Arnav Pandey

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Education

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

2020 **DD Education Centre Kanpur**, *Kanpur, India*.
Class XII, Central Board of Secondary Education (CBSE) — Grade: 92.2%

2018 **Sheiling House School Kanpur**, *Kanpur, India*.
Class X, Indian Certificate of Secondary Education (ICSE) — Grade: 96%

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 – Present ***Software Engineer, Cisco Spaces Team***.

- 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- July 2022 ***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 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*)

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

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

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.

Selected Projects

SMA-based Variable Stiffness Actuator

Dec 2022 – April 2024 ***Paper***

Undergraduate Student Researcher| Smart Materials, Structures and Systems (SMSS) Lab .

- 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 – April 2023 — ***Repo***

Senior Technical Member | Team AUV-IITK .

- 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 – 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
- 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 and tested **robust fail-safe mechanisms** such as on-device buzzers, LED indicators, and offline data caching for scenarios involving power outages, network loss, or sensor malfunctions—integrated with advanced **anomaly detection algorithms** to identify and report faulty sensor data in real time
- Integrated **machine learning models** (LSTM-based deep recurrent neural networks) trained on time-series patient vitals for early detection of health deterioration, aiming to implement a **real-time Early Warning System (EWS)** capable of proactively notifying staff before critical thresholds are crossed

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**

Relevant Coursework

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