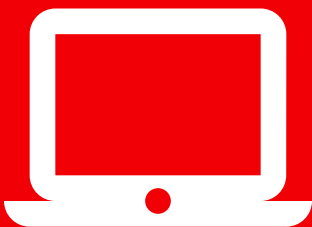
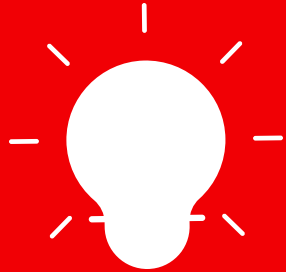
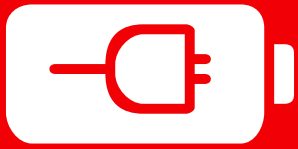


# 15th Annual Graduate Research and Capstone Design Conference



## CDC 2019

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Dr. Len Trombetta

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Dr. Steven Pei

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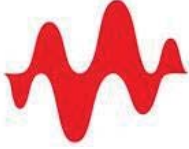
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## 15<sup>th</sup> Capstone Design Conference

April 26, 2019

The Hilton UH Hotel & Conference Center

Houston, Texas

7:00 - 7:35 am	Registration, Conrad N. Hilton, Lobby
7:35 – 7:40 am	Opening Remarks by Dr. Steven Pei, Conrad AB Ballroom
7:40 - 10:00 am	Technical Program – Oral Session A, Conrad AB Ballroom
10:05 -10:30 am	Welcoming Remarks, Plaza Room <ul style="list-style-type: none"><li>• Dr. Badri Roysam, Chairman, Electrical and Computer Engineering</li><li>• Dr. Claudia Neuhauser Associate Vice President/Associate Vice Chancellor for Research and Technology Transfer</li><li>• Dr. Suresh Khator, Associate Dean, College of Engineering</li></ul>
10:30 - 10:45 am	<i>Coffee Break</i> , Conrad N. Hilton, Lobby
10:45 - 11:45 am	Technical Program – Oral Session B, Conrad AB Ballroom
11:50 - 12:45 pm	Lunch, Waldorf Astoria, Ballroom
12:30 - 1:15 pm	Keynote Presentation: <b>“Engineers are from Mars, Students are from Neptune”</b> <i>Dr. Douglas Verret</i> , IEEE Lifetime Fellow, Chair of ECE Industry Advisory Board
1:15 - 2:15 pm	Technical Program – Oral Session C, Conrad AB Ballroom
2:15 - 2:30 pm	<i>Coffee Break</i> , Conrad N. Hilton, Lobby
2:30 - 3:30 pm	Technical Program – Oral Session D, Conrad AB Ballroom
3:30 - 5:30 pm	Technical Program – Poster Session, Conrad CD Ballroom
4:55 - 5:30 pm	Break for Team Preparation
5:30 - 6:00 pm	Elevator Talks by CDC students, Conrad AB Ballroom
6:00 - 6:30 pm	Awards Ceremony and Reception, Conrad AB Ballroom



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# Capstone Design Presentations

# CDC 2019

The Hilton UH Hotel & Conference Center

April 26, 2019

7:35 – 7:40 am      **Opening Remarks by Dr. Steven Pei, Conrad AB Ballroom**

## Session A: Oral Presentations

Poster #

**Time: 7:40-10:00 am, Conrad AB Ballroom**

**Faculty Chair: Dr. Steven Pei**

<b>7:40 – 8:00 am</b>	<b>MOTION KAYAK</b> <i>Roger Canales, Vincent Collier, Cameron Gandy, and Jeffrey Sy</i>	A1
<b>8:00 – 8:20 am</b>	<b>REMOTE DATA EXTRACTOR</b> <i>Thomas Brzezinski, Marinela Kane, Amir Kashefi, and Bryan Rothchild</i>	A2
<b>8:20 – 8:40 am</b>	<b>SMART BAR</b> <i>Shihua Cai, Aaron Hollaway, Christopher McGinniss, and Martin Sillero</i>	A3
<b>8:40 – 9:00 am</b>	<b>SAFEHOME</b> <i>Yash Desai, Nisha Ganeshan, and Tripi Shrivastava,</i>	A4
<b>9:00 – 9:20 am</b>	<b>ANDROID APP-CONTROL SMART LOCK</b> <i>Abdul Asif, Lee Davis, William Gerwin, and Sean White</i>	A5
<b>9:20 – 9:40 am</b>	<b>COOGSTHETIC: ADAPTIVE PROSTHETIC FOR KIDS</b> <i>Kiyah Brooks, Miguel Carrera, Osakpolor Evbuomwan, and Nikita Prasad</i>	A6
<b>9:40 – 10:00 am</b>	<b>INTERFACING NETWORK INFRASTRUCTURE TO PERFORM UDP-BASED COMMUNICATION USING LIGHT FIDELITY (LIFI)</b> <i>Alexander Crosby, Juana Magaña, Jaskaranpreet Singh, and Jayson Varughese</i>	A7

**10:05 – 10:30 am      Welcoming Remarks, Plaza Room**

- Dr. Badri Roysam, Chairman, Electrical and Computer Engineering
- Dr. Claudia Neuhauser Associate Vice President/Associate Vice Chancellor for Research and Technology Transfer
- Dr. Suresh Khator, Associate Dean, College of Engineering



10:30 – 10:45 am Coffee Break, Conrad N. Hilton, Lobby

**Session B: Oral Presentations**

**Time: 10:45 – 11:45 am, Conrad AB Ballroom**

**Faculty Chair: Dr. Dmitri Litvinov**

- 10:45 – 11:05 am **SOLID-STATE RELAY MONITORING SYSTEM** B1  
*Shayan Ghani, Ethan Hitchcock, Daniel Meza, and Audrey Wang*
- 11:05 – 11:25 am **HEY GOOGLE, PLAY MY CD** B2  
*Gerard Barrientos, Nicholas Jagdeo, Ebrahim Meky, and Syed Naqvi*
- 11:25 – 11:45 am **KNUCKLES, THE ASSISTIVE ROBOTIC ARM** B3  
*Rym Benchaabane, Andrew Blanchard, Paola Hernandez, Matthew van Zuilekom*
- 11:50 - 12:45 pm **Lunch**, Waldorf Astoria, Ballroom
- 12:30 - 1:15 pm **Keynote Presentation**, Keynote Presentation:  
**“Engineers are from Mars, Students are from Neptune”**  
*Dr. Douglas Verret, IEEE Lifetime Fellow, Chair of ECE Industry Advisory Board*

**Session C: Oral Presentations**

**Time: 1:15 – 2:15 pm, Conrad AB Ballroom**

**Faculty Chair: Dr. Len Trombetta**

- 1:15 - 1:35 pm **SWARMATHON IV** C1  
*Jenny Duong, Ryan San Miguel, Jordan Perez, and Robert Phu*
- 1:35 – 1:55 pm **AUTONOMOUS DELIVERY DRONE** C2  
*Ashita Bhojwani, Joel Kenneth, Nikhil Prajapati, and Steban Soto,*
- 1:55 – 2:15 pm **MULTI-INPUT GENERATOR** C3  
*Drew Lawyer, Alexander Nguyen, Natasha Roberts, and Juan Sanchez*
- 2:15 – 2:25 pm *Coffee Break*, Conrad Ballroom, Lobby

**Session D: Oral Presentation**

**Time: 2:25 – 3:45 pm, Conrad AB Ballroom**

**Faculty Chair: Dr. Len Trombetta**

- 2:25 – 2:45 pm **MOBILE ROBOTIC VIDEOGRAPHER (MRV)** D1  
*Ramsey Daou, Rhema Ike, Farah D. Luba, and Henry Nguyen*

<b>2:45 – 3:05 pm</b>	<b>AUTOMATIC POWER FACTOR CORRECTION SYSTEM</b> <i>Ben Avner, Binh Duong, Jon E. Games, and Rakshak Talwar</i>	D2
<b>3:05 – 3:25 am</b>	<b>SHASTA ADVERTISER MOBILE ROBOT</b> <i>Matt Anguiano, Jaime Juarez, Brandon Kain, and Matt Metoyer</i>	D3
<b>3:25 – 3:45 pm</b>	<b>AUTOMATING A ROBOTIC ARM TO SORT AND ORGANIZE RESISTORS USING A PROGRAMMABLE LOGIC CONTROLLER (PLC)</b> <i>Tobiloba Atewologun, Michael Bittar, Edgar Castaneda, and Enrique Favela</i>	D4

### **Session E: POSTER PRESENTATIONS**

**Time: 3:45 – 5:30 pm, Conrad CD Ballroom**

**All posters will match talks presented by the undergraduate students in the oral sessions.**

<b>5:30 – 6:00 pm</b>	<b>Elevator Talks by CDC Students</b> , hosted by Dr. Len Trombetta, Conrad AB Ballroom
<b>6:00 – 6:30 pm</b>	<b>Awards Ceremony and Reception</b> , Conrad AB Ballroom

**Plenary Speaker: Douglas Verret, Ph.D.**  
***“Engineers are from Mars, Students are from Neptune”***

This talk is about the state of engineering education in the modern age and the challenges that educators and students will face in a dynamic and fast-changing environment. The global population of engineers has been growing for decades and is forecasted to continue through the next decade and beyond. Except for BSEEs this trend is evident in the US as well. The largest percentage growth of technical professionals has been outside North America and Western Europe. There will be a growing commoditization of technical professionals globally. The average length of a 'technical career' is diminishing, which increases the need for continuing education to prepare people for mid-career job shifts or simply to update people in their current jobs. *The need for and interest in technical information is increasing dramatically.*

There is increasing emphasis on conserving natural resources and on developing renewable energy sources as alternatives to oil and coal. There will be a continuing shift of world influence from present developed nations to developing nations. There will be a continuing “flattening” of the world as the internet allows people to be easily connected around the globe to conduct business. This will be especially true in areas of information and knowledge access *which will influence business and education competitiveness.* Centers of technology excellence (*e.g.* universities) have spread rapidly across the flat world.

There is a greater disconnect between individuals and employers. Engineering will continue to become more interdisciplinary. Employers are expecting immediate value contribution. Changing age demographics will pose a threat of knowledge loss as the “baby boom” generation’s more experienced professionals retire. There will be a need to identify gaps in *practical knowledge* in transfer from one generation to the next.

Because of the ubiquity of mobile devices technical information is available pretty much anywhere at any time. Current boundaries between various disciplines, including science and technology are less distinguishable. There is greater activity in biological and medical systems and interaction with engineering. Many enterprises are awash in data of many different types at high velocity ( $2.5 \times 10^{18}$  bytes/day<sup>1</sup>) and uncertain veracity, some needing rapid analysis. Public perception of the security of data is low. Everything that can be is being made “smart” via artificial intelligence.

Given this climate and the state of the profession, we will provide some perspectives about what this implies for engineering schools and their students, which challenges are present in the current university structure (cost, value, insularity, competition) that will have to be overcome or mitigated and what students will need to do to prepare for this environment beyond what is in the current curriculum. The perception of the student experience is often perceived by industry as “other worldly” as if students inhabit another planet. An attempt will be made to describe the “real world” environment of engineering practice in contrast with the orderly academic environment.

1. Bernard Marr, [www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#6d2f7aa160ba](http://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#6d2f7aa160ba)





## *Dr. Douglas Verret*

*IEEE Life Fellow*

*Texas Instruments Fellow* Emeritus

Chairman of the *Industry Advisory Board* for the Department of Electrical and Computer Engineering.

Dr. Douglas Verret is a world recognized expert in microelectronics with lifetime achievements in the semiconductor industry...a physicist and an engineer in action to create better electronics. He was an architect and leader in developing many new generations of silicon devices and processes for electronic circuits and systems, since he first joined Texas Instruments Inc in 1979. Terms such as

double-level metal (DLM) process for Low Power Schottky TTL devices, polysilicon emitter, deep trench isolation and planarized metal technologies in TI digital Bipolar and BiCMOS circuits and many others have now an important meaning as pioneering steps in the development and progress of microelectronics. The teams he led created numerous Integrated Circuits (ICs) still in use today and sold by companies such as Apple Computer, IBM, Intel, Bosch, Sirius XM and Delphi among others.

Dr. Verret's career in microelectronics includes multiple managerial positions at TI and also in SEMATECH, a consortium of fourteen US semiconductor companies and the US government residing in Austin TX where he was the Director of Manufacturing Techniques and Standards and developed their 0.5um CMOS technology. His most recent positions included Program Manager of 65nm eflash technology followed (in 2012) by Manager of TI's next generation embedded flash technology. The 65nm technology was the first and still is the only 65nm embedded flash technology in the automotive and safety markets.

Dr. Douglas Verret's contributions to science and technology are well recognized by his numerous editorial positions in IEEE journals and conferences, program and leadership committees and by his membership in truly many council and advisory, educational and science boards at several foundations, schools and universities. He holds sixteen patents.

He is married to Ellen Verret Ph.D., who is a psychologist in Fort Bend Independent School District and they are the proud parents of Sybil Lincecum Au.D and Laurence Verret, MBA, CPA. They are also the fawning grandparents of four granddaughters. In his spare time he is a student of comparative mythology and alternates between playing the guitar badly and the trumpet miserably.

## ABSTRACTS

### A1 MOTION KAYAK

*Roger Canales, Vincent Collier, Cameron Gandy, and Jeffrey Sy*  
Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

The Motion Kayak hands-free motor and steering control system controls the speed and direction of a kayak by sensing a user's weight distribution. When the user shifts their body weight, a sensor array generates analog signals that are sent to a microcontroller. The microcontroller determines what direction the input signals indicate, and then outputs a pulse width modulated signal to each of four electronic speed controllers which signal the generation of thrust in the desired direction. Motion Kayak was designed to improve the kayaking experience for any enthusiast including fisherman, photographers, and general hobbyists.

### A2 REMOTE DATA EXTRACTOR

*Thomas Brzezinski, Marinela Kane, Amir Kashefi, and Bryan Rothchild*  
Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

In today's age of rapidly expanding technology, power automation within the industrial sector is an ever-growing demand. Ethernet and its capabilities are beginning to become trusted by leading industry experts, opening new avenues of possibilities. Currently the Common Format for Transient Data Exchange in power systems (COMTRADE) files are extracted manually by an operator or remotely on a vendor specific platform making typical system integration an overly complicated task. These files contain exact waveform data, which is heavily used in fault analysis. Our team has set out to integrate an open platform system for remote data extraction utilizing IEC standard 61850 version 2 over ethernet.

### A3 SMART BAR

*Shihua Cai, Aaron Hollaway, Christopher McGinniss, and Martin Sillero*  
Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

A device capable of dispensing mixed drinks from a drink selection accessible through touchscreen integration or through Alexa's Voice User Interface (VUI). Six drink containers are housed behind the device. A peristaltic pump driven tube stretches from each container to a funnel at the top of the device. The pump accurately measures out a desired volume of liquid in direct proportion to the time pumping. A Raspberry Pi 3 controls the pumps and the touchscreen display unit. Alexa's VUI is installed on the Pi and allows for hands-free use. The Pi lastly monitors a Slack messaging channel and will dispense a drink when a messaging bot is called.

## **A4 SAFEHOME**

*Yash Desai, Nisha Ganeshan, and Tripi Shrivastava*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

SafeHome is an affordable, portable, user-friendly, and wireless solution to traditional home security systems. The system uses sensors to monitor important locations such as doors, living rooms, garages, etc. SafeHome consists of a central hub that will collect data from the door and motion sensors that will notify the user via alarm and a privately accessed web page. An iPhone application allows the user to conveniently view the status of the home in one location, trigger a panic button, and also set a radius for notification of an unarmed system or open garage.

## **A5 ANDROID APP-CONTROL SMART LOCK**

*Abdul Asif, Lee Davis, William Gerwin, and Sean White*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

A smart lock with Android app functionality was designed. The primary goal of this project was to create a secure and cost-effective smart lock. This was accomplished by upgrading an existing RF-controlled lock by installing sensors and a programmable microcontroller with Wi-Fi capabilities called an Electric Imp. It was programmed with a finite state machine and possesses its own secure, HTTPS web server that acts as a liaison between the lock and Android application. The application was designed to require biometric authentication for maximum security. The Electric Imp was configured to control the lock by connecting its outputs to the RF remote circuitry.

## **A6 COOGSTHETIC: ADAPTIVE PROSTHETIC FOR KIDS**

*Kiyah Brooks, Miguel Carrera, Osakpolor Evbuomwan, and Nikita Prasad*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

There are 3.5 million new prosthetics in the market each year, each prosthetic averaging \$20000. Children ages six to twelve make up more than half of the 3.5 million as they require a frequent replacement period of 2 years to compensate for their growth; the long-term cost to maintain a prosthetic in childhood is upwards of \$200000. Coogsthetic is a low cost, adjustable, myoelectric prosthetic. An electromyography signal is acquired from the subject's bicep, processed in the microcontroller leading to motor actuation. There are user defined modes that allow the subject to change sensitivities as the signals acquired vary with age and size. The mechanical elements are designed to expand as the child grows.

## **A7 INTERFACING NETWORK INFRASTRUCTURE TO PERFORM UDP-BASED COMMUNICATION USING LIGHT FIDELITY (LIFI)**

*Alexander Crosby, Juana Magaña, Jaskaranpreet Singh, and Jayson Varughese*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

Light fidelity (Li-Fi), using visible light as a medium for data transfer, has been at the forefront of future communication technologies. Li-Fi was integrated with Power-Line Communication (PLC) to perform data transmission over existing network infrastructures. A Smart Light System was constructed, consisting of a power-line module and two transmitting/receiving BeagleBone microcontrollers interfaced with OpenVLC capes capable of communicating data via Li-Fi. The Smart Light System can be built upon and scaled to support UDP-based communication, addressing issues such as alleviating network congestion, enhancing network security, and serving as an alternative for Wi-Fi in RF sensitive environments.

## **B1 SOLID-STATE RELAY MONITORING SYSTEM**

*Shayan Ghani, Ethan Hitchcock, Daniel Meza, and Audrey Wang*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

Due to an increasing number of solid-state relay (SSR) failures with no known cause at the BP Wind Energy wind farms, a Solid-State Relay Monitoring System (SSRMS) was developed to read the voltages entering an SSR and to send notifications to a remote operator when the voltage exceeds the rating of the SSR. The SSRMS consists of a DC voltmeter, which reads the incoming DC voltage, and a microcontroller, which logs the voltage data with a timestamp and sends notifications to the user. The capabilities of the SSRMS were analyzed through a series of characterization tests.

## **B2 HEY GOOGLE, PLAY MY CD**

*Gerard Barrientos, Nicholas Jagdeo, Ebrahim Meky, and Syed Naqvi*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

The goal of our project is to design a mechanical arm that can pick up discs and transfer them from a storage case to a tray less CD player. The device is also capable of ejecting discs from the player and returning them to the designated storage case through an infrared transmitter. These actions will be completed through Google Assistant to increase the accessibility of the device. The purpose of this device is to make it easier to manage physical disc collections. This device is useful for collectors, including those who are disabled or have bad internet.

### **B3 KNUCKLES, THE ASSISTIVE ROBOTIC ARM**

*Rym Benchaabane, Andrew Blanchard, Paola Hernandez, Matthew van Zuilekom*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

A stationary 3D-printed voice-activated robotic arm that can retrieve objects and give them to a user upon request. This project is designed with the intent to help the elderly and lab researchers. Controlled by the Robot Operating System (ROS), the arm has five degrees of freedom and a two finger gripper. The two types of input sensors are a multi-directional microphone and a camera. The Intel Speech Enabling Developer Kit microphone is connected to a Raspberry Pi3+ and Alexa Voice Service. The RealSense camera detects AprilTags, a form of QR code. To request an object, the user needs to say: "Alexa trigger Knuckles to give me the bottle".

### **C1 SWARMATHON IV**

*Jenny Duong, Ryan San Miguel, Jordan Perez, and Robert Phu*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

The motivation behind Swarmathon IV is to apply the principals of swarm robotics to improve the efficacy and efficiency of searching for resources. While Swarmathon does this on a small scale, similar techniques could be employed on a larger scale for such tasks as searching for resources on Mars. Our approach, which is to implement a so-called spiral search algorithm, sets out to solve the problem of individual robots behaving slowly and inefficiently. Using this approach, six 'swarmie' robots can gather 53 resources in 15 minutes. Based on these results, our team expects to be competitive in the Swarmathon competition.

### **C2 AUTONOMOUS DELIVERY DRONE**

*Ashita Bhojwani, Joel Kenneth, Nikhil Prajapati, and Steban Soto*

Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

The focus of this project is to demonstrate manual and autonomous delivery of a one-kilogram package to a GPS-defined location using a drone. The system consists of a quadcopter whose components are integrated together using a flight controller that runs open source autopilot software. The components of the drone are fixed within a 0.5[m] X 0.5[m] X 0.4[m] carbon fiber frame for durability against weather conditions. The drone performs autonomous delivery by the combination of the autopilot's predefined flight modes along with a custom mode for stabilization in low altitudes and activation of the payload release.

### **C3 MULTI-INPUT GENERATOR**

*Drew Lawyer, Alexander Nguyen, Natasha Roberts, and Juan Sanchez*  
Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

This electrical engineering undergraduate senior design project is a generator with multiple input power sources. Our four input sources are (1) a solar panel, (2) a gas tank, (3) a dynamo driven by pedals, and (4) external batteries. Each input source charges a central, internal battery bank, which in turn is connected to two USB outlets and one standard three-prong outlet. On the generator are also one air quality sensor, one radiation sensor, and voltage and current sensors. Finally, a graphical user interface allows the user to read the sensor data on a small screen mounted on the generator body.

### **D1 MOBILE ROBOTIC VIDEOGRAPHER (MRV)**

*Ramsey Daou, Rhema Ike, Farah D. Luba, and Henry Nguyen*  
Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

There is a lack of solutions for video recording runners. The Mobile Robotic Videographer (MRV) is a 12'' by 6'' robot that's designed to autonomously record a runner throughout a race. It does this by using human recognition software, a pan-tilt camera system, and GPS-based navigation software. The human recognition software identifies the runner in the video, the pan-tilt camera system keeps the runner in the frame, and the navigation software keeps the robot on the race track using GPS waypoints. With our efforts to integrate these technologies, a prototype has been developed for research and development needs.

### **D2 AUTOMATIC POWER FACTOR CORRECTION SYSTEM**

*Ben Avner, Binh Duong, Jon E. Games, and Rakshak Talwar*  
Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

The power company charges customers higher electricity rates based on their power factor. Industrial consumers of electricity typically have large inductive loads that create low power factor. Lower power factor is anything less than 0.95. Raising a plant's power factor will decrease the plant's electric bill, thereby lowering its operating costs. An automatic power factor correction system or APFC was designed to decrease the operating costs of industrial plants due to low power factor by measuring the current power factor then calculating the necessary capacitive reactance necessary to increase the power factor to a value 0.95 or greater.



### **D3 SHASTA ADVERTISER MOBILE ROBOT**

*Matt Anguiano, Jaime Juarez, Brandon Kain, and Matt Metoyer*  
Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

The purpose of the Shasta Advertiser Mobile Robot (SAMR) is twofold: to combine the collective knowledge and skills of each team member into a fully functional and useful project and to provide prospective students of the Cullen College of Engineering with a physical embodiment of what they could accomplish in this program. The user of the SAMR will be able to choose between remotely controlling the robot or letting the on-board sensors autonomously navigate the SAMR through the engineering building, all while displaying custom media on its monitor. This project was accomplished through the integration of embedded systems, remote communications, signal processing, and power distribution, all of which are prominent elements of electrical and computer engineering.

### **D4 AUTOMATING A ROBOTIC ARM TO SORT AND ORGANIZE RESISTORS USING A PROGRAMMABLE LOGIC CONTROLLER (PLC)**

*Tobiloba Atewologun, Michael Bittar, Edgar Castaneda, and Enrique Favela*  
Department of Electrical and Computer Engineering, University of Houston  
Houston, TX 77204-4005

The task of sorting resistors can be done by utilizing a robotic arm in conjunction with a programmable logic controller (PLC). We plan on using OMRON's PLC and corresponding program (Sysmac Studio) to command a robotic arm that is comprised of a single stepper motor and three DC Servomotors. The arm picks up resistors using an electromagnet, then transfers the resistor to multimeter leads where the resistor value will be measured, and an Arduino Uno will round the resistor value, then send the information to the PLC, which will use ladder logic/function blocks to determine where the resistor belongs.

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