Mohd Sajid Zubair

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Education

Computer Science Engineering, *Gokaraju Rangaraju Institute of Engineering and Technology* 08/2023 – present
CGPA : 8.8 Hyderabad, India

Technical Skills

Programming Languages
C, C++, Python, Java, GLSL

Databases
MySQL, SQLite, PostgreSQL, Supabase, MongoDB

Frameworks & Libraries
LLVM, CUDA, NodeJS, ReactJS, NextJS, Flask, Django

Compilers
LLVM, NIR (Mesa), SSA form, control flow graph (CFG) analysis, Compiler pass writing, Shader compiler backends

Professional Experience

Compiler Research Intern, *Indian Institute of Technology, Bombay* 06/2026 – Present

- Integrated SVF-based pointer analysis into the SLIM compiler by wiring the end-to-end pipeline for Points-to Information generation and retrieval.
- Implemented macOS (Apple Silicon) build support, including LLVM toolchain integration, CMake configuration, and automation scripts for pointer analysis generation.
- Investigated pointer analysis behavior across global, local, array, struct, and multi-level pointer test cases, identifying IR transformation issues and proposing improvements to the LLVM/SVF compilation pipeline.

Web Development Mentor, *Advanced Academic Center* 2024 – present
Hyderabad, India

- Mentored 25+ students in C++, Python, JavaScript, and web technologies, ensuring industry-standard coding practices.
- Facilitated cross-functional collaboration between frontend and backend teams, mirroring real-world software engineering workflows.
- Acted as a primary problem solver for technical and debugging queries, improving the resolution time by 40%.
- Supervised project development from design to deployment, emphasizing scalability, performance, and security.

Projects

Control Flow Checking by Software Signatures (CFCSS) 11/2025

- Engineered a custom LLVM transformation pass to implement Control Flow Checking by Software Signatures (CFCSS), enhancing program resilience against runtime transient faults and bit-flips.
- Implemented a signature-based monitoring system that assigns unique identifiers to Basic Blocks and embeds XOR-difference logic into the program's IR, enabling real-time detection of illegal control flow transitions.
- Optimized hardware-independent error detection by automating the insertion of verification instructions at the entry point of every CFG node, ensuring runtime signatures match pre-calculated compile-time constants.

NIR dead-code elimination pass 09/2025

- Wrote a custom NIR post-pass that identifies and removes dead instructions (those with no live uses in the def-use chain) in GLSL fragment shaders targeting the v3d backend
- Reduced emitted QPU instruction count by 8–14% on a suite of synthetic shader benchmarks by eliminating unused arithmetic in loop-heavy shaders
- Verified correctness across 200+ Piglit shader tests with zero regressions introduced

Real-Time Particle System & Physics Solver 07/2025

- GPU-Accelerated Simulation: Engineered a high-performance particle engine capable of simulating 10,000+ active entities by utilizing Vertex Buffer Objects (VBOs) and custom GLSL Shaders for per-particle calculations.
- Physics Integration: Implemented a custom kinematics solver to handle gravity, wind resistance, and Point-to-Circle collisions, ensuring realistic motion and interaction within the environment.
- Efficient Memory Management: Developed a Circular Buffer data structure to manage particle lifecycles, minimizing CPU overhead by recycling memory addresses and reducing frequent allocations.