Hariharan Thiagarajan

thari@ksu.edu
1 785-323-7030

Summary

- Extensive experience in developing scalable static analysis tools
- Model-based systems engineering of safety and security-critical systems

Education

Kansas State University, Manhattan, Kansas USA **2022**
Doctor of Philosophy, Computer Science

Kansas State University, Manhattan, Kansas USA **2011**
Master of Science, Computer Science

Anna University, Chennai, Tamil Nadu India **2009**
Bachelor of Technology, Information Technology

Industry Experience

Senior Software Engineer - Zoox **April 2023 – present**

- Wrote job description, recruited, managed, and evaluated a summer intern
- Managed an intern to develop a Clang-Tidy-based in-house static analysis checker and fixer
- Improved existing tool for collecting and viewing inter and intra-component latency
- Developed A-B comparison framework, automated report generation, and comparison charts
- Built a mechanism for tagging critical components and their information flow in pub-sub graph
- Engineered a querying tool to query and visualize the pub-sub graph

Software Engineer - Zoox **December 2021 – April 2023**

- Architected Software Bill Of Materials web application for continuous tracking and software quality metrics collection for the automotive safety standard
- Integrated tools with Bazel build system to collect metrics such as code coverage, static analysis violations, cyclomatic complexities, memory and thread safety, and SLOC
- Identified bottlenecks in the metrics collection process and improved its performance by 100x
- Built an automated system for communicating safety metrics to the stakeholders and creating release blockers when the quality falls below a specified threshold
- Integrated Coverity static analysis tool with the existing Bazel build system and improved its accuracy by 3x and performance by 8x
- Developed entire pipeline and in-house web app for displaying static analysis violations with false-positive suppression mechanism by files, components, and teams

Summer Internship : *Mathworks - Simulink Compiler Engineering*

❑ Summer 2015
- Worked in Simulink Code Efficiency team, responsible for optimized C code generation
- Developed a novel technique to perform sub-expression elimination in the absence of SSA
- Enhanced for-loop data copies to "memcpy" system call transformation phase

❑ Summer 2014
- Enabled variable dimension matrix in optimization phases
- Identified and fixed a few bugs in Simulink 2014b release

Academic Experience

Graduate Research Assistant - KState University **August 2015 – December 2021**

❑ Security & Safety Co-Analysis Tool Environment
- Designed closed-loop medical devices in AADL modeling language
- Performed risk management using EMv2 (Error Modeling Annex Version 2)
- Engineered model level general information flow framework for AADL + EMv2
- Created a stand-alone web-based model analyzer and visualizer tool
- Automated risk analysis and report generation for ISO14971 medical device standard
- Developed a novel slicing algorithm for AADL models with error behaviors and state machines

❑ Cyber Assured Systems Engineering
- Analyzed an Unmanned Aerial Vehicle (UAV) AADL model for security vulnerabilities
- Built a domain-specific query language to check safety and security properties
- Visualized cyber-physical threat scenarios and effectiveness of the mitigation strategies

❑ Fault Injection and Analysis for Safety and Security
- Enhanced AADL to support modeling multilateral-secure systems through an annex
- Incorporated security annex with Eclipse IDE supporting syntax parsing and semantic checks
- Implemented an automated checker and inference engine to perform effective taint analysis
- Integrated information flow analysis framework with Eclipse-based AADL IDE

Project Website https://awas.sireum.org/

Co-Instructor & Graduate Teaching Assistant **2013 – 2015**

❑ Graduate Course: Translator Design Class size: 12
- Taught various modules of compiler construction, optimization, and memory management
- Designed and graded exams, projects, and final presentation

❑ Undergraduate Course: Programming Logics Total: 200+
- Delivered lectures and conducted quiz to a class of over hundred students
- Designed and graded assignments in propositional and predicate logic

Graduate Research Assistant - KState University **2009 – 2012**

- Involved in SPARK 2014 language design discussion group
- Assisted AdaCore in designing SPARK 2014 information flow analysis tools
- Developed a verification tool for Spark Ada to identify information leak
- Wrote an interpreter for a domain specif language to specify information flow policies
- Implemented information flow analysis framework for SPARK Ada
- Integrated information flow analysis framework with AdaCore GPS IDE.

Publications

Hariharan Thiagarajan, **Supporting model based safety and security assessment of high assurance systems** *Ph.D. Dissertation, 2022, Kansas state University.* Major Professor: Dr. John Hatcliff.

Thiagarajan, H., Hatcliff, J. and Robby, **Awas: AADL information flow and error propagation analysis framework**. *Innovations Syst Softw Eng 18, 485–504 (2022)*

Hariharan Thiagarajan, John Hatcliff, and Robby, **Awas: AADL Information Flow and Error Propagation Analysis Framework**. *ECSA: European Conference on Software Architecture*, ECSA 2020

Hariharan Thiagarajan, Brian Larson, and John Hatcliff, **Model-based Risk Analysis for an Open-Source PCA Pump using AADL Error Modeling**. *International Symposium on Model-Based Safety and Assessment*, IMBSA 2020

Hariharan Thiagarajan, John Hatcliff, Jason Belt and Robby, **Bakar Alir - Supporting Developers in Construction of Information Flow Contracts in SPARK**. *Source Code Analysis and Manipulation*, SCAM 2012

Hariharan Thiagarajan, **Dependence analysis for inferring information flow properties in Spark ADA programs** *M.S. Thesis, 2011, Kansas state University.* Major Professor: Dr. John Hatcliff.

Presentations

Hariharan Thiagarajan, John Hatcliff, and Robby, **Awas: AADL Information Flow and Error Propagation Analysis Framework**. *ECSA: European Conference on Software Architecture*, (ECSA 2020), L'Aquila, Italy, September 2020.

Hariharan Thiagarajan, Brian Larson, and John Hatcliff, **Model-based Risk Analysis for an Open-Source PCA Pump using AADL Error Modeling**. *7th International Symposium on Model-Based Safety and Assessment*, (IMBSA 2020), Lisbon, Portugal, September 2020.

Hariharan Thiagarajan, **Risk Analysis for Medical Device Systems of Systems**. *9th Midwest Verification Day*, (MVD 2017), Manhattan, Kansas USA, October 2017.

Hariharan Thiagarajan, John Hatcliff, Jason Belt and Robby, **Bakar Alir - Supporting Developers in Construction of Information Flow Contracts in SPARK**. *Source Code Analysis and Manipulation*, (SCAM 2012), Riva del Garda, Trento, Italy, September 2012.

Service

Reviewer

- 30th IEEE Real-Time and Embedded Technology and Applications Symposium - RTAS 2024
- Design, Automation and Test in Europe Conference - DATE 2023
- International Journal on Software Tools for Technology Transfer - STTT 2024

Projects

RegEx Comparator **2013**
Developed a tool to identify the equality of regular expressions and sort them by number of states. Provides minimal expression for a given regular expression.

Model Checker **2012**
Built a Model Checker to detect deadlocks in multi-threaded programs. Experimented with depth first search, breadth first search, and various techniques in storing visited states.

Macro Processor **2011**
Programmed a pre-processor to support several programming language and domains. Its features include user defined macros and templates, polymorphic fields, n-ary parameters and named fields.

Java to C **Fall 2010**
Wrote a translator that converts Java programs to C programs. Development stages include parsing, building Abstract Syntax Tree (AST), type checking and generating Java bytecode and C code.

Garbage Collector **Fall 2010**
Devised a system program that periodically walks through heap memory of C programs and frees the garbage memory. This uses the **Mark and Sweep** algorithm to compute and clean garbage memory.

Wireless Security in Ad-hoc Networks Using Hybrid Key Protocol **Spring 2009**
Built an ad-hoc wireless network using hybrid key to provide secure connectivity between hosts. Implemented in Java based mobile platforms using Bluetooth as a communication medium.

Skills

Technical Skills

- ❑ Technical Skills
  - Critical system architecture and system design
  - Practical application of safety & security standards
    - Automotive: ISO 26262 and ISO 21434
    - Medical devices: ISO 14971:2019 and ANSI AAMI 80001
  - Coding standards: AUTOSAR C++14 and MISRA C++17:2023
  - Hazard analysis: STPA, FMEA, and FTA
- ❑ Developer skills
  - Modeling languages: AADL, SysML, Simulink and UML
  - Programming languages: Python, C++, TypeScript, Scala, Java, Bash and OCaml
  - Databases: MySQL, Postgress, Neo4J, DuckDB, MongoDB and HBase
  - Developer boards: Raspberry Pi, Arduino, STM32, BeagleBone, and ESP32
  - Operating systems: Linux, MacOs, QNX, FreeRTOS and SafeRTOS