MOSH Report

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1 Introduction

In this project we add to create a system able to detect gas and send data to a web application in the cloud. This project have three main part : the sensor creation, the electronic circuit design and the web application development. I work with Lucas Baclé on that project, he has been more focus on the electronic part when I was more focus on the web application. We made this decision based on our professional project and the internship we got to develop our skills in our future working field.

2 AIME : Manufacturing of a nanoparticles sensor

We first made a nanoparticules sensor in the AIME lab on INSA campus. We saw the different steps and process link to the manufacturing of this sensor. First, we used a technique of photo-engraving, using a mask, to keep a metal layer only on our future sensor. Then we assembled one of our sensor on a TO5 housing to be able to connect it to electronic circuit.

The next step was to synthesis the nanoparticles for our sensor. Once the nanoparticles created we deposed them on the sensor using NPS selective deposition by dielectrophoresis. Finally, we realized a series of tests to dimension our sensor and later write a datasheet that can be download from the Portfolio.

3 Electronic circuit

We decided that we wanted to create a system using as less energy as possible and completely safe. So we wanted to make a circuit that could be alimented by a LiPo 1 cell with 3.7V. Since component needed other tension than 3.7V as power supply we need to create intermediate circuits to be able to elevate or lower the tension. We used a LoRaWAN as our communication component.

Our system has the following functionalities :

- temperature and humidity sensor (Sensirion SHT4x)
- Volatile Organic Compounds sensor (Sensirion SGP40)
- LoRa communication
- Piezo buzzer with elevate tension to 10V for a louder sound
- RCT which put the system to sleep and wake it up to limit energy waste

3.1 Smart gaz detector

A battery-operated, LoRaWAN-connected, Volatile Organic Compounds (VOC), temperature and humidity sensor. This device could monitor the indoor air quality and trigger an alarm, both on site with its loud piezo and remotly via a LoRaWAN network. The LiPo battery can be recharged with an usual usb charger.

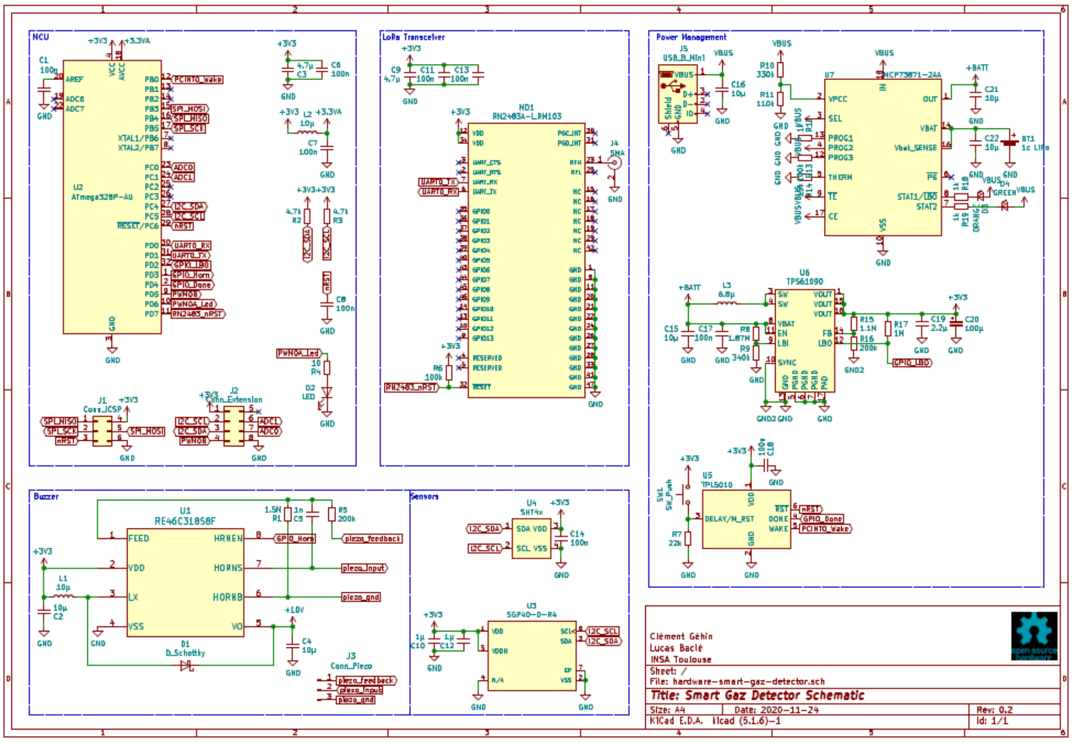

Figure 1: Schematic of the smart gas detector

3.2 PCB (WIP)

Due to the complexity of routing a 4-layer pcb with RF, analog signals and switching power supplies, we were not able to finish the routing but started to place the component according to manufacturer's recommended layouts.

3.3 Expansion Board

Being powered by a relatively small 1-cell LiPo battery, we made the choice not to use the nanoparticles based sensor in our device. Indeed, it requires relatively high voltage which would induces more complex circuitry. This expansion board lets the detector use this sensor. Including the conditioner circuit, an external power source can be connected.

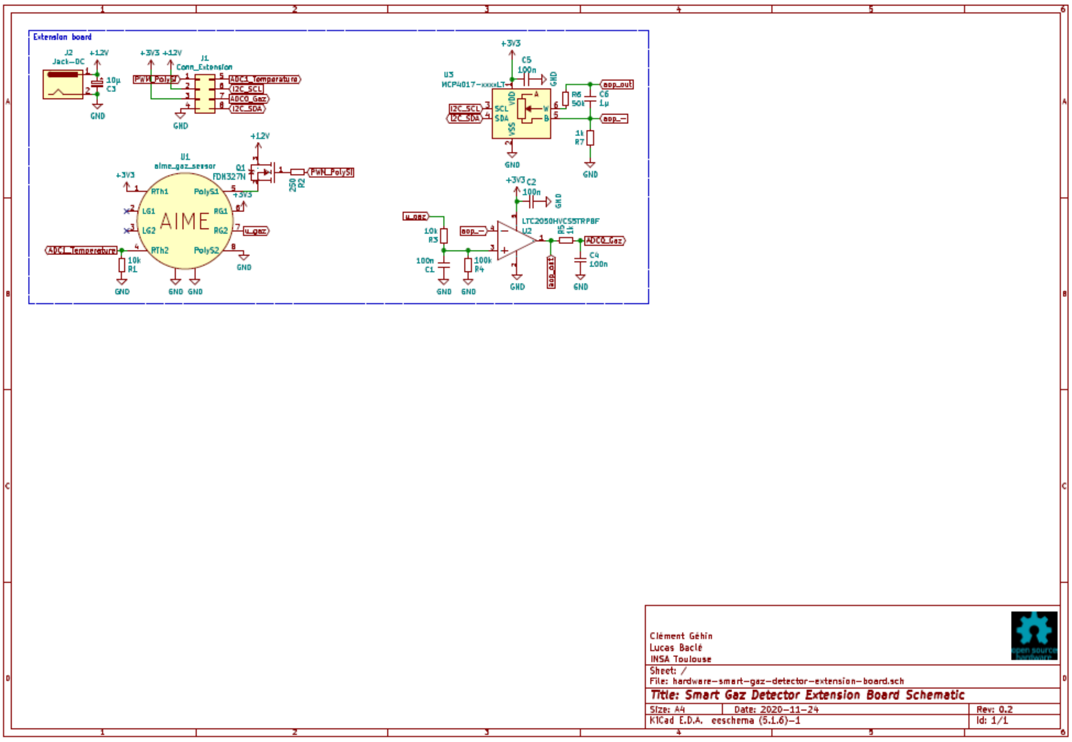

Figure 2: Schematic of the extension board

3.4 Extension board PCB

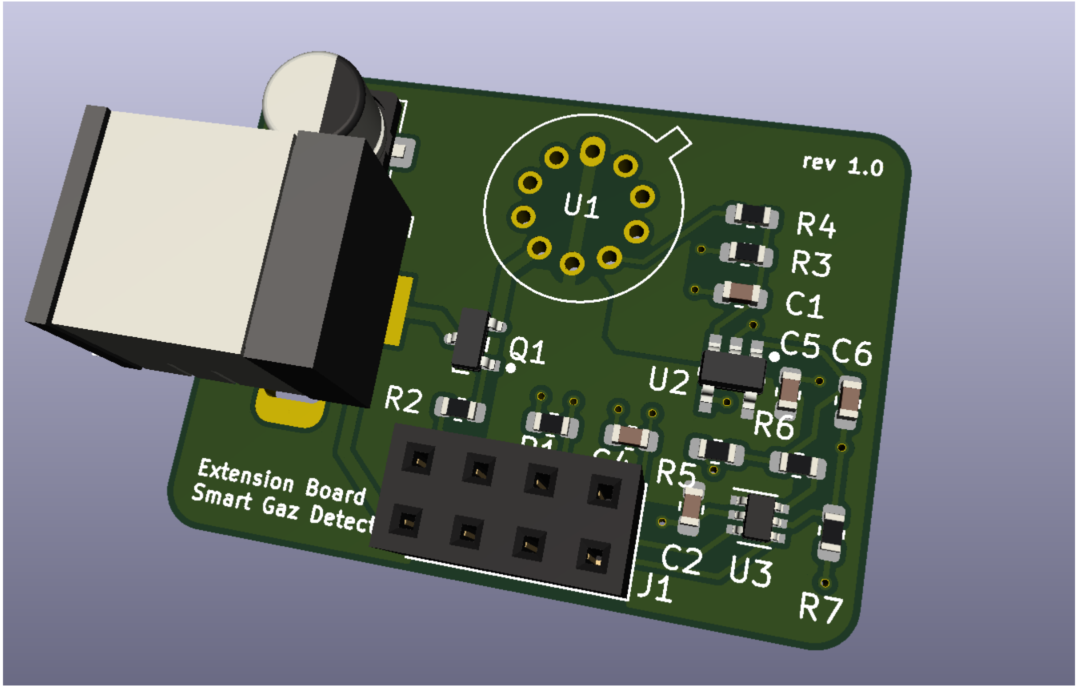

Figure 3: PCB card of the extension board

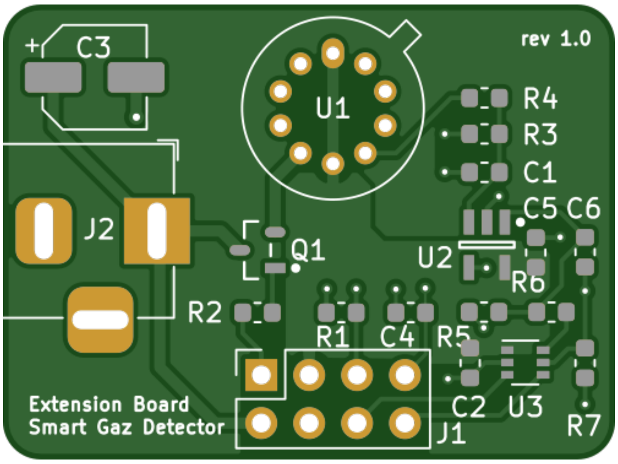

Figure 4: Front of the PCB card of the extension board

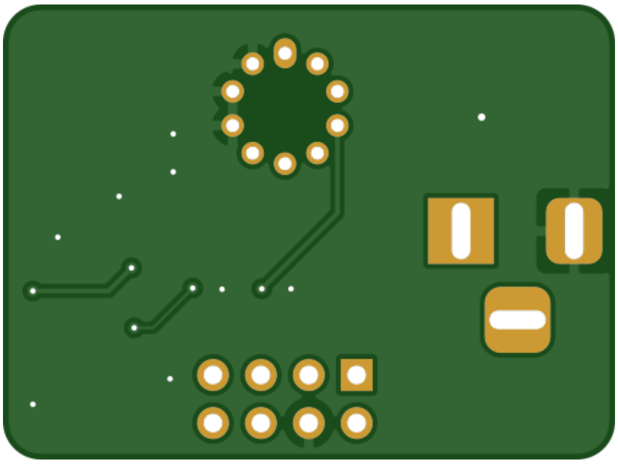

Figure 5: Bottom of the PCB card of the extension board

4 Web application

The last part of this project is a web application that will display the data collected by our system. We decided to develop a SOA web application using Spring Boot. This application will communicate with our system with The Things Network (TTN) and a REST API interface.

4.1 Communication

Like said before our system communicate with a LoRa system with TTN. The data in our packets are a byte for the type of gas and a byte for the quantity. When TTN received a packet from our system it will convert it into JSON using a build-in decoder.

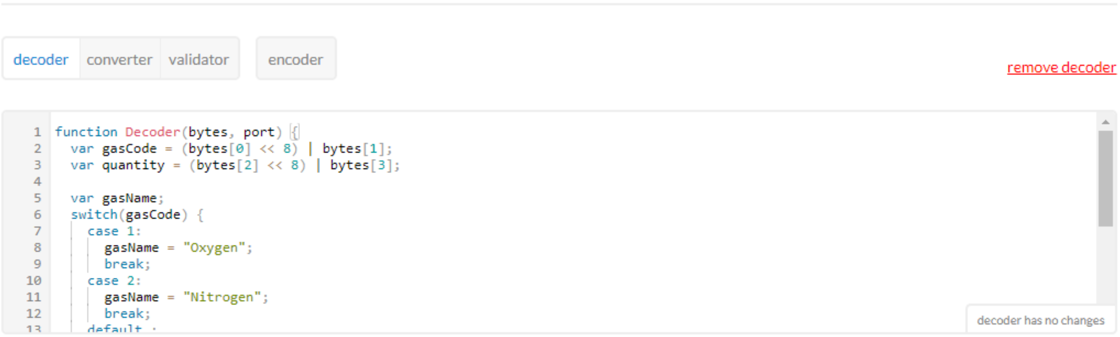

Figure 6: Part of the decoding function

Once the packet convert into JSON, TTN will send a POST request on our application API.On the web application side when a POST request is received, a controller dedicated will store the data from the JSON to a NoSQL database. This database develop with MongoDB allows us to keep all the data we received from our system.

4.1.1 User Interface

The user interface is composed of two parts a dashboard and an history. The dashboard will always display the latest data received by the application from our system. With this dashboard the user can easily check which gas is present in the room and at which quantity.

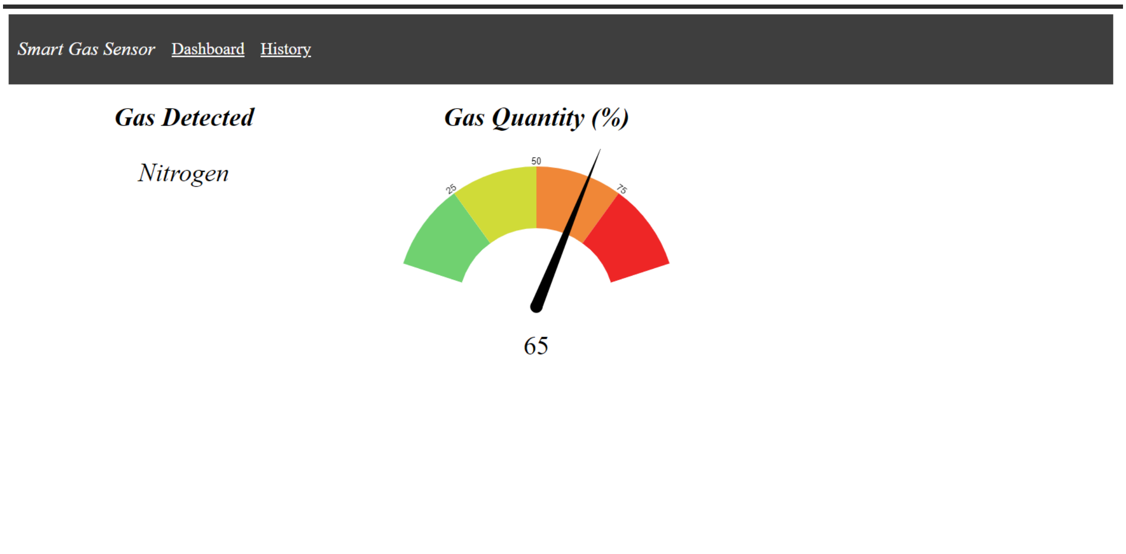

Figure 7: Dashboard of the web application

The history panel allows the user to check all the data for a specific gas from a specific date. This history allow the user to keep a trace of each gas that has been present in the room and follow the evolution of their quantity.

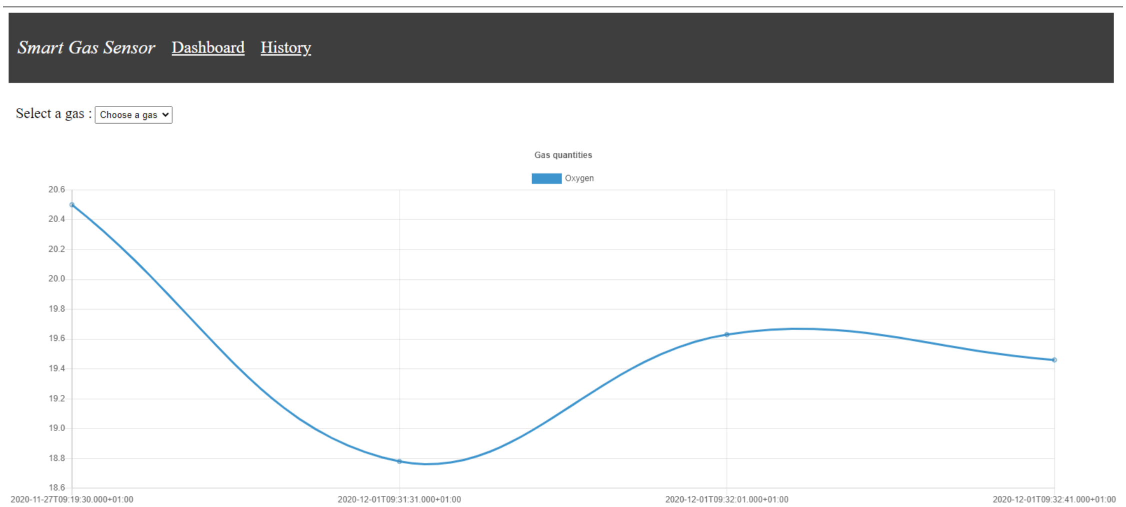

Figure 8: History of the web application

5 Conclusion

In this project, we had the opportunity to create a complete system from the sensor to the web application. As we had two different profiles and two different internships coming next we decided to split the work to be able to completely develop our skills. However, even if we split the work, we participate at the decision and keep trace of the work the other was doing. Thank to that we also acquire skills in the other field that will certainly help us later to better understand the technology we might use.