# Rajat Gupta

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## Professional Summary

Mechanical engineer with hands on experience designing, testing and building control driven mechanical systems. Background includes UAV prototyping, multi-DOF robotics, multibody simulation, fluid-based automation, and embedded control. Interested in hands on development of systems at the intersection of mechanics, controls, and real world behavior, particularly in robotics, aerospace and experimental platforms.

## Education

**New York University, Tandon School of Engineering**, NY, USA
Master of Science in Mechanical Engineering — Aug 2024 to Present

**Manipal Institute of Technology**, Manipal, India
Bachelor of Technology in Mechatronics Engineering, Minor in Digital Marketing — Sept 2020 to May 2024

## Experience

**LawgicHub AI**, Remote
Head of Systems Strategy — 2024 to Present

- An AI driven legal technology startup for intelligent document and case management.
- Led system architecture planning, market research, UI integration, investor outreach, and international hiring.
- Applied systems engineering principles to design multi agent automation workflows for legal document ingestion, analysis, drafting, and revision, incorporating verification loops to cross check outputs across agents and reduce hallucination and formatting errors.

**Emerson Automation Solutions**, Pune, India
Mechanical Engineering Intern — Jan 2024 to June 2024

- Applied Maynard Operation Sequence Technique (MOST) to optimize butterfly valve assembly, reducing lead time by 13 seconds per valve per assembly cell with a 15.6% theoretical throughput gain upon scaling.
- Conducted time motion and PERT analysis to identify non value adding steps and ergonomic inefficiencies.
- Standardized workflows and presented layout changes adopted by management.

**Shapoorji Pallonji Group**, Mumbai, India
HVAC Engineer, Intern — Jan 2023 to June 2023

- Performed heat load calculations, developed BOQ's and deisgned piping schematics for the New Delhi Railway Station project.

## Projects

### 18 DOF Hexapod Robotic Platform

- Designed and built a 6-legged 18-DOF robotic platform, implementing three actuated joints per leg for full spatial articulation under $150.
- Led fulll stack system development including mechanical design in Fusion 360, electronics integration, embedded control, and wireless communication.
- Optimized mechanical design around actuator placement, joint geometry, load paths, and manufacturability, accounting for tolerances, fastener fits, and 3D printing constraints using PLA.
- Implemented ESP32 based WiFi control and synchronized multi joint actuation, demonstrating coordinated full fidelity leg motion across all 18 degrees of freedom for a runtime of 5 mins.

### Vision Guided Payload Delivery UAV Testbed

- Built and tuned a 250 mm quadrotor using Betaflight as a low SWaP experimental platform.
- Performed PID tuning and vibration filtering to improve hover stability.
- Configured failsafe state transitions to enforce controlled throttle reduction and attitude stabilization rather than motor cutoff.

- Integrated simulation-based reinforcement learning experiments in NVIDIA Isaac Sim, where PPO agents generated desired attitude commands that were conceptually mapped to a traditional PID-controlled flight stack, highlighting hybrid ML and classical control architectures..

**Kinetic Assist Launch Dynamics and Sequential Release Control Sim**

- Developed a Python and MuJoCo simulation framework for kinetic launch systems inspired by SpinLaunch architectures.
- Modeled rotational dynamics, centrifugal imbalance forces, hinge reaction loads and performed heuristic optimization of launch angle, spin rate, and release timing.
- Designed a sequential two impulse release concept that reduces post release oscillatory hinge loads by 90

**Closed Loop Thermal Control of Solar Panel Efficiency**

- Designed and implemented a closed loop evaporative cooling system to mitigate PV temperature losses.
- Created second order thermal models and validated controller behavior in Simulink.
- Achieved 5 to 7 degree Celsius reduction in steady state panel temperature and produced repeatable, stable actuation cycles that closely matched Simulink predictions.

**NYC Subway Arrival Countdown Display**

- Built a desk mounted real time subway arrival countdown display for New York City transit, integrating live transit data, microcontroller timing logic, and fault-tolerant update handling for unreliable network conditions.
- Designed and fabricated a clean enclosure with attention to tolerances, fit mechanisms, and manufacturability to create a polished desk ready product.

**Single Propeller Monocopter with Thrust Vectoring Control (In Progress)**

- Designing a single propeller aerial platform using servo actuated thrust vectoring for attitude control.
- Focused on mechanical layout and torque compensation challenges inherent to monocopter configurations.
- Developing analytical models and early prototypes to evaluate control authority, stability limits, and coupling between thrust and attitude dynamics.

## Technical Skills

**Design and Simulation:** SolidWorks, AutoCAD, Fusion 360, Simulink, ANSYS Mechanical
**Programming and Computational Tools:** Python, MATLAB, C, Excel advanced modeling, Basilisk, MuJoCo, Betaflight, Isaac Sim
**Control Systems and Embedded Platforms:** PID tuning, Arduino, Raspberry Pi, ESP32, embedded systems integration, control loop implementation
**Robotics and Mechatronics:** UAV platforms, multi-DOF mechanisms, sensor integration, actuator control, reinforcement learning PPO
**Prototyping and Manufacturing:** CNC machining, polymer 3D printing, metallic 3D printing, hydraulic and pneumatic systems, rapid prototyping, tolerance analysis, mechanical assembly
**Mechanical Systems:** Thermofluid systems, energy efficiency analysis, vibration analysis, HVAC system design.