SASWATA PAUL

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CAREER GOALS

To apply my expertise in formal methods, distributed protocols, cyber-physical systems, and avionics systems to investigate and propose innovative solutions to challenging problems in the domain of safety-critical systems.

EXPERIENCE

Research Engineer May 2022 - Present
General Electric Global Research *Niskayuna, NY*

· Development of tools for the validation and verification of safety-critical systems

Graduate Research Assistant May 2017 - May 2022
Rensselaer Polytechnic Institute *Troy, NY*

· Developed the first machine-checked proof of eventual progress for the Synod consensus protocol.
· Developed a failure-aware actor model for formal reasoning about distributed communication in airborne networks.
· Developed a formal library in Athena tailored towards reasoning about distributed coordination protocols.
· Developed a formally verified protocol for ensuring situational awareness in autonomous aircraft.
· Designed a data-driven approach for the runtime verification of distributed systems using formal proofs.
· Designed a provably-correct decentralized and autonomous air traffic management technique for Urban Air Mobility.
· Developed a formally verified strategic conflict-aware flight planning algorithm.
· Developed a data-driven approach for generating high-fidelity emergency trajectories for fixed-wing aircraft.

Research Intern Jun. 2020 - Aug. 2020, May 2021 - Jul. 2021
General Electric Global Research *Niskayuna, NY*

· Worked on DARPA and NASA-funded programs with the High-Assurance Systems team.
· Developed a formal data model for constructing Operational Risk Assessment artifacts (NASA V&V).
· Developed an approach for auto-generating assurance case fragments from the VERDICT toolchain (DARPA CASE).
· Proposed an approach to generate certification reports from the curated RACK database (DARPA ARCOS).
· Developed an SMT-based approach for strategic detection and elimination of aircraft conflicts for Urban Air Mobility.

Graduate Teaching Assistant Aug. 2016 - May 2017, Aug. 2020 - Dec. 2020
Rensselaer Polytechnic Institute *Troy, NY*

· Conducted practical labs, held office hours, proctored exams, and graded assignments and exams for courses such as Computer Science I, Principles of Software, and Programming Languages.

Summer Intern May 2014 - Jul. 2014
Society for Natural Language Technology & Research *Kolkata, India*

· Developed an Android application for generating the shortest/cheapest bus route between two given destinations.

EDUCATION

Ph.D. in Computer Science *May 2022*
Rensselaer Polytechnic Institute, Troy, NY, USA

M.S. in Computer Science *Dec. 2018*
Rensselaer Polytechnic Institute, Troy, NY, USA

B.Tech. in Computer Science & Engineering *May 2015*
National Institute of Technology, Agartala, Tripura, India

SKILLS

Computer Languages	: over 5000 lines - JAVA, C, Python; over 1000 lines - C++, PHP, Prolog, SALSA, R; familiar with: JavaScript, ErLang, Pict, Haskell, Oz, Scheme, Lisp, Dot
Formal Methods	: Athena, TLA$^+$ Toolbox, SADL-AT, dReal, SMT-Lib, VERDICT
Other Tools	: LaTeX, AADL, SPARQL, JavaFx, GraphViz, Maven, Docker, Github, MS Office, RACK

RELEVANT GRADUATE COURSEWORK

Systems	: Programming Languages, Distributed Computing over the Internet, Operating Systems
Theory	: Design & Analysis of Algorithms, Distributed Systems & Algorithms, Software Verification
ML/Data	: Machine Learning from Data, Xinformatics, Data Analytics, Data Science

HONORS AND DISTINCTIONS

- *Robert McNaughton Prize* for outstanding achievements, Rensselaer Polytechnic Institute, May, 2022.
- *Best Paper Award*, Software Development track, at the 40th AIAA/IEEE DASC, San Antonio, TX, Oct. 2021.
- Received the *GE Impact Award* as a summer intern at GE Research, Niskayuna, NY, Aug. 2020 & Jul. 2021.
- Finalist for *Best Student Paper Award* at the 38th AIAA/IEEE DASC, San Diego, CA, Sep. 2019.
- Topper of the CS, Rensslear Polytechnic Institute, May, 2022. department at NIT Agartala in the 8th semester of B.Tech., May 2015.
- Secured 1st position in inter-college coding competition at NIT Agartala, 2013.
- Secured 2nd position at Holy Cross School Agartala in Indian School Certificate examination, 2011.
- Secured 4th position at Holy Cross School Agartala in Indian Certificate of Secondary Education examination, 2009.

PROFESSIONAL ACTIVITIES

- Mentored undergraduate and graduate researchers working at the Worldwide Computing Laboratory, Rensselaer Polytechnic Institute.
- Reviewer for UCC 2017, IEEE BigData 2017, AAMAS 2019, and IEEE Cluster 2019.
- Conducted workshops for high school students for "STEM Day" at the Worldwide Computing Laboratory, Rensselaer Polytechnic Institute, in 2018 and 2019.

PUBLICATIONS

- **S. Paul**, "Formal Verification of Decentralized Coordination in Autonomous Multi-Agent Aerospace Systems", PhD Dissertation, Rensselaer Polytechnic Institute, Troy, NY, May 2022.
- **S. Paul**, S. Patterson, and C. A. Varela. "Formal Guarantees of Timely Progress for Distributed Knowledge Propagation", *Proc. of the 3rd Workshop on Formal Methods for Auton. Syst.*, Oct. 2021.
- V. T. Valapil, H. Herenzia-Zapana, M.Durling, K. Armstrong, **S. Paul**, S. Borgyos, A. Moitra, and W. Premerlani. "Towards Formalization of a Data Model for Operational Risk Assessment", *Proc. of the 40th AIAA/IEEE Digit. Avionics Syst. Conf.*, Oct. 2021.
- **S. Paul** and C. A. Varela. "Data-Driven Wind-Aware Emergency Trajectory Generation", *Journal of Aircraft*, Accepted May. 2021. *(To appear)*
- B. Meng, **S. Paul**, A. Moitra, K. Siu, and M. Durling. "Automating the Assembly of Security Assurance Case Fragments", *Proc. of the 40th Int. Conf. on Comp. Safety, Reliability, and Security*, Sep. 2021.
- **S. Paul**, G. A. Agha, S. Patterson, and C. A. Varela. "Verification of Eventual Consensus in Synod Using a Failure-Aware Actor Model", *Proc. of the 13th NASA Formal Methods Symp.*, May 2021.
- B. Meng, D. Larraz, K. Siu, A. Moitra, J. Interrante, W. Smith, **S. Paul**, D. Prince, H. Herencia-Zapana, M. F. Arif, M. Yahyazadeh, V. T. Valapil, M. Durling, C. Tinelli, and O. Chowdhury. "VERDICT: A Language and Framework for Engineering Cyber-Resilient and Safe System", *Systems*, Mar. 2021.
- **S. Paul**, S. Patterson, F. Kopsaftopoulos, and C. A. Varela. "Towards Formal Correctness Envelopes for Dynamic Data-Driven Aerospace Systems", *Handbook Dyn. Data-Driven App. Syst.*, Accepted Nov. 2020. *(To appear)*
- **S. Paul**, S. Patterson, and C. A. Varela. "Collaborative Situational Awareness for Conflict-Aware Flight Planning", In *Proc. of the 39th AIAA/IEEE Digit. Avionics Syst. Conf.*, Oct. 2020.
- B. Meng, A. Moitra, A. W. Crapo, **S. Paul**, K. Siu, M. Durling, D. Prince, H. Herencia-Zapana. "Towards Developing Formalized Assurance Cases", In *Proc. of the 39th AIAA/IEEE Digit. Avionics Syst. Conf.*, Oct. 2020.
- **S. Paul**, F. Kopsaftopoulos, S. Patterson, and C. A. Varela. "Dynamic Data-Driven Formal Progress Envelopes for Distributed Algorithms", In *Proc. of InfoSymbiotics/DDDAS2020*, Oct. 2020.

- E. Cruz-Camacho, **S. Paul**, F. Kopsaftopoulos, and C. A. Varela. "Towards Provably Correct Probabilistic Flight Systems", In *Proc. of InfoSymbiotics/DDDAS2020*, Oct. 2020.
- **S. Paul**, S. Patterson, and C. A. Varela. "Conflict-Aware Flight Planning for Avoiding Near Mid-Air Collisions", In *Proc. of the 38th AIAA/IEEE Digit. Avionics Syst. Conf.*, San Diego, CA, USA, Sep. 2019.
- **S. Paul**, "Emergency Trajectory Planning for Fixed-Wing Aircraft", Master's Thesis, Rensselaer Polytechnic Institute, Troy, NY, Dec. 2018.
- **S. Paul**, F. Hole, A. Zytek, and C. A. Varela. "Wind-Aware Trajectory planning for Fixed-Wing Aircraft in Loss of Thrust Emergencies", In *Proc. of the 37th AIAA/IEEE Digit. Avionics Syst. Conf.*, London, England, Sep. 2018.
- **S. Paul**, F. Hole, A. Zytek, and C. A. Varela. "Flight Trajectory Planning for Fixed-Wing Aircraft in Loss of Thrust Emergencies", In *InfoSymbiotics/DDDAS2017*, Cambridge, MA, Aug. 2017.

POSTERS

- **S. Paul**, F. Hole, A. Zytek, and C. A. Varela. "LOT Emergency Trajectory Generation for Fixed-Wing Aircraft", Rensselaer Polytechnic Institute, Nov. 2018.

REFERENCES

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