

# Md Rayhanur Rahman

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## Summary

My research interests are software engineering and cybersecurity, focusing on mining actionable intelligence from open-source knowledge bases for software and security practitioners to design proactive defenses. I rely on a wide range of techniques, such as, natural language processing, machine learning, static analysis, and grounded theory-based approaches.

## Education

- 2018 – 2024 **Ph.D. in Computer Science, North Carolina State University**  
Thesis title: *Towards mining proactive intelligence from OSCTI reports*  
Advisor: Dr. Laurie Williams  
Graduation: Fall 2024
- 2013 – 2014 **M.Sc. in Software Engineering, University of Dhaka**  
Thesis title: *Towards peer to peer resource provisioning in cloud*  
Advisor: Dr. Kazi Muheymin-Us-Sakib
- 2009 – 2012 **B.IT. in Software Engineering, University of Dhaka**

## Work Experience

- 2024 – . . . . **Assistant Professor** at the University of Alabama at Tuscaloosa  
I will be joining the university as a tenure track assistant professor from August 2024 with a primary research focus on software engineering, cybersecurity, and machine learning.
- 2020 – 2020 **Research Intern** at Microsoft Corporation  
I have worked with 1ES team to analyze and investigate how the security tools can be improved through empirical methods.
- 2018 – 2024 **Graduate Assistant** at North Carolina State University  
I served as a research assistant as part of NSA Science of Security Lablet. I investigate the open-source technical reports of past cyberattack incidents to mine malicious behavior patterns. I leverage the patterns to provide proactive and actionable insights for security practitioners. I also served as a teaching assistant for four semesters in software engineering, software security, and DevOps-related courses.
- 2021 – 2021 **Summer Teaching Instructor** at North Carolina State University  
I have worked as a summer teaching instructor for C and Software Tools courses designed for undergraduate students.
- 2014 – 2018 **Lecturer** at University of Dhaka  
I taught undergraduate courses such as Discrete Mathematics, Data Structure, Combinatorial Optimization, Object Oriented Concepts, and Operating Systems. I also taught Formal Methods and Models of Software Engineering to graduate students. Apart from teaching, I oversaw undergraduate students' academic affairs and designed course curricula for external institutions.
- 2015 – 2017 **Guest Lecturer** at Daffodil International University, Dhaka  
I taught undergraduate courses: Software Engineering and Object-oriented Concepts.
- 2015 – 2016 **Guest Lecturer** at East West University, Dhaka  
I taught undergraduate courses: Introduction to Computing.
- 2013 – 2014 **Junior Software Engineer** at Kaz Software  
I worked on a proprietary Google Chrome extension named LinkableNews and a web application named LinkableService, which provided web ontology and identity services.

## Selected Research Publications

### Journal Articles (Published)

- 1 S. Elder, **Md Rayhanur Rahman**, G. finger, K. Kapoor, and L. Williams, "A survey on software vulnerability exploitability assessment," *ACM Computing Survey*, 2024.

- 2 **Md Rayhanur Rahman**, R. Mahdavi-Hezaveh, and L. Williams, "What are the attackers doing now? automating cyberthreat intelligence extraction from text on pace with the changing threat landscape: A survey," *ACM Computing Surveys*, vol. 55, no. 12, pp. 1–36, 2023.
- 3 **Md Rayhanur Rahman**, N. Imtiaz, M.-A. Storey, and L. Williams, "Why secret detection tools are not enough: It's not just about false positives-an industrial case study," *Empirical Software Engineering*, vol. 27, no. 3, p. 59, 2022.
- 4 A. Rahman, **Md Rayhanur Rahman**, C. Parnin, and L. Williams, "Security smells in ansible and chef scripts: A replication study," *ACM Transactions on Software Engineering and Methodology (TOSEM)*, vol. 30, no. 1, pp. 1–31, 2021.
- 5 M. M. Rahman, R. R. Riyadh, S. M. Khaled, A. Satter, and **Md Rayhanur Rahman**, "Mmruc3: A recommendation approach of move method refactoring using coupling, cohesion, and contextual similarity to enhance software design," *Software: Practice and Experience*, vol. 48, no. 9, pp. 1560–1587, 2018.
- 6 **Md Rayhanur Rahman** and K. Sakib, "A scalable resource provisioning scheme for the cloud using peer to peer resource discovery and multi-attribute utility theory," *International Journal of Cloud Computing*, vol. 6, no. 3, pp. 211–237, 2017.
- 7 M. M. Rahman, **Md Rayhanur Rahman**, and B. M. Hossain, "Recommendation of move method refactoring to optimize modularization using conceptual similarity," *International Journal of Information Technology and Computer Science*, 2017.
- 8 M. M. Rahman, S. Rahman, **Md Rayhanur Rahman**, B. M. Hossain, and M. Shoyaib, "Dtcth: A discriminative local pattern descriptor for image classification," *EURASIP Journal on Image and Video Processing*, vol. 2017, pp. 1–24, 2017.
- 9 A. Imran, A. U. Gias, **Md Rayhanur Rahman**, and K. Sakib, "Provintsec: A provenance cognition blueprint ensuring integrity and security for real life open source cloud," *International Journal of Information Privacy, Security and Integrity*, vol. 1, no. 4, pp. 360–380, 2013.

## Conference Proceedings (Published)

- 1 **Md Rayhanur Rahman**, W. Enck, and L. Williams, "Do configuration management tools make systems more secure? an empirical research plan," in *Proceedings of the 7th Symposium on Hot Topics in the Science of Security*, 2020, pp. 1–2.
- 2 **Md Rayhanur Rahman**, R. Mahdavi-Hezaveh, and L. Williams, "A literature review on mining cyberthreat intelligence from unstructured texts," in *2020 International Conference on Data Mining Workshops (ICDMW)*, IEEE, 2020, pp. 516–525.
- 3 **Md Rayhanur Rahman**, A. Rahman, and L. Williams, "Share, but be aware: Security smells in python gists," in *2019 IEEE International conference on software maintenance and evolution (ICSME)*, IEEE, 2019, pp. 536–540.
- 4 A. S. Ami, M. M. Hasan, **Md Rayhanur Rahman**, and K. Sakib, "Mobicomonkey: Context testing of android apps," in *Proceedings of the 5th International Conference on Mobile Software Engineering and Systems*, 2018, pp. 76–79.

## Conference Proceedings (Accepted)

- 1 M. R. Rahman, B. Wroblewski, M. Tamanna, I. Rahman, A. Anufryienak, and L. Williams, "Towards a taxonomy of challenges in security control implementation," in *2024 Annual Computer Security Application Conference*, IEEE, 2024.

## In Review

- 1 **Md Rayhanur Rahman**, B. Wroblewski, M. Tamanna, I. Rahman, and L. Williams, "Towards a taxonomy of challenges in security control implementations," in *Annual Computer Application Security Conference*, 2024.
- 2 **Md Rayhanur Rahman**, R. Mahdavi-Hezaveh, S. Basak, and L. Williams, "Attackers reveal their arsenal: An investigation of adversarial techniques in cti reports," *ACM Transactions on Privacy and Security*, 2023.
- 3 **Md Rayhanur Rahman**, B. Wroblewski, Q. Matthews, B. Morgan, T. Menzies, and L. Williams, "Mining temporal attack patterns from cyberthreat intelligence reports," *IEEE Transactions on Software Engineering*, 2023.

## Preprints

- 1 **Md Rayhanur Rahman** and L. Williams, "An investigation of security controls and mitre attack techniques," *arXiv preprint arXiv:2211.06500*, 2022.

- 2 **Md Rayhanur Rahman** and L. Williams, "From threat reports to continuous threat intelligence: A comparison of attack technique extraction methods from textual artifacts," *arXiv preprint arXiv:2210.02601*, 2022.
- 3 **Md Rayhanur Rahman** and L. Williams, "Investigating co-occurrences of mitre att\&ck techniques," *arXiv preprint arXiv:2211.06495*, 2022.

## Skills

Research methods	■ Mixed methods, meta-analysis, grounded theory approach, survey, empirical analysis
Machine learning	■ Classical learning, deep learning, graph learning, multi-modal learning, association rule mining, social network analysis
Natural language processing	■ Transformers, large language models, language representation learning, fine-tuning, semantic analysis, text classification, entity and relation extraction, knowledge graph extraction
Cybersecurity	■ Threat intelligence, security control, threat modelling, MITRE ATT&CK, NVD, CWE, NIST SP800-53, vulnerability analysis
Program Analysis	■ Static analysis, abstract syntax tree
Tools	■ PyTorch, Deep graph library, Scikit-learn, Networkx, Spacy, OpenAI, Transformers, CodeQL, ZAP, Fortify
Languages	■ Python, C#, Javascript, Prolog, Java, C

## Research Tools

ChronoCTI	■ Extracting temporal patterns of malicious malware behavior from open source textual descriptions of past cyberattacks
PyGistSecuritySmell	■ A static analyzer for finding security weaknesses in Python
SLIC-Ansible	■ A static analyzer for finding security weaknesses in Ansible scripts
Scalable-VFDT	■ An online tree based learner for software defect predictions for large-scale codebases

## Miscellaneous

### Scholarly Contribution

- 2024 ■ **Guest Talk** Large Language Models and Secure Coding, NC State University
- **Reviewer** for Heliyon
- 2023 ■ **Reviewer** for Computers & Security
- **Guest Talk** Inviting Security and Privacy into DevOps, NC State University
- 2021 ■ **Sub-reviewer** for International Conference of Software Engineering
- **Sub-reviewer** for International Conference of Software Engineering
- 2020 ■ **Sub-reviewer** for Mining Software Repositories
- **Sub-reviewer** for Empirical Software Engineering Methods, and Measurements

### Teaching

- 2014-2018 ■ **Undergraduate courses:** Discrete Mathematics, Object-oriented Concepts, Combinatorial Optimization, Operating System and System Programming, Distributed Systems, Computer Data and Network Security, Introduction to Computing
- **Graduate courses:** Formal Methods and Models in Software Engineering, Distributed Software Engineering
- 2021 ■ **Undergraduate courses:** C and Software Tools
- 2018-2024 ■ **Teaching Assistant:** Software Engineering, DevOps, Software Security

## Miscellaneous (continued)

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### Mentoring

2024	■	<b>Undergraduate students:</b> Brandon Wroblewski, Andrew Anufryienak
2023	■	<b>Undergraduate students:</b> Brantley Morgan, Brandon Wroblewski, Quinn Matthews
2022	■	<b>Undergraduate students:</b> Jonathan Buck
2021	■	<b>Graduate students:</b> Aishwarya Seth
2017	■	<b>Graduate Students:</b> Deepak Chandra Das
2016	■	<b>Graduate Students:</b> Masudur Rahman
2015	■	<b>Graduate Students:</b> Md Shafuazzaman

### Awards and Achievements

2024	■	<b>Mentored Teaching Fellowship - Software Security</b> , College of Engineering, NC State University
2020	■	<b>Travel Grant</b> , Science of Security, National Security Agency
2019	■	<b>Travel Grant</b> , College of Engineering, NC State University, United States
2017	■	<b>Research Grant</b> , United Grants Commission, Bangladesh
2016	■	<b>Research Grant</b> , United Grants Commission, Bangladesh
2015	■	<b>Innovation Fund</b> , Ministry of Information, Communication and Technology, Government of Bangladesh
2014	■	<b>National Science and Technology Fellowship</b> , Ministry of Science and Technology, Government of Bangladesh
2012	■	<b>Champion</b> , ByteKnight Cybersecurity Challenge, organized by OWASP, Bangladesh
	■	<b>Finalist</b> , Microsoft Imagine Cup, Bangladesh
2011	■	<b>Champion</b> , GetRoot Cybersecurity Challenge, organized by OWASP, Bangladesh

## References

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1. **Dr. Laurie Williams**  
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