Final Project Presentation

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RIOT - the future of the agriculture

own radio system

control via app and web

controlled electrical fence

animal monitoring via RFID

6:00

Overview

- Determined goals
- Program Structure
- Fence handling
- IEEE 802.15.4
- LoRa
- RFID
- Server & App
- Suggestion
- Conclusion

Goals:

- Communication between nodes via LoRa
- Raspberry Pi as Main station
- Read ID of the livestock
- Homepage and Android App
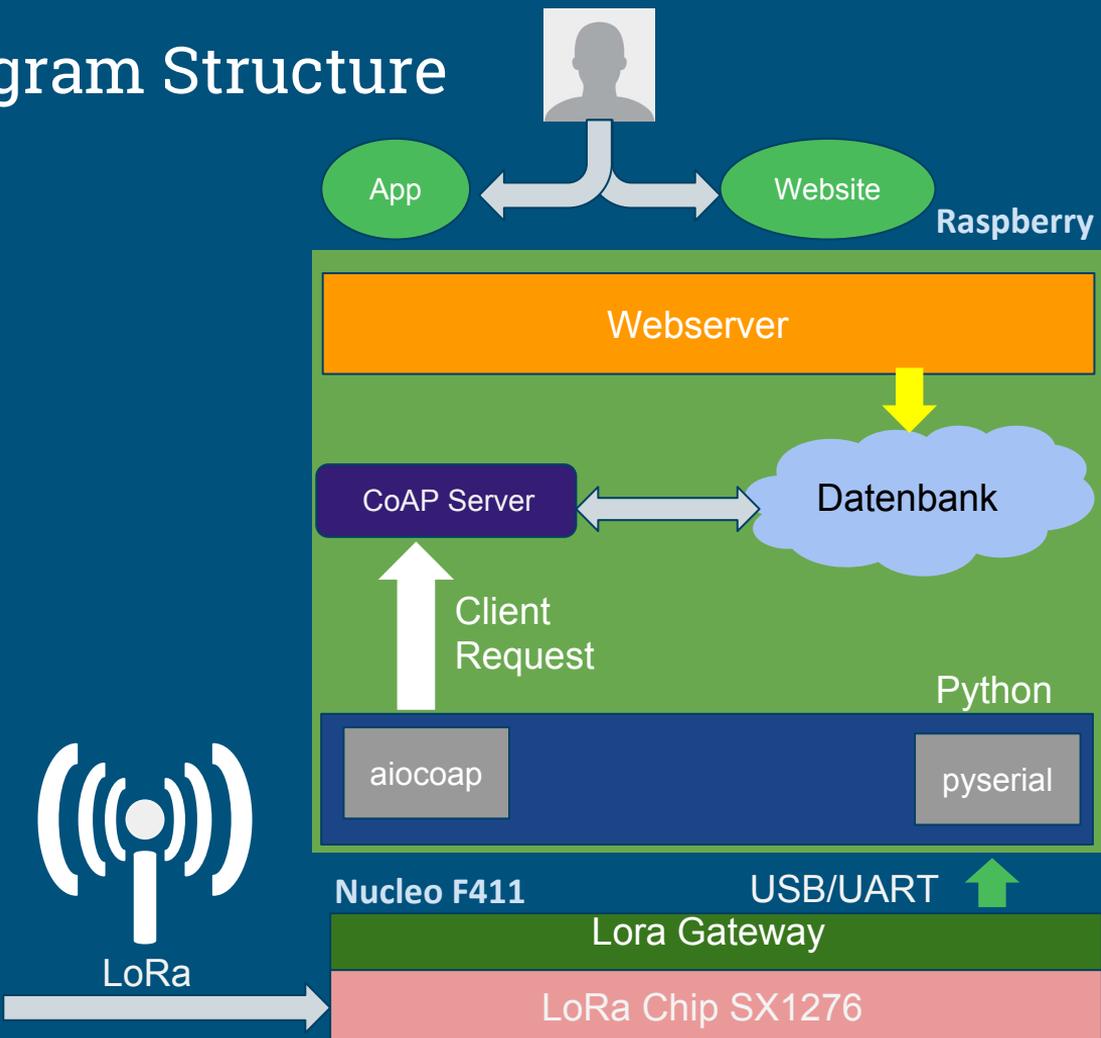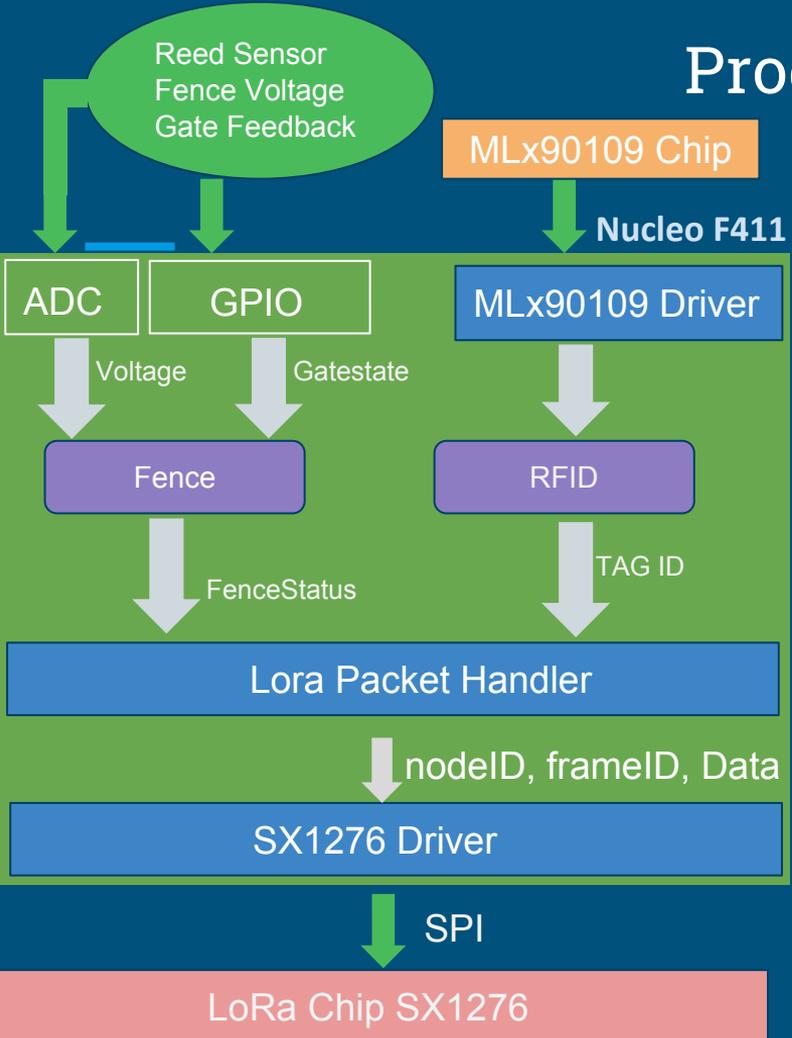- Detection of interruptions in fence
- Detection of open Gate

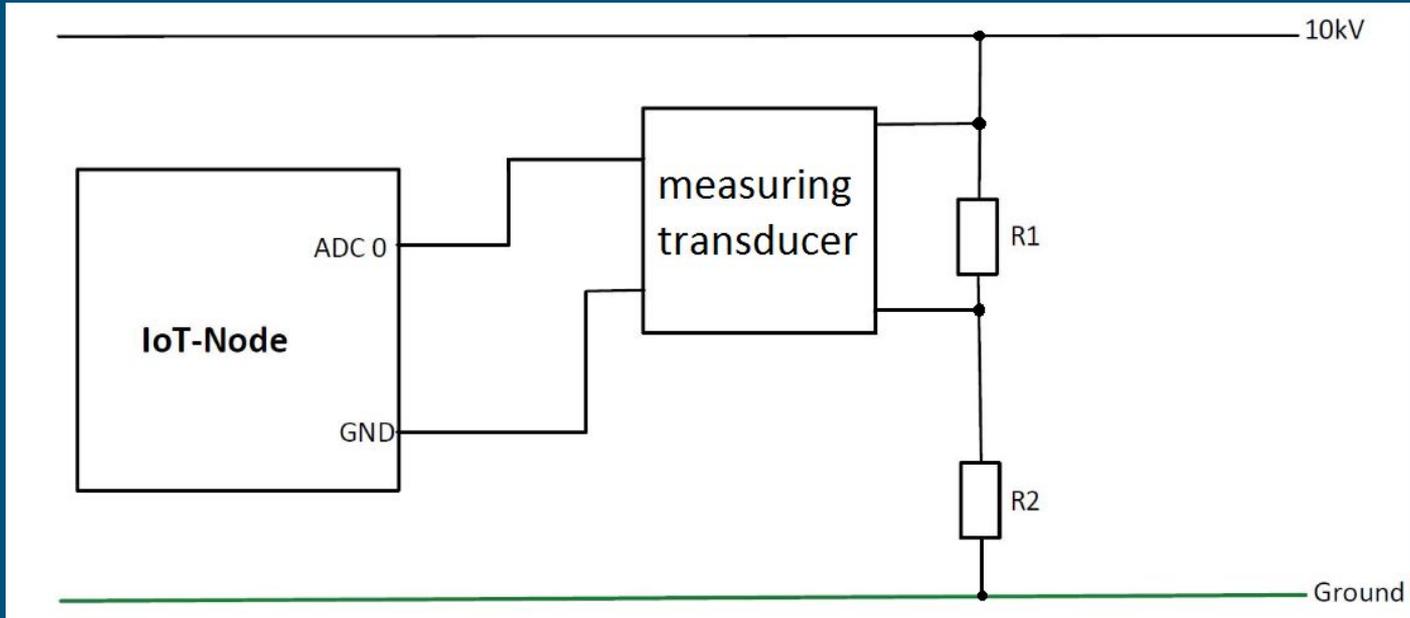**BEFORE** → **AFTER**

Program Structure

Electric fence

- Short voltage pulse up to 10ms for every second
- Voltage pulse up to 10kV
- Problems
  - malfunction from environmental influences
    - fence break
    - fence contact to earth
- Solution
  - Measurement of the fence voltage

Measurements

Theoretical thoughts

Measurements

- Simulation of the fence with a Node
  - We use one node to simulate the pulses
- Measure the Voltage with the ADC of the IoT-Node
  - Recognise there is a pulse
    - Take three samples
    - Calculate the average
- Gate detection
  - Use a reed switch and a simple GPIO-IN
- Calculate transfer value
  - Represent the fence system condition

Backup IEEE 802.15.4

- 6LoWpan-Radio-Shield for the Pi
- Use COAP for communication between IoT-Nodes and Pi
- Use the Python library aiocoap on the Pi
- Pi works as Client and the IoT-Node as Server
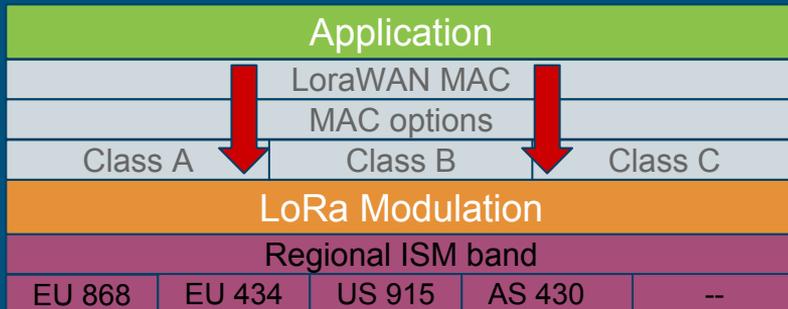- Use the microcoap-server example for the Node

Problems with COAP and the Radio-Shield

- Configuration of the Radio-Shield
  - low performance of Pi 1
- Python version conflicts
  - aiocoap works only with Python 3.5 and higher
- Multithreading on the Node
  - Nodes have just one core
  - Coap-Server is running permanently
    - the workaround is to find a suitable timing for the different threads
    - Changed the Timeout for incoming UDP packet
- Wrong Code in Makefile
  - Turn from: USEMODULE += gnrc_ipv6_default to: USEMODULE += gnrc_ipv6_router_default
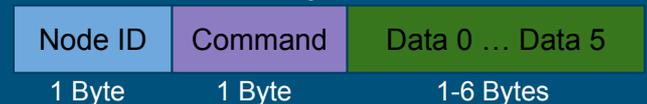
Radio Transmission

- Using the LoRa Modulation of LoRaWAN
- SX1276 as LoRa Modem
- Simple payload structure
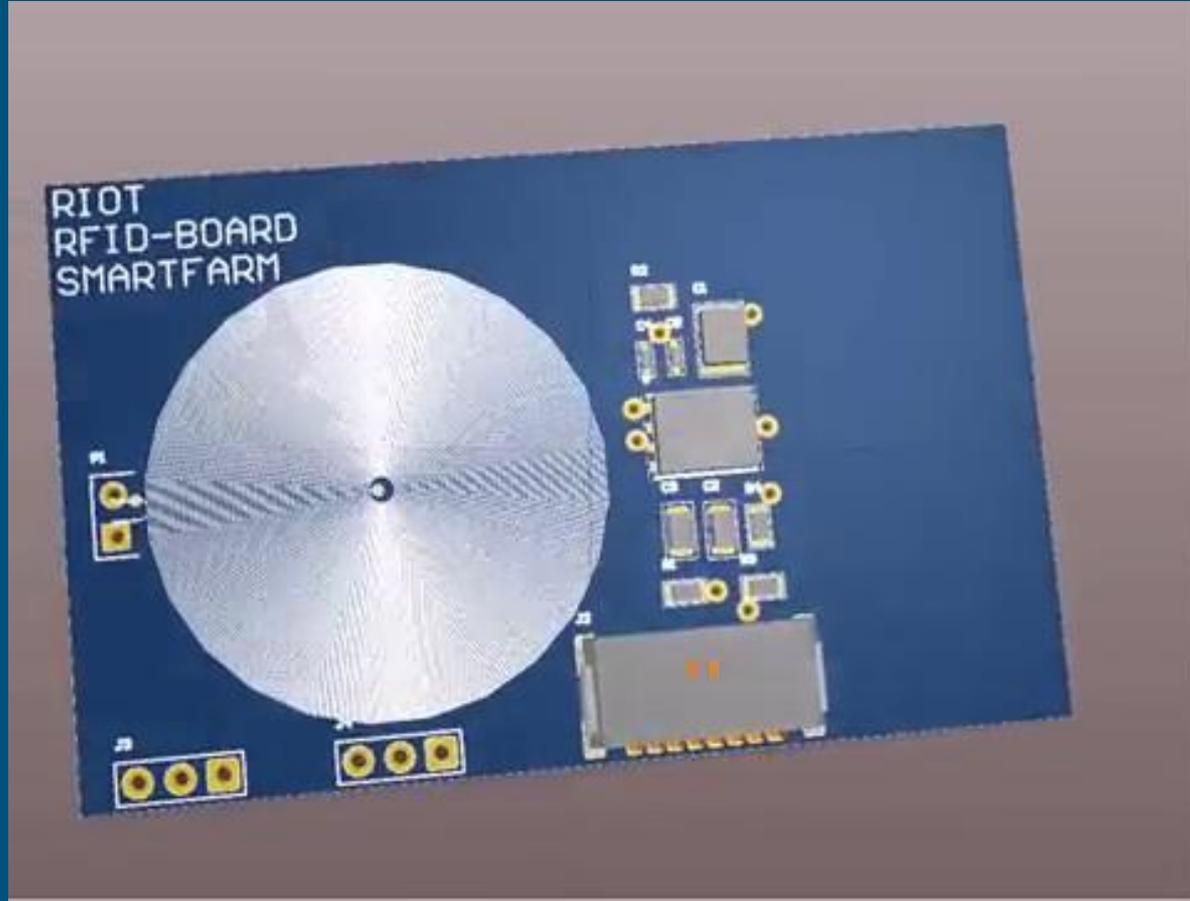- Long ranges (2-40)km

Application				
LoraWAN MAC				
MAC options				
Class A	Class B		Class C	
LoRa Modulation				
Regional ISM band				
EU 868	EU 434	US 915	AS 430	--

LoRa Packet Structure

Preamble	Header	CRC	Payload	Payload CRC

SmartFarm Payload Structure

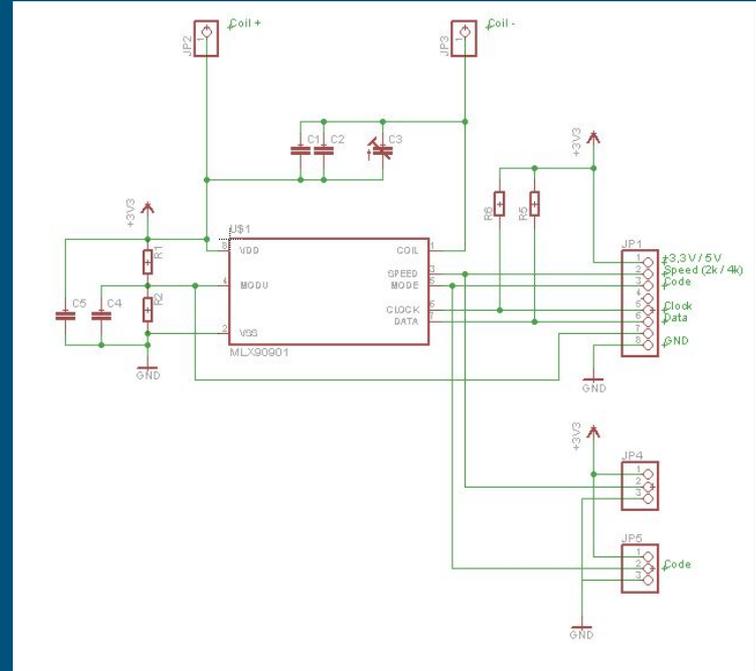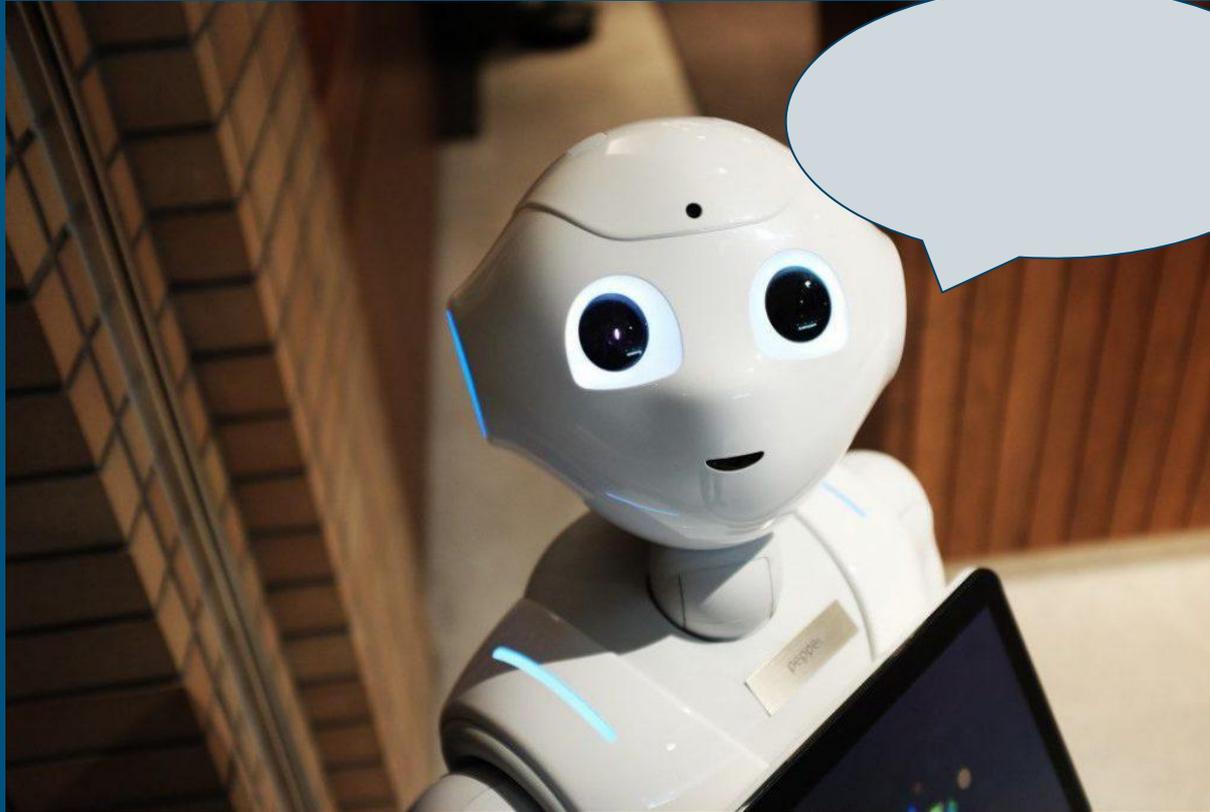| Node ID	Command	Data 0 … Data 5
1 Byte	1 Byte	1-6 Bytes

RFID

RFID

- Animal Identification
  - Tag Id
  - Country Code (not used in project)
- 134,2 kHz Animal RFID Tags
  - ISO 11784 & 11785
- Custom Circuit Board
  - MLX90109 Integrated RFID transceiver
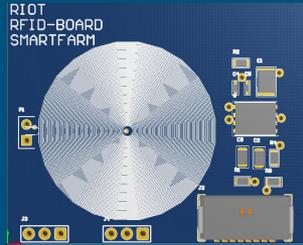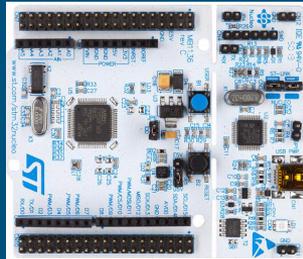- RIOT device driver

Lif(v)e Demo
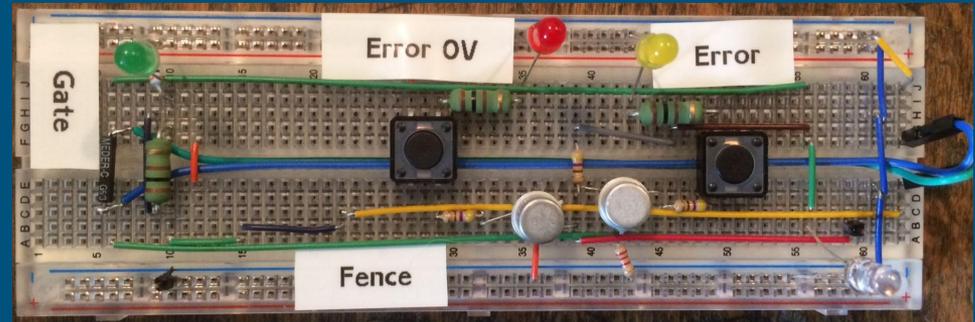
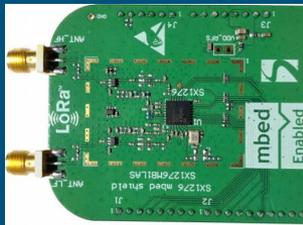# Used Hardware

Selfmade
RFID-Board

Raspberry Pi 1B+

Nucleo-F441

Fence Cuircuit

mbed SX1276MB1xAS
LoRa Shield

References

Riot repository

Smart Farm repository

Teaching-Project-Site

Suggestion

- Implementing LoRaWAN and bi-directional communication between Nodes
- Testing under real conditions
- Notification of battery-life
- Sell the project to an chinese investor?

hisuley commented 9 days ago

I would like to introduce your smart farm project to my hometown's farms, and we can share the profit. Could you provide demo link or video? So I can figure out whether it's suitable for our farm or not.

Thank you for your attention