KDK
KOMPETENZZENTRUM
DIABETES KARLSBURG

LEIBNIZ-INSTITUT FÜR PLASMA-
FORSCHUNG UND TECHNOLOGIE E.V.

KLINIKUM KARLSBURG
HERZ- UND DIABETESZENTRUM

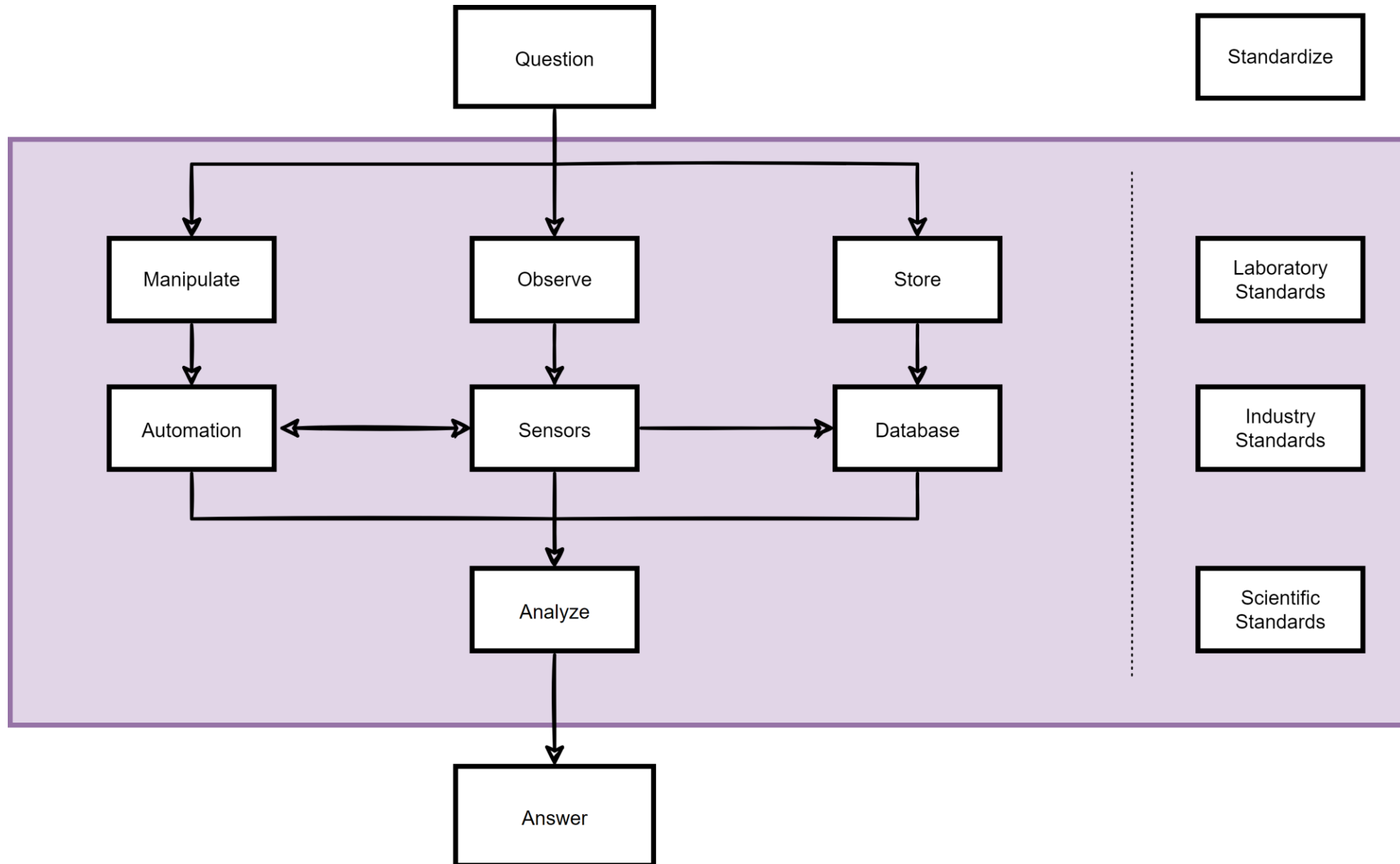# Open Laboratory Environment (OLE)
SensorNet

IoT & I4.0 & FAIR Data
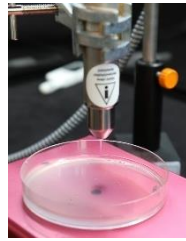# in your Lab

Dr.-Ing. P. Mattern

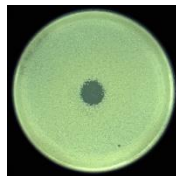# Breaking it down

Let's go All-in …-One

Question

Manipulate

Observe
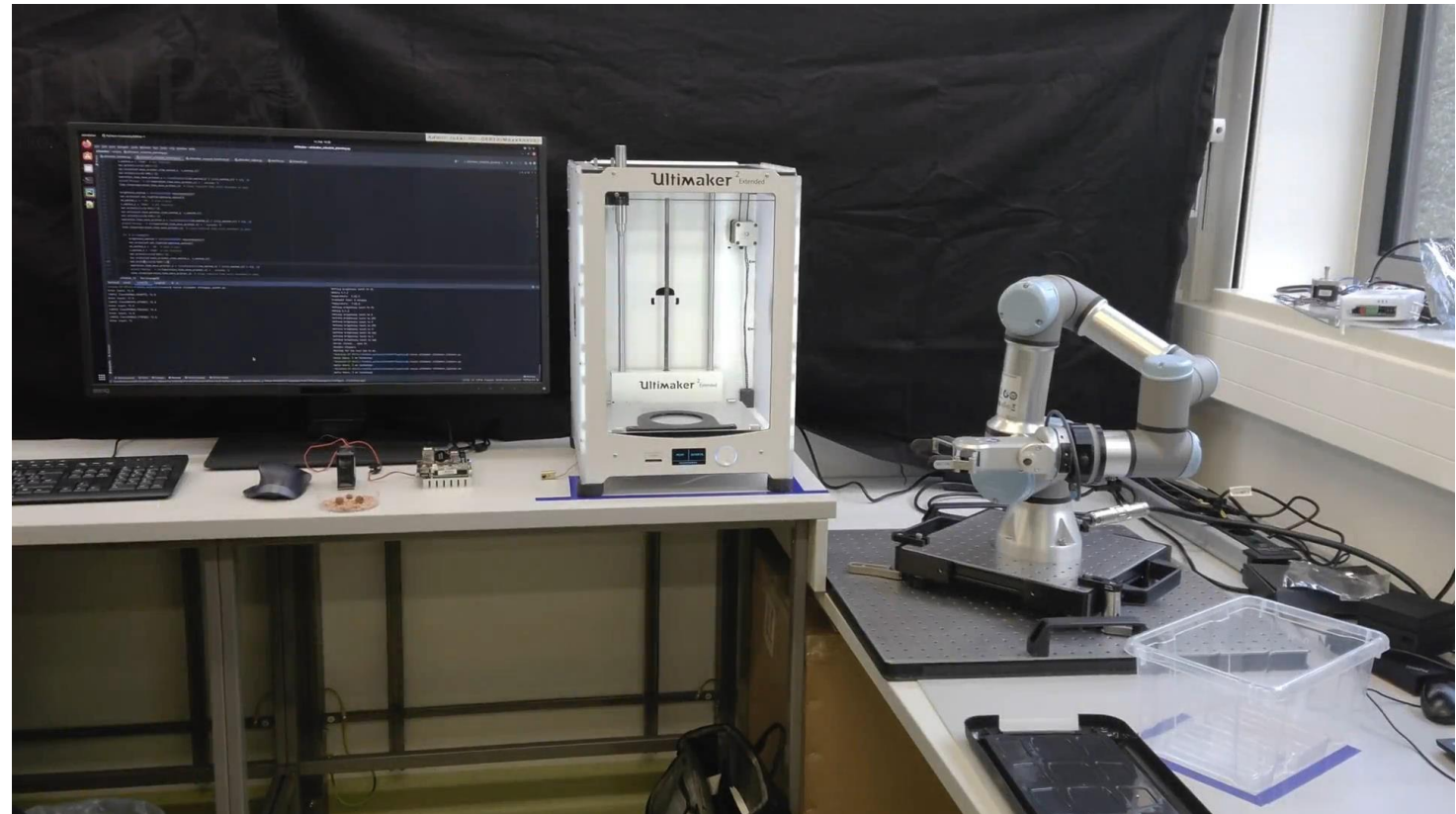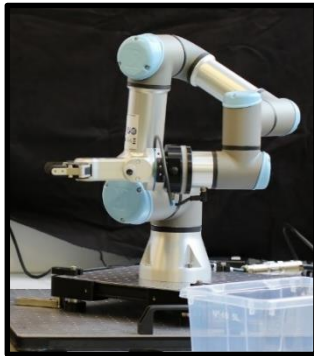
Store

Answer

Concept of an All-In-One approach

Recap 2022

Manipulate → Observe → Store

Robotics

AT-AT

GUI

Analog Sensors

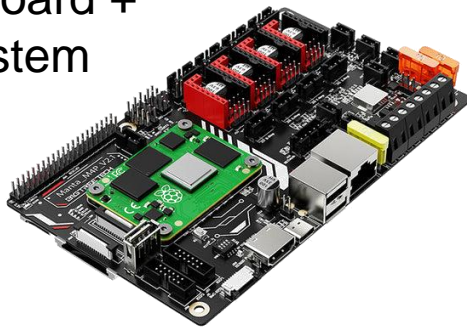Advanced Sensors

Database
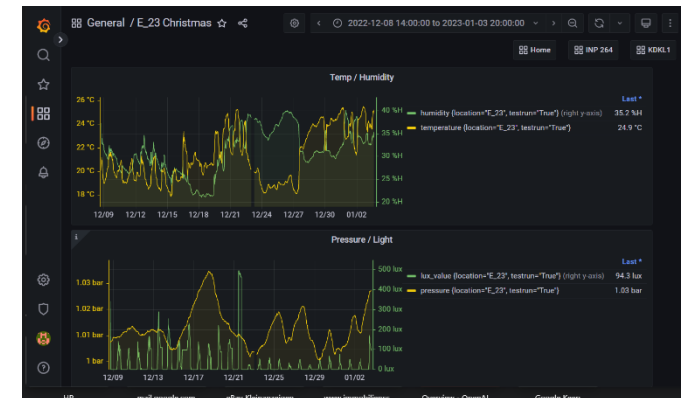
Climate Chamber – An OLE Prototype

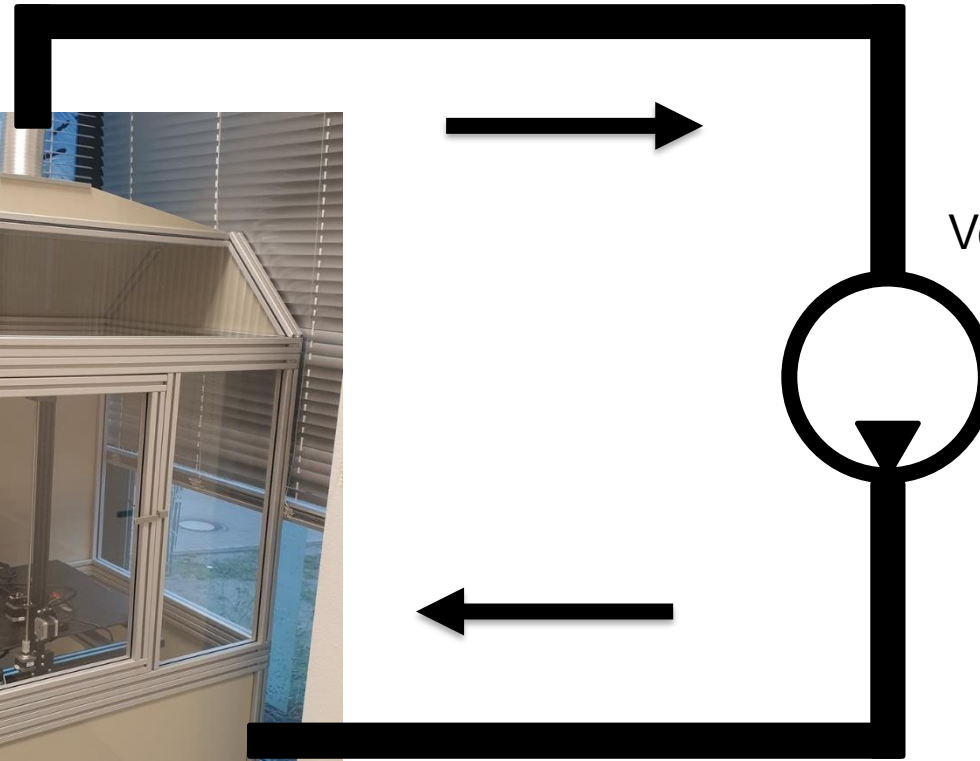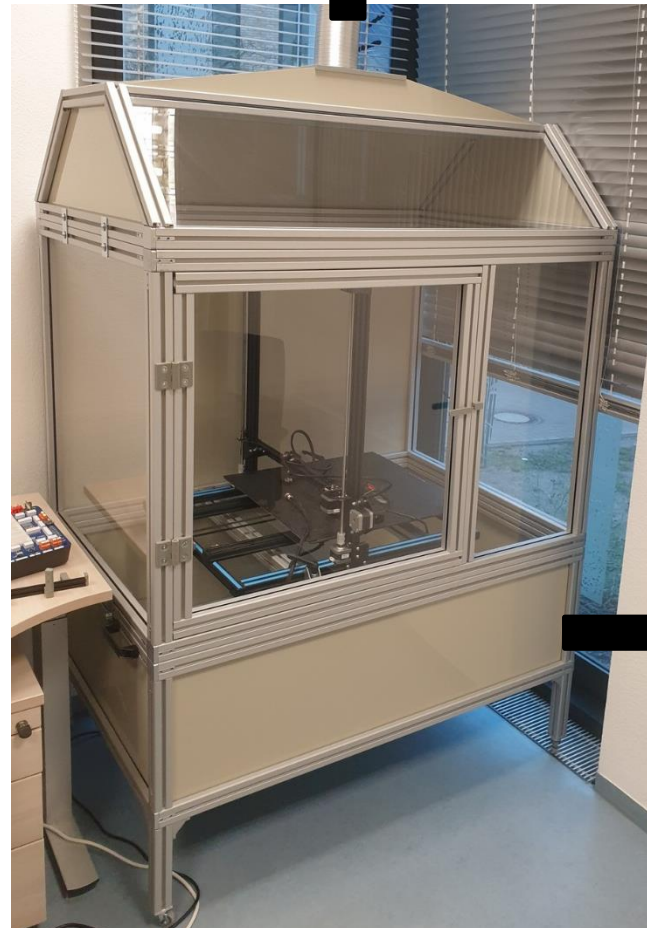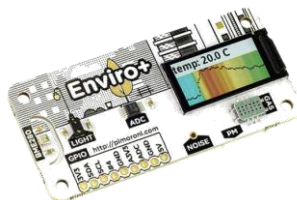Climate chamber for conducting environmental tests:

CR 10 Max 3D printer:
3-axis traversing
system

Printer Mainboard +
RasPi Ecosystem

Multiple
Sensorsystems

Volume Flow / Pressure

Humidity

Temperature

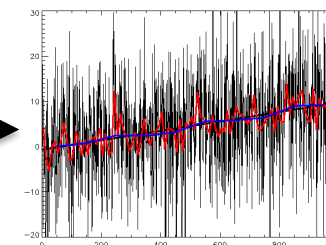# Lab Environment Sensor Package (LESP)
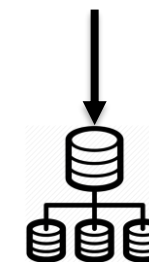

Proven (& installed) Lab Equipment

GitHub

python
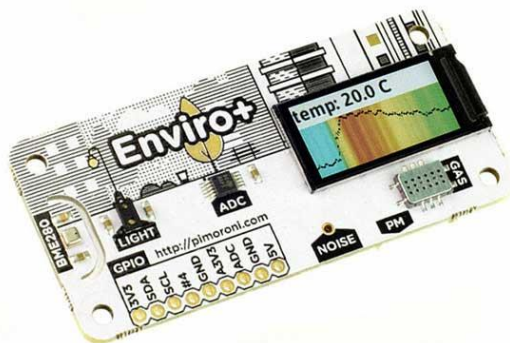
Raspberry Pi

Analog / Digital Outputs

Sensor Packages

Digital Signals

Time series
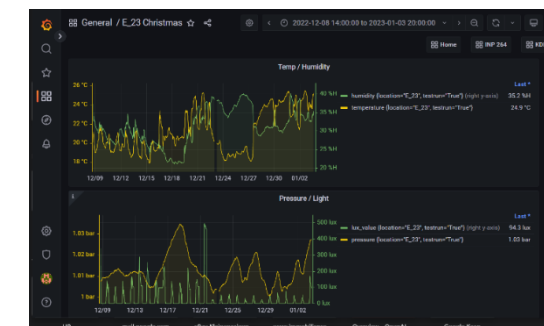
Database

Smart Egg Timer (SET)

Electronic Device

Status (On / Off / Idle/ Part Load)

Sensor
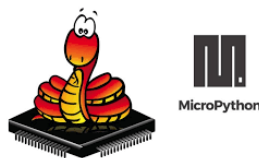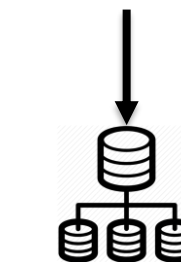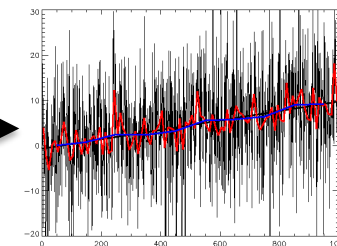
Current Flow

(LED) Color

Weight

ESP 32

MicroPython

M5 CORE2 FOR AWS
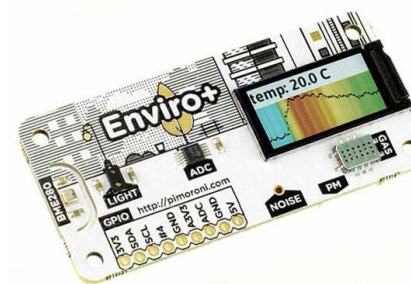
Environmental Conditions

Time series
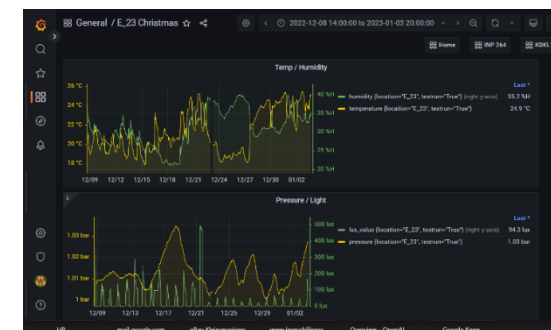
Database

Roadmap 2023

Manipulate	Observe	Store

Climate chamber

Advanced Sensors

xiSPEC hyperspectral
2Mpix multi-linescan
470-900nm

Learn more

OpenCV

Database

Structural Challenges

InfluxDB Overview
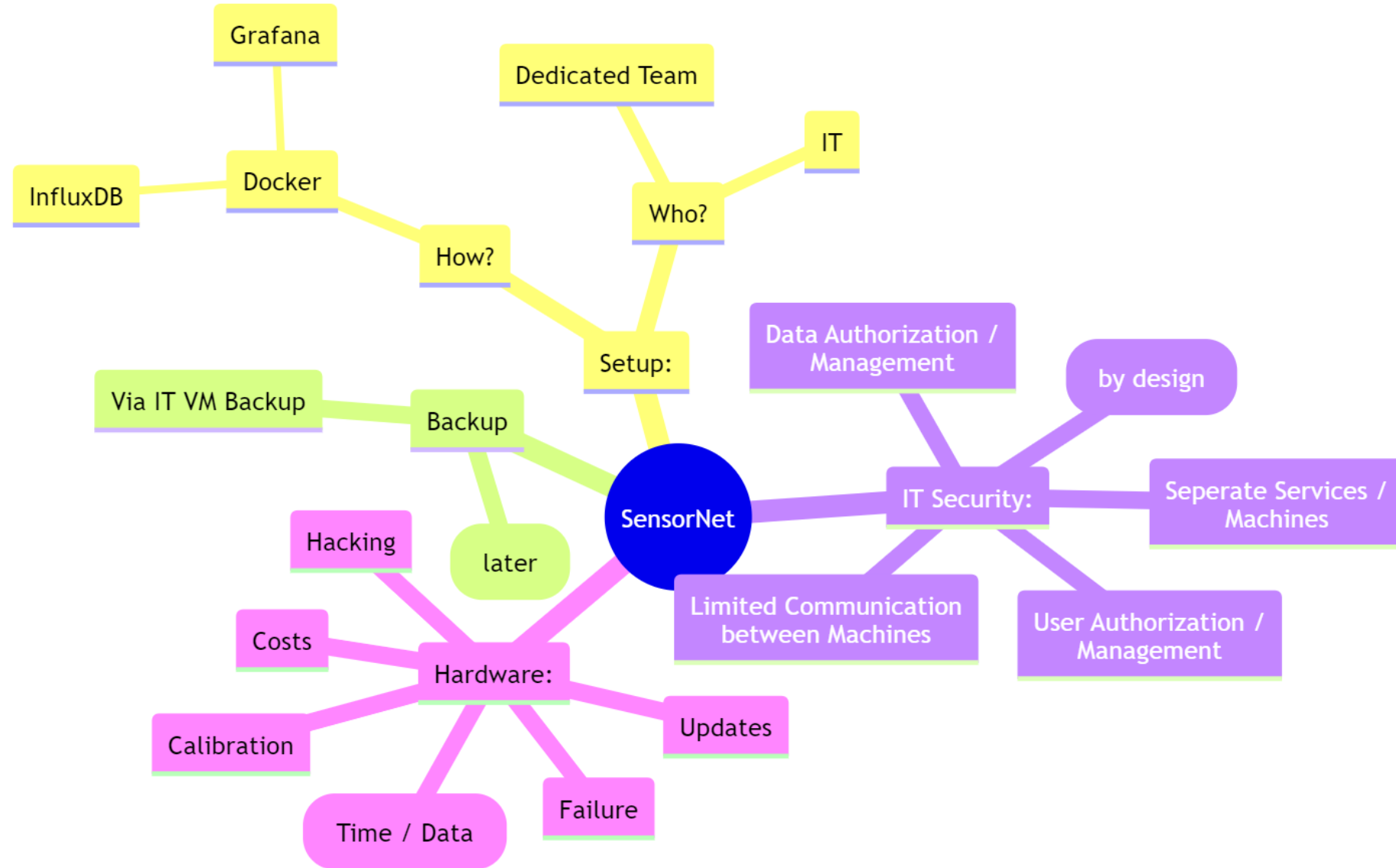
- DATABASE
  - Data Storage Backbone
  - Time-series focused database for real-time data.
- Open-source:
  - user-friendly interface
  - Community-driven
- Built-in data processing features.
- Highly scalable: from Raspi to Data Center
- Flexible data storage:
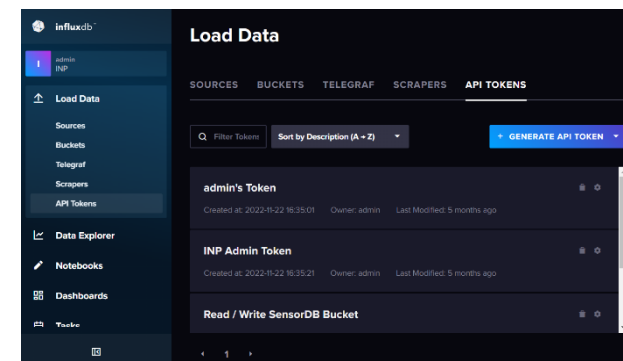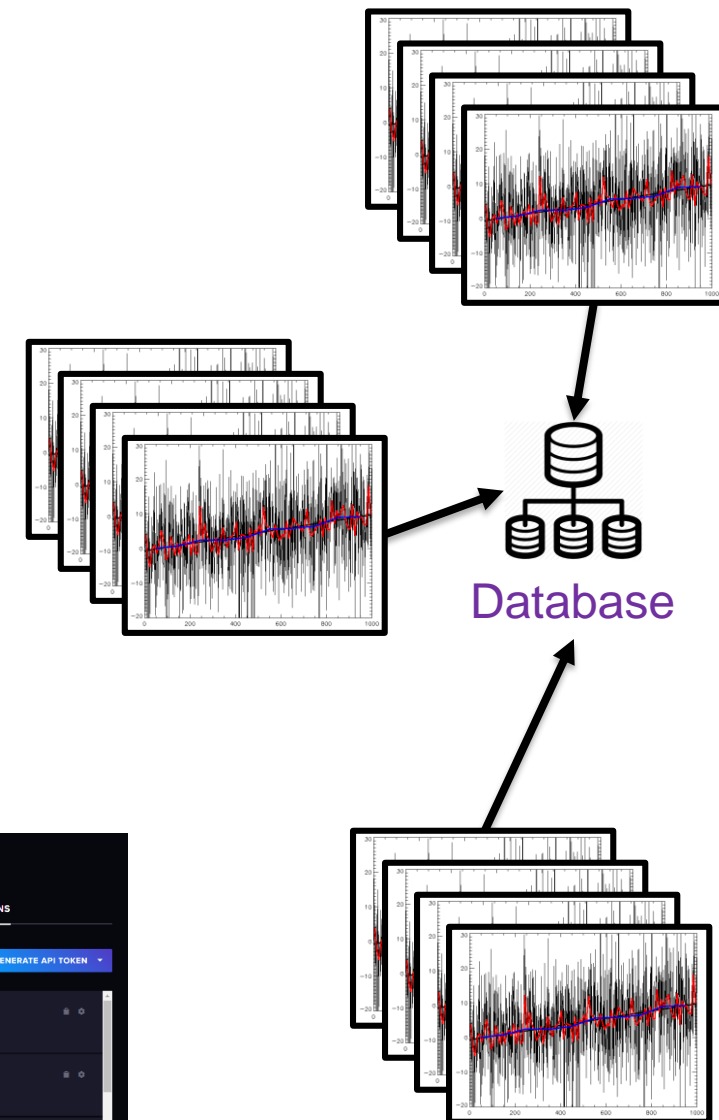 - Different retention policies
  - Data downsampling

Schema

Line Protocol in InfluxDB

```
<measurement>,<tag><field> <timestamp>

sensor_battery,sens_model=XT004,batt_type=LiPo voltage=12.5,current=-0.3,temp=19.4 1658754288
```

1. Measurement: This is **equivalent** to a **table** in a relational database.
2. Tags: **metadata** consisting of **key-value pairs** that contextualize your data. **Indexed.** tag values are **strings**.
3. Fields: Fields are **key-value pairs** for the **actual data points** you're collecting. Fields can be integers, floats, strings, or Booleans.
4. Timestamp

- It is as easy as sending a simple string!

- Client Libraries:

https://www.influxdata.com/blog/time-series-data-cardinality-influxdb/

11
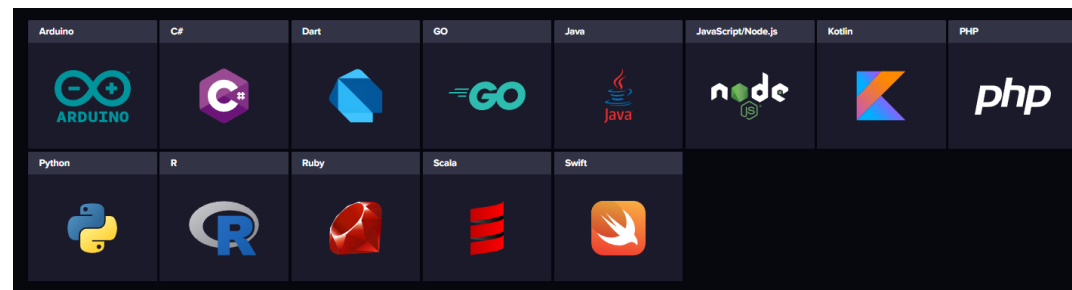
Grafana Overview

- Open-source visualization platform for data analysis.
- Supports various data sources and integrations.
- Offers customizable visualization options.
- Provides real-time streaming of data and alerts.
- Highly extensible with plugins and a large community.
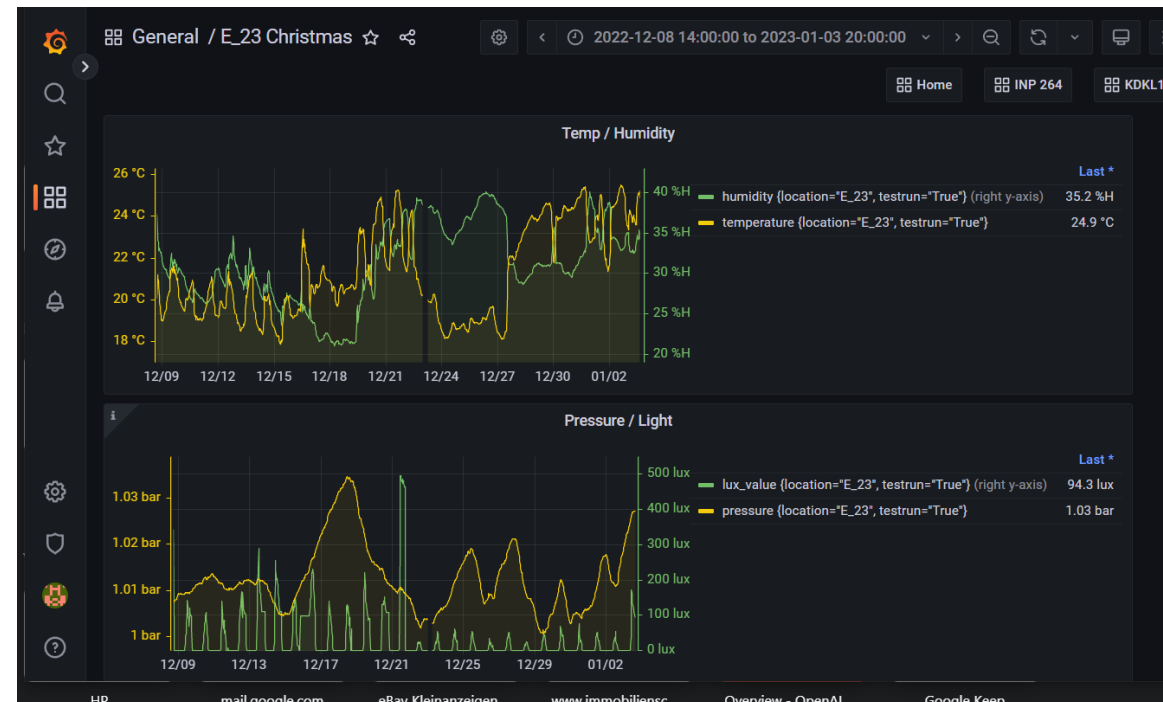
Connecting Everything: Open Laboratory Environment (OLE)

Manipulate	Observe	Store
whatever you want…	whatever you want…	wherever you want…
standardized, open-source	standardized, open-source	standardized, open-source

AT-AT   Robotics   8 Axis Control Board

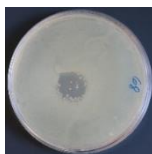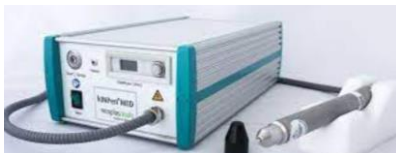Different Samples

Database

CNC   Stepper Motor + Belt

Sensor Packages
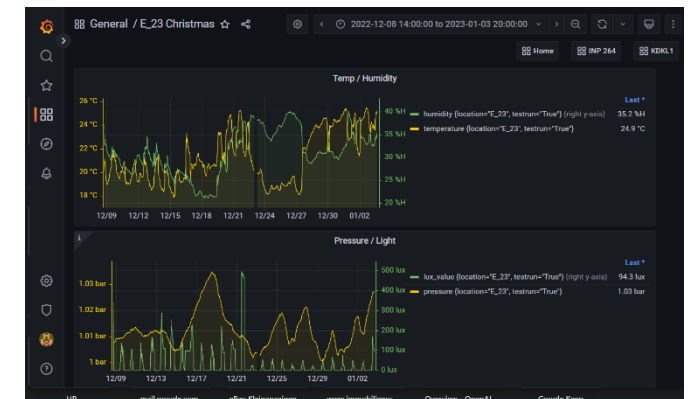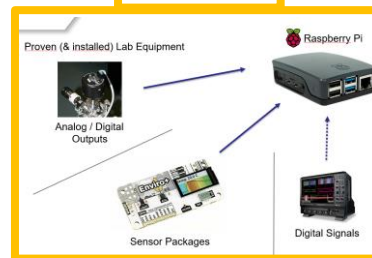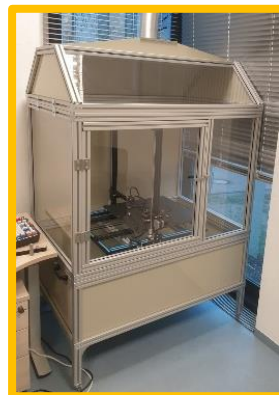
Side Quest C3PO: Protocol Droid

C-3PO is a humanoid protocol droid in the Star Wars universe who is fluent in over six million forms of communication. He is skilled in transcribing audio into text and providing diplomatic protocol advice.
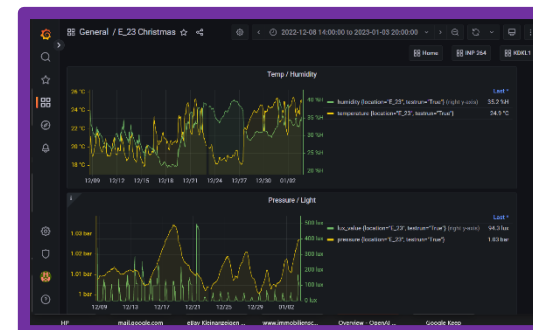
May the 4th...

Audio → Transcript → Protocol
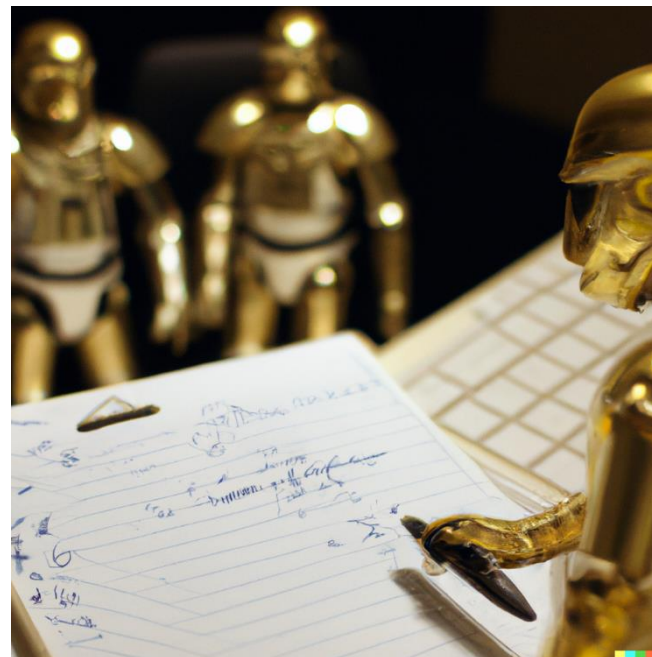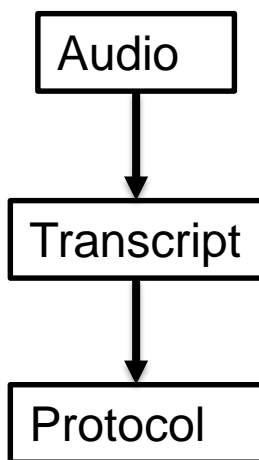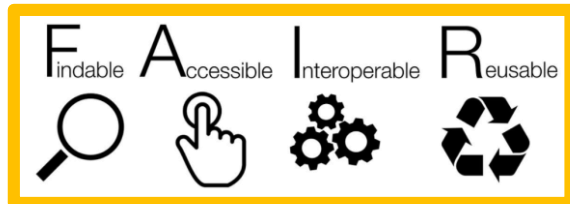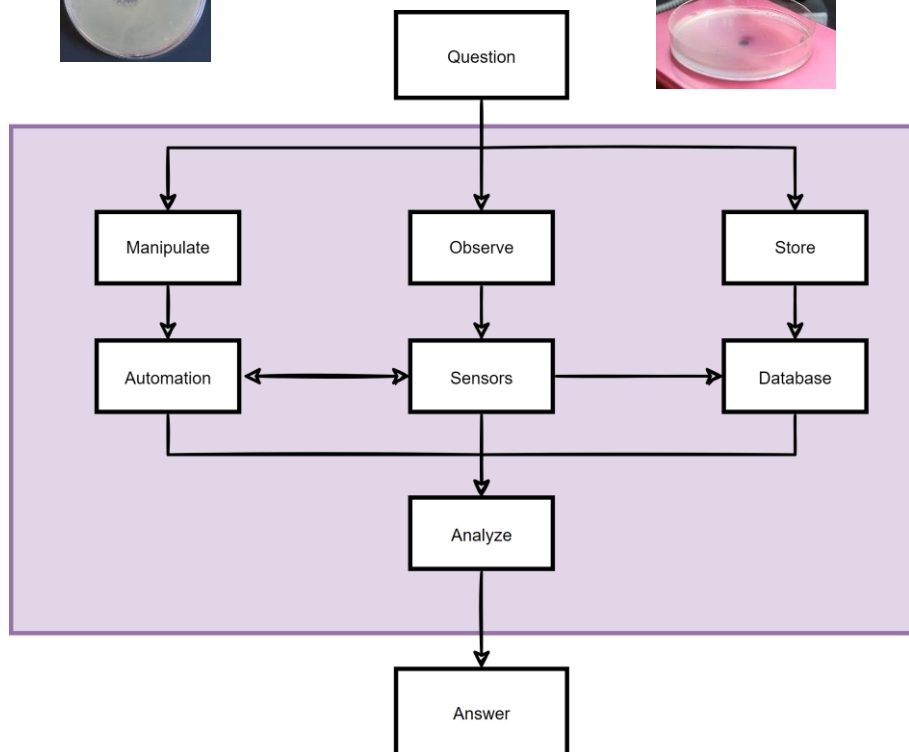
LESP

Towards standardized, open-source measurement procedures to enable Machine Learning in a big data approach

AI (ML(DL))) Magic

Live- Demo