Wireless Sensor Network For Monitoring Enviromental Parameters in the Detector lab of the European XFEL

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DESY Summer Student
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About me

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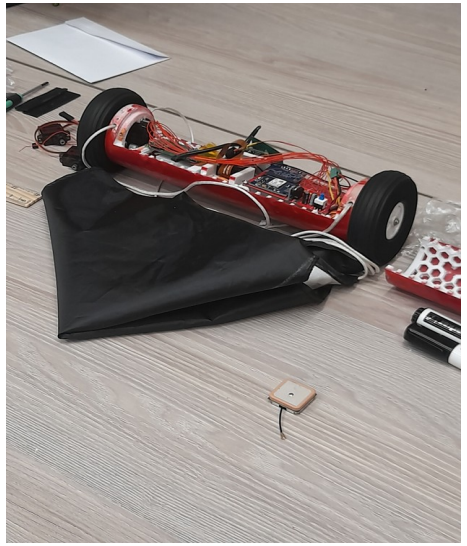
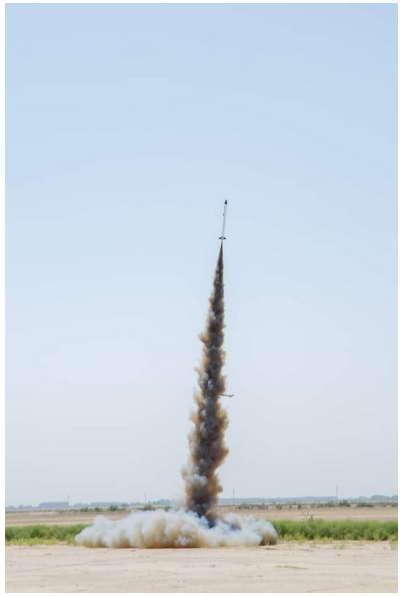
Sensor Subsystem Leader

Computer Engineering Student
(Senior)





Engineering, for me, is more than just a career- it's a lifelong interest!

European XFEL Adventure

The European XFEL is a home to one of the largest X-ray lasers in the world and it’s the leading research facility in Germany. It is staffed by highly skilled scientists, engineers, and technical personnel who collaborate to push the boundaries of science.

During my summer internship, I had the opportunity to work with the European XFEL team and benefit from their expertise. Their guidance and collaboration allowed me to successfully complete my project and enhance my technical skills.

Detector Group

Mission
In the Detector Group, our job is to make sure our detectors can accurately and efficiently collect data from the special X-ray beam at European XFEL. We focus on using our skills to solve problems in creating, improving, and using both current and future detectors, helping to strengthen our research facility

Development
A main goal of the Detector Group is to develop new detectors. To do this, they use **cleanrooms (ISO6)** to create a controlled environment for constructing and improving these sensitive devices.

Why is it necessary to environmental monitoring in a clean room?

- Detector Accuracy
- Human Comfort
- Detector Properties
- X-ray detector Safety
- Static Electricity


My Research
Project

Project Overview

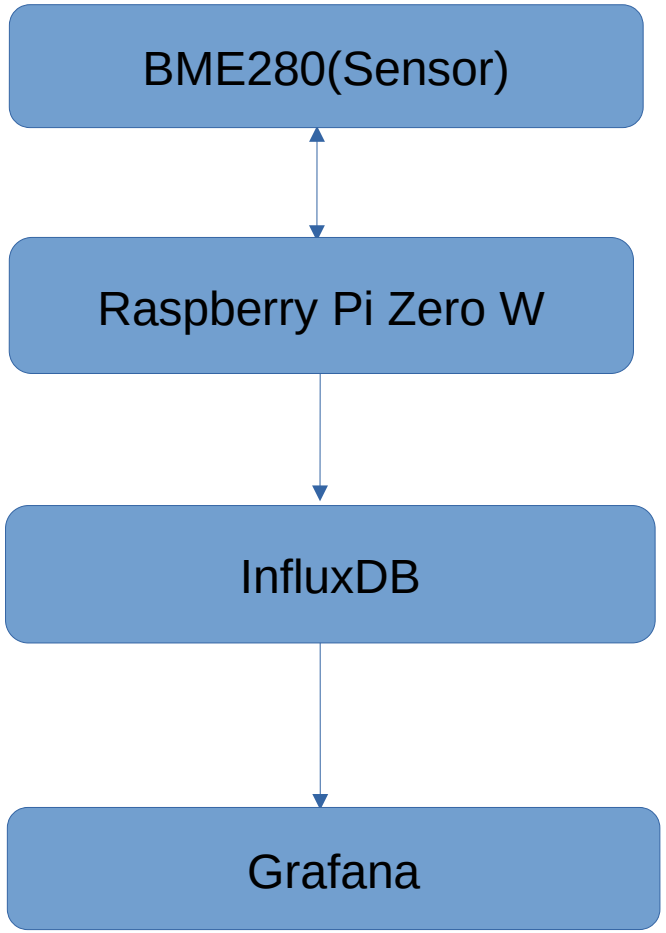
Purpose:

The aim of the project is to create a wireless sensor network for monitoring various environmental parameters. These sensors can measure important parameters such as temperature, humidity and pressure. In particular, we have designed this system to be used in the Clean Room of the European XFEL.

Objectives:

- To integrate the wireless sensor nodes with a Raspberry Pi and develop software for data acquisition and transmission to InfluxDB.
- To test and validate the system in a laboratory environment
- To develop a web-based interface for visualization and analysis of the data

Project Structure



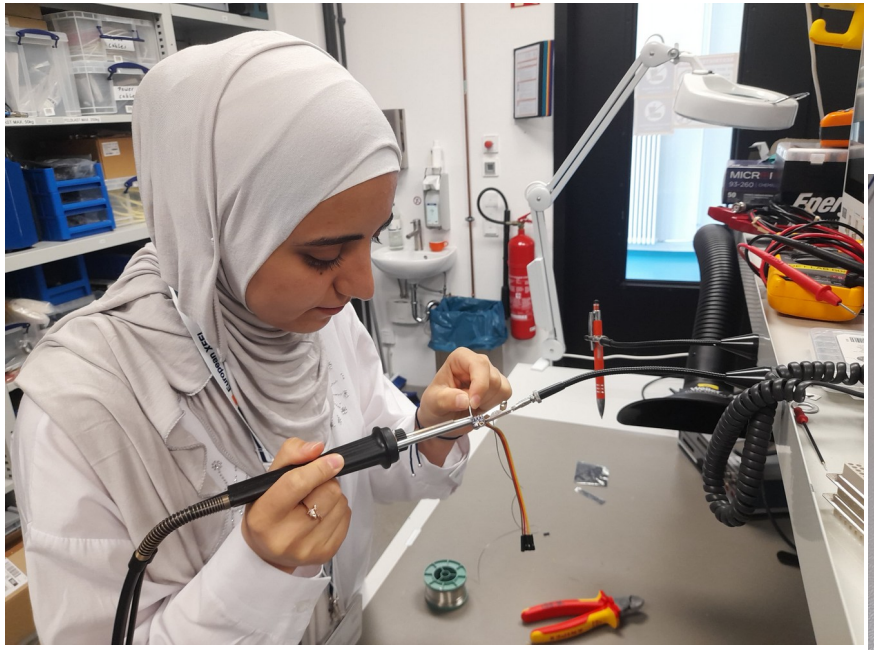
This is the sensor used to measure environmental paramerters such as temperature,humidity and pressure

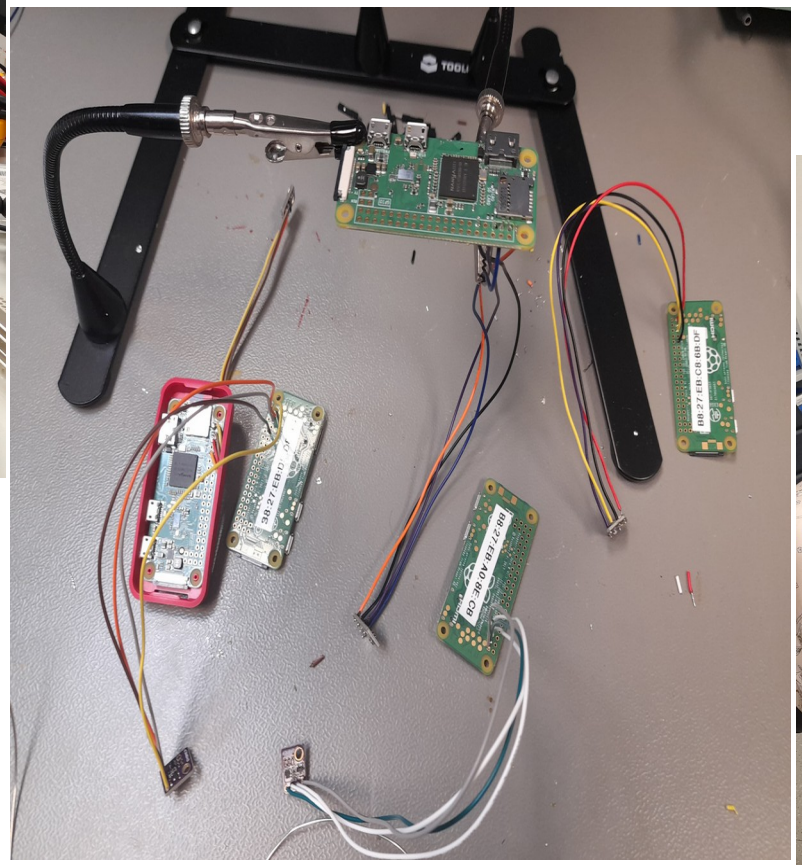
Microprocessor

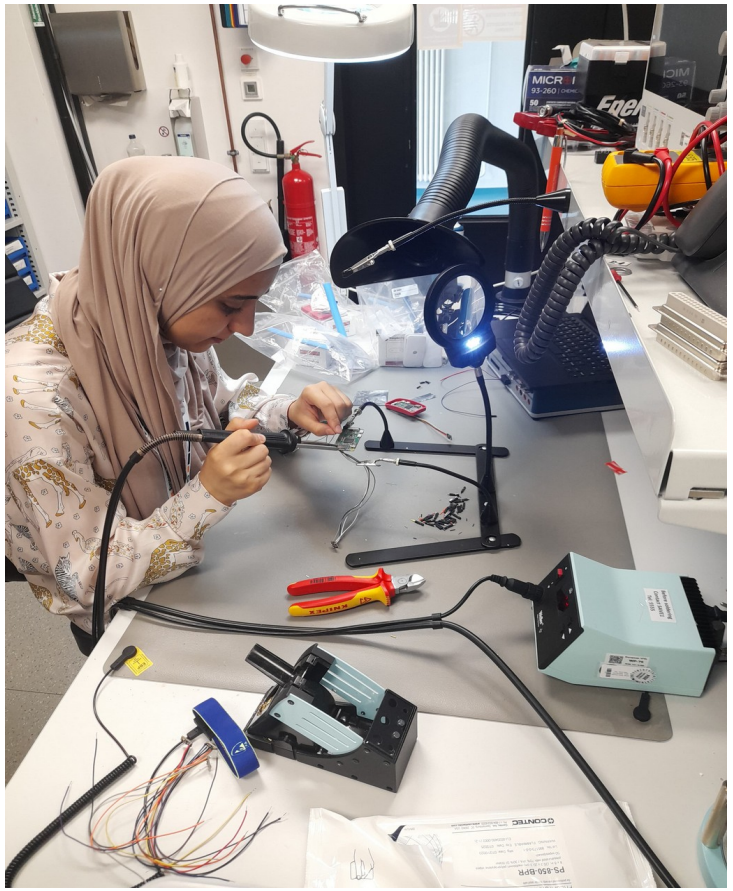
InfluxDB is a time-series database where the data collected from the BME280 sensor is stored.
The data is saved with timestamps, allowing for historical analysis of the environmental conditions

Visualization of data

Project Process







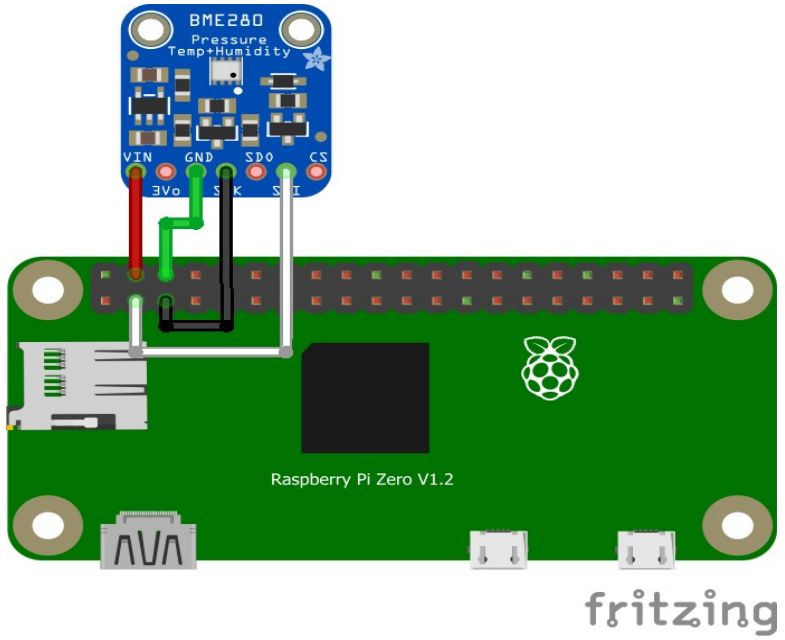
Software/Hardware Employed

- Raspberry Pi Zero W
- BME280
- Jumper Wires
- MicroSD Card: Raspberry Pi OS(32 bits)
- Power Supply for Raspberry Pi
- DESY WiFi: dedicated functional account
- Python
- InfluxDB: Storing sensor data
- Grafana: Visualizing data on a web-based interface.

5 sensors
3 locations:

3 cleanroom
1 lab 605
1 lab 606

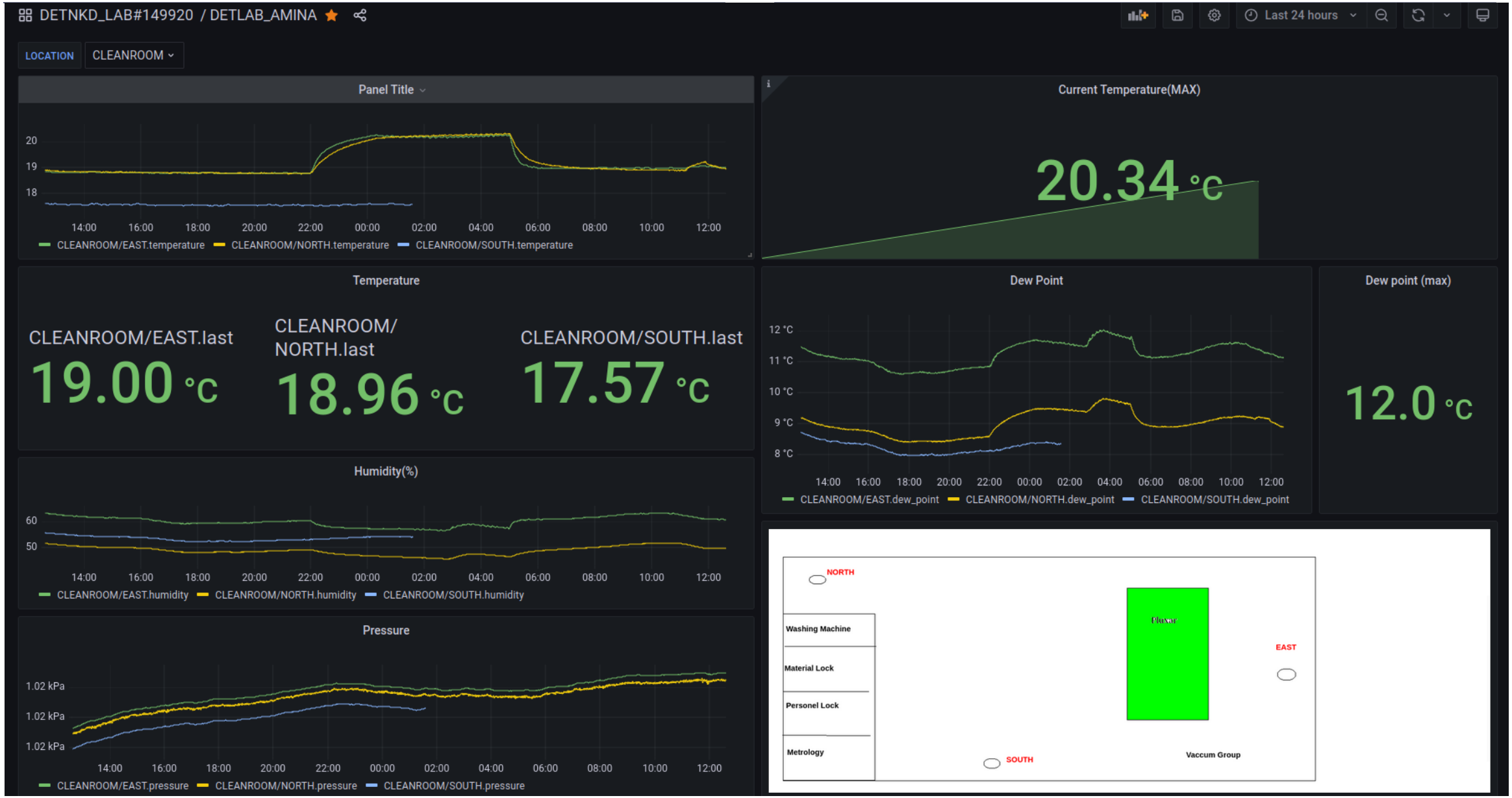
European XFEL



Grafana

European XFEL

Cleanroom


DETNKD_LAB#149920 / DETLAB_AMINA
Last 24 hours
LOCATION
CLEANROOM
Panel Title
20
19
18
14:00 16:00 18:00 20:00 22:00 00:00 02:00 04:00 06:00 08:00 10:00 12:00
CLEANROOM/EAST.temperature
CLEANROOM/NORTH.temperature
CLEANROOM/SOUTH.temperature
Current Temperature(MAX)
20.34 °C
Temperature
CLEANROOM/EAST.last
19.00 °C
CLEANROOM/ NORTH.last
18.96 °C
CLEANROOM/SOUTH.last
17.57 °C
Dew Point
12 °C
11 °C
10 °C
9 °C
8 °C
14:00 16:00 18:00 20:00 22:00 00:00 02:00 04:00 06:00 08:00 10:00 12:00
CLEANROOM/EAST.dew_point
CLEANROOM/NORTH.dew_point
CLEANROOM/SOUTH.dew_point
Dew point (max)
12.0 °C
Humidity(%)
60
50
14:00 16:00 18:00 20:00 22:00 00:00 02:00 04:00 06:00 08:00 10:00 12:00
CLEANROOM/EAST.humidity
CLEANROOM/NORTH.humidity
CLEANROOM/SOUTH.humidity
Pressure
1.02 kPa
1.02 kPa
1.02 kPa
14:00 16:00 18:00 20:00 22:00 00:00 02:00 04:00 06:00 08:00 10:00 12:00
CLEANROOM/EAST.pressure
CLEANROOM/NORTH.pressure
CLEANROOM/SOUTH.pressure
NORTH
Washing Machine
Material Lock
Personel Lock
Metrology
Plexer
EAST
SOUTH
Vaccum Group

Lab605/606

DETNKD_LAB#149920 / DETLAB_AMINA

Last 2 days

LOCATION LAB

Temperature

Current Temperature(MAX)

24.25 °C

Final Temperature of each room

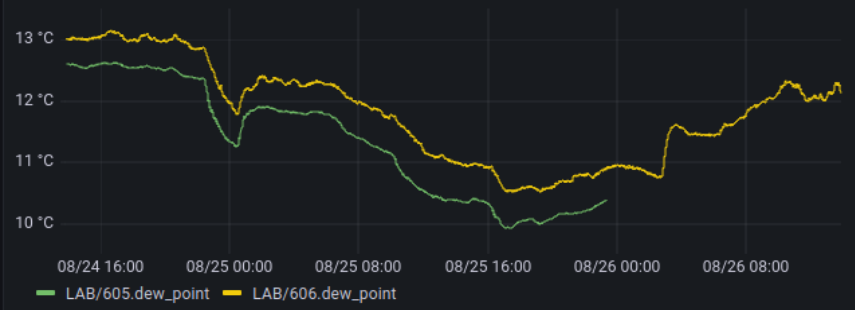
LAB/605.last

20.87 °C

LAB/606.last

24.02 °C

Dew Point



Dew point (max)

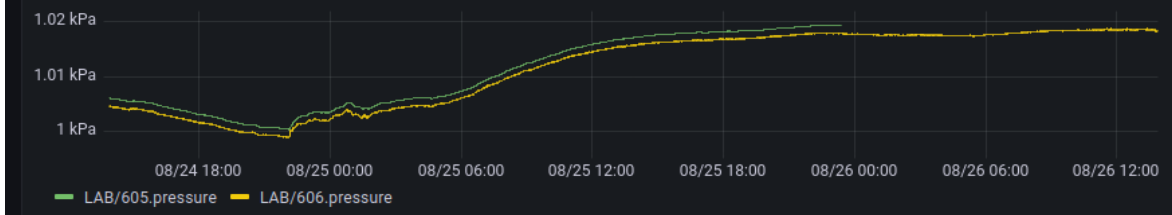
13.2 °C

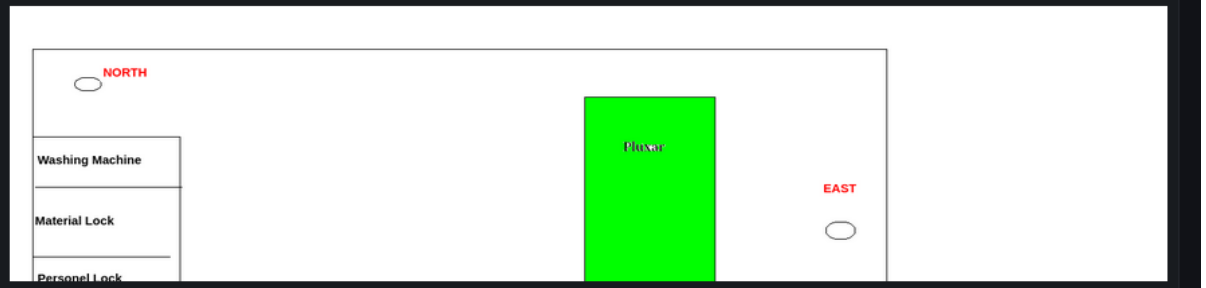
Humidity(%)

ABOUT

This dashboard is designed to monitor and analyze temperature, humidity, pressure and dew point. Real-time data from sensors are visualized at specific time intervals. The data is updated every 20 seconds.

Pressure





Thank you for attention!