The Chair’s Message
Welcome to the Fall 2009 issue of Bits and Bytes. It is a pleasure to share with you news about the Department of Computer Science and the numerous activities and accomplishments which have occurred over the last year. As you read the newsletter, you will see there has been considerable activity and change for faculty and students.

CS students honored at all levels who have had excellent performance in their academic pursuits and who have made extraordinary service contributions to the department are featured in this newsletter. Projects presented at the 43rd and 44th Conferences on Senior Engineering Design Projects are also described. You will also find articles about dissertations, thesis, faculty and student research projects, conference participation and applied student activities.

I hope that you enjoy reading the newsletter, and remember that we are eager to hear from our alumni regarding your career paths and other activities. Please take a few minutes and use the “Tell us About Yourself” form to keep us informed (Send your to Ron Miller, Editor of Bits and Bytes.). We also welcome your feedback and suggestions for improvement of our department and its programs.

Because of the benefits you gained from your education at WMU, we also hope you will consider supporting computer science students through an alumni gift using the special form included within this newsletter. Your support and correspondence continues to encourage and enable the WMU Department of Computer Science to reach for higher excellence in academics, research and service.

Faculty Organize 2nd International Workshop
Several CS faculty participated in organizing the Second International Specialized Ad Hoc Networks and Systems (SAHNS) Workshop at the Conference of IEEE Computer Society Technical Committee on Distributed Processing at Montreal in June 2009. The chair of the SAHNS workshop Dr. Leszek Lilien was assisted by Dr. Ajay Gupta, Steering Committee member; Dr. Ala Al-Fuqaha, Web Support and Publicity Co-Chair; and Dr. James Yang, Publications Chair.

The goal of the SAHNS workshop is to provide sound, efficient, specialized ad hoc networks and systems suitable for building solutions specific for individual or well-defined classes of applications.

Clustering Large Data Sets Is Topic Of Danyang Hua’s Thesis
Danyang Hua, advised by Dr. Li Yang, recently presented his Master’s thesis on Clustering of Large Data Sets Using Multi-resolution Data Aggregation on Hierarchical Data Structures. Clustering of large data sets efficiently and effectively is an important area in data mining. Large data sets cannot be entirely loaded into main memory for processing. Yet, users have the same demand for interactivity and response time as for small data sets. Danyang researched clustering large sets of data sets using multi-resolution data aggregation on hierarchical data structure.

A clustering algorithm (CLUK) is developed using Data Aggregation Tree (DA-Tree) as a common representation of large data sets. CLUK uses only aggregation information of data contained in the DA-Tree nodes as input, offers multi-dimensional interactive visualization of data clusters and the algorithm is scalable to any hierarchical data structure.

Megapixels of CS Research and Events
Kenneth Stroud of Motorola setup the MOTO-MESH network equipment with Drs. Ala Al-Fuqaha and Dionysios Kountanis and graduate student researchers, who will be working with the Michigan Department of Transportation to improve safety of transportation systems.

Advisors for Sunseeker solar car Dr. John Kapenga of CS and Dr. Brad Ba- zuin of ECE are testing for damaged solar panels. CS students working on the car are Dan Gore, Alan Plotkowski, Jesse Wick and Raymond Johnson.

Rajeev Singh (left), owner of the software company Concur, received the 2009 CEAS Alumni Excellence Award from Dr. Anthony Vizzini, the Dean of CEAS.
CS Student Wins All-University Graduate Teaching Effectiveness Award

Stephany Coffman-Wolph, a doctoral student in Computer Science, was honored as one of ten All-University Graduate Teaching Effectiveness Awardees. She has been an instructor of record for CS 1060, Introductory Visual BASIC and CS 1120, Computer Science II, which is a core course for Computer Science majors. Although she is presently teaching sections of CS 1120 with two Computer Science faculty members, she is the most experienced instructor of this course and takes the lead role in preparing and teaching the course.

In nominating Stephany, Dr. Don Nelson, chairperson of Computer Science, noted, “Stephany’s capability for teaching is truly outstanding. She was an outstanding instructor for CS 1060 during her first three years as a graduate student at Western Michigan University. During these three years, she worked with students with diverse interests and backgrounds. Because of her teaching capabilities, superior performance and achievements, the department selected Stephany to be an instructor of record for an important major core requirement course, CS 1120, Computer Science II.” The course features advanced programming concepts in the C#, a programming language used in the industry.

Stephany has continued to excel in this new teaching assignment, effectively adapting her teaching methods to a new course and more advanced students. Her commitment to the success of her students and the overall success of the course is evidenced by the Fall 2008 results of the programming master test (PMT) associated with the course. Her class significantly exceeded the expected pass percentage.

Stephany describes her own course goals for CS 1120: “The main goal of the course is to prepare the students to be independent programmers—which means that they should be able to take a set of instructions and create a fully functioning program. This goal is extremely difficult for most students to reach. I have structured my lectures to help students become independent programmers by the end of the term. The CS 1120 course has two lectures per week. In one lecture period, I introduce the current concepts using PowerPoint slides and show some completed coding examples. For the second lecture period I prepare in-class activities. These in-class activities range from worksheets for a given concept to having the students write programs to demonstrate recently taught concepts. I often have the programming activities cover not only the current concepts but also a few concepts from the previous lectures. These activities allow me to gauge how well the students comprehended the material. If students complete the activities confidently and quickly, I know that the material was clear and well absorbed. However, when students are unsure or confused, then I include more material or examples at the next lecture or I try another approach to teach the concept.”

Three Students Chosen to Receive Department Graduate Awards

Mohammed Elbes, who hails from Jordan, was honored with a CS Department Graduate Research and Creative Scholar Award. He received a Master of Science degree in Computer Science in December 2008 and is now pursuing his doctoral degree in Computer Science.

His current research interests include the timely delivery of messages in vehicular communication networks and Quality of Service (QoS) support in these networks. Mohammed was also involved in the research and development of a funded project from Michigan Department of Transportation (MDOT) as well as the Cisco Systems Reactive Call Home Expert System. The goal of this project is to extend Cisco’s call home feature to an artificially intelligent expert system to help network support engineers match call home messages with relevant documentation and fixes.

Dr. Ala Al-Fuqaha mentions that Mohammed’s research work involves design and simulation of new algorithms, protocols and heuristics for vehicular communication networks using Game theory, Lagrangian Relaxation, Genetic Algorithm, Adaptive Encoding and linear programming optimization techniques. Mohammed presented his work, “A New Hierarchical...
and Adaptive Protocol for Minimum-Delay V2V Communication,” at the 2009 IEEE International Conference in Communications at Dresden, Germany.

Lotfi Ben Othmane, a doctoral student in Computer Science who came to WMU in 2006, also received a CS Department Graduate Research and Creative Scholar Award. Lotfi was previously named a 2009–10 recipient of a Dissertation Completion Fellowship. He also received a Graduate Student Travel Grant from the Graduate College in November 2008 to present his research at the 6th Annual Conference on Privacy in Fredericton, New Brunswick, Canada.

Lotfi received the best student paper award for his presentation on the concept of protecting data through its lifecycle, which had not previously been applied in this context. Protecting the intellectual property rights of corporations and the privacy rights of citizens has become a critical issue. Lotfi brings thirteen years of international experience in computer privacy issues, which forms the background of his dissertation work.

In addition to being selected as an excellent research scholar, Lotfi has been recognized by his department with the 2009 Departmental Graduate Teaching Excellence Award for his teaching capabilities. He was recently selected to be the main instructor for a new Computer Science course, CS 2100, Script Programming in Python, which is used by major corporations and organizations such as Google, NASA and IBM. His class was full, which Dr. Nelson says, “is a significant student endorsement for Lotfi.”

Lotfi is “one of the most experienced teaching assistants” in the Department of Computer Science and his “capability for teaching is absolutely outstanding,” according to Dr. Donald Nelson. “By connecting what he teaches with the needs of the ‘real world’ he fosters his students’ enthusiasm for acquiring knowledge.” Lotfi’s department has recognized his superior teaching skills by assigning him to senior level courses in which he can practice his teaching philosophy of “combining content with critical thinking and preparing students for effective functioning in an information economy.” Lotfi is also editor of Hilltop Review, a journal of the Graduate Student Advisory Committee (GSAC).

Jamie Lynn Groos, a Master’s student in Computer Science, was awarded the CS Department Teaching Effectiveness Award for 2009. In 2008 she received a double Bachelor of Science Degree in Computer Science and in Computer Networking from Lake Superior State University, where she was captain of the Women’s DII Volleyball team for five years.

Jamie’s experience as a coach influences her teaching philosophy as shown by her statement “My style is to teach by example in order to learn. A student athlete has to go beyond the words, beyond the theory and actually see the concept in action,” says Jamie.

Dr. Donald Nelson reports, “Jamie has already contributed many new ideas for improving teaching aids and grading forms in addition to using her exceptional interpersonal skills to enhance classroom instruction.”

Jamie, who assisted with CS 1000, Fluency with Information Technology, is known in her department for her excellent rapport with her students while still challenging them to take responsibility for their learning, according to her Instructor Ron Miller, CS 1000 supervisor.

College of Engineering and Applied Sciences Dean’s Outstanding Seniors

Each year the Dean of the College of Engineering and Applied Sciences honors two graduating students from each major of the college by bestowing the Dean’s Outstanding Seniors Awards. These awards are presented at a luncheon, which also honors the student’s faculty advisor.

This year’s winner of the Dean’s award majoring in the Computer Science-General Program was Joseph E. Smit. The Dean’s award winner in the Computer Theory & Analysis Program was Benjamin A. Mechling.

Dr. Dan Litynski presented the Dean’s awards to (above) Joseph Smit and his advisor Dr. John Kapenga, and (below) Benjamin Mechling and his advisor Dr. Karlis Kaugars.
2009 Computer Science Awards Ceremony

The Fourteenth Annual Computer Science Awards Ceremony took place in the auditorium of the College of Engineering & Applied Sciences Parkview Campus on April 3, 2009. The Department of Computer Science held its first student awards ceremony in April 1996. Award recipients for 2008/2009 are listed with a short description of the award criteria.

The ceremony began with welcoming remarks by Dr. Mark Kerstetter, the Director of CS Undergraduate Programs, and Dr. Daniel Litynski, Interim Dean of CEAS. Steven W. Cooke, a Boeing Company Lead Engineer of R&D in Virtual Warfare, then presented an inspiring presentation on “Computer Science Careers and Research” to the awards recipients. Sheryl Todd, office administrator, and faculty Dr. Ala Al-Fuqaha and Ron Miller coordinated the event.

Department Graduate Research and Creative Scholar
Bestowed by the WMU Graduate College in recognition of scholarly research or creative activity as judged by the Department Graduate Committee.

Recipients: Lotfi Ben Othmane (Doctoral)
Mohammed W. Elbes (Master’s)

Dr. Ajay Gupta, Graduate Program Director, presented the Doctoral Level Department Graduate Research and Creative Scholar Award to Lotfi Ben Othmane.

Department Teaching Effectiveness Award
Awarded by the WMU Graduate College in recognition of outstanding teaching by a graduate assistant.

Recipients: Stephany Coffman-Wolph, Lotfi Ben Othmane (Doctoral)
Jamie Lynn Groos (Master’s)

These lab instructors were honored with CS 1000 Teaching Effectiveness Awards at the annual ceremony.

Software Engineering Certificate
Awarded to graduate students who successfully complete a core set of graduate software engineering courses.

Recipients: Vikash Achuturamaiah, Brian Atkinson, Hector M. Chavez Chavez, Yan Gu, Ibraheem M. Zarea

Dr. Gupta presented certificates of accomplishment to students who completed core software engineering courses.

Excellence in Research Award
Presented to a graduate student who has authored or co-authored at least one full-length refereed paper published or accepted for publication in a technical computer science journal or conference proceedings.

Recipients: Osama Ali Awwad, Chaoli Cai (Doctoral)
Hector M. Chavez Chavez, Mrinal Khanvilkar (Master’s)

CS 1000 Teaching Effectiveness Award
The recipient is determined based on student evaluations, in classroom observations, and recommendations from the course coordinator and other students.

Recipients: Hector Chavez Chavez, Jamie Lynn Groos, Shilpa Lakhanpal, Venkat Chetan Ramachandra, David Rodriguez-Velazquez

Recipients of the Department Teaching Effectiveness Awards were recognized by Dr. Ajay Gupta.

Outstanding Graduate Student Award
Nominated by a department faculty member and selected by the Graduate Committee, based on academic achievement.

Recipients: Jing Zhang (Doctoral)
Hector M. Chavez Chavez, Andrew Hovingh, Michael D. Kincaid, Thap Panitanarak (Master’s)
**Special Research Recognition**
Awarded to students for making major contributions to research in computer science.

**Recipients:** Hesham J. Abed, Ammur M. Kamel, Raed M. Salih

**Outstanding Service Award**
Presented to a graduate assistant in recognition of excellence in teaching or in the performance of other activities beyond what is normally expected.

**Recipients:** Stephany Coffman-Wolph, Lotfi Ben Othmane

**Presidenta Scholar**
This designation is bestowed by the President of the University in recognition of outstanding academic and extra curricular achievements as judged by the CS Undergraduate Committee.

**Recipient:** Daniel E. Frandsen

**Graduation with Honors in Computer Science**
Awarded to students who have maintained a 3.70 GPA in computer science and a 3.50 GPA in overall university studies, recognizing achievement beyond the normal major program. The phrase “Graduation with Honors in Computer Science” is affixed on these students’ transcripts upon graduation.

**Recipients:** Matthew C. Ackerman, Daniel E. Frandsen, Christopher J. Marks, Jamie M. Raab, Joseph E. Smit, Stuart Swope

**Dr. Mark Kerstetter presented the Jim Sleep Memorial Award to William Unsworth (left) and Daniel Frandsen for their project contributions to the university community.**

**Jim Sleep Memorial Award**
A student or group of students who develop a significant project helpful to the community (department, university, off-campus, or utility for a course or research).

**Recipients:** Daniel E. Frandsen, William J. Unsworth

**Dr. Gupta recognized three graduate students for significant contributions in computer science research.**

**Faculty Undergraduate Scholarship**
Awarded to a computer science major who is not yet a Senior, to recognize outstanding promise and encourage the development of that talent, as judged by the Department's Undergraduate Committee.

**Recipient:** Benjamin R. Welton

**Dr. Mark Kerstetter congratulates Benjamin R. Welton for receiving the Faculty Undergraduate Scholarship.**

**These Seniors will have “Graduation with Honors in Computer Science” affixed on their transcripts.**
Undergraduate Honor Roll
Recognizes students who have achieved a 3.40 GPA in all university courses and who have at least 3.90 (Highest Honors), 3.70 (High Honors) or 3.50 (Honors) in computer science courses.

Sophomores: Highest Honors – Brandon J. Andrews
Juniors: Highest Honors – Jamie M. Raab, Benjamin Welton
Seniors: Highest Honors – Matthew Ackerman
High Honors – Sean Lavine, Benjamin R. Welton
Honors – Jeffrey M. Church, Alan M. Plottkowski, Jason A. Smith

Graduate Honor Roll
Recognizes students who have completed three or more graduate courses and who have achieved a grade point average of 3.75 in computer science graduate courses.


Outstanding Senior Major Awards
Presented to Senior computer science majors for outstanding achievement as judged by the faculty and the Undergraduate Committee. CST is the Computer Science Accreditation Board accredited Theory and Analysis major and CSG is the General Computer Science major.

Recipients: Christopher J. Marks (CST)
Jamie M. Raab (CSG)
Honorable Mention: Brandon J. Van Vaerenbergh (CST)
Paul J. Adams (CSG)

Teaching, Service and Research Assistants
The faculty and staff of the Department of Computer Science wish to thank the following teaching, service and research assistants for their effort during the past year.


Undergraduate and graduate students make important contributions to the computer science department.
Osama Awwad Is Recipient of the Eleventh CS Ph.D. Degree from WMU

In June 2009, Osama Awwad was awarded Doctor of Philosophy in Computer Science. Osama previously earned his Master’s Degree in Computer Science from Western Michigan, also. His graduate advisor was Dr. Ala Al-Fuqaha, who is leading additional research for the Michigan Department of Transportation.

Osama’s dissertation was entitled Topology Control Using Joint Power and Beam-Width Control in Hybrid RF/FSO Mesh Networks. In his presentation, Osama reported that most wireless networks are deployed strictly in the radio frequency (RF) domain, since RF channels provide natural support for radial broadcast operations. However, the downside of RF channels is that they introduce many limiting externalities that make providing scalable quality of service (QoS) support difficult, if not intractable. These well-known technical challenges include bandwidth scarcity, lack of security, high interference, and high bit error rates.

Faced with such daunting obstacles to QoS, the use of Free Space Optics (FSO) for wireless communications has been proposed in which it has the potential to support higher link data rates compared to present RF technology. Furthermore, because FSO uses directed optical transmissions in which channel beam-width is adjustable, inter-FSO communication interference can be limited.

Finally, the avoidance of radial broadcasting also provides some degree of security against eavesdropping. The benefits of FSO do not come without a price, most notably of which is the need to maintain line of sight (LOS) between the transmitter and the receiver during the course of communication. Moreover, FSO link availability can be degraded by adverse weather conditions like fog, rain, snow, and haze. In this research work, the proposed a topology control solution meets QoS requirements in hybrid RF/FSO mesh networks using joint power and beam-width control. But deciding to use a hybrid model brings with it, its own set of unique problems, stemming in large part from the fact that nodes can choose between two different channels types—each with its own transmission characteristics.

Given this, steps must be taken to prevent a relay node in a multi-hop connection from being tempted to behave selfishly by forwarding other nodes’ packets using the less reliable channel type, thereby avoiding the individual opportunity cost that would be incurred by a “fairer” choice of allocating a high-quality link. This problem of selfish behavior addressed by formulating node decisions within a hybrid RF/FSO network in a Bayesian game-theoretic model that is designed specifically to guarantee optimal cooperativeness.


Vehicle-to-Vehicle Communications Subject of Mohammed Elbes’ Thesis

Mohammed Elbes, a recent Master’s of Computer Science graduate, presented his research under Dr. Ala Al-Fuqaha using the title of A New Hierarchical and Adapative Protocol for Minimum-Delay Vehicle-to-Vehicle (V2V) Communications. From Mohammed’s study he revealed a great interest in the issues related to transportation efficiency and safety in the past few years.

Intelligent Transportation Systems (ITS) are envisioned to be integrated in vehicles and road-side equipment to alert drivers of hazardous conditions such as slow traffic, pot holes, road construction and lane departures.

Several protocols have been proposed in the literature to achieve Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) communication, reported Mohammed. V2I protocols rely on road-side equipment (RSE) to exchange messages between vehicles and the underlying transportation network. Even though V2I protocols can be used to relay messages between vehicles, these protocols result in unnecessary delays as the packets need to be relayed through the RSE.

V2V protocols serve to minimize the communications delay through the direct exchange of messages between vehicles without the need to rely on any road-side infrastructure, thus providing an economical solution that does not depend on the deployment of expensive infrastructure. The majority of V2V protocols presented in the literature utilize a combination of controlled access techniques (for example, TDMA, FDMA, CDMA) to provide prioritized access to the communication medium, continues Mohammed.

While these protocols split the capacity of the communication link to support a maximum number of users with different priority levels, Mohammed’s work with Dr. Al-Fuqaha utilized a combination of CDMA and TDMA techniques to increase the number of concurrent users sharing the bandwidth. The proposed protocol provides an adaptive scheme that clarifies the vehicle’s messages as “urgent” or “non-urgent” based on statistical parameters (like speed, acceleration and directional stability) and the state (normal or urgent) of its neighboring vehicles.

In addition, Mohammed said the proposed protocol achieves intelligent scheduling and allocation of messages and the underlying bandwidth to minimize the end-to-end communication delay and the costs associated with the deployment of Vehicle Infrastructure Integration (VII) without road-side equipment.
Join the Department of Computer Science Team

Your tax-deductible contributions to the Department of Computer Science Fund will help the department to expand its tradition of excellence in education. Your gifts will enable more student involvement in research, conferences, and programming experiences, as well as enhanced development of the computer science programs.

Yes, I/we would like to support the continued excellence of the WMU Department of Computer Science with the following gift:

☐ $1,000  ☐ $500  ☐ $250  ☐ $100  ☐ $50
Other Amount _________________

Gift Selection
My gift should be used as follows:

$________ to support Undergraduate CS Scholarships.
$________ to support student attendance at conferences and programming competitions.
$________ to support the area of greatest need in the Department of Computer Science.
$________ to support the area specified on the line below:

____________________________________

Many companies have matching gift programs that can double or triple your gift.

Have you enclosed a matching gift form?  
☐ Yes  ☐ No

Check Payment
Please make checks payable to the WMU Foundation and write “Department of Computer Science Fund” on your check. Send it to:

Western Michigan University
WMU Foundation
1903 W. Michigan Avenue
Kalamazoo, MI 49008-5403

Credit Card Payment
Please charge my/our gift to (check one):
☐ VISA  ☐ MasterCard  ☐ Discover

Account #

Expiration Date

Signature(s) Required

Date Mailed: ___________________________

I/we have enclosed a matching gift form?  
☐ Yes  ☐ No

☐ I/We paid with Check
Check was made payable to the WMU Foundation with “Department of Computer Science Fund” written on the check. It was mailed to:

Western Michigan University
WMU Foundation
1903 W. Michigan Avenue
Kalamazoo, MI 49008-5403

☐ I/We paid with Credit Card
I/We charged my/our gift to (check one):
☐ VISA  ☐ MasterCard  ☐ Discover

Account #

Expiration Date

Signature(s)
Eight Senior CS students presented their projects at the 43rd Conference on Senior Engineering Design Projects held December 2, 2008. The systems of the four Senior project teams were presented to visiting clients, students, parents, and faculty. The faculty advisor of the Fall 2008 and Spring 2009 Senior cores courses, CS 4900 and CS 4910, was Dr. John Kapenga. Synopses of the projects are described below.

### Ambulance Maintenance System
Developed by Mike Davis, Christopher Marks and Adam Riggs  
Sponsors: Brian Balow and Shawn Oasterlinck, eInternet Design  
Faculty Advisor: Dr. John Kapenga

Ambulance maintenance is critical when a patient’s life is involved. The Ambulance Maintenance System was implemented to update employees when repairs and upkeep are needed for emergency vehicles. PHP and SQL were used to dynamically allow employees and managers to edit and respond to maintenance alerts. Additionally, employees can create their own custom alerts and view the maintenance history of any ambulance.

### Course Assessment System
Developed by Chris Anthony  
Faculty Advisors: Drs. Don Nelson and John Kapenga

A computer science department had been using a time consuming paper-based course assessment system. A new web-based system was developed to facilitate ease of use, flexibility and extensibility. The system utilized PHP, MySQL and the Apache web server to create a course assessment service similar to other services deployed by the department. The software will benefit many individuals including administrators, faculty and the assessment committee.

### Environment Monitoring with Programmable Microcontroller and Zabbix
Developed by Michael Woods and Michael Yancon  
Faculty Advisor: Dr. John Kapenga

Environment conditions, particularly humidity and temperature, can have an adverse effect on the function and performance of mechanical electrical equipment, which at high levels can cause rust, rot, decay warping and overheating. A solution was implemented that uses Texas Instruments’ eZ430-RF2500, which is a small, low powered wireless, programmable microcontroller that was designed to locally monitor environmental conditions. These local systems are then monitored by Zabbix, an enterprise class, open source network monitoring system, which alerts appropriate personnel when variables are critical. This system can save valuable time, money and equipment by ensuring appropriate conditions are always maintained.

### Just Swipe — A Study Table Time Logging System
Developed by Dustin Duclo and Brian Woodward  
Faculty Advisor: Dr. John Kapenga

Student athletes are required to attend study table, a program for helping athletes to meet academic requirements. Paper work and manually calculating logged minutes was time consuming for the academic advisors of study table. A C# program was designed which allows students to log in and out of study table by swiping their student IDs. All information is recorded into MySQL database. A website was built using HTML and PHP allowing advisors to view, change, or edit data and generate reports. With “Just Swipe” application software, time logging is easier on both academic advisors and students.
13th computer science students presented their Senior projects at the 44th Conference on Senior Engineering Design Projects held April 14, 2009, at the CEAS Parkview Campus. In addition to presenting to visiting clients, students, parents and faculty, the six project teams presented their designs to CS Advisory Industry Board members. Descriptions of the design projects are provided below.

**Distributed Network Monitoring**  
*Developed by Ryan Noble*  
*Sponsor: Noble Networks.net*  
*Faculty Advisor: Dr. John Kapenga*

Maintaining a functioning computer network is vital to businesses. A distributed network monitoring system was created to observe the network operations of several small businesses using Nagios, an open source network monitoring application. This system can be utilized to alert technical staff of network errors, record on-going performance characteristics, and predict trends that may cause future problems. The complete software was extended to include site-specific test and performance statistics, GUI enhancements and easy roll-out installation packages. This system will help to maintain high-availability computer networks, reduce the response time for outages and provide critical information for preventing future interruptions.

**Modification and Revamp of Room Reservation Website and Room Wizards**  
*Developed by Seth Behnke*  
*Faculty Advisor: Dr. John Kapenga*

The Room Wizards outside of each room were not maintainable in their current form. The website back end that allows for room reservations was updated. A completely new operating system was installed on the Room Wizards, along with a new interface. The overall benefits are significant improvements in stability, maintainability and the possibility for future expansion.

**Making An Xbox Game**  
*Developed by Daniel Frandsen*  
*Faculty Advisor: Dr. John Kapenga*

One of the biggest popular interests in computer science is in the creation of video games. A video game was created using Microsoft XNA Framework for the Xbox360 platform. The game, entitled “Olu,” used many different aspects of the computer science curriculum, including threading, linear algebra, optimization, graphical design, coding standards, artificial intelligence and game design. The game was released on the LIVE Community Games service and available for purchase to anyone on Xbox LIVE.

**Material Science Virtual Lab**  
*Developed by Kyle Chouinard, Daniel Frandsen and Richard Herrington*  
*Faculty Advisor: Dr. John Kapenga*

Expensive equipment is required for physical labs used in a material science curriculum. The Virtual Lab is an effort to provide the ability of material science students to work on their labs without the need for a physical environment. The students use HP tablet PCs to interact with a virtual environment. Using the application, students can take notes, perform quizzes, send emails to the professor and complete an entire lab using only their tablet PCs. This provides an effective low-cost replacement for expensive physical labs.
Charities lack an efficient way to collect funds. An e-commerce website was created to facilitate donations to many charities from one central location. Features of the web application include purchasing a gift card, redemption of a gift card and administration of the site. During the redemption process the users donate to the charity of their choice. HTML, CSS, Javascript, PHP and MySQL were tools used in the development process. The web application will benefit charities by allowing a large number of people to easily donate.

**Solar Car Simulator**

*Developed by Paul Adams, Collin Moerman, Cory Nunnery, Brandon VanVaerenbergh and Ryan Woodcox*

*Faculty Advisor: Dr. John Kapenga*

In major inter-collegiate solar car races, performance modeling and strategy are critical to the success of a team. The Solar Car Simulor utilizes the Java programming language, an interactive information visualization toolkit called Prefuse, NOAA’s National Digital Forecast Database and the United States Geological Survey’s Elevation Query Service. The program also takes real-time input from GPS, chase-car weather data and solar car telemetry. The simulation package will enable a team to author and test a strategy before a race, as well as monitor the effectiveness of their plan during the race.

**E-Commerce Gift Card Web Application**

*Developed by Adam Flink, Ted McDonald and Stuart Swope*

*Sponsors: Jerry Howell — Midwest Business Exchange, Art Pearce — Battle Creek Area Habitat for Humanity and John Jozef Kapenga — Kapenga Design*

*Faculty Advisor: Dr. John Kapenga*

An e-commerce website was created to facilitate donations to many charities from one central location. Features of the web application include purchasing a gift card, redemption of a gift card and administration of the site. During the redemption process the users donate to the charity of their choice. HTML, CSS, Javascript, PHP and MySQL were tools used in the development process. The web application will benefit charities by allowing a large number of people to easily donate.

**CS Awards Twelveth Ph.D. Degree To Chaoli Cai**

Chaoli Cai presented his dissertation entitled, *Anomaly Detection Techniques for Ad Hoc Networks*, in November 2009, becoming the twelveth student to be awarded a Doctor of Philosophy in Computer Science.

Chaoli previously earned his Master’s Degree in Computer Science from Western Michigan. Dr. Agay Gupta, Director of the Wireless SensorNetworks Laboratory, was his graduate advisor.

Anomaly detection is an important and indispensable aspect of any computer security mechanism, says Chaoli. Ad hoc and mobile networks consist of a number of peer mobile nodes that are capable of communicating with each other absent a fixed infrastructure. Arbitrary node movements and lack of centralized control make them vulnerable to a wide variety of unknown and known attacks from inside as well as from outside.

Chaoli proposed two efficient statistical techniques for anomaly detection in these networks. He presented a mobility-pattern-based (MPB) anomaly detection algorithm that can identify abnormal pattern behavior of nodes in mobile networks. MPB characterizes the mobility profile of a node by a Multi-Leaf tree structure in which each node corresponds to a possible destination cluster. Through data mining and fuzzy logic techniques, a normal mobility profile is generated during the training process, and abnormal patterns are distinguished from the normal during testing. Statistical simulations demonstrate proposed MPB algorithm achieved reasonably low false alarm rates (FAR) and sufficiently high detection rates (DR).

In order to take into account incomplete testing samples and the interaction among multiple features, Chaoli’s research used BANBAD -- a technique using Belief Networks and Bayesian inference. BANBAD identifies abnormal behavior in any feature, for example, an inappropriate energy consumption of a node in the network. By applying structure learning techniques to the training dataset, it extracts the dependencies among relevant features and represents them by a directed acyclic graph. Probability distributions are associated with the nodes (features) and edges of the graph. BANBAD maintains this belief network as a dynamic, updated normal profile of feature behaviors and then uses a specific Bayesian inference algorithm to detect abnormal behavior in testing data.

This technique works especially well in ad hoc networks, reports Chaoli, but it is applicable to other networks, including wireless and sensor networks. The proposed method bounds FAR at a predefined threshold and maximizes DR. Experimental results demonstrate excellent performance for synthetic as well as real datasets. The real datasets are taken from Intel Lab Data (lab environment monitored by the sensors) and UMASS Trace Repository (users’ laptop usage).

Tell Us about Yourself

As a graduate of the Department of Computer Science, we would like to know about your career and what you have done since your graduation from Western Michigan University. Please complete the information below and mail this form to: Ronald A. Miller, CS Bits & Bytes Editor, Department of Computer Science, College of Engineering & Applied Sciences, Western Michigan University, 1903 West Michigan Ave., Kalamazoo, MI 49008-5466

Name: ______________________________________ Class of: ___________ Degree: __________________

Home Address: __________________________________ City: ____________________________

State: ___________ Zip: ___________ Email Address: ________________________________

Current Position and Title: _______________________________________________________

Business Address: ________________________________________________________________

City: ___________________________ State: ___________ Zip: ___________

News Item Information (title, duties and other significant accomplishments): ________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

May we publish this information in a future CS Bits & Bytes Newsletter?  Yes ___ No ____

(Please feel free to use additional sheets when including information about yourself or other Western Michigan University computer science alumni with whom you have contact.)