



Company Information

Company Name	<i>EPRI</i>	Date Submitted	<i>11/18/2022</i>
Project Title	Automated Drone-based T&D Asset Inspection and Routing (EPRI_ASSET)	Planned Starting Semester	<i>Fall 2023</i>

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		Electrical	
Computer	4	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.

This project will be related to technology related to solar power

Project Requirements:

In the past six years, Unmanned Aircraft Systems (UAS), more commonly referred to as drones, have reinvented the way utilities perform inspections. Looking to the next six years, it is likely these machines may support an automated inspection workflow. Computer systems built on artificial intelligence (AI) can analyze drone imagery and video. This project aims to advance AI-based, drone operations for T&D inspection by focusing on two tasks:

1. Pole detection, 3D projection into physical space using nadir and oblique monocular imagery/video with drone metadata
Drone metadata:(lat, lon, altitude, heading, payload pitch, payload roll, field of view, focal length)

This task can be performed after the data is collected or in real time 'on the aircraft'



Figure 1 Example object detection based 2D projection.



Figure 2 Yolov5 Pole class, object detection

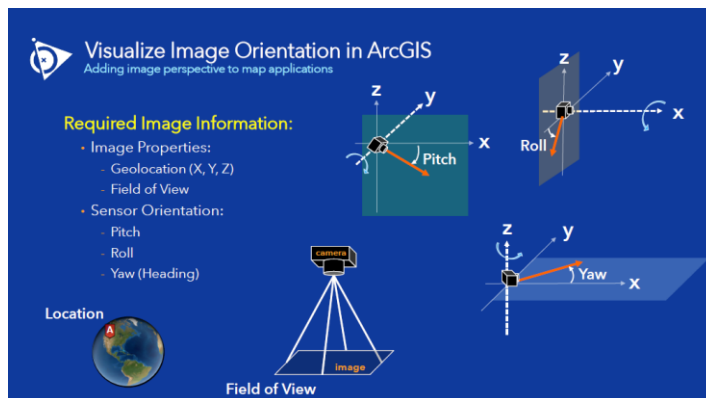


Figure 3. Example drone metadata included in most imagery/video, Source: ESRI

2. Wire detection and path creation/following using monocular RGB imagery/video with drone metadata

Drone metadata: (lat, lon, altitude, heading, payload pitch, payload roll, field of view, focal length)

This task can be performed after the data is collected or in real time 'on the aircraft'

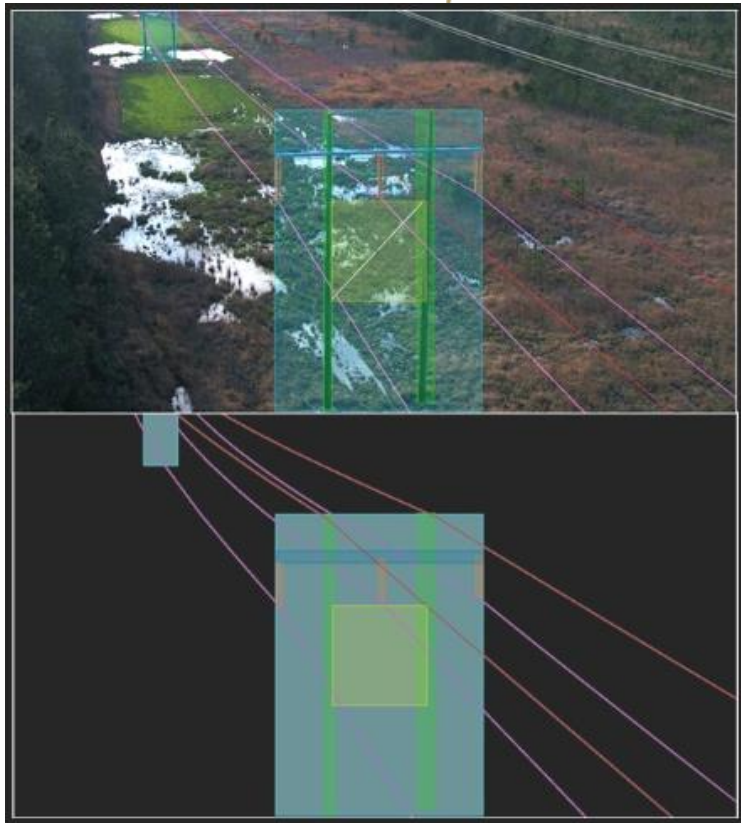


Figure 4 Wire segmentation to use for flight routing

Available datasets:

- <https://www.kaggle.com/competitions/electric-transmission-imagery>
- <https://www.kaggle.com/datasets/dexterlewis/epri-distribution-inspection-imagery/discussion>

Expected Deliverables/Results:

1. The student team will explore the various computer vision and AI techniques relating to image classification, object detection, image segmentation
2. The student team will explore various UAVs in the market available that are capable of computer vision model deployment and navigation.
3. The student team will train the AI model(s) using EPRI's T&D image dataset and test its performance.
4. The best-performing models will be deployed on a UAV (if possible)
5. The student team will also explore methods of estimating the position of assets in real-time from drones and/or in post-processing workflows with drone data.
6. The student team will provide a detailed report or GitHub repo detailing the information below:
 - a. Summary of literature review
 - b. Data acquisition



- c. Reviewed AI techniques
- d. Data analysis approaches
- e. Model development description
- f. Data and model analysis results
- g. List of hurdles and how it was resolved
- h. Future EPRI dataset/research needs
- i. Conclusion

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):

- Interest in image recognition and artificial intelligence.
- Pre or co-requisite: ECGR4161 Introduction to Robotics