CMOS Disruptive Sensing Systems for Dual Applications

Why CMOS?
- Matured/Established Technology
  - Low Cost (wafer level, 8 inch)
  - Low Power
  - Low Weight
- Available: TowerJazz, STM, XFAB, TSMC, Global (former IBM) Foundries
- Enables smart sensors, integrating on a SoC
  - Drivers, Temperature compensation, Offset and noise reduction
  - Amplification, signal processing, wireless recharging/transmission
  - Sensor fusion
- Ideal for mobile applications
  - Military
  - Commercial - IoT, Wearables

Why MEMS?
- MEMS/NEMS: the 21st Century Microelectronics Revolution
  - MEMS Chips Interact with the outside world
    - VLSI/ULSI dies with > 100 mn transistors respond only to electrical signals
    - MEMS/NEMS: enabling technology to integrate sensors for different physical or chemical parameters and actuators on die, forming SoC-system on chip
- The benefits of scaling down
  - Weight reduction as (dimensions)
  - Strength reduction linear with dimension
- The benefits of batch production
  - Mass production
  - Low cost
  - Green industry
- Dual Use applications (military/consumers)

Current Activities with MEMS
- Thermal TMOS IR uncooled sensor
  - TMOS Operation Principle
    The nano-machined thermally isolated transistor has very low thermal mass and very low thermal conductivity
    Absorbed radiation increases the TMOS temperature and modifies the current-voltage characteristics
    Transistor voltage detects temperature changes at Sub-Volt level

Thermal GMOS Gas Sensors
- Operation Principle
  Heated catalytic reaction plate activates the reaction of gases with oxygen in the air. Reaction of Volatile Organic Components liberates heat which is detected by TMOS transistor whose voltage changes due to increased temperature
  For Example: CO+O2 -> CO2 + heat

Journal Papers

Patents
9 Technion-TODOS patents relevant to CMOS-SOI-MEMS
3 Technion patents relevant to CMOS SPAD and CMOS Silicon Photomultiplier

Cross Fertilization Meeting @ Israel’s Micro Nano Fabrication Unit, June 2017