RAMESH NEUPANE

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Research Interests

My research interests focus on **creating secure, resilient frameworks** that address the evolving vulnerabilities in digital systems. While cybersecurity remains central to my work, I am particularly drawn to **system and network security**, where I view cybersecurity as a critical line of defense in our increasingly digital society. My **experience with formal methods** includes techniques like symbolic execution and logic-based approaches to verify the safety and security of critical infrastructure, **making systems more robust against threats**.

I am also invested in software testing, emphasising the use of structured methodologies to identify and address vulnerabilities early in the development process, helping to build resilient software that meets the demands of rapid technological change. Recently, my work has extended my interest into **artificial intelligence—particularly at its intersection with security**—where I want to explore how AI and formal reasoning can enhance security and fairness in digital systems.

My curiosity about human dynamics further drives my interest in **human-computer interaction and social computing**. I am intrigued by human psychology concerning security, system design, and user behavior. Open to exploring new research areas that align with these themes, I am constantly looking to expand my understanding and impact across various sectors within technology and security.

Research Experience

Graduate Research Assistant ***Boise State University****, Jan. 2020 - May 2022*

- Research Student, Cyber Lab for Industrial Control Systems (ICS)
- Led research on securing critical infrastructure, focusing on the safety and security of Programmable Logic Controller (PLC) software used in industrial control systems.
- Utilized Description Logic (DL)-based ontology to construct a knowledge base (KB) for formal verification, ensuring the integrity and security of PLC software applications.
- Applied Satisfiability Modulo Theories (SMT) solvers, particularly Z3, to verify and analyze PLC systems' security properties, helping to identify and mitigate vulnerabilities.
- Developed advanced formal methods and techniques for reasoning about system behaviors, ensuring that security policies were correctly applied and adhered to within the control systems.
- Worked on Timed Automata (TA) model checking tools such as UPPAAL for control systems of Cyber Physical Systems (CPS).
- Designed and implemented APIs for research applications, facilitating smoother data handling and integration with external platforms to support testing and verification workflows.
- Conducted extensive testing of security protocols, identifying weaknesses and proposing practical solutions to improve system resilience.
- Collaborated with interdisciplinary teams to align research with real-world industrial control system challenges, ensuring the relevance of findings to critical infrastructure security.
- Published research findings, contributing to the development of secure, trustworthy frameworks for ICS security in academic and industry communities.

Publications

- An Ontology-Based Framework for Formal Verification of Safety and Security Properties of Control Logics | 14th International Conference on Electronics, Computers and Artificial Intelligence (ECAI), Ploiesti, Romania, 2022, pp. 1-8, doi: 10.1109/ECAI54874.2022.9847508
- Ontology-based Framework for Boundary Verification of Safety and Security Properties in Industrial Control Systems | Proceedings of the 2023 European Interdisciplinary Cybersecurity Conference. ACM Other conferences. Published 2023. Accessed July 7, 2023. https://dl.acm.org/doi/abs/10.1145/3590777.3590785

Education

M.S. in Computer Science *Jan. 2020 - May 2022*
Boise State University, Boise, ID

B.E. in Electronics and Communication *Nov. 2012 - Dec. 2016*
IOE, Pulchowk, Tribhuvan University, Kathmandu, Nepal

Technical Skills

- **Languages** Python (6+ yrs), Java (3+ yrs), NodeJS, C++, MATLAB, Go, Bash
- **Python Libraries** numpy, pandas, scikit-learn, unittest, scipy, matplotlib, requests
- **Applications/Tools** LDAP, AD, Redis, Git, Docker, Tmux, MySQL, MongoDB, Ansible
- **Frameworks** SpringBoot, Angular, Flask, Django, React, React Native,
- **Testing** (Dynamic) Symbolic Execution, JUnit, Selenium, Postman, Formal Methods
- **Others** Linux, Multi-threading, Design Patterns, AWS, Azure, Container

Professional Experience

Senior Software Engineer ***VISA Inc.****, Highland Ranch, CO, June 2022 - Present*

- Working as a full-stack engineer for an Infrastructure Reliability Engineering Team
- Development of a self-service patching application portal with Java Springboot and AngularJS, including CI/CD; this reduces the number of internal tickets by more than 70%
- Developing a Retrieval-Augmented Generation (RAG) agent to answer queries related to AskNow, Prometheus, and other company-specific tools, leveraging LLM APIs (GPT, LLaMA, Gemini, etc.) with few-shot prompting and other context-aware prompting to improve response accuracy and efficiency.
- Proposed and implemented an enhancement to the existing data pipeline by adding multi-level logging, multi-processing, and streaming; this improved the overall latency by 40%
- Automate the remediation of vulnerabilities and security requirements using Bash, Python and Ansible
- Provide analysis, such as severity and resolution date, to the application team for the security resolutions
- Designed automation for generating reports and analyses for the management
- Designed and performed a data migration from multiple databases, i.e. R-SQL to NoSQL
- A scrum master for the team in the US
- Technologies: SpringBoot, Python, Angular, Security Patching, Ansible, Pandas, RHEL, MSSQL

Graduate Teaching Assistant ***Boise State University*** *Boise, Idaho, Jan. 2020 - Aug. 2022*

- Worked as a Teaching Assistant for courses such as Introduction to Programming and Java Programming
- Worked alongside the course professor to design the final project for the course
- Worked as a grader for the mentioned course

Solution Engineer ***LogPoint (SIEM)*** *Nepal, Copenhagen, Denmark, Mar. 2017 - Dec. 2019*

- Worked as an L3/L4 support engineer for ~150 mid-large-sized European and U.S.-based clients
- Worked as a full-stack (Flask+React) developer of queue-based ticket management tools
- Proposed and implemented Python multiprocessing on existing remote health check application; this decreased the wait time from hours to minutes, simply using multiple CPUs for network IO time
- Dealt with problem debugging related to the whole product and development of hotfixes to the problem, sometimes applying fixes on the live environment
- Log format analysis of logs coming from network devices such as Firewalls, Switches, and IDS
- Developed a plugin app for cyber kill chain attack simulation, where I contributed to faking logs coming to the SIEM solutions from diverse sources, securing our position in Gartner Magic Quadrant
- Technologies: Python, Java, C, ExtJS, Kafka, Lucene, Linux, MongoDB

Additional Information

- Passionate about working on cross-disciplinary engineering projects, with a strong foundation in electronics and hardware concepts
- Enjoys outdoor activities such as hiking, skiing, running, and soccer, which help me maintain a healthy work-life balance and foster teamwork
- Enthusiastic about engaging with individuals from diverse backgrounds, asking insightful questions, and collaborating to find innovative solutions

- Avid chess player and follower of the game's evolution, particularly its parallels with advancements in computing and artificial intelligence
- **Certification**: Axelos ITIL 4, 2019. RHCSA (In progress)