Practical and comprehensive lighting quality measurements using IoT

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Introduction

- Part of the interdisciplinary project: OptiLight - Mathematical Optimizations for Human Centric Lighting.
- Despite growing understanding of the impact of light on wellbeing, performance and circadian rhythms, benefits of this understanding cannot (yet) easily be harvested in practical systems.
- Scalable algorithms are lacking that can be used in automated systems.
- There exists a huge gap between results obtained in controlled environments and practical deployment.

- This project aims to measure lighting quality in a practical and unobtrusive manner using an IoT luminance distribution measurement device.
- "Good-quality lighting is lighting that allows you to see what you need to see quickly and easily and does not cause visual discomfort but raises the human spirit"  

I. The Bee-Eye: An IoT-Device for Measuring the Luminance Distribution

- Low cost components: Single board computer, Camera, Fisheye lens

- High Dynamic Range (HDR) technology is required to capture contrasts occurring in real world.
  HDR images are formed based on:
  - 7 exposures with shutterspeeds ranging from 250,000 to 12 μs
  - Specific camera response curve by radiometric self-calibration

- Specifications
  - The accuracy stays within 3.0% to 17.5%.
  - Autonomous, Calculation time = 35 s.
  - Measurement period = 8 s.

- Algorithms aim to optimize variable lighting quality aspects, indicated in green. Except the spectral power distribution (SPD) all aspects can be measured by the Bee-Eye. Hence, the Bee-Eye is an effective Lighting Quality measurement Device