INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	EPRI	Date Submitted	4/6/2023
Project Title	*Design and Build a Dock House for a SPOT Robot* **(EPRI_SPOT)**	**Planned Starting Semester**	*Fall 2023*

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	2
Computer	1	Systems	

Company and Project Overview:

The Electric Power Research Institute (EPRI) conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally. As an independent, nonprofit organization for the public interest, we focus on electricity generation, delivery, and use in collaboration with the electricity sector, its stakeholders and others to enhance the quality of life by making electric power safe, reliable, affordable, and environmentally responsible.

EPRI has collaborated with the electricity sector and its stakeholders since 1972 and our membership has grown to represent approximately 90% of the electric utility revenue generated in the United States and extends to participation in more than 35 countries. The worldwide membership that supports our work comprises more than 1,000 organizations. While most members are electric utilities, others are businesses, government agencies, regulators and public or private entities engaged in some aspect of the generation, delivery, or use of electricity.

Through their advisory roles in EPRI, its research sectors and programs, EPRI members help inform the development of EPRI's annual research portfolio, identify critical and emerging

electricity industry issues, and support the application and technology transfer of EPRI's research and development.

Robots are becoming increasingly common in a variety of applications, including day and night inspections, as well as security purposes. These robots require a reliable docking station that ensures they are always charged and ready to perform their duties. We are proposing a project to design and build a robot docking house with advanced features to support these various applications.

Figure: EPRI's Spot robot by Boston Dynamics

Project Requirements:

Our robot docking house must have the following features:

- Automatic opening/closing door while the robot is going/coming back from an autonomous inspection mission.
- Durable and Climate controlled to ensure that the robot is protected from extreme weather conditions.
- Easy installation for minimal assembly required.
- Integration of Safety sensors such as to detect the presence of obstacles or other hazards, stopping the door from closing/opening, and cameras to provide security monitoring.
- Integration of a safety switch/key to open the door manually for additional security.
- Lighting to ensure the robot can navigate and perform inspections in low-light conditions.
- Wi-Fi connectivity to provide remote monitoring of the robot's charging status and real-time alerts if there is a power cut/robot not charging etc.

- Should be able to support day and night inspections by having proper lighting conditions for the robot to see fiducials/docking station.
- User interface screen integration to see robot features/parameters like battery capacity, mission status, and starting mission using a touch screen that's enclosed in the box.
- (Optional) Emergency backup power and charged by Solar.

Expected Deliverables/Results:

- The team will be responsible for delivering a functional prototype of the robot dock house that meets the project requirements outlined above.
- The team is expected to provide detailed documentation of the design and construction process, including schematics, CAD models, and programming code.

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

Team with a strong background in robotics, embedded systems, electrical engineering, and mechanical engineering. The team should have experience with the following:

- Designing and prototyping embedded systems.
- Developing sensors and safety features for automated systems.
- Programming microcontrollers/Raspberry Pi/Nvidia Jetson and sensors.
- Building and testing durable, weather-resistant climate-controlled enclosures for electronic systems.
- Integrating Wi-Fi connectivity into embedded systems.