# B.ANSHUMAN

**4th Year Undergraduate - Electrical Engineering**

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## Academic Qualifications

| Year | Degree/Certificate | Institute | CPI/% |
|---|---|---|---|
| 2020 - Present | B.Tech | Indian Institute of Technology Kanpur | 9.0/10 |
| 2020 | CBSE(XII) | Jawahar Vidya Mandir, Shyamali | 97.4% |
| 2018 | CBSE(X) | Jawahar Vidya Mandir, Shyamali | 97.2% |

## Scholastic Achievements

- Received **Academic Excellence Award 2021, IIT Kanpur** for the academic year **2020-21**
- Secured **All India Rank 651** in **JEE Advanced 2020** among 1,50,838 shortlisted candidates
- Secured **All India Rank 1638** in **JEE Mains 2020** among 0.8 million applicants
- Secured **All India Rank 44** in **Indian Statistical Institute Admission Test 2020** in B.Math Programme
- **KVPY SX Scholar** in 2020, awarded by **IISc Bangalore**, under the Government of India
- **KVPY SA Scholar** in 2019, awarded by **IISc Bangalore**, under the Government of India
- **NTSE Scholar** in 2018, awarded by **National Council of Educational Research and Training**, New Delhi

## Work Experience

- **Fair Value Beta Automation** | **Goldman Sachs, Dr. Tianmiao Wang** *May 2023 — Jul 2023*
  - Developed end-to-end **ML pipeline** package that generates correlation coefficients between stocks and proxies returns
  - Created dynamic **ETL** pipeline on **Apache-Airflow** scheduler for self-updating stocks data source on **Apache-Hive** DB
  - Implemented **rolling regression** on time-series data collected with centralized configurations using **statsmodels**
  - Created GitLab **CI/CD** pipelines with **92%** coverage of automated testing for package deployment over PyPi
- **Balanced DCCA for Bird Vocalization Detection** | **MadhavLabs IITK, Prof. Vipul Arora** *Aug 2022 — Nov 2022*
  - Developed novel architecture for **skewed multi-modal time-series** dataset for sound event detection
  - Implemented complete model pipeline in **Tensorflow**, included non-uniform distribution sampling for optimal batching
  - Improved F1 score from **76%** to **83%**, surpassing the previous state-of-the-art CRNN performance
  - Paper published and accepted in **IEEE ICASSP'23**, with impact factor of **3.59**
  - Improved F1 score from **76%** to **83%**, surpassing previous SOTA CRNN performance, paper accepted in **IEEE ICASSP'23**

## Key Projects

- **WFSM Logic Locking** | **NeuroCHaSe Group, Prof. Shubham Sahay** *Jan 2023 — Apr 2023*
  - Developed a **novel** defense and attack **logic-locking strategy** for a custom logic architecture on 3D NAND Flash memory
  - Simulated Flash Memory architecture in Python, proved flexible and potentially **infinite key space**, protecting logic against unauthorized use **without hardware overhead**
  - Extensible to protect memory, allowing users to store data that can only be correctly read with the right key
- **MIPS Single-Cycle Processor** | **Course Project, Prof. Urbi Chatterjee** *Mar 2023 — Apr 2023*
  - Developed a modular single-cycle 32-bit processor in **IVerilog** supporting execution of MIPS-I Instruction Set Architecture
  - Built a custom Assembler in Python that converts MIPS-I ISA to 32-bit binaries, demonstrated bubble sort implementation
- **MPC-based landing on Moving Platform** | **Course Project, Prof. Indranil Saha** *Aug 2022 — Nov 2022*
  - Implemented a drone pipeline using RotorS framework and ROS, capable of landing on a path-agnostic moving platform
  - Demonstrated three types of path planning mechanism, given the current location of platform perceived by the drone
- **Few shot Learning** | **SURGE IITK, Prof. Vipul Arora** *May 2022 — Jul 2022*
  - Studied robust features used in statistical and deep learning models for time-series including filter banks, MFCCs
  - Replicated the result of few-shot learning on Omniglot dataset achieving 1-shot based **97.6%** test accuracy
  - Implemented sound event detection using **ProtoNets** and **Model Agnostic Meta Learning** methods in few-shot learning
- **Pluto Drone Swarm Challenge** | **Inter IIT Techmeet 11.0, Drona Aviation** *Jan 2023 — Mar 2023*
  - Led a **team of 10** in **High Prep**, bagging **Bronze** among 22 participating IITs, one of the 2 IITs completing the challenge
  - Created a Python package capable of handling **MSP protocol** packets for low level communication with drone stack
  - Built a custom camera driver with **threading** reaching **60fps** with pose estimation, for adequate 30Hz feedback control
  - Created a custom controller with **Linear Kalman Filter** as state estimator, fine-tuned by logging and flight analysis
- **Automatic identification of solar bursts** | **Inter IIT Techmeet 10.0, ISRO** *Mar 2022 — Apr 2022*
  - Automated demarcation of solar bursts in timeline and their classification given an open-source X-ray light curve dataset
  - Created a multi-filtering algorithm with **outlier detection** to improve performance, developed as a python package
  - Secured the **Second position** out of 22 participating IITs, on the basis of performance and the presentation
- **Direction of Arrival Estimation** | **Course Project, Prof. R. Hegde** *Feb 2022 — Apr 2022*
  - Generated **Spatial Room Impulse Responses** using Image Method, which convolved with plain speech, gave directionality
  - Treated Direction of Arrival estimation as a classification problem on a spherical grid with 5° resolution
  - Implemented a **Convolutional Recurrent Neural Network** on Pytorch that takes in first order Ambisonics-B intensity vector from the above generated speech signals, and predicts one of the 684 lattice points

**MCMC in Julia | Stamatics, IIT Kanpur** *Apr 2022 — Jun 2022*
- Implemented inverse discrete/continuous transform, **accept-reject proposal**, importance sampling estimator in **JuliaLang**
- Analysed the importance of the proposal distributions by judging its bias and variance theoretically and simulation-based
- Implemented MCMC methods including **Metropolis Hastings** algorithm to perform **Bayesian regression**

**Game of Blocks | Science and Technology Council, IIT Kanpur** *May 2021 — Aug 2021*
- Understood principles of **BlockChains**, how a system succeeds to be trustworthy in an otherwise environment
- Implemented Alt-coin cryptocurrency with proof of work mechanism in **Solidity** and **Remix** IDE
- Developed ETH **Smart Contracts** on Instant Run-off Voting and Dutch Auction Mechanisms using Solidity

**Numbers Made Dumber | Stamatics, IIT Kanpur** *Apr 2021— Jul 2021*
- Analysed principles of Number Theory for Cryptography, including Diophantine equations and Congruence Theory
- Implemented standard cryptographic algorithm **RSA** in Python from scratch

**ML with Julia | Association for Computing Activities, IIT Kanpur** *May 2021 — Aug 2021*
- Explored Linux system with Capture the Flag challenges and scripting through Exercism
- Implemented Polynomial Regression Models from scratch in **JuliaLang** and benchmarked using standard implementation
- Implemented derivatives, gradients and Jacobians using concept of Duals and MultiDuals in Julia

**Computational Astrophysics | Science and Technology Council, IIT Kanpur** *May 2021 — Jul 2021*
- Estimated parameters of celestial systems from inference derived by applying **FFT** and **time series kernels** on observations
- Extracted features of datasets from sites including **Vizier** and SDSS using Python's dedicated library **Astropy**

**CSRT Tracking | Aerial Robotics, IIT Kanpur** *Aug 2021 — Oct 2021*
- Developed a **ROS** Package implementing the CSRT Tracker using **OpenCV** to track objects inside an ROI
- Implemented coordinate transformation based algorithm for global pose estimation using camera feed and UAV pose history

**IITK Coin | Science and Technology Council, IIT Kanpur** *Sept 2021 — Oct 2021*
- Developed the **User Interface** of a browser and an app based application, IITK Coin, in a team of 3
- Created a complete visual prototype with the workflow using **Figma** and developed logos using **Adobe Illustrator**

## Technical Skills

| **Languages and Utilities** | **Software and Libraries** |
|---|---|
| C, Javascript, Python, MATLAB, Bash, iVerilog | Pytorch, ROS, Sklearn, Git, Docker, OpenCV, Simulink |

## Positions of Responsibility

**Team Head | Aerial Robotics, IIT Kanpur** *Apr 2021 — Apr 2023*
- Led a team that works on Autonomous Unmanned Aerial Vehicles
- Secured **Bronze** in Inter IIT Techmeet 11.0 on **Swarm control** using single monocular camera for perception
- Qualified for Shaastra'23 by IIT Madras, implemented and executed a complete autonomous pick-up and drop mission
- Involved in Inter IIT Techmeet 10.0 on the problem statement provided by **DRDO** on autonomous navigation of UGV in unknown terrain, securing **Second position**
- Implemented visual Simultaneous Localisation and Mapping for effective localisation and pose estimation

**Secretary | Programming Club, IIT Kanpur** *Sep 2021 — Apr 2022*
- Conducted workshops on pillars of programming, mentored 20 freshers in a summer project on Information Security
- Contributed to the Club's repositories based on deployable projects, directly affecting the campus community

**Secretary | Design and Animation Club, IIT Kanpur** *Jul 2021 — Mar 2022*
- Took part in Team based Rebranding event, the team securing 2nd position out of 9 teams of proficient designers
- Position of Responsibility of holding workshops and introducing freshmen to the concepts of design

**Senior Executive, Design | Udghosh, IIT Kanpur** *Sep 2021 — Mar 2022*
- Involved in the regular creation of graphics for Udghosh, the Sports Festival of IITK
- Involved in the rebranding of the fest and took part in its theme creation and designing of Udghosh'22

## Relevant Courses

| | | |
|---|---|---|
| Fundamentals of Computing | Linear Algebra | Partial Differential Equations |
| *Speech Signal Processing* | Physics I - Mechanics | Physics II - Electrodynamics |
| Introduction to Electronics | Signals and Systems | Control System Analysis |
| Real Analysis | Complex Analysis | Probability and Statistics |
| Microeconomics I | Macroeconomics I | Digital Electronics* |
| Principles of Communication | Power Systems | Electromagnetic Theory |
| Data Structures and Algorithms | Computer Organisation* | Computer Architecture[i] |
| Digital Signal Processing | Operating Systems[i] | Computer Graphics[i] |
| *Cyberphysical and Embedded Systems* | *Introduction to Machine Learning*[i] | Physics of Information Processing[i] |

* - Outstanding Performance, *italics* - *Graduate Course*, i - Ongoing

## Extra-Curricular Activities

- Mentored a project HackIT'22 under Programming Club IITK to introduce freshers to different aspects of Jeopardy based CTFs

- Received 3rd position in COMP'23, Intra-IIT Wall Climbing competition
- Achieved 1st position in Takneek'22, for Evolution Simulation in Python in CGS problem statement
- Achieved 2nd position in a team based rebranding contest organised by Design and Animation Club IITK in 2021
- Created the UI-UX of IITK-Coin, a project of centralised currency system customised for IITK, under SnT Council IITK
- Headed the team Aerial Robotics IITK that works on problems related to Autonomous Unmanned Aerial Vehicles
- Held the position of Secretary in Programming Club IITK, contributed to repositories directly affecting campus community