

A Multispectral Imaging System for Industrial Applications

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Multi-spectral imaging (MSI) is a technique for obtaining spectral information of an object. MSI has rapidly evolved as a non-destructive and non-invasive analytical method in many industrial applications. Multispectral images are rich in information compared to the standard RGB images because they have the capability of acquiring spectral information beyond the RGB bands. Therefore, multispectral images can be used to classify object properties more accurately than an RGB image. However, commercially available multi-spectral cameras with high spectral resolution are very expensive and the implementation of such imaging system is not affordable for medium scale enterprises. In the first part of this research, we were designed an MSI system that can be customized for use in many industrial applications. The developed MSI system can capture multispectral images from near ultraviolet (N-UV) to near infrared (NIR) region of the electromagnetic spectrum with a spectral resolution of nine spectral bands (405 nm - 960 nm). The light emitted by the light emitting diodes reaches the object which is placed inside a dark chamber through an integrating hemisphere. The multi-spectral images of the object were captured using a monochrome camera with a resolution of 1.3M Pixels and saved for each flash. In the second part of this research, MSI system was used to estimate the leakage current through algae aided insulators used in high voltage (HV) transmission lines. The leakage current flows in HV transmission lines are mainly due to the algae contaminated insulators. Inspection of HV insulator conditions are done as visual inspection tasks. However, this process is expensive, time consuming and required skilled workers. The results show that use of MSI system for the condition assessment of HV insulators remotely. Additionally, a hybrid machine learning algorithm was developed based on principal component analysis (PCA) and multivariate statistical methods to estimate the leakage currents through algae aided ceramic plates.

Keywords: Multi-spectral imaging, multi-spectral cameras, high voltage transmission lines, leakage current, machine learning.