PRATEEK TIWARI

Grade 7 Student · Independent Researcher · Lucknow, Uttar Pradesh, India

prateektiwari258@gmail.com · github.com/prateektiwariii · likhavatth.netlify.app

Codeforces: ioi_ico_ioai picoCTF: ioi_ico CryptoHack: ioi_ico pwn.college Medium: @patrick.jane

Summary

A 7th-grade student with a deep interest in AI/ML, cybersecurity, physics, and competitive programming. Independently published two research papers, built real-world software tools, contributed to open-source, and competed nationally in cybersecurity. Currently sharpening problem-solving skills through informatics, AI, and physics-focused preparation. Believes that the most meaningful problems sit at the edge of multiple disciplines.

Research Publications

The Computational Geometry of Heuristic-Driven Shortest Path Search *2026 · Independent*

Benchmarked Dijkstra vs. A* on a 302,066-node graph of Lucknow's road network (4,132 km^2). Built a high-performance C++17 pipeline using the Libosmium framework to parse OpenStreetMap PBF data. Identified the *Riverine Bottleneck Paradox* and *Cantonment Regularity Effect* as topological drivers of algorithm efficiency. A* achieved a mean search-space reduction of **78.13%** ($p < 0.0001$) across 1,000 randomised trials.

AquaNeuron: Graphene Oxide Aptamer Nanosensor Array with Edge AI *2026 · Stockholm Junior Water Prize India*

Collaborative computational study with Raghav Khandelia (Mumbai), Aroush Muglikar (Maharashtra), and Shreyas Roy (West Bengal). Designed a theoretical three-channel rGO-aptamer chip for simultaneous detection of arsenic, fluoride, and lead in rural Indian groundwater. Authored the Python simulation engine (adsorption isotherms, EIS, Monte Carlo LOD propagation, Random Forest classifier). RF classifier achieved **97.3% accuracy** (AUC > 0.999). Led technical development and wrote the full paper. Open-source at github.com/prateektiwariii/AquaNeuron.

OmniSprint : Physics Standard for Elite Sprinting Normalisation *2026 · Independent*

Built a C++ engine that normalises Olympic sprint times (100m, 200m, 400m, Tokyo 2020 and Paris 2024) for wind, altitude, temperature, humidity, lane curvature, and track surface. Proposed *Physics Adjusted Time (PAT)* as a supplementary metric for World Athletics. Discovered the *Jacobs-Lyles Paradox*: Jacobs' Tokyo gold represents superior mechanical output despite a slower raw time. Active development continues on the OmniSprint API, Python library, and public-facing website.

Software Projects

MindShift *2026 · Global Appathon By MIT · w/ Aroush Muglikar*

Full-stack AI emotional-support app for adolescents navigating grief. Features a custom-prompted AI companion (Mira), a grief journey tracker, breathing regulation engine, memory gallery, teacher note generator, and emotional analytics. Built on a glassmorphism UI with three adaptive themes. Submitted to the HackerBoundary Global AI Hackathon.

RSA CTF Tool GUI *2025 · Independent*

Graphical interface for one of the most powerful RSA crackers built specifically for capture-the-flag competitions. Contributed to the open-source CTF community.

Likhavatth *2025 · Independent · likhavatth.netlify.app*

Web app that converts typed text into realistic handwriting. Live and publicly accessible.

Cybersecurity Achievements

- **CryptoHack** — Ranked in the **top 150 cryptographers in India**; handle `ioi_ico` (cryptohack.org/user/ioi_ico)
- **picoCTF** — Active competitor; profile: play.picoctf.org/users/ioi_ico
- **pwn.college** — Hacker profile: pwn.college/hacker/162373; practising binary exploitation and systems security
- Significant achievements in capture-the-flag competitions across cryptography, reverse engineering, and binary exploitation domains

Competitive Programming & DSA

- **Codeforces** — Handle `ioi_ico_ioai`; active participant (codeforces.com/profile/ioi_ico_ioai)
- Strong command of **Data Structures & Algorithms**: trees, graphs, dynamic programming, segment trees, binary search, and combinatorics; applies DSA directly in research projects (e.g. 302k-node graph traversal in C++17)
- Programming since **2nd grade**; currently preparing for IOI, IOAI, and other informatics-focused competitions
- Writes **CTF writeups on Medium** (@patrick.jane) to contribute to the community

Technical Skills

Languages	C, C++17, Python, SQL, Bash, Assembly, C++ STL
Python Libs	NumPy, Pandas, SciPy, Matplotlib, Seaborn, Plotly, SymPy, scikit-learn
Cybersecurity	pwntools, PyCryptodome, SageMath, Z3, GDB, Wireshark, Burp Suite, Nmap, Autopsy, Ghidra, IDA Pro, Vim
ML / AI	scikit-learn, Random Forests, data analysis, simulation pipelines, feature engineering, model evaluation, Manim for fun :)
Systems	Linux, Git, OpenStreetMap / Libosmium, Arduino, embedded systems
Other	CTF tooling, cryptography, open-source contribution, technical writing

Olympiad Preparation

Currently preparing for multiple national and international competitions in informatics, AI, and physics. Target events include IOI (Informatics), IOAI (AI), and physics-focused olympiads, with major milestones planned through 2027.

Education

Army Public School, Sardar Patel Marg — Lucknow, Uttar Pradesh
Grade 7 (current) — 2025–present
Academic score: **96.53-83%** (Grade 7) · Interests: Physics, AI/ML, Cybersecurity, Competitive Programming

Beyond the Screen

Football · Physics · Community teaching and knowledge sharing

All research was conducted independently. No institutional credit is assigned to any school or organisation.