TAILORED LIGHT

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Intelligent photoelectric surface of light emitting modules

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Motivation: The monitoring of technical processes is often realized by means of electrical sensors whose signal and energy transmission is designed as a hardwired network. For customized applications, this approach is not flexible enough due to complex technical structures and a large space requirement. A miniaturization of autonomous sensor nodes in conjunction with an optical signal and energy transmission allows much greater freedom in the integration of sensor systems. For monitoring the system only a local installation of the sensor node is necessary, which is then read out wirelessly. This allows for customized monitoring of technical systems (ubiquitous sensing/ internet of things), while reducing the system's complexity.

Objective of the PhD project: The objective of this project is to build an intelligent photoelectric sensor module which is able to generate electrical energy by energy harvesting, take measurements and emit information in the form of time-tailored light when requested to. For this purpose, new methods of integration and fusion of optical and electrical components are to explore. To enable the module for communication with its environment the integration of an optical interface is intended. A matrix-like arrangement of several such modules makes an intelligent surface which can be used as an individually adapted sensor system. The size of the modules is variable and depends mainly on the solar cells used for the power supply. This makes it possible to realize different surface shapes and variable sizes, depending on the application scenario. The attached sensors cover a wide range, such as sensors for measuring temperature, strain and structure-borne noise. As a read/write unit a smart phone with an individually programmed app can be used to radiate energy through the built-in LED and to read optical information through the built-in camera.

Optical sensor module in a read/write scenario.

The work is based on modules, which currently communicate by means of a radio interface. A further development to a fully optical communication system reduces the technical complexity, is functional within electromagnetic fields and increases the possible readout distance. The figure shows a schematic of the emerging optical modules and a read/write scenario.

This is a PhD-project of Tailored Light. Tailored Light is a coordinated PhD-programme of the Hanover Centre for Optical Technologies from the Leibniz Universität Hannover together with the Hochschule Hannover, the Laser Zentrum Hannover, the HAWK Hildesheim/ Holzminden/ Göttingen, the TU Braunschweig and the TU Clausthal.

Students interested in this or another project of Tailored Light can apply for fellowships. Have a look at www.tailored-light.uni-hannover.de for details.