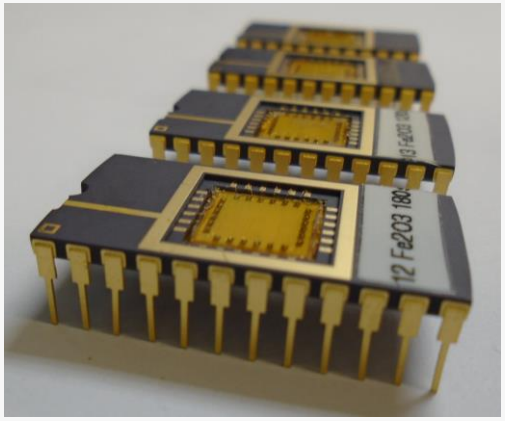
N5 Sensors, Inc.

smart sensors for a safer world

Disruptive mobile-device based chemical sensor technology for industrial, environmental, and safety monitoring

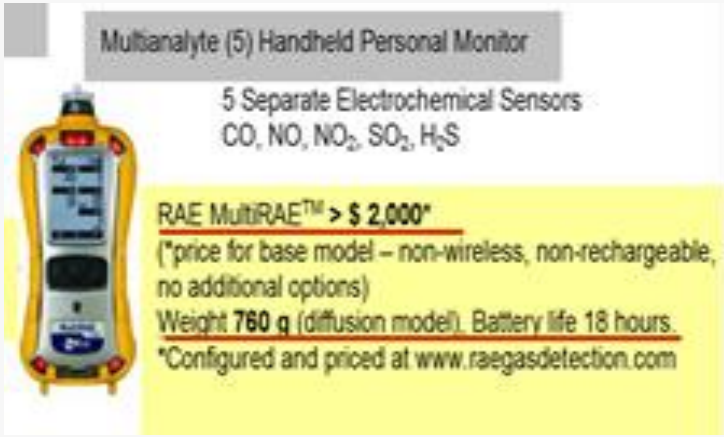


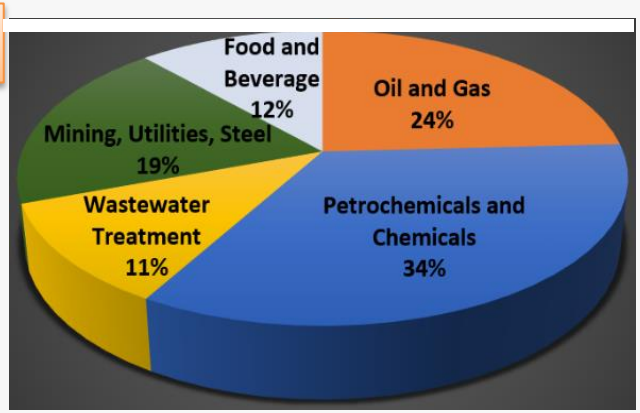
Multi-Sensor Chip

www.N5Sensors.com, email: info@n5sensors.com, Phone: 301-257-6756

The Problems

Commercially-available handheld multigas detector





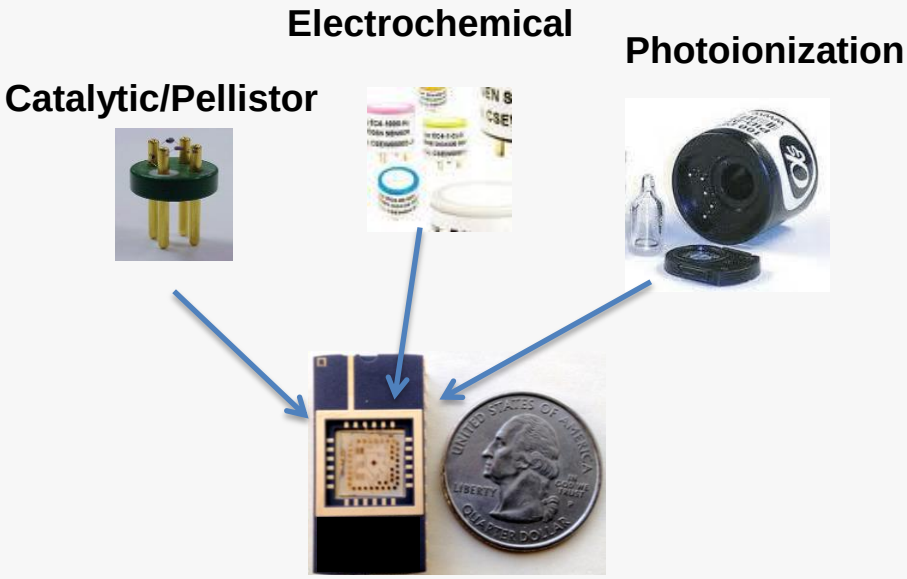
North-American Revenue Distribution for Hand-held Gas Detectors

A Typical 4-Gas Handheld Detector Construction (RAE Systems)

- Bulky, power-hungry detectors (**Inconvenient to carry**)
- Sensors have drifts, cross-sensitivity to other gases, humidity (**Difficult to interpret the measurement**)
- Sensors need routine calibration, frequent maintenance, and replacement (**Hard to maintain**)
- Expensive (**Acquisition and Maintenance**)

N5's Single-Chip Sensor Solution

Toxic, Explosive, and Volatile Organic Compound Sensors – All in a chip!



What our technology can offer

- **1 – Reduced Calibration, Maintenance, and Replacement Burden**
- **2 – Ease of Use**
- **3 – Additional Functionality**
- **4 – Reduced Upfront Acquisition and Downstream Maintenance Cost**

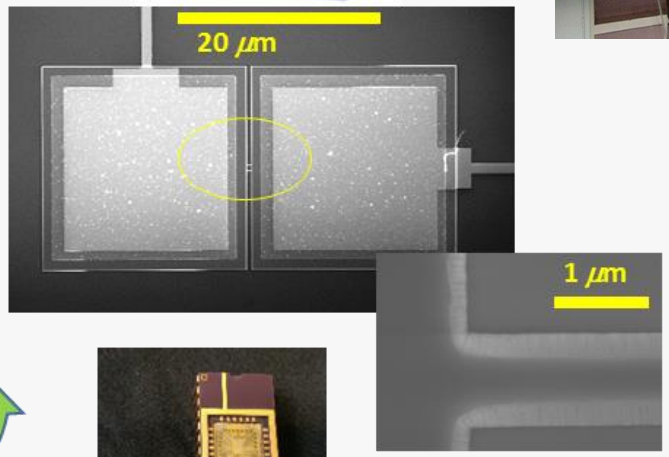
Replaces multiple power-hungry sensor technologies with a arrays of microsensors on a single chip.

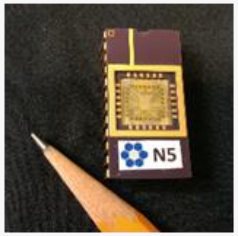
The Manufacturing Process

Semiconductor GaN Epitaxial Wafers on Supplied by Commercial Vendor

DESIGN + GROWTH

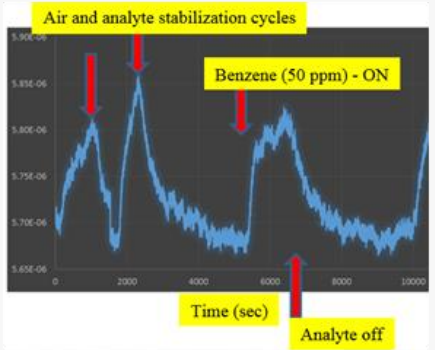
Fabrication of Sensor Devices and Packaging using Class 100 Manufacturing Facility

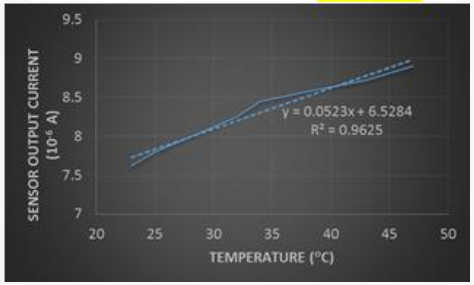




Design Iteration

Sensor Testing and Reliability Assessment





Background

Technology Overview - Uses patent-pending (US 13/861,962) hybrid nanocluster-semiconductor sensor Technology – results in microscale, low-power sensors on one single-chip for detection of different target gases in air

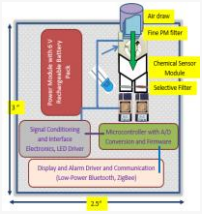
N5 Sensors, Inc. of Rockville, MD is a University of Maryland spin-off founded by Dr. Abhishek Motayed (lead inventor of the sensor technology) in 2012.
N5 has obtained exclusive license to this patent-pending technology from University of Maryland.

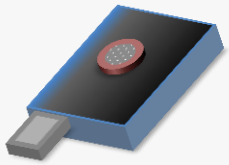
N5 is currently funded at the level of $ 780,000/year with various SBIR and state projects. In 2014, N5 has won TEDCO Maryland Manufacturing Initiative award, EPA SBIR Phase I, NSF SBIR Phase I, DHS Phase I, ARMY STTR Phase I, and UMD MIPS awards.

N5 Sensors currently has 4 full-time engineers/scientists working on the R&D, with additional 2 supporting interns. Dr. Motayed is serving as the CTO. N5 is currently housed at 9610 Medical Center Drive, Suite 200 Rockville, MD 20850 - a 350 sq. ft. laboratory space, where the N5 operates a state-of-the-art chemical sensor testing facility.

N5's Goals

Immediate Goal
Industrial Detection





Using N5's Gas Detection Module Interfaced with Ruggedized, Intrinsically-Safe Mobile Devices Used in Various Industries

Target Customers – Oil and Gas, Mining, Construction, Water Treatment Hazmat/First Responders

Future Goal

Using N5's Gas Detection Module Interfaced with Consumer Mobile Devices for Environmental Pollutant Exposure Measurements

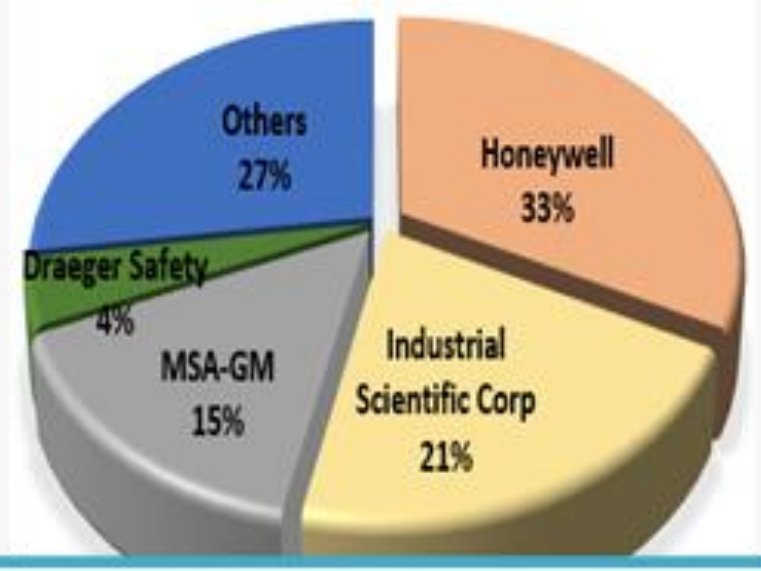
Target Customers – People who want to track exposure to air toxics (people suffering from respiratory conditions)
Personal Breathalyzers
Home Monitoring

Immediate Market Opportunity

North American Portable Multiple Gas Detector Market (2015 – 2016) ~ $ 300 M (~ 300,000 units shipped, ~$ 1000/detectors with individual sensors cost ~ $ 150)
Worldwide ~ $2 billion (with NA and SE Asia being the largest consumer)

Our cost to make (4 –gas detector) ~ $ 300 (low-volume)

Major Players



North American Hand-Held Multigas Detector Market Share

Funding and Support

- TEDCO MII Phase III ($ 100,000) (Completed)
- US Environmental Protection Agency SBIR Phase I ($ 100,000) (Completed)
- National Science Foundation SBIR Phase I ($ 150,000)
- Department of Homeland Security SBIR Phase I ($ 100,000)
- ARMY STTR Phase I ($ 150,000)
- University of Maryland, 2 -Year MIPS Award (~ $ 180 K)
- National Institute of Standards and Technology Engineering Contract ($ 180 K)
- TEDCO JTTI Award ($ 75 K) awarded in 2015
- NSF Phase IB Awarded ($ 52K)
- Private Investment ($ 35K)

Team

Dr. Abhishek Motayed
Founder and President
10+ years semiconductor experience
amotayed@N5Sensors.com

Dr. Ratan Debnath
Director of Research

Dr. Baomei Wen
Senior Device Engineer

Ms. Nichole Sullivan
Research Engineer

Mr. Audie Castillo
Engineering Technician

Team with UMD students
Mr. Gavin Liu (MIPS)
Mr. Ting Xie (MIPS)

Business Team/Advisors

Ken Malone
Business Strategy Development Officer
Serial Entrepreneur
Early Charm Ventures

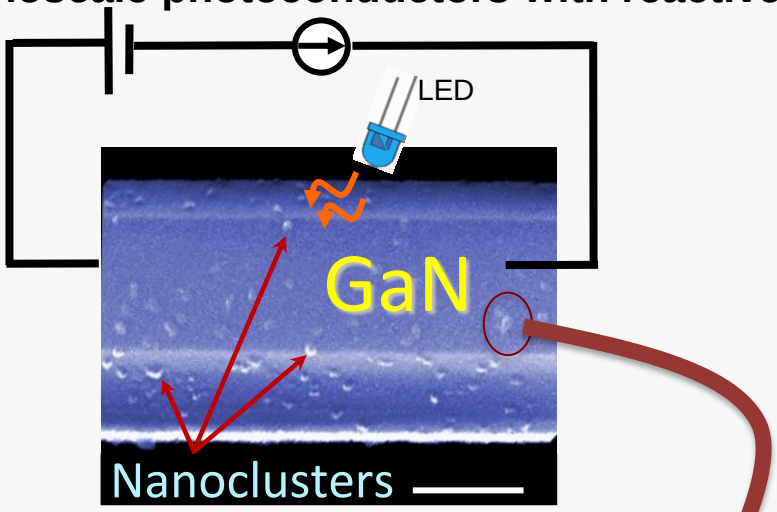
Steven Chen (Board of Advisor)
Serial Entrepreneur and Investors
Chair, IEEE Std for Wireless Sensor Networks
Member, Blu Venture Investors
Former CEO of an Intel Capital Portfolio company

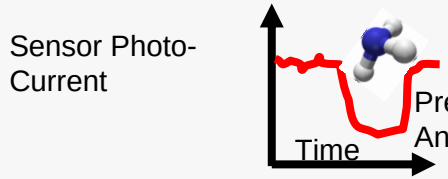
Comparison with existing sensor technologies for handheld detectors

Parameter	Photo Ionization Detector (PID)	Electro-chemical Detectors	Metal-Oxide Sensors	N5's Sensors
Power Consumption	High	Low	10 – 100 mW	< 0.5 mW
Sensitivity	Ppb – ppm	1 – 1000 ppm	100 ppm - %	Ppb - %
Selectivity	Non-selective	Partially Selective	Low	Very High
Operating Temp.	-20°C to 70°C	Limited to Room Temperature	20°C to 70°C	10°C to 80°C
Dynamic Range	Moderate	Low	Low	Very High (% to ppb)
Start-up Time	> 1 min	> 1 min	> 1 min	< 1 min
Operating Life	< 1000 hrs	Very Limited	10,000 hrs	> 2,000 hrs

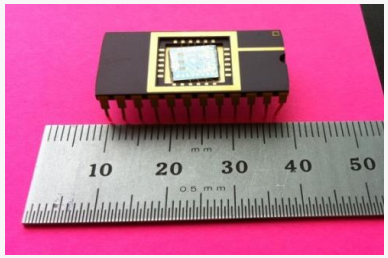
What is Our Chip-Scale Sensor Technology?

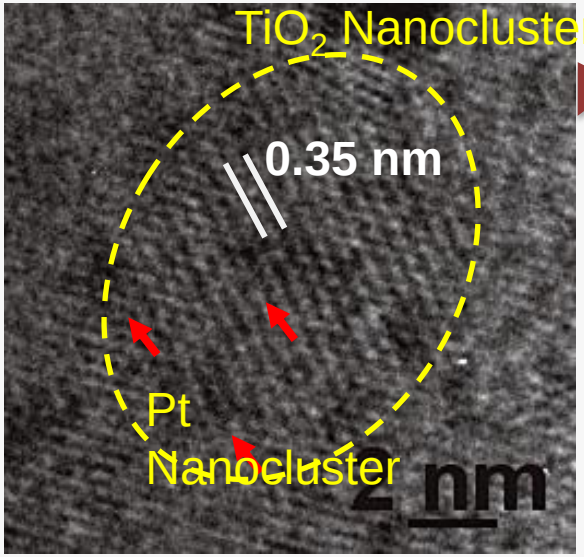
Nanoscale photoconductors with reactive surfaces





Actual Sensor Chip





Active component nanoscale photocatalytic particles

Gases adsorb selectively at the surface of these particles and the “effect” is measured as a change in the photocurrent flowing through the resistor