FIU FLORIDA INTERNATIONAL UNIVERSITY

SENIOR DESIGN EXPO FALL 2017

BIOMEDICAL ENGINEERING
TECHNOLOGY EXPO
& COMPETITION

DISCOVER DESIGN DEVELOP DELIVER

FIU | Biomedical Engineering

Florida International University

MESSAGE FROM THE CHAIR

Congratulations Seniors!

As senior Biomedical Engineering students at Florida International University, you have come to the end of an incredible journey. Your Senior Design Projects are a reflection of your efforts and your capstone undergraduate experience.

Your work is an illustration of the many skills you have sharpened during the course of this yearlong project. you have discoered new ways of thinking, designed and developed an engineering solution for a practical problem, and collaborated with your teammates to deliver innovative solutions. It is encouraging to see your accomplishments and to have witnessed your growth as students.

As you embark on the next stage of your education and careers, keep the confidence that comes from having enhanced your knowledge, remain inquisitive and have the courage to achieve your dreams.

Dr. Ranu Jung

SENIOR DESIGN PROJECT AGENDA

8:00am - Breakfast

8:30am - Welcome
Dr. Ranu Jung,
Chair and Professor - Biomedical Engineering

8:40am - Introduction & Orientation
Dr. Michael Christie,
Senior Instructor - Biomedical Engineering

8:50am - Team 1: System for Whole Field Fluorescent Miroscopy Imaging In-Vitro

9:15am - Team 2: Robotic Erudite Stabilizing Tool (R.E.S.T.)

9:40am - Team 3: C-Scope: A Polarized, Cost Effective, Portable Colposcope

SENIOR DESIGN PROJECT AGENDA

10:05am - Team 4: Active Assisted Device for the Knee

10:30am - Team 5: Field Therapy Accelerator

10:55am - Team 6: Inexpensive Automated Active-Assistive Orthosis to Treat Hemiparesis on Upper Extremities

11:20am - Team 7: Interstitial Pressure Simulator of Subcutaneous Tissue for the Testing of Auto and Pen Injector

11:45am - Lunch

1:00pm - Awarding of Certificates of Concentration

1:10pm - Winner Announcement

1:20pm - Final Remarks

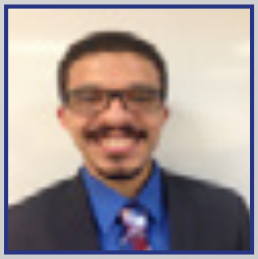
System for Whole Field Fluorescent Microscopy Imaging In-Vivo

Team 1: Asad Mirza, Juan Pinzon, Natalia Fuenzalida, Edwin Robledo
Faculty Advisor: Dr. Wei-Chiang Lin
Company Sponsor: Dr. Jorge J Riera's Neuronal Mass Dynamics Laboratory

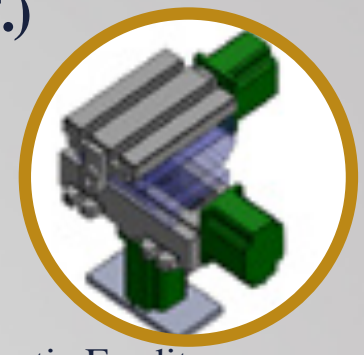
Epilepsy affects roughly 65 million people across the world and has no known cure. This is due to difficulties in being able to record neural activity of cerebral cortical cells where a large portion of these epileptic events occur. Using the modalities of calcium and voltage sensitive dye imaging (VSDI) researchers can record action potential and ion dynamics propagated across the cerebral cortex simultaneously. Our proposed system uses a synchronized fast CMOS for VSDI and a slower CCD for calcium imaging. These cameras are aimed at a stereotaxic, which is attached to a motorized XY stage, holding a rat with a 1 mm2 exposed cranial window. Through a custom built MATLAB GUI the cameras and stage can be controlled and allow for dynamic spatial imaging across the cranial window. Our system allows for faster and more accurate data acquisition to help identify the underlying causes for epilepsy.

Team 1 *Asad Mizra, Juan Pinzon, Natalia Fuenzalida, Edwin Robledo*



Robotic Erudite Stabilizing Tool (R.E.S.T.)



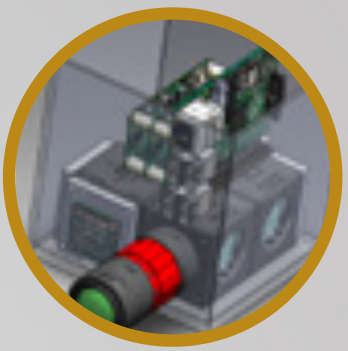
Team 2: Munir Iskandarani, Jenny Dandin, Brian Nonato, Samira Selman
Faculty Advisor: Dr. Michael Christie
Company Sponsor: Garrison's Prosthetics Services Inc.

Our team presents a working prototype of Phase III of the Robotic Erudite Stabilizing Tool (REST). REST is a computer-assisted adjustment tool that provides accurate and efficient alignment of prosthetic limbs for below-knee amputees. The capabilities of Phases I and II include height and tilt adjustments, respectively. Phase III provides more adjustment options to thereby achieve better alignment outcomes for optimal balance and gait, and lower cost due to not having the patient return continuously for adjustments. Phase III allows for biaxial linear translation as well as rotation of the prosthetic. For our device, two linear stages were mechanically interfaced operating in unison, then flushed onto the tilting plate. A rotary stage was interfaced with the translation slides. Verifications were performed to ensure design inputs were met. REST represents a significant advancement in the alignment of transtibial prosthetics and is shown to have superior adjustments in comparison to current modalities.

Team 2 *Munir Iskandarani, Jenny Dandin, Brian Nonato, Samira Selman*




C-Scope: A Polarized, Cost Effective, Portable Colposcope



Team 3: Lorena Castañeda, John Hidalgo, Rayniel Pérez, Andrés Rodriguez
Faculty Advisor: **Dr. Jessica Ramella-Roman**
Company Sponsor: Medical Photonics Laboratory- MLP, Jessica Ramella-Roman, Ph.D.

Cervical cancer can be prevented if detected in its early stages with the use of a colposcope, which facilitates the diagnostic procedure by illuminating and magnifying the view of the cervix and its surrounding vaginal tissues. The high cost, bulkiness, and limiting health care infrastructure necessary to screen in underdeveloped nations, has led to a high incidence of hysterectomies and death. Therefore, our compact and cost-effective C-Scope will non-invasively illuminate the cervix to capture and store polarized images without optical aberrations. These images will be processed with an existing algorithm (based on Mueller Matrix) to detect abnormalities on the cervical collagen fibers and the epithelial cells of the ectocervix. Our portable C-scope will help increase the incidence of screening in women who reside in remote, underdeveloped areas while reducing cost.

Team 3 *Lorena Castañeda, John Hidalgo, Rayniel Pérez, Andrés Rodriguez*




Active Assisted Device for the Knee

Team 4: Michael Beehler, Rafael Ospino, Stacy Joaseus, Roger De La Torre
Faculty Advisor: Dr. Joshua Hutcheson
Company Sponsor: Florida International University Department of Physical Therapy

More than one million total knee joint replacements procedures are performed every year due to either knee injuries or degenerative joint disease. Appropriate therapy after surgery is critical to a patient's full recovery. Currently on the market the modalities available require constant input of a physical therapist or the help of a passive assisted device that does not allow patient's input. The goal of this project is to deliver an active assisted device that will provide full neuromuscular control for patients with knee joint injuries as well as access to medical records to physical therapists. Through a user interface, the device will allow therapist to input parameters associated with a specific patient, a servomotor in correlation with a microcontroller and a load sensor controls these parameters to allow the desired patient range of motion. This device will play a significant role in the recovery rate of patients with knee injuries.

Team 4 *Michael Beehler, Rafael Ospino, Stacy Joaseus, Roger De La Torre*




Field Therapy Accelerator

Team 5: Jose Muñoz, Daniel Villagomez, Andre Chu, Steven Henriquez, Ana Peña
Faculty Advisor: Dr. Zachary Danziger
Company Sponsor: Advatec, LLC.

The Field Therapy Accelerator (FTA) is a therapeutic medical device with the purpose of treating and maximizing the recovery of chronic wounds. The FTA uses a changing magnetic field to induce an electrical field generated by a coil-winded, pure iron core. The device's magnetic fields have a growth phase of at least 10 times the duration of the decay phase. The device will function using two IGBT's to control the opening and closing of the circuit to ground, inducing a rapid decay of current. During the growth phase, the coil is electrically energized, and the time-changing magnetic field creates a DC-like electric field in the space infused by the magnetic field. This allows for the storage of current needed for therapeutic charge transfer in the coil. The high-speed removal of energy results in a high-energy electric treatment field and a high-efficiency duty cycle, which must be at least 10%.

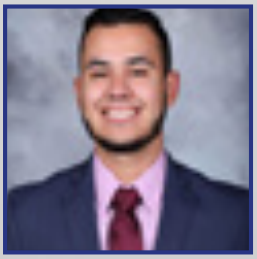
Team 5 *Jose Muñoz, Daniel Villagomez, Andre Chu, Steven Henriquez, Ana Peña*

Inexpensive Automated Active-Assistive Orthosis to Treat Hemiparesis on Upper Extremities

Team 6: Alejandra Rincon, Allan Valiente, Osmel Martinez, Ralph Valentin
Faculty Advisor: Dr. Joshua Hutcheson
Company Sponsor: Teresa Munecas, PT, DPT

Hemiparesis is the deficient ability of an individual to move one side of the body. This often occurs as a result of a pathological condition or trauma. Active-assistive exercises are designed to help recover mobility by promoting neuron plasticity to regain control of skeletal muscle. FLEXROM was developed as an inexpensive automated active-assistive orthosis to treat hemiparesis on patients' upper extremities. The orthosis comprises an upper and lower arm auxiliary support, a processor, a sensor and an actuator. The sensor detects the amount of force the patient is applying and then sends an output signal corresponding to the force. If the force overcomes a given threshold, the processor controls the movement of the actuator to apply a rotation of two degrees on the lower auxiliary support in either extension or flexion. This continuous active-assistive motion will help the patient regain control of their skeletal muscles on the upper extremities.

Team 6 *Alejandra Rincon, Allan Valiente, Osmel Martinez, Ralph Valentin*

Interstitial Pressure Simulator of Subcutaneous Tissue for the Testing of Auto and Pen Injector

Team 7: Paula Oyarce, Alain Prieto, Peterson Etienne
Faculty Advisor: Dr. Anthony J. McGoron
Company Sponsor: SHL Pharma

A hematoma is a solid swelling of clotted blood within the tissues due to a damaged blood vessel. The exposure of blood to the tissue can cause irritation to the surrounding areas which can lead to inflammation, pain, swelling and redness. The viscosity of the medication and speed of injection are the prevailing factors which cause injury to the nearby tissues and blood vessels around the injection site. With the increasing use of viscous drugs, our sponsor SHL Pharma, specialists in Auto and Pen injectors, seeks to design a fixture that can mitigate these effects. Team 7 has been tasked with designing a device that can replicate the interstitial pressures of subcutaneous tissue. Identifying glide force of the needle as the primary factor for safer delivery, we have developed a device that can obtain this required force for the injection of any viscous drug at any interstitial pressure.

Team 7 *Paula Oyarce, Alain Prieto, Peterson Etienne*



THANK YOU
TO OUR SPONSORS!

Dr. Jorge J Riera's
Neuronal Mass Dynamics Laboratory

Garrison's Prosthetics Services Inc.

Medical Phonotics Laboratory- MLP,
Jessica Ramella-Roman, Ph.D.

Florida International University
Department of Physical Therapy

Advatec, LLC.

Teresa Munecas, PT, DPT

SHL Pharma


FIU
Engineering
& Computing
Department of Biomedical Engineering

Be Worlds Ahead

DISCOVER DESIGN DEVELOP DELIVER