



RISE
Research and Immersion
for **STEM** Excellence

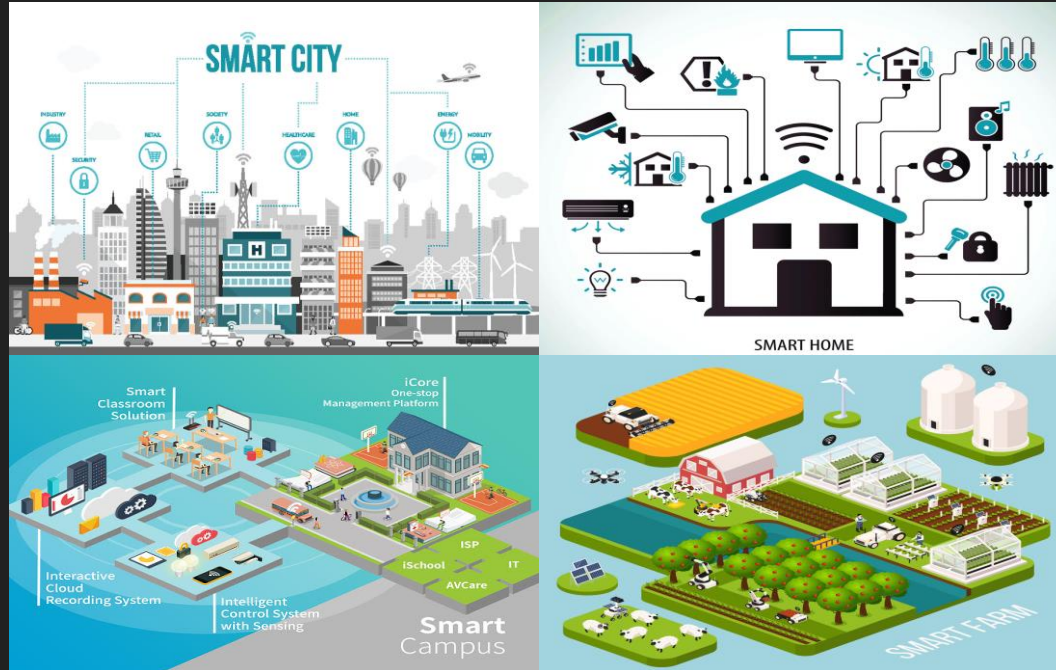
Implementing Smart Farm Prototype with Internet of Things

Jashandeep Singh, Jorge Hernandez, **Crystal Saini***, **Jesus Gonzalez***

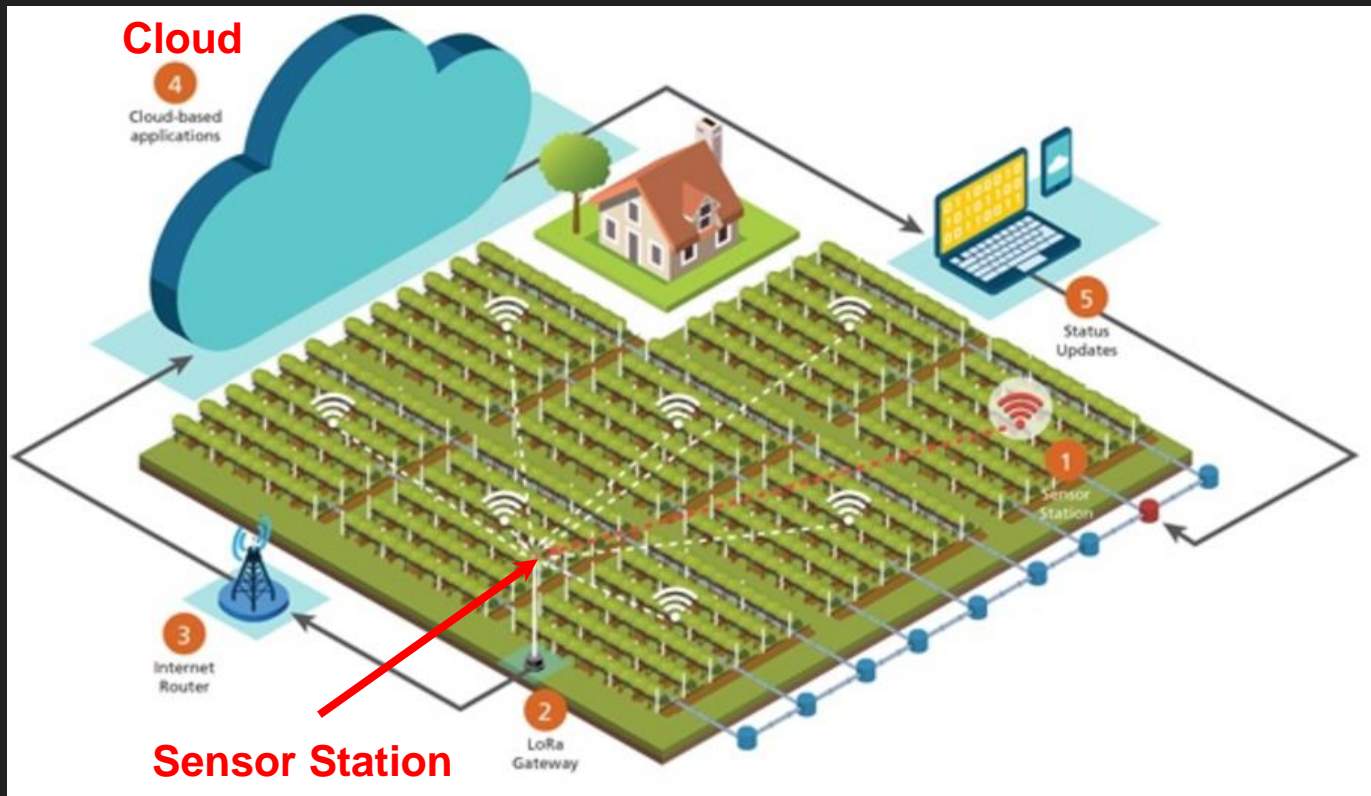
Advisor: Dr. Dae Hee Kim

Internet of Things

The interconnection via the internet of computing devices allowing them to send and receive data.



Smart Farm



Sensor Station

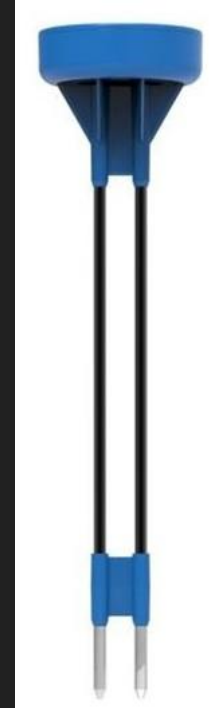
LoRaWAN Gateway

Purchasing Devices (Sensoterra)

- 2 Sensoterra 24 inch (2 feet) Single Depth Moisture Sensors
- 2 Sensoterra LoRaWan Gateways



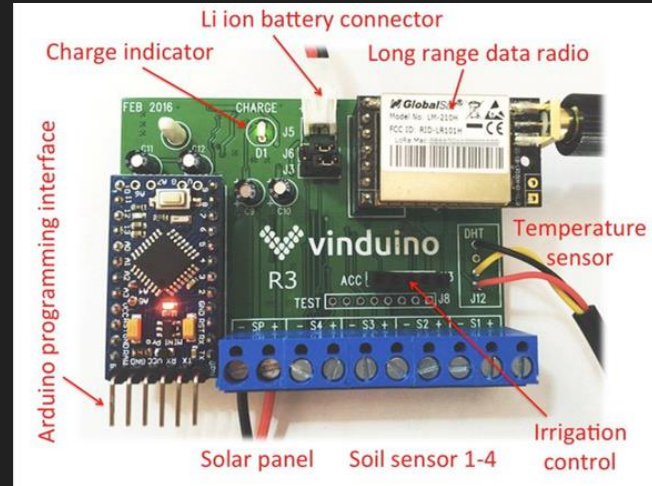
Sensor



Gateway

Purchasing Devices (Vinduino)

- 2 Vinduino LoRa wireless sensor station boards
- 2 8-channel LoRaWAN gateways US/AU 915 MHz
- 2 Watermark Soil Moisture Sensors



Station Board



Sensor



Gateway

Prototype using Sensoterra Devices

- **Deploying the Sensors**

- Registering the sensor using sensoterra phone app
- Deploying the sensor in my backyard
- Activate the sensor by placing the sensor into the soil



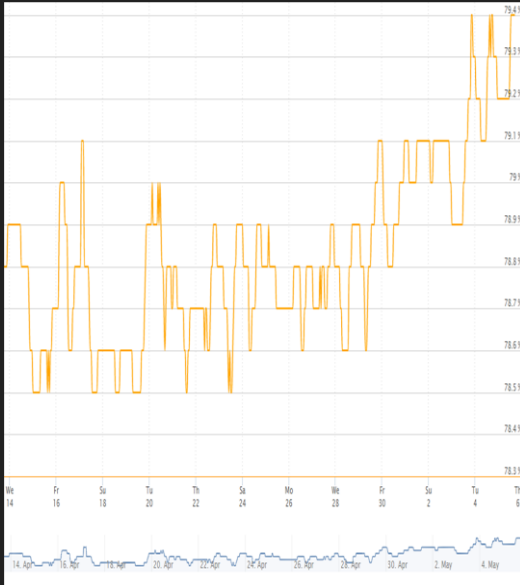
- **Deploying the Gateway**

- Connecting the gateway using Ethernet
- Placing the gateway at close distance to the sensor
- Approximately 50 feet from the sensor



Data Collection and Visualization

- Two ways of getting access to the data:
 - Sensoterra App on a smartphone
 - Web Monitor on a desktop
- Web Monitor Demo
- Then we put the data in BigQuery on Google Cloud



10	2021-03-23 16:24:20 UTC	0.0	
11	2021-03-23 17:24:20 UTC	0.0	
12	2021-02-24 16:46:54 UTC	69.5	
13	2021-02-24 17:46:54 UTC	69.5	
14	2021-02-24 18:46:53 UTC	69.5	
15	2021-02-24 19:46:53 UTC	69.5	
16	2021-02-24 20:46:52 UTC	69.5	
17	2021-02-24 21:46:52 UTC	69.5	
18	2021-02-25 00:46:51 UTC	69.5	
19	2021-04-01 04:49:07 UTC	78.5	
20	2021-04-01 05:49:07 UTC	78.5	
21	2021-04-07 14:48:16 UTC	78.5	

Prototype using Vinduino Devices

- LoRaWAN Module
- Watermark Soil Moisture Sensor
- Battery
- Solar Panel



System Setup

- Assembled the Vinduino System
- Connected LoRaWAN Gateway
- Set up internet connection
- Register gateway at The Things Network

Femto-4573FF AUTO REFRESH ON

Status

- Overview
- Routes
- System Log
- Kernel Log
- Processes
- Realtime Graphs

Status

System

Hostname	Femto-4573FF
Model	GIOT InDoor FemtoCell
Firmware Version	Version 3.02.35 Wed May 23 14:11:22 CST 2018
Kernel Version	3.10.14
Local Time	05/23/18 15:58:35
Uptime	0h 4m 8s
Load Average	0.04, 0.12, 0.06

Femto-4573FF

Status

Ethernet WAN Wireless Extender

System

GloT

Packet Forward

Network

- WAN
- Wireless
- LAN
- DHCP
- Diagnostics

Wireless Extender

Click "Scan" to get Access Point List

Extender mode: enable ▾

SSID:

Security: WPA2-PSK-AES ▾

KEY:

[Logout](#)

Future Work

- Collect and send data from sensors directly to Cloud through LoRaWAN Gateway
- Identify factors affecting the sensor data such as weather, moisture level and placement of the sensors
- Analyze the data using Apache Spark or Tensor Flow
- Visualize with Web/mobile application
- Operate devices on the farm remotely and provide information to farmers through smart devices

Thank You! Questions?



Crystal Saini: csaini@csustan.edu

Jesus Gonzalez: jgonzalez174@csustan.edu

Jashandeep Singh: jsingh72@csustan.edu

Jorge Hernandez Ortega: jhernandezortega@csustan.edu

Advisor: Dr. Dae Hee Kim dkim10@csustan.edu