Purboday Ghosh

Nashville, Tennessee | purboday.ghosh@vanderbilt.edu | LinkedIn | Google Scholar

Initiative-taking, collaborative PhD. in Electrical Engineering researching on fault-tolerant design approaches and model-based analysis of distributed Cyber Physical Systems (CPS). Over four years of combined research and internship experience in building resilient software systems and algorithms for event-driven and multi-threaded safety-critical applications. Experienced in Linux systems and working with different communication protocols using socket programing. Also familiar with deep neural network architectures and applying deep learning for data-driven applications. Looking to work on research related to CPS networks and architectures for larger scale system and opportunities to take on more leadership/ mentoring roles in research projects.

EDUCATION

Vanderbilt University   Nashville, TN
PhD, Electrical Engineering   **Aug 2017 – Defended, Feb 2023**
- Develop approaches to design fault-tolerant distributed applications that go beyond classical questions of fault-tolerant computing. Using case studies from the energy systems field, it highlights how the computing software and communication layer can detect and react to faults affecting the physical system and determine approaches to either mitigate it or recover from it.

Jalpaiguri Government Engineering College   Jalpaiguri, India
Bachelor of Technology (B. Tech), Electronics and Communication Engineering   **Aug 2010 - June 2014**

RESEARCH EXPERIENCE

- **Microgrid Control using Software and Hardware-in-the-Loop Simulation**: Worked on developing fault-tolerant control algorithms for microgrids using a decentralized software platform. Developed interface components to integrate with popular power systems simulators like Gridlab-D and OpenDSS to design hardware-in-the-loop (HiL) simulations running on embedded platforms in real-time.
- **Neural Network based Optimal Dispatch**: Contributed to the development of an energy management application for distributed loads, batteries, and electric vehicle chargers in a microgrid using load predictions with LSTM neural networks and then calculating the optimal power allocation using IBM CPLEX solver.
- **Resilient Deployment Solver for Distributed Software Components**: Built an automated deployment framework for optimal allocation of distributed software components to remote edge computing hardware platforms using SMT constraints and Linear Optimization, subject to fault tolerance requirements and resource constraints.
- **Automated model checking and timing analysis using UPPAAL:** Working on automated model translation and model-based approaches for validation and timing analysis of software components for distributed systems using Timed Automata and UPPAAL.
- **Deep Neural Network based Occupancy Detection using Energy consumption data:** Collaborated with another colleague in building a Deep Learning framework for the Occupancy Classification task and use a new game-theoretic approach called Shapley Additive Explanation (SHAP) to improve explainability and algorithm performance.

SELECTED PUBLICATIONS

- P. Ghosh, S. Eisele, A. Dubey, M. Metelko, I. Madari, P. Volgyesi, and G. Karsai, *"On the design of fault-tolerance in a decentralized software platform for power systems,"* in 2019 IEEE 22nd International

Symposium on Real-Time Distributed Computing (ISORC). IEEE, 2019, pp. 52–60.

- P. Ghosh, S. Eisele, A. Dubey, M. Metelko, I. Madari, P. Volgyesi, and G. Karsai, *"Designing a decentralized fault-tolerant software framework for smart grids and its applications,"* Journal of Systems Architecture, vol. 109, p. 101759, 2020.
- P. Ghosh, S. Shekhar, Y. Lin, U. Muenz, and G. Karsai, *"Peer-to-peer communication trade-offs for smart grid applications,"* in 2022 International Conference on Computer Communications and Networks (ICCCN). IEEE, 2022, pp. 1–10.
- P. Ghosh, H. Tu, T. Krentz, G. Karsai, and S. Lukic, *"An automated deployment and testing framework for resilient distributed smart grid applications,"* in 2022 IEEE International Conference on Omni-layer Intelligent Systems (COINS). IEEE, 2022, pp. 1–6.

PROFESSIONAL EXPERIENCE

Siemens Technology   Princeton, New Jersey
Intern, Resilient Communication at the Edge for Smart Grids   **June 2021 – Sep 2021**
- Worked with open-source Resilient Information Architecture Platform for Smart Grid (RIAPS) platform to develop an automated framework for peer-to-peer communications for microgrids.
- Explored and developed algorithms in Python to optimize peer-to-peer communication for distributed energy resources (DERs) for microgrid Energy Management Systems (EMS) and improve its fault tolerance capabilities.
- Filed an invention disclosure for the technology developed.

Cognizant Technology Solutions India Pvt. Ltd.   Kolkata, India
Programmer Analyst, Integrated Process Management   **Oct 2014 – June 2017**
- Responsible for the development of the end-to-end business workflow software for business clients using Pega PRPC software suite. Modules developed included the user interface, business logic and integrations with upstream/downstream applications using SOAP/ REST/ JMS API.
- Experienced in working in an Agile-Scrum development model. Involved in all phases of software development lifecycle form requirements gathering, development, unit testing, QA testing support and production deployment support.
- Received "Exceeds All" performance review for the year 2016-17.

TEACHING EXPERIENCE

Teaching Assistant (TA), Vanderbilt University   Aug 2017 – Present
- Conducted laboratory practical classes for approx. 30 students for three semesters (Analog Electronic Circuits (Fall 2017), Microcontrollers (Spring 2018)) and Embedded Systems (Fall 2022). Responsible for experiment setup, troubleshoot problems, debug code, grading of lab reports and assignments for students.
- TA for Cyber Physical Systems (Spring 2022)- conducted office hours to interact with students directly and provide guidance on homework, give feedback on grades and clear doubts related to lectures.
- Took classes and gave lectures in absence of the instructor.
- Received complimentary feedback from students regarding approachability, professionalism and ability to provide lucid explanations in end-of-semester surveys.
- Completed *Certificate in College Teaching* from Vanderbilt Center For Teaching, 2022.

COURSES TAKEN

- **Graduate:** Cyber Physical Systems, Real Time Systems, Distributed systems Principles, Resilient

Distributed Systems, Linear Optimization, Systems Theory, Detection and Estimation Theory, Deep Learning.

- **Undergraduate**: Object Oriented Programming, Computer Architecture, Computer Networks, Digital Image Processing, Circuit Theory, Electromagnetic Theory and Transmission Lines. Database /management Systems.

SKILLS

Computer Skills: Python, C, SQL, MATLAB, Simulink, Linear Programming, Z3 constraint solver, ZeroMQ, MQTT, Kafka, Keras, PuLP, CPLEX, InfluxDB, Grafana.
Simulation: Familiar with power systems simulators like Gridlab-D, OpenDSS, Opal-RT and Simulink.
Communication protocols: Familiar with Modbus, DNP3, IEEE C37.118.
Version control: git
Operating Systems: Ubuntu Linux, shell scripting

VOLUNTEERING

- **Global Shapers Nashville** – **Member and elected Vice Curator**. Youth driven organization which is part of the World Economic Forum. Conducted two projects for the Nashville community, namely, providing support to elderly and first responders during Covid 19 and organizing relief for Nashville refugees.

- Member of Vanderbilt University Graduate Student Council and ECE Student Associations.