

Statement of Purpose

Can you deny my claim that the most important tech fields that will dominate our future are Cybersecurity, Nano Technology, Artificial Intelligence, and Quantum Mechanics? While working as an Assistant Manager (Technical) at Bangladesh Telecommunications Company Limited, I observed that, with the invention of cutting-edge technologies (Cyber-Physical Systems, Cloud Services, Block Chains, Artificial Intelligence, etc.), the risk of cyber-crime reached an apex. Therefore, I aimed to study the existing methodologies for information security and cyber-physical system security to contribute to developing new frameworks, and ensuring the safety and security of global cyberspace, industrial control systems, autonomous vehicle technology, etc. Currently, I am a master's student at the South Dakota School of Mines and Technology (SDSM&T) in Computer Science and Engineering, set to graduate by May 2024. With my educational and professional background, the Ph.D. program in Computer Science at the University of Colorado Boulder (CU Boulder) will help me to gain expertise and proficiency in my desired disciplines.

I graduated with a degree in Electrical and Electronic Engineering from Chittagong University of Engineering and Technology (CUET) in 2013. During my final year, I worked on a low-cost embedded car security system project and published a conference paper titled 'Assisted Vehicle Driving Embedded with an Autonomous Security System.' After graduation, I accumulated over eight years of experience in the telecommunications industry, working in various organizations and roles. This experience allowed me to acquire hands-on expertise with a wide range of network elements, design and implement an optical distribution network, and develop a strong understanding of optical transport networking, Flex Ethernet, and more. Additionally, the successful completion of various training programs and workshops, including 'VMware vSphere,' 'GPON Technology,' 'Cloud Identity,' and others, has made me proficient in using a diverse set of tools and technologies, including Active Directory Domain Services, Linux OS, Nmap, SQL, Git, Metasploitable Project, Nessus Tenable, Python, and other relevant tools.

As a cybersecurity enthusiast, I cultivated a daily habit of staying informed about security-related news articles. Participation in a training program on "Cybersecurity and Risk Management," significantly broadened my understanding of cybersecurity, and inspired me to pursue a graduate degree in this discipline. Now, as a Graduate Research Assistant at SDSM&T, I developed a machine learning model based on simulated data, that achieved an impressive accuracy of 93% in detecting anomalous data. Additionally, I worked on a review paper based on 'Cyber-Physical Attacks on Autonomous Vehicles' and am now striving towards its publication at a prominent conference. This work encompassed learning exploitable physical properties of cyber-physical systems, various types of physics-based attacks, and models for detecting and recovering from physics-based attacks. Currently, I am collaborating with a project at the University of Notre Dame to detect optimal hidden attacks in industrial control systems (ICS).

Professor Majid Zamani's research domain includes the control of cyber-physical systems, hybrid systems, networked control systems, incremental properties of nonlinear control systems, and more. He encouraged me to apply for the Ph.D. program in Computer Science. His peer-reviewed paper, titled 'A Framework for Output-Feedback Symbolic Control,' greatly piqued my interest, where his team developed an output-feedback refinement relation

(OFRR). The OFFR framework can fulfill complex requirements for symbolic controllers in real-world applications, whereas existing techniques often assume full-state information of the cyber-physical systems. Professors Dirk Grunwald and Eric Wustrow conduct research in Computer and Cyberphysical Security, Datacenter and Wide-Area Networking, Datacenter and Wide-Area Networking, privacy and data set analysis, and network security domains. Professor Dirk Grunwald's peer-reviewed paper titled 'Exploiting Client Inference in Multipath TCP over Multiple Cellular Networks' greatly captured my attention. In this paper, his team designed, implemented and tested the 'Client-based Multipath TCP (cMPTCP) Framework,' which can leverage multipath capabilities over multiple cellular networks.

My passion spins around studying the development of privacy and security of cyber-physical systems, computer security framework development, developing security frameworks for ICS with low computational resources, and understanding the economics of information security. With exposure to the CU Boulder, during my Ph.D. I will gain the best available knowledge, learn, and network to shape innovative ideas into industry solutions, all with insight and input from the brightest minds in the field. I genuinely believe that the Ph.D. program in Computer Science at CU Boulder will guide me to reach the apex of my capacity.

After completing my PhD in Computer Science, I plan to establish a research facility that will collaborate with industries to build secure ICS. By integrating security aspects with machine learning models for predicting future control inputs in a closed-loop feedback control system, I aim to advance economically feasible, safe, and secure ICS solutions. Given CU Boulder's strong track record of industrial collaboration, obtaining easy access to industrial products will facilitate bridging the gap between theory and real-life challenges. Therefore, I have concluded that the Ph.D. program at CU Boulder would align perfectly with my interests.

The Ph.D. degree in Computer Science will serve as my pathway to addressing the humanitarian, social, and technological challenges of the 21st century through my contributions to security in areas such as network, application, and cyber-physical domains. Therefore, I eagerly anticipate joining the prestigious University of Colorado Boulder for my Ph.D. degree in Computer Science.

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