Ghanghoon **Paik, Ph.D**

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Research Project

Team TK6

Apr. 2022 - PRESENT

Core Member — *United States*

- 2022 ***NIST First Responder UAS Indoor Challenge*** (Prize: $ 80,000)
  - Achieved 3rd place in the final competition and won First Responder's Choice award
  - Designed and developed a custom built quadcopter for GPS denied indoor scenarios and emergency situations
  - Integrated RGB/IR/Thermal sensors with WiFi and FPV system for stable and long distance connectivity
  - Developed a customized high speed WiFi telemetry and sensor transceiver using ESP32 modules and web based smartphone app
  - Implemented a high sensitivity optical flow to ensure UAS stability at different lighting conditions and flight modes
  - Conducted thorough bench/field tests on power, comms, and electronics systems in various environments

Robot Ethics and Aerial Vehicles Lab

Jan. 2022 - Aug. 2024

Research Collaborator — *University Park, PA*

- Collaborated on an Interactive and Collaborative Robot Assist Project
- Controlled robots to perform human-robot interactions during simulated conditions
- Designed research models to evaluate human behavior in multiple simulated conditions
- Conducted maintenance and development of robots controlled by ROS with camera vision and real-time video streaming via GStreamer
- Setting up a autonomous ground robot via Autoware software package
- Developing a ROS environment for autonomous ground robot using AgileX Ranger Mini V2
- Currently working on conference/journal papers with collaborators

Autonomous Robotics Competition Club

Aug. 2020 - Aug. 2024

Core Member — *University Park, PA*

- 29th and 30th ***Annual Intelligent Ground Vehicle Competition***
  - Led as a team leader and lead engineer for software, controls, and electronics systems
  - Designed and developed an autonomous vehicle capable of carrying up to 20 lbs of payload
  - Reverse engineered the ARM ESC microcontroller chip to run customized firmware and integrated it into the vehicle
  - Implemented a fully tuned PID controller on the ESC to manage motor speed using C++ on a Raspberry Pi Pico
  - Developed a pathfinding algorithm for the ground vehicle to navigate an obstacle course and follow GPS coordinates
  - Created a real-time lane and obstacle avoidance algorithm for Intel Realsense and LiDAR using OpenCV/C++ and customized ROS packages
  - Built a simulated environment using Gazebo and performed bench/field tests to optimize the vehicle performance
- 2021 and 2022 ***VFS Design-Build-Vertical Flight Student Competition*** (Prize: $500)
  - Won the Best Computational Simulation Award, 1st place in preliminary report, and 3rd place in finals
  - Developed a quadcopter's trajectory and vision system using Intel RealSense and LiDAR through ROS
  - Collaborated on the design and testing of the quadcopter's structure, power, and electronic systems
  - Calibrated and tuned the flight controller with IMU, GPS, and PID for optimal stability

Astrodynamics Research Group of Penn State

Jan. 2017 - Aug. 2024

Member — *University Park, PA*

- 9th and 10th ***ESA Global Trajectory Optimization Competition***
  - Ranked 7th among all US teams and 1st among US student teams
  - Collaborated on developing a k-Means clustring and graph search algorithm to minimize mission cost
  - Collaborated on developing an parallelizable optimal trajectory design and search algorithm
- Student Competition for the 2017 ***AAS/AIAA Astrodynamics Specialist Conference***

Powered Multiple Gravity Assist Research Project

Aug. 2015 - Aug. 2024

Graduate Student — *University Park, PA*

- Powered Multiple Gravity Assist Mission Planner
  - Developing an automated mission planning software with C++ using mathematical modeling, heuristic, and graph search algorithms
  - Developed numerical ODE solver, PSO, and DE run 10-100 times faster than MATLAB and achieved higher accuracy
  - Developed a fully automated optimal sequence search method using a customized tree-based search algorithm
  - Implemented N-Body dynamics and nonlinear programming techniques to describe and solved dynamic system problems
  - Building a massively parallel C++ libraries for time/fuel optimal trajectory design and visualization

Work Experience

HPC Software Consultant
Jan. 2017 - PRESENT

Institute for Computational and Data Sciences, Pennsylvania State University — *University Park, PA*

- Developed a system performance analyzing tool
- Lead daily customer-facing engagement resolving researcher's difficulties in using clusters and scheduler
- Lead multiple meetings to negotiate and finalize SLAs to ensure PI's satisfaction and success
- Conducted module and software analysis on the cluster to identify missing or malfunctioning components
- Provided code analysis services to clients of the Advanced Cyber Infrastructure provided by ICDS at Penn State
- Developed system monitoring tools for the cluster
- Troubleshot and optimized programs using various software packages such as C/C++, OpenMP, MPI, MATLAB, R, Python, COMSOL, and Ansys, on Legacy, ROAR, and ROAR Collab clusters
- Monitored jobs and schedulers (PBS and SLURM) on RHEL as part of Systems Engineering tasks
- Installed various open-source and licensed software and created Singularity recipes on Github

Contributor to Singularity Hub — *Aug. 2018 - Apr. 2021*

- Recognized as one of the top contributors to the Singularity Hub and provided multiple public containerized environment projects with various tools
- Participated in functional testing with developers to ensure software quality and performance

Parallel Computing Support Application Engineer
Jun. 2021 - Aug. 2021

MathWorks — *Natick, MA*

- Designed and implemented parallel computing support packages using bash and MATLAB scripts
- Developed internal testing tools and provided Git repository management and updates
- Led meetings to support HPC implementation across multiple systems and schedulers
- Customized parallel computing scripts and performed functional testing on various systems and schedulers
- Documented customized package data and instructions for internal and external use
- Engaged with 5-6 different institutes across the world

Graduate Teaching Assistant
Aug. 2015 - Dec. 2016

College of Engineering, Pennsylvania State University — *University Park, PA*

- TA in Aerospace Analysis (AERSP 313)
- TA in Programming for Engineers with MATLAB (CMPSC 200)
- Led weekly interactive lab sessions for 30-60 students
- Conducted weekly lecture-style office hours to support students with course materials

Skills

Programming C/C++, Python, MATLAB, OpenCV, OpenMP, MPI, ROS, R, Bash scripting

Tools PyTorch, Git, SolidWorks, COMSOL, Ansys STK, KiCad, Git, Docker, Apptainer, RHEL, JIRA/Confluence

Education

Ph.D in Aerospace Engineering
Aug. 2024

Pennsylvania State University — *University Park, PA*

- Ph.D Minor in Computational Science
- Dissertation title: Multiple Gravity-Assist Trajectory Design With Continuous-Thrust Synergetic Maneuvers (Advisor: Dr. Robert Melton)

M.S. in Aerospace Engineering
May 2015

Pennsylvania State University — *University Park, PA*

- M.S. Minor in Computational Science
- Thesis title: Optimal Orbit Raising Via Particle Swarm Optimization (Advisor: Dr. Robert Melton)

Paper

Google Scholar
2015 - PRESENT

- `https://scholar.google.com/citations?user=AV4ZtiwAAAAJ&hl=en&authuser=1`