Automated Solar Panel Recognition and Defect Detection using Infrared Imaging
AzTE Case #M16-133P

Background
The vast quantity of solar panels in utility-scale solar farms makes detecting defective panels challenging. Solar farms may have upwards of five million solar modules and, to inspect them, maintenance staff must manually examine them, an often unreliable and straining approach. Power output of solar panels decreases when individual cells or modules malfunction due to age, operational damage, or defects in manufacturing. Inspectors can use infrared thermography to detect elevated heat levels such as in the case of malfunctioning solar modules, which emit more heat than normal. Therefore, scientists are now looking to create a simpler, more reliable method of panel evaluation using infrared imaging.

Invention Description
Researchers at ASU have developed an automated method of solar panel recognition and defect detection using infrared imaging. A camera mounted to a moving cart collects infrared video sequences of each solar panel array wherein an image-processing algorithm segments the solar panels from the background, simplifying the defect detection process. Optical flow (the pattern of motion of objects) establishes a frame-to-frame panel association for reference and gives an overall comparison of panels in an array. The frame-to-frame panel association allows for immediate detection of hotspots and cracks that reduce performance. In summary, researchers have developed a reliable, automated solar panel recognition and defect detection system that can operate in real-time and reduce maintenance costs.

Potential Applications
- Automated Detection Systems
- Solar Panel Evaluation and Maintenance
- Building Diagnostics
- Chemical Imaging
- Stereopsis

Benefits and Advantages
- **Automated** – The method mitigates need for manual inspection, resulting in lower maintenance costs and savings in time
- **Reliable** – The method classifies solar panels with a 98% correct panel recognition and count and a 92% correct defect identification
- **Real-Time Operation** – Real-time operation helps quickly detect malfunction, reducing the time between detection and repair and thus, ultimately maximizing power output per unit of time