Applied Medical Informatics Using LabVIEW

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Abstract- Telemedicine is best example of Applied Medical Informatics. Several physiologic data and Digital images can be transmitted more rapidly and easily than conventional images. In telemedicine expert physicians in tertiary care centers can view a digital image and advice local physicians on the best plan of care without having to move the patient many miles away. The protocols that we are going to use for building networked Vis are TCP, since LabVIEW has full support for TCP/IP (Transmission Control Protocol/Internet Protocol). Hence this system can ensure that the right information is being delivered to the right destination in the right configuration.

Hence LabVIEW based applied medical informatics can play an important role in clinical management, strategic decision support, resources planning management, and enterprise application integration solutions for healthcare organizations.

Keywords: Telemedicine, Medical informatics, LabVIEW, Internet, Protocol

I. INTRODUCTION

So far, some telemedicine systems have been proposed to interface with the Internet. In these system we are still using the traditional instruments as medical peripheral devices, meaning that a large array of separate devices have to be deployed in an already crowded room. We are currently proposing an Internet based telemedicine system. The system has multifunctionality that can be realized using virtual instrumentation technology. The Internet will be used as a vehicle to deliver the virtual medical instruments and medical data in real time. The virtual instrument will be created in front panel having the same look and feel as a physical piece of equipment. The system facilitates the extraction of valuable diagnostic information.

One of the outstanding features of our LabVIEW based server is Network Transparency. Network transparency means the physician who is seated over a distance can do all of the mentioned manipulation of a VI or of LabVIEW itself on another machine across the network in just the same way as if it were on your own machine.

II. TCP/IP PROTOCOL IN LABVIEW

- TCP/IP is a way of sending and receiving data reliably over a network.

A Selection of Communication Protocol

Embedded applications often function as 'data servers' because their primary role is to report information (status, acquired data, analyzed data, etc.) to the client. They are also often capable of responding to commands from the client to perform application-specific activities. So selecting how the data can be transferred through applications often function as 'data servers' because their primary role is to report information (status, acquired data, analyzed data, etc.) to the client. They are also often capable of responding to commands from the client to perform application-specific activities [1]. So selecting how the data can be transferred involves the following:

- For embedded LabVIEW applications, communication with a remote client is often a critical part of the project.
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So selecting how the data can be transferred involves the following:

- Easily packages and parses the data and receives it fully.
- Hides the transport layer (TCP/IP, UDP, etc.) implementation details.
- Minimizes network traffic by sending data only when it is needed.
- Minimizes impact in the overall overhead and throughput
- Lends itself to communication with environments other than LabVIEW (C, C++, etc)

- TCP/IP functions are built into LabVIEW, and give us a way of transmitting information across the network reliably.

• TCP/IP gives you a way to use measurement data at locations remote from where the measurements are performed.

When we send data over the net it is subdivided into packets, and each packet could take a different route from one computer to the other over the net. Those packets could arrive at different times and be out of order. Some might not make it at all, and when that happens, TCP will request a re-send to be sure that all of the packets have been received [3]. Then, TCP reassembles the packets. The good thing is that we don't have to worry about all of those things. TCP makes it all happen reliably.

III.DEVELOPMENT OF THE CODE

There are two steps in the development of code for the program. Acquisition of the signal and transmission of the signal through TCP/IP protocol. The signal is being acquired with the help of Data Acquisition card, which is further processed digitally through LabVIEW. The signal is filtered to remove the noise level present during the acquisition. Since the acquired signal is of Dynamic data type, it has to be converted into either Numeric or String in order to be transmitted through TCP/IP. So first we are converting the dynamic data into a single dimensional array by casting it with the string data type by flattening and un-flattening [4]. The next step is to specify the length of the data to be transmitted through TCP/IP write. Once the length is specified, it will allot the same number of packets for the data. Transmission time depends on the number of the packets to be sent and to be received. Allotting the correct number of packets ensures the proper delivery of the data to the desired location without loss.

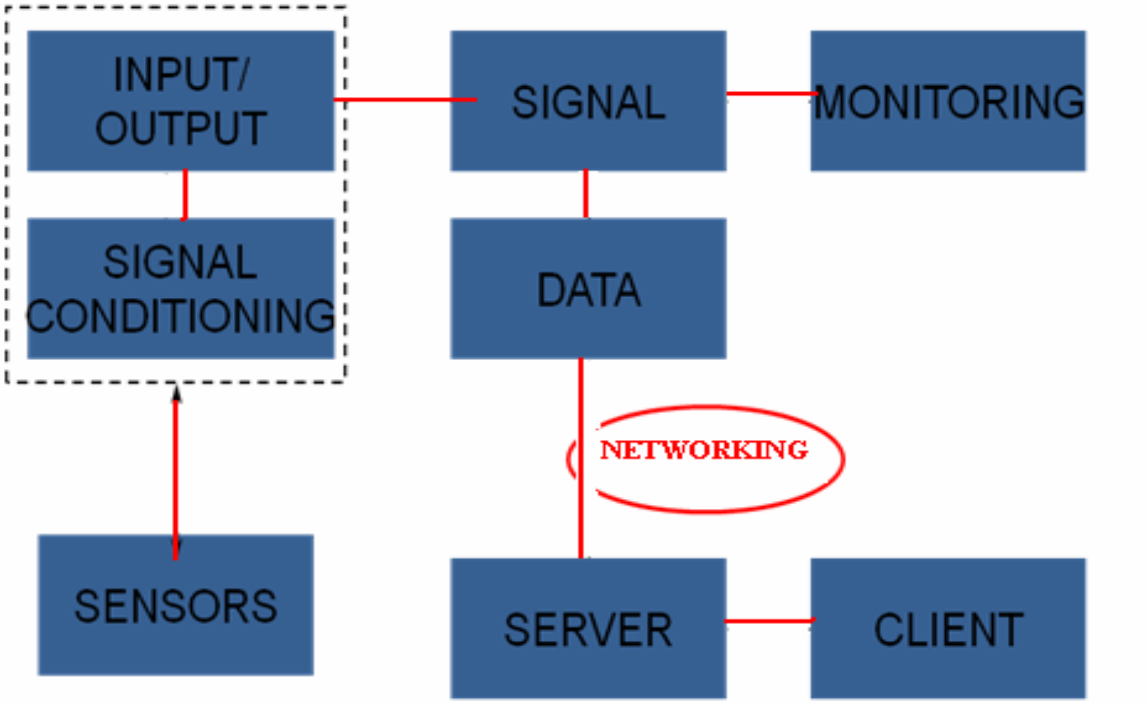

Fig.1. Block Diagram of Server & Client Network

A. Building of the Server Platform

The transmission begins with the “TCP Listen.vi” where the user has to specify the desired port address on which the signal has to be transmitted. Then the “TCP Write.vi” transmits the data in the packets which was previously allotted it. At the end of successful transmission of all the packets, the connection will be closed by “TCP Close Connection.vi”. The server platform consists of three types of signal original signal, detrended signal and filtered signal. Wavelet transform is applied in order to remove the base line noise. After applying wavelet transform detrended signal is obtained. The detrended signal is given to the digital filtered signal is send through the communication channel. The port address is entered in order to assure that signal is being sent

to the right place. The signal transmission can be stopped by using the stop button [6] .

B. Building of the Client Platform

The "TCP Open Connection.vi" opens a connection at the specified port in the remote address given. The remote address is the IP address of the main server. Then the data will be read by the "TCP Read.vi" in specified number of bytes every time. Now the received data has to be unflattened in order to convert it into its original form. This task is performed using the
"Typecast" block. The output of the Typecast is one dimensional array [7] . But in order for the feature extraction to be performed for the received signal, it has been in its original form of dynamic data. This is been done by the "convert to Dynamic data.vi". Once all the packets are received successfully, the "TCP Close Connection.vi" terminates the connection at the client side. At the client platform report is generated which contains all types of information including patient's name ,age, sex & ECG waveform .The front panel shows the port address from where it is receiving the signal.There is provision to stop the receiving of data.

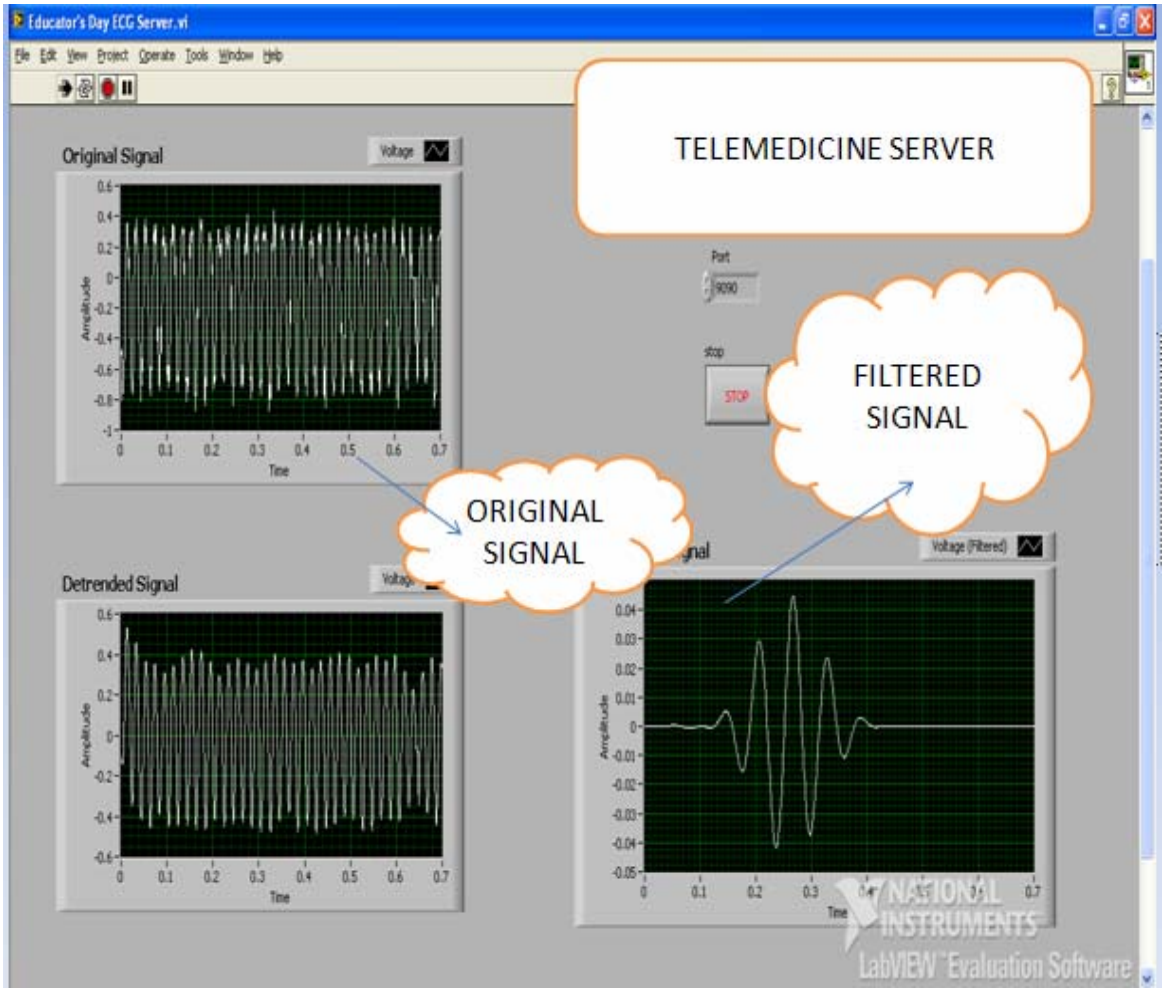

Fig. 2 TCP/IP SERVER built in LabVIEW

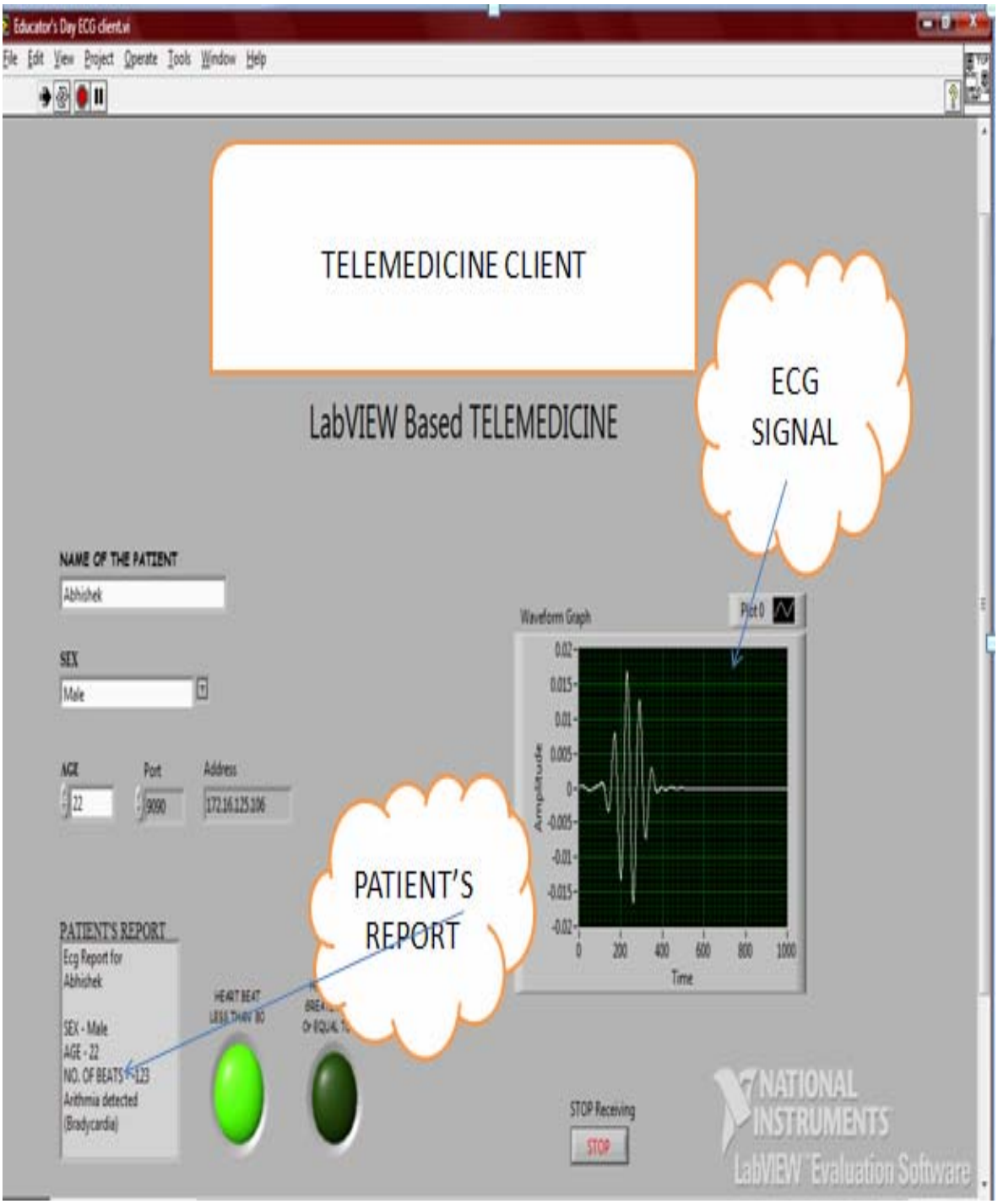

Fig. 3 TCP/IP CLIENT built in LabVIEW

There may be situations when the connection is not successfully established due to the unavailability of the client or error in the specified address or port. So, if the connection is not established properly, the "Error to Warning.vi" will pop-up an error signal depending upon the error codes [8] .

IV. RESULT

Communication protocol breaks the information into smaller pieces & sends it electronically through various networks. One of the biggest advantages of TCP/IP protocol is that it is fast and reliable. The information that is sent through them is also secured due to the high level of encryption. This health informatics system is

required especially for the hospitals where proper diagnosis to report generation has to be done using a single platform. Several physiologic data and Digital images can be transmitted more rapidly and easily than conventional images through this protocol.

V. CONCLUSION

Use of Network & Virtual Bio-instrument will enable people from various areas to get clinical advice from doctors across the country and it will also help in providing modern health care facilities to rural places. It can be brought as a product for health management systems. This Health information system will be playing a vital role in setting up Telemedicine centre for inaccessible areas. Expert physicians in tertiary care centers can view a digital image and advice local physicians on the best plan of care without having to move the patient many miles away. Easy and regular self check up for senior citizens, who cannot visit the clinic regularly. Since TCP/IP protocol enables Online Monitoring of Physiological data. Especially in LabVIEW's communication toolkit, both TCP/IP and UDP protocols are available, but the preference is given to the TCP/IP protocol for the simplicity and capacity of receiving the data fully without transmission losses.

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REFERENCES

[1] C. C. Venturini and S.M.Mazuk "Astronomical Instrument Control Using LabVIEW and TCP/IP" Space Science Applications Laboratory Operations

[2] Zhan-feng Gao, Yan-liang Du, Mu-biao Su, Biaoping Chen "Network Sensor and Its Application in Structure Health Monitoring System" First International Conference on Innovative Computing, Information and Control - Volume I (ICICIC'06), ISBN: 0-7695-2616-0

[3] P.W. Tse, L.S. He, Web and virtual instrument based machine remote sensing monitoring and fault diagnostic system, ASME-DETC2001, in: Proceedings of 18th Biennial Conference on Mechanical Vibration and Noise, DETC2001/VIB21648, 2001.

[4] "Delivery of medical multimedia contents through the TCP/IP network using", Computer Methods and Programs in Biomedicine, Volume 70, Issue 3, Page 253

[5] S.Hau, M.Law, J.Documet "International Internet-2 performance and automatic tuning protocol for medical imaging applications" Computerized Medical Imaging and Graphics, Volume 29,Issue 2, Pages 103-114

[6] Patricia Tidmarsh, Joseph Cummings, William R Hersh, Charles P. Friedman "Distributed Medical Informatics Education Using Internet2" Proceedings of the AMIA 2002 Annual Symposium, Page 787

[7] Jon B. Olansen, Eric Rosow "Virtual Bio-Instrumentation: Biomedical, Clinical, and Healthcare Applications in LabVIEW" Published Dec 18, 2001 by Prentice Hall,ISBN-10: 0-13-065216-4

[8] Yousef Jasemian1, Lars Arendt Nielsen1 "Design and implementation of a telemedicine system using Bluetooth protocol and GSM/GPRS network, for real time remote patient monitoring" Journal of Technology and Health Care, Volume 13, Number 3/2005, ISSN-0928-7329 (Print) 1878-7401 (Online)