I am interested in pursuing a doctorate degree in computer science at <xyzuniversity>, with an interest in distributed systems and security. Namely, I am interested in studying the Internet of Things (IoT), and the security implications of connecting traditionally non-smart devices to internet based services. My undergraduate research experiences focus on analyzing the cyberphysical security of modern IoT devices in both home automation and industrial settings. This new frontier of distributed technologies adds a number of new, interesting security concerns and questions - I intend to expound on these questions and other systems and security concerns in my doctorate study at <xyzuniversity>.

My initial interest in IoT and its security was sparked by an independent research project I conducted, where I built an internet powered garage door and analyzed its security. Perhaps unsurprisingly, I found the system I built to be incredibly insecure. An adversary with knowledge of the web server’s IP address could wholly compromise not only the garage door system, but also operate all other interconnected devices which communicate with the IoT server. What I did find surprising is that some “out of the box” IoT devices have very similar implementations to my homemade system, especially ones of lesser known brands, implying similar vulnerabilities might be exploited on these systems. Clearly, the novelty of these new systems is outweighing the security ramifications of these products - this is an issue I hope to investigate further in my doctoral study.

My undergraduate research experience lies mainly with Professor Z. Morley Mao, in the realm of cyberphysical security. This research studies a mechanical engineering automation testbed, and the security implications of connecting this automation testbed to internet based services. We are interested in observing the effects of operating the system as a whole on a network based industrial protocol, EtherNet/IP, and if there are attack vectors that the system as a whole is susceptible to. Though this is an ongoing project, we have made progress in terms of observing some network patterns and creating reasonable attack vectors. We are evaluating the system from three major angles - a remote attack over the network, a local network attack, or a local sensor attack. By sniffing network traffic, we were able to determine what messages are sent over the network to signal that the system requires immediate shut down. Our first attack is to spoof this message by broadcasting it over the network. My main contribution to this project involves designing the attack vectors we choose to proceed with, and carrying out the implementation of those attacks.

What I find interesting about these systems is that this trend of “connectedness” is not simply isolated to internet powered garage doors and smart thermostats. Instead, almost every field is interested in leveraging the power of the internet and cloud services to improve its efficacy. One observation I have about these new systems is that they all appear to be implementing their own “standards” for communication between devices and between the cloud, and because of this, each implementation is susceptible to independent vulnerabilities. One solution I believe will mitigate some of the more trivial vulnerabilities is the introduction of an IoT networking protocol with a focus on security - one that every device must adhere to if it wishes to be commercially available. While there are many companies and research groups working on this (for example, Qualcomm pushing for “AllJoyn”, while Google is pushing “Thread”), it is currently unclear which protocol is in fact “better” from a security perspective. I believe that a protocol with a focus on security and privacy of information in this new age of IoT devices is an instrumental part of the solution to this problem.

Pursuing a doctoral degree is the best option for me to explore both my personal and technical interests. Doing research allows me to reconcile both the technical knowledge and problem solving skills gained from coursework and apply these skills to solving real world problems. I have always been excited to be on the cutting edge of technology, and working in a research-oriented field provides me with that opportunity. My experiences with research have not only helped solidify my technical knowledge and problem-solving skills, but have also instilled an appreciation and passion for teaching. I am currently an undergraduate teaching assistant for EECS 388, the introductory computer security course at the University of Michigan, and have enjoyed it immensely, and I feel pursuing a Ph.D will allow me to explore that passion more deeply.

<insert college specific paragraph>

I feel my undergraduate experiences have prepared me to do well in graduate school at <xyzuniversity>. I am passionate about distributed technologies and security, excited about the opportunity to delve deeply into research, and looking forward to becoming a better teacher. My learning experiences from both my independent research and my work under my research advisor have solidified my interest in pursuing a Ph.D, and ultimately, have led me to pursue a career in research. Through pursuing my graduate studies at <xyzuniversity>, I am dedicated to becoming the best researcher and teacher that I can be.

Awesome first draft! I really enjoyed reading this and learning more about what you are seeking to learn and do through pursuing your Ph.D. I think your writing style is professional and clear. It is evident you know what you want. It flows pretty nicely as well. I’d fix the little things, and then make sure that there is enough analysis for the main reasons you want to pursue this degree. At times the analysis is thin. End can be a bit stronger. Let’s chat through the whole thing!