

**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 ( $\geq 150$  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 battery monitoring, charge cycles, temp control, etc., all enclosed in a compact, 3D-printed housing

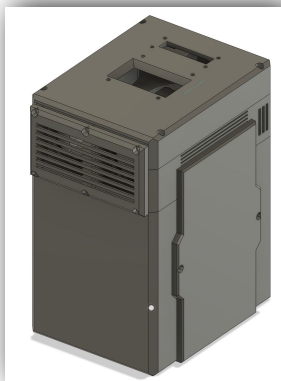


figure 1.1 CAD



figure 1.2 Final parts

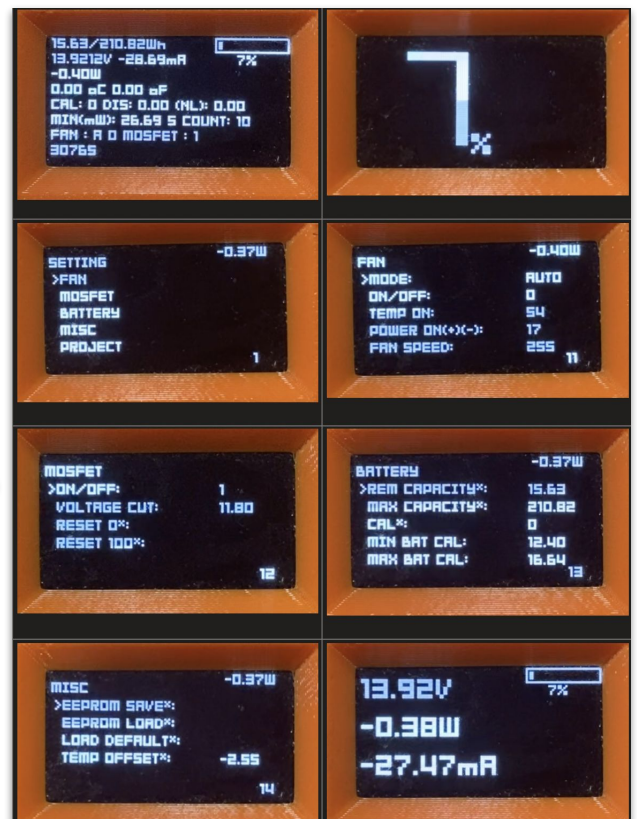


Figure 1.3 124x64 oled UI

# MiR Autonomous Transport System - Work

## 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

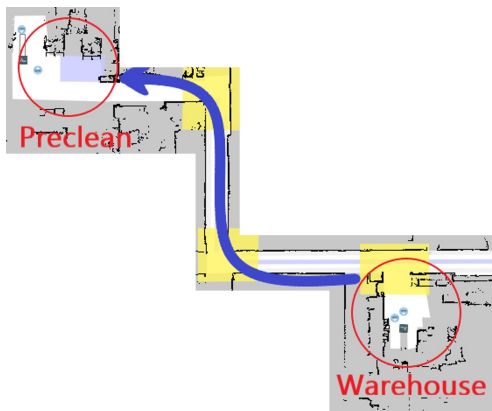


Figure 2.1 top view of scanned map



Figure 2.3 generic pictures that is similar, but do not represent the intellectual property

Source:

[https://www.youtube.com/watch?v=mF1D2cMba6o&t=2s&ab\\_channel=Elin+taRobotics-Robotics%7CVCVision%7CAutomation](https://www.youtube.com/watch?v=mF1D2cMba6o&t=2s&ab_channel=Elin+taRobotics-Robotics%7CVCVision%7CAutomation)

## Simplify Flow Chart

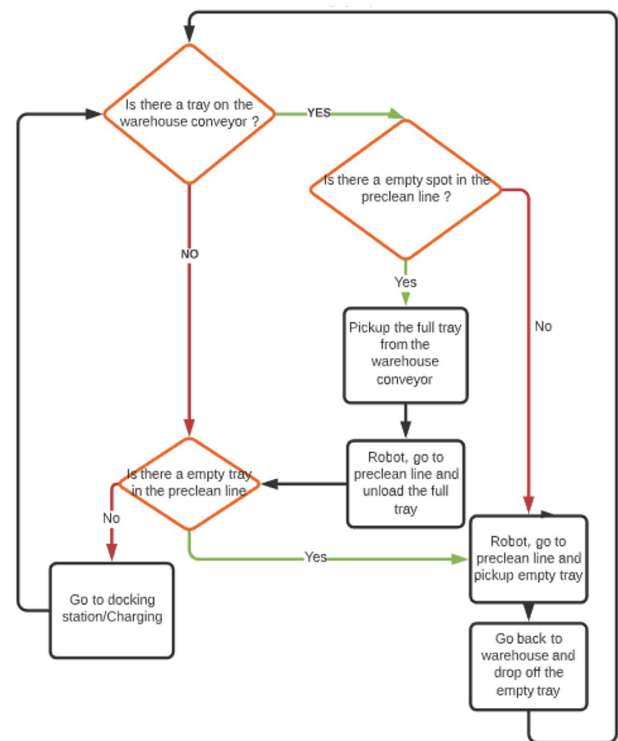


Figure 2.2 simplify flow chart

# LONG DURATION RC HELICOPTER

## Objective

- ❖ Achieve <250 g total weight with  $\geq 50$  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

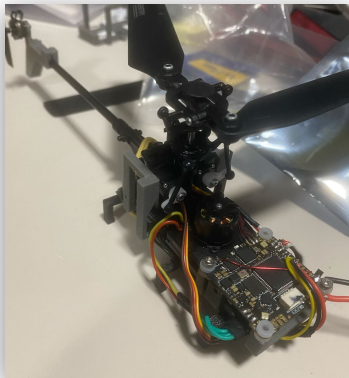


figure 3.1 first prototype using C127 RC as base frame, testing out ardupilot

## 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

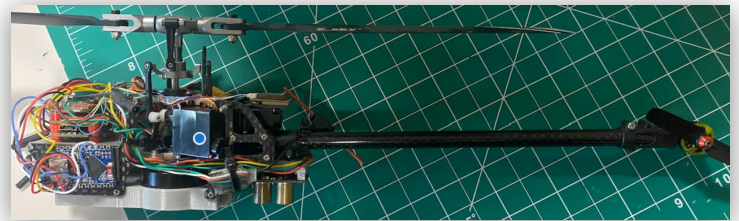


Figure 3.2 third prototype frame

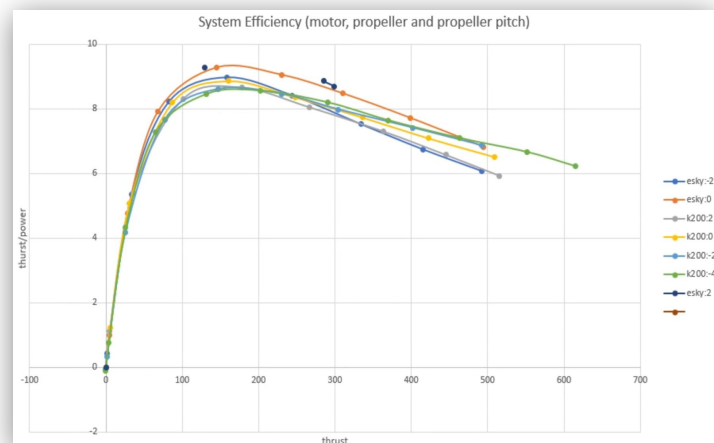


Figure 3.3 this was test on my test thrust meter, measuring the the system efficiency of different blades with the default pitch and manual servo pitch to see its efficiency across thrust(gram) range.

# 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

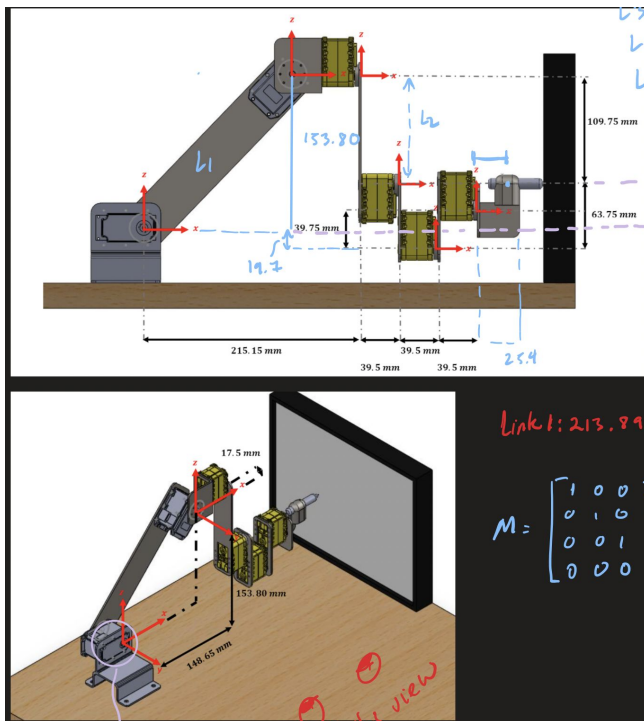


Figure 5.1 The CAD design.  
Note: don't have solidwork license anymore and can't find all the files.

### 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

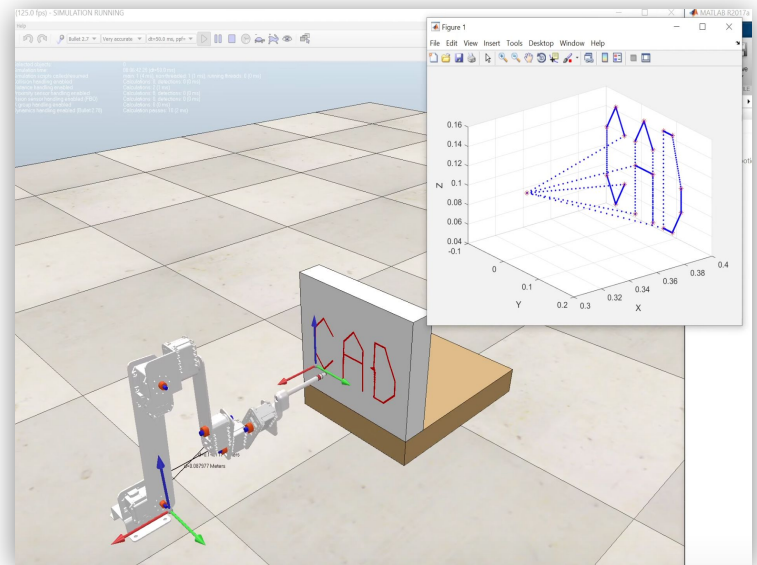


Figure 5.2 Simulated the ARMs in coppeliasim through Matlab.  
video:  
[https://www.youtube.com/watch?v=\\_fAExdOrfIA](https://www.youtube.com/watch?v=_fAExdOrfIA)



## Miscellaneous

