Den ätbara staden

– hur IoT skapar förutsättningar för närproducerad mat

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The Eatable City

How IoT and Machine Learning can boost Urban Agriculture

A **GREAT** Day August 2018

Jonas Wilhelmsson
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Take a deep breath and relax
This bus is 100%
Nordstan


ELECTRIC
Nordstan
Take a deep breath and relax.
This bus is 100% electric

20 mins of IoT-fuelled Urban Agriculture…

1. Why the world needs Urban Agriculture
2. What's happening already?
3. What is the Smart Greenhouse?
4. The future of Farming with machine learning

What is driving Urban Agriculture?

Climate change: We know this will happen. But not how much, or where.

Temperature change

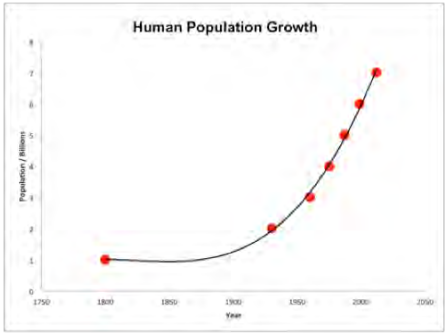
Precipitation change

Sea level rise

These changes affect available arable land, soil quality and water supply

Why does the world need urban agriculture?

66% of pop will live in a city 2050. Earth population ~10 billion.



Population Growth

Urbanization

Arable land will decrease while the world population will increase.

Why does the world need urban agriculture?

Urban Agriculture is the answer

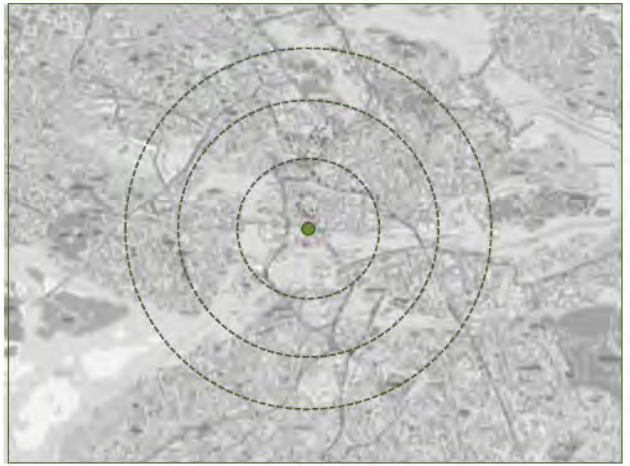
City Farming is modern

- Latest technology
- Exciting for the consumer
- Short lead times

City Farming is stable

- Grow vegetables locally all year
- Independent of logistics
- Always close to consumers

City Farming is sustainable



- Less water / energy waste
- No herbicides / pesticides
- Minimal transportation

What is the current state of urban agriculture?

Photo: ekkun

Japan, leader in field:

- Almost 1/3 of crops in japan come from Urban Agriculture
- 700 000 people in Tokyo can be fed with greens grown in the City

Note:

- Horizontal farming
- Mainly conventional techniques
- Low automation
- No sensors, analytics, monitoring

Urban agriculture can do more with less

Hydroponics

- Used in the current experiment
- 70 % more water efficient than traditional agriculture

Aquaponics

- A variant of hydroponics that uses fish to provide the nutrients for the plants
- The water circulates to the plants which filter it of nutrients, maintaining a small eco-system

Aeroponics

- A variant of hydroponics which sprays the water on the roots, allowing near 100 % oxygenation of the roots
- Requires less nutrients and water than hydro

Close to Home – Stadsjord

Niklas Wennberg har dragit igång fiskodling i Göteborgs gamla slakthusområde. Foto: KAJSA SJÖLANDER

Stadsodlad fisk kan göra oss självförsörjande

https://sverigesradio.se/sida/artikel.aspx?programid=104&artikel=6532735

Why Ericsson in urban agriculture?

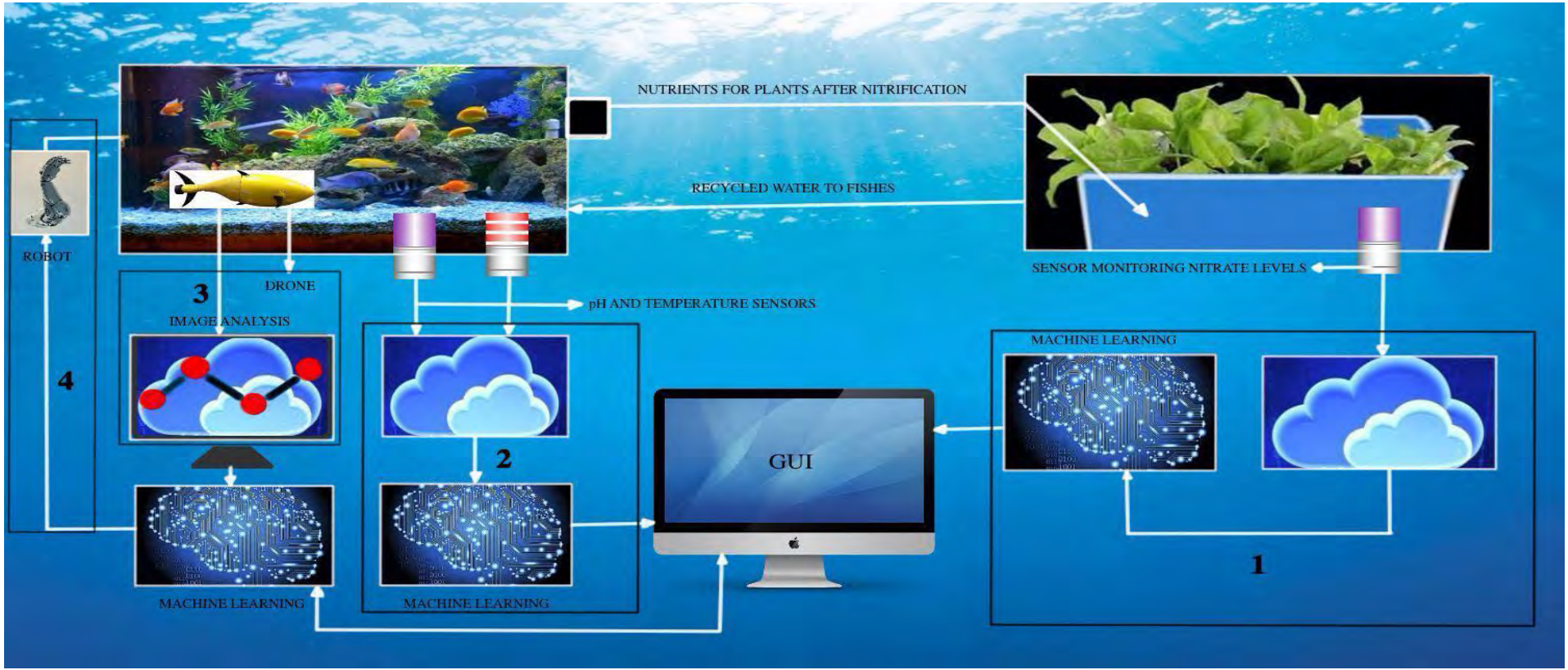
— ICT has a role to play

— **Sensor** intense use case
Measure, measure, measure…

— **Data** intense
Large number of interconnected horticulture parameters to be optimized

Ericsson in India: Connected Aquaponics

Ericsson in India: Connected Aquaponics



Framtidens jordbruk finns mitt i stan

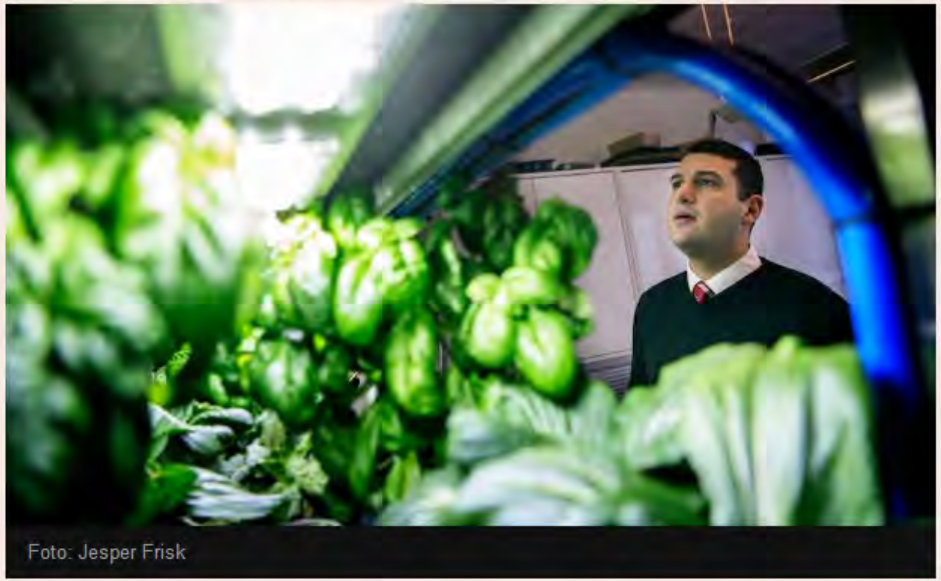


Foto: Jesper Frisk

Av **MAGDALENA STRÖMBERG**
Publicerad: 10 mars 2018, 20:49

I DN-skrapans källare finns snart Sveriges första underjordiska odling. Plantagon, som utvecklar urbant jordbruk, ska där börja odla örter utan jord. ”Det är hållbarhet 2.0”, säger Plantagons Sepehr Mousavi.

https://www.di.se/nyheter/framtidens-jordbruk-finns-mitt-i-stan/

Ericsson and Plantagon

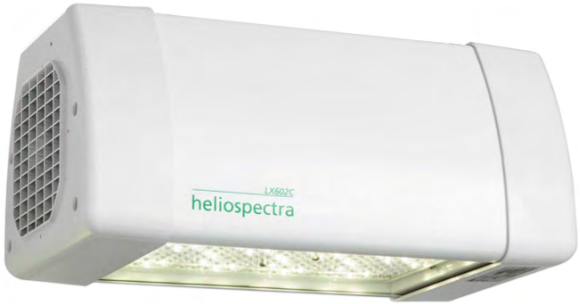
- Plantagon is running an experiment in the basement of DN-skrapan, harvesting 600 m2 of plants in 300 m2 of floor space
- Vertical hydroponic farming
- Excess heat from grow lamps is put into the district heating grid
- 1.1 million bags of basil…

Photo: Plantagon

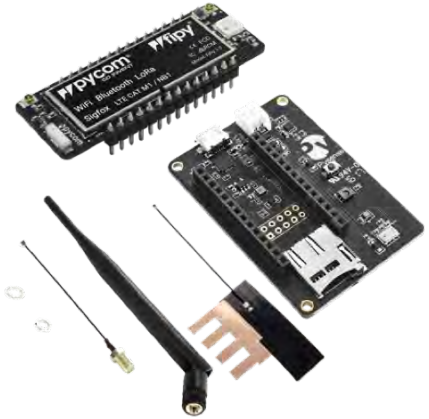
Smart Greenhouse as a test bed for applications in urban agriculture

Current setup

Heliospectra LED Grow Lamp



Pysense board with Fipy board: NB-IoT and Cat-M1 connectivity



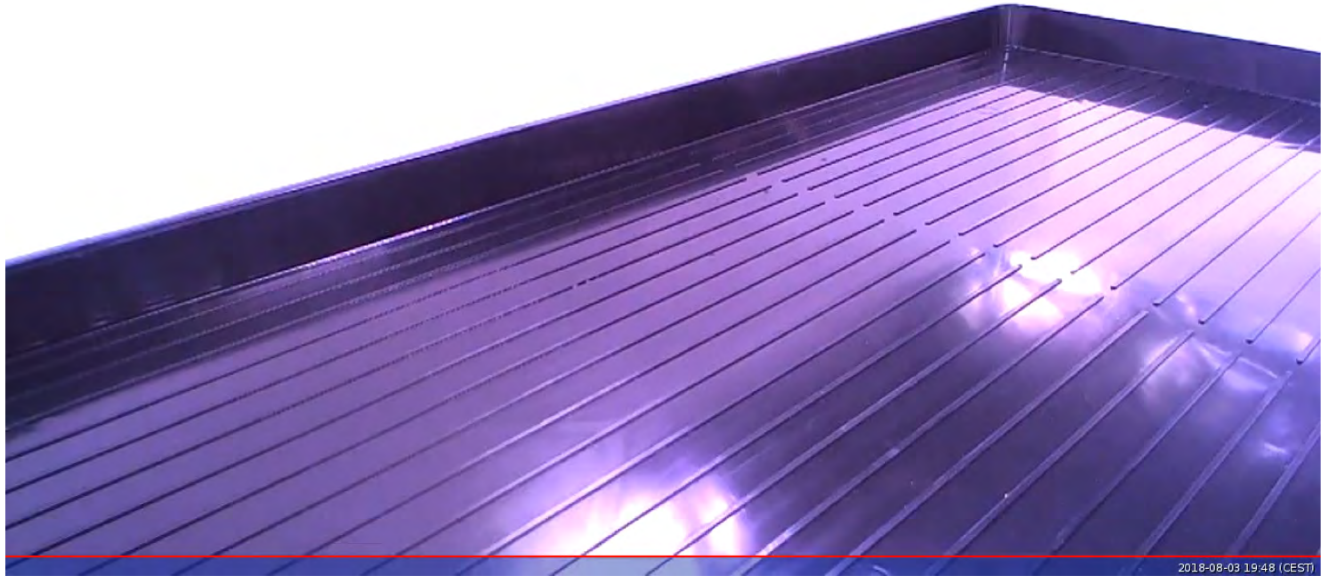
Raspberry PI

Growing plants

- No previous experience growing plants
- First experiments to determine suitable plants for experiments in full size enclosure
- Various types of lettuce, basil and mint seedlings

- Basil and lettuce are most successful. Basil selected for trial.

First trial in large enclosure

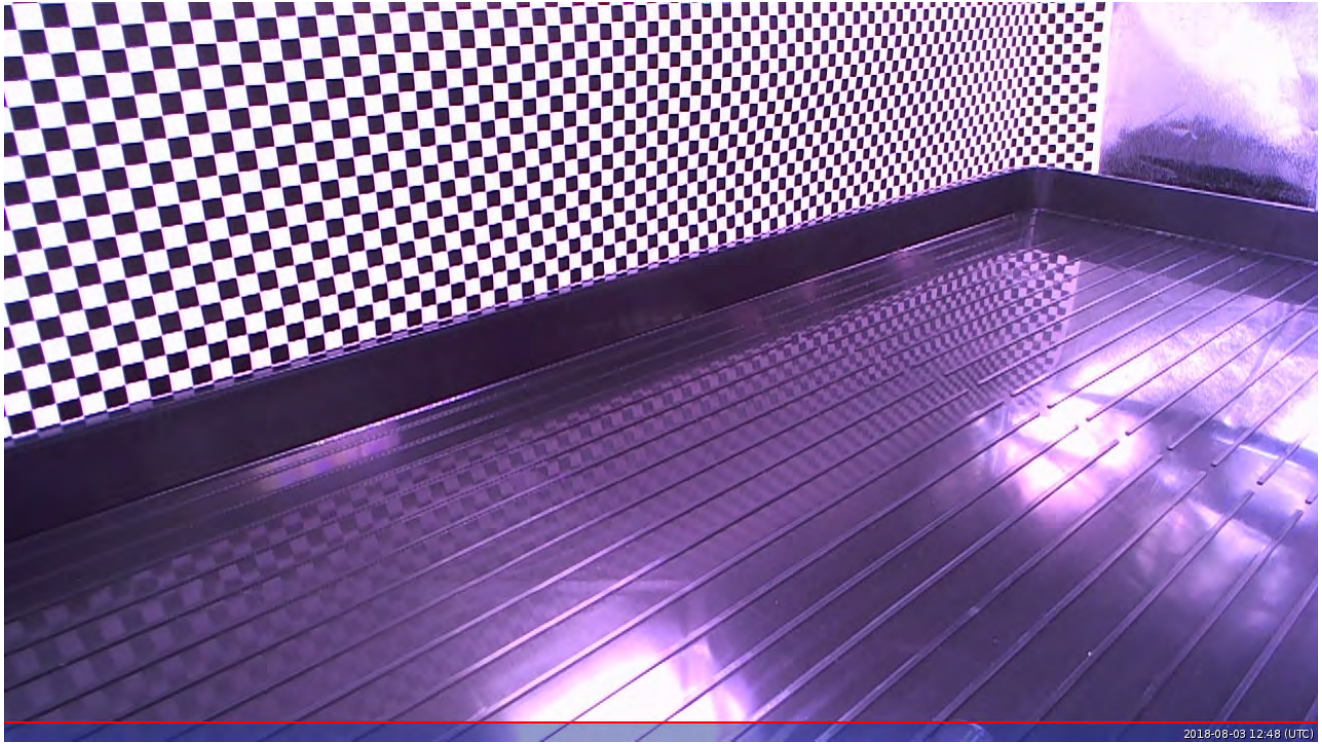


Challenges:

— Reflective surfaces

— Reliable feature extraction

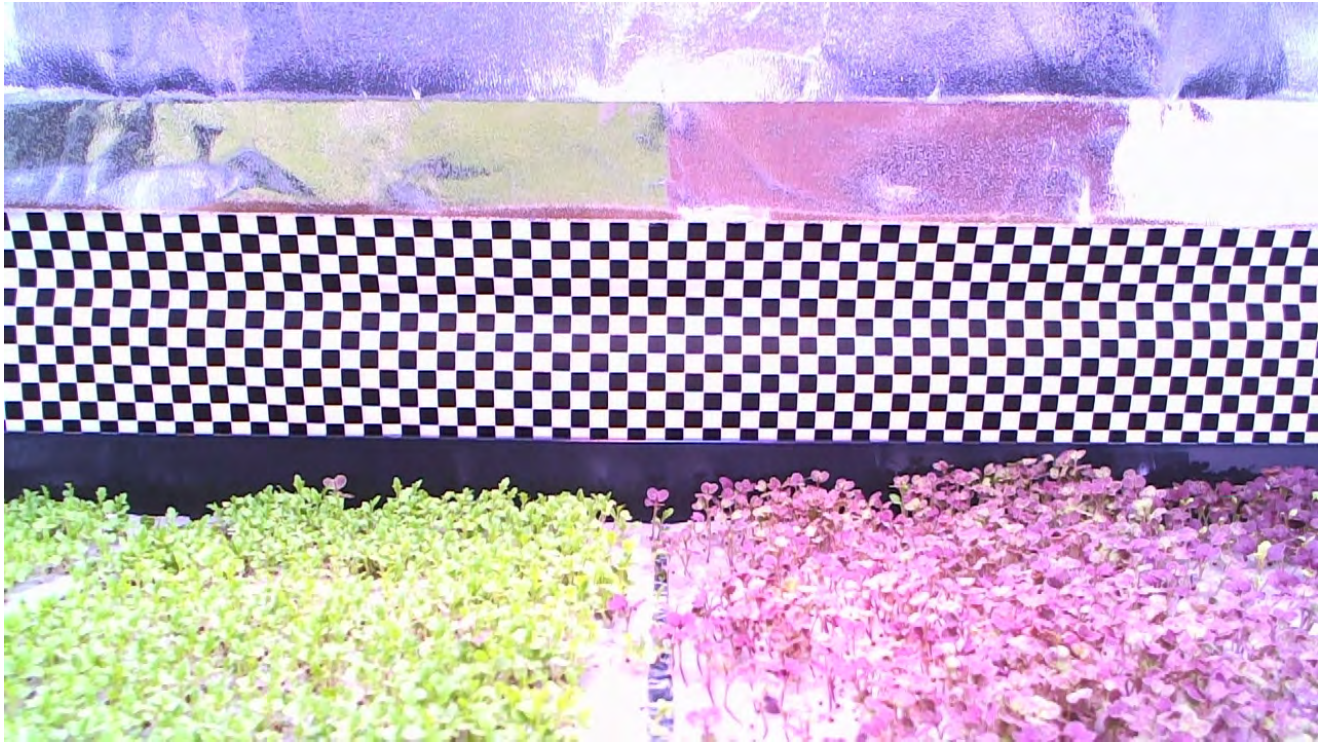
Second trial with microgreens



Aim:

- Determine shortest possible lifecycle to assess maximum
- Grid allows for automatic labelling and fallback manual labelling (height)

Final Microgreen trial



ML Plant challenges:

— They grow slowly

— Microgreens are quick at ~2 week lifecycles

Final Microgreen trial

- **Yield Prediction example:** Given the growth on day 3, which plants will grow to target height by day 5?
- Based on day 5 status all day 3 plants are classified incomplete / complete
- With sufficient data (1000's of images), machine learning model can be deployed on images only

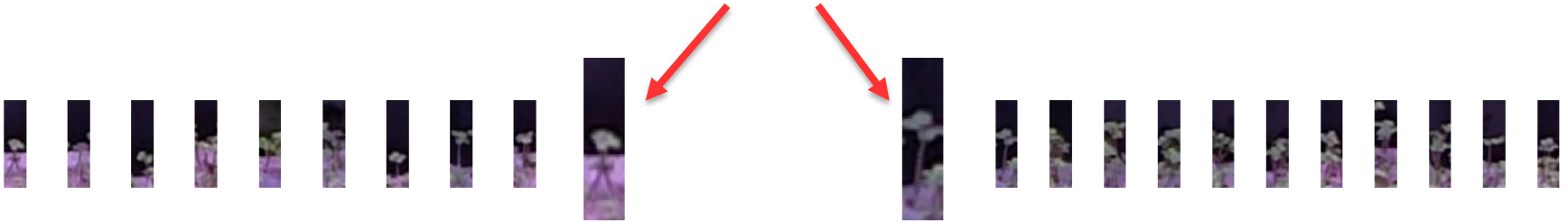
Day 3 growth of plants sorted on their status day 5:

Incomplete Complete

So, what will the prediction be based on one lifecycle of ~20 plants?

Final Microgreen trial

Day 3 growth of plants sorted on their status day 5:



Incomplete

Complete

So, what will the prediction be based on one lifecycle of ~20 plants?

Not accurate. Next step: Gather more data.

THANKS!

ERICSSON
GARAGE
GOTHENBURG

From idea to market with collaborative innovation partnership

jonas wilhelmsson

jonte142