INTEGRATING TECHNICAL INNOVATION AND DESIGN INTO THE ENGINEERING AND ENGINEERING TECHNOLOGY CURRICULUM

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Abstract — *Examples are presented here on how several schools are meeting the challenges of integrating technical innovation and design into the engineering and engineering technology curriculum. Georgia Southern University is developing a compact instrument (permeameter) that will measure the coefficient of permeability of soil based on the water content and dry-unit weight of the soil. At Wentworth Institute of Technology an application has been developed where multiple Melexis MLX90614 infrared temperature sensors are transformed into wireless sensors via a hybrid-connection to a Texas Instrument ezMSP430-rf2500 microprocessor. And at Yeditepe University in Turkey and Texas A&M University in the United States the authors explore the issues of design of business process management systems from a cognitive systems perspective.*

Index Terms — clay liners, dry unit weight, hydraulic conductivity, permeability, water content, wireless, curriculum, microprocessor, serial communication, SMBus, sensors, smart sensors, cognitive system design, business process management

DEVELOPMENT OF A COMPACT PERMEAMETER TO MEASURE THE HYDRAULIC CONDUCTIVITY OF CLAY LINERS BASED ON THE WATER CONTENT AND THE DRY UNIT WEIGHT OF THE COMPACTED CLAY

The permeability (hydraulic conductivity) of clay liners depends on several interrelated factors. As a result, it has been difficult to develop simple equations and/or methods to determine the permeability of a soil, and for this matter, clay. It is proposed to develop a compact instrument (permeameter) that will measure the coefficient of permeability of soil based on the water content and dry-unit weight of the soil. The water content and dry-unit weight were selected using regression analysis on a data bank of several soil properties, including water content, dry-unit weight and lab- measured hydraulic conductivity, published in a refereed journal. The selection was also proved by using existing hydrologic theories, such as, Poiseuille's equation and the established interrelations of the factors influencing the flow of water in a soil. The proposed instrument will be portable and smaller than current equipment. It will measure permeability faster than the current methods and equipment used in the laboratory or the field with equal consistency and accuracy. As a compact permeameter, it will be more advantageous in the field because it will be easier to carry. [1]

INTEGRATING WIRELESS SENSORS USING A HYBRID INTERFACE ON A TEXAS INSTRUMENT EZMSP430-RF2500 MICROPROCESSOR INTO THE CURRICULUM

Universities and colleges are faced with an increasingly complicated technology base that hinders curriculum development because the tools at reasonable cost are not available to teach the principles that are the basis for this new technology. An application is discussed where multiple Melexis MLX90614 infrared temperature sensors are transformed into wireless sensors via a hybrid-connection to a Texas Instrument ezMSP430-rf2500 microprocessor. The hybrid interface solves a problem that allows the sensors which use SMBus two-wire serial protocol to communicate with the MSP430 remote unit that use an I^2C 2-wire serial protocol without any additional hardware. Because the protocols are different, the devices were not able to communicate natively. The methodology for resolving this problem involved modification to the software code operating the I^2C hardware so that SMBus data packets were accepted at the remote unit. The information is then transmitted to the base unit and display on a computer screen by making modification to the example code shipped with the units. The project successfully collected data from the remote infrared temperature sensors. This application will be of interest to the global community because of the low cost of the wireless microprocessors and the temperature sensors. A methodology is demonstrated for successful strategies and practices for integrating wireless communication into the curriculum at a cost that is significantly less than a new textbook. [2]

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COGNITIVE SYSTEM DESIGN AND BUSINESS PROCESS MANAGEMENT

The aim here is to explore some of the important issues involved in the design of business process management (BPM) systems from a cognitive systems perspective. BPM is viewed as a socio-technical construct where Cognitive Systems Engineering (CSE) serves as a guiding framework for design. The design process is centered on Joint Cognitive Systems (JCS) paradigm, which is relatively new, compared to the classical Information Processing Systems (IPS) paradigm. The potential benefits offered by the JCS in the design of human-machine systems will be elaborated, and design for simplicity and design for complexity will be contrasted as alternative approaches. Design for complexity is suggested as a more promising approach for designing BPM systems.

Business process management (BPM) has become quite an important aspect of modern management recently. The number of publications in the area and applications in industry seem to be increasing rapidly. In literature, the treatment of business processes can be categorized roughly into three groups. The first and probably the most popular one is to view business processes as structured processes, similar to production processes, with inputs and outputs. This linear view tends to oversimplify the social realities and the complexity involved in business processes. This approach is usually associated with the information processing (IPS) paradigm. The second view may be summarized as seeing the whole exercise as methodologies for achieving specified business goals. These solutions appear to be fragmented and isolated. The third view is the socio-technical perspective where the processes involved are seen as complex socio-technical constructs.

The theme here is based on this new paradigm. Firstly, an overview of the CSE framework, the IPS paradigm, and the JCS paradigm is given. This section also includes a comparative view of the two paradigms. Following the overview, the important issues involved in the design of BPM as an STS through the CSE framework and the JCS paradigm are discussed. Here, *design for simplicity* and *design for complexity* approaches are contrasted, and the reasons for recommending the latter approach are explained. The conclusion summarizes the major points of the study [3]

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