

Hi, nice to meet you! My name is Nikolai Nekrutenko and here is my portfolio:

I am a senior Physics major at Cornell University, also pursuing a Master of Engineering in Electrical Engineering through the Early M.Eng. program. I will graduate with my Bachelor's in December 2024 and my M.Eng. in May 2025. I am eager to bring my background in physics and electrical engineering, my hands-on experience in software and hardware engineering, physics-based modeling and simulation, data analysis and visualization towards solving complex, open-ended problems.

Website: <https://nekrutnikolai.com>

GitHub: <https://github.com/nekrutnikolai>

YouTube Channel: <https://www.youtube.com/channel/UC-WSQ21Q2O36urFPc4e5T6Q>

LinkedIn: <https://www.linkedin.com/in/nikolai-nekrutenko/>

Low-Cost Depth Sensing Module for Deep-Water Research [Sep 2024 - Present]:

Researching and developing a custom sensor mechanism and embedded systems module in collaboration with Dr. Hunter Adams and the Woods Hole Oceanographic Institution for depths up to 2000 meters. Documentation and updates to come as the project progresses.

Infrared Sensor Evaluation for next-gen SLS products [Jun 2024 - Aug 2024]: Devised an experimental setup and methods to evaluate thermopile array infra-red (IR) sensors for next-gen SLS printing technology to maximize performance and dimensional accuracy. Calculated the off-axis projection of sensor pixels and made an interactive tool in Observable JavaScript. Developed test and alignment scripts in Python, automating the test setup to characterize IR sensors. Built analysis Jupyter Notebooks in Python to compare the performance of sensors across varying environmental conditions and sensor configurations using NumPy and SciPy.

Infrared Sensor Transform Utility & Documentation:

<https://observablehq.com/@nikolaiteslovich/infrared-sensor-transform-utility>

Non-Orthogonal Gimbal Development [Jan 2024 - Apr 2024]: Deriving a physics-based model of the forward and inverse kinematics for an experimental non-orthogonal gimbal to be used in a future product. I am assessing its experimental performance with modeled IMU data in Python. Throughout this experience I am continually learning about how to analyze and verify assumptions with experimental data, research and derive difficult concepts on my own, and communicate with the team.

Kinematics Derivation: <https://hackmd.io/@nekrutnikolai/Sku14A-sa>

Mōvi Pro Pan/Tilt Limits [Jun 2023 - Dec 2023]: Developed an embedded systems algorithm for smooth hard stops on Mōvi Pro gimbal pan and tilt axes based on IMU data, gimbal physics, and user input via Mōvi Wheels and Mōvi Controller as part of an upcoming experimental firmware release. Created an interactive graphical interface with Javascript in Observable HQ for the documentation to help users visualize how their user-defined settings would affect the motion of the gimbal. This firmware release was requested by Larry McConkey and will be used by him in upcoming productions such as new seasons of Marvelous Mrs. Maisel.

User Documentation: <https://observablehq.com/d/2b2149d8f6355702>

Engineering Documentation: <https://observablehq.com/@nikolaiteslovich/ptlimits>

Short Demonstrational Video: https://www.youtube.com/watch?v=7P_ka9fk7zw

QCoDeS-Interfacing [Jun 2022 - May 2023]: A bundle of installation shell scripts, drivers, well-documented documentation and Jupyter notebooks to setup a computer for programmatic interfacing with older lab equipment over the GPIB interface with Python and QCoDeS, a Python data acquisition framework.

GitHub Repository: <https://github.com/nekrutnikolai/QCoDeS-Interfacing>

Presentation:

<https://docs.google.com/presentation/d/11rxnWTJ9ADGM96VsQI7Guu8UMdggNuGSXEt3azbtYpw/edit?usp=sharing>

NeoPixel FFT Audio Visualizer [Jun 2022 - Jan 2023]: Co-designed and wrote a program that visualizes the waveform and intensity of music for a custom-built individually-addressable RGB led matrix using FFTs in Python on a Raspberry Pi and a few components beautifully hacked together on a breadboard using output from the Raspberry Pi's GPIO pins.

GitHub Repository: <https://github.com/nekrutnikolai/leds/tree/main>

The Rocket Lab Initiative [Sep 2020 - Jun 2021]: Developed a 3D printed lightweight Raspberry Pi sensor and imaging payload as part of a PSU outreach with Dr. McEntaffer's lab. Simulated the suborbital model rocket trajectory in OpenRocket and compared actual data against predicted.

GitHub Repository: <https://github.com/nekrutnikolai/RISE>

MinerWrangler [Nov 2020 - Apr 2021]: Wrote a custom installation shell script for headless Ubuntu-powered machines to allow for Ethereum mining. “MinerWrangler is the ultimate bundle of bash scripts to ease your way into cryptocurrency mining that is open-source and gives you full control over your rigs—by default. No monitor, keyboard, or mouse required.”

GitHub Repository: <https://github.com/nekirutnikolai/minerwrangler>

Arduino Consolometer [Oct 2019 - Feb 2020]: Designed an Arduino-powered device that acts both as a thermometer and game console. Utilized a thermistor in a custom 3D printed waterproof enclosure to measure the temperature of water for a Science Olympiad Competition. Gathered data with a voltage divider setup for the thermistor and analog readout pins on the Arduino to analyze the data with Python and come up with the best line of fit and algorithm. Resulted in first place in the regionals competition right before the start of COVID-19.

GitHub Repository: <https://github.com/nekirutnikolai/Consolometer>

Stop-Motion Film: <https://www.youtube.com/watch?v=Srl9ST27SpA>

FPV Drones & Aircraft [Oct 2019 - Present]: Building, flying (mostly crashing) FPV drones and aircraft with custom-designed 3D printed components, and autonomous flight capabilities using open-source flight software such as Betaflight and iNav. Occasionally use these drones for cinematographic applications such as exploring the Colorado Plateau or chasing and filming a car on a winding road.

Cinematic Drone Flight Playlist:

https://youtube.com/playlist?list=PLWoHVszdLgExfQIUunZmBZD9PeuAHc0xA&si=1jTZ_nR5UKnXjRYS

Mostly Printed CNC [Nov 2019 - May 2020]: 3D printing parts and components, assembling and configuring the mostly printed CNC machine. Developed a custom needle cutter head powered by a brushless motor, electronic speed controller, and an Arduino Nano that was used to send varying PWM signals to the electronic speed controller to alter the speed of the needle spindle. This was then used to cut out foam board model aircraft parts for an aeronautics club that I co-founded at my local highschool.

Blog Post: <https://shmac.netlify.app/posts/2020/01/flite-test-tiny-trainer-kits/>

COVID-19 Tracker [Aug 2020 - Oct 2020]: Wrote a custom Python program in Jupyter Notebook for the analysis of COVID-19 data from the NYTimes database to visualize the spread and effects of the disease on any county in the United States. Learned how to properly use Matplotlib, Pandas, and iPyWidgets to create widgets in Python.

GitHub Repo: <https://github.com/nekirutnikolai/COVID-19-Tracker>
