Ayush Soni

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Education

Indian Institute of Information Technology Tiruchirappalli — *Aug 2023 - May 2027*
B.Tech in Electronics and Communication Engineering (CGPA: 9.20) — Tiruchirapalli, TN, India

Research

- **Second Order Differential Equation Solver Using Programmable Integrated Photonic Circuits** — *2026*
  Presenting author / Poster at FOP 2026 @ IIT Delhi
  - ◇ Developed an FPPGA framework using SVD to map non-unitary second-order differential equations onto reconfigurable hexagonal MZI meshes for analog optical computing.

Experience

- **IIT Kharagpur, supported by QMD Foundation, under National Quantum Mission (NQM)** — *May 2026 – Jul 2026*
  Summer Research Fellow (Prof. S. K. Varshney) — On-site
  - ◇ Developed a high-speed analog differential equation solver on programmable Photonic Integrated Circuits (APPICs), achieving RMSE values between 0.047–0.052 for undamped solutions and 0.070–0.072 for damped solutions when benchmarked against Runge-Kutta 4th order (RK4) methods.

- **Indian Institute of Technology Madras (IIT Madras)** — *Nov 2025 – May 2026 (6 months)*
  ANRF PAIR Project Research Intern (Prof. S. Ramakrishna) — Hybrid
  - ◇ Developed a predictive ECG acquisition reliability assessment framework using Random Forest regression for healthcare Digital Twin (DT) applications under the ANRF PAIR Project, achieving an R2 score of 0.9697 and RMSE of 0.067 for continuous Dynamic Reliability Index (DRI) prediction.

- **Indian Council of Social Science Research (ICSSR)** — *Mar 2024 – Aug 2024 (6 months)*
  Data Analyst Intern — On-site
  - ◇ Analyzed, cleaned, and validated datasets, created research dashboards, and automated data handling workflows using Python and Excel, cutting manual effort by 60%.

Projects

- **Photonic Hexagonal Mesh Studio** — *2026*
  Self Project / Silicon Photonics, Python, Optical Simulation, GUI - CustomTkinter — Github
  - ◇ Built a GUI simulation tool to model hexagonal Programmable Photonic Integrated Circuit of up to **16 by 16 Meshed Computational blocks (768TBU)**, computing optical transfer matrices with <**50 ms** routing latency.
- **PCB Defect Detection** — *2025*
  Self Project / Python, YOLOv8, Computer Vision — Github
  - ◇ Developed a YOLOv8-based PCB defect detection system achieving **98.6% mAP@50** and **97.3% precision**.
- **Cluster-Based Optimization of Phased Array Antennas** — *2024*
  Self Project / Python, MATLAB, EM analysis (HFSS), Tkinter — Github
  - ◇ Optimized phased array layouts using polyomino clustering, reducing phase shifters by 30–40% and lowering side-lobe levels by up to 6 dB.
- **IronHound: Mine Detector and Surveillance Rover** — *2024*
  Team Triggerz, Group Project, in Lead / ESP32, LC Resonant Sensor, Python, ROS — Github
  - ◇ Built a mine-detection surveillance rover achieving 85

Technical Skills

- Qiskit, Qiskit Metal
- Silicon Photonics (PICs) & Optical Modeling (Ansys Lumerical suite)
- High-Frequency EM/RF Simulation and Modeling (Ansys HFSS, Fekko)
- System-Level Programming & Scripting (C/C++, Python, MATLAB)
- Hardware Description, FPGA Prototyping & Xilinx Vivado (Verilog)
- Electronic Circuit Design, Schematics & PCB Layout (KiCad, LTspice)

Achievements

- **NIT Trichy Ingenium Hardware Hackathon Winner – Pragyan (2024)**: Winner of a national-level hackathon for the project *Ironhound*.
- **IIIT Trichy Software Hackathon Winner – Atrang (2023)**: Secured top position in inter-college software development competition by presenting *Noteweb*.
- **STAR Olympiad Qualified**: Qualified in the competitive STAR Olympiad for high-level problem-solving skills.

Positions of Responsibility

- **Co-Curricular Affairs Secretary (Technical Secretary)**: IIIT Tiruchirappalli - Student Council Member
- **Senior Coordinator – Robotics Club**: IIIT Tiruchirappalli