



IoT Farm Ambassador Wrap-Up Meeting

22nd June 2021

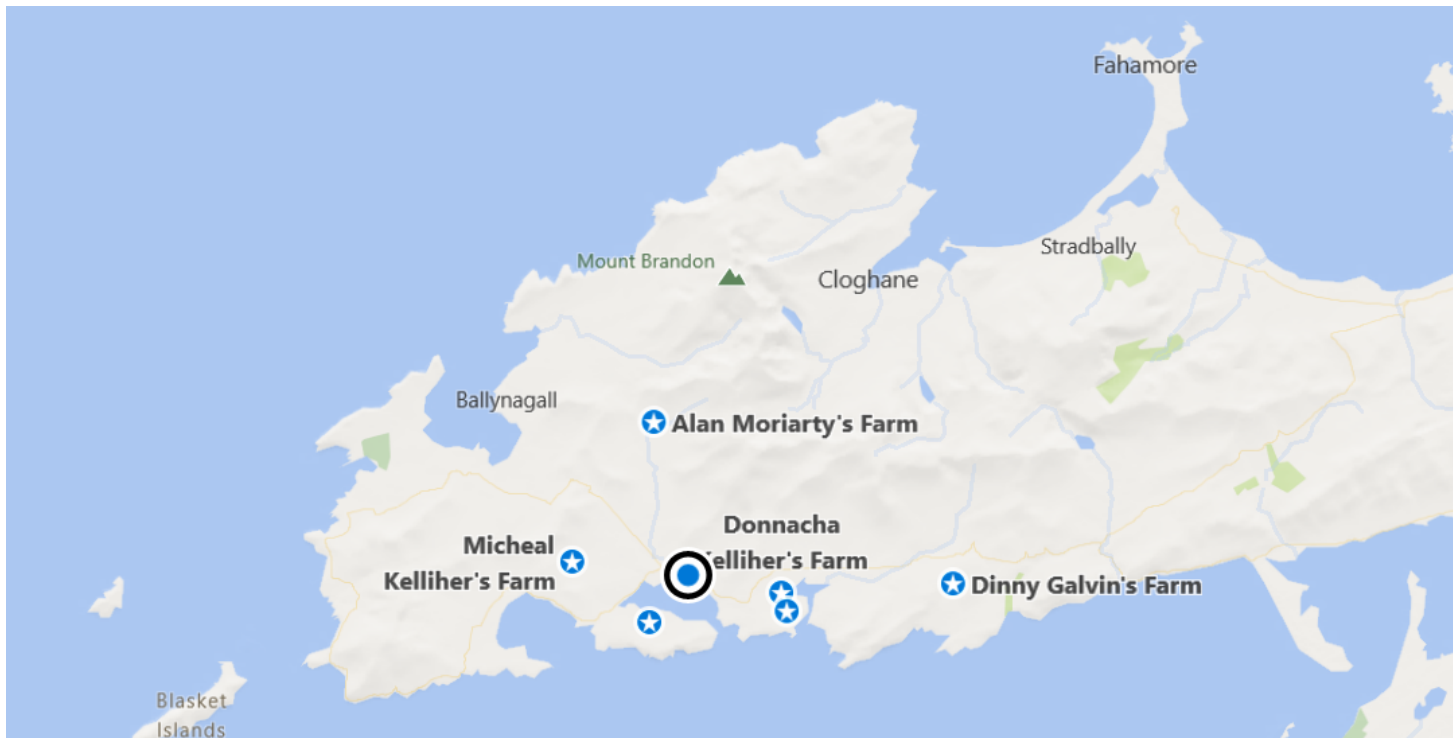
Presented by :
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Michelle Fitzgerald
Domhnall Sheehy

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Project Overview

IoT Farm Locations



Farm Lat / Lon Co-Ordinates	
Dinny Galvin	52.135487, -10.138685
Seán Kennedy	52.126661, -10.225440
Micheal Kelliher	52.142639, -10.337639
Alan Moriarty	52.187563, -10.294962
Ronán Sugrue	52.123133, -10.297277
Donnacha Kelliher	52.132559, -10.228300

Equipment Installed

Multitech LoRaWAN Gateways

- MultiTechConduit®IP67 Base Station
- Gateway relays messages between sensors deployed on the farm and NetFeasa's central network server and data platform, EvenKeel.
- Backhauled using Eir sim's
- Four gateways deployed, covering the six farms
- Recommendation :
 - Proved to be reliable, outages only observed due to power outages or loss of cellular coverage on farm or wider area.
 - Good performance and coverage with minimal message loss
 - For scaling this initiative across the 30 farms, it is recommended to use the IoT technology NB-IoT



Equipment Installed

Libelium Smart Agri Node

Libelium Smart Agri sensor array allowing implementation of up to six sensors, with one rechargeable central control unit. Following probes attached :

- **WS-3000 Weather Station**
 - Wind Speed m/s
 - Wind Direction
 - Rainfall mm
- **BME280 node**
 - Air Temperature (°C)
 - Relative Humidity
 - Atmospheric Pressure (Pascal, kPa)
- **Soil Moisture, Watermark (2 depths 10cm & 20cm)**
- **PT-1000 Soil Temperature (°C) (Depth of 10cm)**
- **Solar Panel to recharge battery**
-

- Data validation carried out by Teagasc
- Improvements made to program to improve data collection and accuracy
- Number of node failures resulting in data gaps
- High failure rate of node (4 of 6 BME280 node replaced, 2 x weather station replaced)
- Data from this sensor can be used to produce a soil moisture deficit model and correlated to grass growth rates and milk production rates allowing a localised model for the farm to give predictive decision making matrix for the farmer.

Recommend use of sensor, but

- Float stock made available
- Five working day workaround, on breakdowns to ensure data continuity



Equipment Installed

Tekelek Ultrasonic LoRaWAN Tank Sensor

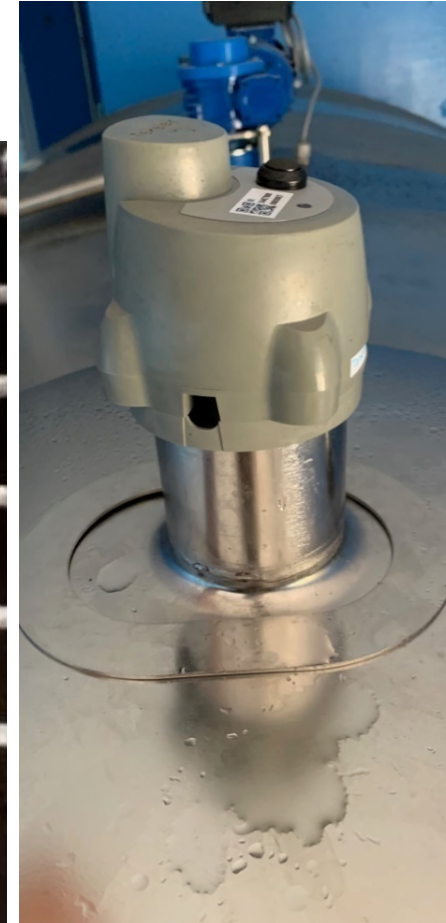
Sensor measuring distance from sensor to liquid in cm

Two installed per farm :

- Milk Tank reporting hourly
- Slurry Tank reporting every 6 hours

Recommendation & Findings

- Most successful and reliable sensor used in trial
- Suggested extra sensors per farm to attach to extra slurry tanks as necessary



Equipment Installed

Sensoterra Soil Moisture

- Plug and Play device, inserted into the soil and give soil reading in %
- Transmitting hourly, depth of 15cm

Recommendations and Findings

- Technology easy to use, sensors robust and portable
- Poor soil calibration curves, make sensor inaccurate and unreliable
- Sensor not recommended for further use, on the project, however suggest approach manufacture on a joint calibration trial with Teagasc for use on Irish soil.



Ongoing Project Work

Smart Agri Unit

- Several iteration of program during project
- Weather stations height adjusted 2meter

Soil Moisture probes

- Depths changed from 20cm / 50cm to 10cm / 20cm
- Method of installation improved for ease of install / removal

Tekelek (Milk Tank)

- Installation method improved, to ensure device fixed firmly to tank to prevent damage to sensor and for hygiene reasons

Site Visits

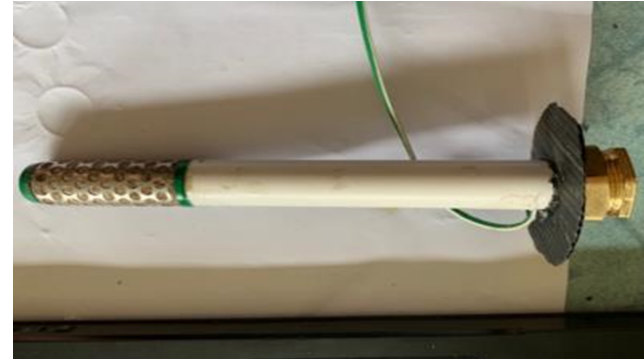
- Over 40 on-site visits by Net Feasa

Reports

- 54 reports delivered to farmers by Net Feasa and Teagasc.
- New format derived showing milk production / slurry production and summary weather data

Data Validation

- Initial validation done by Net Feasa and further verification and validation on data by Teagasc.



Weather data			
Rain		Value	Soil temperature
Total mm		44.94	Daily average °C
Daily avg. mm/day		5.6175	Max °C
Max mm		Multiple 6.42	18/12/2020 9.26
			Min °C
			20/12/2020 7.19
Air Temp.		Atmospheric pressure	
Daily average °C		7.434356	Daily avg. HPa
Max °C		18/12/2020 11.17	Max HPa
Min °C		20/12/2020 3.97	08/12/2020 992.1725
			Min HPa
			11/12/2020 961.2644
Humidity		Wind km/h	
Daily avg %		94.09472	Daily avg.km/h
Max %		Multiple 99.9	No Data
Min %		20/12/2020 72.92	No Data
			Avg. wind direction
			NE



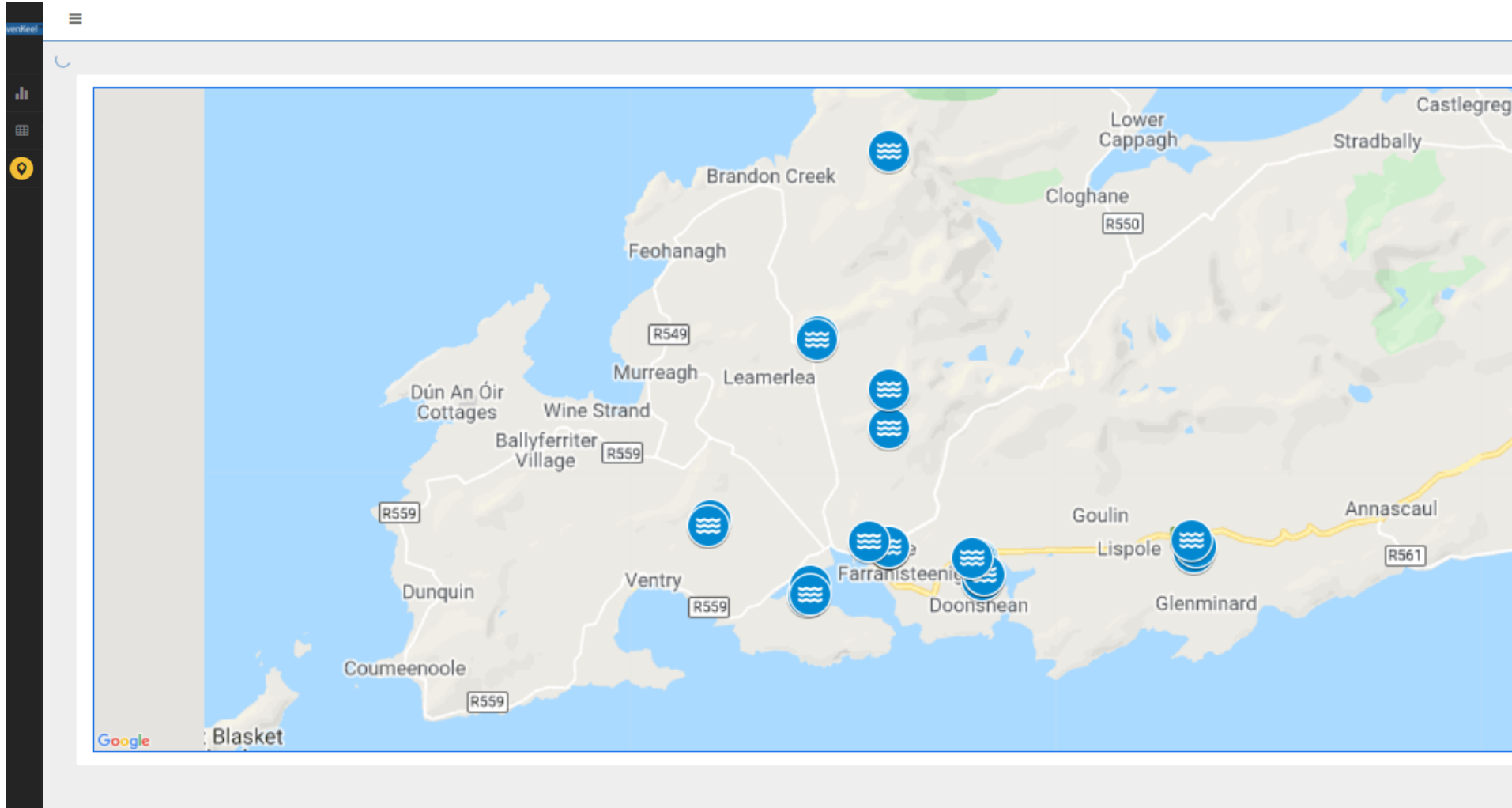
Difficulties / Issues during the Project

- **Sensor Issue**
 - No replacement units available resulting in large data gaps when sensor offline
 - Smart Agri Unit
 - Several iterations of the program to improve data collected eg(changing reporting interval, to improve rainfall readings)
 - Significant outages, requiring manual intervention to recover
 - Nodes returned to manufacture due to failure, significant delay with this due to pandemic
 - *4 / 6 of the temp/humidity/atmospheric pressure had to be replaced.*
- **Backend Issue**
 - EvenKeel Outage, some sensors auto-recovered, but other required manual intervention
- **Access to the data**
 - Net Feasa produced weekly / monthly data presentations depicting graphical representations of the data collected.
 - No real-time access to the data for the end user

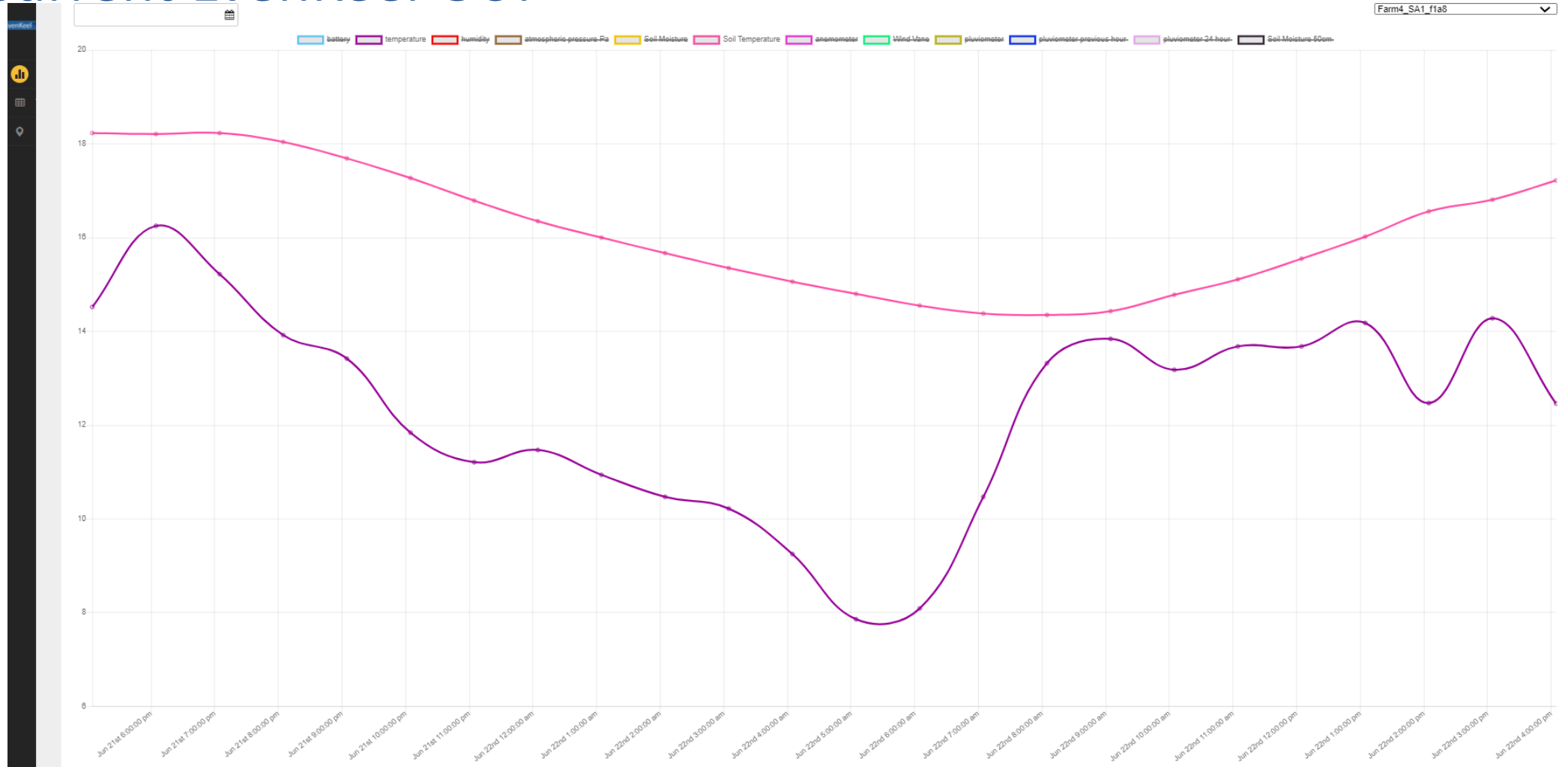
Lessons Learned

- **Uniform installation method on all sensors**
 - Weather stations all same height
 - Soil moisture / Soil temperature depths
- **Weather stations positioned away from ditches, trees, sheds etc to prevent shadow effect**
- **Strong mounting pole for Libelium**
- **Protection of sensors to prevent animal interference**
- **Protective covering on nodes**
- **Watermark placement important to ensure good contact with soil**
- **Milk Tank sensor firmly attached to tank to prevent damage**
- **Slurry Tank sensor firmly attached to prevent loss**
- **Replacement Stock in case of failures**
 - Recommended to have a float stock that would allow continuation of data in event of failures
- **Real-Time Access to the data**
 - Progressive Web App for display of end user data

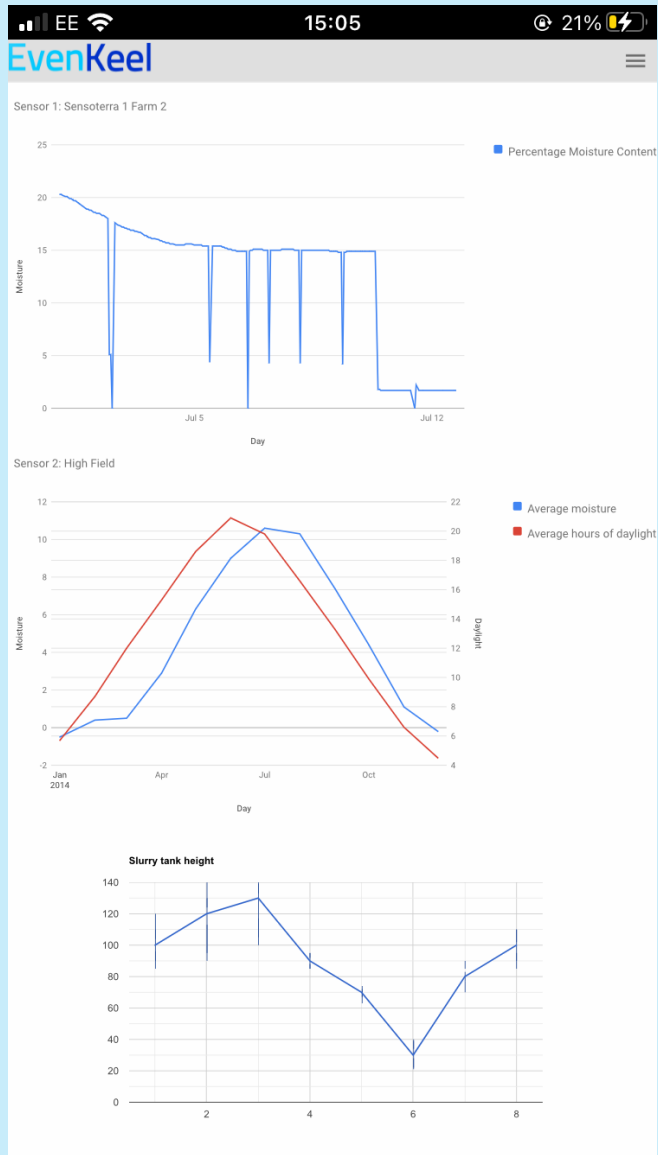
Current EvenKeel GUI



Current EvenKeel GUI



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EvenKeel

REGION 1 REGION 2 REGION 3

Date ↑	Event	Links
Mon Sep 09 2019	Temperature 14C, Moisture 5mm	
Tue Sep 10 2019	Temperature 14C, Moisture 5mm	
Wed Sep 11 2019	Temperature 14C, Moisture 5mm	
Thu Sep 12 2019	Temperature 14C, Moisture 5mm	
Fri Sep 13 2019	Temperature 14C, Moisture 5mm	
Mon Sep 30 2019	Temperature 14C, Moisture 5mm	
Sat Sep 14 2019	Temperature 14C, Moisture 5mm	
Mon Sep 30 2019	Temperature 14C, Moisture 5mm	
Sat Sep 15 2019	Temperature 14C, Moisture 5mm	



