DEVELOPMENTS in Optics and Communications 2018

Non-invasive optical skin evaluation device for cancer screening

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Univeristy of Latvia

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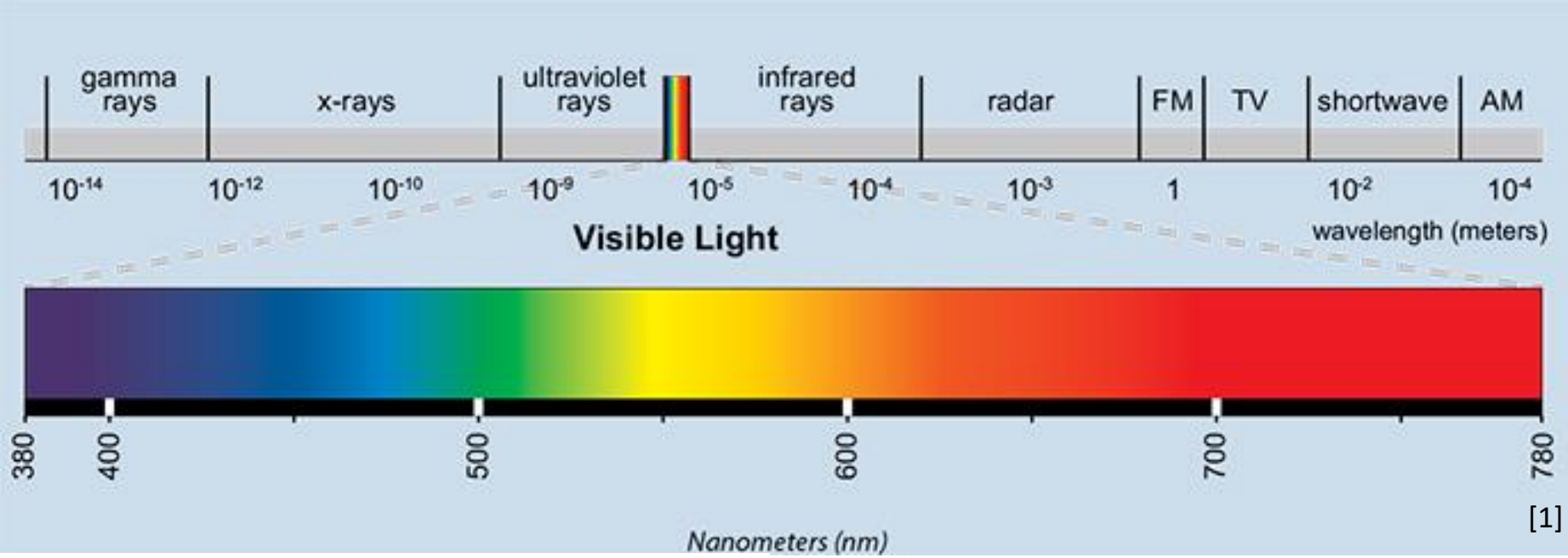
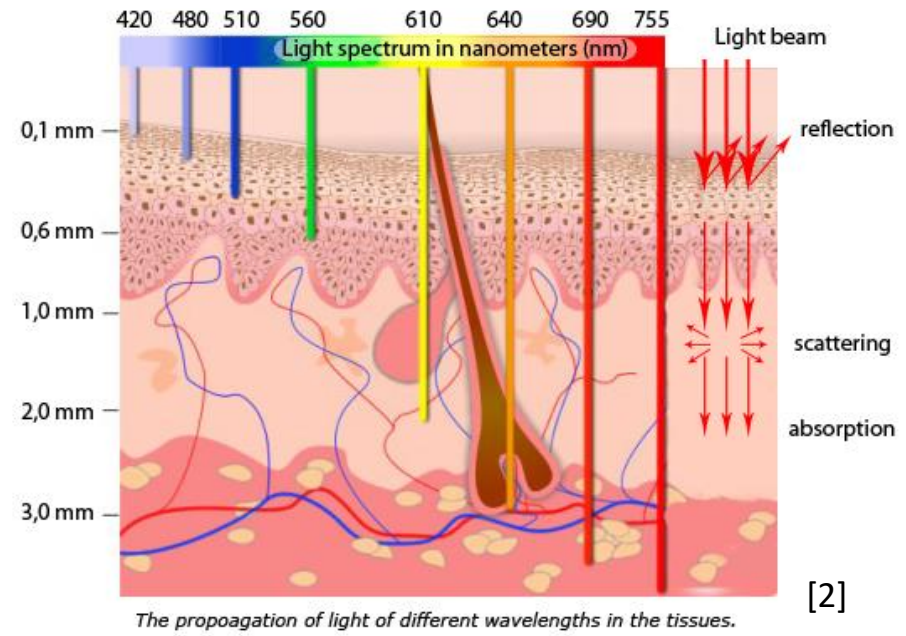
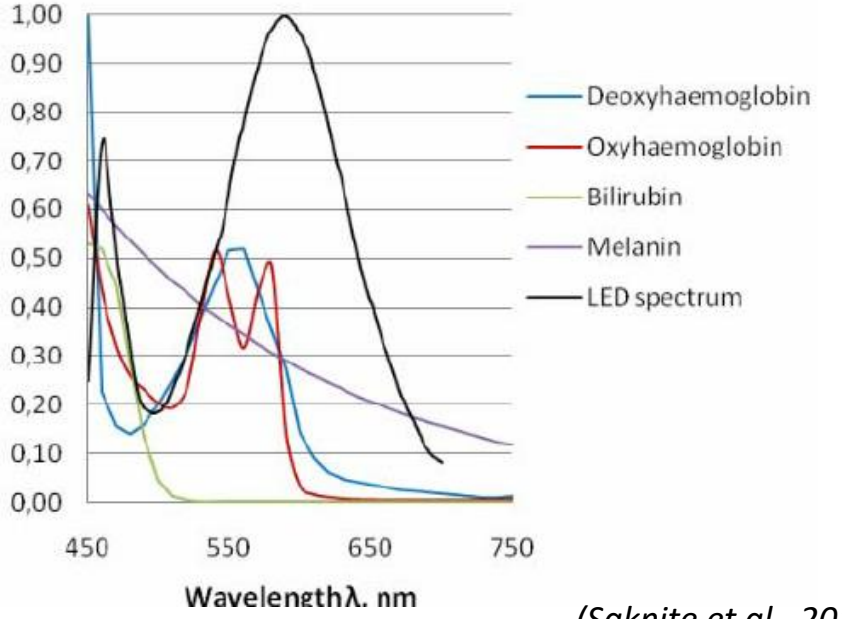


[1]



The propoagation of light of different wavelengths in the tissues.

[2]

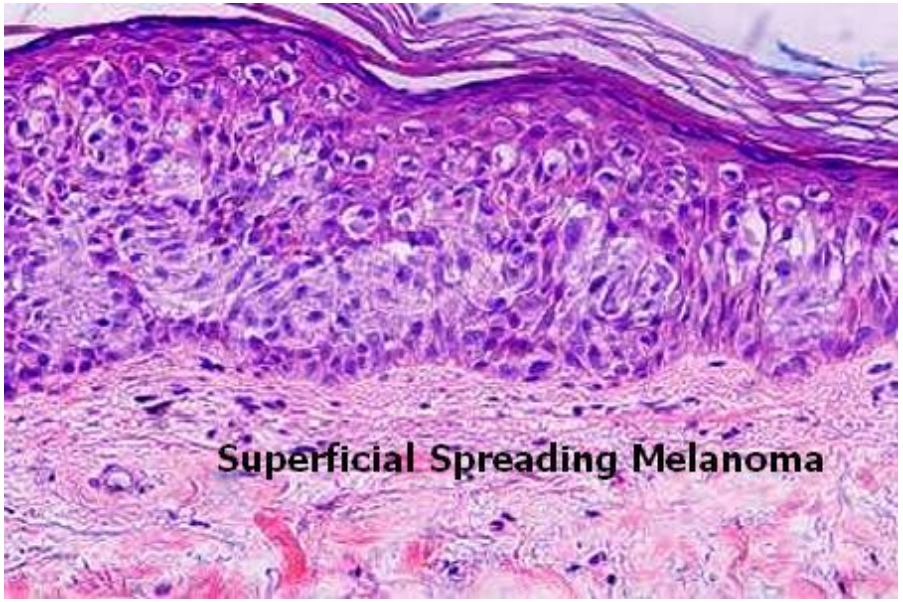


(Saknite et al., 2011)

[1] http://eyelighting.com/wp-content/uploads/2018/02/quality-of-a-light-source.jpg
[2] http://voltaicplasma.com/wp-content/uploads/2016/04/light_penetration_skin.png

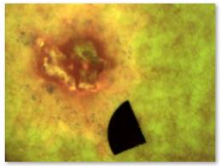
Challenge

To create a screening **device**, that is inexpensive, **available** in regional clinics and at primary care physician in order to evaluate the suspicious malformations **fast, non-invasive and quantitative**.

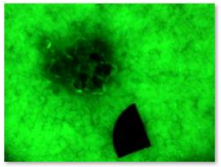


http://indeksonline.net/wp-content/uploads/2018/03/LekuraKancer.jpg
http://www.histopathology-india.net/SuSM.JPG

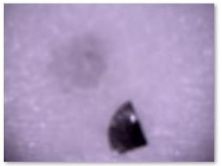
Method



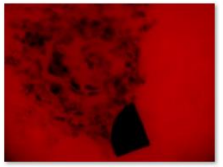
B (AF).png



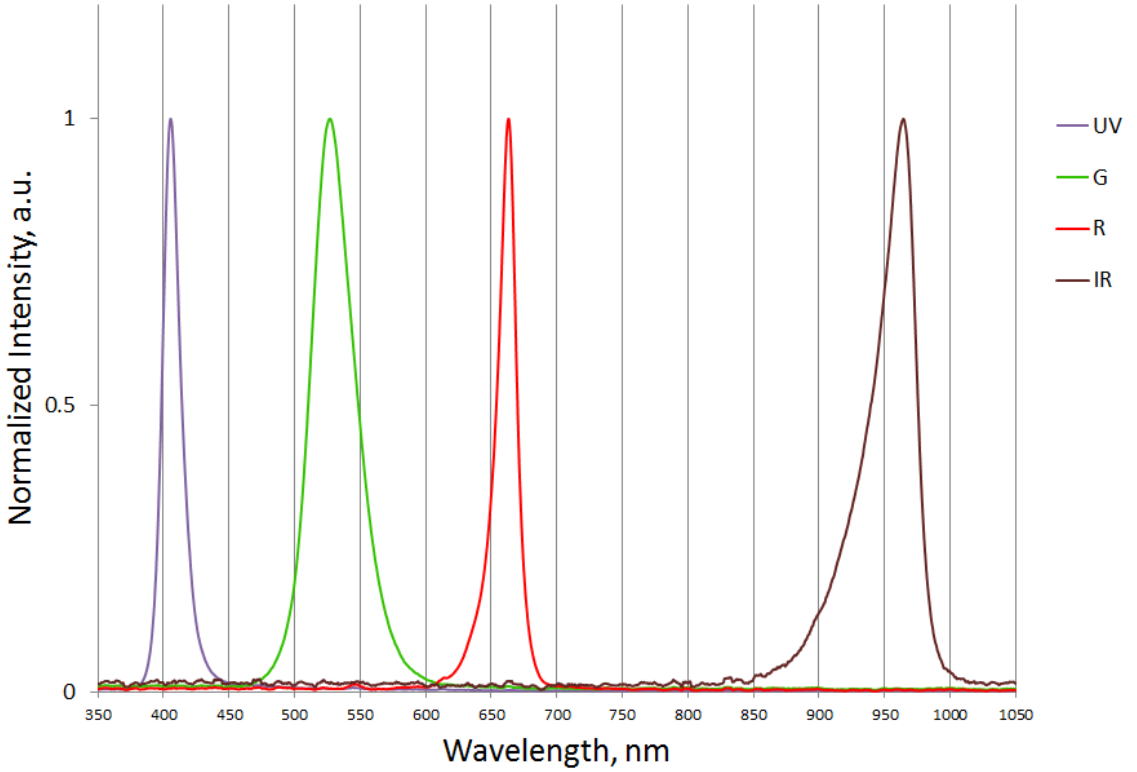
G.png



IR.png



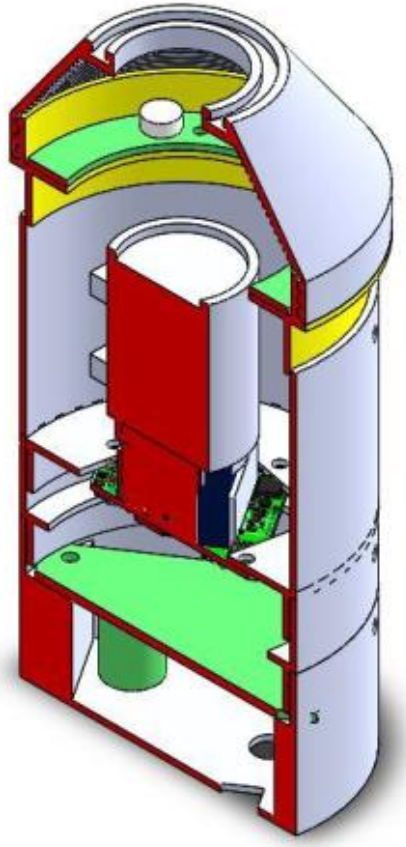
R.png



525nm, 405nm (AF), 660nm, 940nm

First device prototype

a)

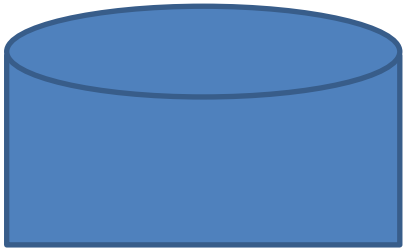


b)

a) First prototype with the wide end (70mm)
b) 3D designed model with the improved cone tip

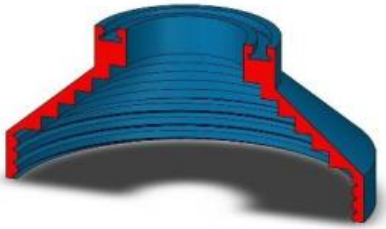
Photocredit & design: Dmitrijs Bliznuks

Development of the tip

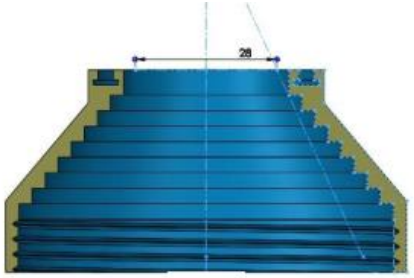


Flat walls
Sharp tip
Big diameter (70mm)
Not centered ROI

Cone shape
Flat walls
Sharp tip
better centered ROI



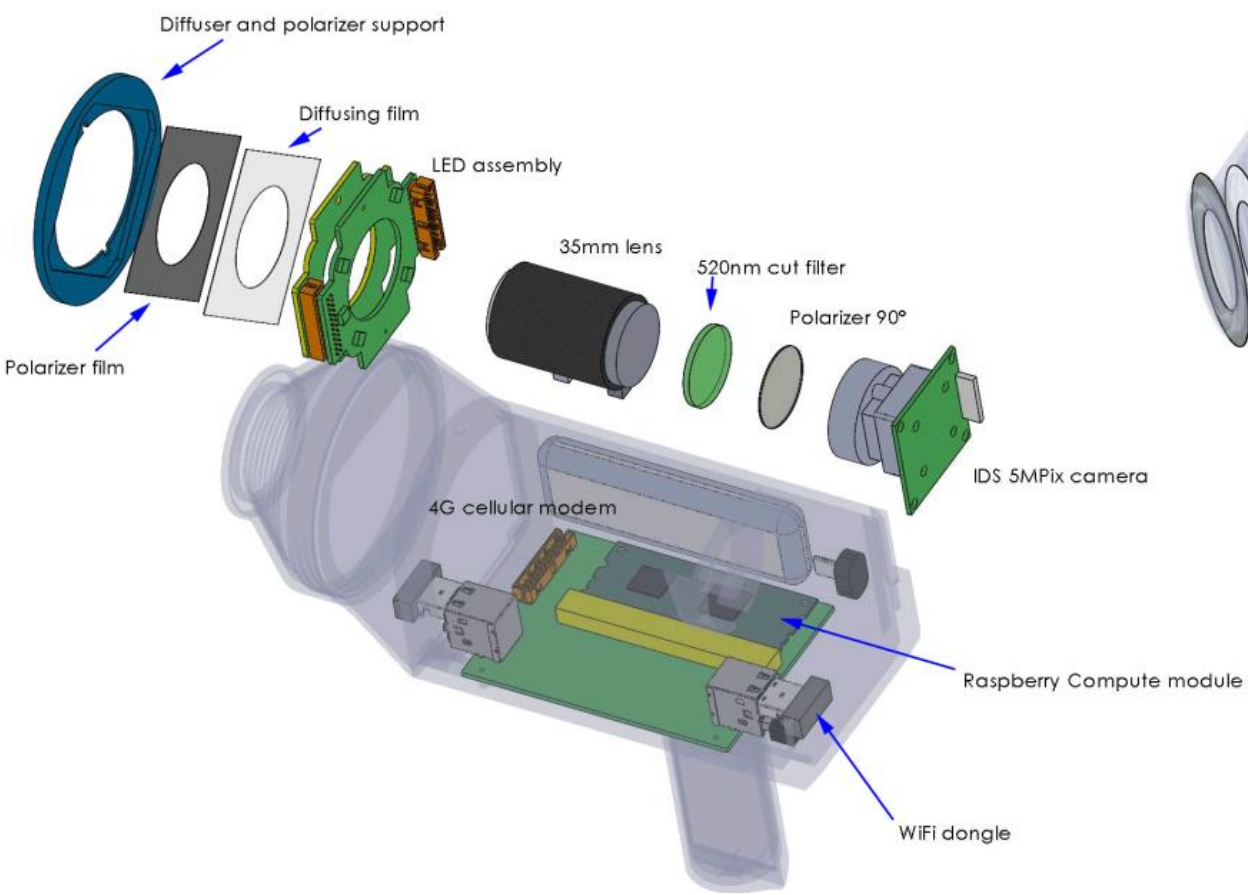
Cone shape
Smooth tip – silicone filament
better ROI
Step-type internal walls

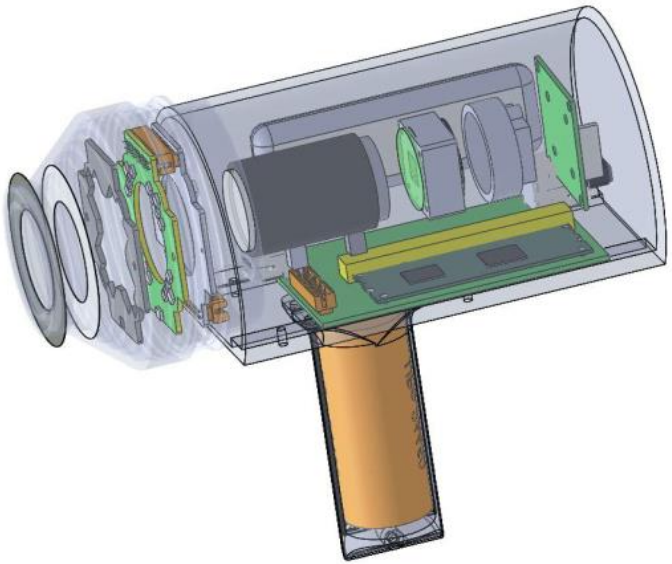


Cone shape
Smooth tip – silicone filament
better ROI
Step-type internal walls to improve light polarisation
(2nd prototype)

Step-like internal structure allows redirecting reflected light that has lost its linear polarization away from the skin.

Second prototype





+ Lighter
+ smaller, more compact in size
+ White LEDs

+ Case: easier assembling for repairs
+ better support for the camera, improved 3D printed case
+ Handle with battery

Photocredit & design: Dmitrijs Bliznuks

Figure 9. Full prototype printout. Uppercase with lens and camera attached (a), back view with opened upper case(b), attached case without LED holder cone (c), assembled case (d).

Photocredit & design: Dmitrijs Bliznuks

Conclusions

- With the developed **screening** device it is possible to **evaluate** skin malformations by imaging at various wavelengths.

- During the development of 1st and 2nd ptototype, a lot of **improvement** have been achieved, for instance:

+ precise, centered **tip** with ROI imaging;
+ designed a **silicone filament** for patient comfort;
+ **wireless** battery solution;
+ added **white LED** ilumination and **one-button** switch for each LED light;
+ **wireless** image transformation to the cloud with 4G modem.

- It is possible to **distinguish** such malformations: melanoma, basal cell carcinoma (both cancers), hyperkeratoses, melanocytic nevi and hemangioma (benign).

Thank you!

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This study has been approved by Ethics Comitee, the research has been conducted in accordance with the Declaration of Helsinki, as well as with the Oviedo Convention.