Boat automation

Monitoring and controlling a liveboard boat with AirLink and AirVantage

Boat Automation

Needs:

- Local control:
  - how much electricity from panels, from genset, how much used, how much stored.
  - On smartphones through local Wi-Fi
- Remote control:
  - information (mostly state of batteries + solar production)
  - remote action through relays (switch on/off appliances, including inverter, remotely)
- History:
  - Where are the good solar spots on the canal?
  - adequation with the season's expected solar yield
    (“can we live comfortably there at this time of year?”)
- Automation:
  - dump extra energy (water heaters, washing machines)
  - Mix solar + shore, with software-controlled hysteresis.

Preffered electrical source:

18m² of thin-film solar panels

- 1.8kWc STC / 1.2kW NOCT
- good €/Wc ratio
- good resiliance to cloudy weather
- poor Wc/m² ratio

“Plan B”

In case of misplanning:

- 5kW (batteries won't take more than 1.5kW)
- ~100dB
- smelly
- 1.5l/h of diesel fuel
- not maintenance-free

Depending on the place

Under the port's trees...

Storage

- Stored in batteries
- Inverted on demand

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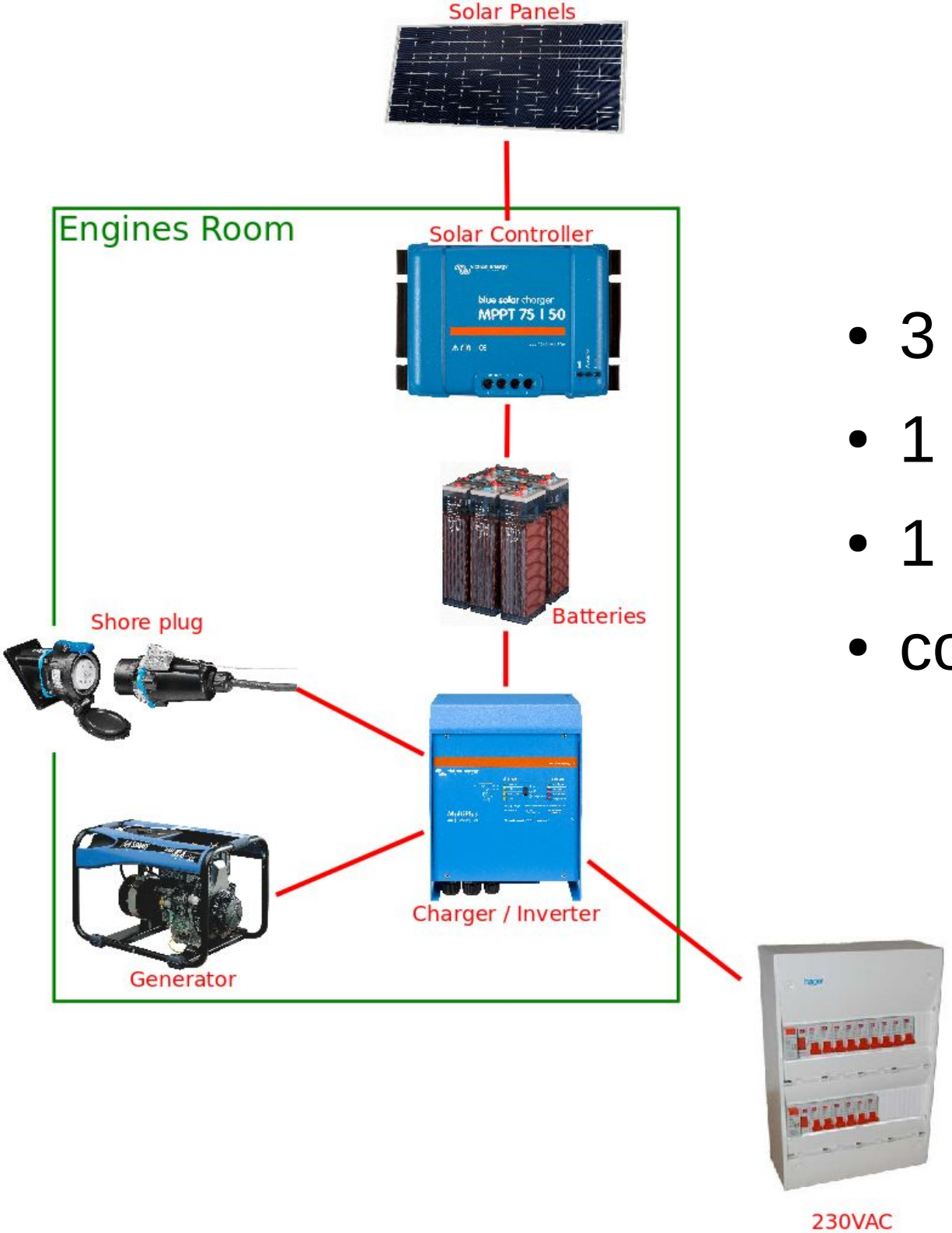
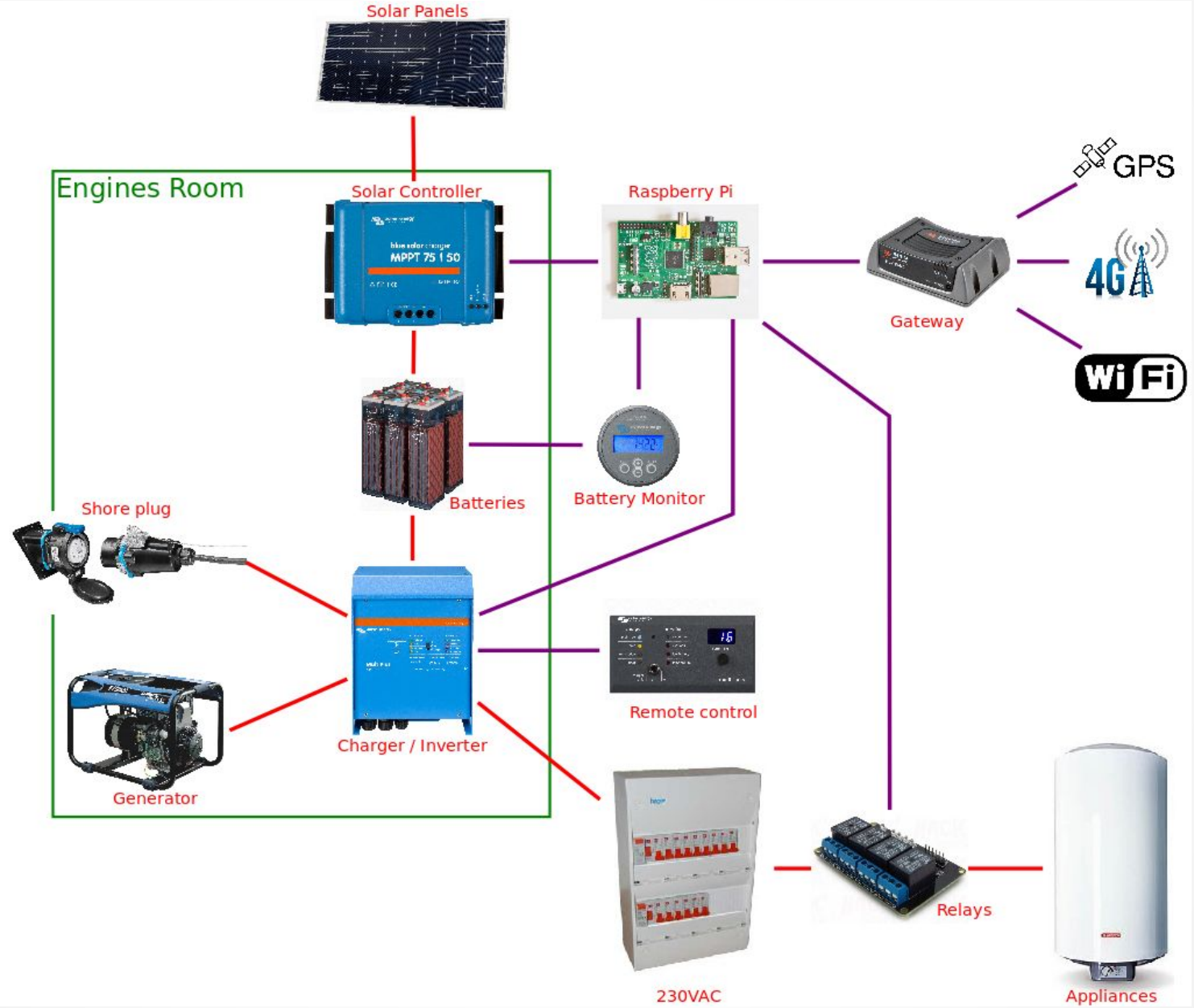
Production



- 3 sources
- 1 (limited) buffer
- 1 converter
- consumers

Control


Solar Panels
Engines Room
Solar Controller
MPPT 75 | 50
Raspberry Pi
GPS
4G
Gateway
WiFi
Batteries
Battery Monitor
Shore plug
Charger / Inverter
Remote control
Generator
230VAC
Relays
Appliances

Computers

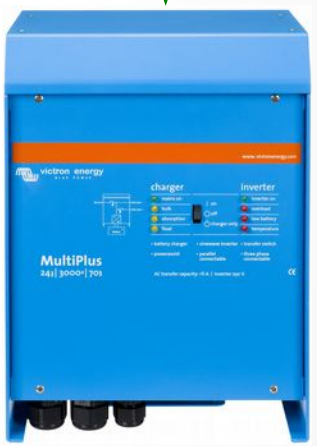
- Raspberry Pi
  - runs Eclipse Mihini (connects to AirVantage out-fo-the-box)
  - lots of cheap I/O
  - Excellent community support
- Airlink GX440
  - Provides Internet to the boat
  - Remotely managed
  - GPS, signal monitoring...
  - Modem management + business application seamlessly integrated

If the Gx440 had unlimited UARTs and GPIOs, I'd have done without the R-Pi, thanks to Aleos Application Framework

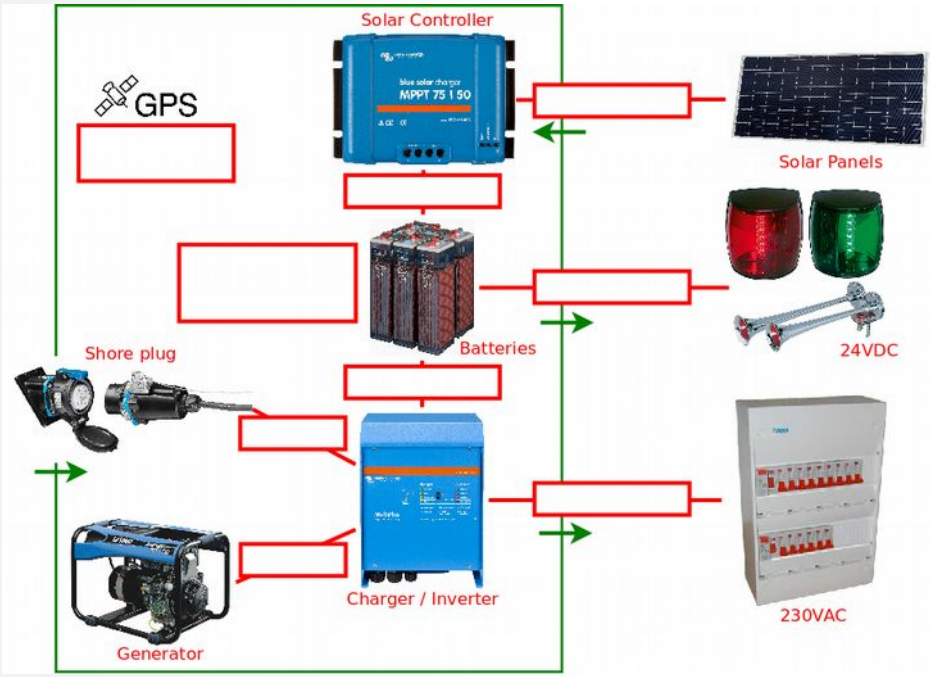
(also, I can hack on the R-π without interfering with the family's Internet connectivity)

Data Acquisition

- UART interface,
- or converter to UART-like interface



Web App

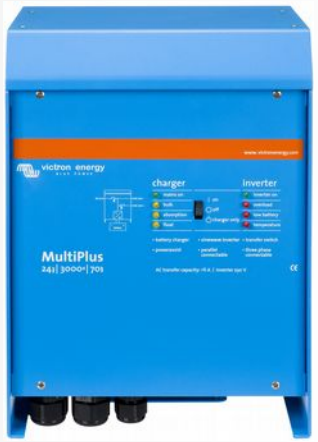


- Simple HTML page, with a bit of Javascript/jQuery (it runs as `file://...`)
- Tries to find the Raspberry and issue an AJAX request
- In case of failure, accesses AirVantage, gets last uploaded data.

History

Everything stored and graphed for free, online.

TODO (electricity)



Charger/Inverter:

- Finalize driver
- Allow the R-Pi to limit input current

230VAC/10A Relays:

- Control big appliances
- Remote control
- Extra energy dump

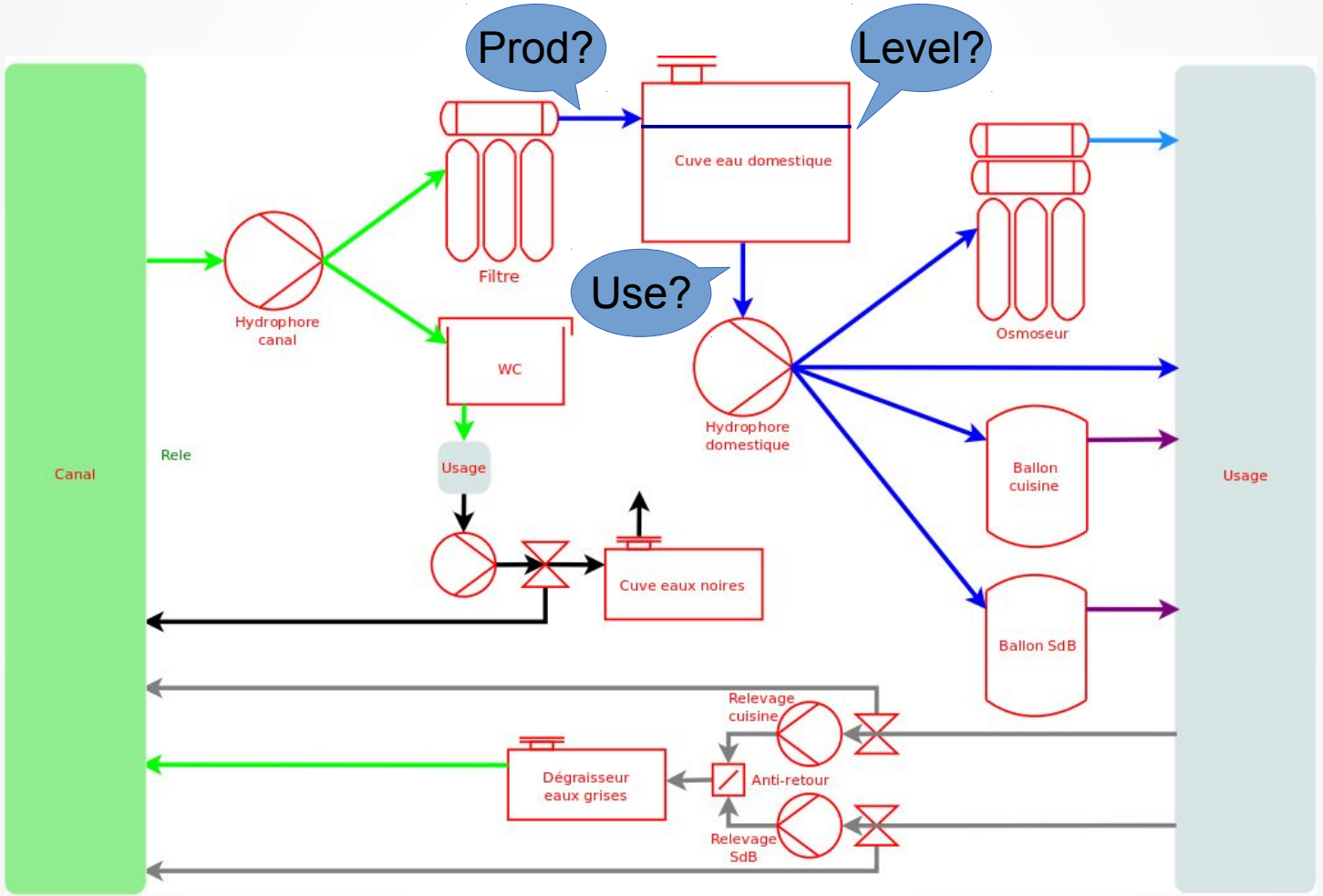
Analogic AC Current sensors:

- on shore plug;
- on genset.

TODO 2: Water

- River water,
  directly pressurised:
  - Hose & Kärcher
  - WC
  - Filters
- Filtered + UV + carbon treated water, buffered in a 1500l tank:
  - taps & shower
  - washing machines
  - rev. osmosis filter
- Rev. osmosed water,
  buffered in a 15l tank:
  - Drinking & cooking

Water


Prod?
Level?
Use?
Cuve eau domestique
Filtre
Hydrophore canal
WC
Usage
Rele
Canal
Hydrophore domestique
Osmoseur
Ballon cuisine
Ballon SdB
Usage
Cuve eaux noires
Relevage cuisine
Dégraisseur eaux grises
Anti-retour
Relevage SdB

Water management wishlist

Built around an Arduino Uno (autonomous wrt the rest of the system) with:

- Flow sensors (production, use)
- distance sensor (reading water level in main tank)
- moisture level
  (reliable tank full trigger)
- (normally closed!) valve