

# SHASHANK BAGDA

## Research Engineer - AI Systems & Hardware Security | HW-SW Co-Design

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## SUMMARY

Master's student in **Software Engineering** with hands-on research experience in secure and high-performance **AI systems**, adversarial threat modeling, and hardware-software co-design. Proficient in **C++**, **Python** and **Java**, with experience building and benchmarking system-level optimizations using PyTorch/TensorFlow, SIAM and GEM5. Focused on designing scalable, trustworthy and performance efficient AI systems at the intersection of ML infrastructure and computer architecture.

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## EDUCATION

### NATIONAL UNIVERSITY OF SINGAPORE | ISS

Master of Technology - Software Engineering

Aug 2025 -  
Sep 2026

- Coursework: Software Architecture & Design, Cloud-Native & Platform Engineering, DevSecOps, Secure SDLC, Agile Methodologies

### MARWADI UNIVERSITY

Bachelor of Technology - Information and Communication Technology

Sep 2021 -  
May 2025

- Honors: First Class with Distinction

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## PROJECTS

- Hardware Security & Systems Research (IIT Guwahati)
  - Conducted system-level research on secure and performance-efficient multicore architectures, including NoC security analysis, adversarial threat modeling, and simulation-driven benchmarking.
- Handwriting to G Code
  - Designed an AI-driven pipeline converting handwritten input into machine-readable control instructions, focusing on robustness, preprocessing accuracy, and system reliability.
- Telecom Architecture
  - Designed and documented a scalable telecom system architecture, analyzing performance, reliability, and fault-tolerance trade-offs using graph-based modeling.

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## RESEARCH EXPERIENCE

### INDIAN INSTITUTE OF TECHNOLOGY - GUWAHATI

Research Intern

May 2024 - Aug 2024

- Designed and evaluated **homogeneous and heterogeneous AI system architectures** using the **SIAM simulator**, enabling scalable training and inference across 12+ distinct AI workload configurations.
- Reduced end-to-end processing latency by 22–28% through **parallel execution** and **in-memory computing** techniques on multicore platforms.
- Engineered **hybrid network structures** that improved inference responsiveness and sustained throughput under production-scale deep learning workloads.
- Conducted system-level performance benchmarking across 8000+ simulation runs, analyzing latency, throughput, and resource utilization trade-offs.
- Developed high-performance experimental pipelines in **C++** and **Python**, automating configuration sweeps and reducing research iteration time by ~35%.

- Designed and implemented **Hardware Trojan Detection** mechanisms for **multicore Network-on-Chip (NoC) systems**, improving system trustworthiness under adversarial conditions.
  - Performed **threat modeling** and attack-defense evaluation to quantify security performance trade-offs in cyber-physical and on-chip communication systems.
  - Evaluated NoC security and performance using the **GEM5 simulator (Garnet Standalone)** across 3500+ simulation scenarios, identifying critical attack vectors and communication bottlenecks.
  - Improved on-chip communication efficiency by implementing dynamic routing algorithms in **C++** and **Python**, reducing average packet latency by 17–21%.
  - Delivered measurable gains in system resilience (~30%) and hardware efficiency (~18%) through detailed simulation-driven performance analysis.
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**SKILLS****Programming & Systems**

- Languages: C++, Python, Java
- Parallel & Performance Computing: Multicore processing, system profiling, performance optimization

**Machine Learning & AI**

- Frameworks: PyTorch, TensorFlow
- Core Concepts: Deep Learning, Neural Networks, Model Optimization, Performance Benchmarking
- AI Safety & Security (Foundational): Adversarial ML concepts, Threat Modeling, Robustness Evaluation

**Systems & Hardware**

- Computer Architecture, Digital Systems
- Embedded & IoT Systems: Arduino, Raspberry Pi, ESP8266/ESP32, Zigbee
- Circuit Design & Simulation: PCB Design, Circuit Simulation, Logic Design

**Software & Platforms**

- Backend & APIs: REST APIs, Java (JSP/Servlets), MySQL
  - Web (supporting): ReactJS, HTML, CSS, JavaScript
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**INTELLECTUAL PROPERTIES****Patent**

- Method for Converting Handwritten Characters into Machine-Readable Instructions (202421033236)

**Copyright**

- Telecom Architecture (8416/2023-CO/SW)
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**AWARDS, HONOURS & ACHIEVEMENTS**

- Student Startup and Innovation Policy (SSIP) Hackathon 2022 - Second Highest Honour (Government of Gujarat, India)
  - Club Founder Award 2024 - Circuitology Club, Marwadi University
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**LEADERSHIP & STEM ACTIVITIES**

- Chair - IEEE MEGI Student Branch (2024): Led student operations, coordinated technical events, and collaborated with industry professionals.
- Founder - Circuitology Club (2021): Built a 110+ member technical community, secured USD 3,500+ in funding, and organized 30+ workshops and STEM outreach sessions.