

Available Position: Undergraduate Research Student

Topic: Vehicular Networks

Research overview:

In a new effort, we are studying secure communication infrastructures for vehicular networks. A critical feature of emergent vehicles is the ability to communicate with other vehicles (V2V), with the infrastructure (V2I), and with devices connected to the Internet (V2IoT). Vehicular communications, collectively called V2X, constitute a highly vulnerable attack target and can be compromised by simply sending misleading or malformed communications. This effort will explore V2X vulnerabilities and their impact on connected autonomous vehicles, and current defenses. We propose to manage these networks using software-defined network control. SDN can provide management of routing tables, protocols, and algorithms in the path selection for increased security.

What are Software-Defined Networks?

Software-Defined Networking (SDN) is a networking technique that communicates with underlying hardware infrastructure and directs traffic on a network using software-based controllers or application programming interfaces (APIs). Software-defined networking (SDN) is a newer network management architecture that separates the network control plane and data plane forwarding activities. Not only does the network controller keep track of data flow, but it also sets forwarding rules. Our research focuses on developing these SDN topologies using an open-source emulation tool, Mininet, in a virtual machine (VM) Linux environment. Within our VMs, we are able to launch cyber-attacks against these networks such as Denial-of-Service (DoS), Botnet, Man-in-the-Middle (MiTM), False Data Injection (FDIA), etc. using tools such as Iperf, Hping3, dSniff, and Ettercap. Using the data collected from these attacks on our SDN frameworks, we are able to produce datasets for machine learning models that predict and classify attack types. With that information, we can levy the central control logic of SDN to mitigate attack instances quickly and efficiently.

Undergraduate Project

We are looking for an undergraduate student with computer communications knowledge, some coding experience, preferably with python. The project would consist of producing python scripts that use Mininet's APIs to generate custom SDN network topologies for testing different satellite, drone, or multi-tier scenarios. In this position, the student will learn about Software Defined Networking and data generation for machine learning models. They can also further their computer networks and programming experience. We are looking for someone interested in SDN, vehicular networks and wireless standards. There is a potential opportunity to continue participating in our work beyond the initial scope of this project.

Minimum Qualifications

- Some experience in Python, experience in C/C++
- Basic understanding of programming and network devices
- Desire to learn more about Software-Defined Networking and vehicular networks