# GREENDOW

A smart, convenient and energy saving window management option

# The concept

- We aim to automate opening and closing your window in order to ventilate your room more efficiently
  - With a smart, scalable, multi-purpose and cost-effective solution
- When you leave the window open for too long, it wastes a lot of energy
- Having electrically controllable windows is very fun, but our automation also pays for itself after a while
- Automated decision with multiple input parameters
  - Temperature in the room
  - Air quality in the room
  - Desired temperature (set by the user or got from an already smart system)
  - Outside weather (through WiFi)
  - Example: when it is raining outside (or when it is very cold compared to the desired temp), de device will be much more reluctant to open the window

12
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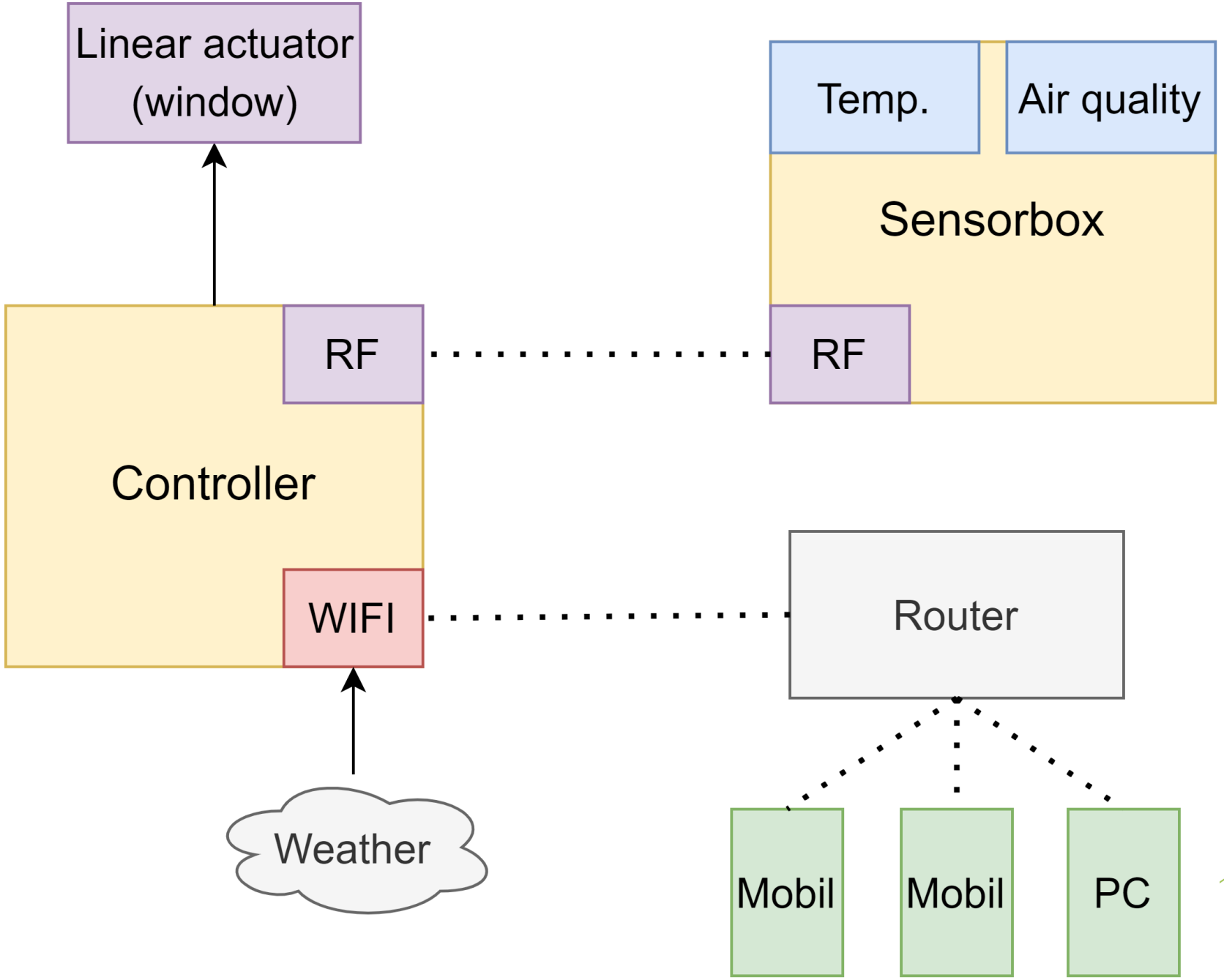
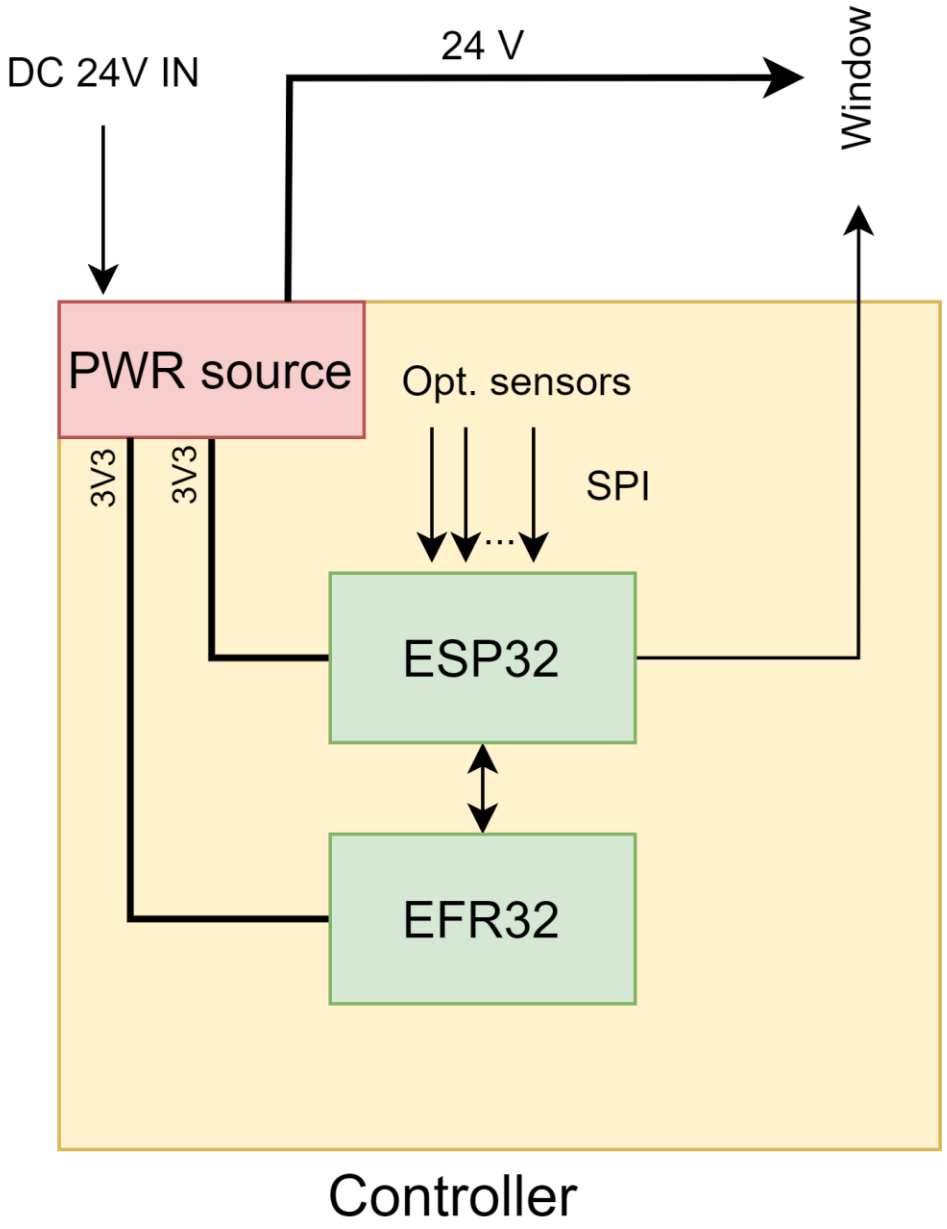
11

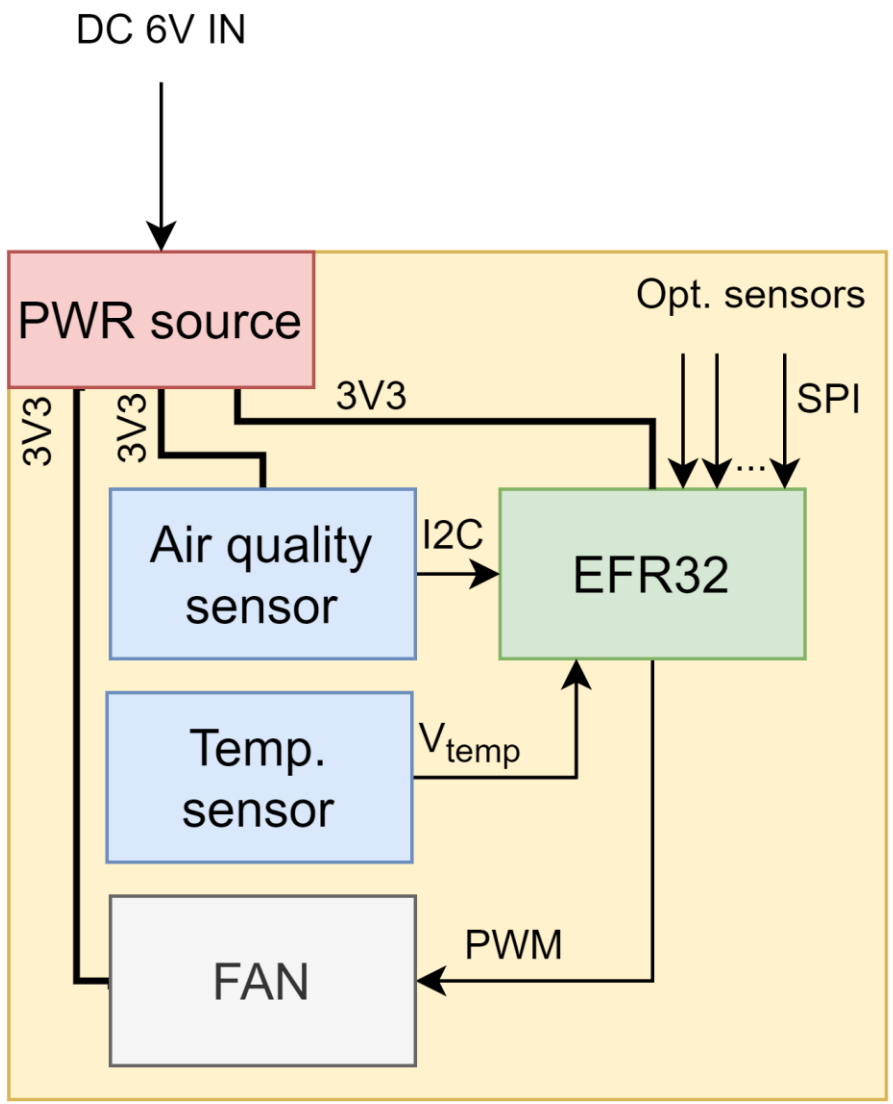
# The system itself

- Two types of devices: a Sensor and a Controller
  - Sensor: measuring temperature and air quality
    - VOC sensor (SGP40)
  - Controller: opening and closing the window and communicating with the outside world through WiFi
- Comm between devices: 433 MHz (Silicon Labs RF chip)
  - This is more secure and uses less energy than having WiFi on every board
- Scalable: you can use any number of devices
  - One Controller will be the gateway to the outside world through WiFi, everything else is internal communication in the network
- Expandable: you can add extra sensor through external headers (SPI)
- Easy to use and integrate: the ESP32 is easily controlled through Home Assistant for example


Linear actuator (window)
Temp.
Air quality
Sensorbox
RF
RF
Controller
WIFI
Router
Weather
Mobil
Mobil
PC




Controller




Sensorbox

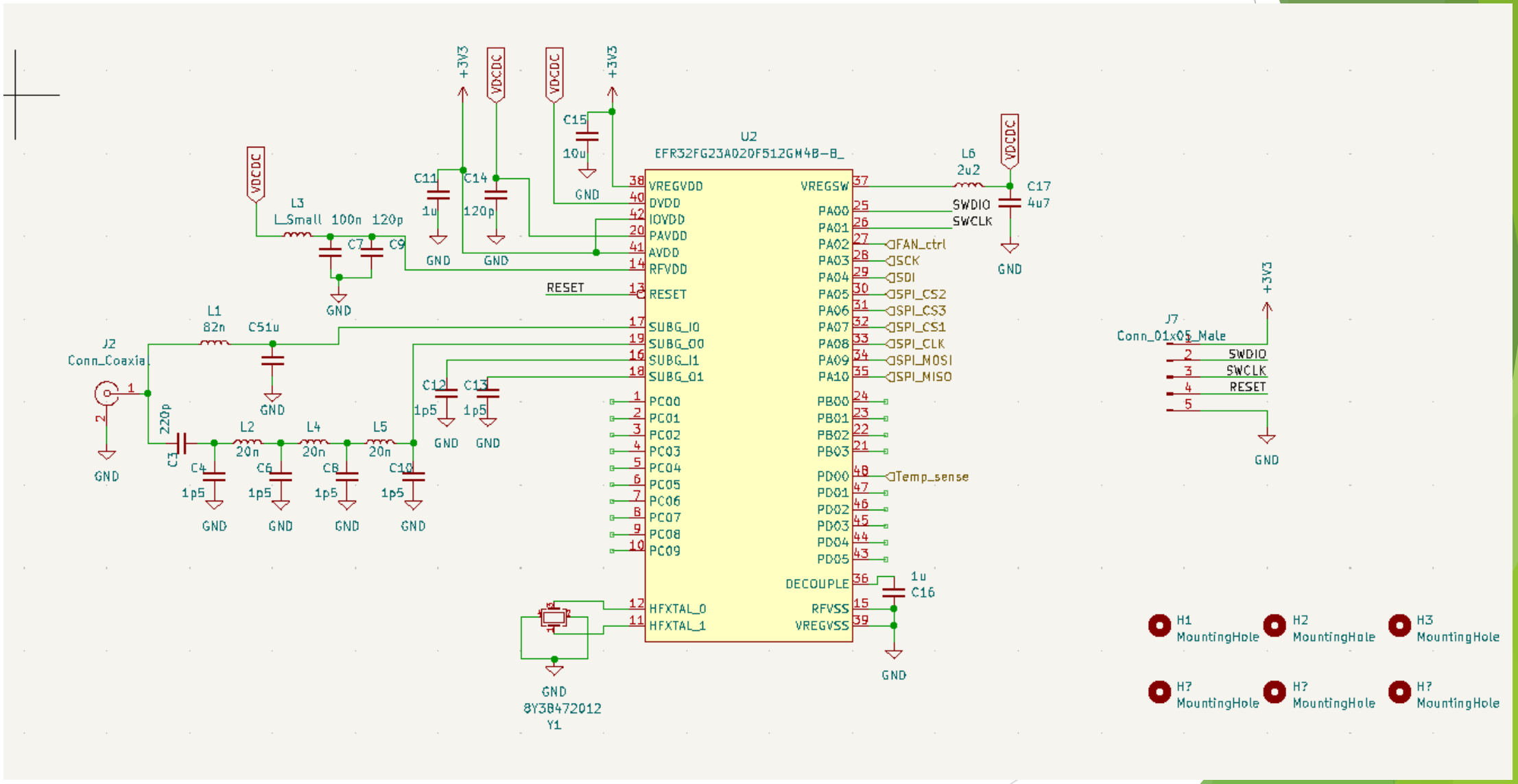
# Costs, savings

- If you can supply power to the window, the installation is basically free
- The cost of the energy use is close to negligible
  - Sensor: 4 AAA batteries last for about 2.5-3 months (or plug in)
  - Controller: consumes about 6 Wh in a day
- Very rough estimation: you can save around 60-85 EUR per year in a small apartment
  - Part cost for one pair of devices: 85 EUR
  - PCB + assembly cost for one pair of devices: 57 EUR
  - So the system pays back its price in about 2 years
    - Pretty good investment for a cool home automation project!

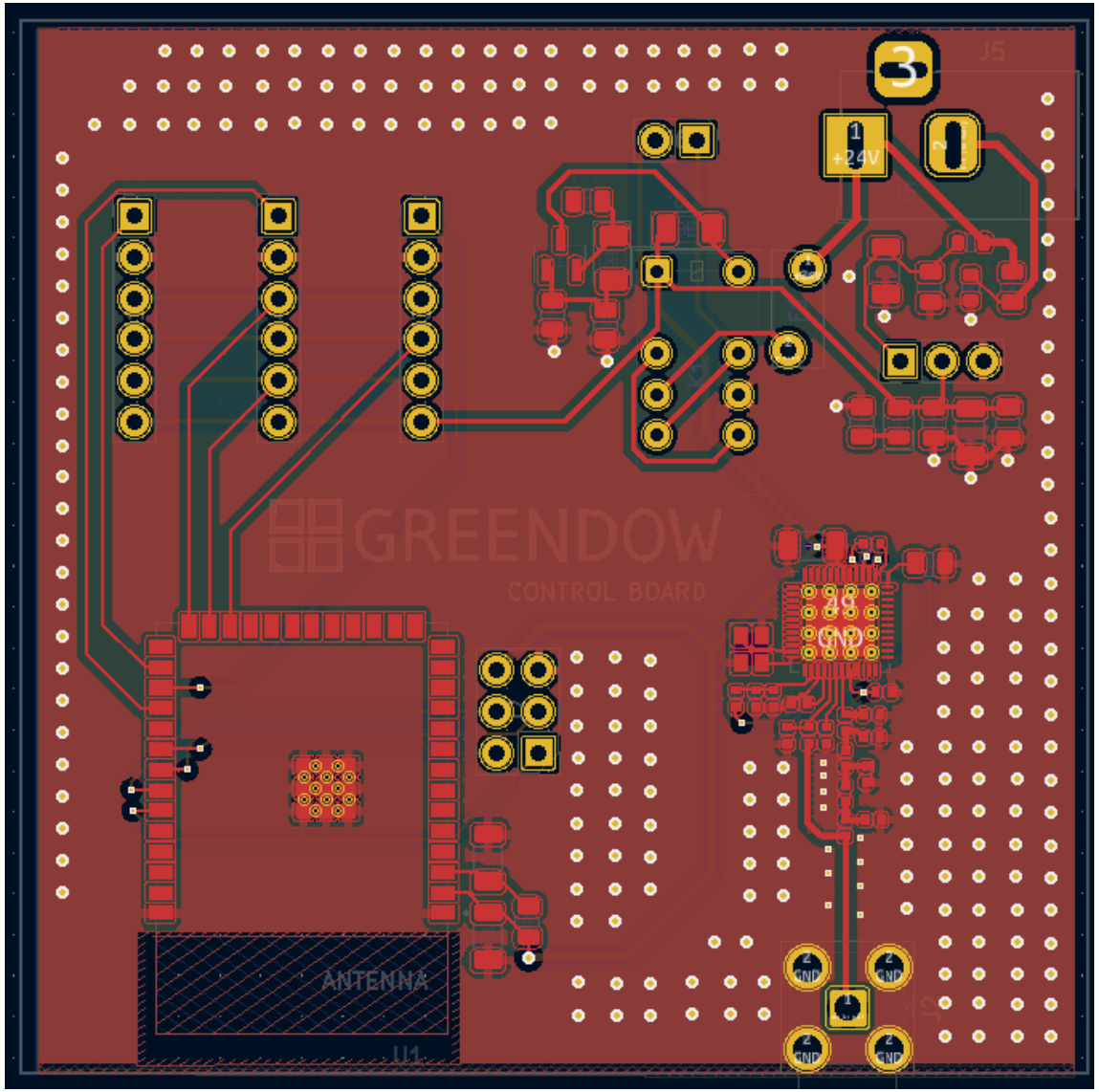
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Flat size (m^2) | 60 | | Air heat capacitance (kJ/[kg*K]) | 1,0035 | | Gas price (EUR/MWh) | 250 |
| Flat height (m) | 3,5 | | Air density (kg/m^3) | 1,2 | | Elect. price (EUR/KWh) | |
| Starting temp. (°C) | 22 | | | | | EUR/HUF | 420 |
| Ending temp. (°C) | 12 | | | | | Heating efficiency | 0,5 |
| | | | | | | | |
| | | | | | | | |
| deltaT (K) | 10 | | | | | | |
| volume (m^3) | 210 | | | | | | |
| air mass (kg) | 252 | | | | | | |
| deltaQ (kJ) | 2528,82 | | | | | | |
| deltaQ (kWh) | 1,4049 | | | | | | |
| deltaMoney (EUR) | 0,351225 | | | | | | |
| deltaMoney (Ft) | 147,5145 | | | | | | |
| | | | | | | | |
| **Estimated savings (HUF/winter)** | 19 914 Ft | | Num. of ventillations per day | 1,5 | | | |
| **Est. savings (EUR/winter)** | 47 € | | | | | | |
| | | | | | | | |
| **Est. savings (HUF/year)** | 29 872 Ft | | | | | | |
| **Est. savings (EUR/year)** | 71 € | | | | | | |

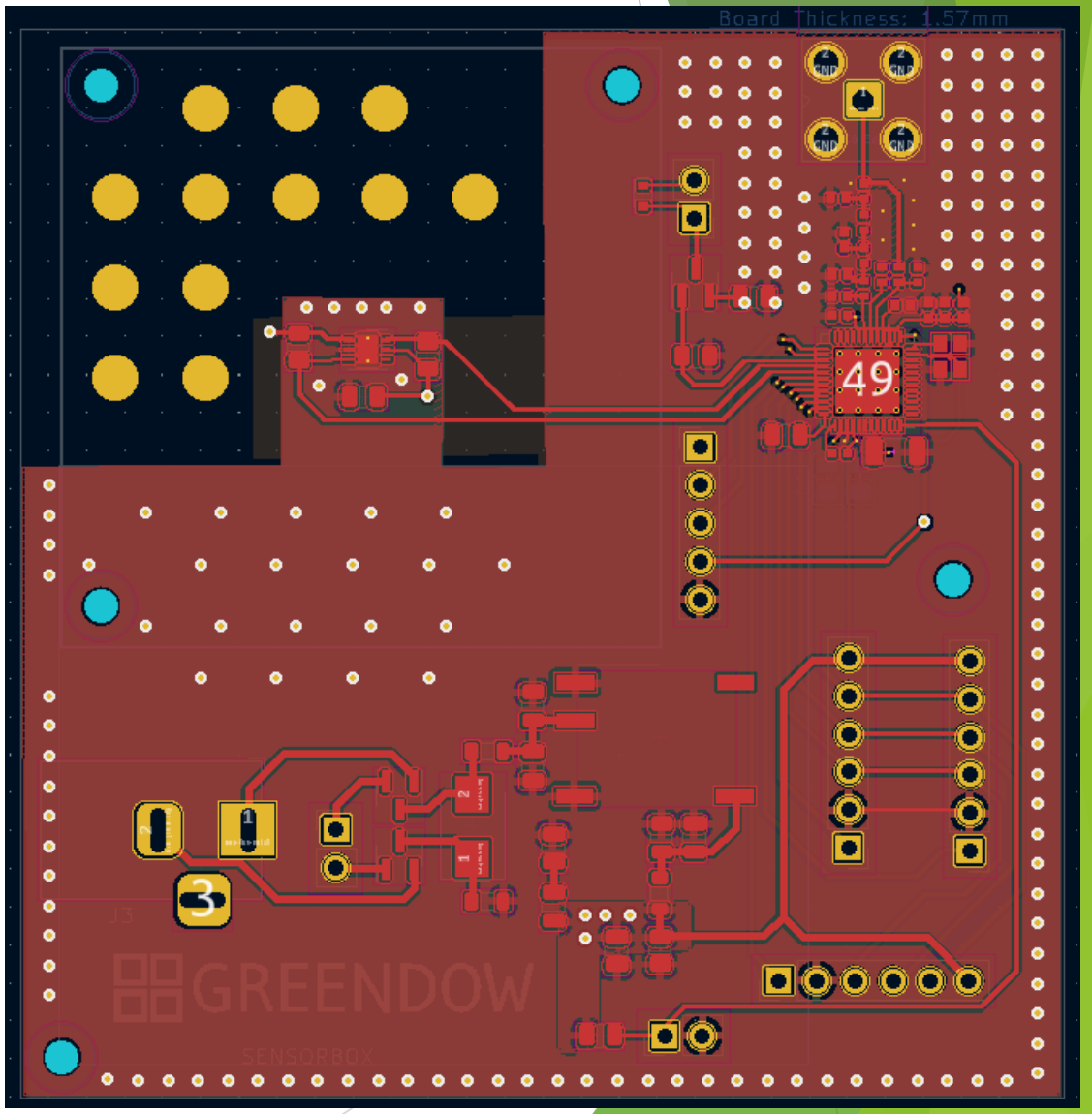
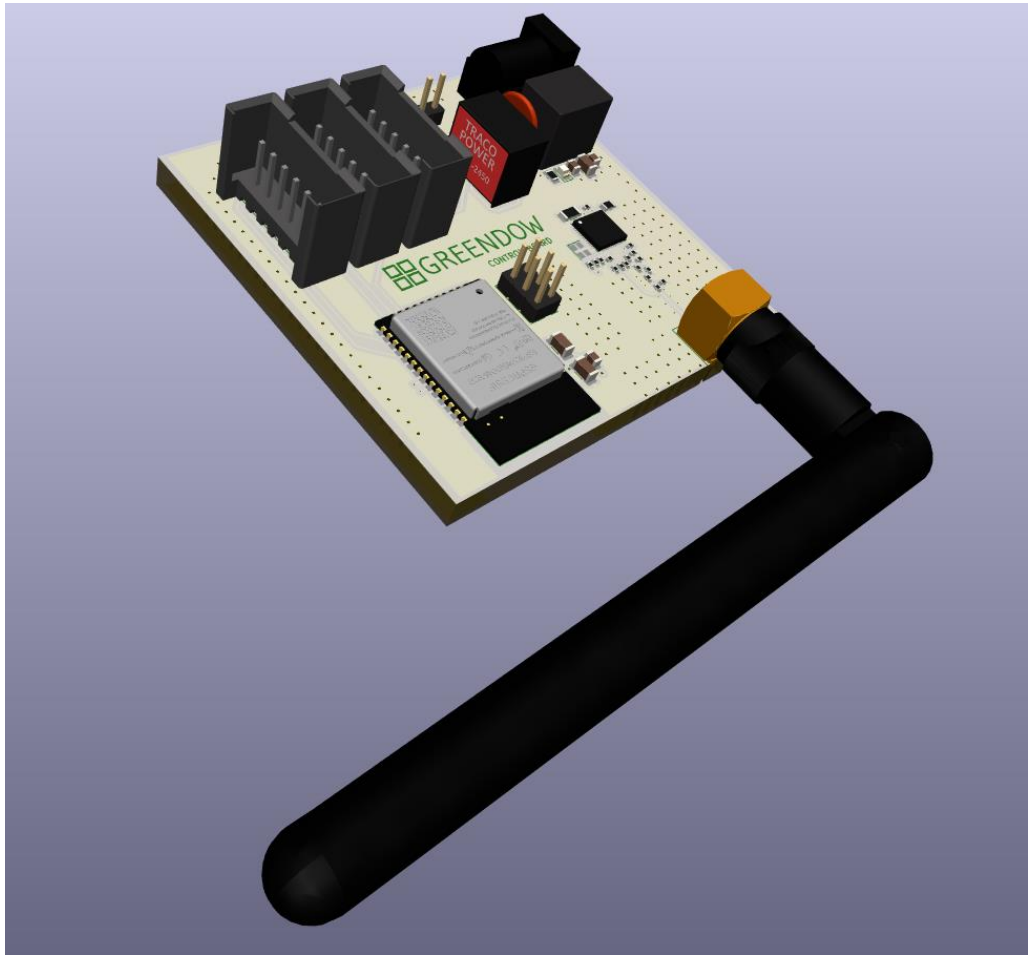
# Schematic

Example: RF frontend



# Layout


J5
+24V
GREENDOW
CONTROL BOARD
49
GND
ANTENNA
U1


Board Thickness: 1.57mm
49
J3
GREENDOW
SENSORBOX

# 3D model