Requirment specification

Project Title	Wetterstation
Project Leader	Matthias Brückl
Created on	03.12.2025
Last changed on	25.01.2026
state	Currently in work
Current Version	5

Change History

Nr.	Date	Version	Changed Chapter	Type of Change	Author	State
1	03.12.25	1	2-5	Start to fill out	Aistleitner Daniel	
2	07.12.25	2	1-6	renewal	Aistleitner Daniel	
3	10.12.2025	3	1-8	Finished	Aistleitner Daniel	
4	12.12.2025-	4	1-8	Review	Brückl Matthias	
5	25.01.2026	5	1-8	Update according to the feedback	Brückl Matthias	

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1 Introduction

This requirements specification describes all functional and non-functional requirements for the development of a weather station. It forms the binding foundation for planning and implementation of the project. It also explains the points on which the client, HTL Wels, and the contractor, Matthias Brückl, agreed.
The goal of the project is to design and implement a fully functional weather station capable of measuring environmental data such as temperature, humidity, air pressure, light intensity, UV index, and wind speed.
The system will be based on a Raspberry Pi Zero and various sensors. The collected data shall be processed locally and displayed via a web-based user interface, without the use of cloud services.
The final product will be energy-efficient and housed in a minimalist enclosure.

2 General

2.1 Aim and purpose of the document

The purpose of this document is to clearly define all requirements, constraints, and objectives of the Weather Station project.
It provides a common understanding for all project participants and serves as the basis for development.

2.2 Initial situation

The project was initiated as part of a school assignment.

No existing weather station system is available. The entire software is being developed from scratch by the project team. The hardware is being purchased online.

The team already possesses basic knowledge of electronics, programming, and web development.

2.3 Project Context

This project is an independent project and is not directly dependent on other projects. However, similar projects, for example “Indoor weather stations” or “Smart gardening systems”, may provide inspiration or technical know-how.

2.4 Abbreviations

Abbreviation	**Meaning**
API	Application Programming Interface
DB	Database
UV	Ultraviolet
REST	Representational State Transfer
UI	User Interface

2.5 Teams and Interfaces

Rolle(n)	Name	Telefon	E-Mail	Team
Project-Owner	HTL Wels	0123456789	office@htl-wels.at	HTL Wels
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3 Concept

3.1 Goal(s) of the provider specification

- Build a fully functional weather station.
- The measurement of temperature, humidity, air pressure, UV and windspeed
- Implement a web-based data visualisation system.
- Create a minimalistic, aesthetically pleasing case.
- Learn new skills (sensor handling, electronics, full-stack development).

3.2 Specifications Goals and benefits for the user

- Accurate measurement of environmental data in the garden
- A self-sustaining device with solar power.
- A live dashboard accessible via web browser.
- A durable and visually appealing design.

3.3 Target group(s)

- Home users with interest in local weather conditions.
- Garden owners wanting real-time climate data.
- Technology enthusiasts seeking a simple, local, non-cloud solution.

4 Functional Requirements

4.1 Sensor Data Measurement

- Temperature
    - **Range:** -40°C to +80°C
    - **Accuracy:** ±0.5°C
    - **Sampling Rate:** Every 10 seconds
    - **Output Format:** Celsius with 1 decimal places
    - **Error Handling:** Display "N/A" if sensor fails, log error to system
- Humidity
    - **Range:** 0% to 100% relative humidity
    - **Accuracy:** ±3% relative humidity
    - **Sampling Rate:** Every 10 seconds
    - **Output Format:** Percentage with 1 decimal place
    - **Alert:** Notify if humidity >70% (mold risk) or <30% (too dry)
- Air pressure
    - **Range:** 300 hPa to 1100 hPa
    - **Accuracy:** ±1,5 hPa
    - **Sampling Rate:** Every 10 seconds
    - **Output Format:** Hectopascal (hPa) with 1 decimal place
- UV index
    - **Range:** 0 to 20+ mW/cm^2
    - **Accuracy:** ±10 UV index
    - **Sampling Rate:** Every 10 seconds (daylight hours only)
    - **Output Format:** Integer value (0-15+)
- Wind speed (with pinwheel)
    - **Range:** 0 to 100 km/h
    - **Accuracy:** ±5%
    - **Sampling Rate:** Continuous with 10-second rolling average
    - **Output Format:** km/h with 1 decimal place
    - **Gust Detection:** Record maximum wind speed in 1-minute intervals

4.2 Data Processing and Storage

- locale Database
  - **Technology**: use a lightweight SQLite
  - **Data structure**: Save time ISO 8601 format, a unique Sensor-ID and the maesurement value
  - **Memory Space**: Delete all data, which is older than 30 days, to have always enough space
- Update of the data
  - **Interval:** every second
- API
  - **Architecture**: a RESTful API to show the stored data in the web interface
  - **Endpoints**: GET /api/sensors/current" to get the current values and "GET /api/sensors/history" to get historical value of for example the last 24 hours

4.3 Web Interface

- Visualization
  - **Dashboard**: show all important values at first sight
  - **Latency:** update the data every second
  - **Mobile readiness**: build a responsive layout to ensure usability on PC, Tablet and smartphone
  - **visual indicators**:use color coded status rings for example the UV index

Green	Low	UX Index 1-2
Yellow	Moderate	UX Index 3-5
Orange	High	UX Index 6-7
Red	Very High	UX Index 8-10
Purple	Extreme	UX Index 11+

- Development
  - **Technology**: Build Frontend with React Vite
  - **Styling**: use Tailwind fro clean design
- Network access
  - **Connectivity**: the web interface is accessible via a domain using mDNS for easy discovery without static IP addressesS

4.4 Case

- Design
    - **Style**: “Dieter Rams Design”
    - **Colors**: White, Black, Creme, Grey
    - **Material**: 3D printed PETG
- functional Aspects
    - **Ventilation**: integration of vents to ensure accurate sensor readings
    - **Mounting**: Wall mounting and stand feet
    - **Connections**: recessed USB-C port

5 Non-Functional Requirements

5.1 General Requirements

- Modular and extendable system design
- Easy maintenance during project runtime

5.2 Legal Requirements

- No personal data processing
- No cloud services used

5.3 Technical Requirements

- Raspberry Pi Zero 2W
- Local database
- REST API
- Web frontend

6 Framework conditions

6.1 Schedule

- **Project start:** 12.01.2026
- **Project end:** 10.06.2026

Main phases:

1. Hardware setup & sensor integration
2. Backend (DB, API, server)
3. Frontend (framework, design, integration)
4. Power system (solar + battery)
5. 3D case design and assembly

6.2 Technical Requirements

Hardware Requirements

Minimum	Recommended
Raspberry Pi Zero 2W	Raspberry Pi Zero 2W
BME280, DHT11, VEML6075	BME280, DHT22, VEML6075
Pinwheel for wind measurement	Pinwheel for wind measurement
---	Solar panel + Li-ion battery
PETG filament for 3D printing	ABS filament for 3D printing
Breadboard and wiring	Breadboard and wiring

Software Recommended Requirements

- Git for version control
- Visual Studio Code
- Raspberry Pi OS (Lite)
- Python 3
- React
- Sensor Libraries
- SQL

6.3 Problem Analysis

Risk	Solution
Sensor inaccuracies	Calibration and testing
Power instability	Battery buffering
Software bugs	Incremental testing

6.4 Quality Requirements

- Code reviews within team
- Component testing after each milestone
- 48-hour uninterrupted test run required
- Final acceptance by teacher

7 Delivery and Acceptance conditions

The project is considered complete when:

- All sensors work reliably.
- Web dashboard displays all live data.
- Device runs power-autonomously via solar energy.
- Documentation is complete.
- Device is formally handed over to the teacher.

8 Appendix

- Project Handbook
- Goals document
- Sensor datasheets
- Circuit drawings
- 3D case models
- API documentation