IoT
Anything from Anywhere
With the Internet of Things

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Apple supports Windows?

What is the IoT?

and why can't you capitalize it right?

Internet ***o***f ***T***hings

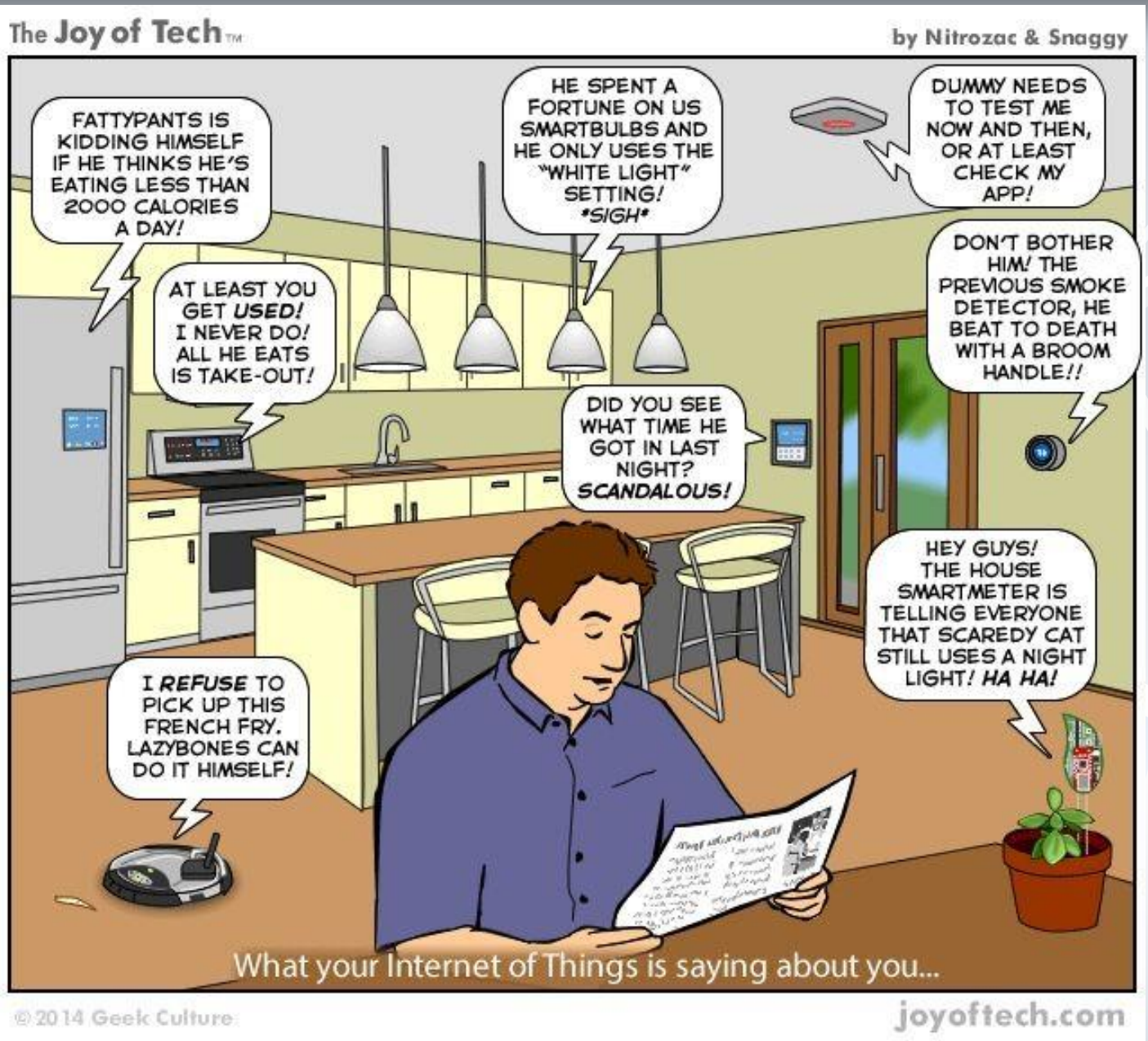
Defined in Recommendation

ITU-T Y.2060, sec 3.2.2

A *system* of interrelated computing *devices* provided with unique identifiers and ability to *transfer data* over a *network* without human interaction.

Brave New World?

Maybe…



"Bad news - the scale is threatening to cut off our access to the fridge..."

Typical DCC-inspired Project

Possible Result if you Don't Pay Attention

IoT – the Big Picture

Components of IoT

- devices
- data
- network
- storage
- access

IoT – the Big Picture

Components of IoT

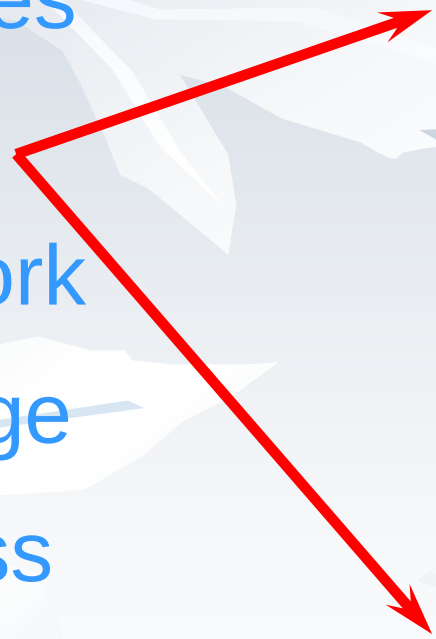
- **devices**
- data
- network
- storage
- access

- sensors
- servos
- displays
- motors
- processors
- nuclear reactors
- nanobots

IoT – the Big Picture

Components of IoT

- devices
- **data**
- network
- storage
- access



- temperature
- time
- velocity
- orientation
- elevation
- audio/video
- … just numbers

IoT – the Big Picture

Components of IoT

- devices
- data
- **network**
- storage
- access

- WAN, LAN
- Bluetooth
- Ethernet
- cellular network
- WiFi
- mesh networks
- *typically* wireless

IoT – the Big Picture

Components of IoT

- devices
- data
- network
- **storage**
- access

- cloud servers
- NAS
- distributed
- persistent
- backed up
- secure (or not!)
- multiple access

IoT – the Big Picture

Components of IoT

- devices
- data
- network
- storage
- **access**

- Web browsers
- custom GUIs
- raw data ports
- remote servers
- devices
- other devices
- network gateways

IoT – the Big Picture

Components of IoT

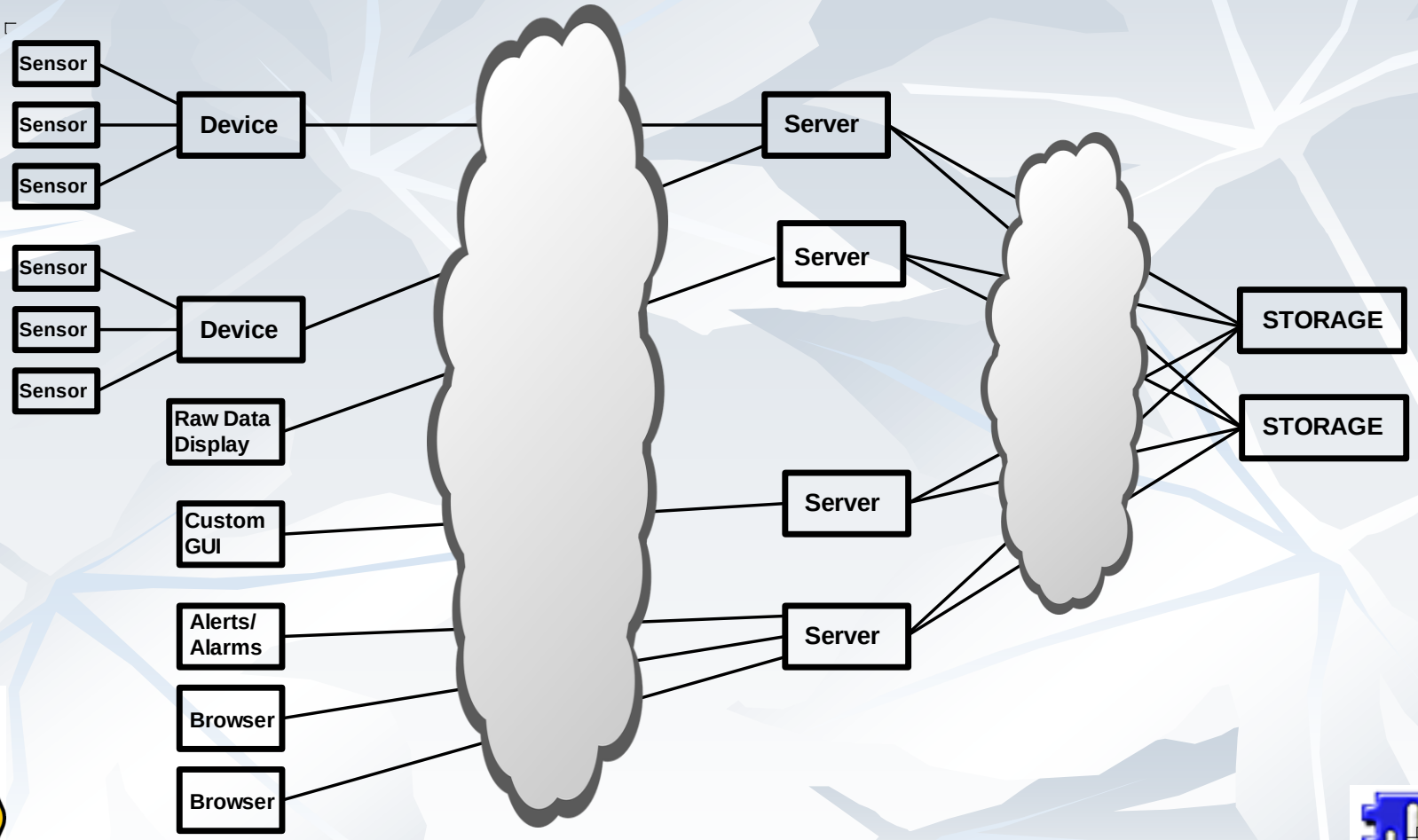
- devices
- data
- network
- storage
- **access**

We get to make this

These exists already!

So does most of this!

IoT – One Implementation



Leaky Clouds

The Project: Goals

Hardware

- Renesas Synergy SK-S7G2 Board
  - Custom Arduino sensor board
    - AMS 5-way sensor PMOD
      - WiFi PMOD
    - 4G LTE CAT1 modem PMOD
      - Vibration motor
    - USB drive, ear buds

The Project: Goals

Software

- Use existing e2Studio IDE, SSP
- Custom Arduino sensor board
- Five Lab exercises to demonstrate
  - Local control and sensor display
  - Cloud connectivity via WiFi
  - Cloud connectivity via 4G LTE
  - BLE connectivity

The Project: Goals

Lab Exercises

- Lab 1: WiFi and AMS proximity sensor
- Lab 2: MP3 player
- Lab 3: multi-sensor
- Lab 4: Bluetooth connectivity
- Lab 5: Multiple board connectivity

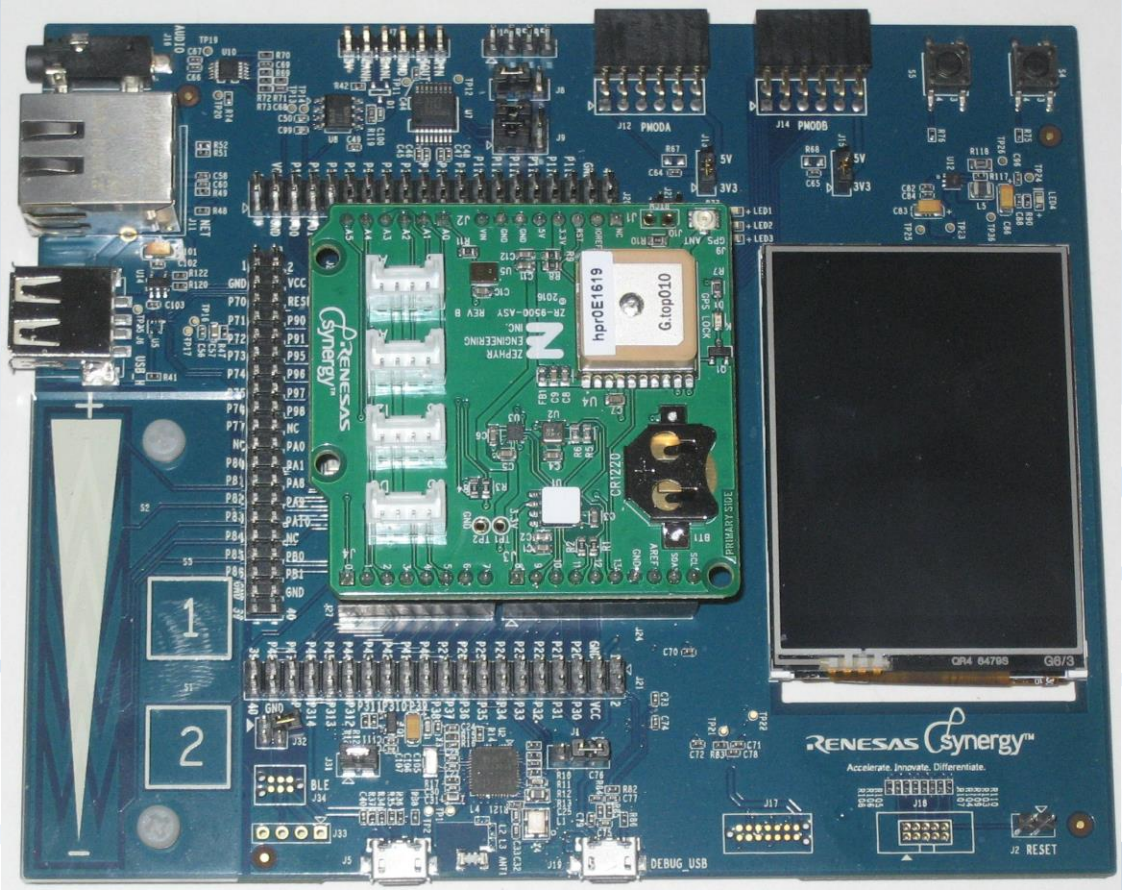
The Project: Goals

Lab Exercises

Labs must show examples of:

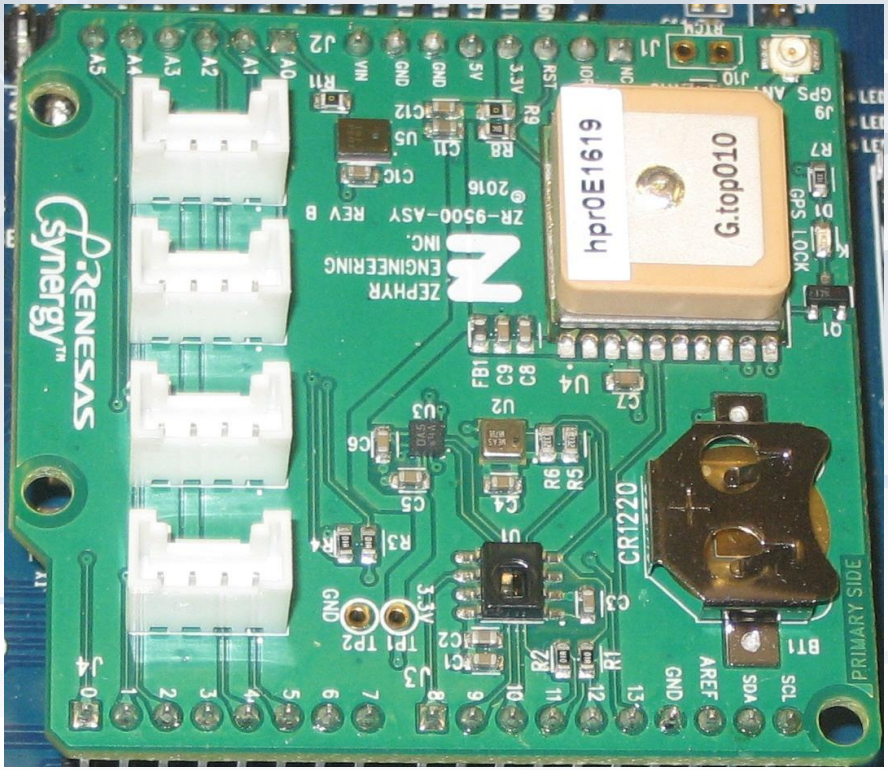
- Local sensor data display
- Display or control of data in the Cloud
- Bluetooth to connect a sensor
- Access multiple boards in one GUI
- Show use of Verizon's Freeboard Dashboard

Hardware (device)



Renesas Synergy SK-S7G2 Board

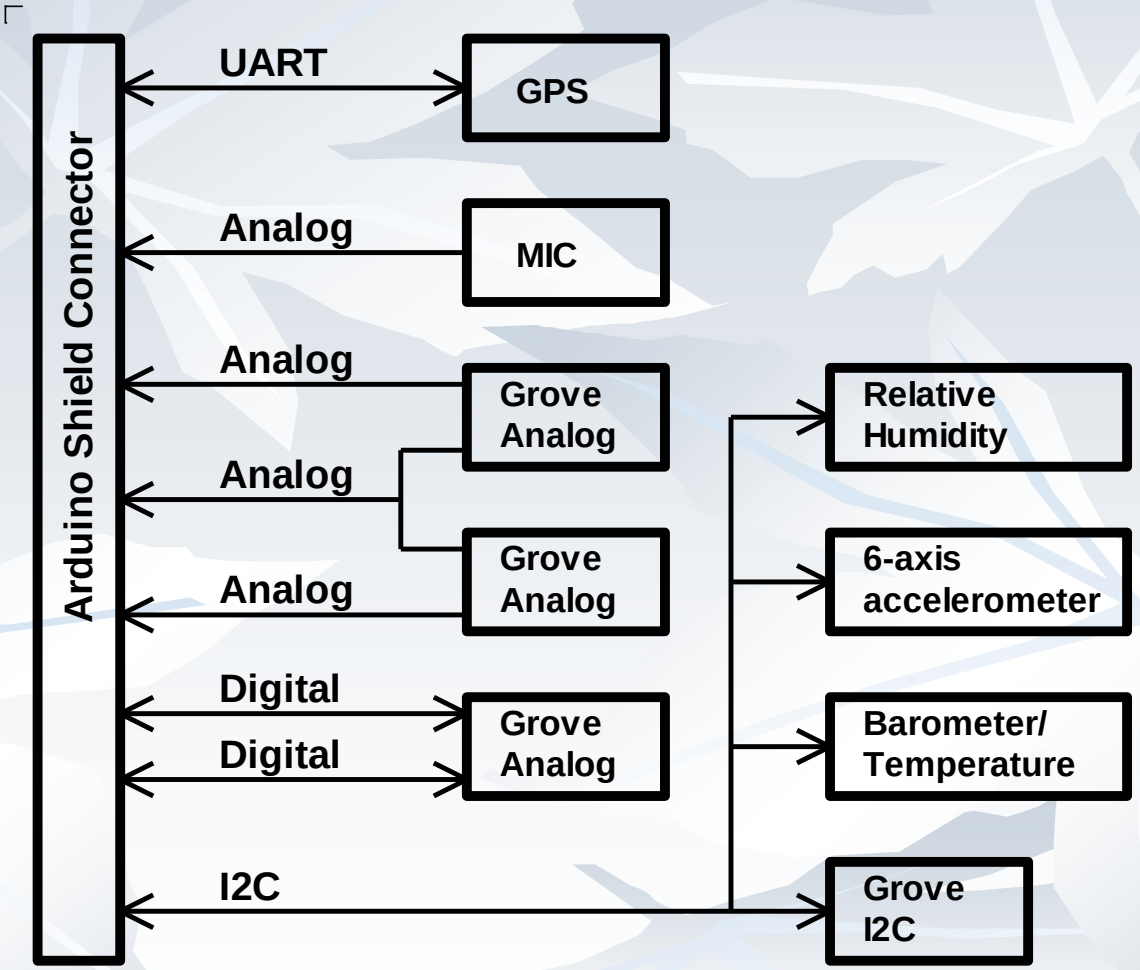
Hardware (device)



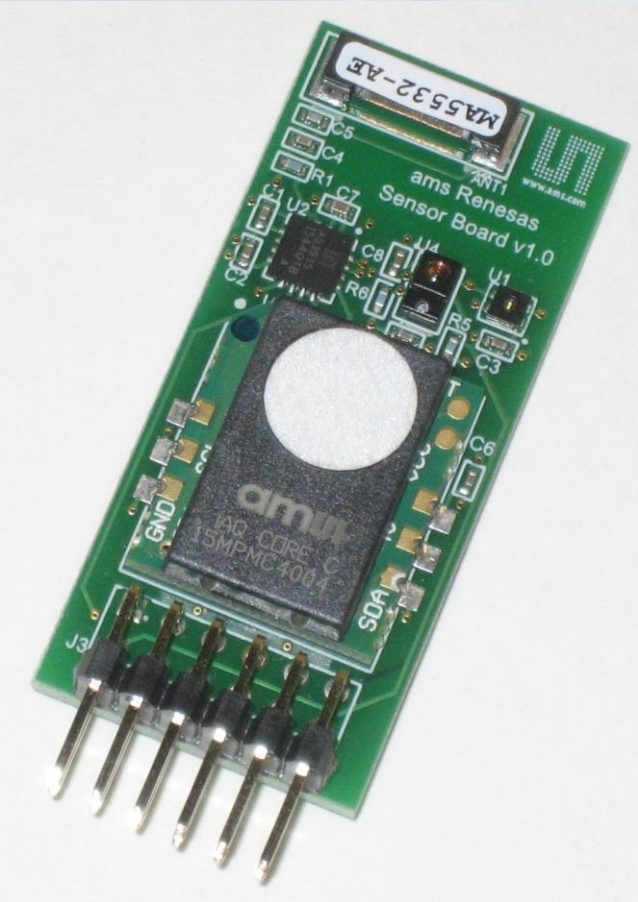
Sensor Shield Board

Hardware (device)

Sensor Shield Block Diagram



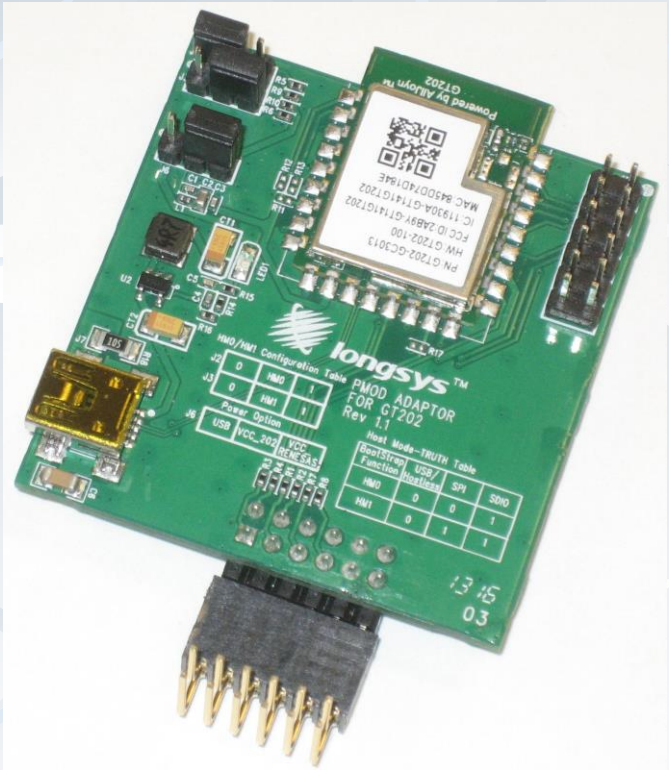
Hardware (device)



AMS 5-way sensor PMOD

- Proximity/ambient light
- Temperature
- Humidity
- Air quality
- Lightning

Hardware (device)



WiFi PMOD

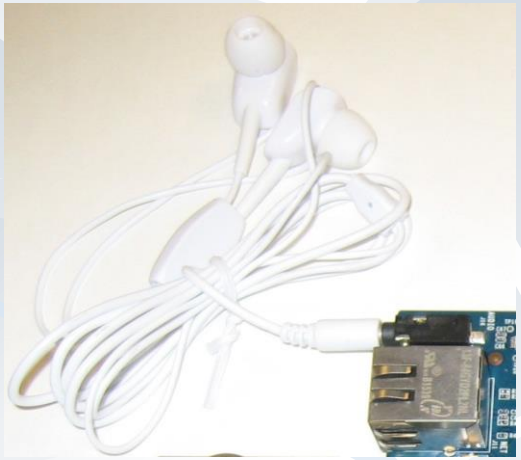
4G LTE Modem PMOD

UART communications interface over PMOD

Hardware (device)

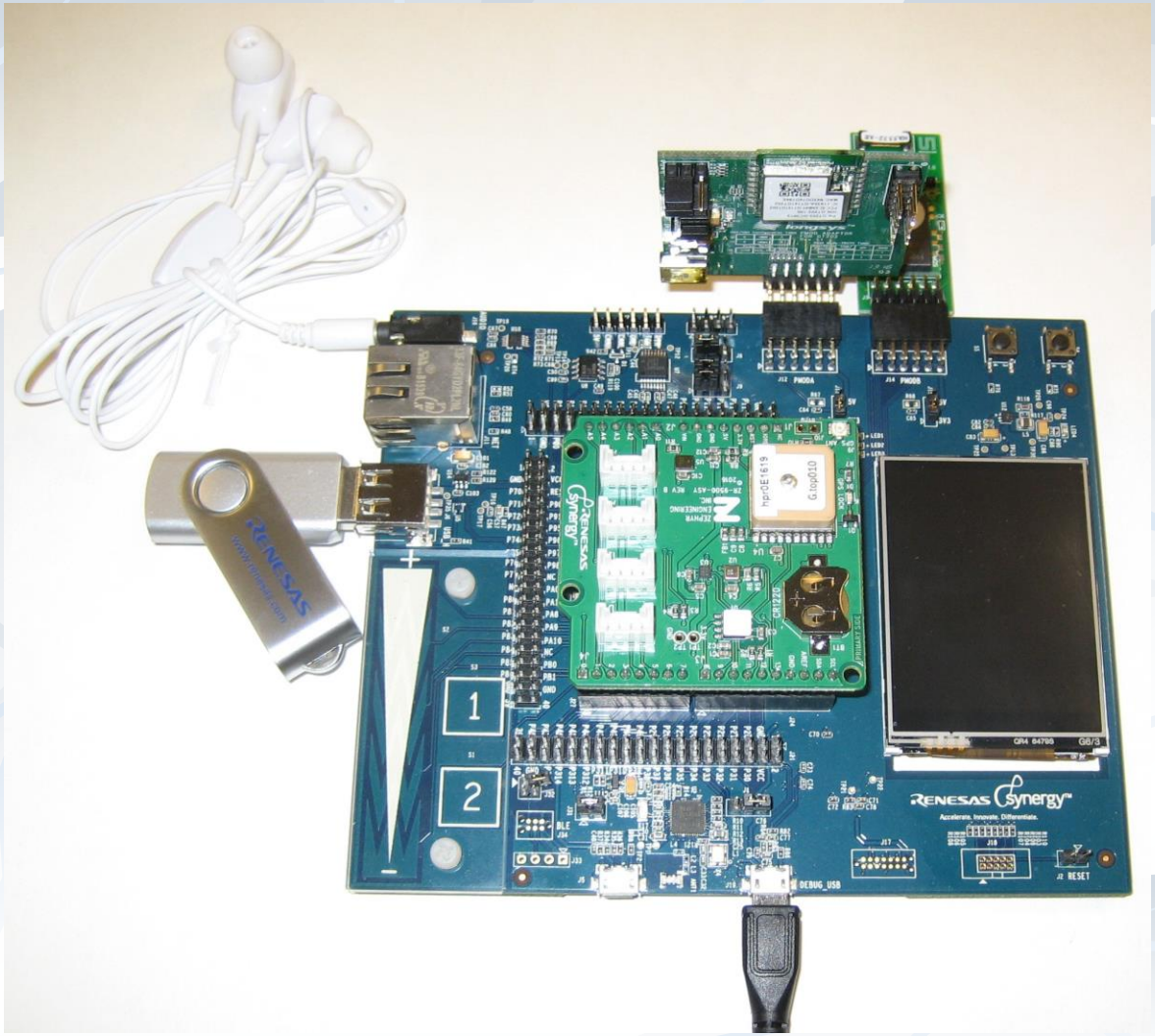
USB drive
For S/W and documentation

Haptic motor
For physical alerts



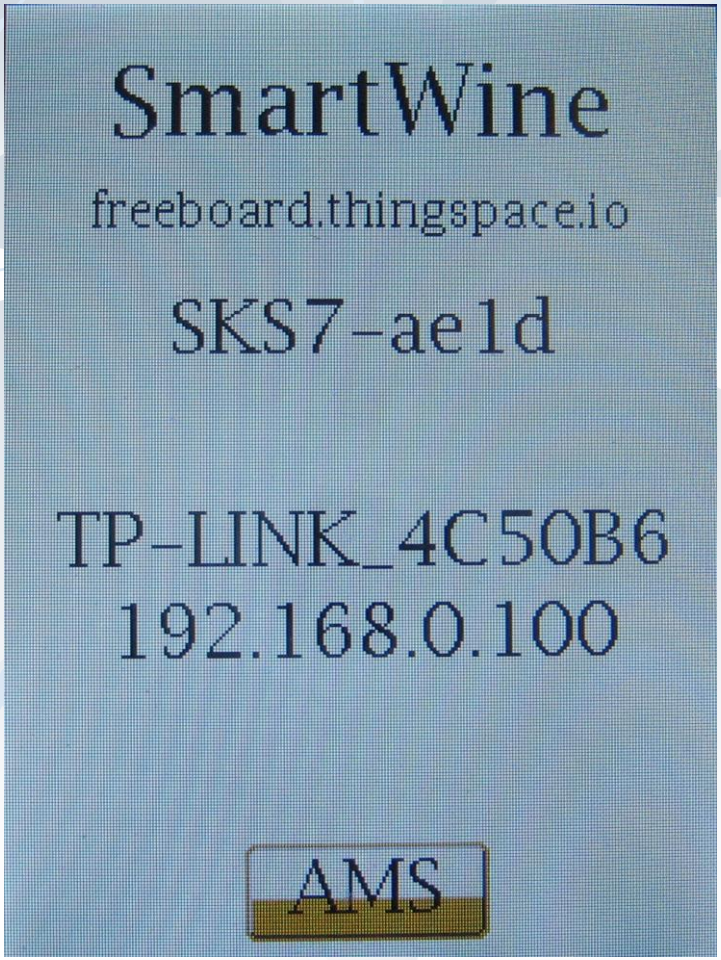
Ear buds
For MP3 audio and alarms

Lab 1: SmartWine

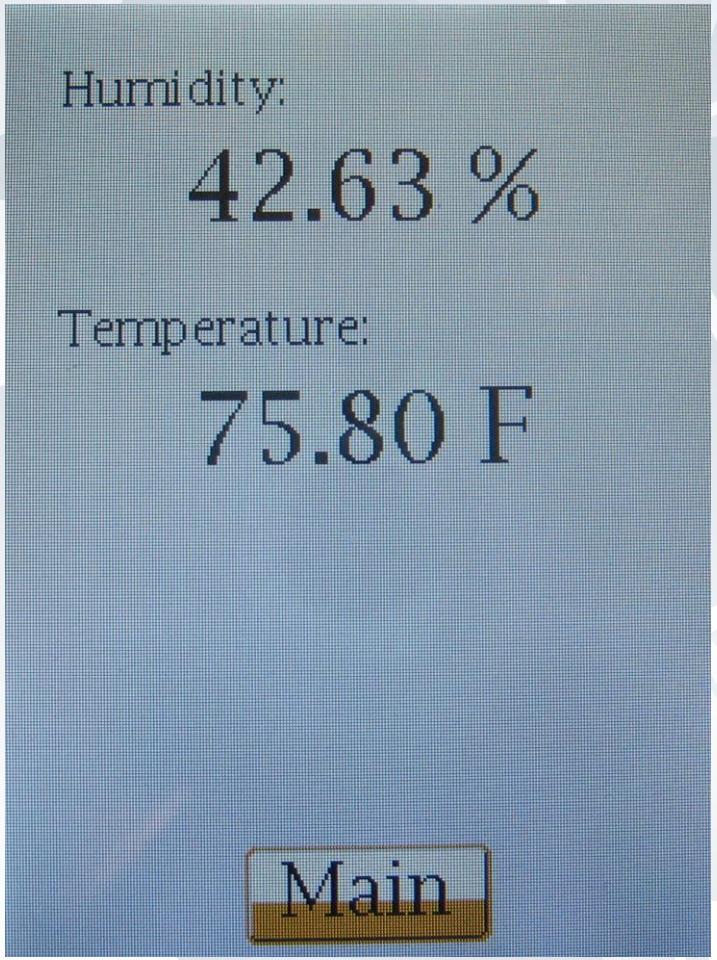


Ready
For Lab 1

Lab 1: SmartWine

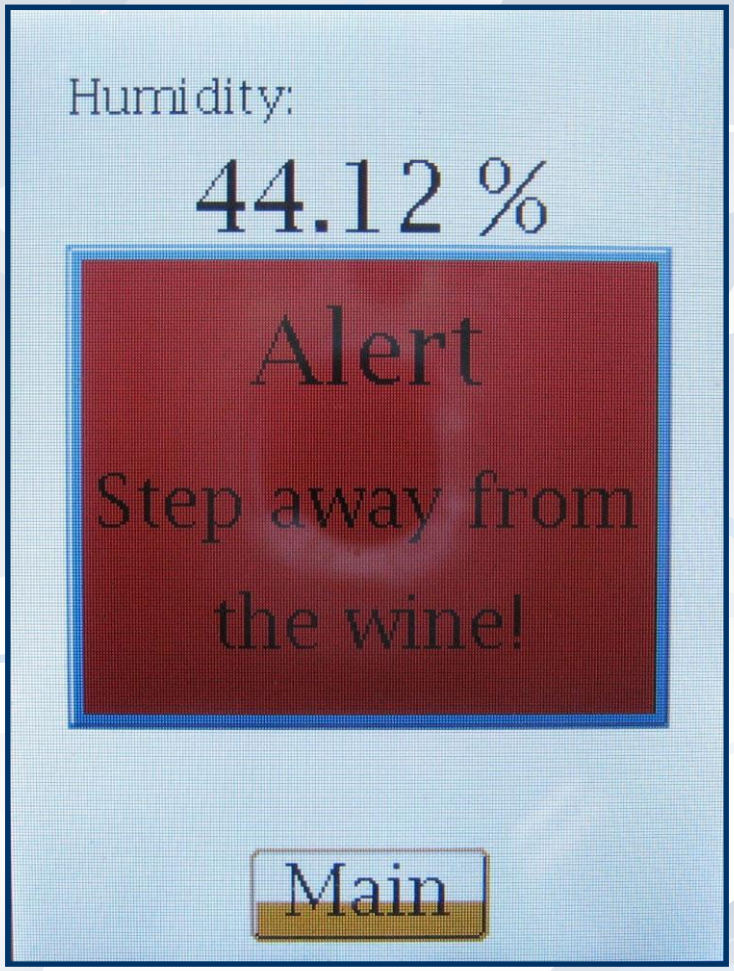


Main Screen



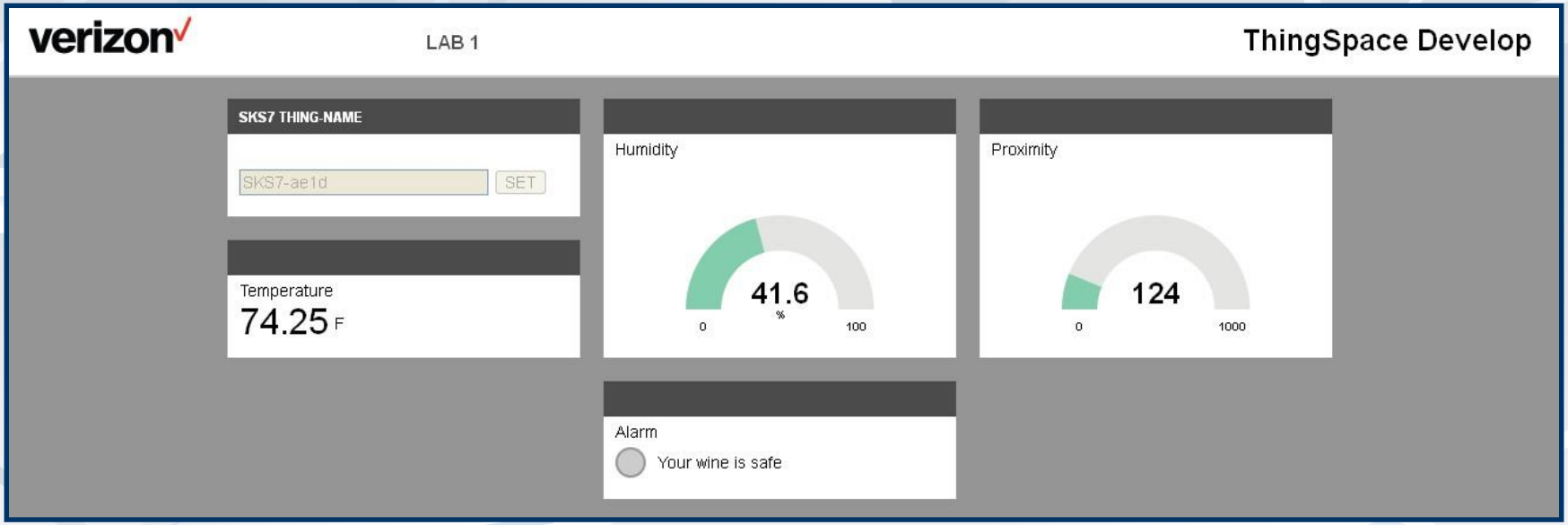
AMS Screen

Lab 1: SmartWine



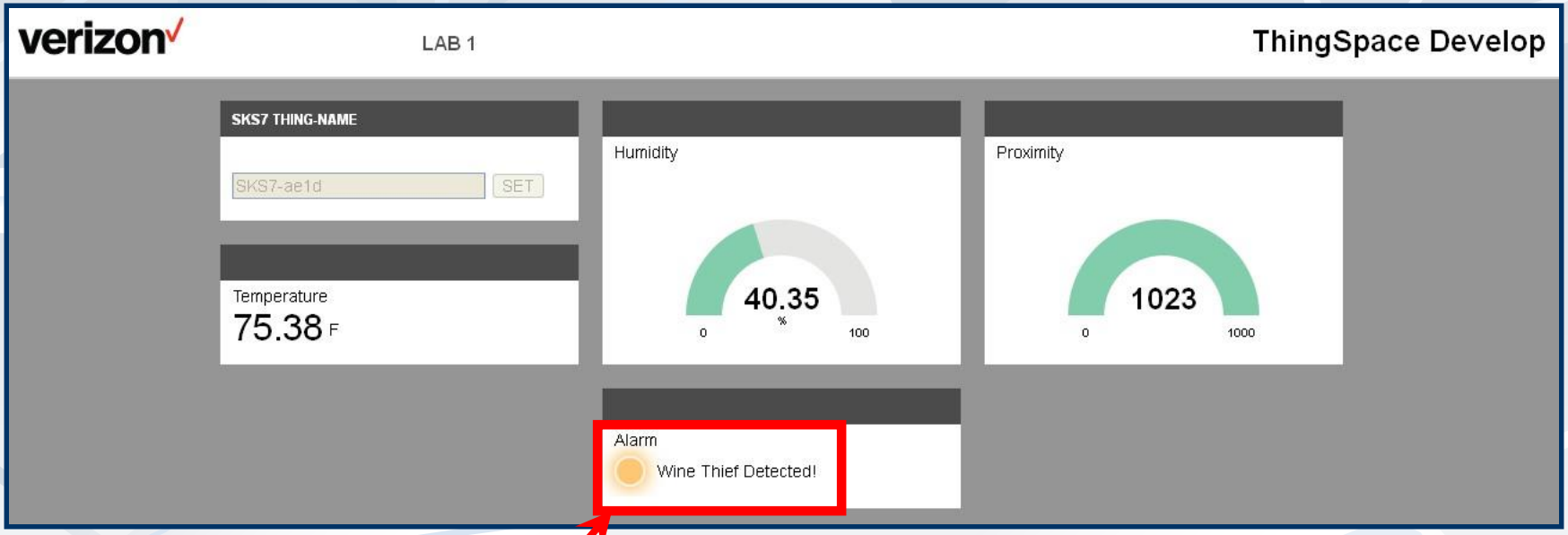
AMS Screen with Alert

Lab 1: SmartWine



ThingSpace Dashboard in the Cloud

Lab 1: SmartWine



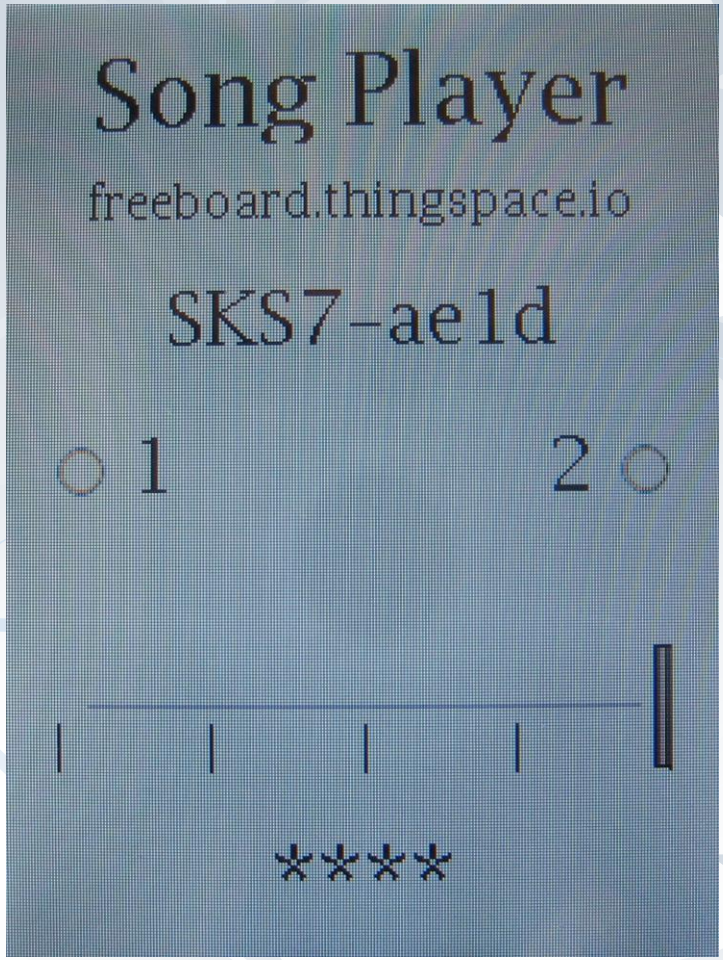
Lookout!

ThingSpace Dashboard in the Cloud

Lab 2: RemoteSongPlayer

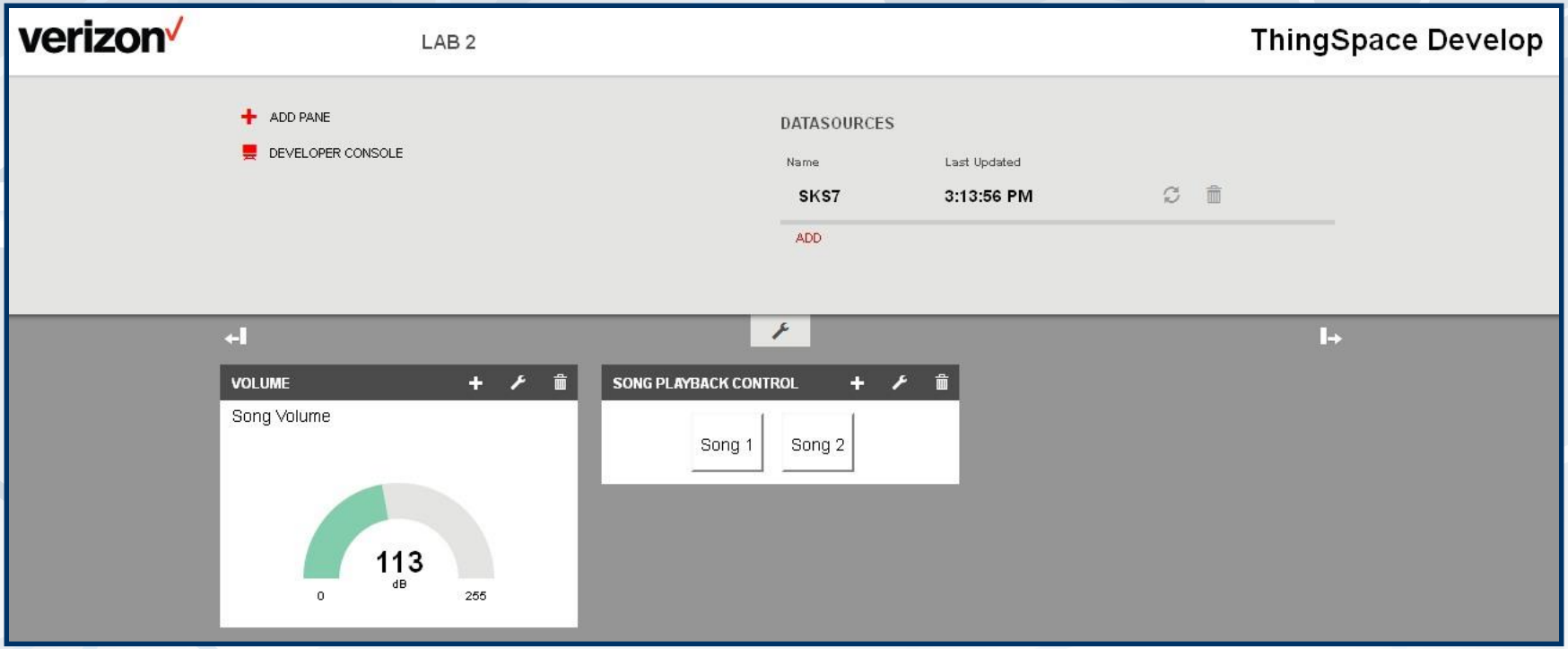
Ready
For Lab 2

Lab 2: RemoteSongPlayer



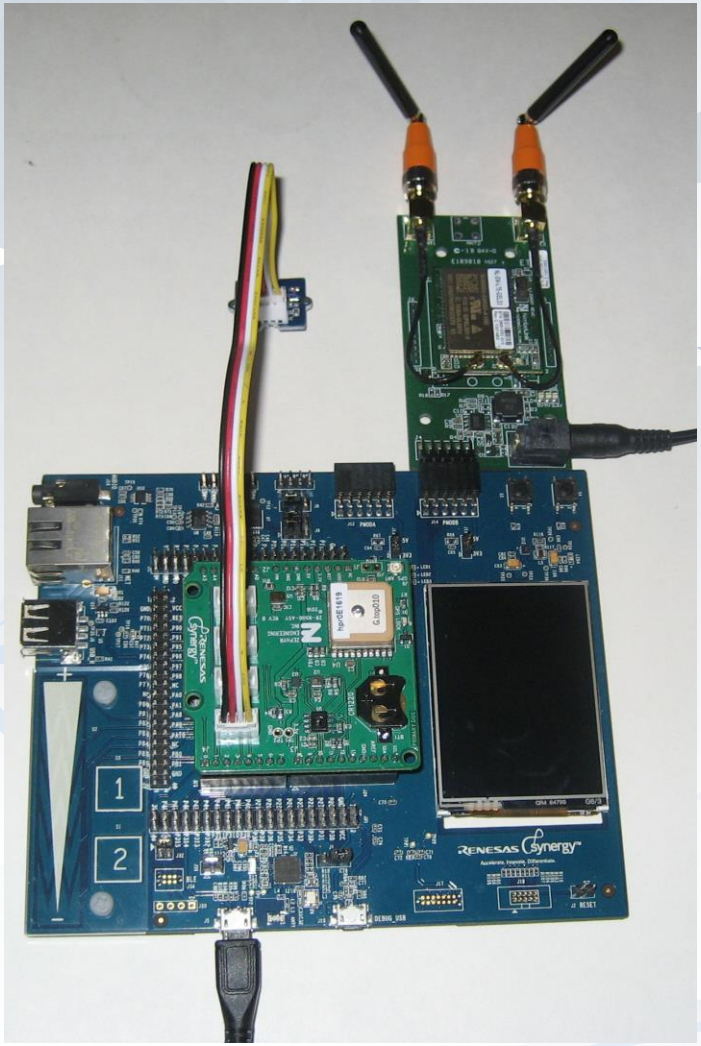
Main Sceen

Lab 2: RemoteSongPlayer



Thingspace Dashboard in the Cloud

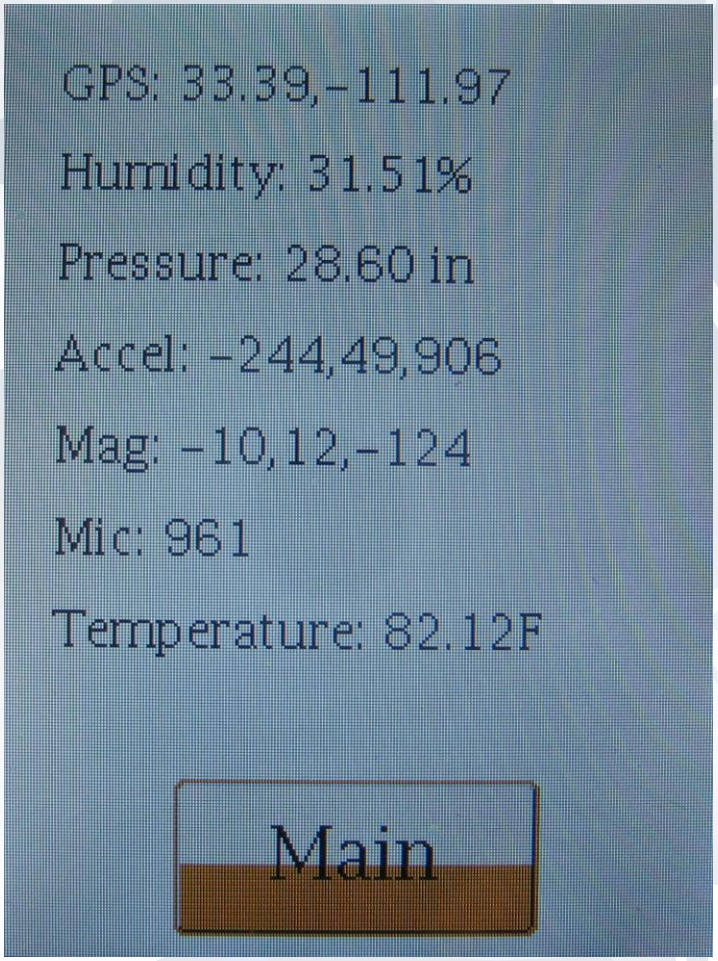
Labs 3, 4 & 5: FunWithSensors



Ready
For Labs 3, 4 and 5

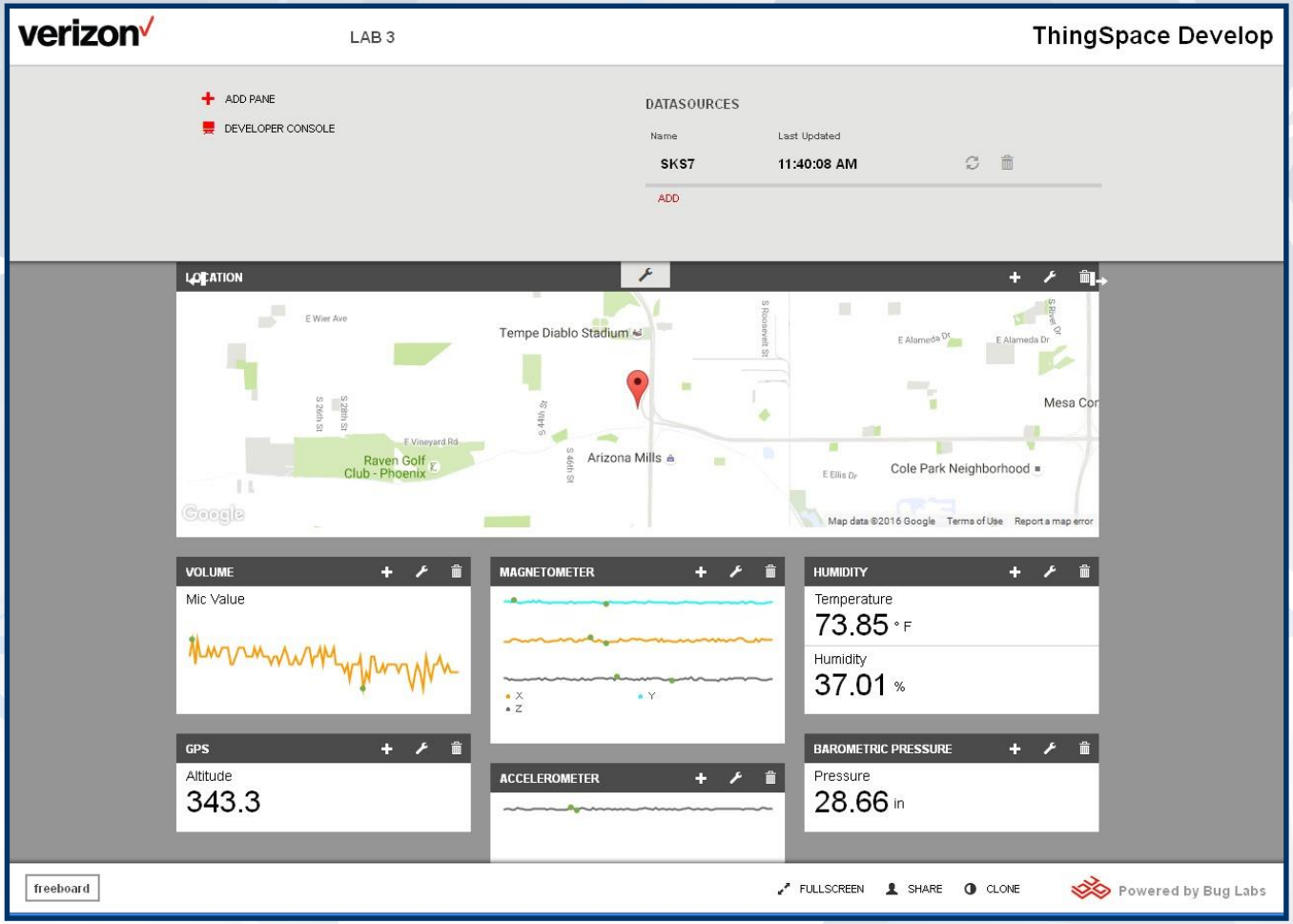
Lab 3: FunWithSensors

Main Screen



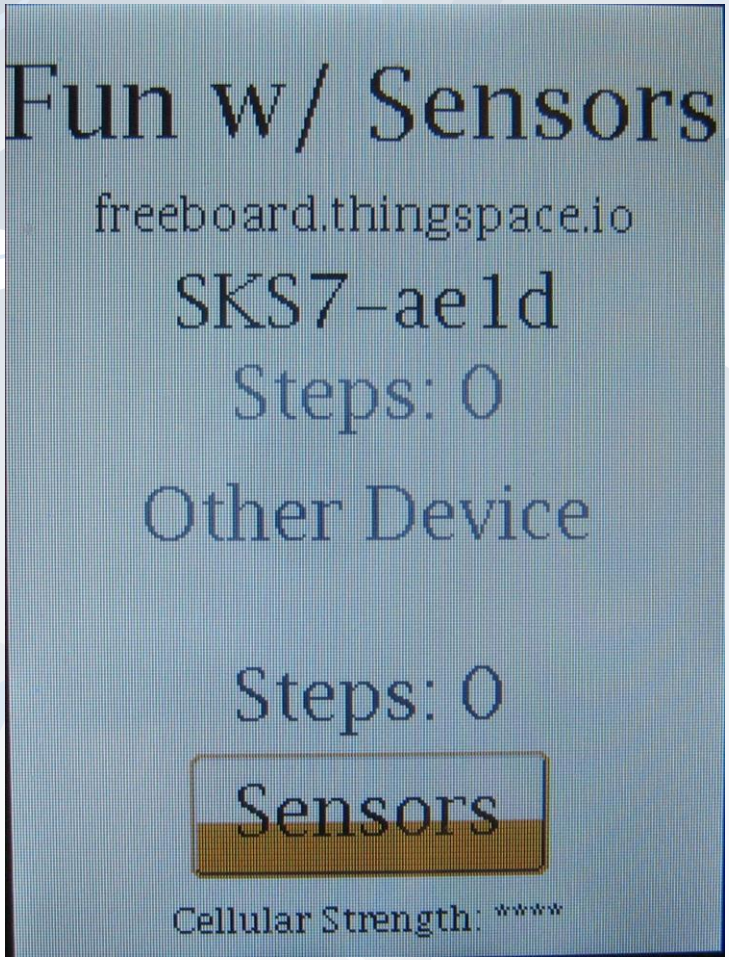
Sensors Screen

Lab 3: FunWithSensors



ThingSpace Dashboard in the Cloud

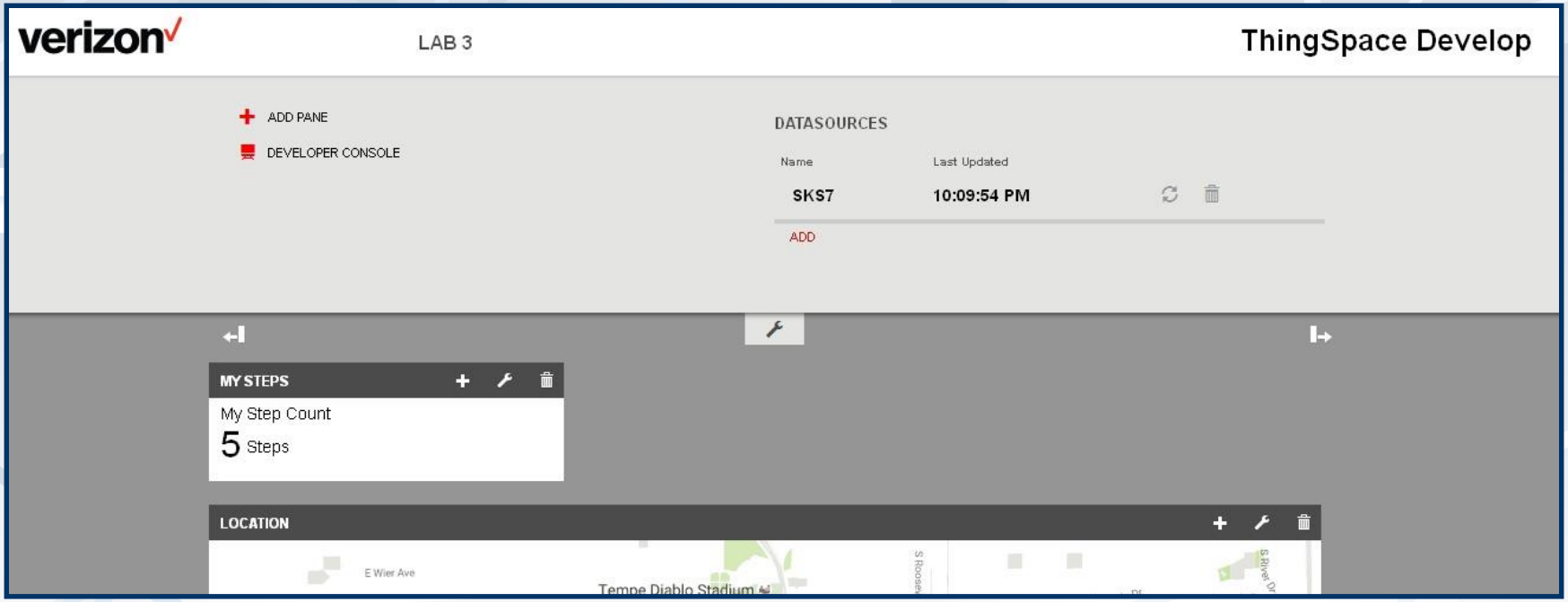
Lab 4: FunWithSensors



Main Screen

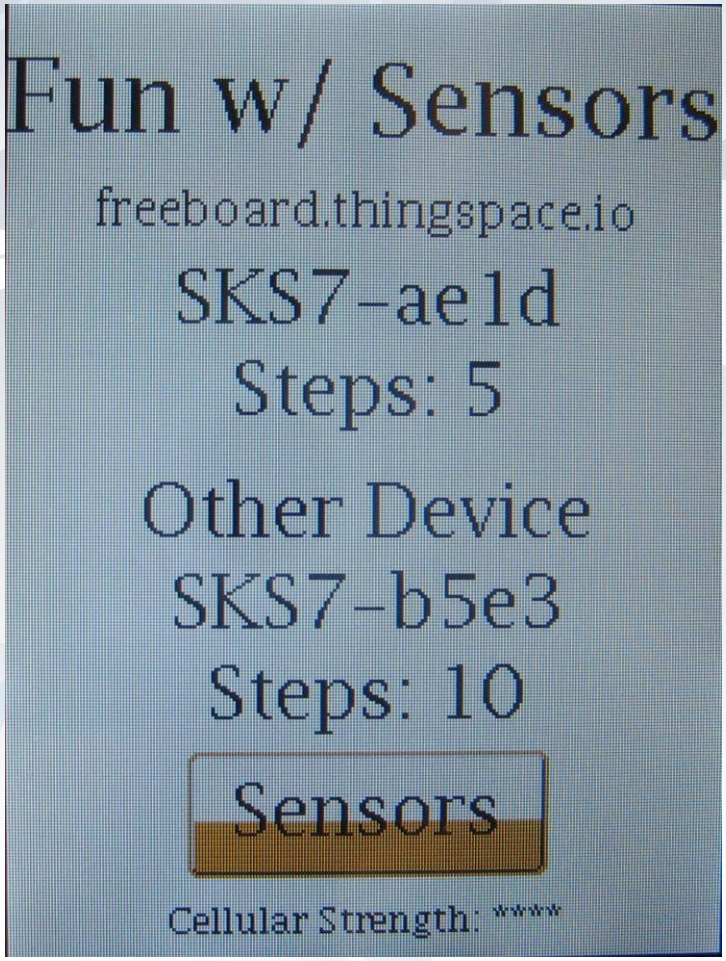
Phone Screen

Lab 4: FunWithSensors



ThingSpace Dashboard in the Cloud

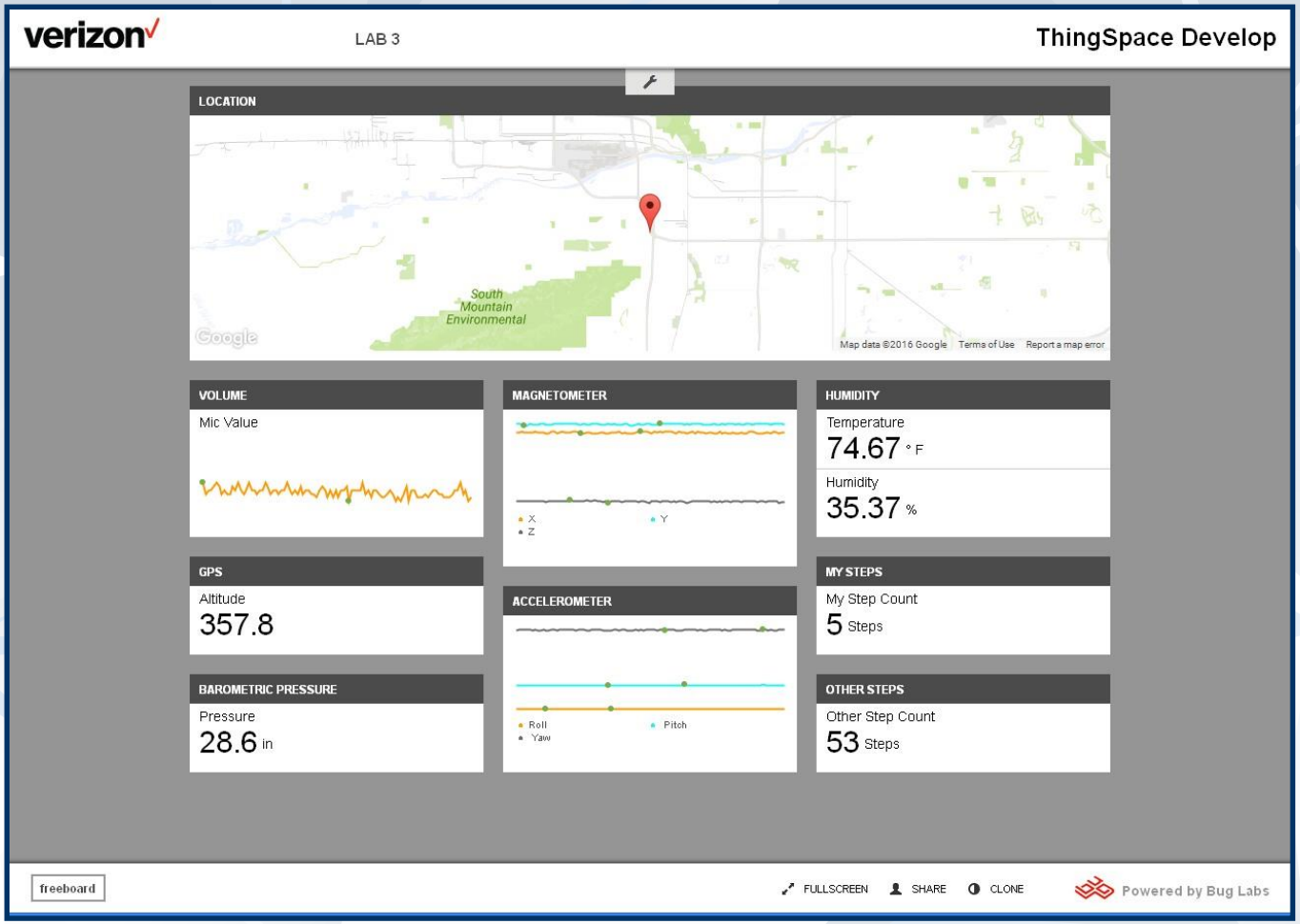
Lab 5: FunWithSensors



Main Screen

Phone Screen

Lab 5: FunWithSensors



ThingSpace Dashboard in the Cloud

Thank You!

Renesas Synergy:
renesas.com/synergyapplicationprojects

BugLabs Freeboard: freeboard.io

Verizon ThingSpace:
thingspace.verizon.com/developer

Arrow Electronics (Seminars): arrow.com

Zephyr Engineering, Inc: zpci.com/renesas