

# Akash Banerjee

## Contact

akashbanerjeeab.github.io

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## Languages

English, Hindi, Bengali

## Programming Languages

C  
C++, JAVA  
C#, JavaScript  
Python  
Flex/Bison  
LLVM, GOTO  
Git, GDB,  $\LaTeX$

## Qualifications

2021–Pres	<b>Graphics Compiler Engineer</b> at Imagination Technologies	Kings Langley, UK
2018–2021	<b>M.Tech.</b> in Computer Science and Engineering - 9.50/10 CGPA	IIT Hyderabad
2013–2017	<b>B.Tech.</b> in Computer Science and Engineering - 8.37/10 CGPA	RERF, Kolkata

## Interests

### Compiler Optimizations

Using novel techniques and engineering principles for optimizing software systems.

### Software Verification

Exploring techniques for formal verification of programs like Symbolic Execution, Abstract Interpretation, etc.

### SAT Solvers

Studying and exploring techniques and encoding to make SAT/MaxSAT solvers more efficient

## Skills

### Programming Ability

Skilled in C, C++ and able to adapt quickly to new languages

### Frameworks

LLVM Compiler Infrastructure, CPRover Verification Framework

### Tools

Git,  $\LaTeX$ , GDB, LLDB, Eclipse

## Projects

Jun. - 2021	<b>Proteus: Polymorphic Compilation</b>	IIT Hyderabad
	Proteus is a compiler tool which uses polymorphic compilation and execution techniques to mitigate a class of side channel attacks with minimal performance overhead, compared to the other state-of-the-art solutions available. This work was done as part of my master's thesis project. It is currently in submission awaiting reviews at a peer reviewed conference.	
Apr. - 2020	<b>BPI Enhancements</b>	IIT Hyderabad
	Proposed and implemented improvements to the Branch Probability Information pass in LLVM to allow better static profiling leading to speed-up of up to 1.07x, as part of the course project for Advanced Compiler Optimizations - CS6240. Accepted as a poster in EuroLLVM-20 held at Paris, France.	
Oct. - 2019	<b>Loop Acceleration</b>	IIT Hyderabad
	Added a loop acceleration module to the Pinaka verifier for quick detection of counterexamples in loops simulating polynomial functions. Pinaka is developed by IITH Software Verification Group which won the third-fastest verifier position in SV-COMP'20 Floats sub-category, amongst other positions and was the only entry from Indian academia. Appreciated by the Dept. of CSE for this work here.	

- Sep. - 2019 **LLVM2GOTO** IIT Hyderabad  
 Created a tool to translate LLVM IR to CBMC-GOTO. LLVM supports multiple front-ends like C, C++, FORTRAN, Swift, etc., which get converted to LLVM-IR. CBMC is a tool to verify programs which has its own GOTO IR, this tool translates LLVM-IR to GOTO IR, allowing us to potentially verify all the languages that are supported by LLVM's front-end.
- Aug. - 2019 **COOL Compiler** IIT Hyderabad  
 Designed and implemented a compiler for the COOL language to generate LLVM IR as part of the course project for Advanced Compiler Design - CS CS6240.
- Mar. - 2019 **SAT Solvers** IIT Hyderabad  
 Implemented DPLL SAT Solver with MOMS heuristics, CDCL SAT Solver with Lazy Datastructure and Watch Literals, MaxSAT with Totalizer encoding and an Incomplete SAT Solver based on Break-only-poly algorithm and WalkSAT. As part of the course project for Constraint Programming - CS6483.
- Nov. - 2018 **Hybrid Mutual Exclusion in Distributed Systems** IIT Hyderabad  
 An efficient implementation of a hybrid mutual exclusion algorithm for distributed systems by combining Raymond's and Maekawa's algorithms by multiplexing between them when communicating within clusters and across clusters, based on load, latency and throughput. As part of the course project for Distributed Computing - CS5320.
- Aug. - 2018 **Distributed Systems** IIT Hyderabad  
 Implemented Vector Clocks with optimization, Snapshots using Chandy-Lamport and Lai-Yang algorithms, and Distributed Mutual Exclusions using Suzuki-Kasami and Kerry Raymond algorithms. This was done as part of the course Distributed Computing - CS5320.

## Co-Curricular

- Jan. - 2020 **Teaching Assistant** IIT Hyderabad  
 Helped in grading and evaluating assignments for the CS6483-Constraint Programming course
- Aug. - 2019 **Webpage Moderation** sat-smt.in  
 Maintainer for the Indian SAT+SMT School website :<https://sat-smt.in>
- Jul. - 2019 **FMUpdate-India 2019** fmindia.cmi.ac.in  
 Organizing team member at the Formal Methods Update Meeting 2019
- Jun. - 2019 **System Security** COEP Pune  
 Attended ACM India Summer School on Detection and Analysis of Malware

## Hobbies

### Gaming

Competitively play MMO games, and also design games

### Photography

In the top 10% of contributors at Unsplash

### Fishkeeping

Enjoy building and maintaining nature Aquascapes

### Astrophysics

Curious about the Cosmos and the pale blue dot we live in

## References

Dr. Saurabh Joshi - [sbjoshi@cse.iith.ac.in](mailto:sbjoshi@cse.iith.ac.in)

Dr. Ramakrishna Upadrasta - [ramakrishna@cse.iith.ac.in](mailto:ramakrishna@cse.iith.ac.in)