

SAMSAAM ALI BAIG

PhD Candidate — Robotics, Control & AI for Autonomous Systems

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Master's in Advanced Mechatronics specializing in nonlinear observer design, physics-informed neural networks, and safety-critical control for autonomous systems (ISAT internship). Skilled in modeling complex systems (MATLAB/Simulink), ROS Python/C++ development, and experimental validation. Seeking a PhD in robotics, control, and AI for autonomous systems. First-authored a journal paper (in preparation) on a PINN observer, with open-source code on GitHub. Strong foundation in state estimation, and embedded systems; eager to advance research at the intersection of control, robotics, and AI.

EDUCATION

Masters in Advanced Mechatronics | 15.34 /20 | 120 ECTS **Sep 2024 – Sep 2026**
Université Savoie Mont Blanc | Polytech Annecy, France
Signals and Systems, Continuous Control, Modelling, Simulation and Numerical Analysis, Architecture and Robotics, Projects

Bachelor of Mechanical Engineering | CGPA: 3.36 / 4 | 240 ECTS **Sep 2018 - Aug 2022**
University of Engineering and Technology, Peshawar Pakistan
Manufacturing, Mechatronics, Production Automation, Automatic Control Power Plant, Heat & Mass Transfer

PROFESSIONAL EXPERIENCE

Research Intern — Physics-Informed Neural Network Observer for 12 State Quadrotor under partial measurement
DRIVE-SIC Laboratory, ISAT at Université Bourgogne Europe,| **May 2026 – Sep 2026**

Developed a physics-informed neural network (PINN) observer in PyTorch that reconstructs a quadrotor's six hidden velocity states from partial pose measurements, extending the PINN-Obs method to a full twelve-state, controller-driven system (hidden-state RMSE ≈ 0.056, robust to sensor noise and ±20% model error). First-authored a journal paper (with Dr. A. Chaibet), in preparation, with reproducible open-source code and datasets on GitHub (github.com/alisamsam/pinn-quadrotor-observer), including an original negative result on the method's adaptive learned gain. (***link***)

Environmental Data & Sustainability Intern *AGA KHAN SCHOOLS, Geneva* **July 2025 –Nov 2025**

Prototyping a smart solution for measuring carbon footprint by using autonomous systems, based on microcontrollers and an integrated and centralized system. Structured and analyzed sustainability metrics (water/energy/GHG) and coordinated with 10+ regional facilities managers for data collection from 100 + schools based on 10 different countries.

Climate and Environment Intern *Aga Khan University*, *London* **Oct 2024 - Dec 2024**

Developed learning outcomes, coordinated with students to create the conference theme and schedule, and facilitated the selection of student presenters. Collaborated with the Aga Khan Schools network, identified guest speakers, and managed the logistical plan for the conference.

Sustainable Buildings and Energy Audit Intern *Aga Khan Agency for Habitat Pakistan* **Jul 2024 - Aug 2024**

Primary focus on sustainable building: energy monitoring, and auditing. Also conducting HVRA (Hazard Vulnerability and Risk Assessment), implementing early warning systems, and performing hazards and risk mappings. Additionally, conducted site visits to various construction sites to oversee the MEP aspects.

Research Assistant (3D Modeling & Simulation) *NUST UNIVERSITY*, *Islamabad* **Sep 2022 – Mar 2024**

Actively engaged in 3D design and simulations (COMSOL, Solidworks/CREO) for chemical and material processes. Analyzed porous media structures for efficient engineering solutions (catalyst supports, filters)

TECHNICAL & RESEARCH SKILLS

- **Robotics & Simulation:** ROS 2 (Humble), ROS 1 (Noetic), Navigation2, SLAM, RViz, Gazebo, Docker, Git
- **Embedded Systems & Hardware:** STM32, Raspberry Pi, ESP32, Arduino IDE, sensors IMU/Lidar/camera, motor drivers
- **Modeling & Analysis:** MATLAB/Simulink, Simscape, COMSOL, Dynamic Modeling, FEA, SolidWorks, Python (PyTorch)
- **Energy & Modeling:** Thermodynamics, heat transfer, energy systems, energy auditing, COMSOL Multiphysics, Simscape,
- **Languages:** English (C1), French (A2)

REFERENCES

Dr. Francoise Grandvaux - francoise.Grandvaux@univ-savoie.fr **Dr. Ahmed Chaibet -** Ahmed.chaibet@u-bourgogne.fr

TECHNICAL PROJECTS (Research Emphasis)

Master Thesis: Learning to Observe: Physics-Informed Neural Network Design for UAV State Estimation under Model Uncertainty | *Laboratoire DRIVE, Université Bourgogne Europe (UBE)*| link
Designed and trained a Physics-Informed Neural Network (PINN) observer for autonomous quadrotor state estimation, generalizing to unseen trajectories across circle, figure-eight, and spiral paths.

Undergraduate Thesis: Dynamic Modeling and Analysis of Oil Emulsion Separation | *University of Engineering & Technology (UET)Pakistan* | link
Conducted rigorous dynamic modeling and finite element simulation of oil-in-water and water-in-oil emulsion behavior using COMSOL Multiphysics.

Eurobot Challenge – Autonomous Robot Software Architecture | *Polytech Annecy-Chambéry* |link
Developed autonomous robot for hazelnut crate collection using ROS 2 Humble and Gazebo simulation, Implemented Navigation2 stack (nav2_bringup, AMCL, slam_toolbox) for collision-free path planning.

Model Context Protocol (MCP) Development for LLM-MATLAB Integration | *Polytech Annecy-Chambéry* | link
Developed two-way API architecture enabling Claude AI to autonomously control MATLAB/Simulink simulations.

Biomechanics Modeling for Postural Control Analysis | *Polytech Annecy-Chambéry* | link
Developed Simscape Multibody model of Winter's inverted pendulum for prosthetic ankle design applications and Processed experimental data from Kistler force platforms and EMG sensors using signal processing (FFT, PSD).

Mobile Robotics & ROS Development (Horizon Sunrise X3 Pi) | *Polytech Annecy-Chambéry* | link
Developed high-level control nodes in ROS1 (Noetic) for the Horizon Sunrise X3 Pi mobile platform, utilizing Gazebo for simulation and RViz for visualization. Integrated and calibrated multiple sensors (IMU, Lidar, Camera) to enable localization and environment mapping.

Smart Pill Box: Assistive Embedded System | *Polytech Annecy-Chambéry* | link
Designed and fabricated a complete embedded system using an ESP32 microcontroller, integrating sensors (FSR, reed switch) for state monitoring. Established connectivity via a Flask web server for remote data monitoring and CallMeBot notification integration.

3D Modelling of the Jet Turbine | *University of Engineering & Technology (UET) Pakistan* | Link
CAD modelling and working mechanism animation of Jet turbine n PTC CERO.

Detailed Material product analysis of the Kemei (KM-2668) ladies shaver machine | *University of Engineering & Technology (UET) Pakistan* | link
The object of this report is to give an in-depth Cradle to grave analysis of the electrical appliance of the electric rechargeable Shaver Machine.

Failure Analysis of Machine Shaft | ***University of Engineering & Technology (UET)*** *Pakistan* | link
Performed the failure analysis of the machine shaft and find out the best possible solutions to minimize these failures.