the application again.

The frame acquisition process is relatively memory and processor intensive. Therefore, when acquiring videos it is important to close all other applications like a web browser. There should not be an issue if an excel spreadsheet is open at the same time.

Captured video files take up a fair amount of hard-drive space. After capturing multiple trials it is important to monitor the amount of HD space taken up by the files. If little space is remaining on the local hard drive, the video files should be transferred to an external hard drive.

IV. Video Capture Process

A diagram of the video capture process is seen in **Figure 5**.
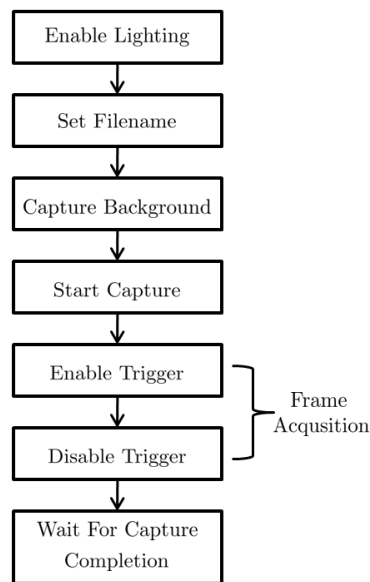
Figure 5 : Video Capture Process

a. Enable Lighting

Prior to capturing any sort of file, it should be verified that all the lighting is enabled. Double check that the front and back-lighting is enabled. Use the live display panels to verify proper lighting.

b. Setting Filename

Press the "Capture" button. The dialog in **Figure 4** should open. The first step in the capture process is setting the video file save location and prefix. When the "File" button is pressed a file save browser will open. The folder in which video files should be saved should be navigated to. A new folder can be created by right clicking and selecting new->folder. Once in the desired folder, the file prefix is set by typing a name in the "File Name" box and pressing the "Save" button. Four files are saved during a complete capture process: *prefix*_back_left.avi, *prefix*_back_right.avi, *prefix*_cap_left.avi,

*prefix*_cap_right.avi. The first two files are the captured background for the left and right view camera. The second two files are the actual capture of the simulated surgical trial for the left and right view camera.

c. Capture Background

Prior to capturing video of a surgical exercise, the background (setup without instruments) must be captured. This is used by the instrument tracking algorithm. Prior to capturing the background, all of the lighting should be enabled. Pressing the "Background" button will initiate the background capture. A dialog will appear indicating the completion of the background capture process.

d. Start Capture

The surgical exercise video capture process is initiated by pressing the "Start" button. **The start button does not start the acquisition of frames.** It prepares the software application and cameras to acquire frames. Enabling the trigger signal, as explained next, starts the acquisition of frames.

e. Enable Trigger

The trigger signal is enabled by pressing the "Output" button on the signal generator. **After the trigger is enabled, video frames are acquired**. Therefore when performing a surgical exercise, the subject should be instructed to start after enabling the trigger. A small pause should be taken between pressing the "output" button on the signal generator and instructing the subject to begin. A click will be heard at the signal generator and the output button will light up green. Information on preparing the signal generator is found in section II subsection b of this document.

f. Disable Trigger

After the surgical exercise is completed, the acquisition of frames is stopped by disabling the trigger. This is done by pressing the "output" button on the signal generator. A click will be heard and the output button will no longer be lit green. All video frames acquired by the cameras between the enabling and disabling of the trigger signal will be saved to the left and right view capture files. The remainder of the capture process consists of waiting for the software application to save the video files.

f. Wait for Capture Completion

After frame acquisition, the status indicator of the capture dialog will read "Writing Acquired Frames". At this point video files are being saved to the PC's hard drive. This is the final step in the video capture process. The status bar within the dialog will fill as frames are written to the video file. A dialog will appear indicating the completion of the capture process.