Bishal Basak Papan

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RESEARCH INTERESTS

Distributed Systems, Software Engineering, Fuzzing, Security, Operating Systems, Systems for Machine Learning, Large Language Models for Software Testing, Graph Theory

WORK EXPERIENCE

Purdue University   West Lafayette, Indiana
Graduate Teaching Assistant   *Jan. 2024 – Present*

- **CS 307 Software Engineering I**: Coordinated five teams where each team were working on developing a software over the whole semester divided into three sprints, following agile methods. The main responsibilities involved helping the teams organize their tasks, plan the sprints, prepare the design documents and debug issues in their systems.
- **CS 252 Systems Programming**: Covered wide range of programming assignments while helping the students including memory management with C, shell scripting, multithreaded programming and http-server implementation using C, and the term project of implementing a shell terminal.

Incepta Solutions Inc   Ontario, Canada
Software Developer (Remote)   *Jun. 2021 – Jul. 2023*

Languages and Frameworks: Java, TypeScript, Python, MuleSoft, Workato, React

Projects worked on:

- API integration through MuleSoft for **Incepta SmartConnect**, an IoT platform solution: connected systems like SMTP, Twilio, Azure with SmartConnect portal through MuleSoft
- MuleSoft Integration support for **The Nationwide Group of Companies**: worked on migrating NAS mobile app middleware from Mule 3.9 to Mule 4.4 using MuleSoft and Java
- **Incepta HRTech**, HR Automation system that enables faster HR on-boarding: implemented a proof-of-concept applicant tracking system using React, TypeScript, Workato and Salesforce

RESEARCH EXPERIENCE

Purdue University   West Lafayette, Indiana
Graduate Research Assistant   *Aug. 2023 – Present*

- Zlab-Purdue, PI: Dr. Yongle Zhang

Bangladesh University of Engineering and Technology (BUET)   Dhaka, Bangladesh
Undergraduate Research Assistant   *2020 – 2023*

- Graph Drawing and Information Visualization Laboratory, PI: Dr. Md. Saidur Rahman

EDUCATION

Purdue University   West Lafayette, Indiana
Ph.D. in Computer Science   *Aug. 2023 – Present*
Advisor: Dr. Yongle Zhang
Research Concentration: Distributed Systems, Software Engineering & Security
Courses: Distributed Systems, Information Security, Data Communication and Computer Networks, Algorithm Design, Analysis and Implementations

Bangladesh University of Engineering and Technology (BUET)   Dhaka, Bangladesh
B.Sc in Computer Science and Engineering   *Feb. 2016 – Feb. 2021*
Thesis Supervisor: Dr. Md. Saidur Rahman
Thesis Concentration: Graph labeling problems, Pairwise Compatibility Graphs, Network modeling

Publications

- Zahin Wahab, **Bishal Basak Papan**, Md. Shohrab Hossain, Md. Atiquzzaman, "Dealing with Smart GPS Spoofing Attacks in VANETs: 3BSM Approach", 2024 IEEE International Conference on Communications (ICC) (Accepted), Denver, Colorado.

- Sheikh Azizul Hakim, **Bishal Basak Papan**, Md. Saidur Rahman, "New Results on Pairwise Compatibility Graphs" Information Processing Letters, Elsevier, May, 2022. (PDF)

- **Bishal Basak Papan**, Protik Bose Pranto, Md. Saidur Rahman, "On 2-Interval Pairwise Compatibility Properties of Two Classes of Grid Graphs", The Computer Journal, Oxford University Press, February, 2022.

- Protik Bose Pranto, **Bishal Basak Papan**, Md. Saidur Rahman, "k-Safe Labelings of Connected Graphs", 2021 IEEE International Conference on Telecommunication and Photonics (ICTP), Dhaka, Bangladesh.

Research Summary

Distributed Systems Testing
Purdue University
Aug. 2023 – Present

We have developed a framework which utilizes input mutation to detect bugs while upgrading the version of a distributed system. To improve the performance of our framework and generate the failure inducing tests quickly, we developed a new metric to guide our fuzzer and integrated virtual machine snapshot mechanism to reduce the overhead caused by the upgrade procedure.

Undergraduate Thesis
Bangladesh University of Engineering and Technology
Mar. 2019 – Feb. 2021

- k-**Safe labeling problem:** We developed a polynomial time approximation algorithm to solve an NP-Complete graph labeling problem, k-safe labeling problem, which has application in radio frequency assignment of mobile network towers.

- **Pairwise Compatibility Graph recognition problem:** Pairwise compatibility graph (PCG) has applications in phylogenetic tree reconstruction but a complete characterization of PCG class is yet unknown. We proved a specific graph class to be PCG, a graph class to be a superclass of PCG and two graph classes to be not PCGs in order to solve some open problems which might help characterizing PCG class.

Selected Projects

eMarketPlace | *PHP, HTML, JavaScript, CSS, MySQL, Laravel*
- A simple E-commerce website containing different modules for customer, vendor and admin
- Customers can search and order different categories of products online and provide feedback
- Vendors can add new product or update existing products' attribute

GPS Spoofing Detection in VANETs using ML | *Python*
- Detection of GPS Spoofing attack in a VANET from three consecutive BSM packets using the VeReMi dataset
- Performance comparison with existing two consecutive BSM approach on KNN, Naive Bayes, Decision Tree and Random Forest models
- Analyzing how three consecutive BSM approach beats the existing two consecutive BSM approach

Hall Management System for BUET | *Java, Oracle, SQL, C++, CSS*   Code
- A residential hall management system for BUET students and authorities
- Can be used by students and hall and university administrators in their respective modules to assign hall and room to BUET students, to clear fees of students

Simulation of TCP Session Hijacking Attack | *Python, Shell*   Code
- TCP Session Hijacking attack in a network using three SEED virtual machines
- First, the attacker will launch arp spoofing attack to sniff the packets between client and server
- Then the attacker will generate a correct session id depending on the ongoing sessions and hijack the session

A Comparison of Modern JVM Based Garbage Collectors | *Shell, Python* <u>Code</u>
- A study of the performance of three JVM based garbage collectors: G1GC, ZGC and Shenandoah
- Observed performance variation with modifying heap sizes by analyzing log files using GCEasy
- Comparing their performance on several big-data benchmarks from two Benchmark Suites: Renaissance and DaCapo, on OpenJDK Java version 11.0.15

Predicting Football Players' Injuries from Past Injuries | *Python*
- Developed crawlers to collect data from a website and collected injury history along with other relevant data of around 4000 footballers currently playing
- Used deep learning models to predict footballers' injuries using time series forecasting techniques

TECHNICAL SKILLS

Languages: Java, Python, C, C++, MySQL, PosteGRESQL, DataWeave, RAML, TypeScript
Frameworks: Mule 4, React, JavaFX, OpenGl, Laravel
Platforms: MuleSoft Anypoint Platform, Workato, Salesforce
Tools: Git, Bitbucket, Overleaf, Gephi, Mathcha, JMeter, Postman, Wireshark

ACADEMIC SERVICES

Conference Sub Reviewer
- ACM Symposium on Operating Systems Principles (SOSP) 2024
- ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS) 2025
- ACM European Systems Conference (EuroSys) 2024
- USENIX Annual Technical Conference (ATC) 2024
- USENIX Symposium on Networked Systems Design and Implementation (NSDI) 2024
- International Conference and Workshops on Algorithms and Computation (WALCOM) 2021, 2022
- IEEE International Conference on Data Engineering (ICDE) 2022

Journal Sub Reviewer
- Information Processing Letters (IPL)
- Discrete Mathematics and Theoretical Computer Science (DMTCS)

EXTRA CURRICULAR ACTIVITIES

Bangladesh Students Association (BDSA) Purdue University
Treasurer *Aug. 2024 – Jul. 2025*

Bangladesh Physics Olympiad
Academic Team Member *2016 – 2018*

REFERENCES

Dr. Yongle Zhang - *Assistant Professor*
Department of Computer Science,
Purdue University.
Email: <u>yonglezh@purdue.edu</u>

Dr. Md. Saidur Rahman - *Professor*
Department of Computer Science and Engineering,
Bangladesh University of Engineering and Technology.
Email: <u>saidurrahman@teacher.cse.buet.ac.bd</u>