

VITA – VIPIN KUMAR KUKKALA

November, 2023

Highlights

- **R&D Accomplishments:** Led the automotive cyber-physical systems research initiatives in the embedded systems, high performance, and intelligent computing (EPIC) lab at Colorado State University. Conducted research on the design of fault-tolerant, reliable, and secure automotive systems and developed various management techniques to improve real-time performance in automotive cyber-physical systems. Developed several intrusion detection systems for time-critical automotive systems using advanced machine learning and deep learning-based techniques. I also advised cybersecurity researchers at National Renewable Energy Laboratory (NREL) in setting up an automotive cybersecurity testbed.
- **Publications:** A total of 12 publications consisting of 6 peer-reviewed journals and 6 peer-reviewed conference papers with *one* best paper award candidate. Also published *seven* book chapters, *two* poster presentations, and *one* Ph.D. forum. Currently writing a research book on machine-learning and optimization techniques for automotive cyber-physical systems.
- **Select Honor and Awards:** Best paper award candidate at IEEE/ACM Asia & South Pacific Design Automation Conference (ASPDAC), 2022. Won multiple awards in U.S. Department of Energy (DOE) sponsored intercollegiate automotive engineering design competition EcoCAR3.
- **Student Mentoring:** I mentored 2 M.S. students who graduated successfully. Currently mentoring 1 M.S. student. I also mentored 14 senior design projects at Colorado State University (total: 63 undergraduate senior year students and 11 ViP students).
- **Professional Service:** I peer-reviewed various IEEE journals in the area of automotive cyber-physical systems, cybersecurity, connected and autonomous vehicles, and intelligent transportation systems.
- **Industry Experience:** I worked as a research intern at National Renewable Energy Laboratory (NREL) and Hewlett Packard Enterprise – HP Labs. I am currently working as a senior architect at NVIDIA.

Vipin Kumar Kukkala

(Computer Scientist, Ph. D.)

Senior High Performance Compute Architect
NVIDIA, Santa Clara, CA

Web Page: <https://kvipinkumar.github.io/>

Professional Experience

2022 – present	NVIDIA <i>Senior High Performance Compute Architect</i>	Santa Clara, CA
2019 – 2021	Hewlett Packard Enterprise – HP Labs <i>Research Associate Intern</i>	Fort Collins, CO
2018 – 2019	Colorado State University <i>Graduate Teaching Fellow</i>	Fort Collins, CO
2018	National Renewable Energy Laboratories <i>Summer Ph.D. Intern</i>	Golden, CO
2014 - 2022	Colorado State University Graduate Research Assistant at EPIC (Embedded Systems and Intelligent Computing) Lab	Fort Collins, CO
2014 – 2018	Colorado State University EcoCAR3 Lead graduate student advisor	Fort Collins, CO
2018 - 2019	Colorado State University EcoCAR Mobility Challenge Lead graduate student advisor	Fort Collins, CO

Education

2022	Colorado State University Ph.D. in Electrical Engineering Doctoral Dissertation: “ROSETTA: Robust and Secure Resource Management for Automotive Cyber-Physical Systems” Advisor: Sudeep Pasricha	Fort Collins, CO
2015	Colorado State University M.S. in Electrical Engineering Advisor: Sudeep Pasricha (Converted to Ph.D. and degree not awarded)	Fort Collins, CO
2013	Jawaharlal Nehru Technological University B. Tech. in Electronics and Communications Engineering	Hyderabad, Telangana

2009 Narayan Junior College Hyderabad, Telangana
High school

Awards and Honors

2022 Best Paper Award Candidate, IEEE/ACM ASPDAC, 2022 for the paper: S. V. Thiruloga, V. K. Kukkala, and S. Pasricha, “*TENET*: Temporal CNN with Attention for Anomaly Detection in Automotive Cyber-Physical Systems”

2018 Graduate Teaching Fellow – Colorado State University

2017 Dr. Don Streit Sportsmanship Award – Colorado State University EcoCAR3

2015 Most Compelling Mission & Vision Statement – Colorado State University EcoCAR3

Professional Society Memberships

2022 - *present* Member, IEEE

2014 - 2022 Graduate Student Member, IEEE

2010 - 2013 Member, IETE

Research Activities

Research Interest Statement

My Ph.D. research broadly focused on addressing various design challenges related to reliability, security, and real-time performance in automotive cyber-physical systems. During my internship at Hewlett Packard Enterprise, I developed a strong research interest in the field of high-performance computing (HPC), primarily in the HPC networks and large-scale heterogeneous system design. Currently at NVIDIA, my primary research focus revolves around accelerating scientific computing and HPC + AI workloads.

Research Books Authored

B1 – V. K. Kukkala and S. Pasricha, “Machine Learning and Optimization Techniques for Automotive Cyber-Physical Systems,” in Springer Nature, 2023.

Research Book Chapters Authored

BC7 – S. V. Thiruloga, V. K. Kukkala, and S. Pasricha, "Deep AI for Anomaly Detection in Automotive Cyber-Physical Systems," in *Machine Learning and Optimization Techniques for Automotive Cyber-Physical Systems*, Springer Nature, 2023.

BC6 – V. K. Kukkala, S. V. Thiruloga, and S. Pasricha, "Stacked LSTM Based Anomaly Detection in Time-Critical Automotive Networks," in *Machine Learning and Optimization Techniques for Automotive Cyber-Physical Systems*, Springer Nature, 2023.

BC5 – V. K. Kukkala, S. V. Thiruloga, and S. Pasricha, "Real-time Intrusion Detection in Automotive Cyber-Physical Systems with Recurrent Auto Encoders," in *Machine Learning and Optimization Techniques for Automotive Cyber-Physical Systems*, Springer Nature, 2023.

BC4 – V. K. Kukkala, T. Bradley, and S. Pasricha, "Security-Aware Design of Time-Critical Automotive Cyber-Physical Systems," in *Machine Learning and Optimization Techniques for Automotive Cyber-Physical Systems*, Springer Nature, 2023.

BC3 – V. K. Kukkala, T. Bradley, and S. Pasricha, "Reliable Real-Time Message Scheduling in Automotive Cyber-Physical Systems," in *Machine Learning and Optimization Techniques for Automotive Cyber-Physical Systems*, Springer Nature, 2023.

BC2 – V. K. Kukkala, S. V. Thiruloga, and S. Pasricha, "Machine Learning for Anomaly Detection in Automotive Cyber-Physical Systems," in *Embedded Machine Learning for Cyber-Physical, IoT, and Edge Computing*, Springer Nature, 2023.

BC1 – V. K. Kukkala, S. V. Thiruloga, and S. Pasricha, "AI for Cybersecurity in Distributed Automotive IoT Systems," in *Electronic Design for AI, IoT, and Hardware Security*, Springer Nature, 2023.

Peer-Reviewed Journal Publications

J6 – V. K. Kukkala, S. V. Thiruloga, and S. Pasricha, "Roadmap for Cybersecurity in Autonomous Vehicles," in *IEEE Consumer Electronics Magazine (CEM)*, February 2022.

J5 – V. K. Kukkala, S. V. Thiruloga, and S. Pasricha, "LATTE: LSTM Self-Attention based Anomaly Detection in Embedded Automotive Platforms," in *ACM Transactions on Embedded Computing Systems (TECS)*, Vol. 20, No. 5s, Article 67, August 2021.

J4 – V. K. Kukkala, S. V. Thiruloga, and S. Pasricha, "INDRA: Intrusion Detection using Recurrent Autoencoders in Automotive Embedded Systems," in *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD)*, Vol. 39, Iss. 11, November 2020.

J3 – V. K. Kukkala, S. Pasricha, and T. Bradley, "SEDAN: Security-Aware Design of Time-Critical Automotive Networks," in *IEEE Transaction on Vehicular Technology (TVT)*, Vol. 69, Iss. 8, August 2020.

J2 – V. K. Kukkala, S. Pasricha, and T. Bradley, "JAMS-SG: A Framework for Jitter-Aware Message Scheduling for Time-Triggered Automotive Networks," in *ACM Transactions on Design Automation of Electronic Systems (TODAES)*, Vol. 24, Iss. 6, September 2019.

J1 – V. K. Kukkala, S. Pasricha, and T. Bradley, “Advanced Driver-Assistance Systems: A path toward autonomous vehicles,” in IEEE Consumer Electronics Magazine (CEM), Vol. 7, Iss. 5, September 2018.

Peer-Reviewed Conference Publications (approx. 20-30% acceptance rate)

C6 – S. V. Thiruloga, V. K. Kukkala, and S. Pasricha, “TENET: Temporal CNN with Attention for Anomaly Detection in Automotive Cyber-Physical Systems,” in Proc. of IEEE/ACM Asia & South Pacific Design Automation Conference (ASPDAC), January 2022. **(Best paper award candidate)**

C5 – D. Emmot, R. Menhusen, D. Dauwe, V. K. Kukkala, and K. Bresniker, “Designing Heterogeneous Systems: Large Scale Architectural Exploration Via Simulation,” in IEEE/ACM Programming Environments for Heterogeneous Computing (PEHC), December 2021.

C4 – G. C. DiDomenico, J. Bair, V. K. Kukkala, et al., “Colorado State University EcoCAR 3 Final Technical Report,” in SAE World Congress Experience (WCX), April 2019.

C3 – V. K. Kukkala, S. Pasricha, and T. Bradley, “JAMS: Jitter-Aware Message Scheduling for FlexRay Automotive Networks,” in Proc. of IEEE/ACM International Symposium on Network-on-Chip (NOCS), October 2017.

C2 – V. K. Kukkala, T. Bradley, and S. Pasricha, “Uncertainty Analysis and Propagation for an Auxiliary Power Module,” in Proc. of IEEE Transportation Electrification Conference (TEC), June 2017.

C1 – V. K. Kukkala, T. Bradley, and S. Pasricha, “Priority-based Multi-level Monitoring of Signal Integrity in a Distributed Powertrain Control System,” in Proc. of 4th IFAC Workshop on Engine and Powertrain Control, Simulation and Modeling, July 2015.

Research Posters

P2 – V. K. Kukkala, T. Bradley, S. Pasricha, “Uncertainty Analysis and Propagation for an Auxiliary Power Module,” in Proc. of IEEE Transportation Electrification Conference (TEC), June 2017.

P1 – V. K. Kukkala, S. Pasricha, T. Bradley, “Reliability Aware Message Scheduling for FlexRay Automotive Networks,” CSU Ventures Innovation Forum, April 2016.

Press Coverage

A3 – “And they’re off again: CSU chosen for EcoCAR Mobility Challenge”, Colorado State University Source Magazine, October 2018.

A2 – “EcoCAR 3 secures top-8 finishes and sportsmanship award at Year Three Competition”, Colorado State University Source Magazine, June 2017.

A1 – “EcoCAR 3 Students Drive Innovation”, CSU College Avenue, March 2017.

Ph.D. Forum

PF1 – V. K. Kukkala, S. Pasricha, “*ROSETTA: Robust and Secure Resource Management for Time-Critical Automotive Systems*,” in IEEE/ACM Design Automation Conference (DAC) Ph.D. Forum, July 2020.

Industry Advising

National Renewable Energy Laboratory (NREL)

2019 I advised a team of cybersecurity researchers at NREL in developing an automotive cybersecurity testbed.

C. Hodge, K. Hauck, S. Gupta, and J. C. Bennett, “Vehicle cybersecurity threats and mitigation approaches,” in U. S. Department of Energy Office of Scientific and Technical Information (OSTI) Report - No. NREL/TP-5400-74247, National Renewable Energy Laboratory (NREL), Golden, CO, USA.

Educational Activities

M.S. Thesis Students Mentored

2021 *Sooryaa Vignesh Thiruloga*, M.S. in Electrical and Computer Engineering
Anomaly Detection with Machine Learning for Automotive Cyber-Physical Systems

M.S. Project Students Mentored

2018 *Bharadwaj Gorthy*, Electrical and Computer Engineering

Current Graduate Students

M.S. *Chris Taylor*, Electrical and Computer Engineering

Undergraduate Senior Design Project Students Mentored

2022 Justin Cao, Calvin Tai, *Automotive Network Security*

2021 David Rohrbaugh, Andy Worcester, *Automotive Network Security*

2019 Shaolong Shi, Haoying Wang, Abdulla Alghfeli, Abdulaziz Alshamsi, *Advanced Driver Assistance Systems (ADAS)*

2019 Brandon McDonald, Cameron Cummings, Derek Adelman, Grant Moore, Josh Urban, Nikki Machado, *EcoCAR Mobility Challenge Controls*

2018 Alexandro Segura, Juhyup Kim, Stephen Bellig, Yi Wang, *EcoCAR3 ADAS*

- 2018 Joshua Ax, Michael Krause, Marco Peyfuss, *EcoCAR3 System Modeling and Simulation*
- 2018 Corey Cooke, Eric Christensen, Eric Vargas, Jeremy Lazzari, Kevin (Xinzhe) Cao, Matthew Munin, *EcoCAR3 Controls*
- 2017 Jordan Tunnel, Derek Isabelle, Drew DeVos, *EcoCAR3 ADAS*
- 2017 Carter Hough, Floyd Bundrant, Gavin Miller, Martin Miller, Omar Alrasheed, Veronica Foster, *EcoCAR3 Keysight*
- 2017 Gabe DiDomenico, Hayden Jones, Jack Vulcani, Jacob Gover, Justin Cogswell, Jesus Garcia, Ryan Moore, Qingruo (Angela) Si, Tanner Griffin, *EcoCAR3 controls*
- 2016 Alex Banner, Brendan Isbell, Scott Smith, *Advanced Driver Assistance Systems (ADAS)*
- 2016 Andy Ingle, Erin Coppersmith, Max Beard, *EcoCAR3 Keysight*
- 2016 Alex Larson, Chen Bao, Jeff Gier, Kevin Ball, Kaden Strand, Katie Wetzels, Kelty Tobin, Matthew Bulow, *EcoCAR3 Controls*
- 2015 Levi Weber, Tim Allman, Michael Smith, Greg Emmen, *EcoCAR3 Controls*

Undergraduate Vertically Integrated Project (ViP) Students Mentored

- 2018-19 Katia Benson, *EcoCAR3 Controls*
- 2018-19 Bryce Barsnick, *EcoCAR3 Controls*
- 2018-19 JT Bovee, *EcoCAR3 ADAS*
- 2018-19 Hein Thant, *EcoCAR3 ADAS*
- 2018-19 Xinming Ye, *EcoCAR3 ADAS*
- 2018-19 Wes Taylor, *EcoCAR3 ADAS*
- 2018 Haoying Wang, *EcoCAR3 ADAS*
- 2017 Minjie Shen, *EcoCAR3 ADAS*
- 2017 Yi Wang, *EcoCAR3 ADAS*
- 2017 Juhyup Kim, *EcoCAR3 ADAS*
- 2016 Jordan Tunnel, *EcoCAR3 ADAS*

Teaching

- Fall 2018 Introduction to Model-Based System Design and Vehicle Modeling using MATLAB and

SIMULINK

Spring 2018 Practical Introduction to Controller Area Network (CAN)

Fall 2017 Introduction to Model-Based System Design and Vehicle Modeling using MATLAB and SIMULINK

Spring 2017 Practical Introduction to Controller Area Network (CAN)

Fall 2016 Introduction to Model-Based System Design and Vehicle Modeling using MATLAB and SIMULINK

New Courses Designed

2017-2018 Practical Introduction to Controller Area Network (CAN)

2016-2018 Introduction to Model-Based System Design and Vehicle Modeling using MATLAB and SIMULINK

Profession Service

International Conferences

2022 Embedded Systems Week
Panel member - ACM SIGBED Student Research Competition (SRC)

2022 Transport Reviews
Reviewer

2022 IEEE Consumer Electronics Magazine
Reviewer

2022 IEEE Transactions on Intelligent Transportation Systems
Reviewer

2021 Security and Communication Networks
Reviewer

2021 IEEE Consumer Electronics Magazine
Reviewer

2019 IEEE Consumer Electronics Magazine
Reviewer

2018 IEEE Access
Reviewer

2017 IEEE Consumer Electronics Magazine
Reviewer