COVID BUSTER 2000

An integrated and embedded prototype

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Use Cases

➔ **Notifications**

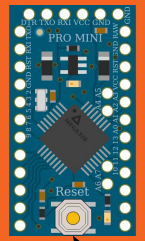
The app user will get notified when to ventilate a room to keep the covid infection rate at a minimum

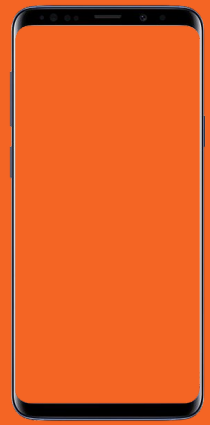
➔ **Overview**

A user can access the status for all registered rooms

➔ **Covid-19 App Monitor**

A user is able to see how many people are using the covid-19 app. This will help to decide for an additional need of contact tracing





Why ventilation conditions matter?

- ➔ Every person exhales around 8 liters of air per minute.
- ➔ In addition to the CO2, exhaled air contains aerosols, which, due to their small size, can stay in the air for a long time.
- ➔ The aerosols from an infected person can also contain virus particles. If healthy person inhales the necessary amount of contaminated aerosols, the disease can be transmitted.

Source: https://frida-kahlo-schule.lvr.de/media/lvrfridakahloschule/aktuelles/corona/Lueften_in_Klassenraeumen_Empfehlungen_LVR_Dezernat_12.40_Arbeitssicherheit.pdf

How we can prevent the infection?

- ➔ Depending on the CO_2 concentration in a room, it is possible to determine what percentage of the air has already been exhaled by other people.
- ➔ A CO_2 concentration of approx. 1200 ppm shows, for example, that almost 2% of the air in the room has already had lung contact at least once.
- ➔ With good ventilation of the rooms the risk of infections can be reduced.

Source: https://frida-kahlo-schule.lvr.de/media/lvrfridakahloschule/aktuelles/corona/Lueften_in_Klassenraeumen_Empfehlungen_LVR_Dezernat_12.40_Arbeitssicherheit.pdf

CO_2-concentration threshold values

< 1000 ppm

Recommended area:

Ventilate from approx. **800 ppm** in such a way that a value of **500 ppm** is **reached** and the value **above 1000 ppm** is never **exceeded**

1000 - 2000 ppm

Alarming area:

Immediate ventilation of the room with the aim of keeping the concentration **below 1000 ppm**

> 2000 ppm

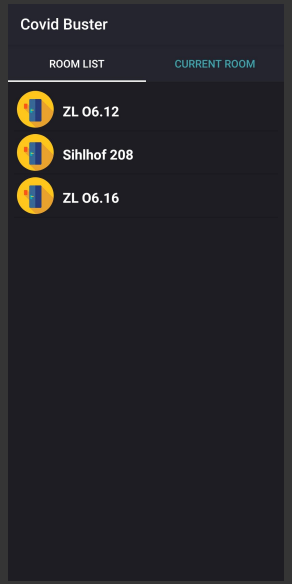
Unacceptable area:

Leave the room and ventilate util a **value below 1000 ppm** has been reached again

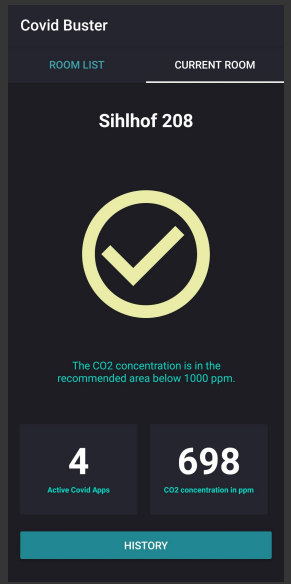
Source: https://www.umweltbundesamt.de/richtig-lueften-in-schulen#wie-funktioniert-richtiges-luften-im-schulalltag

Screenshots

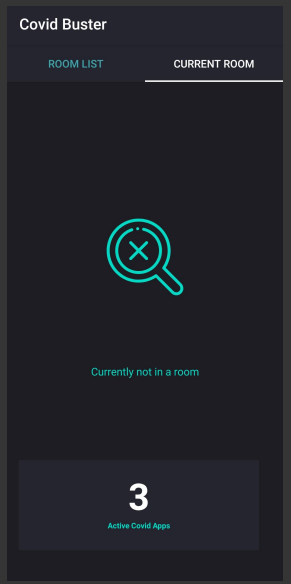
Room List Screen



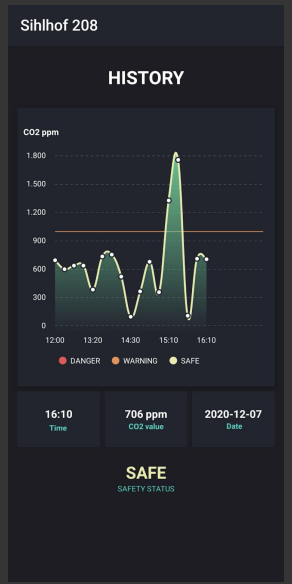
Current Room Screen



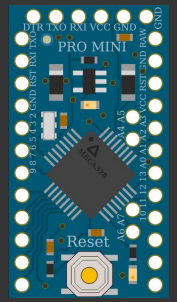
No Room Found Screen



History Screen



System architecture



Send CO2 value and room ID

BLE advertisement (non connectable)

Store co2 values and get history

HTTPS request

ThingSpeak

Adafruit nRF52840

Measure CO2 value

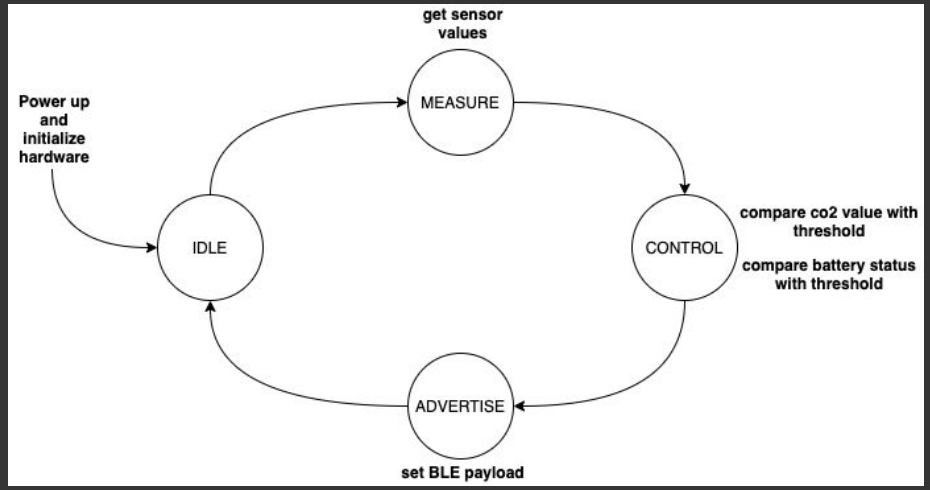
Android smartphone

Shows room list, history and actual co2 value and measures active covid apps

ThingSpeak

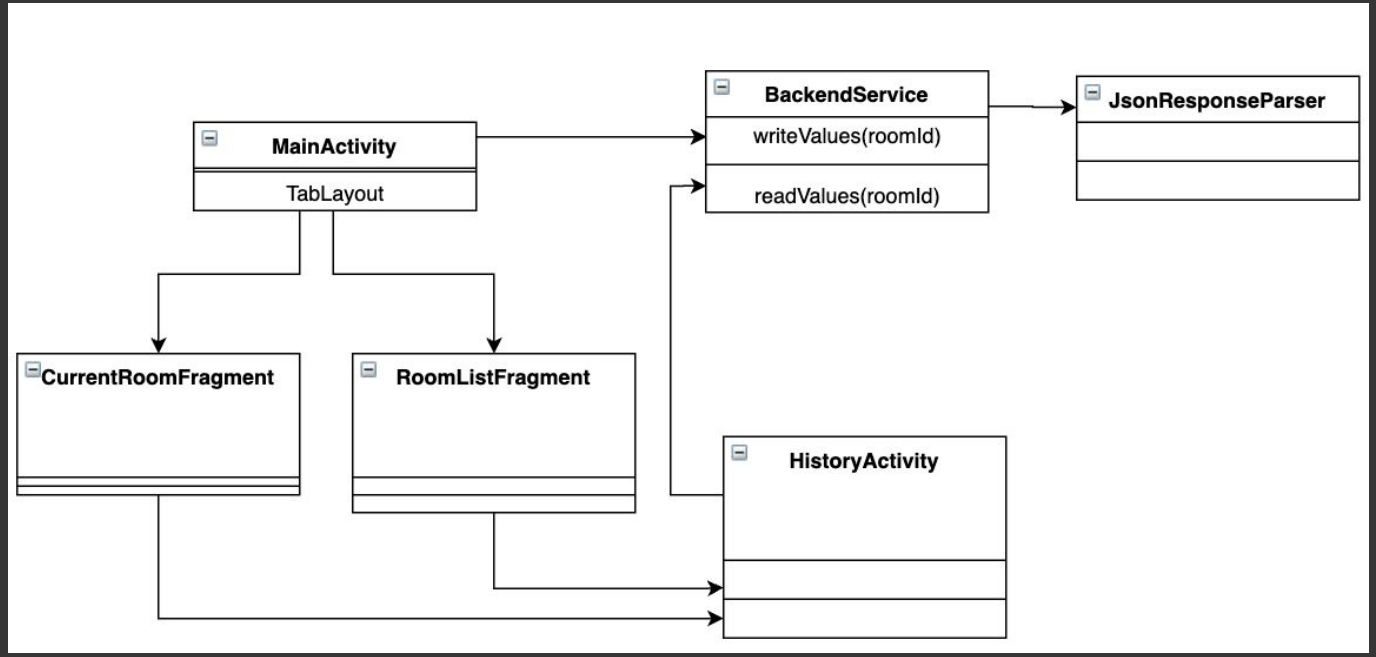
Stores CO2 value for each room

State machine nRF52840



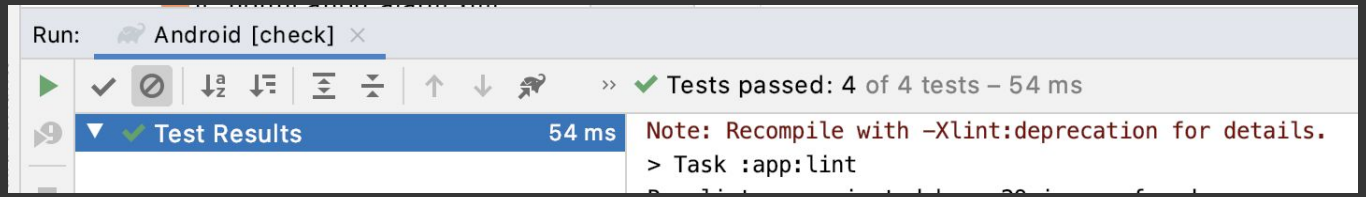
- BLE advertising interval is set to 160*0.625ms = 100ms
- Independent from state machine

Class Diagram



Code Quality: Tests

Tests on Android



on Arduino

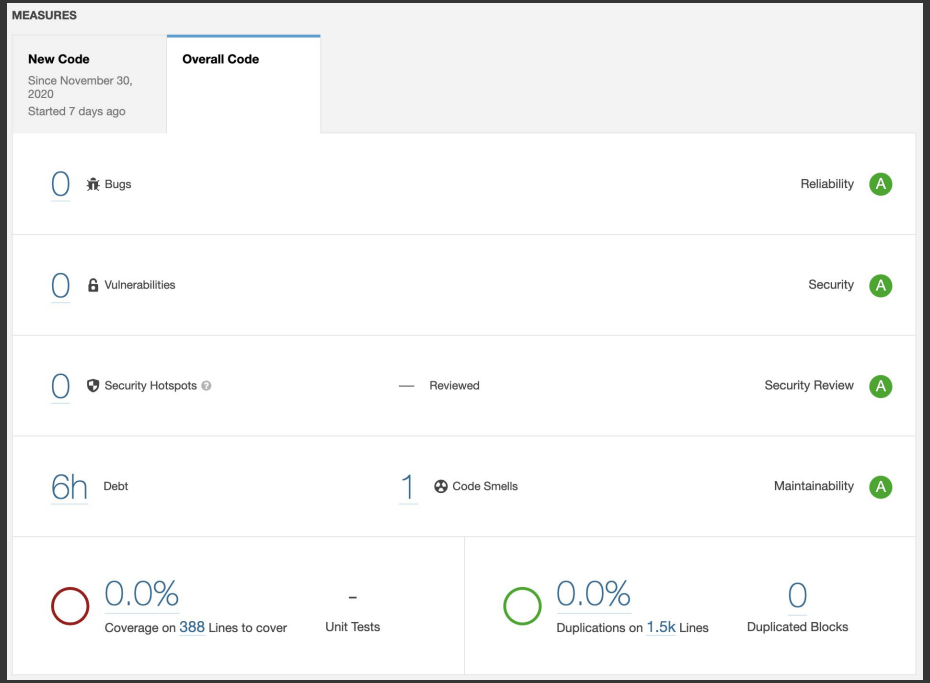
```
Testing...
If you don't see any output for the first 10 secs, please reset board (press reset button)

test/test_main.cpp:86:test_basicTest    [PASSED]
test/test_main.cpp:87:test_led  [PASSED]
test/test_main.cpp:88:test_sensor       [PASSED]
test/test_main.cpp:89:test_payload      [PASSED]
test/test_main.cpp:90:test_alert        [PASSED]
test/test_main.cpp:91:test_measurements [PASSED]
-----------------------
6 Tests 0 Failures 0 Ignored
========================================= [PASSED] Took 22.14 seconds =========================================

Test    Environment                     Status    Duration
------  ------------------------------  --------  ------------
*       adafruit_feather_nrf52840_sense PASSED    00:00:22.141
========================================= 1 succeeded in 00:00:22.141 =========================================
```

Code Quality: Sonar

- Sonar ignores our tests
- 1 Codesmell cause of too many Dependencies in MainActivity



Project Evaluation

What went well

- Collaboration with three people
- Project Management with Kanban Board hosted on Trello
- No surprises using the CO2 sensor

Project Evaluation

What went not as planned

- ➔ We chose not to pair with the peripheral, but to use the advertisement for data transmission
- ➔ We spend way more time to complete this project than we expected for a 3 ECTS module

Project Highlights

There was some overtime work involved 🤓

Outlook

- Before going to production:
  - Case for the controller and less parts
  - Better Room Management
- Attach Controller to Wi-Fi and make it configurable over BLE

Meet The App

Demo Video