

# Optical Principle for Liveness Detection

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# Technologies of Fingerprint Sensors

## Optical Technology



## Capacitive Technology



## Ultrasound Technology



## E-Field Technology



## Electro-optical Technology



## Pressure Technology



## Thermal Technology



# Liveness Detection

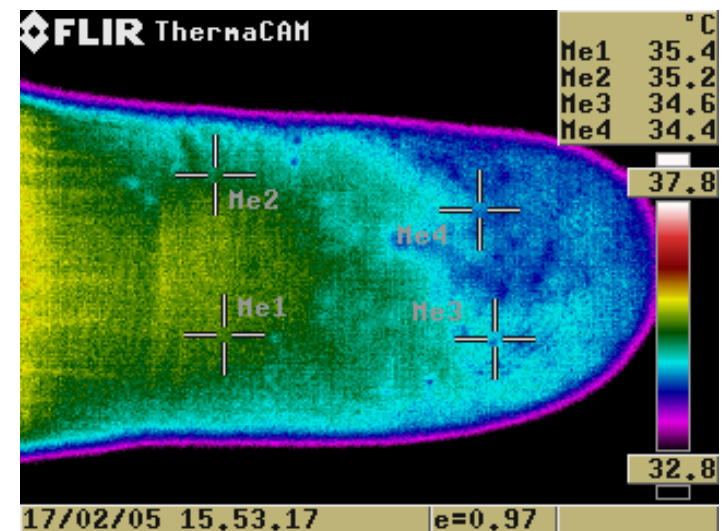
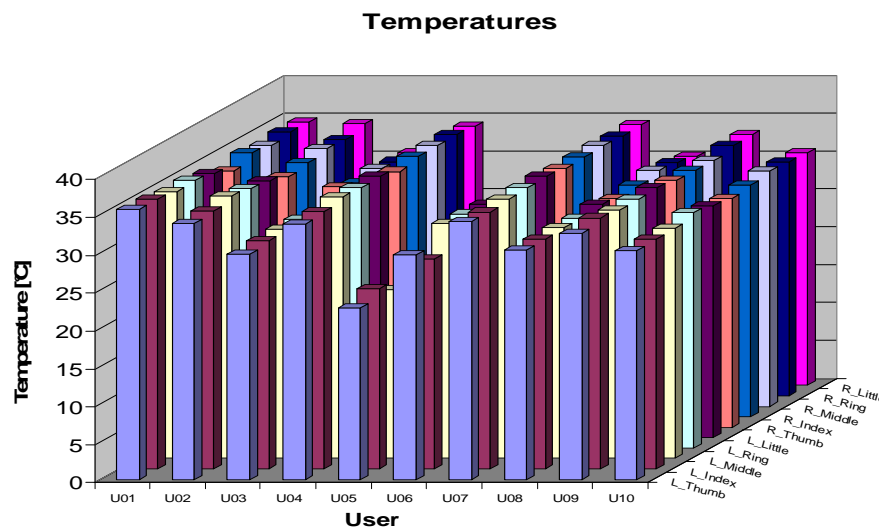
- Requires a new application of known physiological aspects of human body
- It means often:
  - Enlargement of sensor + new development
  - Higher costs of actual solution
  - Increase of number of failure rejections
- Some methods are patented
- No method is a 100% protection (each solution is somehow cheatable!)



# Liveness Detection – Experiments I

- Temperature

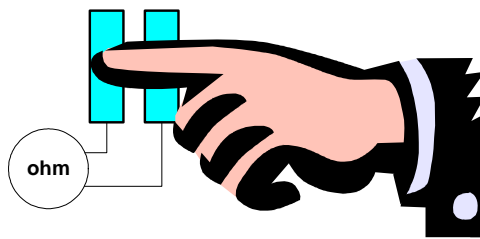
- Temperature measurement of epidermis layer
- Our measurements (thermo-camera and pyro-thermometer) have shown that the temperature lies in the range  $\langle 21,5^{\circ}\text{C}; 35,7^{\circ}\text{C} \rangle$



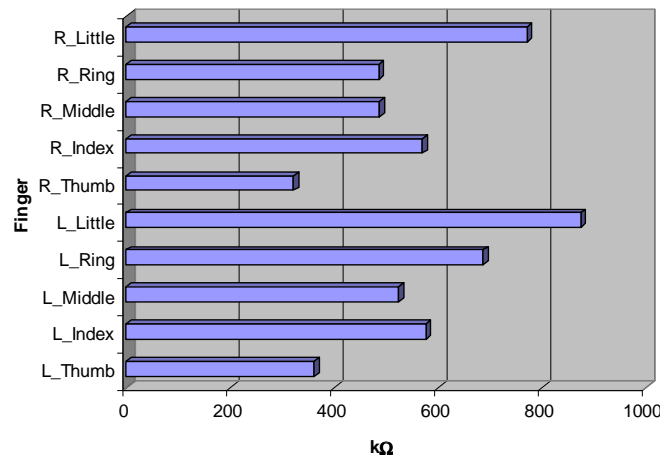
# Liveness Detection – Experiments II

- Electrical characteristics

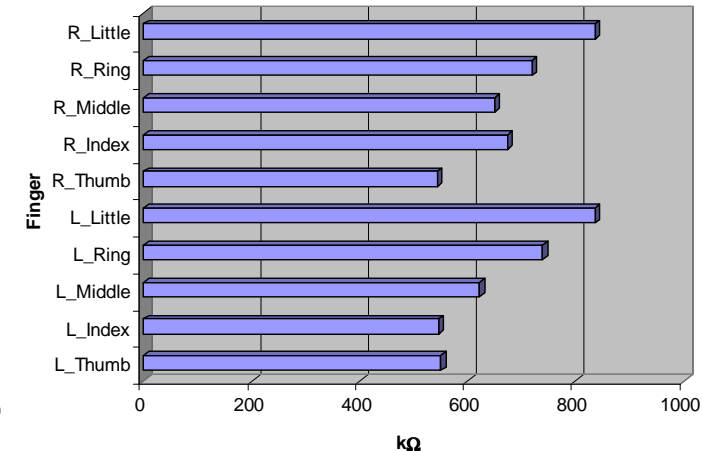
- Conductivity / Resistance / Relative el. constant
- **R** moves from 20kΩ to 2MΩ (AC/DC)
- Influence: skin humidity (sweat), outdoor humidity (weather) etc.



Measurement with AC low voltage



Measurement with DC low voltage



# Liveness Detection – Method I

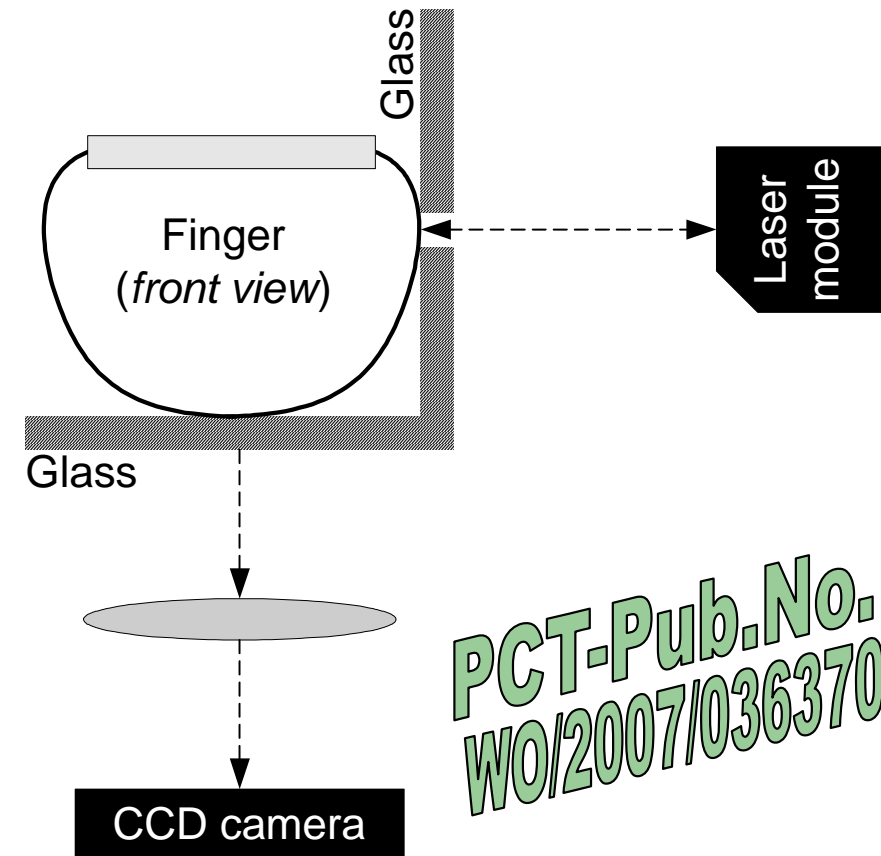
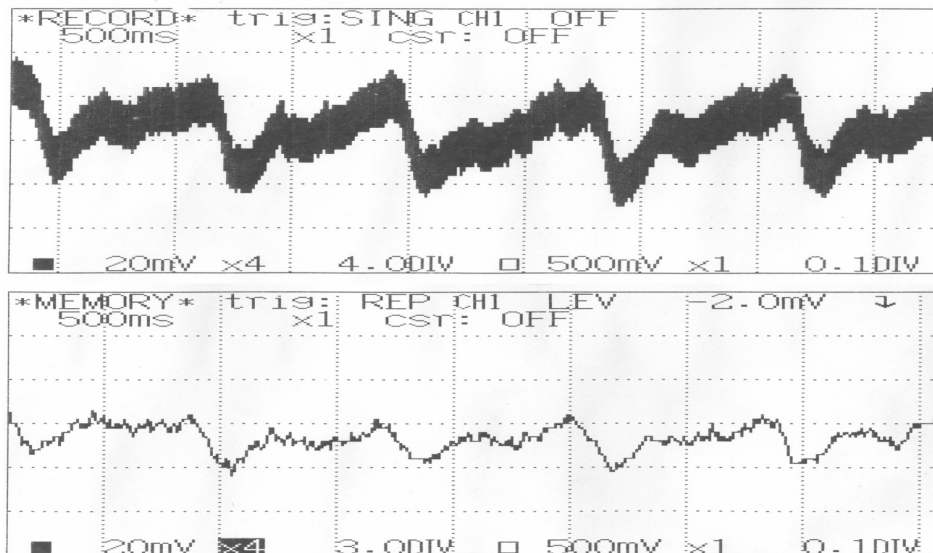
- Pressure change
  - This method is in the enrollment process for a utility model in CZ





# Liveness Detection – Method III

- Pulse (heart activity) – Laser-Module
  - Patented method
  - The same principle



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# Liveness Detection – Method II & III



**Panasonic LM10**

**Sony XCD-SX910CR + Computar MLH-10x**



# Liveness Detection – Method IV

- Blood oxygenation

- Hemoglobin → (de-)oxygenated blood – have different colors
- Two LED-wave-lengths:  $\lambda = 660 \text{ nm}$  &  $940 \text{ nm}$
- Different light absorption of hemoglobin by both wave lengths
- Color change (luminosity) means blood transport, consequently a live finger
- Length of measurement approx. 5 seconds
- Work on this method has been started (pilots)

# End of the presentation

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- Thank you for your attention.