

Innovative CS Capstone Projects on Green Energy Applications with WSN in a Box

Chia-Tien Dan Lo, Kai Qian

Computing Science and Software Engineering

Southern Polytechnic State University

{clo, kqian}@spsu.edu

Li Yang

Department of Computer Science

University of Tennessee at Chattanooga

li-yang@utc.edu

ABSTRACT

Green computing has become an important subject due to global warming caused by man-made greenhouse gas emissions. While green computing is an active research area, it is still of infancy in computer science (CS) education. In this regard, we propose to bring green computing into CS capstone curriculum. This integration culminates in a portable and affordable platform, a portable Wireless Sensor Network (WSN) in a Box (WinBox) with emerging ZigBee wireless technology. Both instructors and students benefit from this innovation. It allows an instructor to sponsor a realistic, significant, and feasible semester-long project. It provides students a challenge to integrate their learnt principles and theories to analyze, design, implement a product-oriented project creatively. Students are well prepared for the professional workforce by gaining hands-on experience from developing a real-world product. Our publicly accessible “learning by doing” pedagogical model promotes lifelong learning.

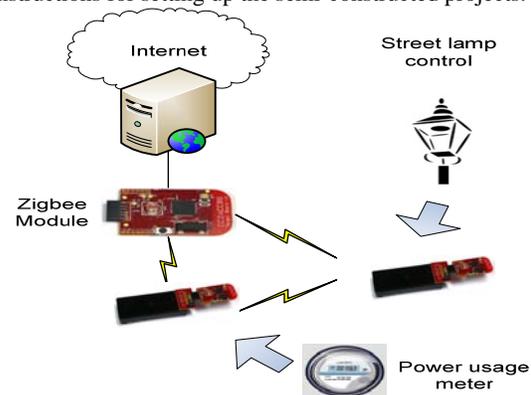
1. Green Computing on CS Capstone Projects

Green computing has become an urgent topic that deserves a space in CS capstone education. Over the years, many efforts have been made in improving and enhancing the effectiveness of CS capstone curriculum by integrating cutting edge technology into capstone projects. CS graduates need to keep up the latest technology and skills in the rapid advances in both hardware and software co-design development. Emerging ZigBee based Wireless Sensor Network (WSN) technology has a great potential in a green energy computing environment such as power consumption control applications by automatic meter reading as shown in the figure. This project allows students to develop products that precisely monitor power consumption, make power usage patterns on-line for people to analyze and control to maximize power efficiency, and detect the possible waste of energy by a web-enabled wireless distributed network of smart sensor meters.

Students complete the project following the software development life cycle (SDLC) milestones. This project involves a wide range of CS and computer engineering curriculum components including programming, operating systems, microcontroller architecture, database, networking and wireless communication, web server technology, software engineering, and basic electrical engineering. Since the project is developed on a portable (USB memory key size) and inexpensive (textbook price) ZigBee WinBox toolkit, students

will be able to develop a variety of green computing projects, and participate in national green computing design competitions to demonstrate their creativity and innovation in their ideas.

Students not only gain hands-on experience on hardware/software co-design of a real-world project, and broaden their knowledge and working skills, but also have opportunities to design and develop their own embedded applications on smart embedded devices. A class survey shows that students highly appreciate the “learning by doing” approach and are excited about the hands-on project completed on the portable toolkit in a box. Project supporting materials are available on-line at (<http://cse.spsu.edu/clo/winbox>). So students can easily get access to the materials for their project. Also included in the website are lab modules, and tutorials for green computing. One of the project’s goals in promoting lifelong learning can be realized via these lab modules and step-by-step instructions for setting up the semi-constructed projects.



The proposed innovative approach for the senior capstone course is unique in

- (1) infusing CS core curriculum with green computing via well structured hands-on activities,
- (2) making lab intensive curriculum feasible at a minimal cost by using the portable WinBox, and
- (3) providing self-learning for both students and instructors.

With the success of the capstone course based on the WinBox, we plan to expand this pedagogical model to other CS core curriculum such as computer architecture, operating system, computer network, and embedded systems.

ACKNOWLEDGMENT

The work is partially supported by the National Science Foundation under award: DUE-0942097. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Copyright is held by the author/owner(s).

ITiCSE'10, June 26–30, 2010, Bikent, Ankara, Turkey.

ACM 978-1-60558-820-9/10/06.