

## ABSTRACT

- The inspection of solar photovoltaic fields is a necessary routine to ensure proper function of solar panels. Research was done by reading various articles addressing solar panel defects and various forms of inspection. Drones were also flown to thoroughly understand the operation and use of drones in terms of photovoltaic inspection. Articles were gathered from online sources during August and September of 2018. Drone flights were taken in November of 2018. Photos included are gathered from the articles read or were taken in November 2018 with a DJI Phantom 4 Pro V2.0 drone at Spruill Farms in Roper, North Carolina.

## INTRODUCTION

- The purpose of this research was to understand the process of inspecting solar photovoltaic fields with drones. The research was also conducted to prove that drones are the most advantageous form of inspection.



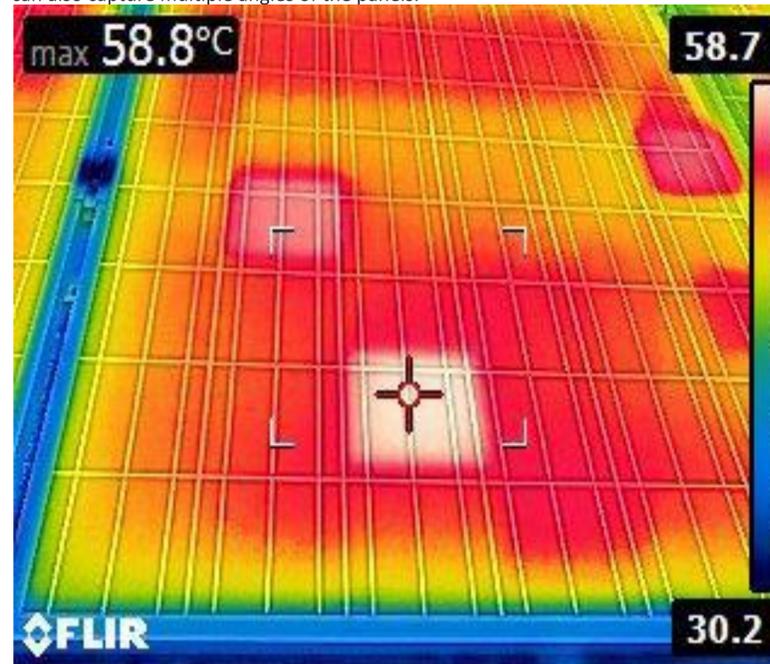
(Aghaei, 2014)

## METHOD

- Five articles were gathered from various online sources. All articles dealt with the inspection of solar photovoltaic fields using drones. Each article was read and summarized. Points made within the article relating directly to the research topic were recorded and combined. The summaries of the articles were then combined into one single research paper discussing the research topic. This paper was used to explore and explain the inspection of solar panels using drones. Drones being the most appropriate form of inspection was also proved with this paper.
- After completion of the research paper, drones were then taken to Spruill Farms and flown. The flight of the drones was done to understand in a hands-on manner how inspection of solar panels with a drone is conducted. Through flight it was understood how the drone is controlled and how photos of the solar panels are taken.

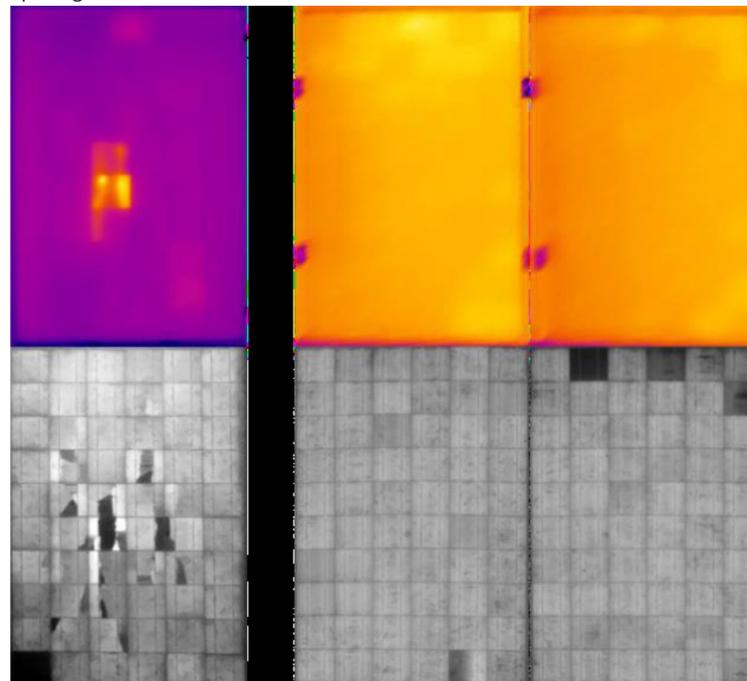
## RESULTS

- Through the research done it was found exactly why drones are the best form of inspection. This is because drones are much quicker at inspecting solar panels due to them being able to fly. With the drones capable of changing in altitude and position they can also capture multiple angles of the panels.



(Leloux and Narvarte, 2015)

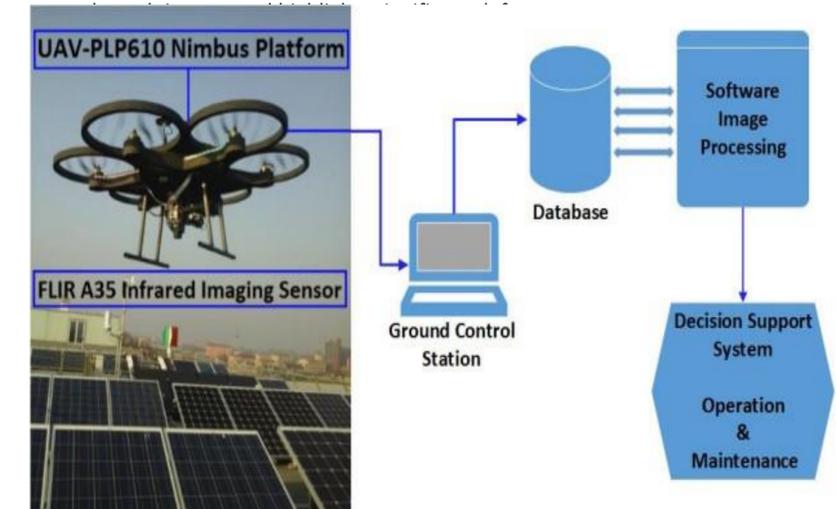
- Various forms of defects were also explored during the research process. These defects include hot spots and micro-cracks. The cameras that best depict these defects were also explored through research. It was found that infrared cameras were best for revealing hot spots, while electroluminescent cameras were best for exposing micro-cracks.



(Koch et al, 2016)

## RESULTS

- The technology responsible for capturing and transporting the images captured by the drones was also explored. The research showed that developments have been made that allow the drone to send the images to a database that automatically



(Aghaei et al, 2015)

## DISCUSSION AND CONCLUSIONS

- Drones are the most precise and efficient method for solar photovoltaic field inspection.
- Infrared cameras best depict hot spots, while electroluminescent cameras best depict micro-cracks.
- Solar photovoltaic fields are continually changing and growing, drone inspection methods must do the same to ensure they are the optimal form of inspection.

## REFERENCES

- [1] Mohammadreza Aghaei, Student Member, IEEE, Francesco Grimaccia, Member, IEEE, Carlo A. Gonano, and Sonia Leva, Senior Member, IEEE, "Innovative Automated Control System for PV Fields Inspection and Remote Control", *IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS*, 2015.
- [2] Simon Koch, Thomas Weber, Juliane Berghold, Christian Sobottka, "OUTDOOR ELECTROLUMINESCENCE IMAGING OF CRYSTALLINE PHOTOVOLTAIC MODULES: COMPARATIVE STUDY BETWEEN MANUAL GROUND-LEVEL INSPECTIONS AND DRONE-BASED AERIAL SURVEYS", 32nd European Photovoltaic Solar Energy Conference and Exhibition, June 2016.
- [3] Jonathan Leloux, L. Narvarte, "Advanced PV modules inspection using multirotor UAV", 31st European Photovoltaic Solar Energy Conference and Exhibition, September 2015, Hamburg.
- [4] John A. Tsanakas\*, Long D. Ha, F. Al Shakarchi, "Advanced inspection of photovoltaic installations by aerial triangulation and terrestrial georeferencing of thermal/visual imagery", *Renewable Energy*, 2016.
- [5] Mohammadreza Aghaei, "Unmanned Aerial Vehicles in Photovoltaic Systems Monitoring Applications", 29th European Photovoltaic Solar Energy Conference and Exhibition, 2014.