

# Jacob Sindorf

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## 1. Education

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Arizona State University	Systems Engineering	Ph.D., 2023
Arizona State University	Systems Engineering	M.S., 2021
University of Arizona	Biomedical Engineering	B.S., 2020

## 2. Research Interests and Skills

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### Principle Research Interests:

*Wearable robotic systems, embedded devices, robotic control systems and manipulation, rehabilitation and medical robotics.*

**Programming:** Python/Jupyter, MATLAB, Arduino (C/C++), TensorFlow

**Software:** Solidworks, Simulink, GitHub, Virtual Machine, Edge Impulse

## 3. Research Experience

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**Research Assistant** | Arizona State University | Supervisor: Dr. Sangram Redkar **Aug. 2020 – Present**

- Studied wearable sensor systems and the applications of embedded machine learning through Python
- Applied trained CNN model to an embedded system for daily heart rate estimation
- Researched photoplethysmography (PPG) sensor signals and the underlying mathematics behind the signal's dynamics through MATLAB

**Research Assistant** | University of Arizona | Supervisor: Dr. Kaveh Laksari **Oct. 2018 – May 2020**

- Analyzed statistics of multi-subject MRI data in MATLAB and JMP
- Identified statistically significant brain region trends between healthy adults, mild cognitive impairment (MCI), and young adults

**Research Assistant** | Clemson SURE Program | Supervisor: Dr. Bruce Z. Gao **May 2018 – July 2018**

- Developed and designed a laser cell micro patterning control system using stepper motors, Arduinos, LEDs, joysticks, switches, and Solidwork designed laser cut acrylic pieces
- Professional project poster and PowerPoint presentation to Clemson Engineering and Science faculty

## 4. Teaching Experience

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**Teaching Assistant** | *EGR456: Robotic Systems II* / Arizona State University

**Jan. 2023 – May 2023**

- Advised students and aided in debugging their MATLAB and Simulink course projects and assignments.

**Instructor** | *FSE100: Introduction to Engineering* / Arizona State University

**Aug. 2022 – Dec. 2022**

- Instructed 40 student Introduction to Engineering course and advised both a graduate and undergraduate teaching assistant.
- Delivered lectures covering the engineering design process, circuits, Arduino, TinkerCAD, MATLAB, and design.
- Facilitated final student design project covering the topic of ‘Mission to Mars’ by fostering creativity and safety and assisted students with Arduino code, circuits, build design, and power tool usage.

**Teaching Assistant** | *EGR304: Embedded Systems Design Project I* / Arizona State University

**Aug. 2022 – Dec. 2022**

- Reviewed and debugged student circuit projects and PCB designs.
- Assisted students in microcontroller programming through PSoC creator and advised students with KiCAD and Cadence.

**Teaching Assistant** | *EGR202: Use Inspired Design II* / Arizona State University

**Jan. 2022 – May 2022**

- Held weekly supplemental instruction sessions and created quiz questions.

**Teaching Assistant** | *EGR202: Use Inspired Design II* / Arizona State University

**Aug. 2021 – Dec. 2021**

- Aided in the overall course development, assignment creation, and structure and graded assignments.
- Course development was centered around electronic skateboards, and how students can reverse engineer them by examining the motor and electronic components.

**Teaching Assistant** | *EGR201: Use Inspired Design I* / Arizona State University

**Jan. 2021 – May 2021**

- Drafted course material including lectures, homework, and reading guides.
- Assisted students with CAD drawings and 3D printing.

**Teaching Assistant** | *EGR280: Engineering Statistics* / Arizona State University

**Aug. 2020 – Dec. 2020**

- Hosted open office hours and recorded supplemental review sessions for each exam.

## 5. Projects

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### 5.1 Arizona State University

- Embedded Deep Learning Heart Rate Estimation Device** | *Course project* **Jan. 2022 – May 2022**
- Developed an embedded wrist-worn heart rate sensor with PPG and Arduino
  - Deployed a trained deep neural network through TensorFlow lite to Arduino
  - Generated Python and Arduino/C++ scripts for training and preprocessing
- Anatomy Inspired Animatronic Head** | *Course project* **Jan. 2022 – May 2022**
- Created ESP32 with Bluetooth capable PS3 controller controlled animatronic head.
  - Allowed for full manipulation of the neck and eyes in 3 dimensions, and the lips in 2 dimensions through servo motors. Calculated the kinematics of the neck joint to map the PS3 gyroscope to the servo motors allowing for real time rotations of the controller to move the neck.
  - Followed real neck and face muscle anatomy with laser cut polyester fabric to create structure and drive motion.
- Data Driven Dynamic Discovery of the PPG** | *Course project* **Jan. 2022 – May 2022**
- Created data-driven mathematical descriptions of the underlying dynamics of the photoplethysmogram (PPG) signal through time linear system identification and sparse identification of nonlinear dynamics (SINDY) in MATLAB.
- Reinforcement Learning in UR5 Task Training** | *Course project* **Aug. 2021 – Dec. 2021**
- Programmed two reinforcement learning algorithms on a UR5 for reaching tasks
  - Organized software dependencies to allow for seamless use and deployment to the hardware
  - Debugged Python scripts and UR5 software to allow for real time reaching task training
- PBVI for Motion Artifact and Sensor System Energy Savings** | *Course project* **Aug. 2021 – Dec. 2021**
- Compiled a partially observable Markov decision process (POMDP) based point-based value iteration (PBVI) algorithm through MATLAB to maximize rewards
  - Derived extensive mathematical formulations that were used to run simulations in MATLAB
  - Found maximum rewards with high accuracy and low energy cost in a multi-wearable sensor system
- Single Motor Foldable Paper Leg Robot** | *Course project* **Jan. 2021 – May 2021**
- Created a paper robot with a single dc motor actuated paper leg. Explored different leg stiffness values and their effect on the paper robots distance traveled.
  - Explored extensive kinematic and dynamic simulation of the device through Python prior to prototyping.
  - Documented all progress, code, write-ups, and presentations on a GitHub pages website.
- Design of a Soft Passive Wearable Ankle Device** | *Course project* **Jan. 2021 – May 2021**
- Tested a soft passive ankle orthotic through a low-cost pneumatic actuator worn from the foot to the knee intending to provide dorsi and plantarflexion assistance. Through an air reservoir under the ball of the foot, the system can be passively actuated when stepped on to fill the actuator with air, extending it.
  - Verified the system through filtered EMG and goniometer data, as well as force plate response to heel strikes.

## 5.2 University of Arizona

### **Automated Pick and Place Device Design** | *Course project*

**Aug. 2019 – May 2020**

- Led 5-person interdisciplinary engineering team through a yearlong senior design project by communicating with the sponsor, delegating tasks, updating Gantt charts, drafting presentations and scripts, and ensuring the project met the customer needs and wants.
- Drafted and simulated Solidworks files of a fully automated pick and place device

### **Automated Skittle Sorting Device** | *Course project*

**Jan. 2018 – May 2018**

- Designed and built a fully automatic skittle color sorting system
- Through Raspberry Pi, Python, Solidworks, a laser cutter, and a 3D printer, the final system achieved a 90% accuracy at high speeds.

## 6. Publications

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### **6.1 Contributor**

C. Grijalva, N. Toosizadeh, J.Sindorf, Y.H. Chou, K. Laksari, “Dual-task performance is associated with brain MRI Morphometry in individuals with mild cognitive impairment”, Journal of Neuroimaging, March, 2021.  
doi:10.1111/jon.12845

## 7. Scholarships

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**Harold & Lucille Dunn Memorial Scholarship** | *Arizona State University*

**2020-2021**

**ITServe Alliance Scholarship** | *Arizona State University*

**2022-2023**