

# Neeraj Gandhi

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## Education

Received academic awards from **computer science**, **electrical**, and **mechanical** engineering departments

University of Pennsylvania	<b>Ph.D. Computer Science</b>	Expected May 2024
	<b>M.S. Robotics</b>	2020
University of Virginia	B.S., Computer Engineering	2017

## Projects

### DISTRIBUTED CYBER-PHYSICAL SYSTEM SAFETY & SECURITY

University of Pennsylvania, 2018 - Present

- Formulated **MILP** problems in **Gurobi** for task allocation in multi-mode realtime systems
- Developed **security protocols** to guarantee recovery of the system within bounded time of benign / adversarial fault
- Developed **mode-change protocols** to transition system from one mode to next in event of benign / adversarial fault
- Designed **PCB** in **Altium** for new electronic architecture to enable novel security protocol in multi-robot systems.
- Implementing serial communication between chips over I2C and SPI buses
- First-author papers published in EuroSys 2021, RTAS 2020 | one paper to-submit
- **Guiding** student group in adapting techniques to data center streaming applications

### ROTOR FAULT DETECTION, ISOLATION, AND RECOVERY IN MODULAR ROBOTS

University of Pennsylvania, 2018 - Present

- Discovered a relationship between faulty rotor and state error; used this to find faulty rotors in modular robots with dozens of rotors
- Developed algorithm to self-reconfigure a modular robot to mitigate the impact of a faulty rotor on the motion of the system
- Contributed **open source** minimum-snap **trajectory planner** to [github.com/swarmslab/modquad-simulator](https://github.com/swarmslab/modquad-simulator)
- First author paper co-published in RA-L 2020 & ICRA 2020 | one paper to-submit
- **Guiding** student group in extending techniques to eVTOL systems

### TEAM FOUNDER & LEADER, NASA ROBOTIC MINING COMPETITION

University of Virginia, 2013 - 2017

- Spearheaded **team management**, **systems integration**, and manufacturing of custom-designed  $\approx$  80kg robot to mine on Mars
- 2016 **Honorable Mention for Innovation** for (1) first working auger-based mining and screw propulsion systems in competition history; and (2) fault-tolerance: system able to correct orientation after tumbling in sandy Martian terrain
- Annually **fundraised** \$5K-\$10K for project via funding proposals to engineering school
- Designed controls PCB using **Eagle ECAD** to integrate XBEE, Propeller microcontrollers, sensors, and motor drivers
- Designed chassis, gear boxes, and managed sub-assembly integration in **SolidWorks**
- **Competition Video**: <https://youtu.be/g8ZjUn0TVRY>

### DEMENTIA AGITATION PREDICTION

University of Virginia, 2014 - 2017

- Developed **open source** Eagle ECAD libraries: <https://github.com/ng4mf/EagleLibs>
- Designed and built PCB to connect sensors to BeagleBoard microcomputer, where data was used to predict agitation episodes
- Designed casing in SolidWorks to house sensors and microcomputer so as to be easily deployed in real dementia patient homes
- Developed Android application to collect patient and caregiver feedback
- Co-authored paper in CHASE 2017

### PHOTOACOUSTIC IMAGING FOR IMPROVED SURGICAL GUIDANCE

Johns Hopkins University, 2016

- Designed phantom in SolidWorks – and built it – to mimic carotid arteries for intranasal transphenoidal surgery
- Analyzed photoacoustic image data collected with and without da Vinci surgical robot to determine helpfulness during surgery
- First author papers in SPIE BIOS & Journal of Biomedical optics, co-authored paper in ICRA 2017

## Selected Publications

- ③ REBOUND: Defending Distributed Systems Against Attacks with Bounded-Time Recovery  
N. Gandhi, E. Roth, B. Sandler, A. Haeberlen, L.T.X. Phan  
EuroSys 2021
- ② Self-Reconfiguration in Response to Faults in Modular Aerial Systems  
N. Gandhi, D. Saldaña, V. Kumar, L.T.X. Phan  
ICRA & Robotics and Automation Letters 2020
- ① Bounded Time Recovery for Distributed Real-Time Systems  
N. Gandhi, E. Roth, R. Gifford, L.T.X. Phan, A. Haeberlen  
RTAS 2020

## Skills

<b>Software/Programming</b>	ROS, Gurobi, ns-3, git, Linux    C++, C, Python, MATLAB, Bash
<b>Electrical/Electronics</b>	Altium, KiCAD, Eagle, PIC, MSP430, XBEE, Raspberry Pi, Oscilloscope, Soldering
<b>Mechanical/Manufacturing</b>	SolidWorks, AutoCAD, CNC Mill, Water Jet, Plasma Cutter, Laser Cutter, Lathing, Welding
<b>Natural Languages</b>	(Fluent) English, Hindi, Marwari; (Low Intermediate) Mandarin