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About: This consists mostly of personal projects I completed for fun. Some content may be derived from work, but that will be clearly stated. Any confidential details will be removed, and generic visuals will be used where necessary.

PowerPack 9000

why:I had a random assortment of batteries and wasn't sure what to do with them. Additionally, there weren't many power banks available at the time that exceeded 100 Wh capacity.

Objective

- ❖ Design a compact, high-capacity (≥150 Wh) power bank with 100 W continuous output, low idle draw, USB-C/USB-A/wireless charging interfaces, and embedded control for display.

Implementation

- ❖ Designed custom PCB using KiCad for schematic capture and layout (PCB was not fabricated; off-the-shelf modules were used in the final build)
- ❖ Programmed Arduino Mini (ATmega328) in C/C++
- ❖ Integrated an OLED display (128x64) to show real-time system metrics (voltage, current, temperature, fan speed, etc.)

Results

- ❖ Met all functional targets using modular off-the-shelf components integrated
- ❖ Implemented responsive OLED UI and features like like battery monitoring, charge cycles, temp control, etc., all enclosed in a compact, 3D-printed housing

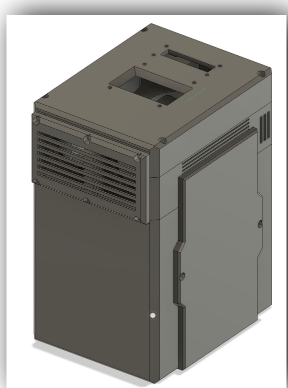

figure 1.1 CAD

figure 1.2 Final parts

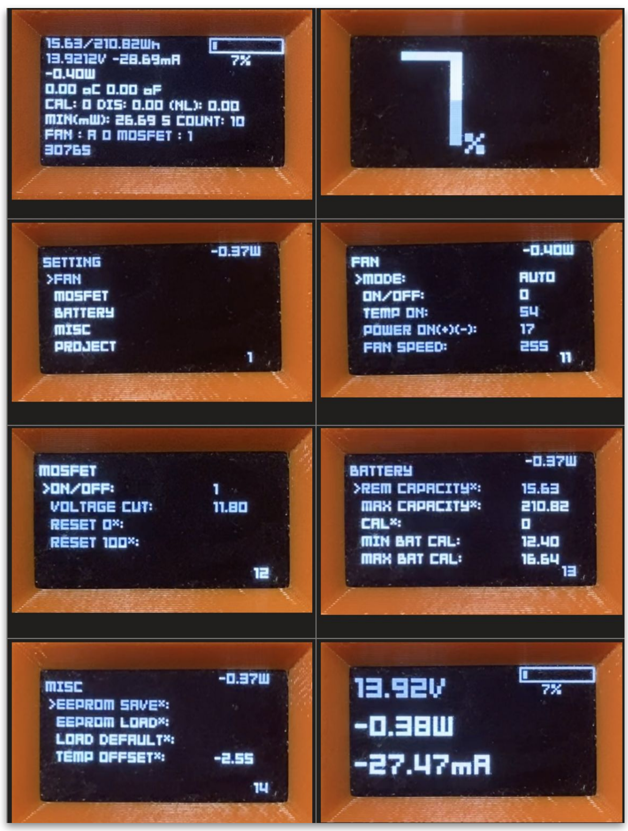

Figure 1.3 124x64 oled UI

MiR Autonomous Transport System - Work (TTM)

Objective

- Design and fabricate an autonomous material transport solution for a manufacturing environment
- Increase payload capacity and reduce manual handling

Implementation

- Designed mechanical system and electrical control enclosure using SolidWorks
- Created schematics using QElectroTech
- Published GD&T drawings for in-house manufacturing
- Integrated solution with an existing legacy system (controller, hardware, and software) with minimal modifications

Results

- Improved line efficiency by minimizing delays between batch transfers and queue system.
- Enabled automated transport of loads up to 100 lbs
- Reduced operator strain and manual intervention

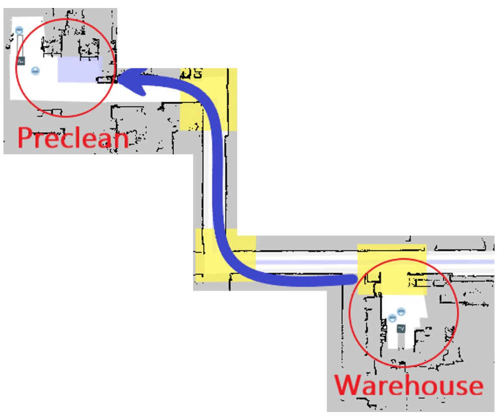

Figure 2.1 top view of scanned map

Figure 2.3 This system is quite familiar with what I have worked on. (due to TTM being a defense contractor, this is the best I can show)
https://www.youtube.com/watch?v=mF1D2cMba6o&t=2s&ab_channel=ElintaRobotics-Robotics%7CVision%7CAutomation

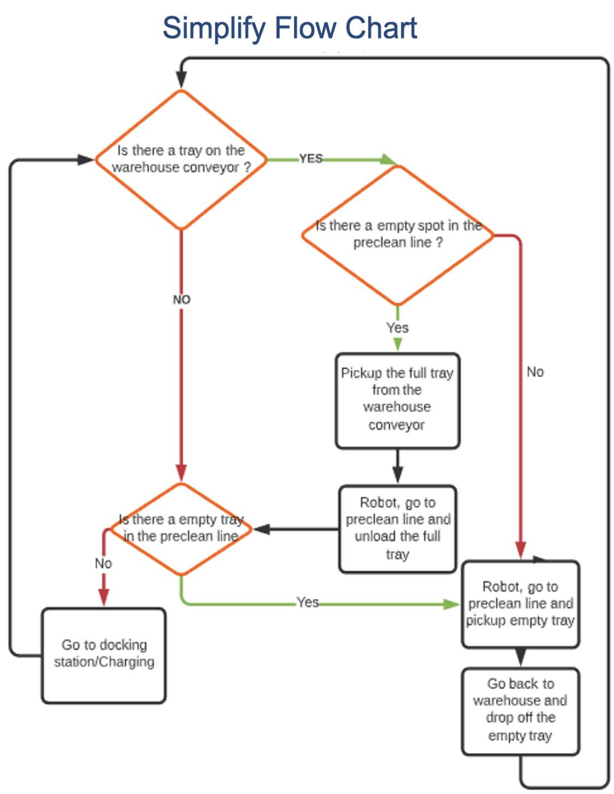

Figure 2.2 presentation flow chart

LONG DURATION RC HELICOPTER

Objective

- ❖ Achieve <250 g total weight with ≥50 min flight time
- ❖ Integrate GPS, LiDAR, optical flow, compass, and camera
- ❖ Use off-the-shelf components: motors, frames, controllers

Implementation

- ❖ Tested various batteries to determine the highest energy-density option that allows sustained power for flight
- ❖ Designed and built a custom load test rig to evaluate different propeller efficiency across pitch ranges

Results - Ongoing

- ❖ Achieved over 40 minutes of hover time; sustained low speed forward flight suggests 50-minute endurance is attainable
- ❖ Staying under the 250 g limit is challenging with off-the-shelf components (e.g., flight controller, battery)
- ❖ Planning to shift to the 300 g class to allow greater flexibility in component selection and integration

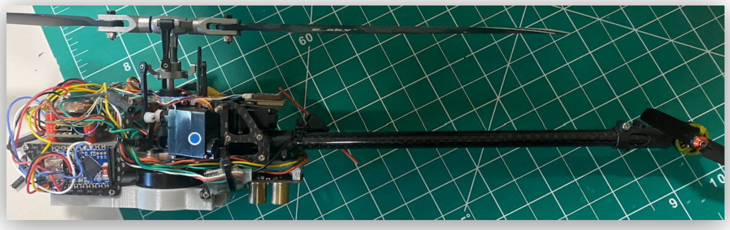

Figure 3.2 third prototype frame

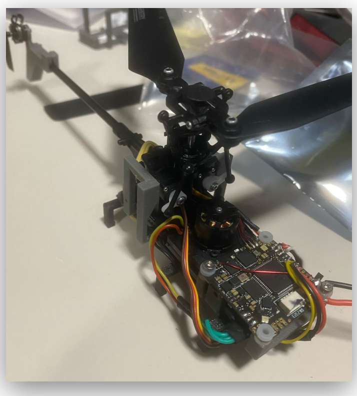

figure 3.1 first prototype using C127 RC as base frame, testing out ardupilot

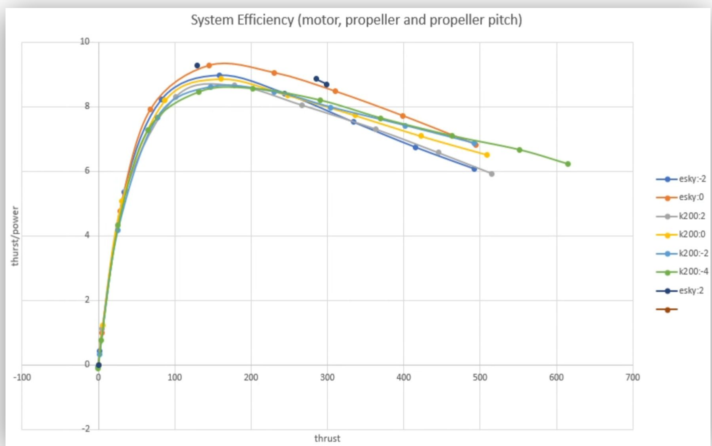

Figure 3.3 this was test on my test thrust meter, measuring the the system efficiency of different blades with the default pitch and manual servo pitch to see its efficiency across thrust(gram) range.

Letter-Writing Robot: An Inverse Kinematics Study
Class Project - ME557

Objective
- ❖ Simulate a 6-DOF robotic arm in CoppeliaSim using AX-12A and MX-64T motors

- ❖ Develop a control system capable of writing three letters from the alphabet on a vertically mounted board

Implementation
- ❖ Modeled the robotic arm in SolidWorks based on predefined servo specifications

- ❖ Implemented inverse kinematics using the Jacobian pseudo-inverse method to compute joint angles for target end-effector positions

- ❖ Validated motion accuracy through simulated path tracking in CoppeliaSim

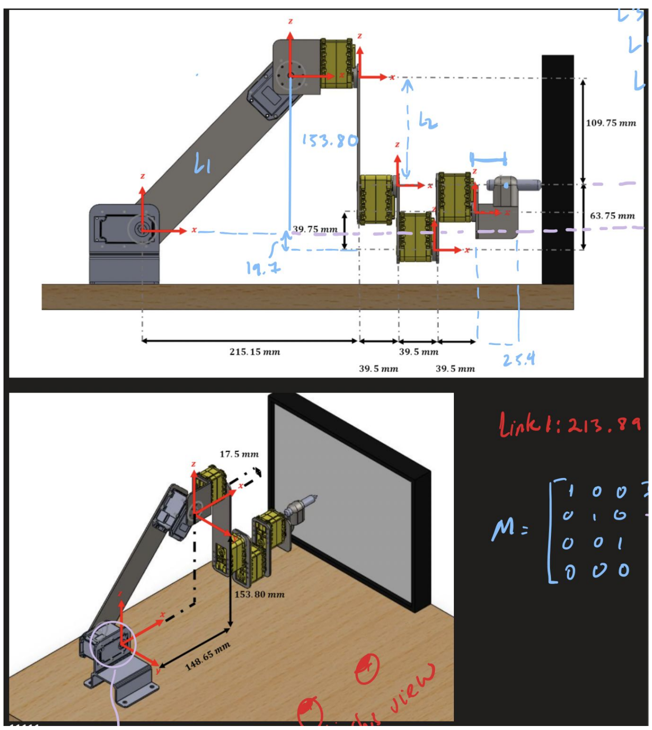

Figure 5.1 The CAD d esign.
Note: don't have solidwork license anymore and can't find all the files.

Results
- ❖ Successfully achieved letter-drawing tasks with accurate end-effector control
- ❖ Gained experience with closed-form and numerical IK techniques for non-standard geometries
- ❖ Project met all functional requirements and received full credit

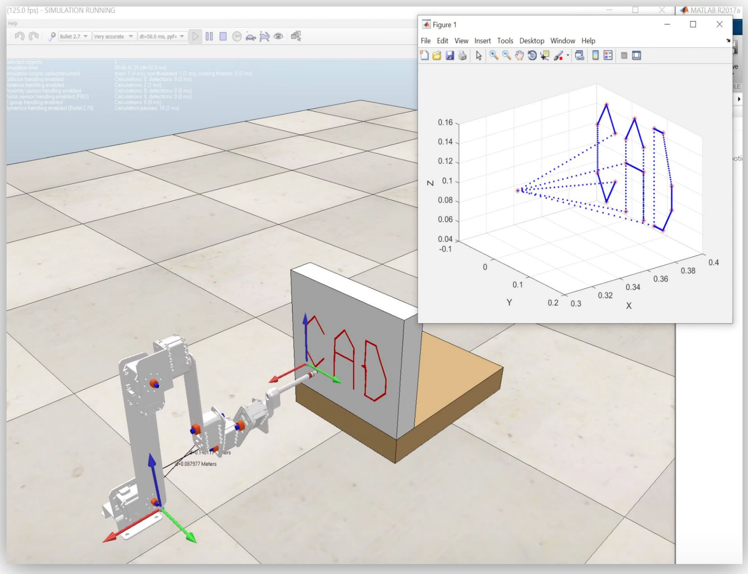

Figure 5.2 Simulated the ARMs in coppeliasim through Matlab.
video:
https://www.youtube.com/watch?v=_fAExdOrfIA