FIELD BUS INSTRUMENTATION TECHNOLOGY DEVELOPMENT AT HOUSTON, TEXAS AREA UNIVERSITIES AND COLLEGES.

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Abstract

The purpose of this paper is to discuss the Fieldbus foundation grant and development at Lee College, Baytown, Texas and the dissemination of this Fieldbus bus instrumentation technology to the University of Houston-Downtown, Brazosport College, San Jacinto College and other instrumentation technology programs.

Lee College in Baytown Texas has received a National Science Foundation grant to study Fieldbus instrumentation technology and develop courses in Fieldbus instrumentation technology. Lee College, a two-year college, is working with four-year schools in particular, with the University of Houston-Downtown to develop Fieldbus technology at all levels of higher education.

A Fieldbus technology workshop for educators from two-year and four-year colleges, and universities was held at Lee College during August 2001 and July 2002. Both technical and educational aspects were covered in each workshop.

Fieldbus technology networks all devices of an instrumentation system to each other and is truly an advanced distributed control system (DCS). Previous systems were called DCS but were not truly 100% distributed. The single twisted pair bus of the fieldbus system provides both power and information to each device. Because each device has the "smarts" provided by an implanted chip to perform both control and communication, it is possible to use software to choose the location and function of control and process blocks.

The Fieldbus technology system is entirely distributed. For example, PID control could be done at various device locations. Note that the process logic controller (PLC), personal computer (PC), and system software are also linked to the Fieldbus. Hardware devices are added to the Fieldbus using power conditioners and bus terminators.

The setup of each device and tagging is done through software in the PC. Each Fieldbus device has a unique serial number assigned by the manufacturer and a device type number that is assigned through standards, for example those of the fieldbus foundation.

A Fieldbus technology course has been proposed for the University of Houston - Downtown Control and Instrumentation Electronics Design program. The integrating of Fieldbus technology into existing courses has begun and is helping recruit students.

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The development and dissemination of instrumentation fieldbus technology to education was accomplished through various means.

First, the National Center for Digital and Fieldbus Technology (NCDFT) was established through a National Science Foundation (NSF) grant to Lee College a two-year college in Baytown, Texas. The center became a focal point of information. In addition, The NCDFT at Lee College became the primary force behind the dissemination of fieldbus technology to higher level education.

The NCDFT charter stated that it was an organization composed of instrumentation and controls technology educators, instrumentation providers and their businesses, industry and community advisors, cooperatively working toward common goals.

The objectives of the charter included development of job-based curriculum and training module units, and the dissemination of these materials to instructors at educational institutions.

The development of standards for control systems personnel was a priority goal of the charter. The charter also included the goal to develop widespread support from local, national, and international industry. The building of strong bonds between education, industry, community, and government was another goal in the charter, as was the sharing of resources that included materials, projects, staff and faculty, equipment and facilities, grants, and others.

The development of Fieldbus technology and its dissemination was also accomplished through workshops. The center presented Fieldbus workshops for educators during two summers. About twenty educators from two-year and four-year programs attended each of the workshops

The first summer (2001) workshop introduced Fieldbus technology in general. In addition, a roundtable discussion on development of courses in the subject was held. Ideas from the educators were received and a plan for future workshops, training, and credit courses was made.

The second workshop held the following summer (2002) was more technical and had an extensive hands-on lab.

Topics in the second summer workshop included an introduction and history of instrument signals, types of instrument signals, and benefits of Fieldbus instrumentation. Also discussed were the challenges, costs, and limitations of the technology. Technical details given included segment wiring, bus requirements, measurement elements, and electronics. Additional technical items included software files, function blocks, linking blocks, control loops, human machine interfaces (HMI's), graphical user interfaces (GUI's), and configurations.

Additionally, in the second summer workshop a comparison was made of the FOUNDATION ™ Fieldbus, PROFIBUS ™, and HART ™ systems.
Also, the impact on educators, training methods, and ways of obtaining manufacturers support were examined.

The extensive materials obtained from the workshops served as a basis for developing courses in the Fieldbus instrumentation technology. The workshops inspired the subject of Fieldbus instrumentation technology to be taught at a higher level as part of the Instruments and Transducers Course of the UH-Downtown four-year Control and Instrumentation Electronics Design program.

Another means that provided development and dissemination of Fieldbus technology was the formation of an instrumentation alliance between two-year colleges, four-year colleges and universities, and industry.

The Industrial Instrumentation and Controls Technology Alliance (IICTA) was formed to promote a standard set of courses for instrumentation technology. Included in this set of courses was Fieldbus instrumentation technology. The alliance set curriculum development goals for both two-year and four-year schools. The alliance formed committees one of which was charged with creating standards for instrumentation courses. These standards were made so that industry could have quality educated instrumentation personnel.

The alliance held meetings about once a quarter to discuss topics on education and training. The alliance developed a curriculum for instrumentation that included Fieldbus technology. Although the IICTA members were mostly from Texas and the surrounding states that included Oklahoma and Louisiana, the alliance also worked with educators and industrial professionals from as far away as Alaska. Before an instrumentation alliance was formed in Texas, another instrumentation alliance had been independently formed in the state of Alaska. The cooperation of both alliances helped each obtain experience from the other. This experience was passed on to the Texas area schools.

Other various means that provided the dissemination of fieldbus technology in a variety of ways, follow.

The Fieldbus technology center worked with institutions in both Canada and Singapore. The center recently held a series worldwide press conferences on Fieldbus technology.

Fieldbus technology information also was spread through the presentations of papers and reports. Papers and reports were presented to the U.S. Government in Washington, D.C. as part of the NSF grant and to other societies. These papers became part of the information available to both local Texas area schools and national educators.

The Instrumentation Systems and Automation Society (ISA) developed training courses in fieldbus technology. In addition, it published a fieldbus technology textbook by Jonas Berge. This textbook was used to incorporate fieldbus technology material into the UH-Downtown Instruments and Transducers course

Overview of Fieldbus Technology

Fieldbus technology uses digital communication for both the instrumentation and process control. It is designed to analyze and solve process control applications rather than just transfer digital data. It is an all-digital serial two-way communications system, which interconnects instrumentation equipment. Fieldbus is a local area network (LAN) of instrumentation devices. It has the intrinsic capability to distribute the control application across the entire network. The control strategy is distributed throughout the "smart" field devices and programmable logic controllers. This enables discrete and analog devices to work together.

An advantage of fieldbus technology is that there are fewer hardware pieces since the control is truly distributed. Fieldbus technology uses standard function blocks that perform typical automation functions. These familiar functions include analog inputs, analog outputs, and proportional, integral, and derivative control. Note that these function blocks are distributed throughout the system devices. In addition, because less equipment is needed in fieldbus technology than previous conventional systems, the amount of power supplies required is reduced.

Another advantage is that Fieldbus technology greatly reduces the amount of wiring required because the bus is simply a single twisted pair of wires. Fieldbus also reduces the amount of safety barriers and connection cabinets required for installation.

Fieldbus technology additionally has the advantage of obtaining data directly from all of its devices. In previous conventional instrumentation systems, data was often difficult to obtain. With the fieldbus system, the use of comprehensive digital signals for all its communications allows data from all the networked devices to be accessible to all the others. Because it uses digital signals to communicate, the Fieldbus system is robust. The digital signal data is transmitted in a manner that makes it less sensitive to distortion. The superiority of digital signals over analog signals results not only in higher accuracy, but also in greater reliability.

Finally, the fieldbus system is totally distributed. Note that its forerunner the distributed control system (DCS) was named as such because at the time it was less centralized than previous control systems. However, by present standards the DCS is considered relatively centralized and vulnerable to failure because each single failure often has widespread consequences.

Summary

In summary, Fieldbus technology appears to be defining the future of instrumentation technology. It is being disseminated at an increasing rate. When new process plants are built, more Fieldbus instrumentation technology systems are likely to be the choice. Through the Fieldbus center, the industry and college alliances, papers, textbooks, credit courses, and training, technology educators are moving to meet the present and future educational requirements of instrumentation technology.

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