Avishkar Bahirwar

Second-Year Undergraduate
B.Tech | Civil Engineering
Indian Institute of Technology Bombay

E-mail
LinkedIn
Phone No.

Examination	University	Institute	Year	CPI/%
Graduation	IIT Bombay	IIT Bombay	2023-2027	8.97

Pursuing **Minor** in **Artificial Intelligence and Data Science (AI-DS)** offered by **C-MInDS**, IIT Bombay

Scholastic Achievements

- Conferred a **Department Rank** of **11**, among **170+** students in the department of **Civil Engineering** *[Present]*
- Successfully earned **5 AA** grades across various subjects, including **Computer Programming and Utilization** *[2024]*
- Ranked among the **top 2** percentile in **Joint Entrance Examination Advanced** amongst **200,000+** candidates *[2023]*
- Secured **99.44** percentile in **JEE-Mains** exam among more than **1.2 million** candidates from all over India *[2023]*
- Secured **99.88** percentile in **MHT-CET** exam among more than **0.3 million** candidates from all over Maharashtra *[2023]*

Research Experience

Self Driving Car (SeDriCa) | Team UMIC- *Unmesh Mashruwala Innovation Cell* *[Nov'24-Present]*
Guide: Prof. Archak Mittal | IIT Bombay
SeDriCa is a dynamic student technical team of over 30 members dedicated to developing autonomous vehicles for urban driving and racing. We participate in competitions such as ***FIRA RoboworldCup*** *and* ***F1tenth***

- Implemented a **real-time reactive navigation** system accounting for **nonholonomic** constraints and dynamic obstacles
- Researched and simulated the "**Follow the Gap**"algorithm in **F1TENTH Gym Environment** for obstacle avoidance
- Simulated environments and robots in **Ignition Gazebo**, leveraging **ROS 2** tools and **RViz2** for visualization

Fractional Order Electrical Damping for Haptic Rendering *[Jan'25-Present]*
Co-Guides: Prof. Abhishek Gupta (IIT Bombay) & *Prof. Volkan Patoglu* (Sabanci University)

- Researching methods to expand the **impedance range** of **haptic devices** to enhance tactile feedback and realism
- Researching the impact of **discretization** on haptic displays and developing strategies to mitigate resulting **oscillations**
- Modeling **RC** circuits with **fractional-order impedance** to achieve **frequency**-based damping and minimize oscillations

Research on Non -Newtonian fluid dampers | Hydromechanics *[Sept'24-Nov'24]*
Guide: Prof. Bausdev Biswal | IIT Bombay

- Developing **MATLAB simulations** comparing **shear thickening** and **Newtonian fluids** for **impulse damping**
- Demonstrated **reduced oscillations** in shear thickening fluids with **increasing impulse**, surpassing Newtonian fluids
- Researching shear thickening fluids and developing **physical models** with potential for **improving** damping systems

Key Projects

Universal Testing Machine | *Course Project* | MS-101 *[Sept'23-Nov'23]*
Guide: Prof. Joseph John | Department of Electrical Engineering | IIT Bombay

- Developed a UTM in a group of 5 using **Arduino, IR sensors**, and grippers to measure and analyse stress and strain
- Designed and **coded the Arduino control system** from scratch, integrating sensors for automated data collection
- Applied **CAD skills in Fusion 360, laser cutting, and 3D printing** to design and build the machine structure

6-DOF Robotic Arm | *Tinkerers' Laboratory* *[Sept'24-Dec'24]*

- Spearheaded a team of 5 to develop a **6-DOF multipurpose robotic arm** with a modifiable end effector, simulated using **ROS2, Gazebo**, and **MoveIt2**, focusing on seamless integration and precise motion control
- Writing **kinematic equations in MATLAB** and creating the CAD models in **SolidWorks** to design the robotic arm
- Leading efforts to implement **image processing using OpenCV** for enhanced functionality and automation

Compact Quadruped Robot | *LearnerSpace* | Tinkerers' Laboratory *[Jul'24-Sep'24]*

- Utilized **3D modeling, PCB designing, laser cutting, ESP,** and **servos** to construct a functional robotic dog
- Gained hands-on experience in **circuit design, microcontroller programming,** and **mechanical assembly**
- Worked to the integrate hardware and software components, ensuring **smooth operation** and **responsiveness**

Automatic Door Operator | *Tinkerers' Laboratory* *[Feb'23 - Mar'23]*

- Developed an **automatic door closer** with pulleys, DC motors, and a lead screw mechanism for **latch control**
- Programmed the **ESP32** and set up electrical connections, enabling **Bluetooth control** via a mobile application
- Integrated an **LDR circuit** to detect the door's end position and automatically stop the motors at end point

Roll Angle Estimation with Kalman Filter | *Course Project* | *SC-651* *[Jan'25 - Feb'25]*
Guide: Prof. Ravi Banavar | IIT Bombay
- Implemented a Kalman filter on **ESP32** for roll angle estimation using **LSM9DS1 gyroscope** and **accelerometer** data
- Analyzed the effects of **noise parameters** and **sampling time** on estimation accuracy across methods
- Developed and tested **sensor fusion** algorithms using **Arduino IDE** for real-time roll angle visualization

Stock Market Prediction | *Course Project* | CE-465 *[Sept'24]*
Guide: Prof. Sangram Nirmale | Department of Civil Engineering | IIT Bombay
- Working on **stock market prediction** using historical data on **interest rate hikes** to forecast future market prices
- Applying advanced **numerical methods** and developing predictive models in **Python** to simulate market behaviours
- Using **backpropagation** to fine-tune predictive models and enhance accuracy in forecasting market trends and outcomes

Audio Classification with MFCC | *Course Project* | DS-203 *[Sept'24]*
Guide: Prof. Vinay Kulkarni | Dept. of Centre for Machine Intelligence and Data Science | IIT Bombay
- Developed an **MFCC**-based audio classification system, classified **115+** files into artist categories with **95%** accuracy
- Optimized **PCA** and **t-SNE** for clustering, using **100+** known labeled songs to refine **K-Means** and **GMM** classification
- Implemented a **Logistic Regression** pipeline, achieving **F1-scores>0.90** for **binary classification** of artist prediction

Other Projects

Joystick Controlled Bot | *XLR8 Competition* | *Electronics and Robotics Club* *[Sept'23]*
- Designed and modified a **Remote-Controlled Car-bot** capable of moving across various surfaces and terrains.
- Established **wireless communication** using **ESP01** and **ESP-32** via**Wi-Fi** protocol to relay **IMU** data to the vehicle
- Programmed the **ESP32 Micro-controller** using **Arduino IDE** for precise **2-D control** and **Wi-Fi integration**

Control Theory Bootcamp | *LearnerSpace* | Electronics & Robotics Club *[Jul'24 - Aug'24]*
- Learned **open** and **closed-loop control systems** and the equations governing a self-balancing bot
- Developed and simulated a **DC motor** model in **Simulink**, including both mechanical and electrical dynamics
- Modeled a **self-balancing bot** in **Simulink** and **Simscape**, utilizing **PID control** to achieve stability

Paper on Holographic Food Generators | *Rumbled Papers* *[Nov'23]*
EnPower Club | *UGAC* | *IIT Bombay*
- Secured **2nd place** by proposing a **holographic food generator** to simulate the appearance, smell, and taste of food
- Suggested use for **diabetic** individuals and those with **dietary restrictions** to enjoy virtual food without actual intake
- Introduced **interactive food displays** to replace traditional menus and help users better assess their meal options

Feel The Graph | *Self Project* *[Jul'24]*
- Initiating and spearheading the development of a **graphical tool** for the visually impaired, integrating **real-time plotting**
- Designing a system using **Python** libraries for dynamic function rendering and **grid-based** visualisation of functions
- Facilitating interaction between hardware & software, utilising **Raspberry Pi** for adaptive graph input and tactile feedback

Positions of Responsibility

Institute Technical Convenor | *Tinkerers' Lab* | IIT Bombay *[Mar'24- Present]*
- Leading an overhaul of the lab inventory, managing a budget of **INR 20 million**, improving resource management
- Initiated **RFID** integration for over 8+ tools and machinery, improving **security** and **equipment tracking** within the lab
- Organized an orientation for **1.4k** attendees, introducing a flamethrower demonstration initiative.Guided **school students** visiting TL, providing basic machine introductions and assisting them in **mini projects**
- Spearheading IIT's **1st Mini Robowars**, showcasing **advanced robotics** and cutting-edge custom **combat bots**

Amazon Future Engineer's Challenge Mentor | *The Innovation Story* *[Aug'24]*
- Mentored **2 high school teams** of 3 students each from under-served communities to bring their ideas into reality
- Fostered their interest in technology by providing **guidance** and **resources** throughout the process
- Enabled students to understand **resource allocation** and **project planning**, fostering skills in project management

Technical Skills

Languages	C++, Python, MATLAB
Development	HTML, CSS, Git,GitHub, Linux, LaTeX
Libraries	PyTorch, Matplotlib, NumPy, Pandas, Sklearn
Softwares	Fusion360, SolidWorks, Simulink, Simscape, Arduino IDE, LaserCad, EasyEDA, ROS2

Relevant Courses

Computer Science	Computer Programming and Utilization, Programming for Data Science
Mathematics	Calculus, Differential Equations, Probabilistic and Statistical Methods, Numerical Methods
Others	Robotics, Introduction to Entrepreneurship, Economics, Introduction to Design