

RFID Sensor Fundamentals

New Zealand RFID Pathfinder Group Webinar





Corporate Overview

- Founded 2017
- IoT sensors
- Funding
 - Hunt Venture Fund
 - InSite Partners
 - Employees
- Average growth rate ~70% per annum

 SensThys provides creative endcustomer solutions that enhance
 business decision-making by
 solving high-value business
 problems using sensors and
 technical ingenuity



Why We Win

Infrastructure

- USA design and marketing
- Foxconn supply chain
- MTI engineering

Team

- Global operations experience
- Public/Private leadership
- Strong restructuring skills
- Technical strength

- Innovation
 - 5 readers in 5 years
 - Security
 - Reliability
 - Passive sensor
- Scope
 - Solution provider
 - **Custom** software/hardware



SensThys Partners



The Problem

Sensing is expensive and often a drag

- Bulky
- Batteries
- Wires
- Limited function
- Ease of use
- Cost



Solution: Ideal Sensor



- No wires or batteries
- Small
- Maintenance free
- Placed within layers
- Remote detection
- Automated
- Economics



Supply Chain

- * Die
- Inlay

- Software



Die



The word "ASYGN" is 7mm



Die with Inlay

Sensor Enabled Label





Full Label (or Package)









What? Where? State?

- Sensing and location combined
 - Unique 128b Sensor ID
 - ID number identifies location & item
 - Each sensor reports condition & ID
 - Many reads per second
 - Insight: condition, location and time
- Low-cost wireless, battery-free
 - Passive Sensors (RFID)
 - Single transceiver gathers data from many sensors (100's or 1000's)
 - 50+ year lifetime
 - **Inexpensive** enough to be disposable

Sensing capability







Temp



Index of refraction



Capacitance

Pressure





Moisture and





Capability Map

		Proto Die(1)	Beta Die (2)	Commercial Die(3)	Proto Label (4)	Sample (5)	Production (6)
AXZON	Temperature						
	Moisture						
	Index						
ASYGN	Temperature						
	Strain w/Temp						
	Motion						
	Relative Humidity	/					
	Pressure						
	Diff Cap (index)						
	Light						
	Magnetic Fields						

5. Low volume dry inlay, preferable with label covering. Suitable for sampling to end customers.

6. Production inlay, with label, bar code, writing, color printing available. Available for purchase.

Software

User

- ProSens
- PhySens
- ProSens Mobile
- Command Center
- AutoSens
- Performance
 - Low level reader control
 - Sensor sophistication
 - EPIC

- Developer-Friendly SDKs
 - RESTful
 - C# (.NET)
 - Java
 - Visual Basic (.Net)
- Security
 - NIST 8259A compliant
 - TLS encryption
 - Black/whitelisting
 - Port control



PhySens

- Support multiple die vendors
- Decodes tag type (strain, temp, light, etc.)

Real-time graphing

- Selectable "sampling" period
- Reports two parameters simultaneously
 - Example: Temp and Strain
- All tag **data output** in convenient data files





Passive Sensor Solution

sensors

Wired/Wireless Connectivity Mounted anywhere inside or outside. RF cables connect to each antenna Reader communicates via ethernet. Wi-Fi, Bluetooth or external Zigbee Each antenna gathers data from 100's or 1000's of sensors **Power wirelessly** transmitted to remote

100's or 1000's of Passive Sensors... Mix of Temp, Moisture and Strain ok... Powered by remote transceivers



Placed on any area or equipment of concern...



Antenna

Reader

1-4 per reader

- Mounted to walls or other existing chassis members or equipment
- ~3 meters from sensors
- *RF* cable to the reader (also powers antenna)
- No wires required to sensors

PASSIVE SENSOR DETECTION WITH PHYSENS

Real-Time Sensor Reporting











No. of Concession, Name of Street, or other designments

Resin Detection

Digital Manufacturing

Metric	Value		
Resin Arrival (min)	3.5		
Phase Change (min)	49.3		
T,max (time, min)	51		
T,max (F)	257		
SCDE (cured)	260		
SCDE (min)	180		
SCDE (120min)	68.4%		
SCDE (180min)	82.8%		
SCDE (240min)	90.0%		



Smart Building Materials

- Smart Building Materials
 - Sensor embedded in roofing
 - Tags report moisture
 - Reader cart identifies leaks
- Key features used:
 - Rugged chassis/connectors
 - GPS reports leak location
 - Battery operation



Machinery Condition

Conventional Approach

- No monitoring
- FLIR detection (\$\$\$)



Passive Sensor Approach

- Direct placement of sensor
- Reader antenna above machine
 - Constant measurement
 - Temperature spike can
 IMMEDIATELY shut machine
 - Fully automated
 - No battery/wires



Automotive

Conventional Approach

- Customer complains weeks after delivery
- \$1000's of repairs and customer satisfaction hit



Passive Sensor Approach

- Production line testing
- Place tags where water shouldn't be
 - On-metal sensor tags
 - Wicking tails
 - **Calibrate** (read) when dry
 - Blast car with water
 - Find leaks by **comparison** read
 - Fix avoiding warranty repairs

Smartrac Sensor Tadpole in Automotive Video: https://youtu.be/TjUYkMj2a2I



Pharmaceuticals

Conventional Approach

- Bar codes or pen/paper
- Manual input
- Data integrity unchecked
- Temp/humidity not monitored



Sensor Approach

- Pharma management
 - Automate stock refill
 - Drug distribution
 - Expiry dates alerts / prioritization
- Temperature/moisture logging
 - Real-time passive RFID sensor
- Track and Trace
 - Low-cost, high read-point
 - In building location (10ft accuracy)



Not just "RFID"

- What **material** are you tagging?
 - Real and imaginary index of stack up
- What conditions require monitoring?
 - What is the physical change being detected
- Does your **environment** corrupt sensor data?
- Optimize reader for sensor type
- Complex die/inlay interaction
- **Sources** of interference, reflection, absorption

SensThys has years of knowledge in this area ... use us!





Questions...

...Reach Out!

