Sweat Sensor for Sports Physiological Monitoring

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Outlook

- Sweat, Why is Important?
- Introduction: Wearable Chemical Sensors
- Fabrication of the device
- Characterisation of the Device
- Results
- NAP: Wearable Wireless Sweat Sensor Device
- Conclusions

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Introduction

SWEAT, WHY IS IMPORTANT?

Sweat is naturally generated during exercise.

Monitoring its contents provides very rich information about the physiological condition of the individual.

Rehydration and re-mineralisation

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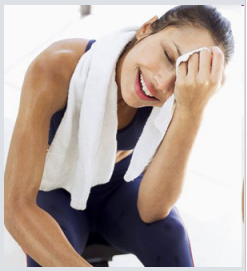
Improve performance and general health



Sweat analysis: identify pathological disorders

* **cystic fibrosis***
* **information on dehydration**
* **changes in the concentration of biomolecules and ions.**
  hyponatremia (low sodium concentration)

*Common hereditary disease which affects the entire body, causing progressive disability and often early death.

Introduction

PHYSIOLOGICAL SENSORS

Breath rate, heart rate, activity, posture, skin temperature…

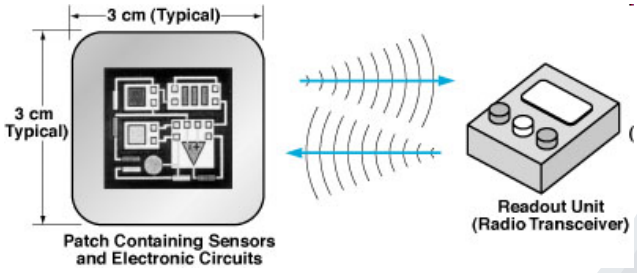
LIFESHIRT®

TRAINTRAK™

NIKE-APPLE IPOD SPORTS KIT

Introduction

CHEMICAL SENSORS



GLUCOWATCH

NASA: WEARABLE SENSOR PATCHES

PharmChek Sweat Patch

SWEAT COLLECTION PATCHES

Current Ways of Sweat Collection and analysis

S. M. Shirreffs and R. J. Maughan, J Appl Physiol 82: 336-341, 1997

Introduction

PROBLEMS TO OVERCOME WITH CHEMICAL SENSORS?

SAMPLE GENERATION

COLLECTION

DELIVERY

SENSOR CALIBRATION

WEARABILITY

SAFETY ISSUES

SWEAT RATE AND FLUID LOSSES VARY FOR INDIVIDUALS AND ARE GENERALLY DEPENDENT ON BODY SIZE, GENDER, EXERCISE INTENSITY, ENVIRONMENTAL CONDITIONS AND INDIVIDUAL METABOLISM.

Introduction

WHAT DO WE NEED????

DEVICE:

WEARABLE

ROBUST

FLEXIBLE / ADAPTABLE

REUSABLE/ DISPOSABLE → **CHEAP**

CONTINUOUS REAL TIME ANALYSIS → **IMMEDIATE FEEDBACK**

MICRO-DEVICES!!

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Introduction

DETECTION:

NOT INVASIVE

WIRELESS

OPTICAL SENSORS!!

FREEDOM FROM ELECTRICAL NOISE

MINIATURIZATION

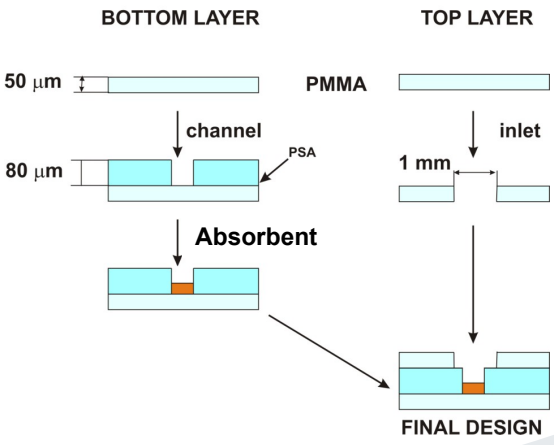
NOT PHYSICAL CONTACT

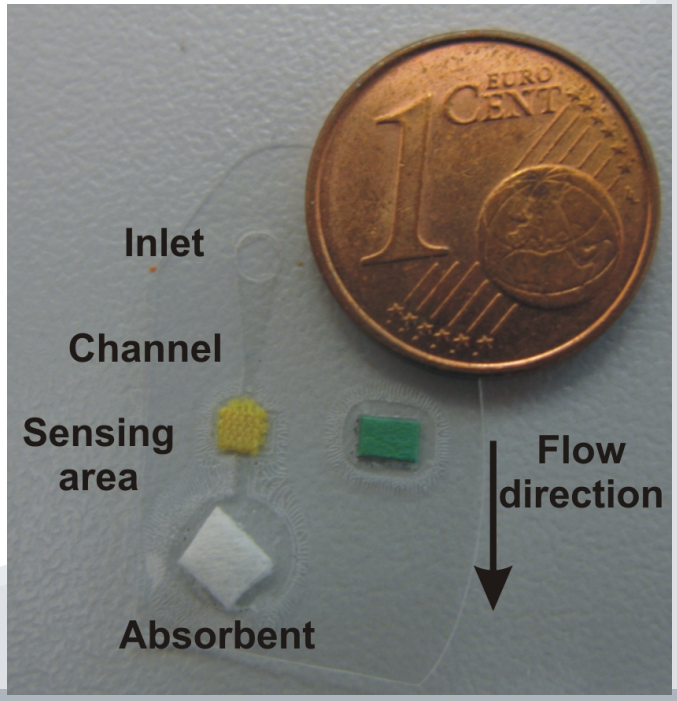
FLEXIBILITY IN INTERROGATION APPROACHES
(HUMAN EYE, LED-SENSORS, CAMERAS, SPECTROMETERS, …)

Fabrication

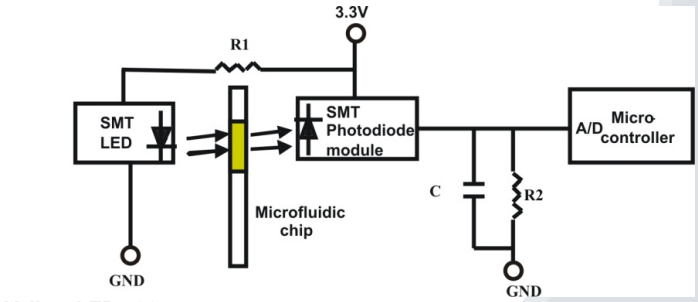
MICRO-FLUIDIC DEVICE

FABRICATION



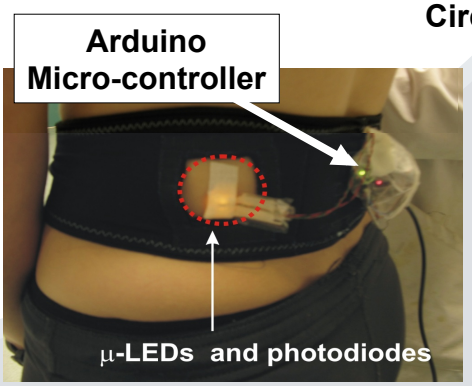


Performance



Yellow LED 590 nm

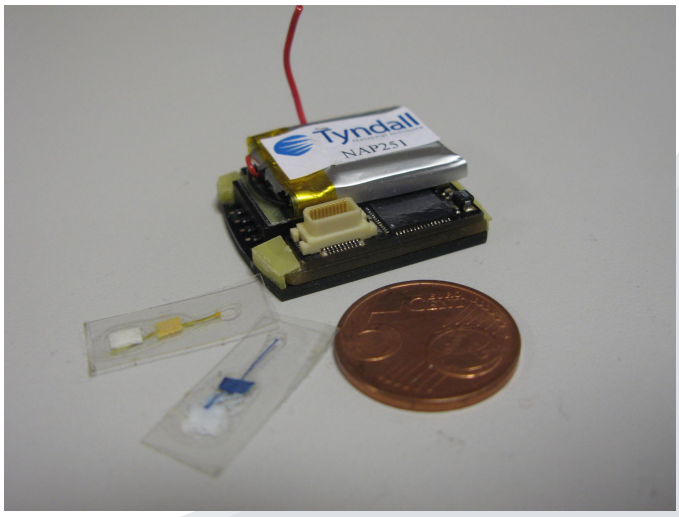
Circuit diagram



Possible wireless connection by attaching a Bluetooth® modem

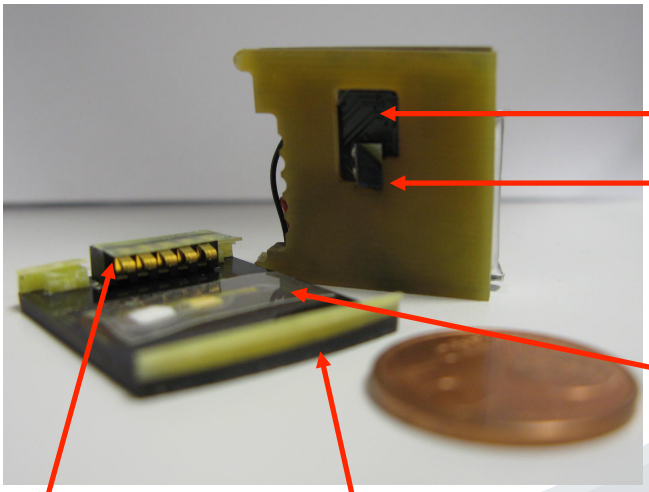
Wearable wireless sweat sensor

MULTI-LAYER DESIGN



4 SWEAT SENSING MOTES, 1 BASE STATION, LABVIEW INTERFACE

Wearable wireless sweat sensor



TOP LAYER

Cavity for absorbent to expand

Photodiode

Wireless communications

MIDDLE LAYER

Microfluidic chip

Interconnector

BASE LAYER
LED light source
Temperature sensor

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