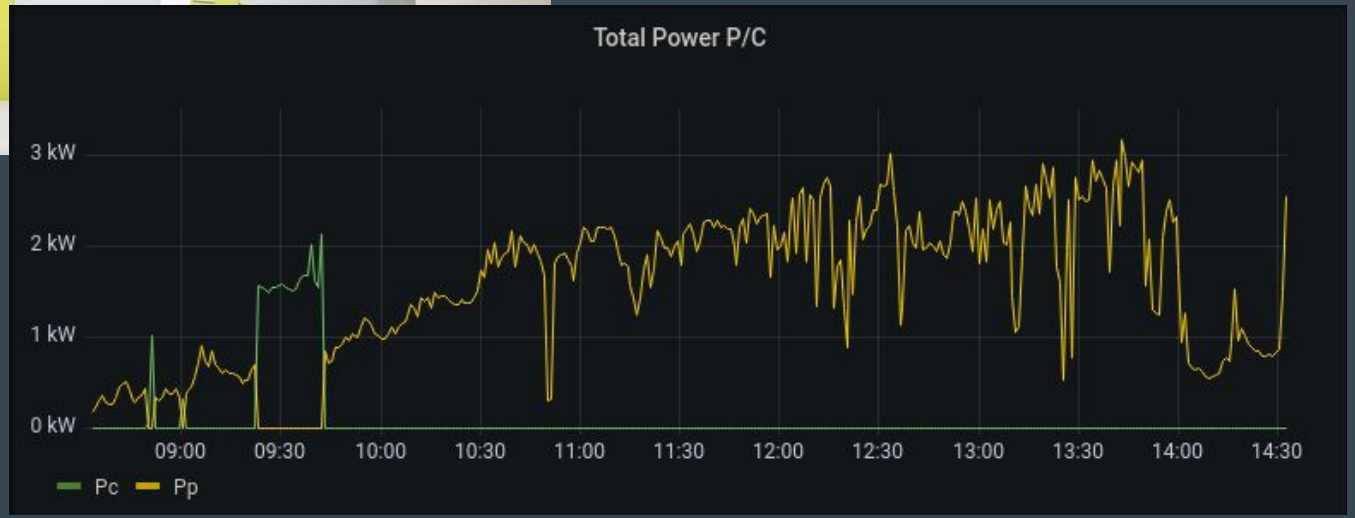
Smart Energy Meter (SEM)

By Sander Speetjens
Electronics ICT
Embedded Software

Idea


Total Power P/C
3 kW
2 kW
1 kW
0 kW
09:00
09:30
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
Pc
Pp

Requirements

- Reading Meter
- Processing frame
- Save the Data
- Show the Data

Implementation

Fluvius Meter

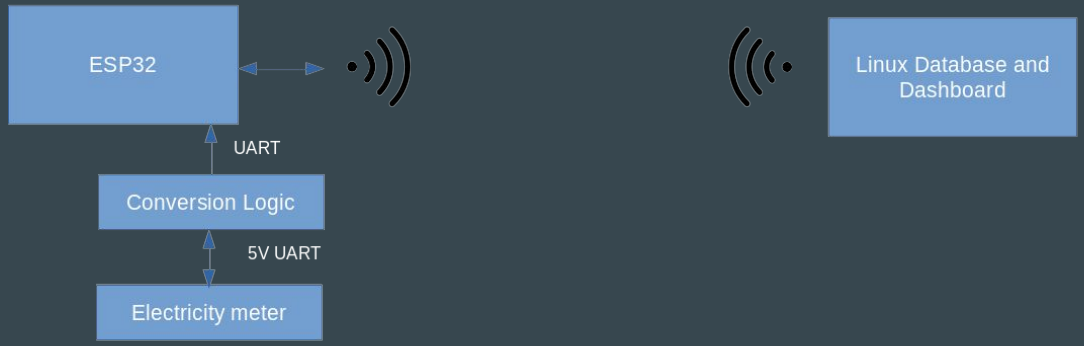
Database

Monitoring Webpage

Implementation: Meter side

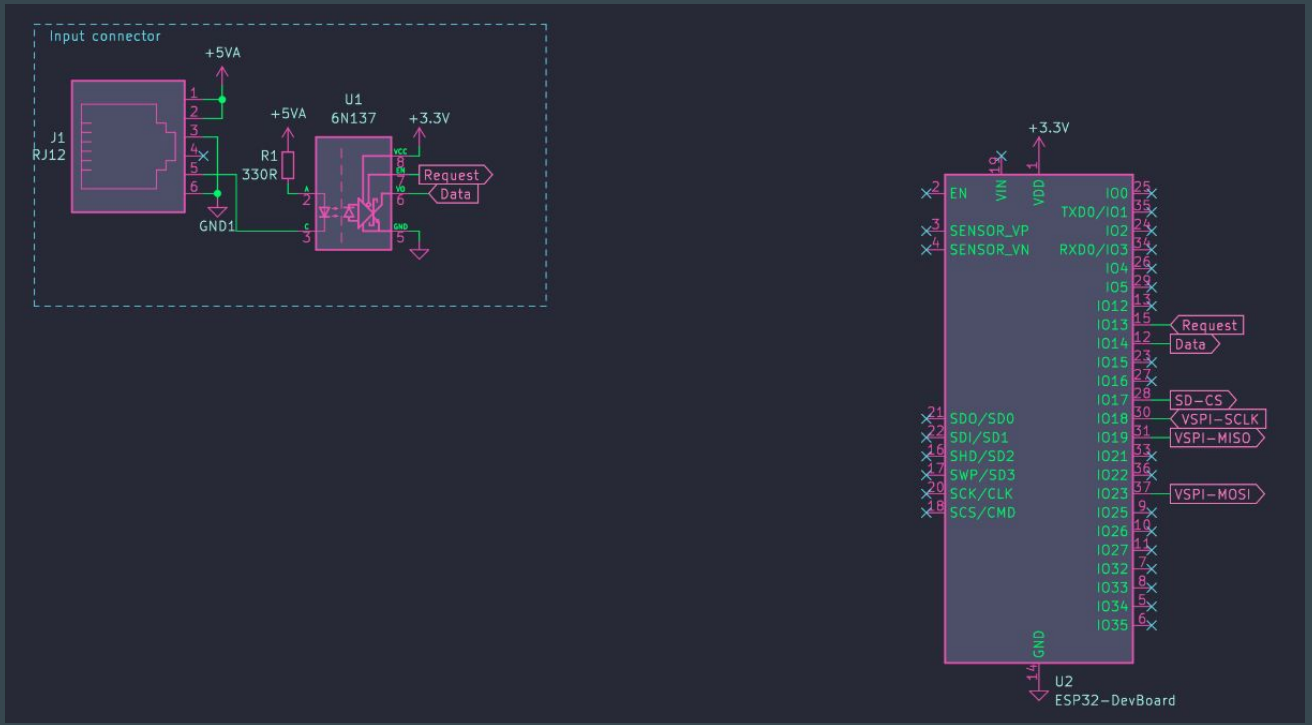
- Open Drain -> Opto-Isolation
- Read UART (inverted)
- Decode datagram
- Send Data via HTTP Post

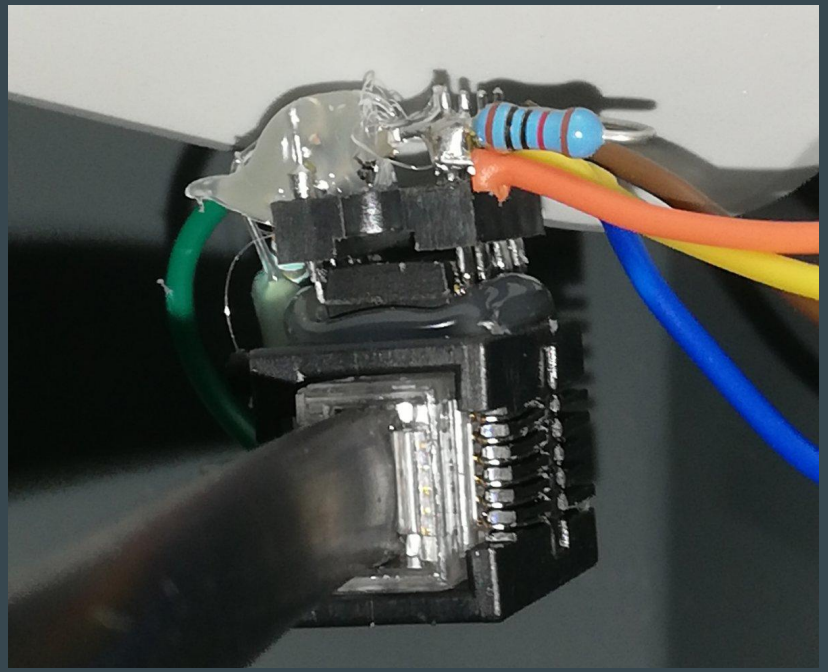
Block Diagram



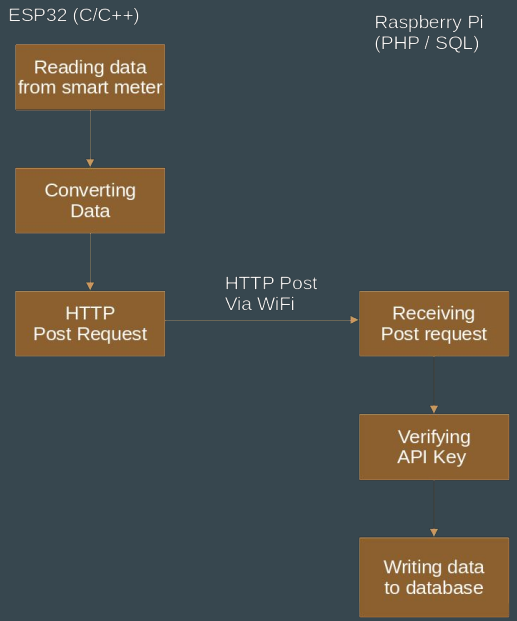
Sander Speetjens 1 (E)ES

Schematic


Input connector
+5VA
J1
RJ12
GND1
+5VA
R1
330R
U1
6N137
+3.3V
Request
Data
+3.3V
EN
SENSOR_VP
SENSOR_VN
SDO/SD0
SDI/SD1
SHD/SD2
SWP/SD3
SCK/CLK
SCS/CMD
VIN
VDD
GND
IO0
TXD0/IO1
IO2
RXD0/IO3
IO4
IO5
IO12
IO13
IO14
IO15
IO16
IO17
IO18
IO19
IO21
IO22
IO23
IO25
IO26
IO27
IO32
IO33
IO34
IO35
Request
Data
SD-CS
VSPI-SCLK
VSPI-MISO
VSPI-MOSI
U2
ESP32-DevBoard



Implementation: Block Diagram



Decoding Datagram

/	X	X	X	5	Identification	CR	LF	CR	LF	Data	!	CRC	CR	LF

1) Search for ‘/’
2) Read UART buffer
    1) Char to buffer
    2) Buffer full => bad datagram
    3) ‘\r’ and ‘!’ was character - 6
3) Start decoding the Datagram
    1) Check Datagram again
    2) Search for OBIS references
       =>Not found makes the value -1

Implementation: Database

- MariaDB
- PHP
- Apache2 (HTTP web server)

Data management:

- Retrieve
- Write

Implementation: Visualisation

Grafana Dashboard

- Production and Consumption (KWh)
- Total Production and Consumption (KW)
- Gas Consumption (m^3)
- Voltage and Current

Possible improvements

- PCB
- Time Series database vs Relational database
- Setup via a web server instead of hard coded

Conclusion

- ✓ Reading Meter
- ✓ Processing frame
- ✓ Save the Data
- ✓ Show the Data

Demo

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