



VIRGINIA MOUNTAIN SECTION NEWSLETTER

IEEE Region 3, Council 09, Section 65

February 2008

Thursday, February 21, Holiday Inn Hotel Roanoke Airport

Student Paper Contest

**Presentation of Papers by Undergraduate Students
from Virginia Tech and VMI on**

***Automatic Generation of Multi-Threaded Embedded Control Software
for Multi-Core Processors***

Design of a Controller for Fuzzy Logic Control of a Robot Arm

Date: Thursday February 21, 2008
Social: 6:30 PM
Dinner: 7:00 PM
Talks: 8:00PM
Cost: Member or Guest \$20.00
Student \$10.00

Reserve by **5 PM Monday Feb. 18**
Dr. Wilbur Dale (540) 464-7547
[mail to:dalewn@vmi.edu](mailto:dalewn@vmi.edu)
Please specify number of attendees.

**Directions to
Holiday Inn Hotel Roanoke Airport**
2727 Ferndale Drive NW
I581 Exit 3 Hershberger Rd West
1st Rt. onto Ordway Drive,
¼ mile, Rt. Into Parking Lot.

Automatic Generation of Multi-Threaded Embedded Control Software for Multi-Core Processors
*Frank Calise and Jay Modi,
Virginia Tech*

Embedded control is common in most of our daily life electronics including DVD players, building heating and cooling systems, drive-by-wire automotive

control of cars, and avionics control of airplanes, among many others. Due to the rising demand for the automation provided by such systems, the embedded hardware and software systems is becoming increasingly complex, and performance requirements are also increasing. Hardware vendors are providing multi-core processors which imply increased opportunities for parallel computing. The multi-threading model for software provides an opportunity to exploit concurrency in the control tasks in the embedded software allowing concurrent tasks to be run on the multiple cores.

Embedded control software design is not an easy task, because such software interacts with the environment in which the system is embedded. This interaction is often asynchronous in nature. The asynchronously arriving stimuli from the environment have to be processed fast enough so that the next arriving stimuli from the same environmental sensors are not missed while processing the previous set of stimuli. Designing such software requires very subtle

balance of timeliness of processing, scheduling of reading the environment stimuli, and producing outputs fast enough to activate the control signals.

Synchronous programming languages assume that computation and communication between the various parts of the software takes no time, and the only time passing activity is the stimuli generation by the environment. Since computers are fast, and environment is typically an analog domain, such assumptions are often justifiable, provided two consecutive stimuli do not come within the time when the computation and output signal generation based on one set of stimuli is happening. Multi-threaded software generation is more complex owing to the need for correct synchronization of the multiple threads. In this undergraduate research work we have been investigating the use of a French synchronous programming language (SIGNAL) for sequential software generation in a novel way to generate multi-threaded code.

To verify that this method actually works, we have examined a Simulink model for an essential part of the control system of an Unmanned Aerial Vehicle (UAV) that presently has a concurrency problem. This problem is corrected by the new method of multi-threaded code generation. Although additional experiments using other models are needed, we believe our method could be successfully used to engineer better embedded control systems which conform to the concurrency requirements of high performance embedded systems.

Frank Calise is a senior Computer Engineering major from Long Island, NY. He expects to graduate in May 2008 and work full-time.

Jay Modi is a senior Computer Engineering major with a minor in Mathematics, and is from Oakwood, VA. He expects to graduate in May 2008. After graduating, he plans to work for Lockheed Martin.

Messrs. Calise and Modi have both been working at the FERMAT Lab at Virginia Tech since September 2007

Design of a Controller for Fuzzy Logic Control of a Robot Arm

Jonathan Ostermann, VMI

This project involves the modification to a robotic arm and redesign of its control system. The old power and control equipment in the control box was damaged and had to be replaced. Using this as an opportunity, it was decided that the new controller would be implemented using a network of microcontrollers which are to be programmed to implement a fuzzy logic controller.

The majority of the project has been the design of the controller's hardware. Each part of the robot, such as each of the five degrees of freedom, the gripper, brake, as well as human interfaces required a control system. The first part of the

project was the design of the gripper motor controller.

Next, the layout for the five degrees of freedom was chosen. Each degree of freedom will be controlled by a single ATmega8 microcontroller. The microcontroller will drive the motor controller via pulse-width modulation as well as read the output from a quadrature axis encoder. All the ATmega8 microcontrollers will be controlled by a single ATmega128 communicating on a I²C network. The ATmega128 will also control the human interface on the front of the controller, the gripper motor, the robot brakes, and will communicate with a desk-top computer via a USB connection.

Presently, we are in the process of laying out the printed circuit board for the main control board. This is where each of the ATmega8s and the ATmega128 will be installed. After that each of the microcontrollers will have to be programmed, implementing the fuzzy logic control at each level.

Jonathan Ostermann is a senior at the Virginia Military Institute, from Daleville Virginia, and is majoring in Electrical and Computer Engineering. Jonathan is active in the Regimental Band as well as the Marathon Club. He is on a full scholarship from the US NAVY and once commissioned will attend Nuclear Power School in Charleston, South Carolina.

IT Worker Shortage and the Indian Connection

Is there an Information Technology (IT) Worker Shortage in the U.S.?

If so, is increasing the number of allowed H-1B visas the answer?

Are there quality issues in the growth of IT workers in India?

An Indian billionaire argues U.S. must address IT worker shortage, and a Virginia Tech Computer Engineering Professor, Sandeep Shukla, provides

some alternative thoughts on these questions.

The Atlanta Business Journal (2/4, Rubner) reports, "Azim Premji, an Indian entrepreneur who became one of the richest men in the world transforming a small cooking oil business into a global information technology powerhouse," said the U.S. must "better address the country's growing shortage of high-tech professionals." Premji, the CEO of the Bangalore-based Wipro Ltd., said, "America does not have the talent. There's a huge shortage of IT professionals here" in the U.S. That is evident by "the growing demand for H-1B visas, which allow foreigners to temporarily live here to fulfill specialty jobs, usually in technology." According to the Journal, "Premji has advocated that a cap on the number of H-1B visas allowed in the country hurts American competitiveness. But he also says the high-tech industry here needs to proselytize more to students about the benefits of computing jobs." Premji pointed out that "[o]ne problem technology leadership needs to address with students is the stigma that it's futile to study for a high-tech career because all the jobs are going overseas to India." Another problem, according to Premji, "is that too many Americans and Europeans find high-tech and math courses boring or too difficult."

Sandeep Shukla, Chair of the of the IEEE-VMS Computer Society Chapter, and Associate Professor of Computer Engineering and Director of the FERMAT Laboratory at Virginia Tech, provided the following reaction to the Premji comments.

"It is true that there is a shortage of IT workers in the U.S., at least partially due to lack of student interest. However, that does not mean that increasing H1-B visas will solve the problem. There are several issues. India itself now has a shortage of IT workers, particularly top quality IT workers. With the outsourcing boom, many new private

Colleges in India, awarding CS and IT degrees, have been started. They produce IT workers of limited quality willing to work for low wages.

A more comprehensive look at the problem is warranted, than what Premji and other CEOs say. They want to make money by creating hype and fear. The fundamental problem here in the US is the lack of educational and research funding. President Bush's proposed 2009 budget does not appear to increase these, contrary to what was indicated in his State of the Union address. We will not be able to produce sufficient MS and PhDs without increases in funding. Increased outsourcing, or increasing the number of H-1B visas is not the answer. Contrary to much hype, the quality of IT and CS education in India is pretty poor. There are top institutes such as the IITs and some state universities that really produce quality graduates, but they are capacity limited, and resource constrained. The private colleges are trying to sell the dream of the IT future, but they are not producing quality graduates, and these graduates constitute the majority of the IT workers in India.

Outsourcing to India or bringing more H-1B workers from India may work as a short term fix for IT work that is routine in nature. However, to retain technological leadership, the US needs to find a sustainable strategy, through long term planning and investment in our University system. This will also benefit India, because once the US is self-sustaining in producing quality IT workers, selling the IT dream will reduce in India. Then only quality graduates will start coming out of the good Indian Universities, and the dream shops will begin to close down."

We ordinarily do not use the IEEE-VMS Newsletter for advertisements. However, both to support local industry, and because this GE Hiring Event may be of interest to many of our members, we are including this announcement

from GE Energy Systems.

GE ENERGY HIRING EVENT

"Due to unprecedented growth, GE Energy in Salem, VA is having this extraordinary event on February 22 and 23, 2008!

If you have a Bachelors Degree in Electrical, Electronic, Software or Computer Engineering, and have at least two years of experience and live within an hour of Salem, we want to hear from you.

Want to learn more? Simply send an email to Thomas Weber at Thomas2.weber@ge.com for consideration."

"Jeopardy!" Game Show Ties Into National Engineers Week

In celebration of National Engineers Week (17-23 February), "Jeopardy!" will feature on 18 February a category devoted to questions about the engineering concepts used in "Design Squad," a reality show cosponsored by the IEEE. The second season of "Design Squad", in which teams of students compete to build engineering projects, begins on PBS in April. Episodes from the first season can be viewed at <http://bmsmail3.ieee.org:80/u/10182/00847004>

MARCH MEETING

The January meeting of VMS was cancelled owing to inclement weather, and the talk planned for that meeting has been rescheduled for March 20. This meeting will be held in Blacksburg, and the speaker will be Professor Dan Stilwell of Virginia Tech whose talk will deal with the combining of data ("data fusion") from multiple moving sensors. Dr. Stilwell's research deals with autonomous undersea vehicles, but the research is applicable to wireless networks as well. The title of the talk is "Distributed Data Fusion for Mobile

Sensor Networks: Theory and Experiments."

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