

Pradyumna Kaushal

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EDUCATION

National Institute of Technology (NIT), Tiruchirappalli

Bachelor of Technology (B.Tech.) (3rd. Year)

Major in Production Engg. with Minor in Computer Science & Engg.

Trichy, India

Aug. 2023 – May 2027

Dept. Rank 1 — CGPA: 9.87/10.0

AREAS OF INTEREST

Blockchain and Cryptography (Privacy-Preserving Computation, Traceability, Big Data), Cyber-Physical Systems and IoT Security, Industry 4.0 and Automation (Digital Twins, Simulation, AR/VR), Artificial Intelligence and Machine Learning, Sustainable Technologies and Smart Cities

PUBLICATIONS

- (Preprint) **VehiclePassport: A GAIA-X–Aligned, Blockchain-Anchored Privacy-Preserving, Zero-Knowledge Digital Passport for Smart Vehicles**, *arXiv:2509.06133 [cs.CR]*, 2025. Cross-listed in *cs.DC*, *cs.SE*, *eess.SY*. [arXiv](#) [↗](#) - [DOI](#)

EXPERIENCE

King Abdullah University of Science and Technology (KAUST)

Thuwal, Saudi Arabia

Visiting Student, Cyber Security and Resilience (CyberSaR) Lab - Prof. Ali Shoker *Dec. 2025 – Apr. 2026 (ongoing)*

- Conducting **state-of-the-art zero-knowledge** research in **applied cryptography** and **security/privacy**, focusing on rigorous protocol analysis, **secure sharding** primitives, and adversarial threat modeling.
- Producing internal artifacts (formal reasoning, experiments, and documentation) to support secure, reproducible system design under confidentiality constraints.

National Institute of Technology (NIT), Tiruchirappalli

Trichy, India

Research Assistant - Circular Economy & Sustainability - Prof. S. Prasanna Venkatesan

Aug. 2025 – Present

- Advancing a Government of India funded project on carbon accounting, life cycle assessment, and traceability of refurbished devices; aligned with **ISO 14040/14044**, the **GHG Protocol Product Standard**, and delivering a **Digital Product Passport** tool with **12N QR-based** device identities for MSMEs.
- Implementing **component-level emissions models** (replacements, logistics, use-phase) using **vendor PCFs/LCI datasets** with a **DPRNN deep learning** model for richer temporal and nonlinear pattern capture; designing **verifiable certificates** (VC/NFT badges) to incentivize refurbishers and buyers beyond offsets.

Complere.xyz

Mumbai, India

Research Intern - Blockchain Scalability & RWA DLT

Jul. 2025 – Oct. 2025

- Engineered an **app-specific L2 rollup** on Cosmos-SDK to bridge RWA and stablecoin ecosystems, integrating **proto-danksharding (EIP-4844)**, **modular DA layers** (e.g., Celestia), and **optimized batching** delivering $\approx 3,000$ TPS, $< 1s$ latency, and 40% gas reduction.
- Investigated scaling primitives like **EIP-1559 fee markets**, **MEV mitigation** (mempool filters, inclusion rules), and **IBC/custom bridges** (ICS-20/27/29 with ZKP/SBT claims), and integrated **indexers and audit-ready settlement layers** to advance a secure, high-throughput L2 for RWA and regulatory use.

Matter Motor Works

Bangalore, India

Research Intern - Digital Identity & Vehicle Data Systems

May 2025 – Aug. 2025

- **VehiclePassport™** : extended to the **Battery Passport** under **EU Reg. 2023/1542**; engineered blockchain-anchored architectures aligned with **GAIA-X** and **Catena-X**, integrating **ZK proofs**, **dual-signing**, **access tokens**, and **verifiable ledgers** for privacy-preserving traceability.
- Prototyped **real-time telemetry pipelines** for IoT vehicle data anchoring and storage; applied **LSTMs**, **XGBoost**, **Autoencoders** for anomaly detection with 92% accuracy, 30% faster fault prediction, and **privacy-preserving access** in global automotive systems.

Miruvor LLC

Virginia, USA

Cryptography & Blockchain Researcher

Apr. 2025 – Jul. 2025

- Built advanced wallet primitives including **multisig**, **MPC**, and **HD derivation**, with escrow and matchmaking protocols using **multi-currency stablecoin pools** to enhance security and usability.
- Developed **liquidity architectures** with **stablecoin baskets**, **AMM invariants**, and **AI-driven optimization**, achieving 25% lower slippage in **cross-chain settlement** and compliance-ready DeFi.

PROJECTS

402Guard - x402 Policy & Subscription Guard

Nov. – Dec. 2025

Avalanche x402 Hack2Build (Tooling & Infrastructure)

- Built a **TypeScript SDK** adding **x402-aware middleware** to **axios/fetch**: intercepts **HTTP 402**, enforces **per-endpoint/service budgets + rate limits**, and automates **quote→pay→retry** with pluggable **UsageStore (SQLite → Postgres/Redis)**. Achieved **<10ms** local policy overhead per request.
- Implemented an **Avalanche Fuji on-chain subscription registry** (`Guard402Subscriptions.sol`) with **plan caps/expiry + invoice hooks**; shipped **viem TS bindings** and a **Next.js** demo validating **100+** end-to-end guarded x402 requests, leveraging Avalanche **fast finality** for **~1.5–2s** quote→pay→verify→deliver settlement.

On-chain ML Weights with ZK Proofs

Sep. – Oct. 2025

ETH Global

- Prototyped an **Ethereum-based inference layer** enabling deployment of **TensorFlow/PyTorch models** with privacy-preserving verification via **zkSNARK circuits (Circom, SnarkJS)**; leveraged **IPFS** for model storage and **L2 rollups** cutting proof costs by 40%.
- Engineered **gas-optimized smart contracts** for model registry, inference oracles, and payment flows, achieving **0.8s inference latency** while ensuring private model weights and verifiable predictions on-chain.

CosmoTrace - Permissioned Supply-Chain Ledger with MES/DT Anchoring

Jul. – Aug. 2025

Cosmos SDK & Ignite CLI

- Developed a **private chain** with **CometBFT**, implementing **ACL/PoA validators** and custom modules to log **orders, WIP, QC, and shipments** with **Merkle-proof auditability** and actor **DIDs**.
- Integrated **MES/digital-twin telemetry** via **OPC-UA/Modbus**, batched with **Ev-Stack rollups** and anchored on-chain; exposed an **IBC gateway** for inter-org traceability and external anchoring.

Programmable Escrow & Fraud-Resilient Marketplace Payments

Jun. – Jul. 2025

HackOn with Amazon - Season 5

- Built a **Solana escrow contract** in **Rust + Anchor** with **PDA vaults**, auto-releasing funds post return window and preventing refund/settlement fraud.
- Scaled **AWS** backend with **EventBridge, Lambda + Step Functions**, and **DynamoDB**; integrated **Amazon Fraud Detector** for 50K+ tx/day risk scoring at 95% accuracy with full auditability.

EchoPay - Voice & NLP Agent for Crypto Transactions

May – Jun. 2025

Monad Blitz & Google Cloud Agentic AI Day 2025

- Built an **agentic pipeline** on **Monad MCP servers** using **LangChain.js, Gemini Pro**, and speech-to-text to parse voice/text prompts into structured **txn JSON**, validated and executed as **smart contract calls**.
- Integrated a **multi-rail payment router** across CeFi & DeFi (banks, CEX APIs, Solana/Jupiter), with fraud/anomaly detection, **account abstraction**, and real-time execution at **1s block times, 10K+ TPS**.

AWARDS & HONORS

- 2025** Selected for and completed **Amazon ML Summer School** among 60,000+ applicants
- 2025** Winner of **Solana CTF** by Microsoft Azure & Solana Superteam (rewards > **1.5 SOL**)
- 2025** Awarded **\$10K Solana Almighty Grant** for escrow scholarship platform **medici.ac**
- 2025** Achieved **Top 5** in **Monad Ecosystem Blitz** hackathon by Monad Blockchain (100+ teams)
- 2024** **1st Rank Medal**, highest academic performance across NIT Trichy (CGPA: **10.0/10.0**)
- 2024** Awarded **S. J. Chainlu Medal of Excellence**, best performer in Production Engineering
- 2024** Nominated for **Springer Nature Research Ambassador Program** by NIT Trichy
- 2023** Cleared **JEE Advanced**, one of the world's toughest engineering entrance exams (190K+ candidates)
- 2023** Secured **2nd Rank in Pune** (2000+ students) in **CBSE Class XII**, School Topper

RELEVANT COURSEWORK

Matrices, Linear Algebra and Calculus; Probability and Statistics; Operations Research and Data Analytics; Industrial Automation, Robotics and Industry 4.0; Manufacturing System Simulation; Lean Mfg.; Data Structures and Algorithms; Cryptography and Big Data; Computer Networks; Artificial Intelligence & ML