



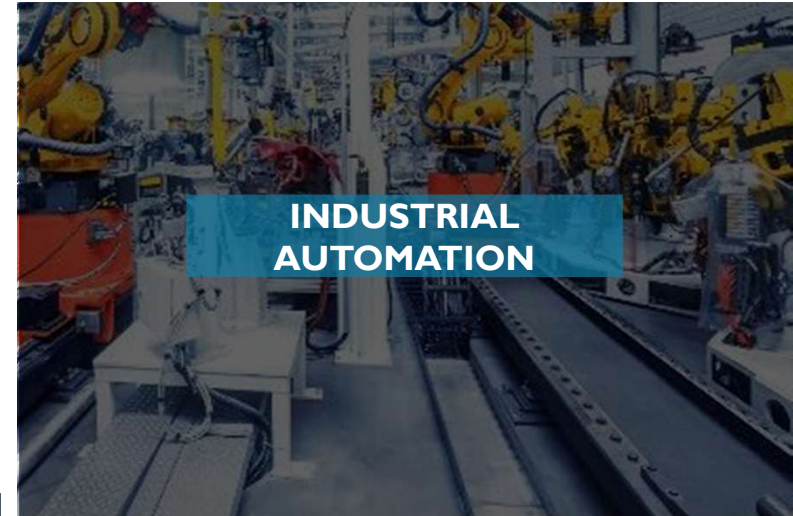
TECHNOSPHERE  
Design driven innovation

- An Overview





**CONSUMER  
ELECTRONICS**



**INDUSTRIAL  
AUTOMATION**

## **DIGITAL TRANSFORMATION ACROSS INDUSTRIES**



**MEDICAL DEVICES &  
HEALTHCARE**



**IOT DEVICES &  
CONNECTIVITY  
SOLUTIONS**

# WHAT MAKES US DELIVER TO OUR PROMISE...



100+ man years of Technology & Development	IOT / Wireless Technologies	80+ Projects Delivered
50+ satisfied global customers	Tools and Test Equipment	Partnerships enabling New Age Delivery

## EXPERTISE ACROSS INDUSTRIES



Consumer



Industrial



Medical Devices & Healthcare



IOT Devices & Connectivity Solutions

# DESIGN EXPERIENCE

# Hardware Design

- Complex Multi-layer PCBs
- Miniature components – BGA, Flip Chip, 0201 discrete
- High Speed Design
- Flex and Flex Rigid PCBs
- Analog – Audio, ADC, DAC
- RF : Chip level , PCB antenna
- 8/16/32 bit  $\mu$ Controllers and Processors
  - Microchip (PIC) / Atmel (AVR),
  - TI MSP430, CC2651x
  - ST Micro : STM32
  - Nordic – NRF5160, NRF52xxx, NRF53xxx
  - Infineon PSOC6 / PSOC4
  - Atmel ATM2202
  - ARM uP : TI (AM335x), Freescale : Kinetis
  - MIPS uP

# Firmware Design

- Bare metal Coding
- RTOS (Real Time Operating Systems)
  - MQX
  - FreeRTOS
  - Contiki
- Embedded Linux
- Languages
  - C, C++
  - Python
- Device Drivers
- Graphical User Interface GUI Development
- Board Support Packages
- Diagnostics Tools

# Sensors & Interface

## Variety of Sensors like :

- Temperature Sensors
  - NTS, PTS, RTD, Thermocouple
- Infrared / UV
- Contact Image Sensors
- Gas Sensors
- Ultrasound
- Vibration sensors
- Radiation Detector
- Current / Voltage / Power Factor
- Agri
  - Soil Temperature / Moisture
  - Soil Nutrient level
- Non-invasive Health sensors
  - PPG
  - Bio-impedance
  - Body temperature

## Output Devices :

- Display Units – LCD, OLED ..
- Touch – PCB based
- Thermal Printers
- Motor Control
  - BLDC
  - PMSM
  - Servo
- Audio – Speaker/Microphone
- LED Drivers
- Relay control
- and many more..

# Communication Protocols & Stacks

Expertise in various wired and wireless communication technologies

- Ethernet, RS-485, RS-232, CANBUS, USB
- Zigbee, BT, BLE, 6LOWPAN, GSM/GPRS, 4G
- LoRa, Sigfox, NBloT, LTE-M
- Future plans :Wifi6, 5G

Worked with key protocol stacks

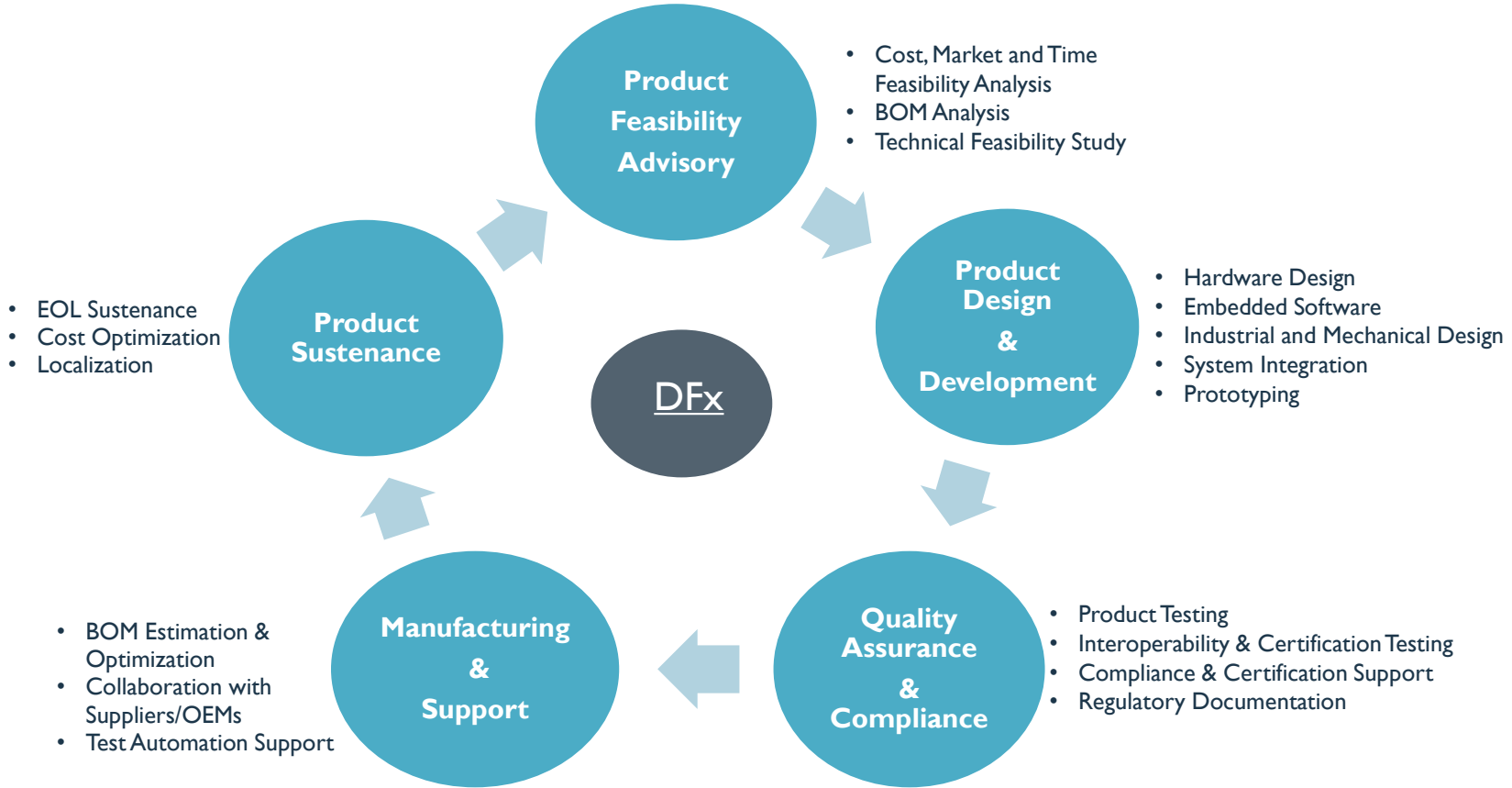
- Lonworks, Modbus, TCP/IP, CoAP, HTTP, MQTT

**Technosphere team has extensive experience in developing connected devices**

# Compliance & Certifications

- Expertise:
  - Regulatory : EMI/EMC compliance IEC- 61000
  - Reliability : HALT/HASS IEC-62506
  - Safety for Household Appliances : IEC-60730
  - Standards : USB, Wifi, BT, EMV
- Successfully implemented Compliance & Certifications on Multiple Products
  - Wearable Device : FCC / CE
  - Gaming Device : FCC / CE
  - High end Tablet : Consumer product UI : FCC/CE
  - Environment, Health & Safety Device : EIRP, Radiation testing
  - Pest Monitoring Solution : Global RF Power
  - Calibration validation for Temperature Monitor
- Relationship with Several Test Laboratories
  - UL
  - TUV
  - ETDC

# Product Life Cycle



# IoT CASE STUDIES

# Case Study - Industrial Asset Monitoring

## Problem Statement

- Monitor signals from **CANBUS / MODBUS**
- Route critical fields to **SCADA over MODBUS**
- Up to 180 bytes per record
- Up to 10 records / second
- Store monitored data into SD card
- Client: Top elevator company, India

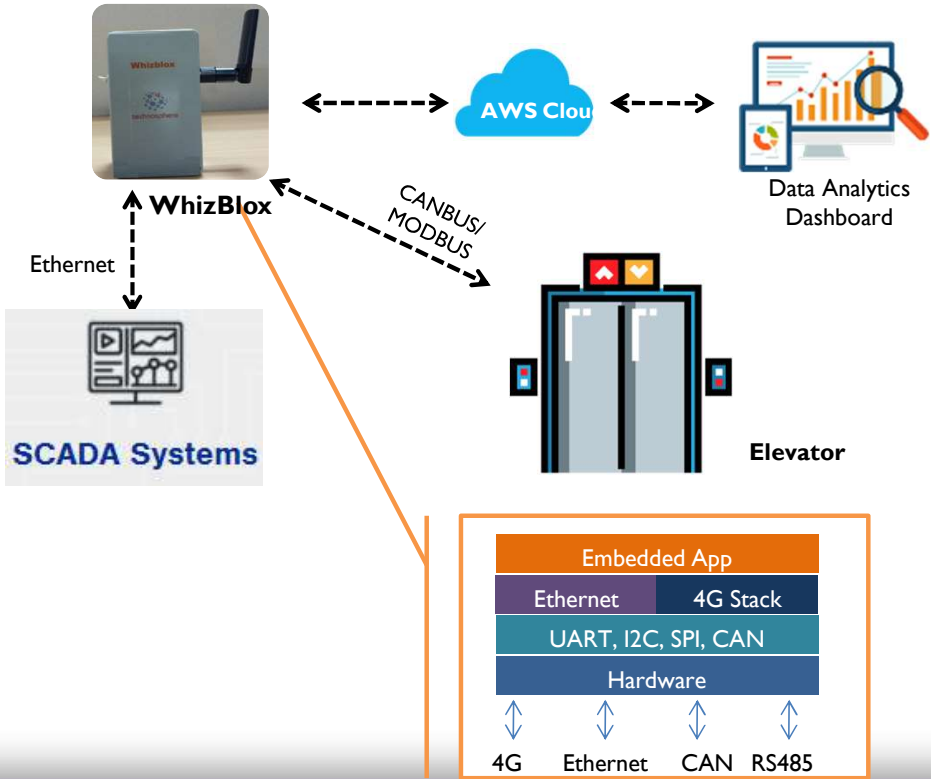
## Implementation

- 32-bit Controller with **CANBUS, SPI and I2C**
- RTC with battery for time-stamp of stored data
- 100Mbps Ethernet port and RS-485 for SCADA communication
- 10/100Mbit ethernet port for debug and configuration
- Hardware Design, Prototyping and Manufacturing
- Firmware development
- Testing and sign-off
- Duration: 8 months

## Business Impact

- Critical alerts via SCADA helps to address immediate issues
- Stored data in SD Card is used to analyze multiple data points of the elevator to prevent breakdowns
- Over 1K units installed and functioning 24x7
- Success motivated client to trigger follow-on project - IoT enabled solution with 2G/4G communication

**Tech Stack:** Embedded App, Ethernet, 4G Stack, UART, I2C, CAN, Hardware – 4G Modem, Ethernet, CAN, RS485



# Case Study - Pest Monitoring and Control

## Problem Statement

- Pest menace needs to be controlled in key areas like Airports, Granaries
- Rodent eradication using legacy methods not feasible due to new eco regulations
- Introduce smart methods
- Client: Pest Management Company from Asia-Pacific

## Implementation

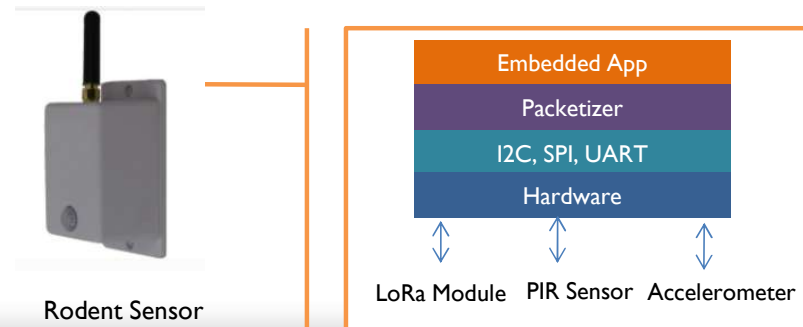
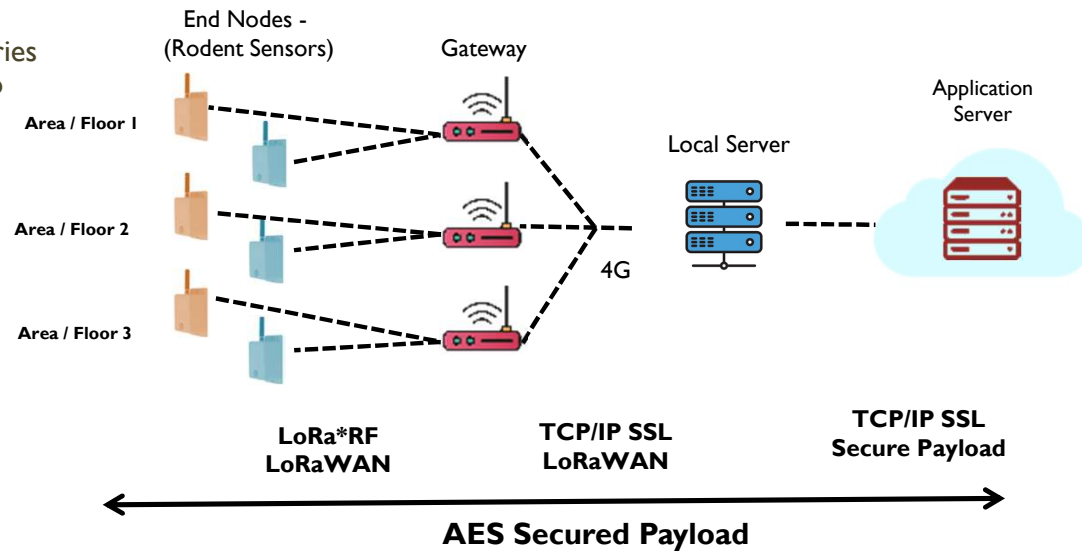
- Ultra low powered devices – over 6 years battery life
- Low power radio communication – LoRa & Sigfox
- Use of Integrated Module's controller for reduced power and space
- Hardware and Firmware Development
- Prototyping and Pilot Production
- Fitment to selected ready enclosure
- Detailed testing and certification support
- Transfer to High end Contract Manufacturing facility
- Duration : 7 months

## Business Impact

- Award winning unique technology solution for real-life problem
- Meeting target BOM costs
- Over 10K units installed in critical locations

## Tech Stack:

Embedded App, Packetizer, I2C, SPI, UART, Hardware – LoRa Module, PIR Sensor, Accelerometer



# Case Study - Vitals Monitor Safety Wearable

## Problem Statement

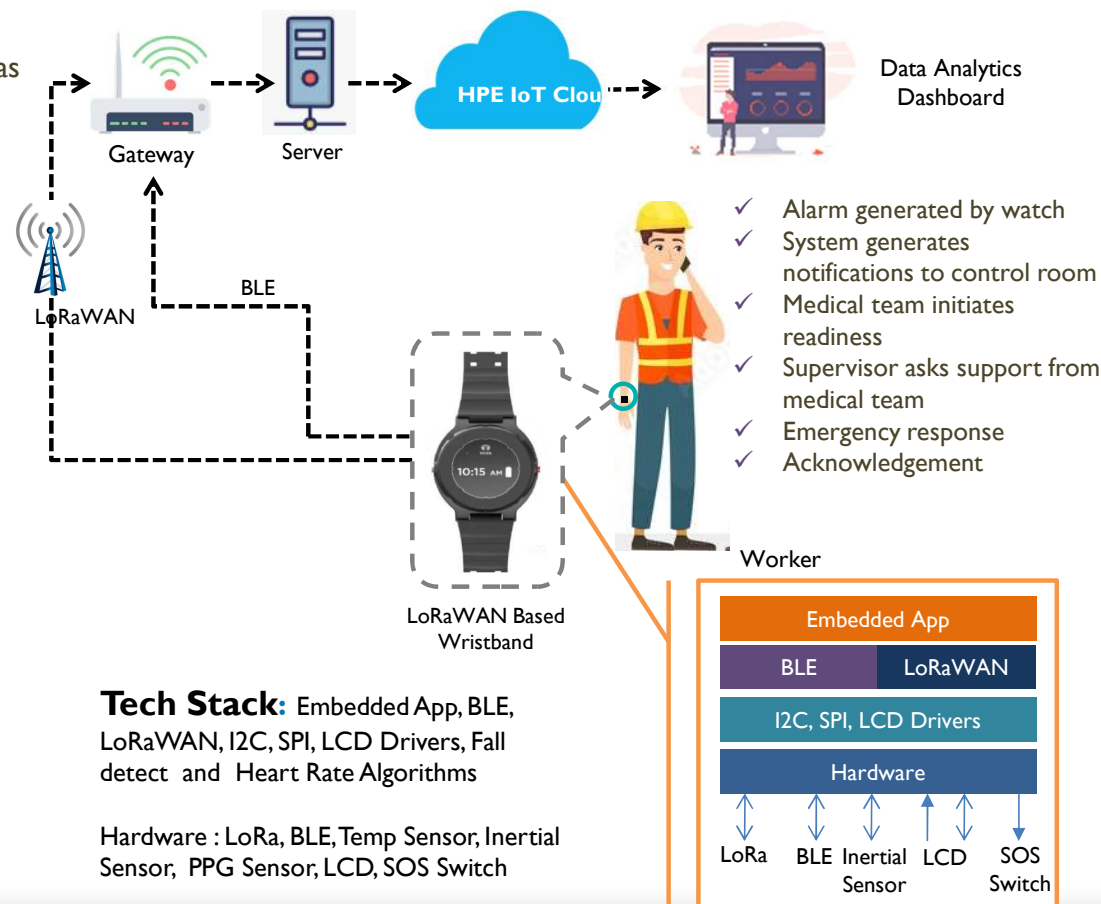
- Monitor critical health parameters of workers in Hazardous areas
- Ability to identify location within the premises
- Extended battery life
- Client: Top Indian Conglomerate

## Implementation

- Wearable device in watch form-factor
- Heart rate and temperature sensing
- Fall and immobility detection algorithm using Accel/Gyro
- LoRa communication for range and minimal infrastructure
- BLE based indoor location sensing
- Low power design and power management
- Hardware & Firmware Development, Testing and Qualification
- Technology Transfer to High Volume Manufacturing facility
- Accuracy validated against clinically approved devices
- Duration : 12 months

## Business Impact

- World's first LoRa based wearable
- Over 7K workers wearing the device everyday
- Early alerts have helped to reduce accidents and fatalities
- Proof of high technology miniature device development in India
- Type approval enabled smooth roll-out with end client



# Case Study - IoT Enabled Smart Lock

## Problem Statement

- Lock / Unlock through Touch Keys
- Lock / Unlock through Phone Application
- Secure Key enablement through Cloud
- Secure Key Storage in NFC

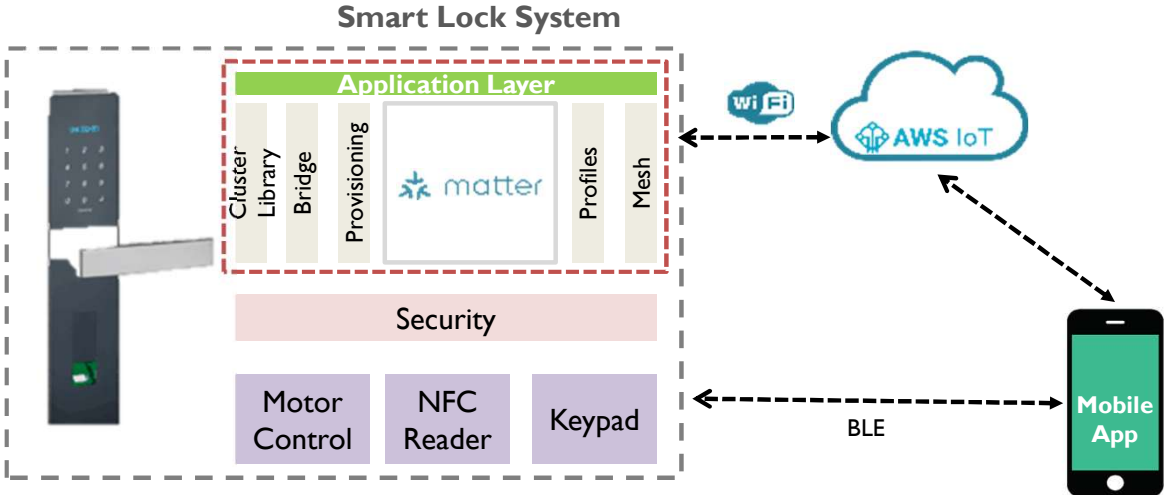
## Implementation

- Wireless Module based on ARM Cortex M4
- NFC reader
- Capsense for Touch
- Stepper Motor Control for Door Lock/Unlock
- Matter Protocol
- Android and IOS Phone Application
- AWS for Cloud Interface
- Duration :6 months

## Business Impact

- Able to showcase multiple Silicon solutions of vendor
- Ability to demonstrate new technology like Matter
- Seamless Integration with AWS
- SDK for easy customization

**Tech Stack:** Cluster Library, Matter Protocols, Mesh, AWS IoT Cloud, Wi-Fi & BLE Connectivity



Project Scope	Development Kit
Project status	Final integration and builds in progress
Duration	6 months
HW Iterations	2

# Case Study - IoT Enabled Gas Sensor

## Problem Statement

- To be able to remotely sense critical gas status
- Battery operated device - Low on Battery power consumption
- Alert to relevant agencies

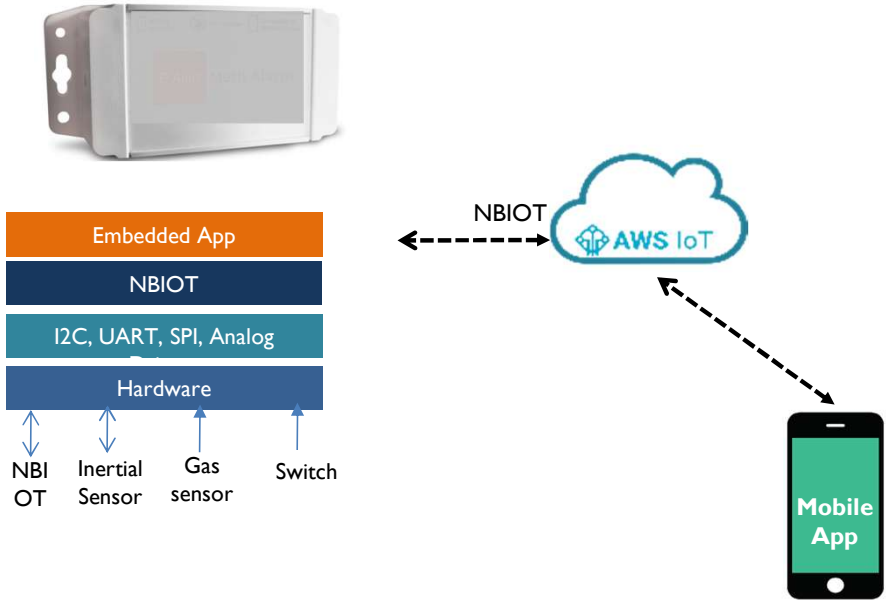
## Implementation

- CAT-M/NB-IoT implementation
- Single chip Wireless SOC
- FOTA updates
- Implementation in USA, NZ and Australia

## Business Impact

- Client able to obtain good business traction with the device
- Unique business opportunity

**Tech Stack:** NB-IoT, Shock sensing, analog to PPM conversion, Tamper detection



# Case Study – Building Monitor

## Problem Statement

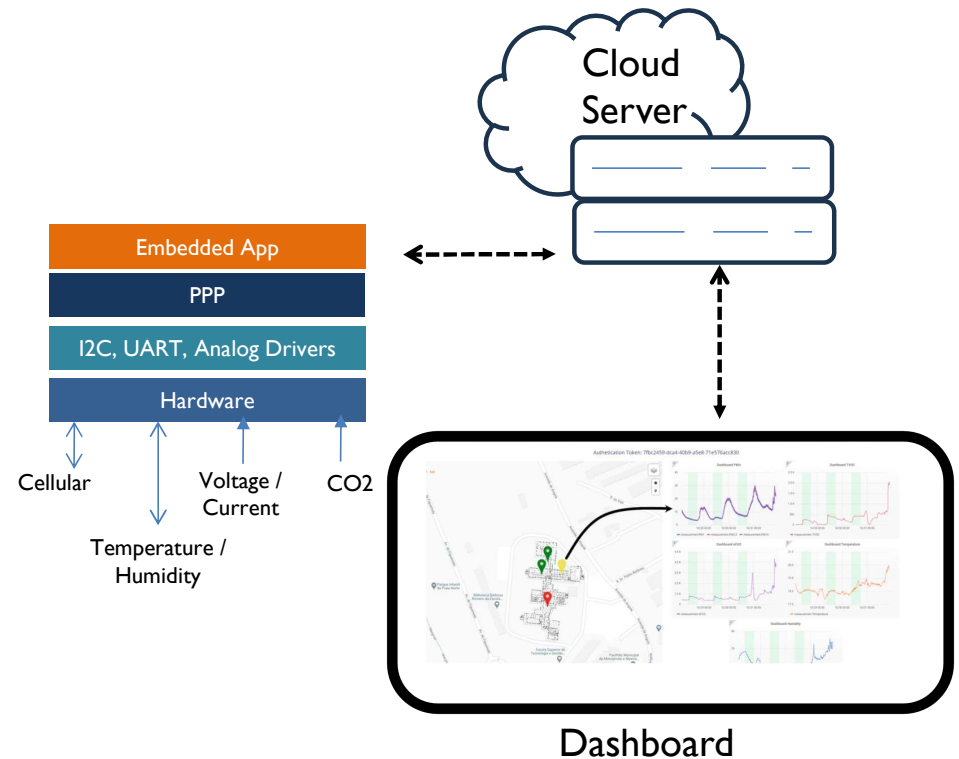
- Client creating buildings with innovative building material
- Need to evaluate the impact on energy consumption with each building in several locations across India
- Continuous monitoring of environment and power consumption

## Implementation

- Multiple sensors for environment - Temperature, Humidity, CO2
- Multiple sensors for measurement of instantaneous power – Voltage, Current, Frequency
- Cellular connectivity
- Implementation in multiple locations across India

## Business Impact

- Client able to evaluate the efficacy of building materials



# Case Study – Smart Farm Solution

## Problem Statement

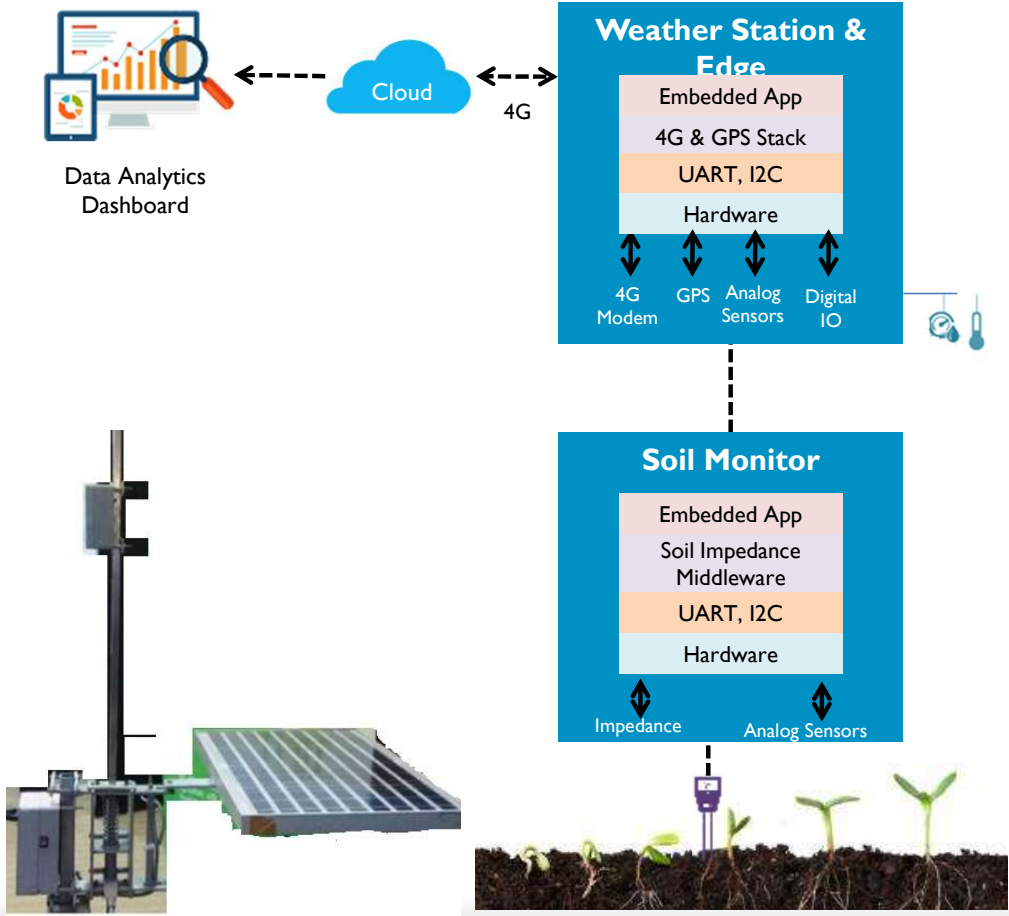
- To improve productivity and yield in Agriculture
- Monitoring of soil parameters and Weather in Agricultural lands
- Ability to function in areas with no electrical power
- Client - Top Indian Conglomerate

## Implementation

- Solar Powered solution
- Integration of multiple sensors for Soil and Ambient measurements
- Soil impedance measurement for Soil Nutrient measurement
- Working closely with mechanical team for finalizing PCB location, size and Ingress protection
- Hardware & Firmware Development
- Support in Cloud Integration
- Extensive field testing

## Business Impact

- Client was able to establish the Smart Farming concept with the prototypes
- Able to build the business case for large scale operation
- Successfully able to use technology for improving yield to the farming customer



# Thank You !!

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