



School of Engineering

ICP Institute of
Computational Physics

Smartwatch for optical detection of impaired lymphatic vessel function

Lymph vessels play an important role in the human immune system. They absorb fluid that leaks into the tissue. During cancer surgery, lymph vessels may have to be removed. In such a case, the risk of getting lymphedema (localized fluid retention and tissue swelling) increases.

The aim of this bachelor thesis was to improve an existing device, which is able to detect malfunction of lymph vessels. In cooperation with Swiss Federal Institute of Technology (ETH), the device should be enhanced, and its components investigated. The device is able to excite a marker called indocyanine green (ICG) which is injected in human skin. After the excitation of the marker, it radiates and the thus emitted light travels through a filter to a sensor. For this purpose, light with a wavelength of 780nm is used, since ICG has a physical reaction with near-infrared radiation (NIR). Information about the clearance is depicted on a display. If the marker dissipated fast, the lymph vessels are stable, if it dissipates slowly, there might be a problem with the vessels.

As a first step, the current excitation source was examined. Therefore, the stability and temperature were measured. This could be accomplished with measurements of the spectrum and thermal imaging respectively. Afterwards, the whole set up was scaled up, in particular the optical components. With a newly designed frame and a bigger lens, the project could be finalized.

At the end, the results were not satisfying. The excitation source could be exchanged and showed just slightly better behavior than the previous version. Due to the bigger lens, the signal from the ICG is stronger. However, the optical set up still needs to be analyzed further.



Diplomierende

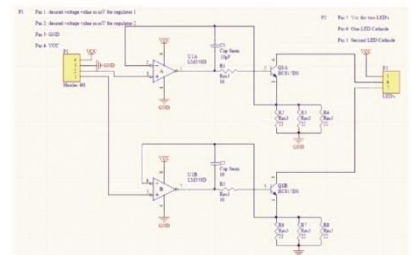
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Exploded view of the new designed device.



Finished scheme of the current controller, which is now on a print.