Virtual Instrumentation for Smartphones

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Abstract- PDA-based instruments with wireless capabilities are a powerful aid to monitor and control applicationS. Using virtual instrumentation abilities of Labview 8.2, PDA, communications protocols and wireless devices we developed and tested some applications dedicated to the data transfer, workable for Pocket PC 2003. LabVIEW allow the addition of the dedicated module LabVIEW PDA Module, an essential resource in the development of graphical applications GUI usable on the PDA level

Keywords*:* LabVIEW PDA Module, Data transfer, Pocket PC, Microsoft ActiveSync, Windows Mobile

I. Introduction

Personal digital assistants (PDAs) provide a powerful platform for engineers looking to design portable and flexible PC-based measurement devices. While PDA-based devices give engineers the capability to add wireless data transfer, real-time analysis, voice recognition, and personalized audible alerts to measurement applications, careful selection of the PDA and corresponding development tools is required to meet desired measurement performance and feature implementation.

LabVIEW allow the addition of the dedicated module LabVIEW PDA Module [1], an essential resource in the development of graphical applications GUI usable on the PDA level. For example, the LabVIEW PDA Module reconfigures the LabVIEW development environment to compile code that is optimized for memory usage, which is essential for the processors typically used in Palm OS or Pocket PC-based PDA devices. Choosing an ADE (application development environment) with built-in measurement and analysis tools removes the burden of coding analysis algorithms and hardware drivers from the PDA application development process. In this way the transfer process PDA- PC becomes much more accessible.

Figure 1. Wireless Transmission

The mains objectives of this paper have followed the development and testing some applications dedicated to the data acquisition, operable for Pocket PC 2003. The steps are:

- Programming PDA VI at the level of host PC
- Compilation, discharge and execution of application at the level of Pocket PC
- Options for data transfer were: serial connection, USB, wireless or IrDA [2]. Data synchronization between PDA and Host was managed by Microsoft Active Sync
- In *Debugging* phase because PDA VI doesn't contain the block diagram, the connection PC Host - PC Pocket was established using RS-232 Serial cable.

II. Development Tools and Resources

Choosing the operating system (OS) on which to build the application is the first step to building a PDA-based measurement device [5]. Microsoft Windows Mobile software for Pocket PC provides a robust platform enabling the development of innovative mobile applications. Using a common core operating system and programming model, Windows Mobile streamlines development and deployment of mobile applications for Pocket PC.

ActiveSync is a synchronization program developed by Microsoft that allows a mobile device (PDA) to be synchronized with either a desktop PC, or a server running Microsoft Exchange Server or Kerio MailServer. ActiveSync acts as the gateway between your Windows-based PC and Windows Mobile-based device, enabling the transfer of Outlook information, Office documents, pictures, music, videos and applications to and from your device [3].

An important tool of Windows Mobile is the device emulator. Along with the two drivers: Virtual Machine Network Driver for Microsoft Device Emulator and VPC Network Driver it provides the virtual hardware platform that we use to test applications on multiple virtual devices.

Figure 2. Device Emulator

LabVIEW PDA Module is the toolkit of the LabVIEW, used to create the applications that run on Windows Mobile and Pocket PC handheld devices.

III. Wireless Application for Pocket PC

PDA devices and other mobile handheld devices make it easier than ever to develop remote applications that transmit and receive information from a remote site back to a host computer.[8]

If the host and client computers contain support for wireless communication, we use the LabVIEW Communication VIs and functions to create wireless applications. We have to change the execution target in LabVIEW to a PDA device or emulator before we set up wireless communication.

Wireless TCP, like wired TCP, ensures reliable transmission across networks while delivering data in sequence without errors, loss, or duplication. The TCP Connection automatically retransmits the datagram, which contains the data and a header that indicates the source and destination addresses, until the TCP connection receives acknowledgment of the transmission. Use the LabVIEW TCP VIs and functions to interface with devices on a TCP network. Setting up a TCP connection is similar to setting up file I/O or instrument I/O communication. Communicating using TCP involves the following:

1. Opening the connection.
2. Reading and writing the data.
3. Closing the connection.

The challenge is to develop a complex application capable to transfer data from a base station to a PDA with infrared connection followed by a retransmission of the same data to a second station using LAN interface. The application includes the possibility of data memorizing in files created on PDA for later use (offline analysis, new transmissions).

A. Transmission IrDA to LAN Interface

The PDA application is written within the LabVIEW PDA Module and consists of two tasks. The first task sets up an infrared connection base station -- PDA in order to establish a transfer between the two devices.[9] The second task takes care of data acquision and stores the data in a queue after

establishing a WiFi connection. Practically the application contains three VIs, each of them with well-defined function as Server or Client.

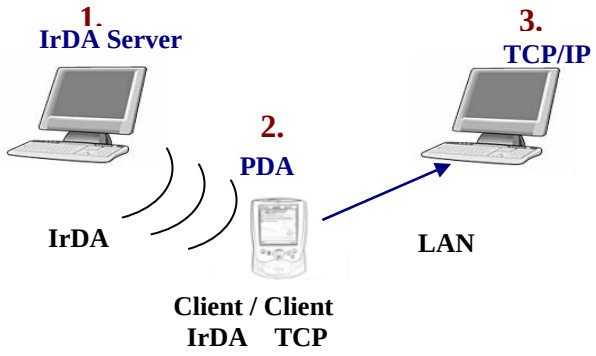

Figure 3. IrDA- LAN Interface

IrDA Server VI (runs first, on the base station) generates simulated waveforms given the size n points of the wave. The number of acquisition and the number of points per acquisition are fixed on the front panel**.** IrDA- Wi-Fi Client VI, developed for the Pocket PC, is client for the IrDA Server but in the same time is client for the second server: Wi-Fi Server. This means that the Pocket PC will receive the waveforms transferred by the IrDA Server using an infrared connection. Only after the waveforms are displayed on the PDA is establish a TCP connection with the second in order to transfer forward the graphic shapes. In this case the Wi-Fi Server must run second.

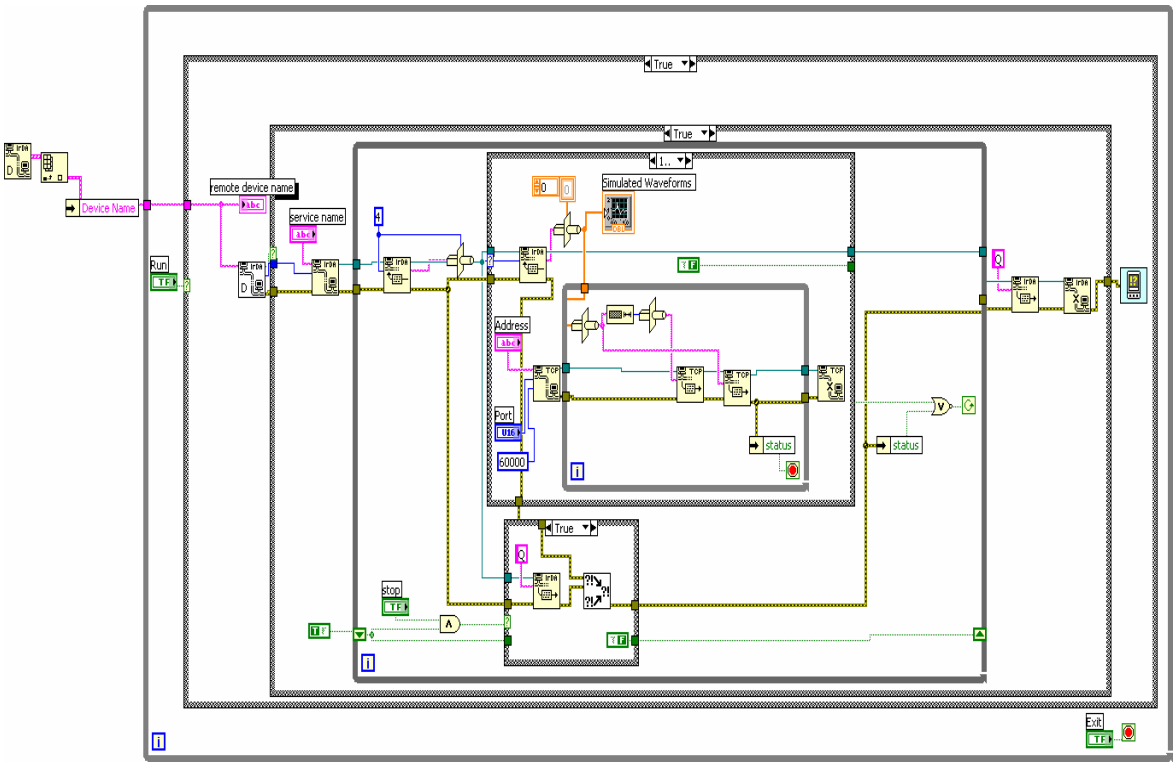

Figure 4. PDA VI block diagram

After the waveforms are displayed on the PDA the program open the TCP connection to the specified address and port of the second server and sent the dates to be plotted. Once the transfer is complete the TCP connection is closed. If an error occurred or the user presses the stop button it sends a ´´Q´´ to the IrDA Server to notify it to quit.

B. IrDA datalog with LAN communications

Unlike first case the system we developed stores all the data locally, in files, to the PDA's memory, which can be 128 MB on-board memory or 512 MB secure digital memory. Each measurement requires up to 8 MB of memory.

The data transfer is realised using the same IrDA and TCP protocols only that now are necessary four programs:

On the Host PC is performed the IrDA File Server PC VI that transfers the data with Infrared connection, after establishing it, send the number of byte to be sent followed by data. After the VI sends the data, it waits for an all received signal from the client and breaks the connection. Two programs are designed for PDA: the IrDA File PDA Client program that is receiving the data using infrared connection and write the data in a file, the WiFi File PDA Client program reads the file earlier created and transfer them to the Receiver PC by Ethernet. The Receiver PC runs the WiFi File Server PC VI the received informations using TCP protocol.[11]

Once the connection is opened and the data is received this will be write in a text file. To create a text file have to follow the next steps: ● use a File Dialog express VI that is configured as follows:Selections Mode: New or Existing File. This displays a dialog box with which we can specify the path to a file or directory, ● create a new file programmatically or interactively using dialog box. Here we can optionally specify a dialog prompt or default file name, ● write to text file - write a string of characters to a file. If a path is wired to the file (use dialog) input, the function opens or creates the file before writing to it and replaces any previous file contents. Here the data that we want to be kept is written in the file, ● close file - this function closes an open file specified by refnum and return the path to the file associated with the refnum. After the data is saved in the text file the infrared connection is closed.

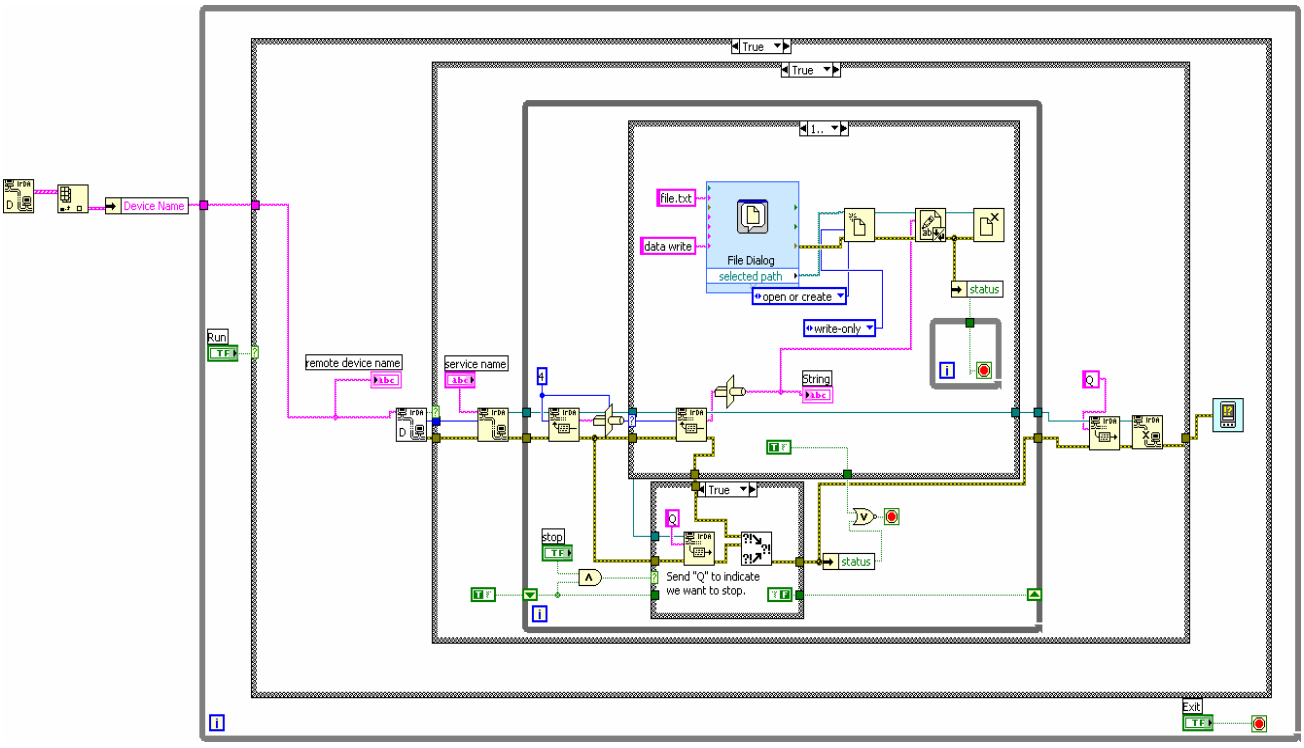

Figure 5. IrDA File PDA Client.VI Block Diagram

IV. Conclusions

Pocket PCs are becoming significant players in the mobile computing arena, competing with otherpalm-sized devices, WAP cell phones, and laptops in terms of usability, price, and programming power

In LabVIEW, PDA Module offers efficient resources in programming of a dedicated applications

running on Pocket PC very usefully for creating data acquisition and remote system monitoring applications that are both portable and flexible[4].

The developed applications can be used in a large area: automobile navigation, medical and scientific, education, sporting.

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