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Smart Passive Sensors

Sensors Extend our Understanding

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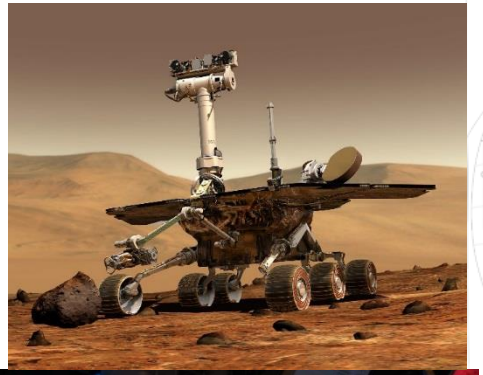
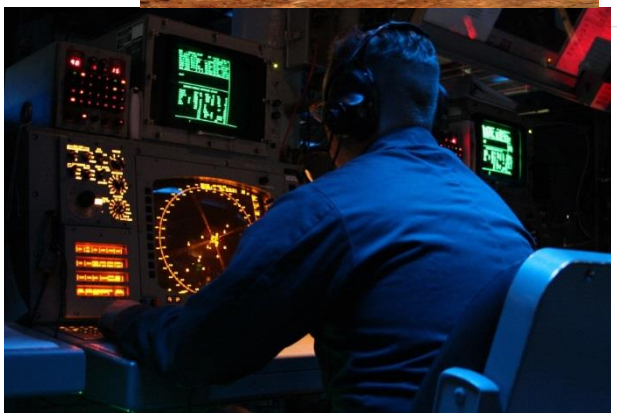
We manage what we measure

To understand the world beyond our immediate reach to expand our knowledge and actions.





How can we simplify information capture?

SPS Design Objectives

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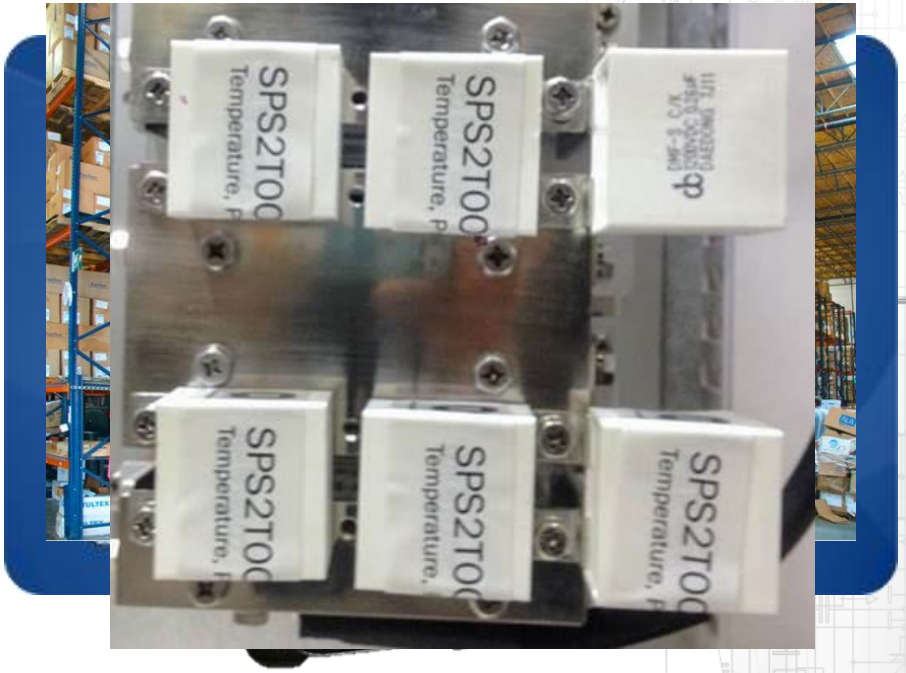
- Implementation Simplicity
- Low Operational Cost
- Zero Maintenanc
- Leverage E & Trace Infras

Peel- Stick-Read

- An RFID tag uses power from the antenna to power its chip, and send the return signal with the data.
- This data can be:
  - A Command (unlock car door)
  - A Unique Identifier (Tag ID)
  - Data from sensor (e.g. temperature)



Let's Meet the Players

Antenna

"Send your tag Data"

Reader

Tag

"Tag ID is 100A2342"

"Temperature is 23°C"

The Command is broadcast through the antenna

The Reader initiates a command

The tag responds

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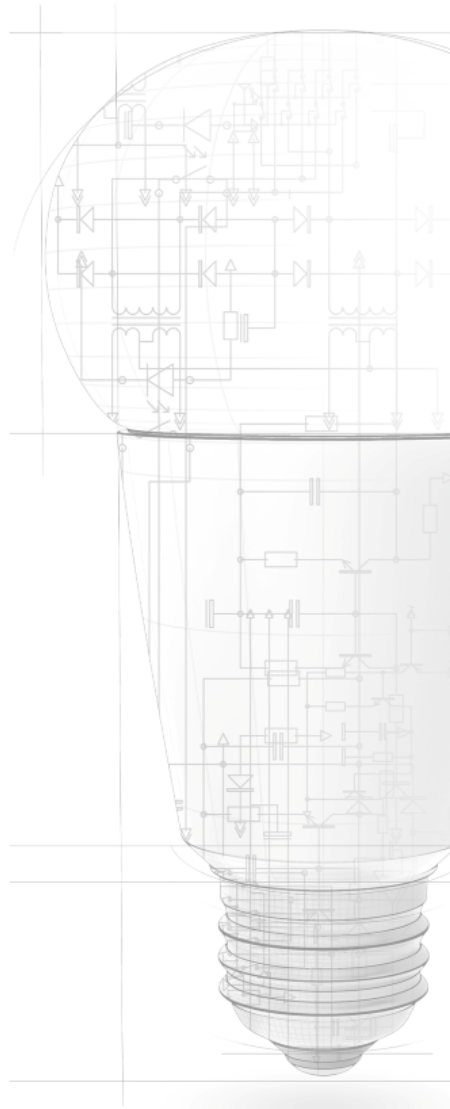
SENSORS



Temperature Tags

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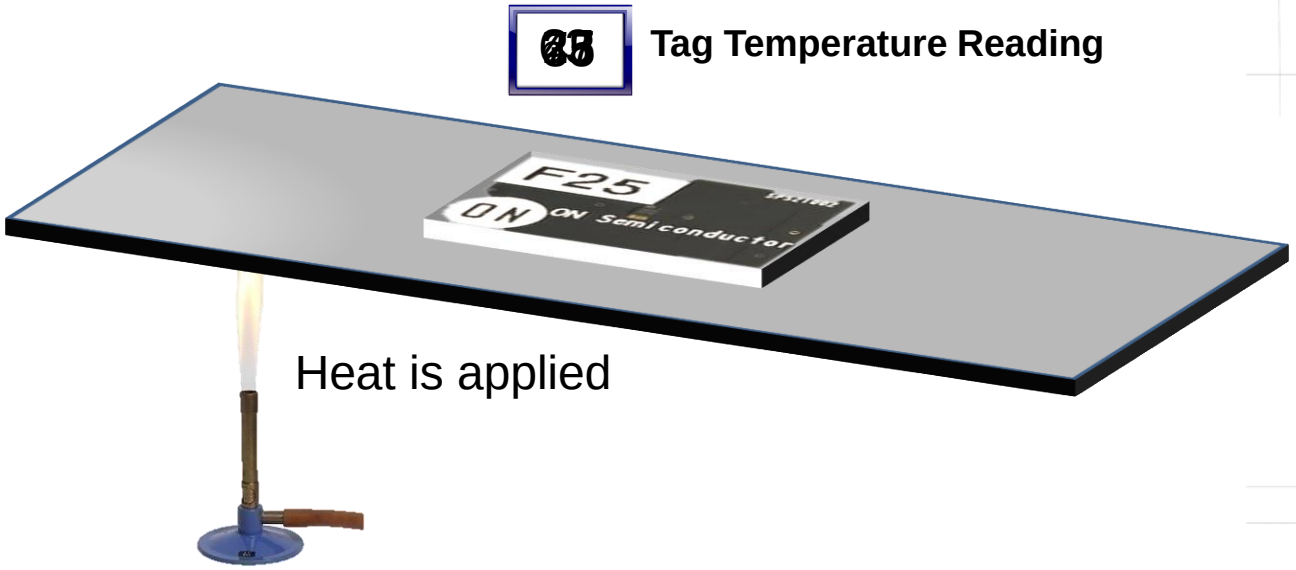
Battery-Free Sensor Harvests Energy to Measure Temperature and Wirelessly Transmit the Data Back to the Reader



Moisture Tags

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Battery-Free Sensor Harvests Energy to Measure Moisture and Wirelessly Transmit the Data Back to the Reader

Unexpected Moisture Seeps Into Building

DRY **Tag Moisture Reading**

Fluid Level Tags

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Battery-Free Sensor Harvests Energy to Measure Fluid Level and Wirelessly Transmit the Data Back to the Reader

Full

Someone Is Thirsty!

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Battery-Free Sensor Harvests Energy to Detect Presence and Wirelessly Transmit the Data Back to the Reader

Unoccupied

Sensor tag applied to door frame

Someone Arrives!

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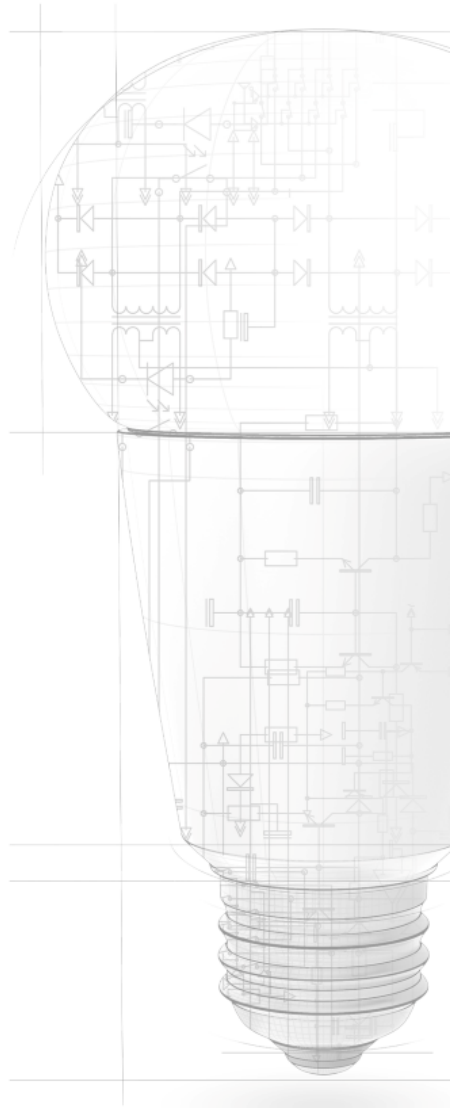
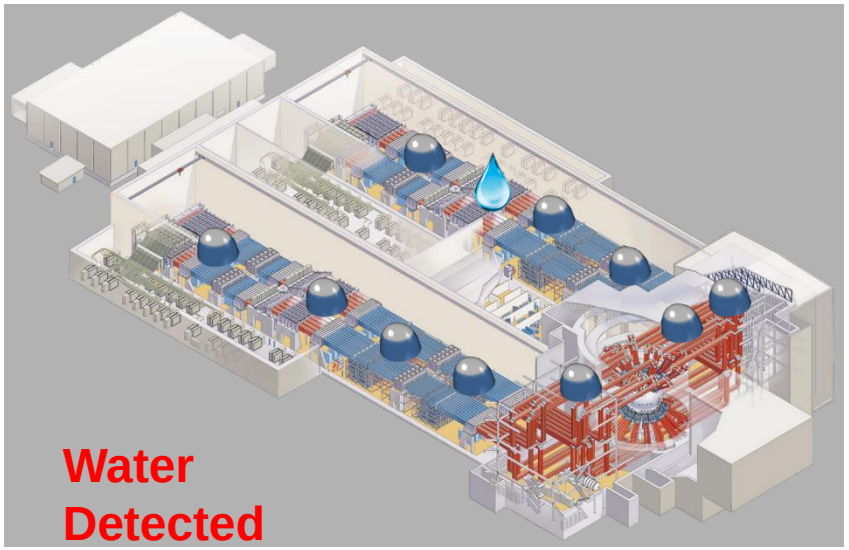
APPLICATION EXAMPLES



Building Management



Industrial Building Emergency Control

Temperature Exceeds Threshold. Current Temp = 140°F

Call Supervisor

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- Monitors bus bar temperature
  - No suit-up required
  - Provides historical data
  - No “line of sight” required
  - Watches for temperature rises
- Detects moisture
  - On floor
  - In concrete slab
  - Behind walls
- Identify Personnel in secure areas

Medical and Care Facilities

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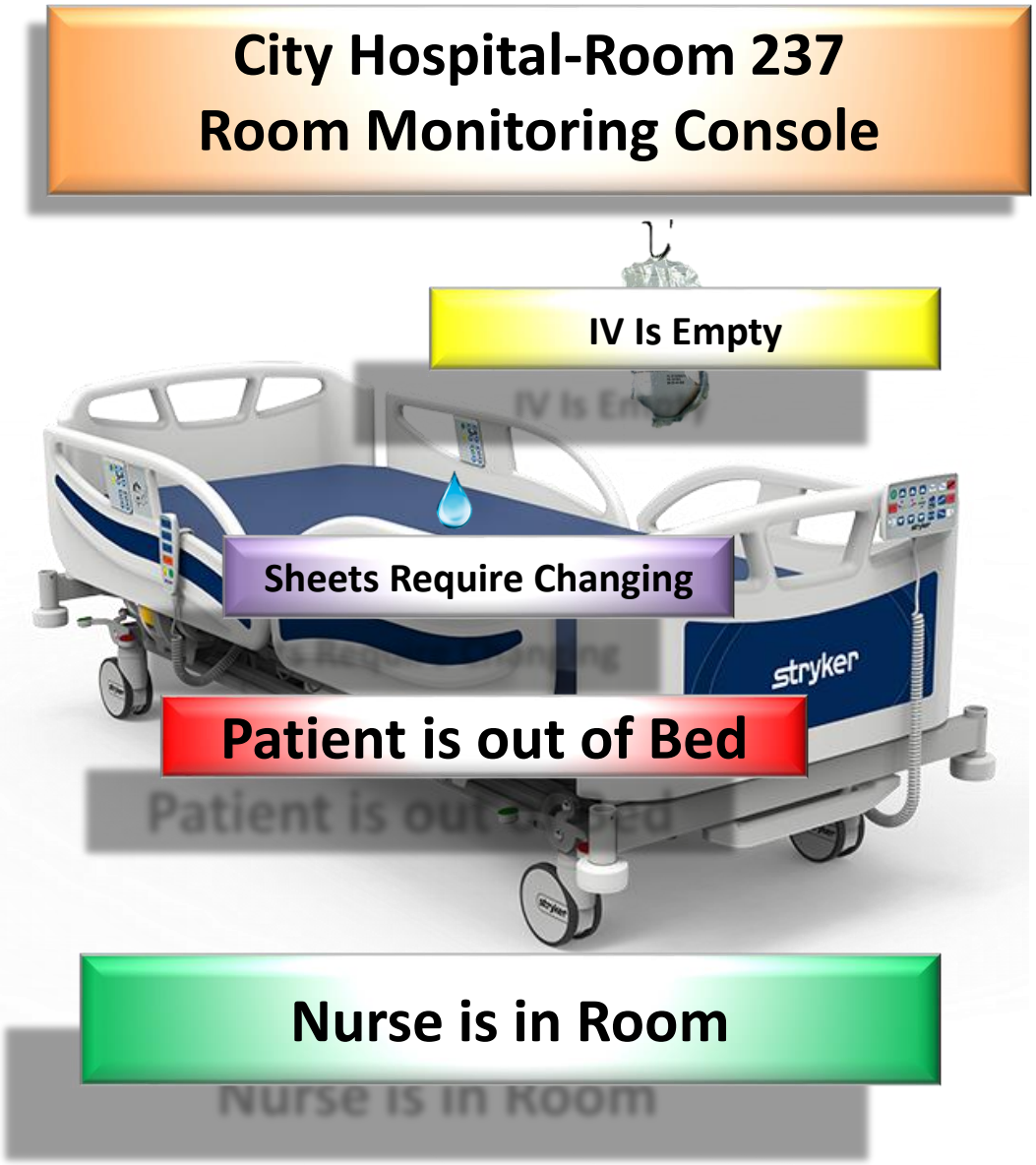

- Monitors Fluid Level
  - IV Bag
  - Catheter Bag
- Detects moisture
  - Reduces inflammation
  - Keeps patient comfortable
- Detects Presence
  - Inadvertent falls
  - Restlessness
- Detects Caregiver
  - Proof of presence
  - Helps locate staff

Livestock

- Captures Animal Temperature
  - Early illness detection
  - Fertility determination
- Control Gate Management
  - Automated sorting
  - Rapid isolation of sick animal
- Handheld or Fixed Reader
  - Flexibility
  - Automated alerts

Data Center

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Server Rack Monitoring Console

Temperature Exceeds Threshold. Current Temp = 140°F

Underfloor Water Detected

- Monitors Server Rack
  - Protects sensitive electronics
  - Better airflow management
- Detects Underfloor Moisture
  - Leak detection
  - Avoids electrical shorts

Railroads

Railroad Track Monitoring Console

Rail Temperature Exceeds Threshold.
Current Temp = 42°C

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- Weather Collected in Key Cities
  - Temperature (blue)
  - Wind Speed (yellow)
  - Precipitation (purple)
- Monitors Rail Temperature
  - Alert if threshold exceeded
  - Reduces unnecessary slowdown
- Detects Rail Moisture

Construction

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Low Cost Battery Free Moisture Sensors Embedded into the Concrete Slab Identify Location of Leak

Leak Detection

Water Detected in Basement
Location A3-6

Automotive

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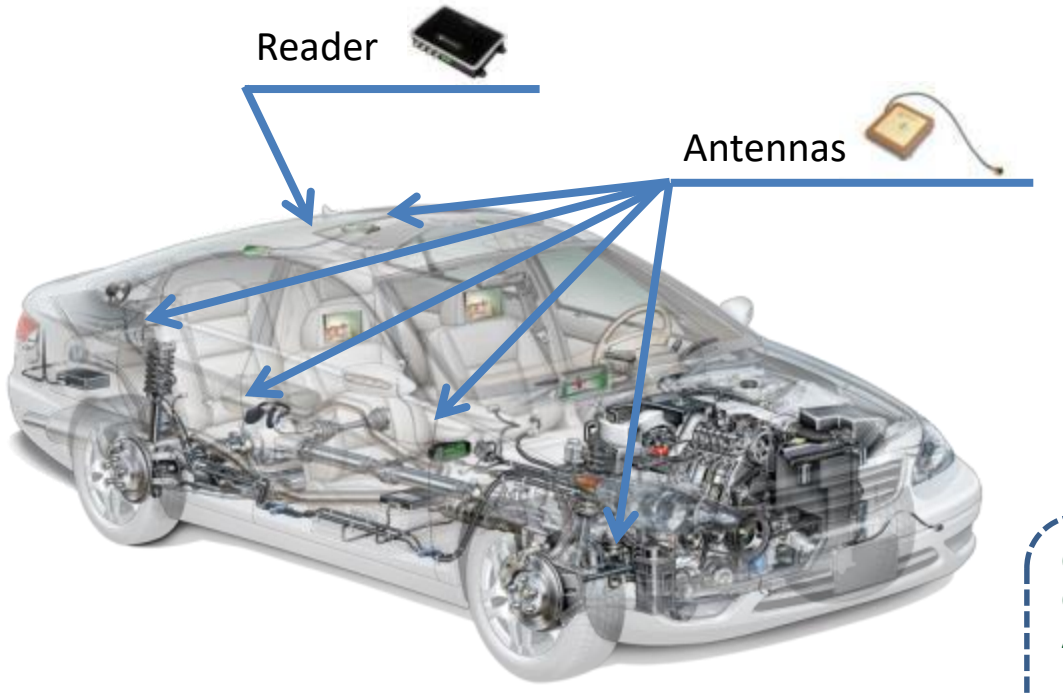
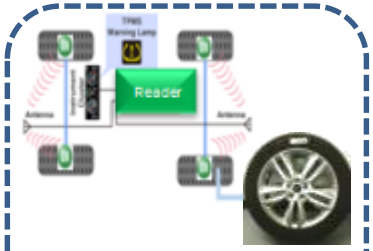


Moisture Sensor

Fluid Level



Pressure Sensor

TPMS

In-cabin Temp. Control

Seat Occupant Detection System

Headlight Moisture/Leak Detection

Quality Control Automated Rain Test

Wiper Control

Agriculture

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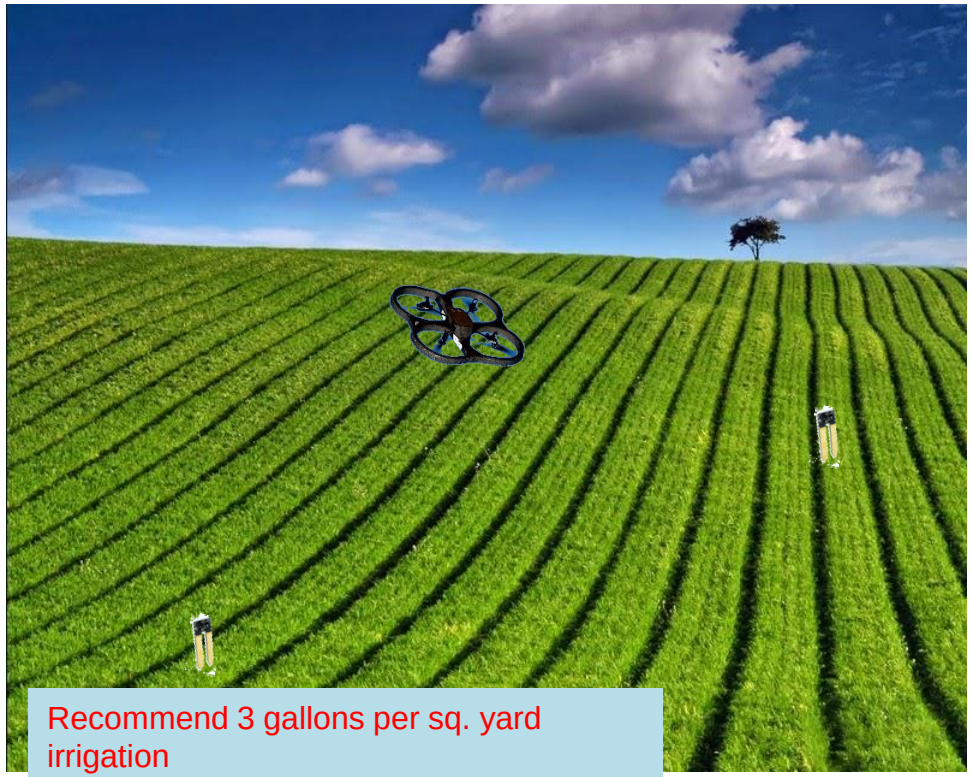

Field Moisture Monitoring Console

Sensor 3B8486: Soil Moisture 9%
Sensor 3B8457: Soil Moisture 6%

- Drone Collects Data from Sensors
  - Moisture Percent
  - Soil analysis?
- Enables Precision Irrigation
  - Optimized for soil and plant type
  - Saves water

Creating New Sensing

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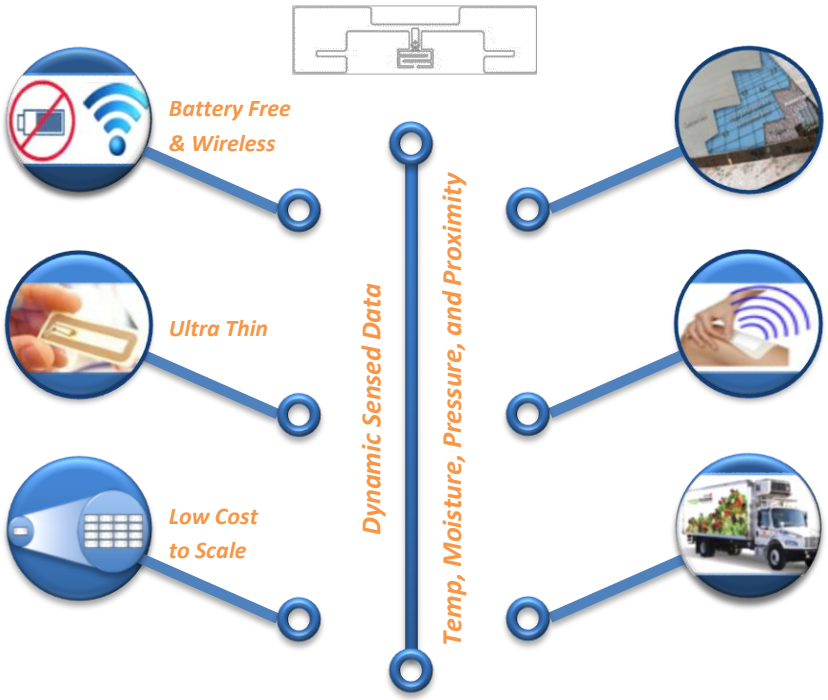
Introducing the World's First Battery Free, µC Free, Sensor Tag

Breakthrough Sensor Technology Implemented on RFID



Locations Hard to Access

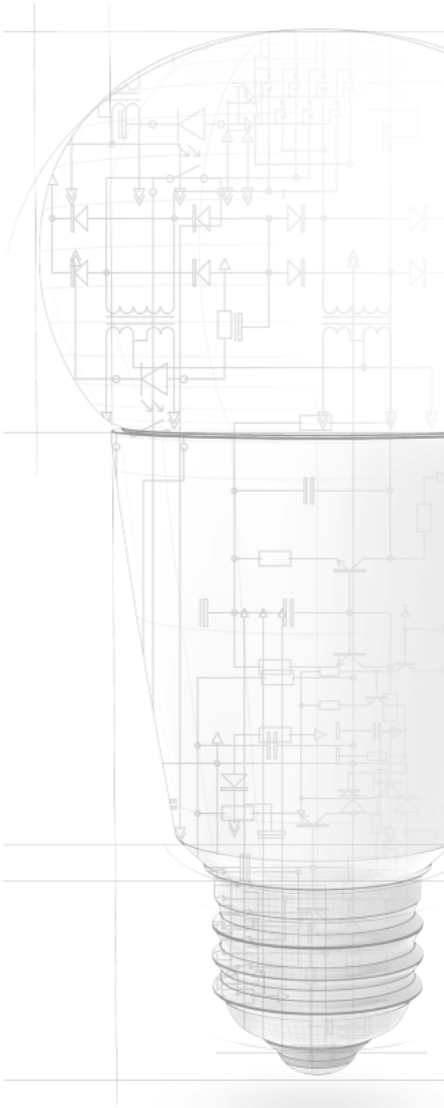
– Underground, Within walls, Intrusive to body, Within boxes, Toxic or Dangerous to health

Space Constrained Applications

– Within doorways, within RFID tags, Peel and stick, Bandages

Multiple Sensors Required

– Disposable products, multiple data points, increasing needs over time



Available Sensors

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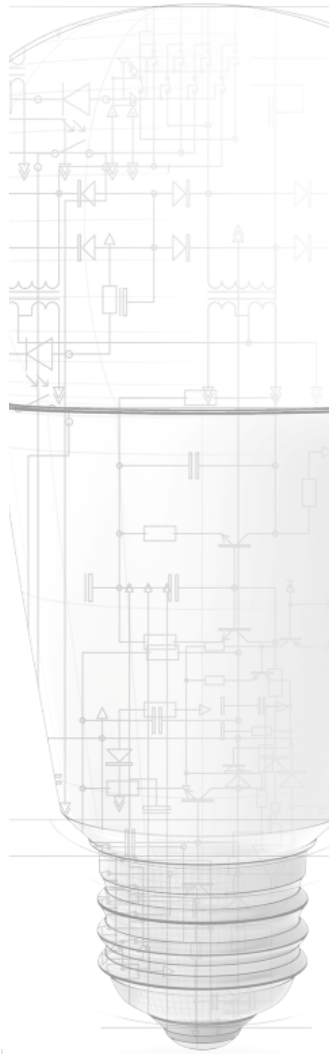
Battery Free Wireless Sensors SPS

Device	Sensing Function	Form factor	UHF Band	Attach Material	Package	Sensor
SPS1M001FOM	Moisture	Foam	FCC 902 - 928 MHz	Metal	RF Tag 165x20mm	
SPS1M002PET	Moisture	flexible PET		Non-metal	RF Tag, 91x26mm	
SPS1M003PET	Moisture	flexible PET		Non-metal	RF Tag, 91x26mm	
SPS2T001PET	Temperature	flexible PET		Non-metal	RF Tag 93x26.5mm	
SPS2M001FOM	Moisture	Foam	ETSI 866-868 MHz	Metal	RF Tag 166.5x20.0mm	
SPS2M002PET	Moisture	flexible PET		Non-metal	RF Tag 96.5x26.5mm	
SPS2M003PET	Moisture	flexible PET		Non-metal	RF Tag 99.5x11.12mm	
SPS2T001PET	Temperature	flexible PET		Non-metal	RF Tag 93x26.5mm	
SPS2T001PCB *	Temperature	printed circuit board	FCC 902 - 928 MHz ETSI 866-868 MHz	Metal	PCB RF tag 25mmx15mm Read range: approx. 2m	
SPS2T002PCB *			FCC 902 - 928 MHz ETSI 866-868 MHz		PCB RF tag 5cm x 5cm read range: approx.. 10m	

* Available May 2018



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THANK YOU