

2nd Annual

Iowa State University
Undergraduate
Research Symposium

April 15, 2008



A Message from the University Honors Program

Welcome to Iowa State University's Second Annual Undergraduate Research Symposium! The Symposium is organized by the University Honors Program to provide undergraduates—both Honors and non-Honors students—from all academic disciplines with the opportunity to share their research with the university community and other guests through oral presentation sessions. The Symposium represents part of a larger effort of Iowa State University and its Honors Program to enhance, support and celebrate undergraduate research activity.

At this 2008 event, the 51 students presenting research results in 37 coauthored or single authored sessions cover a broad range of the types of research conducted on campus. Please note that these undergraduates and their mentors (faculty, staff and graduate students) represent all eight of the Colleges at ISU: Agriculture and Life Sciences, Business, Design, Engineering, Graduate, Human Sciences, Liberal Arts and Sciences, and Veterinary Medicine.

A new addition to the forum this year will be an invited lecture by David Lopatto, Professor of Psychology at Grinnell College, who has studied the impact of undergraduate research on student cognition, attitude, and career choice. He will talk about the benefits of undergraduate research from the perspective of both the student and the faculty mentor. We hope that you enjoy the 2nd annual Undergraduate Research Symposium!

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SYMPOSIUM OVERVIEW

- 8:00-8:45 am **Registration and Refreshments**
Pioneer Room, Memorial Union
- 8:45-9:00 am **Opening Remarks by Elizabeth Hoffman**,
Executive Vice President and Provost, ISU
Pioneer Room, Memorial Union
- 9:10-10:30 am **Session I** (*concurrent presentations in 4 rooms*)
- I.A – COMPUTER-AIDED MODELING & DESIGN APPLICATIONS
Room 3219, Memorial Union
- I.B – HUMAN HEALTH: KINESIOLOGY, NUTRITIONAL BIOCHEMISTRY, & GENETICS
Room 3505, Memorial Union
- I.C – PSYCHOLOGY & SOCIOLOGY
Room 3538, Memorial Union
- I.D – SYSTEMS ANALYSIS IN ENGINEERING & AGRICULTURE
Room 3558, Memorial Union
- 10:30-10:45 am **Break and Refreshments**
Pioneer Room, Memorial Union
- 10:45 am-12:05 pm **Session II** (*concurrent presentations in 3 rooms*)
- II.A – PLANT PATHOGENS & MYCOTOXICITY
Room 3219, Memorial Union
- II.B – SURVEY ANALYSIS IN BUSINESS, SOCIAL SCIENCE, & EDUCATION
Room 3505, Memorial Union
- II.C – ELECTRIC SENSOR & WIRELESS NETWORK TECHNOLOGY
Room 3538, Memorial Union
- 12:15-1:30 pm **Remarks by Balaji Narasimhan**, Associate Dean for Research and Economic
Development, College of Engineering, ISU, and **Luncheon** for presenters, research
mentors and invited guests
Sun Room, Memorial Union
- 1:30 pm-2:30 pm **Session III** (*concurrent presentations in 3 rooms*)
- III.A – ANIMAL GENETICS, BIOLOGY & BEHAVIOR
Room 3219, Memorial Union
- III.B – MOLECULAR MICROBIOLOGY IN HUMAN & ANIMAL SYSTEMS
Room 3505, Memorial Union
- III.C – MATERIALS, ELECTRICAL, & COMPUTER ENGINEERING
Room 3538, Memorial Union
- 3:10-4:00 pm **Invited Lecture by David Lopatto**, Professor of Psychology, Grinnell College –
“UNDERGRADUATE RESEARCH AS A CATALYST FOR ENHANCED LEARNING”
Pioneer Room, Memorial Union
- 4:00-5:00 pm **Refreshments**
Pioneer Room, Memorial Union

PROGRAM – Session I

CONCURRENT SESSIONS I.A, I.B, I.C, I.D

SESSION I.A **COMPUTER-AIDED MODELING & DESIGN APPLICATIONS**

Memorial Union, Rm. 3219

9:10-10:30 am

Moderator: Ulrike Passe, Dept. of Architecture

I.A.1 **Model Based Software Verification**

DANIEL DE GRAAF, Computer Engineering, College of Engineering; CORY KLEINHEKSEL, Computer Engineering, College of Engineering; KEVIN KORSLUND, Computer Engineering, College of Engineering; AND BENJAMIN MILLER, Computer Engineering, College of Engineering (Mentor: Suraj Kothari)

I.A.2 **An Undergraduate Research Assistant's Role Relating to Spatial Composition**

BONNY REYNOLDS, Architecture, College of Design (Mentor: Ulrike Passe)

I.A.3 **Internal Volume Scaling and Effects on Internal Pressure**

MICHAEL PETERSON, Meteorology and Spanish, College of Liberal Arts; and Sciences (Mentors: Partha Sarkar and Hitomitsu Kikitsu)

I.A.4 **Financial Pictures: An Analysis of Graphical Displays Online**

VIRGINIA ROBERSON, Finance and International Business, College of Business (Mentor: Diane Janvrin)

SESSION I.B **HUMAN HEALTH: KINESIOLOGY, NUTRITIONAL BIOCHEMISTRY & GENETICS**

Memorial Union, Rm. 3505

9:10-10:30 am

Moderator: Ann Smiley-Oyen, Dept. of Kinesiology

I.B.1 **Egg White Protein Prevents Hyperhomocysteinemia in Folate-deficient Rats**

REBECCA LUCHTEL, Nutritional Science, College of Human Sciences (Mentor: Kevin Schalinske)

I.B.2 **Perceptions and Attitudes toward Physical Activity of Postmenopausal African American Women**

MILEKA SCURLOCK, Kinesiology and Health, College of Human Sciences (Mentor: Panteleimon Ekkekakis)

I.B.3 **The Effect of Task Complexity on Walking in Young Adults**

LINDSAY THOMPSON, Kinesiology and Health, College of Human Sciences (Mentors: Kristin Lowry and Ann Smiley-Oyen)

I.B.4 **Genetic Regulation of Milk Fatty Acid Composition: Developing Tools for Use in Selection**

KATHLEEN KORN, Animal Science and Microbiology, College of Agriculture and Life Sciences (Mentors: Donald Beitz, Rafael Nafikov, Jon Schoonmaker, James Reecy, Diane Moody Spurlock, Travis Knight, Kenneth Koehler, and Jennifer Minick Bormann)

SESSION I.C **PSYCHOLOGY & SOCIOLOGY**

Memorial Union, Rm. 3538

9:10-10:30 am

Moderator: Nancy Grudens-Schuck, Dept. of Agricultural Education & Studies

I.C.1 **Media and the (Mis)Representation of Crime in America: Analyzing NBC's "To Catch A Predator" Series**

TYLER BARRETT, Political Science, College of Liberal Arts and Sciences (Mentor: Brian Monahan)

I.C.2 **Unable to Focus: Modulation of Cognitive Control by Negative Affect**

PETER CHOI, Psychology, College of Liberal Arts and Sciences (Mentors: Robert West and Stephanie Travers)

- I.C.3 **Diversity and Group Counseling**
COURTNEY CORNICK, Psychology, College of Liberal Arts and Sciences (Mentor: Nathaniel Wade)
- I.C.4 **Attitudes Toward Help-Seeking**
ASALE HUBBARD, Psychology, College of Liberal Arts and Sciences (Mentor: David Vogel)

SESSION I.D SYSTEMS ANALYSIS IN ENGINEERING & AGRICULTURE

Memorial Union, Rm. 3558

9:10-10:30 am

Moderator: Mary Wiedenhoef, Dept. of Agronomy

- I.D.1 **Stall Hysteresis on Low-Reynolds-Number Airfoil**
MATTHEW MARTIN, Aerospace Engineering, College of Engineering (Mentors: Hui Hu and Hirofumi Igarashi)
- I.D.2 **Student Design of a Satellite for Lunar Surface Analysis and Solar Sailcraft Demonstration**
NATHAN WILLIS, Aerospace Engineering, College of Engineering AND SAMUEL WAGNER, Aerospace Engineering, College of Engineering; and Mathematics, College of Liberal Arts and Sciences (Mentors: Bong Wie and Matthew Nelson)
- I.D.3 **Analysis of Nuclear Standoff Explosions for Deflecting Near-Earth Objects**
BRIAN KAPLINGER, Aerospace Engineering, College of Engineering (Mentors: Bong Wie and John Basart)
- I.D.4 **Comparing Energy Use and Efficiency in Central Iowa**
RACHAEL COX, Agronomy, College of Agriculture and Life Sciences (Mentor: Mary Wiedenhoef)

PROGRAM – Session II

CONCURRENT SESSIONS II.A, II.B, II.C

SESSION II.A PLANT PATHOGENS & MYCOTOXICITY

Memorial Union, Rm. 3219

10:45 am-12:05 pm

Moderator: Gary Munkvold, Dept. of Plant Pathology

- II.A.1 **A Comparative Study of *Fusarium* Damaged Kernels and Deoxynivalenol (DON) Among Winter Triticale**
COLLIN LAMKEY, Agronomy, College of Agriculture and Life Sciences (Mentors: Lance Gibson and Gary Munkvold)
- II.A.2 **Fungal Species Colonizing Ethanol Fermentation Co-Products**
CHRISTINE WEBER, Microbiology, College of Agriculture and Life Sciences (Mentor: Gary Munkvold)
- II.A.3 **Effects of Temperature on Growth Rate and Sporulation in Four Different Isolates of *Fusarium viguliforme***
PRISCILLA DELGADO, Microbiology, College of Agriculture and Life Sciences (Mentors: Leonor Leandro and Gladys Mbofung)
- II.A.4 **Spatial Distribution of Soybean Root Rot, Root Pathogens, and Soil pH**
KOK KEONG LIM, Microbiology, College of Agriculture and Life Sciences (Mentors: Leonor Leandro and Carlos Gongora-Canul)

SESSION II.B SURVEY ANALYSIS IN BUSINESS, SOCIAL SCIENCE, & EDUCATION

Memorial Union, Rm. 3505

10:45 am -12:05 pm

Moderator: Jacqueline Pryor, Dept. of Educational Leadership & Policy Studies and Ronald E. McNair Postbaccalaureate Achievement Program

II.B.1 **Success of Iowa State University Students: The Effects of Family and High School Background**

BRITTNEY SCHMIDT, Marketing, College of Business (Mentor: Darin Wohlgemuth)

II.B.2 **Music and Brand Image in the Retail Environment**

ASHLEY RATUTE, Apparel Merchandising, Design and Production, College of Human Sciences (Mentor: Ann Marie Fiore)

II.B.3 **Different Parental Styles between Intercultural and Homogeneous Families**

KAROL KING, Child, Adult and Family Services, College of Human Sciences (Mentor: Marta Maldonado)

II.B.4 **Effect of Sexual Education Curriculum on Iowa Youth**

SIMONE RAINEY, Kinesiology and Health, College of Human Sciences (Mentor: Marian Kohut)

SESSION II.C ELECTRICAL SENSOR & WIRELESS NETWORK TECHNOLOGY

Memorial Union, Rm. 3538

10:45 am -12:05 pm

Moderator: Hui Hu, Dept. of Aerospace Engineering

II.C.1 **Smart Emergency Evacuation Systems Using Wireless Sensor Networks**

TYCHO ANDERSEN, Computer Engineering, College of Engineering (Mentors: Srikanta Tirthapura and Puviyarasan Pandian)

II.C.2 **The Muscle Behind the New Bionic Woman**

ELEASE MCLAURIN, Materials Engineering, College of Engineering (Mentor: LeAnn Faidley)

II.C.3 **Localization in Wireless Sensor Networks**

KYLE BYERLY, Computer Engineering, College of Engineering and Mathematics, College of Liberal Arts and Sciences (Mentor: Daji Qiao)

II.C.4 **Outdoor Tracking using Radio Frequency Wireless Sensor Networks**

CORY SIMON, Computer Engineering, College of Engineering (Mentor: Manimaran Govindarasu)

PROGRAM – Session III

CONCURRENT SESSIONS III.A, III.B, III.C

SESSION III.A ANIMAL GENETICS, BIOLOGY & BEHAVIOR

Memorial Union, Rm. 3219

1:30 -2:30 pm

Moderator: Jeffrey Essner, Dept. of Genetics, Development, & Cellular Biology

III.A.1 **Genetic, Gender and Behavioral Effects on Neonatal Growth in Garter Snakes with Two Growth Phenotypes**

ABIGAIL LEHMAN, Biology, College of Liberal Arts and Sciences; MATTHEW MORRILL, Zoology, College of Liberal Arts and Sciences; NICOLE RUTSCHER, Biology, College of Agriculture and Life Sciences; AND JEREMY CHAMBERLAIN, Biology, College of Agriculture and Life Sciences (Mentor: Anne Bronikowski)

III.A.2 **Short Term Exposure to Herbicide Yields Long Term Effects in Map Turtles (Graptemys)**

LORI NEUMAN-LEE BIGGS, Biology (B.S. Fall 2007) and English, College of Liberal Arts and Sciences (Mentor: Fredric Janzen)

III.A.3 **RecA Targeted Homologous Recombination in Zebrafish**

KATIE LUTZ, Genetics, College of Liberal Arts and Sciences (Mentors: Jeffrey Essner and Hsin-Kai Liao)

SESSION III.B MOLECULAR MICROBIOLOGY IN HUMAN & ANIMAL SYSTEMS

Memorial Union, Rm. 3505

1:30 -2:30 pm

Moderator: Melissa Madsen, Dept. of Veterinary Pathology & Preventative Medicine

III.B.1 Construction of a *hyd* Mutant of *Escherichia coli* O157:H7

LEANNE SCHULTZ, Food Science and Technology, College of Human Sciences (Mentors: F. Chris Minion and Supraja Puttamreddy)

III.B.2 Comparison of Sensitivity and Specificity of *Mycoplasma hyopneumoniae*-specific PCR Assays

DAVID BENSON, Biochemistry, College of Liberal Arts and Sciences (Mentors: F. Chris Minion and Erin Strait)

III.B.3 Transcriptome Analysis of a High Adherent Variant of *Mycoplasma hyopneumoniae*

ANDREW PETERSEN, Computer Science, College of Liberal Arts and Sciences; and Microbiology, College of Agriculture and Life Sciences (Mentors: F. Chris Minion and Melissa Madsen)

SESSION III.C MATERIALS, ELECTRICAL, & COMPUTER ENGINEERING

Memorial Union, Rm. 3538

1:30 -2:30 pm

Moderator: Nicola Elia, Department of Electrical & Computer Engineering

III.C.1 Flow Optimization of Osteoceramic Cement

JARRETT WENDT, Materials Engineering, College of Engineering (Mentor: Thomas McGee)

III.C.2 Omnidirectional Robot

KYLE MILLER, Electrical Engineering, College of Engineering, MARK RABE, Computer Engineering, College of Engineering; JONATHAN WATSON, Electrical Engineering, College of Engineering; CHRISTOPHER TOTT, Electrical Engineering, College of Engineering; JOSHUA WATT, Computer Engineering, College of Engineering; JONATHAN DASHNER, Computer Engineering, College of Engineering; SHANE GRIFFITH, Electrical and Computer Engineering, College of Engineering AND ALEX BAUMGARTEN, Electrical and Computer Engineering, College of Engineering (Mentor: Nicola Elia)

III.C.3 Adaptive Processor Clocking Using Error Monitoring Feedback

ADAM JACKSON, Computer Engineering, College of Engineering (Mentors: Arun Somani and Viswanathan Subramanian)

ABSTRACTS

Model Based Software Verification

Daniel De Graaf, Cory Kleinheksel, Kevin Korslund, and Benjamin Miller (Session I.A.1)

This research is aimed at developing a new tool to facilitate efficient development of control software for safety-critical applications. Like spreadsheets, Model-based development (MBD) tools offer a graphical programming environment where the user develops the program as a graphical model from which the code is generated automatically. At present, code generators are not as mature as compilers and thus their output must be checked with almost the same, expensive effort as for manually written code. Our research goal is to create a tool to check the equivalence of the executable model and the generated code so that human experts can perform model-based software safety analysis that is a lot less cumbersome and far more efficient than the current manual practices. Our approach is summarized as follows. Let M be the model and let C be the auto-generated code. We have an inverse transform, to be performed by the proposed tool, which will extract a Model M_e from the code C . The second part will be another tool to prove that M and M_e are equivalent. The equivalence proof is based on the mathematical theory of graph isomorphism. This undergraduate research focuses on the first part, the inverse transform tool. The second part is being done by another team of graduate students.

An Undergraduate Research Assistant's Role Relating to Spatial Composition

Bonny Reynolds (Session I.A.2)

The research presented here is part of a larger research project which explores how the architectural layout of free-flow open spaces impacts air circulation and can be studied through the use of computational fluid dynamics (CFD). In order for CFD to be applied to a building to examine these spaces, numerous tasks involving multiple computer programs are completed. Information is gathered from literature and other archival resources to analyze working drawings of the building being researched. Floor plans, sections, and elevations are needed to accurately express the building. Once these drawings are analyzed, a two-dimensional drawing of the building can be produced in AutoCAD. The building is broken up into parts by floor level, which is conducive to generating the three-dimensional Autodesk Inventor model. The parts of the model are brought together to make an enclosed form to be filled with a solid volume. This volume is used to apply CFD to the building. Presentation-quality drawings are created in Adobe Illustrator to accent how volumes of space within the building relate to one another. Through the use of AutoCAD drawings, Inventor models, volumetric analysis drawings in Illustrator, a comparison of spatial composition and air-flow patterns can be analyzed in CFD.

Internal Volume Scaling and Effects on Internal Pressure

Michael Peterson (Session I.A.3)

While there have been countless laboratory studies on lift on structures in a straight-line wind event using wind tunnels and scale models, applying this concept to tornados has been a relatively recent endeavor. Based on previous studies and our current understanding of tornadic vortices, the internal pressure fluctuations seem to play a key role in the total lift felt by the building's roof during the event. Past research also hints at a relationship between internal pressure and internal volume scaling. The problem is that when a structure is scaled down, the length scale decreases differently than the volume scale, so in order to get accurate readings of internal pressure, it is necessary to compensate for this volume loss. The aim of this study is to explore this relationship for a number of common wind engineering problems and situations that are likely to occur during a tornado. This study also examines the effects of a number of other parameters on internal pressure, including the diameter of the vortex and orientation of the structure relative to the path of the tornado.

Financial Pictures: An Analysis of Graphical Displays Online

Virginia Roberson (Session I.A.4)

This project analyzes how companies display their financial statements to investors via the internet. Interest in this project stemmed from a combination of relevance to my field of study and an introduction to the topic last year as part of my freshman mentor program. This project is relevant both to my major and to investors worldwide. Providing investors a broader range of ways to display the data on a company's website enables investors to make more informed decisions. We are collecting data from 100 of the Fortune 500 companies by either accessing their websites directly or using specific search engines such as Merchant Online. We are already starting to see trends as to which formats are most popular overall and also which industries lean towards the same type of reporting. Recently, the Securities Exchange Commission (SEC) is also examining how companies display such financial information as they attempt to have companies move towards using XBRL (Extensible Business Reporting Language). Thus, this research may become more important in accounting/finance in the next few years.

Egg White Protein Prevents Hyperhomocysteinemia in Folate-deficient Rats

Rebecca Luchtel (Session I.B.1)

Maintenance of homocysteine (hcy) homeostasis is regulated through folate-independent and folate-dependent remethylation, as well as irreversible transsulfuration. Folate deficiency perturbs hcy balance resulting in hyperhomocysteinemia, an independent risk factor for cardiovascular disease. Because of the marked difference in sulfur amino acid profile, we conducted a study to compare egg white and casein protein with respect to their ability to prevent hyperhomocysteinemia in folate-deficient rats. Rats were fed 20% casein or egg white protein diets for 2 wk, followed by folate-free diet treatment in half of the rats for an additional 4 wk. As expected, hyperhomocysteinemia was seen in folate-deficient rats fed a casein diet. However, the folate-deficient rats fed egg white protein exhibited hcy levels that were not statistically different from those rats receiving adequate folate. It appears that the effectiveness of egg white protein to prevent hyperhomocysteinemia was due to a 40%

increase in hepatic betaine-homocysteine methyltransferase, the enzyme that catalyzes folate-independent hcy remethylation. Taken together, these results indicate that dietary egg white protein has a significant impact on hcy metabolism and is extremely effective in the prevention of hyperhomocysteinemia (Support: Egg Nutrition Center, Iowa Egg Council).

Perceptions and Attitudes toward Physical Activity of Postmenopausal African American Women

Mileka Scurlock (Session I.B.2)

This study sought to investigate the perceptions and attitudes toward physical activity, as well as other psychosocial determinants of lifestyle physical activity participation in older African American post-menopausal women in the Midwest. Participants were between the ages of 46 and 72 years. Semi-structured interviews were conducted with eight women. Content analysis was employed to reveal common themes of perceived barriers, benefits, and enablers. Factors that influenced decreased physical activity over the lifespan included aging, increased responsibilities, and inconvenience of facilities. Perceived barriers included exercise-induced pain, time, health conditions, and lack of intrinsic motivators. Benefits of physical activity were similar to those of previous studies with improved health, vigor, and weight management. Enablers included self-determination, outdoor activities, and support groups. This study provides information on these issues and can also help to create and promote effective physical activity interventions tailored to the needs of older African American women.

Effect of Task Complexity on Walking in Young Adults

Lindsay Thompson (Session I.B.3)

Walking in the real world involves divided attention i.e., walking while listening or talking. Falls in older adults may occur more frequently during divided attention. The purpose of this study was to determine how dual-task conditions affect walking in young adults. It is expected that young adults will exhibit greater gait variability when engaged in more difficult cognitive tasks. Twenty-one young adults (11 men, 10 women) performed verbal and nonverbal tasks while walking around an oval track at their preferred pace. Data were collected using an instrumented walkway (GAITRite System). Tasks ranged in complexity from simple (listening or doing a simple talking task) to complex (listening for multiple items or performing a talking task involving a series of items). Analyses of Variance indicated that young adults did not increase variability with complexity. They did increase step width when talking and walked more slowly during the complex verbal (but not complex nonverbal) task. The gait of young adults is sufficiently automated, resulting in only subtle changes in walking balance and speed when engaged in cognitive verbal tasks. These results indicate that step width may be an important variable to examine in older adults.

Genetic Regulation of Milk Fatty Acid Composition: Developing Tools for Use in Selection

Kathleen Korn (Session I.B.4)

Cardiovascular disease (CVD) causes the most deaths in the United States. Decreasing the percentage of saturated fatty acids in milk and other animal products can lead to healthier foods and to decreased incidence of CVD in humans. This study's objective was to determine if variations in single nucleotide polymorphism (SNP) in thioesterase and diacylglycerol acyltransferase-1 genes would explain variations in milk fatty acid composition among Holstein dairy cattle. From about 100 cows, milk samples were collected monthly throughout the first six months of lactation and analyzed for milk fatty acid composition by gas chromatography. DNA for each animal was obtained from blood samples. Cows with thioesterase GG genotype and cows with diacylglycerol acyltransferase-1 GC genotype tended to have a lower atherogenic index (AI) when compared to cows with AG and GG genotypes, respectively. A decrease in the concentration of myristic and palmitic acids and an increase in the concentration of polyunsaturated fatty acids achieved the AI decrease. These results indicate the potential of using earlier mentioned SNPs as DNA markers to select breeding stocks that have a healthier milk fatty acid composition. (Supported by National Research Initiative Grant no. 2005-35205-16235 from the USDA Cooperative State Research Education, and Extension Service).

Media and the (Mis)Representation of Crime in America: Analyzing NBC's "To Catch A Predator" Series

Tyler Barrett (Session I.C.1)

This paper and its subsequent presentation analyzes NBC's popular "To Catch A Predator" television series to examine how this program contributes to the social construction of Internet "predators" as a pressing contemporary social concern. The premise of the show is quite simple: identify potential sex offenders on the Internet and lure them to a house filled with hidden-cameras and a television host waiting to pounce on the unsuspecting deviant, thus giving viewers a voyeuristic window into the identification, public shaming, and arrest of adults who would use the Internet to seek minors for sex. Since the first episode was broadcast in 2004, "To Catch A Predator" has gained tremendous popularity, reinvigorated the reality-crime genre, and helped galvanize political and popular discourse about the prevalence and threat of sex offenders in society. Our findings, based on content analysis of broadcast episodes, reveal that "To Catch A Predator" like its reality-crime predecessors (e.g., COPS, America's Most Wanted), draws on typifications of crime and criminal justice and conventions of the reality crime genre to construct this issue as a pervasive and imminent threat. Additionally, we show how the format and production methods of "To Catch A Predator"--most notably the one-on-one interaction between the show's host and the offender--create a situated performance of collective morality that serves to both further shame and debase the would-be offenders while also staunchly affirming long-held collective values about crimes against children.

Unable to Focus: Modulation of Cognitive Control by Negative Affect

Peter Choi (Session I.C.2)

There is a significant overlap in the neural structures supporting cognitive and affective control. Not surprisingly, many behavioral studies suggest that elevated levels of negative affect can have a detrimental effect on various neuropsychological measures. In our study, we considered the influence of variation in trait and state level negative affect on proactive and reactive cognitive control. The study was grounded in the dual process theory of cognitive control. Participants were selected based on the Beck's Depression Inventory, and we measured the pre- and posttest levels of negative affect. Event-related potentials were measured while participants performed a counting Stroop task. We expected to observe a decrease in proactive control (operationalized by a decrease in amplitude of contingent negative variation (CNV)) and an increase in reactive control (operationalized by an increase in the amplitude of medial frontal negativity and sustained potential) in participants with elevated negative emotions. The CNV decreased with negative emotions; the medial frontal negativity increased with negative emotions; and the sustain potential was not influenced by negative emotions. These findings may indicate that individuals with elevated levels of negative emotion fail to engage in either proactive or reactive cognitive control.

Diversity and Group Counseling

Courtney Cornick (Session I.C.3)

Over the past 30 years, there has been a growing concern regarding issues of race and ethnicity in counseling (Beutler, 1996). Much of the literature and research has focused on counselors and how they can better serve minority clients, whereas little has focused on the client's perceptions of group counseling. There hasn't been research regarding diversity in group counseling. In the present study minority and Caucasian college students were involved in an experimental study to understand their views of diversity in a group counseling session. This study focused on how the discussion of diversity within a group counseling session affected the perceptions of minorities.

Attitudes Toward Help-Seeking

Asale Hubbard (Session I.C.4)

This study looks at the interpersonal and societal stigmas in the African-American community by counselor type. The study will primarily use the college student population, but may include faculty to see if there are differences in views based on educational attainment. The data will be collected by an online survey randomized to show a Caucasian or African-American practitioner. It is expected that there will be significant differences between the Caucasian group and African-American group. The Caucasian group will report higher stigma values due to the fact that they are seeing a practitioner not of their ethnicity.

Stall Hysteresis on Low-Reynolds-Number Airfoil

Matthew Martin (Session I.D.1)

An experimental study of stall hysteresis was performed on a GA(W)-1 airfoil. Pressure measurements were used to calculate aerodynamic coefficients. Particle image velocimetry (PIV) was used to visualize mean streamwise velocity and instantaneous spanwise vorticity. The results of each validated the other. A better understanding of the physics of the airflow over an airfoil is gained from the research presented.

Student Design of a Satellite for Lunar Surface Analysis and Solar Sailcraft Demonstration

Nathan Willis and Samuel Wagner (Session I.D.2)

Iowa State Student Moon Orbiter (ISSMO) is a project put forth by Iowa State University to meet NASA's American Student Moon Orbiter (ASMO) challenge. This inter-disciplinary team is lead by highly motivated students enrolled in various fields of engineering, as well as other relevant disciplines. The ISSMO project is integrated within the framework of Iowa State University's proprietary Space Systems and Controls Laboratory (SSCL), which provides the necessary infrastructure and logistical support. Funding, organization, mission design, registration and engineering of the ASMO craft are all responsibilities of the ISSMO team. The two primary missions of ISSMO are to send a small satellite into a lunar orbit and launch a solar sailcraft while in transit. The secondary mission is to carry a small scientific payload for lunar research. The craft will be designed by Iowa State students and commanded from the SSCL in Ames, Iowa.

Analysis of Nuclear Standoff Explosions for Deflecting Near-Earth Objects

Brian Kaplinger (Session I.D.3)

A collision of an asteroid with the Earth could destroy entire cities. Asteroids have collided with the Earth in the past and are predicted to do so in the future. For years the scientific community has been analyzing various techniques for deflecting an asteroid away from its collision path with the Earth. Early in 2007, NASA's study report stated that a nuclear approach was 10 to 100 times more effective for deflection than non-nuclear alternatives. Our research is focused on assessing this assertion. We use geometric principles and basic physics to build our model. This approach can be augmented to account for icy bodies, anisotropic ejecta distributions, and effects unique to the nuclear blast model. Possible fragmentation and other anticipated outcomes of a nuclear blast are analyzed. We conclude our discussion with future work on improving our simple model.

Comparing Energy Use and Efficiency in Central Iowa

Rachael Cox (Session I.D.4)

The study of energy use is relevant to the understanding of agricultural systems, especially in creating sustainable systems. The goal of this research is to compare energy usage and efficiency in different agroecosystems. To understand the flow of energy in different agroecosystems, three different farms were selected for comparison. Each farm was selected to fit into three categories: industrial row crop production, integrated crop and livestock production, and small-scale mixed vegetable production. In each system, energy was quantified in Mega joules (MJ) using information provided through interviewing the producer, including information on yields, chemical input, gasoline usage, and more. This data was organized into solar energy input, human energy input, and total energy output. Data was compared by analyzing the ratio of energy input to energy output in each system. The most energy efficient system, meaning the system which maximized output per input, was the integrated crop and livestock agroecosystem. The second highest efficiency was the conventional corn and soybean production. The lowest level of efficiency was found in the mixed vegetable production. The research suggests that certain farming systems are more energy intensive than others, and as oil and energy continue to be debated in society, keeping in mind the use of energy in agriculture is essential.

A Comparative Study of *Fusarium* Damaged Kernels and Deoxynivalenol (DON) Among Winter Triticale

Collin Lamkey (Session II.A.1)

Fusarium head blight (FHB) is a global disease caused by *Fusarium graminearum* Schwabe and affecting small grains like barley, wheat, and triticale. The *Fusarium* fungus produces the mycotoxin deoxynivalenol (DON),

which limits use of FHB infected grain in human and animal diets. The purpose of this project is to characterize *Fusarium* head blight (FHB) damage of triticale grain in Iowa by testing for *Fusarium* damaged kernels (FDK) and DON. FDK levels will be visually measured and DON will be quantified using an enzyme-linked immunosorbent assay (ELISA). Thirteen genotypes grown in variety tests at Ames, Calumet and Crawfordsville in 2005, 2006, and 2007 will be tested. These data will be added to previous data from 2004 and expand current literature on FHB characterization in triticale. The results of this project will allow breeders to better select for resistance among triticale genotypes and lead to future research targeting improved FHB resistance in triticale.

Fungal Species Colonizing Ethanol Fermentation Co-Products

Christine Weber (Session II.A.2)

The recent increase in ethanol production has resulted in an increase in ethanol co-products available for livestock consumption. Feeding ethanol co-products can have health implications for livestock. As a result of the fermentation process, original concentrations of mycotoxins in the grain may be increased in the co-products, and new fungal colonization may occur. Our study sought to identify potential mycotoxin-producing fungi present in samples of ethanol co-products, including wet distillers' grains (WDG), dried distillers' grains (DDGS), and condensed distillers' solubles (CDS). Samples of co-products were collected from two locations and were diluted and cultured on semi-selective media for fungi. Colony counts were performed and some of the fungi were isolated and identified by morphological characters, carbon-source utilization (Biolog® analysis), and ITS sequences. Fungal populations ranged from 2.00×10^4 cfu/g to 2.10×10^7 cfu/g. Isolates were identified as *Penicillium*, *Cladosporium*, *Aspergillus*, and *Mucor* species, as well as various yeast species. Some isolates are potential mycotoxin producers. These results indicate the need for further studies to determine the harmful mycotoxin levels found in each type of co-product. In addition, more detailed studies are needed on the growth rate of fungi in each type of co-product to reduce spoilage during transport and storage.

Effects of Temperature on Growth Rate and Sporulation in Four Different Isolates of *Fusarium virguliforme*

Priscilla Delgado (Session II.A.3)

Soybean sudden death syndrome, caused by *Fusarium virguliforme*, reduces soybean productivity. The fungus infects the roots and produces a toxin that causes foliar symptoms. Temperature and light are known to affect root infection and severity of foliar symptoms but the effect on fungal growth and sporulation has not been clearly demonstrated. The objective of this experiment was to define the optimum temperature and light for mycelium growth and sporulation. Four genetically different isolates were compared on PDA and SNA media. Fungal cultures were incubated at 4, 10, 15, 20, 25, 30, and 35 °C for 15 days. For the light experiment, incubation was done under continuous light, 12 hour light/12 hour dark, and continuous dark. Fungal colony diameter was measured every 3 days to determine mycelial growth rate. Spore production was quantified at the end of the experiment. The optimum temperature for fungal growth was 25 °C on both media, while sporulation showed an optimum between 15-25 °C. On PDA, the fastest growth rate was observed under continuous light and the slowest in continuous dark, but the opposite was observed on SNA. In addition, variation in growth rate was observed among isolates on SNA but not on PDA. Colony morphology and pigmentation differed among isolates. This research offers important insights for better understanding how temperature and light affects pathogen growth and reproduction in field conditions.

Spatial Distribution of Soybean Root Rot, Root Pathogens, and Soil pH

Kok Keong Lim (Session II.A.4)

Root health is essential for the growth and productivity of crops, but the importance of root rot on soybean yield is poorly understood. Soybean roots can be infected by diverse soilborne pathogens, including the soybean cyst nematode (SCN) and several fungi that cause root diseases. Abiotic factors, such as soil pH, may also affect root growth and pathogen reproduction. The objective of this work was to gain a better understanding of the relationship between soybean root rot, root pathogens and soil pH. Two soybeans field trials were established in a grower's farm in Nevada, in 2006 and at ISU Burkey Farm, in 2007. Plants were sampled ten days after emergence and at flowering. Roots were assessed for rot severity, dry weight, and fungal colonization. Soil samples were assessed for SCN populations and pH, and yield was determined. A strong spatial relationship was observed between root rot, soil pH, and SCN, with areas of lowest yield showing the highest pH, SCN levels and root rot severity. *Fusarium* was the predominant fungus isolated from roots and tended to increase root rot

severity. This study suggests that root rot is important for soybean productivity, and encourages further research to clarify the interaction between soil pH, root pathogens and yield.

Success of Iowa State University Students: The Effects of Family and High School Background

Brittney Schmidt (Session II.B.1)

This research examines if there is a link between a student's high school and family background and their success at Iowa State University. We measured academic success by cumulative grade point average after the spring semester and student retention. The study was initially a freshmen Honor's project to understand college search process. It was expanded to capture academic success. The hypothesis being tested is that a student's background directly impacts their success at Iowa State. During the spring 2005 semester, ESSAy successfully called 340 freshmen and asked a series of 22 questions. These questions aimed to find out information about a student's high school and family background. To analyze the information collected from the survey, we compiled the information into Excel. We completed statistical analysis in excel and STATA. Preliminary findings include that the marital status does not have a significant impact on academic success but the importance of academics to friends and self does. We also find, consistent with expectations, that the class rank and ACT scores do play an important role in academic success. This research could help students, parents, and educators to better understand how to help students succeed at Iowa State University.

Music and Brand Image in the Retail Environment

Ashley Ratute (Session II.B.2)

How does music affect the way you see a store and its products? The present study has examined the relationships between (a) presence or absence of music and store image, (b) congruence of genre of music with store image and (c) level of liking the music played in a retail store and store's brand image on consumers' responses towards the store. Studies focusing on the effect of music have commonly examined music and in-store experiences or behavioral outcomes, however little attention has been paid to consumers perceptions of retail environments in correspondence to the music being played in that space. This study focuses on how music (i.e., presence, congruence or appropriateness, liking) affects brand image of the store.

Different Parental Styles between Intercultural and Homogeneous Families

Karol King (Session II.B.3)

The purpose of this study is to compare the different parental styles between intercultural and homogeneous families with specific focus on Latino, Anglo, and mixed families. This study expects to show the variation in parenting practices among different ethnic groups and how childrearing varies within these families. This study will refer to other studies pertaining parenting styles and childrearing. We'll conduct interviews with Latino-Latino, Latino-Anglo, and Anglo-Anglo families, and contrast their parenting styles.

Effect of Sexual Education Curriculum on Iowa Youth

Simone Rainey (Session II.B.4)

The continuous debate about sexual education as part of K-12 curricula has existed for decades. While there have been various efforts to establish a uniform sexual education program in the U. S. since the early 1900s, there is no national policy that defines the concept and/or dictates the content of courses. In the case of the state of Iowa, an increasing number of schools receive abstinence-only education funds. Conversely, the Iowa Department of Public Health has reported an increase in sexually transmitted diseases (STD) infections from 2004 to 2005. This study proposes that the use of a more complete sexual education program will decrease the chances of youth aged 13-19 contracting a STD or HIV/AIDS. To evaluate this assumption data will be collected from schools throughout the state classifying the topics covered in their particular sexual education programs. Also, after consent forms have been obtained, surveys will be distributed among a sample of 100 freshmen students at an Iowa university who have graduated from an Iowa high school. The findings of this research study will report a correlation between sexual education curriculums and the likelihood of being infected with an STD.

Smart Emergency Evacuation Systems Using Wireless Sensor Networks

Tycho Andersen (Session II.C.1)

Most modern evacuation systems simply consist of signs that say "Exit" with an arrow. These signs give no indication of whether or not this exit is safe. Further, if the exit is not safe there are no more indications of where to exit, which, in unfamiliar locations (like large concert halls with many panicking people) can be disastrous. With today's sensor networks, we can gather real time information on the physical characteristics of the environment. Our goal is to use this to provide smart, adaptive directions to users in case of an emergency. There are several technical problems that we have focused on: 1) Deploying a sensor network to measure the surrounding environment, 2) Fault tolerant wireless communication among sensors, 3) How to determine alternate exits, and 4) Keeping a consistent system state throughout the network. This project may lead to the next generation of evacuation systems. Our algorithms could be extended or redesigned to incorporate gas leaks and other disasters as well.

The Muscle Behind the New Bionic Woman

Eleese McLaurin (Session II.C.2)

What gave the Bionic Woman, from the same named 1976 TV show, the ability to bend steel and outrun a speeding car?—artificial muscles! Her muscles would have been electric field sensitive actuators. The goal of this research is to investigate the load and strain capabilities of magnetic field sensitive gel actuators, or ferrogels. Ferrogels are soft polymers which contain ferrous particles. These actuators offer large strains, inexpensive and easy fabrication, potential biocompatibility, and lifelike movement capabilities. However, before this smart material can be applied in future technological developments, further characterization is necessary to understand how to optimize these characteristics. Previous research has focused on ferrogels fabricated using either the chemical or physical crosslinking method for a variety of applications. However, only limited characterization of their actuator behavior has been reported. In this research project, gels having similar composition weight percentages are fabricated using both fabrication methods. Their magnetically driven maximum strain and load capabilities are then measured to determine the dependence of these actuator characteristics on the fabrication methods. The test results will enable ferrogel optimization for applications requiring the maximum amount of load and/or strain capabilities. Who knows, ferrogels might be the muscle behind the future bionic woman.

Localization in Wireless Sensor Networks

Kyle Byerly (Session II.C.3)

Localization is a difficult challenge for today's Wireless Sensor Networks. The goal of localization is to find the location of each device as cheaply and as accurately as possible while using the least amount of energy. High accuracy requires more energy usage, and in general more costly sensor devices which is at odds with a cheap and energy efficient network. Localization is important as the nodes of a WSN may be scattered about with few, if any, nodes knowing their actual location. With a good localization system the individual nodes should be able to know their location with minimal overhead. A modular localization system will be presented. The current implementation uses Received Signal Strength Indication (RSSI) and Link Quality Indicator (LQI) from packets received to infer distance. The individual nodes then calculate their position using lateralization and make it available to applications. An added benefit of this system is that new Localization algorithms can be added as they are developed without changing the overall system. It is even possible to run multiple algorithms concurrently. Future work will include implementing more algorithms, taking more data on RSSI and LQI, as well as using different nodes.

Outdoor Tracking using Radio Frequency Wireless Sensor Networks

Cory Simon (Session II.C.4)

Today, the vast majority of outdoor tracking and localization systems are GPS-based. Relatively few papers have been published dealing with the implementation of wireless sensor networks (WSN) for outdoor tracking and localization. This research seeks to fill some of that void by modifying several indoor tracking methods to function in larger outdoor environments. Research papers that use WSN for indoor tracking contain several methods which have the potential to also be effective in outdoor use. Based on these papers and the results of small tests, a new method of outdoor tracking using signal presence, signal strength, trilateration, and a restricted location set has been developed. A limited version of the theoretical system has been implemented to test the functionality of certain parts of the system. This research addresses the lack of non-GPS outdoor tracking systems available today. If fully deployed, this system would have the ability to track objects over a fixed area with better reliability than GPS systems. Future research will attempt a full implementation of this system with a detailed performance analysis. A more complex tracking algorithm using RF signal strength matching may also be implemented.

Genetic, Gender and Behavioral Effects on Neonatal Growth in Garter Snakes with Two Growth Phenotypes

Abigail Lehman, Matthew Morrill, Nicole Rutscher, and Jeremy Chamberlain (Session III.A.1)

Populations of garter snakes (*Thamnophis elegans*) have been monitored in Northern California since the 1970s. From these long-term data, two growth phenotypes have been identified: fast growth with subsequent early sexual maturation, large reproductive effort and short lifespan; slow growth with corresponding late sexual maturation, small reproductive effort per litter, and long lifespan. Previous laboratory studies have shown that the growth difference is due to genetic divergence among populations, as well as environmental differences. In this common environment study, neonates of both growth phenotypes were raised in the laboratory to study the effect of feeding behavior, gender, and source population on first year growth rate. Fast-growth individuals ate more readily and more often. Even after accounting for feeding rate differences, the two growth phenotypes varied with neonates from fast-growth populations growing fastest in the laboratory. Thus, the growth rate differences that underlie lifetime differences in reproduction and survival between the two phenotypes are present at birth.

Short Term Exposure to Herbicide Yields Long Term Effects in Map Turtles (Graptemys)

Lori Neuman-Lee Biggs (Session III.A.2)

Atrazine is a widely used pre-emergent herbicide for controlling broadleaf plants. Since atrazine (a known endocrine disrupting chemical) is applied in the late spring and early summer, its impact on turtles nesting in water-saturated sandbars during this time is very relevant. To examine this possible impact of atrazine, eggs were obtained from 10 nests of two closely related map turtles, *Graptemys ouachitensis* and *G. pseudogeographica*. Two eggs from each nest were incubated in sand containing one of four concentrations of atrazine (control, 0.1ug/L, 10ug/L, 100ug/L) based on levels measured in the river adjacent to the site where eggs were collected. Hatching success, incubation length, external morphological abnormalities, gonadal sex, three measures of body size, righting speed, and swimming speed were recorded for all turtles. The remaining neonates were reared individually for 10 mo during which time nest escape behavior, time to first foraging event, foraging speed, and growth were evaluated. None of the variables recorded at hatching was affected by atrazine treatment. However, turtles deriving from atrazine-treated eggs had a significantly lower success in several of the behavior trials, such as eating and escape. These findings reveal persistent fitness-reducing impacts on neonatal turtles of atrazine exposure during embryonic development.

RecA Targeted Homologous Recombination in Zebrafish

Katie Lutz (Session III.A.3)

Zebrafish are an important vertebrate model organism for human disease and development. However, there is no means to use this model in reverse genetics to mutate specific genes and observe the effects. In this research, we hypothesized that the prokaryotic protein RecA could create targeted mutations in the genome by homologous recombination. RecA functions by coating single stranded DNA, finding homologous regions of DNA in the

genome, and promoting homologous recombination. A fusion RecA protein and a linear, double-stranded DNA molecule coding for a gene and the green fluorescent protein (gfp) were coinjected into 1-cell zebrafish embryos. Recombination events were observed in embryos as fluorescence in the area of expression of the targeted gene. Molecular techniques confirmed the targeted recombination event. Furthermore, targeted fluorescence has also been observed to be inherited in the next generation. While these techniques are being developed in zebrafish, we believe they will provide the ability to perform genome modifications in most models for human disease and have applications for human gene therapy.

Construction of a hlyD Mutant of *Escherichia coli* O157:H7

Leanne Schulz (Session III.B.1)

Escherichia coli O157:H7, a human food borne pathogen, causes diarrhea, hemorrhagic colitis and hemolytic uremic syndrome. This organism has the ability to form biofilms that helps bacterial persistence and dissemination in the environment. Earlier work in our lab focused on understanding the process of biofilm formation, and identified 51 genes that are involved in biofilm formation by screening Tn5 transposon insertion mutants. Ten of these genes were further tested by constructing deletion mutations. The phenotype of nine of these deletion mutants was consistent with the cognate Tn5 insertions and exhibited no biofilm formation. However, the hlyB deletion mutant showed no difference in biofilm formation when compared to wild type. We hypothesize that the reason for this inconsistency is the polarity effect of insertion of the transposon on downstream translation of hlyD in the hlyCABD operon. We further hypothesize that hlyD is the critical element in biofilm formation and not hlyB. To test this hypothesis, we are generating a deletion in hlyD of *E. coli* O157:H7 using a process called recombineering. This mutant will be tested for its ability to form biofilms.

Comparison of Sensitivity and Specificity of *Mycoplasma hyopneumoniae*-specific PCR Assays

David Benson (Session III.B.2)

Mycoplasma hyopneumoniae is an important cause of pneumonia in pigs around the world, but confirming its presence (or absence) in pigs can be challenging. It is difficult to culture, and seroconversion is often delayed after natural infection, limiting the use of serology. Numerous PCR assays for the detection of *M. hyopneumoniae* have been developed targeting several different genes. Recently, genetic diversity among strains of *M. hyopneumoniae* has been demonstrated. The effect of this diversity on the sensitivity and specificity of the *M. hyopneumoniae* PCR assays has resulted in false negative results in current PCR tests. In this study *M. hyopneumoniae*-specific PCR assays were tested against a panel of different bacterial swine pathogens and environmental contaminants. Included were: *M. hyopneumoniae*, *Mycoplasma flocculare*, *Mycoplasma hyorhinis* and *Mycoplasma hyosynoviae*, some infrequently identified mycoplasmas and acholeplasmas of swine, and ten other respiratory bacterial pathogens. The results of this study identified a range of sensitivities in the PCR assays tested. In addition, amplified products were produced in some assays using template DNAs from sources other than *M. hyopneumoniae*. This indicates the need for further research to improve diagnostics for this important swine pathogen.

Transcriptome Analysis of a High Adherent Variant of *Mycoplasma hyopneumoniae*

Andrew Petersen (Session III.B.3)

Mycoplasma hyopneumoniae attaches to swine cilia in the respiratory tract resulting in colonization and disease. The overall attachment process is poorly understood, but one component, P97, has been defined as a major cilium adhesin. Studies with a non-adherent, high passage strain of *M. hyopneumoniae*, strain J, showed that P97 was functional in that strain and thus P97 must work in concert with other mycoplasma adhesins to colonize respiratory epithelium. To study this system further, high and low adherent variants of the lab adapted virulent strain 232 were identified using an in vitro cilium binding assay. The original variants were compared by transcriptional profiling using a microarray containing 91% of the open reading frames of *M. hyopneumoniae*. Genes up-regulated in the high adherent variant ($p < 0.05$) compared to strain 232 included a series of ribosomal proteins and other proteins associated with translation. Enolase, a key enzyme in the glycolytic pathway is also up-regulated as is a member of the protein export machinery, SecD. Genes down-regulated in the high adherent variant relative to strain 232 were mostly hypothetical genes with no assigned functions.

Flow Optimization of Osteoceramic Cement

Jarrett Wendt (Session III.C.1)

PMMA (poly methyl methacrylate) has been used since the 1960s as the cement for hip-replacement surgeries, and although it has been a success for many years, some of its properties are less than desirable. In recent years, osteoceramic cement has been developed that is designed to function structurally with better tissue response. This cement behaves as a dilatant fluid and will not flow unless vibrated, which allows the implant to be vibrated into place. Past research focused on the composition, strength, and in vivo performance of this cement, but it is desirable to better understand the flow characteristics. It is hypothesized that frequency and amplitude of vibration, as well as temperature each affect the flow rate, and it is known that the flow rate decreases with time after mixing. In order to analyze these variables, a multivariate experiment has been designed to measure flow rate at distinct times during the working period while changing frequency and amplitude and recording the temperature. Equations will then be derived to characterize the flow rate at various times according to these variables. It is preferable to optimize this flow so that the surgeon can more easily manipulate this cement during its short working period.

Omnidirectional Robot

Kyle Miller, Mark Rabe, Jonathan Watson, Christopher Tott, Jonathan Dashner, Joshua Watt, Shane Griffith, and Alex Baumgarten (Session III.C.2)

The Omnidirectional Robot project consists of a robot that can move in any direction without rotating first. This property allows the robot to be extremely responsive and a very attractive research platform to experiment with networked cooperative robots in dynamic environments. Iowa State currently does not have comparable tools to do research in this area. The senior design group that is currently working on the project will characterize the performance of the robot for Dr. Elia and come up with a workable localization system. Currently, the localization system is made up of a stationary webcam that is overhead the robot and its environment. The pictures from this camera can be processed to act like a GPS for the robot. Once the project is done, the robot should be able to use localization to detect a slowly rolling tennis ball and follow behind it in its environment. This is the first prototype and will serve as a basis for developing more robots wirelessly communicating with each other to perform cooperative tasks. Examples of applications include containment of pollutant spills, or find and rescue mission in hostile environments.

Adaptive Processor Clocking Using Error Monitoring Feedback

Adam Jackson (Session III.C.3)

Processor clock frequency estimations are based on worst case timing scenarios which occur infrequently and result in wasted performance under typical operating conditions. Dynamically adapting the frequency of a processor based on the number of errors during a previous time interval allows for operation at higher frequencies while still keeping the number of resulting errors manageable. Using a Xilinx Virtex II Pro FPGA based system board and an off-board clock generation circuit, this research project provides a design for creating a dynamically clocked processor. The implementation of this design proves the feasibility of dynamically clocking a processor. The feedback control based on the number of errors produced in a time interval ensures improvement in system performance. Possible future research directions include incorporating other important factors, such as power consumption and thermal condition of the core, in the feedback control that aids adaptive clocking.

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