



**Avinash Kumar Dubey**  
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## Summary

Control and Robotics Engineer specializing in multi-agent systems, decentralized control, and optimal trajectory planning, with 12+ peer-reviewed publications (IEEE, ACC, IFAC). Proven expertise in MPC, Kalman filtering, LQR, and sensor fusion with implementation in autonomous drones and IoT-enabled systems. Adept in MATLAB, Python, Embedded C, and real-time embedded hardware. Coordinated national-scale robotics outreach, setting up 250+ labs and guiding 1400+ educators. Skilled in developing scalable, intelligent solutions for autonomous vehicles, energy systems, and industrial automation with hands-on experience in IoT and drone-based platforms.

## Specialization & Certifications

- **Energy Production, Distribution & Safety** : Enhanced working knowledge of electric power systems, energy markets, natural gas operations, and OSHA-aligned safety standards.
- **Applied Kalman Filtering**: Designed and implemented linear, nonlinear (EKF, UKF, CKF), and particle filters for state estimation, target tracking, and navigation. Covered robust filtering techniques and real-world adjustments beyond standard assumptions using Octave/Matlab-based implementations.
- **Digital Technologies and the Future of Manufacturing**: Gained insights into Industrial Internet of Things (IIoT), digital twin modeling, and additive manufacturing technologies.
- **Algorithms for Battery Management Systems**: Strengthened understanding of BMS architecture, equivalent circuit modeling, and SOC estimation techniques. Simulated battery behavior using RC models and implemented algorithms for state-of-charge (SOC) tracking.
- **Self-Driving Cars**: Programmed algorithms for vehicle localization using Kalman and particle filters, and built vision pipelines for lane detection and object classification. Acquired hands-on experience with the **CARLA simulator** for testing perception and localization in realistic urban scenarios.

## Skills

- **Control, Estimation & Robotics**: MPC, LQR, PID, Kalman Filters (EKF, UKF), Particle Filters, Sensor Fusion, Consensus & Containment Control in Multi-Agent Systems
- **Programming & Modeling**: MATLAB/Simulink, Python, Embedded C
- **Perception & Vision**: OpenCV (basic), CARLA Simulator (for localization & perception validation)
- **Embedded & IoT Systems**: Raspberry Pi, ESP8266, Arduino, MQTT, ThingsBoard

## Education

**Ph.D. in Control & Computing**, *IIT Bombay*, CPI: 8.79 2018–Present  
**M.Tech in Control Systems**, *NIT Kurukshetra*, CPI: 8.02 2010–2012  
**B.Tech in Electronics & Comm.**, *UPTU*, 62.6% 2006–2010

## Experience

**PhD Researcher**, *IIT Bombay* 2018–Present

- Published **12+ peer-reviewed papers** in leading control conferences, including **ACC, MED, and IFAC-PapersOnline**; full list available on Google Scholar.
- Evaluated **Robustness of consensus performance** in multi-agent systems using  $\mathcal{H}_2$  norm, uncovering critical insights on the role of cycles and network topology.
- Formulated **decentralized consensus algorithms** for **directed graphs with cycles**, enabling robust coordination in dynamic and asymmetric communication networks.
- Proposed a **scalable containment control strategy** for multi-agents formations, capable of accommodating **arbitrary numbers of follower agents**; validated on **Crazyflie drone swarm**.
- *Research directly supports control and coordination in energy networks, autonomous robotics, and distributed cyber-physical systems.*

**Project Research Associate**, *ARDB, DRDO, IIT Bombay* 2023–2024

- Planned a **Dubins-path-based trajectory planning algorithm** that satisfies **terminal time and angle constraints**, enhancing path optimality for autonomous vehicle applications.

*Leadership & Program Management*

- Orchestrated a nationwide robotics outreach program; established **250+ labs** and empowered **1400+ educators** across Asia under MoE funding.
- Directed a team of 6+ members in delivering **35+ workshops**, standardizing instructor training across 100+ institutions.
- Facilitated **2 national-level e-Yantra Design Sprints (eYDS)** and coached **25+ student teams** for the e-Yantra Innovation Challenge (eYIC).
- Coordinated recruitment drives and curriculum planning; led interview panels and onboarding for 100+ project assistants and interns.

*Hands-on Robotics & Control Development*

- Conceptualized and fabricated **4 educational robot platforms** (e.g., Biped Patrol, Dairy Bike), achieving **50% size reduction** while doubling onboard capabilities.
- Constructed **2 full-stack training robots** used by **5000+ students** to teach advanced control: linearization, nonlinear systems, LQR, and digital control.
- Devised a custom MATLAB GUI for PID tuning exercises, for **100+ participants** nationwide.
- Mentored **8+ project teams** in embedded control applications including Ball Bot, Hopping Bot, Self-Balancing Robots, and Formation Control Systems.

*Embedded Systems & IoT Integration*

- Deployed an IoT-enabled smart irrigation prototype using **ESP8266, MQTT**, and integrated a user dashboard on **ThingsBoard**.
- Enabled real-time data visualization and remote actuation for hardware-in-the-loop systems.
- Supervised microcontroller-based automation projects and conducted practical sessions on real-time communication protocols.

*Assistant Professor, Sharda University & IEC College*

2012–2017

- Taught 10+ undergraduate and graduate-level courses in control systems, analog/digital communication, and antenna design.
- Advised 6 B.Tech thesis projects, resulting in **2 peer-reviewed publications** co-authored with students.
- Launched GATE coaching for the ECE department, leading to **16 student qualifications in GATE 2014**.
- Oversaw hostel facility operations and student mentorship as part of campus administration.

**Extracurricular Responsibilities**

- Served as a Teaching Assistant for 5 editions of Applied Linear Algebra (IITB/NPTEL), 4 editions of Control Systems Lab, and 1 Control Systems Theory course.
- Awarded **Best TA** for EE635 (Spring 2020-21) and EE302 (Autumn 2021-22).
- Set-up the **Cooperative Control and Multi-Agent Systems Lab** under Prof. Dwaipayan Mukherjee.
- Procured and integrated **Crazyflie Drone System** for consensus and containment experiments; enabled **50+ flight trials** across 5 research projects.

**Academic Projects**M.Tech **Control and Performance Analysis of Haptic Device**, *NIT Kurukshetra*

- Thesis
- Investigated methods to reduce inertia in haptic devices based on device parameters and operating modes.
  - Performed stability assessment of human-machine interaction using hybrid impedance-admittance frameworks.

B.Tech **Online Instrument Control (Ground Robot)**, *GLA Institute of Tech. & Mgmt.*

- Project
- Curated a ground robot monitoring system using embedded internet technology.
  - Created a web-based client-server interface using HTTP protocol for real-time control and telemetry.

**Hobbies**

Lateral thinking, trekking, and cricket discussions.