**Jujhaar Singh** | **200110052**
**Electrical Engineering** | **B.Tech.**
**Indian Institute of Technology Bombay** | **Gender: Male**
**DOB: 9/24/2002**

| Examination | University | Institute | Year | CPI / % |
|---|---|---|---|---|
| Graduation | IIT Bombay | IIT Bombay | 2024 | |
| Intermediate | CBSE | Delhi Public School, Bangalore East | 2020 | 95.60% |
| Matriculation | CBSE | Delhi Public School, Bangalore East | 2018 | 92.40% |

Pursuing a **Minor** in **Computer Science and Engineering**

## Scholastic Achievements

- Earned a **Change of Branch** to the department of **Electrical Engineering** in the **BTech program** among **12** out of **1300**+ students owing to excellent academic performance in the first year *('21)*
- Awarded the **KVPY fellowship** and offered admission at the prestigious **IISc** for an **All India Rank 170** *('20)*
- Secured a percentile of **99.74%** nationwide in JEE(Main) among **1 million** candidates *('20)*
- Ranked in the **top 2%** in JEE(Advanced) amongst more than **150,000** candidates *('20)*

## Key Projects

### Superscalar Out-of-Order and Multi-core Architectures | *Research Project* *(Jun '22 - present)*

*Prof. Virendra Singh*

- Investigated the working of **Superscalar Out-of-Order** and **In-Order Architectures** extensively
- Developed a deep understanding of topics like **Register Renaming**, functioning of **Reservation Station**, **Re-order Buffer** and **Out-of-Order Execution** and their role in exploiting **ILP** in the program
- Analyzed the working of the **Mirage Core** and **DynaMOS Core** architectures which present ideas to achieve performance similar to an **Out-of-Order** core but with the low power consumption of an **In-Order** core
- Implementing the **Mirage Core** design on **sniper**, a **C++** based simulator for **Heterogeneous Multiprocessors**

### IIT Bombay Racing | *Student-led Technical Team* *(Feb '21 - present)*

*IIT Bombay Racing, a 3-tier, all-student team consisting of 70+ members, works on building an electric vehicle for competitions such as Formula Student UK, an international student race car design competition held at Silverstone in England, and Formula Bharat, which is India's very own Formula Student competition*

**Design Engineer, Battery Management System** | *Electrical Subsystem*

- Leading a team of students responsible for the Battery Management System of the car, which monitors **Cell Parameters** to ensure that they are within safe limits and implements **Passive Cell Balancing**
- Designed and programmed the BMS boards using **C++** and the **mbed** framework and libraries to monitor and store critical battery parameters like **Cell Voltages** and **Temperature**
- Implemented a **Daisy-Chain** structure to communicate to 6 slave boards using the **isoSPI** protocol
- Overhauled the data-logging capabilities using a **CAN** based data-logger to store system critical information
- Created a GUI in **Python** using **PyQt5** which connects to the the mbed based master board of the BMS and reads **serial data** which it uses to display critical battery parameters as well as any errors that may have occurred
- Simulating the **Extended Kalman Filter** based **State of Charge Estimation Algorithm** to ascertain its accuracy in calculating SoC against previously collected data

### Regret Minimization in Sample-path Correlated Bandits | *Research Project* *(Jun '22 - present)*

*Prof. Sharayu Moharir*

- Extensively studied the mathematics behind algorithms used in multi-armed bandit setups from the book **Bandit Algorithms** by **Tor Lattimore** and **Csaba Szepesvari**
- Implemented a framework in **Python** to simulate the **Regret** for various policies in sample-path correlated bandits whose unknown mean rewards increase with increasing known costs
- Exploring methods to minimize the regret achieved by making modifications to existing policies like **UCB** and **Thompson Sampling** to exploit the correlation between the bandit rewards

### ThreeD - Designing a Game Engine Scripting Language | *Student Project* *(May '22 - present)*

*Compiler and Programming Language Design Project*

- Designing a scripting language to interact with game engine objects which makes use of **LLVM**
- Programming a lexer which tokenizes the input stream and a parser which produces an **Abstract Syntax Tree** using **top-down parsing** in **C++**
- Implementing code generation to produce **LLVM Intermediate Representation** code from the **AST** produced by the parser which is fed to **LLVM** to produce a binary

### Pipelined RISC Processor | *Course Project* *(Jan '22 - Apr '22)*

*Prof. Virendra Singh, EE309 Microprocessors*

- Designed a **6 stage pipelined** RISC processor with the stages fetch, decode, register read, execute, memory access and write back in **VHDL** in order to achieve an IPC close to 1
- Tested the design by viewing the simulated waveforms generated by **GHDL** and viewed them using **GTKWave**
- Implemented **forwarding logic** for the register file and the memory access unit to prevent pipeline stalls

### Lasso Game | *Course Project* *(Nov '20 - Feb '21)*

*CS 101: Computer Programming and Utilization, Prof. Bhaskaran Raman*

- Created a **C++ & SimpleCPP graphics** based game by adding **1000+ lines** to a pre-existing codebase in which the player must earn points by catching coins that are tossed up randomly with the help of the lasso
- Made the game more enjoyable by adding multiple **game modes** and introducing lives and a timer
- Enhanced the user experience by introducing the **mode selection page** and the **instructions page**
- Strengthened understanding of C++ and **Object Oriented Design** through the project

### Machine Learning for Image Super-Resolution | *Seasons of Code* *(May '21 - Aug '21)*

*Web and Coding Club, IIT Bombay*

- Understood the basic concepts of Machine Learning through the **Google Machine Learning Crash Course**
- Learnt working of **TensorFlow** from the course **Intro to TensorFlow for Deep Learning** on Udemy
- Trained a **Convolutional Neural Network(CNN)** to classify **hand-drawn digits**
- Created a model to **colorize sketches** using a **Conditional Generative Adversarial Network(CGAN)**
- Worked with various types of architectures such as **CGAN**, **CNN** and **RESNET**
- Implemented and trained the final model based on **Enhanced Super-Resolution Generative Adversarial Network(ESRGAN)** after going through two research papers on SRGAN and ESRGAN

## Mentorship and Teaching Roles

### Department Academic Mentor | *Department of Electrical Engineering* *(Jun '21 - Present)*

*Department Academic Mentorship Program, IIT Bombay*

*Selected from 100+ candidates after a rigorous procedure which included extensive peer reviews and interview*

- Mentoring **3 sophomores** on managing academic and co-curricular pursuits and helping with general concerns
- Involved in **Know-Your-Lab** initiative which aims to make information about research labs easily accessible

### Teaching Assistant | *PH107: Introduction to Quantum Mechanics* *(Dec '21 - Mar '22)*

*Department of Physics, IIT Bombay*

- Tutored, mentored and guided a batch of **39 first year** students through the course on **Quantum Mechanics**
- Conducted **weekly sessions** which involve interaction with the students, question solving, and doubt clearing

## Technical Skills

| | |
|---|---|
| **Software** | Intel Quartus, Simulink, LTSpice, Keil, ngspice, Eagle, Arduino IDE, MS-Office, LaTeX, AutoCAD, Unix Command Line, git, Sniper Simulator |
| **Languages** | C/C++, Python, JavaScript/TypeScript, VHDL |
| **Web Development** | Node.js, Next.js, React, HTML, CSS |
| **Python Packages** | Tensorflow, Numpy, Pandas, PyQt5, OpenCV |

## Key courses

| | |
|---|---|
| **Electrical** | Microprocessors, Analog Electronics, Digital Systems, Control Systems, Signal Processing, Probability and Random Processes, Communication Systems*, EM Waves* |
| **CS and AI/ML** | Introduction to Machine Learning, Computer Programming and Utilization, Computer Networks* |

* To be completed by December 2022

## Extracurricular

- **Crowdfunded** in excess of **50,000** Rupees to **provide prosthetics to villagers** who have lost a leg through **Walk India**, a wing of the Freedom Trust NGO *('20)*
- Participated in the **CBSE Archery Nationals Tournament**, a national level tournament organized for students belonging to CBSE Schools from all over India *('16)*
- Ranked **1st in the State** in the *National Science Olympiad* organized by the Science Olympiad Foundation *('19)*
- Completed **year-long** training under **NCC** at IIT Bombay *('21)*
- Awarded **3rd** place at the Freshie Hackathon, a website development competition organized by the Web and Coding Club at IIT Bombay for first year students *('20)*
- Secured **3rd** place at CodeWars at PES University, a **competitive programming** tournament organized as a part of their annual science fest called The Amateur Scientist in which students **all over India** participate *('19)*
- **Won 1st place** at the Code Bramha Event at Alpine School, Bangalore, a **competitive programming** event held at their school fest which saw participation from schools across Bangalore *('19)*