

EMBEDDED MEASUREMENT AND CONTROL

Towards a generic data logger

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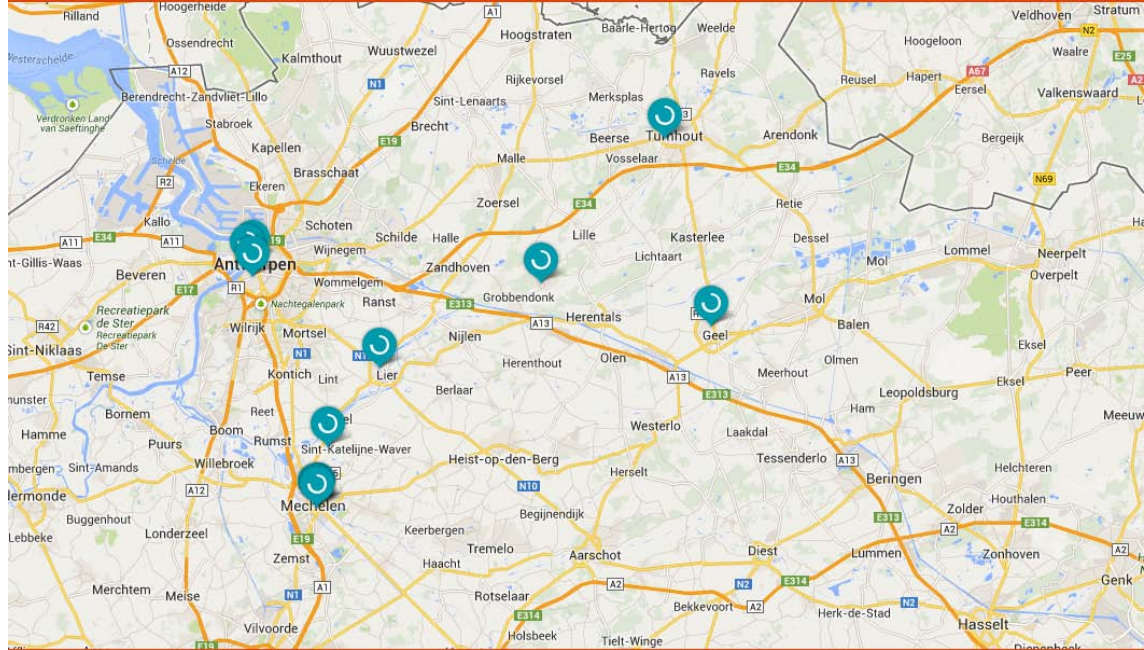
THOMAS MORE

Education

- 29 professional bachelors degrees
- 4 academic KUL bachelor degrees
- 13 academic KUL master degrees
- 13 bachelor after bachelor degrees
- 1 master after master degree
- 36 postgraduates
- 44 transition programs

7 campuses in the province Antwerp

- Campus Antwerpen
- Campus De Nayer
- Campus Geel
- Campus Lier
- Campus Mechelen
- Campus Turnhout
- Campus Vorselaar



RESEARCH GROUPS THOMAS MORE

- 16 research groups
 - EmSys
 - Knowledge centre of energy
 - Mobilab
 - ...

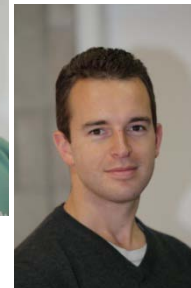
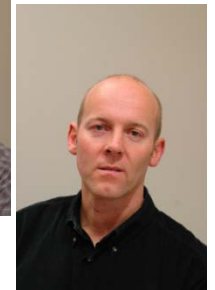
EMSYS RESEARCH GROUP

- Research group specialized in embedded systems
- Expertise in the development of digital, analog and software systems
- Development from design to realization



EMSYS RESEARCH GROUP

- Patrick Pelgrims
- Wim Dams
- Jan Derua
- Marc Roggemans
- Marc Scheirs
- Lars Struyf
- Bart Tanghe
- Johan Van Bauwel
- Dirk Van Merode
- Nathalie Maes
- Sofie Beerens
- Jurre De Weerd



EMSYS RESEARCH GROUP

- INS-OT: Instrumentation for orthopedic applications
- S.O.S. OpenCL: Multicore Cooking
- EmCam: Multifunctional Embedded Digital Camera-system
- EmDem: Embedded System Design Methodology
- EmTas: Technological Advice Service For Reconfigurable Embedded Systems
- EmPro: Embedded System design based on soft- and hardcore FPGA's

OVERVIEW EMMAC

- Measurement and control of process parameters
- Not trivial to set up such a data logger system
- Can the “setup” be more generic ?
- Rapid prototyping, “plug-and-play”
- Reduce personnel cost
- Specific cases

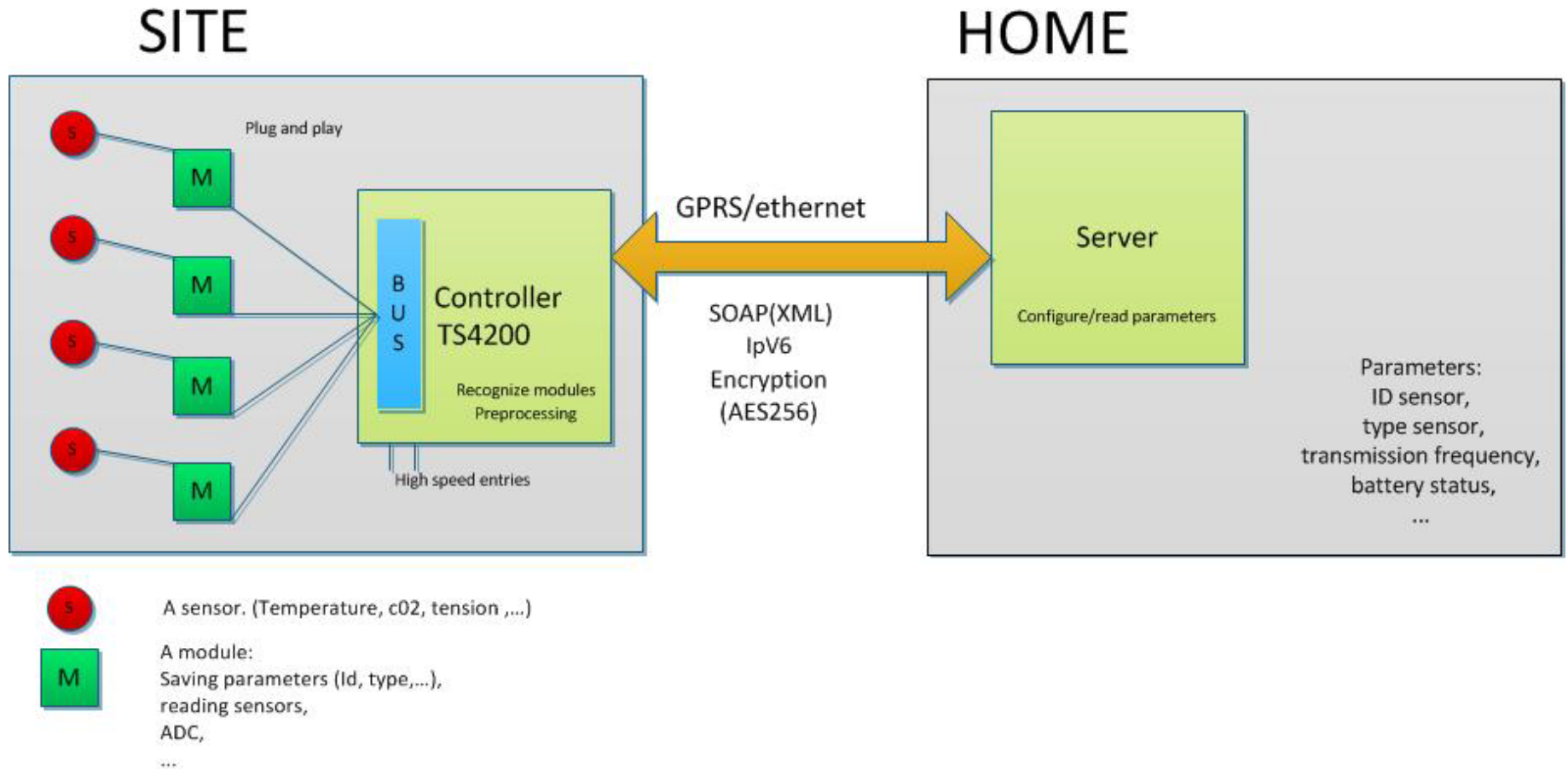
ISSUES

- No upgrades or reconfiguration from a distance
- Inadequate security measures
- No or not much modular or compatible parts
- No data compression before sending
- Insufficient data storage on the data logger
- No IPv6 support
- Lack of performance to do statistical pre-processing
- High power consumption
- Weight and dimensions
- No 24/7 access to data
- No bidirectional communication to server

ISSUES (ACCORDING TO SURVEY)

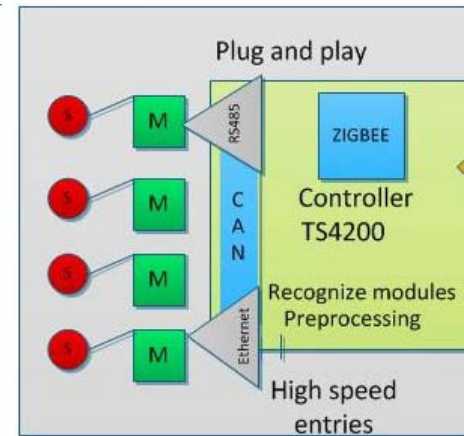
- Correct data retention after power failure
- Data must be sent to the customer's own server
- Compatibility/interconnection with other data loggers
- The software must be open source
- Data being stored in a .csv format
- 24/7 access to data
- Change parameters of your data logger from the server
- Preferred Ethernet connection to the server
- Configurable and programmable interface
- A large community to help with issues

SETUP



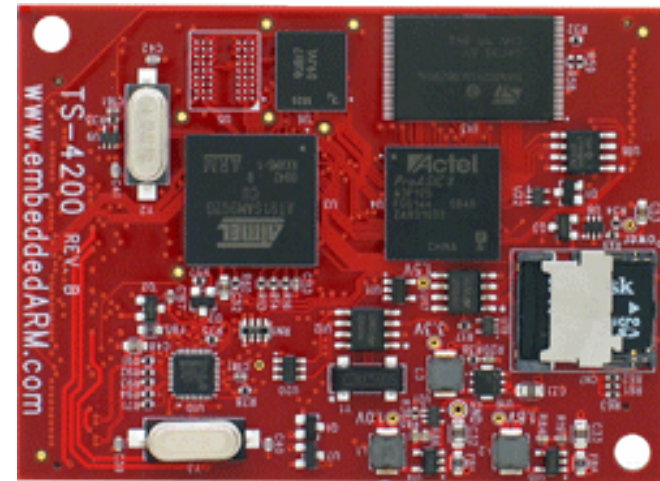
DATALOGGER

- Pre-processing
- High speed entries
- Communication with server
- Communication with sensors
- Plug and play: the system is aware of the sensors attached to it



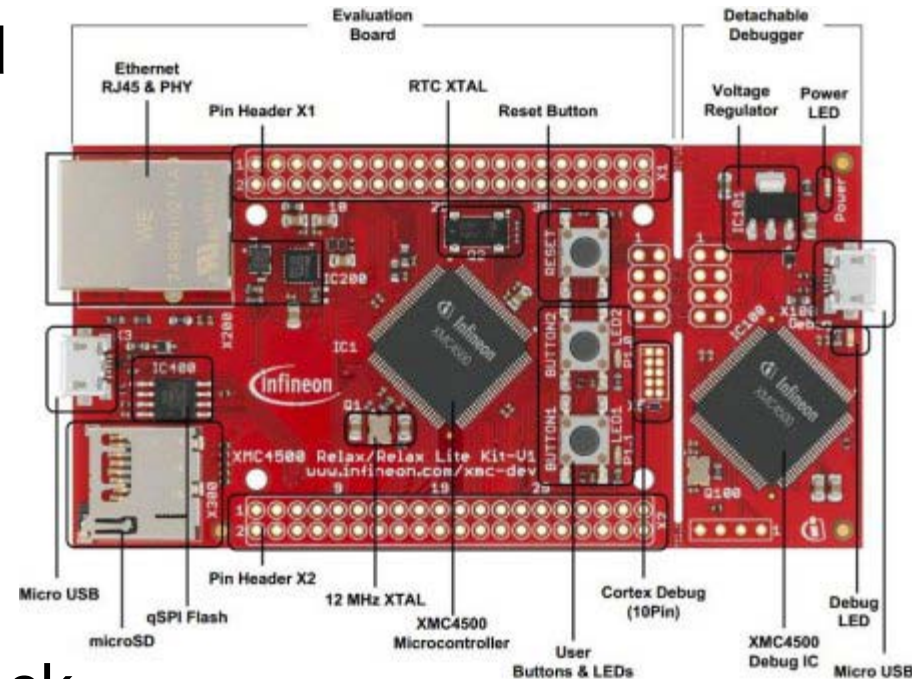
DATALOGGER

- TS-4200
 - Atmel AT91SAM9G20 ARM9 @400MHz
 - 128MB DDR-RAM
 - 256MB XNAND
 - MicroSD
 - 1.2K LUT Actel Low-power FPGA
 - Very Low Power (75mA at 5V)
 - Up to 6 UARTs (1 Auto-485 capable), SPI, I2C, I2S, ADC, up to 78 GPIO/DIO



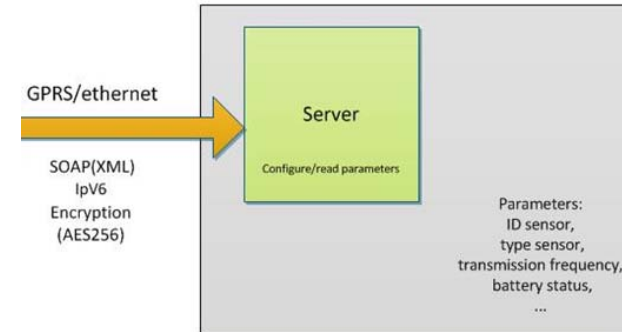
SENSOR MODULE

- Infineon XMC4500 Relax Kit
 - ARM® Cortex™-M4F based
 - SPI, I2C, I2S, 3 x UART, CAN, 17 x ADC (12 bit), DAC, PWM
 - Real Time Clock
 - 32 Mbit Quad-SPI Flash
 - microSD card slot
 - Ethernet PHY and RJ45 jack

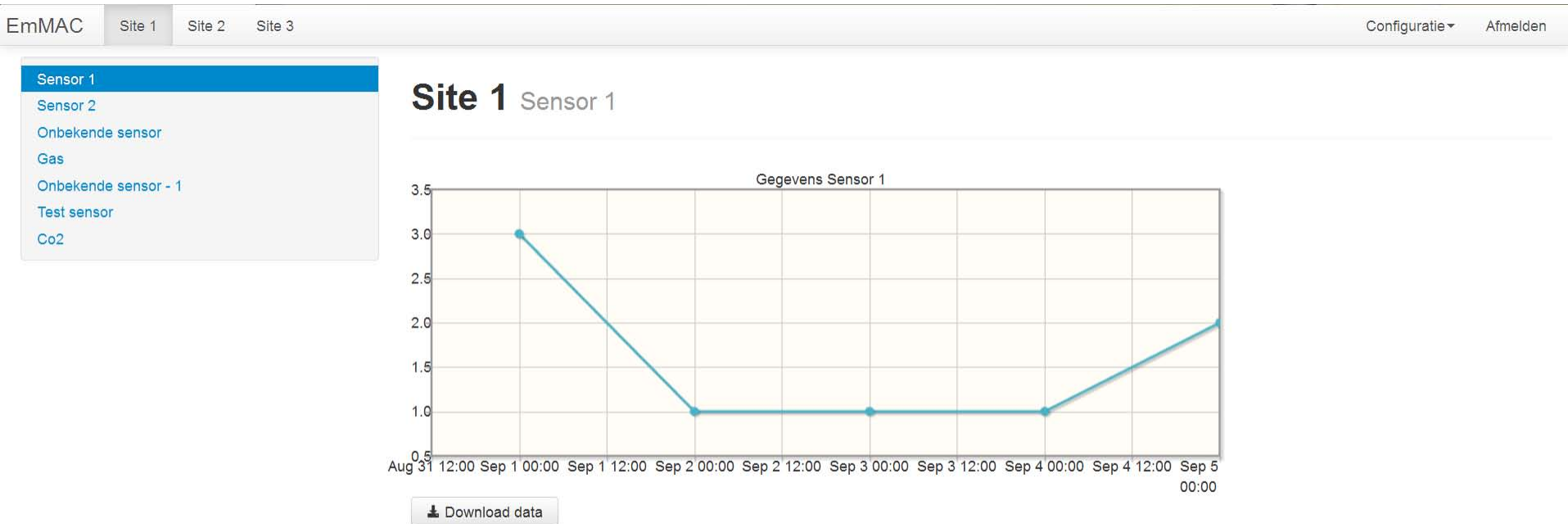


SERVER

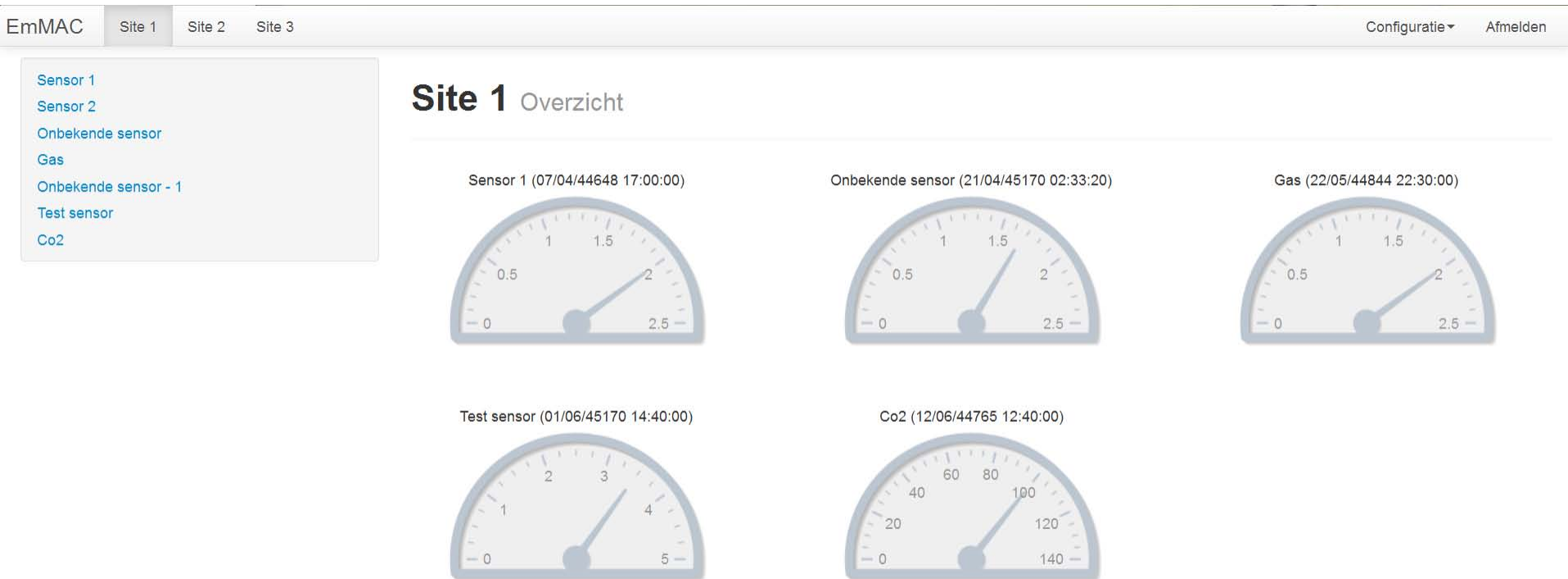
- AES256 encryption
- Gprs/Ethernet
- Parameters
- IpV6
- Soap protocol (xml)



SERVER & VISUALISATION



SERVER & VISUALISATION



TEST CASES

- Water purification station in Ghana
- Formula Student project
- Energy management system

TEST CASES

- Water purification station in Ghana



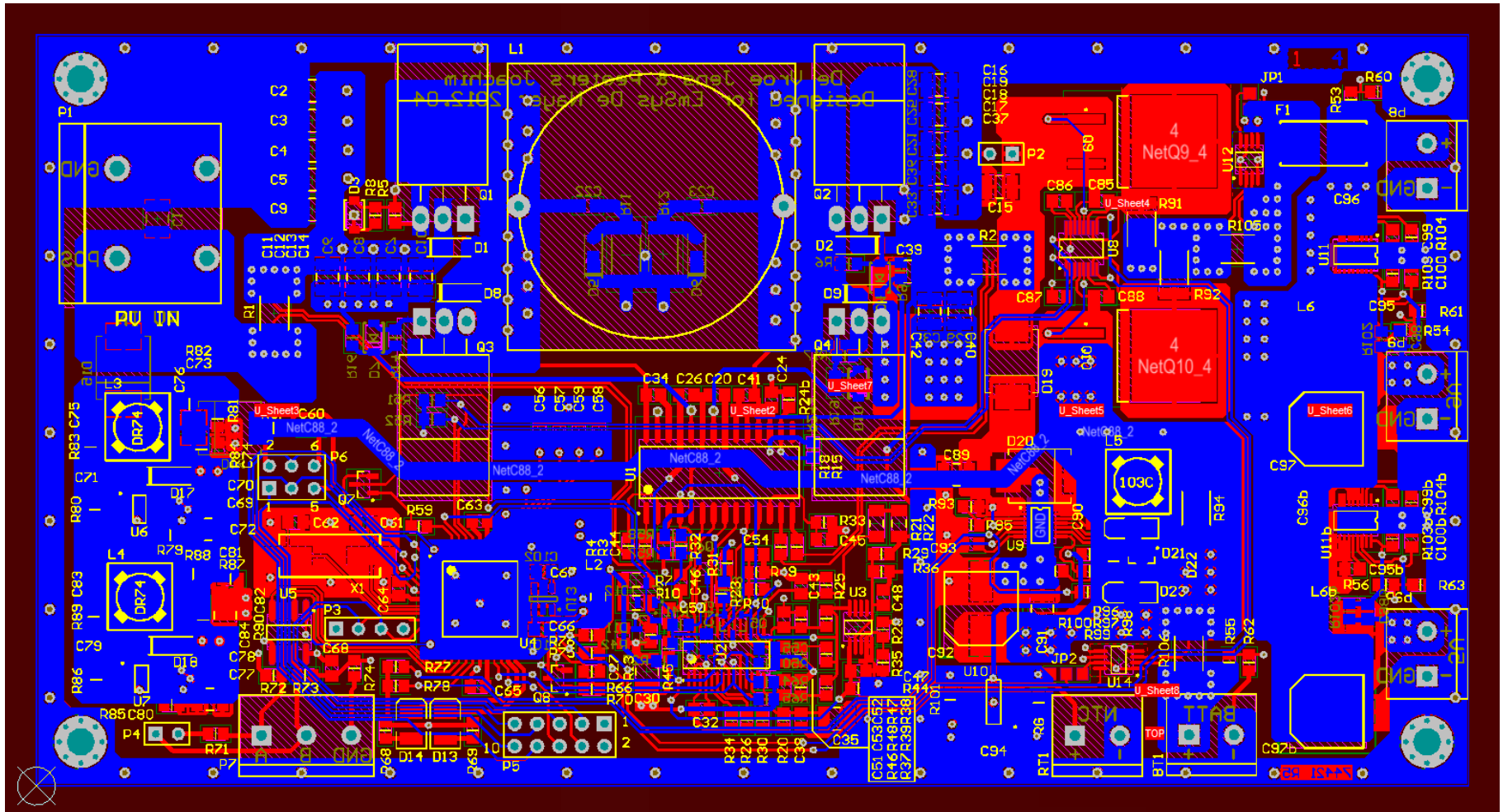
TEST CASES

- Water purification station in Ghana
 - Need to know the operational status
 - Sensor readings:
 - Flow rate
 - Water level
 - Status of UV disinfecting lamp
 - Solar panel power => Low-power requirements
 - Need for a power buffer => battery required

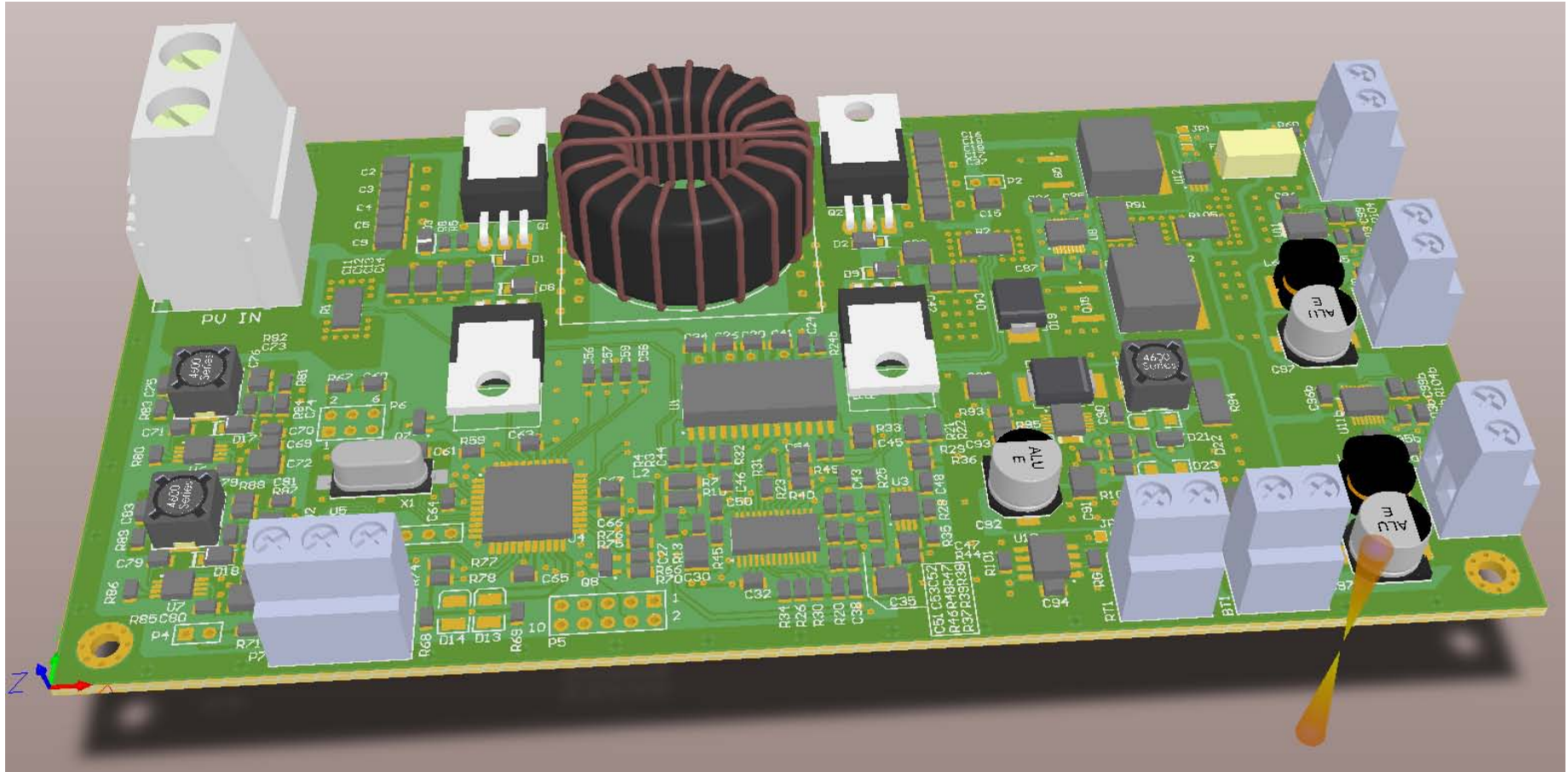
INTELLIGENT BATTERY CHARGER

- Battery charger for SLA batteries
- Communication between charger and embedded system

INTELLIGENT BATTERY CHARGER



INTELLIGENT BATTERY CHARGER



FUTURE WORK

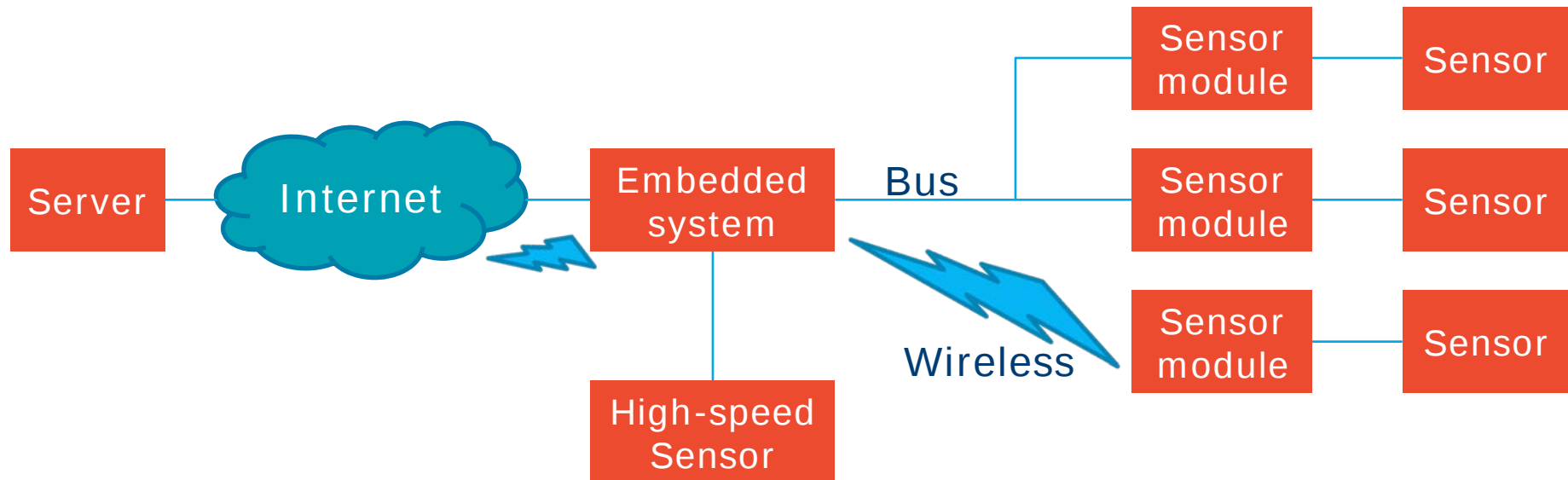
- Plug and play
- Connect a sensor and see if the data is correctly displayed at the server
- Debugging
- Not only via Ethernet, but also via Gprs
- Communicate with CAN, ZigBee, Ethernet
- Data encryption
- Preprocessing
- Set parameters through the server
- Specific case testing

CONCLUSION

- The requirements are known for our prototype
- Simple software where simple parameters can be adjusted and received
- Working intelligent battery charger

CONCLUSION

- Data communication between data logger and server via Ethernet
- Connection between a sensor module and the data logger via RS232 and Ethernet



CONTACT

- We are always looking to participate in projects involving:
 - Embedded systems
 - System prototyping (Idea to realisation)
- Contact:
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THANK YOU

