IEEE MIT URTC 2015

UNDERGRADUATE RESEARCH TECHNOLOGY CONFERENCE

November 7 - 8, 2015 | Cambridge, Massachusetts, USA

MEET INNOVATIVE TECHNOLOGY

CONFERENCE PROGRAM

Organized and Sponsored by IEEE Boston Section and MIT IEEE Student Branch

http://ieee.scripts.mit.edu/conference

IEEE Catalog Number: CFP15E50-ART
ISBN 978-1-4673-8559-6

2015 IEEE MIT Undergraduate Research Technology Conference

Meet Innovative Technology

Table of Contents

Welcome Messages from Conference Chair

Miri Choi
Conference General Chair
mirichoi@mit.edu

Welcome! It is my pleasure to have you at our first IEEE MIT Undergraduate Research Technology Conference 2015. It is the first student-plan and run conference in collaboration with IEEE Boston Section. We have 2 exciting days filled with technical research papers, posters, lightening talks, workshops, Brainstorming Competition, and networking opportunities. We have excellent speakers line up who are all very excited to meet you and want to share their field experiences and lessons learned. So, please enjoy the programs that we have prepared, hear how technology is changing the world we live in, and meet lots of people from all around the nation and the world. As one of the many undergraduate students like you are, I am just as excited to take this opportunity and learn. At the end of the day, we hope this conference can enhance your professional growth and give you an insight of the world and of the person you are. Let's work together to change the world, because we are the leaders of our future. Hope you enjoy the conference! :)

Best Regards,
Miri Choi
Conference Chair

Soon Wan
Program General Chair
gimsoon@ieee.org

On behalf of the Program Committee and IEEE Boston Section, we welcome you to the inaugural IEEE MIT Undergraduate Research Technology Conference (URTC). We are excited about this new conference that initiated by the MIT IEEE Student Branch. I strongly believe it will meet the IEEE's core purpose to foster technological innovation and excellence for the benefit of humanity.

The conference is packed with two days of oral presentation sessions, poster sessions, and lightning talks organized into four technical tracks, plus plenary keynotes, exhibitions, workshops, and contests. There should be something for everyone in attendance. So, please use this opportunity to enhance your personal and professional growth, network with friends and colleagues, and meet new ones. Enjoy the conference!

Sincerely,
Soon Wan ☺
IEEE Region 1 Membership Development Chair

MIT IEEE UNDERGRADUATE RESEARCH TECHNOLOGY CONFERENCE

MEET INNOVATIVE TECHNOLOGY

NOVEMBER 7-8
STATA CENTER & BUILDING 34

Organizing Steering Committee

Conference Chair
Miri Choi, MIT

General Program Chair
Soon Wan, Vicor Corporation

Finance and Sponsorship Chair
Treasurer: Bob Alongi, IEEE Boston Section
Co-Treasurer: Soon Wan, Vicor Corporation

Local Arrangement and Exhibition Chair
Alice Zhan, MIT

Registration Chair
William Huang, MIT

Speaker Program Chair
Philip Ferguson, MIT

Technical Paper Session Co-Chairs
Soon Wan, Vicor Corporation
Joseph Sheehan, IEEE Life Member

Poster Session Chair
Elizabeth Wei, MIT

Lightning Talks Session Chair
Christina Chen, MIT

IEEE SPAx Welcome Event Chair
Joseph Cunningham, MIT

Hack This Conference Chair
Bruce Hecht, Analog Devices

Student Brainstorming Competition Chair
Tim Johnson, IEEE Boston Section

Social Event Chair
Jessy Lin, MIT

Publicity and Outreach Co-Chairs
Gia Min, MIT
Billy Moses, MIT
Mina Mengyuan Sun, MIT

Marketing Chair
Erick Pinos, MIT

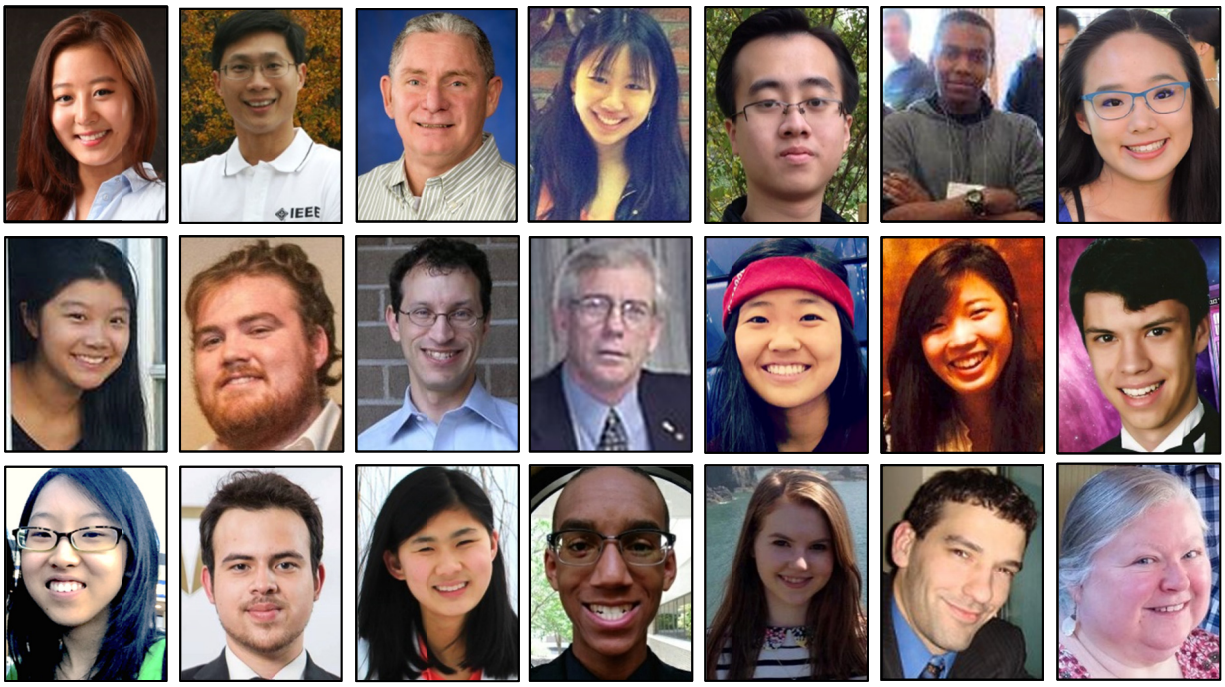
Webmaster
Helene Zhou, MIT

A/V Production Chair
Nicholas Curtis, MIT

Volunteer Coordinator
Anna Sappington, MIT

IEEE Young Professional, SPAC Liaison
Rob Vice, Vicor Corporation

MIT IEEE Student Branch Advisor
Anne Hunter, MIT



Proud Patrons, Partners and Exhibitors

IEEE University Partnership Program

ABB Power and productivity for a better world™

http://new.abb.com/products/robotics

IEEE Collabratec™

https://ieee-collabratec.ieee.org

onset® HOBO® Data Loggers

www.onsetcomp.com

powered by IEEE MEETINGS, CONFERENCES & EVENTS

ANALOG DEVICES AHEAD OF WHAT'S POSSIBLE™

www.analog.com

NORTHEASTERN UNIVERSITY BOSTON, MASSACHUSETTS LVX VERITAS VIRTVS FOUNDED A.D. 1898

www.northeastern.edu

IEEE CONSUMER ELECTRONICS SOCIETY

http://cesoc.ieee.org

IEEE BOSTON SECTION

http://ieeeboston.org

MIT

http://ieee.scripts.mit.edu

General Information

Badges

Badges must be worn at all times and are necessary for entrance into all the conference sessions and foods.

Registration Hours (MIT Stata Center)

The registration will take place at the Stata Cnenter 1st floor entrance. The conference information desk is adjacaent to the registration area. All attendees and accompanying guests must register and receive a conference badge in order to participate in conference activities.

Registration and Information Desk Hours
Saturday, 7 November: 7:30am – 5:00pm
Sunday, 8 November: 7:30am – 12:00noon

Exhibition Hours (MIT Stata Center – Student Vest Street)

Saturday, 7 November: 10:00am – 6:00pm
Sunday, 8 November: 9:30am – 3:30pm

Welcome Reception

On Friday, 6 November, 6:30pm. At MIT Building 34-401 Grier Room
All conference registrants are cordinally invited to the Welcome Reception (included with the conference registration fee). Don't miss the opportunity to network.

Language

All Conference Sessions and Publication will be in English.

November 7, 2015 (Saturday)
Program Summary
8:30am – 8:30pm MIT Stata Center 32-123

7:30am

Registration (MIT Stata Center - Entrance)
Breakfast (MIT Stata Center - Student Vest Street)

8:30am – 10:00am

Opening Plenary (MIT Stata Center 32-123)

David Perreault, MIT EECS
"Opening Remarks"

Barry Shoop, 2016 IEEE President & CEO
"Leadership in the 21st Century"

Tadayoshi Kohno, University of Washington
"Computer Security and the Internet of Things"

10:30am – 12:30pm

Technical Paper Oral Presentation (MIT Stata Center 32-123)

- Energy, Renewable, and Sustainability
- Communication and Connectivity
- Humanity and Social Development

12:30pm – 1:30pm

Lunch and Exhibits (MIT Stata Center - Student Vest Street)

1:30am – 3:30pm

Technical Paper Oral Presentation (MIT Stata Center 32-123)

- Computer and Information Technology

4:00pm – 6:00pm

Hack This Conference (MIT Stata Center 32-123)

The Future of URTC Conference

powered by IEEE MEETINGS, CONFERENCES & EVENTS

6:30pm – 8:30pm

Social and Dinner (MIT Stata Center 32-123)

Mildred Dresselhaus MIT, *2015 IEEE Medal of Honor*

Elliot F. Kaye
Chairman of US Consumer Product Safety Commission

Door Prize Drawing – Kindle Fire

November 7, 2015 (Saturday)

Opening Plenary

8:30am – 10:0am MIT Stata Center 32-123

- **Welcoming Remarks** – David Perreault, MIT EECS

Professor David Perreault received the B.S. degree from Boston University in 1989, and the S.M. and Ph.D. degrees from the Massachusetts Institute of Technology (MIT), in 1991 and 1997, respectively. In 1997, he joined the MIT Laboratory for Electromagnetic and Electronic Systems as a Postdoctoral Associate, and became a Research Scientist in the laboratory in 1999. Currently, he is a Professor and Associate Department Head of Electrical Engineering and Computer Science at MIT. Dr. Perreault's research interests include design, manufacturing, and control techniques for power electronic systems and components, and their use in a wide range of applications. He received the Richard M. Bass Outstanding Young Power Electronics Engineer Award from the IEEE Power Electronics Society, the Ralph R. Teetor Educational Award from the Society of Automotive Engineers, and an ONR Young Investigator Award, and has received four IEEE prize paper awards. He is a member of Tau Beta Pi and Sigma Xi. He received the IEEE Power Electronics Society Transactions Prize Paper Award (Awarded June 2008 for the paper "Resistance Compression Networks For Radio-Frequency Power Conversion") and the IEEE Power Electronics Society PESC Conference Prize Paper Award (Awarded June 2008 for the paper "A Very High Frequency dc-dc Converter based on the Class Phi-2 Resonant Inverter")

- **Opening Plenary**

  Leadership in the 21st Century

  Professor Barry Shoop, 2016 IEEE President and CEO

Technology has reshaped our world repeatedly since the foundations of IEEE were laid over a century ago; it continues to reshape it today. Recently, however, the role and influence of technology on the human experience has fundamentally changed. Previously, technology played a secondary and supportive role while social, political and cultural dimensions played a primary role. Today, technology is actually leading these dimensions in the influence on humanity. To be successful in this changed environment, increased emphasis and value is being placed on written and oral communication skills, teamwork, critical thinking, innovation and entrepreneurship. While some leadership skills are immutable, there are others that technology professionals will need to add to be competitive and successful.

Professor Barry Shoop is the 2016 IEEE President and CEO, and Professor of Electrical Engineering and Head of the Department of Electrical Engineering and Computer Science at the U.S. Military Academy at West Point. During his 20 years at West Point he has served in a number of key leadership positions including Director of the Photonics Research Center and Director of the Electrical Engineering Program. Currently as Professor and Head he is responsible for an undergraduate academic department with over 79 faculty and staff supporting ABET accredited programs in electrical engineering, computer science, and information technology. The department engages over 1800 students each year and has 4 affiliated research centers including the Cyber Research Center, Network Science Center, Photonics Research Center and a burgeoning Robotics Program. Dr. Shoop holds 1 patent and has authored or co-authored 8 books and book chapters, and over 146 publications. He received a B.S. from the Pennsylvania State University in 1980 and Ph.D. from Stanford University in 1992, both in electrical engineering. His research interests include optical information processing, neural networks, image processing, disruptive innovations and educational pedagogy. He is a Fellow of the IEEE, OSA and SPIE, and a member of Phi Kappa Phi, Eta Kappa Nu, and Sigma Xi. He is a licensed Professional Engineer in the Commonwealth of Virginia.

- **Keynote**

  Computer Security and the Internet of Things

  Professor Tadayoshi Kohno , University of Washington

Computers are now integrating into everyday objects, from medical devices to children's toys. This integration of technology brings many benefits. Without the appropriate checks and balances, however, these emerging technologies also have the potential to compromise our digital and physical security and privacy. This talk will explore case studies in the design and analysis of computer systems for several types of everyday objects, including wireless medical devices, children's toys, and automobiles. I will discuss the discovery of security risks with leading examples of these technologies, the challenges to securing these technologies and the ecosystem leading to their vulnerabilities, and new directions for security and privacy. For example, I will discuss efforts (in collaboration with UC San Diego) to compromise the computers in an automobile from a thousand miles away, and the implications and consequences of this and other works. I will also discuss directions for mitigating computer security and privacy risks, including both technical directions and education.

Professor Tadayoshi Kohno is the Short-Dooley Professor of Computer Science & Engineering at the University of Washington and an Adjunct Associate Professor in the UW Information School. His research focuses on helping protect the security, privacy, and safety of users of current and future generation technologies. Kohno is the recipient of an Alfred P. Sloan Research Fellowship, a U.S. National Science Foundation CAREER Award, and a Technology Review TR-35 Young Innovator Award. Kohno has authored more than a dozen award papers, has presented his research to the U.S. House of Representatives, was profiled in the NOVA ScienceNOW "Can Science Stop Crime?" documentary, and is a past chair of the USENIX Security Symposium. Kohno is also a member of the U.S. Government's Defense Science Study Group, the National Academies Forum on Cyber Resilience, the IEEE Center for Secure Design, and the USENIX Security Steering Committee.

November 7, 2015 (Saturday)

Technical Paper Oral Presentation #1

10:30am - 12:30pm MIT Stata Center 32-123

Session Chair: Soon Wan

➢ 10:30am

A miniature combined horizontal wind-turbine and PV demonstration kit for K-12 STEM programs

Alexander Proulx, Anthony D'Amico, Charles Thangaraj (Roger Williams University)

Increasing green energy usage has become a top priority for towns and municipalities. A general lack of awareness regarding the many benefits of green energy remains a formidable impediment for wide spread adoption of green technologies. A potential solution to this problem is educating K-12 students and increasing their awareness of the benefits of green energy. Doing so will lead to an increase in the community's overall awareness, through secondary knowledge dissemination, especially of those communities not easily reachable through adults. Furthermore as part of a STEM educational series, demonstration of a wind-turbine system will greatly benefit the students understanding of wind-turbine designs. To this end, two undergraduate engineering students, during summer 2015 term, designed and implemented a miniature horizontal wind-turbine demonstration kit for K-12 STEM programs. This paper outlines the design process and presents the implemented prototypes.

➢ 10:50am

Evaluation of Standard Municipal Energy Benchmarking Tools

Ethan Daniel, Charles Thangaraj, Benjamin McPheron (Roger Williams University)

Over the spring and summer 2015 semesters, two undergraduate students completed a full energy audit of two local municipalities in order to provide recommendations for usage reduction. This audit was done as part of a community partnership initiative with Emerald Cities Collaborative, a community development collective focused on promoting sustainable communities through environmental energy education. Utilizing the data provided by a local utility company; students were able to analyze current EPA and DOE online tools for energy benchmarking. These tools are freely available for small local governments. The results of this study suggest that improvements can be made to the existing tools that increase their usefulness to municipalities. Further analysis capabilities beyond what these tools provide were shown to enhance the tools' utility.

➢ 11:10am

Lowerbounds for the Online Minimum Matching Problem on the Line

Maximillian Bender (Connecticut College)

We present lowerbounds for the competitive ratio of randomized algorithms on the online minimum matching problem on the line for both the minimum weight and bottleneck objectives. To the best of our knowledge, there is no established lowerbound for randomized algorithms for either objective on the line: we show a lowerbound of 2 for the minimum weight objective and a linear lowerbound for the bottleneck objective, hence proving that the bottleneck objective is a harder problem than the minimum weight objective on the line. We also present a tool for establishing a higher lower bound for the minimum weight objective.

We consider the online minimal metric matching problem, where we are a priori given a set of servers in a metric space in which a request sequence of equal length will arrive in locations unknown until arrival. As each request arrives, it must be irrevocably matched to a server. Each server can only be matched to one request. The two different goals we discuss for the problem are 1) the minimum weight objective, which minimizes the average (or equivalently total) distance between any request and its paired server and 2) the bottleneck objective, which minimizes the maximal distance.

When the metric is the line, then this problem can be viewed as equivalent to the following shoe store problem: in the shoe store problem, the owner has a set of shoes of various sizes and will sell them to customers who will arrive sequentially, where each customer finishes their transaction before the next customer arrives. If the owner tries to minimize the average difference in shoe size between a shoe and its buyer, then the owner is using the minimum weight objective. If the owner instead tries to minimize the maximal difference, then the owner is using the bottleneck objective.

This problem has been studied most for the general metric, however significant work remains to be done even in the special case of the line metric. Despite the problem having a very ‘simple’ description, there is still a large gap between the effectiveness of the best known algorithms and the established lowerbound for the effectiveness of any algorithm on this problem. In fact, Koutsoupias and Nanavati in [8] consider the line-metric to be the most interesting, citing reasons such as the offline-version being a trivial problem, the relation to the well-studied cow-path problem, and the applications of this problem in web-markets.

➢ 11:30am

Spectral Anomaly Detection with Machine Learning for Wilderness Search and Rescue

Julia Proft (Connecticut College)

In wilderness search and rescue missions, unmanned aerial vehicles (UAVs) may be deployed to collect high-resolution imagery which is later reviewed by a first responder. The volume of images and the altitude from which they are taken makes manually identifying potential items of interest, like clothing or other man-made material, a difficult task. For this reason, we created a program that automatically detects unusually-colored objects in aerial imagery in order to assist responders in locating signs of missing persons. The program uses the Reed-Xiaoli (RX) spectral anomaly detection algorithm to determine which pixels in an image are anomalous and then generates an "anomaly map" where brighter pixels signify greater abnormality. While the RX algorithm has previously been proposed for search and rescue missions, up until now it has not been evaluated in a high-fidelity setting with real responders and real equipment. We tested the program on 150 aerial images taken over the Blanco River area in Hays County, Texas after the May 2015 flooding and demonstrated the results at a workshop on flooding hosted by Texas A&M's Center for Emergency Informatics. Early feedback from responders suggests that RX

spectral anomaly detection is a valuable tool for quickly locating atypically-colored objects in images taken with UAVs for wilderness search and rescue.

- 11:50am

Interactions Between Gliding Dislocations in 3C-SiC(001)

Steven Ceron (University of Florida), Hiroyuki Nagasawa, Maki Suemitsu (Tohoku University)

3C-SiC has been identified as a leading semiconducting material for use in high voltage, high temperature, and high frequency devices. However, stacking faults form as a result of the 19.7% lattice mismatch at the 3C-SiC/Si interface, and then propagate during epitaxial growth along four equivalent planes. After epitaxial growth has concluded, the presence of the stacking faults causes an intrinsic stress in the system that allows for the carbon-core partial dislocations to deviate in specific directions from their current plane, thus producing crowd lines of point defects as a result of forest dislocation formations, which are believed to be the main cause of high leakage current density in 3C-SiC. Monte Carlo simulations are employed to model the formation, propagation, and expansion of stacking faults, as well as the generation of the forest dislocations. The numerical analysis allows for a clear picture of the density of the forest dislocations throughout the system as a function of the stacking fault density and material thickness. In addition, the study predicts the orientations along which the forest dislocations will most likely form. Further analysis of the mechanisms by which forest dislocations form and the leakage current occurs will lead to more sophisticated fabrication processes of 3C-SiC.

- 12:10pm

Developing an Integrated Mobile Medical Platform for Rural India: Power Supply and Signal Compression to Reduce Power Requirements

Manting Lao (Massachusetts Institute of Technology)

Although technological advancement has all but eradicated numerous deadly diseases that have plagued humanity for generations, rural areas worldwide are still struggling to catch up to modern-day levels of basic healthcare. This is especially true in rural India, where official healthcare is provided through tiers of health centers from local to regional levels. However, the lack of medical staff and technological support has led to an alarmingly large patient-to-provider ratio. This has in turn led to the dissemination of many monitorable and curable illnesses such as anemia and heart disease in rural communities. While portable medical sensors and mobile medical apps have been designed, there has yet to be a complete, system-wide mobile solution. The goal of my project is to develop and test a complete mobile health suite, which will include a mobile app, portable medical sensors for medical screening, and a reliable self-contained power system for use in rural areas. My main focus is to analyze and engineer the power system behind our mobile medical suite and research different signal compression algorithms over Bluetooth Low Energy for electrocardiogram. The goal is to minimize the amount of data that needs to be processed and sent from the electrocardiogram sensor to the mobile phone so that minimal power is used.

November 7, 2015 (Saturday)

Technical Paper Oral Presentation #2

1:30pm - 3:30pm MIT Stata Center 32-123

Session Chair: Joseph Sheehan

➢ 1:30pm

Extension of Fuzzy Gustafson-Kessel Algorithm Based on Adaptive Cluster Merging

Austin Krauza (CUNY College of Staten Island)

The performance of objective function-based fuzzy clustering algorithms depends on the shape and the volume of the clusters, the initialization of the clustering algorithm, the distribution of the data objects, and the number of clusters contained in the data. We propose an extension of Gustafson-Kessel (FGK) fuzzy algorithm by developing adaptive validation criteria for merging of clusters during the unsupervised learning. There are no mathematical methods for solving this optimization task analytically. The performance of the proposed approach was examined on generated and benchmark data sets, and compared to those received by respective fuzzy counterparts. Additionally, its efficiency was tested on data collected from some current real world applications.

➢ 1:50pm

Algebraic Conditions for Generating Adjacency Arrays

Karia Dibert, Hayden Jansen, Jeremy Kepner (Massachusetts Institute of Technology)

Data processing systems impose multiple views on data as it is processed by the system. These views include spread- sheets, databases, matrices, and graphs. Associative arrays unify and simplify these different approaches into a common two- dimensional view of data. Graph construction, a fundamental operation in the data processing pipeline, is typically done by multiplying the incidence array representations of a graph, E_in and E_out, to produce an adjacency matrix of the graph that can be processed with a variety of machine learning clustering techniques. This work focuses on establishing the mathematical criteria to ensure that the matrix product E^T_out E_in is the adjacency array of the graph. It will then be shown that these criteria are also necessary and sufficient for the product of incidence arrays, E^T_in E_out to be the adjacency matrix of the reversed graph. Algebraic structures that comply with the criteria will be identified and discussed.

➢ 2:10pm

Spike Train Encoding of Analog Signals in a Graphene Fiber Ring Laser

Leonidas Tolias, Bhavin Shastri, Mitchell Nahmias, Alexander Tait, Thomas Ferrieira de Lima
(Princeton University)

Spiking neural networks (SNN) have inherent advantages over traditional computing architectures for many computational problems such as adaptive control, sensory processing, and pattern recognition. Recently, a graphene-based fiber laser has been shown that demonstrates all the key properties of spike processing: logic-level restoration, cascadability and input-output isolation, in one device [1]. Here, we show that this device is able to perform unique nonlinear operations on analog input signals, including the ability to convert those signals into spike train outputs. This represents a stepping stone towards practical implementations of laser devices that can perform spike-based operations on high frequency analog signals.

Shastri, Bhavin J. et al. "Dynamical laser spike processing", ArXiv Physics - Optics. arXiv:1507.06713. July 24, 2015.

➢ 2:30pm

UVision: A Lightweight Portable UVR Detection System

Matthew Sheehan, Omar Hoblos, Devin Laferriere, Chen-Hsiang Yu
(Wentworth Institute of Technology)

Ultraviolet radiation (UVR) from the sun can cause major damage to the skin if it is overexposed. The damage can be minor, from a sunburn to accelerated skin aging, to major with the development of detrimental skin cancers. UV photons that are able to bypass the natural defenses of the skin, melanin and DNA, can cause mutagenic damage to DNA, which can result in a range of harmful effects. Relying solely on the skin's natural defenses against the sun is ill advised. The use of sunblock decreases a person's chances of skin damage, but changing overall behavior through education is healthier. We propose a lightweight portable UVR detection system, UVision, to prevent users from harmful UVR radiation. The system contains two parts: a wearable UV sensor to collect real time UVR data and an Android mobile application to have the user's attention by display the sensor's results. The data connection is implemented by using Bluetooth. Early testing shows that UVision not only provides a cost-efficient option to the public, but it also has an easy-to-use design to provide a good user experience.

➢ 2:50pm

Smart Guide: Mid-Scale NFC Navigation System

Nicolas Bonzani, Edward Kang, Mira Yun, Chen-Hsiang Yu
(Wentworth Institute of Technology)

Existing navigation systems that utilize GPS are unreliable on any smaller scales ventures such as on or within a campus and generally are unstable within buildings or other structures. We found a need to have a more reliable way to access directions when GPS systems were inaccurate or inaccessible. Since NFC readers are not uncommon in mobile phones nowadays, we propose a new portable system, Smart Guide, to utilize this underused technology in a new way. In this paper, we present Smart Guide that is an Android application using NFC to aid a user in mid-scale navigation.

- 3:10pm

Software development for correlating multi-wavelength images

Samantha Miller (St. Joseph's College Long Island)

The National Synchrotron Light Source II (NSLS-II) at Brookhaven National Laboratory offers a large variety of synchrotron based imaging techniques that provide users with structural and chemical information of materials at the nanoscale. Multiple imaging techniques such as light microscopy, infrared imaging and X-ray fluorescence microscopy are commonly used to correlate information from the same sample. Correlating the important information in images presents a large technological challenge because the various imaging techniques generate images of different sizes and spatial resolutions. To overcome this challenge, there are two goals involving software development. The first is to identify a method for using fiducial markers to correlate visible light images with X-ray fluorescence microscope images at the micro- to nanoscale and secondly to develop software for fusion(i.e. overlap) and correlation of these images. Numerous programs were identified to complete this project, such as Matlab, Python, Photoshop, ImageJ and Fiji. After doing much research and testing a variety of these programs, it was clear that Fiji is the best and most efficient program for solving these challenges. It has the capability to align images automatically by converting the image to 8-bit gray scale, finding the maxima (darkest points), and stacking/and/or/corresponding these max points to perfectly align images. Moreover, it has the capability to use manually chosen fiducial point markers where the user inputs landmarks or fiducial points on the image and the program triangulates the points to align them. In addition, I wrote a user manual so that other synchrotron users can benefit from this methodology as well. Overall, this process will prove to be very useful in the future of the laboratory in cases where image correlation is vital. The majority of photon sciences involve correlating images and analyzing the data that come out.

- 3:30pm

Using SVM for User Profiling for Autonomous Smartphone Authentication

Trisha Datta (Princeton University), Kyriakos Manousakis (Applied Communication Sciences)

While we have all been warned about viruses attacking our computers and hackers stealing our private information, very few of us realize the similar threat to our phones. With the number of smartphones in use growing each day, we now find ourselves to be a society equipped with devices packed with personal information and small enough to be easily stolen or misplaced. Millions of smartphone users are reporting unauthenticated behavior on their phones, yet many refuse to use passcode protection. Our goal is to use information gathered from the phone, specifically app usage statistics, in order to determine if a user is the actual owner of the smartphone. For this project, we created an app that could record a variety of information from smartphones and their sensors and make simple decisions about whether the person using the phone was the actual owner and lock itself accordingly. Because of time constraints, we looked at data sets from Glasgow Caledonian University and LiveLab at Rice University rather than collecting our own data. We used the LIBSVM library to create two-class SVM models for each of the 34 users in the LiveLab datasets. We then constructed testing datasets of both owner and non-owner data and tested the accuracy of the models. Accuracy rates for all 34 users were for the most part over 85%, and while false positive (identifying the owner as non-owner) rates were sometimes high, these false positive diagnoses would not compromise the security of the phone.

MIT IEEE UNDERGRADUATE RESEARCH TECHNOLOGY CONFERENCE

MEET INNOVATIVE TECHNOLOGY

NOVEMBER 7-8 STATA CENTER & BUILDING 34

November 7, 2015 (Saturday)

Hack This Conference

4:00pm - 6:00pm MIT Stata Center 32-123

Session Co-Chairs: Susan Root, Fred Schindler, Bruce Hecht

Hack This Conference

Imagining Futures: Technologies & Experiences of the Next Gen Conference

Wrap up the afternoon with energy and fun. Join us in Room 32-123 of the Stata Center for a rewarding experience. We'll take a hands-on look to the future of convening. Come generate insights and predictions about how we might engage in the future and then help build that future for the URTC conference and more.

The Future of URTC Conference

Join us as we take a hands-on look to the future of convening. How will our expectations and experiences change and how will technologies affect our experiences? Come generate insights and predictions about how we might engage in the future and then help build that future for the URTC conference.

Session Objective

Working with the participants at this year's URTC conference, which has a traditional scholarly conference footprint, to imagine the next conference in a new wholly different way using technologies and experiences as the change catalyst. Time is short and it will be important to keep energy up for this late afternoon session. The most important information we can derive from this audience will be their fresh eyes as they look to the future of convening, helping them to create some clarity around their expectations and providing us that understanding. To that end, the work session is focused on "dreaming".

This will be a non-traditional session where we break down into groups and create lots of interaction among audience members. We will challenge the attendees to conceptually design events of the future that will be attractive to them, looking both at the same event next year and conferences in general. The non-traditional nature of the session is part of the demonstration, but the outcomes of the session will also be valuable to us especially with the identification of the 5 big ideas at the end.

powered by IEEE MEETINGS, CONFERENCES & EVENTS

MIT IEEE UNDERGRADUATE RESEARCH TECHNOLOGY CONFERENCE
MEET INNOVATIVE TECHNOLOGY
NOVEMBER 7-8 STATA CENTER & BUILDING 34

November 7, 2015 (Saturday)

Social Event and Dinner

6:30pm - 8:30pm MIT Stata Center 32-123

Session Chair: Jessy Ln

Door Prize Drawing – Kindle Fire

- Keynote #1: **Views on the Oncoming Challenge in Engineering Research and Education**
  Professor Mildred Dresselhaus
  MIT Professor, Departments of Physics and Electrical Engineering and Computer Science
  2015 IEEE Medal of Honor

  MIT President Rafael Reif has alerted our research and education community to an expected revolution that will be occurring in electrical engineering as the feature size in semiconductor devices reaches some very small length scale (~10 nm) where Moore's law breaks down. This talk speaks to both the expected challenges and opportunities, based on my experience with former revolutions in 1960 and 1990.

Professor Mildred Dresselhaus is a native of the Bronx, New York City, where she attended the New York City public schools through junior high school, completing her high school education at Hunter College High School in New York City. She began her higher education at Hunter College in New York City and received a Fulbright Fellowship to attend the Cavendish Laboratory, Cambridge University (1951-52). Professor Dresselhaus received her master's degree at Radcliffe College (1953) and her Ph.D. at the University of Chicago (1958). Professor Dresselhaus began her MIT career at the Lincoln Laboratory. During that time she switched from research on superconductivity to magneto-optics, and carried out a series of experiments which led to a fundamental understanding of the electronic structure of semi-metals, especially graphite. A leader in promoting opportunities for women in science and engineering, Professor Dresselhaus received a Carnegie Foundation grant in 1973 to encourage women's study of traditionally male dominated fields, such as physics. In 1973, she was appointed to The Abby Rockefeller Mauze chair, an Institute-wide chair, endowed in support of the scholarship of women in science and engineering. Professor Dresselhaus has greatly enjoyed her career in science. On her experience working with MIT students, she says, "I like to be challenged. I welcome the hard questions and having to come up with good explanations on the spot. That's an experience I really enjoy." Thus far, she has graduated over 60 Ph.D. students.

- Keynote #2:
  Chairman Elliot F. Kaye, U.S. Consumer Product Safety Commission (CPSC)

Chairman Elliot F. Kaye was sworn in as the 10th Chairman of the U.S. Consumer Product Safety Commission (CPSC) on July 30, 2014. President Barack Obama nominated Mr. Kaye on March 31, 2014, and he was confirmed by the U.S. Senate on July 28, 2014, to a term that expires in October 2020. Mr. Kaye served as CPSC's Executive Director from 2013 until his confirmation as Chairman. Previously at CPSC, Mr. Kaye served as Chief of Staff and Chief Counsel to former Chairman Inez Moore Tenenbaum in 2013, Deputy Chief of Staff and Senior Counsel to the Chairman from 2012 to 2013, and as Senior Counsel to the Chairman from 2010 to 2012. He has been the driving force behind many of the agency's most successful initiatives in recent years, including efforts aimed at addressing the chemical burn hazard to young children from the ingestion of coin cell batteries. Mr. Kaye is widely recognized for having played a key role in coalescing the leading organizations and companies in American football around a common goal of creating a culture change to reduce the risk of brain injuries in youth football. From 2007 to 2010, he was an attorney at Hogan Lovells. Prior to this, he was an attorney at Cooley Godward Kronish LLP and a Judicial Clerk for the Honorable Sterling Johnson, Jr. of the United States District Court for the Eastern District of New York. Mr. Kaye has served as Chief of Staff and Legislative Director for U.S. Representative John Tierney, Chief of Staff and Communications Director for U.S. Representative Pat Danner, and held a number of positions with U.S. Representative Earl Hutto. He received a B.S.J. from the Medill School of Journalism at Northwestern University and a J.D. from New York University School of Law.

November 8, 2015 (Sunday)
Program Summary
8:30am – 4:30pm MIT Stata Center 32-123

7:30am
Registration (MIT Stata Center - Entrance)
Breakfast (MIT Stata Center - Student Vest Street)

8:30am – 9:30am
Sunday Plenary (MIT Stata Center 32-123)

Sponsors Presentation
"Career Opportunity"

Door Prizes Drawing - $50 Apple Gift Card, 2x ABB Robots

9:30am – 10:00am
Lightning Talks (MIT Stata Center 32-123)

10:30pm – 12:30pm
Posters Session (MIT Stata Center - Student Vest Street)

12:30pm – 1:30pm
Lunch and Exhibits (MIT Stata Center - Student Vest Street)

1:30am – 3:30pm
Brainstorming Competition (MIT Building 36-462)

4:00pm – 4:30pm
Closing Plenary (MIT Stata Center 32-123)

Door Prize Drawing - $50 Amazon Gift Card

MIT IEEE UNDERGRADUATE RESEARCH TECHNOLOGY CONFERENCE

MEET INNOVATIVE TECHNOLOGY

NOVEMBER 7-8 STATA CENTER & BUILDING 34

November 8, 2015 (Sunday)

Sponsors Presentation (Career Opportunity)

8:30am - 9:30am MIT Stata Center 32-123

Door Prizes Drawing – $50 Apple Gift Card, 2x ABB Robots

- IEEE University Partnership Program – Kristen MacCartney, Senior UPP Manager
- IEEE Consumer Electronic Society – Dennis Shapiro
- ABB – Harald Staab, Senior Principal Scientist – Mobile and Service Robotics
- Onset Computer – Jim Towey, Vice President Engineering
- Analog Devices – Bruce Hecht
- Qorvo - Fred Schindler

ANALOG DEVICES
AHEAD OF WHAT'S POSSIBLE™

onset
HOBO® Data Loggers

IEEE CONSUMER ELECTRONICS SOCIETY

ABB
Power and productivity for a better world™

qorvo
all around you

November 8, 2015 (Sunday)

Lightning Talks

9:30am - 10:00am MIT Stata Center 32-123

Session Chair: Christina Chen

Software development for multi-wavelength image correlation

Samantha Miller (St. Joseph's College)

The National Synchrotron Light Source II (NSLS-II) at Brookhaven National Laboratory offers a large variety of synchrotron based imaging techniques that provide users with structural and chemical information of materials at the nanoscale. Multiple imaging techniques such as light microscopy, infrared imaging and X-ray fluorescence microscopy are commonly used to correlate information from the same sample. Correlating the important information in images presents a large technological challenge because the various imaging techniques generate images of different sizes and spatial resolutions. To overcome this challenge, there are two goals involving software development. The first is to identify a method for using fiducial markers to correlate visible light images with X-ray fluorescence microscope images at the micro- to nanoscale and secondly to develop software for fusion(i.e. overlap) and correlation of these images. Numerous programs were identified to complete this project, such as Matlab, Python, Photoshop, ImageJ and Fiji. After doing much research and testing a variety of these programs, it was clear that Fiji is the best and most efficient program for solving these challenges. It has the capability to align images automatically by converting the image to 8-bit gray scale, finding the maxima (darkest points), and stacking/and/or/corresponding these max points to perfectly align images. Moreover, it has the capability to use manually chosen fiducial point markers where the user inputs landmarks or fiducial points on the image and the program triangulates the points to align them. In addition, I wrote a user manual so that other synchrotron users can benefit from this methodology as well. Overall, this process will prove to be very useful in the future of the laboratory in cases where image correlation is vital. The majority of photon sciences involve correlating images and analyzing the data that come out.

FingerReader

Sophia Wu (MIT)

Visually Impaired (VI) persons number 285 million with 60 million residing in the United States. An estimated 10% of the world's population is dyslexic, numbering around 40 million in the United States population, of which 2 million are students. While the severity of the condition for people with reading impairments varies from individual to individual, they still lack in independence and the proper technology to aid in everyday tasks. When it comes to reading menus, pamphlets, signs and plain texts, we often take for granted the information we process in a single glance: visual layout and design, sentence structure, font size and face, line spacing and many other features.

There are existing solutions by which people with impairments can access printed texts, such as Braille, audiobooks, phone apps and human readers. Blind guides and auditory signals also aid in mobility through the streets. However, the business overhead for developing assistive products is high. Thus, more often than not, people with impairments are left out when it comes to experiencing reading through sight. From tasks such as ordering a meal at a restaurant, catching up on the news from the daily paper, to reading the product label at the store, people with reading impairments often have to ask for help as they are unable to intake this visual information independently. FingerReader aims to give people with impairments real-time, independent access to such visual images.

FingerReader is a wireless finger-worn assistive device that does real-time text-to-audio translation. It utilizes a person's natural scanning motion to read plain texts. FingerReader is worn on the right index finger and provides haptic feedback to guide users along a line of text, vibrating when the user reaches the end of a line or angles their finger incorrectly.

The correct form factor is a crucial aspect of making FingerReader an effective tool. The goal is to make FingerReader an extension of the user's body. Designed with the VI in mind, the ring form factor features simplistic curves that offer fluidity and smoothness to the user experience. The VI interact with the world mainly through touch, thus the device features asymmetrical curves to help minimize the potential of incorrect wearing. To increase the comfort of the device, the curves of the ring band and bezel were designed according to the shape and size of a typical right index finger. Furthermore, the ring band size must be adjustable as finger sizes vary significantly. A spring-loaded clamping mechanism securely fastens the device to the finger to prevent any form of rotation during use. This form factor is also easily injection molded, increasing FingerReader's manufacturability and thus scalability.

The next step is to conduct a user study to verify the effect of the form factor. FingerReader will also expand this text-to-audio technical capability in other markets for people with learning disabilities or who are illiterate. In the future, this technology can also be used as a translation device for language learning.

Interactions Between Gliding Dislocations in 3C-SiC(001)

Steven Ceron (University of Florida)

Throughout the 20th century there were a number of innovations that contributed towards the improvement of transmitting, recording, and processing information. Perhaps the most important breakthrough of all was the invention of the first transistor by William Shockley at Bell Laboratories in 1947. The downscaling of transistors from about the size of a hand to 7nm has led to the tight packing of millions of transistor on tiny chips that allow for more information to be processed and recorded.

However, one of the most important obstacles to overcome when making transistors at the nano-scale is the emergence of electrically active defects that cause the leakage of current in the semiconducting material. One such transistor that continually suffers from this is the metal oxide semiconducting field-effect transistor (MOSFET), which commonly utilizes the SiC semiconducting material. One of the most common polytypes utilized due to its high saturated electron drift velocity is 3C-SiC. This polytype is a cubic crystal structure composed of silicon and carbon that has a low density of states at the 3C-SiC/SiO interface, making it the most attractive polytype for MOSFETs with a blocking voltage of 600 – 1200V in switching applications.

The 19.7% lattice mismatch at the 3C-SiC/SiO interface causes the formation and propagation of stacking faults (SFs). After the semiconducting material has undergone epitaxial growth, there is an intrinsic stress caused by the presence of the SFs that causes them to expand out of their planes of propagation and in specific orientations. It is believed that leakage current is mainly caused by the intersection of the expanding SFs post-epitaxial growth, forming crowd lines of point defects called forest dislocations (FDs).

In order to fabricate superior transistors so that devices may perform at maximum efficiency, it is crucial that the mechanisms by which leakage current occurs be closely analyzed. Due to limitations in equipment that can accurately measure physical and electrical characteristics of the material at the molecular level, it is necessary to conduct numerical analyses on the formation, propagation, and interactions of SFs. The results of the simulations are validated by the direct correlation between SF density and FD density. In addition, the simulations predict the orientation in which FD lines will most likely form which are predicted to be the dislocation lines along which leakage current occurs. Further study of the generation of FD could lead to more sophisticated fabrication processes of 3C-SiC.

By continuing the study of 3C-SiC and other common semiconducting materials used in a variety of transistors, we will be able to improve the efficiency of electrical equipment. As the world becomes more interconnected it is of paramount importance that we focus on the improvement of the devices that handle information, and the first step is to analyze the issues that are taking place at the molecular level and are decreasing the efficiency of the devices.

Session Chair: Elizabeth Wei

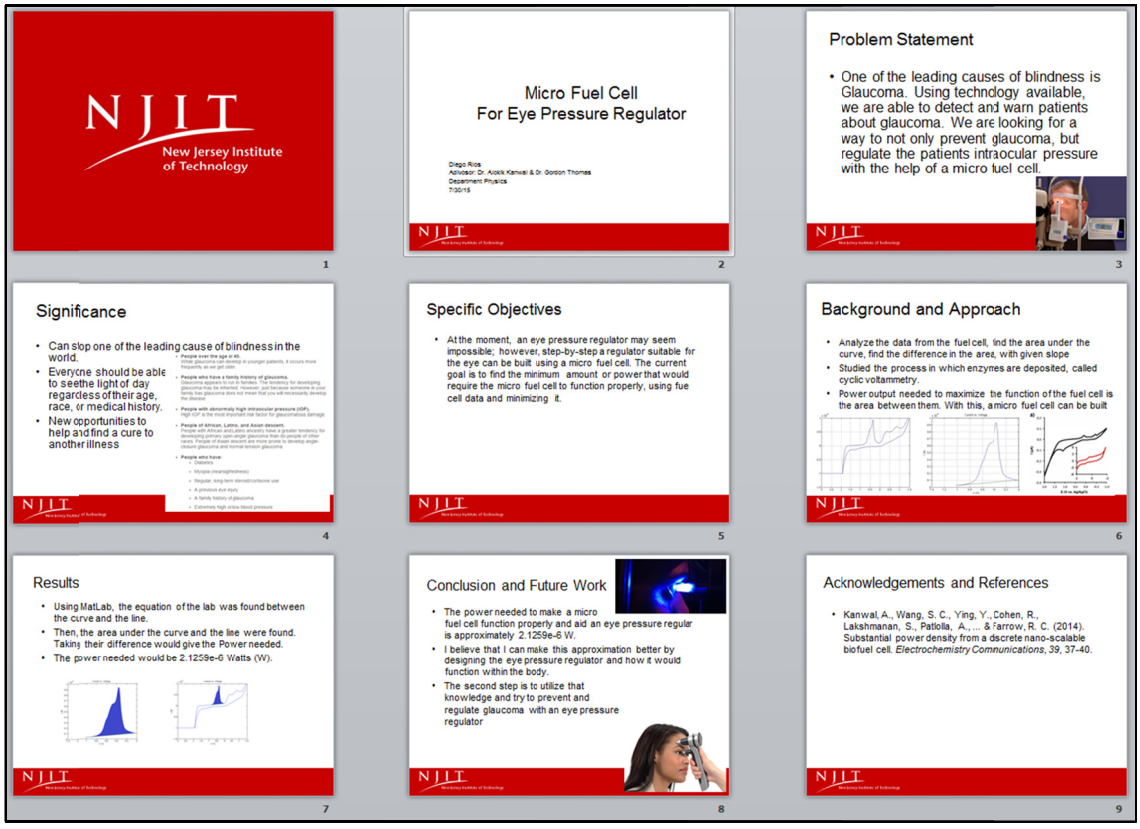
PO-0907 (Track: Energy, Renewable, and Sustainability)
Micro Fuel Cell for Eye Pressure Regulator
Diego A Rios (New Jersey Institute of Technology)

Glaucoma is one if the leading cause of blindness in the world. There are ways to prevent and regulate glaucoma, but majority of these techniques are not noninvasive. The research objective is to determine what the power output would be of a micro fuel cell using previous data acquired from fuel cells.

The fuel cell that we are using gives off energy from oxidation and reduction reactions with glucose and oxygen, using catalysts that are enzymes attached to the tips of carbon nano tubules. The first stage in improving the fuel cell is to study the process in which the enzymes are deposited, called cyclic voltammetry. From this study, data obtained can be used for the production and planning of micro fuel cells.

Using MatLab, the data was plotted and graphed. From this graph, the area under the peak of the cyclic voltammetry was obtained. Cyclic voltammetry is the process in which the enzymes are deposited into the fuel cell. This peak would give the power output by the fuel cell and whether or not a micro fuel cell would function. Using a line and its slope to find the peak, a total power output of 2.1259 * 10-6 Watts was found for this specific cyclic voltammetry.

With the help of other data, the power output of a micro fuel cell was found. With this power, a design can be made for an eye pressure regulator that is noninvasive, unlike the eye pressure regulator on the market at the moment. This design has to incorporate and take into account the power outputted by the micro fuel cell. Otherwise the eye pressure regulator may not function properly.

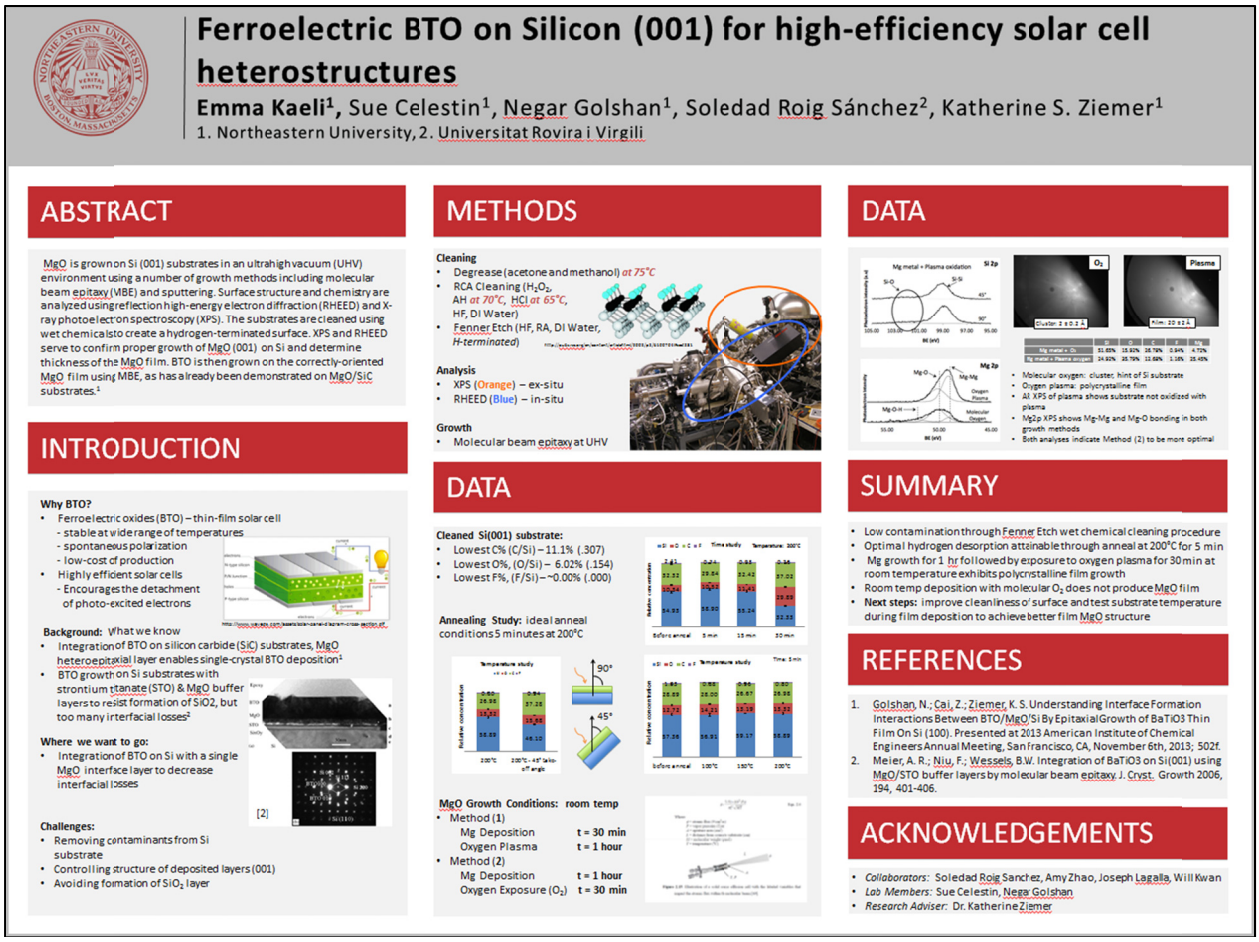


PO-0692 (Track: Energy, Renewable, and Sustainability)

Ferroelectric BTO on Silicon (001) for high-efficiency solar cell heterostructures

Emma Kaeli (Northeastern University)

MgO is grown on Si (001) substrates in an ultrahigh vacuum (UHV) environment using a number of growth methods including molecular beam epitaxy (MBE) and sputtering. In comparing differences in surface structure using reflection high-energy electron diffraction (RHEED) and surface chemistry using X-ray photoelectron spectroscopy (XPS), we can understand surface interactions between Si, Mg, and O. By understanding the relationship between atomic level interactions and ultimate film characteristics, we can engineer the most effective process for BTO integration on Si. The substrates are cleaned using wet chemicals to create a hydrogen-terminated surface that resists contamination from laboratory exposure. XPS and RHEED are used to verify the lack of contamination on the surface and proper crystallographic orientation. XPS and RHEED will serve to confirm proper growth of MgO (001) on Si and determine thickness of the MgO film. BTO is then grown on the correctly-oriented MgO film using MBE, as has already been demonstrated on MgO/SiC substrates.



PO-4367 (Track: Energy, Renewable, and Sustainability)

An experimental analysis of right-sizing algorithms for power-proportional data centers

George Sarkar, Christine Chung (Connecticut College)

Due to the rising cost of energy at data centers, there is an increasing demand for making data centers more energy efficient and more environmentally friendly. One method of achieving better energy efficiency is "rightsizing" the data center by switching off unused servers during periods of predictably low loads. This paper provides an experimental analysis of the performance of a number of algorithms recently proposed in the data and communication networks, learning theory, and algorithms communities.

In our problem, data centers are modeled as a collection of homogenous servers and each of the algorithms determine the number of servers that should be active at time t. The input data used in the analysis of this work are two data center load traces (one from Hotmail and the other from Microsoft research, Cambridge) used in the paper by Lin et. al [1].

The first algorithm of Bansal et al. [1] is a randomized algorithm that maintains a probability distribution over all possible states, x, which represents the number of active servers. Since in data centers, there are "sufficiently many servers" [1], the variable x is modeled as a continuous variable. At each time t, given the work-load L, the algorithm evaluates the value of x, the number of servers that should be active to handle load L and calculates the cost of switching on and switching off servers and the cost of processing the load.

The second algorithm of Bansal et al. [1] is a memoryless algorithm. This algorithm does not maintain a probability distribution over all states like the first Bansal et al. [1] algorithm, however, it is based on a similar idea as the first. For the given load at time t, the algorithm evaluates x, the number of servers that should be active to handle the load L, the hit cost H (the cost of processing the load), and the move cost M, cost of switching on and switching off servers.

The Lazy Cost Provisioning (LCP) Algorithm [2] uses convex optimization to compute the optimal solution for the work-load that has arrived thus far. Given the load L at time t, the algorithm calculates an upper bound and a lower bound based on the optimal solution up to time t for the variable x, which represents the number of active servers. The output of the algorithm moves "lazily" within these bounds. The operating cost for this algorithm is calculated as a sum of delay cost (the loss in income for delay d and load L), the energy cost (the cost of processing load L) and the cost of switching on and switching off servers.

The Randomly Biased Greedy (RBG) algorithm of [3] is the first to obtain simultaneous bounds on regret and competitive ratio. The strategy of the algorithm is to minimize the work function greedily with a randomized bias.

One of the challenges of this study is that the cost function of the LCP algorithm is defined differently from the cost function for the algorithms from Bansal et al. [1]. We have implemented the algorithms from Bansal et al. [1], but must now redesign and implement the LCP algorithm in terms of the cost function of Bansal et al. [1], complete implementation of the RBG algorithm, and evaluate their performances against both the optimal solution as well as against one another.

Bibliography:

[1] Nikhil Bansal, Anupam Gupta, Ravishankar Krishnaswamy, Kirk Pruhs, Cliff Stein. A 2-Competitive Algorithm For Online Convex Optimization With Switching Costs. APPROX/RANDOM 2015, 40:96-109, 2015

[2] Minghong Lin, Adam Wierman, Lachlan L. H. Andrew, and Eno Thereska. Dynamic right-sizing for power-proportional data centers. INFOCOM 2011, pages 1098-1106, 2011

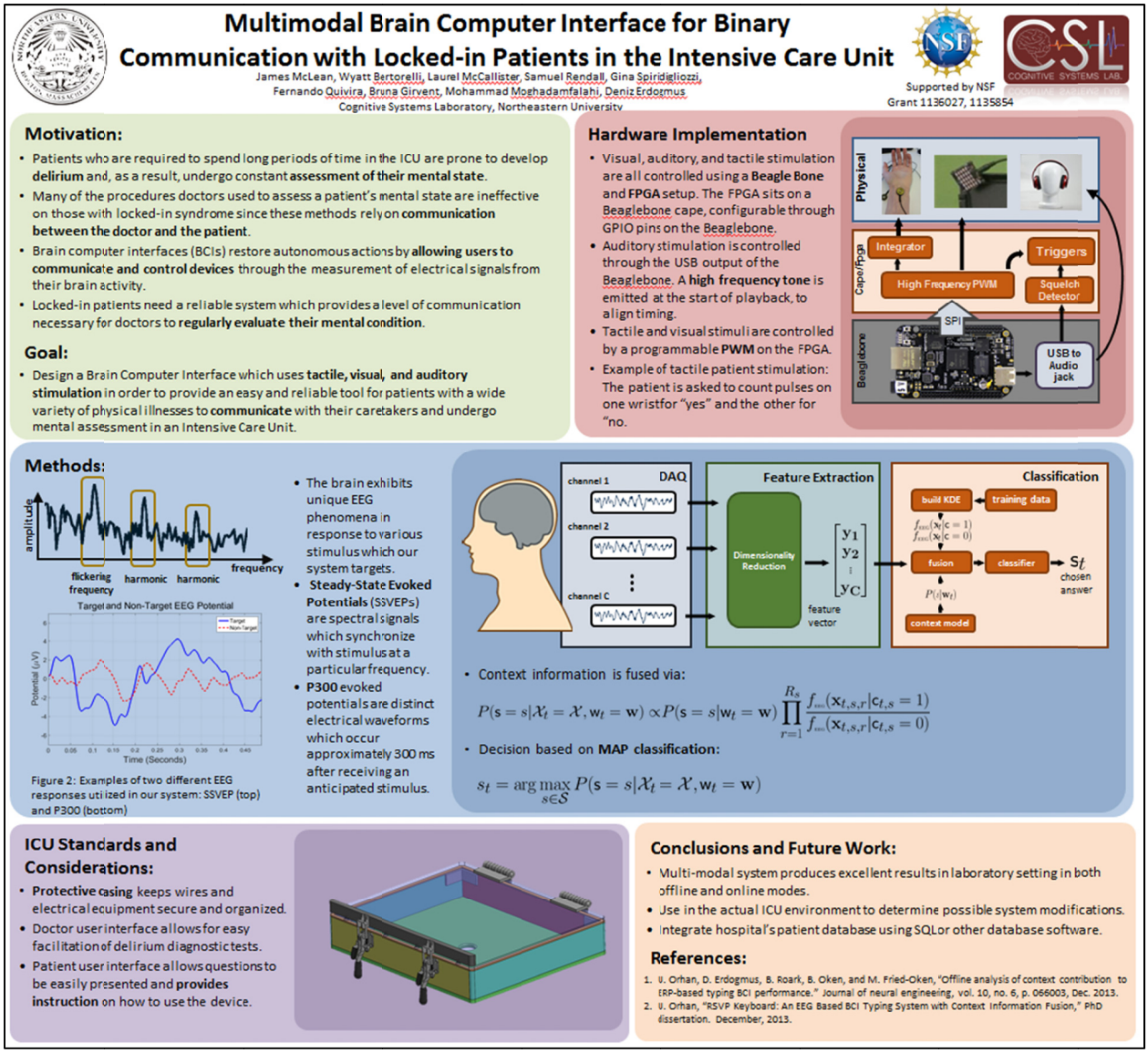
[3] Lachlan L. H. Andrew, Siddharth Barman, Katrina Ligett, Minghong Lin, Adam Meyerson, Alan Roytman, and Adam Wierman. A tale of two matrices: Simultaneous bounds on competitiveness and regret. In Colt 2013 – The 26th Annual Conference on Learning Theory, June 12-14, 2013, Princeton University, NJ, USA, pages 741-763, 2013

PO-8507 (Track: Computer and Information Technology)

Multimodal Brain Computer Interface for Binary Communication with Locked-in Patients in the Intensive Care Unit

James McLean, Wyatt Bertorelli, Laurel McCallister, Samuel Rendall, Fernando Quivira (Northeastern University)

Delirium is a mental health condition characterized by disorganized thinking, inattention, and in some cases, hallucinations. Its occurrence has a direct correlation with mortality rate in the intensive care unit (ICU). Screening for this affliction involves asking a series of unambiguous yes or no questions to assess the patient's awareness. Unfortunately, some patients are disabled so severely that they are unable to communicate through conventional means. While some patients can manage basic communication with hand squeezes or small eye motions, many are unable to perform even these rudimentary actions. Brain computer interfaces (BCIs) provide a robust platform for doctor-patient communication by utilizing non-invasive physiological signals such as electroencephalography (EEG) to detect a subjects' intent without having to rely on any physical response. Our group proposes a multi-sensory BCI system specially designed for delirium assessment in the ICU. This device will be equipped to communicate with patients through the visual, auditory, and tactile modalities to accommodate the myriad of patient conditions encountered in the ICU. Additionally, the device will conform to all ICU standards for electronic devices and utilize a novel machine learning pipeline for high accuracy classification.

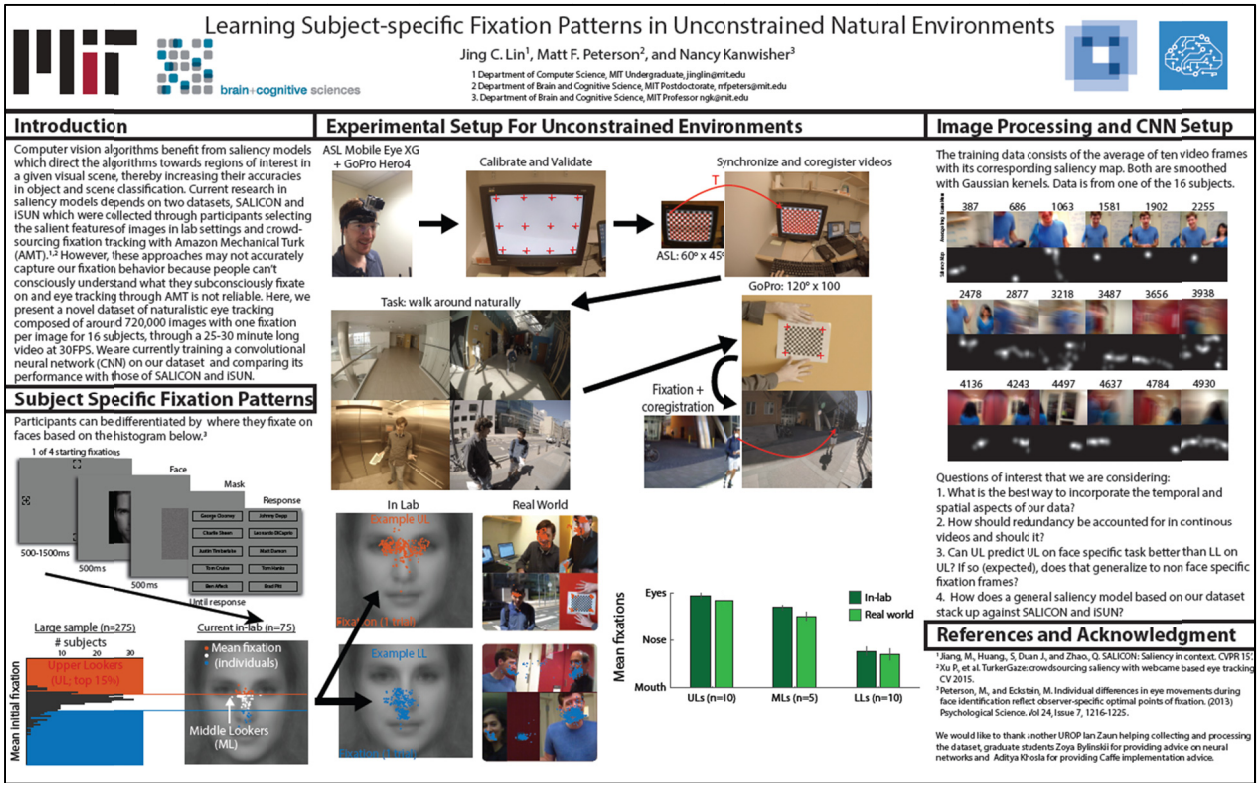


PO-9047 (Track: Humanity and Social Development)

Learning Subject-specific Fixation Patterns in Unconstrained Natural Environments

Jing Lin, Matt Peterson, Nancy Kanwisher (MIT)

The human visual system is remarkably adept at transforming visual signals from the external world into neural and cognitive representations. These representations must retain accurate task-specific information to form appropriate action plans and update world knowledge to create accurate models of the world. This implies that the brain has likely developed an information-processing structure tuned to the statistical properties of the visual world. This is especially true for facial recognition where people regularly outperform the state of the art computer vision algorithms at recognizing a diverse set of signals, from detection to identity and intent, from small samples in unconstrained environments. Human face recognition ability remains robust across increasingly unconstrained viewing environments, where uncertainty in pose, illumination, expression, occlusion, etc. create significant computational challenges. A complete understanding of these mechanisms requires a comprehensive statistical estimate of the visual input we encounter every day, determined by a combination of the surrounding visual environment and our eye movements. Here, we use a recently developed mobile eye tracking framework to gather and analyze an unprecedented large data set of the fixation patterns of thirty subjects as they walk about in natural, unconstrained real world environments. We develop machine learning models to answer two questions. First, do people enact distinct and reliable gaze patterns during everyday vision? To answer this, we attempt to classify our subjects based on each individual's fixation pattern. Second, what are the visual features that predict where we look next in the real world? Using the Caffe Deep Learning Framework on our fixation points, we develop a new real world saliency model. A more accurate saliency model would provide a more complete understanding of the computations and representations that underlie human perception. Furthermore, computer vision algorithms that combine a saliency model trained on real world natural image statistics with an object detection model may be more proficient and robust than object detection models alone.

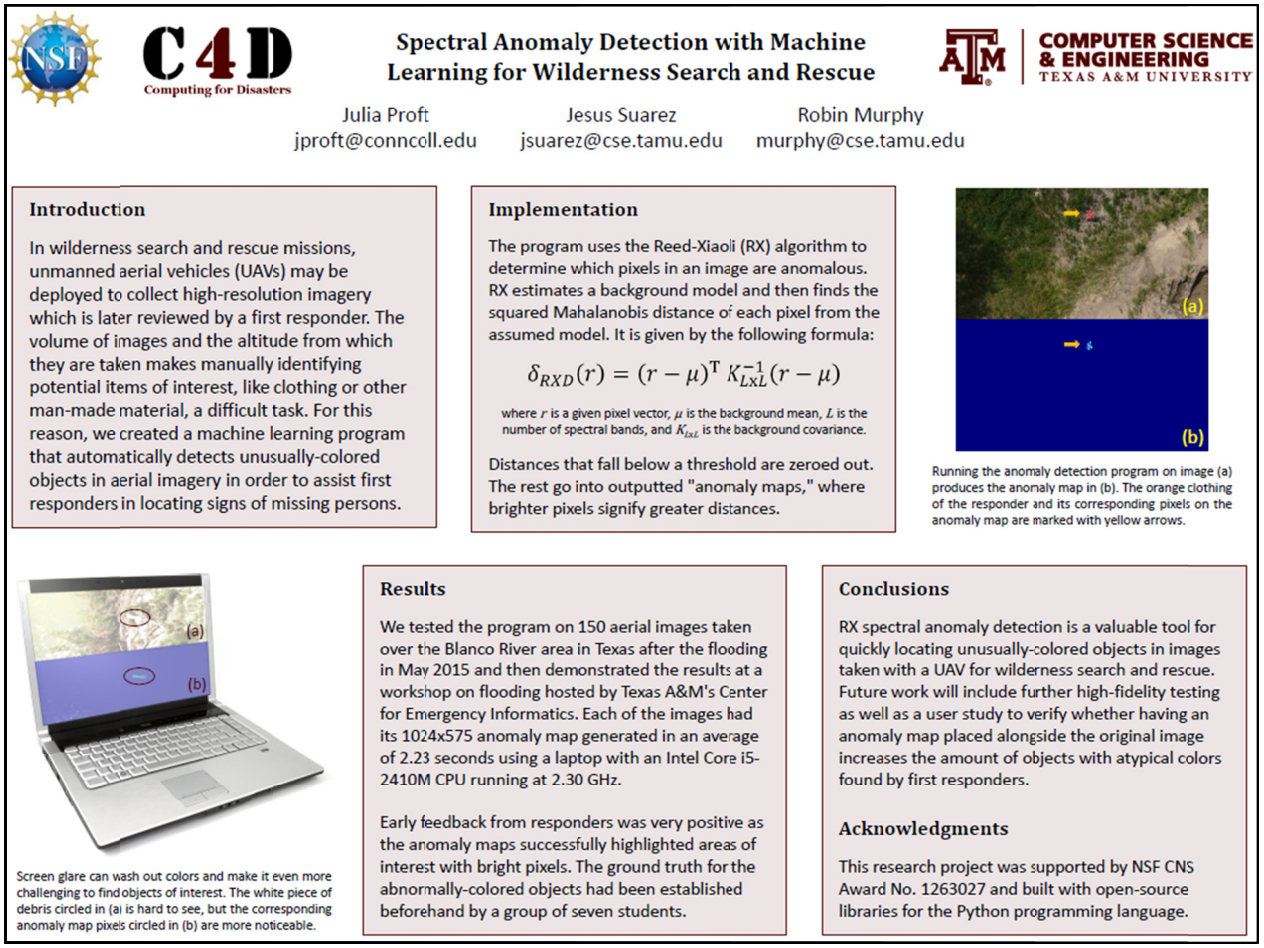


PO-3912 (Track: Humanity and Social Development)

Spectral Anomaly Detection with Machine Learning for Wilderness Search and Rescue

Julia Proft (Connecticut College); Jesus Suarez, Robin Murphy (Texas A&M University)

In wilderness search and rescue missions, unmanned aerial vehicles (UAVs) may be deployed to collect high-resolution imagery which is later reviewed by a first responder. The volume of images and the altitude from which they are taken makes manually identifying potential items of interest, like clothing or other man-made material, a difficult task. For this reason, we created a program that automatically detects unusually-colored objects in aerial imagery in order to assist responders in locating signs of missing persons. The program uses the Reed-Xiaoli (RX) spectral anomaly detection algorithm to determine which pixels in an image are anomalous and then generates an "anomaly map" where brighter pixels signify greater abnormality. While the RX algorithm has previously been proposed for search and rescue missions, up until now it has not been evaluated in a high-fidelity setting with real responders and real equipment. We tested the program on 150 aerial images taken over the Blanco River area in Hays County, Texas after the May 2015 flooding and demonstrated the results at a workshop on flooding hosted by Texas A&M's Center for Emergency Informatics. Early feedback from responders suggests that RX spectral anomaly detection is a valuable tool for quickly locating atypically-colored objects in images taken with UAVs for wilderness search and rescue.

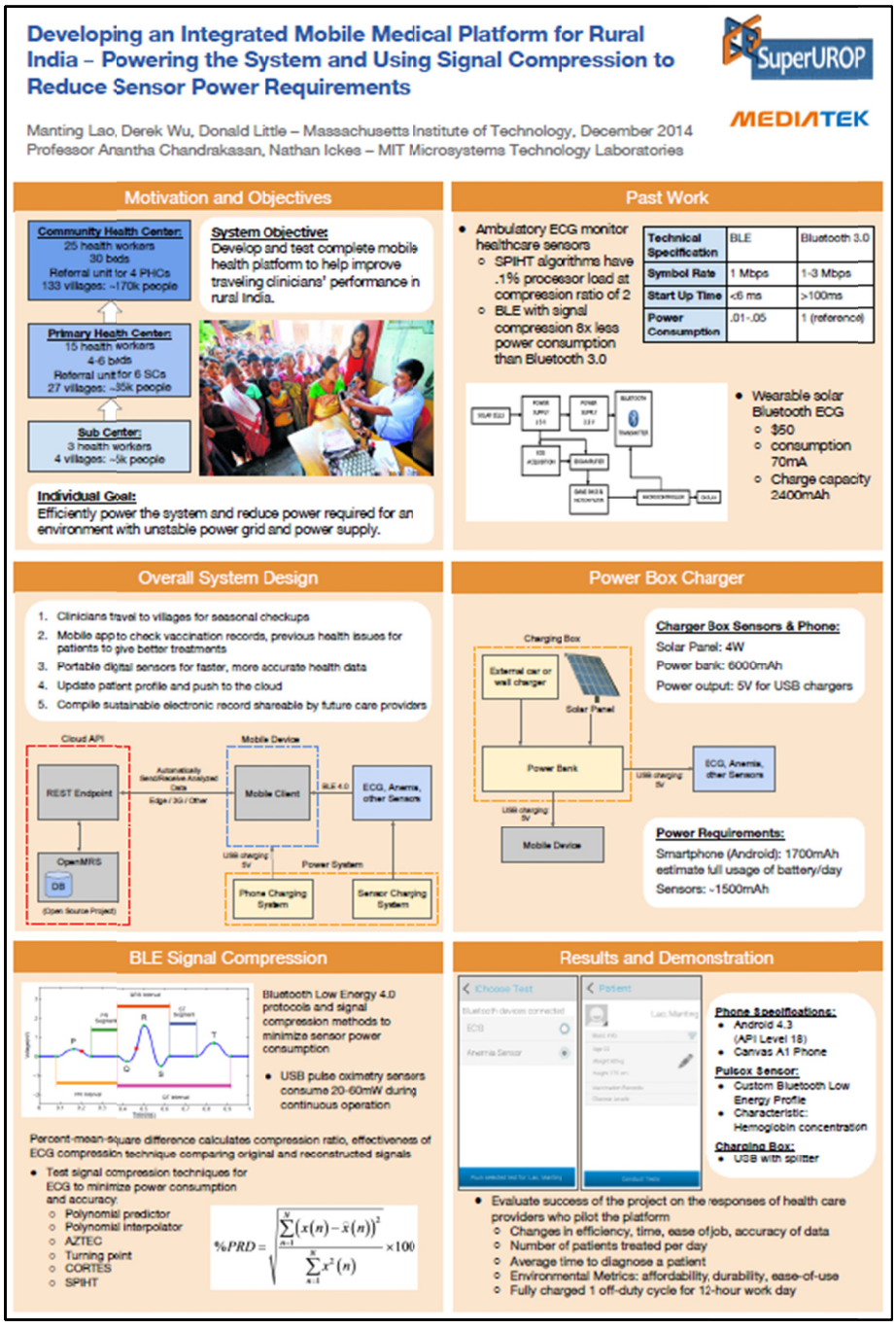


PO-0233 (Track: Humanity and Social Development)

Developing an Integrated Mobile Medical Platform for Rural India –Powering the System and Using Signal Compression to Reduce Sensor Power Requirements

Manting Lao (MIT)

Although technological advancement has all but eradicated numerous deadly diseases that have plagued humanity for generations, rural areas worldwide are still struggling to catch up to modern-day levels of basic healthcare. This is especially true in rural India, where official healthcare is provided through tiers of health centers from local to regional levels. However, the lack of medical staff and technological support has led to an alarmingly large patient-to-provider ratio. This has in turn led to the dissemination of many monitorable and curable illnesses such as anemia and heart disease in rural communities. While portable medical sensors and mobile medical apps have been designed, there has yet to be a complete, system-wide mobile solution. The goal of my project is to develop and test a complete mobile health suite, which will include a mobile app, portable medical sensors for medical screening, and a reliable self-contained power system for use in rural areas. My main focus is to analyze and engineer the power system behind our mobile medical suite and research different signal compression algorithms over Bluetooth Low Energy for electrocardiogram. The goal is to minimize the amount of data that needs to be processed and sent from the electrocardiogram sensor to the mobile phone so that minimal power is used.

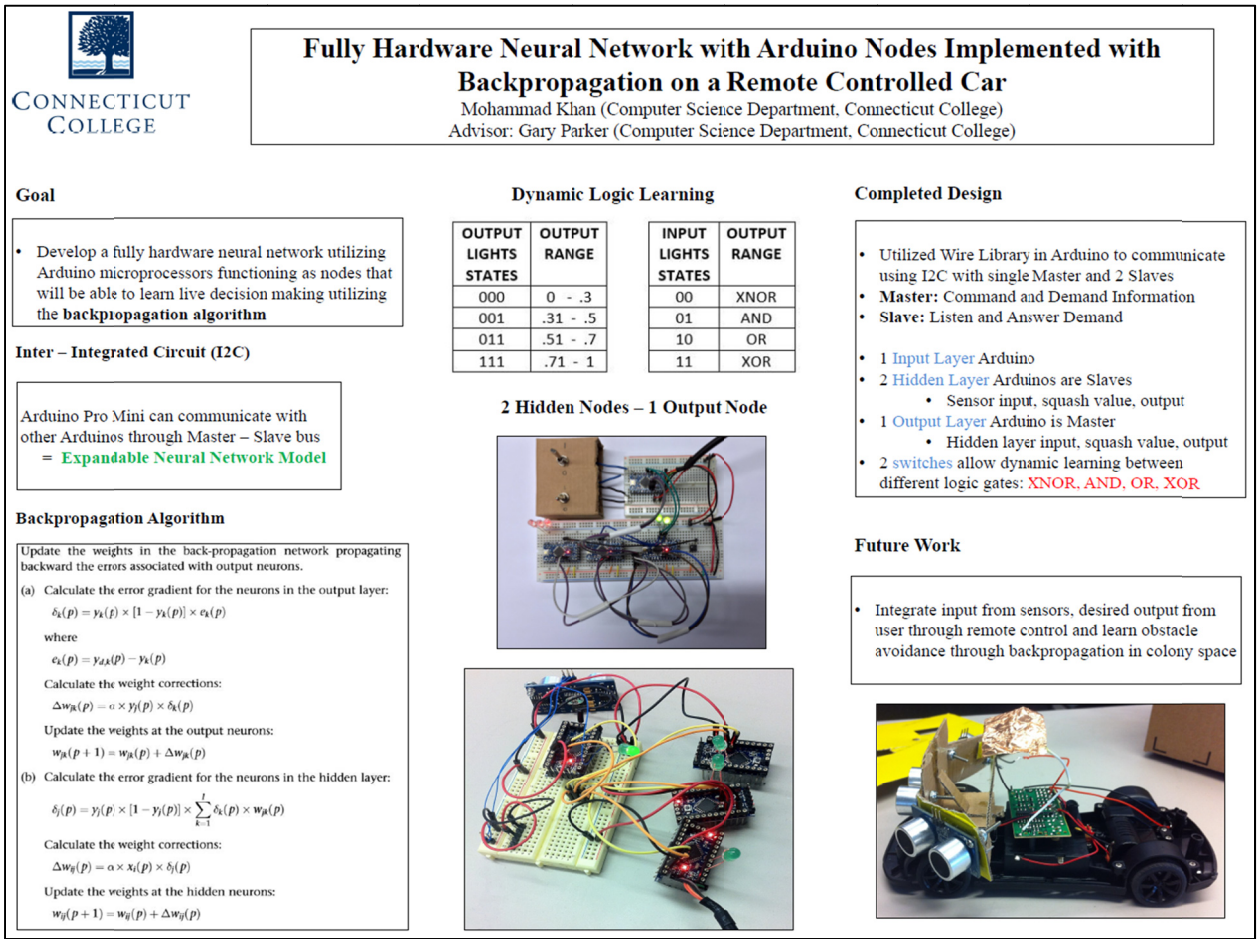


PO-0694 (Track: Computer and Information Technology)

Fully Hardware Neural Network with Arduino Nodes Implemented with Backpropagation on a Remote Controlled Car

Mohammad Khan (Connecticut College)

The goal is to develop a fully hardware neural network utilizing Arduino microprocessors functioning as nodes that will be able to learn live decision making utilizing the backpropagation algorithm. In this implementation, each of a set of Arduino microprocessors will act as a single neuron with learning capabilities. This mechanism will be applied to a small model car, equipped with sonar sensors for distance detection that will learn to drive without collisions in a colony space by observing control inputs by a human driver performing the same task. Instances of previous research were considered in this implementation. Although a few described using neural networks for similar tasks, none used ones that were fully implemented in hardware with individual microprocessors performing the task of a single neuron. The most similar previous work was in optimizing a neural network driven car that utilized image processing done by Hadik et al. from Brown University. They developed a robust neural network running on an iPhone that learned decisions from pictures. Publications on other neural network implementations were studied. The ALVINN (An Autonomous Land Vehicle In a Neural Network) by Pomerleau from Carnegie Mellon University was studied for adaptive approaches to neural network testing. An overview of two decades of practise in applications of neural networks by Misra et al. from the Institute of Engineering and Technology, India was studied to get a grasp on neural network applications. There are no results at this time; the research is ongoing. Focus is currently being given to producing optimal communication between single chips in order to determine how to build the network. We will test the implementation on learning logic gates. We are experimenting with wiring and simulations of remote control signals to optimize communication. Coding is done in Arduino.

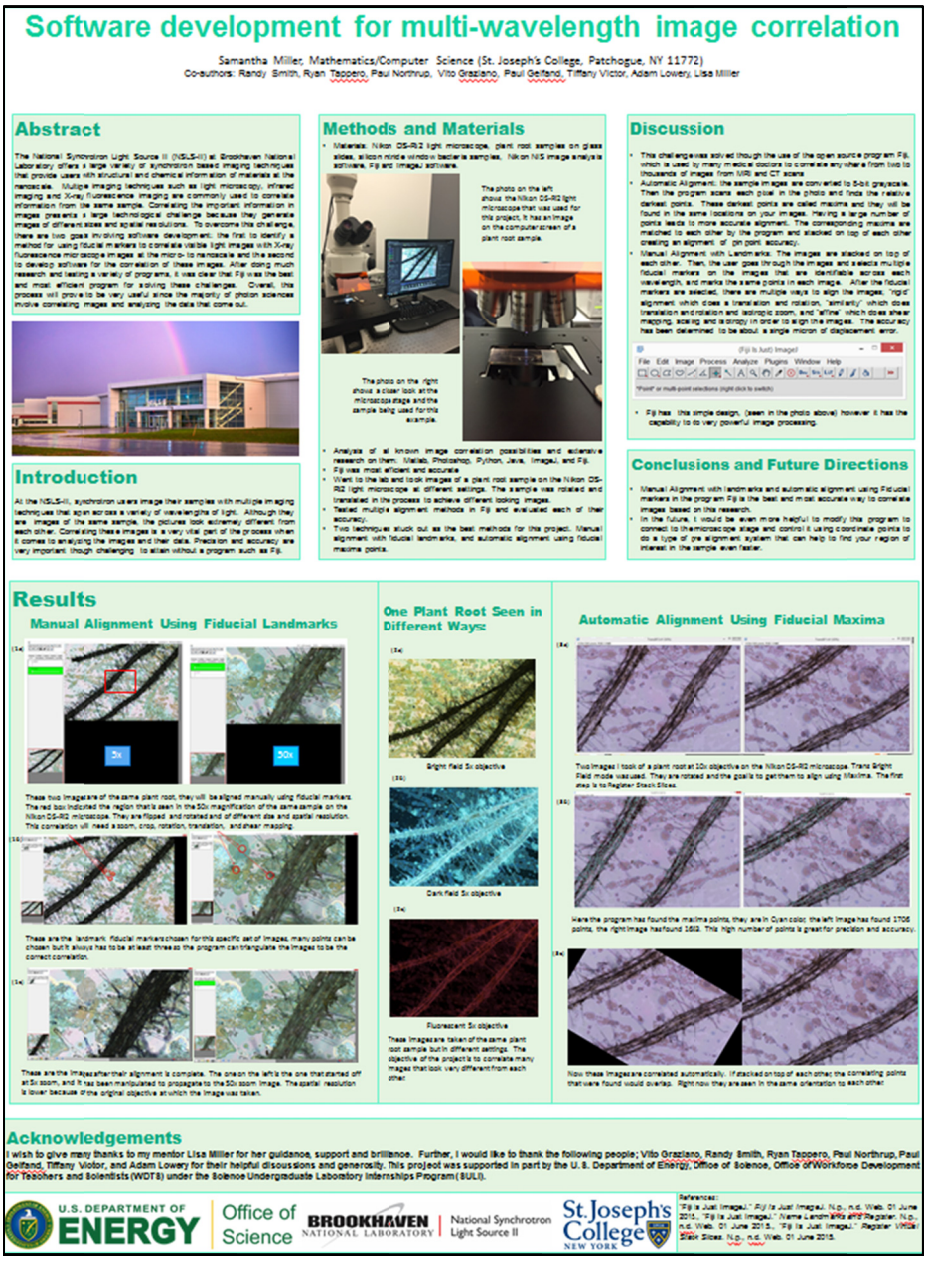


PO-6949 (Track: Computer and Information Technology)

Software development for multi-wavelength image correlation

Samantha Miller (St. Joseph's College)

The National Synchrotron Light Source II (NSLS-II) at Brookhaven National Laboratory offers a large variety of synchrotron based imaging techniques that provide users with structural and chemical information of materials at the nanoscale. Multiple imaging techniques such as light microscopy, infrared imaging and X-ray fluorescence microscopy are commonly used to correlate information from the same sample. Correlating the important information in images presents a large technological challenge because the various imaging techniques generate images of different sizes and spatial resolutions. To overcome this challenge, there are two goals involving software development. The first is to identify a method for using fiducial markers to correlate visible light images with X-ray fluorescence microscope images at the micro- to nanoscale and secondly to develop software for fusion(i.e. overlap) and correlation of these images. Numerous programs were identified to complete this project, such as Matlab, Python, Photoshop, ImageJ and Fiji. After doing much research and testing a variety of these programs, it was clear that Fiji is the best and most efficient program for solving these challenges. It has the capability to align images automatically by converting the image to 8-bit gray scale, finding the maxima (darkest points), and stacking/and/or/corresponding these max points to perfectly align images. Moreover, it has the capability to use manually chosen fiducial point markers where the user inputs landmarks or fiducial points on the image and the program triangulates the points to align them. In addition, I wrote a user manual so that other synchrotron users can benefit from this methodology as well. Overall, this process will prove to be very useful in the future of the laboratory in cases where image correlation is vital. The majority of photon sciences involve correlating images and analyzing the data that come out.



PO-8658 (Track: Computer and Information Technology)

SUNglass: An Infrastructure for the Understanding of Physical Contexts

Pallavi Koppol (Princeton University)

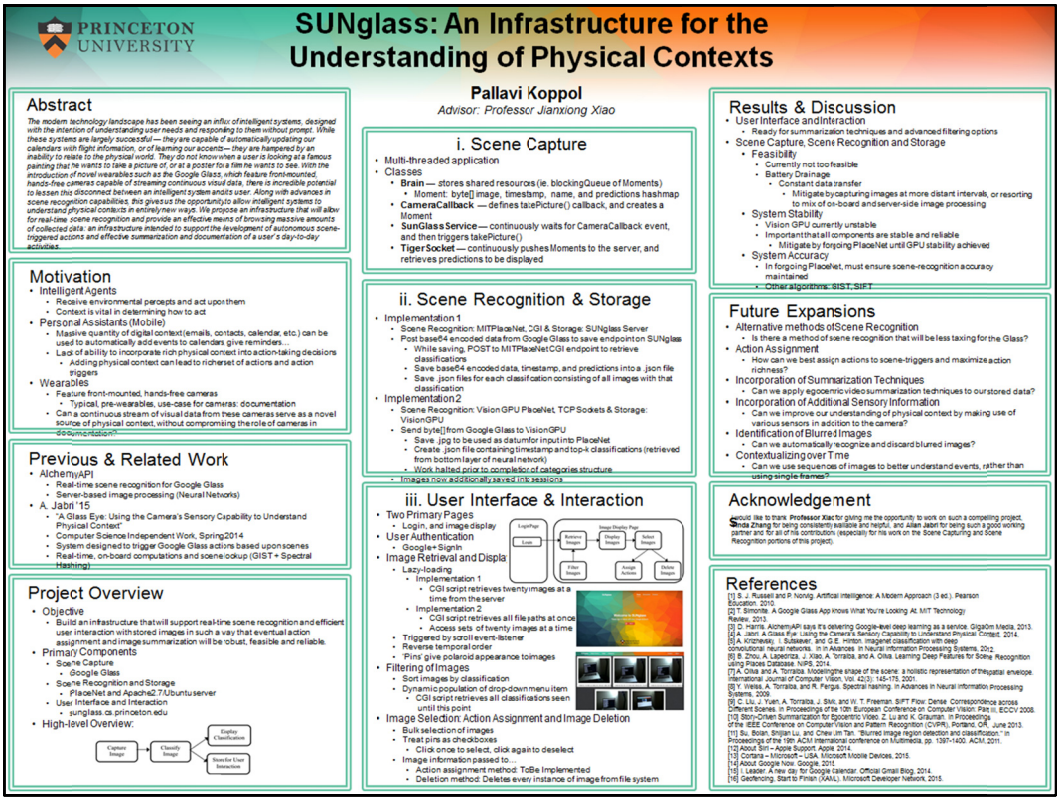
The modern technology landscape has been seeing an influx of intelligent systems designed with the intention of understanding user needs and responding to them without prompt. While these systems are largely successful — they are capable of automatically updating our calendars with flight information or of learning our accents — they are hampered by an inability to relate to the physical world. They do not know when a user is looking at a famous painting that he wants to take a picture of, or at a poster for a film he wants to see.

Consider that on most mobile devices, a camera is the technological equivalent of a human being's eyes, with the added ability to retain information accurately and without alteration. However, on many of those mobile devices, cameras are reserved solely for capturing images and videos that are of particular interest to the user. In addition, there are a wide range of applications that are created especially for the purpose of editing, touching up and sharing these images. Furthermore, there is an entire subset of journaling applications that similarly encourage the capturing of images of interest as a means of documenting a person's life.

People are increasingly choosing to document and annotate their life with pictures. The sudden emergence and incredible popularity of applications such as Instagram, which revolves solely around the sharing of images, is evidence of this. However, because cameras on most mobile devices require the user to actively decide to take a picture, it is simply not feasible to use these cameras in the same way that a person might use their eyes. Intelligent systems have, therefore, relied on less information-rich means of understanding their context and providing useful forms of information, and people have continued to use their cameras to manually document their lives.

With the introduction of novel wearables such as the Google Glass, which feature front-mounted, hands-free cameras capable of streaming continuous visual data, there is incredible potential to lessen this disconnect between an intelligent system and its user. Along with advances in scene recognition capabilities, this gives us the opportunity to allow intelligent systems to understand physical contexts in entirely new ways. In this paper, we propose an infrastructure that will allow for real-time scene recognition and provide an effective means of browsing massive amounts of collected data: an infrastructure intended to support the development of autonomous scene-triggered actions and effective summarization and documentation of a user's day-to-day activities. This is a two-part process. One part, scene recognition, has some degree of immediacy to it. The second part is more user-oriented: users should be able to effectively make sense of and interact with vast amounts of collected visual data.

As a proof of concept, we have designed and constructed a Google Glass application and a website, which work together to achieve these two goals.

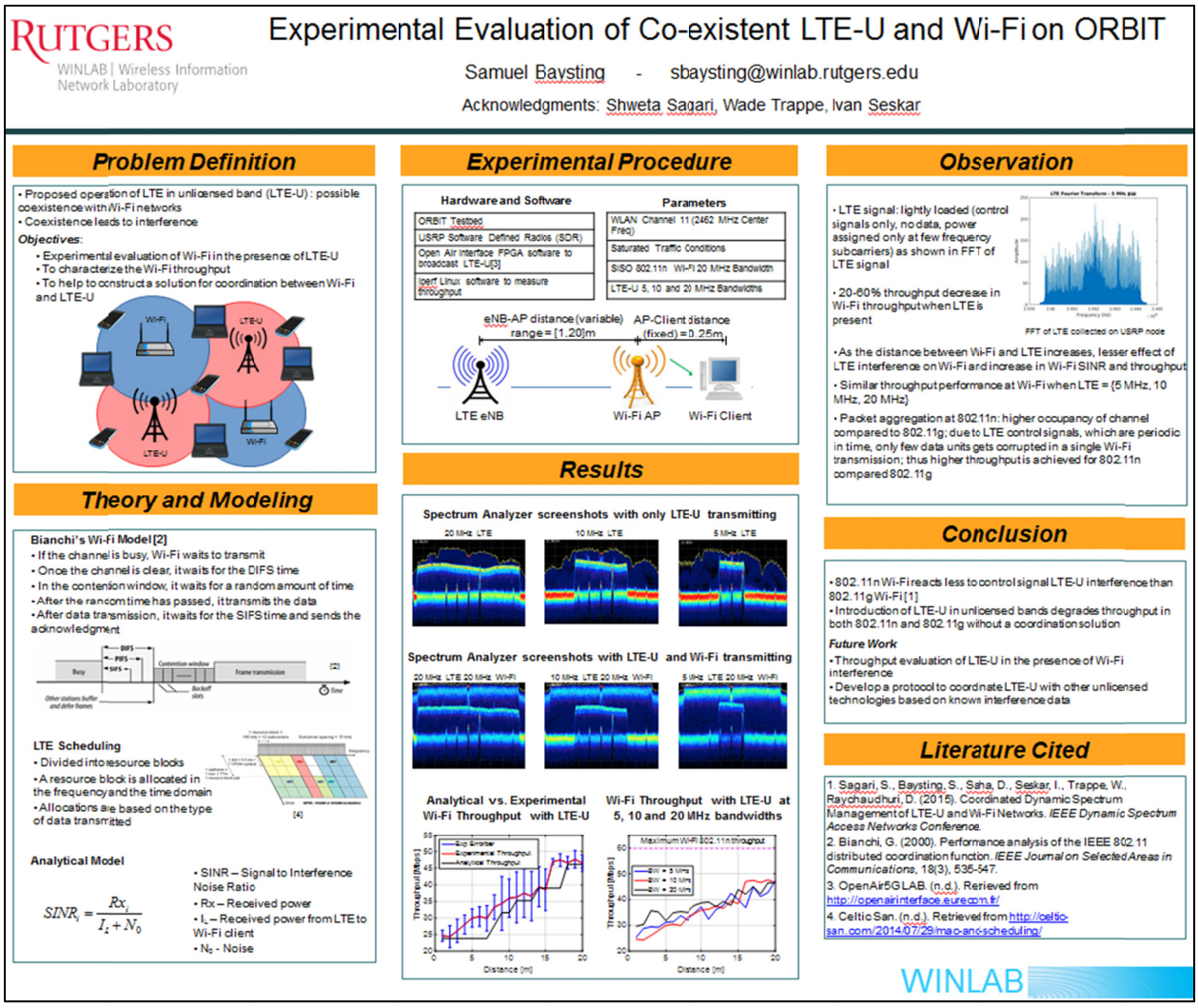


PO-8588 (Track: Communication and Connectivity)

Experimental Evaluation of Co-existent LTE-U and Wi-Fi on ORBIT

Samuel Baysting (Rutgers University)

LTE and Wi-Fi are the two prominent wireless technologies in the market today, each with its own advantages. Wi-Fi resides in the unlicensed 2.4 GHz and 5 GHz spectra, making it readily available for consumers while LTE requires a licensed spectrum to operate, usually under the supervision of cellular service providers, but provides data connectivity for mobile devices and ensures the quality of service. To satisfy the increasing mobile data demand, unlicensed operation of LTE services is emerging as a solution which conflicts with the Wi-Fi operation in these spectrum bands. This research project aims for experimental evaluation of the performance of Wi-Fi in the presence of co-channel LTE-U. In our previous work, an analytical model is constructed based on the protocols of LTE and Wi-Fi and used as a baseline in this current work. I have conducted experiments on the ORBIT testbed at WINLAB using USRP SDR technology as well as the open-source OpenAirInterface (OAI) which is the software implementation of LTE. Also, I have used off-the-shelf available Wi-Fi 802.11n nodes in single-input-single-output (SISO) mode. For evaluation purposes, we have tested the Wi-Fi throughput under different LTE bandwidths- 5, 10 and 20 MHz. Our results show that, in the co-channel operation with LTE, Wi-Fi throughput gets degraded by 20 to 60% for the scenario under consideration. We also show that our analytical model matches with these experimental results. We note that no such experimental evaluation is available in the literature. Thus, this experimental evaluation provides the validation of the analytical model using real systems. This evaluation further helps to support inter-network coordination between Wi-Fi and LTE to mitigate interference and improve overall data rate of the network.



PO-2922 (Track: Information Processing Technologies)

Interactions Between Gliding Dislocations in 3C-SiC(001)

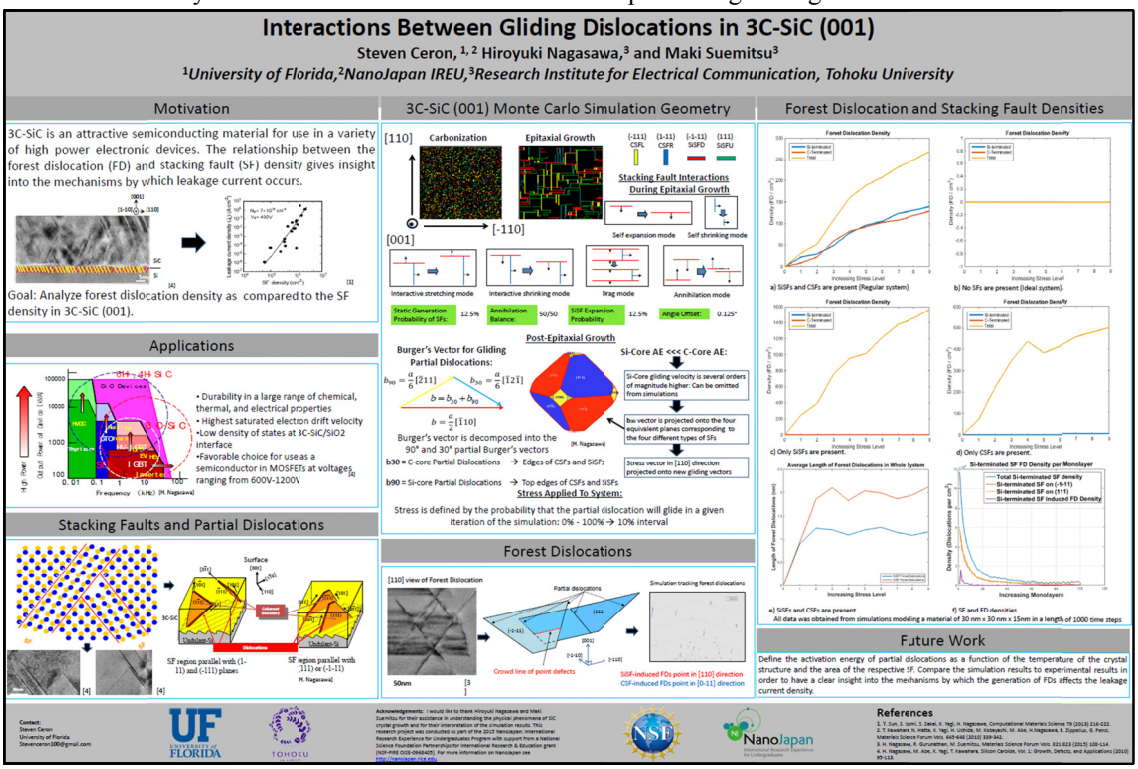
Steven Ceron (University of Florida); Hiroyuki Nagasawa, Maki Suemitsu (Tohoku University)

3C-SiC has been identified as a leading semiconducting material for use in high voltage, high temperature, and high frequency devices. In contrast to the other SiC polytypes, 3C-SiC has shown great potential through its high saturated electron drift velocity and its exceptionally low density of states at the 3C-SiC/Si interface, making it an attractive option for use in power-switching metal oxide semiconductor field-effect transistors (MOSFETs) with a blocking voltage of 600 – 1200V. However, stacking faults form as a result of the 19.7% lattice mismatch at the 3C-SiC/Si interface, and then propagate during epitaxial growth along four equivalent planes. The counter pair of carbon-terminated stacking faults will propagate along the (-111) and (1-11) planes, and the counter pair of silicon-terminated stacking faults along the (111) and (-1-11) planes. During epitaxial growth, there is no possibility for opposing stacking faults to intersect; as a result, one stacking fault simply terminates the other and thus an electrically active defect is formed.

After epitaxial growth has concluded, the presence of the stacking faults cause an intrinsic stress to play a role on the system. The stress causes the carbon-core partial dislocations at the edges of the stacking faults on the four respective planes to deviate in specific directions from their current plane, resulting in the expansion of the stacking faults along those directions. As a result of the deviation of the stacking faults from the four equivalent planes, they are now able to perpendicularly intersect, thus producing crowd lines of point defects called forest dislocations. The forest dislocations are made up of a line of frank type dislocations and are believed to be the main cause of high leakage current density in the semiconducting material.

Monte Carlo simulations are employed to model the formation, propagation, and expansion of stacking faults, as well as the generation of the forest dislocations. The numerical analysis allows for a clear picture of the density of the forest dislocations throughout the system as a function of the stacking fault density, shear stress, and material thickness. In addition, the study predicts the orientations along which the forest dislocations will most likely form. It is expected that the highest leakage current will occur when the electricity is transmitted through the material in these orientations. Further analysis of the mechanisms by which forest dislocations form and the leakage current occurs will lead to more sophisticated fabrication processes of 3C-SiC.

The results of these simulations are not only applicable to 3C-SiC but could also lead to greater insight into the mechanisms by which electrical degradation occurs in different semiconducting materials that are used for a variety of transistors. The application of these numerical studies to different crystal structures could result in a major improvement in the efficiency of transistors which would lead to the processing of larger amounts of information in a shorter amount of time.



PO-2156 (Track: Humanity and Social Development)

Comparing Auction Pricing Mechanisms for Single-Minded Bidders

Tyler Wood, Rodrigo Rogel-Perez (Connecticut College)

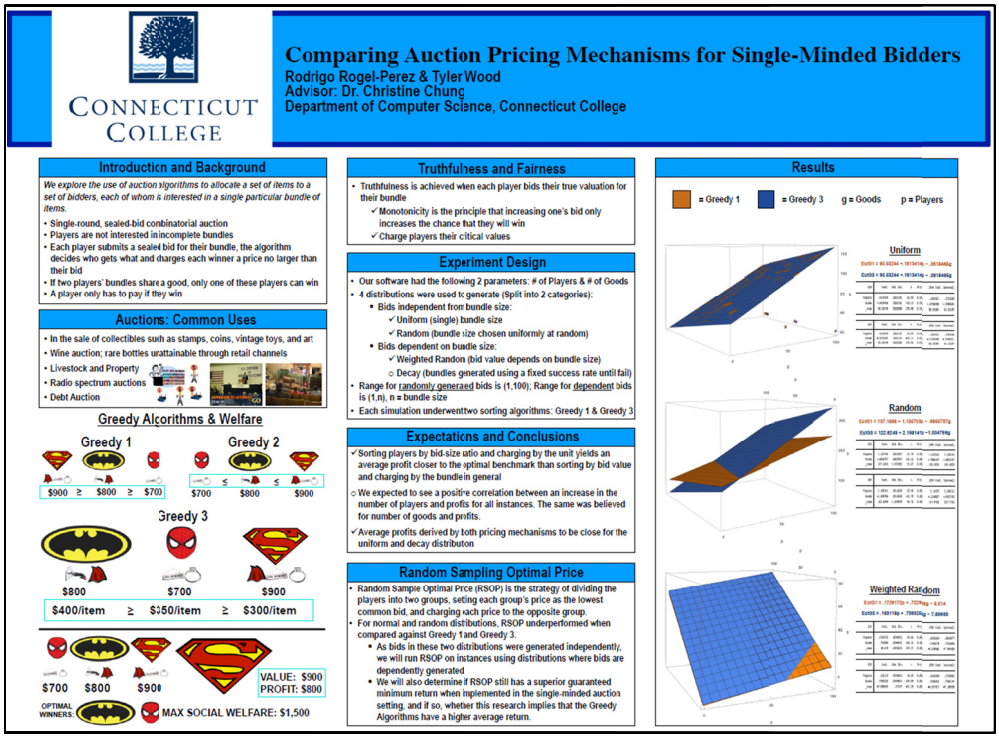
We consider a single-round, sealed-bid combinatorial auction for allocating a set of items to a set of bidders, each of whom is interested in a single particular bundle of items, also known as the single minded bidders problem. In this model, we have a limited number of goods, and a limited number of players. Each player desires a specific bundle of goods and has a valuation for this bundle. Players are not interested in incomplete bundles. Without knowing any other player's bid, each player privately submits a bid for their bundle, the algorithm decides who gets what and charges each winner a price no larger than their bid value. Furthermore, if two players' bundles share a good, only one of these players can win, as the items are distinct and indivisible. A player's payoff if they win is the difference between their valuation and their payment amount, and 0 if they lose.

Two key constraints of auction mechanism design include maintaining truthfulness and fairness. Truthfulness is achieved when each player bids their true valuation for their bundle and receives no competitive advantage from inflating or deflating this value when bidding. The way we do this is by charging players their critical values: the value under which they would no longer win their desired bundle. The other characteristic of a truthful auction is monotonicity, which is the principle that by changing one's bid upward, they are not going to go from being a winner to being a loser; they only risk paying more than their valuation.

Using a variety of selection methods for winners - arranging players by number of desired goods in their bundle, by overall value they place on their bundle of goods, or by the value per item in their bundle - we implement three distinct greedy algorithms in this auction setting. We also look at a variety of pricing mechanisms. We elected to charge players either their simple critical value (the full value of the next highest competing player), by the critical value per item of the next highest competing bidder multiplied by the number of goods in the winner's bundle, or by adapting and using Random Sample Optimal Price (RSOP), which, informally speaking, is the strategy of dividing the players into two groups, finding the best price for each group, and charging it to the other.

The main optimization benchmark we examined was social welfare, which is the sum of the valuations of the winning bidders. We also compared the profit earned by the different auction mechanisms, which is the sum of what winners actually paid for their bundle.

We experimentally show that when using a uniform distribution of goods, higher profits are yielded on average when charging by the unit. We also find that expected profit grows the fastest when we increase the number of players in the uniform distribution. Results for social welfare will be determined with ongoing research, but we expect to see similar trends as those found with profit.



PO-8313 (Track: Humanity and Social Development)

CamelTours: Preserving Cultural Heritage through a Mobile Web-App

Virginia Gresham (Connecticut College)

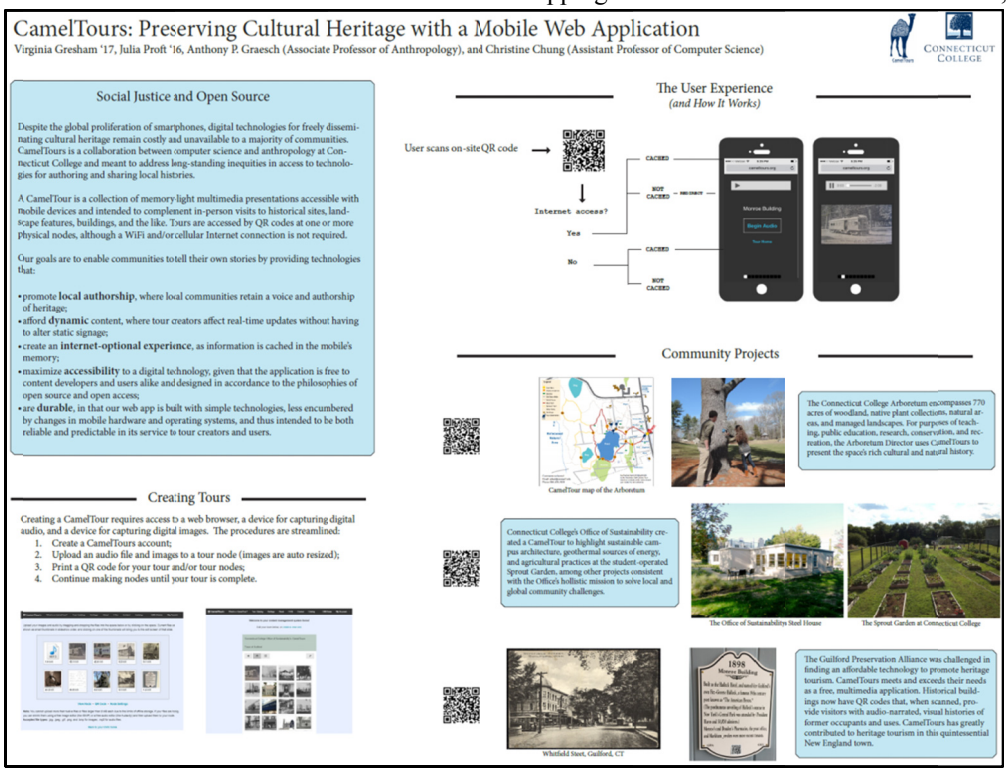
CamelTours is an open-source software web application developed by an interdisciplinary research team comprising students and faculty at Connecticut College. The project addresses persistent inequities in access to the means and technologies by which local communities can author their own histories. CamelTours has two main purposes: (1) to allow anyone with access to a web browser to easily and automatically build multimedia tours by uploading images and audio files; and (2) deliver multimedia content onto the mobile devices of tourists and other end-users in the form of audio-narrated image slideshows.

One defining feature of CamelTours is that on-site access to tour content does not require an Internet connection. Tours can be downloaded and cached prior to travel or at a WiFi-enabled starting point. Users access narrated slideshows by scanning QR codes during their self-guided tour. Because ours is a web app rather than a native OS app, offline access of data posed a significant and unique technical challenge. Our solution to this problem was that we used local browser storage as a method for caching tour content.

CamelTours serves the interests of historical societies, museums, and other communities by allowing their visitors to engage in the site outside of the regularly scheduled hours, increasing the use of modern technology at their sites, introducing a new method of teaching the material, and dovetailing with the cultural movement towards mobile devices. Since it is a free and open source software application, organizations that would need to spend thousands of dollars to develop their own native applications do not need to raise funds for adding new technology to their location. In addition, since the QR code for each tour stop links directly to the web-hosted content that is controlled and managed by the tour creator, the information can be dynamically updated, preventing the need for signage to be updated when the information needs to be.

Currently, there are several CamelTours being created by communities within Connecticut College, in the surrounding area, and across the state. These communities include Connecticut College's Office of Sustainability, Connecticut College's Office for Volunteers for Community Service (OVCS) along with Southeast Area Transit (SEAT), Guilford, CT's Guilford Preservation Alliance (GPA), and the Connecticut College Arboretum. We are currently in conversation with national parks, nature reserves, and other organizations who might be interested in using CamelTours. We view CamelTours as a sustainable, convenient tool which many groups would benefit from.

Ongoing and future work on CamelTours includes the addition of a mapping feature for node and tour locations, creation of a searchable, browse-able catalog of existing tours, enhanced features for ease-of-use such as automatic re-sizing of images, auto-conversion of audio files, and making use of geo-location data from the tourist's mobile device to enhance their experience on the tour.



November 8, 2015 (Sunday)

Consumer Product Safety Commission – Brainstorming Competition

1:30pm - 3:30pm MIT Building 36-462

Session Chair: Tim Johnson

Door Prizes Drawing – 3 Gift Bags

Student Competition - Competitive Brainstorming

This is a team competition where students can demonstrate their problem-solving abilities for engineering design. They are presented with a societal problem requiring an improvement from the current solution. They demonstrate their ability to analyze a problem by thinking up a solution during a brainstorming session that applies new/novel/or even older technology for a better result, and communicate their solution. They are judged based on their presentation of their ideas and teamwork. Nothing is required of the student prior to the competition other that a portable device to help document their ideas and maybe a pencil and pad for sketching.

Brainstorming aspects

In design it is important to recognize a need. What does a client actually need? This is step one in designing. The articulation of the need can be an expression of a dissatisfaction with the current situation. The second step is to realize the need can be expressed as a problem "Too many people are drowning accidently, how can this be prevented?" By digging into the problem and refining it you are clarifying what is needed. In step 2 you construct a problem statement that consist of three components:

Goal Statement - a brief, general and ideal response to the needs statement. Our goal is to "prevent people from drowning." Limit goal statement to 25 words or less.

Objectives - a description of the conditions under which a design must perform. This leads to a consideration of narrowing the problem because there are many ways people can drown. You need to list the performance characteristic your solution will satisfy. "In hotel pools" would signify and limit the scope of your design because a life guard is usually not present but a video camera could be.

Constraints - define the range of the design and performance parameters. A parameter for "drowning in a hotel pool" could be "after hours." Another could be "using software" or "24-7" or "by adding surveillance using video monitoring". Other typical constrains are time and money.

In step 3, an explanation of how the improvement can deliver the expected results and what those results are. A consideration of potential problems should be included that the improvements are expected to overcome.

Finally, an elevator speech is required that combines the problem and your solution (in brief) in a one-minute blurb.

Team Composition

In the competition students would be on teams of 2 to 5+ members usually from the same school. They would join with other teams in a common room for the braining session but members of the same team should not sit together during the initial rounds. Ad-hoc teams can be formed for participation. A facilitator and/or subject matter expert (SME) conducts the common brainstorming session.

Scheduling

If 3 hours have been allotted for the brainstorming competition, two additional rounds featuring different problems may be started after the initial session's first stage is complete. Students may sit through and observe earlier presentation if they desire but if they have not selected one of the earlier subjects for presentation, the 3rd round becomes their default selection. Judging begins one and a half hours after the first session began. All teams presenting on that topic are required to be present at that time else penalty points will be assessed for taking additional time for preparation. The presentation by the teams would take approximately 1/2 hour with 5 minutes allotted per team.

General Rules for Brainstorming

There are 3 stages in conducting a competitive, brainstorming session.

The first stage is held in the common room where a problem is presented and individual participants offer suggestions for solving a problem. This will take approximately 1/2 hour. There are two phases in this stage: the problem presentation and reflection then the initial sharing of ideas for solution.

The following two stages are team based.

The second stage begins with participants who have decided to work on this problem leaving the room to form up into teams, deciding what solution idea(s) they will present and preparing the presentation. There is one hour allowed for this stage. There are two parts in this stage, research and development.

The final stage is the presentation where the teams present their ideas and judges complete an evaluation rubric. This is conducted in the common room using media service for power point presentation. Once a team has finished their preparation and returned to the common room no more work is allowed on their presentation and/or preparation. Multiple teams may present using the same solution.

Stage 1 Initial presentation

It is useful if participants have a note pad handy. After the problem is presented by the facilitator or SME there is 1-2 minutes of reflective thinking. Solution ideas are written down by individuals in their own note pad. Sketching is an important factor.

Stage 1 Revelation process

The facilitator then goes around the room one time and asks everyone to express their "initial" idea to the group. No suggestion is ruled out as being ridiculous and no criticism (including moaning) is not allowed by other participants. These initial ideas are written down on a white board or flip chart on an easel. These list is the session list. If you have no initial idea, say so. This doesn't mean you won't have a great idea later. Questions will come up with discussions for clarity but some questions may be addressed in the later parts of Stage 1.

Participants should draw a line on their notepad to separate their initial ideas from those ideas that are collaborations of ideas presented by other participants (and your improvements).
After the last person's suggestion is posted, this is the end of the revelation portion of stage 1.

Stage 1 Collaborative process

A second reflective thinking period is held but it doesn't need to be as long as the first round. This time, the posted suggestions are allowed to be consider by all. What someone else said can inspire more and different ideas within you. In this 2nd round the participants are allowed to:

- Present a completely different idea from their first idea and distinct from any in the session list,
- Confirm another idea already listed,
- Or add an improvement/twist to an idea already listed.
- And participants can make a statement as to why they make their suggestion.
- Or if the participant is out of ideas, indicate why they support another idea.

The facilitator adds any new ideas to the group list, puts a check that confirms another idea, and notes any modification suggested by starting a list under the idea modified. Once every one is finished adding their ideas the collaboration process as individuals is closed. During this rounds no criticism is allowed by participants, just why you support your selection. The facilitator/SME could be consulted or they may volunteer clarifications to concepts during this round.

Stage 2 Team collaboration and research

Teams collect together to select one solution idea for development preferably in different classrooms. Team members can write down more ideas in their note-pads and/or drawing graphics. As this stage progresses, two or more ideas may be attracting support/suggestions from team members. At this time criticism by team members can be allowed provided supporters are allowed to explain their ideas. After a discussion, a raise-your-hand vote within the team can be taken to select one solution idea for development. In rare cases, if there are enough members, the team can be split into groups of 2 or more.

Stage 2 Development

By development what is meant is the team writes a power point presentation that describes their understanding of the problem, solution, drafting of their elevator speech, and practice in handling questions. Each team member should have a verbal portion of the presentation to handle.

The presentation should include:

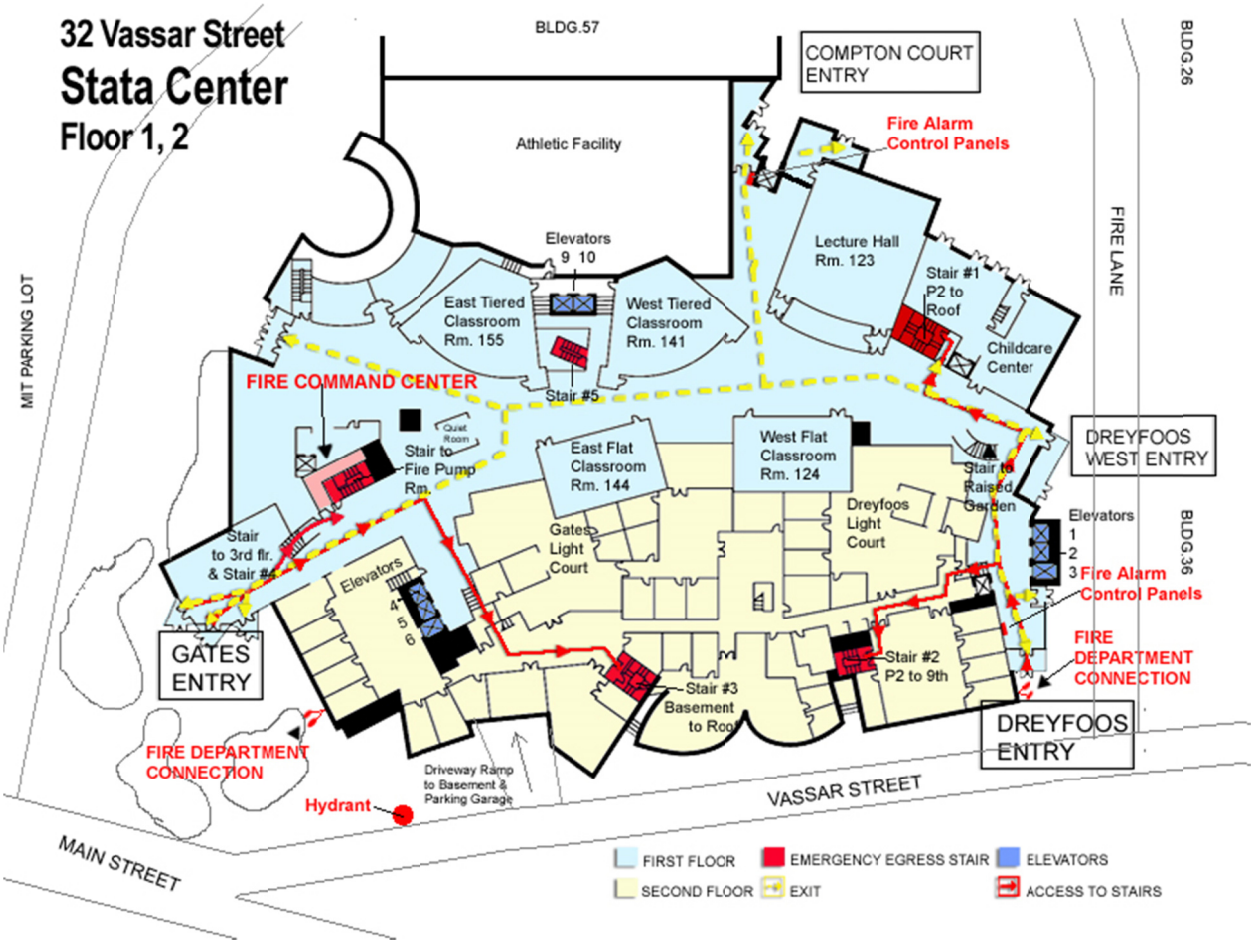
- A cover page including affiliation and team member listing
- The problem statement (as understood by the team)
- A Needs statement
- A Goal statement
- An Objective statement
- A Constraint statement
- The elevator speech spoken by a team member
- A verbal defense that addresses why this solution satisfies the need.

This stage is wide open with team members allowed to access the Internet and/or consult with an industry expert. Sources should to be referenced in a casual manner, your ideas do not. Graphics may be added to support explanation of the solution or improvements. If the hosting facility has the capability, drawings can be scanned so an image can be included in their presentation or simply drawn on a white board or easel during the presentation. Also, a printed copy of the presentation (3 slides per page) for each judge would be useful.

Stage 3 Presentation/Judging

After the teams finish and at the appointed time they should gather in the common room. The facilitator will then call on teams to come forward and present their solutions. Judges are selected from sponsors, IEEE Boston Section members, and other guest will complete a rubric evaluating the team's solution and presentation. They may ask questions after the team's presentation for clarification or to solicit additional aspects. Winners will be announced during the evening event.

STATA Center Floor Plan



IEEE MIT Undergraduate Research Technology Conference 2015

PROGRAM AT A GLANCE

IEEE Advancing Technology for Humanity

Massachusetts Institute of Technology

Time	November 05, 2015 Thursday	November 06, 2015 Friday	November 7, 2015 Saturday	November 8, 2015 Sunday	Time
7:30am			Registration Open and Breakfast (Stata Center)	Registration Open and Breakfast (Stata Center)	7:30am
8:30am - 10:00am	IEEE University Partnership Program		**Opening Plenary** (Stata Center 32-123) **David Perreault, MIT EECS** (Opening Comments) **Barry Shoop, 2016 IEEE President & CEO** (Leadership in the 21st Century) **Tadayoshi Kohno , University of Washington** (Computer Security and the Internet of Things)	**Sunday Plenary** (Stata Center 32-123) **Sponsors Presentation** (Career Opportunities) **Door Prize Drawing - $50 Apple Gift Card, ABB Robots**	8:30am - 9:30am
		IEEE University Partnership Program Meeting (Building 34-401 Grier) Kristen MacCartney Ice-Breaker with Natalia Baklitskaya (Qualcomm), Bryan Cover (Altera) "Fun with Wearables" Workshop (Invited only) Media Labs Tour by Joost Bonsen	IEEE SPAC Committee Meeting (Building 34-401 Grier) Rob Vice Exhibitions (Stata Center - Student Vest Street) Alice Zhan	Exhibition (Stata Center - Student Vest Street) Alice Zhan **Lightning Talks** Christina Chen	9:30am - 10:00am
10:00am			**Break**	**Break**	10:00am
10:30am			*Stata Center 32-123* **Technical Paper Oral Presentation** **Energy, Renewable, and Sustainability** **Communication and Connectivity** **Humanity and Social Development** Soon Wan	*Stata Center - Student Vest Street* **Posters Session** Elizabeth Wei	10:30am
11:00am					11:00am
11:30am					11:30am
12:00pm					12:00pm
12:30pm			**Lunch**	**Lunch**	12:30pm
1:30pm			*Stata Center 32-123* **Technical Paper Oral Presentation** **Computer and Information Technology** Joseph Sheehan	*Building 36-462* **CPSC Student Brainstorming Competition** Tim Johnson **Door Prize Drawing - 3 Gift Bags**	1:30pm
2:00pm					2:00pm
2:30pm					2:30pm
3:00pm					3:00pm
3:30pm			**Break**	**Break**	3:30pm
4:00pm			*Stata Center 32-123* **Hack This Conference** "The Future of URTC Conference" Susan Root, Fred Schindler, Bruce Hecht IEEE MCE powered by IEEE MEETINGS, CONFERENCES & EVENTS	**Closing Plenary** (Stata Center 32-123) **Miri Choi & Soon Wan** (Closing Comments) **Door Prize Drawing - $50 Amazon Gift Card**	4:00pm
4:30pm					4:30pm
5:00pm					
5:30pm					
6:00pm		**Break**	**Break**		
6:30pm - 9:00pm	**IEEE UPP Reception (Catalyst)** 300 Technology Square, Cambridge, MA 02139 (Invited Only)	**IEEE SPAx Event Welcome Reception** (Building 34-401 Grier) Joseph Cunningham Speakers: - Jignasa Ray - Krenar Komoni	**Social Event & Dinner** (Stata Center 32-123) Jessy Lin **Mildred Dresselhaus, 2015 IEEE Medal of Honor** **Elliot F. Kaye, Chairman of US Consumer Product Safety Commission** **Door Prize Drawing - Kindle Fire**		