



UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

Precision Agriculture

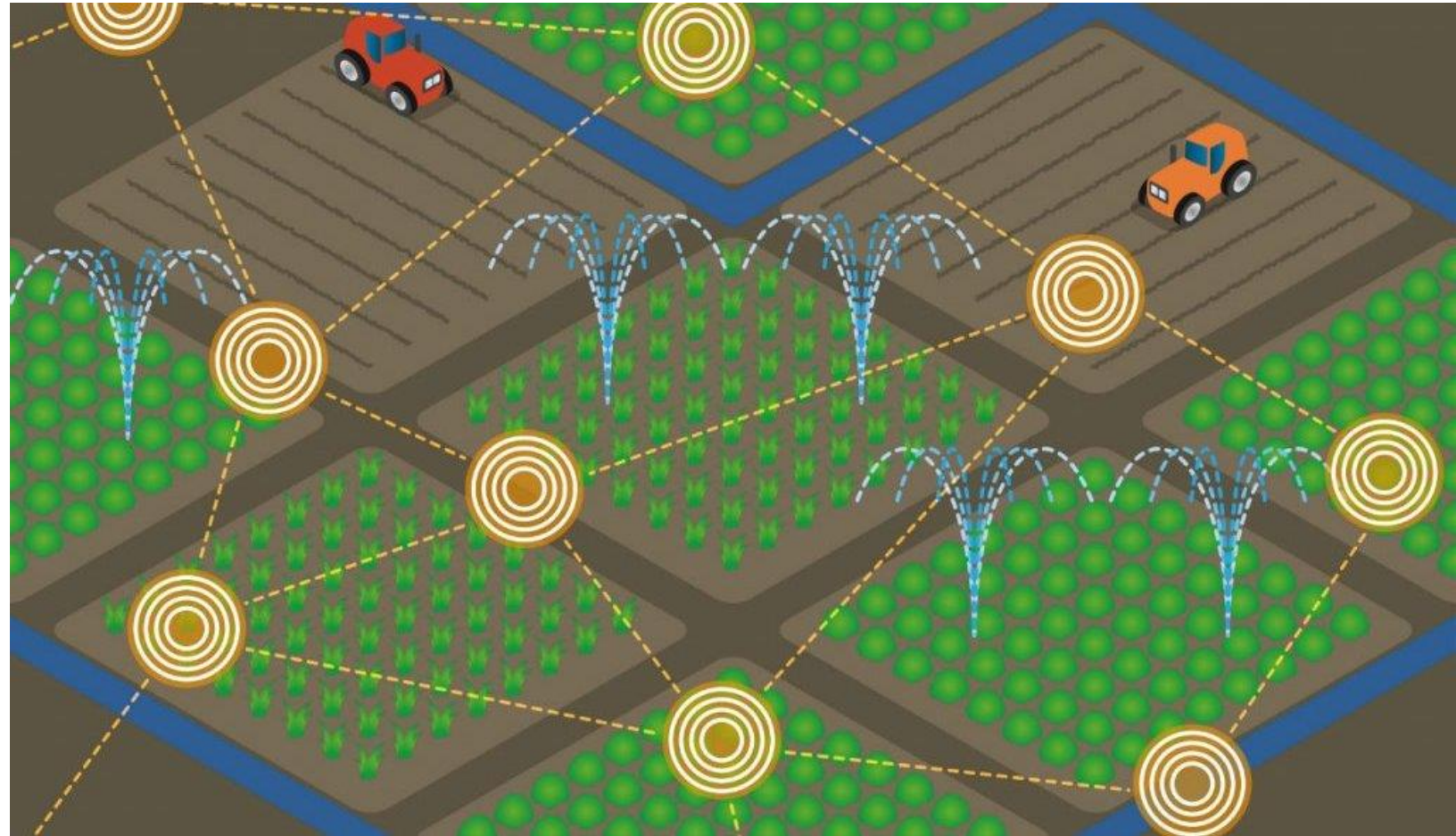
Project
Networked Embedded Systems – W17/18
A.Cerullo, V.Šafran



Project goal

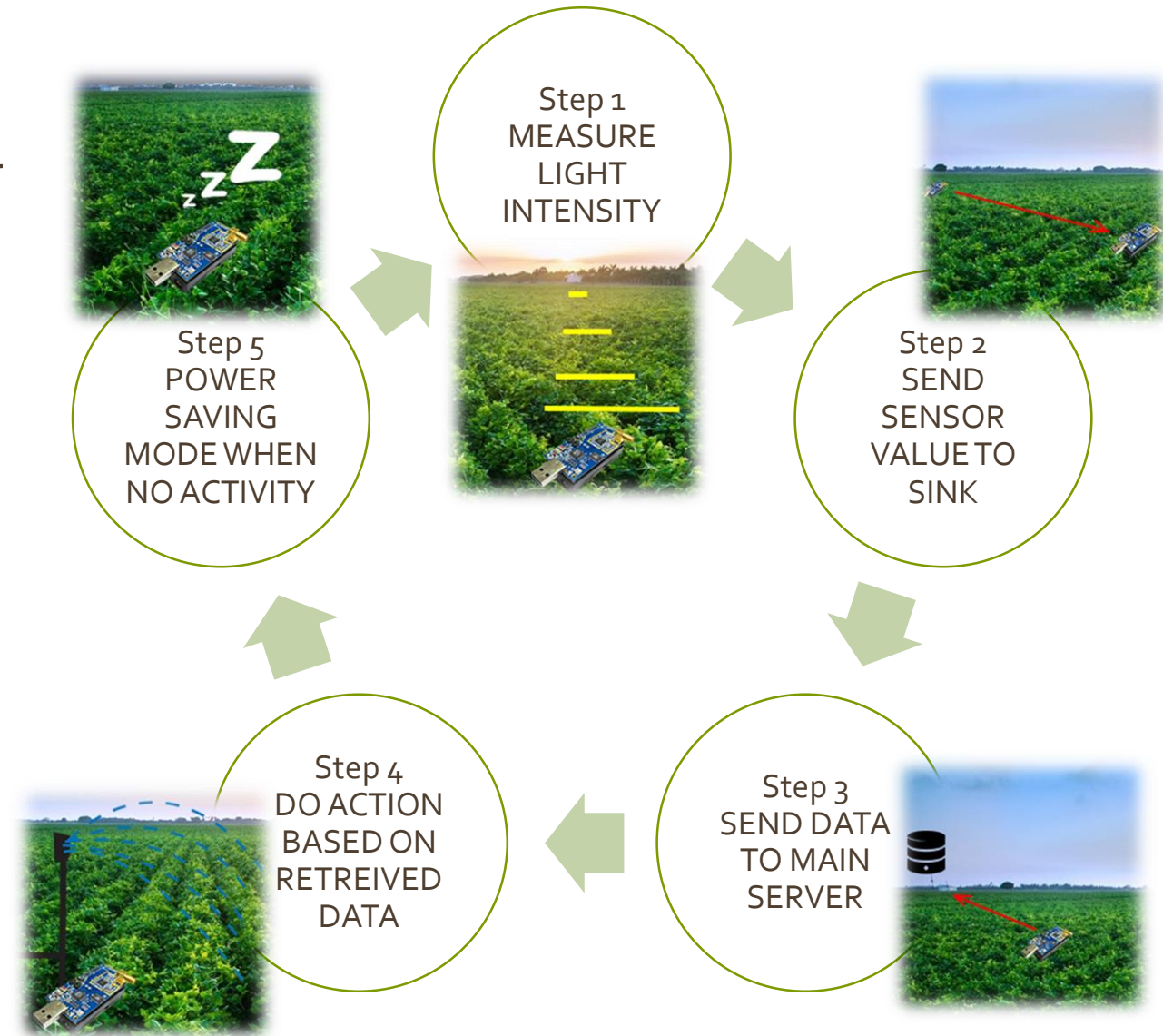
Implement an energy conserving way of monitoring incident sunshine on a patch of land, reporting whether some patches receive less sunlight than others.

Additionally do actions based on measured data.



Work cycle

- measure light value with light sensor e.g. every hour or some random time
- if measured value is big enough to know that light source is present on some patch of land send that value to sink
- send data from sink to main server for future analysis
- based on retrieved sensor value make action, e.g. send less or more water to patch of land
- every mote go in power saving mode when no activities

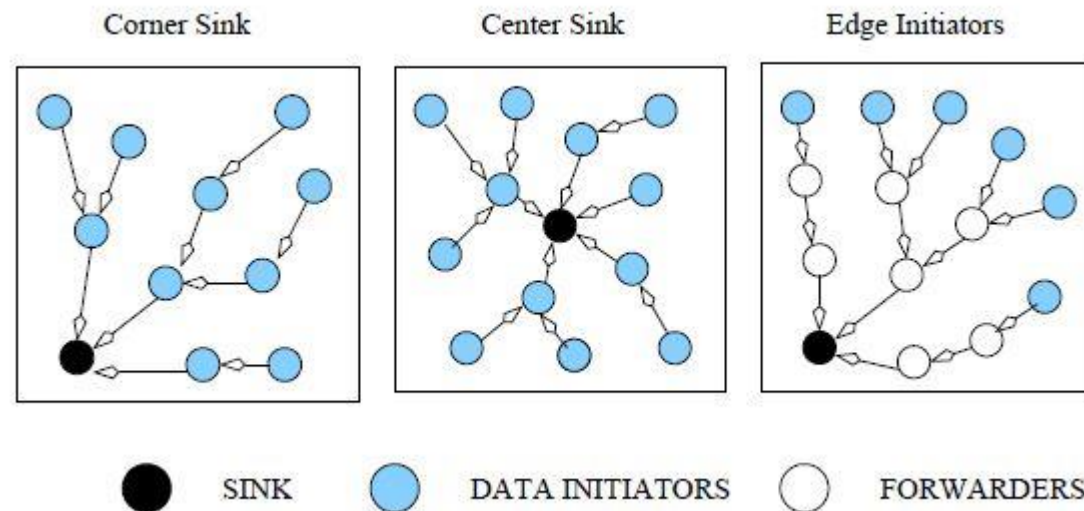


Data collection

It is used principle of tree-based hop-by-hop reliable data collection that is part of the [Rime communication stack](#).

The *collect* module uses 2 channels; one for neighbor discovery and one for data packets.

In our example (corner sink) using *collect* library all motes (using same program) in network are sending data packets to sink (mote with different program that's collecting data).



Simulation

Simulation of sensors network in Cooja with 7 + 1 mote, where mote 1 is sink and it is receiving data from all other motes (2-8).

Disadvantage in this approach is if the number of motes is large – sink overload. One of the solutions would be to use more than one sink for collecting data.

project_sim - Cooja: The Contiki Network Simulator

File Simulation Notes Tools Settings Help

Network

View Zoom

Simulation control

Run Speed limit

Start Pause Step Reload

Time: 1:12:08.492
Speed: 746,19%

Notes

Enter notes here

Mote output

Time	Mote	Message
58:56.632	ID:5	Sending
58:56.635	ID:5	Sensor value: 218
58:56.636	ID:5	#L 7 0
58:56.636	ID:5	#L 3 1
58:57.051	ID:1	Sink got message from 5.0, seqno 5, hops 3: len 4 '218'
58:57.053	ID:1	I'm sending water to mote 5
59:28.963	ID:3	Sending
59:28.965	ID:3	Sensor value: 210
59:29.050	ID:1	Sink got message from 3.0, seqno 6, hops 2: len 4 '210'
59:29.052	ID:1	I'm sending water to mote 3
1:08:40.371	ID:8	Sending
1:08:40.373	ID:8	Sensor value: 192
1:08:40.549	ID:6	Sending
1:08:40.551	ID:6	Sensor value: 164
1:08:40.554	ID:6	#L 2 0
1:08:40.555	ID:6	#L 7 1
1:08:40.613	ID:2	Sending
1:08:40.615	ID:2	Sensor value: 12
1:08:40.647	ID:4	Sending
1:08:40.649	ID:4	Sensor value: 164
1:08:40.701	ID:7	Sending
1:08:40.702	ID:7	Sensor value: 108
1:08:41.014	ID:5	Sending
1:08:41.015	ID:5	Sensor value: 192
1:08:41.175	ID:1	Sink got message from 4.0, seqno 7, hops 1: len 4 '164'
1:08:41.177	ID:1	I'm sending water to mote 4
1:08:41.198	ID:3	Sending
1:08:41.200	ID:3	Sensor value: 164
1:08:42.675	ID:1	Sink got message from 3.0, seqno 7, hops 2: len 4 '164'
1:08:42.677	ID:1	I'm sending water to mote 3
1:08:43.675	ID:1	Sink got message from 5.0, seqno 6, hops 3: len 4 '192'
1:08:43.677	ID:1	I'm sending water to mote 5
1:08:44.425	ID:1	Sink got message from 8.0, seqno 6, hops 4: len 4 '192'
1:08:44.427	ID:1	I'm sending water to mote 8
1:08:44.550	ID:1	Sink got message from 7.0, seqno 7, hops 3: len 4 '108'

Light sensor values - actions table

- values may differ for other types of plants
- sink mote contain preprogrammed actions that are executed based on this table

Intensity	Action	Action ID
<= 10	POWER SAVE / SLEEP	1
> 10 and <= 100	SEND WATER	2
> 100 and <= 200	SEND MORE WATER	3
> 200	WARNING / VERY HOT	4

Tools

- Contiki OS v3.x
- Cooja Contiki Network Simulator
- Suitable for Moteiv Tmote Sky sensor motes
- Program written in C language

Contiki

The Open Source OS for the Internet of Things

