

Development of Data Acquisition System using Xbee Modules and LabVIEW for Ion Beam Micromachining System

Prof. Ajinkya S. Rasal

Abstract: Ion beams are becoming increasingly important in miniaturization of semiconductor devices. When ion beam is focused to micron / submicron spot size, several processes takes place on the substrate at the same time. Ion beam interaction with the surface produces various phenomena such as sputtering of substrate material, ion implantation, secondary electron emission etc. By using heavy ions such as Ar, Kr, Xe one can create microstructures on substrate in a single step without having to go through several steps that are used in conventional semiconductor process technologies. Recently plasma based focused ion beam system has been developed in Variable Energy Cyclotron Centre, Kolkata. At present the entire system is controlled using conventional control system (using cables). The performance of the system is seriously affected by the EMI/EMC due to high noise from the RF generators, sparks from high voltage power supplies used in ion beam extraction section of Ion Beam Micromachining system.

In this paper, development of wireless control system within Personnel Area Network and few experimental results are presented.

Keywords: Xbee RF module, LabVIEW etc.

I INTRODUCTION

There are lots of troubling with cabling used in wired communication as cabling necessarily tethers equipment to fixed locations, thus reducing flexibility in equipment placement and reorganization. On the other hand Wireless communication has changed the dynamics of the working environment and workforce mobility.

The following part gives the brief introduction of the Xbee RF module and LabVIEW.

II. XBEE RF MODEM

XBee RF Modem from Digi International is a wireless transceiver. The XBee uses a fully implemented protocol for data communications that provides features needed for robust network communications in a wireless sensor network (WSN). Features such as addressing, acknowledgements and retries help ensure safe delivery of data to the intended node. The XBee also has additional features beyond data communications for use in monitoring and control of remote devices. Xbee RF module supports two types of command modes:

- AT command mode
- API command mode

III. LabVIEW

Virtual instrument is the software instrument which based on computer, and it is the product by combing instrument system with computer technology. It uses computer as key, and integrates the functions that instruments should have into computer. Eventually, it can realize all kinds of functions by means of computer. One of the most important concepts about virtual instrument is that Software is Instruments. Virtual instruments play the roles of computer entirely. And it has such advantages as easy structure, low cost, high measuring precision and people can develop the software by themselves. Lab VIEW is a kind of virtual instrument software developing tool which based on G Language (Graphics Language) which developed by NI Corporation. Usually, visual programming language environment, such as Visual C++, Visual Basic are also used to develop virtual instruments, but the programming are very difficult and complex. On the other hand, their developing periods are so long and it is not convenient to upgrade and maintain. LabVIEW can replace traditional program code only by means of icons, connecting lines and block diagram. So it has such advantages as easy learning, short developing period, humanistic and beautiful application program interface, and strong functions, which are especially for engineering technology personnel.

The programs of Lab VIEW are driven by data stream. The design of data stream prescribes that only when all inputs are effective, one object can be executed; and only when all functions are finished, its output can be effective. So, the executing sequences of LabVIEW are controlled by the data stream program between the connected block diagrams. It doesn't be restricted by serial execution which just likes text program. So, we can develop application program by interconnecting functional block diagrams rapidly and

Mr. Ajinkya Subhashrao Rasal is working as Asst. Professor in Department of E&TC, PICT, Pune (MH). Email: rasalajinkyas@gmail.com

compactly. Sometimes, there are many data channels can be even operated synchronously.

IV. CONTROL AND ACQUISITION OF DEVICES
 There are total four Xbee RF modules required to develop this system. Among that one which is the Coordinator is



Figure1. Block diagram of PAN network

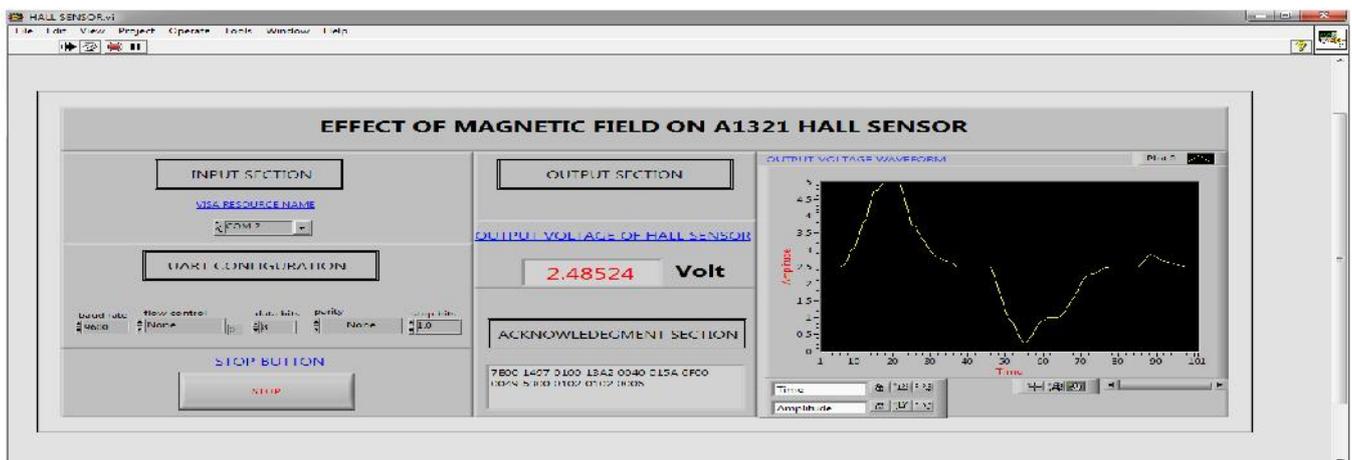


Figure2. Front panel of Hall sensor

connected to host PC on which the main LabVIEW program was running and remaining three end devices are connected to each one of the devices discussed below. Each Xbee RF module in the network have its unique 64-bit device address assigned by manufacturer and also, the PAN ID of all the Xbee module within PAN is identical.

A. Hall Sensor

Hall sensors are one of the best examples of Magnetic sensor. These are activated by an external magnetic field. It converts magnetic or magnetically encoded information into electrical signals for processing by electronic circuits. When the magnetic flux density around the sensor exceeds a certain preset threshold, the sensor detects it and generates an output voltage called the Hall Voltage V_H .

The aim of this chapter is to acquire the Hall sensor output remotely. For project i used A1321 Radiometric Linear Hall Effect Sensor. The A132X family of linear Hall-effect sensors are optimized, sensitive, and temperature stable. The main VI

of PAN network is shown in figure 1. Also the Front panel of Hall sensor VI is shown in figure 2.

B. BERTAN High Voltage Power Supply

The Bertan brand of 210 Series of 125 to 225 watt high voltage power supplies provide regulated high voltage outputs from 1 to 50kV. The low noise, linear topology employed results in extremely low output ripple specifications. The output high voltage of the Series 210 can be remotely programmed.

For project i have used BERTAN high voltage power supply model 210-10R with maximum output of 10kV and 150W Regulated DC Power Supply. Figure 3 shows Front panel of BERTAN 210-10R high voltage power supply.

C. SPELLMAN High Voltage Power Supply

The SPELLMAN'S MP Series has been designed as high performance dc to dc converters with output voltages up to 40kV. Each module provides well regulated, low ripple and

high stability high voltage in a highly versatile compact design, combining linear and switched mode techniques to minimize internal dissipation and generated EMI/RFI interference. The higher voltage modules are vacuum encapsulated to ensure corona free operation.

Here, for project i have used Spellman MP1.5N24 module, with high voltage dc-dc convertors designed to produce a high quality dc output for a very wide range of instrumentation and analytical applications. Maximum output voltage of MP1.5N24 module is 1.5 KVolt. The figure 4 shows Front panel of SPELLMAN high voltage power supply for output voltage.

V. CONCLUSEION

In the section IV, i have discussed controlling and acquisition of the devices and few experimental results.

The result shows that, it is possible to control and acquire the output of devices within PAN network remotely using Xbee RF modules and LabVIEW 2011. Such wireless system improves performance, efficiency and flexibility and reduces wiring costs, complexity compared to wired system.

VI. REFERENCES

- [1] "A Comparative Study of Wireless Protocols: Bluetooth, UWB, Zigbee, and Wi-Fi", by Jin-Shyan Lee, Yu-Wei Su, and Chung-Chou Shen, The 33rd Annual Conference of the IEEE Industrial Electronics Society (IECON) Nov. 5-8, 2007.
- [2] "Application of Zigbee sensor network to data acquisition and monitoring", by Mitsugu Terada Department of Applied Physics, Faculty of Science, Fukuoka University, MEASUREMENT SCIENCE REVIEW, Volume 9, No. 6, 2009.
- [3] "Application of Virtual Instrumentation which Based on Lab VIEW in Electronic Measurement Technology Course", by Yujun Bao, Xiaoyan Jiang 2011 International Conference on Electronics and Optoelectronics (ICEOE 2011) 978-1-61284-276-9/111/IEEE.
- [4] www.ni.com
- [5] www.digi.com
- [6] "LabVIEW for engineers", by Ronald W. Larsen.



Author was born in Phaltan (Maharashtra), in 1987. He received the Bachelor of Engineering degrees in Electronics & communication from the Pune University, in 2009 and the Master of Technology degree in VLSI Design and Embedded System, in 2012. He has five months of industrial experience as a Research and Design engineer. Since June 2013, he has been an Assistant Professor with the Electronics Engineering Department, PICT, Pune. He is the co-author of one National Conference paper.