Arnav Pandey

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Website
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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 **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.

Professional Experience

Cisco Systems, Inc, India

August 2024 - Present ***Software Engineer***, *Cisco Spaces Team*.

- 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 the 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 (VSA)

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

- Prototyped an 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 Optimisation (PPO) within a reinforcement learning framework to effectively achieve adaptive control of SMA 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)

Sakura Exchange Program, Japan

February 2024 — **Slides**

Kyushu Institute of Technology, *Robotics Group*

- 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 modelling.
- Studied EEG-based communication through Event Related Potential (ERP) and eye-tracking with Tobii Glass, and synchronisation 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 ageing demographics, labour 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 - July 2022 — ***Abstract***

Soft Robotics Research Intern *, 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 behavior, 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*** | 57th Convocation | Dept. of Mechanical Engineering, IIT Kanpur
For the best undergraduate project work (SMA-based VSA) 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 (SMA-based VSA)

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 - 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.
- Reviewed and analyzed RatSLAM, BioSLAM, and GraphSLAM algorithms by studying their bio-inspired mechanisms, graph-based optimization, and topological mapping to evaluate suitability 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

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

Project Lead | *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 clubs and societies. I also secured the Director's grant, raising €46,000 for the institute's robotics teams, spearheaded key initiatives including the establishment of an alumni-funded €1.1M 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)*.