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DRONE4PV

Project’s execution overview

The Drone4PV project ended at the end of May 2021. It has been in development for 9 months, in which Isotrol and Dronetools have collaborated to develop a new solution for improving the failure detection on photovoltaic (PV) power plants and the automation of inspection processes in using drones.

Figure 1. Equipment for the executions of the first flights

The development of the project began back in September 2020, and, by the end of the year 2020, some initial developments were finished and tested on a real photovoltaic power plant. This initial validation allowed the detection of problems and the re-design of the initial solution to the version that has been obtained by the end of the project.

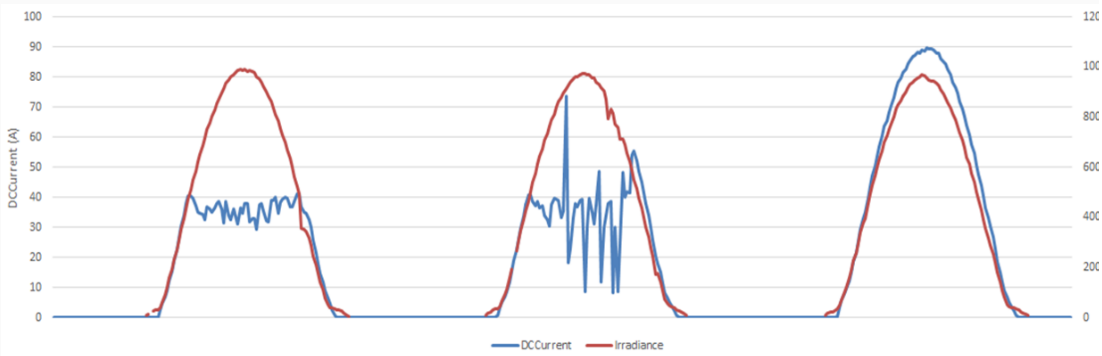

Figure 2. DC power to irradiance

After implementing the necessary improvements and corrections to the drone's hardware and software, and the development of tools and algorithms for the analysis of SCADA data and failure detection in images, a first functional prototype has been developed, successfully meeting with all the requirements initially defined for the project.

Automated process description

The result of the project is an automated system capable of using advanced AI analytic tools for the generation of recommendations for operation and maintenance in large PV power plants. Algorithms for the analysis of the overall performance of PV plants and the detection of problems are capable of identifying strings or groups of PV panels that are behaving below their expected performance. When potentially faulty groups of panels are detected, flight orders can be sent to a drone, using GPS coordinates to identify in which area of photovoltaic plant those panels are located.
This flight order is generated only when the energy losses on the group of panels is high enough to justify the execution of the flight.

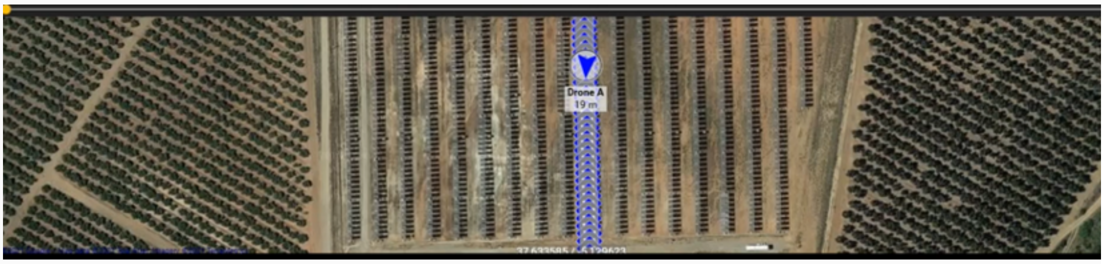

Figure 3. Flight path and points for taking images definition

Once the order has been sent to a drone flight management system, the order is transformed into specific waypoints according to a ser of parameters such as the height of the flight and the dimensions of the panels, a specific route is defined. This supposes the creation of a set of GPS locations from which photographs and thermographic images of the group of panels under study are taken and automatically uploaded to a database for their later analysis.
In the end, this allows **to use the drone and their attached cameras as an additional sensor,** improving the reach of SCADAS and their data acquisition.

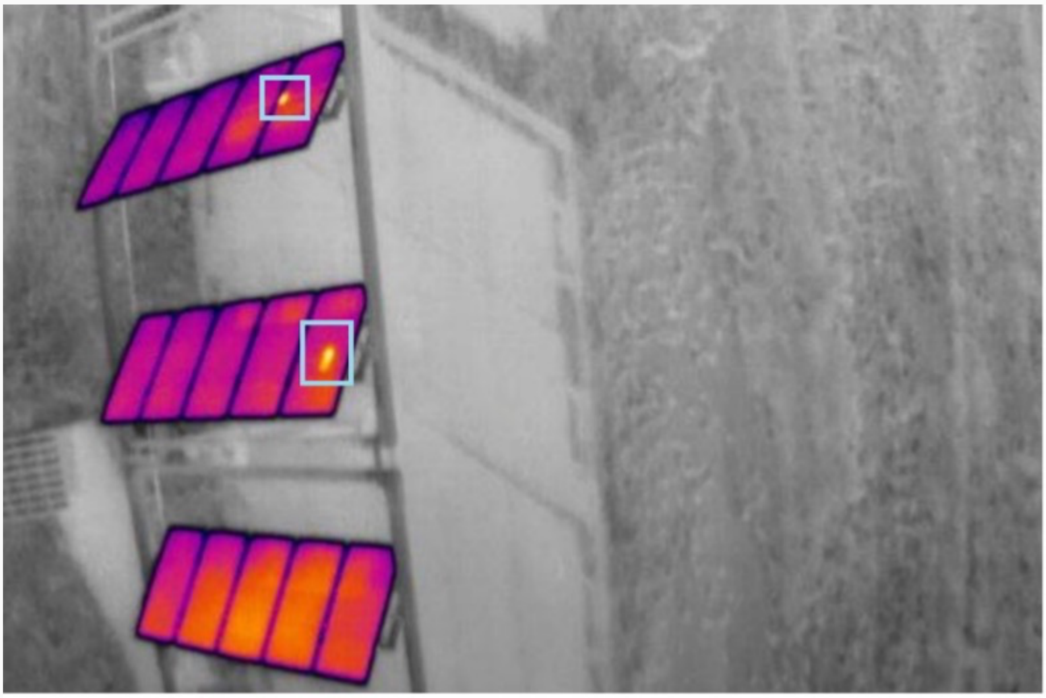

Figure 4. Failure detection (hotspots) on PV modules

At this point, a system based on convolutional neural networks uses said images as inputs to identify which panels are present in the image under study, to segregate them, and to look for failures and problems in each module individually.

Finally, operation and maintenance recommendations are generated using all the information that has been generated in the whole process. A matching of the results of the image analysis with that of the SCADA data takes place, for a final estimation of underperformances and their root cause.

After this, the identified failures are represented on a map, allowing the localization of said issues in the PV power plant, helping maintenance personnel to attend the problems easily.

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