



## Harshvardhan

Electrical Engineering

Indian Institute of Technology Bombay

B.Tech+M.Tech

Dual Degree

Examination	University	Institute	Year	CPI/%
Graduation	IIT Bombay	IIT Bombay	2020-25	-
Intermediate/+2	CBSE	Bansal Public School	2019	90
Matriculation	CBSE	Bansal Public School	2017	9.2

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Pursuing **Minor in Computer Science & Engineering**

Only student out of **1400+** students to have received **Organizational Color Award** in Dept. of EE

('22)

## SCHOLASTIC ACHIEVEMENTS

- Secured an **All India Rank - 391** in **JEE-Advanced** among 0.2 million candidates ('20)
- Secured an **All India percentile of 99.62** in **JEE-Mains** among 1.2 million candidates ('20)
- Secured an **All India Rank - 14** in **Unified Cyber Olympiad** conducted by Unified Council ('17)

## INDUSTRIAL EXPERIENCE

**Ideaforge** | *Research and Development- Controls & Software Intern*

(May '22 - Jul '22)

*Under professor guidance of Prof. Debraj Chakroborty, IIT Bombay*

- Worked on the **Gimbal stabilization system** mounted on the UAV and **robustness of pointing accuracy** of gimbal system using both the **model-based & model-free** control system development techniques
- Explored **Advanced space-craft dynamics**, **Line of Sight** optimizations and various control optimizations such as **Fuzzy control**, **LQR**(Linear Quadratic Regulation) & **PID** to be implemented for the UAVs

## TECHNICAL PROJECTS

**Drone Swarm Network: Distributed Beam-forming** | *Proposed to ISRO*

(June '22 - Present)

*Prof. Dwaipayan Mukherjee & Prof. Shashi Ranjan Kumar, IIT Bombay*

- Surveying concepts on **opportunistic arrays & distributed beamforming** to be used with UAV swarms
- Exploring **swarm coordination algorithms** for UAVs to carry out tasks in a scalable & dependable way
- Developing solutions to issues on Geolocation, Synchronisation, Transmission Losses, & Range Limitations that are related to collective beamforming using concepts of **Control System & Signal Processing on FPGA**

**Image Segmentation using Deep Learning** | *EE610: Image Processing*

(Oct '22)

*Prof. Amit Sethi, IIT Bombay*

- Used the concepts of Deep Learning for the semantic segmentation of binary nuclei using Tensorflow/Pytorch.
- Implemented and Coded a basic UNet for the segmentation and trained it via Dice Loss and modeled the baseline architecture of UNet and used Watershed segmentation on the UNet in order to segment individual nuclei.

**Image Restoration using Wavelets based Transform** | *EE610: Image Processing*

(Sept '22)

*Prof. Amit Sethi, IIT Bombay*

- Made basic functions of PSNR, SSIM, Wiener filtering and denoising functions for wavelet Transforms
- Implemented the method proposed in paper "Image Denoising using Neighbouring Wavelet Coefficients" by Chen-et-al and compared with hard and soft thresholding wavelet transform

**Signal Reception & Decoding from NOAA satellite using GNURadio** | *EE340: Comms. Lab* (Nov '22)

*Prof. Jayakrishnan Nair, IIT Bombay*

- This proposed solution offers the possibility of decoding and processing the signals in form of .wav files to GNURadio using the signals received from satellite in form of audio file recorded directly from NOAA satellite
- Output from GNURadio is a grayscale image of a section of earth based on the recording time of signal, which is improved after image processing, The results are cross verified using a software "WXtoImg" for decoding process

**Multi-stage cycle & Pipelining on RISC-IITB** | *EE309 (Course Project)*

(Mar '22 - May '22)

*Prof. Virendra Singh*

- Modelled a **multicycle** and a **6-stage pipelined** 16-bit IITB-RISC microprocessor to implement 17 instructions
- Used **Behavioral Modelling** for creating components such as register-bank and memory modules on VHDL
- Mapped out a suitable datapath with control status word and designed a **finite state machine** for implementations
- Optimized the pipelined architecture by using **hazard detection** including **Forwarding and Branch Prediction**

## IIT Bombay Racing Team |

(Feb'21 - May'22)

### Junior Design Engineer | Motor Controller, Controls/Electrical Division

- Worked in the **Motor Controller Designs** sub-division under the Electrical section of IITB-Racing Team
- Implemented **PID controller** for the upcoming model which will have indigenous motor controller with Field of Controls development on **SimuLink (MATLAB)** and contributed in the **design of CAN card**

### Trainee | Electrical Subdivision

- Explored around the three subsections under the Electrical division of the IITB Racing Team that is, **Low Voltage Safety(LV), High Voltage (HV) & Motor Controller (MC)**
- Investigated the various aspects of electric vehicles and driver-less car, its working and production

### Microprocessor Lab | EE337 (Course Lab)

(Jan '22 - May'22)

Prof. S. Saravasan

- Learned **Assembly Language** and **Embedded C** coding on **ARM Keil and RealTerm** software
- Performed software experiments using an **8051 Kit** to learn its **instruction set** and hardware experiments using a development board to learn the instruction set and **assembly programming** for 8051 family of micro-controllers
- Implemented **Binary Search** using Assembly programming, Assembly language subroutine for conversion of any string to its **ASCII representation**, Matrix multiplication, **ATM simulation on Embedded C**

### CS347: Operating System | Course Projects

(Jan '22 - Apr'22)

Prof. Mythili Vutukuru

- Analysed Operating Systems in four parts, namely **Processes, Memory, Concurrency, I/O and File-Systems**
- Programmed multiple **C++ algorithms** for **process classification, dynamic memory management, pthreads synchronization and file-system management** on MIT developed open-source XV6 operating system

### Digital Circuits Lab | EE214 (Course Lab)

(July '21 - Nov'21)

Prof Maryam Baghini

- Learned **VHDL coding** and verified design by performing simulations on inputs by using Scanchain on Krypton
- Studied **structural and behavioural modelling** and performed **RTL and gate level simulation** on labs
- Implemented 4-bit Adder/Subtractor, Decoder, Universal Shifter, Sequential Circuits and Finite state machines

### Stock Market Predictions | Summer of Code, WnCC, IIT Bombay

(May '22 - July'22)

- Explored Python and its libraries for e.g. **NumPy, Pandas, Matplotlib, Keras, sklearn** studied and implemented feature engineering like missing data and outlier with regressions and classification techniques
- Implemented Machine learning & Deep learning models like **Linear regression, LSTM, ARIMA** to model the 'closing price' target variable of Google Stocks file and attained predictability of **98.54** using ARIMA model

### Data Science | Summer of Science, MnP Club, IIT Bombay

(May '22 - July'22)

- Explored the basics of probability & statistics with concepts of hypothesis testing, classification algorithms, distribution functions, p-value, error measurements in model, Exploratory Data Analysis and **SQL programming**
- Analysed Machine Learning(**Supervised and Unsupervised**) and explored different regressions techniques, algorithms using in real-world statements along with **Deep Learning in both CNN and RNN framework**.
- Final report included a **video presentation** explaining the basic concepts of Machine Learning & Deep Learning

### Deep Learning Graded Challenge | DPhi & Analytics Club, IIT Bombay

(May '22 - June'22)

- Successfully completed a 4 week long bootcamp consisting of 2 Graded Quiz Assignments, 1 Graded Datathon on **Real-World Dataset** based on weather prediction and got a **rank of 19 out of 586 submissions**
- Learned fundamentals of **Deep learning and Neural networks**, explored **Computer Vision, OpenCV**, Digital Image Processing, **CNN(Convolutional Neural Network)** and **GAN(Generative Adversarial Network)**

### Natural Language Processing Bootcamp | DPhi

(July '22)

- Successfully completed a 10 day long bootcamp with **industrial case-studies** and two hands-on tutorials on **movie recommendation system** and **product ratings prediction** from reviews using sentiment analysis
- Explored the fundamentals of natural language processing, word embedding models, **text parsing**, text preprocessing and its applications, **text modeling, pattern mining** for evaluation and deployment of the model

### Special Theory of Relativity | Summer of Science, MnP Club, IIT Bombay

(May '21 - July'21)

- Studied Galileo's and Einstein's views on the understanding between space and time with the three postulates of the Special Relativity with Lorentz transformation and its derivations
- Explored the Twin Paradox theory and General Theory of Relativity as interest point of view and Made a **video presentation** explaining Michelson Morley's experiment

### Line Follower | Electronics and Robotics Club, IIT Bombay

(Sept'21)

- Designed and tested an **autonomous robot** which follows a black line drawn on a white background using its photo-diode sensor.

- Working of the bot was based on the illuminating a surface with infrared light which was part of its chassis and the sensor then picks up the reflected infrared radiation and, based on its intensity, enabling it to follow the line.

## TECHNICAL SKILLS

<b>Languages</b>	Python, C++, C, Embedded C, Java, VHDL, Verilog, Assembly Language
<b>Software</b>	Git, L <sup>A</sup> T <sub>E</sub> X, MATLAB, Simulink, GNU Radio, LTSpice, NGSpice, Eagle, Solidworks
<b>Python Libraries</b>	Numpy, Pandas, Matplotlib, Keras, Tensorflow, sklearn, PyTorch, OpenCV, PySpark
<b>Publishing</b>	Adobe Photoshop, Adobe Indesign, Adobe Premier Pro, MS Office, Flash, CorelDraw
<b>Development</b>	HTML, XML, MySQL, ReactJS, NextJS

## POSITIONS OF RESPONSIBILITY

**Coordinator** | *Alumni Co-operate Engagement(ACE), EE, IITB* (May'22 - Present)

- Co-working with team and **Dean(ACR)** for engagement programs for students, staff, faculty and alumni to give a Department-level platform for industry and alumni who wish to connect with Electrical Engineering
- Co-organizing a series of events for e.g. Alumni Day, Industry Day, Distinguished Alumni Talk and Lecture series
- Performing information collection with **data-basing** and **writing articles for department magazine** of alumni based on their work/research in the industry and showcasing latest research in Electrical Engineering department

**Joint Secretary** | *Electrical Engineering Student Association, IITB* (Mar'21 - May'22)

*Council Representing 1800+ students of Electrical Engineering Department*

- Co-headed a two-tier team of 12 members** responsible for executing and managing competitions, department treks/trips, interactive sessions, placement and internship blogs for all the students of the department
- Negotiated a deal of **INR 0.52 M+** for Department merchandise and handled distribution pan India
- Organized a series of **candid interviews** and **articles** with **professors and alumni** to the department helping in providing better connections between students, professors and alumni

**Class Representative** | *Electrical Engineering Department, IITB* (Dec '20 - Jun '21)

- Class Representative for the batch of **182 first-year undergraduates** in Electrical engineering department
- Being the link between prof and students **addressed the academic as well as non-academic issues of the batch** to concerned authority & organizing some fun cultural/extra-curricular activities in vacations

**Mentor, Summer of Science** | *Special Theory of Relativity* (May'22 - Jul'22)

- Mentoring the students and get them familiarized with the concepts of **Special & General Theory of Relativity**

## COURSES UNDERTAKEN

<b>Electrical</b>	Image Processing, Electronic Devices & Circuits, Microprocessor & Microprocessor Lab, Analog Circuits & Analog Lab, Control System & Control Lab, Digital Systems Digital Circuits Lab, Signals & Systems, Probability and Random Processes & Power Electronics, EM Waves, Communication System-I & Lab,
<b>Computer Science</b>	Computer Programming and Utilisation, Operating Systems, Advanced Computer Architecture & Automata Theory
<b>Physics</b>	Quantum Theory and its applications & Electrodynamics
<b>Mathematics</b>	Calculus, Linear Algebra, Differential Equation I & II, Complex Analysis
<b>Others</b>	Molecular Biology, Engineering Drawing, Chemistry, Economics
<b>Online</b>	Machine Learning, Deep Learning, Reinforcement Learning*, Natural Language Processing*

\*(to be completed by Dec'22)

## EXTRACURRICULAR ACTIVITIES

- Doing courses for **BigData Handling, WebDev and Finance** under Learner Space, IIT Bombay ('22)
- Completed a year long program by National Sports Organisation in **Guitar** at IIT Bombay ('20- '21)
- Participated in **Hult prize** and **presented startup ideas** on agriculture and aquaponics farming ('20)
- Secured an **All India Rank - 1** in **Cyber Olympiad** conducted by Humming Bird Organization ('13)
- Secured an **All India Rank - 3** in **Talent Search Olympiad** conducted by Humming Bird Organization ('13)
- State Winner of Vodafone Quiz by Derek O'Brien** out of 30 participating schools ('13)
- State Winner of Bharat Vikas Parishad's Bharat ko Jano** out of 50 participating schools ('13)
- State **Rank 2** in **Unified Cyber Olympiad** conducted by Unified Council ('15)
- State **Winner** of Jagran's Sanskarshala conducted by Dainik Jagaran, All India ('12)
- PREFECT** for three consecutive years in school. ('12-'14)