SINGAPORE POLYTECHNIC
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

ET0104 Embedded Computer Systems Laboratory

Laboratory 7 - Graphics Display Technology

Objectives

- Set up ETS to generate an application that uses graphics and a local filesystem.
- To prepare images for viewing in an embedded system
- To transfer images to an embedded system

Small sized graphical LCDs have steadily decreased in cost due to large numbers of devices using such displays like handphones, PDAs, and the various portable entertainment devices. In this lab, we will prepare images so they can be displayed on a small graphics LCD. We will transfer these devices to the embedded system and look at a simple application to display these images. We will also incorporate a filesystem, so that an embedded system can manage files.

Displaying and managing graphics files on Embedded Systems

Because of the very flexible way humans interact with graphics, GUI software is complex and occupies large amounts of memory. In ETS, we display graphics using the Portable Embedded Graphics (PEG) software. Though it is not as fully featured as say Windows, it provides attractive graphics capabilities with small memory requirements. We shall restrict ourselves to just displaying static images, but you should be aware that it is capable of handling controls, like various buttons, edit boxes and even touch screens. To go into the intricacies of creating and designing such applications is beyond the scope of this course. Because of this complexity, PEG is coded in C++. Concepts like classes, inheritance, virtual functions are heavily used, as is the message passing paradigm used to control such displays. But we hide all this detail and concentrate on getting a simple application working. PEG is also available for other processors.

It is not practical to embed images into C programs because of their size. Because of this, we will now make use of the ETS file system. This works in the same way as a typical Windows/DOS FAT32 system. However, we will limit ourselves to a “8.3" file naming convention, because of software restrictions.

In the rest of this lab, please note the following:
The embedded system will be referred to as the Single Board Computer or SBC. The system which runs VC/ETS will be referred to as the Development System or DS. Because we are using different software to accomplish various tasks, the terminology for each will differ.

Dual boot

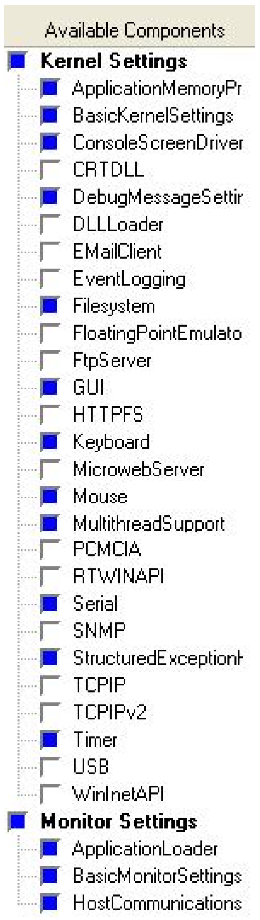
To accommodate file transfer which uses DOS, the SBC is capable of dual booting. Upon reset, a single beep is emitted by the BIOS. After a while, the startup program will issue two beeps, and the LED will blink. If the keypad is pressed within 3 seconds, the file transfer program will load. Otherwise, the ETS monitor program on the SBC will load which will enable C programs to be downloaded and execute on the SBC.

As before, all items to be clicked or typed are marked in ***bold italics*** font.

A. ETS Graphics and Filesystem Setup

1. Create a new project and call it ***lab7***.

2. In the Kernel settings, Click on ***Filesystem*** and ***GUI***.

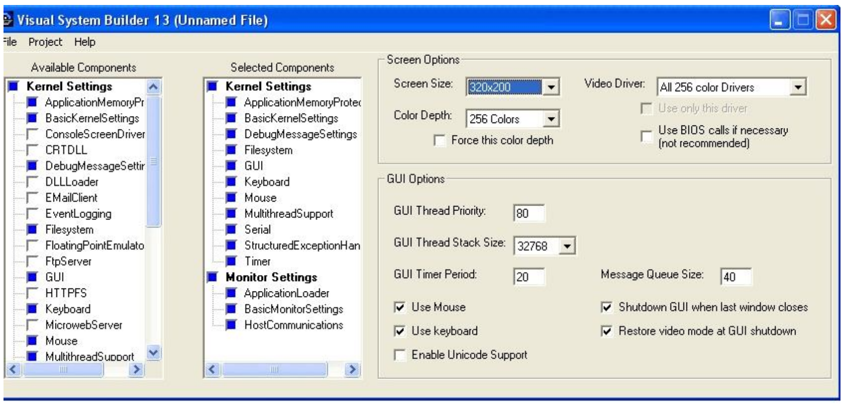


Available Components

- ■ **Kernel Settings**
  - ■ ApplicationMemoryPr
  - ■ BasicKernelSettings
  - ■ ConsoleScreenDriver
  - □ CRTDLL
  - ■ DebugMessageSettir
  - □ DLLLoader
  - □ EMailClient
  - □ EventLogging
  - ■ Filesystem
  - □ FloatingPointEmulato
  - □ FtpServer
  - ■ GUI
  - □ HTTPFS
  - ■ Keyboard
  - □ MicrowebServer
  - ■ Mouse
  - ■ MultithreadSupport
  - □ PCMCIA
  - □ RTWINAPI
  - ■ Serial
  - □ SNMP
  - ■ StructuredExceptionH
  - □ TCPIP
  - □ TCPIPv2
  - ■ Timer
  - □ USB
  - □ WinInetAPI
- ■ **Monitor Settings**
  - ■ ApplicationLoader
  - ■ BasicMonitorSettings
  - ■ HostCommunications

3. Now we want to make sure ETS will display at the correct
In the Selected Components column, click on GUI.

4. In the GUI Dialog, click on: ***320x200***, ***256*** colours and ***All 256 Color Drivers***.



Visual System Builder 13 (Unnamed File)

File Project Help

Available Components

- ■ **Kernel Settings**
  - ■ ApplicationMemoryPr
  - ■ BasicKernelSettings
  - □ ConsoleScreenDriver
  - □ CRTDLL
  - ■ DebugMessageSettir
  - □ DLLLoader
  - □ EMailClient
  - □ EventLogging
  - ■ Filesystem
  - □ FloatingPointEmulato
  - □ FtpServer
  - ■ GUI
  - □ HTTPFS
  - ■ Keyboard
  - □ MicrowebServer
  - ■ Mouse
  - ■ MultithreadSupport

Selected Components

- ■ **Kernel Settings**
  - ■ ApplicationMemoryProtec
  - ■ BasicKernelSettings
  - ■ DebugMessageSettings
  - ■ Filesystem
  - ■ GUI
  - ■ Keyboard
  - ■ Mouse
  - ■ MultithreadSupport
  - ■ Serial
  - ■ StructuredExceptionHan
  - ■ Timer
- ■ **Monitor Settings**
  - ■ ApplicationLoader
  - ■ BasicMonitorSettings
  - ■ HostCommunications

Screen Options

Screen Size: 320x200
Video Driver: All 256 color Drivers
Color Depth: 256 Colors
□ Use only this driver
□ Force this color depth
□ Use BIOS calls if necessary (not recommended)

GUI Options

GUI Thread Priority: 80
GUI Thread Stack Size: 32768
GUI Timer Period: 20
Message Queue Size: 40
✓ Use Mouse
✓ Shutdown GUI when last window closes
✓ Use keyboard
✓ Restore video mode at GUI shutdown
□ Enable Unicode Support

5. Close the box in the usual way when done.

6. Open up the workspace and add `lab7.cpp` into your project. Also, include in the other support files like `EcsGUI.cpp, LCD.cpp, Keypad.cpp`. There are subtle differences between how VC++ handles C and C++ programs. If you create functions in this project, do use the CPP extension.

7. Build and Run the application, which invites you to choose one of 3 images to display.

8. Examining the source code is useful here. Note that the images are located at the `C:\images` directory of the SBC (not the DS!). Note the use of '\\' in the C++ program to denote the path separator character.

B. Preparing images for the SBC

Desktop systems can read a file header and determine how the system should display it, resizing and recolouring to fit the capabilities of the hardware. This involves a lot of resources. Embedded systems, with their modest memory and storage, do not have this flexibility. Usually, the resolution of the display and the colour depth is fixed. So in order to use our own images in our system, we have to *prepare* our images to the desired format.

Also, while the JPEG format is very popular, it takes a processor with a fair bit of memory and floating point capabilities to handle it. This is because of its sophisticated encoding techniques. Alternatively, a popular graphics file format is the BMP or bitmap format. Most BMP files are uncompressed so there is a fixed relationship between the number of bytes in the file to each pixel in the image.

The LCD used in the lab is 2.5" in size. This can accommodate a small sized image. But we are making use of VGA compatible hardware and the nearest VGA mode uses a screen size is 320x200 pixels which is more than enough. In this mode, the VGA specification allows 256 colours to be displayed. So images to be displayed on our system will be 320x200 pixels, with a 256 colour depth. Considering these in more detail:

Image bit depth

We should recall that “photo-like” images need 24 bits to display an image, but “animation-type”images like cartoons require much less bits. However, it is surprising what an 8-bit image can display when down sampled from a 24-bit image.

Aspect ratio

If we were to just convert an image the desired resolution, severe distortion will occur. For example, an image taken in a poster or “upright” position would look “squashed” when converted to a landscape or “lying down” position. It may be better to cut or “crop” a portion of the original image that has a aspect ratio closer to the desired one.

Software used

We will use a software known as FastStone (available as freeware, with thanks to the author) which allows you to resize and change the colour depth of your images. It can also add annotations like text and simple graphics to your image.

To acquaint ourselves with the capabilities of this software, we will prepare an image for use on the embedded system. It is `SPGrad.JPG` and can be found in the:

`D\ECSLAB\images` directory.

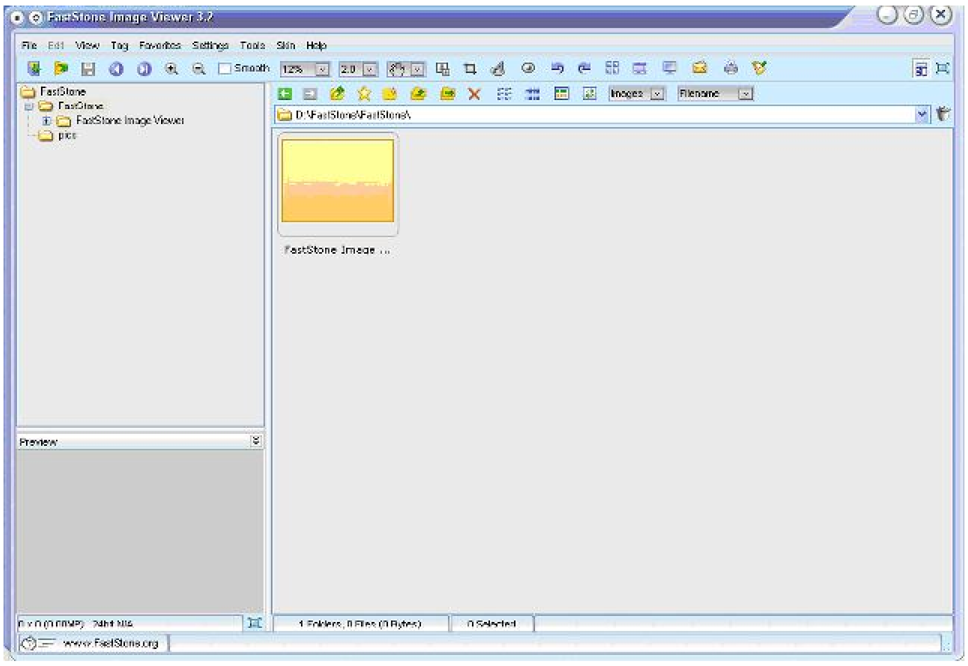
1. Use the default picture viewer program to look at it’s resolution and note its:

I) aspect ratio ii) colour depth

Compare this with our target requirement, which is 320 by 200 with 8 bit colour. We will now see what is the best way to achieve our target requirement.

2. Start the FastStone program double clicking on the FastStone icon.

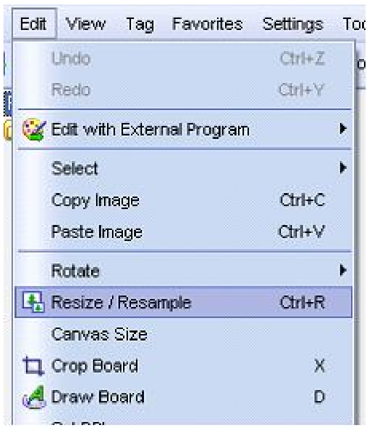
This is what you will see when you first load FastStone.



FastStone start up screen

Please NOTE that the appearance *<u>may not be exactly the same</u>* as what you see here, as the software will remember the last directory it worked with.

<u>Resizing the image</u>
To illustrate the issues at hand, we will first resize an image right away. The supplied image, named SPgrad.JPG needs to be 320x200 pixels with an 8 bit colour depth, or 256 colours.



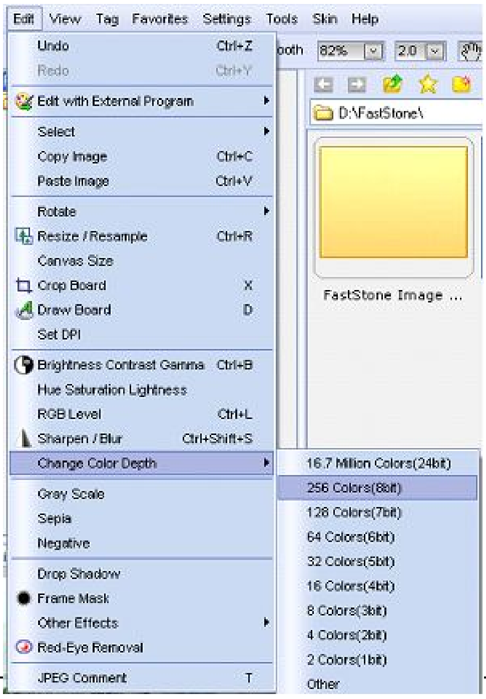
3. To do this, select the image by left clicking on it once. And then click on ***Edit*** then in the drop down menu, ***Resize / Resample***.

Ensure that “Preserve Aspect Ratio” is unchecked. With pixels selected, change the width to ***320*** and the height to ***200*** and click ***OK***.

Note: The shortcut for this function is Ctl-R.

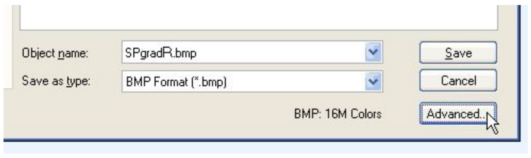
Reducing colour depth

4. To reduce the colour, click ***Edit*** again, then in the drop down menu, ***Change Colour Depth*** and select 256 colours (8bits).

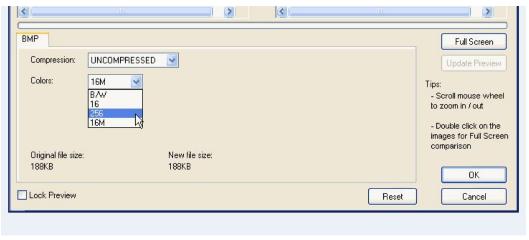


5. Begin to save the image.
Click ***File / Save As***. For the file, type ***SPGradR.bmp*** in the BMP Format, in the same directory as the original file.

6. In the Save dialog, click on ***Advanced***


Object name: SPgradR.bmp
Save as type: BMP Format (*.bmp)
BMP: 16M Colors

7. In the BMP tab, select ***256*** colours.

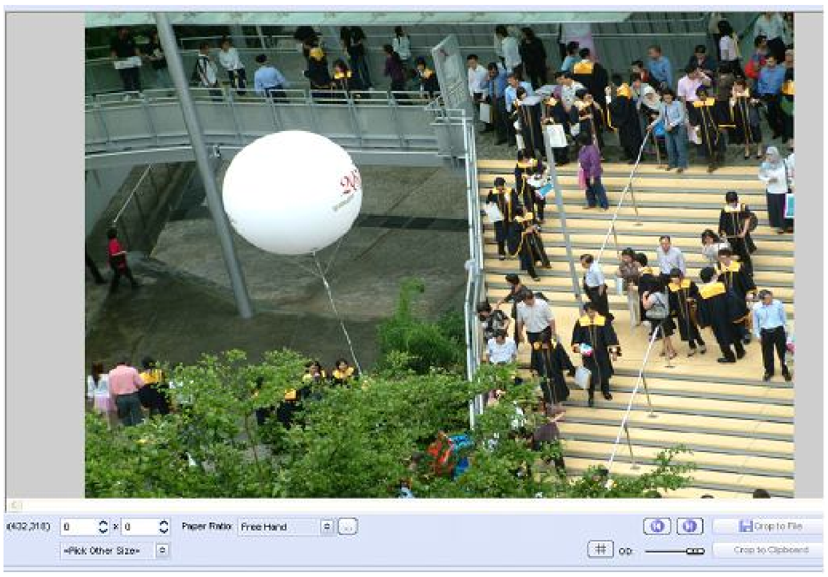

BMP
Compression: UNCOMPRESSED
Colors: 16M
B/W
16
256
16M
Original file size: 188KB
New file size: 188KB
Tips:
- Scroll mouse wheel to zoom in / out
- Double click on the images for Full Screen comparison

Finally ***OK*** the dialog.

The image will saved and shown in the preview window on the bottom left hand size of your screen. NOTE: the file size should be about 65 Kbytes in size.

One of the first things you will note about the resized image is that the round balloon looks oval now.

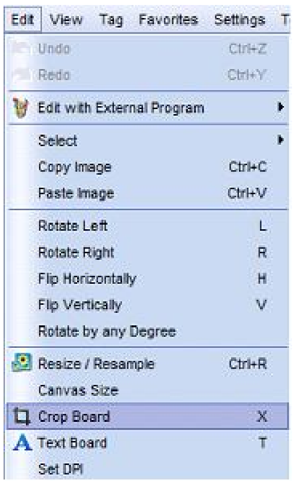
This is a consequence of the aspect ratio being changed.


Resized image with altered aspect ratio

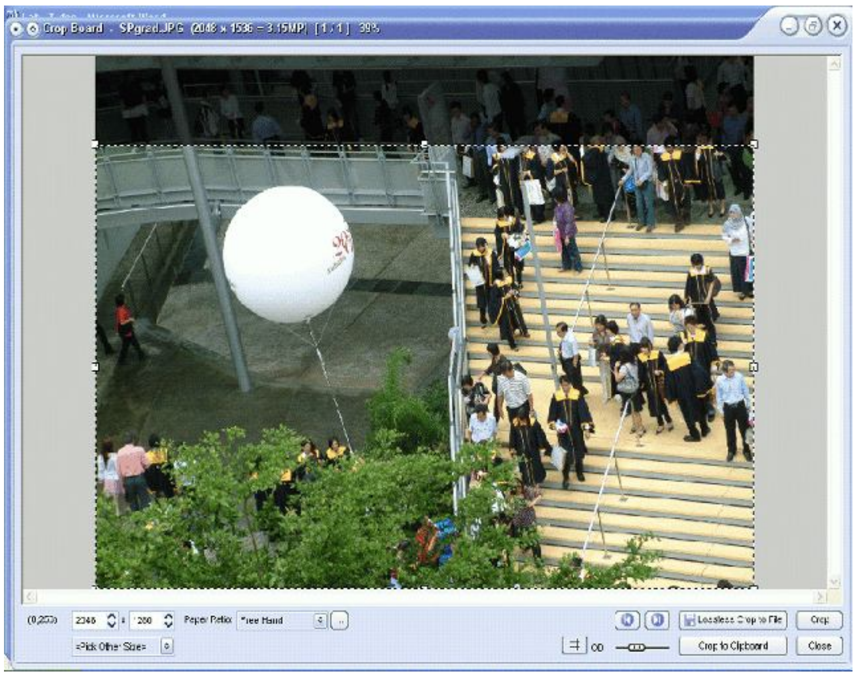
Aspect ratio
The image that has been resized looks “squashed” as the aspect ratio of the original image is 1.33 (2048/1536) while that of the new resized image is 1.6 (320/200). This resizing step that you have just done is to illustrate the guidelines one has to follow in order to properly prepare an image for display in an LCD screen used by the SBC. However, in some cases, the distorted image is tolerable.

Cropping an image
In order to maintain a desired aspect ratio for resizing, one has cut off a part of the original image to achieve the aspect ratio of 1.6. The term used is “crop”.

Before doing so, we should do some calculations. Say we want to keep the image width, then the new dimensions for the desired will have to be 2048 x 1280 (2048/1.6).



5. First highlight the image you want to crop. Then, click ***Edit***, select ***Crop Board***.



6. Using the crop tool, select an area of 2048 by 1280. Choose which area to remove. This can be done by the mouse by entering the dimensions at the bottom left corner.

The dotted box shown can be moved to indicate which part of the picture to retain. The dark area is the part that will be cropped away. In the figure, we crop the top part of the image, leaving the bottom behind. Click ***Lossless Crop to File***.

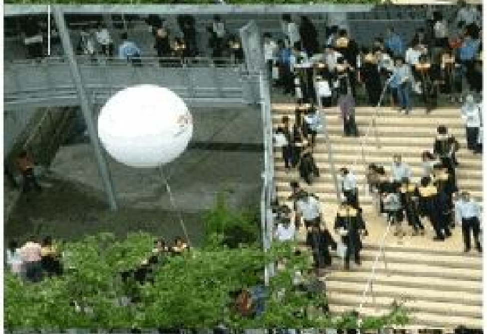
Finally, resize this newly cropped image to 320x200 and in 256 colours. Save as ***SPGrad8B.bmp*** in the same directory as the original, using the Advanced options.

The figures in this new image will now have a sense of being proportionate, as the aspect ratio has been retained.

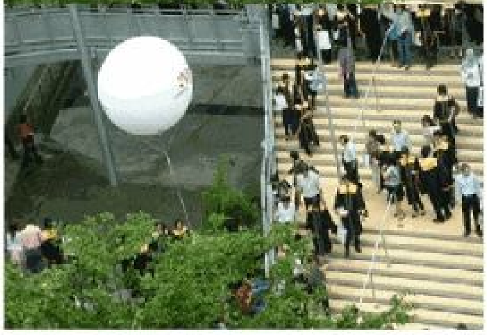
For comparison, you may wish to examine the three images you have worked with.

Original - SPGrad.JPG

Resized, aspect ratio not retained -
SPGradR.BMP



Cropped to aspect ratio, then resized.
SPGrad8B.BMP



Note that when the smaller images are compared, they look less sharp than the original. This is because of the downsampling process.

Note: It may be a good idea to take note of the shortcut keys for several of the more common functions if you might be working on many images. This can help reduce overall working time.

C. File Transfer

In the earlier labs, we note that all the data needed was available in the main program. As we shall see, when the amount of data becomes large, we need a file system to manage the data. ETS allows us to access files by linking in file system software. Now we have to transfer data from the host to the embedded system. In today's devices, the USB port is widely used. But it should be noted that incorporating such a feature will certainly result in higher hardware cost. It is not possible to incorporate USB using software alone because of the high speeds involved. In this case, we go back to the venerable serial port. File transfer software allows us to transfer data easily. We will use the trial edition of FastLynx 3.3 which works on Windows 9x, NT, XP and even on DOS based systems.

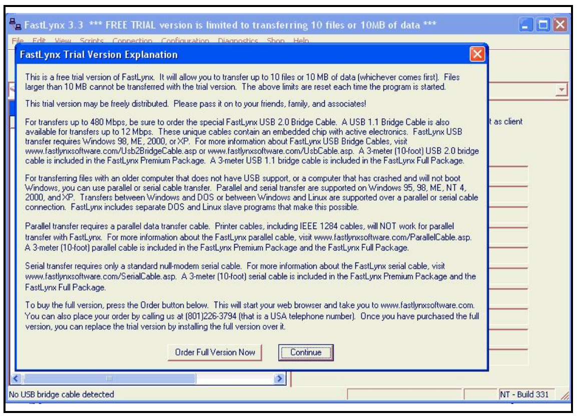
When transferring data, one terminal is designated as a server which receives commands. This will be the SBC, where we have installed FastLynx server. Because it is running in DOS mode, all files follow the “8.3" file naming system.

The other terminal acts as a client and is the DS. We use FastLynx to:

i) View the contents of this directory
ii) Create a new directory
iii) Transfer files between SBC and DS.

1. Start by resetting the SBC. We have included a DOS program that will prompt you by sounding two loud beeps. Press any key on the keypad within two seconds. You will hear a confirmatory three beeps and FastLynx on the SBC will load. Otherwise the ETS monitor will load (which allows you to transfer your application to the SBC).

2. On the DS, click on the FastLynx icon FastLynx 3.3 Shortcut 1 KB and you will see the initial screen.



FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***

FastLynx Trial Version Explanation

This is a free trial version of FastLynx. It will allow you to transfer up to 10 files or 10 MB of data (whichever comes first). Files larger than 10 MB cannot be transferred with the trial version. The above limits are reset each time the program is started.

This trial version may be freely distributed. Please pass it on to your friends, family, and associates!

For transfers up to 480 Mbps, be sure to order the special FastLynx USB 2.0 Bridge Cable. A USB 1.1 Bridge Cable is also available for transfers up to 12 Mbps. These unique cables contain an embedded chip with active electronics. FastLynx USB transfer requires Windows 98, ME, 2000, or XP. For more information about FastLynx USB Bridge Cables, visit www.fastlynxsoftware.com/Usb2BridgeCable.asp or www.fastlynxsoftware.com/UsbCable.asp. A 3-meter (10-foot) USB 2.0 bridge cable is included in the FastLynx Premium Package. A 3-meter USB 1.1 bridge cable is included in the FastLynx Full Package.

For transferring files with an older computer that does not have USB support, or a computer that has crashed and will not boot Windows, you can use parallel or serial cable transfer. Parallel and serial transfer are supported on Windows 95, 98, ME, NT 4, 2000, and XP. Transfers between Windows and DOS or between Windows and Linux are supported over a parallel or serial cable connection. FastLynx includes separate DOS and Linux slave programs that make this possible.

Parallel transfer requires a parallel data transfer cable. Printer cables, including IEEE 1284 cables, will NOT work for parallel transfer with FastLynx. For more information about the FastLynx parallel cable, visit www.fastlynxsoftware.com/ParallelCable.asp. A 3-meter (10-foot) parallel cable is included in the FastLynx Premium Package and the FastLynx Full Package.

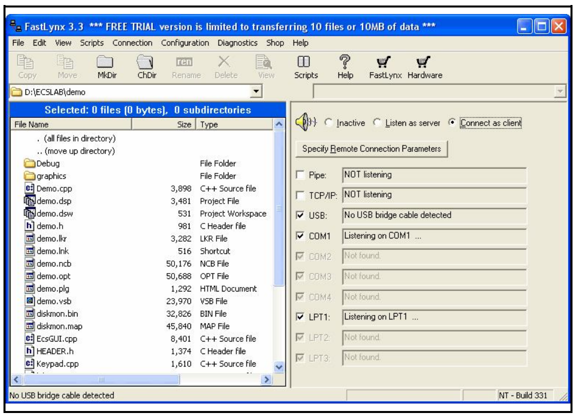
Serial transfer requires only a standard null-modem serial cable. For more information about the FastLynx serial cable, visit www.fastlynxsoftware.com/SerialCable.asp. A 3-meter (10-foot) serial cable is included in the FastLynx Premium Package and the FastLynx Full Package.

To buy the full version, press the Order button below. This will start your web browser and take you to www.fastlynxsoftware.com. You can also place your order by calling us at (801)226-3794 (that is a USA telephone number). Once you have purchased the full version, you can replace the trial version by installing the full version over it.

No USB bridge cable detected

File Edit View Scripts Connection Configuration Diagnostics Shop Help
Order Full Version Now
Continue
NT - Build 331

Click on ***Continue*** to proceed.



FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***

D:\ECSLAB\demo

Selected: 0 files (0 bytes), 0 subdirectories

```
File Name                      Size  Type
 . (all files in directory)
 .. (move up directory)
Debug                                File Folder
graphics                             File Folder
Demo.cpp                      3,898  C++ Source file
demo.dsp                      3,481  Project File
demo.dsw                        531  Project Workspace
demo.h                          981  C Header file
demo.lkr                      3,282  LKR File
demo.lnk                        516  Shortcut
demo.ncb                     50,176  NCB File
demo.opt                     50,688  OPT File
demo.plg                      1,292  HTML Document
demo.vsb                     23,970  VSB File
diskmon.bin                  32,826  BIN File
diskmon.map                  45,840  MAP File
EcsGUI.cpp                    8,401  C++ Source file
HEADER.h                      1,374  C Header file
Keypad.cpp                    1,610  C++ Source file
```

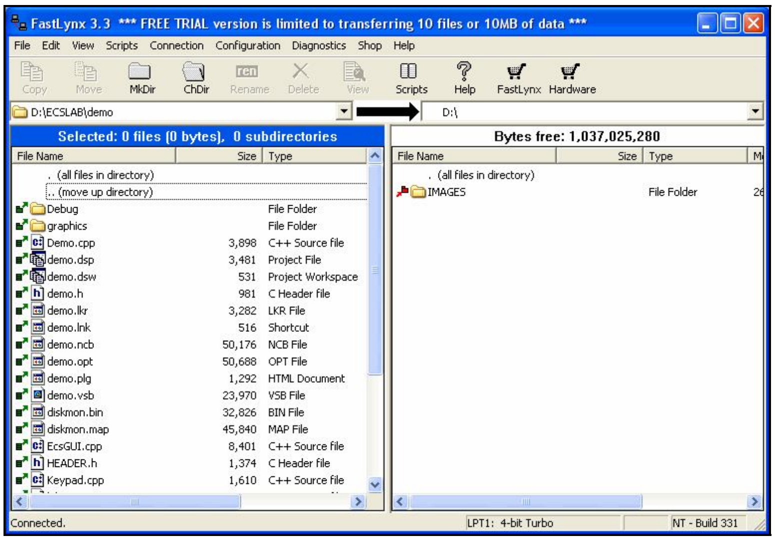
Inactive Listen as server [✓ Connect as client]

```
[ ] Pipe:    NOT listening
[ ] TCP/IP:  NOT listening
[✓] USB:     No USB bridge cable detected
[✓] COM1     Listening on COM1 ...
[✓] COM2     Not found.
[✓] COM3     Not found.
[✓] COM4     Not found.
[✓] LPT1:    Listening on LPT1 ...
[✓] LPT2:    Not found.
[✓] LPT3:    Not found.
```

No USB bridge cable detected

File Edit View Scripts Connection Configuration Diagnostics Shop Help
Copy Move MkDir ChDir Rename Delete View Scripts Help FastLynx Hardware
Specify Remote Connection Parameters
NT - Build 331

This screen MAY NOT be shown, but if it appears, click on ***Connect as client***. Note that the file display on the left may not be the same as what you see.



FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***

D:\ECSLAB\demo → D:\

Selected: 0 files (0 bytes), 0 subdirectories

```
File Name                      Size  Type
 . (all files in directory)
 .. (move up directory)
Debug                                File Folder
graphics                             File Folder
Demo.cpp                      3,898  C++ Source file
demo.dsp                      3,481  Project File
demo.dsw                        531  Project Workspace
demo.h                          981  C Header file
demo.lkr                      3,282  LKR File
demo.lnk                        516  Shortcut
demo.ncb                     50,176  NCB File
demo.opt                     50,688  OPT File
demo.plg                      1,292  HTML Document
demo.vsb                     23,970  VSB File
diskmon.bin                  32,826  BIN File
diskmon.map                  45,840  MAP File
EcsGUI.cpp                    8,401  C++ Source file
HEADER.h                      1,374  C Header file
Keypad.cpp                    1,610  C++ Source file
```

Bytes free: 1,037,025,280

```
File Name                      Size  Type
 . (all files in directory)
IMAGES                               File Folder
```

Connected.   LPT1: 4-bit Turbo   NT - Build 331

File Edit View Scripts Connection Configuration Diagnostics Shop Help
Copy Move MkDir ChDir Rename Delete View Scripts Help FastLynx Hardware

You will then see the transfer window, which has two file displays.

Note:
1) On the LEFT file view is the DS, the current directory and its contents. You can navigate by clicking on the **.. (move up directory)** or clicking on the folder icon to go IN to the directory.
The currently active window has a BLUE title area.

2) In the RIGHT file view is the SBC acting as a Server, showing the current directory and its contents. You can navigate it in the same way.

Note the BLACK ARROW which shows the direction of data transfer.To change the currently active computer system, just click anywhere within the file area.

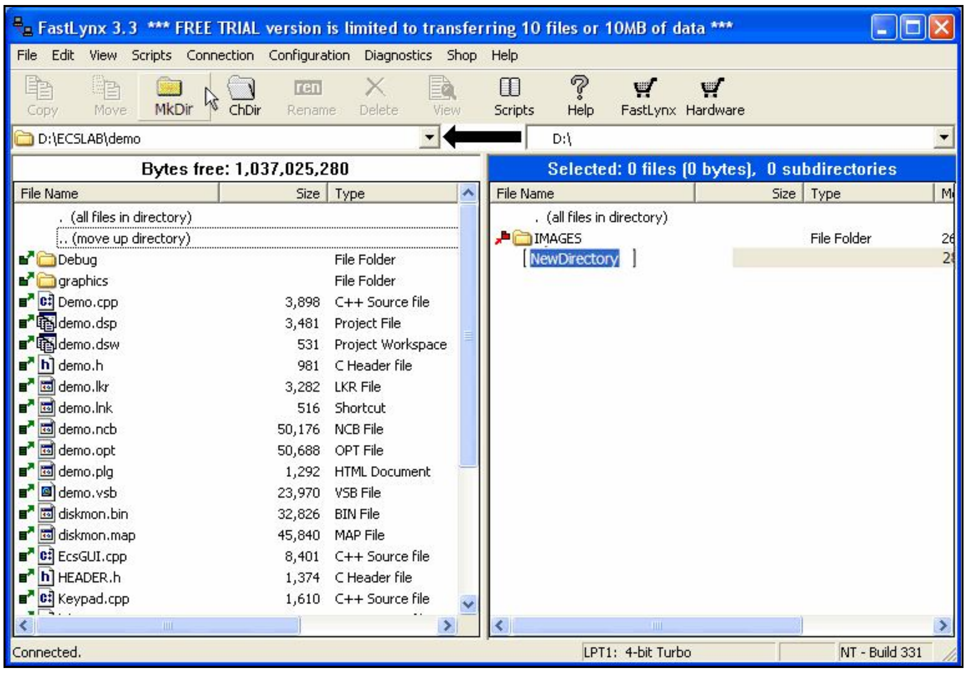
<u>Creating a new directory</u>

Here we create a directory called NEW at the server.

<u>REMEMBER</u>: The LEFT display shows the current directory on the DS or client.

It displays the contents of the *current* directory and may differ from what you see.

The RIGHT side shows the SBC or server


FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***
File Edit View Scripts Connection Configuration Diagnostics Shop Help
Copy Move MkDir ChDir Rename Delete View Scripts Help FastLynx Hardware
D:\ECSLAB\demo
D:\

Bytes free: 1,037,025,280

File Name	Size	Type
. (all files in directory)		
.. (move up directory)		
Debug		File Folder
graphics		File Folder
Demo.cpp	3,898	C++ Source file
demo.dsp	3,481	Project File
demo.dsw	531	Project Workspace
demo.h	981	C Header file
demo.lkr	3,282	LKR File
demo.lnk	516	Shortcut
demo.ncb	50,176	NCB File
demo.opt	50,688	OPT File
demo.plg	1,292	HTML Document
demo.vsb	23,970	VSB File
diskmon.bin	32,826	BIN File
diskmon.map	45,840	MAP File
EcsGUI.cpp	8,401	C++ Source file
HEADER.h	1,374	C Header file
Keypad.cpp	1,610	C++ Source file

Selected: 0 files (0 bytes), 0 subdirectories

File Name	Size	Type
. (all files in directory)		
IMAGES		File Folder
NewDirectory		

Connected. LPT1: 4-bit Turbo NT - Build 331

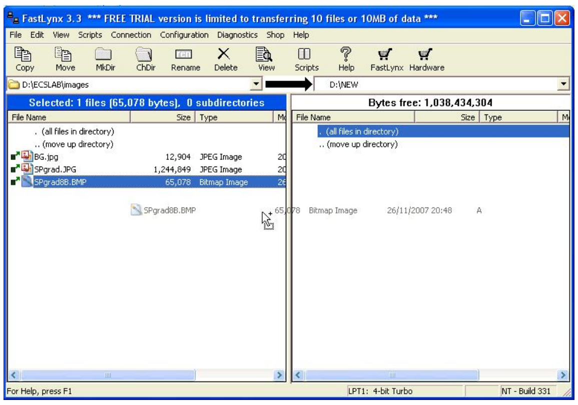
1) Activate the Server file window (right display) by CLICKing anywhere within it. An existing directory called IMAGES contains images used in the demo for the assignment. However, we will create a new directory to familiarize ourselves with the functions of FastLynx.

2) Click on the Mkdir icon MkDir on the FastLynx toolbar.

3) A highlighted area with the text NewDirectory will appear. The text cursor will appear here. Overtype the text, so the new directory name is ***NEW***. To finish, press `<-` .

<u>Transferring Files</u>

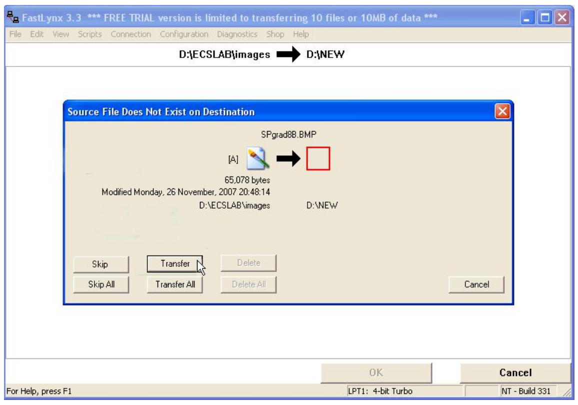
Now we want to transfer files into the directory `D:\NEW\` on the server (SBC). First of all, we need to locate the files on the DS. Double-click on the DS file display until you are viewing the directory `D:\ECSLAB\images`, where the files to be transferred are located.


FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***
File Edit View Scripts Connection Configuration Diagnostics Shop Help
Copy Move MkDir ChDir Rename Delete View Scripts Help FastLynx Hardware
For Help, press F1
LPT1: 4-bit Turbo
NT - Build 331

```
D:\ECSLAB\images  ➡  D:\NEW
Selected: 1 files (65,078 bytes), 0 subdirectories      Bytes free: 1,038,434,304
File Name            Size       Type                    File Name            Size   Type
 . (all files in directory)                              . (all files in directory)
 .. (move up directory)                                  .. (move up directory)
BG.jpg               12,904     JPEG Image
SPgrad.JPG           1,244,849  JPEG Image
SPgrad8B.BMP         65,078     Bitmap Image
          SPgrad8B.BMP          65,078   Bitmap Image   26/11/2007 20:48   A
```

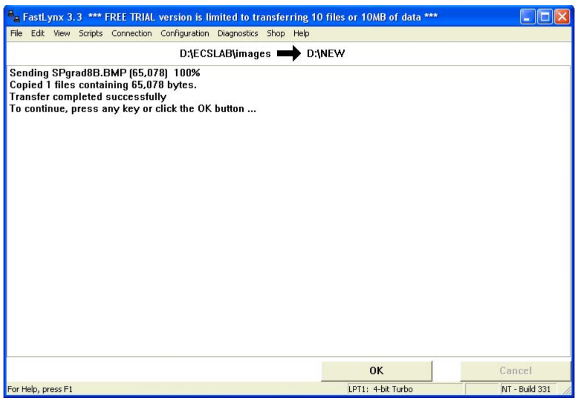
1. Select the file or files (use Shift / Control click or drag the files) to be transferred. They will be highlighted.

2. Now CLICK and DRAG the highlighted files to the Server window.


FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***
File Edit View Scripts Connection Configuration Diagnostics Shop Help
Skip
Transfer
Delete
Skip All
Transfer All
Delete All
Cancel
OK
Cancel
For Help, press F1
LPT1: 4-bit Turbo
NT - Build 331

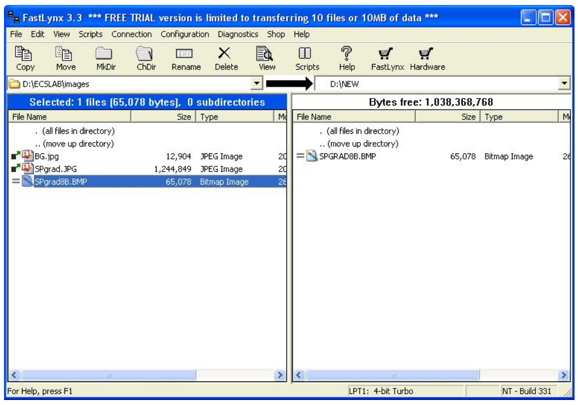
```
D:\ECSLAB\images  ➡  D:\NEW

Source File Does Not Exist on Destination
                    SPgrad8B.BMP
               [A]       ➡
                  65,078 bytes
   Modified Monday, 26 November, 2007 20:48:14
               D:\ECSLAB\images        D:\NEW
```

3. Release the mouse button and click on ***TRANSFER***.


FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***
File Edit View Scripts Connection Configuration Diagnostics Shop Help
OK
Cancel
For Help, press F1
LPT1: 4-bit Turbo
NT - Build 331

```
D:\ECSLAB\images  ➡  D:\NEW
Sending SPgrad8B.BMP (65,078)  100%
Copied 1 files containing 65,078 bytes.
Transfer completed successfully
To continue, press any key or click the OK button ...
```

4. Dismiss the box by pressing ***OK***.


FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***
File Edit View Scripts Connection Configuration Diagnostics Shop Help
Copy Move MkDir ChDir Rename Delete View Scripts Help FastLynx Hardware
For Help, press F1
LPT1: 4-bit Turbo
NT - Build 331

```
D:\ECSLAB\images  ➡  D:\NEW
Selected: 1 files (65,078 bytes), 0 subdirectories      Bytes free: 1,038,368,768
File Name            Size       Type                    File Name            Size     Type
 . (all files in directory)                              . (all files in directory)
 .. (move up directory)                                  .. (move up directory)
BG.jpg               12,904     JPEG Image              SPGRAD8B.BMP         65,078   Bitmap Image
SPgrad.JPG           1,244,849  JPEG Image
SPgrad8B.BMP         65,078     Bitmap Image
```

5. Your final display should look like this.

6. In order to prepare the SBC to receive your ETS application, you need to reset the system. Download your application as in the previous labs.

REMINDER TO BACKUP

Please remember to backup all your files, both on the DS and SBC as others will use the same platform.

D. Modifying the display program

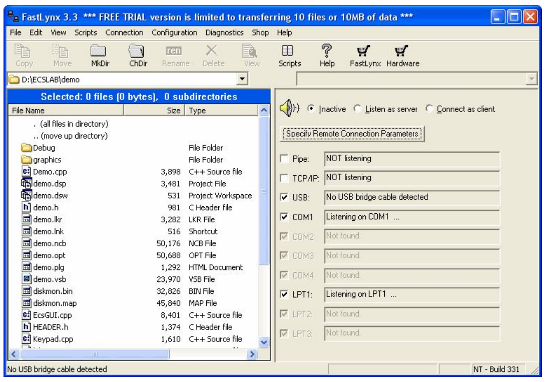
We now want to test out the effect of your changes. Before doing so,

1. You need to ***RESET*** the SBC so it boots into ETS. When prompted by two beeps, simply ignore it for 3 seconds, then proceed to download your program in the usual manner.

2. Modify `lab7.cpp` to display the file SPGrad8B.BMP. Modify the program so there is a *new* option to display it.

Setting options (optional step)

To check the settings of FastLynx, you will need to Disconnect. If you have not done so, type or select ***C*onnection / *D*isconnect** from the menu.



FastLynx 3.3 *** FREE TRIAL version is limited to transferring 10 files or 10MB of data ***

D:\ECSLAB\demo

Selected: 0 files (0 bytes), 0 subdirectories

File Name	Size	Type
. (all files in directory)		
.. (move up directory)		
Debug		File Folder
graphics		File Folder
Demo.cpp	3,898	C++ Source file
demo.dsp	3,481	Project File
demo.dsw	531	Project Workspace
demo.h	981	C Header file
demo.lkr	3,282	LKR File
demo.lnk	516	Shortcut
demo.ncb	50,176	NCB File
demo.opt	50,688	OPT File
demo.plg	1,292	HTML Document
demo.vsb	23,970	VSB File
diskmon.bin	32,826	BIN File
diskmon.map	45,840	MAP File
EcsGUI.cpp	8,401	C++ Source file
HEADER.h	1,374	C Header file
Keypad.cpp	1,610	C++ Source file

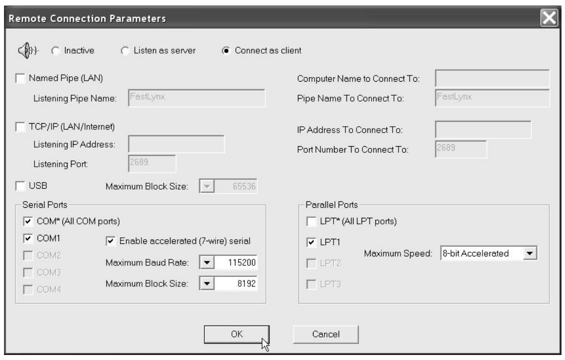
[✓ Inactive] Listen as server Connect as client

☐ Pipe:	NOT listening
☐ TCP/IP:	NOT listening
☑ USB:	No USB bridge cable detected
☑ COM1	Listening on COM1 ...
☑ COM2	Not found.
☑ COM3	Not found.
☑ COM4	Not found.
☑ LPT1:	Listening on LPT1 ...
☑ LPT2:	Not found.
☑ LPT3:	Not found.

No USB bridge cable detected NT - Build 331

File Edit View Scripts Connection Configuration Diagnostics Shop Help
Copy Move MkDir ChDir Rename Delete View Scripts Help FastLynx Hardware
Specify Remote Connection Parameters

Select ***Specify R*emote Connection Parameters**



Remote Connection Parameters

Inactive Listen as server [✓ Connect as client]

☐ Named Pipe (LAN)
Listening Pipe Name: FastLynx
Computer Name to Connect To:
Pipe Name To Connect To: FastLynx

☐ TCP/IP (LAN/Internet)
Listening IP Address:
Listening Port: 2689
IP Address To Connect To:
Port Number To Connect To: 2689

☐ USB Maximum Block Size: 65536

Serial Ports
☑ COM* (All COM ports)
☑ COM1 ☑ Enable accelerated (7-wire) serial
☐ COM2 Maximum Baud Rate: 115200
☐ COM3 Maximum Block Size: 8192
☐ COM4

Parallel Ports
☐ LPT* (All LPT ports)
☑ LPT1 Maximum Speed: 8-bit Accelerated
☐ LPT2
☐ LPT3

You should make sure you are connecting over LPT1. ***OK*** the prompt.

It will bring you back to original screen.