

AKOND ASHFAQUE UR RAHMAN

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RESEARCH INTERESTS

Software engineering focused in the area of Continuous Deployment, DevOps, and mining software repositories

EDUCATION

- **Doctor of Philosophy (Ph.D.) in Computer Science** Aug 2014 - Present
 - Adviser: Dr. Laurie Williams
 - North Carolina State University, Raleigh, NC, USA
- **Master of Science (M.Sc.) in Computer Science and Engineering** Jan 2012 - May 2014
 - University of Connecticut, Storrs, CT, USA
- **Bachelor of Science (B.Sc.) in Computer Science and Engineering** Dec 2004 - Sep 2009
 - Adviser: Dr. Mahmuda Naznin
 - Bangladesh University of Engineering and Technology, Dhaka, Bangladesh

AWARDS & HONORS

- **NSF Graduate Stipend**
As part of presenting my paper at the 2016 Conference on Cybersecurity Education, Research and Practice Graduate Student Workshop, I received the National Science Foundation (NSF) Graduate Stipend.
- **Microsoft Open Source Challenge**
I am the **Grand Prize** winner of the 2016 Microsoft Open Source Challenge. I used Microsoft Research's Deep Semantic Similarity Model (DSSM) tool to quantify the semantic similarity of software repositories. Details are available here <http://tiny.cc/unp1by>.
- **First prize in IUT National ICT Festival**
In August, 2009, I received this award in IUT National ICT Festival, in Software Projects category.
- **Dean's List Award**
I received this award for achieving academic excellence for two semesters in the year of 2008 during my Bachelors program in Bangladesh University of Engineering and Technology.
- **University Scholarship for Merit**
I received this award for maintaining decent academic progress for four semesters from 2007 to 2009 during my Bachelors program in Bangladesh University of Engineering and Technology.

PEER REVIEWED PUBLICATIONS

- **Akond Ashfaqur Rahman**, "Code Metrics For Predicting Risk Levels of Android Applications", to appear in Proceedings of 2016 KSU Conference on Cybersecurity Education, Research and Practice (CCERP' 2016), October, 2016.
- **Akond Ashfaqur Rahman** and Laurie Williams, "Software Security in DevOps: Synthesizing Practitioners' Perceptions and Practices", in Proceedings of International Workshop on Continuous Software Evolution and Delivery (CSED), May, 2016, Austin, TX, USA.
- **Akond Ashfaqur Rahman** and Laurie Williams, "Security Practices Used in DevOps", in Proceedings of Symposium and Bootcamp on the Science of Security (HotSoS), April, 2016, Pittsburgh, PA, USA.

- **Akond Ashfaq Ur Rahman**, Eric Helms, Laurie Williams, and Chris Parnin, “Synthesizing Continuous Deployment Practices in Software Development”, in Proceedings of 13th Agile Conference, pages 1-10, Washington D.C., USA, August, 2015.
- **Akond Ashfaq Ur Rahman**, Md. Atiqul Islam Mollah, and Mahmuda Naznin, “Multiple Targets Tracking Using Kinematics in Wireless Sensor Networks” in Wireless Sensor Network, pages 263-274, August, 2011.
- **Akond Ashfaq Ur Rahman**, Mahmuda Naznin, and Md. Atiqul Islam Mollah, “Energy Efficient Multiple Targets Tracking Using Target Kinematics in Wireless Sensor Networks” in Proceedings of 4th International Conference on Sensor Technologies and Applications (SensorComm), pages 275-280, Venice, Italy, July, 2010.
- **Akond Ashfaq Ur Rahman**, Mahmuda Naznin, and Md. Atiqul Islam Mollah, “Service Priority Based Target Tracking Framework in a Wireless Sensor Network” in Proceedings of 3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT), pages 389-392, Chengdu, China, July, 2010.
- M.M.Shahiduzzaman, Mahmuda Naznin, and **Akond Ashfaq Ur Rahman**, “Portable and Secure Multimedia Data Transfer in Mobile Phones Using Record Management Store (RMS)” in Proceedings of 3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT), pages 364-367, Chengdu, China, July, 2010.

PRESENTATIONS

- “Software Security in DevOps: Synthesizing Practitioners’ Perceptions and Practice”, in First International Workshop on Continuous Software Evolution and Delivery, Austin,TX, USA, May, 2016 URL
- “Synthesizing Continuous Deployment Practices in Software Development”, in 13th Agile Conference, Washington D.C., USA, August, 2015 URL

PROFESSIONAL EXPERIENCE

- **Systems Infrastructure Intern** May 2016 - Aug 2016
 - Redhat Inc., Raleigh, NC, USA
 - Activities:
 - * Developed monitoring facilities for the OpenShift infrastructure to facilitate continuous deployment of internal Redhat applications.
 - * Facilitated Integration of in-house Redhat application into the OpenShift infrastructure.
 - * Collaborated with full time members and interns of the PlatOps and SysEng team at Redhat.
- **Research Assistant** Jan 2016 - May 2016
 - Science of Security Lablet, National Security Agency (NSA), USA
 - Activities:
 - * Investigated research aspects of DevOps.
 - * Research methods for science of security.
 - * Collaboration with Science of Security Lablet participants.
- **Software Research Intern** May 2015 - Aug 2015
 - ABB Corporate Research, Raleigh, NC, USA
 - Activities:
 - * Designed, and developed a software framework to detect similar software applications in ABB.
 - * Collaborated with full time members and interns of the Software Architecture Team and Industrial Software Engineering team at ABB Corporate Research.
- **Teaching Assistant** Aug 2014 - Dec 2015
 - Department of Computer Science, North Carolina State University, Raleigh, NC, USA
 - Activities:

- * Provided lectures for a graduate course.
- * Managed Apache Virtual Computing (VCL) images to administer course projects and homeworks.
- * Designed requirements for class projects.
- * Designed questions for class quizzes, and exams for graduate and undergraduate courses.
- * Graded homeworks, and exams for graduate and undergraduate courses.

- **Graduate Assistant**

Jun 2013 - May 2014.

- Engineering Computing Services (ECS), University of Connecticut (UConn), Storrs, CT, USA
- Activities:
 - * Troubleshooted ECS computer systems and services.
 - * Solved day to day software and hardware problems of the administrative staff in School of Engineering at UConn.

- **Teaching Assistant**

Aug 2012 - Dec 2012

- Department of Computer Science and Engineering, University of Connecticut, Storrs, CT, USA
- Activities:
 - * Provided lectures for an undergraduate course.
 - * Administered lab sessions focused on Matlab programming.
 - * Graded homeworks, and exams for an undergraduate course.

- **Software Engineer**

Jan 2010 - Jun 2011

- Dohatec New Media, Dhaka, Bangladesh
- Activities:
 - * Designed and developed a Java-based multi-modal biometric system using the MegaMatcher SDK.
 - * Developed and tested an online procurement system for the Ministry of Planning of the People's Republic of Bangladesh using ASP.NET with C# and Microsoft SQL Server.

ANALYTICAL SKILLS

Natural Language Processing: Deep Structured Semantic Model (DSSM), N-gram Models, Topic Model (LDA, LSI)

Optimization: Differential Evolution(DE), MaxWalkSat, Simulated Annealing

Qualitative Analysis: Grounded theory, Survey analysis and design

Regression: l_1 and l_2 -penalized Logistic Regression, Multiple Linear Regression, Random Logistic Regression, Simple Linear Regression, Simple Logistic Regression

Sampling: Oversampling, Synthetic Minority Over-sampling Technique(SMOTE), Undersampling

Statistics: ANOVA, Association Rule Mining, Chi-square Test, Correlation Analysis, Effect Size, Non-parametric hypothesis tests

Supervised Learning: Artificial Neural Network, Decision Tree, Hidden Markov Model, kNN Classifier, Maximum Likelihood Classifier, Naive Bayes Classifier, Random Forest, Support Vector Machine

Unsupervised Learning: DBScan, Hierarchical Clustering, K-Means Clustering

LANGUAGES AND TOOLS

Programming Languages: Bash, C, C#, CSS, HTML, Java, PHP, Python, R, SQL

Data Analysis Tools: Apache Spark, Excel, Matlab, Natural Language Toolkit (NLTK), NVivo, R Studio, SAS, SciKit

Database Tools: Microsoft SQL Server (v. 2005, 2008), MySQL (v. 5.0, 5.5), PostgreSQL, SQLite

DevOps Tools: Amazon Web Services (EC2 Services, Code Deploy), Ansible, Cumulus, Git, Jenkins, JUnit, OpenShift, Vagrant

Development Kits: Android SDK, Eclipse Plugin Development Kit (PDK), Wordpress

IDEs: Anaconda (v. 2.3), Eclipse (v. 3.5, 4.4, 4.5), Microsoft Visual Studio (v. 2005, 2008, 2013)

Security Tools: Findbugs, Fortify, IBM BlueMix Static Analyzer, Microsoft Threat Modeling Tool (MSTMT), Prospector

VOLUNTARY EXPERIENCE

- **Team Leader for NCSU Team at IT Architecture Competition:**

I led the NCSU team in the Student Showdown competition arranged by the Raleigh Chapter of International Association for Software Architects (IASA) (<http://members.iasaglobal.org/news/281134/Iasa-IT-Architect-Competition.htm>).

- **External Reviewer:**

I reviewed multiple articles that were submitted in the Research track and the Software Engineering Industry Practitioner's (SEIP) track in the International Conference of Software Engineering (ICSE), 2015. I am also a member of the Science of Security (SoS) Lablet publication review team, and have voluntarily reviewed 44 security-related publications.

MAJOR RESEARCH PROJECTS

- **How the Crowd is Shaping the Domain of Startup Knowledge?:**

In this project I have investigated how *startup.stackexchange.com*, a question and answer website is helping people who are enthusiastic about startups. I summarized the discussion issues using topic modeling, and applied multiple statistical analysis techniques such as non-parametric statistical tests, and effect size.

- **Mining Discussion Topics related to Infrastructure as Code (IaC) from Q and A Websites:**

Infrastructure as Code (IaC) tools are integral to DevOps. As a relatively new topic, IaC programmers can face issues with technologies, and identifying these issues can help in identifying the knowledge base, as well as improve the tools themselves. In this research project I investigate the topics that IaC programmers are facing from five question and answer websites. I use topic modeling and qualitative analysis to identify these topics. For topic modeling I use LDA, and perplexity to identify the optimal number of topics used in case of topic modeling.

- **What Factors Influence the Usage of Modern Release Engineering Tools?:**

Modern release engineering is a big shift from traditional software engineering with respect to development and deployment practices. In this research project I investigate the factors that influence the usage of modern release engineering software tools such as Ansible, Git, Maven, and Puppet. As part of conducting this project I am collecting survey responses, and analyzing those using regression techniques. The ultimate goal of this project is to systematically find and quantify the factors that affect the usage of modern release engineering tools. I am using logistic regression and association rule mining to identify the factors that significantly influence usage of modern release engineering tools.

- **Code Metrics as Predictors of Android Application Risk:**

Prior research has provided empirical evidence on how Android applications can expose security and privacy issues of Android users. In this research project I aim to investigate if code metrics such as number of functions, cyclomatic complexity can be used to predict multiple levels of risk for Android applications. In this project I have used multiple supervised and unsupervised machine learning techniques such as decision tree, gaussian naive bayes classifier, hierarchical clustering, k-means clustering, knn classifier, random forest, SMOTE, and support vector machine.

- **Investigating the Effects of Context Switching on Programmer Productivity:**

In this project I have analyzed a dataset generated by Codealike, a plugin that tracks programmer activities from popular IDEs such as Visual Studio, and Eclipse, and reports developer activity accordingly. In this research project I am investigating to categorize 84, 030 developer programming sessions that are spread across 15, 178 days. Another goal of this research project is to investigate the effects of context and task switching on programmer productivity measured in terms of programmer actions such as code, debug, and build.

- **Perception and Adoption of Software Security in DevOps Organizations:**

The goal of this ongoing research project is to identify the software engineering practices used for software security in IT organizations who have adopted DevOps. We have studied 350 Internet artifacts to gain background knowledge about security aspects of DevOps. Using this background knowledge we would like to identify the notion of software security among different IT organizations who have adopted DevOps, and what software practices they are using.

- **Supporting Enterprise-Wide Software Reuse Using Semantic Similarity of Software Projects:**

In this ongoing project, I along with my colleagues at ABB Corporate research are investigating how semantic similarity amongst software projects can be quantified, and used to perform software reusability. To detect software similarity, our tool called *Simila*, converts software applications into natural language tokens. These natural language tokens are used as input to *semantic comparator*, to compare the natural language tokens of one project to another. As next steps, first we are planning to detect software similarity amongst open source project repositories, and then amongst enterprise software repositories.

- **Investigating Continuous Deployment Practices Used in Software Development:**

The goal of this research project was to aid software practitioners in implementing continuous deployment through a systematic analysis of software practices that are used by software companies. I studied the continuous deployment practices of 19 software companies by performing a qualitative analysis of Internet artifacts and by conducting follow-up inquiries. In total, I found 11 software practices that are used by 19 software companies. I also found that in terms of use, eight of the 11 software practices are common across 14 software companies URL: <http://www.realsearchgroup.org/realsearch/agile-software-development/>.

- **Diagnosing Configuration Induced Software Performance Interference:** In this project I investigated how tuning of one software configuration setting affects the performance of another application running in a Linux system. I developed a novel framework that will monitor different system and application performance metrics to identify interference of application performance. The framework first identifies interference of application performance between two applications due to a certain configuration parameter of one application. Next it reports possible causes of performance interference in terms of system calls, hardware events, CPU, memory, and disk consumption etc. that can be helpful for a system administrator.

- **SettingRanker: Identifying Android Application Configuration Settings Responsible for Increased Power Consumption:**

In this project I investigated the effects of configuration settings of different Android applications on Android device power consumption. The research effort also resulted in a tool called SettingRanker, that provides a relative ranking of settings for an application; this ranking gives a prediction stating which setting is more likely to increase power consumption, when that particular configuration setting is turned on or assigned a certain value. The tool uses system resource consumption information such as CPU, memory, network, screen brightness etc. as input.

- **Leaveraging Physiological Measures to Predict Task Quality:** In this project I investigated the possibilities and challenges of predicting task quality for different computational tasks using different physiological measures such as heart rate, galvanic skin response, and body temperature. From this research study I concluded that variation in physiological measures significantly affect task quality which can be leveraged to predict task quality using a linear regression model.

- **Energy-Efficient Multiple Targets Tracking Using Target Kinematics in Wireless Sensor Networks:** In this project, I along with my colleagues, proposed, and implemented a distributed tracking method for tracking multiple targets considering targets' kinematics. We incorporated sensor network properties which results into a novel and service priority based dynamic tracking framework. We simulated our method by a sensor network simulator OMNeT++ and empirical results state that our proposed methodology outperforms traditional tracking algorithms.

MAJOR PROFESSIONAL PROJECTS

- **Integration of In-house Applications and Monitoring in OpenShift:**

This project focuses on integrating monitoring alerts so that OpenShift hosts can be monitored for troubleshooting and debugging. The project also included integration of *Redhat Insights* into the Openshift architecture. I implemented the project using Ansible, Python and Puppet scripts.

- **SIMILA: Detecting Similar Software Applications in ABB:** I developed a software framework that detects similarity amongst software applications by converting software artifacts into natural language

tokens. I implemented the project using SrcML.NET, Swum.NET, and Python Natural Language Toolkit (NLTK). To facilitate performance gain and scalability I used Apache Spark with Python.

- **Multi Modal Biometric SDK:** I developed a software framework that provides multi-functional biometric utilities such as capturing, quality checking, auto rotation, cropping, etc. of biometric images like face, finger, and iris. I implemented this project using the Megamatcher 3.1 SDK tool.
- **Central Procurement Management Information System (PROMIS):** I was actively in development, and testing of this software package which is a information management system developed for the Planning Ministry of the Government of People's Republic of Bangladesh. For implementation I used C#, and Microsoft SQLServer 2005.

MAJOR COURSE PROJECTS

- **Optimizing Integrated Project Model Defect Flow Chains for Software Development Teams:**
The goal of this project is to help software engineering practitioner to analyze the Integrated Project Model Defect Flow Chain proposed by Abdel-Hamid and Madnick, by implementing the model, and optimizing the model using a standard optimizer. In this project I implemented a standard software model that takes development effort into account and calculates the amount of development errors with certain assumptions, and considering a subset of the full development resource inputs. To optimize the development resources needed to reduce development errors we use differential algorithm (DE). URL: <https://github.com/akondrahman/59115ASE/tree/master/project>.
- **Automatic Deployment of Applications on Amazon EC2 Using DevOps Practices:**
The goal of this project was to automatically deploy Java-based web applications using two DevOps practices namely, *blue green deployment*, and *chaos monkey*. In this project I implemented the concept of blue-green deployment that re-routes traffic based on monitoring a certain application. I also implemented a miniature version of *chaos monkey* a practice that Netflix uses for reliability testing. I used Amazon EC2 service, Amazon Code Deploy, Java Melody, and Vagrant to implement this project. URL: <https://github.com/akondrahman/Miscellaneous/tree/master/DevOps>.
- **University Housing Management System:**
In this project I along with my colleagues developed a university housing management system in MySQL and PHP. The developed management system provided several features such as renting and leasing on-campus and off-campus housing, submitting and acquiring parking permits, and submitting and reviewing housing complaints. This management system was designed for different entities of the university such as students, teachers, guests, university staff, and parents. URL: <https://github.com/akondrahman/DBMS>.
- **Decaf Compiler:** The goal of this project was to implement a compiler for *Decaf*, a subset of the Java programming language. Me and my partner used Java, JavaCC, and Jasmin to compile and run 120 Decaf programs, to implement this project.
- **Finding the Optimal Comfort Temperature of Human using Bio Sensors:**
This goal of this project was to introduce a novel technique to control different thermal systems. In this project I proposed and implemented a “user-oriented” methodology that leveraged physiological measures and activities of human. The final output of this project was a functional Android application integrated with a wearable sensor called “Bio Harness Kit” which provides different physiological measures of human.
- **Knot Applications in Mobile Applications:** I along with my colleagues developed an Android application that can render different complex knots and structures. The developed Android application supported nine knot-like structures. The developed Android applications also had multi-touch interactions to support zooming and presets. We developed this application in Android 4.2 - 4.2.2 (API Level 17).