

Arin Weling

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EDUCATION

B.Tech. in Electrical Engineering

IIT Bombay, India

Honours in Electrical Engineering &

Minor in Artificial Intelligence & Data Science

October 2022 - May 2026

- **CPI: 9.59 / 10.00**
- **Department Rank: 10 / 114**

ACADEMIC ACHIEVEMENTS

- Awarded the **Undergraduate Research Award (URA) 01** for investigating thermal voltage drift mechanisms and the impact of X-ray exposure on the reliability of **3D NAND Flash Memory** devices
- Attained an **AP Grade** (Advanced Performer) for outstanding performance in the course **CH107(Physical Chemistry)**
- Achieved **All India Rank 3** in **Technothon 2019** (IIT Guwahati), a national logic and problem-solving contest
- Attained **All India Rank 356** in **JEE Advanced 2022**, competing against 1,00,000+ candidates from across the country
- Attained **All India Rank 472** in **JEE Mains 2022**, duly competing against 10,00,000+ candidates from across the nation
- Secured a notable position by ranking within the **top 1%** in the Maharashtra (State) region for **IOQP Part 1** examination

RESEARCH EXPERIENCE

Mars Rover Team, IIT B

Student Technical Team

Team Lead / Guide: Prof. P.J. Guruprasad

December 2022 – March 2026

- Successfully integrated a **Robotic Arm URDF** model with **RViz** and **Gazebo** to perform **Inverse Kinematics** simulations using **MoveIt2**
- Implemented a bidirectional long-range (**LoRa**) telemetry link to facilitate real-time command transmission at 433 MHz
- Integrated **CAN communication** and designed **custom PCBs** to increase the robustness of the electronic system
- Established efficient **RPi–STM32 UART communication**, enabling offloading of the **PID control loop** and quadrature encoder data retrieval to the STM32, significantly improving processing speed
- Coordinated a **50-member team** across software, electrical, and mechanical divisions to ensure smooth system integration
- Secured **2nd place** worldwide in the **Remote Edition of the European Rover Challenge, 2025**
- Placed **9th** globally in the Bio-Science Task at the **University Rover Challenge, 2024** held in Utah, USA
- Attained the **6th position** amongst 30 teams in the **International Rover Design Challenge, 2023**

3D NAND Flash Memory

Research Project

Research Assistant / Guide: Prof. Sandip Mondal, IIT Bombay

June 2023 - June 2025

- Designed a custom PCB to interface the **FTDI Mini Module** with **3D NAND Flash Memory**, facilitating precise byte programming and block erasure operations
- Characterized the detrimental effects of **medical-grade X-rays** on **3D NAND Flash watermarks** stored via **oxide degradation** and analyzed how radiation exposure disrupts the trapped charges used for physical-layer security
- Presented research findings on 3D NAND **watermark reliability** at the **2nd Annual SemiX Summit, IIT Bombay**
- Delivered an oral presentation titled “**Thermal-Induced Threshold Voltage Distribution Changes in 3D NAND Flash Cells: Experimental Characterization**” at the **Electronic Materials Conference, 2025, Durham, USA**

Electron Beam Additive Manufacturing

Research Assistant

Research Assistant / Guide: Prof. K.P. Karunakaran, IIT Bombay

January 2024 - May 2024

- Designed a wireless feedback circuit using **Opamps**, and **MOSFETs** to regulate heater current for thermionic emission
- Conducted extensive **research** on various **high-speed data transmission** methods and their implementation techniques
- Designed and programmed a **mobile app** using **Java** on **Android Studio** to communicate with the **Node MCU**

INDUSTRY EXPERIENCE

Smart Sentry AI

Remote

Intern / Guide: Prof. Amit Sethi

August 2025 - January 2026

- Engineered a custom **multi-agent architecture** for a **MongoDB** query chatbot that translates natural-language inputs into optimized database operations
- Integrated **Redis** for distributed state management and deployed the system on **Kubernetes**, enabling scalable performance
- Developing an **active-learning** pipeline for continuous model improvement, incorporating human feedback loops, data selection heuristics, and automated retraining cycles

- Developed a **debug tool** integrating the **Cursor IDE** with Synopsys APIs to enable **AI-assisted hardware debugging**
- Implemented a **FastMCP** server with **stateless HTTP** design for analysis of **FSDB** waveforms and **RTL** designs
- Designed **debug flows** which helped in reducing the time required for manually debugging complex SoC designs by **30%**

KEY PROJECTS

S.N.A.S.H Morphobot

Course Project

Guide: Prof. Siddharth Tallur, IIT Bombay

January 2025 - April 2025

- Developed a simplified version of the **Morphobot** designed by researchers at **Caltech** utilizing **Ardupilot** to enable a seamless **transition** between **ground** and **drone** modes
- Engineered the **mechanical** and **electrical** design, optimizing the system and reducing the **transition time** to **5 seconds**
- Successfully tested the bot, demonstrating its performance with **3 minutes** of **flight time** and **15 minutes** of **drive time**
- Secured the **Course Best Project Award** and a Special Mention at **YUGM 2025** during an exhibition attended by the **Hon. Prime Minister of India**

Centralized Intelligence for Dynamic Swarm Navigation

Technical Competition

Inter IIT Tech Meet 13.0

November 2024 - December 2024

- Secured **3rd place** in the **problem statement** and **2nd place overall** at the **Inter IIT tech meet 13.0**
- Engineered a custom **DBSCAN** clustering algorithm to facilitate low-latency detection of dynamic obstacles in real-time
- Implemented Conflict-Based Search (**CBS**) and Non-linear Model Predictive Control (**NMPC**) algorithms to generate collision-free **Multi-agent** paths while avoiding **dynamic obstacles**
- Simulated multi-bot **ROS2 Humble–Gazebo** setups with custom algorithms to optimize task priority and execution time

Falsification-Driven Robust Training

Course Project

Guide: Prof. Supratik Chakraborty, IIT Bombay

August 2025 - November 2025

- Architected a falsification-driven pipeline integrating **CARLA sim** and **VerifAI** to synthesize adversarial examples
- Leveraged **Alpha-CROWN (via AutoLiRPA)** to compute certified L2 robustness radii, overcoming the VRAM and latency bottlenecks that rendered standard Branch-and-Bound methods infeasible
- Expanded certified **L2 robustness radii** by **48%** via falsification-driven active learning, demonstrating superior sample efficiency compared to random sampling over **5 training cycles**

Foundations of Intelligent and Learning Agents

Course Project

Guide: Prof. Shivaram Kalyanakrishnan, IIT Bombay

August 2025 - November 2025

- Implemented and benchmarked **UCB**, **KL-UCB**, and **Thompson Sampling** for regret minimization, including a computationally optimized KL-UCB variant for stochastic environments
- Modeled a strategic card game as a **Markov Decision Process** and developed a solver using **Howard's Policy Iteration** and **Linear Programming** to derive optimal winning policies
- Engineered a **Microchess agent** using **Minimax search** with custom heuristics, optimizing depth and execution time

AstroTinker Bot

Technical Competition

eYRC 2023-24: Robotics Competition, E-Yantra, IIT Bombay

September 2023 - January 2024

- Engineered a **miniature AstroTinker bot** capable of **drag-and-drop** functionality
- Implemented the **Verilog HDL** designs for a **ripple carry adder**, **FSM-based sequence detector**, **UART Transmitter and Receiver**, and a **RISC CPU**, integrating them with the infrared sensors and the **DE0-Nano FPGA** board
- Integrated a **C-based path-planning algorithm** proficient in calculating a route between two randomly specified points

Control Systems Engineering Lab

Course Project

Guide: Prof. Debraj Chakraborty, IIT Bombay

August 2024 - November 2024

- Implemented a **Linear Quadratic Regulator (LQR)** control strategy to stabilize the dynamics of an **inverted pendulum**
- Built a **closed-loop noise cancellation system** with a **custom compensator**, achieving **20 dB attenuation** at **100 Hz**

Superscalar CPU Architecture

Course Project

Guide: Prof. Virendra Singh, IIT Bombay

January 2025 - April 2025

- Led a **team of 4** in the design and testing of a **superscalar, out-of-order CPU** in **VHDL** using **Quartus Prime**
- Designed a customized **user interface** using **Python** to significantly improve the ease of **debugging and implementation**
- Optimized VHDL design by removing non-synthesizable constructs and validated functionality on **MAX 10 FPGA** board

Interfacing a Biosensing Multi-Electrode System

Academic Project

Guide: Prof. Sandip Mondal, IIT Bombay

August 2024 - November 2024

- Integrated a **Bluetooth application** with **biosensing electrodes** to enable seamless reception of data
- Developed and implemented a customized **Python program** that efficiently reads **CSV files**, processes the data to extract important information, and produces detailed **graphical representations**, thus enabling comprehensive **data evaluation**

ECG Amplifier

Course Project

Guide: Prof. Anil Kottantharayil, IIT Bombay

January 2024 - April 2024

- Designed and developed a high-performance ECG (**Electrocardiogram**) **Amplifier** utilizing **Instrumentation Amplifiers**, **Opamps**, various **capacitors** and **resistors**, achieving signal amplification for accurate biomedical data acquisition

Covert Channels and Secure Cache Partitioning

Course Project

Guide: Prof. Biswabandan Panda, IIT Bombay

January 2025 - April 2025

- Implemented **Flush+Reload** and **Occupancy-based covert channels** in C to transmit images and audio across cores
- Designed custom protocols to establish shared memory using occupancy channels and verified end-to-end communication
- Developed **Dynamic Set Partitioning** in Low Level Cache (**LLC**) and evaluated the Instructions Per Cycle (**IPC**), Missed Predictions per Kilo Instructions (**MPKI**), **self-evictions** vs baseline on **SPEC** benchmarks

Neural Networks and Large Language Models

Learners' space

Web and Coding Club, IIT Bombay

December 2023 - January 2024

- Successfully **fine-tuned** a pre-trained **GPT-2 transformer model**, achieving high accuracy in answering various questions
- Developed and implemented an **image classifier** with an accuracy of **81%** for distinguishing pizza from non-pizza images

Infrastructure Monitoring App Development

SIH Finals 2023

Smart India Hackathon / Government of India

November 2023 - December 2023

- Led a 6-member team** in driving the development of a **mobile app** targeting **construction project management**
- Seamlessly integrated **Flutter** for the **front-end** and **Django** for the **back-end**, ensuring a scalable and optimized system
- Created a simple, user-friendly interface featuring a **customized login**, placeholders for projects, and intuitive navigation

Optimizing Signal Quality in Solar Transformer Data

Course Project

Guide: Prof. Vinay Kulkarni, IIT Bombay

August 2023 - November 2023

- Developed and implemented a **custom algorithm** to calculate **local deviation** of **transformer current data** at **five-minute intervals**, thus accurately differentiating between good and bad days
- Utilized **moving averages** and **data interpolation techniques** to enhance the quality and accuracy of the raw data
- Successfully implemented a **Random Forest model** to predict **missing data** on days with **incomplete records**

Autonomous Pickup and Place Line follower

Course Project

Guide: Prof. Joseph John, IIT Bombay

November 2022 - February 2023

- Engineered a comprehensive **line-following robot** from inception, including the creation of a detailed **CAD model** using **Autodesk Fusion 360** and incorporated **custom-made mechanisms** for efficient retrieval of a **3D printed box**
- Implemented custom algorithms incorporating an **ultrasonic sensor** for the accurate detection of box edges in order to localize the box with respect to the bot
- The robot's performance contributed to its recognition as **one of the top 24 bots** developed by freshmen

SKILLS

Languages	C, C++, C#, Python, Verilog HDL, VHDL, Dart, SQL, R, L ^A T _E X
Software	Git, ROS, Gazebo, MATLAB, AutoDesk Fusion 360, Quartus, OpenCV, MoveIt, LTspice, Carla Sim
Machine Learning	PyTorch, Scikit-Learn, Pandas, Matplotlib, Plotly, VerifAI, AutoLiRPA

COURSES UNDERTAKEN

Mathematics	Probability and Random Processes, Calculus, Linear Algebra, Differential Equations
Data Science	Programming for Data Science, Introduction to Machine Learning, Formal Methods in Machine Learning, Foundations of Intelligent and Learning Agents
Electrical Engineering	Power Engineering, Analog Circuits, Signals Processing, Control Systems, Digital Systems, Microprocessors Lab, Wavelets, Advanced Processor Design
Computer Science	Computer Programming and Utilization, Computer Architecture for Performance and Security, Digital Image Processing
Miscellaneous	Quantum Physics and applications, Physical Chemistry, Biology, Makerspace, Design Thinking and Innovation, Estimation on Lie Groups, Wavelets, Economics

EXTRACURRICULARS

- Actively took part in the **Dahisar River March** and **Gorai Beach cleanups** to promote environmental sanitation
- Participated in a **STEM awareness drive**, introducing robotics and space technology concepts to underprivileged students
- Acted as a **mentor** for the **XLR8 competition**, offering guidance and support to **2 teams** throughout the competition
- Attained a **FIDE rating** of **1434** in **chess** through consistent dedication to skill development and strategic gameplay
- Served as the **Head Boy** of my school in **2020**, demonstrating strong leadership and assuming significant responsibilities