

# Arnav Pandey

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## Education

2020–2024 **Indian Institute of Technology (IIT) Kanpur, Kanpur, India.**  
Bachelor of Technology (B.Tech) in Mechanical Engineering

## Publications

- 2024 **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 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.

## Work Experience

Cisco Systems, Inc, India

August 2024 – **Software Engineer, Cisco Spaces Team.**

- Present
- Contributed to **cloud infrastructure** powering **real-time data pipelines** for **edge-perception** and **localization** using Wi-Fi and Meraki camera feeds for **indoor navigation, asset tracking, and mapping**
  - Worked on **cloud orchestration** and infrastructure management with Kubernetes, Docker, and AWS, supporting the Dragonfly PaaS platform for scalable, secure deployment of polyglot applications
  - Engineered **multi-tenant, cloud-agnostic services** for deployment of **event-driven applications** with minimal latency, **supporting scalable real-time processing** for **intelligent systems and automation**
  - Developed **visual analytics workflows** on Meraki camera streams to support **intelligent event edge-detection**, simulating **robotics vision applications** in **resource-constrained environments**
  - Won a global hackathon** for developing a Snooker Ball Tracking System with Meraki cameras and Arduino lasers, automating foul detection via real-time object detection - reducing the latency by **95%**

Sakura Exchange Program, Japan

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

- Explored **multi-body dynamics, compliant materials** for joint support in **exoskeletons**, and studied **cyber-physical systems, ontology-based knowledge representation**, and compliant Absolute Nodal Coordinate Formulation (**ANCF**) methods for advanced biomechanical motion modeling.
- Studied **EEG-based communication** through Event Related Potential (**ERP**) and **eye-tracking** with Tobii Glass, and synchronization patterns in **fireflies, metronomes, and human response behavior**
- 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 bio-inspired robotic leg** using **CAD** tools, and conducted experiments to evaluate its jumping ability, shock absorption, and overall biomechanical performance
- Reviewed key **societal drivers for robotics** like **aging demographics, labor gaps, and inaccessible environments**, highlighting the need for safer **Human-Robot Interaction (HRI)**

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

## Student Undergraduate Research and Graduate Excellence (SURGE) Program 2022

April 2022– **Soft Robotics Research Intern , 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 review of 15+ research papers on **soft actuation**, **fluidic artificial muscles**, and **bioinspired robotics** to guide actuator design, material selection, and structural compliance strategies
- Designed and developed a **soft continuum manipulator** with **pneumatically-actuated segments** and a **compliant gripper**, 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 behavior, and **optimize control precision** under pneumatic actuation

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

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## Awards and Achievements


- 2024 **ISSS UG Student Project Award** | Institute for Smart Structures and Systems (ISSS)  
**International Conference on Micro, Nano and Smart Systems (IC-MNSS 2024)**  
Best undergraduate project
- 2024 **Jayesh Memorial Award** | Dept. of Mechanical Engineering, IIT Kanpur  
For the best undergraduate project work amongst all graduating students.
- 2024 **Winner- HackAlthon 2024** | Cisco Systems, Inc  
The project "Snooker Ball Tracking Using Computer Vision" won the global hackathon
- 2022 **Silver Medal, Silicon Labs Social Entrepreneurship Challenge** | 10th Inter-IIT Tech Meet  
Runner-up among the 23 IITs for developing an IoT-based cloud health-monitoring system
- 2018 **Techkriti Open School Championship(TOSC) Finalist** | IIT Kanpur  
Selected among 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.

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## Selected Projects

### SMA-based Variable Stiffness Actuator

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





April 2024  
 **Paper**

- Prototyped the actuator based on the Mechanically Adjustable Compliance and Controllable Equilibrium Position Actuator (**MACCEPA**) framework, for safe and adaptable robotic joint articulation
- Analysed 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 load conditions
- Structured a **control framework** utilizing a recurrent **Long Short-Term Memory (LSTM)** to model **nonlinear, time-dependent** behavior 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 Optimization (PPO)** within a **reinforcement learning** framework to effectively achieve **adaptive control** of Shape-Memory Alloy (SMA) actuators under complex biased loading scenarios, leading to enhanced system robustness and **learning-driven motion control**

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

## Autonomous Underwater Vehicle (AUV)


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

- April 2023  **Repo**
- Solved **localization** for autonomous underwater vehicles using a custom **landmark-based FastSLAM in C++** () , integrated with ROS, Gazebo, and **RViz** for real-time sensing and simulation.
  - Reviewed and analyzed **RatSLAM**, **BioSLAM**, and **GraphSLAM** algorithms by studying their **biologically inspired mechanisms**, **graph-based optimization**, and **topological mapping** to evaluate suitability for robust **underwater navigation and mapping** in low-visibility, sensor-noisy environments
  - Integrated **SLAM navigation algorithms** with the robot's software stack and evaluated the algorithm's performance using the multi-sensor Caves dataset () for real-world underwater scenarios
  - Implemented an Extended Kalman Filter (**EKF**) () for **multi-sensor fusion** of **camera feeds**, Doppler Velocity Log (**DVL**), and Inertial Measurement Unit (**IMU**) data for navigation

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
  - Developed a **cloud-powered health analytics pipeline** that receives sensor data via an ESP32 **Wi-Fi module**, computes a dynamic **risk score** using a rules-based threshold model, and triggers **push notifications** on a companion mobile app to alert doctors and caregivers during medical emergencies
  - Implemented a multi-layered **data privacy and security architecture**, including **RSA-based end-to-end encryption**, **AES-256 server-side encryption**, and **blockchain-based decentralized access logging**, ensuring tamper-proof storage and controlled retrieval of sensitive patient health records
  - 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
Utilities	Git, Bash, Linux, REST, MS Office, LaTeX
Programming	Python, C, C++, MATLAB, Java,SQL
Cloud	AWS, Docker, Kubernetes, Terraform

## Leadership Positions

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

**Elected representative of 8000+ students**, leading a 3-tier team of **500+** overseeing technical activities across clubs and societies. Directed major initiatives, fostered collaboration among projects, mentored **80+** members for the annual tech meet, and **chaired Pan-IIT Tech Board**

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**

## Standardized Test Scores

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

## Relevant Coursework

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