



Portable Device for Skin Cancer Diagnostics by Combined Diffuse Reflectance and Autofluorescence Photobleaching

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The work aims at development of a low-cost user-friendly portable device for skin cancer screening using previously developed algorithms. The algorithm for VIS and NIR diffuse reflectance (DR) images at selected wavelengths showed high sensitivity and specificity for melanoma diagnostics [1]. A temporal analysis of autofluorescence (AF) intensity during the photobleaching showed a potential for primary evaluation of basal cell carcinoma [2].

A prototype of the device module

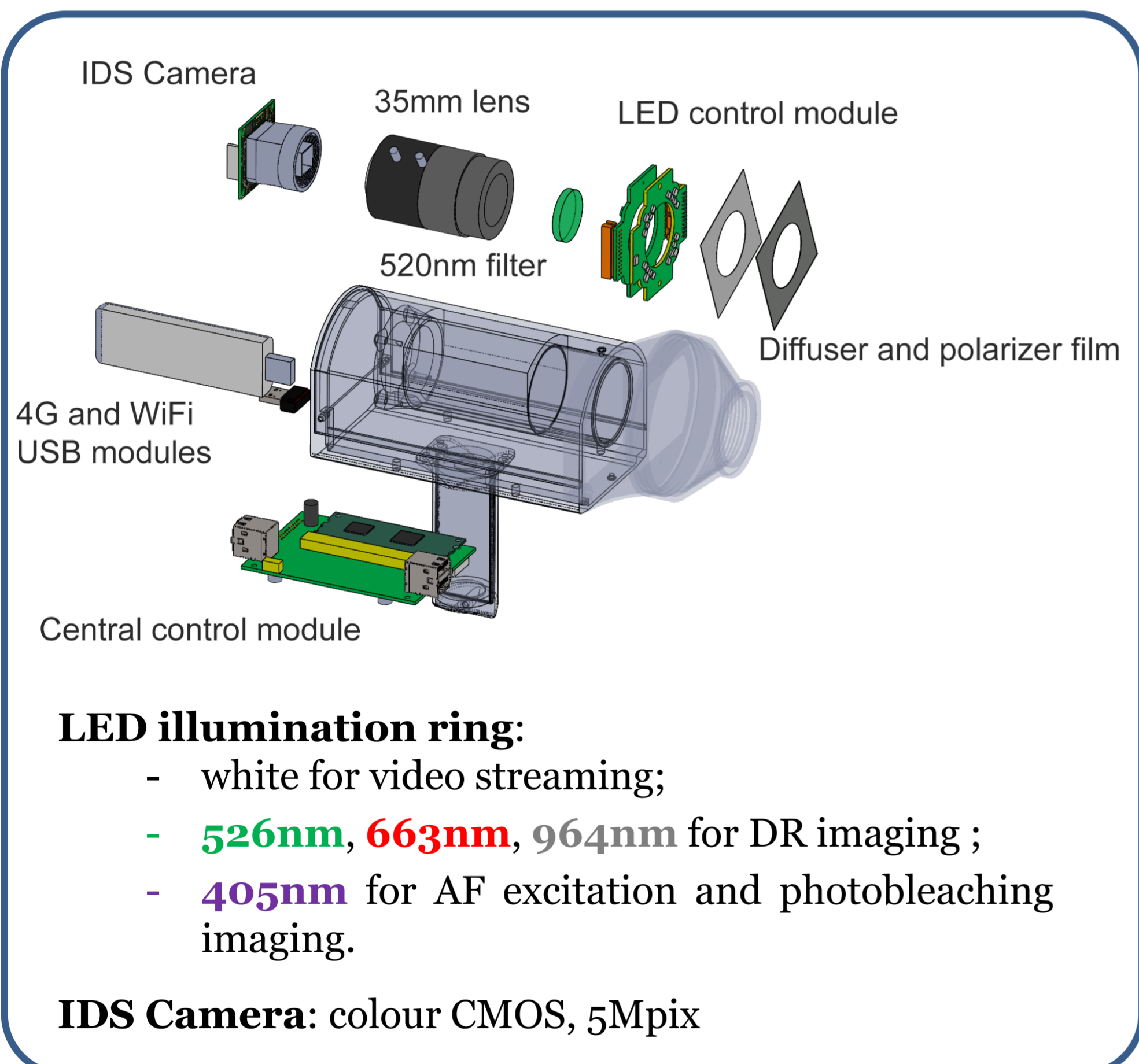


Image processing

Image acquisition

Automatic transfer to cloud service

Automatic processing in Cloud service:

1. Pre-processing: light balance, removal of hairs, marker registration, image alignment, segmentation

2. Diagnostics by combined algorithm:

- **Melanoma** diagnostics using DR imaging

$$p' = \lg \left(\frac{I(526) \cdot I_{skin}(663) \cdot I_{skin}(964)}{I(663) \cdot I(964) \cdot I_{skin}(526)} \right)$$

Criterion for melanoma: $p' > 1$

- **Basal Cell Carcinoma** diagnostics and border demarcation using AF and photobleaching imaging

$$I_{neopl}, I_{neopl}/I_{skin}$$

I_{neopl} - mean AF intensity of neoplasm
 I_{skin} - mean AF intensity of neoplasm

Discussion

The low-cost user-friendly portable device developed for skin cancer screening in general practitioner practice **will significantly improve the accessibility of early diagnostics**, thereby reducing mortality.

The first results of combination of DR and AF imaging revealed a promising differentiation of neoplasms[3]: melanoma could be distinguished from BCC and other benign neoplasms using criterion $p' > 1$; BCC and seborrheic keratosis – from melanoma using mean AF intensity values.

Acknowledgment

This work has been supported by European Regional Development Fund project under grant agreement # 1.1.1.1/16/A/197

References

1. I.Diebele, et al, Biomedical Optics Express 3(3), 467-472, 2012.
2. A.Lihachev, et al, J. Biomed. Opt. 20(12), 120502-1-4, 2015.
3. I.Lihacova, et al, in Proc. of SPIE, 10685, 1068535-1-9, 2018.

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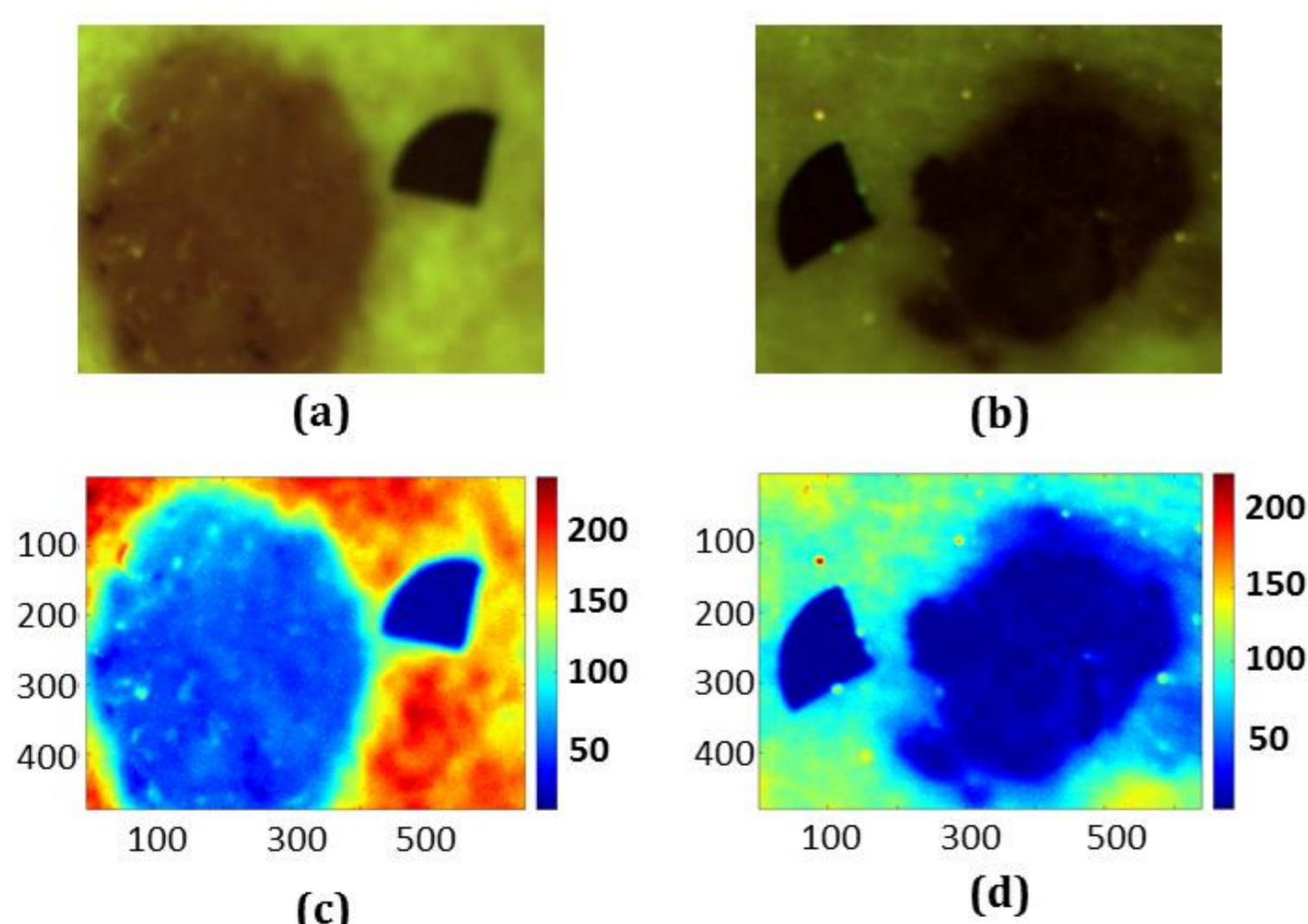


Fig.1. AF images (a, b) and intensity maps (c, d) of a BCC (a, c) and a melanoma (b, d)

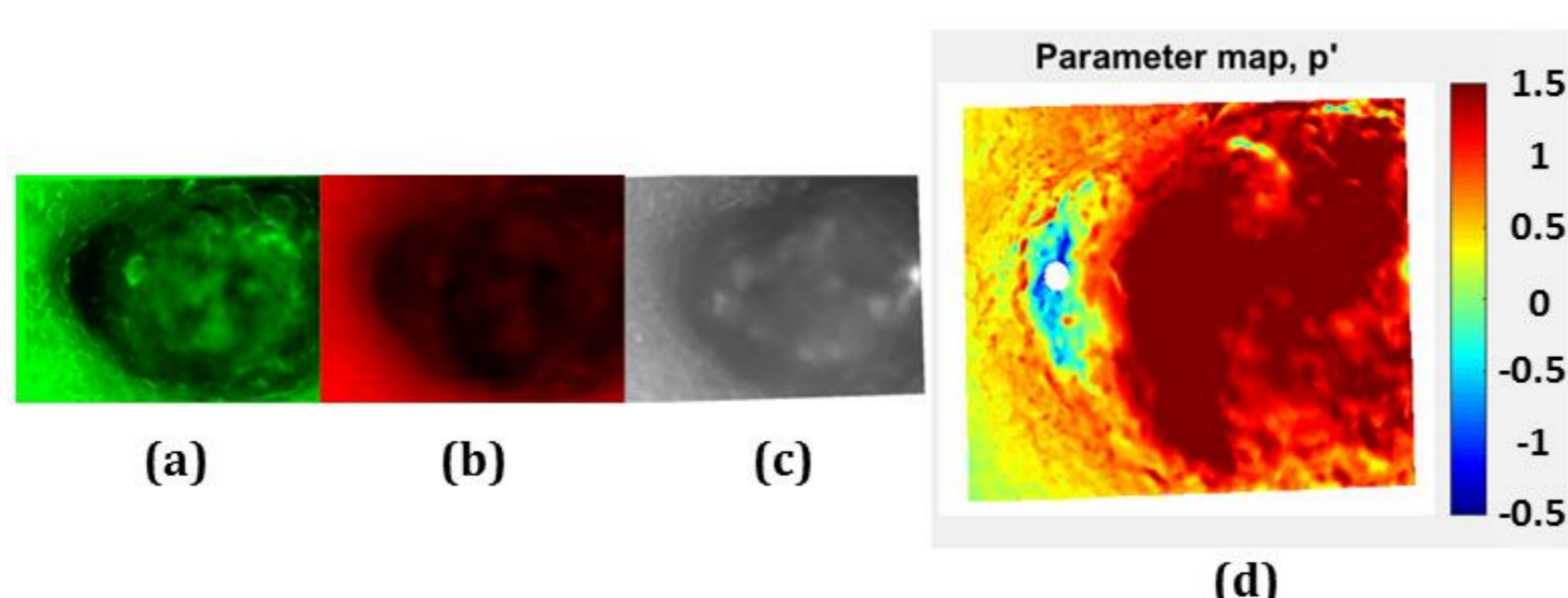


Fig.2. Images of a melanoma in green (a), red (b) and infrared light (c) and calculated map of the p' parameter (d)