

Saving the earth with IoT

Sensefarm 2014

www.sensefarm.com

anders.hedberg@sensefarm.com

Tel 046-288 45 20

Agenda

Background Sensefarm

Saving the earth

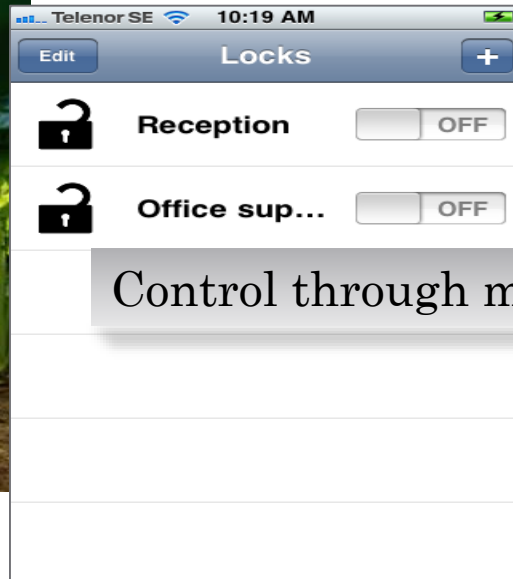
Principles of life

Ideas of control

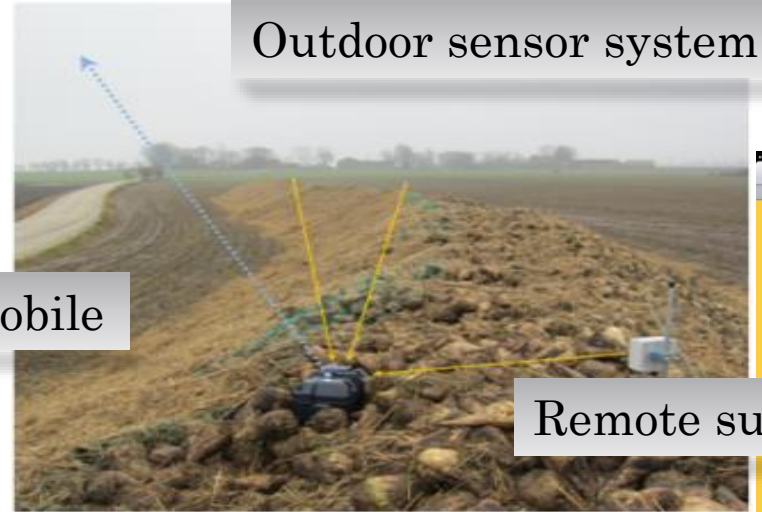
Field examples

Technology behind Sensefarm

Sensors to the Internet, Videocent AB

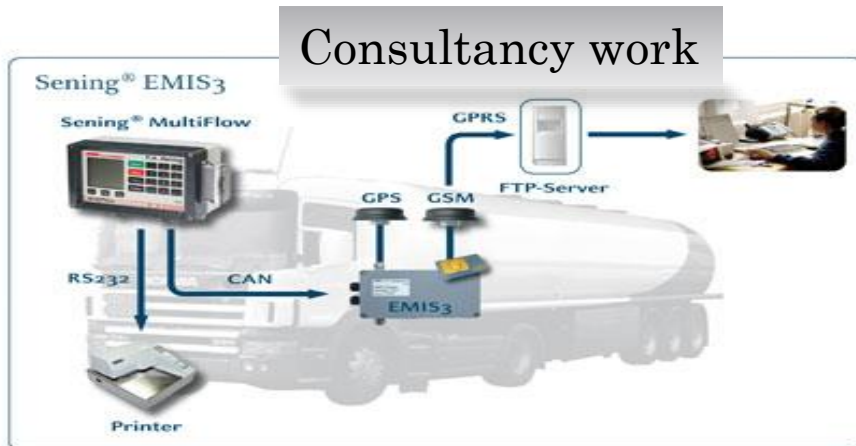


Control through mobile

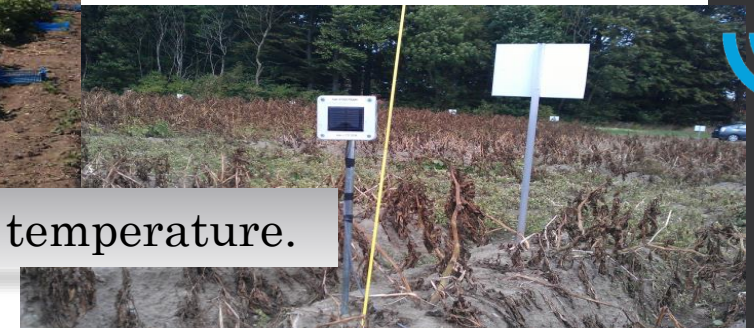


Remote supervision

Consultancy work



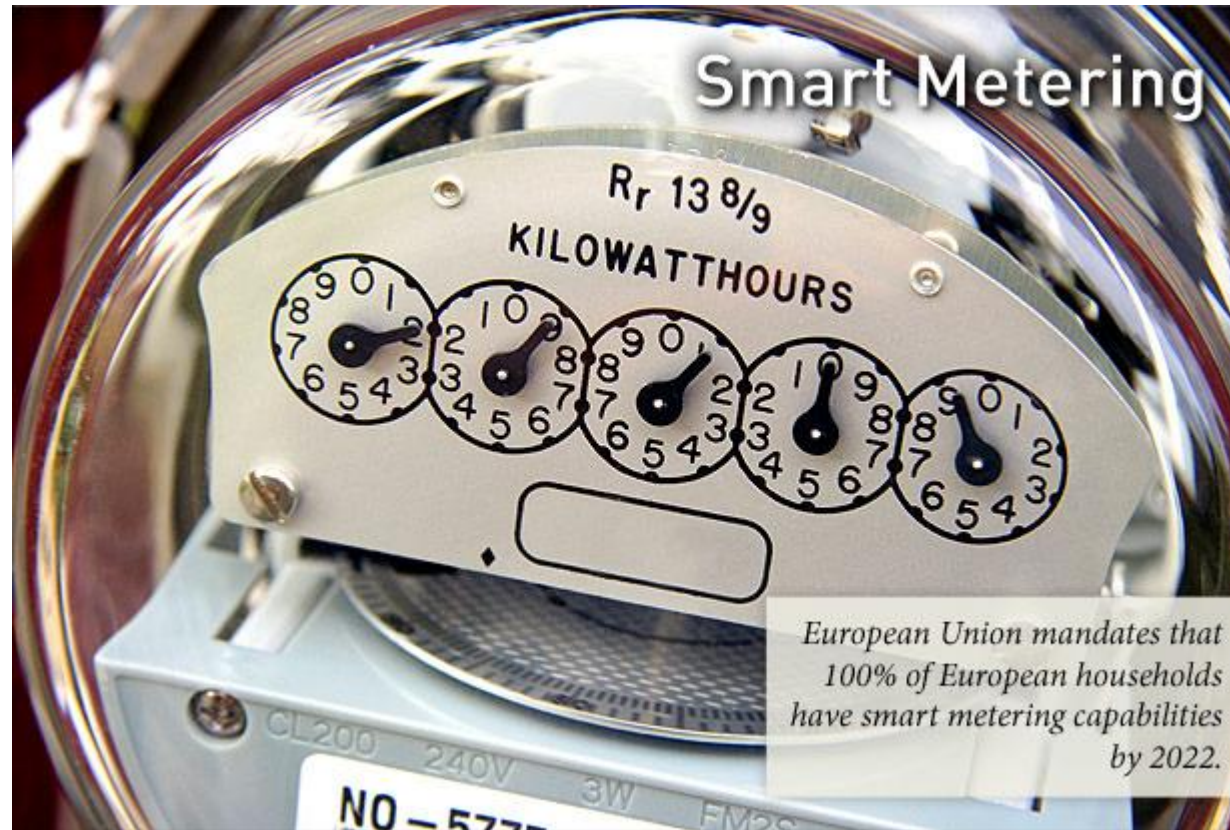
Soil & air moisture, temperature.



Saving the earth

CO2 green house effect

- Energy



Over-fertilisation

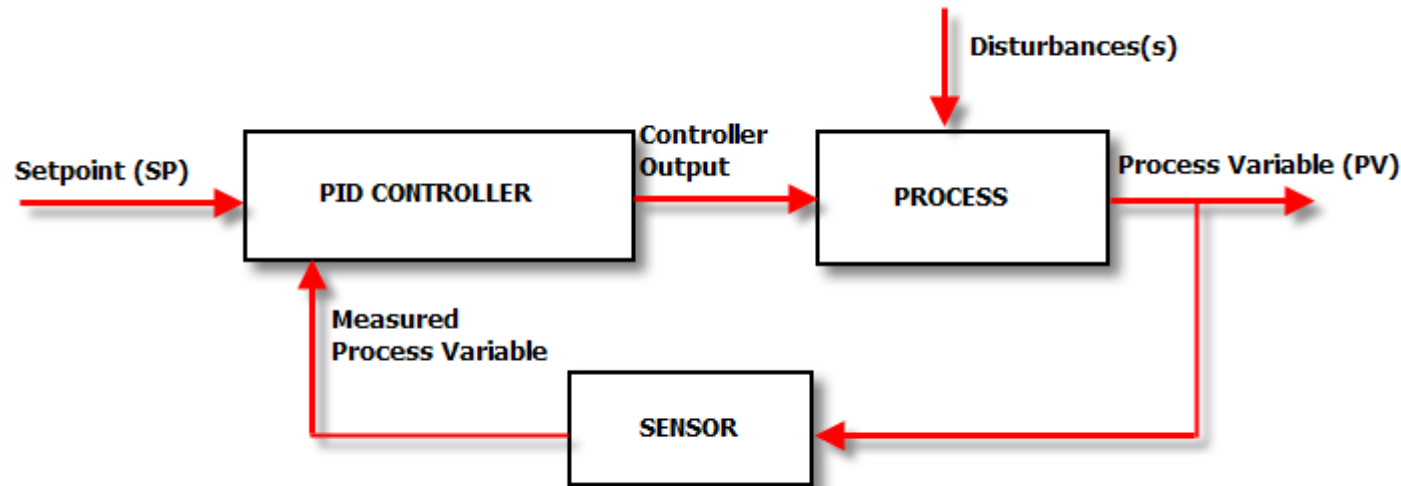
- Algae
 - Growths due to phosphate and nitrogen
 - Eaten by plankton->fish = good
 - Too much P and N gives too much algae
- Some sorts are
 - Poisoneous
 - Irritates skin
 - Known to kill animals that drink water
 - Kills people who eats seafood
- All consumes oxygen when dead
 - Can consume all oxygen killing life



Starvation



Dynamic System Regulation - I'm an engineer



Three principles

- Limiting factor
- Time and temperature
- Special events

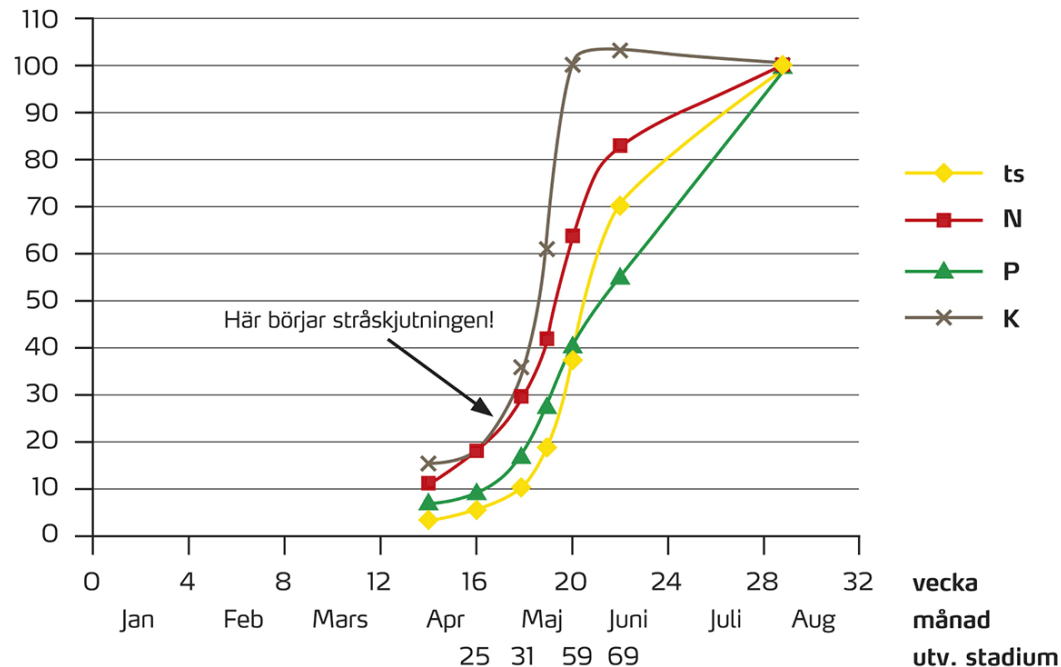
Liebig's law of the minimum

“Limiting factor”

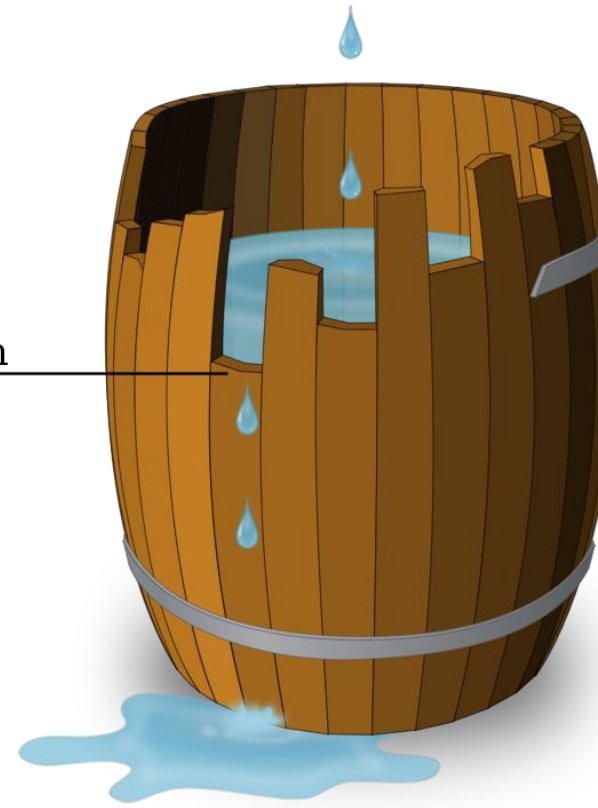
- growth is controlled not by the total amount of resources available, but by the scarcest resource (limiting factor)

Höstsädens upptagning av N, P och K

Andel upptaget, %



Minimum



How do life know time? – Time and temperature

- Growing **Degree Days**

- Daily GDD = $((T_{\text{max}} + T_{\text{min}}) \div 2) - T_{\text{base}}$
- T_{base} = Base Temperature 10°C (varies with lifeform)

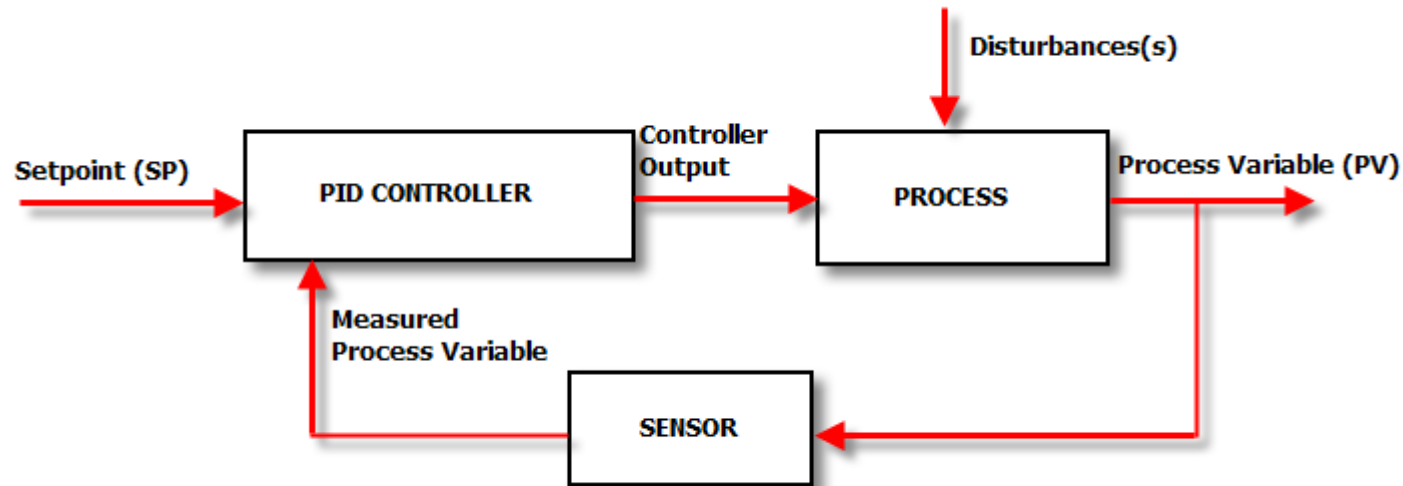
Month	...	June mid	June mid	June late	July early	July late	Aug	Aug- sep	Sep- okt
GDD		200- 300	300- 400	300- 500	500- 700	700- 900	900- 1100	1100- 1300	1300- 1700 GDD
<i>Phytophthora infestans</i>					potato blight	potato blight	potato blight	potato blight	potato blight
1845					Belgium	England	France Holland	Ireland	

Special events

- **Potato blight epidemic starts if...**
 - A Smith Period is at least two [consecutive](#) days where min **temperature** is 10 °C (50 °F) or above and on each day at least 11 hours when the **relative humidity** is greater than 90%.



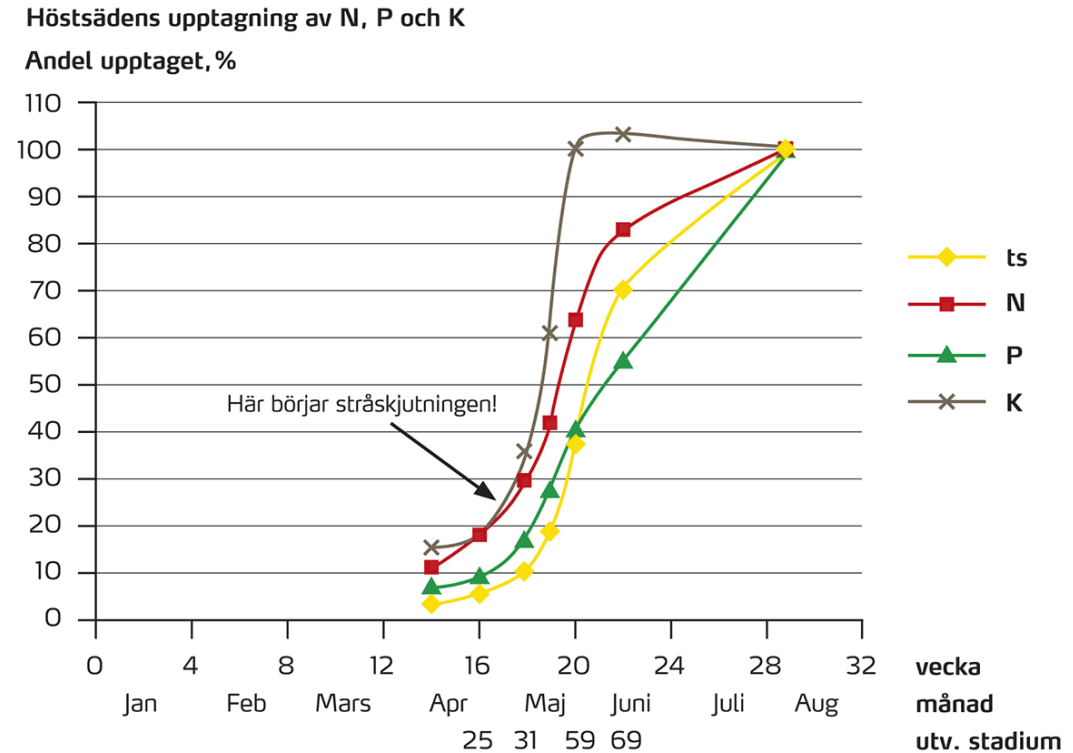
Regulation - I'm an engineer



Three principles

Action plan

- Limiting factor
 - Measure all factors
 - Find the limiting one
 - Optimize
- Time and temperature
 - Logistics
- Special events
 - Prediction models
 - Preventive actions



Three principles Improvement

- Limiting factor
 - Measure all factors
 - Find the limiting one
 - Optimize

20% increase in productivity

- Time and temperature
 - Logistics

30% increase in yield

- Special events
 - Prediction models
 - Preventive actions

= 56% improvement

Three principles Impact on earth

- Limiting factor

- Measure all factors
- Find the limiting one
- Optimize

No over-fertilization

- Time and temperature

- Logistics

No over-production

- Special events

- Prediction models
- Preventive actions

No hunger crises

Sensefarm Field examples

Hardware

- Low cost GSM platform
 - Based on Arduino
- Works directly in 144+ countries
- Extreme low-power modes
- Plug and play sensors
- Waterproof
- Options
 - Solar cell
 - Display
 - eSIM
 - GPS

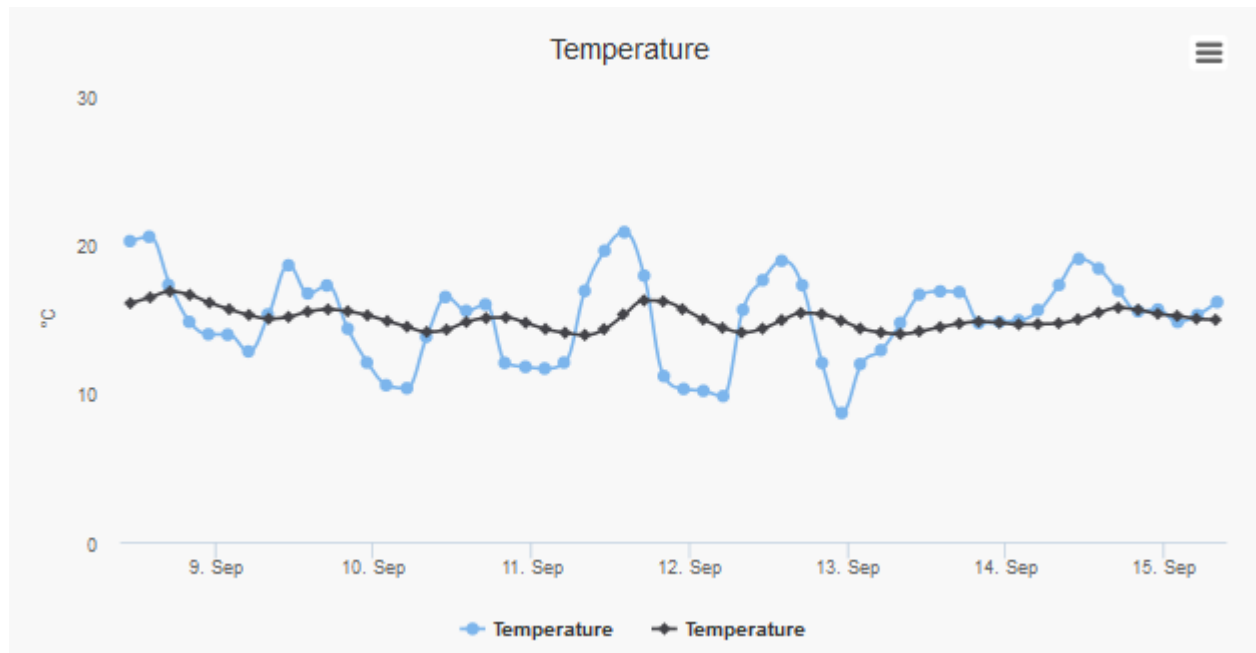


Nitrogen(N), Phosphorus(P), and Kalium(K) and Water



Nitrogen – Organic material->Humus -> Nitrogen

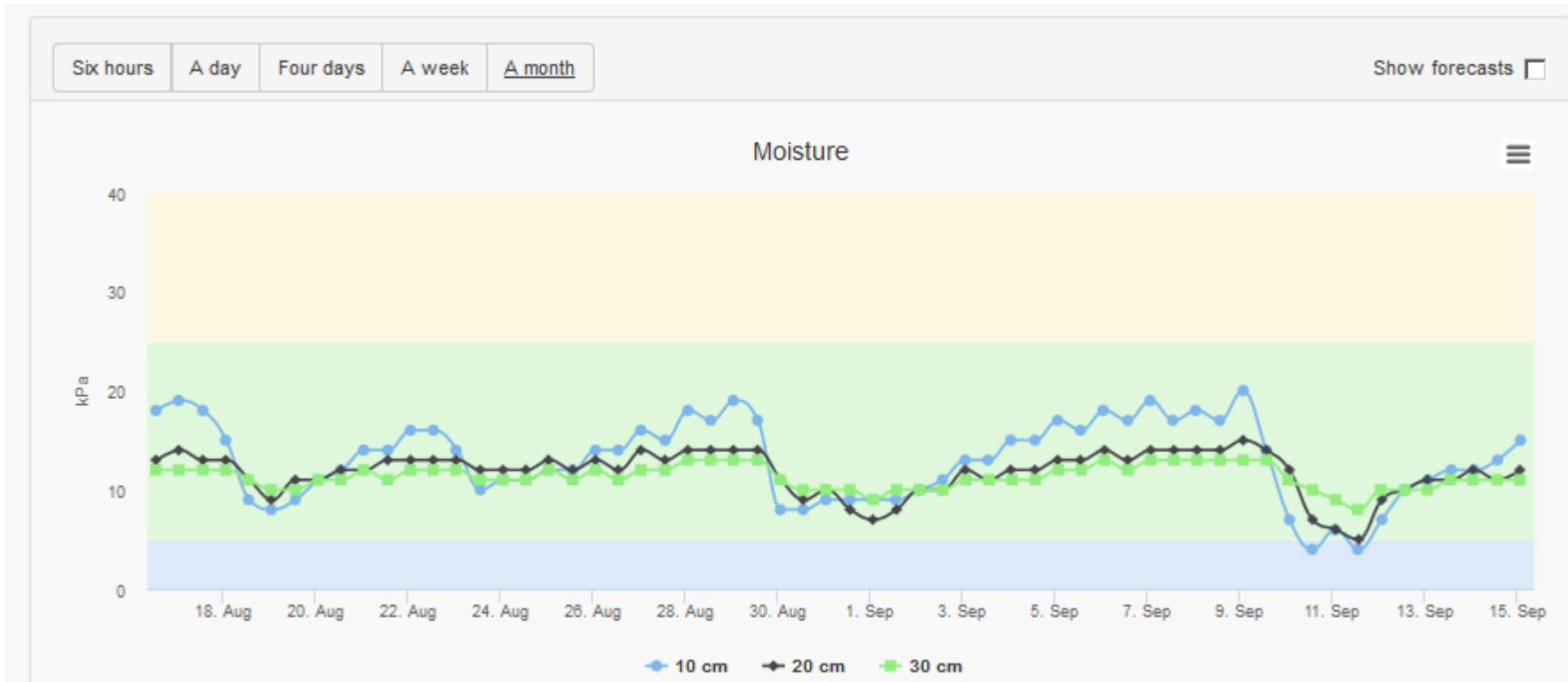
- Temperature dependent



*Trials by SLU Alnarp
(Swedish University of Agricultural Science)*



Nitrogen – Leaching nitrate NO_3^-



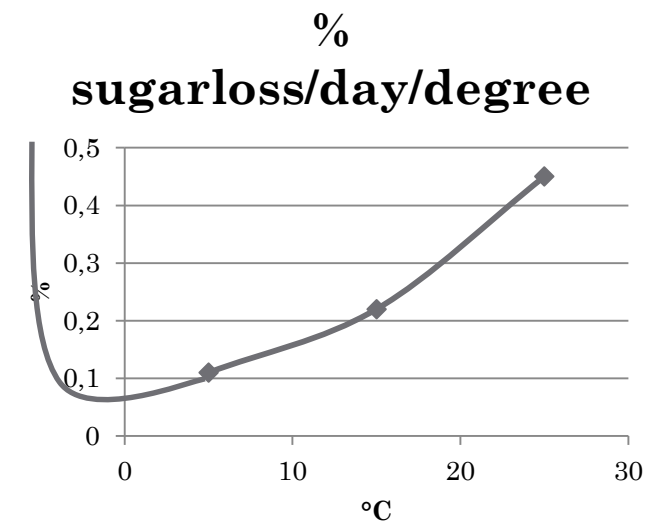
Irrigation



Logistics

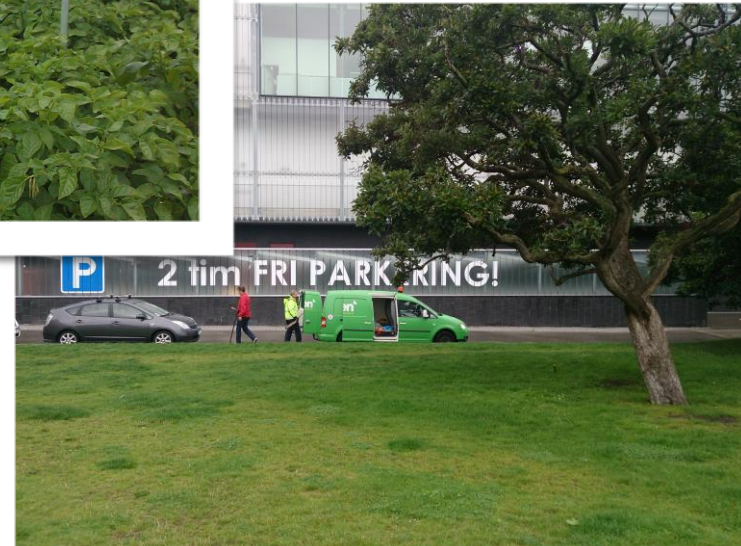


Storage



Sensefarm technology

Remote supervision examples



Temperature logging during transport



GPS tracking of irrigation



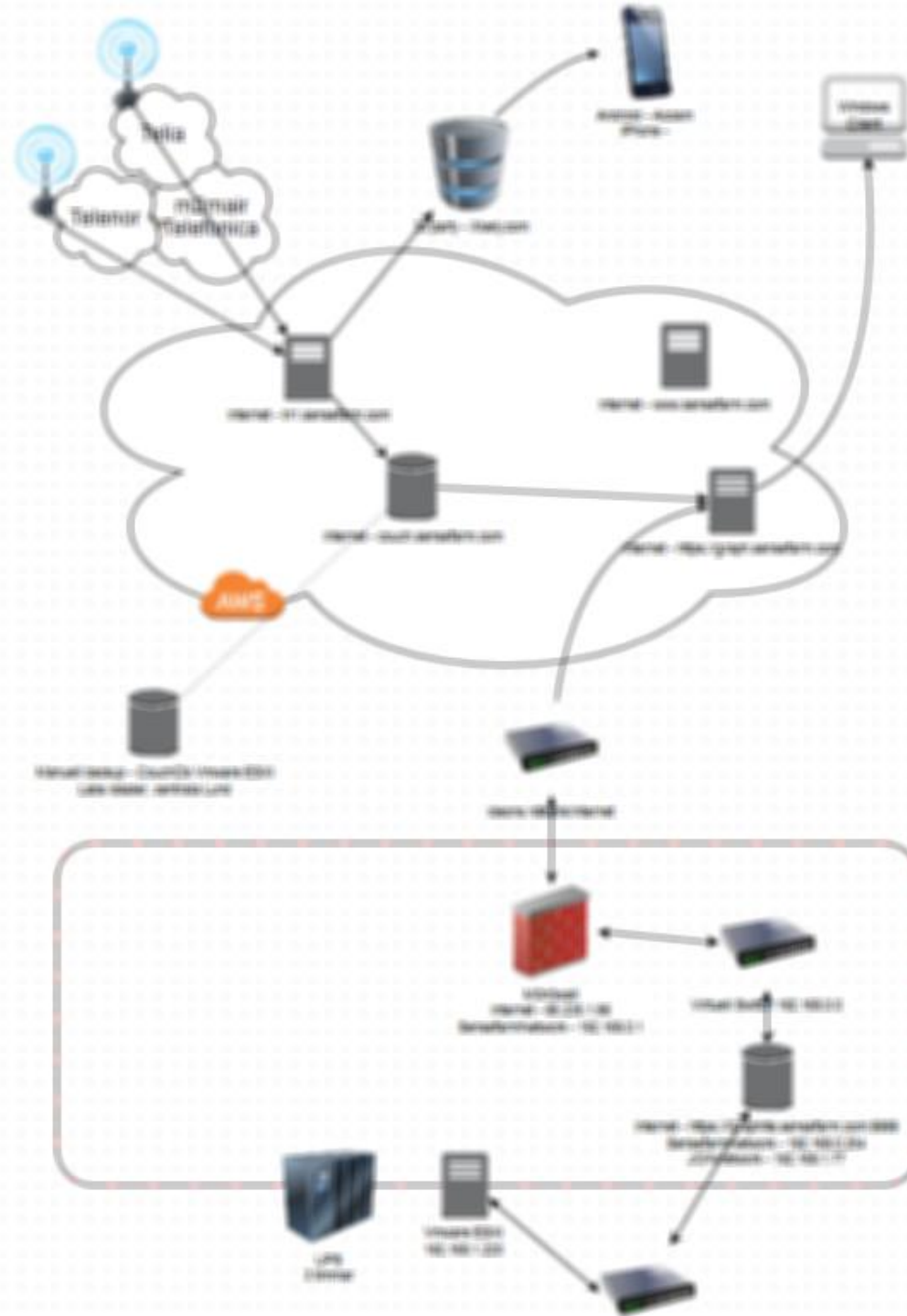
Borgeby



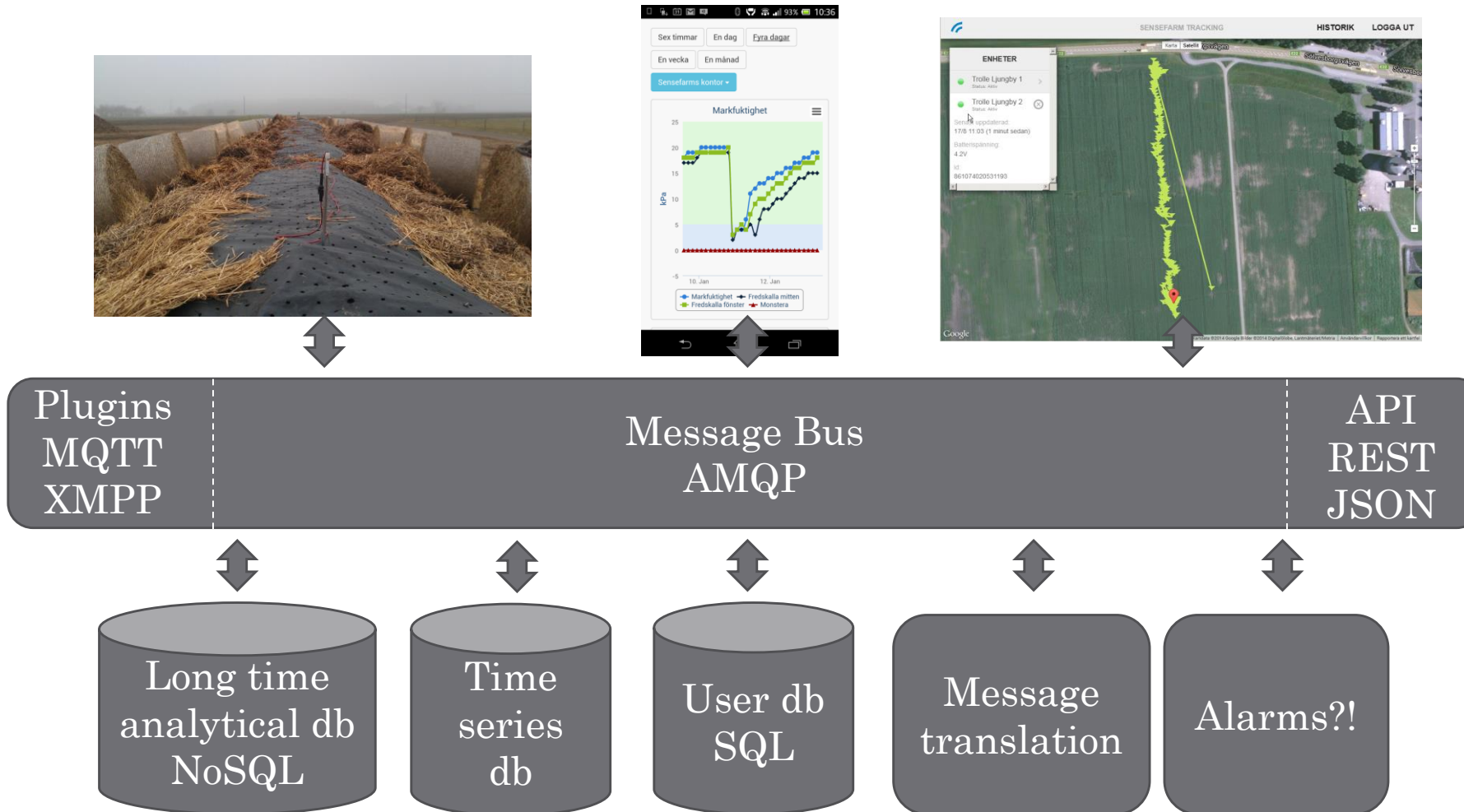
Sensefarms offer

Servers

- AWS
- Sensefarm

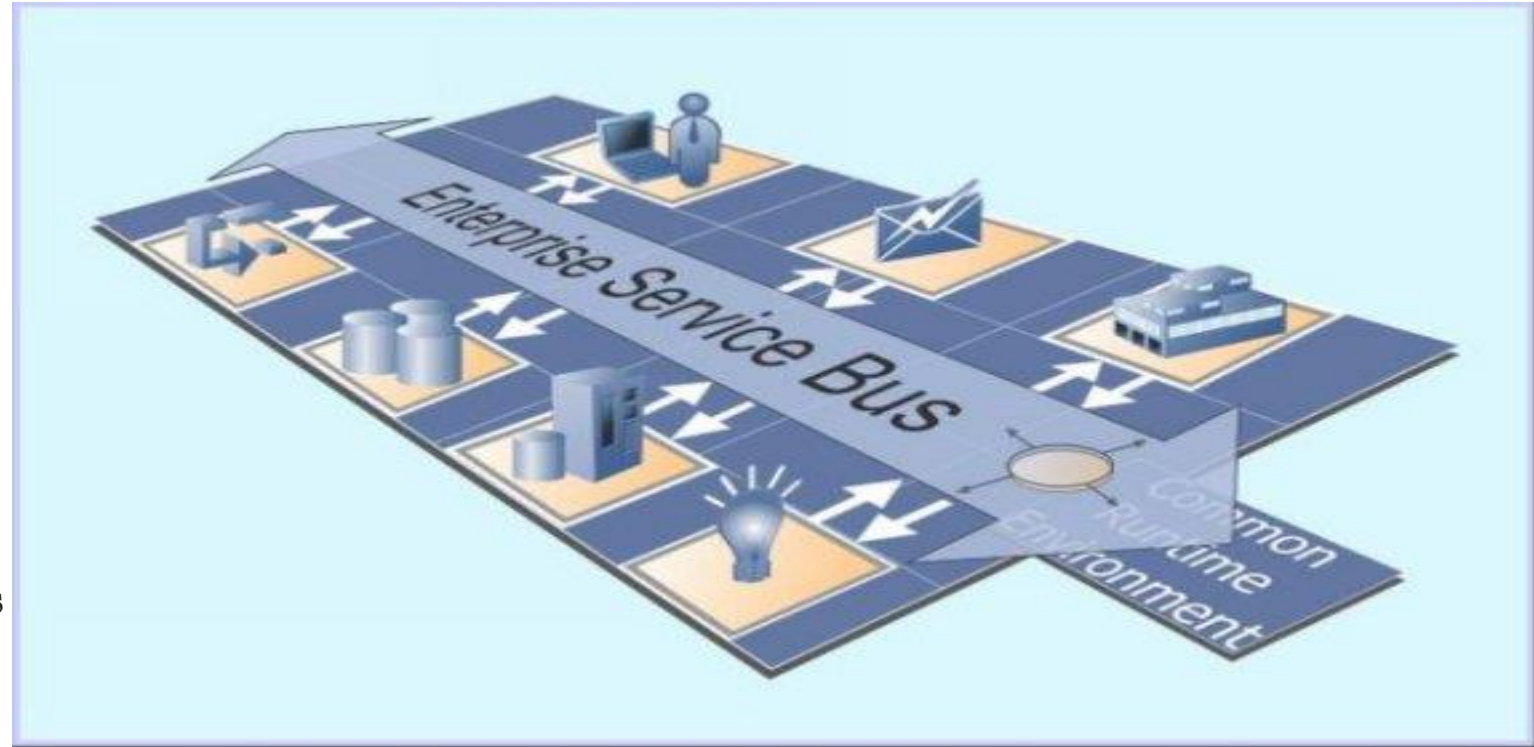


Backend



Why build systems like this?

- Decoupled
 - Add/remove service
- Asynchronous
 - Queues
 - Maintenance
- Distributed
 - Scalable
 - 1 million messages/s
- Redundant
 - Uptime



Looking for Customers and Partners

- Hardware
- Backend

Questions?

- www.sensefarm.com
- anders.hedberg@sensefarm.com
- Tel +46 46 288 45 20