

## Personal Statement

Md Atiqur Rahman  
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In 2020, when the COVID-19 outbreak was at its peak, I along with some of my university peers came up with the idea of a relief activities coordination platform to assist numerous voluntary organizations in providing essential aid nationwide. Despite our dedicated efforts to launch the platform named [Traan-Chitro](#), we encountered minimal interest from these organizations due to their concerns about data security and hesitance to adopt a new system. I was quite disheartened after this setback, but I never stopped thinking about why we failed. After some time, it became evident to me that our failure was not due to a lack of project potential, but rather stemmed from the oversight of conducting adequate research before initiating the idea. We overlooked assessing the targeted organizations' needs, their receptiveness to new systems, and their willingness to share data. That was the time when I learnt the critical importance of research, not just in understanding the technical aspects of software engineering and privacy, but also in acknowledging the pivotal role of human factors.

During my time at [BUET](#), I developed a keen interest in software development and security. Engaging in challenging academic projects like creating '[E-luxurious](#)'—a property rental platform like Airbnb—and designing a full-scale [DNS flood attack](#) with a corresponding defense mechanism heightened my skills. I also ventured into multiple outsourced projects to broaden my experience in software development practices. Later, I started participating in CTF competitions, where I learnt about various security tools. I especially loved solving reverse engineering problems and I found it amazing how much information can be recovered through this process. I came to know about this tool [Ghidra](#), which is broadly used for software reverse engineering. I was fascinated by its decompilation capabilities. After graduation, I became a software engineer at [IQVIA](#), specializing in C#.NET backend development. In this role, I extensively worked with various DBMS and gained proficiency in writing and analyzing unit tests and BDD tests in Gherkin language. I also focused on improving program analysis techniques to identify and resolve security vulnerabilities in developer-written code, ensuring compliance. These experiences allowed me to closely observe prevailing issues in the software industry, thus motivating me more to pursue a research career in which I can continue to delve further into various facets of software development. My ambition is to excel as a researcher specializing in **Security, Software Engineering, and AI**.

My journey into formal research began with my undergraduate thesis in computational criminology, where I developed a decision-aid system named '[Cri-Astrologer](#)'. Its main purpose was to assist in the conduct of police investigations by predicting criminal demographic profiles using crime evidence data and victim demographics. With the guidance of my supervisor [Dr. A. B. M. Alim Al Islam](#), I proposed a deep factorization machine based DNN architecture which outperformed existing machine learning and deep learning algorithms in predicting criminal demographics. It was published as a conference paper in **ACM NsysS'22**. At IQVIA, I have led research and development efforts to enhance database query performance, reduce query counts, and explore cost-efficient solutions. Currently, I am actively engaged in an R&D project at IQVIA aimed at revolutionizing user interactions with data visualization. The aim of this project is to simplify complex dashboard configurations by integrating large language models (LLMs) into the user interface. This approach will allow users to ask natural language queries and the LLM provides insights to automatically generated charts, delivering an exceptional user

experience. Throughout this project, I have explored various LLMs including GPT, Llama and Mistral, delving into prompt engineering and fine tuning these models. Working with LLMs in this project opened a new door of research interest for me: **Leveraging LLMs in solving software and security related problems.**

In pursuing my research interests encompassing **Security, Software Engineering**, and the **Application of LLMs**, I want to combine the strengths of each field to enhance one another. In my doctoral research, I aim to conduct an extensive investigation into software stack vulnerabilities, particularly examining the multifaceted applications of LLMs within the domain of software security research. This includes investigating and identifying ways to utilize LLMs in detecting and mitigating software stack vulnerabilities. Additionally, I am keen on enhancing existing security tools, delving into different static and dynamic analysis methods to develop practical solutions that can benefit the wider community.

I consider North Carolina State University a suitable place to pursue my PhD, as there are several active researchers with whom I believe I will be able to contribute. Regarding that, I am particularly interested in collaborating with **Dr. Alexandros Kapravelos**, whose forthcoming work titled '**UntrustIDE: Exploiting Weaknesses in VS Code Extensions**' has piqued my interest. I am fully aware how essential VS Code IDE is for the community and how developers install and use extensions available there without much thought. Recognizing the often-unquestioned use of its extensions, addressing the trustworthiness of these extensions is an intriguing endeavor. If given the opportunity, I aspire to develop an extension aimed at safeguarding the IDE against potential threats posed by other malicious extensions. I am also interested in **Dr. William Enck's** work on '**TaintDroid**', particularly its dynamic taint analysis approach aimed at the Android platform. As most smartphone applications are closed-source, static source code analysis becomes unfeasible, impeding the ability to track control flow. Given the opportunity, I aim to explore a reverse engineering approach to extract the source code and conduct static analysis. This method would enable us to comprehensively track control flow within these closed-source applications. Furthermore, I am interested in the projects '**Software Vulnerability Detection**' and '**Risk-based Secret Detection**' led by **Dr. Laurie Williams**. With my background as a software engineer and my expertise, I am confident in my ability to make meaningful contributions to these projects. As a future direction, I want to explore fuzzing to detect software stack vulnerabilities. I am enthusiastic about exploring the performance of LLMs if utilized as a fuzzer. I believe using LLMs to generate fuzzing inputs could potentially resolve several limitations inherent in existing fuzzers. Additionally, I am open and enthusiastic about collaborating with others who share similar research interests.

My future goal is to become an accomplished academic, emphasizing both research and teaching while maintaining active connections with the industry. To achieve these goals, I am willing to explore new domains and embrace challenges that arise during my graduate studies. Please feel free to visit my portfolio at <https://atiqur-rahman-0041.github.io> for a detailed overview of my research, publications, and work experiences.

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