LUMPED CONTROL VIRTUAL INSTRUMENTATION FOR BIOMEDICAL APPLICATIONS

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ABSTRACT

Virtual instrumentation can be used to acquire and store the sensed or measured data and centrally monitor a biomedical phenomenon. The integration of Local Area Network will facilitate the central recording and monitoring of data acquired through VI from different locations at a remotely located control server. The papers proposes implementation of intelligent instrumentation for determining measurand signals of biomedical applications and LAN technique for recording (data mining) and monitoring the measurand, and utilize the recorded data for providing a remote-controlled treatment or remedy or intimate the specialist to prescribe the correct treatment round the clock. A number of virtual instruments can be connected through LAN, with each other and also with the (server) main station where the data from each instrument is received, and report generated by the secondary virtual instruments is analyzed and the prescriptive measures are supervised and controlled.

Keywords: Biomedical application, Measurand, Virtual Instrumentation (VI), Local Area Network (LAN).

I INTRODUCTION

The development of modern electronics, computer technology and digital communication paved the innovative way for researchers make use of new technologies to harness and process the signal like ECG, EEG. Virtual instrumentation (VI) technology is a novel method based on computer signal detection and analysis and its presence along with LAN communication to receive and send the signals and reports accordingly can open the way for revolution in biomedical VI technology by connecting the stations situated at remote locations to the main station at hospitals present at developed areas.

1.1 Block Diagram

The basic block diagram consists of a sensor, signal processing system, multiplexer, temporarily storage system which consists of a buffer and a watch dog timer, a DAQ card which is connected to a secondary system. Then this secondary system is connected to a main station through LAN. A secondary standby wireless connection is provided in case the primary LAN communication system breaks down.

Sensor converts physical signals into electrical signal which can be read by signal processing system. Signal processing system amplifies and filters the incoming signal from sensors. The treated signal is passed through a multiplexer which enables the selection of one of the inputs out of the different available biomedical parameters, with the help of select lines. Before giving input to DAQ card, it is stored in a temporarily storage system (buffer). In case of failure of secondary virtual system, it provides a bypass network to main system server. The DAQ card is connected to a computer system which generates a report which is sent to main system by using LAN or if required, Wide Area Network technique. Main system analyzes the report and gives command to secondary system accordingly.

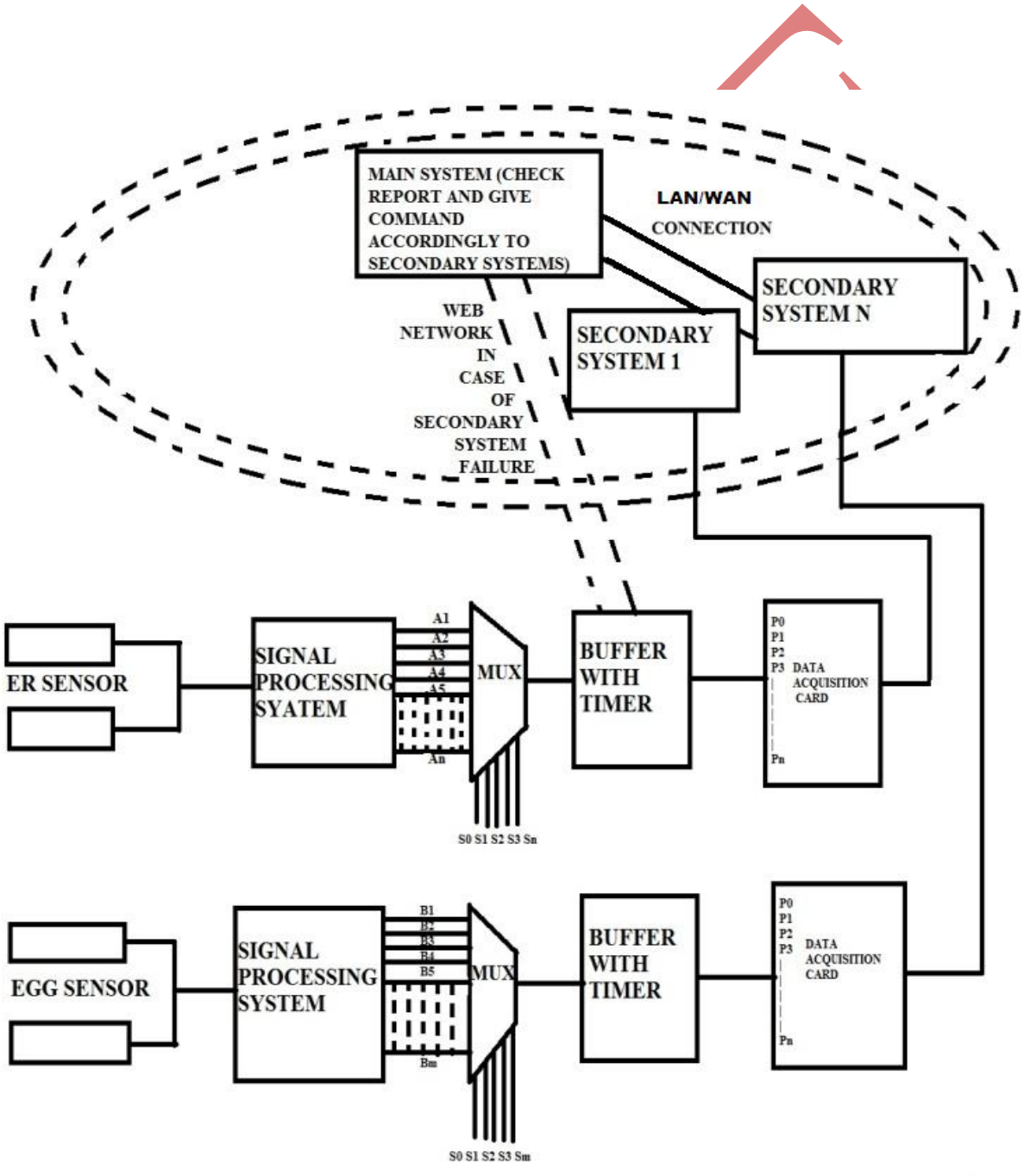

Fig 1: Block diagram

1.2 Software

There are many software packages available for the acquisition and display of electrical signals. Of these packages LabView, by National Instruments, is one of the most popular and powerful available tools. Acquisition of signals can be handled through built in procedure and LabView's ability to easily create a user interface. Analysis of the signal received can be readily performed by ready-made procedures which can be obtained through Virtual Instruments (VIs) of LabView. LabView provides a clear and easy-to-use method for obtaining, analyzing and displaying the signal desired. LAN Technology plays an increasingly important role in our technology society. We carry equipments for LAN/ WAN setup from manufactures such as CISCO, SMC networks, Motorola etc. WAN network is used to connect computers and other communication devices using public or private connections. So by using the private networks WAN, in which the whole network is dedicated to biomedical purposes, we can develop the system as per our requirements.

II METHODOLOGY

The electrical signal produced by the sensor is in millivolt range due to which it is conditioned before sending to the DAQ card. A buffer for temporary storage along with a watch dog timer having time period equal to the total time taken by the DAQ to acknowledge the buffer and some extra predefined time, is placed between the signal conditioning system and the DAQ card. Combination of both avoids the failure of whole system, which is caused due to failure of one of the secondary systems, by itself setting up a web connection with main server, when timer reaches to zero.

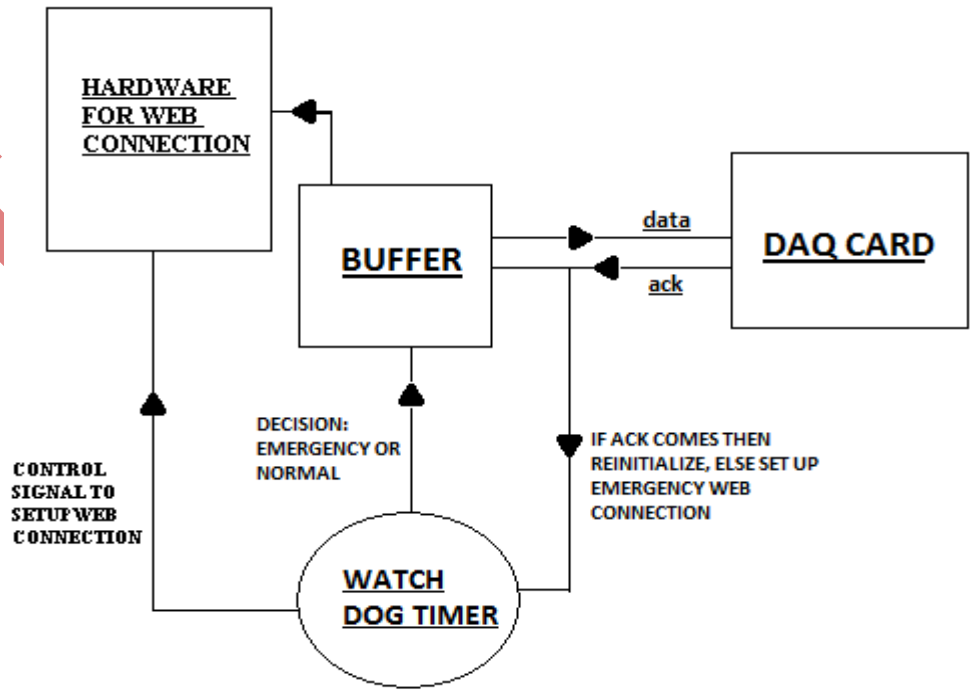

Fig2: Working of Timer and Buffer

NI VXI-PXI is the DAQ card used to connect the PXI system directly to the VXI bus using high speed MXI-2 link. A PXI system thus operates as though it were plugged directly into a VXI backplane, giving external VXI system the capability of an embedded VXI computer. DAQ card is connected to system and provides the interface. The secondary system generates the report according to the input of DAQ and sends it to the main server through LAN/ WAN designed especially for the biomedical purposes. Dedicated data line delivers high-speed bandwidth over great distances with reliability, efficiency, and without interruption. Trango's long range fixed wireless broadband equipment is also a solution if we opt for Wireless Wide Area Network (WWAN) and Wireless Local Area Network (WLAN) applications. Trango outdoor wireless networking solutions allow quick, easy, and cost effective deploy reliable, high-speed, secure wireless IP connections between multiple remote locations at distances up to 45 miles, and enables elimination of costly leased lines and avoid expensive time consuming fiber trenching.

Trango WWAN equipment is available in licensed wireless and license-exempt frequencies to provide many choices and ultimate flexibility during building of an outdoor network. WWAN applications are endless for Trango long-range wireless Ethernet bridges. It may use to establish a secure link to a clinic from urban to rural areas so that doctors may securely exchange patient information over a high-speed connection. Trango long-range wireless wide area network solutions are well suited for a wide variety of biomedical applications because they deliver high-capacity bandwidth, are extremely reliable, highly secure, and can be established with minimal effort and cost. Trango's high-performance, enterprise and carrier-class solutions consistently provide a level of network reliability and manageability demanded by network professionals.

III CONCLUSION

We are designing a greater insight in the design of virtual instrument through wired LAN to measure biomedical responses and simulate the various activities of the body and generate the report accordingly at a remote location. The inclusion of Digital communication technology in the Virtual Instrumentation for biomedical applications not only enhances its performance, reliability and speed but also broadens the use of Virtual Instrumentation in the biomedical field. It connects the rural area to main city hospital thus, decreasing the death rate as well as costing especially in developing and underdeveloped nations. By increasing the level we can connect all the hospitals through a government-authorized WWAN designed especially for biomedical purposes, thereby enabling web monitoring, controlling and sharing of remotely located resources. The application can be extended with use of Zigbee networks coupled with LabVIEW or Lab Windows CVI.

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