CSUN | COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

AIMS² STUDENT RESEARCH SYMPOSIUM

October 4, 2017
3:30 – 6:30 p.m.
USU Northridge Center

¡EX! RECOGNIZED EXAMPLE of EXCELENCIA

AIMS^2 2.0

ATTRACT, INSPIRE, MENTOR, AND SUPPORT STUDENTS

This collaborative project is led by the College of Engineering and Computer Science (CECS) at California State University, Northridge (CSUN), in partnership with five community colleges: Glendale Community College (GCC), College of the Canyons (COC), Pierce College, Moorpark College, and LA Mission College (LAMC). It builds on the highly successful and nationally recognized AIMS^2 program that has served approximately 240 students during the past five years, supported by the US Department of Education and led by Dr. S. K. Ramesh, faculty and staff from the partner institutions. The program has been nationally recognized by Excelencia in Education (2014), and as a Bright Spot in Hispanic Education (2015) by the White House Initiative for Educational Excellence for Hispanics for its success in retention and improved graduation of Latino/a students and under-represented minorities in engineering and computer science. Students enrolled in the AIMS^2 cohorts continue to have access to special mentoring and advisement by faculty, tutoring and peer mentoring, social activities, field trips and opportunities to take part in undergraduate research projects. They are expected to carry a full academic load (a minimum of 30 semester units/year). Results from our previous five year grant indicate that student contact with faculty mentors on research projects, coupled with participation in cohort group meetings, and informal interaction leads to their academic, social, and career development. The new grant aims to increase the numbers of students served to over 500, bridge the achievement gaps, improve transfer success, and increase overall graduation rates for all Hispanic and low-income students in CECS and across CSUN's STEM programs.

AIMS² Director Message

I am delighted to invite you to the third annual AIMS² Student Research Symposium at CSUN supported through a new collaborative grant under the 2016 HSI-STEM Initiative from the US Department of Education. We are thrilled to be selected for this sequel multi-million dollar grant which allows us to scale and institutionalize our ongoing work with the original program that was funded in 2011. Students in the AIMS² cohorts are supported and mentored by our outstanding faculty through numerous "hands-on" learning experiences. Our data clearly reveals that participation in undergraduate research projects connects students to their disciplines and builds career capital and practical skills marketable in their future careers. Turning to engineering, we have a number of global challenges in the world today: Food, Clean Air, Clean Water, Energy, Sustainability, Health Care, Transportation, Climate Change, Education, etc., Engineers continue to find innovative solutions to these global challenges that confront society. We have a workforce development challenge across the entire tech sector especially with the rapid advances in technology. We have an enormous challenge attracting and retaining students to study in the STEM disciplines. Programs like AIMS² provide adequate, appropriate, and timely opportunities for advancement for graduates in STEM disciplines. Diversity and Gender Equity are major challenges as well. Last but not least, I will take poetic license with the phrase, "To err is human. To forgive is divine" and say "To err is human, to engineer is divine, to educate is sublime". As leaders of organizations we have a responsibility to engineer and educate the next generation of leaders, unafraid to confront the challenges that they will encounter, firm in the belief that they have the technical and business skills and the intuition to succeed. Nothing succeeds like success. Success ultimately is the greatest legacy that inspires future engineers to celebrate their diversity and soar ever higher than they ever imagined. Don't miss this opportunity to see and hear firsthand from our outstanding AIMS² students. I am sure you will be impressed with the diversity and quality of their work and look forward to seeing you on October 4th!

AIMS² Project Director and
Lead Principal Investigator

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Research Projects

AIMS² STUDENT RESEARCH SYMPOSIUM

October 4, 2017
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University Student Union, Northridge Center

CIVIL ENGINEERING & CONSTRUCTION MANAGEMENT

- Experimental Research of Building Structures with Water Tank as Tuned Liquid Damper
- Augmentation of a Structural Engineering Encounter (SEE) Active-Learning Laboratory Environment: Phase I

COMPUTER SCIENCE

- Simulating Network Discrimination by Intermediaries on the the Internet

ELECTRICAL & COMPUTER ENGINEERING

- Electric Speed Drives Technology in Transportation (ESDTT)
- Low-Profile Wireless Power Receivers for Pediatric Circulatory Blood Pumps

MANUFACTURING SYSTEMS ENGINEERING & MANAGEMENT

- Application of High Strength Aluminum Alloys for Aircraft and Automotive Applications
- Creation of an Entrepreneurial Mindset among Undergraduate Students
- 3D Bioprinting of Aneurysm Blood Vessel

MECHANICAL ENGINEERING

- Experimental Study of Airfoils in the Wake of a Bluff Body
- Eco Four-Wheel Drive

FACULTY MENTOR

Dr. Anwar Alroomi
Dr. Tzong-Ying Hao

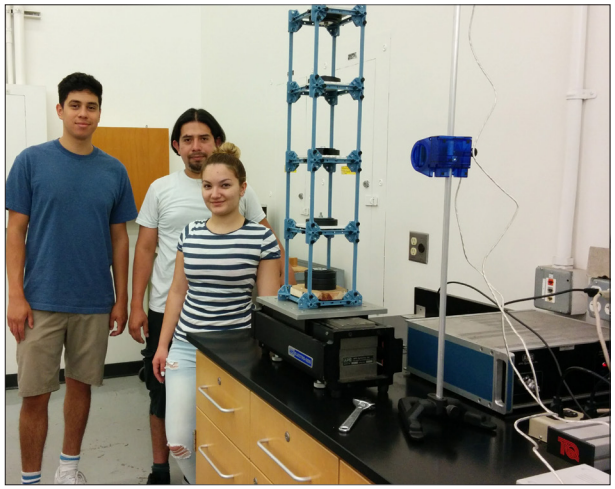
RESEARCH ASSISTANTS

Andres Navarrete
Cruz Reyes
Lilian Simonian

Experimental Research of Building Structures with Water Tank as Tuned Liquid Damper

Project Description: Studies show that the passive tuned liquid damper (TLD) may reduce the seismic response of buildings. In the projects, students assembled various building models with and without dampers to observe their dynamic responses on a shaking table. The effectiveness of the passive TLD for buildings will be evaluated using the experimental data from the tests. The faculty mentors guide students in group discussions about building modeling and earthquake safety through simple physics. An overview of fundamental seismology, including sources of earthquakes, propagation of seismic waves, and earthquake impacts to urban environment are introduced to the students.

Through hands-on learning experiences students were introduced to fundamental engineering problem-solving steps from the issue discovery, problem identification (convert to a solvable engineering and science project from a real-life issue), solution plans, implementation, analysis and interpretation. These projects will enhance students' engagement to engineering and help them to establish a strong sense of belonging in peer groups, and to ultimately motivate and retain students in their engineering careers.



FACULTY MENTORS

Dr. David Boyajian
Dr. Tadeh Zirakian

RESEARCH ASSISTANTS

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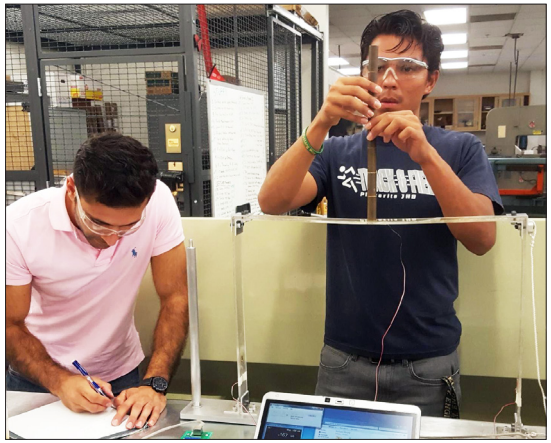
Edgar Chavez
Brayon Rodriguez
Iman Sharifirad

Augmentation of a Structural Engineering Encounter (SEE) Active-Learning Laboratory Environment: Phase I

Project Description: During the initial development phase of the Structural Engineering Encounter (SEE) Active-Learning Laboratory Environment, back in the Summer of 2016, the faculty mentors directed the AIMS^2 student researchers to successfully construct a single-story, single-bay portal frame with complete instrumentation.

In the Summer of 2017, the faculty mentors envisioned the first phase of augmenting the Structural Engineering Encounter (SEE) Active-Learning Laboratory Environment. To this end, student researchers were involved in the fabrication and instrumentation of new structural models to conduct experiments along with theoretical and numerical investigations. The expected outcomes of this research endeavor involves the drafting of a detailed testing manual as well as publication(s) and presentation(s). The products and findings of this research effort will be used in the following three areas: (i) enhancing the Mechanics Lab (AM 317) course at CSUN, (ii) recruiting college and high school aged students by introducing them to the world of engineering, and (iii) developing new research endeavors.



FACULTY MENTOR

Dr. Vahab Pournaghshband

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Richard Dojillo
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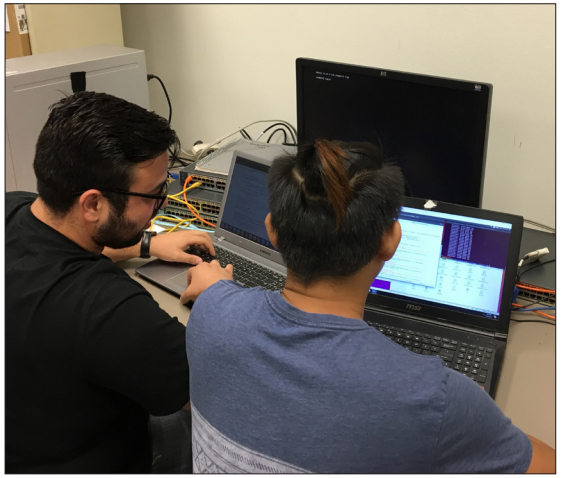
Simulating Network Discrimination by Intermediaries on the the Internet

Project Description: Currently, every packet sent on the Internet goes through numerous routers and intermediaries until it gets to the intended receiver. While routing the traffic, these intermediaries (referred to as middleboxes) are potentially capable of making significant changes to what happens to a traffic stream on the network. During the past decade, a wide variety of middleboxes have been proposed, implemented and deployed. Examples include traffic shapers, proxies, firewalls, and WAN optimizers. These middleboxes are becoming a common element of various types of networks, making their detection by end-hosts beneficial and in some cases crucial. In this project, we will investigate if these middleboxes are detectable through implementing network tools. The project involves implementation using object-oriented programming (OOP) network simulation, scripting, automation, and configuration of network switches. The goal of this project is to emphasize on OOP paradigm, critical thinking, software development, hands-on experience with network equipment, innovation, and small group collaborations.



FACULTY MENTOR

Prof. Bruno Osorno

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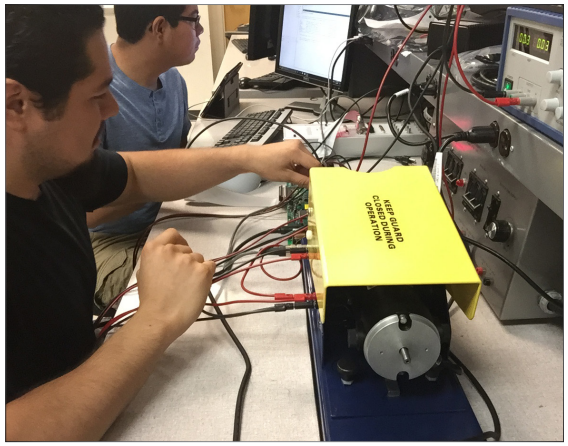
Samuel Ochoa

Electric Speed Drives Technology in Transportation (ESDTT)

Project Description: Electric car sales increased by 50% in 2015, which surpassed the car (combustion engines) market sales by ten times. The components industry is also booming rapidly with components such as batteries, super capacitors, in wheel-systems, transmission and electric motors, and power electronics. There is a tendency to use electric speed drives with capacities from 5 to 15 KW for specific vehicles, such as golf carts, cargo vehicles, lifting vehicles and small shuttle buses. Permanent magnet synchronous motors (PMSM) and Induction Motors (IM) are the motors of choice for electric-drives. To put it in perspective of education, job market and state of the art technology, in 2013, 63 billion dollars were spent on electric motors alone and it is projected that 302 billion dollars will be spent by the year 2023. This trend is very important in terms of CO2 pollution and the environment as a whole. This project will introduce students to the speed-drive technologies with hands on laboratory experience. Arduino microcontrollers will be utilized to control Direct Current (DC) motors.

Students learn fundamentals of power electronics, MATLAB/Simulink software, modeling of Induction Machines and PMSM, and Arduino programing.



ELECTRICAL & COMPUTER ENGINEERING

FACULTY MENTOR

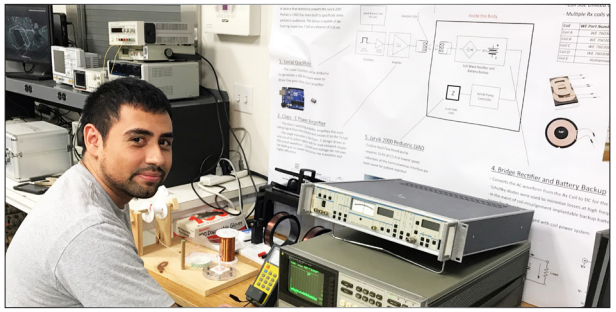
Dr. John Valdovinos

RESEARCH ASSISTANT

Ivan Garcia

Low-Profile Wireless Power Receivers for Pediatric Circulatory Blood Pumps

Project Description: Heart failure (HF) affects approximately 12,000-35,000 children each year in the U.S. The development of blood pumps that provide circulatory support for many adults suffering with HF has allowed them to survive until they receive a heart transplant. However, while the development of blood pumps for adults has led to fully-implantable devices, blood pump technology for children has lagged significantly behind. One area for improving the implantability of blood pumps for children is the use of wireless powering systems, which eliminate the power cord connecting the implanted blood pump to the external power supply. In adults, wireless power systems have decreased the number of power cord-related infections and have improved patient outcomes after pump implantation. Unfortunately, the components of these wireless systems are too large for children. We propose the development of low-profile wireless power receivers to improve the implantability of blood pumps for children. In this research students will study the feasibility of using flexible printed circuit boards and thin-film magnetic alloys to design implantable receivers for wirelessly powering a child-specific blood pump (Jarvik 2000 Child). This research will require students to use finite element modeling software to predict the magnetic interaction (mutual inductance and coupling) between transmitting and receiving coils and to design, fabricate, and test various coils. Students will use modeling software like Finite Element Method Magnetics (FEMM) and printed circuit board layout software like Eagle to design transmitters and receivers. Coils will be fabricated using basic etching procedures.



FACULTY MENTORS

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Prof. Lisa Reiner

RESEARCH ASSISTANTS

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Application of High Strength Aluminum Alloys for Aircraft and Automotive Applications

Project Description: Students investigated mechanical and corrosion behavior of high strength aluminum alloys used in aircraft and automotive industry. Fellow researchers spent multiple weeks training to learn sample preparation, to use universal test equipment (for tensile, hardness and cold working) and microscopes, to conduct metallographic analysis, and function safely in a laboratory environment. Aluminum alloys were subjected to various heat treatment conditions by students to achieve optimal properties. Further materials characterization for the aluminum alloys was done using Scanning Electron Microscopy (SEM) with Energy Dispersive X-Ray (EDX) analysis.

MANUFACTURING SYSTEMS ENGINEERING
& MANAGEMENT

FACULTY MENTOR

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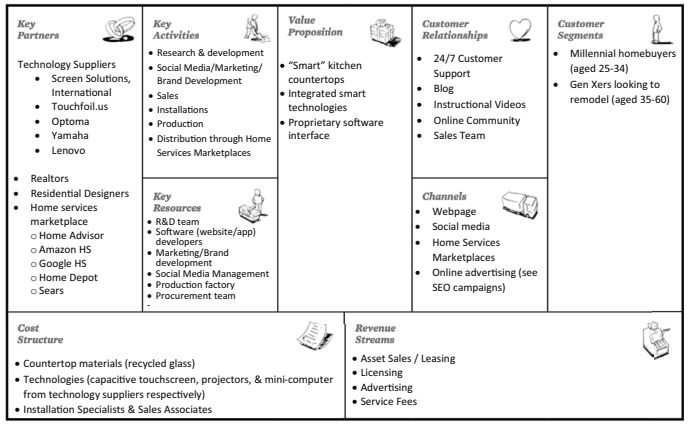
Christina Seeholzer
Justin Timbol

Creation of an Entrepreneurial Mindset among Undergraduate Students

Project Description: An entrepreneurial mindset involves creating a competitive advantage for yourself in an increasingly competitive and changing business environment. The expectations for an engineering graduate of 2020 has changed considerably. Creativity will become one of the top three skills workers will need.

As part of this research project, the AIMS² students will be doing research to understand what an entrepreneurial mindset is in an industry of their choice and how to go about creating that mindset. This will include Opportunity Identification, Developing Customer Awareness, Determining Market Risks and obtaining funding for Engineering Projects to start and operate. Without these key initiatives, most industries would not be profitable because for any project worked on, there needs to be an awareness of who the customer is and what the customer's needs are—otherwise, there will be no interest in buying the product or technology produced.



FACULTY MENTOR
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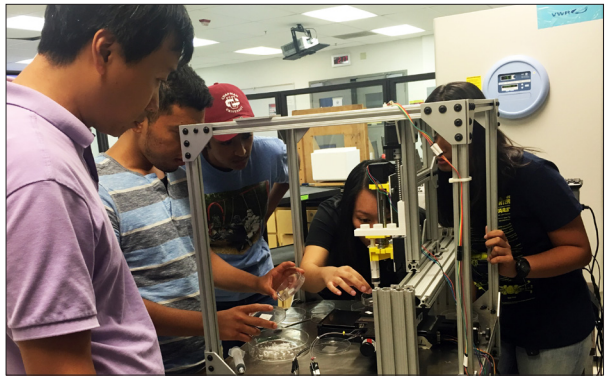
3D Bioprinting of Aneurysm Blood Vessel

Project Description: Three-dimensional (3D) bioprinting has opened the door to new methods of printing, especially the methods used for tissue engineering and the production of artificial organs and tissues. Having the capability to 3D print functional artificial tissues on demand is extremely beneficial for studying all aspects of these tissues and organs and ultimately eliminating the need for donors. Cardiovascular disease is the leading cause of death in the United States, at a staggering 25% of fatalities for both men and women. Estimated annual incidence rates of Aneurysm, an excessive localized enlargement of an artery, range from 10 to 15 cases per 100,000, which translates to at least 30,000 annual cases in the United States.

A better understanding of the flow parameters that causes rupture is crucial. Therefore, the production of an aneurysm blood vessel model can allow researchers to find new methods of testing and analyzing this naturally occurring abnormality. The Aneurysm model is a complex structure due to the bulge created on the artery. This work explores the micro-extrusion method for bioprinting Aneurysm models. This method is inexpensive, can be used to print desired shapes, and has flexibility in the selection of the 3D printer. The use of a hydrogel as support bath allows this method to be implemented with other hydrogels that are printed within the hydrogel support bath which maintains the intended structure while printing.



FACULTY MENTOR
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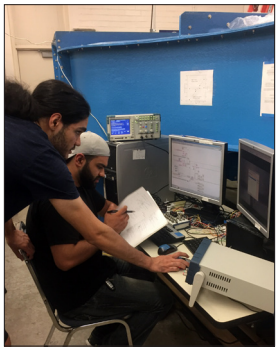
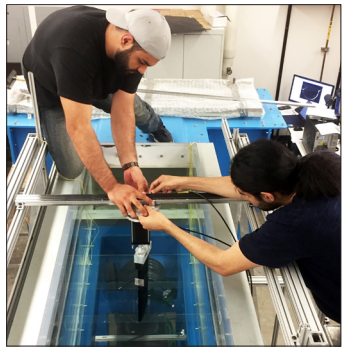
Experimental Study of Airfoils in the Wake of a Bluff Body

Project Description: The successful operation of aircraft is critical to a wide variety of missions routinely performed by Navy Aircraft Carriers. Shipboard launch and recovery of aircraft are some of the most challenging, training-intensive and dangerous flight operations, due to factors like rolling and pitching decks, adverse weather conditions, and aircraft landing in the wake of superstructure of the ship. Flight characteristics of an aircraft are adversely impacted when it is in the wake of a ship superstructure, and the maneuverability and controllability of the aircraft becomes challenging. Therefore, the proposed investigation focuses on studying the aerodynamic behavior of an airfoil operating in the wake of a bluff body, in order to develop a deeper understanding of the adverse impact of large scale flow structures (i.e., eddies) on the flight characteristics of an aircraft. The experiments for this investigation are performed in the water tunnel facility in the Department of Mechanical Engineering at California State University, Northridge. For this investigation an automated system is being developed to accurately change the angle of attack of the airfoil in the wake of a bluff body. Such a system will allow for an accurate quantification aerodynamic performance of the airfoil when operating in wake of bluff body. Students learn about data acquisition system, data analysis using MATLAB and Labview, they get familiarized with airfoil aerodynamics, water tunnel testing, and they learn about automation and how to precisely control the airfoil's angle of attack during testing.





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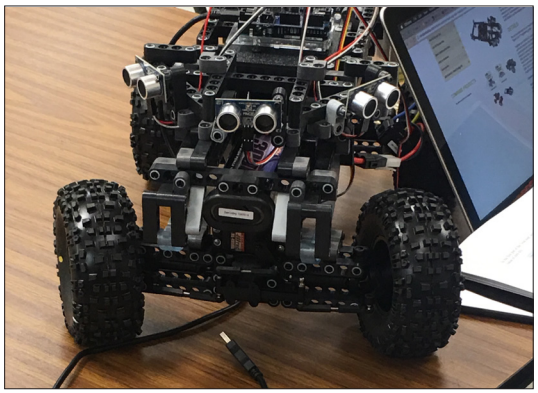
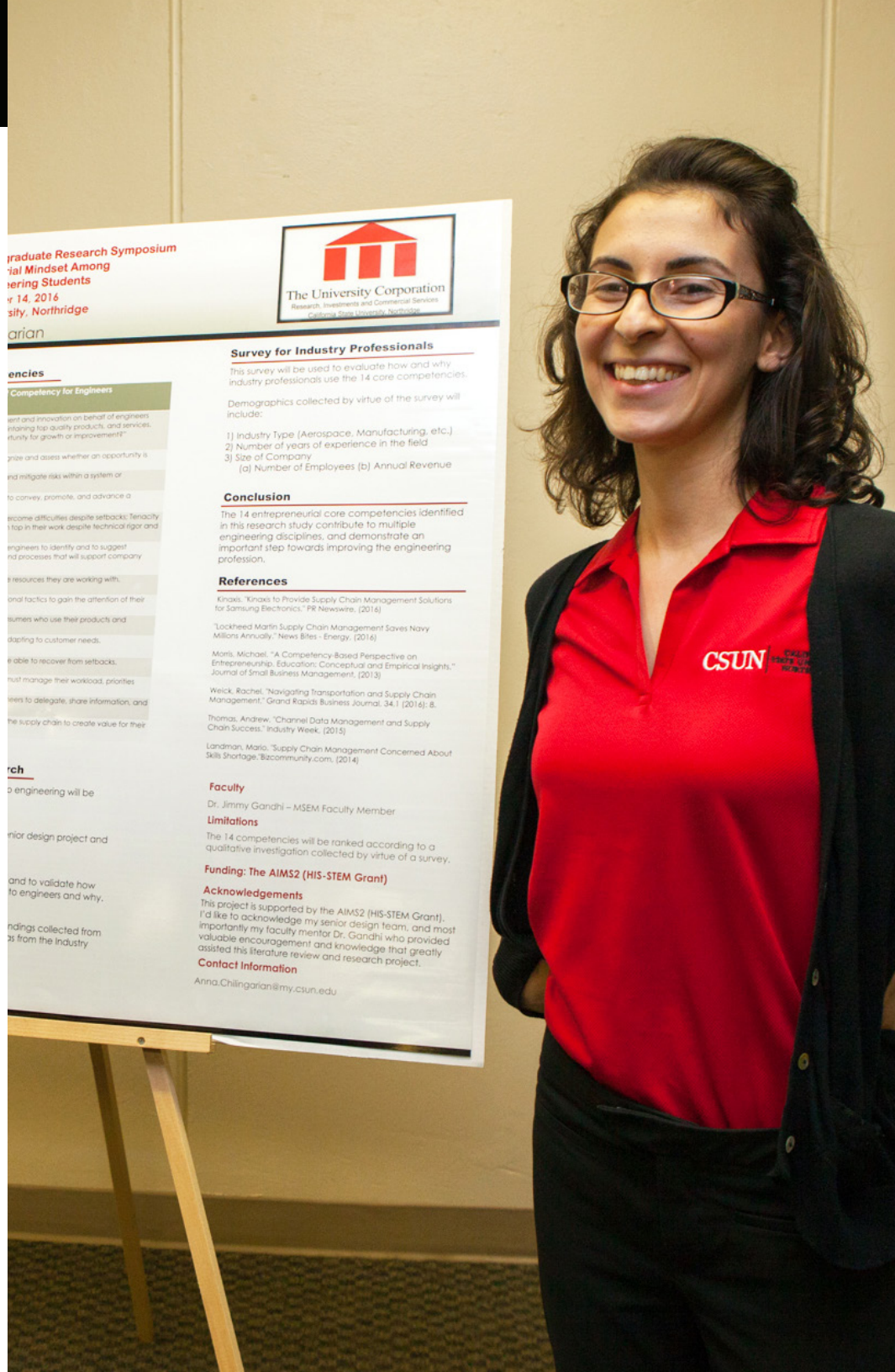
Eco Four-Wheel Drive

Project Description: The overall focus of this project is to seamlessly integrate the interdependent disciplines of Science, Technology, Engineering and Math (STEM) into a focused and real-world robotic project. A robot can be a mechanical agent using an electronically operated mechanical machine guided by computer program or electronic circuitry. They can be autonomous, semi-autonomous or remotely controlled. The eco friendly robotic project will teach the concepts of how to build a four-wheel drive; understand the power requirements; and how to integrate solar panels as power source. This project will develop understanding of various sensor communication, behavior issue, signal processing, microcontroller programming and concepts of motion control.





Attract Inspire Mentor Support Students

AIMS²

HSI STEM Grant Program

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http://www.ecs.csun.edu/aims2/

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