FIU | Engineering & Computing

Department of Biomedical Engineering

BIOMEDICAL ENGINEERING SENIOR design EXPO

SUMMER 2023

AN UNDERGRADUATE STUDENT PROJECT SHOWCASE & COMPETITION

DISCOVER | DESIGN | DEVELOP | DELIVER

Presented through the generous support of the Wallace H. Coulter Foundation

BIOMEDICAL ENGINEERING PRESENTS

Senior Design Project Showcase & Competition

Thursday, July 27, 2023

The Biomedical Engineering Senior Design Showcase & Competition is the culminating experience for undergraduate seniors in Biomedical Engineering. Teams of senior students complete and present their capstone projects, which entails the design and manufacture of a prototyped medical device, process, or software system solution to address unmet biomedical needs.

Congratulations
Graduating Seniors!

Jorge Riera Diaz, Ph.D.
Associate Professor,
Interim Chair of Biomedical Engineering

CHAIRPERSON MESSAGE

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 discovered 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

Best wishes for continued success,

Jorge Riera Diaz

AGENDA

SUMMER 2023 COMPETITION - THURSDAY, JULY 27th, 2023

Room EC 2300

7:30 AM

Breakfast

8:15 - 8:30 AM

Introduction & Orientation - Dr. Michael Christie, Associate Teaching Professor

Welcome Remarks from Dr. Jorge Riera Diaz, Associate Professor of Biomedical Engineering and Interim Chair

Instructions to Judges - Dr. Christie

8:30 - 9:15 AM

Poster Presentations: Team S1, Team S2, Team S3, and Team S4

9:15 - 10:15 AM

Oral Presentations

9:15 AM - Team S1
9:30 AM - Team S2
9:45 AM - Team S3
10:00 AM - Team S4

Room EC 2300

10:15 AM - Congratulatory Messages (Video Compilation) & Senior Design Montage

11 - 11:15 AM

Awards Ceremony with Dr. Wei-Chiang Lin, Dr. Riera, Dr. Christie & Professor Shahrestani

Certificates of Concentration - Dr. Lin - Associate Professor and Acting Undergraduate Program Director

Presentation of Senior Design Project Awards Spring 2023

Word of Thanks - Dr. Lin
Concluding Remarks – Dr. Riera

TEAM PROJECTS

SUMMER 2023 ORAL AND POSTER COMPETITION - THURSDAY, JULY 27th, 2023, ROOM EC 2300

Poster Presentations

8:30 - 9:15 AM - Poster Presentations

Oral Presentations

9:15 AM - Team S1: Intraocular Phototherapeutic Implant

9:30 AM - Team S2: Continuous EEG (cEEG) Cap for Critically Ill-Epileptic Patients: NeuroTrack

9:45 AM - Team S3: Deinde Head Stabilizer

10:00 AM - Team S4: Photonic Analysis for Transcutaneous & Continuous Hemoglobin Oximetry PATCH

10:15 AM - Congratulatory Messages (Video Compilation) & Senior Design Montage

Team S1

Intraocular Phototherapeutic Implant

Faculty Mentor: Dr. Michael Brown

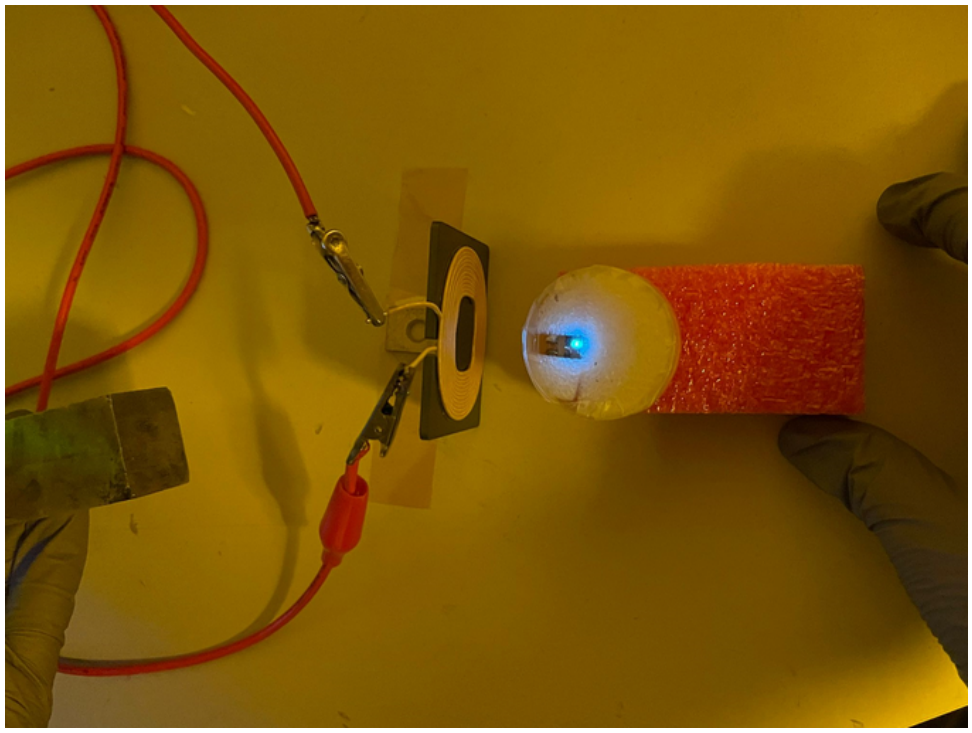
Alumni Mentor: Veeru Jaiswal

Project Sponsor:

Jephte Aristilde, Christina Ganan-Singh, Srujana Yellapragada. Johann Hernandez

BetaBlue

Diabetic Retinopathy is the fifth leading cause of preventable blindness among diabetic patients. Over 22% of diabetics in the United States develop this disorder after their 40s. Current treatment modalities are prone to patient noncompliance because of multiple clinic visits needed. This form of treatment often causes inconvenience and risk of further corneal damage to the patient. The aim of this project is to decrease patient noncompliance through the development of an intraocular phototherapeutic implant. This long lasting and miniaturized implant, activated by a magnet and powered by a multiferroic stack, is designed to modulate doses of light at a target intensity during the patient's sleep. The goal of this phototherapeutic device is to lower retinal oxygen consumption, a common treatment meant to reduce disease progression.



Team S2

Continuous EEG (cEEG) Cap for Critically Ill-Epileptic Patients: NeuroTrack

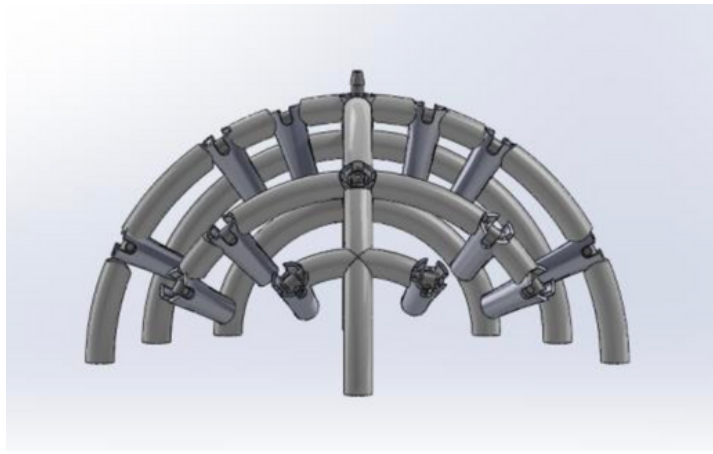
Faculty Mentor: Dr. Anamika Prasad

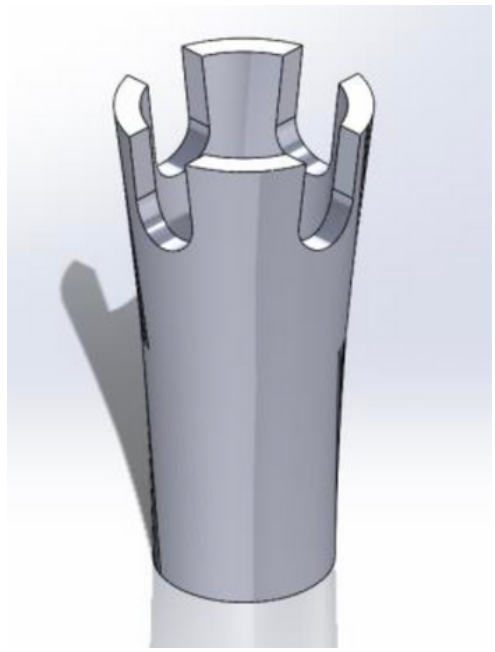
Alumni Mentor: Yency Perez

Project Sponsor: Cutting-Edge Medicine, LLC, and Dr. Victor Lami

Waleed Abusaif, Rebekah Arias, Chenxu Han, Hary Usaquen

Around 3.4 million people are affected by epilepsy in the United States. A standard 30-minute EEG recording captures about 15% of seizures in an epileptic patient but in order to significantly increase the odds of seizure detection, monitoring for more than 24 hours is critical. Therefore, patients can be diagnosed accurately by continuous brain activity recording their event-related potentials with cEEG, allowing for earlier seizure detection and prompt therapeutic intervention, thereby reducing any potential harm of seizure appearance. NeuroTrack aims to bridge the gaps between many current cEEG modalities through optimization of the cEEG procedure. cEEG must deliver a consistent signal quality over a 24+ hour time period, which NeuroTrack achieves through skin-tight contact with the use of distinctive comb electrodes for paramount hair penetration and adhesive paste application via soluble polyvinyl alcohol films. NeuroTrack also features a unique saline tubing system which saturates all 23 10-20 standard electrode sites, providing high signal conductivity in a simple fashion w ithout the need for trained technicians. These features, as well as the adherence of NeuroTrack to the standard 10-20 electrode placement system for EEG devices provides critically ill patients with an accurate, affordable, and simple alternative for continuous brain wave monitoring in a universally adaptable form factor.





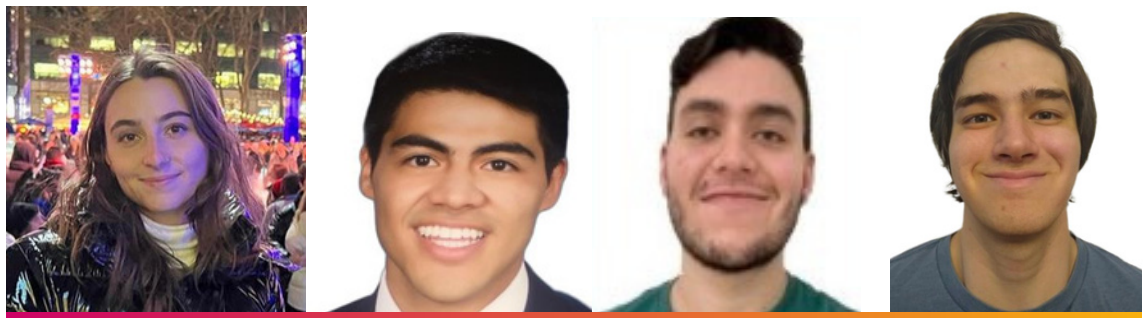
Team S3

Deinde Head Stabilizer

Faculty Mentor: Dr. Anthony McGoron

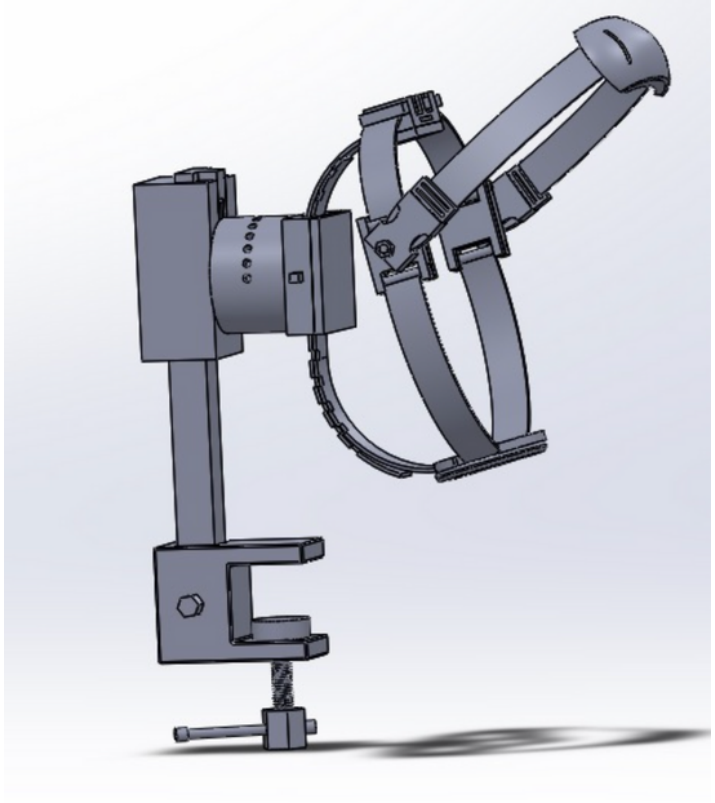
Alumni Mentor: Chandler Wilson

Project Sponsor:



Daniella Menendez, Fernando Melara, Freddy Ziegler, and Nathan Matlock

Annually, approximately 691,500 ischemic strokes transpire within the U.S., with a notable 10,000+ being eligible for the mechanical thrombectomy procedure. Physicians require the patient's head to be stable during the procedure because unplanned patient movement can detrimentally affect the precision of fluoroscopic imaging and pose an inherent risk of injury due to unintended interaction with the surrounding surgical instruments. Until the development of our device, the market lacked noninvasive devices capable of ensuring patient head steadiness and fixation without inflicting harm. Compromised of thermoplastics and hook-and-loop fabric, the Deinde head stabilizer presents a unique capability to safely secure the patient's head in an array of diverse positions. This versatility considers constraints of cervical mobility, while providing the surgeon to have access to the cranial vasculature. Its noninvasive attributes of our device substantially minimize both pain and injury endured by patients during the thrombectomy, effectively preventing head slippage. Having passed verification tests for durability, simulated use, tensile, and dimensional analysis, our device offers a viable alternative to current modalities in assisting patients maintain a stable head position during surgery.



Team S4

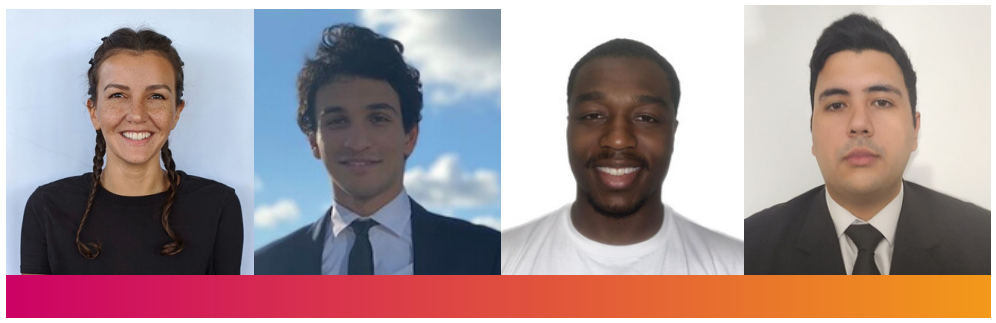
Photonic Analysis for Transcutaneous & Continuous Hemoglobin Oximetry PATCH

Faculty Mentor: Dr. Raj Pulugurtha

Alumni Mentor: Tiffany Moreno

Project Sponsor:

JABIL



Diane Airala, Basil Usama Hamed, Kenneth Dames, Ernesto Sanfiel

Deep Vein Thrombosis (DVT) poses a significant health burden in the United States, affecting a substantial number of individuals annually, with an estimated incidence of up to 900,000 cases. This condition contributes to a considerable number of deaths each year, ranging from 60,000 to 100,000 Americans. Furthermore, individuals with a history of DVT are at an elevated risk of long-term complications, including post-thrombotic syndrome and Pulmonary Embolism (PE). Unfortunately, current detection methods are inadequate for continuous monitoring, impeding early identification of asymptomatic patients. This project proposes a novel noninvasive optical monitoring tool designed to continuously assess tissue oxygenation levels in anatomical regions with the highest incidence of DVT. By utilizing hemoglobin oxygenation as a surrogate for blood flow, this technology aims to enable early detection of blood flow abnormalities. The proposed device has the potential to significantly improve patient outcomes by facilitating timely intervention and prevention of complications associated with DVT. Through continuous monitoring, this wearable tool offers a promising approach to enhance clinical management strategies for DVT, ultimately reducing morbidity and mortality rates associated with this condition.

To Our Funder

Project Sponsors

Cutting-Edge Medicine, LLC

BetaBlue Deinde Medical JABIL

Project Judges

On behalf of the entire Biomedical Engineering staff, we'd like to thank our judges for their dedication and skill when it came to the judging of our Senior Design Expo and Competition oral and poster presentations. It is thanks to your generosity, knowledge and patience that this celebration of our students' efforts has been immensely successful.

To Our Dedicated and Distinguished Faculty


Michael Brown, M.D., Ph.D.


Michael Christie, Ph.D.


Zachary Danziger, Ph.D.


Anuradha Godavarty, Ph.D.


Joshua Hutcheson, Ph.D.


Shuliang Jiao, Ph.D.


Wei-Chiang Lin, Ph.D.


Anthony McGoron, Ph.D.


Raj Pulugurtha, Ph.D.


Sharan Ramaswamy, Ph.D.


Jessica Ramella-Roman, Ph.D.


Jorge Riera, Ph.D.

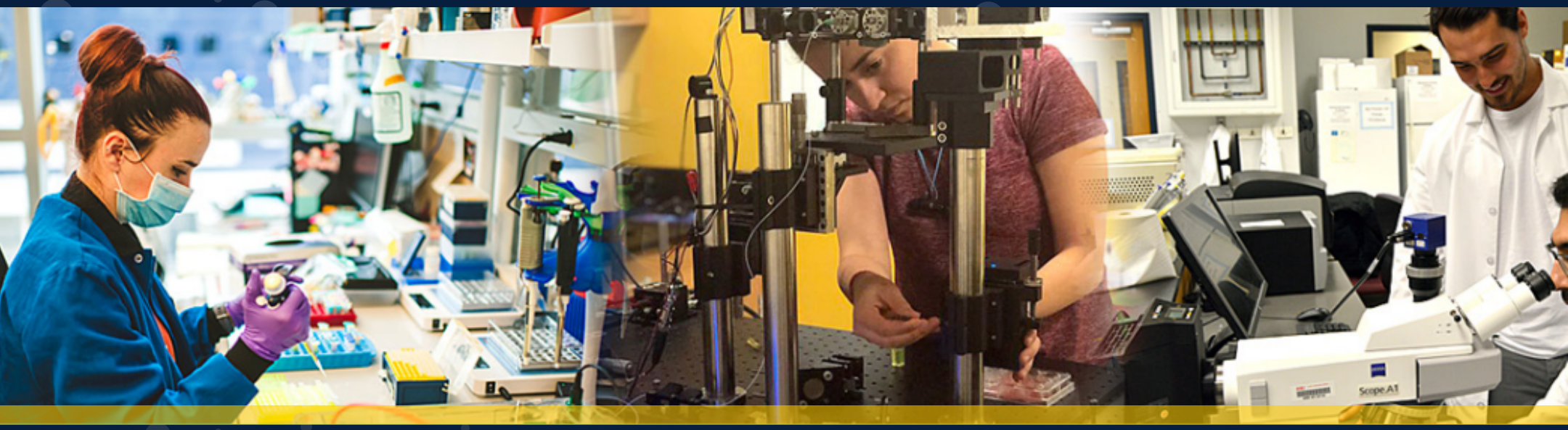

Nikolaos Tsoukias, Ph.D.


Anamika Prasad, Ph.D.


Oleksii Shandra, Ph.D.

This academic event is made possible by the generous support of the Wallace H. Coulter Foundation. To learn more about the Wallace H. Coulter Foundation, please visit whcf.org.

DREAM, DISCOVER, INSPIRE, INVIGORATE



FIU | Engineering & Computing

Department of Biomedical Engineering

The Department of Biomedical Engineering at Florida International University (FIU) located in Miami is committed to preparing ambitious students who want to combine their love of problem-solving with their desire to help others through this fascinating growing field that applies cutting-edge technologies and modern engineering techniques to improve healthcare.

bme.fiu.edu

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