Enabling an algorithm to be executed in parallel on a multicore or a multiprocessor system has become a necessity for many real time applications. Multicore systems are widely used to improve performance and satisfy time and power demands. In this study, solar energy, which has proved itself as the future clean source of energy, is also considered in real time. Optimum utilization of this energy propelled research efforts into many directions of the solar system components. However, while real time operations of Photovoltaic (PV) systems occur without any supervisory mechanisms, many internal and/or external obstacles can occur and hinder system’s efficiency. To address fault detection in solar systems and thus provide a safer and more time efficient inspection in real time, this study proposes using videos for real time inspection and fault detection of the solar panel.
To monitor the conditions of the solar system and issue an alert when a faulty condition is detected, an integrated multicore CPU system using real time recording and analyzing of thermal and digital videos has been developed. The system using a multiprocessing module in Python and under a multicore CPU system executes input thermal and digital videos into different segments and executes detection algorithm in parallel. Each segment should be processed via a specific process. Several Pattern Recognition algorithms are investigated for real time fault detection suitability.

Two cameras are used to capture the scene of the solar panels simultaneously while mounted on a drone. The FLIR Vue Pro thermal camera was used for thermal video recording with 7.5 Hz (NTSC) frame rate, and with a resolution of 336x256 pixels. This resolution is high enough to show an accurate thermal resolution from the solar panels. GoPro Hero 4 Black digital camera was used in the system, the camera has effective photo resolution 12.0 MP, and the max video resolution 3840x2160. These two cameras are connected on the Yuneec Typhoon Q500 quadcopter. The recorded videos are streamed into the ground workstation where they are processed using the Python 2.7- IDE for Eclipse (Luna Service Release 2 (4.4.2)).

To validate our real time proposed system, this study used a mobile solar system that was constructed primarily for this project in the Digital Image and Signal Processing Laboratory (DISPLAY) at Western Michigan University (WMU). This system is composed of two panels of SUNIVA OPTIMUS 60 Cell modules (Model OPT285-60-4-1B0); each panel produces 285W. The proposed system, as demonstrated by the results, has the following contributions: 1) using the multiprocessing module in Python and the thermal and digital video processing on multicore CPU shows execution time improvement and processor performance enhancements, the average improvement for the processing time of the detection algorithms for thermal and digital videos was 3.1 times using 2 processes, and 6.3 times using 4 processes; and 2) a multicore real time system for the analysis of thermal and digital videos, drone mounted, provides the capability to accurately detect defects in the solar panels and give location information in terms of panel location by longitude and latitude.