



VIRGINIA MOUNTAIN SECTION NEWSLETTER

IEEE Region 3, Council 09, Section 65

February 2005

February 17, Clarion Hotel Roanoke Airport

Student Paper Contest

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

Cascading Failure in Complex Systems, Detecting Network Intrusion on Mobile Devices, Lossless Audio Coding, Autonomous Robot for Collecting & Exterminating Ticks, and the Design and Realization of NMOS Devices

The Study of Cascading Failure in Complex Systems

*Bertrand Nkei, * VT, Benjamin Carreras, and Vickie Lynch, ORNL*

The disturbance of large interconnected infrastructure is very often caused by cascading failures of loaded system components. For instance, large blackouts of electric power system are caused by cascading failures of overloaded components. The CASCADE model of cascading failures of a system with many identical components randomly loaded is used to study the propagation of failures in both a single system and then extended to coupled systems.

Mr. Nkei is from Cameroun (Central Africa), and received his Associate Degree in EE from Northern Virginia Community College in December 2003. He was selected for the Student Undergraduate Learning Internship program at the Oak Ridge National Laboratory where this work was done. He entered VT in Fall 2004, and expects to graduate in May 2006.

Detecting Network Intrusion on Mobile Device by Monitoring Power Consumption

James Chung, Dr. Grant Jacoby, Dr. Nathaniel Davis, VT*

A battery-based intrusion detection (B-bid) system was investigated by correlating attacks with their impact on device power consumption using a rule-based host intrusion detection engine (HIDE). HIDE monitors power behavior to detect potential intrusions by noting irregularities of power consumption. A program was written that logs the instantaneous battery current every few seconds until the user stops the program. The user can set the threshold current as well as the number of consecutive threshold violations required to trigger a warning for a possible intrusion.

This work was done during the spring and fall semesters of 2004 as an Undergraduate Research Project. Mr. Chung graduated from VT with a BS in CS and CpE in December 2004, and is working for Solers in Falls Church, VA

Reservations

Date: Thursday February 17, 2005
Social: 6:15 PM
Dinner: 6:45 PM
Talks: 7:45 PM
Cost: Member or Guest \$15.00
Student \$ 8.00

Reserve by **5 PM Monday Feb. 14**
Dr. James Squire (540) 464-7548
<mailto:squirejc@vmi.edu>

Please specify number of attendees.

Directions to

Clarion Hotel Roanoke Airport

2727 Ferndale Drive NW
I581 Exit 3 Hershberger Rd West
1st Rt. onto Ordway Drive,
¼ mile, Rt. Into Parking Lot.

Please mark the date and plan on coming. Learn about interesting student projects and undergraduate research at VMI and Virginia Tech.

See following page for additional abstracts

Lossless Audio Coding: Not Losing Any Bits Here

Matthew Roney*, (Dr. Amy Bell), VT

Lossless audio coding (unlike lossy coding such as MP3) is the process of compressing speech or music into a smaller size file without losing any information. In lossless compression, there is no performance degradation since the original, uncompressed audio signal can be exactly reconstructed from the compressed audio signal, but results in larger sizes than lossy compression. Performance measures for lossless audio coding include compression ratio, and encoding and decoding times. Matlab code was written utilizing two stages of compression, linear prediction and entropy coding. Various commercial lossless compression programs were compared and indicate that the various approaches achieve about the same compression ratio, but differ in the processing time. Our ongoing work explores hardware architecture design for fast hardware implementations of a state-of-the-art lossless audio codec.

Matthew Roney is an EE Senior at VT from Fredericksburg, VA. This research began in May 2004 under the guidance of Dr. Amy Bell and was an outgrowth of collaborative design combining material from DSP and digital design courses.

An Autonomous Robot for the Collection and Extermination of Ticks

Justin H. Woulfe*, Dennis J. Crump*, Glenn B. Hammond*, (Dr. James Squire, Dr. David Livingston), VMI

Ticks are a health hazard; infesting our pets and vectoring human diseases such as Rocky Mountain spotted fever and Lyme disease. We propose a robotics-based solution to reduce tick populations. The ecotone, a fifteen foot wide swath defining the boundary between cultivated lawn and woods, is the ticks' natural habitat. A small perforated tube is routed around the ecotone that emits a chemoattractant such as carbon dioxide, drawing ticks from the ecotone into a narrowly-defined path. A robot is programmed to travel around this path collecting and

exposing ticks to promethren, a common insecticide. The chemoattractant tube also houses a signal wire that the robot follows using magnetic sensors to navigate the path, sweeping the entire ecotone. Sensor information is relayed to the robot's microcontroller which, using a fuzzy logic algorithm, keeps the robot directly over the tube and the attracted ticks. The robot stops every lap in a specially designed shed to be recharged, cleaned, and UV sterilized. If continued for three months, the ticks' life cycle will be broken leaving the protected area tick-free for years.

Justin Woulfe, Barry Hammond, and Dennis Crump are ECE Juniors at VMI. Cadet Woulfe is from Fairfax, VA, and plans to attend law school after graduation. Cadet Hammond is from Roanoke, VA and plans to commission in the United States Air Force upon graduation. Cadet Crump is from Fairfax, VA. He is a Nuclear Propulsion Officer Candidate, and plans to commission in the United States Navy upon graduation.

The Design and Realization of Basic nMOS Digital Devices

Kanchanadet Banchusuwan, Wei-Han Jeng, Jeffrey S. Dudas (Dr. J. Shawn Addington)

Our study involves the design, fabrication, and characterization of basic nMOS digital logic gates, including basic Inverter, NAND, and NOR devices on four-inch silicon wafers. The results of our study includes: 1) basic semiconductor device design and processing procedures using laboratory facilities within the ECE Department at VMI; 2) n-channel enhancement MOSFET (nMOS) technology, including device structure, design layout, fabrication procedures; 3) nMOS digital device technology, including basic logic gate design options, and device operation; 4) an evaluation of the performance characteristics of the basic digital logic devices that are fabricated in our laboratory; and 5) the influence of body effect on the logic gates performance. As these basic logic gates are the fundamental building blocks used in digital circuit design, a thorough

understanding of their design and realization is essential before more complex circuits are attempted.

Kanchanadet Banchusuwa & Wei-Han Jeng are ECE Seniors, and Jeffrey Dudas a Sophomore at VMI. Cadet Banchusuwan is concentrating in Microelectronics and has a minor in Mathematics. He plans to attend graduate school after graduation. Cadet Jeng is from Taiwan and plans to attend graduate school after graduation. Cadet Dudas is from Buffalo, NY and plans to commission in the US Air Force after graduation

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