Contents

Sagar Behere - Curriculum Vitæ

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Summary

Architect and systems integrator for complex, safety-critical, intelligent autonomous systems. Experienced in strategically leading cross-functional product development and scaling up Systems, Safety, and core engineering teams to accelerate transformation of advanced technology prototypes into validated products. Technical expert in Autonomous Vehicle Safety and robotics.

Current role

Vice President, Safety at Foretellix Inc. I lead the safety discipline at Foretellix to create novel Safety Verification and Validation solutions for Advanced Driver Assistance Systems (ADAS) and Autonomous Driving. My belief is that these novel solutions will help the industry overcome the biggest unsolved challenge in the space – Safety!

Previous roles/projects

At Aurora Innovation Inc., in Mountain View, CA, USA

August 2021 – September 2022: **Senior Director, Systems, Safety Engineering and Validation**

I led the teams for Systems Engineering, Safety Engineering, and Validation of autonomous driving. Grew the total headcount from single digits to three digits. Was heavily involved in the technology and people integration activities pertaining to Aurora's acquisition of Uber's Advanced Technologies Group (ATG). Helped define and execute Aurora's overall validation strategy for autonomous driving.

April 2020 – August 2021: **Director, Systems and Safety Engineering**

I helped define and lead Aurora's rigorous engineering efforts to deliver safe and highly performant autonomous driving. I also directed safety research for autonomous driving.

At Toyota Research Institute in California, USA

March 2018 – April 2020: **Senior Manager, Systems Engineering (Highly Automated Driving)**

Leadership for innovation and development in the following areas of highly automated driving:

- Complete System Reference Architecture (functional, software, hardware): Modular, scalable, high performance reference architecture poised to take advantage of changing requirements and technology.
- Functional Safety: Proof, evidence, arguments for absence of unreasonable risk.
- Systems Integration: Ensuring the vehicle-as-a-whole consistently exhibits desired behavior
- Model Based Systems Engineering: Technologies, tools, and processes to manage development of complex, safety-critical systems

August 2017 – March 2018: **Manager, AD Architecture and Functional Safety**

- Creating reference architectures for autonomous driving that can be tailored and instantiated across a variety of vehicle platforms
- Establishing goals, designs, technology and tools, verification and validation, and operational processes for functionally safe autonomous vehicles
- Systems engineering and integration

At Zoox Inc. – an autonomous driving startup in California, USA

August 2016 – July 2017: **Head of EE Integration**

- Create and manage the "function book" for vehicle integration. This defines how various bits of functionality come together to provide relevant customer and vehicle features e.g. energy management.
- Oversee drill down of E/E architecture and functional safety from previous role. Scope: all vehicle subsystems, emergency and safe stop strategies
- Define and implement cybersecurity architecture. Scope includes partitioning, specifying requirements on firewalls, gateways, individual ECUs and network communication, as well as establishment of in-house public key infrastructure for operational and supply chain support
- Establish systems engineering processes and tools for safety critical embedded systems. Scope includes practices for architecture representation, requirements management with traceability, selection and roll-out of an Application Lifecycle Management (ALM) tool across the company, and systems to generate compliance, testing, and activity reports for accident investigation and regulatory committees
- Define program management tasks, milestones and priorities for vehicle integration

October 2015 – August 2016: **Head of System Architecture**

- Led design and development of the novel vehicle platform which helped Zoox raise $250 million in seed A funding

- Established baseline mechatronics (E/E) architecture for production intent autonomous vehicle. Scope included sensing/perception, compute, networking, cybersecurity, diagnostics, over-the-air updates, as well as distributed software architecture for vehicle dynamics control and communications middleware
- Led preliminary functional safety assessment (and subsequent revisions) of the production intent architecture. Scope included ISO26262 relevant lifecycle activities for analysis of hazards and risks, establishment of safety goals, functional and technical safety concepts, redundancy management, selection of safety relevant implementation technologies and software/programming tools
- Established baseline electrical, control, and software architecture for the more "traditional" automotive areas: braking, steering, propulsion, body controls, HMI, and high availability low voltage power supply

With KTH, Sweden

2015
Developed an upgraded version of the KTH Research Concept Vehicle (RCV-2.0) to be used as the basis for a completely autonomous vehicle. Technology licensed to a private company.
2014
Developed Electrical/Electronic (E/E) system architecture for the KTH Research Concept Vehicle (RCV). The RCV platform is the basis for significant research at KTH and a number of its variants are commissioned by field-leading private companies in Sweden, Europe, and USA
2011+2012
Lead architect and developer of a partially autonomous driving system for a commercial truck. System demonstrated at the Grand Cooperative Driving Challenge, the Netherlands, 2011 and CoAct 2012 Driving demonstration, Sweden 2012.
2010
Developed a generalized Motion Planning and Control system for robot manipulators moving in the presence of obstacles. Demonstrated on 3 different robot platforms.
2009
Designed a mobile robotics platform with vision, manipulation and computation capabilities for EU FP7 cognitive robotics project CogX. Platform in use at 6 partner universities.
2008
Integration engineer for EU FP6 cognitive robotics project CoSy. Assignment involved integrating research output from all project partners into the robotics platform.

With Mahindra & Mahindra Ltd., India (M&M is one of India's largest automobile companies)

2005–2007
Developed a Common Rail Diesel Engine for a commercial Sports Utility Vehicle, with vehicle integration and emissions engineering to meet Euro IV emission norms. Vehicle was launched in many countries in Europe, Africa, the Americas, Australia and India.
2004–2005
Developed a highly fault tolerant system to program in-vehicle ECUs at vehicle assembly line. System was used for several years at manufacturing plant during daily vehicle production.
2003–2004
Developed a hand-held, computer based diagnostic tool to read and resolve faults in vehicle ECUs. Tool was deployed to workshops and service centers across India.

Skills

Automotive
Electric powertrain, chassis control, energy management, HVAC, Body controls, infotainment, telematics
System Engineering
Model Based Systems Engineering (MBSE), SysML, UML, AADL, EAST-ADL, Requirements manage-

ment, traceability, Polarion, architecture representation

Embedded hardware

Microcontrollers, board bringup, device drivers, clock synchronization, analog and digital i/o, dSpace autobox tools

Software

C/C++, Matlab/Simulink, Real Time Operating Systems (RTOS), Linux, Boost. Some familiarity with Ada2012, Scala, Python, Java, Javascript, HTML, CSS, AngularJS, Networking, CAN, Ethernet, TCP/UDP IP, Data Distribution Service (DDS), ZeroMQ, various UNIX Inter-Process Communication (IPC), Universal Diagnostic Services (UDS)

Functional safety

HARA, FMEDA, Functional safety concept (FSC), Technical safety concept(TSC), Fault Tree Analysis (FTA), ISO26262 lifecycle, SOTIF

Cybersecurity

Asymmetric and symmetric encryption, hash digests, hardware security modules, public key infrastructure, certificate authorities, seed-key protocols

Languages

Fluent in English, Marathi, and Hindi. Working knowledge of Swedish. Basic knowledge of German, French, and Italian

Patents

- (Pending) System and method for detecting errors and improving reliability of perception systems using logical scaffolds
  Application number US20210056321A1
  Filed date January 17, 2020
- Internal Safety Systems for Robotic Vehicles
  US Patent number 10303174
  Publication date May 28, 2019
- Resilient Safety System for a Robotic Vehicle
  US Patent number 10745003
  Publication date August 18, 2020

Education

- PhD in Machine Design. KTH, Sweden 2016
- Licentiate in Machine Design. KTH, Sweden 2013
- Master in Systems, Control and Robotics. KTH, Sweden 2010
- Bachelor in Mechanical Engineering. University of Pune, India 2003

Distinctions

- Member of Standards Technical Panel (STP) for the UL 4600 AV Safety Standard
- Invited expert/speaker/chair at industrial conferences and educational courses in Europe and USA. See Invited talks
- Represented Sweden in the area of autonomous systems, as part of a Swedish government+industry+academia delegation to explore cooperation with counterparts in Brazil, Nov. 2014, São Paulo
- M&M Product Innovation Award for best business driven product innovation in 2004-2005
- M&M Process Innovation Award for best business driven process innovation in 2005-2006
- M&M Outstanding Job Achievement Award for work on an electric hybrid vehicle displayed at the 8th Auto Expo in New Delhi in 2006
- Best Outgoing Student Award during final year of graduate studies

Teaching

- MF2044 Embedded Systems for Mechatronics, II (Spring 2012, 2013, 2014)
- MF2058 Mechatronics, Advanced Course (2013, 2014)
- MF2063 Embedded Systems Design Project (Autumn 2012)
- MF2042 Embedded Systems for Mechatronics, I (Autumn 2011)

Supervision

At KTH, Sweden

- Naveen Mohan (PhD. ongoing) Co-supervision of PhD research on architecture and methods for autonomous driving
- Adam Lundström (MSc. 2016) Co-supervision "Finding strategies for running Ada code in real-time on a Linux-based single board computer platform"
- Stefanos Kokogias (MSc. 2015) "Design and implementation of a fault tolerant controller on a prototype vehicle, using an active steering approach"
- Karin Fåhraeus (MSc. 2015) "Enhancement of the development process with software in the loop simulations, An embedded control case study"
- Jonathan Holmström (MSc.2015) "Lane keeping assistance using low-cost satellite aided positioning technology in modern highway navigation"
- Ioannis Tzioumakas (MSc. 2015) "Centralized environment database for vehicles"
- Daniel Eriksson and John-Eric Ericsson (MSc. 2014) "Indoor positioning and localization system with sensor fusion"
- Johan Schagerström (MSc. 2014) "Cow behavior monitoring with motion sensor"
- Johanna Simonsson and Kim Öberg (MSc. 2014) "Power consumption and optimization of an irrigation network"
- Daniel Lind, (MSc. 2014) "Performance evaluation of HTTP servers in embedded systems"
- Emelie Brus, (MSc. ongoing) "Controlling Wifi components from a web interface"
- Gustav Karlsson and Magnus Dormvik (MSc. 2011) "Construction of generic test environment for embedded systems"

Invited talks

- Safety Validation for Highly Automated Driving
  Panel host and moderator of track on Safety Validation at ADAS & Autonomous Vehicle Technology Expo
  20-21 September 2023, Santa Clara, USA
- Safety-driven V&V and Assessment
  Co-organizer and speaker of full Safety session at the 2023 Automated Road Transportation Symposium (ARTS23)
  09-13 July, 2023, San Francisco, USA
- Safety validation for Highly Automated Driving
  Panelist and moderator of track on "Validation, Verification, Data Management, and in-the-loop testing" at ADAS & Autonomous Vehicle Technology Conference 2023
  13-15 June, 2023, Stuttgart, Germany
- Challenges to V&V of Autonomous Driving
  Workshop on Safe Autonomy and Practical AI, University of Southern California Center for Autonomy and Artificial Intelligence
  12 November, 2021
- Safety Architectures for Autonomous Driving
  Panelist at The Autonomous Main Event, Vienna, Austria
  29 September, 2021
- Continuous Safety Cases for Automated Driving
  Keynote talk at Operational Safe Systems (OSS.5) USA

12 July, 2021, USA
- What Does Safety Mean for Automated Trucks?
  Panelist at AUVSI's Automated Freight Summit
  08 July, 2021
- Where the Rubber Meets the Road: Ensuring Safe AV Road Testing
  Panelist at virtual event organized by the Partners for Automated Vehicle Education (PAVE)
  04 November, 2020
- Robots in a human world
  Panelist at ValleyML AI Expo 2020, USA
  28 September, 2020
- How to develop a continuous safety case for autonomous driving?
  Panel host and moderator at OSS.5 Conference, USA
  24 February, 2020, San Francisco, USA
- Collaboration for the safety of autonomous vehicles
  Invited panelist at State of AI and ML, Silicon Valley
  14 January, 2020, Santa Clara, USA
- A commentary on the SOTIF draft
  Panel host and moderator at The SOTIF Conference, USA
  02 October, 2019, Austin, Texas, USA
- U.S. Dept. of Energy workshop on Advanced Computing for Connected & Autonomous Vehicles
  Invited panelist on Automotive Systems Panel
  07 May, 2019, UC Berkeley, USA
- Testing ADAS and Self-Driving Cars
  Conference chairman
  26-27 March, 2019, Munich, Germany
- Building an AV Safety Case
  Invited talk at Operational Safe Systems for Level 5 Automation (OSS5)
  28 February, 2019, San Francisco, USA
- Solving the Autonomous Vehicle Safety Assurance Challenge: A Discussion Featuring Leading Voices from Industry, Academia, and Governments
  Invited panelist at IEEE ITSC '18 – The 21st IEEE International Conference on Intelligent Transportation Systems
  06 November, 2018, Maui, Hawaii, USA
- Cybersecurity for Highly Automated Driving
  Invited keynote at Vehicle Electronics and Connected Services (VECS) 2018
  13 April, 2018, Gothenburg, Sweden
- Architectures, ODDs, and Testing of Autonomous Vehicles
  Invited workshop at Testing ADAS and Self-Driving Cars
  16 March, 2018, Dusseldorf, Germany
- Testing ADAS and Self-Driving Cars
  Conference chairman
  13-16 March, 2018, Dusseldorf, Germany
- Cybersecurity for Autonomous Vehicles
  Invited workshop at Automotive Tech.AD
  17 November, 2017, Detroit, USA
- New Concepts of Steer-by-Wire
  Invited workshop at 4th International Conference Steering Systems USA 2017
  14 June, 2017, Ann Arbor, USA
- Testing ADAS and Self-Driving Cars
  Conference chairman
  28-29 March, 2017, Frankfurt, Germany
- Cybersecurity for Highly Automated Driving
  Invited speaker at Automotive Tech.AD

02 December, 2016, Detroit, USA
- Safety of Non-deterministic Functions
  Invited speaker + Chairman of conference day 1 at System Safety 2016
  19-21 September, 2016, Las Vegas, USA
- Preparing for the Robo-Taxi: Emerging Technology Perspectives
  Invited Expert for Panel Discussion at AUVSI's workshop "The Future of Shared Mobility: Making the Robo-Taxi a Reality"
  03 December, 2015, Jacksonville, USA
- Testing and Verification for Autonomous Driving
  Moderated World-Café session at Automotive Tech.AD
  17 November, 2015, Detroit, USA
- The Long Term Vision for Autonomous Driving
  Moderated Round Table discussion at Automotive Tech.AD
  16 November, 2015, Detroit, USA
- Prototyping Cyber-Physical systems:A hands-on approach to the Cyber part
  EIT Digital summer school on Cyber-Physical Systems 2015
  23 June, 2015, Stockholm, Sweden
- A systems engineering approach to the design of complex systems
  EIT Digital summer school on Cyber-Physical Systems 2015
  22 June, 2015, Stockholm, Sweden
- A holistic approach to systems autonomy – For complex, intelligent, safety-critical systems
  1st Brazilian Swedish Workshop in Aeronautics and Defence, Aeronautics Institute of Technology (ITA)
  14 November, 2014, São Jose dos Campos, Brazil
- The safety-availability tradeoff in autonomous driving
  Moderated World-Café sessions at Automotive Tech.AD – The road towards autonomous driving
  27 February, 2015, Berlin, Germany
- Prototyping Cyber-Physical systems: A hands-on approach to the Cyber part
  EIT ICT Labs summer school on Cyber-Physical Systems 2014
  04 July, 2014, Trento, Italy
- A systems engineering approach to design of complex systems
  EIT ICT Labs summer school on Cyber-Physical Systems 2014
  03 July, 2014, Trento, Italy
- Pitfalls in Embedded Software (and how to avoid them)
  Embedded Systems II course (MF2044), KTH
  31 March 2014, Stockholm, Sweden
- Architecting for autonomy: Exploring the landscape
  ICES Workshop on Architectures for Autonomous Machines
  14 January, 2014, KTH, Stockholm, Sweden
- Vehicle architectures for increasing autonomy
  Elektronik i Fordon 2012
  25 April, 2012, Gothenburg, Sweden

Publications

Book chapters

- Systems engineering and architecting for intelligent autonomous systems
  Behere S., Törngren M
  Chapter in book "Automated Driving – Safer and more efficient future driving"
  Springer International Publishing (2017) DOI: 10.1007/978-3-319-31895-0_13 ISBN: 978-3-319-31895-0
- Functional safety and evolvable architectures for autonomy
  Rolf Johansson, Jonas Nilsson, Carl Bergenhem, Sagar Behere, Jörgen Tryggvesson, Stig Ursing,

Andreas Söderberg, Martin Törngren, Fredrik Warg
Chapter in book "Automated Driving – Safer and more efficient future driving"
Springer International Publishing (2017)
DOI: 10.1007/978-3-319-31895-0_25 ISBN: 978-3-319-31895-0

- Architecture and Safety for Autonomous Heavy Vehicles: ARCHER
  Viktor Kaznov, Johan Svahn, Per Roos, Fredrik Asplund, Sagar Behere, Martin Törngren
  Chapter in book "Automated Driving – Safer and more efficient future driving"
  Springer International Publishing (2017)
  DOI: 10.1007/978-3-319-31895-0_27 ISBN: 978-3-319-31895-0

Journals

- Educating Embedded Systems Hackers – A practitioner's perspective
  Behere S., Törngren .M
  ACM Sigbed Review – Special Issue on Embedded and Cyber-Physical Systems Education, Volume 14, Issue 1, October 2016, Pages 8-15
  DOI: 10.1145/3036686.3036687
- A functional reference architecture for autonomous driving
  Behere S., Törngren M.
  Journal of Information and Software Technology
  DOI: 10.1016/j.infsof.2015.12.008
- A reference architecture for cooperative driving
  Behere S., Törngren M., Chen D.
  Journal of Systems Architecture, Vol. 59, Issue 10, Part C, November 2013, Pages 1095-1112
  DOI: 10.1016/j.sysarc.2013.05.014
- The development of a cooperative heavy-duty vehicle for the GCDC 2011: Team Scoop
  Mårtensson J., Alam A., Behere S. et al
  Intelligent Transportation Systems, IEEE Transactions on, vol.13, no.3, pp.1033-1049, Sept. 2012
  DOI: 10.1109/TITS.2012.2204876

Conferences/Workshops

- ATRIUM – Architecting under uncertainty: For ISO 26262 compliance
  Mohan N., Behere S., et al
  IEEE International Systems Conference (SysCon) 2017, Montreal
  DOI: 10.1109/SYSCON.2017.7934819
- A method for the systematic architecture of functionally safe automated driving: Leveraging diagnostic specifications for FSC design
  Mohan N., Törngren M., Behere S.
  SAE World Congress 2017
  DOI: https://doi.org/10.4271/2017-01-0056 ISSN 0148-7191
- A functional brake architecture for autonomous heavy commercial vehicles
  Behere S., Zhang X., Izosimov V., Törngren M.
  SAE World Congress 2016
  DOI: 10.4271/2016-01-0134
- A functional architecture for autonomous driving
  Behere S., Törngren M.
  First International Workshop on Automotive Software Architectures (WASA) 2015, Montréal, Canada
- Educating Embedded Systems Hackers: A practitioner's perspective
  Behere S., Törngren M.