Portfolio – Leander Ullmann

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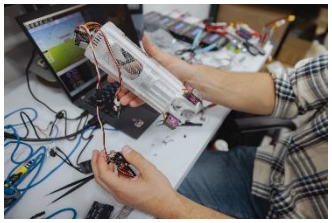
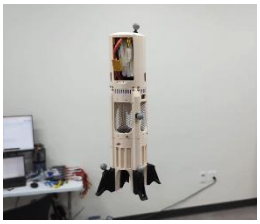
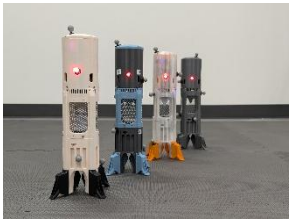
Selection of Projects in the Field of Mechatronics

"Firefly" – A mono-copter scout drone (Stanford Robotics Center) *08/2024 – 11/2024*

Originally developed to aid firefighters with near real-time information gathering, Firefly has been adapted to showcase indoor thrust vectoring capabilities. Its versatile design allows for potential applications beyond firefighting, demonstrating the possibilities of drone technology in confined spaces and harsh environments.

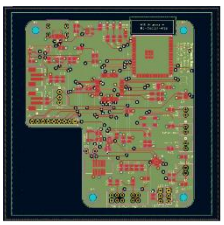
Skills & Technologies used: Sensor and actuator integration (I2C, SPI, etc.), visual odometry, motion capture, wireless transmission, CAD (Solidworks), laser cutting, additive manufacturing

"Knock Box" – Course Project in EE256: *PCB Design* (Stanford University) *12/2023 – ongoing*

The device is designed to create a sense of proximity for users separated by long distances. By knocking on one box, the corresponding box replicates the physical knocking, and the devices can also exchange short audio messages, fostering interactive and personal communication.

Skills & Technologies used: Initial concept creation, circuit design with SAMD51 microcontroller, PCB layout, sensor and actuator integration (I2C, SPI, USB, etc.), signal processing, wireless transmission, embedded programming (Python), CAD (Solidworks), laser cutting


"Blood Glucose Measurement Device" – *Accurex Biomedical* (Visakhapatnam, India) *07/2023 – 09/2023*
(documentation not disclosed)

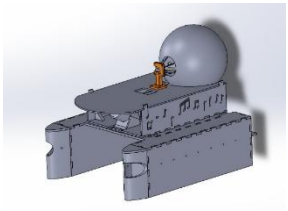
The project aimed to improve healthcare access for diabetics in low-resource settings. It featured a low-cost glucometer built from scratch that measures blood glucose levels using a minimalistic user interface, making it easy to operate.

Skills & Technologies used: Supervision of three interns, product management, hierarchical state machines, comparison of various microcontrollers, circuit design with PIC16 microcontroller, biochemical sensor integration, embedded programming (C/C++)

"KaraokeKatamaran" – Course Project in ME218C: *Smart Product Design* (Stanford Univ.) *04/2023 – 06/2023*

The innovative watercraft implements a custom-designed RC protocol that translates real-time audio and percussive inputs into propulsion and steering commands. It also includes a competitive element, where participants navigate their boats to pop opponents' balloons.

Skills & Technologies used: Initial concept creation, circuit design with PIC32 microcontroller, sensor and actuator integration, wireless transmission, embedded programming (C/C++), CAD (Solidworks), 3D-printing, laser cutting



"Tera Turbine" – Course Project in ME218B: *Smart Product Design* (Stanford University) *01/2023 – 03/2023*

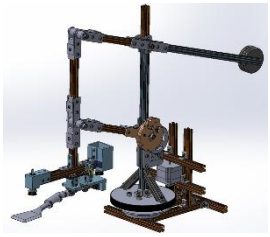
A fully autonomous robot equipped with perception and localization capabilities. It features motor control, orientation through IR sensing, navigation via tape detection, distance sensing with ultrasound, and adaptive game logic that responds to the behavior of other robots.

Skills & Technologies used: Initial concept creation, circuit design, PID control, sensor and actuator integration, signal filtering, embedded programming (C/C++), CAD (Solidworks), 3D-printing, laser cutting

"Flipster" – Course Project in ME223: *Applied Robot Design* (Stanford University) *09/2022 – 12/2022*

An advanced robotic system designed for automated flipping tasks. It incorporates a combination of DC motors, a stepper motor, a brushless motor, and a servo motor to achieve precise control of its movements. The design is constructed from laser-cut and 3D-printed components and ensures both stability and flexibility.

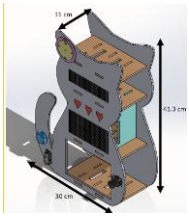
Skills & Technologies used: Initial concept creation, sensor and actuator integration, embedded programming (Python), CAD (Solidworks), 3D-printing, laser cutting



"CAT" – Course Project in ME218A: *Smart Product Design* (Stanford University) *09/2022 – 12/2022*

The Calming Animatronic Therapist (CAT) is designed to reduce anxiety for airline passengers through interactive caregiving. This therapeutic companion helps users manage stress by engaging them in activities like feeding and petting a cat, which promote relaxation and emotional support during flights.

Skills & Technologies used: Initial concept creation, sensor and actuator integration, embedded programming (Python), CAD (Solidworks), 3D-printing, laser cutting



"Breathe" – Research Project at the *IDSC* (ETH Zurich, Switzerland) *01/2022 – 06/2022*

An affordable medical ventilator for low-resource settings. The solution focuses on simplicity, ease of use, and modular design, ensuring accessibility and reliability in challenging environments.

Skills & Technologies used: User interface development, communication between Raspberry Pi and Arduino, sensor integration, embedded programming (Matlab/Simulink, Python, C/C++), state diagrams, CAD (Siemens NX), laser cutting