# CS486C – Senior Capstone Design in Computer Science

## Project Description

| **Project Title:** Site Locking and Alerting Mechanism for Doors (SLAM-Doors) | |
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| **Sponsor Information:**<br><br>GENERAL DYNAMICS<br>Mission Systems | Dr. Glen Abousleman, Senior Distinguished Member of the Technical Staff<br>Tactical Algorithms Laboratory<br>General Dynamics Mission Systems<br>Glen.Abousleman@gd-ms.com<br>480-441-2193<br><br>Alexander Gebhart<br>General Dynamics Mission Systems<br>Alexander.Gebhart@gd-ms.com<br>602-622-6421 |

**Project Overview:**

General Dynamics Mission Systems has physical remote locations across the United States that harbor sensitive and expensive equipment. Managing these sites requires door controllers that can monitor/mitigate intrusion, be unlocked/locked both onsite and remotely. This functionality must be continuous, including during power outages or intermittent and high ping networks. Originally developed to meet the growing demand for secure, centralized access control in corporate offices, government buildings, and industrial facilities, remote door controllers have evolved alongside advancements in IoT and cloud technology. They now play a critical role in smart building management, enabling real-time access logging, intrusion detection and remote credential management. This ensures that only authorized personnel can enter sensitive areas, no matter where administrators are located.

A project to develop a remote door controller system would focus on creating a secure, scalable, and user-friendly solution that allows administrators to manage door access from anywhere. The system would include both hardware and software components: a compact control unit installed at each entry point integrated with electronic locks. A management platform that handles user authentication, access logs, and remote command execution. Communication between the controller and the platform would be encrypted and authenticated using industry-standard protocols like TLS and OAuth 2.0 to ensure data integrity and security.

The project would begin with a requirements analysis phase, identifying key use cases such as shelter access, delivery control, or critical infrastructure protection. From there, hardware prototyping would run in parallel with backend software development, using microcontrollers (e.g., ESP32 or Raspberry Pi) for control logic and IoT communication. A key goal would be to ensure compatibility with *existing physical security infrastructure*. Testing phases would validate not only functionality and performance but also fail-safe behavior—ensuring the door remains

secure during power or network outages. Ultimately, the system would empower users to grant or revoke access in real time, and receive instant notifications of unauthorized attempts, significantly enhancing both operational flexibility and physical security.

Completing a remote door controller system project would offer students hands-on experience in a broad range of technical and professional skills that are highly valuable in both engineering and tech-focused careers. On the technical side, students would gain knowledge in embedded systems design, working with microcontrollers, sensors, and actuators to build the physical hardware interface. They would also develop skills in IoT communication protocols (e.g., MQTT, HTTP, or WebSockets), network security, including database design, user authentication, and data encryption. Students will also develop an access management dashboard and engage in UI/UX design. Furthermore, they would be challenged to think critically about security, scalability, and reliability, which are crucial when designing systems intended for real-world deployment in secure environments. Overall, the project would provide a comprehensive experience that mimics the challenges faced in industry.

### Knowledge, skills, and expertise required for this project:

Background information required to successfully execute the project includes:

- Programming and software development
- Basic assembly skills
- Some knowledge of microcontrollers, circuits, communications and networking
- U.S. citizenship required

### Equipment Requirements:

The equipment that will be required for this project are a microcontroller and access control hardware. All equipment will be provided by General Dynamics.

### Software and other Deliverables:

Project deliverables are phased through the two-semester sequence and include:

- Door Controller:
    - Requirements
    - Design
    - Assembly and testing
    - Test results and test report
- Software:

- Requirements
- Design
- Programming and testing
- Test results and test report