Arnav Pandey

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Education and Test Scores

2020–2024 **Indian Institute of Technology (IIT) Kanpur** CPI: 7.6/10.
Bachelor of Technology (B.Tech) in Mechanical Engineering

2025 TOEFL iBT: 110/120 | GRE General Test: 325/340 (170/170 Quant) .

Publications

2024 [1] **Pandey, A.**, Haneef, J., Sinha, Y., Chaurasiya, K.L., Bhattacharya, B., 2024, May. *"Design and development of a shape memory alloy-powered rotary variable stiffness actuator embedded with an agonist-antagonist mechanism"*. In *Active and Passive Smart Structures and Integrated Systems XVIII* (Vol. 12946, pp. 468–477). SPIE. [DOI]

2024 [2] Subudhi, K.P.*, **Pandey, A.***, Chandraprakash, C., 2024, August (in press). *"A soft robot for the rescue of a child trapped in a borewell"*. In Proceedings of INCAM 2024. Springer Nature.

* equal contributors

Awards and Achievements

2024 ***Jayesh Memorial Award*** | 57th Convocation | Dept. of Mechanical Engineering, IIT Kanpur
For the best undergraduate project work [1] amongst all graduating students.

2024 ***Winner - HackAIthon 2024*** | Cisco Systems, Inc
The project "Snooker Ball Tracking Using Computer Vision" won the global hackathon.

2023 ***ISSS UG Student Project Award*** | Institute for Smart Structures and Systems (ISSS)
International Conference on Micro, Nano and Smart Systems (IC-MNSS 2024)
For outstanding innovation in undergraduate research [1].

2022 ***Silver Medal, Silicon Labs Social Entrepreneurship Challenge*** | 10th Inter-IIT Tech Meet
Runner-up amongst the 23 IITs for developing an IoT-based cloud health-monitoring system.

2018 ***Techkriti Open School Championship(TOSC) Finalist*** | IIT Kanpur
Selected amongst the top 50 nationwide to present a smart card-based fuel efficiency project.

2017 ***Uttar Pradesh State Talent Search Examination (UPSTSE) Scholar*** / *Govt. of U.P., India*
Awarded to 1000 students to encourage a research career in science.

Professional Experience

Cisco Systems, Inc, India

August 2024 - Present *Software Engineer, Catalyst Engineering*.

- Contributed to the cloud infrastructure powering real-time data pipelines for **indoor navigation**, **asset tracking**, and **mapping** using Wi-Fi and Meraki camera feeds.
- Managed **cloud orchestration** using K8s, Docker, and AWS for Cisco Catalyst devices.
- Developed **visual analytics workflows** on Meraki camera streams for a snooker ball-tracking system with 2-DOF Arduino-controlled lasers to automate foul detection, which reduced the latency by 95%.
- Performed literature review and delivered a tech talk titled *"Rapyuta: a cloud robotics platform"*.

May 2023 - July 2023 *Software Intern, Cisco DNAC- DevOps Team.*

- Developed Flask-based backend APIs for the SCUBA scalability dashboard, leveraging **sensor data** from vSphere, secured with BasicAuth, and enhanced with Python automation using Bitbucket REST APIs.
- Retrieved cluster build data and leveraged Kibana APIs for visualization and trend analysis.

Research Experience

SMA-based Variable Stiffness Actuator [1]

Dec 2022 - April 2024 *Undergraduate Student Researcher* | Smart Materials, Structures and Systems (SMSS) Lab .

Paper

- Prototyped a Shape-Memory Alloy **(SMA)**-powered variable stiffness actuator for safe and adaptable robotic joint articulation in physical **Human-Robot Interaction (HRI)**.
- Analyzed the weight-bearing characteristics of Shape Memory Alloy (SMA) springs by training Artificial Neural Networks **(ANN)** on displacement data acquired from a laser-based deflection sensing, enabling **performance prediction** under varying thermal and biased load conditions.
- Structured a **control framework** utilizing a Long Short-Term Memory (**LSTM**) to model nonlinear, time-dependent behaviour of the actuator under fluctuating inputs and temperature dynamics.
- Designed and implemented a **real-time deflection-sensing system** with an embedded microcontroller (Arduino) and rotary encoder, offering continuous feedback on the actuator deformation.
- Applied Proximal Policy Optimisation **(PPO)** within a **reinforcement learning** framework to effectively achieve **adaptive control** of the SMA actuator through **learning-driven motion control**.

Advisor : **Prof. Bishakh Bhattacharya**, *Dept. of Mechanical Engineering*, IIT Kanpur (*Web-page*)

Sakura Exchange Program, Japan

February 2024 *Kyushu Institute of Technology, Robotics Group* .

Slides

- Studied **EEG-based communication** through Event Related Potential **(ERP)** and **eye-tracking** with Tobii Glass, and synchronisation patterns in fireflies, metronomes, and **human response behaviour**.
- Programmed a 4-DOF *DOBOT Magician* **robotic manipulator** to perform pick-and-place operations using its suction cup, and developed trajectory logic for drawing texts and geometric shapes.
- Designed and 3D-printed a compliant **bio-inspired robotic leg** using CAD tools, and conducted experiments to evaluate its jumping ability, shock absorption, and overall biomechanical performance.
- Studied multi-body dynamics in **cyber-physical systems** using ontology-based and Absolute Nodal Coordinate Formulation (ANCF) methods for biomechanical motion modelling.
- Reviewed key **societal drivers for robotics** like ageing demographics, labour gaps, and inaccessible environments, highlighting the need for safer HRI.

Advisor : **Prof. Hiroaki Wagatsuma**, *Dept. of Human Intelligence Systems*, Kyutech (*Web-page*)

Soft Robot for Borewell Rescue Operations [2]

April 2022 - July 2022 *Research Intern* | SURGE Program (2022), IIT Kanpur.

- Prototyped a **vine-like soft robot** for the **rescue of children from borewell accidents**, integrating biomimetic growth strategies and continuum navigation to navigate confined vertical shafts.
- Conducted an in-depth literature review on soft actuation and **bioinspired robotics** to guide actuator design, material selection, and structural compliance strategies.
- Designed and developed **soft continuum manipulators** with pneumatically-actuated **fluidic artificial muscles** controlled via air compressors, solenoid valves, and pneumatic regulators.
- Integrated sensors and actuators through **Arduino** Mega, interfacing with HC-05 Bluetooth module, pressure sensors, accelerometers, temperature/humidity sensors, relays, and motor drivers.
- Simulated and analyzed **inverse kinematics** of multi-end-effector soft robot to validate reachable workspace, assess deformation behaviour, and **optimize control precision** under pneumatic actuation.

Advisor : **Prof. Chandraprakash Chindam**, *Dept. of Mechanical Engineering*, IIT Kanpur (*Web-page*)

Selected Projects

Autonomous Underwater Vehicle (AUV)

May 2021 - April 2023
Code

Senior Technical Member | Team AUV-IITK .

- Implemented **YOLOv3** for object detection and a custom landmark-based **Visual FastSLAM** (*code*) in C++ for AUV localization, integrating it into the robot's navigation stack and evaluating its performance on the multi-sensor Caves dataset *(data)* for real-world underwater scenarios.
- Analyzed RatSLAM, BioSLAM, and GraphSLAM algorithms to assess their bio-inspired and graph-based approaches for robust **underwater navigation and mapping** in low-visibility, sensor-noisy environments.
- Implemented an Extended Kalman Filter **(EKF)** *(code)* for **multi-sensor fusion** of **camera feeds**, Doppler Velocity Log **(DVL)**, and Inertial Measurement Unit **(IMU)** data for navigation.
- Mentored junior members through lectures and tasks, guiding them to compete in Robosub and SAUVC.

Advisor : **Prof. Indranil Saha**, *Dept. of Computer Science & Engineering*, IIT Kanpur (*Web-page*)

Biometric Rapid Automated Health Monitoring Assistant (BRAHMA)

Feb 2022 - April 2022
Report

Silver Medalist | Inter-IIT Tech Meet 10.0.

- Engineered an **IoT-based wearable system** capable of continuous monitoring of six critical vital parameters-SpO_2, pulse rate, blood pressure, ECG, respiratory rate, and body temperature by integrating MAX32664D, AD8232, and flex/temperature sensors into a wrist-worn device.
- Built a **cloud-based health analytics pipeline** with ESP32 data streaming, rules-based risk scoring, and mobile alerts, secured through RSA/AES256 **encryption** and blockchain-backed access logging.
- Designed fail-safe mechanisms (buzzers, LEDs, offline caching) with integrated anomaly detection and deployed **LSTM**-based models on patient vitals to build a real-time Early Warning System.

Technical Skills

Robotics: ROS, Gazebo, Arduino, AutoCAD
Programming: Python, C, C++, MATLAB, Java, SQL
Utilities: Git, Bash, Linux, LaTeX, OpenCV, REST
Cloud: AWS, Docker, Kubernetes, Terraform

Leadership Positions

2023-24 **General Secretary, Science and Technology** | Students' Gymkhana IIT Kanpur

Elected as the student representative by an electorate of over 8,000 students to lead the institute's scientific and technical activities, I headed a 3-tier team of over 600 members overseeing all the clubs and societies. I secured the Director's Grant, raising **$53,000** for the institute's robotics teams, and spearheaded key initiatives including the establishment of an alumni-funded **$1.5M** student-driven innovation lab - *Makerspace*, and led the organizing body of *Techkriti* - Asia's largest techno-entrepreneurial fest.

2022-23 **Coordinator, Robotics Club** | Science and Technology Council IIT Kanpur

Managed the club's finances, industrial projects, and competitions. **Conducted robotics workshops for 70+ underprivileged students**, and led a team of 25 secretaries. Recruited 80 students from 300+ applicants for project allocations and **mentored multiple robotics projects**.

Relevant Coursework

- Machine Learning for Engineers
- Embedded & Cyber-Physical Systems
- Cognitive Neuroscience
- Dynamics
- Robot Motion Planning
- Introduction to Electronics
- Linear Algebra
- Ordinary Differential Equations
- Human Computer Interaction
- Manufacturing Automation
- Design of Machine Elements
- Engineering Design & Graphics

Volunteering and Extra-curriculars

- *Student Guide, IITK:* Ensured junior students' welfare through emotional and academic support.
- *Suicide Prevention Gatekeeper, IITK:* Trained to recognize signs of emotional distress and guide peers toward professional mental health support.
- Prototyped and pitched *"Aphbot"* - an assistive robot for Aphasia therapy at an entrepreneurship event *(Ideathon, IITK-2021). (deck).*