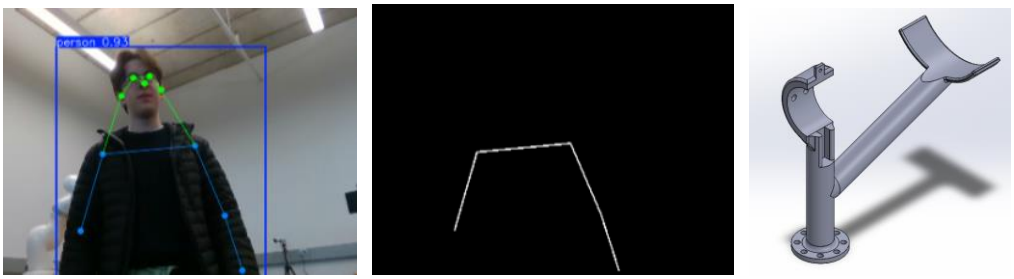
PORTFOLIO BEN BOGUSLAVSKY

Undergraduate Robotics Research Project 2

HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/KUKAURA

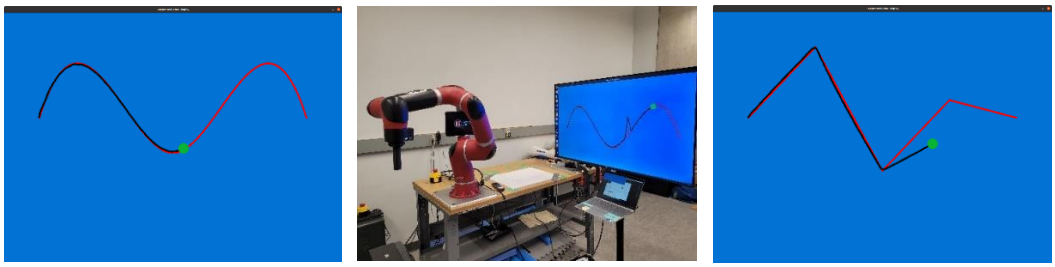
- Created a collision avoidance system for a **KUKA** robotic arm using 2D pose detection from **Ultralytics YOLO (python)** processed in **OpenCV** and **RealSense depth** camera to track human position, sending spatial info in **Java** to the KUKA controller over **UTP**
- Designed a **3D-printable end-effector** attachment in **SolidWorks** to connect with a human model leg, enabling ankle support and knee repositioning for ACL surgery simulation



Undergraduate Robotics Research Project 1

HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/SAWYER_RESEARCH_IMPLEMENTATION

- Designed and implemented a human-robot interaction experiment to study participant responses to autonomous versus manual arm control and motion accuracy, focusing on perceptions of trust, safety, and intent in robotic behavior
- Leveraged **ROS** and **Python** on Sawyer robot arm to coordinate spline arm movements along randomized and pre-defined paths, with intentional error in motion to study participant's reaction.
- Captured **GSR data** with Shimmer3 GSR+, analyzed results using **pandas**
- Developed a real-time visualization for trial participants using **Pygame**, dynamically displaying the arm's motion and path for enhanced experimental monitoring and participant interaction



Toyota Innovation Challenge – Hole/Sticker Detector

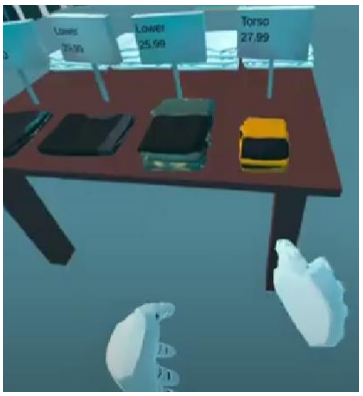
HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/TOYOTACHALLENGE-STICKERS

- Worked in teams to develop an AI program to detect/differentiate between holes and stickers on extrusions with **98% accuracy**
- Employed **Jupyter** Notebooks as a primary tool for developing and training a **CNN**, utilizing **Python**, **Keras** and **OpenCV**
- Engaged in peer-to-peer learning and knowledge sharing, actively seeking feedback from teammates and incorporating suggestions in brainstorming sessions

Hack The North 2024 – VR Clothes Shopping

HTTPS://DEVPOST.COM/SOFTWARE/SHOP-THE-NORTH

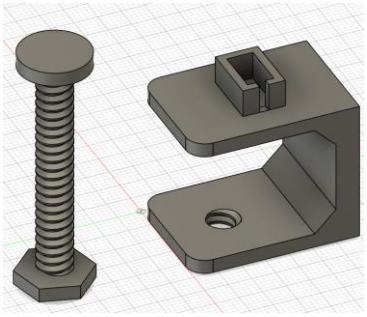
- Designed and developed a **VR** application simulating online clothes shopping, utilizing **C#** and **Unity**
- Integrated **Shopify API** to create a dynamic and interactive shopping environment, enabling users to see online store items and try them on
- **Shopify API Challenge Winner** (Best use of API) and **3rd place in the Ubisoft Game Dev Challenge**

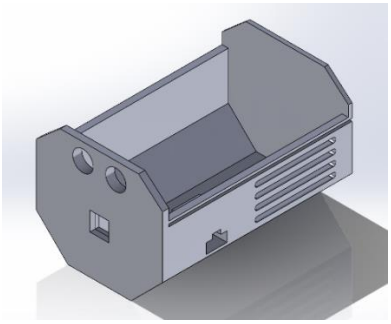


Home Security Camera

HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/SECURITY-CAMERA-PROJECT

- Implemented **ESP32Cam (C++)** locally hosted web server for real-time video
- Incorporated and programmed sensing components such as **ultrasonic sensor, servo motor** and **IR remote sensor** for functionality including controlled camera panning, password authentication, and person detection
- Designed and modelled lightweight, 3D-printable camera shell and desk clamp using **SolidWorks** and **Fusion360**





Two-Axis Machine Control

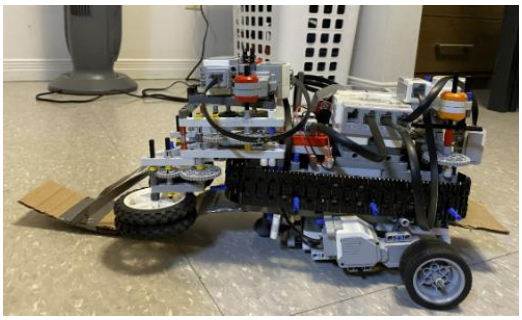
HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/TWO-AXIS-MACHINE-PROJECT/

- Programmed real-time control for a two-axis machine using an **STM32** microcontroller in **C**, enabling dynamic speed modulation via **analog** potentiometers and bidirectional motor control
- Implemented **interrupt-driven limit switch handling,** modular **ADC** channel reading, and **UART**-based debugging for robust system feedback and safety
- Applied embedded systems and microprocessors principles from coursework including **ISRs**, timers, GPIO (open-drain/push-pull), and structured interfacing with external motor drivers (**L6470**)

Tennis Training Robot

HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/TENNISTRAININGROBOTPROJECT

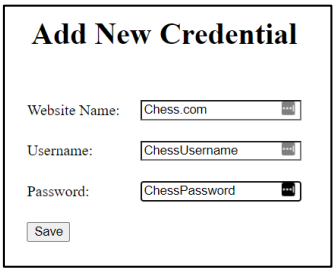
- Programmed and built prototype tennis training robot that positions itself in various positions on a tennis court and launches tennis balls in random directions
- Constructed mechanical components such as **geared flywheels**, **intake system** and **internal conveyors** using Lego EV3 Robotics Kit
- Implemented **automated runtime functionality** and initial **mode selection** user interface using **RobotC**
- Developed a **color detection mechanism**, enhancing system safety and preventing insertion of unauthorized hazardous objects
- Led and collaborated within an Agile environment, participating in sprint planning/reviews while completing deliverables on time

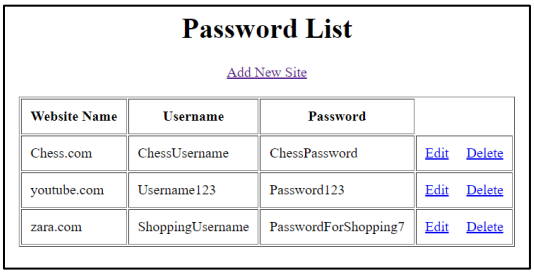


Website Credential Storage

HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/PASSWORDCARDS

- A **Maven**-based locally hosted website developed with **Java** to store username and password credentials, implementing **REST APIs** and **Spring Boot 2**
- Applied OOP principles from university course topics

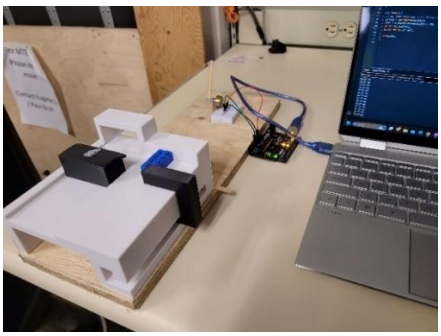


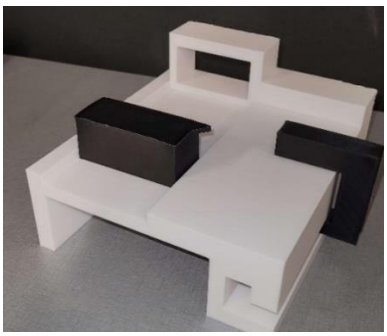


Digital Measurement Device

HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/MEASUREMENT-DEVICE

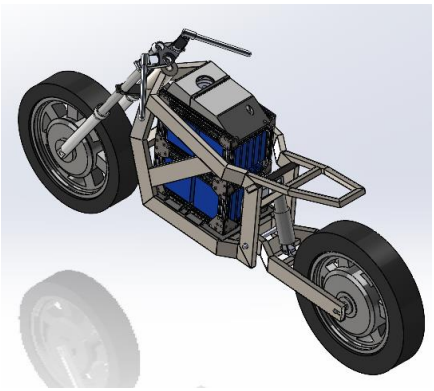
- Designed, modelled and **3D printed** parts for a precision measurement device created using statistical methods using an **Arduino** with a **rotary potentiometer**, successfully achieving measurement **accuracy within one millimeter**
- Conducted **data acquisition**, **calibration** and **uncertainty analysis** to maximize measurement precision and consistency

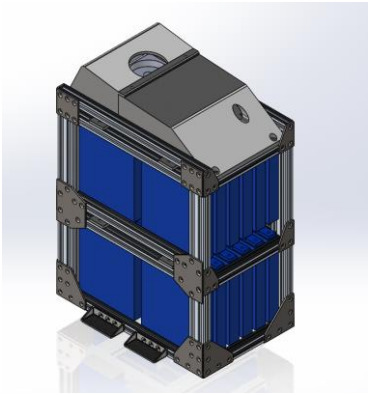




Electric Motorcycle Design Team – UW Electrium Design Team

- Participated in the design, CAD (**SolidWorks**) and **machining** of Electric Motorcycle
- Researched, documented and conducted analysis of several important processes, such as **FEA** and fairing manufacturing for improvement of future design iterations
- Conducted **FMEA**, identifying potential failure modes to maximize safety and robustness of motorcycle components





Robot Arm Torque Calculator Algorithm

HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/ROBOT-ARM-TORQUE-CALCULATOR-PROJECT

- Created a program using **C++** which inputs lengths of part of a 3 DOF robot arm and outputs the optimal angles and resulting torque required to hold the manipulator at a specific static position
- Leveraged physics concepts to eliminate repetitive calculations, successfully identifying some of the lowest achievable torque values in the class.

```
**********INPUT**********
Enter 3 lengths.
L1:0.9
L2:1.2
L3:1.0
----------CASE 1----------
Angle Q1 = 2.68332 RADIANS
Angle Q2 = 0.49294 RADIANS
Angle Q3 = PI/3 RADIANS
Total Moment For Case One: -20.8815
```

```
----------CASE 2----------
Angle Q1 = 4.02931 RADIANS
Angle Q2 = 1.51404 RADIANS
Angle Q3 = 0 RADIANS
One of the arms goes below x-axis, try again.
```

```
----------CASE 3----------
Angle Q1 = -0.964888 RADIANS
Angle Q2 = -3.69693 RADIANS
Angle Q3 = PI/4 RADIANS
One of the arms goes below x-axis, try again.


TOTAL TORQUE: 20.8815
```