

Nanotechnology Sensor Research, Development and Applications



Shiva Hullavarad, PhD, MBA
Office of Electronic Miniaturization
University of Alaska Fairbanks

SENOOK - Robust and Reliable Pressure,
Temperature and Gas Sensor

OFFICE OF ELECTRONIC MINIATURIZATION

...A HOLISTIC DISCIPLINE

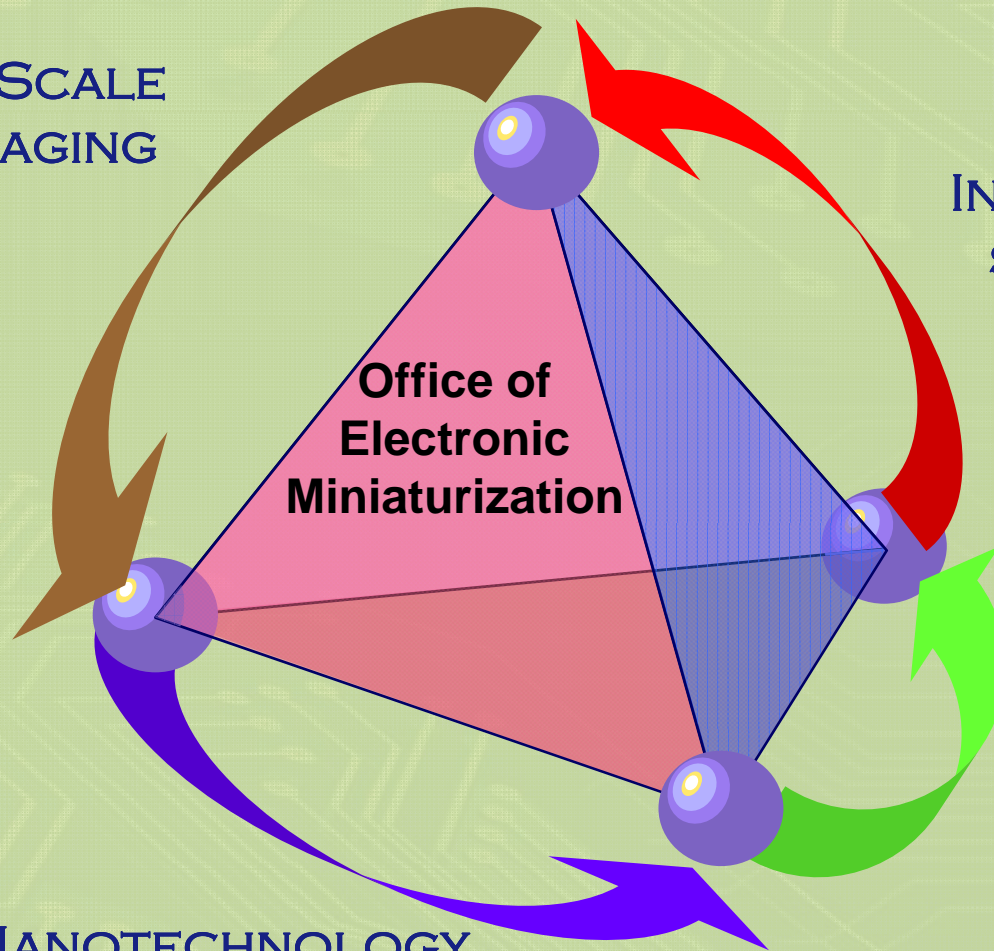
CHIP SCALE
PACKAGING

INTEGRATED
SENSORS

Office of
Electronic
Miniaturization

MOLECULAR
ELECTRONICS

NANOTECHNOLOGY







SENOOK - Robust and Reliable Pressure, Temperature and Gas Sensor

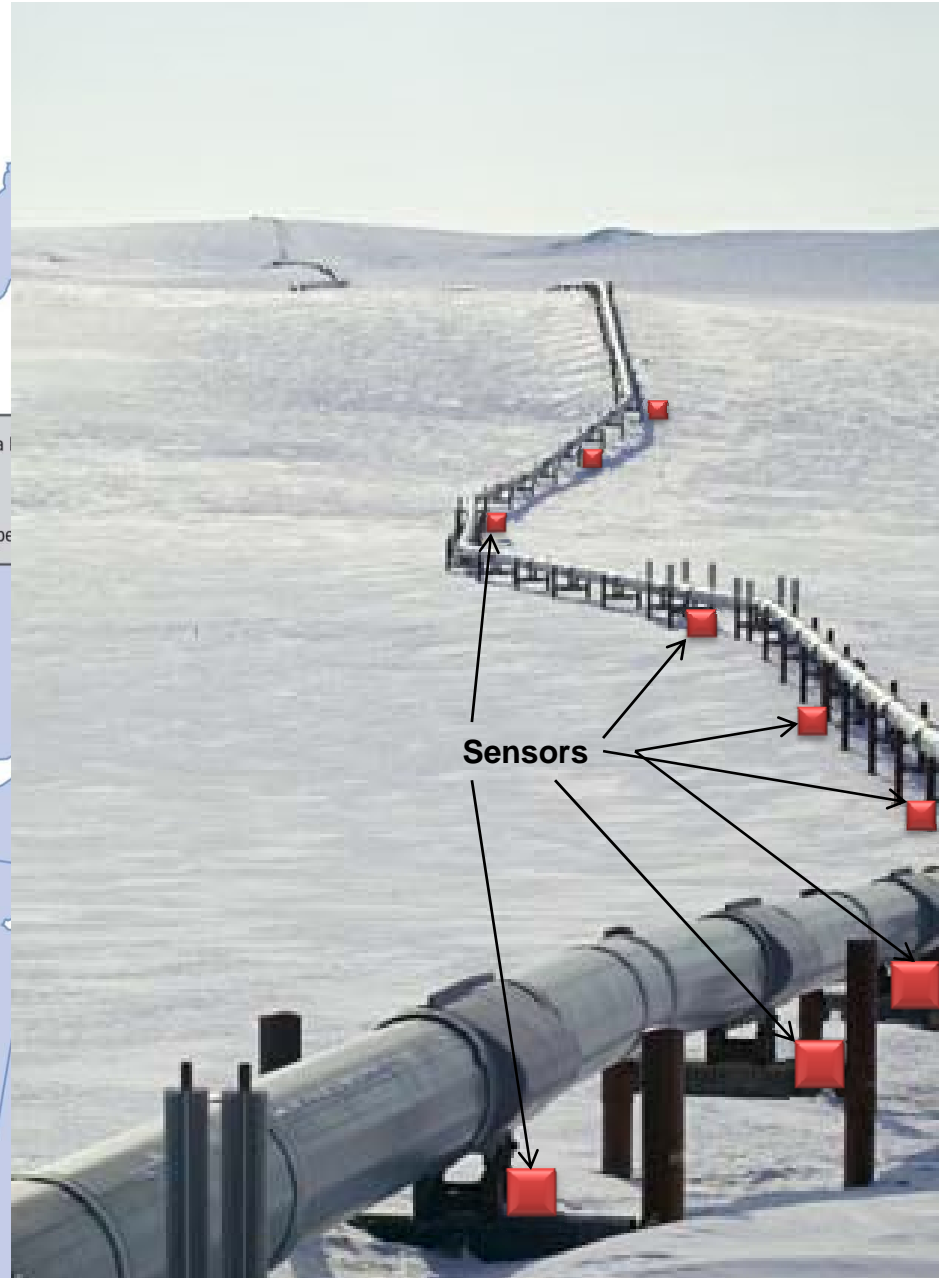
- The technology is based on simultaneous detection of
 - Pressure, Gas & Temperature
- The detection can be tracked in real time
- Technology is developed in Alaska
- Selected in World's Best Technology Showcase in World's Top 100 Technologies

WBT showcase

w o r l d ' s b e s t t e c h n o l o g i e s

Arlington Convention Center, Arlington, TX March 23-25, 2009

1. Nation's premier technology event
2. Showcases the largest collection of vetted and mentored companies around the globe
3. Produced in cooperation with the National Association of Seed and Venture Funds, the Federal Laboratory Consortium for Technology Transfer, and the Southeastern Universities Research Association
4. Selects Top 100 technologies of high market potential – UAF is one in 100 technologies selected



Sensors can be mounted along the gas pipeline for simultaneous detection of seismic activity and any gas leaks for real time detection

Target Market

1. Homeland security

- Shipment inflow/outflow and safety
- Monitoring of hazardous transport

2. Oil and Gas

Increasing production & total recovery

3. Aerospace

SENOOK Sensor – UAF Technology

1. Provisional Patent on the invention in 2008 through University of Alaska, Technology Transfer Office
2. UAF-Office of Electronic Miniaturization is exploring following options;
 - Angel investors, federal laboratories for developing technology
 - Form an alliance with similar organization
 - License full/part of the technology to interested organization as a complementary technology

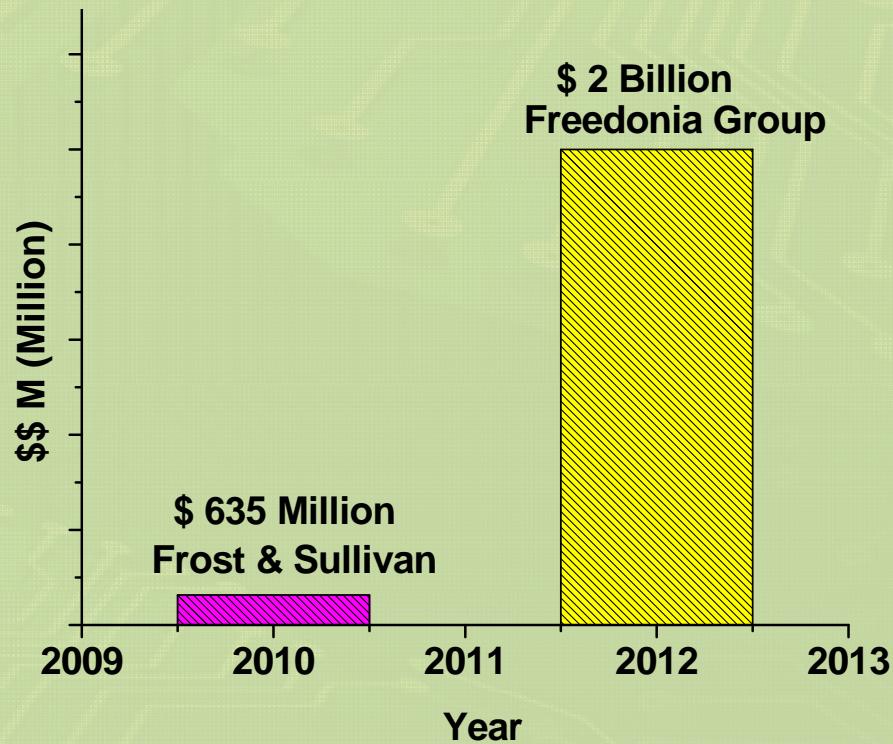
SENOOK Sensor

1. Is an electronic device including:
 - Sensing element,
 - Interfacing
 - Signal processing
 - One- or several intelligent functions as self-testing
 - Self-identification
 - Self-validation or self-adaptation
2. Applications in simultaneous detection of pressure, gas and temperature
3. Based on MEMS/NEMS resonant phenomenon
4. Information embedded in the frequency or time parameters of the signal

SENOOK - Salient Features

1. Developed using the top-down approach for operation in extreme environment
2. Enhanced functionality
3. Power consumption reduced by 90% by the MEMS/NEMS based sensors fabrication protocols
4. Nanocrystalline diamond used as a isolation and heat sink
5. Reproducibility
6. Advantageous in batch processing
7. Packaged with Multi-Chip Module (MCM) technique

Sensors Market Potential



Frost & Sullivan –
 North American Smart
 Sensors Market is to reach
 \$635 million in 2010

Freedonia Group –
 4% annual growth through
 2010 and will reach \$2 billion
 by 2012

Strong growth expected for sensors based on

- MEMS-technologies,
- Intelligent sensors and
- Sensors with bus capabilities

Market Needs and Opportunity

1. Simultaneous real-time detection of temperature, pressure, and gas for precise determination of ambient
2. Distributed, non-destructive sensors to measure (near hole and deep into the formation)
3. Data processing and storage
4. Knowledge management

Investment and Economic Benefits

1. SENOOK is seeking investment of \$2 million for developing product
2. Once developed, SENOOK has a potential of complementing large shipping industries thus providing revenue source through patent licensing and royalties
3. Sustainable economic development of Alaska through high tech industry and employment generation
4. Training Alaska students in state-of-the-art technology