Platform for the study and development of applications for optical analysis of peripheral superficial vein patterns in biometry and biomedicine

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A vein pattern detection provides many important biometric features

       - uniqueness and permanence of the pattern

       - non-contact detection procedure

       - almost impossible to forge or copy.

   - the biometric parameter is hidden from general view

Vein detection devices can be successfully used in medicine and forensics

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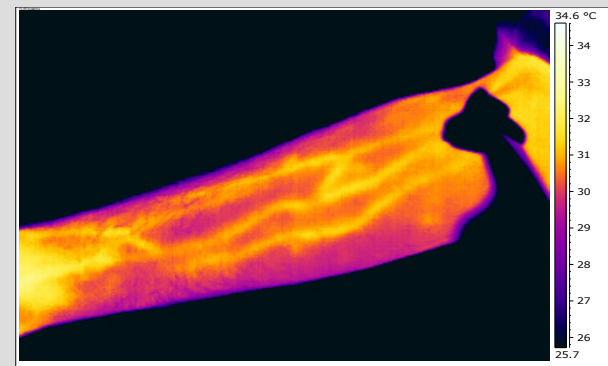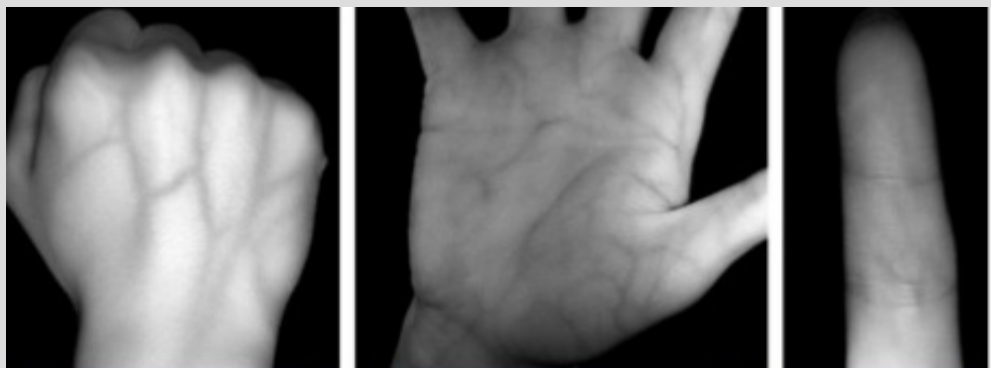
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•**The device takes a snapshot of the subject's veins under a source of near infrared radiation at a specific wavelength**

•**The system is able to detect veins but not arteries due to the specific absorption of infrared radiation in blood vessels**
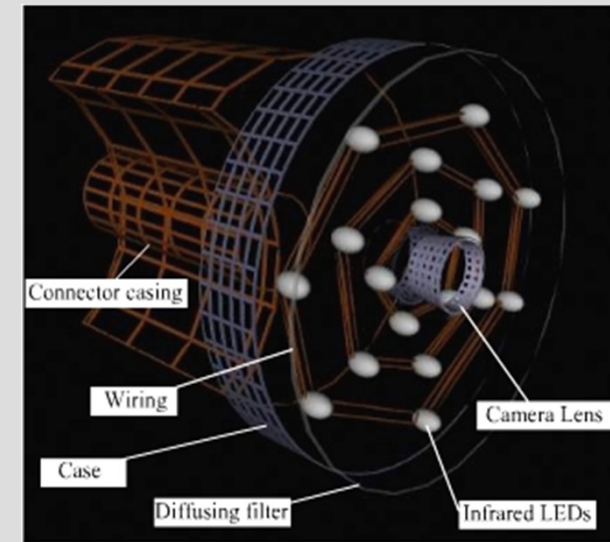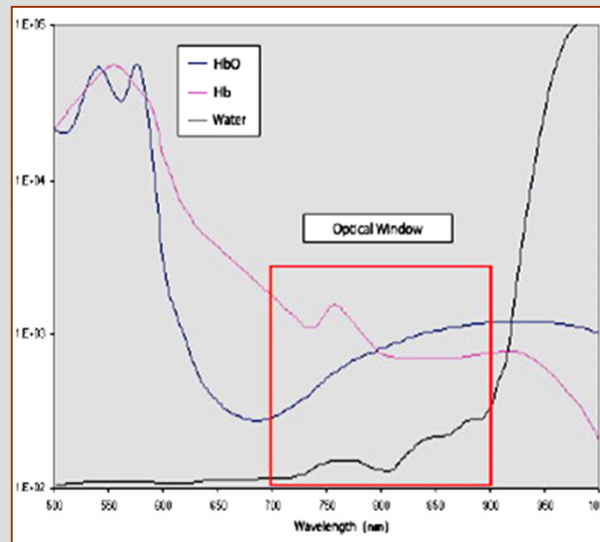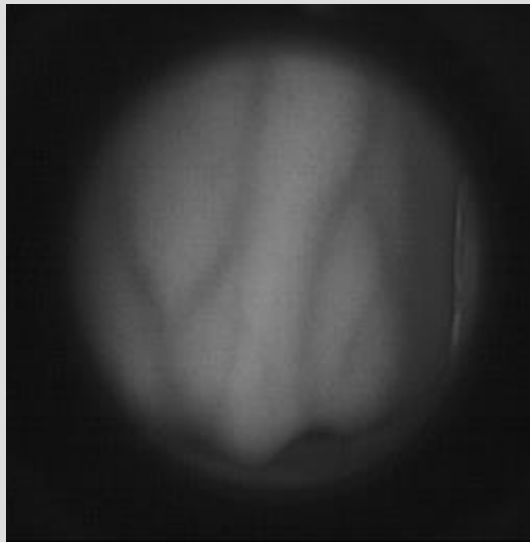
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• The preferred part of the body used for detection is the hand (forearm, palm, back of the hand, fingers)

• Veins are thicker and closer to the surface than arteries in the back of the hand and forearm
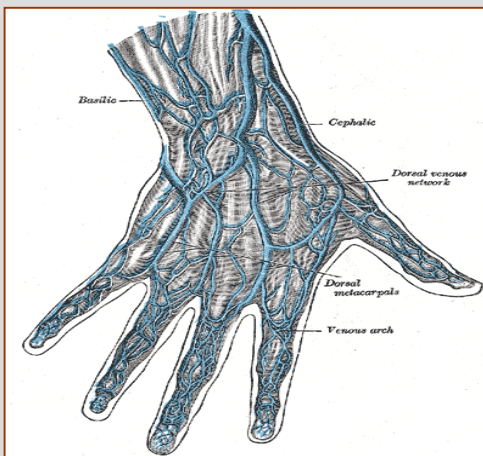
Uncovered part of the body

Reduced amount of hair

Veins closer to the surface

Intricate vein pattern

High acceptance of the method

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First set of problems

- the acquisition technology is not standardized
- algorithms are often optimized for a small number of samples
- methods and techniques proposed in various scientific papers can not be replicated due to the lack of access to the original image set

Second set of problems

- lack of a consistent real vein pattern image database
- In the palm or dorsal veins, synthetic databases are not existent
- commercial systems are often restrictive, with high acquisition costs
- proprietary interface that doesn't allow for adjusting acquisition values

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- **The project aims to deliver a complete hardware and software platform**

- **Vein pattern acquisition device, processing algorithms, simulation methods**
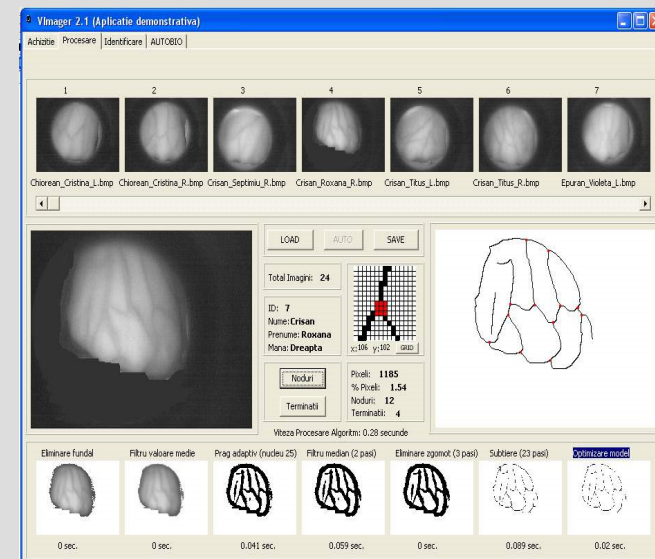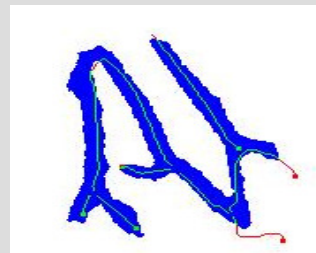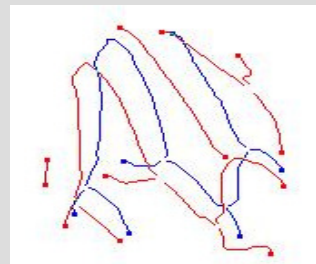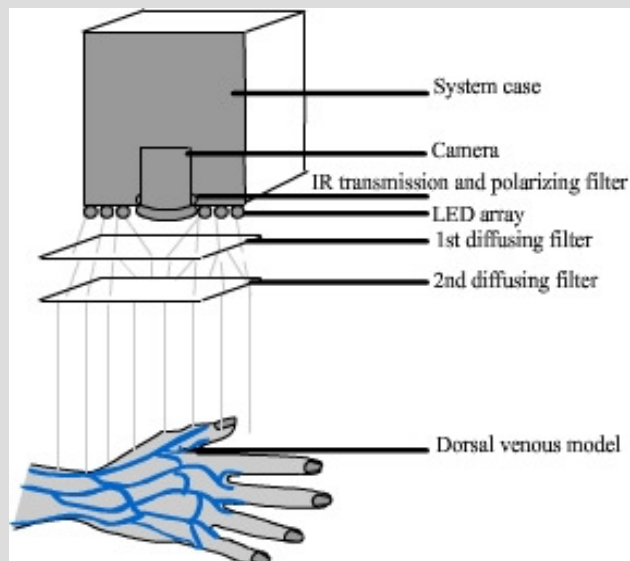
Main Objective

Development of a hardware and software integrated platform for the acquisition, visualization and simulation of the superficial vein pattern parameters in order to facilitate the implementation of algorithms and methods for the processing of real and virtual vein pattern images

Specific Objective 1

The development of an optical-electrical system for the acquisition of features of superficial vein patterns, immune to uneven illumination and position variations

Specific Objective 2

The implementation of a standardized set of techniques and methods for the detection, processing, simulation and storage of vein patterns in an integrated platform

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Specific Objective 1

A1.1 Identification of the optimal configuration for the experimental device based on the analyzed hardware solutions and the determination of optical, electrical and mechanical parameters.

A1.2 Construction of the optical acquisition system for vein pattern images (radiation source, sensorial acquisition module, lighting control elements, connection elements)

Specific Objective 2

A2.1 Creation of optimized algorithms for the analysis, processing and feature extraction of superficial vein patterns from different body locations.

A2.2 Implementation of different algorithms for the generation of photorealist synthetic images of vein patterns

A2.3 Development of software modules for the integrated platform (database, interactive website, real-time extraction and generation system for vein pattern features)

A2.4 Integration of results in the informational platform

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"PRO INVENT" RESEARCH CONFERENCE–24.03.2016

High degree of sustainability after the end of the project
future research with minimal maintenance costs
Standardization proposal for hardware modules
Integration of high-end graphical engine for realistic simulations

Internal and external project risks
Mitigation strategies in the project proposal

Modular approach, permanent hardware - software feedback
intermediate dissemination methods attached to milestones

Profound applicative character of the project
Hardware centric phase, results and deliverables after device completion

2 patent proposals finished
Several articles/conference papers submitted.

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biomedical applications - in addition to the biometric component
- identify the vein model in flebology or venipunctures
- visualization of varicose veins
- correct needle insertion in intravenous access

correct **reproduction** of vein patterns / accurate vein structure simulation

hand shape and vein pattern visualization in **virtual reality** applications

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