Remote Data Acquisition and Control
Using LabVIEW VI SERVER
Omaria E. Tucker

Senior
Department of Mathematics and Computer Science
South Carolina State University
Florence, SC
South Carolina State University
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**Engineering Group**

Dr. Nikunja N. Swain, Mentor
Garrett M. Joseph   Marvin Fulton, Jr.   Omaria E. Tucker
Introduction

- The SCSU PAIR is a program divided into 3 sections
  - 6 weeks during the Summer
  - Fall Semester
  - Spring Semester
- SMILEY radio-telescope at PARI (Pisgah Astronomical Research Institute)

Team Objectives:
- To design and modify the SMILEY front panel
- To develop a simple interface to allow LabVIEW to interface with PARIs' controls
- To allow remote operation access to SMILEY over the Internet
Background Information

- LabVIEW--Laboratory Virtual Instrument Engineering Workbench
  - Flexible
  - Cost effective
  - Powerful
  - Increases Productivity
VIRTUAL INSTRUMENTS—VIs
- Can build using software objects
- Can be used for:
  - Remote data acquisition
  - Analysis
  - Design and distributed control

APPLICATIONS
- VI Server (Web Server)
- Data Socket Server
- ActiveX
- Java and JavaScript
Why LabVIEW VI Server?

- Used to control entire VIs
- Allow multiple users/clients to connect simultaneously to the same front panel
- Allows machines without LabVIEW installed to view and control VIs, with LabVIEW run-time engine
- Can run from many different software platforms
Disadvantages

- Must configure license to support the number of clients
- Cannot manipulate the dimension of the front panel because of web browser constraints
- May not run exactly the same on a remote computer, as it would when ran locally
What is the VI Server?

- An easier way to build a networked LabVIEW application over TCP/IP
- Gives the capability to access features programmatically by using VI Server functions in the block diagram or through an ActiveX control
- Because of network transparency, users can perform manipulations of a VI or of LabVIEW itself on another machine across the network
VI Server Functionality

- **Open Application Ref**
  - Returns a reference to a VI Server app running on the specified machine

- **Open VI Ref**
  - Returns a VI reference to a VI specified in the path

- **Call By Ref Node**
  - Use to call a VI
  - VI determined at runtime by its value and could be on another computer

- **Property Node**
  - Sets (writes) or gets (reads) VI and application property info

- **Invoke Node**
  - Invokes a method or action on a VI or Application object

- **Close Application or VI Ref**
  - Closes the reference to an app or VI

*VI Server programming model follows the convention similar to file I/O and network references*
Application Controls Palette in LabVIEW
Object-Orientation in LabVIEW

VI Server gives a mechanism to create references to two classes of LabVIEW objects, allowing operation on the objects by invoking methods and setting properties.

Two General Classes of Objects

- **Application** - refers to graphical programming environment: obtaining info from the operating system
  - i.e. set or read status of Web server

- **VI Class** - refers to a VI
  - i.e. loading a VI into memory
Application Class Properties and Methods

- **Properties**
  - Application
  - Display
  - Operating System
  - Printing
    - Allows users to set printing options
  - Server
    - Modify VI Server configuration itself
  - Web Server
    - Configuration of the built-in server
    - i.e. turn on/off, change access permissions

- **Methods**
  - Bring to Front
  - Mass Compile

*three most powerful properties are Printing, Server, and Web Server*

*many Application class properties are read-only and some are read and write*
Web Server

What is it?
- A useful tool to interface between the Web and equipment connected to Data Acquisition and Control of computers
- Used to allow users anywhere on the Web to run actual laboratory experiments with equipment in Engineering labs

Direct Internet Communication
- Interface with Operating Equipment
- Remote user runs a Remote Client LabVIEW program that also uses TCP/IP communication (UDP also used)
- Equipment available on a 1st come, 1st served basis (2nd user can observe the results of 1st user that’s already in control)
- In this mode the Web server only needs to receive a short string of info as well as send, making this communication faster than a WWW interface
What actually happens?

"Web Server" VI

Waits for a TCP/IP connection

"Receive Command"

Receives the message from the browser

"Generate Reply"

Decides on the appropriate response to the message

Sends the response to the browser
Configuration
LabVIEW gives you three sets of setup panels when configuring the Web Server:

Either Allowed/Denied access to the Browser and/or Remote Viewing and Controlling

Used to enable or disable the web server
Configuration

LabVIEW gives you three sets of setup panels for the VI Server:

- Either Allowed/Denied access to the Server and/or VIs
- Sets up how the VI server resources are shared
Welcome to
SCSU/NASA PAIR and PARI
SPACE SCIENCE STUDIES RESEARCH LABORATORY
Login

Hello Mr. Fulton
You are Client number 1
You are scheduled for today
10/31/2002
Press O.K. to proceed to the experiment

Today's Date
10/8/2002
Current Time (EST)
4:41:03 PM

OK

Smiley Front Panel.VI
*Configured so that a user can not Calculate, Position, or Acquire Data from Smiley without “Logging In” first.
Conclusion and Future Plans

With the use of LabVIEW and its VI Server we were able to complete our objectives to modify the Smiley Front Panel, implement usernames and passwords for security, and allowing remote access and control over the SCSU Network and the Internet. In the future we plan to use VisualBasic and Java in completing our objectives.
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