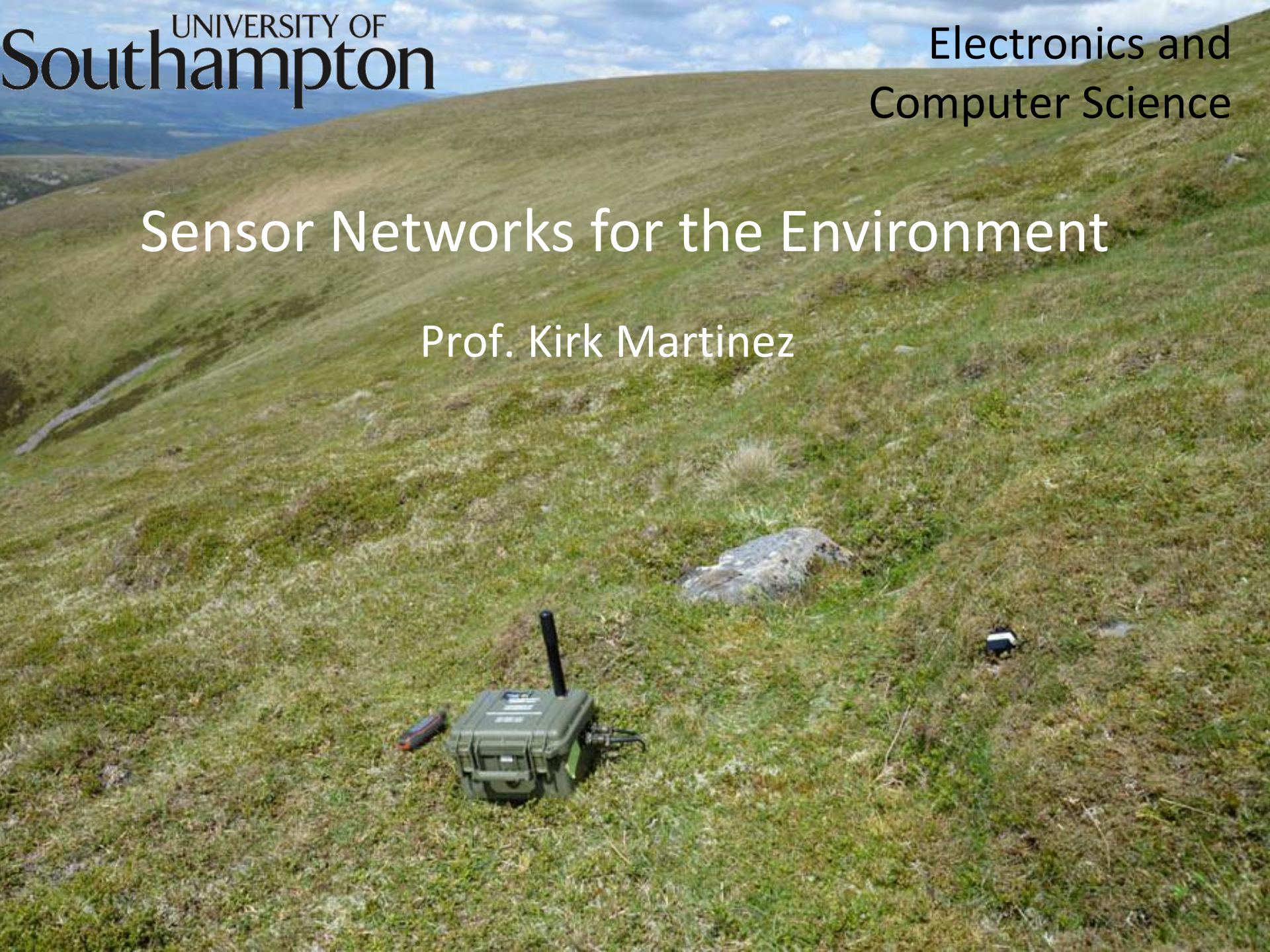


UNIVERSITY OF Southampton

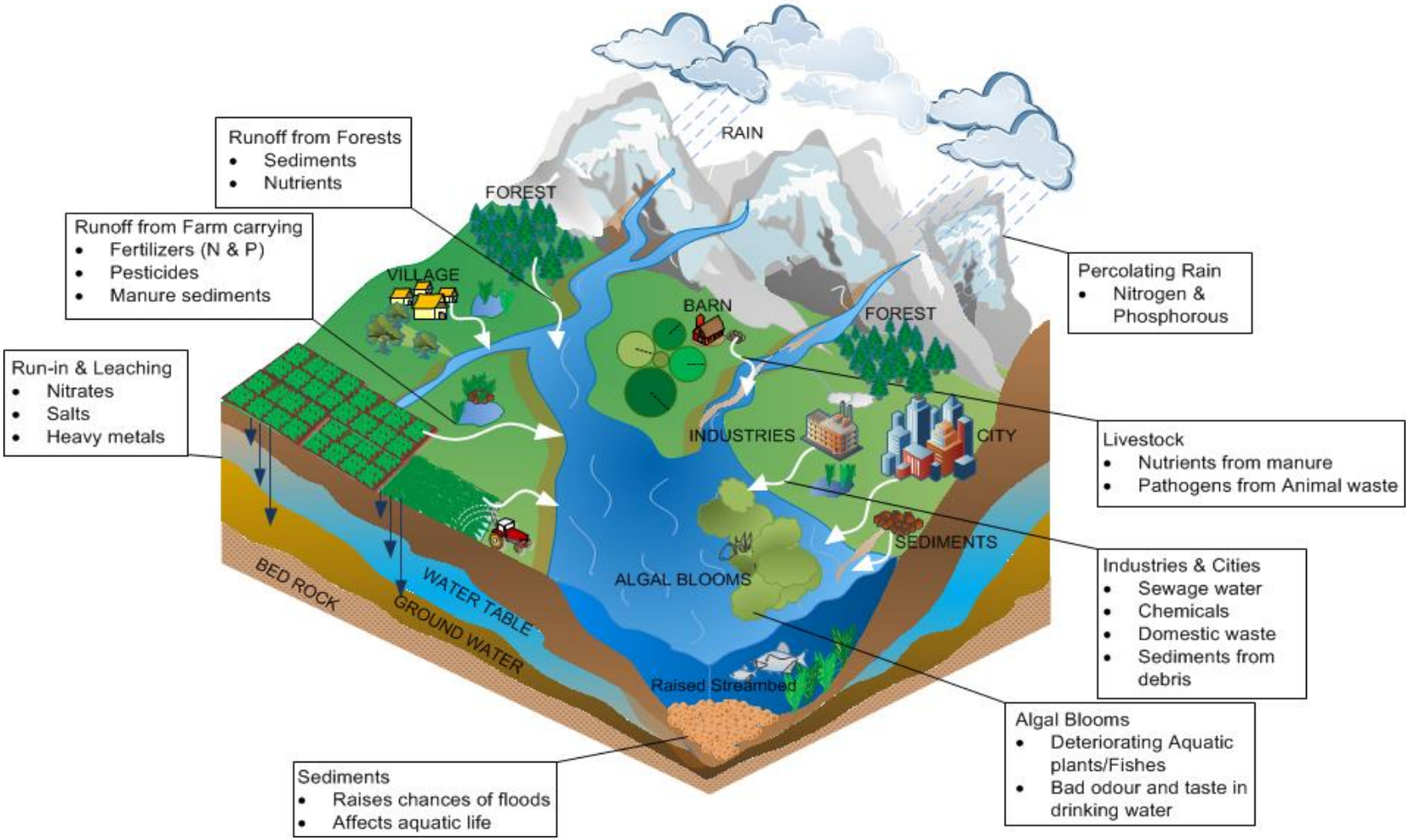
Electronics and Computer Science

Sensor Networks for the Environment

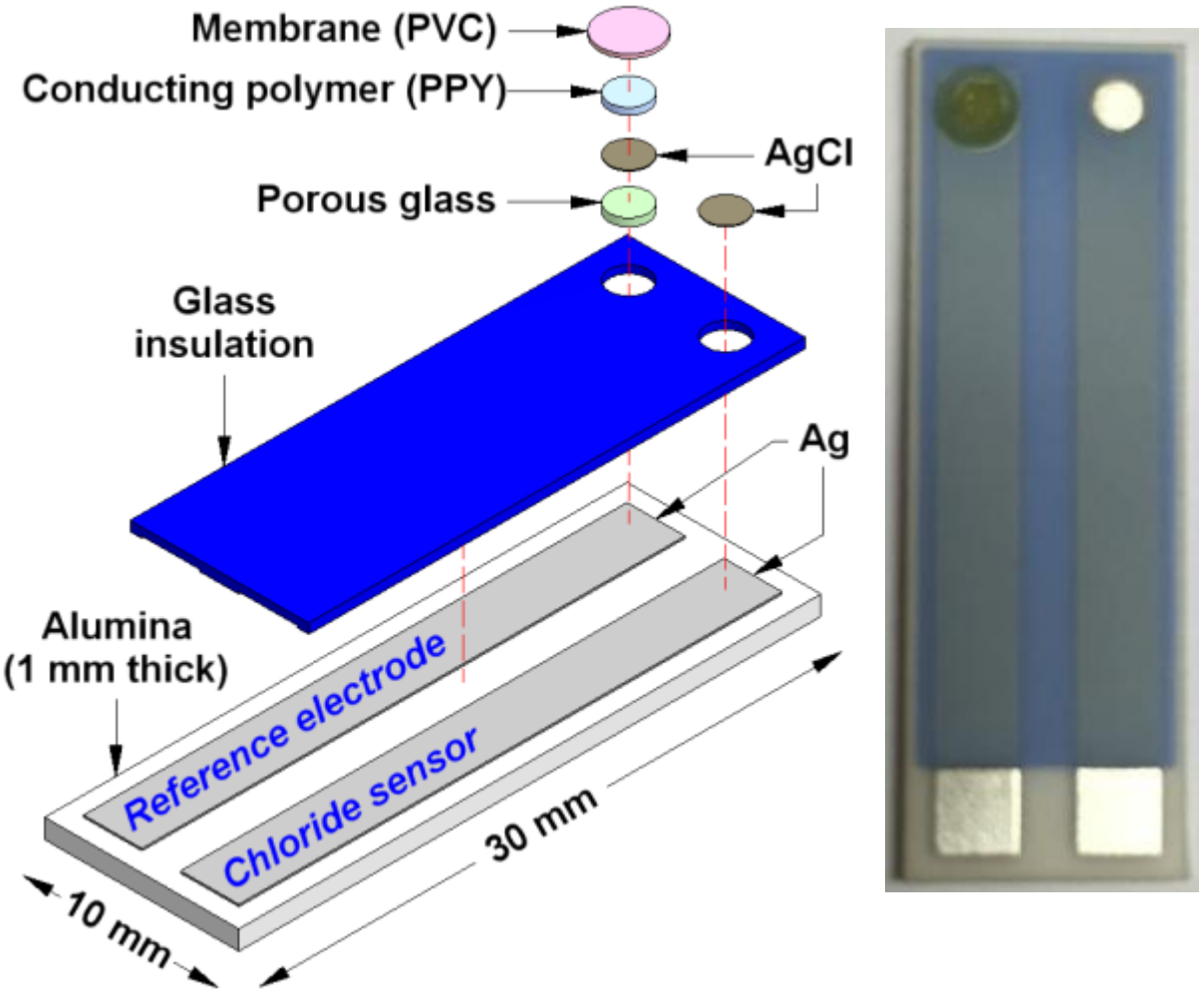
Prof. Kirk Martinez

Distributed Environmental Sensors for Water Quality Monitoring - Nick Harris

Can we learn environmental effects, predict them and improve responses?



Example sensor – low cost, robust

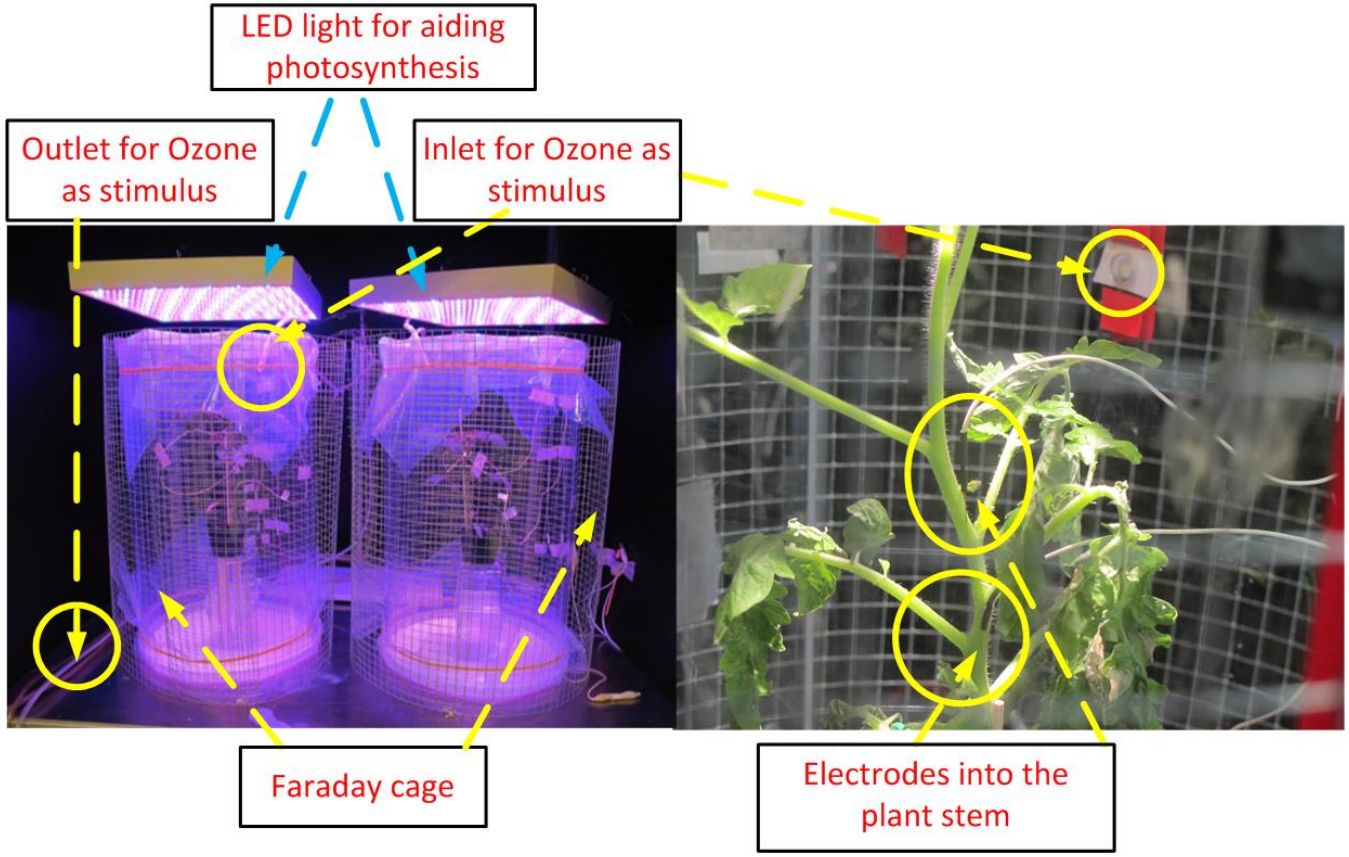


Schematic showing layers of the chloride sensor in the order they are processed (bottom to top) and photograph of completed device

Nick Harris

Bio-sensing

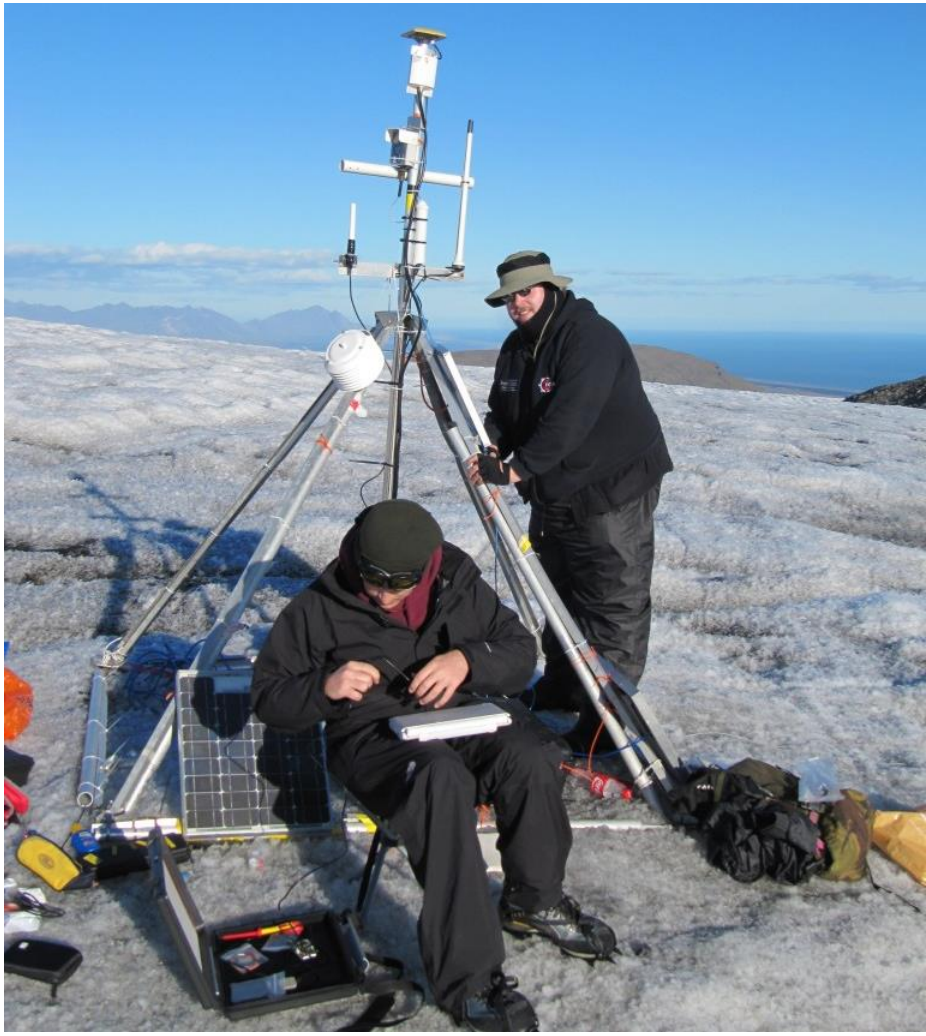
Can we use plants as “living sensors” for environmental monitoring?



Koushik Maharatna

Environmental sensor networks for Glaciers - Glacsweb

Subglacial sensing
Geophones
dGPS
Camera Sensing of rivers
Deployments in Norway & Iceland

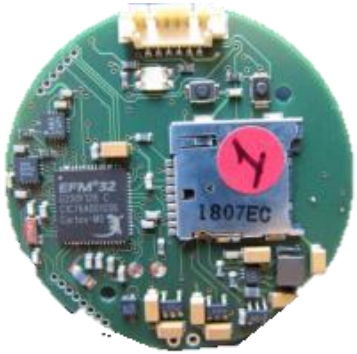


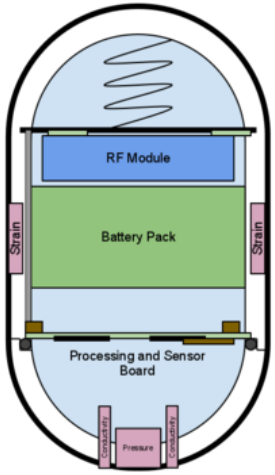
With Prof. Jane Hart, Geography & Environment

Glacsweb probe

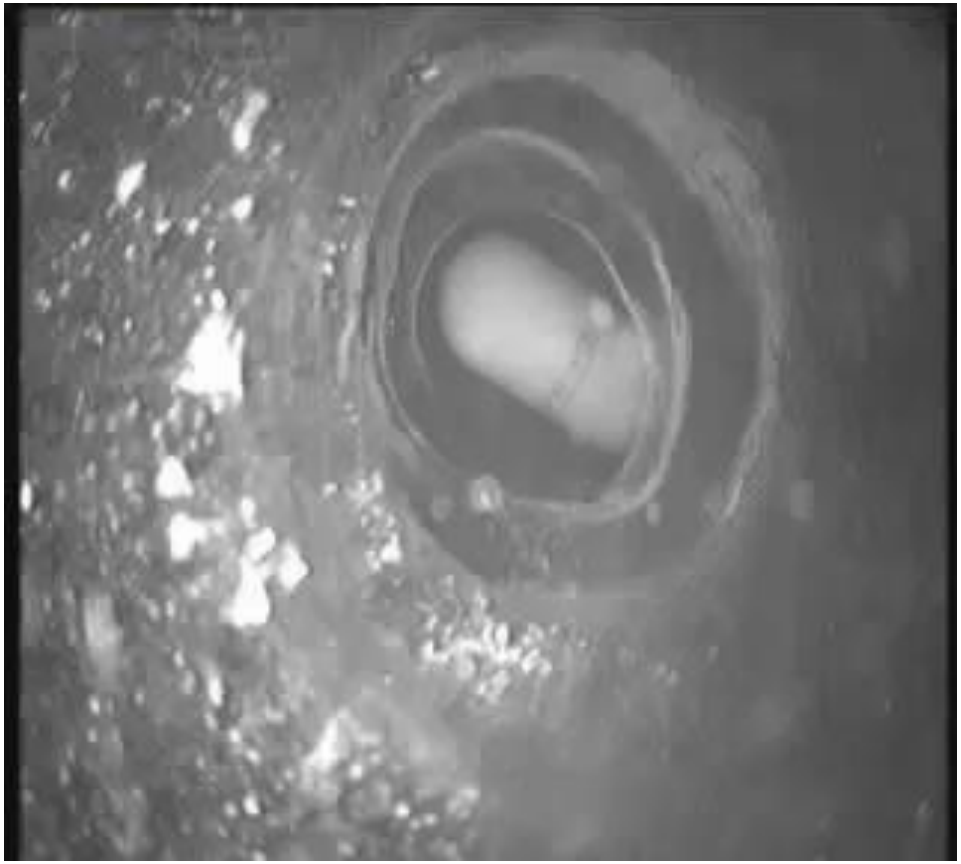
- Temperature
- Pressure
- Case strain
- Conductivity
- Orientation

- Cortex M3
- 151MHz radio link

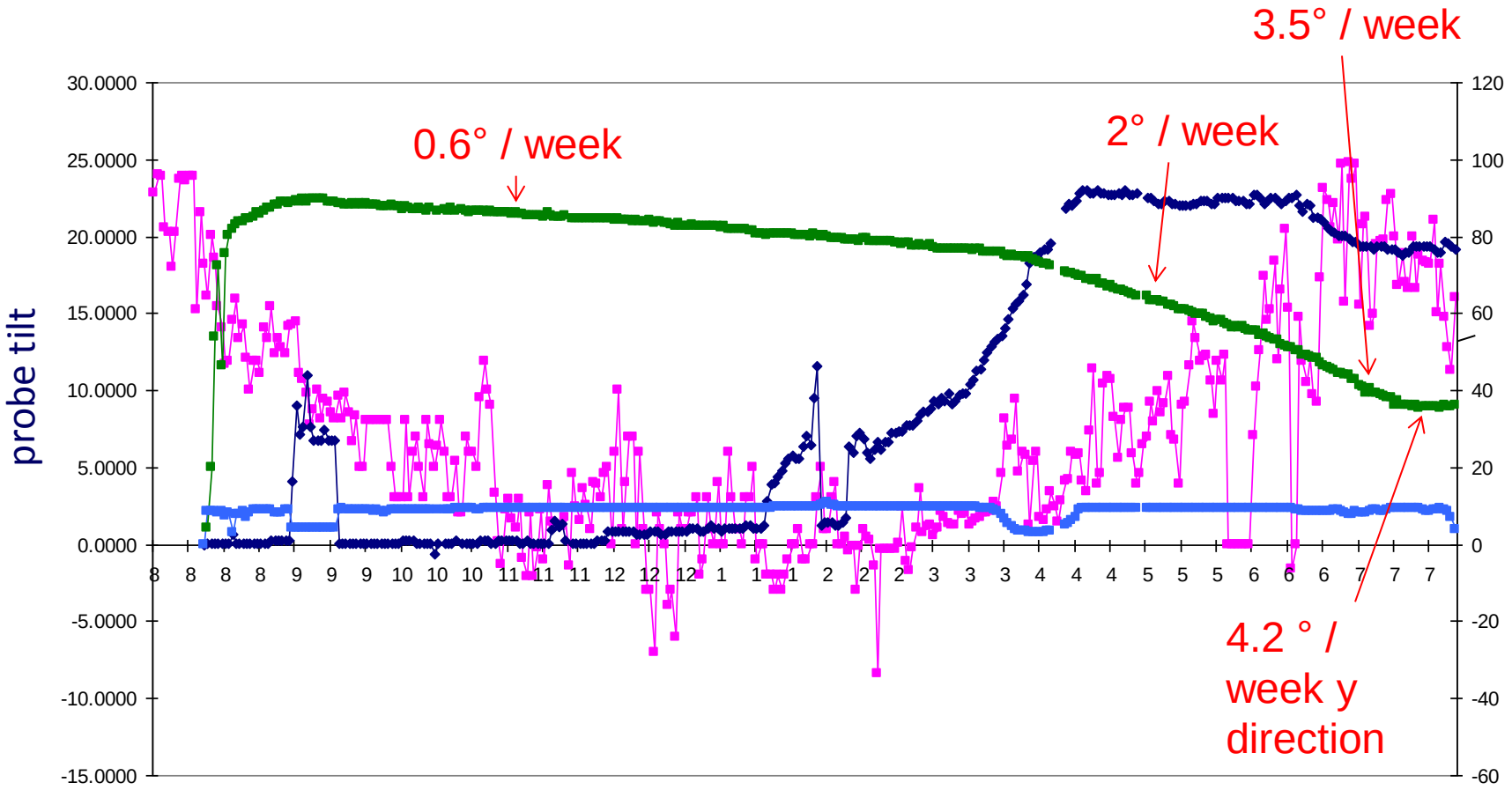




Probe deployment



Briksdalsbreen Norway data sample



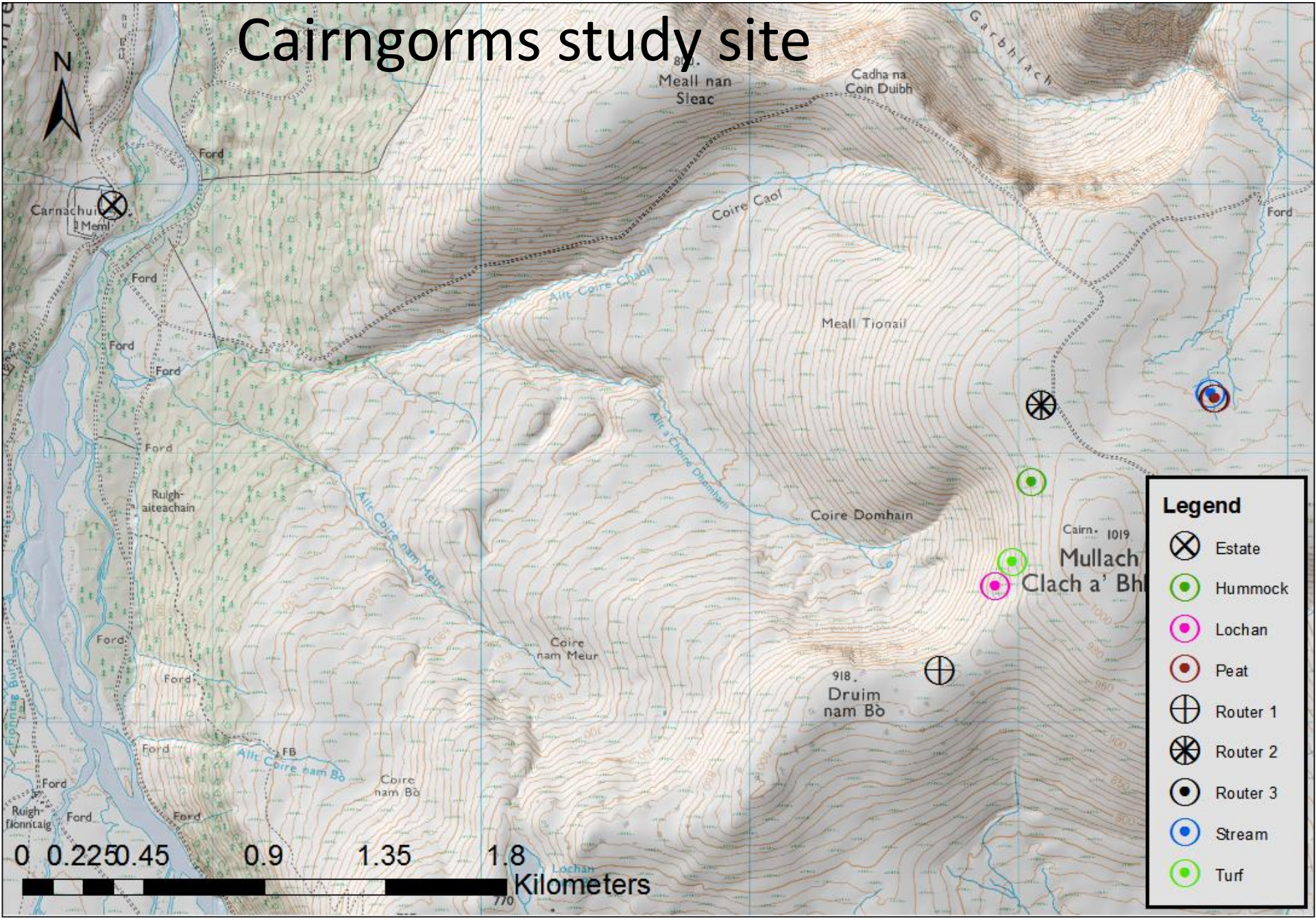
Gephone nodes

Sensing seismic-shocks in glacier

mountainsensing project

- Standards and IP-based sensor network (IoT)
- Based on three use-cases in the Cairngorms

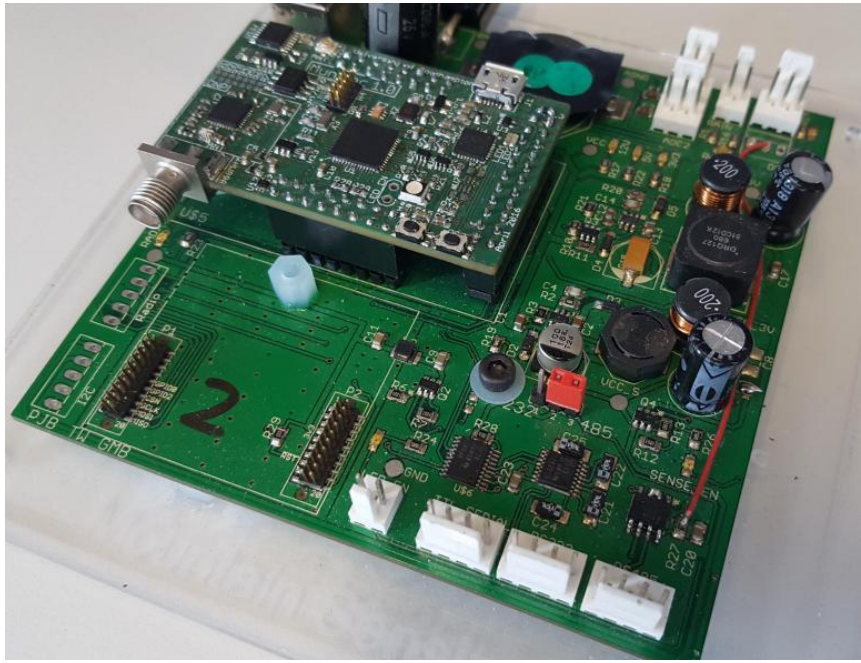
Funded by NERC


Cairngorms study site
N
Meall nan Sleac
Cadha na Coin Duibh
Garbhlach
Coire Caol
Allt Coire Chaoil
Meall Tionail
Allt a'Choire Dhemhaill
Coire Domhain
Allt Coire nam Meur
Coire nam Meur
Cairn 1019
Mullach Clach a' Bh
918
Druim nam Bò
Allt Coire nam Bò
Coire nam Bò
Ruigh-aiteachain
Ruigh-fionntaig
Carnachuin
Ford
FB
Lochan
0 0.225 0.45 0.9 1.35 1.8
Kilometers
Legend
Estate
Hummock
Lochan
Peat
Router 1
Router 2
Router 3
Stream
Turf

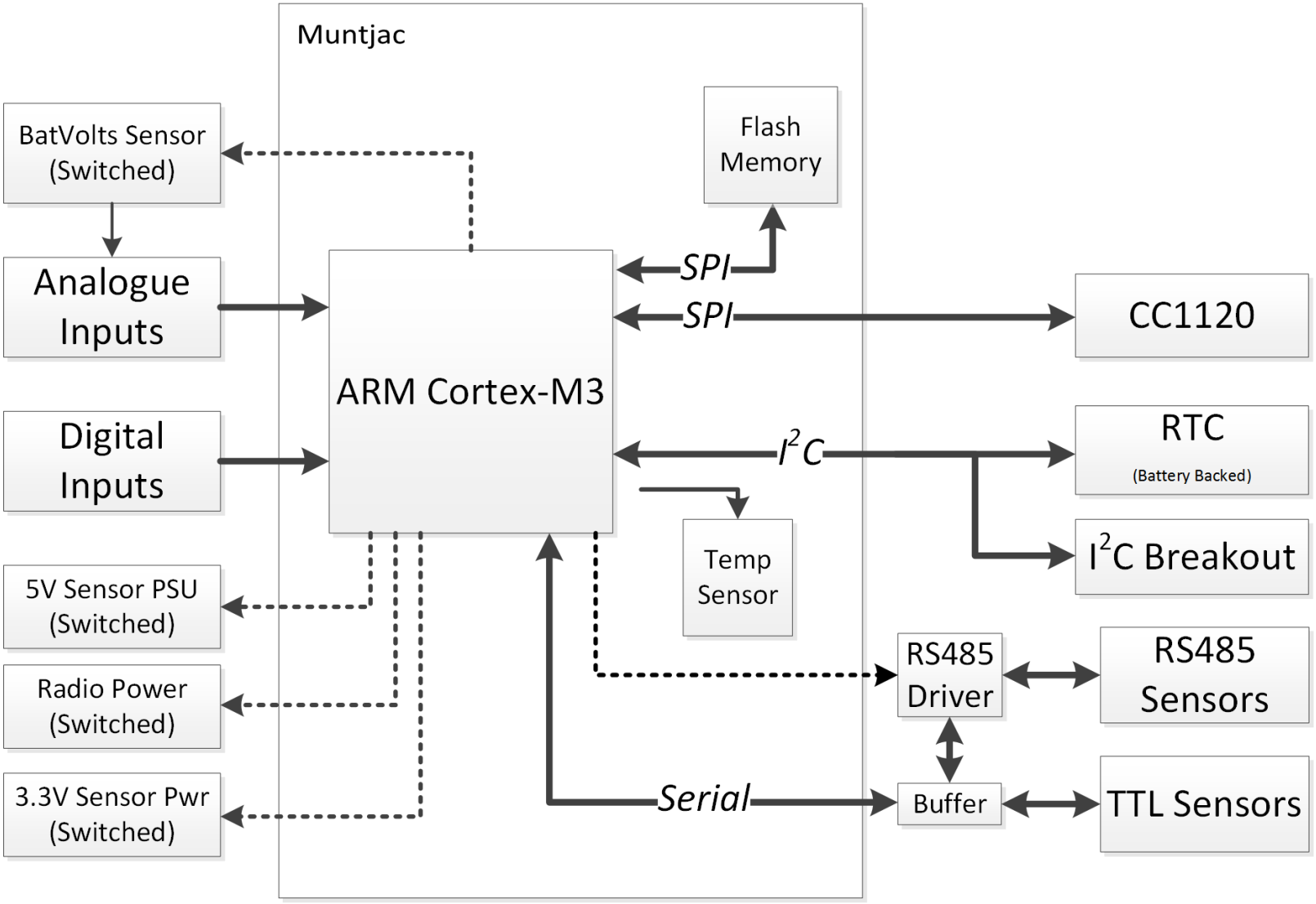
Our sensor node

Custom PCBs

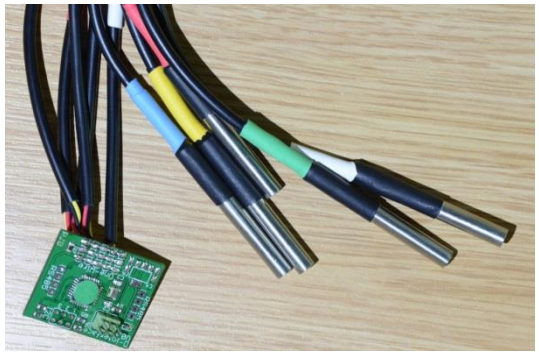
- CC2538 (M3)
- 86MHz CC1120 radio
- External Flash
- Bat-backed RTC
- Switched power supplies
- RS485 drivers
- ADC and GPIO inputs



Sensor node overview



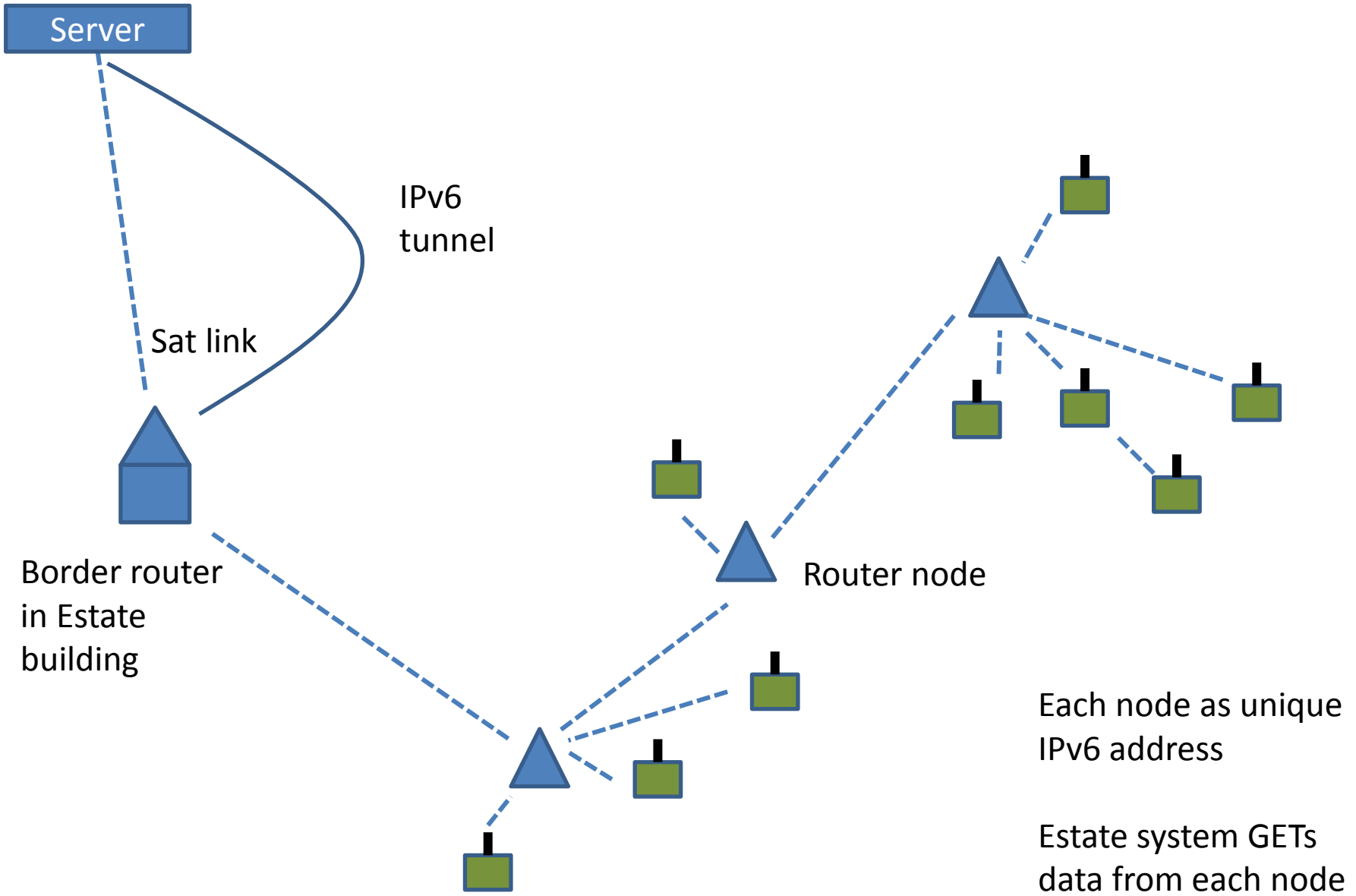
Sensors



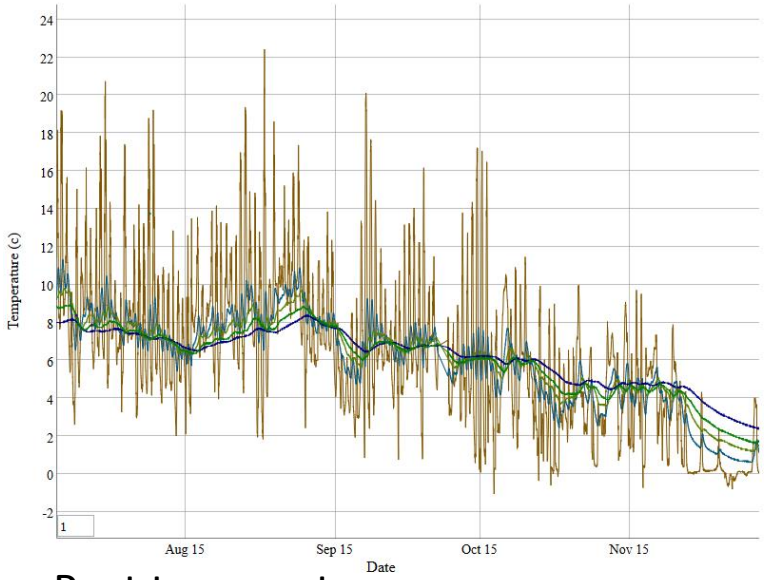
- Temperature
- Soil Moisture
- Rainfall

Embedded AVR sensors:

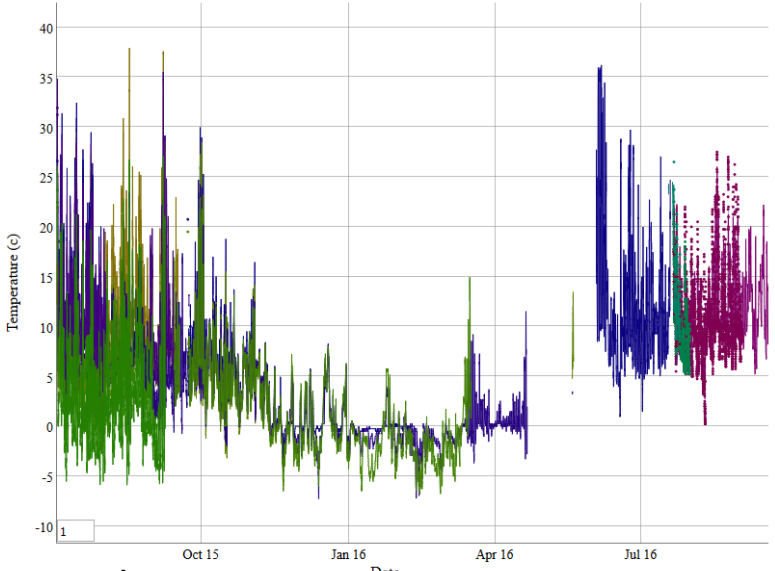
- Temperature set (5)
- Temperature, Accelerometer chain
- Water depth (2 pressures)
- RS485 link to node


Server
IPv6
tunnel
Sat link
Border router
in Estate
building
Router node
Sensor node
Each node as unique
IPv6 address
Estate system GETs
data from each node
CoAP binary protocol

Sample Data



Peat temperatures



node temperatures

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Environmental Sensor Networks

- Sensors
- Low power
- Operating Systems
- Autonomy
- Usability
- Reliability
- Networks
- Deployments
- Data

More info: Kirk Martinez glacsweb.org mountainsensing.org