

Trust and Security of Embedded Smart Devices in Advanced Logistics Systems

Technical Report
Presented to the Faculty of the
School of Engineering and Applied Science
University of Virginia

By


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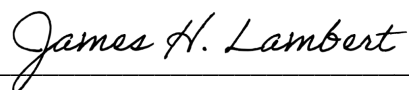
May 3, 2021

Technical Project Team Members

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Signed:  Date 05/03/2021

Approved:  Date May 3, 2021

James H. Lambert, Department of Engineering Systems and Environment

The Center for Hardware and Embedded Systems Security and Trust (CHEST) is an Industry-University Cooperative Research Center (IUCRC) funded by the National Science Foundation (NSF). CHEST strives to address the research challenges that industry and government partners face concerning trust, security, and assurance for electronic hardware and embedded systems through the coordination of university-based research (*CHEST*, 2020). The following projects are part of the efforts to meet the needs of the industry and government sponsors under CHEST. The respective industry sponsors are SPA, Fermata and CCALS, each with their own research and Excel workbooks that apply scenario analysis to the respective topic. The approach to the capstone will be a combination of established resources and publications combined with new ideas from the research group headed by the capstone advisor and Systems Engineering Professor, James Lambert. Contributions are also made by Dr. Zachary A. Collier, Thomas L. Polmateer, Mark C. Manasco, Negin Moghadasi, and Kelsey A. Hollenback.

SPA- Hypersonic Glide Bodies

One of the industry sponsors, Systems Planning and Analysis Inc. (SPA), is a defense contracting company that provides acquisition support for the interested parties of the Department of Defense (DOD) concerning the DOD's conventional prompt global strike program (CPGS). As the United States is left further behind in the research and development of hypersonic technologies compared to other countries, such as China and Russia, urgency and support for the CPGS program has been growing. The US needs to catch up to countries, like China and Russia, in the research and development phase so we can have a safe and able technology ready for deployment. To do this, the system needs to have protections in its production and supply chain, as well as during its system life.

The capstone team will analyze literature that pertains to the subject of hypersonic technology and the challenges related to the system. The team will then produce a scenario analysis of potential conditions that can affect the success of the system, which is the deployment of the hypersonic glide bodies.

With the focus on the deployment of a fully functioning hypersonic glide body, the performance of the HGB is evaluated through a variety of metrics describing it from the moment of deployment to the moment of impact. With the scenario analysis approach, success criteria are not the only aspect to be considered but also initiatives, emergent conditions, and their respective relationships. As this project is partially sponsored by SPA, the team will provide the scenario analysis to guide SPA in understanding which scenarios to focus on and plan for in the deployment of the hypersonic glide bodies.

Fermata- Bidirectional Charging Networks

Fermata is the national leader in proven Vehicle to Building (V2B) and Vehicle to Grid (V2G) systems. As electric vehicles become more popular, there is a growing need for forward thinking about how the power grid will handle the increased stress of not only powering all the buildings and infrastructures in an area but also the need for electricity in new electric vehicles. More specifically, the project's main goals are to find potential risks to the research and development of a bidirectional charger network and to assess the resilience of a power grid that supports electric vehicle charging. Bidirectional charging allows electric vehicle owners to get paid to give power back to the grid during times of grid stress.

CCALS- Advanced Logistic Systems

CCALS deals with the trust and security in advanced logistic systems as a whole. The rise of interconnected devices has led to an equal growth in a systems' security issues such as

privacy, authentication, and secure storage of data. CCALS aims to provide a collaborative environment between industry, government, and universities designed to deliver transformational improvements to logistics systems with the main goal of accelerating the transition of technologies from fundamental developments through proof of concept and into commercialization of these technologies.

The scope of our work with CCALS ranges from anything having to do with the risk management of technological systems across the nation. In the consideration of success criteria and initiatives, there are emergent conditions that can impact the ability to meet the success criteria and potential scenarios can give rise to the emergent conditions that would impact the ability to meet the success criteria, so it is important to recognize them