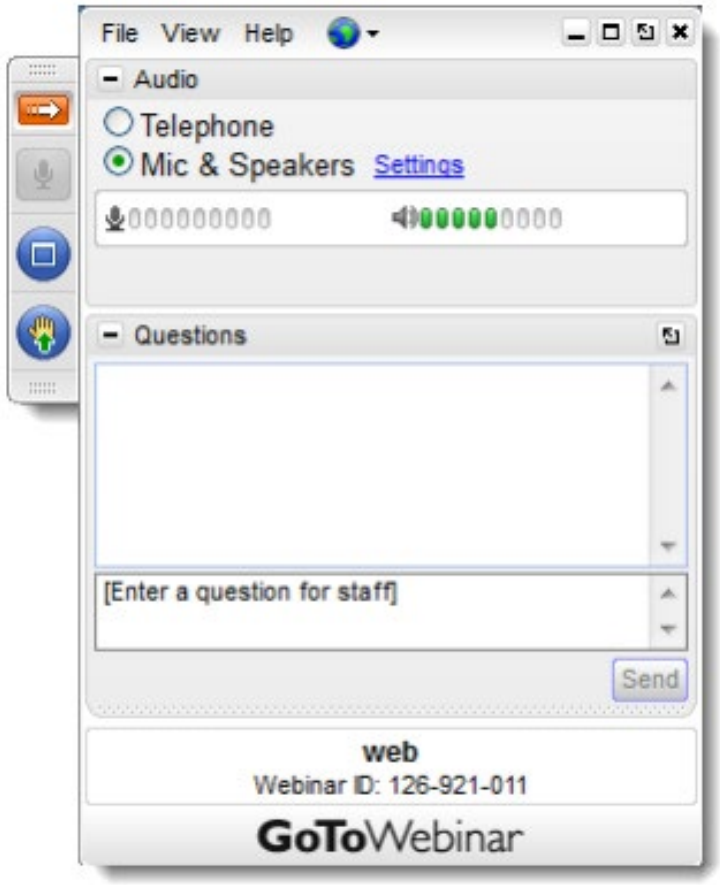
EXPLORING THE FUTURE OF HEALTHCARE WITH INNOVATIONS IN NFC TECHNOLOGY

Webinar

HOUSEKEEPING

- Control Panel:
  - You will be defaulted to Mute by the organizer.
  - Use the Questions Pane for comments or questions or any technical issues.
- Audio Pane: Use the Audio Pane to switch between Telephone and Mic & Speakers.
- Questions Pane: Post your questions for speakers
  - Questions will be answered at the end of the presentation, time permitting.



WELCOME AND INTRODUCTIONS

HEALTHCARE
TASK FORCE

NFC Forum's Healthcare Task Force

Our target is the promotion of NFC in the Healthcare industry. We want to share our enthusiasm on use cases and the added value this technology can generate.

Stefan Genser

Sales Director for RFID/Transponder Solutions, IDENTIV
Chair of the NFC Forum Healthcare Task Force

MEET THE SPEAKERS

Tania Guidet
STMicroelectronics

Dr. John Rogers
Northwestern University

Vincent Bouchiat
Grapheal

AGENDA

- About the NFC Forum
- NFC in Healthcare– Hear from industry leaders some of the inspiring ways NFC technology is making a positive impact on lifestyle and quality of life in healthcare
- Closing Remarks

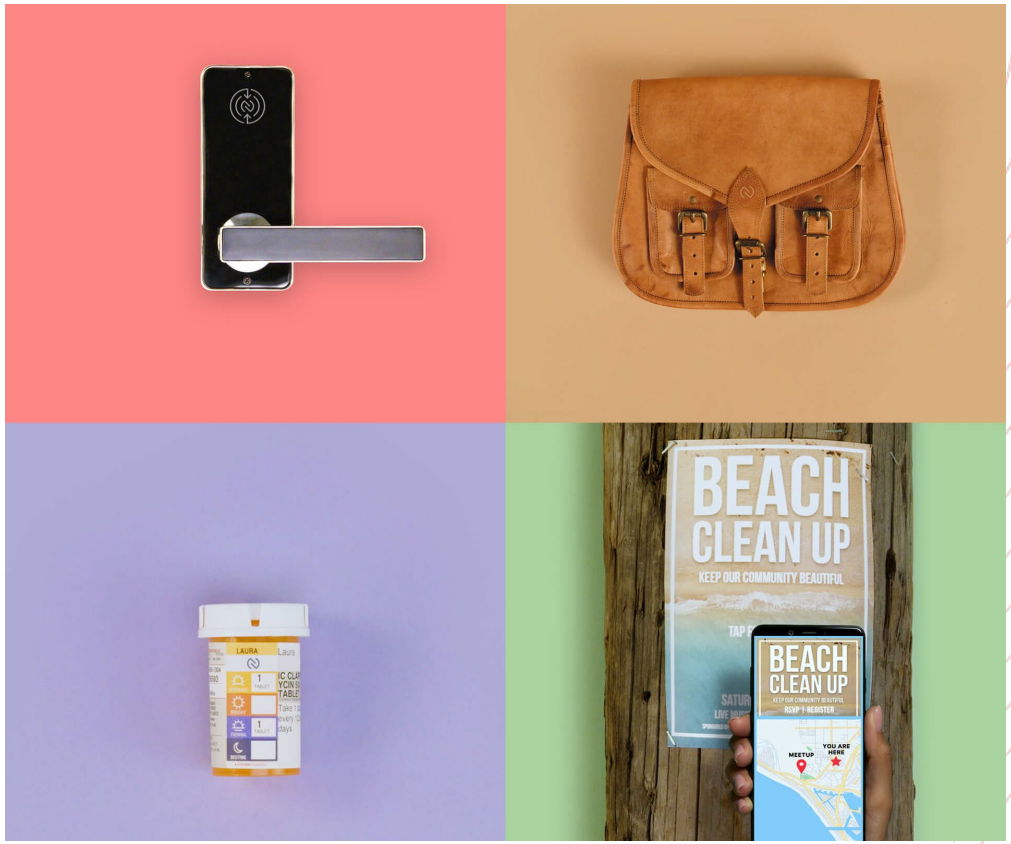
OVERVIEW OF THE NFC FORUM

CONTACTLESS ADVOCATES

The NFC Forum is comprised of **300+ member organizations** including some of the most familiar global technology and consumer companies who actively collaborate with dozens of adjacent technical bodies to deliver technology, transport, digital key, packaging, and automotive solutions.

ALL IT TAKES IS A TAP

Near Field Communication (NFC) is a standards-based, short-range wireless technology that makes life easier and more convenient. With a range of 2cm and the ability to share power across connections, NFC is finding its way into almost everything.



CONVENIENT & PERVASIVE

Key takeaways from a recent ABI Research report across nine different countries, covering a variety of age ranges revealed that:

- **85%** of consumers use NFC technology.
- Beyond mobile payments, **public transportation** is a key driver for contactless use cases.
- Also becoming increasingly important is **tapping** consumer products and unlocking doors.
- **Nearly half prefer using their mobile phone** or smartwatch over a contactless card.

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NFC can enhance healthcare experiences

Tania Guidet

NFC Product Marketing

STMicroelectronics

Various NFC use cases in Healthcare

Data logging

Parameter settings

Maintenance

Firmware upgrade

Pairing

NFC

…

Monitoring

Charging

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ISO/IEEE 11073 & NFC Forum PHD standards

AGENT

- Takes measurements (sensor)
- Simple (minimal HW)
- Limited power resource (small battery)
- Highly specialized
- Low cost
- Ex: Glucose meter, blood pressure monitor…

ISO/IEEE 11073-20601
PHD

NFC PHDC

ISO/IEEE 11073 'Core Standards'

10407 Blood Pressure	10417 Glucose	10408 Thermometer	….

20601 *Optimized Exchange Protocol*

BLE | NFC* | …

} Application Layer
(Device specialization (one for each device type)

} Transport and communication Layer

} Data link and physical Layer
*NFC defined in NFC Forum PHDC standard

MANAGER

- Receives measurements from one (or more) agent system
- High-end device
- Usually generic (handles many agents)
- Ex: mobile phone, computer system, health system

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NFC data transfer for personal health devices

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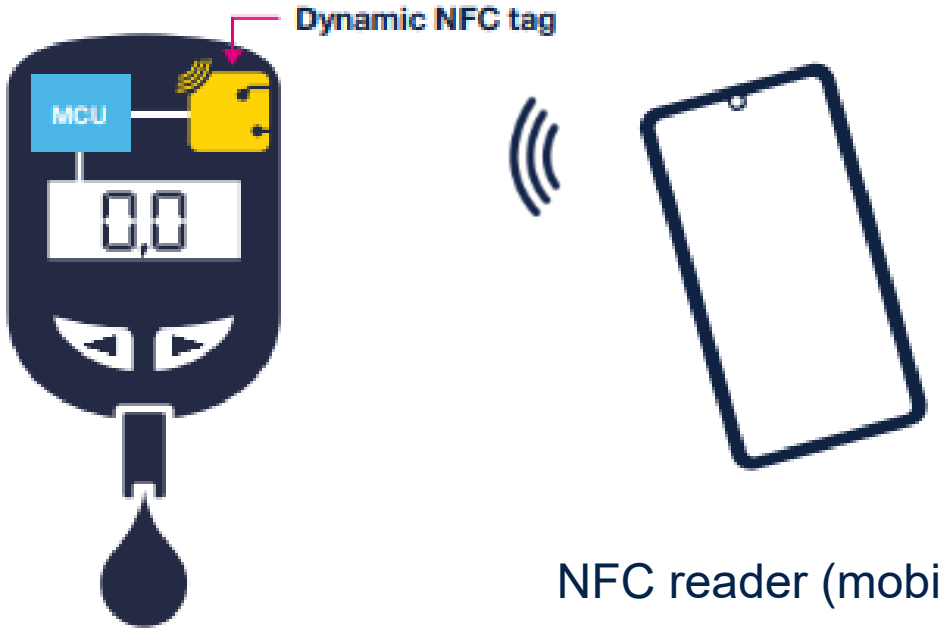
Examples of implementation of these NFC use cases

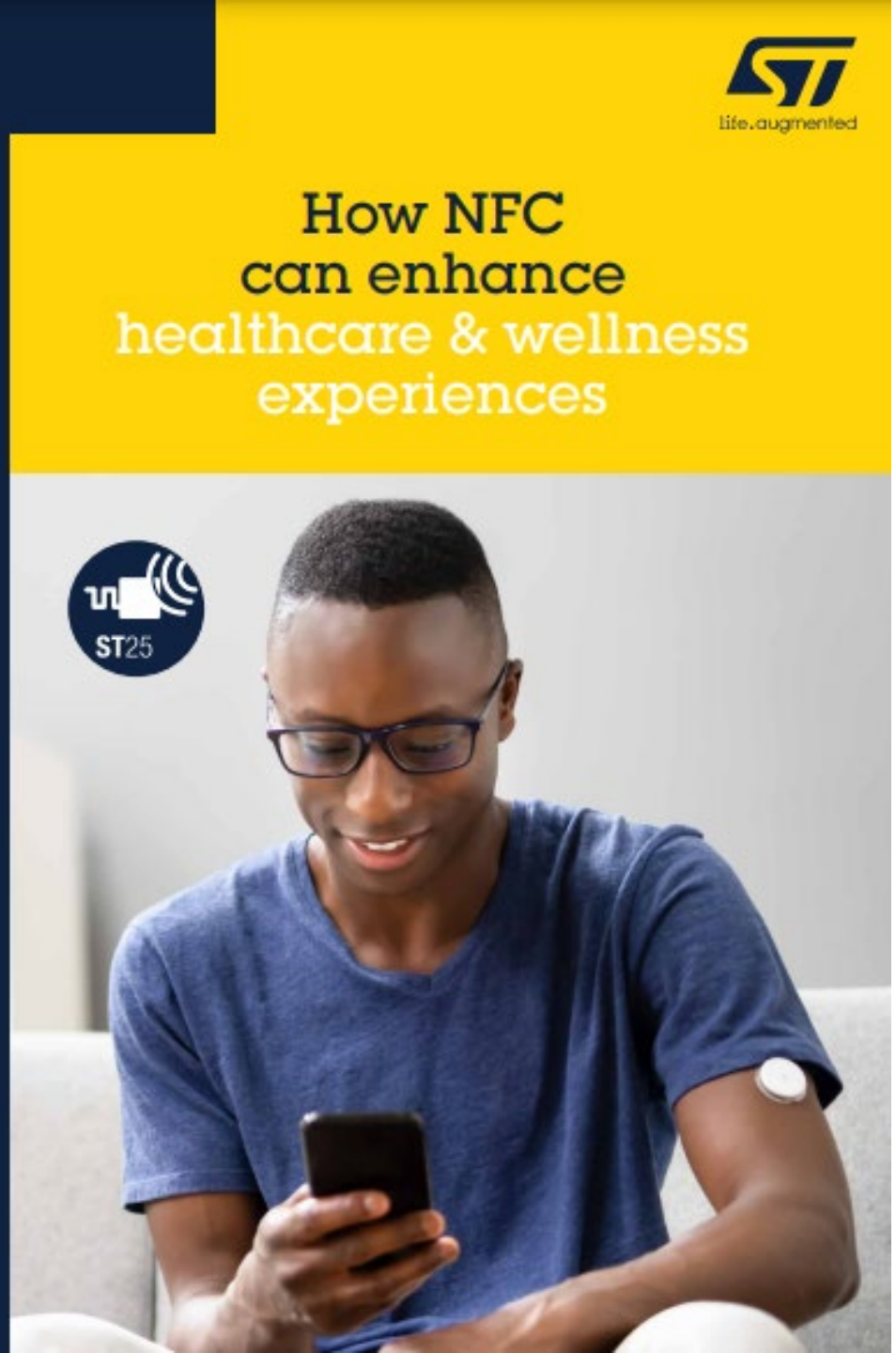
Dynamic NFC tag (ST25DV64KC)

- NFC Forum Type 5
- Memory EEPROM up to 64kbit
- Fast Transfer Mode
- PHDC compliant
- Low-power capabilities
- Energy harvesting



NFC-enabled glucose meter

NFC reader (mobile phone…)



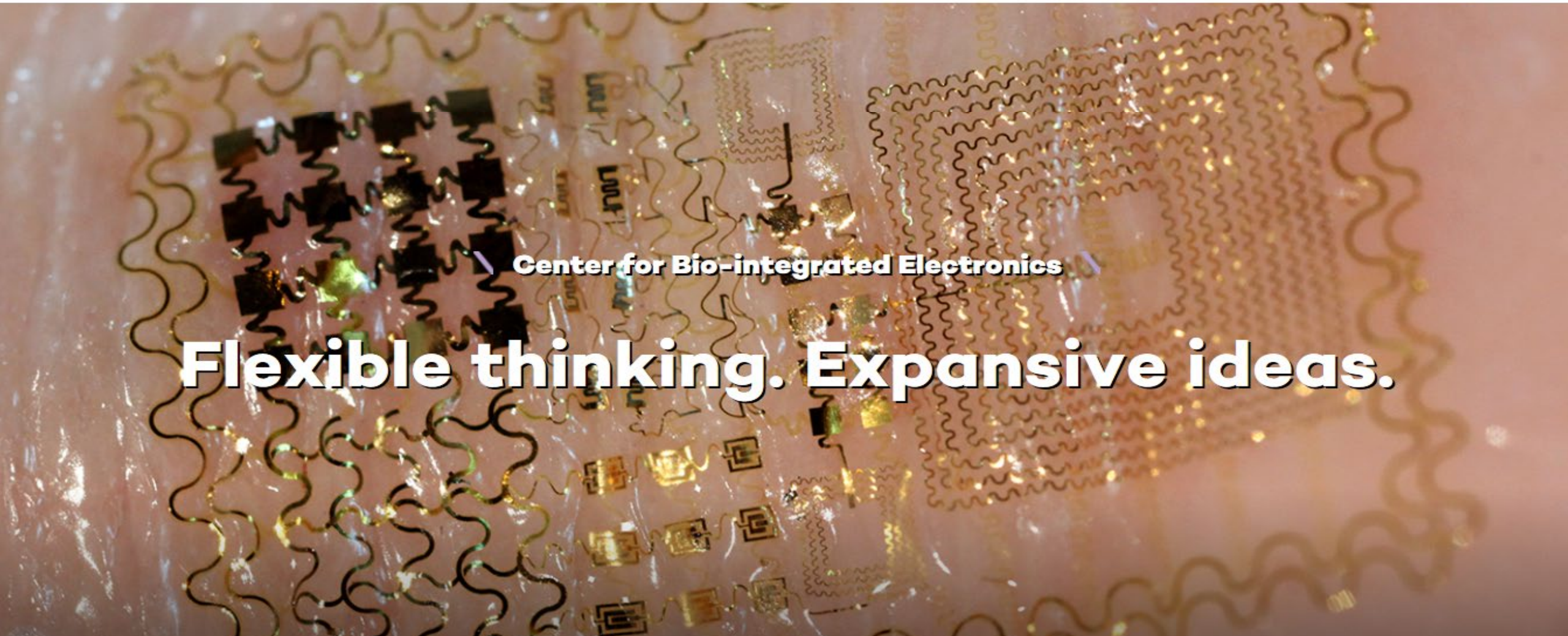
For more information

More at https://www.st.com/st25dv-i2c-series

Our technology starts with You

Find out more at www.st.com

life.augmented


Center for Bio-integrated Electronics
Flexible thinking. Expansive ideas.

LOUIS A. SIMPSON AND KIMBERLY K. QUERREY BIOMEDICAL RESEARCH CENTER AT NORTHWESTERN MEDICINE

Northwestern | McCORMICK SCHOOL OF ENGINEERING

Corporate Partnerships

Neonatal Intensive Care

Current → ***Future***

Wireless, Epidermal Vital Signs Monitoring Systems

Science **363**, 6430, eaau0780 (2019).

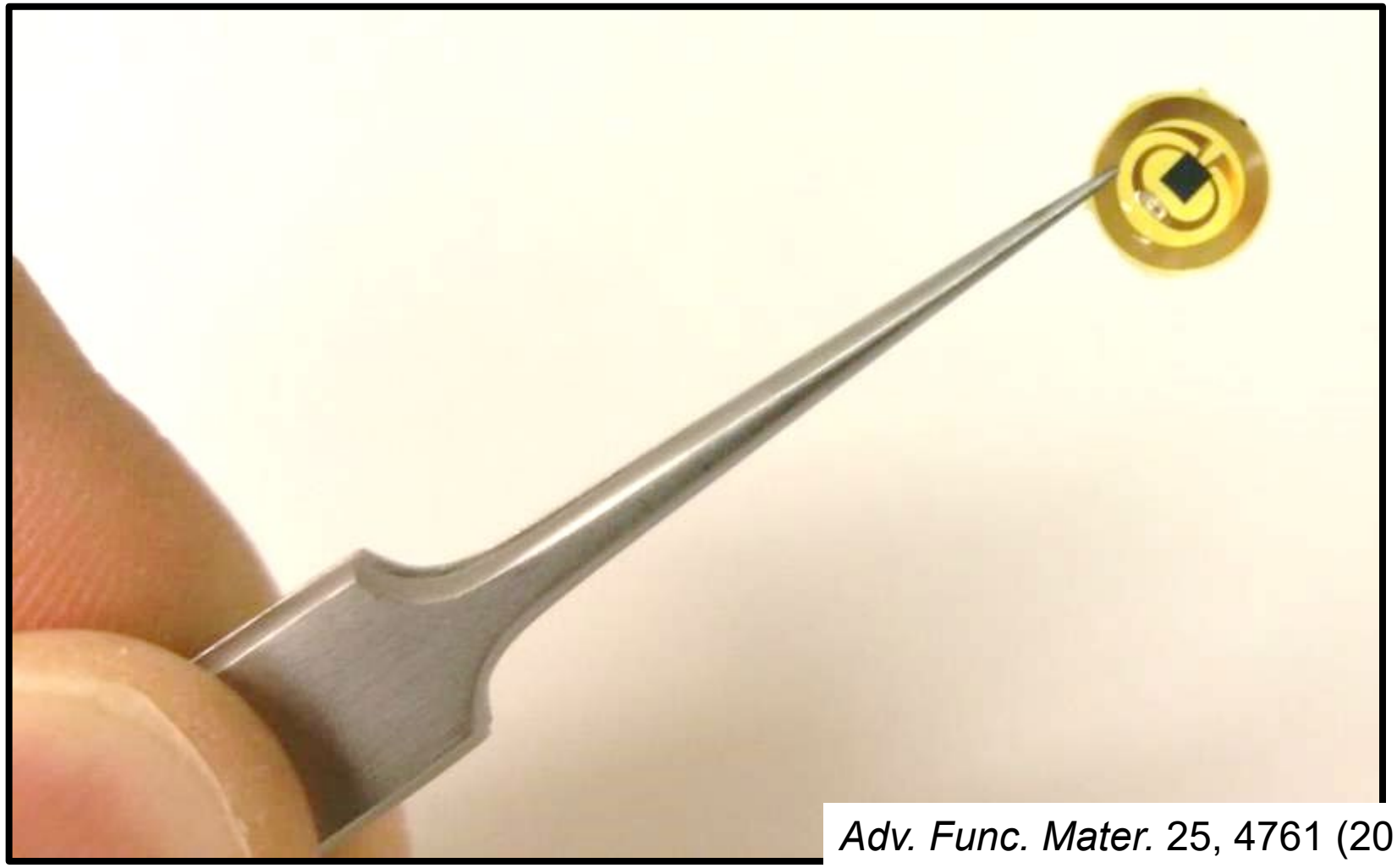
Science **363**, 6430, eaau0780 (2019).

Soft, NFC Electronics for Skin Hydration Measurements

Sci. Adv. **6**: eabd7146 (2020).

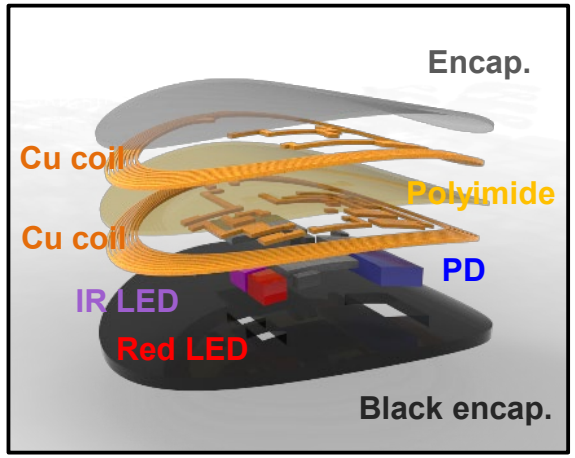
Ultra-Miniaturized Wireless Wearables

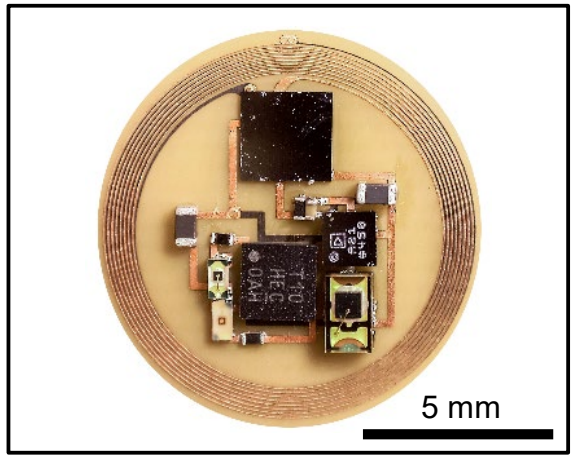
Thin, flexible, millimeter-scale NFC technology



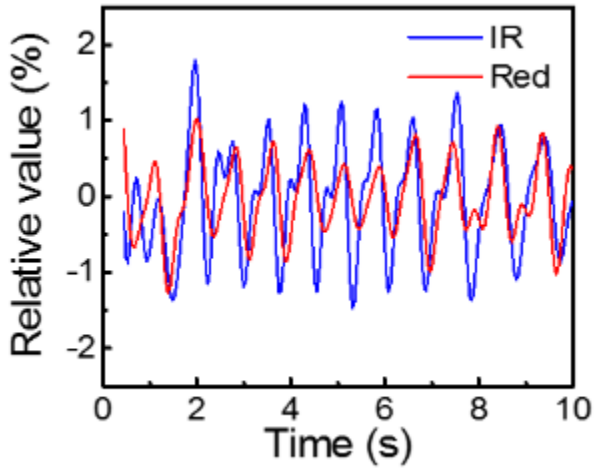
Adv. Func. Mater. 25, 4761 (2015).

Advanced Health Apps – Heart Rate, Blood Ox

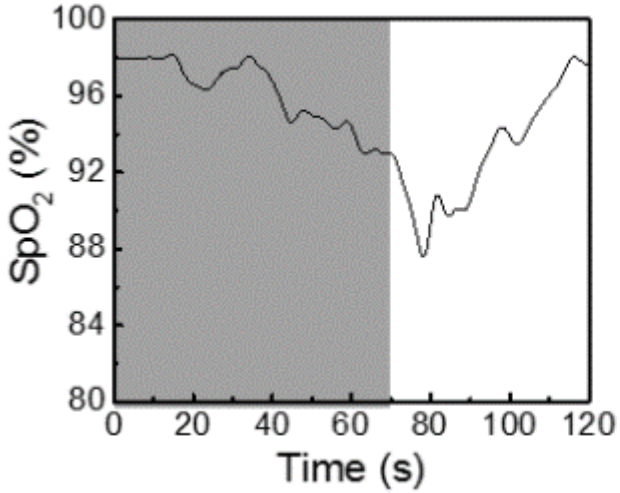




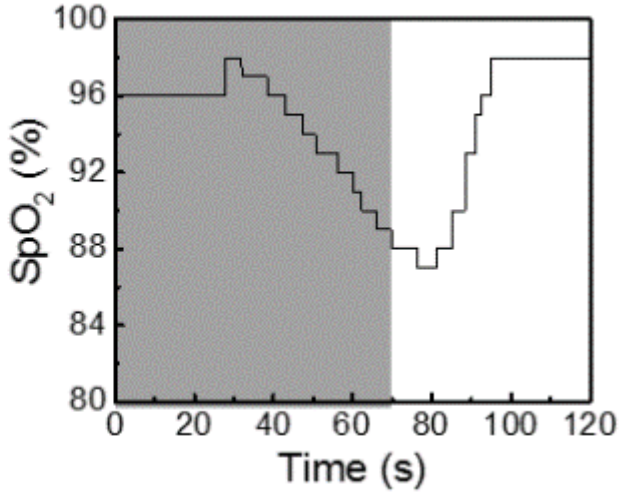
HR, HRV



Oximetry - Fingernail



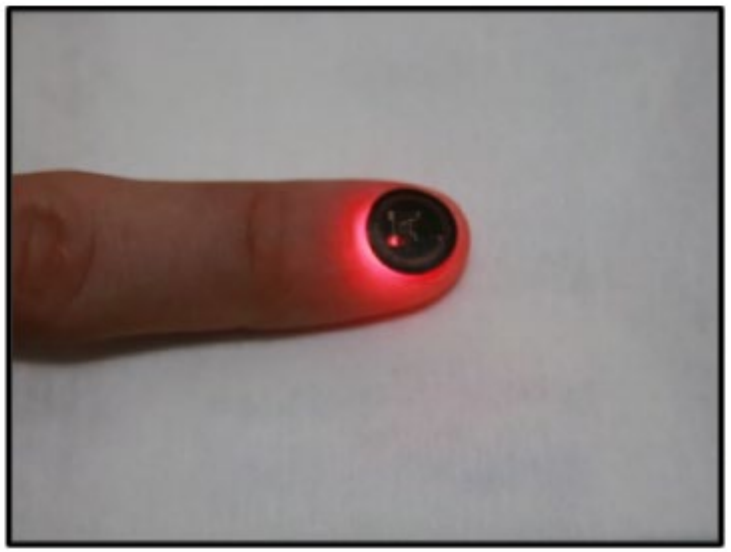
Oximetry – Clinical Std



Adv. Func. Mater. **27**, 1604373 (2017).

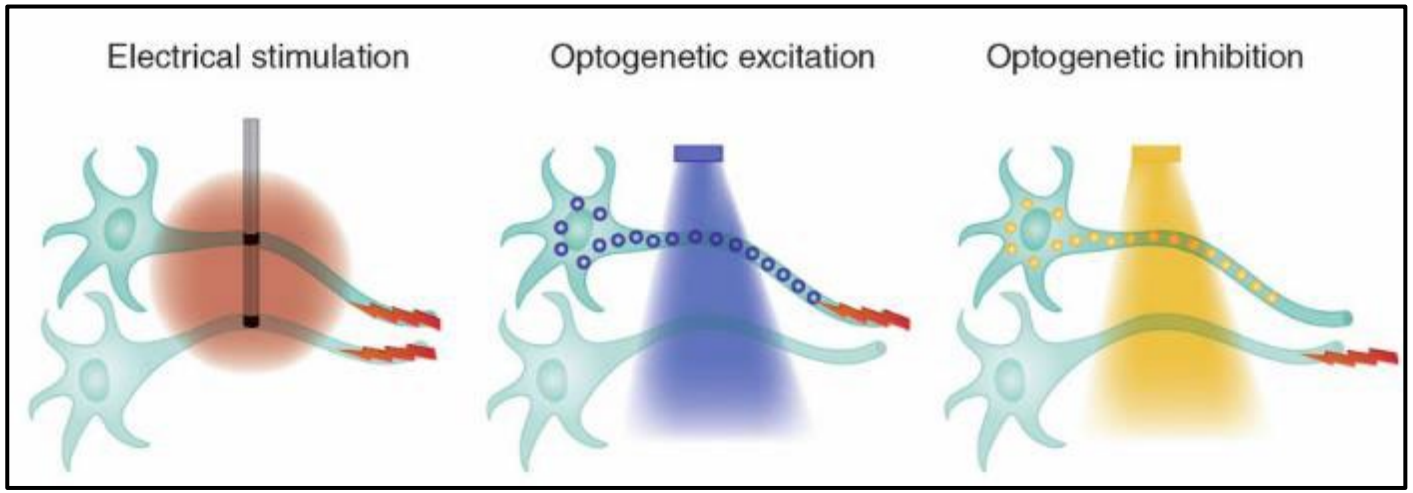
Demonstrations

SpO_2	Mean (%)	STD
Subject 1	99.9	0.1
Subject 2	98.6	0.6
Subject 3	98.9	0.6
Subject 4	99.8	0.3
Subject 5	99.1	0.2
Subject 6	99.8	0.4



Adv. Func. Mater. **27**, 1604373 (2017).

Optogenetics for Control of Brain Function

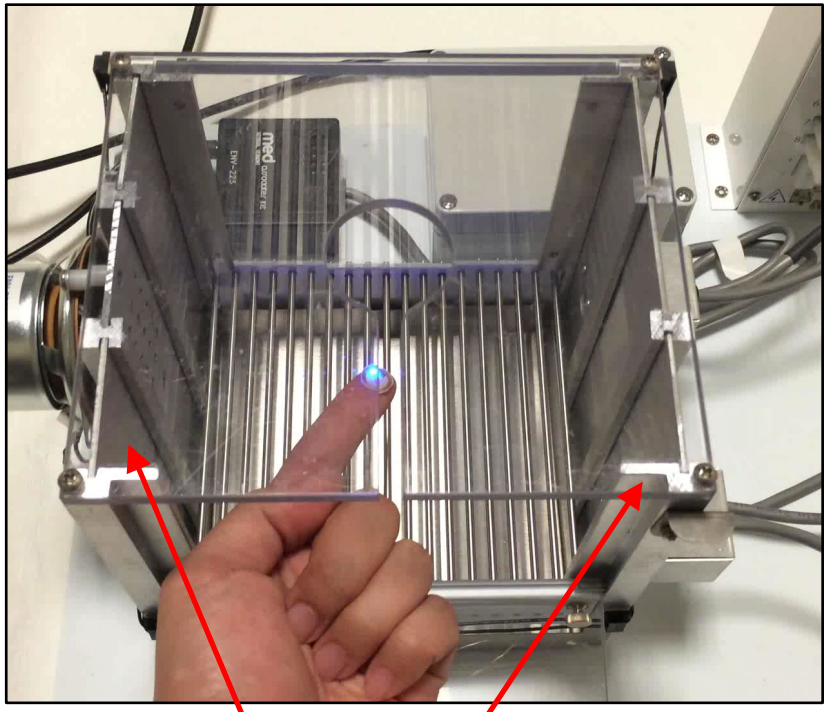


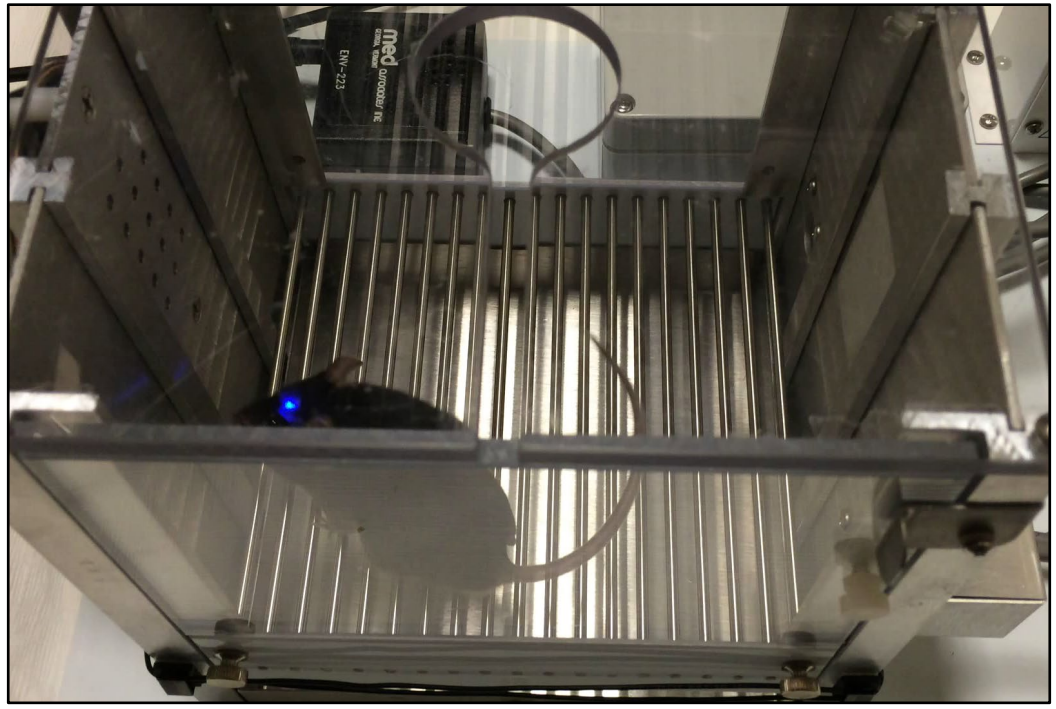
Nature Meth. **8**, 26 (2011)

Low Cost, Manufactured Devices for Wireless Optogenetics

unpublished

Uninterrupted Wireless Operation in a Metal Operant Box





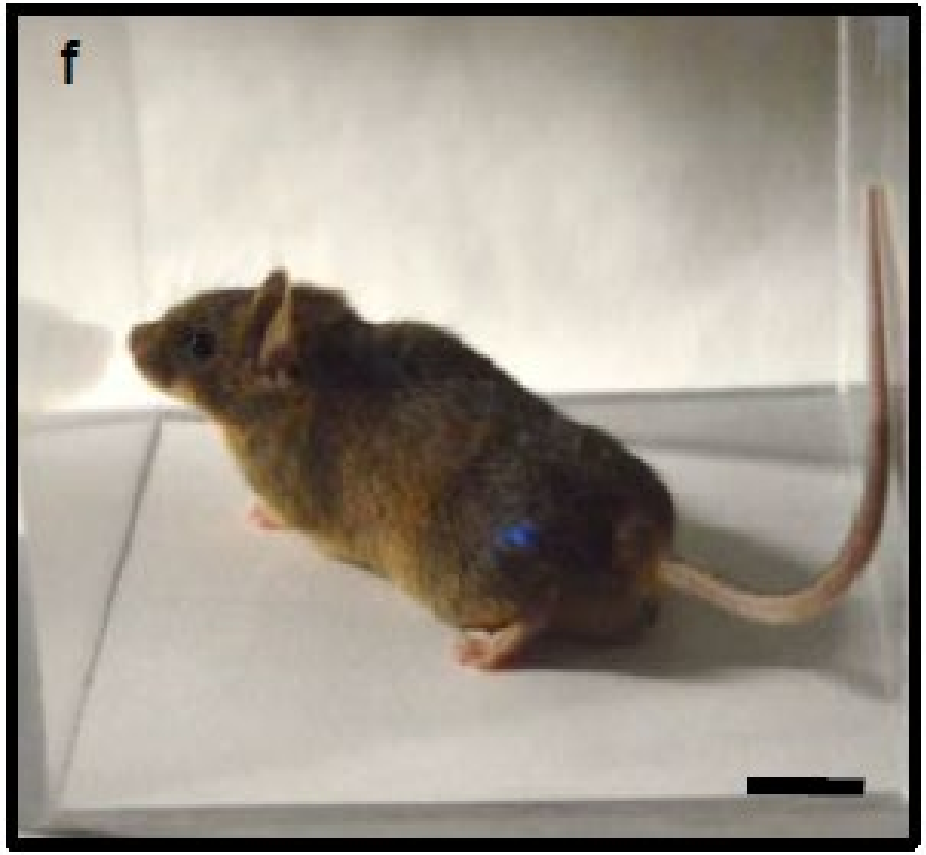
(implanted 3 months ago)

- Long-range operation: Up to ~ 40 cm from the antenna
- Wide usability: Low sensitivity to metal, water, environmental props

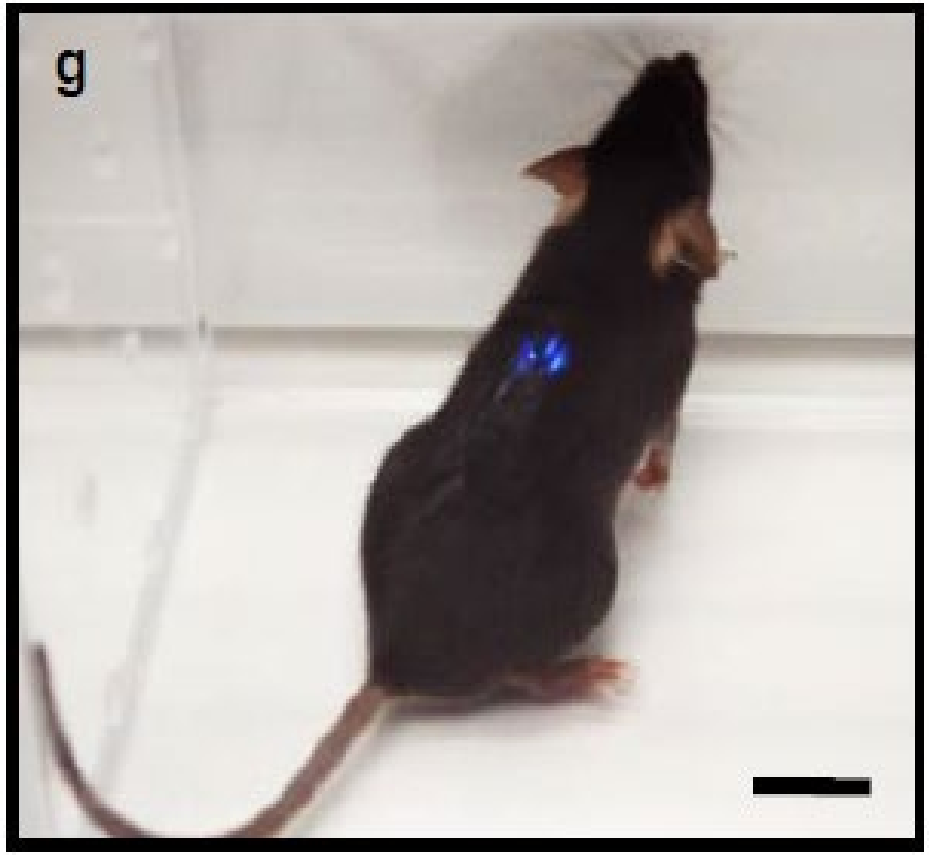
Neuron, in press

Fully Implantable Wireless Optogenetics

Sciatic Nerve



Spinal Cord

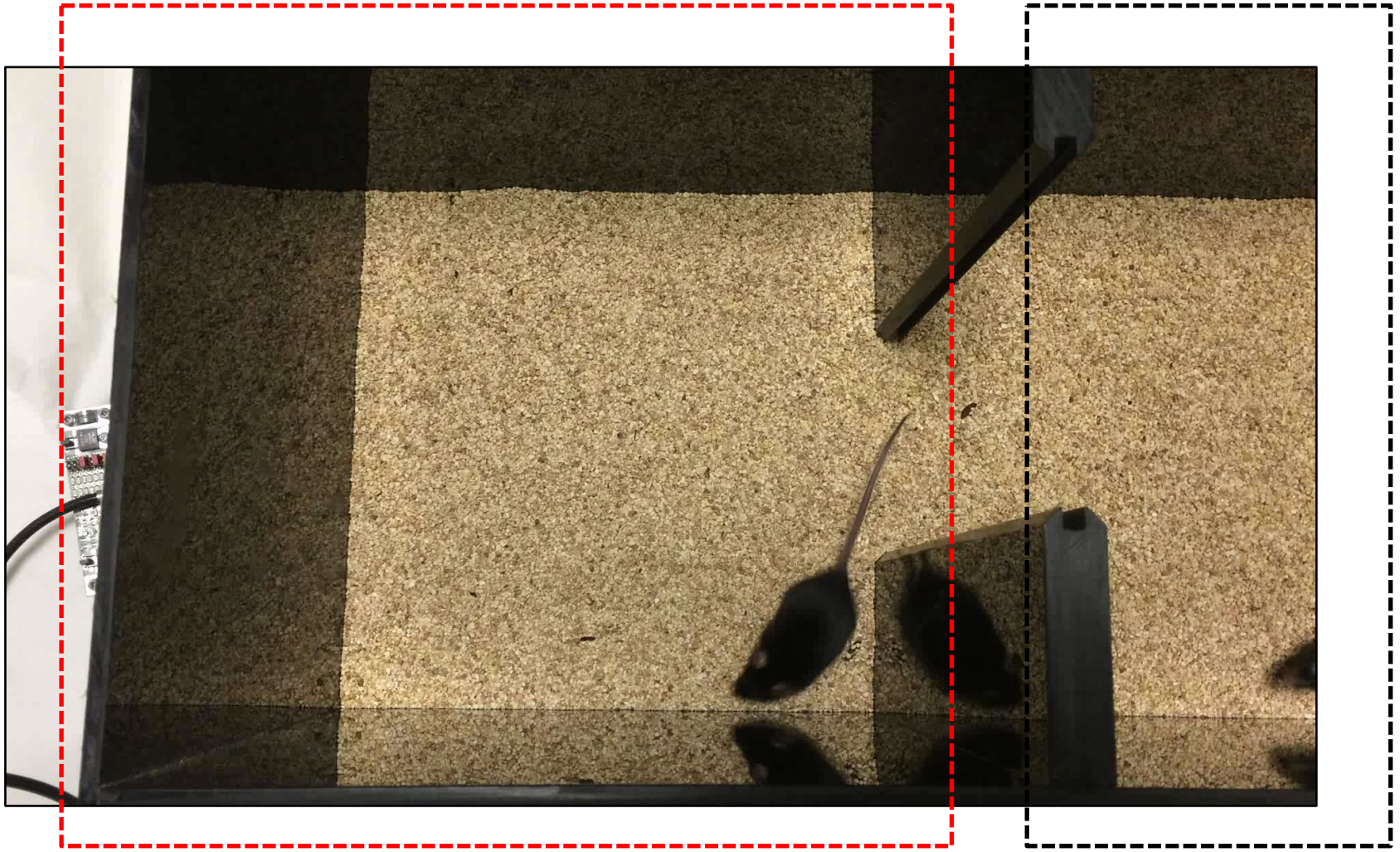


Nature Biotechn. **33**, 1280 (2015).

No Measurable Impairment of Locomotor Behavior

Nature Biotechn. **33**, 1280 (2015).

Operation w/ Multiple Animals in a Place Preference Box



Stimulated **Non-stimulated**

Neuron **93**, 509 (2017).

QUERREY FOR BIOE

NeuroLux

http://www.neurolux.org/

thwestern

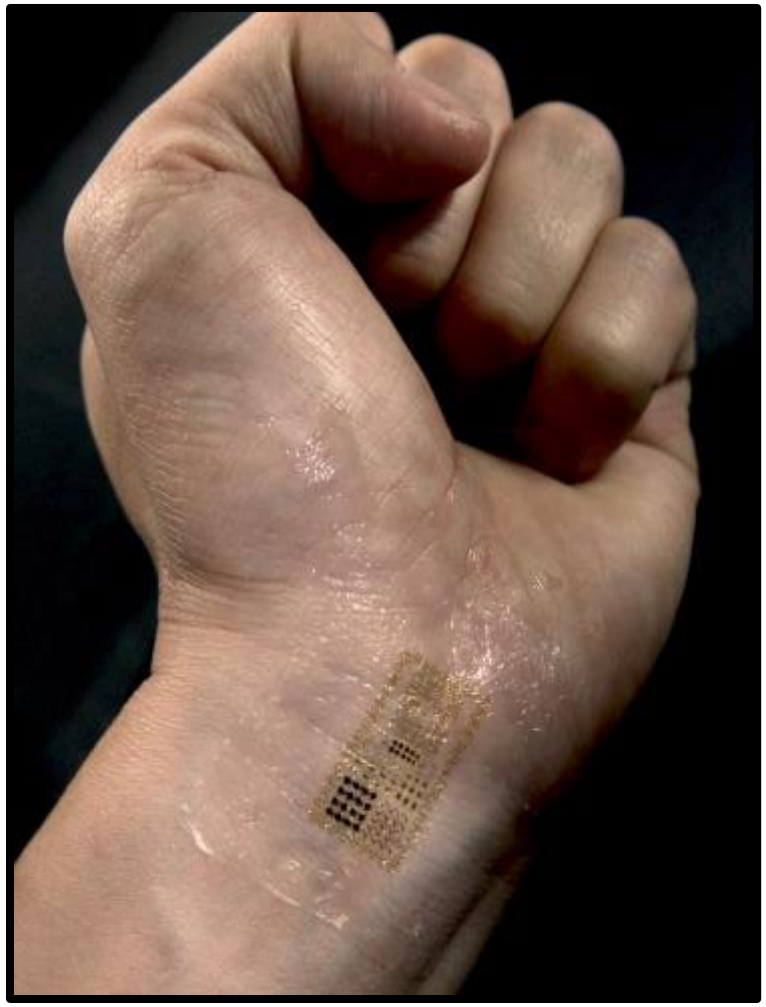
Disposable Wireless Optoelectronic Implants for Optogenetics

Launch @ SFN – Nov 2016

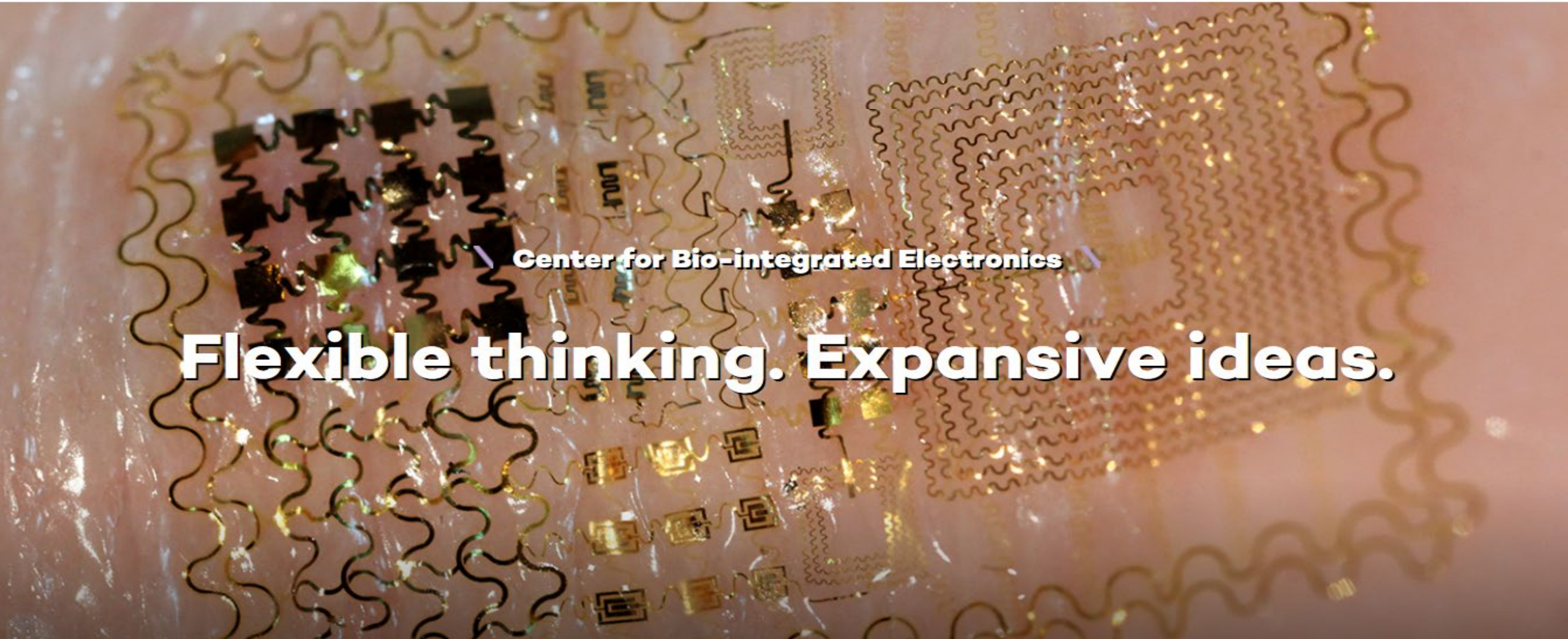
>350 systems deployed, worldwide; >25k implants

NFC-Based Wearable Devices:
Stretchy and mm-Scale

Skin



Fingernail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Flexible thinking. Expansive ideas.

NFC-coupled Biosensors for Field Tests and Monitoring

Grapheal

Prof. Vincent Bouchiat

CEO /Co-FOUNDER of GRAPHEAL

Grenoble, France.

Digital Biosensing

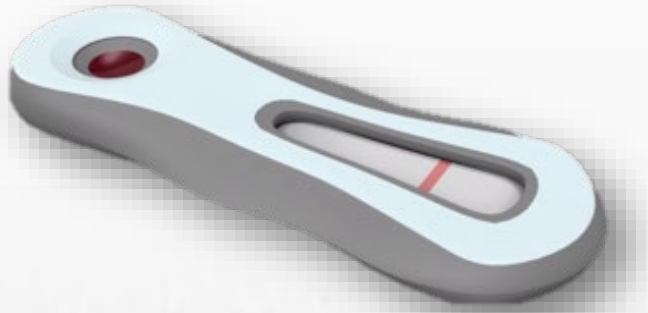
Wireless & Continuous Monitoring

Instant Sensitive Diagnosis

Today, field Diagnostics are still Inefficient & Costly in a digital world

Data Quality & Connectivity

Not Accurate w/o Connectivity



Data Throughput

Slow , not Digital, manual inputs

Cost-Efficiency

Speed

Sample Integrity

High precision but **Slow** , **Costly** + **Logistics** issues

NFC ICs enable digital solutions for an easy, fast, cost-effective, secure, and real-time data collection in the field

Financial data

Health data

94 % of the world population own or has direct access to a smartphone connected to the internet, capable of acquiring, processing, and securely communicating meaningful health data.

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Novel solutions are requested for fast and affordable tools for diagnostic and follow-up at the point-of-need

Efficient pathology detection outside the lab is required to support caregivers within a decentralized and digital healthcare system

Hospital at Home / Remote patient monitoring of chronic diseases

Rapid molecular detection on site

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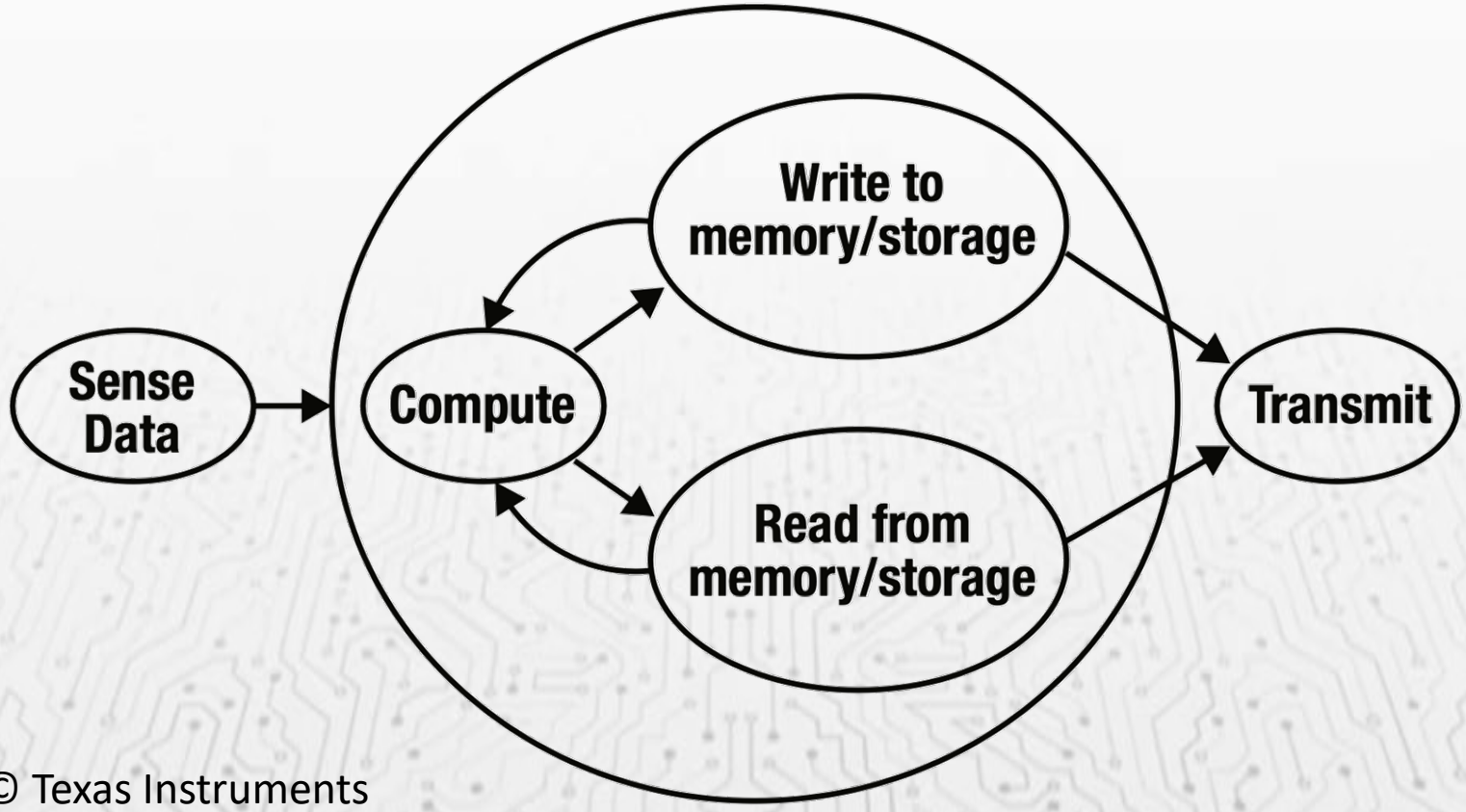
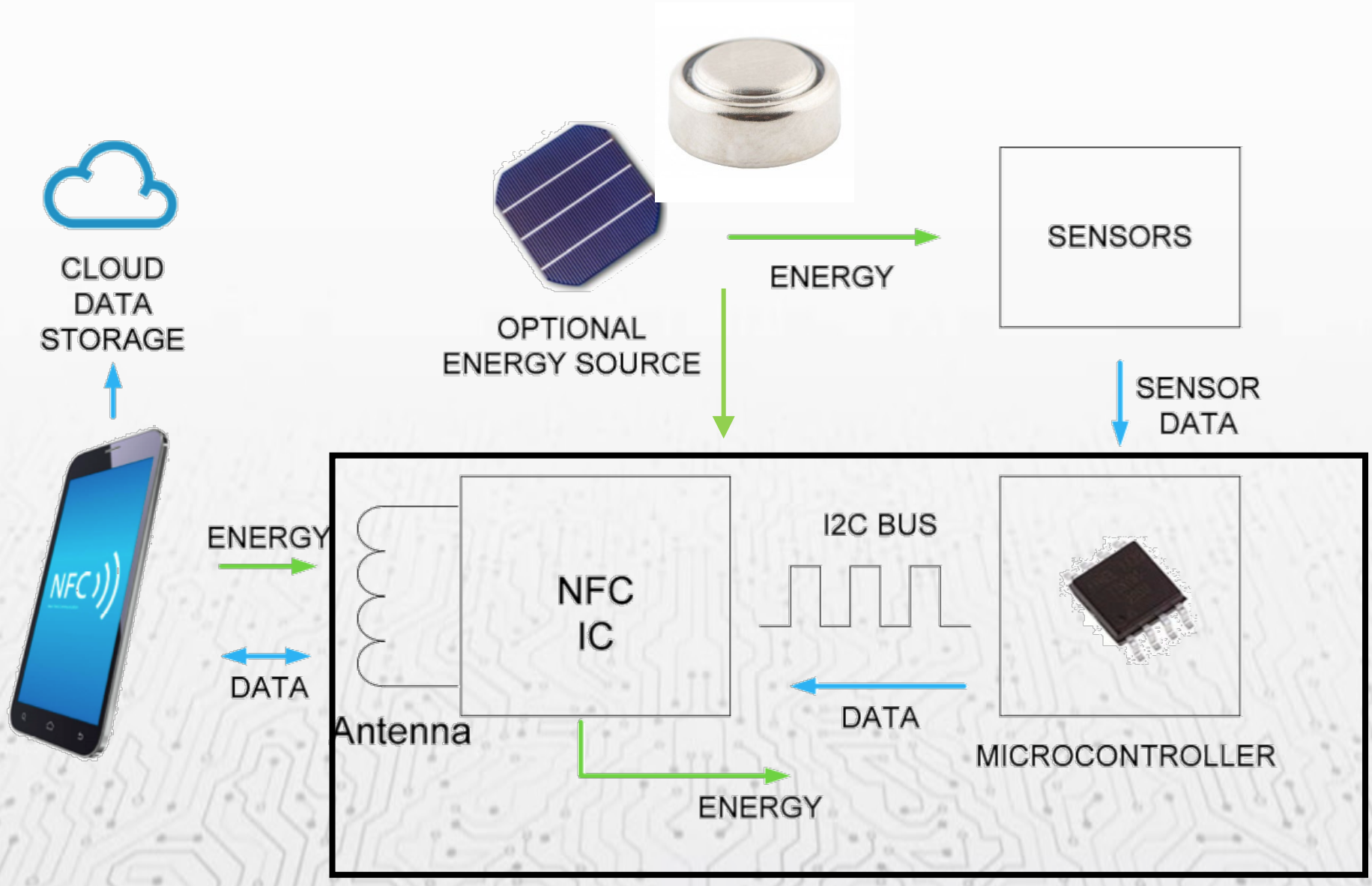
Data Process Flow for data Acquisition in the Field



NFC Solutions for data Acquisition in the Field



Lazaro et al. Sensors (2018), ***18*** (11), 3746

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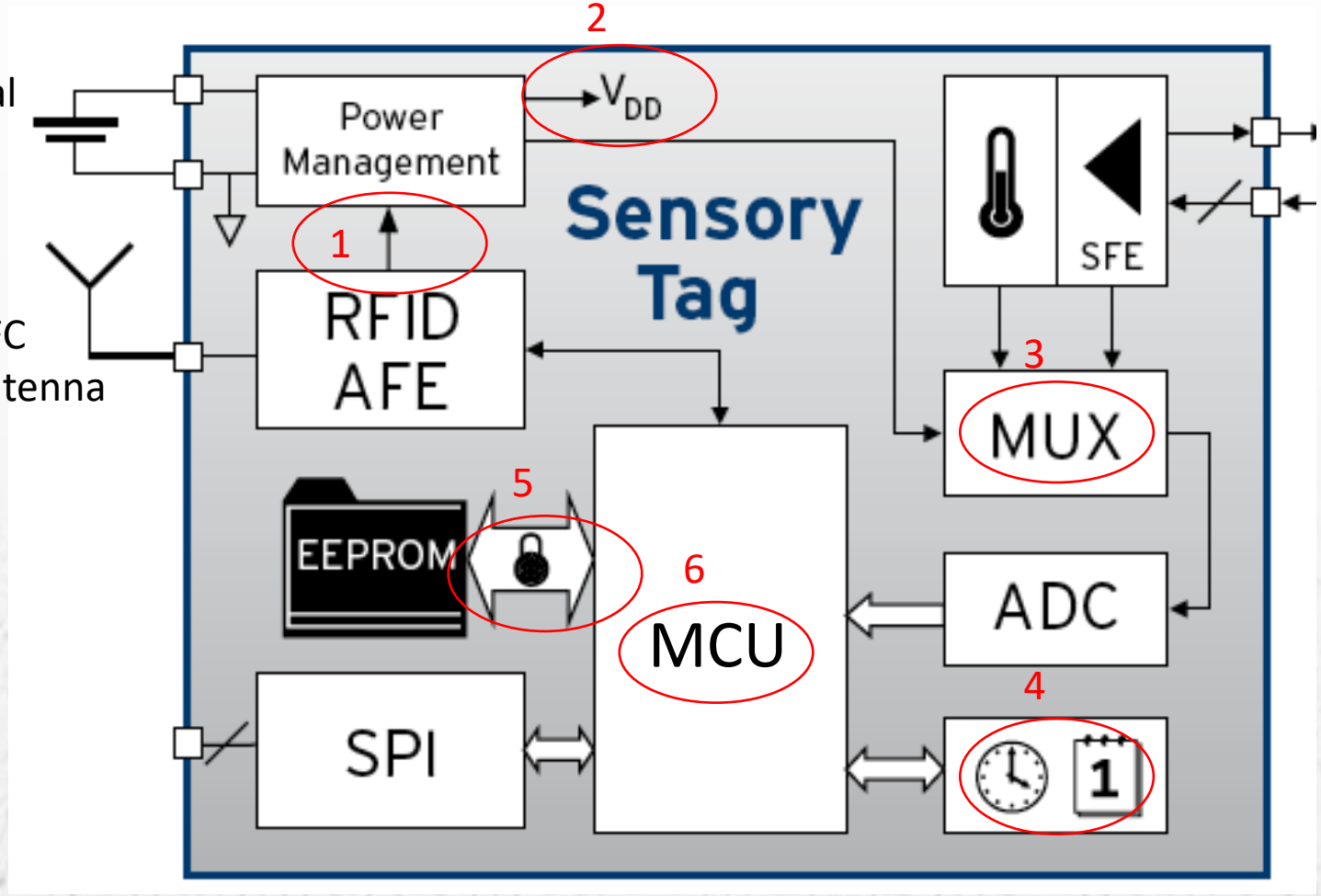
Single IC « System-on-chip » ideal for Sensor Acquisition



Key features : Unique ID

1. Energy Harvesting
2. Sensor powering
3. ADC Multiplexing
4. Time logging
5. Data storage Encryption
6. Data processing capabilities

Importance of the MCU firmware as it becomes the key part of the medical device (diagnostic made on chip , not in App)

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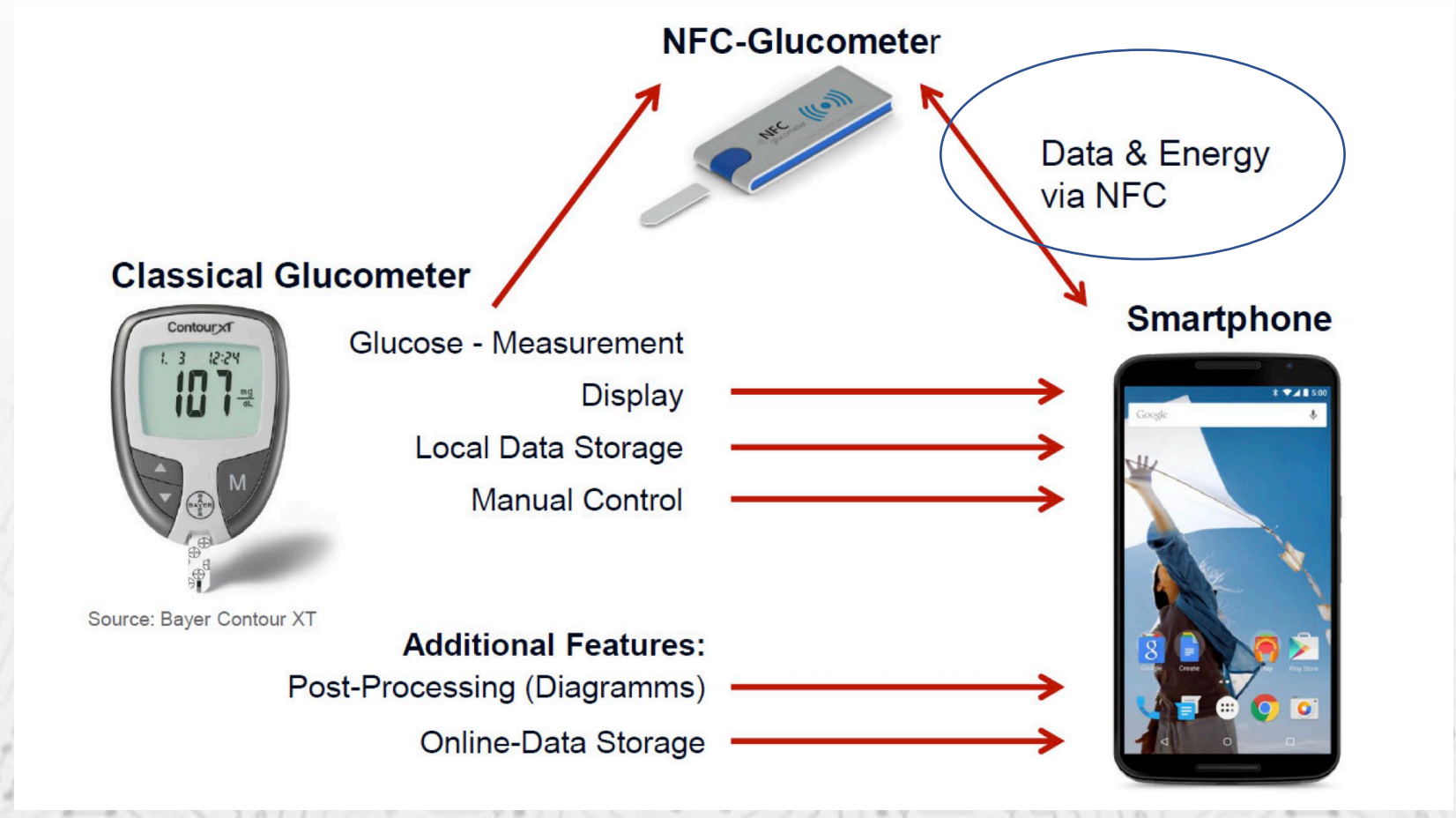
First large scale use of NFC for Health Data acquisition / transmission : The CGM revolution

Continuous Glucose Monitoring



C. Matoschitz et al. / Procedia Technology 27 (2017) 44 – 45

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Benchmarking NFC sensing Solutions Vs other RFIDs

Property	Chipless RFID	NFC	UHF RFID	Bluetooth BLE
Typical read range	<50 cm frequency coded 2–3 m, time-coded UWB	1–2 cm for proximity cards with energy harvesting, 0.5 m for vicinity cards	Up to 15 m with inlay tags with −22 dBm read IC sensitivity. Up to 3 m UHF sensors (with −9 dBm read IC sensitivity). Up to 30 m BAP.	10 m
Power source	Passive	Passive or semi-passive	Passive or semi-passive	Active
Tag price	Moderate	Low	Low	High
Reader cost	High, no commercial	Low, smartphone	High, $1000–$2000	Low, smartphone
Standard	No	Yes	Yes	Yes
Universal frequency regulation	No, often used UWB	Yes, ISM	No, by regions	Yes, ISM
Tag size	Large	Medium	Medium	Small
Memory capacity	<40 bits	<64 kilobits	96bits EPC, typically 512 bits for users (<64 kbytes)	Several kilobytes depending on the microcontroller
ID rewritable	No	Yes	Yes	Yes
Energy harvesting	No	Approx. 10 mW	Few µW	No
Tag substrate	Low loss microwave substrates	Low cost or FR4	Low cost or FR4	FR4
Tag flexibility	Depends on the substrate	Depends on the substrate	Depends on the substrate	No
Tag robustness	High	Low (inlays)	Low (inlays)	Moderate

NFC enables direct power/communication with mobile and suppresses the need of a dedicated reader commonly found in Point-of Care Devic

- Reduces costs , maintainance
- No battery (energy harvesting from the smartphone)
- Improves ergonomy
- Improves access in remote areas.
- Enables auto-testing by the patient

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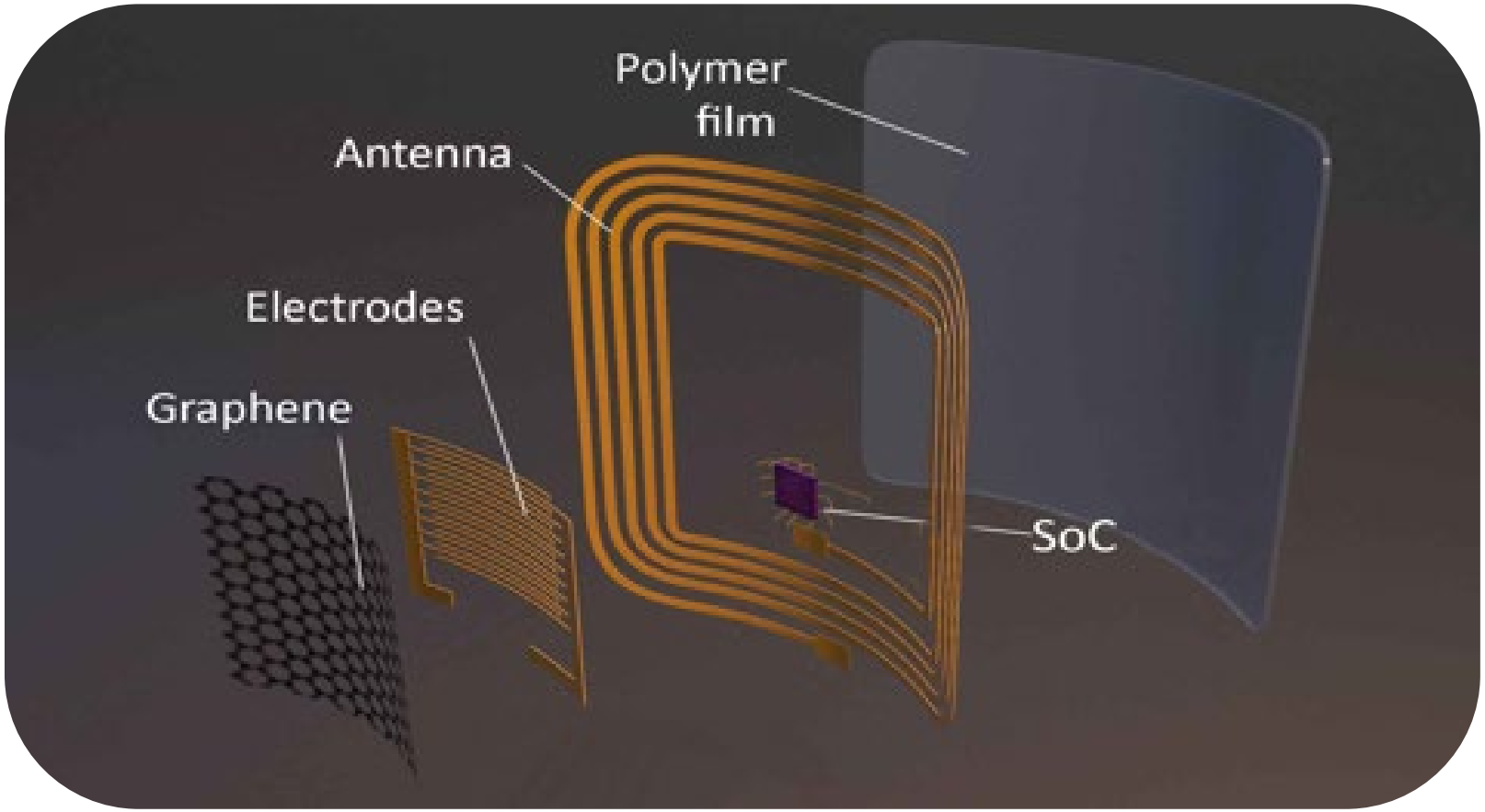
Flexible sensor patch



wearable biosensors, **digital** by design, **minimalistic** in components, with capabilities to detect and **dose molecular** biomarkers & pathogens and follow their **evolution** anywhere with a simple **smartphone**.

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WoundLAB™

Real-time wound monitoring
Protect the healing process
Alert on infections and moisture levels

Wearables for Wound Care Management

- **Medical Cloud**
- **Telehealth Services**
- **Remote Monitoring**
- **Hospital At-Home**

Example of "smart bandage" use case

Patients

WoundLABΓ Smart patch

pH, Temp, Wound Exsudates Biomarkers

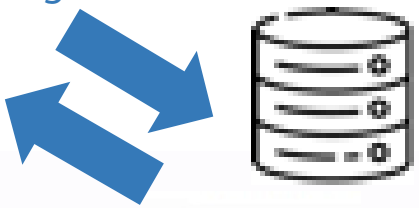
Hospitals and Nurses

Data sent to Cloud

TeleHealth Services

AI Engine

1. Better Outcome
2. Prognosis



Sensor Cloud

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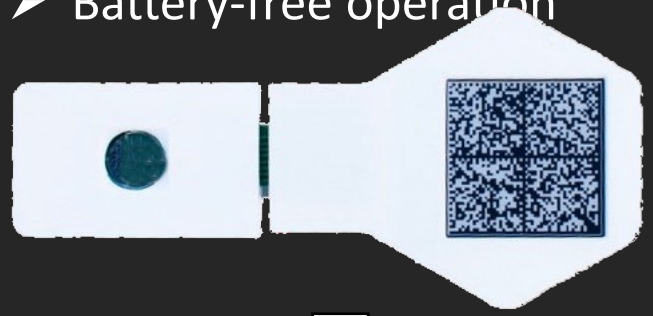
TestNpass™

Screening and triage of infected personnel and users

- Results in less than 200s
- Digital data encrypted on-chip
- Battery-free operation

CES INNOVATION AWARDS 2022 BEST OF INNOVATION



Delivers a tamperproof digital NFC Pass ‘certifying current COVID status’

Ultrafast Digital Antigen Test

In Vitro implementation : TestNpass diagnostics (Dx)

Providing Fast and tamperproof digital evidence of the test

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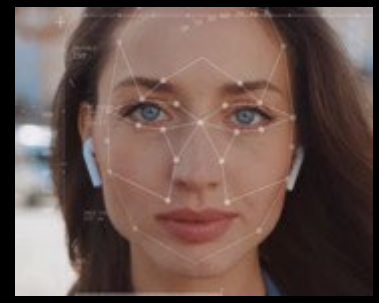
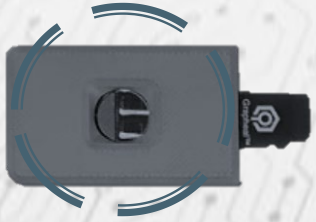
The same NFC IC chip has 2 usage :
Firstly the NFC **powers the biosensors** And **ensures**
secure communication between the smartphone App and the MCU
-> Energy harvesting prevent the use of battery

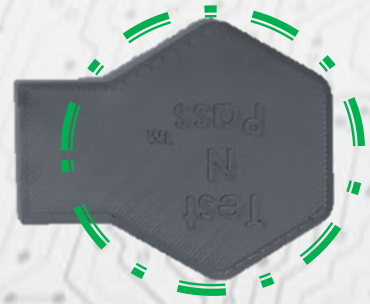
Secondly (after the test is done) the **NFC provides a pass**
(nfc token) which is a **digital evidence of the test**
-> encryption and biometric protection ensures fast check
The NFC Sensing chip can be further recycled for another use



Optional Biometric protection
GDPR-compliant



DisposableBiosensor



ReusableNFC tag
NFC energy harvesting

On-site and tamperproof
On-chip data

Take-home messages

By combining energy harvesting, interoperability with mobile technologies and sensing capabilities, NFC solutions are extremely suitable for health data collection in the field, at the point of use, by both patients and by caregivers.

NFC ICs coupled to new generations of wearable sensors (such as those produced on flexible printed electronics) are giving rise to a new generation of patient monitoring solutions with minimal e-waste and reasonable cost.

Safe by design NFC ICs enables novel use cases:

- Acquisition in the field / continuous data monitoring
- Secure storage & processing of health data
- Tamper-proof digital evidence of a health condition

Sensors coupled to NFC are addressing unmet needs by directly coupling a wide range of data directly to smartphones. **NFC is becoming the medium for biomarker dataprovider** and therefore a key asset for **Precision Medicine.**

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CLOSING REMARKS

BECOME A MEMBER

The NFC Forum offers four membership levels designed to match your organization's interests and market plans. All levels provide excellent business networking and time-to-market opportunities.

- **Adopter** . Our entry-level membership for access to networking and market requirements discussions. No Annual Dues.
- **Associate** . Monitor and influence key work items and specifications for the NFC Marketplace.
- **Principal** . Strategic level of leadership, participation and influence of NFC Forum deliverables and 1st Party Testing Privileges.
- **Sponsor** . Shape the mission and direction of the organization at all levels and for every market. Includes Board seat.

ENGAGE WITH THE HEALTHCARE TASK FORCE

Highlights for 2023

Use case-focused events to talk about challenges in the market and how to overcome them using NFC technology. Get informed, discuss with experts, and share your experiences with us!

Upcoming use cases:

- **Smart Diagnostics**
- **Patient Interaction**
- **Anti Counterfeit**

Follow NFC Forum's social channels for updates:

- …LinkedIn
- …Facebook
- …Twitter

LEARN MORE ABOUT NFC

Visit the NFC Forum website and
social channels for all the latest news!

THANK YOU! QUESTIONS?

@nfcforum