

# Arnav Pandey

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## Education and Test Scores

2020–2024	<b>Indian Institute of Technology (IIT) Kanpur</b> Bachelor of Technology (B.Tech) in Mechanical Engineering	CPI: 7.6/10.
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 child trapped in borewell". In Proceedings of INCAM 2024. Springer Nature.

\* equal contributors

## Professional Experience

### Cisco Systems, Inc, India

August 2024 - *Software Engineer, Catalyst Engineering.*

- Present
- 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 - *Software Intern, Cisco DNAC- DevOps Team.*

- July 2023
- 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 -	<i>Undergraduate Student Researcher</i>   Smart Materials, Structures and Systems (SMSS) Lab .
April 2024  Paper	<ul style="list-style-type: none"><li>Prototyped a Shape-Memory Alloy (<b>SMA</b>)-powered variable stiffness actuator for safe and adaptable robotic joint articulation in physical <b>Human-Robot Interaction (HRI)</b>.</li><li>Analyzed the weight-bearing characteristics of Shape Memory Alloy (SMA) springs by training Artificial Neural Networks (<b>ANN</b>) on displacement data acquired from a laser-based deflection sensing, enabling <b>performance prediction</b> under varying thermal and biased load conditions.</li><li>Structured a <b>control framework</b> utilizing a Long Short-Term Memory (<b>LSTM</b>) to model nonlinear, time-dependent behaviour of the actuator under fluctuating inputs and temperature dynamics.</li><li>Designed and implemented a <b>real-time deflection-sensing system</b> with an embedded microcontroller (Arduino) and rotary encoder, offering continuous feedback on the actuator deformation.</li><li>Applied Proximal Policy Optimisation (<b>PPO</b>) within a <b>reinforcement learning</b> framework to effectively achieve <b>adaptive control</b> of the SMA actuator through <b>learning-driven motion control</b>.</li></ul>

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

- July 2022
- 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](#))

## Awards and Achievements

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

## Selected Projects

### Autonomous Underwater Vehicle (AUV)

May 2021 - Senior Technical Member | Team AUV-IITK .

- April 2023
- 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 - Silver Medalist | Inter-IIT Tech Meet 10.0.

- April 2022
- Report
- Engineered an **IoT-based wearable system** capable of continuous monitoring of six critical vital parameters-SpO<sub>2</sub>, 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, L<sup>A</sup>T<sub>E</sub>X, 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](#)).