# ACUSON Freestyle Tablet Application

## Study List View

This view shows the list of studies present on the Freestyle. The studylist.xml file is transferred from the system to the tablet device. The patient name and study date are displayed in the Table view. The user can select a study and all images for that study will be transferred to the tablet and the Image View will be displayed.

## Image View

All images in the selected study (both jpg and mov) are displayed in a scroll view. The user can swipe to move between images. The images can be magnified (pinch gesture), and mov files play in a movie player. Still images may be emailed. When the review of the images is complete, pressing the “Done” navigation item brings the user back to the Study List View and image files are deleted.

## Worklist

The worklist screen allows the user to make a new patient entry in the worklist on the target Freestyle. Patient name, ID, gender, and birthdate are entered and transferred in a tagged format to the Freestyle. The information is added to the worklist.xml file on the Freestyle. The worklist.xml file is used to automatically populate the patient entry page to create a study, saving the Freestyle operator from manual patient data entry. This feature could be used to create a worklist of patients scheduled for the current day.

## Settings

The settings screen allows the user to set up the IP Addresses and alias of the Freestyle systems that the application can communicate with. The application communicates with a single Freestyle at a time – you cannot get the patient lists from multiple Freestyles merged into one list, for example. The alias and IP address is stored in a plist on the iPad so it is present each time the application is started. The last used device is retained as the active device. The user selects the Freestyle to communicate with by selecting it from the Table View and pressing the target icon in the upper right. To edit the information, the target is selected from the Table View and the edit button in the upper left is pressed. The Alias and IP address can then be modified. The alias of the currently selected Freestyle is displayed at the top of the Study List and Image View pages.

## System

The system page is not implemented. The purpose of this page is to collect information from the system that would be useful in making a service request, such as system serial number, software version, probe information, etc.

# Communication

Communication between the Freestyle and the tablet is done with TCP/IP sockets. The Freestyle opens port 5104 for communication with the tablet. Communication is initiated from a UI action on the tablet, the socket is opened, a command is sent, and a response is received. The socket is then closed by the tablet.

## Tagged Data

The patient and study related xml files in the Freestyle and the worklist command that are described in this document use tagged data. The tags are in the format DCM\_nnnnnnnn, where nnnnnnnn is an eight digit number that indicates the DICOM element number. DICOM (Digital Imaging and Communications in Medicine) is a medical imaging standard maintained by NEMA.

The data dictionary that defines the DICOM element numbers is found in Part 6 of the DICOM standard. For example, the Patient ID is defined by the DICOM standard as element (0010,0020). For use in the Freestyle, Patient ID data is tagged with DCM\_00100020.

## Image Data Format

### Still Frame Images

Still frame images are JPEG Baseline encoded images with a suffix of jpg.

### Multi-Frame Images

Multiframe images are Motion JPEG movies in QuickTime format with a suffix of mov. Each frame is JPEG Baseline encoded.

## Commands

A description of the command set follows. The commands are all ASCII encoded.

### STUDYLIST

The STUDYLIST command is sent when the Refresh button is pressed at the upper left of the Study List View. This command initiates the transfer of the studylist.xml file from the Freestyle to the tablet. This information is used to populate the study list screen of the application. When the parsing of the xml file is complete on the tablet, the socket is closed. The patient name (xml tag DCM\_00100010), study date (xml tag DCM\_00080020), and study uid (xml tag DCM\_0020000D) are used to display patient data and request images from the Freestyle.

### ALLIMAGES

This command is sent from the tablet when a study is selected from the patient list. The format of the command is STUDYLIST u, where u is the study instance uid data (tag DCM\_0020000D) for the selected study, which is obtained from the STUDYLIST command.

For each image in the study (either jpg or mov), the Freestyle sends a 16 character string. This string is composed of the last 8 characters of the image filename and eight hex characters indicating the length of the data to be transferred. For example:

0000.jpg00006402

Indicates that the file 0000.jpg is about to be transferred, and the file length is 0x6402 bytes long. The image file data immediately follows this 16 character string. When the image file is completely sent, another 16 byte string is sent for the next image file, followed by the image data. This process repeats until all image files are sent. To indicate that all images have been sent, the 16 character string ENDIMAGE00000000 is sent to the tablet and the connection is closed.

Image files are stored on the Freestyle with sequential numbering, in the form:

r.n.sss

where r is the series uid

n is a 4 digit sequential number starting at 0 indicating image number

sss is the suffix – jpg or mov

### WORKLIST

The WORKLIST command is sent from the tablet to the Freestyle to add a new patient to the system worklist. The data for this command is encoded in a tagged format. An example of this command would be

WORKLIST<DCM\_00100010>DOE^JOHN</DCM\_00100010><DCM\_00100020>12</DCM00100020><DCM\_00100030>19701101</DCM\_00100030><DCM\_00100040>M</DCM00100040>

This will add the following patient to the worklist:

Name: John Doe

Patient ID: 12

Birthdate: November 1, 1970

Gender: Male

The response sent from the Freestyle to the tablet is </ELCMD>. When the tablet receives this, it closes the connection.

### REQIMAGE

This command is not implemented yet. One of the issues with transferring movie files is the large amount of data that needs to be transferred, and the length of time that that the transfer takes. If there are several movie files in a study, there can be a wait before the scroll view is loaded with all images. What we are planning is to transfer only the first frame of the movie file (which is a jpg frame) to facilitate quick loading of the study.

During the ALLIMAGES command, when a movie file is encountered in the study, the Freestyle will extract its first frame and send only that frame. The 16 character string that includes the filename and length will be:

nnnn.prvXXXXXXXX

where nnnn is the image file number

prv is a suffix (preview) that indicates to the tablet that this is the first frame of a movie

XXXXXXXX is the length of that frame

The prv suffix will cause the tablet to treat the prv file as a jpg and to display a play icon to be displayed over the frame. When the play button is pressed, the REQIMAGE command is sent to request the entire movie file.

The anticipated format of the REQIMAGE command is

REQIMAGE nnnn.sss

Where nnnn is the image file number

sss is the file suffix jpg or mov

When the image is sent, the Freestyle will send the string ENDIMAGE00000000, which will cause the tablet to close the connection.

# Study files

## File: studylist.xml

An example studylist.xml file is listed here. This file is sent as a response to the STUDYLIST command and contains the list of studies that is present on the Freestyle.

<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>

<STUDYLIST>

<STUDY EXPORTED="Y">

<DCM\_00100010 VR="PN">Doe^John</DCM\_00100010>

<DCM\_00100020 VR="LO">2012.03.06.15.38.04</DCM\_00100020>

<DCM\_0020000D VR="UI">1.2.840.113879.00.00.00000007.20120306.153750</DCM\_0020000D>

<DCM\_00080020 VR="DA">20120306</DCM\_00080020>

<DCM\_00080030 VR="TM">1537</DCM\_00080030>

</STUDY>

<STUDY EXPORTED="Y">

<DCM\_00100010 VR="PN">Smith^Jane</DCM\_00100010>

<DCM\_00100020 VR="LO">2012.03.06.15.53.21</DCM\_00100020>

<DCM\_0020000D VR="UI">1.2.840.113879.00.00.00000007.20120306.155311</DCM\_0020000D>

<DCM\_00080020 VR="DA">20120306</DCM\_00080020>

<DCM\_00080030 VR="TM">1553</DCM\_00080030>

</STUDY>

<STUDY EXPORTED="Y">

<DCM\_00100010 VR="PN">Jones^Frank</DCM\_00100010>

<DCM\_00100020 VR="LO">2012.03.06.16.12.21</DCM\_00100020>

<DCM\_0020000D VR="UI">1.2.840.113879.00.00.00000007.20120306.161214</DCM\_0020000D>

<DCM\_00080020 VR="DA">20120306</DCM\_00080020>

<DCM\_00080030 VR="TM">1612</DCM\_00080030>

</STUDY>

</STUDYLIST>

## File: study.xml

The detailed study information is contained in a file called study.xml, which is not currently transferred to the tablet. This file contains the detailed information about the study. An example of a study.xml file that corresponds to the John Doe study in the studylist.xml file follows.

<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>

<STUDY SRC="MAN" CTRL="0">

<DCM\_00080020 VR="DA" TYPE="2">20120306</DCM\_00080020>

<DCM\_00080030 VR="TM" TYPE="2">162749</DCM\_00080030>

<DCM\_00100010 VR="PN" TYPE="2">Doe^John</DCM\_00100010>

<DCM\_00100020 VR="LO" TYPE="2">2012.03.06.15.38.04</DCM\_00100020>

<DCM\_00100030 VR=”DA” TYPE=”2”>19630103</DCM\_00100030>

<DCM\_00100040 VR="CS" TYPE="2">M</DCM\_00100040>

<DCM\_0020000D VR="UI" TYPE="1">1.2.840.113879.00.00.00000007.20120306.153750</DCM\_0020000D>

<DCM\_0020000E VR="UI" TYPE="1">1.2.840.113879.00.00.00000007.20120306.153750.01</DCM\_0020000E>

</STUDY>

# Future Work

## Security

Work needs to be done to secure the connection to the Freestyle. Currently there is no authentication performed to check if the Freestyle is communicating with an authorized tablet/user.

## Display of Diacritical Characters

The Freestyle supports the storage and entry of diacritical characters, but the current tablet implementation does not support the display of these characters.

## Entry of Diacritical Characters

The tablet could provide a convenient interface for the entry of patient information, which would include diacritical characters.

## System Information Page

The system information page, described in section 1.5 needs to be completed. This would require work on both the tablet and Freestyle.

## Remote Control

Include the ability to provide a remote control of the Freestyle over the tablet. This would require work on both the tablet and the Freestyle.

## Bluetooth

The Freestyle has a spare Bluetooth 2.0 interface that could be used with the tablet. It communicates using the Serial Port Protocol. Is there an available Bluetooth SPP interface on the Surface tablet?