Tanmay D. Bangalorekar, Dr. M.S.Panse, Ajay Khandare / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 3, Issue 1, January -February 2013, pp.1690-1693

Communication of Ionosonde system with a PC using LabVIEW for Hexadecimal data and comparison between Hexadecimal and ASCII modes

Tanmay D. Bangalorekar*, Dr. M.S.Panse, Ajay Khandare*****

* (M.Tech. Electronics student, V.J.T.I. College, Mumbai, India)
** (H.O.D., Electrical department, VJTI college, Mumbai, India)
*** (IMSD Dept, SAMEER, IIT Campus, Mumbai, India)

ABSTRACT

Ionosonde is a RADAR system used to study the Ionosphere of the earth. The data collected by the Ionosonde must be transferred to a PC for analysis. This communication is done using TCP/IP protocol with hexadecimal data format. LabVIEW program is used to communicate with the Ionosonde system. LabVIEW, by default, uses ASCII format for data communication over internet. Hexadecimal data format is required in various data processing applications. To communicate hexadecimal data over internet, certain conversion steps are needed. This paper examines the way to communicate hexadecimal data over internet using LabVIEW. Further a comparison is also made between the hexadecimal data communication and ASCII data communication over the internet using LabVIEW.

Keywords - ASCII, Hexadecimal, Internet, Ionosonde, LabVIEW, TCP/IP

I. INTRODUCTION

The Ionosonde is a stand-alone system which uses radar technique to probe the Ionosphere. This system radiates pulsed electromagnetic radiation with carrier frequency in the range 1 – 20 MHz towards the sky. The received echo is subjected to the measurement of parameters like the amplitude, phase, Doppler frequency shift and polarization, as a function of the range. The parameters like critical frequency, virtual heights of ionospheric layers electron density profile are computed from these echoes. The other parameters like maximum usable frequency (MUF), skin distance etc can also be derived from the ionospheric observations in near real time

The DSP hardware system is developed for processing Ionosonde Radar Signals in real time. This system is having 4 signal processing boards and one mother board.

Motherboard generates the required transmit code signals with the help of DDS. These signals are fed to antenna to transmit into the space. The transmitted signals are reflected back from the ionosphere. An external signal conditioning sub-system (HF receiver) will receive these signals and amplify / band pass filter adaptively using suitable timing signals generated by the motherboard.

. Over all, the DSP hardware system is capable of receiving 8 analog inputs as 4 pairs of received echo signals in two polarizations each. The echo signals are received by the receiving antennae and these received signals are fed to the inputs of signal processing boards, where, these signals are digitized and digitally down converted (HF to base band). In-phase and Quadrature-phase signals are derived by using the digital down converter. This down converted data is sent to PC via mother board.

Mother board transfers the down converted data to PC via Ethernet interface.

The communication between the motherboard and computer uses hexadecimal data.

II. HEXADECIMAL AND ASCII FORMAT COMMUNICATION

Hexadecimal data is almost universally used in computing. It is a positional numeral system which has base 16. It uses symbols 0 to 9 and A to F. Each hexadecimal digit represents 4 bits. Its primary use is a human friendly representation of binary coded values in computing.

First advantage of hexadecimal data is that it can be used to write down very large integers in compact form. As the value of the number increases, the difference between lengths of hexadecimal representation and its decimal form becomes more pronounced. The most significant advantage is that the hex values are closely related to binary values.

Hexadecimal format communication is required when data is required to be sent to microprocessors of controllers for direct processing. If the data is intended to be displayed, then hexadecimal numbers tend to produce non-readable characters on the display. In that case, ASCII format is preferable.

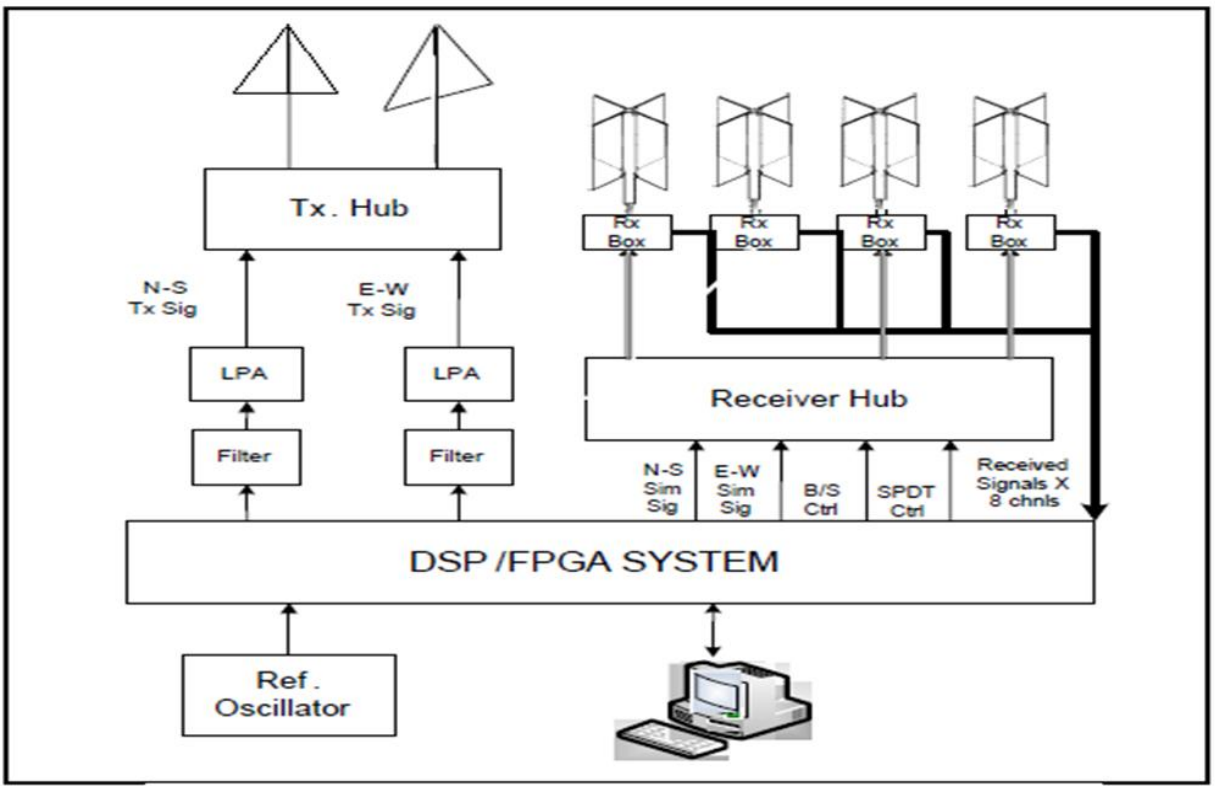

Figure 1: Block Diagram of the Ionosonde system

ASCII[1] is a character encoding scheme based on the English alphabet. Hence it can represent the different characters properly for purposes such as displaying on a screen. It is used to represent text in computers and other devices that use text. Most modern character encoding schemes are based on ASCII.

III. TCP/IP COMMUNICATION IN LABVIEW [2]

LabVIEW contains a set of functions related to TCP/IP for setting up internet communication. The architecture used in LabVIEW for internet communication is the Client-Server architecture. One terminal will act as the server terminal. This terminal generally provides data to the clients. Hence the server manages the centralized database. The clients can access the database through the server only. The server can also read data from the clients for storage in the database.

The client is a computer or a device which relies on the server for its data requirements. The client connects to the server via a network.

The communication is always initiated by the client. The server responds to the incoming requests. The link is then set up between the client and the server. The data is then transferred between the two.

The default format used by LabVIEW for TCP/IP communication is ASCII [3]. Hence if we directly write some data using the TCP Write function, then the data is transmitted in ASCII Format.

IV. HEXADECIMAL FORMAT COMMUNICATION [5]

For hexadecimal format communication, we are having the data to be transmitted already in hexadecimal format. But for transmission over internet, it must be in string form. So some conversion is needed.

First the data must be converted into an array form. In this array, each element contains a byte of data in hexadecimal format. This data can then be converted to string format. This is done using the "Byte to string converter" function. This data can now be transmitted over TCP/IP.

If the hexadecimal data is being read from a file stored on the computer, then it can be read using the Read spreadsheet function or Read text file function, as per the requirement. The data is then stored into an array and further processed as indicated above.

The block diagrams for client and server using hexadecimal data format are shown in this paper.

The Server uses the TCP Listen function and keeps waiting for an incoming request from a client. The client can then communicate with the server using the TCP Open connection function. The Server's IP address must be given to the client. Also the server and client must communicate on the same port.

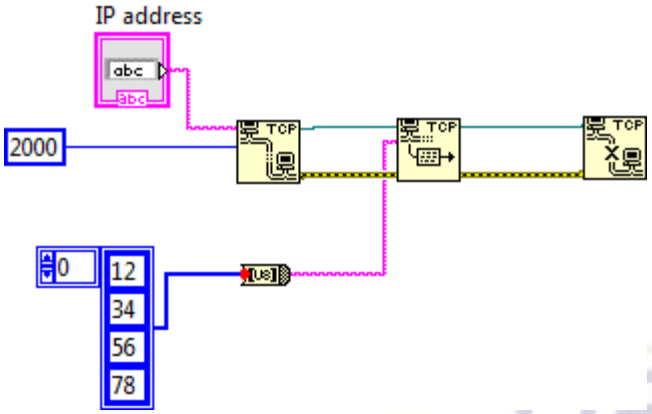

Figure 2: Client Block diagram for hex communication

The above figure shows the block diagram of a Client which is sending hexadecimal data over TCP network.
Similarly data is received over TCP/IP using the TCP read function. This data is again received in string format. Hence it must be converted. This is done using the "String to Byte converter" function.

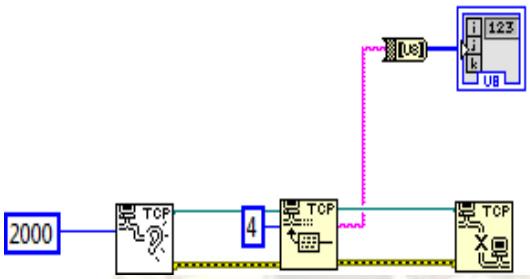

Figure 3: Server Block Diagram for hex communication

This is the block diagram of a server which receives the hexadecimal data from the client over internet.

V. COMPARISON OF HEXADECIMAL COMMUNICATION AND ASCII COMMUNICATION

As mentioned before, LabVIEW can directly send or receive ASCII data without need of any conversion. The block diagrams of client and server using ASCII communication is shown below:

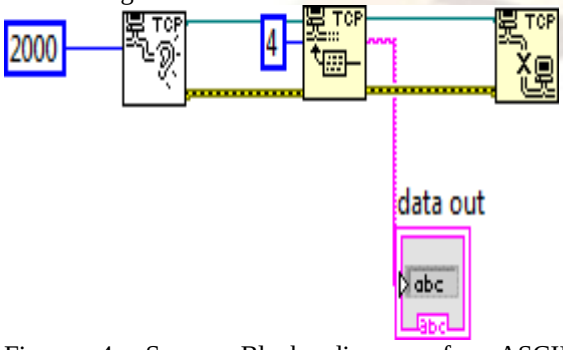

Figure 4: Server Block diagram for ASCII Communication

In hexadecimal transmission, there is an extra step of conversion.
The disadvantage of ASCII over hexadecimal communication is that ASCII will transmit the string one character at a time. Hence, if we want to transmit data "1234", then the characters will be transmitted one by one, i.e. four bytes will be transmitted. But in hexadecimal communication, the data 1234 will constitute only 2 bytes ie 1st byte: 12 and second byte 34. Hence the actual transmission time is shorter in hexadecimal communication. But due to the conversion step, the overall time required will be about the same for both formats.

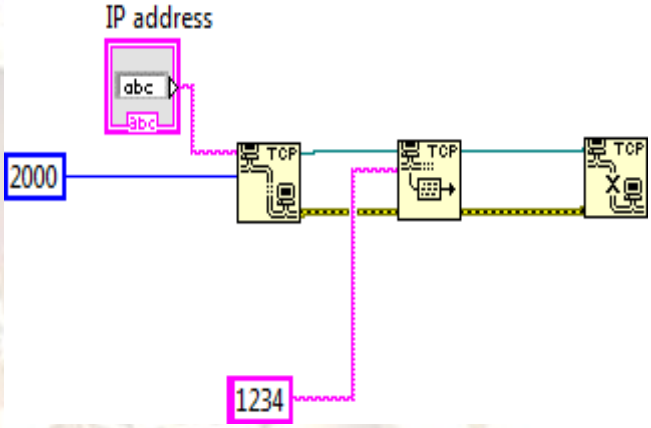

Figure 5: Client Block Diagram for ASCII communication

VI. CONCLUSION

By using Ionosonde system, important characteristics of the Ionosphere can be found. The study of these characteristics helps us to determine parameters of a signal to be transmitted, such as the frequency of the carrier, the transmitted power, the type of modulation, the angle of radiation, etc.. The Ionosonde motherboard can communicate with a computer system running LabVIEW using TCP/IP with hexadecimal data format.

Both hexadecimal communication and ASCII communication have their own advantages and disadvantages. The format to be used will depend on the application. Hexadecimal communication is used when the data is to be sent to a processor for direct processing, whereas ASCII is preferred in cases where the data is to be displayed rather than processed. The hexadecimal communication requires an additional step of conversion, but time is made up in the actual transmission

REFERENCES

[1] R.S.Cahn, "ASCII protocol conversion revisited", *IEEE Journal on Selected Areas in Communications*, Jan 1990, vol 8, issue 1, pp 93-98
[2] A. Yazidi, "A Web-Based Remote Laboratory for Monitoring and Diagnosis",

IEEE Transactions on Industrial Electronics, Vol 58, Issue 10, Oct 2011, pp. 4950-4959

[3] P.Reddy, "Ethernet aggregation and transport infrastructure OAM and protection issues", *IEEE Communications Magazine*, Vol 47, Issue 2, Feb 2009, pp 152 – 159

[4] Decotignie, "Ethernet-Based Real-Time and Industrial Communications", *Proceedings of the IEEE, June 2005*,vol 93, issue 6, pp 1102-1117

[5] J.J.Shea, "Internet applications in LabVIEW", *IEEE Electrical Insulation Magazine*, Jan-Feb 2001, vol 17, issue 1

[6] Bingsheng Wu, "Remote Data Acquisition and Signal Processing System Based on LabVIEW", *ICMTMA '09*, April 2009, Vol 1, pp 308-3