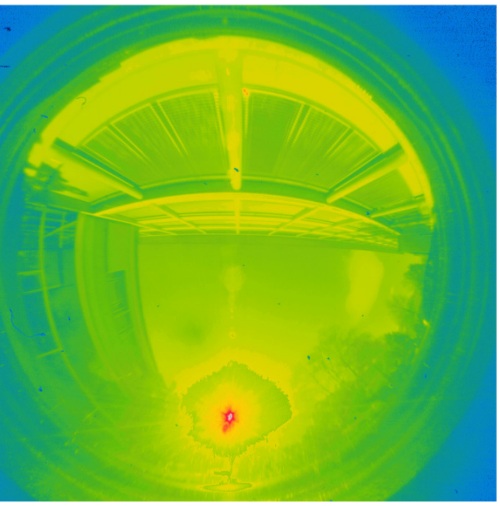

SPATIAL RADIATION DISTRIBUTION

Sensing System

Project Summary

An alternative to the traditional pyranometer sensor measuring total radiation intensity is being developed. The new set-up is based on a CMOS camera combined with a fisheye objective. The new sensing system is capable to not only quantify the total received radiation but also its spatial distribution. This is done by processing the acquired image. It turned out that radiation intensity within the disc of the sun is extremely superior to blue sky radiation, about 6 orders of magnitude. Since such variation cannot be covered by pixel intensity quantization and variation of exposure time alone, it is necessary to use a variable neutral density filter within the optical path. Its attenuation is command by a stepper motor. Several images can be superimposed to account for the intensity dynamics.

Problems were encountered with stray light in the optical path, non-linearity of pixel sensitivity, filter inhomogeneity and image variation between successive acquisitions. The calibration of the system without an additional global intensity sensor is not realizable. The additional global sensor should be a silicon photodiode, to obtain comparable spectral sensitivity.

Valorisation

Possible applications of the sensing system are in several areas:

- Building climate control: Sensing the direction and intensity of incoming light, the operation of stores to control room light intensity can be optimized.
- Performance monitoring, determination of optimal orientation and prediction of short term generation of photovoltaic power plants.
- Plant and fruit growth monitoring. Light exposure, together with temperature and soil moisture is the most important environmental factors for biological growth.

The camera based system is potentially less costly and provides more information than a classical pyranometer.

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