Personal Statement

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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 **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 the University of Virginia a suitable place to pursue my PhD, as there are several active researchers with whom I believe I will be able to contribute. I am particularly enthusiastic about collaborating with **Dr. Yixin Sun**, given her focus on network security and privacy, notably in TLS/PKI, DNS, and attack detection. Her recent work titled '**Behind the Scenes: Uncovering TLS and Server Certificate Practice of IoT Device Vendors in the Wild**' intrigued me, particularly addressing server-side certificate management for servers interacting with IoT devices. If provided the opportunity, I am eager to investigate TLS behaviors exhibited by IoT devices to uncover potential security vulnerabilities. Furthermore, I am interested in the works of **Dr. Matthew Dwyer** and **Dr. Sebastian Elbaum** because of their interest in software testing. Their recent work "**Neural-Based Test Oracle Generation: A Large-Scale Evaluation and Lessons Learned**" piqued my interest. As a future direction, I want to explore automated test generation and the potential of LLMs in automated test oracle generation. I am also interested in the research works of **Dr. David Evans** and **Dr. Wajih Ul Hassan** due to their emphasis on web and system security. Leveraging my background expertise, I aspire to develop tools capable of extensive coverage in these domains. Additionally, I am also open and would be happy to work with others and explore the areas with similar focus.

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.