Introduction

Jeppe Hinrichs, background in electrical engineering

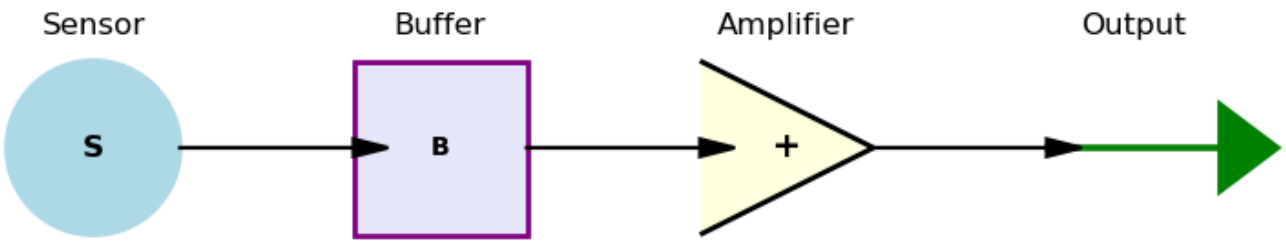
Currently in DkCCC/NL as a process specialist

Prior experience as a researcher in biomedical microsystems laboratory

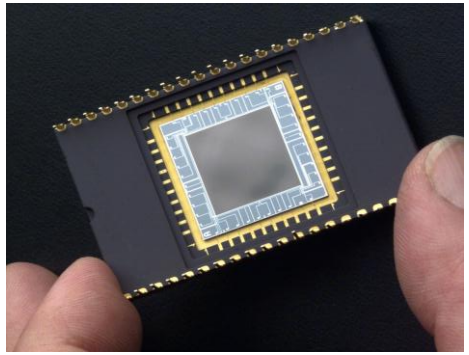
My agenda: Integrating sensors with microelectronics

Transistor enhanced sensors from DTU NL

- Current: MOS capacitor fabrication
- Goal: Fabricate FET structure and validate with characterization
- Target: High-performance, flexible, multi-functional sensors



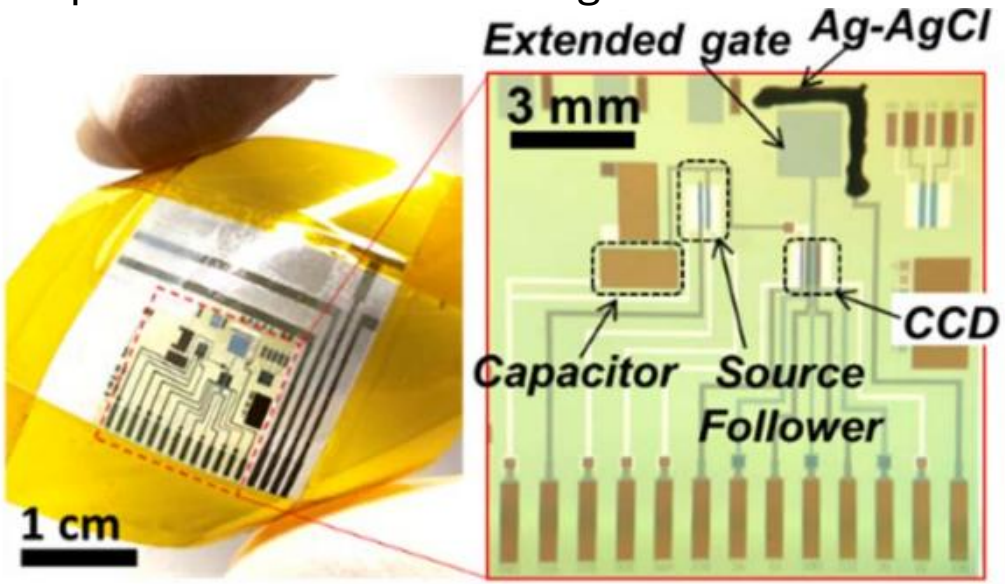
- Previous sensors from NL include:
  - Temperature
  - Humidity
  - Pressure
  - Light
  - Sound
  - Ultrasound transducer
  - Accelerometer
  - Chemical/Nose
  - Magnetic field



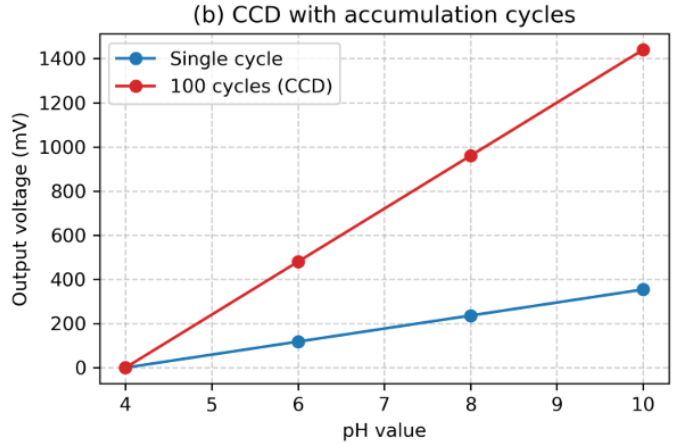
Example of Benefits

- Broad benefits of transistor integration with sensors
  - Signal amplification – Boost weak sensor signals before degradation by interconnects
  - Higher sensitivity – CCD/FET architectures can use electronic control for increased resolution
  - Miniaturization – reduced need for external electronics
  - Multi-parameter sensing – Allows integration of different sensing modalities

Example of a pH sensor with CCD integration to beat Nernst limit



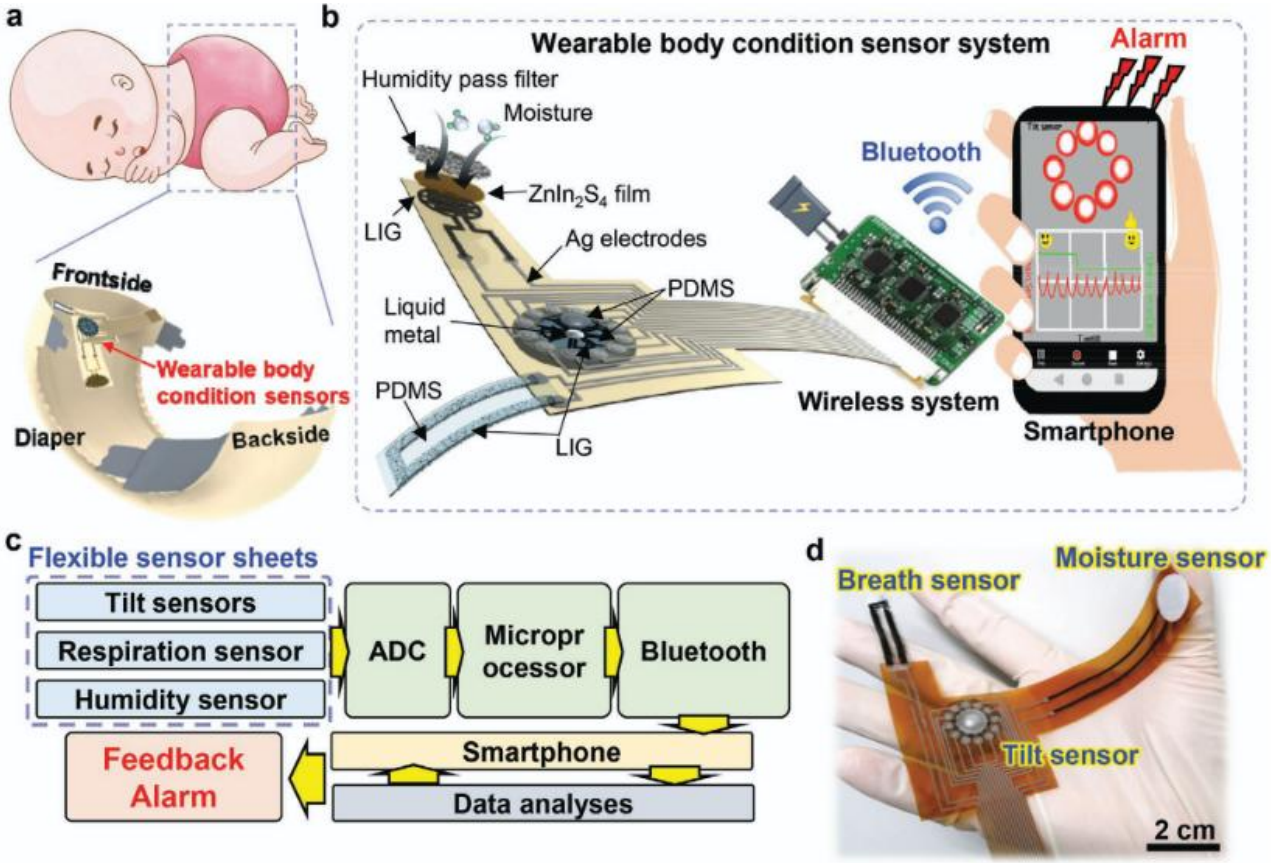
(10.1109/TRANSDUCERS.2019.8808504)



Future potential

- Expand to chemical, biological, and physical sensing
- Physical modalities
  - Wearable
  - Implantable (if biocompatible)
  - Environmental monitoring
- Compact, flexible, multi-sensor platforms

Example of a multisensor wearable to prevent SIDS:



(10.1002/adma.202008701)

Next steps and anticipated timing

- Phase 1: Foundation (MOSCAP) – 2025 Q4
  - Objective: Master basic CMOS process (oxidation, LPCVD, litho, metal.)
  - Deliverable: Validation of 6” process flow, characterization of LF/HF C-V and I-V.
  - Coordination: Self-contained process, mentoring with fabrication support
- Phase 2: Transistors – 2026 Q1
  - Objective: Transition to MOSFETs on rigid substrate, planar test structures
  - Deliverable: Id-Vg, Id-Vd curves, transistor parameters, mobility
  - Coordination: Coordination with characterization groups
- Phase [illegible]gration – TBD
  - Objectiv[illegible]T process with sensor desig[illegible]t of FET/CCD topolog[illegible]
  - Deliverable: Prototype [illegible] transistor integration
  - Target application:
    - Chemical/bio/imaging sensors
    - Others (?)

To Be Determined