Engineering Portfolio

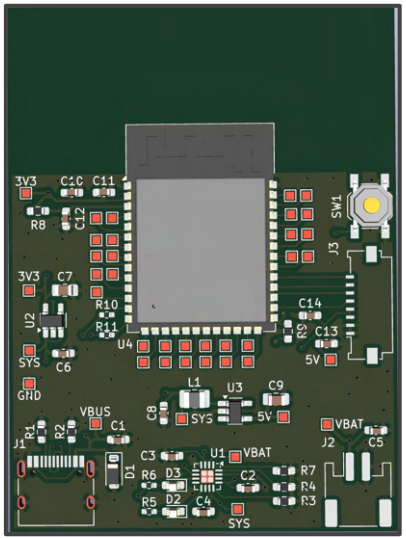
Haya Dakhil

Concentray: PCB

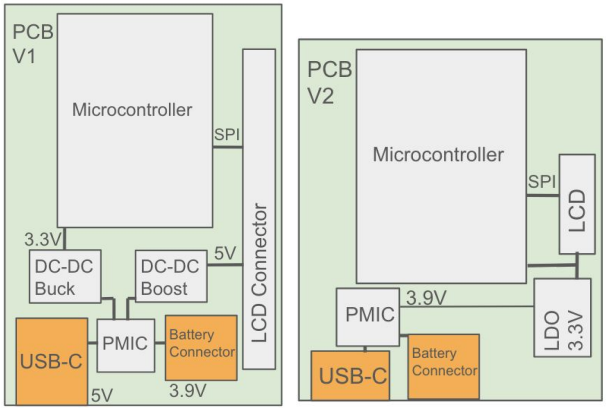
Embedded controller / display board for a desk-mounted focus device with screen timers and task tracking.
Schematic & PCB design, simulations, component selection & BOM, assembly, bring-up, documentation.
Design includes: 4-layer PCB, ESD protection, DC-DC Buck (3.3V) and Boost (5V) Regulators, SPI communication, Smart power path management, header (V1) / FFC (V2) connectors, SWD, via stitching.
Tools used: KiCad, LTSpice, EE lab tools (oscilloscope, DMM, power supply, LPKF Reflow, SMT/stencil soldering).

V1

V2



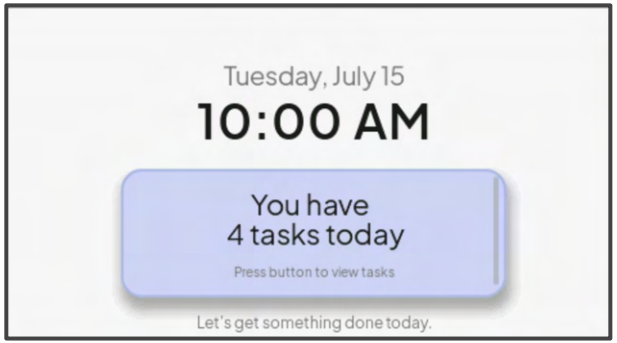
Circuit Block Diagrams

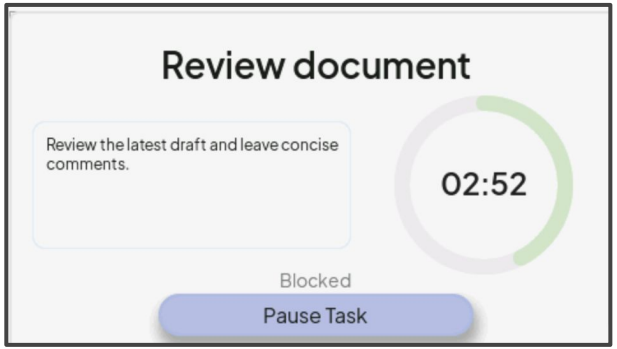


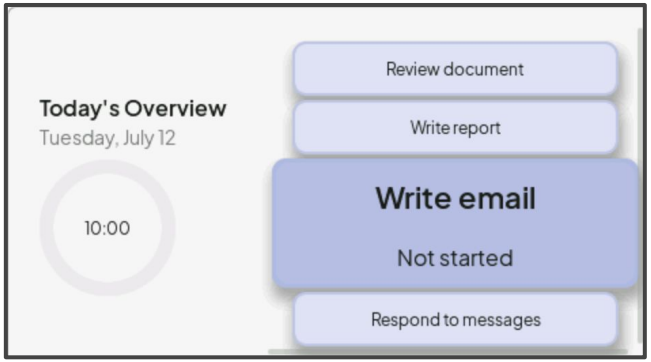
CONCENTRAY

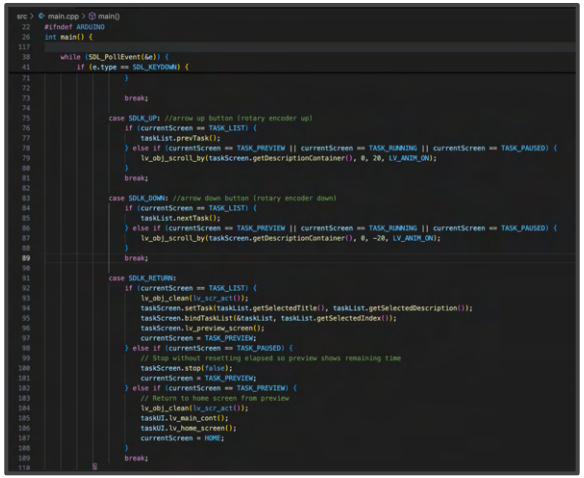
Concentray: Firmware

UI/UX firmware, validated with simulation to bypass the need for microcontroller hardware.
Wireframing, UI/UX principles, widget drawing, navigation logic, simulation, documentation
Firmware includes: Timer countdown, scrolling navigation, button animations, start/stop/pause/resume.
Software / Frameworks: C++, LVGL graphics library, Arduino, PlatformIO, SDL.







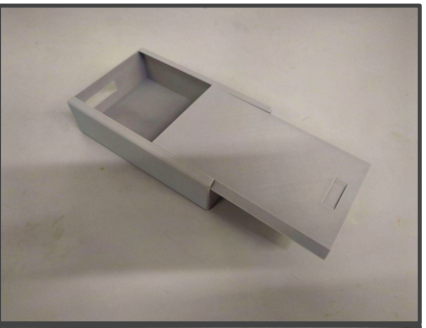


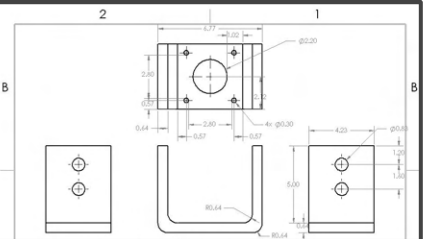
UW NanoRobotics Group

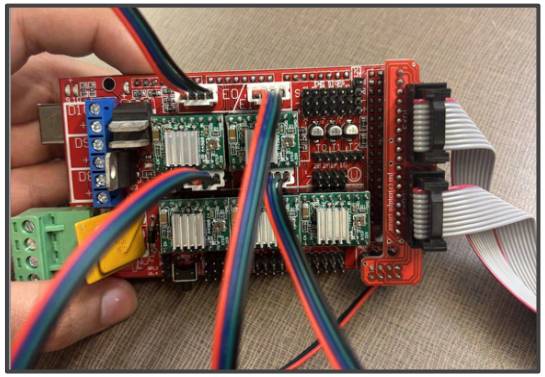
CHIP Project: Developing a conductive hydrodynamic ink printer that uses nanoparticle inks to fabricate PCBs.

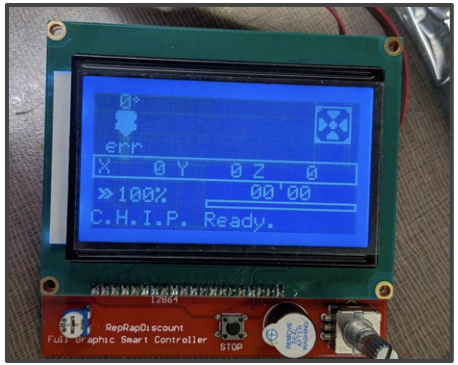
PSU Encasing, 5 U-Bracket custom mounts & mechanical drawings, Electronics assembly/validation/measurements, Fluid integration mechanics schematics.

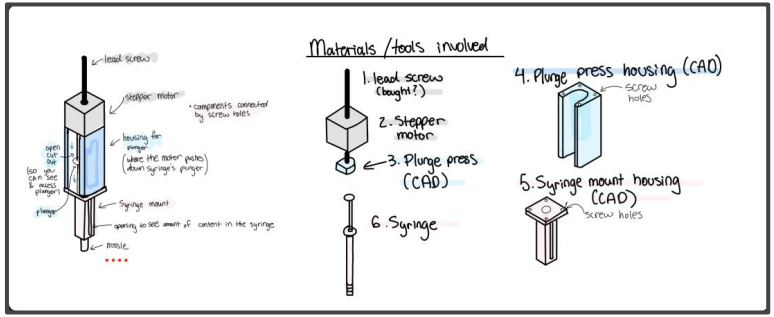
Tools: UW Student Machine Shop, Solidworks, 3D printing, DMM, stepper motor, soldering.

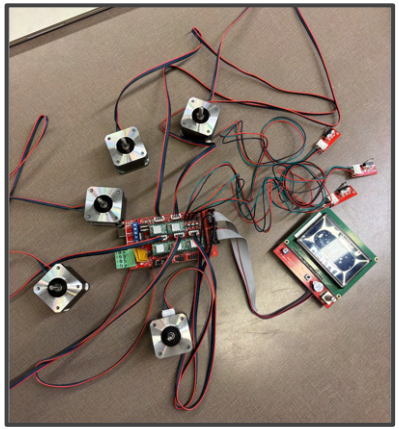




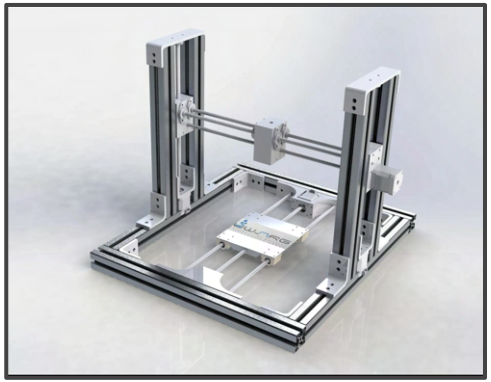




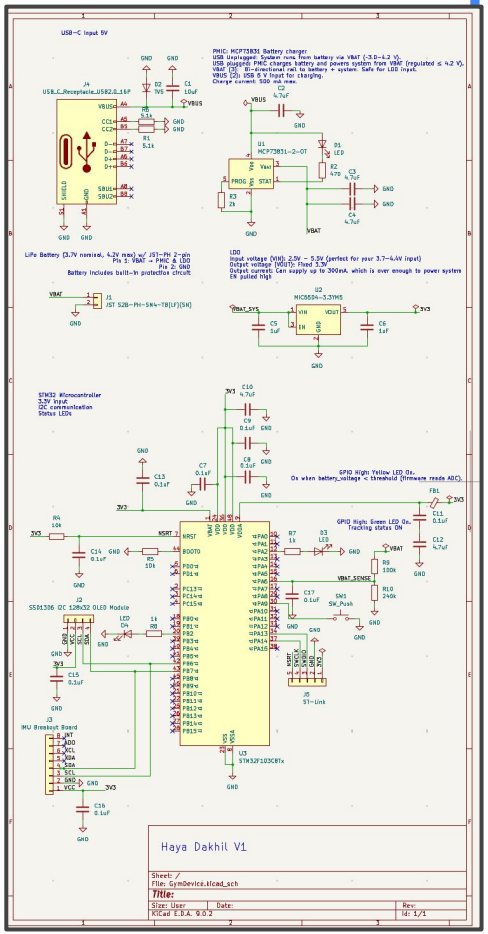




Printer demo



Fitness Rep Tracker - Hardware (Solo Project)

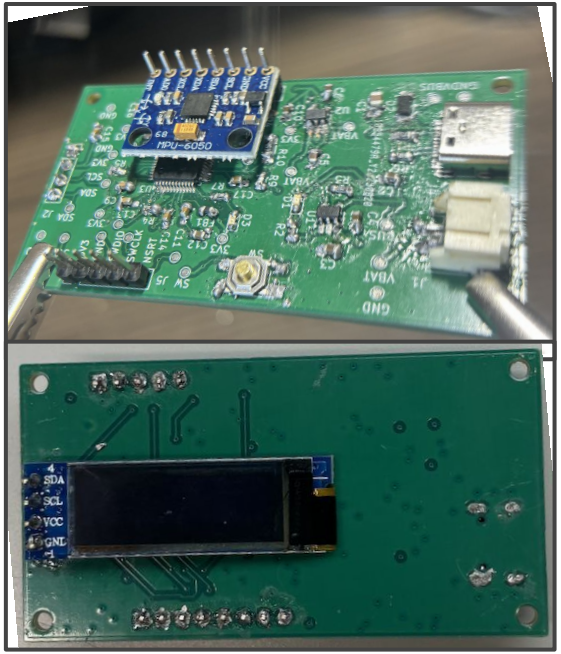


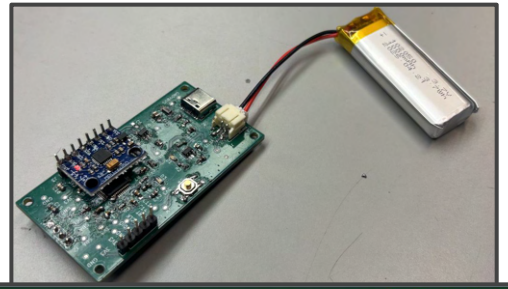
Wrist-mounted STM32 controller board to detect and classify gym exercises with real-time OLED feedback.

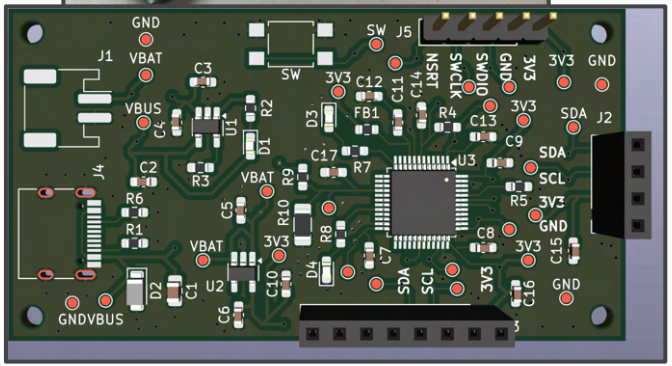
Schematic & PCB design, component selection & BOM, assembly, bring-up, voltage division.

Hardware includes: STM32F103 MCU, MPU-6050 IMU (I²C), SSD1306 OLED (I²C), 3.3 V LDO regulation, Li-Ion charging via USB-C, low-battery sense divider, status LEDs, ESD protection, SWD programming/debugging header.

EE software / tools: KiCad, EE lab tools (oscilloscope, function generator, DMM, power supply, soldering).





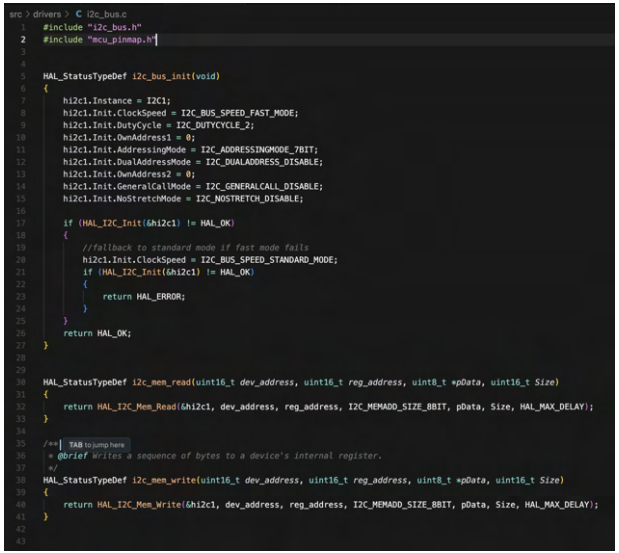


Fitness Rep Tracker - Firmware

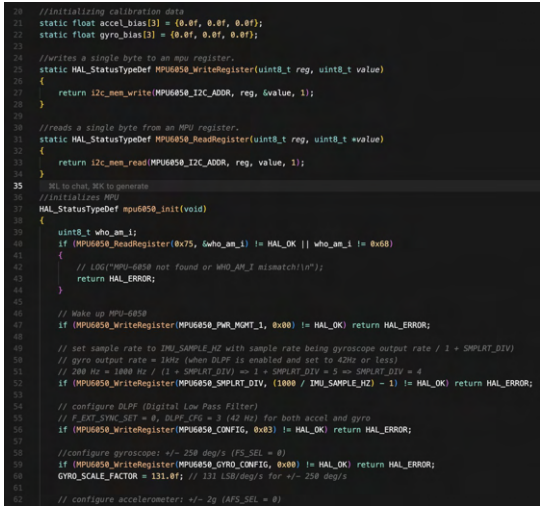
Wrist-mounted STM32 controller board to detect and classify gym exercises with real-time OLED feedback.
Driver development (I²C, UART, SysTick), real-time filtering, calibration routines, adaptive thresholding, finite-state machines, custom OLED UI.
Firmware includes: IMU (MPU6050) driver with calibration, OLED (SSD1306) display driver, rolling buffer stats, low-pass filters, rep detection with peak/refractory logic, exercise-specific configs, state machine (boot → select → calibrate → run), UART logging, systick timing, and peripheral init with fallback/error handling.
Software / Frameworks: C (PlatformIO), STM32 HAL, FreeRTOS-style FSM (bare-metal), I²C, UART, SDL (sim testing).

Adaptive rep detection & rolling statistics

I²C bus initialization with fallback protection

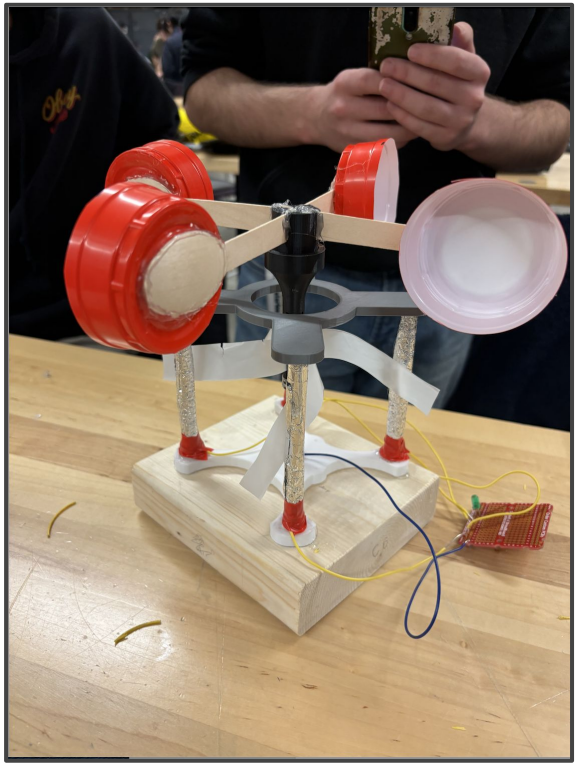


MPU6050 IMU Initialization & Configuration



Triboelectric Nano-Generator (TENG)

Won 1st place out of 144 students in the TENG prototyping competition to harvest mechanical energy into electricity.
Solidworks, 3D printing, assembly, materials science, rapid prototyping, cost efficiency
Tools: Soldering, prototyping / building tools (wood block, paper cups, teflon, aluminum, wooden sticks)



Video Link Here

Bio-Mechatronics Design Team

Developing affordable exoskeleton prosthetics for children with muscular dystrophy.
Base designing & prototyping (ESP32 / servo housing), component / material research, exoskeleton assembly.
Tools: EMG electrodes, Solidworks, 3D printing, servo motors.