

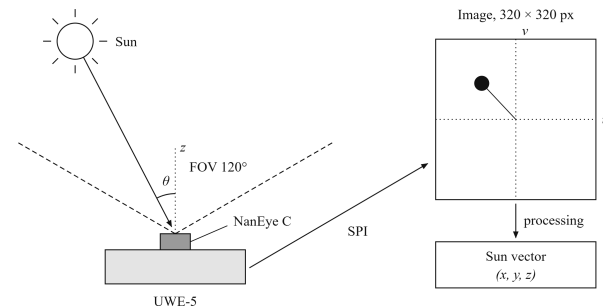
Commissioning and Calibration of the NanEyeC Camera as a Sun Sensor

Motivation and Tasks

For the upcoming satellite UWE-5, a NanEye C camera is to be used as a sun sensor. The NanEye C is a miniature monochrome (black-and-white) camera with a field of view of 120° and a resolution of 320×320 pixels. Its smaller footprint makes it well suited for many applications that are resource and size constrained. The camera is controlled and read out via an SPI interface; further technical details can be found in this datasheet.

A sun sensor determines the direction of the Sun relative to the satellite. This information is essential for attitude determination and for sun-pointing of the satellite. The idea is to capture a frame with the NanEye C and process it on board to obtain the sun coordinates, i.e., the sun vector in the satellite's body frame.

The goal of this thesis is to implement the image-processing pipeline, from image acquisition to the sun coordinates, and to calibrate and characterize the resulting sun sensor. Depending on the quality of the code, it can be included in the final flight software for the satellite's ADCS system. This thesis needs working knowledge of C-programming and willingness to learn the image processing methods and algorithms.



Goals

1. Design and implement an image-processing algorithm that detects the Sun in the image and computes the sun coordinates (e.g. via the centroid of the sun spot and a camera model).
2. Calibrate the sensor, including lens distortion, the mapping from pixel position to viewing angle, and the effect of exposure settings.
3. Characterize the performance of the sun sensor (accuracy, precision, frequency).
4. Document the design, the calibration procedure, and the results thoroughly.

What we offer

- You will be provided with all the necessary hardware including the drivers for camera
- Opportunity to contribute your own ideas when designing solutions
- Supervision and support throughout the thesis

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