

# A study on the possibility of extracting and processing CPAP data to ensure storage and secure access to this data by patients and physicians

**Student : Spieldenner Marina**  
**Professor : Dr Henning Müller**

## Summary

1. 100.000+ patients in Switzerland suffer from sleep apnea disease. These patients use predominantly CPAP machines as a treatment.
2. It is possible to create a software that can read data correctly of SD cards from CPAP devices independently from the producers' software.
3. The decoding of the protocols of CPAP devices is possible, but time-consuming and should be repeated as the producers of CPAP devices update their protocols regularly

## Introduction

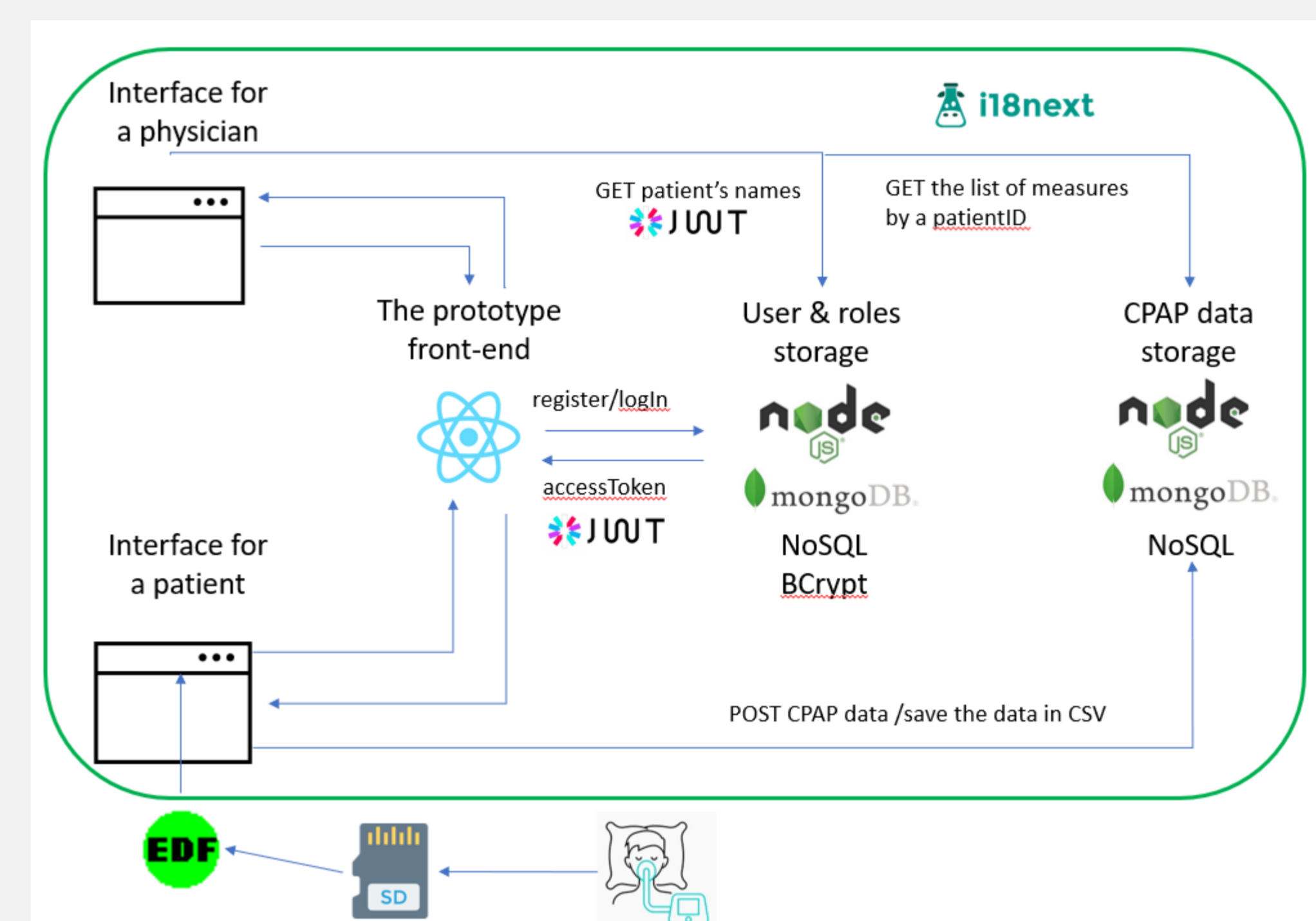
- **CPAP data** are important for the success of the therapy.
- **CPAP devices'** producers in Switzerland: ResMed®, Philips® and Löwenstein® propose their own software to read CPAP data.
- **Objective** : a possibility to create **one software for all devices** and to explore the opportunity of **remote patients' monitoring**.



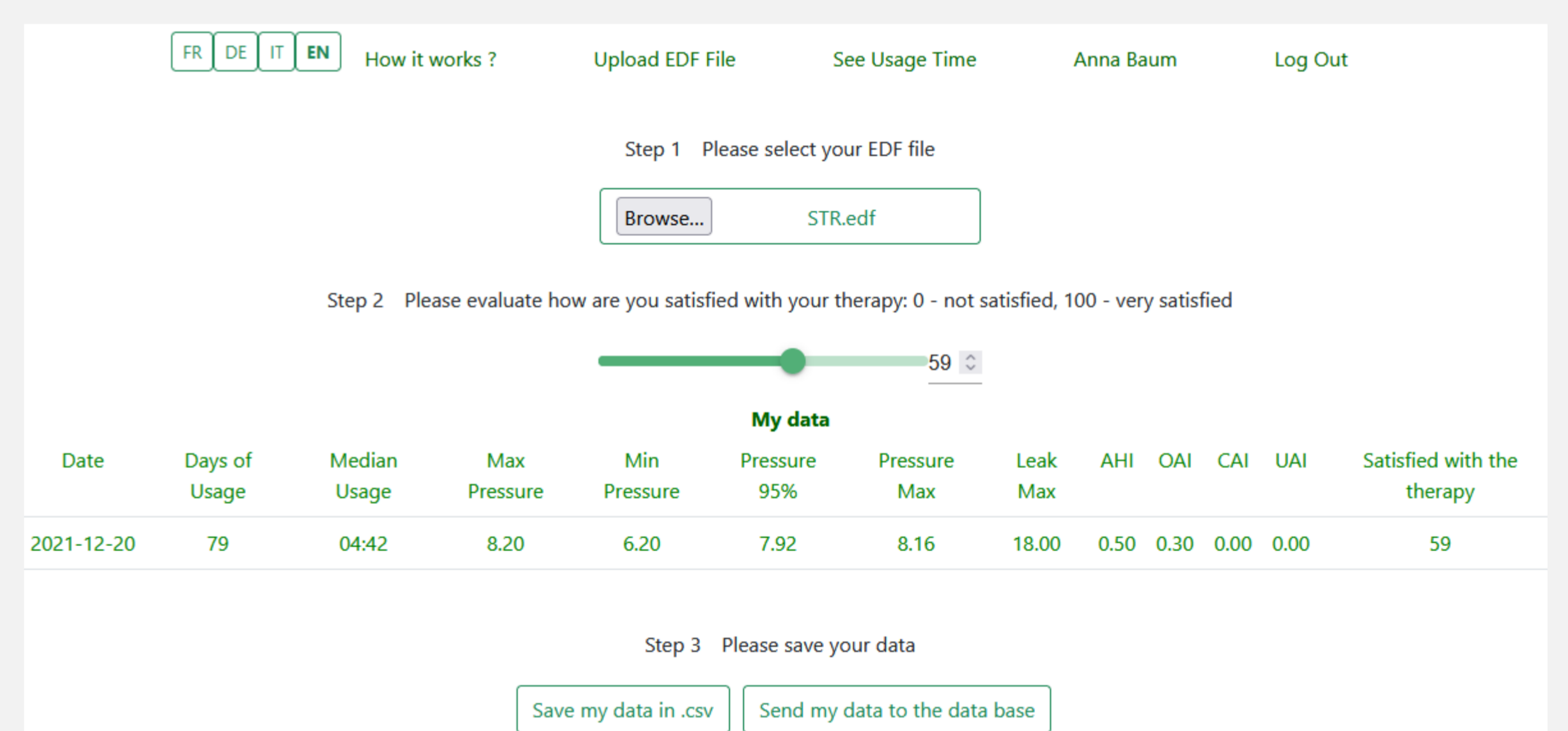
## Methods

- The steps to decode protocols of CPAP devices:
  1. **SD cards of ResMed® and Löwenstein®**: the binary EDF file decoding from ResMed® AirSense®10 and 9
  2. **Open-source software Oscar**: the results comparison
  3. **An algorithm to read and process the data from EDF to CSV** : 11 signals of the key CPAP data selected out of 80 signals registered
  4. **The prototype creation with 2 interfaces for physicians and patients**: authentication, JWT, BCrypt, AccessControl
  5. **Two NoSQL databases to store personal data separately from medical data**: two MongoDB data bases and backends API
  6. **The results comparison** from the prototype, ResMed® and Oscar

## Results



Images of the prototype :  
for a patient



for a health care professional

Name	Date	Days of Usage	Median Usage	Max Pressure	Min Pressure	Pressure 95%	Pressure Max	Leak Max	AHI	OAI	CAI	UAI	Satisfied with the therapy
Anna Baum	2021-12-20	79	04:42	8.2	6.2	7.92	7.08	18	0.5	0.3	0	0	59
Mary Stern	No data uploaded yet												
André Paul	No data uploaded yet												
Albert Favre	2019-05-13	43	08:23	12	6	7.92	7.92	30	13.5	1.4	7.4	0	84
Thomas Dittel	2020-03-19	414	07:31	16	8.6	14.52	12.84	34.8	2.3	0.9	0.1	0	89

## Conclusions

- The prototype reads the key data from an SD card of AirSense®10 (STR.edf) equally to ResMed® in most of cases.
- KeyCPAP data can be stored in CSV file and can be integrated into an electronic health record of a patient.
- Remote monitoring of patients, using ResMed® devices, by health care professionals is possible.
- The protocols of Löwenstein® and Philips® still need to be explored and decoded.
- The access to data from CPAP device via wireless connexions should be explored.