

Master 2016

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Integration of Organic LED and Optical Sensing to Create a Wearable Health Monitoring Device.

ABSTRACT - Masterthesis

The developing field of wearable electronics has been made possible through the recent advances in technologies allowing for flexible devices. At the Wearables and Printed Electronics Unit at Fraunhofer Institute for Silicon Technology (ISIT) in Itzehoe, Germany, a great interest has been taken in the development of such devices with biomedical applications.

Through the collaboration with the Mads Clausen Institute (MCI) in Sønderborg, Denmark, Fraunhofer ISIT requested that a wearable health monitoring device be made, integrating optical sensing to display the wearer's body temperature and heartbeat on a rigid-glass organic LED display. At MCI, the organic layer thicknesses of the small molecule OLED structure was optimized. A display was then designed and fabricated using the optimized structure to graphically depict the user's heart-beat and temperature.

At Fraunhofer ISIT, a wearable health monitoring wristband was designed and assembled using a flexible PCB and SMD components, integrating the displays fabricated at MCI. The adjustable device can be worn by users with different wrist sizes, and the measurement mode as well as display animations can be set by the user. The device successfully measured infrared radiation to determine and display body temperature. In addition, using reflectance-mode photoplethysmography (PPG), a PPG signal was successfully extracted from the wearer's wrist, from which the heart rate was calculated and a real-time heartbeat visualization was displayed.