Grand Opportunities and Greatest Adventures in Software Engineering

Ready?

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भारतीय प्रौद्योगिकी संस्थान तिरुपति
IIT TIRUPATI

IIT Tirupati Campus (A glimpse)

Not generated by Generative AI/LLM

Department of Computer Science & Engineering

Established 2017 | 11 Faculty + (2) | ~320 Students

Programs: B.Tech CSE, M.Tech CSE, M.Tech DSAI, **Dual Degree**, MS by Research, PhD

Research Groups: AI & ML, Architecture & Parallel Computing, Connectivity Technologies, Software Engineering, Theoretical CS

Alumni at: Amazon, Google, Microsoft, Salesforce, Qualcomm, Harvard, Waterloo, EPFL, IIM-A/L/B, IISc

RiSHA LAB

RESEARCH IN INTELLIGENT SOFTWARE AND HUMAN ANALYTICS

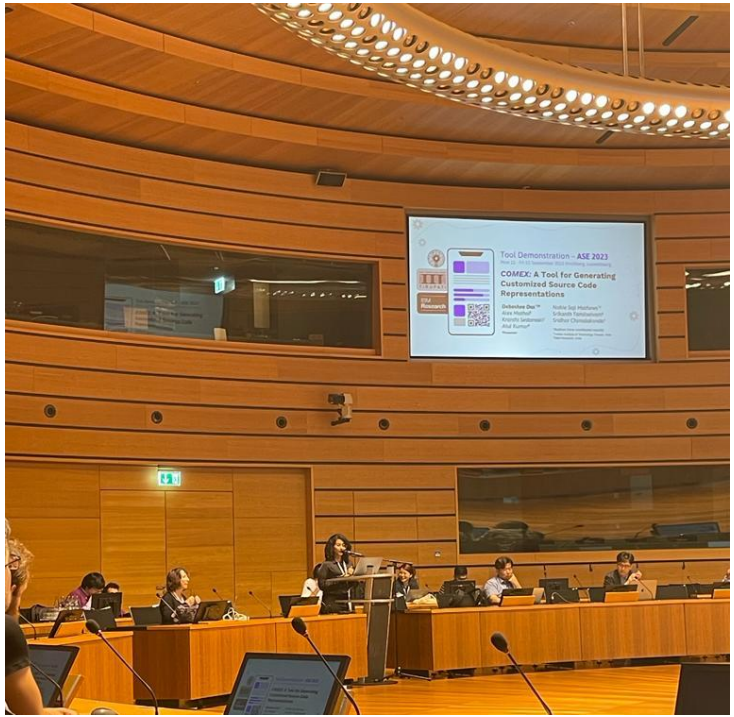
🎯 *15 research works with undergrads as*

- ~4 Key Research Themes
  - Software Documentation & Legacy Modernization
  - Green Software Engineering
  - Source Code Representation, Bugs, Code Smells, Patterns
  - Compliance and Standardization
- ~20+ Software Tools
- ~ Publications in multiple tracks - ICSE , FSE, ASE, MSR, EASE, ICSME…
- + Lots of explorations and unpublished ideas!

AR Storytelling for Śrīmad-Bhāgavatam: An Immersive Experience Through Time and Scale

SANER 2026 (Cyprus), ICPC 2026 (Brazil), ICSE 2026 (Brazil),
ICSE 2025 (Canada), FSE 2025 (Norway), EASE 2025 (Turkey)

DocMine Dataset @MSR 2023 (Australia)
COMEX Tool @ ASE 2023 (Luxemburg)



The World Runs on Software

20M+

GitHub Copilot Users

100M+

ChatGPT Users

~$600B

Global Software Market

~28M?

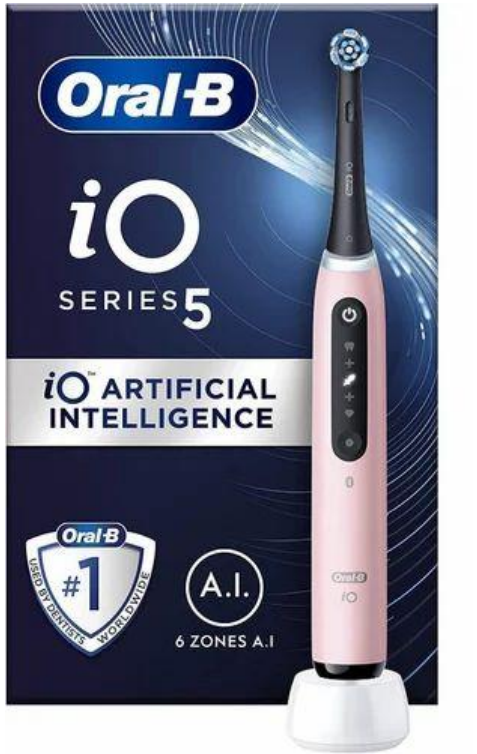
Software Devs Worldwide

Every product, every service, every transaction today is powered by software (and AI?).

Your UPI payment. Your food delivery. Your flight booking. Your hospital records.

Software Engineering is the discipline that makes ALL of this work.

Software (*with AI*) is Ubiquitous* Today!



Can Generative AI automate the software engineer's work?

Anthropic CEO claims software engineering will be obsolete in 12 months, Sridhar Vembu says pay attention

Anthropic CEO Dario Amodei has warned that software engineering could become obsolete within the next 12 months as AI systems take over most coding work. Now, Zoho founder Sridhar Vembu has reiterated the warning, saying it should

Your PC ran into a problem and needs to restart. We're just collecting some error info, and then we'll restart for you. (0% complete)

If you'd like to know more, you can search online later for this error: UNEXPECTED KERNEL MODE TRAP

"I Agree" for What????

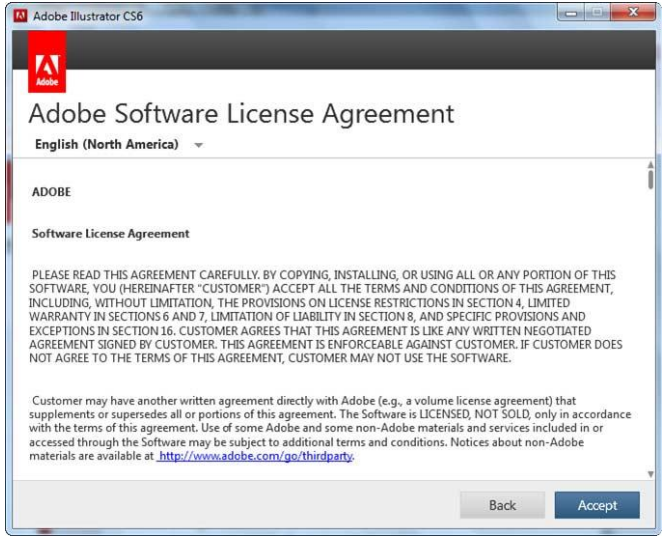
Every day, billions of people click "I Agree" without reading a single line of terms and conditions.

You install an app. You click Accept. You have no idea what you just agreed to. Neither does the developer who wrote it.

No warranty. No guarantee. No liability.
"This software is provided AS IS, without warranty of any kind."

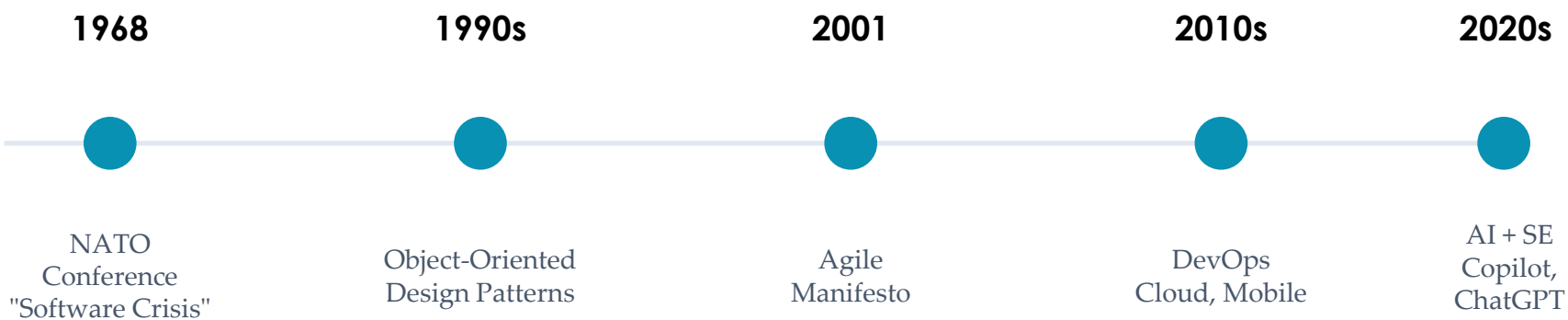
Imagine if civil engineers built bridges this way.
Imagine if doctors prescribed medicine this way.

This is a Software Engineering problem.
And it is waiting for YOU to solve it.



How Did We Get Here?

A Brief History of Software Engineering



Software Engineering is one of the youngest and fastest-evolving engineering disciplines!

The AI + Software Engineering Moment

AI is writing code. AI is testing code. AI is reviewing code.

But who builds the AI (but AI is software too!)? Who ensures it is correct? (secure, reliable, maintainable, available, usable…)

Software Engineers.

The more AI we build, the more Software Engineering we need. This is not a threat.

This is the greatest opportunity for this generation

The Grand Opportunities

What exciting questions can we explore?

Healthcare for a Billion People: Who Builds the Software?

- Electronic Health Records that work across India's diverse systems
- AI-powered diagnostics accessible in rural areas
- Telemedicine platforms in 22+ Indian languages
- Privacy-compliant health data systems (DPDP Act)

Education in 100+ Indian Languages: Who Makes the Software Accessible?

- Adaptive learning platforms for diverse learners
- All learning material in regional languages? Personalized?
- Educational games for computer science literacy
- AR/VR immersive learning experiences

Legacy (Software) Systems: Who Modernizes Them?

- COBOL still powers ~80% of financial transactions worldwide
- Government e-governance systems need modernization
- AI-assisted code migration and refactoring
- Millions of lines of legacy code await innovation

AI is ~~Writing Code~~ Generating Software. Who Ensures It Actually Works?

- Who tests the AI? Who debugs the AI agent?
- Trust models for AI-generated code
- Standards and compliance (ISO, EU AI Act, India's DPDP)
- Energy efficiency of AI systems (Green Software)

1.4 Billion People (~8 billion), Infinite Needs: Who Builds Software for Everyone?

- Accessibility for persons with disabilities (WCAG standards)
- User interfaces that work across devices and literacy levels
- Software for underrepresented and underserved communities
- Ethical AI that does not discriminate

And Many More Questions...

? How do we automatically find and fix bugs in software?

? How do we make AI and software energy efficient?

? How do we design personalized user interfaces for everyone?

? How do we build software that respects privacy by design?

? How do we ensure AI-generated code is safe and secure?

? How do we trace requirements from design to deployment?

? Why does software quality suffer? How to improve it?

? Can AR/VR transform how we visualize Indian epics?

Each question is a research opportunity. Each is a career.

When to use and when not to use the capabilities of Generative AI for software development?

Who Sets the Rules?

Standards & Regulation in Software Engineering

सत्यमेव जयते

INDIAai
A MEITY INITIATIVE

International Standards

ISO/IEC JTC1/SC7: Software & Systems Engineering standards used worldwide

ISO/IEC SC42: Artificial Intelligence standards

NEW: AI-Assisted Software Development

Chair, ISO/IEC SC7 AHG9 on AI-Assisted SW Dev
Shaping global standards for how AI tools are used in software development

Regulation Landscape

EU AI Act: World's first comprehensive AI regulation

India DPDP Act: Digital Personal Data Protection

BIS (Bureau of Indian Standards): India's role in shaping global standards

Opportunity: India needs researchers who understand BOTH the technology AND the regulation

Green Software Engineering (AI)

How do we make software energy efficient?

AI models consume enormous energy. Data centers are the new power plants.

Questions:

How much energy does a single ChatGPT query consume?
Can we measure energy consumption of legacy vs modern software?
Can we build energy-efficient AI agents?
What is the carbon footprint of your code?

At RISHA Lab: We built COBJoules and CPPJoules, tools to measure energy consumption of COBOL and C++ programs. SLEM framework for energy measurement.

Why Software Engineering is Hard

The Ill-Formed World

Well-Formed Problems

Sorting a list of numbers
Computing a shortest path
Compiling code into machine language
Running a test suite

Clear input, clear output, clear solution.

Ill-Formed Problems

What does the customer actually want?
Is this design good enough?
Will this system scale to 1 billion users?
Should we refactor or rewrite?

No clear input, no clear output, no clear solution.

Software Engineering lives in the ill-formed world.
No physical artifacts. Mind-boggling complexity. Rapid change.
Intangible products. Human factors everywhere.

This is why SE needs researchers. AI can solve well-formed problems.
The ill-formed ones? That is where YOU come in.

The Greatest Adventures

Where does Software Engineering research happen?

World-Class SE Conferences

Where the best SE research is presented

ICSE

International Conference on Software Engineering

The flagship. Top venue since 1979.
Upcoming: ICSE 2026 in Milan

FSE

Foundations of Software Engineering

ACM SIGSOFT's premier conference.
Core systems and methods

ASE

Automated Software Engineering

Automation, AI for SE, tools.
Highly competitive

ISEC

India Software Engineering Conference

India's own SE conference!
ACM SIGSOFT sponsored

AIware - ACM Conference on AI-Powered Software

The newest conference at the frontier of AI + Software Engineering

Vision: "Software for all and by all"

Software is evolving through generations:
Codeware (human) → Neuralware (AI expert) → Promptware (prompts) → Agentware (agents) → Mindware (brain-computer)

AIware 2024: Porto de Galinhas, Brazil (co-located with FSE)
AIware 2025: Seoul, South Korea (co-located with ASE)
AIware 2026: Montreal, Canada (co-located with FSE 2026)

Why this matters: This conference is shaping the future of how software is built.

SERI - Software Engineering Research in India

A growing community of SE researchers across India

What is SERI? A network connecting SE researchers in Indian academia and industry. Building a collaborative ecosystem for world-class SE research from India.

Why it matters: India has one of the world's largest software industries but needs more SE researchers. SERI bridges this gap.

For students: Mentorship, research exposure, connections to SE labs across the country, pathways to ISEC, ICSE, FSE

ISEC - Innovations in Software Engineering Conference

India's own ACM SIGSOFT-sponsored SE conference

Tracks: Research papers, industry track, student research competition, tool demos, doctoral symposium

Why attend: Present your first research paper, network with SE researchers, learn about career opportunities

Great entry point for students beginning their SE research journey!

ISOFT - ACM SIGSOFT India Chapter

The India Chapter of ACM SIGSOFT

ACM SIGSOFT: The global body for SE research. Sponsors ICSE, FSE, ISEC, and many more.

ISOFT: Connects the Indian SE community. Organizes events, workshops, supports student participation.

For students: Student memberships, travel grants, mentorship, access to global SE community

RISHA Lab @ IIT Tirupati

Research in Intelligent Software & Human Analytics

Research Themes

AI + Software Engineering
Legacy Software Modernization (COBOL)
Green / Energy-Efficient Software
Computing for Society
Accessibility & Indian Languages
AR/VR for Education & Heritage
AI Trust, Reliability & Standards

Impact

25+ publications at ICSE, FSE, ASE
20+ open-source tools
Funding: ISRO, DST, SERB, ANRF
Industry: Google, Microsoft, IBM, Accenture

rishalab.in

RISHA Lab Alumni Stories

Where our students go:

Higher Education: EPFL, Harvard, Waterloo, Rutgers, IISc, IIM-A/L/B

Industry: Amazon, Google, Microsoft, Salesforce, Qualcomm, X

What makes it work: We nurture students not just for their first job, but for their last job.
UG students lead publications at top conferences.
Interns become collaborators and co-authors.

Openings: Internships, BTP, MS/PhD positions, Anvesthan Setu (ACM India)

"RISHA Lab is an addiction" - multiple alumni

Your Pathway to the Adventure

How do you get started?

Direct PhD Is Now One of the Best Routes*

PMRF, Fellowships: Up to ₹80,000/month

IITs, IISc, IIIT-H, NITs offer Direct PhD programs.

No need to do MTech first. Go directly from B.Tech to PhD.

UG (1st, 2nd, 3rd)

Research internships
(SURGE, Anvesthan Setu)

Final Year

Apply for Direct PhD / MS
Pre-doctoral fellowships
Industry R&D labs in India

MTech / MSc

Thesis → publication
Convert to PhD proposal
Research engineer roles
Faculty track at IITs, NITs
Industry

The Great Indian Wedding
AI + Software Engineering

The Greatest Adventure of Our Times

The wedding is happening, whether we planned it or not.

Was it a **Love Marriage**? (Developers who chose AI)

An **Arranged Marriage**? (Management mandated it)

Or did it just... ***happen***?

Either way, someone needs to make this marriage work.

That someone could be YOU.

The Seven Sacred Vows

A Word of Caution: Making the AI + SE Marriage Work

1	**I promise to validate, not just generate**	*Every AI output needs human verification. Always.*
2	**I vow to maintain human oversight**	*AI assists. Humans decide. No exceptions for safety-critical systems.*
3	**I accept hallucinations with patience**	*AI will be wrong. Plan for it. Test for it. Build guardrails.*
4	**I promise to keep learning**	*The field changes every month. Stay curious. Read. Experiment.*
5	**I vow to respect privacy and ethics**	*Data is not free. Consent matters. Bias is real. Act accordingly.*
6	**I promise not to replace humans entirely**	*Augment, don't replace. The goal is better software, not fewer people.*
7	**Together, we debug till deployment do us part**	*This marriage requires commitment, patience, and continuous improvement.*

The key is not which type of marriage. It is making ANY marriage work.

India AI Impact Summit 2026

IIT Tirupati as Official Pre-Summit Event Host

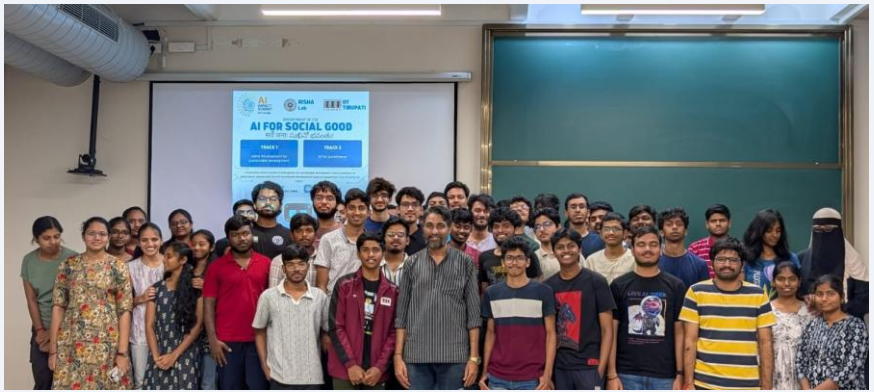
We hosted the "AI for Social Good Hackathon"
60 students, 11 teams, 11 working prototypes in 24 hours

Key Insights for India:

1. AI for Social Good requires deep domain expertise and context. Generic AI solutions fail.

2. Significant challenges: resource constraints, data availability, India-specific models needed.

3. India needs multidisciplinary research across AI, Software Engineering, HCI, Accessibility.



CSE @ IIT Tirupati – Research Opportunities

Dr. Jaynarayan T.T.
Computer Architecture

Dr. Raghavendra K.
Parallel Computing

Dr. Ramakrishna G.
Algorithmic Eng.

Dr. Raja S.
Theoretical CS

Dr. Sridhar Chimalakonda (Head)
Software Engineering

Dr. V. Mahendran
ML for IoTs

Dr. Ajin George
Reinforcement Learning

Dr. Kalidas Y.
ML & AI

Dr. Chalavadi Vishnu
Computer Vision

Dr. Varsha Bhat
Cryptography

Dr. Venkata Ramana B.
Computer Networks

Key Takeaways

Software Engineering is not just coding. It is designing, testing, maintaining, and evolving complex systems.

AI creates MORE need for SE researchers, not less. The opportunities are exploding.

India is building world-class SE research labs. You can be part of this exciting journey.

Standards and regulation are shaping the future. India is at the table.

There are clear pathways: internships, Direct PhD, MS, PMRF, industry research, faculty careers.

The best time to start is NOW. Reach out to a lab (RISHA Lab). Read a paper. Start exploring!

Your Next Steps

Do this TODAY, not tomorrow

THIS WEEK	Pick one question from today that excites you. Google it. Read one paper about it.
THIS MONTH	Check a professor's work at ANY SE lab in India. Ask about internships or projects. One email could change your career.
THIS SEMESTER	Attend ACM SIGSOFT Webinar Series. Start building something (novel)
THIS YEAR	Build your profile! Publication, product or any form! Apply to MS/PhD programs. Join SERI.
RIGHT NOW	Take a photo of this slide. Save rishalab.in. Connect on LinkedIn.

The adventure starts with a single step. Take it now.

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Greatest Adventures
Software Engineering.

Ready?

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IIT Tirupati

"Necessity is the mother of invention"
Creativity is the father
Passion, Curiosity & Originality are siblings
Capability & Copability are cousins
Inventions & Innovations are heirs!!!
[while luck is the best friend]