Hotspot Detection in Photovoltaic Array Using Thermal Imaging Method

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Abstract To maintain the long-term reliability of photovoltaic (PV) modules while maximizing the power output, possible faults in the PV modules need to be diagnosed at an early stage. One of the problems that arise in the PV system is the formation of the hotspot. Numerous hotspot detection methods have been presented over the years to address this issue. This paper presents a non-destructive method based on aerial infrared thermography inspection using a drone for detecting the hotspot in a large-scale PV system. The result shows that the approach can successfully detect the formation of the hotspot in the PV array with overall temperature differences between normal and hotspot cells in the range of 0.6 to 20.4 °C.

Keywords Hotspot detection · Thermal imaging · PV array

1 Introduction

PV devices capture that energy and convert them into electricity. Generally, a PV system requires less maintenance as the design is simple. Since the PV modules do not have moving parts, the modules can usually last up to 20 years [1]. However, due to several reasons, this lifespan is getting shorter. One will never know if a PV module has already experienced a significant performance drop without proper monitoring. Normally, the source of these damages begins as a hotspot [2]. Hotspot can lead to irreversible damage and reduces the overall performance of the PV module. Hence, it is necessary to detect hotspots at the early stage to maintain the long-term reliability of PV modules. An existing defect in the PV module such as crack, oxidize or a dent is also a potential cause of hotspot.

This defect turns into a load that makes the current concentrates on this part. This results in huge dissipation of power in the damaged cell causing it to heat up and forming a hotspot. Therefore, the output power reduces, thereby reducing the performance of the PV module. Due to the heat up of the damaged part, the

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