IsoPrüfi

Documentation

Manuel Schülein, Mara Küfer, Danylo Tulainov, Diana Huynh

Table of contents

1. Welcome to IsoPrüfi 4
   1.1 Quick Overview 4
   1.2 Getting Started 4
   1.3 Architecture 4
   1.4 Documentation Structure 5
2. Getting Started 6
   2.1 Contribute & Build 6
   2.2 Contributing Guide 8
3. Development 12
   3.1 Guidelines / Conventions 12
   3.2 Testing Strategy 15
   3.3 API Reference 16
   3.4 API V1 18
   3.5 Troubleshooting Guide 19
4. Code Documentation 25
   4.1 Assembly Rest-API 25
   4.2 Assembly MQTT-Receiver-Worker 27
   4.3 Assembly MQTT-Sender 28
   4.4 Assembly Database 29
   4.5 Assembly UnitTests 31
   4.6 Assembly IntegrationTests 32
   4.7 Assembly LoadTests 34
   4.8 Contents pages 36
   4.9 Index pages 36
   4.10 Frontend 37
5. Docker 170
   5.1 Environment Files 174
6. System Documentation 177
   6.1 Database Schema 177
   6.2 MQTT Protocol Documentation 180
   6.3 Monitoring & Observability 182
7. IsoPrüfi Documentation 184
   7.1 Introduction and Goals 184
   7.2 Quality Requirements 186
   7.3 Architecture Constraints and Solution Strategy 188

7.4 Architecture Decisions 191
7.5 Context and Scope 199
7.6 Risks and Technical Debts 201
8. License 206

1. Welcome to IsoPrüfi

We are happy that you are here 🥳🎉

IsoPrüfi is an IoT-based system for testing building insulation effectiveness by monitoring temperature differences between indoor and outdoor environments.

1.1 Quick Overview

The system uses Arduino-based sensors to collect temperature data from multiple locations, processes it through a containerized backend, and presents insights via a web interface.

Key Features:
- Real-time temperature monitoring with Arduino sensors
- Automated data collection and analysis
- Web-based dashboard for visualization
- Containerized architecture for easy deployment
- Offline data buffering with SD card storage

1.2 Getting Started

- **Setup & Build** - Initial project setup and development environment
- **Docker Environment** - Container overview and local development
- **API Reference** - REST API documentation
- **Guidelines** - Development conventions and best practices

1.3 Architecture

Built with modern technologies:
- **Backend**: .NET REST API, MQTT message broker
- **Frontend**: React with TypeScript
- **Database**: PostgreSQL + InfluxDB for time-series data

- **Hardware**: Arduino MKR WiFi 1010 with temperature sensors
- **Infrastructure**: Docker containers with Traefik load balancer

1.4 Documentation Structure

- **Getting Started** - Setup guides and quick start
- **Development** - Guidelines, API docs, and troubleshooting
- **Architecture Documentation** - Technical design using arc42 template

---

Ready to contribute? Start with our contributing guide or jump into the build setup.

September 2, 2025

DianaTin23, deadmade, deadmade

2. Getting Started

2.1 Contribute & Build

2.1.1 How do I contribute as a developer?

READ THIS GUIDE BEFORE CONTRIBUTING

Since our project is secured by two pre-commit hocks, it is important to set up the project correctly before contributing.

This is done as followed:

Clone the project

`git clone https://github.com/deadmade/IsoPruefi.git`

Make sure you have installed the following packages globally.

- Python: Needed for MkDocs
- Node Package Manager: Used to install needed dependencies for pre-commit hooks
- .NET 9.0 SDK: Used for our Rest-API
- Docker

After you've cloned the repo make sure to install all needed packages for the hooks via:

`npm i`

and run:

`npm run init`

Now it should be configured 🚀

To get the development environment up and running, follow these steps:

1. Open a terminal, navigate to the `IsoPrüfi` directory, and run:

```
docker compose up
```

1. Once the containers are running, create an admin token for InfluxDB:

```
docker exec -it influxdb influxdb3 create token --admin
```

1. Copy the generated token string.
2. Create a `config.json` file at the following location:

```
IsoPruefi/isopruefi-docker/influx/explorer/config
```

1. Add the following content to `config.json`, replacing `"your-token-here"` with the copied token:

```
{
  "DEFAULT_INFLUX_SERVER": "http://host.docker.internal:8181",
  "DEFAULT_INFLUX_DATABASE": "IsoPrüfi",
  "DEFAULT_API_TOKEN": "your-token-here",
  "DEFAULT_SERVER_NAME": "IsoPrüfi"
}
```

1. Run dotnet user-secrets set "Influx:InfluxDBToken" "" --project
2. Paste InfluxDBToken in secrets.env
3. Restart the Containers

2.1.2 Arduino Set Up

Hardware

- MKR WiFi 1010
- Analog Devices ADT7410 Breakout
- DS3231 RTC
- SD Card Module

Software

`⚠️ Important: Always open the Arduino firmware folder (e.g., code/arduino/) as a PlatformIO Project (via Open Project or Pick a folder in the PlatformIO sidebar). Otherwise, dependencies from platformio.ini might not be detected and you may see false errors in the editor.`

To work on the Arduino/PlatformIO part of the project:

1. Install the PlatformIO Extension in Visual Studio Code
2. Open the folder IsoPruefi/isopruefi-arduino
3. Build and upload the firmware using the PlatformIO toolbar or PlatformIO terminal
4. Make sure your board is connected and properly selected in platformio.ini

```
[env:mkrwifi1010]
platform = atmelsam
board = mkrwifi1010
framework = arduino
lib_deps =
    arduino-libraries/WiFiNINA
    adafruit/Adafruit ADT7410 Library
    adafruit/RTClib
    arduino-libraries/ArduinoMqttClient
    greiman/SdFat
    gyverlibs/UnixTime
    bblanchon/ArduinoJson@^7.4.2
```

Tips:

- PlatformIO installs the required libraries automatically on first build
- To run the programm run `pio run -e mkrwifi1010` in the PlatformIO terminal
- To flash the Arudion with new code run `pio run -e mkrwifi1010 --target upload` in the PlatformIO terminal
- The main firmware entry point is located at src/main.cpp
- Use the Serial Monitor (🔌) to debug via USB
- To run the all unit tests run `pio test -e native` in the PlatformIO terminal

Happy Coding 😊

September 3, 2025

DianaTin23, deadmade, deadmade

2.2 Contributing Guide

2.2.1 Getting Started

Welcome to IsoPrüfi! We appreciate your interest in contributing. Please read this guide before making your first contribution.

Prerequisites

Before contributing, ensure you have:
- Read the build setup guide
- Completed the initial project setup
- Familiarized yourself with our development guidelines

2.2.2 Development Workflow

1. Branch Creation

Create branches following our naming convention:

```
git checkout -b [type]/[description-with-hyphens]
```

Branch Types:
- `feat/` - New features
- `fix/` - Bug fixes
- `docs/` - Documentation updates
- `refactor/` - Code refactoring
- `test/` - Adding/updating tests
- `chore/` - Maintenance tasks

Examples:

```
git checkout -b feat/temperature-alerts
git checkout -b fix/mqtt-connection-timeout
git checkout -b docs/api-reference-update
```

2. Development Process

1. **Make your changes** following our coding standards
2. **Test thoroughly** - run relevant tests for your changes
3. **Update documentation** if needed
4. **Commit with conventional messages** (see below)

3. Testing

Run tests before committing:

```
# Frontend tests
cd isopruefi-frontend && npm test

# Backend tests
cd isopruefi-backend && dotnet test

# Arduino tests
cd isopruefi-arduino && pio test -e native
```

4. Pre-commit Hooks

Our project uses pre-commit hooks that automatically run:
- Commit message validation (Conventional Commits)

- Code formatting checks
- Basic linting

If hooks fail, fix the issues before committing again.

2.2.3 Commit Message Standards

We follow Conventional Commits:

```
<type>: <description>

[optional body]

[optional footer]
```

Allowed Types:
- `feat` - New features
- `fix` - Bug fixes
- `docs` - Documentation changes
- `style` - Code style/formatting
- `refactor` - Code refactoring
- `test` - Adding/updating tests
- `chore` - Maintenance tasks
- `ci` - CI/CD changes
- `perf` - Performance improvements
- `revert` - Reverting commits

Examples:

```
feat: add temperature alert notifications

fix: resolve MQTT connection timeout issue

docs: update API reference with new endpoints

refactor: improve error handling in sensor module
```

2.2.4 Pull Request Process

1. Create Pull Request

1. Push your branch to GitHub
2. Open a Pull Request against the current `sprint` branch
3. Use a descriptive title following commit conventions
4. Fill out the PR template completely

2. PR Requirements

Your PR must:
- Pass all automated checks (CI/CD)
- Have clear, descriptive commit messages
- Include tests for new functionality
- Update relevant documentation
- Be reviewed by at least one maintainer

3. Review Process

- Address all reviewer feedback
- Keep PR scope focused and manageable
- Squash commits if requested

- Ensure CI passes before merge

2.2.5 Documentation

When to Update Documentation

- Adding new features or APIs
- Changing existing behavior
- Fixing bugs that affect user experience
- Adding configuration options

Documentation Types

- **API changes**: Update `api-reference.md`
- **Setup changes**: Update `build.md` or `docker-dev.md`
- **Architecture changes**: Update relevant arc42 sections
- **New features**: Update main documentation

2.2.6 Issue Reporting

Bug Reports

Include:
- Clear description of the problem
- Steps to reproduce
- Expected vs actual behavior
- Environment details (OS, Docker version, etc.)
- Relevant log output

Feature Requests

Include:
- Clear description of the proposed feature
- Use case/problem it solves
- Suggested implementation approach
- Consider alternatives

2.2.7 Getting Help

- **Technical questions**: Open a GitHub issue
- **Setup problems**: Check troubleshooting guide
- **Architecture questions**: Reference arc42 documentation

2.2.8 Code of Conduct

- Be respectful and constructive
- Focus on the code, not the person
- Help others learn and improve
- Keep discussions technical and relevant

Thank you for contributing to IsoPrüfi! Your efforts help make the project better for everyone.

September 2, 2025

deadmade

3. Development

3.1 Guidelines / Conventions

3.1.1 General Formatting Guidelines

- Preserve Settings: Follow the existing project formatting rules.
- Automatic Formatting: Regularly use Rider's automatic formatting function (Ctrl+Alt+L).

3.1.2 Code Layout

- Line Length: Maximum of 120 characters per line.
- Indented Blocks: Use tabs or 4 spaces for indentation (depending on project settings).
- Blank Lines: Use blank lines to separate logical code blocks.

3.1.3 Indentation and Spacing

- Indent Blocks: Always use 4 spaces per indentation level.
- Braces: Opening braces on the same line as the statement, closing braces on a new line.
- Operator Spacing: Add spaces around operators like +, -, *, /, =, ==, etc.
- Commas and Semicolons: Add a space after commas and semicolons, not before.

3.1.4 Naming Conventions

- Classes and Methods: Use PascalCase.
- Variables and Fields: Use camelCase.
- Constants: Use SCREAMING_SNAKE_CASE.

3.1.5 Documentation Comments

If not obvious, or the method is more than 5 lines, it should be commented.

- Single-line Comments: Use // for single-line comments
- Multi-line Comments: Use /* ... */ for multi-line comments.
- Documentation Comments: Use /// for documentation comments.

Documentation Comments (C#)

We use the xml documentation convention by Microsoft

In short: You can use the following tags structures in your documentation comment to specify properties of the following code:

- `<summary>Your code summary</summary>`
- `<param name="str">Describe parameter.</param>` : Usage may also be nested within summary
- `<code>Use a codeblock within</code>`
- `<example>Put a example here</example>`

There are plenty more tags. You can even reference other doc segments.
If you need other tags, take a look here

Doxygen (C/C++)

For Arduino and C++ code, we use Doxygen style comments:

- `/// Brief description`
- `/** Detailed description */`
- `@param name Description of parameter`
- `@return Description of return value`
- `@code ... @endcode` for code blocks
- `@example ...` for examples

More tags: Doxygen documentation

TypeDoc (TypeScript)

For TypeScript, we use TypeDoc style comments:

- `/** Summary of the function or class */`
- `@param name Description of parameter`
- `@returns Description of return value`
- `@example Example usage`
- `@see Reference to related code or docs`

More tags: TypeDoc tags

3.1.6 Usings and Namespaces

- Sorting: Sort usings alphabetically and group by system namespace.
- Removing: Remove unused usings.
- Namespace: A file should contain a single namespace.

3.1.7 Error Handling

- Exceptions: Always catch specific exceptions when possible.

3.1.8 Unit Tests

Every method should be unit testable and have a unit test for it.

3.1.9 Commit Messages

How should my commit messages look like?

Our repo follows the Conventional Commits guidelines.

Allowed commit types are specified as following:

- feat -> Introduces a new features
- fix -> Fixes a bug
- docs -> Updates on the docs
- chore -> Updates a grunt task; no-production code change
- style -> Formatting code style (missing semicolon, prettier execution, etc)
- refactor -> Refactoring existing code e.g. renaming a variable, reworking a function
- ci -> CI Tasks e.g. adding a hook
- test -> Adding new tests, refactoring tests, deleting old tests
- revert -> Revert old commits
- perf -> Performance related refactoring, without functional changes

3.1.10 Branch Naming

Your branche names should follow this style:

[commit-type]/[topic-of-branch-seperated-by-hyphen]

F.e. if you want to introduce a new cool type of button your branch should have the name:

feat/cool-new-button

August 31, 2025

DianaTin23, deadmade, deadmade

3.2 Testing Strategy

3.2.1 Overview

IsoPrüfi uses a multi-layered testing approach across all components to ensure reliability and quality.

3.2.2 Test Types

Unit Tests

- **Backend**: NUnit framework with FluentAssertions and Moq for mocking
- **Arduino**: Unity framework for embedded testing on native platform
- **Frontend**: Not currently implemented

Integration Tests

- **Backend**: Full API testing with real database connections
- **Load Tests**: Performance testing with realistic data loads

3.2.3 Running Tests

Backend Tests

```
cd isopruefi-backend
dotnet test UnitTests/UnitTests.csproj
dotnet test IntegrationTests/IntegrationTests.csproj
dotnet test LoadTests/LoadTests.csproj
```

Arduino Tests

```
cd isopruefi-arduino
pio test -e native
```

3.2.4 CI/CD Testing

All tests run automatically on GitHub Actions:
- Unit tests on every push
- Integration tests on pull requests
- Docker build tests for deployment verification

September 3, 2025

deadmade

3.3 API Reference

3.3.1 Interactive API Documentation

The IsoPrüfi REST API provides endpoints for managing temperature data, sensors, and system health monitoring. Explore the interactive API documentation below to test endpoints directly.

3.3.2 Overview

Base URL:
- Development: `https://backend.localhost`
- Production: `https://aicon.dhbw-heidenheim.de:5001/backend`

API Version: v1

3.3.3 Authentication

The API uses JWT Bearer token authentication for protected endpoints.

Getting Started

1. **Login** using `/v1/Authentication/Login` to get your access token
2. **Add token** to requests using the `Authorization: Bearer <token>` header
3. **Refresh tokens** using `/v1/Authentication/Refresh` when they expire

3.3.4 Key Features

Temperature Data Management

- **Real-time data retrieval** from multiple sensor sources
- **Time-range filtering** with ISO 8601 timestamps
- **Unit conversion** between Celsius and Fahrenheit
- **Data quality validation** with plausibility checks

Sensor Configuration

- **MQTT topic management** for sensor integration
- **Location-based sensor mapping** (North, South, East, West)
- **Dynamic sensor registration** and configuration

User Management

- **Role-based access control** (Admin/User roles)
- **Password management** and user registration
- **JWT token refresh** for seamless authentication

Location Services

- **Postal code management** for weather data integration
- **Geographic coordinate mapping**
- **External weather service integration**

3.3.5 Error Handling

The API uses standard HTTP status codes and returns detailed error information:

```
{
  "type": "https://tools.ietf.org/html/rfc7231#section-6.5.1",
  "title": "Bad Request",
  "status": 400,
  "detail": "Start time must be before end time",
  "instance": "/api/v1/TemperatureData/GetTemperature"
}
```

September 2, 2025

deadmade

3.4 API V1

September 2, 2025

deadmade

3.5 Troubleshooting Guide

3.5.1 Common Setup Issues

Docker Container Problems

CONTAINERS WON'T START

Problem: `docker compose up` fails or containers exit immediately

Solutions:
- Check Docker daemon is running: `docker info`
- Clear Docker cache: `docker system prune -a`
- Check logs: `docker compose logs [service-name]`
- Ensure sufficient resources: Check Docker Desktop settings (minimum 4GB RAM recommended)

INFLUXDB CONNECTION ERRORS

Problem: Cannot connect to InfluxDB or token issues

Solutions:
1. Verify InfluxDB is running: `docker ps | grep influxdb`
2. Check InfluxDB logs: `docker compose logs influxdb3`
3. Recreate admin token:

```
docker exec -it influxdb influxdb3 create token --admin
```

4. Update `config.json` with new token in `isopruefi-docker/influx/explorer/config/`
5. Restart affected services: `docker compose restart`
6. Verify token permissions: Test with API call: `curl -H "Authorization: Token <paste-token-here>" http://localhost:8181/health`

TRAEFIK ROUTING ISSUES

Problem: `*.localhost` domains not accessible

Solutions:
- Verify Traefik dashboard: `https://traefik.localhost:8432`
- Check container labels in `docker-compose.yml`
- Clear browser cache/cookies for localhost domains
- Try different browser or incognito mode
- On Windows: Add entries to `C:\Windows\System32\drivers\etc\hosts`:

```
127.0.0.1 traefik.localhost
127.0.0.1 frontend.localhost
127.0.0.1 backend.localhost
127.0.0.1 grafana.localhost
127.0.0.1 explorer.localhost
```

- Check Traefik logs: `docker compose logs traefik`

DATABASE CONNECTION ISSUES

Problem: Services can't connect to PostgreSQL or InfluxDB

Solutions:
- Verify database containers are healthy: `docker compose ps`
- Check connection strings in environment files
- Test PostgreSQL connection:

```
docker exec -it postgres psql -U Isopruefi -d Isopruefi
```

- Test InfluxDB connection:

```
curl -H "Authorization: Token <paste-token-here>" http://localhost:8181/health
```

- Check network connectivity: `docker network ls` and `docker network inspect [network-name]`

Arduino/PlatformIO Issues

PLATFORMIO BUILD FAILURES

Problem: Library dependencies not found or compilation errors

Solutions:
1. Clean and rebuild:

```
pio run -e mkrwifi1010 -t clean
pio lib update
pio run -e mkrwifi1010
```

2. Update PlatformIO: `pio upgrade`
3. Update platform/libraries: `pio pkg update`
4. Verify `platformio.ini` configuration
5. Check VS Code opened correct folder (`isopruefi-arduino/`)
6. Clear PlatformIO cache: `pio system prune`

SERIAL CONNECTION PROBLEMS

Problem: Cannot upload code or monitor serial output

Solutions:
- Check USB cable and connection (try different cable/port)
- Verify correct board selected in PlatformIO
- Close other applications using the serial port (Arduino IDE, other serial monitors)
- Reset board manually and try upload again
- Check device permissions (Linux/macOS): `sudo usermod -a -G dialout $USER` (logout/login required)
- Windows: Update/reinstall board drivers
- Try different baud rate: `pio device monitor --baud 115200`

MQTT CONNECTION FAILURES

Problem: Arduino can't connect to MQTT broker

Solutions:
- Verify WiFi credentials in `secrets.h`
- Check MQTT broker is accessible:

```
# Test MQTT broker connection
mosquitto_pub -h your-mqtt-broker -p 1883 -t test/topic -m "test message"
```

- Verify network connectivity from Arduino location
- Check MQTT topic/payload format matches backend expectations
- Enable serial debugging in Arduino code to see connection attempts
- Try different MQTT broker (for testing): `mqtt://test.mosquitto.org`

Development Environment

NPM/NODE.JS ISSUES

Problem: `npm install` fails or pre-commit hooks don't work

Solutions:
- Update Node.js to latest LTS version (18.x or 20.x recommended)
- Clear npm cache: `npm cache clean --force`
- Delete `node_modules/` and reinstall: `rm -rf node_modules package-lock.json && npm install`
- Check node/npm versions: `node --version && npm --version`
- Try yarn instead of npm: `yarn install`
- On Windows: Run as Administrator if permission issues persist
- Check proxy settings: `npm config get proxy` and `npm config get https-proxy`

.NET BUILD FAILURES

Problem: Backend won't compile or test failures

Solutions:
1. Verify .NET 9.0 SDK: `dotnet --version`
2. Restore packages: `dotnet restore`
3. Clear build cache: `dotnet clean && dotnet build`
4. Check database connection strings in `appsettings.json`
5. Verify user secrets are set:

```
dotnet user-secrets list --project isopruefi-backend/MQTT-Receiver-Worker
```

6. Update NuGet packages: `dotnet add package Microsoft.AspNetCore.App`

FRONTEND BUILD ISSUES

Problem: React/TypeScript compilation errors

Solutions:
- Clear Vite cache: `rm -rf node_modules/.vite`
- Update dependencies: `npm update`
- Check TypeScript configuration: Verify `tsconfig.json` settings
- Restart Vite dev server: `npm run dev`
- Check for TypeScript errors: `npm run type-check`

3.5.2 Performance Issues

High resource usage

Problem: Docker containers consuming too much CPU/RAM

Solutions:
- Monitor usage: `docker stats`
- Increase Docker resource limits in Docker Desktop settings
- Check for memory leaks in application logs
- Optimize database queries and indexing
- Consider limiting container resources:

```
deploy:
  resources:
    limits:
      memory: 512M
      cpus: '0.5'
```

Slow web interface

Problem: Frontend loading slowly or timeouts

Solutions:
- Check browser developer tools (Network tab for slow requests)
- Verify backend API response times: `docker compose logs isopruefi-backend-api-1`

- Clear browser cache and data for localhost domains
- Check for JavaScript errors in browser console
- Verify network connectivity between frontend and backend containers
- Test API endpoints directly: `curl -k https://backend.localhost/api/health`

Database performance issues

Problem: Slow queries or connection timeouts

Solutions:
- Monitor database logs: `docker compose logs postgres` or `docker compose logs influxdb3`
- Check database indexes and query optimization
- Verify sufficient database resources
- Consider connection pooling configuration
- Monitor disk space: `docker system df`

3.5.3 Data Issues

Missing sensor data

Problem: Temperature readings not appearing in the system

Solutions:
1. Check MQTT message flow:

```
# Check MQTT receiver logs
docker compose logs isopruefi-mqtt-receiver-1

# Test MQTT connection
mosquitto_sub -h your-mqtt-broker -t "isopruefi/+/temperature"
```

2. Verify InfluxDB data:
- Access InfluxDB Explorer: `https://explorer.localhost`
- Check database and bucket configuration
- Verify data retention policies
3. Check Arduino serial monitor for sensor readings and MQTT publish attempts
4. Verify SD card fallback is working (if offline)
5. Check sensor wiring and power supply
6. Validate MQTT message format matches backend expectations

Incorrect timestamps

Problem: Data shows wrong time or timezone issues

Solutions:
- Verify Arduino RTC module battery level
- Check system timezone settings on host machine
- Synchronize time (Linux/macOS): `sudo ntpdate -s time.nist.gov`
- Verify UTC handling in backend code
- Check Docker container timezone: `docker exec -it container_name date`
- Configure timezone in containers if needed:

```
environment:
  - TZ=Europe/Berlin
```

Data duplication

Problem: Duplicate sensor readings in database

Solutions:
- Check MQTT QoS settings and message deduplication
- Verify unique constraints in database schema
- Review SD card fallback and sync logic
- Check for network reconnection issues causing retransmission
- Implement idempotent writes in backend services

3.5.4 Production Environment Issues

Health check failures

Problem: Services failing health checks in production

Solutions:
- Check service logs: `docker compose logs [service-name]`
- Verify health check endpoints are accessible:

```
docker exec -it container_name curl localhost:8080/health
```

- Adjust health check intervals and timeouts if needed
- Check service dependencies are ready before health checks start
- Verify network connectivity between containers

SSL/TLS certificate issues

Problem: HTTPS certificates not working in production

Solutions:
- Check Traefik certificate configuration
- Verify domain name resolution
- Check certificate expiry: `openssl s_client -connect your-domain:443 -showcerts`
- Review Traefik logs for certificate acquisition errors
- Ensure proper DNS configuration for domain validation

Load balancer issues

Problem: Requests not properly distributed across service instances

Solutions:
- Verify Traefik configuration and service labels
- Check service discovery and registration
- Monitor load balancing metrics in Grafana
- Test individual service instances directly
- Review sticky session configuration if needed

3.5.5 Getting Help

Log Analysis Priority

Always check logs in this order:

```
# 1. Check overall container status
docker compose ps

# 2. Check specific service logs
docker compose logs [service-name] --tail=100 -f

# 3. Check application logs inside containers
docker exec -it [container-name] tail -f /var/log/app.log
```

```
# 4. Check system logs
journalctl -u docker (Linux)
```

Debug Information Checklist

When reporting issues, include:
- **Error messages** and complete stack traces
- **Environment info**: OS, Docker version, available resources
- **Docker version**: `docker --version && docker compose --version`
- **Container status**: `docker compose ps`
- **System resources**: `docker stats` output
- **Recent changes** to configuration files
- **Steps to reproduce** the problem consistently

Essential Debug Commands

```
# Container inspection
docker inspect [container-name]
docker compose config  # Validate compose file

# Network debugging
docker network ls
docker network inspect [network-name]

# Volume inspection
docker volume ls
docker volume inspect [volume-name]

# Resource monitoring
docker stats --no-stream
df -h  # Check disk space

# Service-specific debugging
curl -k https://service.localhost/health
netstat -tulpn | grep :PORT
```

Common Log Locations

- **Backend API**: `docker compose logs isopruefi-backend-api-1`
- **Frontend**: Browser developer console + `docker compose logs isopruefi-frontend-1`
- **Arduino**: PlatformIO serial monitor (`pio device monitor`)
- **MQTT**: `docker compose logs isopruefi-mqtt-receiver-1`
- **Databases**: `docker compose logs postgres` or `docker compose logs influxdb3`
- **System logs**:
- Linux: `journalctl -u docker`
- macOS: Console.app or `log show --predicate 'process == "Docker"'`
- Windows: Event Viewer (Application logs)

For additional help beyond this guide:
- Check the contributing guide for development workflow issues
- Review API documentation for backend integration problems
- Create an issue in the GitHub repository with debug information

September 2, 2025

deadmade

4. Code Documentation

4.1 Assembly Rest-API

4.1.1 Namespace Rest_API

- Program

4.1.2 Namespace Rest_API.Controllers

- AuthenticationController
- LocationController
- TemperatureDataController
- TopicController
- UserInfoController

4.1.3 Namespace Rest_API.Helper

- HealthCheck
- StringTools

4.1.4 Namespace Rest_API.Models

- ChangePassword
- JwtToken
- Login
- Register
- Roles
- SensorData
- TemperatureData
- TemperatureDataOverview

4.1.5 Namespace Rest_API.Seeder

- SeedUser

4.1.6 Namespace Rest_API.Services.Auth

- AuthenticationService
- IAuthenticationService

4.1.7 Namespace Rest_API.Services.Temp

- ITempService
- TempService

4.1.8 Namespace Rest_API.Services.Token

- ITokenService
- TokenService

4.1.9 Namespace Rest_API.Services.User

- IUserService
- UserService

September 4, 2025

4.2 Assembly MQTT-Receiver-Worker

4.2.1 Namespace MQTT_Receiver_Worker

- HealthCheck
- NullMetaListConverter
- Program
- Worker

4.2.2 Namespace MQTT_Receiver_Worker.MQTT

- Connection
- MqttHealthCheck
- Receiver

4.2.3 Namespace MQTT_Receiver_Worker.MQTT.Interfaces

- IConnection
- IReceiver

4.2.4 Namespace MQTT_Receiver_Worker.MQTT.Models

- TempSensorMeta
- TempSensorReading

September 4, 2025

4.3 Assembly MQTT-Sender

4.3.1 Namespace MQTT_Sender

- Connection

September 4, 2025

4.4 Assembly Database

4.4.1 Namespace Database.EntityFramework

- ApplicationDbContext

4.4.2 Namespace Database.EntityFramework.Enums

- SensorType

4.4.3 Namespace Database.EntityFramework.Models

- ApiUser
- CoordinateMapping
- TokenInfo
- TopicSetting

4.4.4 Namespace Database.Migrations

- RefactorMigrations

4.4.5 Namespace Database.Repository.CoordinateRepo

- CoordinateRepo
- ICoordinateRepo

4.4.6 Namespace Database.Repository.InfluxRepo

- IInfluxRepo
- InfluxRetryService

4.4.7 Namespace Database.Repository.InfluxRepo.Influx

- InfluxHealthCheck
- InfluxRepo

4.4.8 Namespace Database.Repository.InfluxRepo.InfluxCache

- CachedInfluxHealthCheck
- CachedInfluxRepo

4.4.9 Namespace Database.Repository.SettingsRepo

- ISettingsRepo
- SettingsRepo

4.4.10 Namespace Database.Repository.TokenRepo

- ITokenRepo
- TokenRepo

September 4, 2025

4.5 Assembly UnitTests

4.5.1 Namespace UnitTests.Controllers

- AuthenticationControllerTests
- LocationControllerTests
- TemperatureDataControllerTests
- TopicControllerTests
- UserInfoControllerTests

4.5.2 Namespace UnitTests.MqttReceiver

- ConnectionTests
- NullMetaListConverterTests
- ReceiverTests
- TempSensorReadingTests
- WorkerTests

4.5.3 Namespace UnitTests.Repositories

- InfluxRepoTests
- SettingsRepoTests

4.5.4 Namespace UnitTests.Services

- AuthenticationServiceTests
- TempServiceTests
- TokenServiceTests
- UserServiceTests

September 4, 2025

4.6 Assembly IntegrationTests

4.6.1 Namespace IntegrationTests

- HealthCheckIntegrationTests
- SimpleAuthTest
- StartupIntegrationTests

4.6.2 Namespace IntegrationTests.ApiClient

- ApiException
- ApiException<TResult>
- ApiUser
- AuthenticationClient
- ChangePassword
- CoordinateMapping
- FileResponse
- IdentityUser
- IdentityUserOfString
- JwtToken
- LocationClient
- Login
- ProblemDetails
- Register
- SensorData
- SensorType
- TemperatureData
- TemperatureDataClient
- TemperatureDataOverview
- TopicClient
- TopicSetting
- UserInfoClient

4.6.3 Namespace IntegrationTests.Controllers

- AuthenticationControllerIntegrationTests
- LocationControllerIntegrationTests
- TemperatureDataControllerIntegrationTests
- TopicControllerIntegrationTests
- UserInfoControllerIntegrationTests

4.6.4 Namespace IntegrationTests.Infrastructure

- ApiClientTestBase

- IntegrationTestBase

4.6.5 Namespace IntegrationTests.WeatherWorker

- WeatherWorkerIntegrationTests

September 4, 2025

4.7 Assembly LoadTests

4.7.1 Namespace IntegrationTests.ApiClient

- ApiException
- ApiException<TResult>
- ApiUser
- AuthenticationClient
- ChangePassword
- CoordinateMapping
- FileResponse
- IdentityUser
- IdentityUserOfString
- JwtToken
- LocationClient
- Login
- ProblemDetails
- Register
- SensorData
- SensorType
- TemperatureData
- TemperatureDataClient
- TemperatureDataOverview
- TopicClient
- TopicSetting
- UserInfoClient

4.7.2 Namespace LoadTests.Infrastructure

- AuthHelper
- LoadTestBase
- TokenResponse

4.7.3 Namespace LoadTests.Seeder

- InfluxSeeder
- SensorSeeder

4.7.4 Namespace LoadTests.Tests

- BasicInfrastructureTest
- MqttSensorLoadTest
- RestApiLoadTest

September 4, 2025

4.8 Contents pages

- Global contents
- Structures
- Files
- Modules
- Directories

4.9 Index pages

- Global index
- Structures
- Files
- Modules
- Directories

September 4, 2025

4.10 Frontend

isopruefi-frontend v1.0.0

4.10.1 isopruefi-frontend v1.0.0

Modules

- api/api-client
- api/clients
- App
- auth/AuthForm
- auth/SignIn
- auth/SignUp
- components/Navbar
- components/ProtectedRoute
- components/Weather
- main
- pages/AdminPage
- pages/UserPage
- pages/Welcome
- utils/authApi
- utils/config
- utils/tokenHelpers

September 4, 2025

4.10.2 Api

api-client

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client

API/API-CLIENT

Enumerations

- SensorType

Classes

- ApiException
- ApiUser
- AuthenticationClient
- ChangePassword
- CoordinateMapping
- IdentityUser
- IdentityUserOfString
- JwtToken
- LocationClient
- Login
- ProblemDetails
- Register
- SensorData
- TemperatureData
- TemperatureDataClient
- TemperatureDataOverview
- TopicClient
- TopicSetting
- UserInfoClient

Interfaces

- FileResponse
- IApiUser
- IChangePassword
- ICoordinateMapping
- IIdentityUser
- IIdentityUserOfString
- IJwtToken
- ILogin
- IProblemDetails
- IRegister
- ISensorData

- ITemperatureData
- ITemperatureDataOverview
- ITopicSetting

September 4, 2025

CLASSES

isopruefi-frontend v1.0.0

---

isopruefi-frontend / api/api-client / ApiException

Class: ApiException

Defined in: api/api-client.ts:1846

Extends

- `Error`

Constructors Constructor

> **new ApiException**(`message` , `status` , `response` , `headers` , `result`): `ApiException`

Defined in: api/api-client.ts:1853

Parameters message

`string`

status

`number`

response

`string`

headers result

`any`

Returns

`ApiException`

Overrides

`Error.constructor`

Properties headers

> **headers**: `object`

Defined in: api/api-client.ts:1850

Index Signature

[`key` : `string`]: `any`

---

isApiException

> `protected` **isApiException**: `boolean` = `true`

Defined in: api/api-client.ts:1863

---

message

> **message**: `string`

Defined in: api/api-client.ts:1847

Overrides

`Error.message`

---

response

> **response**: `string`

Defined in: api/api-client.ts:1849

---

result

> **result**: `any`

Defined in: api/api-client.ts:1851

---

status

> **status**: `number`

Defined in: api/api-client.ts:1848

Methods isApiException()

> `static` **isApiException**(`obj`): `obj is ApiException`

Defined in: api/api-client.ts:1865

Parameters obj

`any`

Returns

`obj is ApiException`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ApiUser

Class: ApiUser

Defined in: api/api-client.ts:1811

Represents an application user in the system

Extends

- `IdentityUser`

Implements

- `IApiUser`

Constructors Constructor

> **new ApiUser**(`data?`): `ApiUser`

Defined in: api/api-client.ts:1813

Parameters data?

`IApiUser`

Returns

`ApiUser`

Overrides

`IdentityUser` . `constructor`

Properties accessFailedCount?

> `optional` **accessFailedCount**: `number`

Defined in: api/api-client.ts:1688

Gets or sets the number of failed login attempts for the current user.

Implementation of

`IApiUser` . `accessFailedCount`

Inherited from

`IdentityUser` . `accessFailedCount`

---

concurrencyStamp?

> `optional` **concurrencyStamp**: `string`

Defined in: api/api-client.ts:1676

A random value that must change whenever a user is persisted to the store

Implementation of

`IApiUser` . `concurrencyStamp`

Inherited from

`IdentityUser` . `concurrencyStamp`

---

email?

> `optional` **email**: `string`

Defined in: api/api-client.ts:1666

Gets or sets the email address for this user.

Implementation of

`IApiUser` . `email`

Inherited from

`IdentityUser` . `email`

---

emailConfirmed?

> `optional` **emailConfirmed**: `boolean`

Defined in: api/api-client.ts:1670

Gets or sets a flag indicating if a user has confirmed their email address.

Implementation of

`IApiUser` . `emailConfirmed`

Inherited from

`IdentityUser` . `emailConfirmed`

---

id?

> `optional` **id**: `string`

Defined in: api/api-client.ts:1660

Gets or sets the primary key for this user.

Implementation of

`IApiUser` . `id`

Inherited from

`IdentityUser` . `id`

---

lockoutEnabled?

> `optional` **lockoutEnabled**: `boolean`

Defined in: api/api-client.ts:1686

Gets or sets a flag indicating if the user could be locked out.

Implementation of

`IApiUser` . `lockoutEnabled`

Inherited from

`IdentityUser`.`lockoutEnabled`

---

lockoutEnd?

> `optional` **lockoutEnd**: `Date`

Defined in: api/api-client.ts:1684

Gets or sets the date and time, in UTC, when any user lockout ends.

Implementation of

`IApiUser`.`lockoutEnd`

Inherited from

`IdentityUser`.`lockoutEnd`

---

normalizedEmail?

> `optional` **normalizedEmail**: `string`

Defined in: api/api-client.ts:1668

Gets or sets the normalized email address for this user.

Implementation of

`IApiUser`.`normalizedEmail`

Inherited from

`IdentityUser`.`normalizedEmail`

---

normalizedUserName?

> `optional` **normalizedUserName**: `string`

Defined in: api/api-client.ts:1664

Gets or sets the normalized user name for this user.

Implementation of

`IApiUser`.`normalizedUserName`

Inherited from

`IdentityUser`.`normalizedUserName`

---

passwordHash?

> `optional` **passwordHash**: `string`

Defined in: api/api-client.ts:1672

Gets or sets a salted and hashed representation of the password for this user.

Implementation of

`IApiUser` . `passwordHash`

Inherited from

`IdentityUser` . `passwordHash`

---

phoneNumber?

> `optional` **phoneNumber**: `string`

Defined in: api/api-client.ts:1678

Gets or sets a telephone number for the user.

Implementation of

`IApiUser` . `phoneNumber`

Inherited from

`IdentityUser` . `phoneNumber`

---

phoneNumberConfirmed?

> `optional` **phoneNumberConfirmed**: `boolean`

Defined in: api/api-client.ts:1680

Gets or sets a flag indicating if a user has confirmed their telephone address.

Implementation of

`IApiUser` . `phoneNumberConfirmed`

Inherited from

`IdentityUser` . `phoneNumberConfirmed`

---

securityStamp?

> `optional` **securityStamp**: `string`

Defined in: api/api-client.ts:1674

A random value that must change whenever a users credentials change (password changed, login removed)

Implementation of

`IApiUser` . `securityStamp`

Inherited from

`IdentityUser` . `securityStamp`

---

twoFactorEnabled?

> `optional` **twoFactorEnabled**: `boolean`

Defined in: api/api-client.ts:1682

Gets or sets a flag indicating if two factor authentication is enabled for this user.

Implementation of

`IApiUser.twoFactorEnabled`

Inherited from

`IdentityUser.twoFactorEnabled`

---

userName?

> `optional` **userName**: `string`

Defined in: api/api-client.ts:1662

Gets or sets the user name for this user.

Implementation of

`IApiUser.userName`

Inherited from

`IdentityUser.userName`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1817

Parameters _data?

`any`

Returns

`void`

Overrides

`IdentityUser.init`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1828

Parameters data?

`any`

Returns

`any`

Overrides

`IdentityUser.toJSON`

---

fromJS()

> `static` **fromJS**(`data`): `ApiUser`

Defined in: api/api-client.ts:1821

Parameters data

`any`

Returns

`ApiUser`

Overrides

`IdentityUser.fromJS`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / AuthenticationClient

Class: AuthenticationClient

Defined in: api/api-client.ts:10

Constructors Constructor

> **new AuthenticationClient**(`baseUrl?`, `http?`): `AuthenticationClient`

Defined in: api/api-client.ts:15

Parameters baseUrl?

`string`

http? fetch Returns

`AuthenticationClient`

Properties jsonParseReviver

> `protected` **jsonParseReviver**: `undefined` | (`key`, `value`) => `any` = `undefined`

Defined in: api/api-client.ts:13

Methods login()

> **login**(`input`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:25

Authenticates a user and returns a JWT token for API access.

Parameters input

`Login`

The login credentials containing username and password.

Returns

`Promise` \< `FileResponse` >

Authentication successful. Returns JWT access token and refresh token.

---

processLogin()

> `protected` **processLogin**(`response`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:45

Parameters response

`Response`

Returns

`Promise` \< `FileResponse` >

processRefresh()

> `protected` **processRefresh**(`response`): `Promise` \< `void` >

Defined in: api/api-client.ts:155

Parameters response

`Response`

Returns

`Promise` \< `void` >

---

processRegister()

> `protected` **processRegister**(`response`): `Promise` \< `void` >

Defined in: api/api-client.ts:91

Parameters response

`Response`

Returns

`Promise` \< `void` >

---

refresh()

> **refresh**(`token`): `Promise` \< `void` >

Defined in: api/api-client.ts:136

Refreshes an expired JWT access token using a valid refresh token.

Parameters token

`JwtToken`

The JWT token object containing both the expired access token and valid refresh token.

Returns

`Promise` \< `void` >

Token refresh successful. Returns new access and refresh tokens.

---

register()

> **register**(`input`): `Promise` \< `void` >

Defined in: api/api-client.ts:72

Registers a new user in the system. Admin access required.

Parameters input

`Register`

The registration data containing username and password for the new user.

Returns

`Promise` \< `void` >

User registered successfully.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ChangePassword

Class: ChangePassword

Defined in: api/api-client.ts:1600

Represents a request to change a user's password.

Implements

- `IChangePassword`

Constructors Constructor

> **new ChangePassword**(`data?`): `ChangePassword`

Defined in: api/api-client.ts:1611

Parameters data?

`IChangePassword`

Returns

`ChangePassword`

Properties currentPassword?

> `optional` **currentPassword**: `string`

Defined in: api/api-client.ts:1606

Gets or sets the current password of the user.

Implementation of

`IChangePassword.currentPassword`

---

newPassword?

> `optional` **newPassword**: `string`

Defined in: api/api-client.ts:1609

Gets or sets the new password to be set for the user.

Implementation of

`IChangePassword.newPassword`

---

userId?

> `optional` **userId**: `string`

Defined in: api/api-client.ts:1603

Gets or sets the unique identifier of the user whose password is to be changed.

Implementation of

`IChangePassword.userId`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1620

Parameters _data?

`any`

Returns

`void`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1635

Parameters data?

`any`

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `ChangePassword`

Defined in: api/api-client.ts:1628

Parameters data

`any`

Returns

`ChangePassword`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / CoordinateMapping

Class: CoordinateMapping

Defined in: api/api-client.ts:1508

Stores geographic coordinates associated with postalcodes, including the time the mapping was used.

Implements

- `ICoordinateMapping`

Constructors Constructor

> **new CoordinateMapping**(`data?`): `CoordinateMapping`

Defined in: api/api-client.ts:1528

Parameters data?

`ICoordinateMapping`

Returns

`CoordinateMapping`

Properties lastUsed?

> `optional` **lastUsed**: `Date`

Defined in: api/api-client.ts:1523

Gets or sets the time the postalcode was last entered by the user.

Implementation of

`ICoordinateMapping` . `lastUsed`

---

latitude?

> `optional` **latitude**: `number`

Defined in: api/api-client.ts:1517

Gets or sets the latitude for the location.

Implementation of

`ICoordinateMapping` . `latitude`

---

location?

> `optional` **location**: `string`

Defined in: api/api-client.ts:1514

Gets or sets the name of the location.

Implementation of

`ICoordinateMapping` . `location`

lockedUntil?

> optional **lockedUntil**: Date

Defined in: api/api-client.ts:1526

Gets or sets the time until which the entry is locked.

Implementation of

ICoordinateMapping.lockedUntil

---

longitude?

> optional **longitude**: number

Defined in: api/api-client.ts:1520

Gets or sets the longitude of the location.

Implementation of

ICoordinateMapping.longitude

---

postalCode?

> optional **postalCode**: number

Defined in: api/api-client.ts:1511

Gets or sets the postalcode which is also the uniqe identifier.

Implementation of

ICoordinateMapping.postalCode

Methods init()

> **init**(_data?): void

Defined in: api/api-client.ts:1537

Parameters _data?

any

Returns

void

---

toJSON()

> **toJSON**(data?): any

Defined in: api/api-client.ts:1555

Parameters data?

any

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `CoordinateMapping`

Defined in: api/api-client.ts:1548

Parameters data

`any`

Returns

`CoordinateMapping`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IdentityUser

Class: IdentityUser

Defined in: api/api-client.ts:1782

The default implementation of IdentityUser`1 which uses a string as a primary key.

Extends

- `IdentityUserOfString`

Extended by

- `ApiUser`

Implements

- `IIdentityUser`

Constructors Constructor

> **new IdentityUser**(`data?`): `IdentityUser`

Defined in: api/api-client.ts:1784

Parameters data?

`IIdentityUser`

Returns

`IdentityUser`

Overrides

`IdentityUserOfString` . `constructor`

Properties accessFailedCount?

> `optional` **accessFailedCount**: `number`

Defined in: api/api-client.ts:1688

Gets or sets the number of failed login attempts for the current user.

Implementation of

`IIdentityUser` . `accessFailedCount`

Inherited from

`IdentityUserOfString` . `accessFailedCount`

---

concurrencyStamp?

> `optional` **concurrencyStamp**: `string`

Defined in: api/api-client.ts:1676

A random value that must change whenever a user is persisted to the store

Implementation of

`IIdentityUser` . `concurrencyStamp`

Inherited from

`IdentityUserOfString` . `concurrencyStamp`

---

email?

> `optional` **email**: `string`

Defined in: api/api-client.ts:1666

Gets or sets the email address for this user.

Implementation of

`IIdentityUser` . `email`

Inherited from

`IdentityUserOfString` . `email`

---

emailConfirmed?

> `optional` **emailConfirmed**: `boolean`

Defined in: api/api-client.ts:1670

Gets or sets a flag indicating if a user has confirmed their email address.

Implementation of

`IIdentityUser` . `emailConfirmed`

Inherited from

`IdentityUserOfString` . `emailConfirmed`

---

id?

> `optional` **id**: `string`

Defined in: api/api-client.ts:1660

Gets or sets the primary key for this user.

Implementation of

`IIdentityUser` . `id`

Inherited from

`IdentityUserOfString` . `id`

---

lockoutEnabled?

> `optional` **lockoutEnabled**: `boolean`

Defined in: api/api-client.ts:1686

Gets or sets a flag indicating if the user could be locked out.

Implementation of

`IIdentityUser`.`lockoutEnabled`

Inherited from

`IdentityUserOfString`.`lockoutEnabled`

---

lockoutEnd?

> `optional` **lockoutEnd**: `Date`

Defined in: api/api-client.ts:1684

Gets or sets the date and time, in UTC, when any user lockout ends.

Implementation of

`IIdentityUser`.`lockoutEnd`

Inherited from

`IdentityUserOfString`.`lockoutEnd`

---

normalizedEmail?

> `optional` **normalizedEmail**: `string`

Defined in: api/api-client.ts:1668

Gets or sets the normalized email address for this user.

Implementation of

`IIdentityUser`.`normalizedEmail`

Inherited from

`IdentityUserOfString`.`normalizedEmail`

---

normalizedUserName?

> `optional` **normalizedUserName**: `string`

Defined in: api/api-client.ts:1664

Gets or sets the normalized user name for this user.

Implementation of

`IIdentityUser`.`normalizedUserName`

Inherited from

`IdentityUserOfString`.`normalizedUserName`

---

passwordHash?

> `optional` **passwordHash**: `string`

Defined in: api/api-client.ts:1672

Gets or sets a salted and hashed representation of the password for this user.

Implementation of

`IIdentityUser`.`passwordHash`

Inherited from

`IdentityUserOfString`.`passwordHash`

---

phoneNumber?

> `optional` **phoneNumber**: `string`

Defined in: api/api-client.ts:1678

Gets or sets a telephone number for the user.

Implementation of

`IIdentityUser`.`phoneNumber`

Inherited from

`IdentityUserOfString`.`phoneNumber`

---

phoneNumberConfirmed?

> `optional` **phoneNumberConfirmed**: `boolean`

Defined in: api/api-client.ts:1680

Gets or sets a flag indicating if a user has confirmed their telephone address.

Implementation of

`IIdentityUser`.`phoneNumberConfirmed`

Inherited from

`IdentityUserOfString`.`phoneNumberConfirmed`

---

securityStamp?

> `optional` **securityStamp**: `string`

Defined in: api/api-client.ts:1674

A random value that must change whenever a users credentials change (password changed, login removed)

Implementation of

`IIdentityUser`.`securityStamp`

Inherited from

`IdentityUserOfString`.`securityStamp`

---

twoFactorEnabled?

> `optional` **twoFactorEnabled**: `boolean`

Defined in: api/api-client.ts:1682

Gets or sets a flag indicating if two factor authentication is enabled for this user.

Implementation of

`IIdentityUser.twoFactorEnabled`

Inherited from

`IdentityUserOfString.twoFactorEnabled`

---

userName?

> `optional` **userName**: `string`

Defined in: api/api-client.ts:1662

Gets or sets the user name for this user.

Implementation of

`IIdentityUser.userName`

Inherited from

`IdentityUserOfString.userName`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1788

Parameters _data?

`any`

Returns

`void`

Overrides

`IdentityUserOfString.init`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1799

Parameters data?

`any`

Returns

`any`

Overrides

`IdentityUserOfString.toJSON`

---

fromJS()

> `static` **fromJS**(`data`): `IdentityUser`

Defined in: api/api-client.ts:1792

Parameters data

`any`

Returns

`IdentityUser`

Overrides

`IdentityUserOfString` . `fromJS`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IdentityUserOfString

Class: IdentityUserOfString

Defined in: api/api-client.ts:1658

Represents a user in the identity system

Extended by

- `IdentityUser`

Implements

- `IIdentityUserOfString`

Constructors Constructor

> **new IdentityUserOfString**(`data?`): `IdentityUserOfString`

Defined in: api/api-client.ts:1690

Parameters data?

`IIdentityUserOfString`

Returns

`IdentityUserOfString`

Properties accessFailedCount?

> `optional` **accessFailedCount**: `number`

Defined in: api/api-client.ts:1688

Gets or sets the number of failed login attempts for the current user.

Implementation of

`IIdentityUserOfString` . `accessFailedCount`

---

concurrencyStamp?

> `optional` **concurrencyStamp**: `string`

Defined in: api/api-client.ts:1676

A random value that must change whenever a user is persisted to the store

Implementation of

`IIdentityUserOfString` . `concurrencyStamp`

---

email?

> `optional` **email**: `string`

Defined in: api/api-client.ts:1666

Gets or sets the email address for this user.

Implementation of

`IIdentityUserOfString`.`email`

---

emailConfirmed?

> `optional` **emailConfirmed**: `boolean`

Defined in: api/api-client.ts:1670

Gets or sets a flag indicating if a user has confirmed their email address.

Implementation of

`IIdentityUserOfString`.`emailConfirmed`

---

id?

> `optional` **id**: `string`

Defined in: api/api-client.ts:1660

Gets or sets the primary key for this user.

Implementation of

`IIdentityUserOfString`.`id`

---

lockoutEnabled?

> `optional` **lockoutEnabled**: `boolean`

Defined in: api/api-client.ts:1686

Gets or sets a flag indicating if the user could be locked out.

Implementation of

`IIdentityUserOfString`.`lockoutEnabled`

---

lockoutEnd?

> `optional` **lockoutEnd**: `Date`

Defined in: api/api-client.ts:1684

Gets or sets the date and time, in UTC, when any user lockout ends.

Implementation of

`IIdentityUserOfString`.`lockoutEnd`

---

normalizedEmail?

> `optional` **normalizedEmail**: `string`

Defined in: api/api-client.ts:1668

Gets or sets the normalized email address for this user.

Implementation of

`IIdentityUserOfString`.`normalizedEmail`

---

normalizedUserName?

> `optional` **normalizedUserName**: `string`

Defined in: api/api-client.ts:1664

Gets or sets the normalized user name for this user.

Implementation of

`IIdentityUserOfString`.`normalizedUserName`

---

passwordHash?

> `optional` **passwordHash**: `string`

Defined in: api/api-client.ts:1672

Gets or sets a salted and hashed representation of the password for this user.

Implementation of

`IIdentityUserOfString`.`passwordHash`

---

phoneNumber?

> `optional` **phoneNumber**: `string`

Defined in: api/api-client.ts:1678

Gets or sets a telephone number for the user.

Implementation of

`IIdentityUserOfString`.`phoneNumber`

---

phoneNumberConfirmed?

> `optional` **phoneNumberConfirmed**: `boolean`

Defined in: api/api-client.ts:1680

Gets or sets a flag indicating if a user has confirmed their telephone address.

Implementation of

`IIdentityUserOfString`.`phoneNumberConfirmed`

---

securityStamp?

> `optional` **securityStamp**: `string`

Defined in: api/api-client.ts:1674

A random value that must change whenever a users credentials change (password changed, login removed)

Implementation of

`IIdentityUserOfString`.`securityStamp`

---

twoFactorEnabled?

> `optional` **twoFactorEnabled**: `boolean`

Defined in: api/api-client.ts:1682

Gets or sets a flag indicating if two factor authentication is enabled for this user.

Implementation of

`IIdentityUserOfString`.`twoFactorEnabled`

---

userName?

> `optional` **userName**: `string`

Defined in: api/api-client.ts:1662

Gets or sets the user name for this user.

Implementation of

`IIdentityUserOfString`.`userName`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1699

Parameters _data?

`any`

Returns

`void`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1726

Parameters data?

`any`

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `IdentityUserOfString`

Defined in: api/api-client.ts:1719

Parameters data

`any`

Returns

`IdentityUserOfString`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / JwtToken

Class: JwtToken

Defined in: api/api-client.ts:1130

Represents a JWT token and its associated refresh token and metadata.

Implements

- `IJwtToken`

Constructors Constructor

> **new JwtToken**(`data?`): `JwtToken`

Defined in: api/api-client.ts:1147

Parameters data?

`IJwtToken`

Returns

`JwtToken`

Properties createdDate?

> `optional` **createdDate**: `Date`

Defined in: api/api-client.ts:1142

Gets or sets the creation date and time of the JWT token.

Implementation of

`IJwtToken` . `createdDate`

---

expiryDate?

> `optional` **expiryDate**: `Date`

Defined in: api/api-client.ts:1139

Gets or sets the expiry date and time of the JWT token.

Implementation of

`IJwtToken` . `expiryDate`

---

refreshToken?

> `optional` **refreshToken**: `string`

Defined in: api/api-client.ts:1136

Gets or sets the refresh token string.

Implementation of

`IJwtToken` . `refreshToken`

---

roles?

> optional **roles**: string []

Defined in: api/api-client.ts:1145

Gets or sets the user roles associated with the JWT token.

Implementation of

IJwtToken.roles

---

token?

> optional **token**: string

Defined in: api/api-client.ts:1133

Gets or sets the JWT access token string.

Implementation of

IJwtToken.token

Methods init()

> **init**(_data?): void

Defined in: api/api-client.ts:1156

Parameters _data?

any

Returns

void

---

toJSON()

> **toJSON**(data?): any

Defined in: api/api-client.ts:1177

Parameters data?

any

Returns

any

---

fromJS()

> static **fromJS**(data): JwtToken

Defined in: api/api-client.ts:1170

Parameters data

any

Returns

`JwtToken`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / LocationClient

Class: LocationClient

Defined in: api/api-client.ts:189

Constructors Constructor

> **new LocationClient**(`baseUrl?`, `http?`): `LocationClient`

Defined in: api/api-client.ts:194

Parameters baseUrl?

`string`

http? fetch Returns

`LocationClient`

Properties jsonParseReviver

> `protected` **jsonParseReviver**: `undefined` | (`key`, `value`) => `any` = `undefined`

Defined in: api/api-client.ts:192

Methods getAllPostalcodes()

> **getAllPostalcodes**(): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:203

Retrieves all saved locations.

Returns

`Promise` \< `FileResponse` >

A list of all postalcodes; otherwise, NotFound.

---

insertLocation()

> **insertLocation**(`postalcode?`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:246

Checks for existence of location and if necessary inserts new location.

Parameters postalcode?

`number`

(optional) Defines the location.

Returns

`Promise` \< `FileResponse` >

Ok if successful; otherwise, an error response.

---

processGetAllPostalcodes()

> `protected` **processGetAllPostalcodes**(`response`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:219

Parameters response

`Response`

Returns

`Promise` \< `FileResponse` >

---

processInsertLocation()

> `protected` **processInsertLocation**(`response`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:266

Parameters response

`Response`

Returns

`Promise` \< `FileResponse` >

---

processRemovePostalcode()

> `protected` **processRemovePostalcode**(`response`): `Promise` \< `void` >

Defined in: api/api-client.ts:312

Parameters response

`Response`

Returns

`Promise` \< `void` >

---

removePostalcode()

> **removePostalcode**(`postalCode?`): `Promise` \< `void` >

Defined in: api/api-client.ts:293

Deletes location from the database.

Parameters postalCode?

`number`

(optional) Postalcode

Returns

`Promise` \< `void` >

Ok if successful; otherwise, an error response.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / Login

Class: Login

Defined in: api/api-client.ts:966

Represents the login credentials for a user.

Implements

- `ILogin`

Constructors Constructor

> **new Login**(`data?`): `Login`

Defined in: api/api-client.ts:974

Parameters data?

`ILogin`

Returns

`Login`

Properties password

> **password**: `string`

Defined in: api/api-client.ts:972

Gets or sets the password of the user.

Implementation of

`ILogin.password`

---

userName

> **userName**: `string`

Defined in: api/api-client.ts:969

Gets or sets the username of the user.

Implementation of

`ILogin.userName`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:983

Parameters _data?

`any`

Returns

`void`

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:997

Parameters data?

`any`

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `Login`

Defined in: api/api-client.ts:990

Parameters data

`any`

Returns

`Login`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ProblemDetails

Class: ProblemDetails

Defined in: api/api-client.ts:1015

Implements

- `IProblemDetails`

Indexable

[`key` : `string`]: `any`

Constructors Constructor

> **new ProblemDetails**(`data?`): `ProblemDetails`

Defined in: api/api-client.ts:1024

Parameters data?

`IProblemDetails`

Returns

`ProblemDetails`

Properties detail?

> `optional` **detail**: `string`

Defined in: api/api-client.ts:1019

Implementation of

`IProblemDetails.detail`

---

instance?

> `optional` **instance**: `string`

Defined in: api/api-client.ts:1020

Implementation of

`IProblemDetails.instance`

---

status?

> `optional` **status**: `number`

Defined in: api/api-client.ts:1018

Implementation of

`IProblemDetails.status`

---

title?

> `optional` **title**: `string`

Defined in: api/api-client.ts:1017

Implementation of

`IProblemDetails.title`

---

type?

> `optional` **type**: `string`

Defined in: api/api-client.ts:1016

Implementation of

`IProblemDetails.type`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1033

Parameters _data?

`any`

Returns

`void`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1054

Parameters data?

`any`

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `ProblemDetails`

Defined in: api/api-client.ts:1047

Parameters data

`any`

Returns

`ProblemDetails`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / Register

Class: Register

Defined in: api/api-client.ts:1080

Represents the registration credentials for a new user.

Implements

- `IRegister`

Constructors Constructor

> **new Register**(`data?`): `Register`

Defined in: api/api-client.ts:1088

Parameters data?

`IRegister`

Returns

`Register`

Properties password

> **password**: `string`

Defined in: api/api-client.ts:1086

Gets or sets the password for the new user.

Implementation of

`IRegister` . `password`

---

userName

> **userName**: `string`

Defined in: api/api-client.ts:1083

Gets or sets the username for the new user.

Implementation of

`IRegister` . `userName`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1097

Parameters _data?

`any`

Returns

`void`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1111

Parameters data?

`any`

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `Register`

Defined in: api/api-client.ts:1104

Parameters data

`any`

Returns

`Register`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / SensorData

Class: SensorData

Defined in: api/api-client.ts:1278

Represents an overview of sensor data.

Implements

- `ISensorData`

Constructors Constructor

> **new SensorData**(`data?`): `SensorData`

Defined in: api/api-client.ts:1289

Parameters data?

`ISensorData`

Returns

`SensorData`

Properties location?

> `optional` **location**: `string`

Defined in: api/api-client.ts:1284

Gets or sets the location of the sensor.

Implementation of

`ISensorData.location`

---

sensorName?

> `optional` **sensorName**: `string`

Defined in: api/api-client.ts:1281

Gets or sets the name of the sensor.

Implementation of

`ISensorData.sensorName`

---

temperatureDatas?

> `optional` **temperatureDatas**: `TemperatureData[]`

Defined in: api/api-client.ts:1287

Gets or sets the temperature data of the sensor.

Implementation of

`ISensorData.temperatureDatas`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1298

Parameters _data?

`any`

Returns

`void`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1317

Parameters data?

`any`

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `SensorData`

Defined in: api/api-client.ts:1310

Parameters data

`any`

Returns

`SensorData`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / TemperatureData

Class: TemperatureData

Defined in: api/api-client.ts:1344

Represents a single temperature data point with timestamp and value.

Implements

- `ITemperatureData`

Constructors Constructor

> **new TemperatureData**(`data?`): `TemperatureData`

Defined in: api/api-client.ts:1355

Parameters data?

`ITemperatureData`

Returns

`TemperatureData`

Properties plausibility?

> `optional` **plausibility**: `string`

Defined in: api/api-client.ts:1353

Gets or sets the plausibility of the temperature data.

Implementation of

`ITemperatureData`.`plausibility`

---

temperature?

> `optional` **temperature**: `number`

Defined in: api/api-client.ts:1350

Gets or sets the temperature value.

Implementation of

`ITemperatureData`.`temperature`

---

timestamp?

> `optional` **timestamp**: `Date`

Defined in: api/api-client.ts:1347

Gets or sets the timestamp of the temperature measurement.

Implementation of

`ITemperatureData`.`timestamp`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1364

Parameters _data?

`any`

Returns

`void`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1379

Parameters data?

`any`

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `TemperatureData`

Defined in: api/api-client.ts:1372

Parameters data

`any`

Returns

`TemperatureData`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / TemperatureDataClient

Class: TemperatureDataClient

Defined in: api/api-client.ts:328

Constructors Constructor

> **new TemperatureDataClient**(`baseUrl?` , `http?`): `TemperatureDataClient`

Defined in: api/api-client.ts:333

Parameters baseUrl?

`string`

http? fetch Returns

`TemperatureDataClient`

Properties jsonParseReviver

> `protected` **jsonParseReviver**: `undefined` | (`key` , `value`) => `any` = `undefined`

Defined in: api/api-client.ts:331

Methods getTemperature()

> **getTemperature**(`start?` , `end?` , `place?` , `isFahrenheit?`): `Promise` \< `TemperatureDataOverview` >

Defined in: api/api-client.ts:346

Retrieves comprehensive temperature data for a specified time range and location.

Parameters start?

`Date`

(optional) Start date and time for the data range (ISO 8601 format).

end?

`Date`

(optional) End date and time for the data range (ISO 8601 format).

place?

`string`

(optional) Location name for external weather data (e.g., "Berlin", "Munich").

isFahrenheit?

`boolean`

(optional) Optional. If true, converts all temperatures to Fahrenheit. Default is false (Celsius).

Returns

`Promise` \< `TemperatureDataOverview` >

Successfully retrieved temperature data. Returns comprehensive temperature overview.

processGetTemperature()

> `protected` **processGetTemperature**(`response`): `Promise` \< `TemperatureDataOverview` >

Defined in: api/api-client.ts:378

Parameters response

`Response`

Returns

`Promise` \< `TemperatureDataOverview` >

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / TemperatureDataOverview

Class: TemperatureDataOverview

Defined in: api/api-client.ts:1212

Represents an overview of temperature data for different locations.

Implements

- `ITemperatureDataOverview`

Constructors Constructor

> **new TemperatureDataOverview**(`data?`): `TemperatureDataOverview`

Defined in: api/api-client.ts:1220

Parameters data?

`ITemperatureDataOverview`

Returns

`TemperatureDataOverview`

Properties sensorData?

> `optional` **sensorData**: `SensorData` []

Defined in: api/api-client.ts:1215

Gets or sets the list of Sensor data for the inside temperature.

Implementation of

`ITemperatureDataOverview` . `sensorData`

---

temperatureOutside?

> `optional` **temperatureOutside**: `TemperatureData` []

Defined in: api/api-client.ts:1218

Gets or sets the list of temperature data for the outside location.

Implementation of

`ITemperatureDataOverview` . `temperatureOutside`

Methods init()

> **init**(`_data?`): `void`

Defined in: api/api-client.ts:1229

Parameters _data?

`any`

Returns

`void`

---

toJSON()

> **toJSON**(`data?`): `any`

Defined in: api/api-client.ts:1251

Parameters data?

`any`

Returns

`any`

---

fromJS()

> `static` **fromJS**(`data`): `TemperatureDataOverview`

Defined in: api/api-client.ts:1244

Parameters data

`any`

Returns

`TemperatureDataOverview`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / TopicClient

Class: TopicClient

Defined in: api/api-client.ts:422

Constructors Constructor

> **new TopicClient**(`baseUrl?` , `http?`): `TopicClient`

Defined in: api/api-client.ts:427

Parameters baseUrl?

`string`

http? fetch Returns

`TopicClient`

Properties jsonParseReviver

> `protected` **jsonParseReviver**: `undefined` | (`key` , `value`) => `any` = `undefined`

Defined in: api/api-client.ts:425

Methods createTopic()

> **createTopic**(`topicSetting`): `Promise` \< `any` >

Defined in: api/api-client.ts:563

Creates a new MQTT topic configuration for sensor monitoring.

Parameters topicSetting

`TopicSetting`

The complete topic setting configuration to create.

Returns

`Promise` \< `any` >

Topic setting created successfully. Returns the new topic ID.

---

deleteTopic()

> **deleteTopic**(`topicSetting`): `Promise` \< `any` >

Defined in: api/api-client.ts:701

Deletes an existing MQTT topic setting from the system.

Parameters topicSetting

`TopicSetting`

The topic setting object identifying the configuration to delete.

Returns

`Promise` \< `any` >

Successfully deleted the topic setting.

---

getAllSensorTypes()

> **getAllSensorTypes**(): `Promise` \< `string` []>

Defined in: api/api-client.ts:499

Retrieves all available sensor types from the system.

Returns

`Promise` \< `string` []>

Successfully retrieved the list of sensor types.

---

getAllTopics()

> **getAllTopics**(): `Promise` \< `TopicSetting` []>

Defined in: api/api-client.ts:436

Retrieves all configured MQTT topic settings from the system.

Returns

`Promise` \< `TopicSetting` []>

Successfully retrieved all topic settings.

---

processCreateTopic()

> `protected` **processCreateTopic**(`response`): `Promise` \< `any` >

Defined in: api/api-client.ts:583

Parameters response

`Response`

Returns

`Promise` \< `any` >

---

processDeleteTopic()

> `protected` **processDeleteTopic**(`response`): `Promise` \< `any` >

Defined in: api/api-client.ts:721

Parameters response

`Response`

Returns

`Promise` \< `any` >

---

processGetAllSensorTypes()

> `protected` **processGetAllSensorTypes**(`response`): `Promise` \< `string` []>

Defined in: api/api-client.ts:515

Parameters response

`Response`

Returns

`Promise` \< `string` []>

---

processGetAllTopics()

> `protected` **processGetAllTopics**(`response`): `Promise` \< `TopicSetting` []>

Defined in: api/api-client.ts:452

Parameters response

`Response`

Returns

`Promise` \< `TopicSetting` []>

---

processUpdateTopic()

> `protected` **processUpdateTopic**(`response`): `Promise` \< `any` >

Defined in: api/api-client.ts:652

Parameters response

`Response`

Returns

`Promise` \< `any` >

---

updateTopic()

> **updateTopic**(`topicSetting`): `Promise` \< `any` >

Defined in: api/api-client.ts:632

Updates an existing MQTT topic setting in the system.

Parameters topicSetting

`TopicSetting`

The topic setting object containing updated configuration.

Returns

`Promise` \< `any` >

Successfully updated the topic setting.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / TopicSetting

Class: TopicSetting

Defined in: api/api-client.ts:1402

Represents the settings for a specific MQTT topic, including default path, group, and sensor information.

Implements

- `ITopicSetting`

Constructors Constructor

> **new TopicSetting**(`data?`): `TopicSetting`

Defined in: api/api-client.ts:1431

Parameters data?

`ITopicSetting`

Returns

`TopicSetting`

Properties coordinateMapping?

> `optional` **coordinateMapping**: `CoordinateMapping`

Defined in: api/api-client.ts:1411

Navigation property for the related CoordinateMapping entity.

Implementation of

`ITopicSetting`.`coordinateMapping`

---

coordinateMappingId?

> `optional` **coordinateMappingId**: `number`

Defined in: api/api-client.ts:1408

Gets or sets the foreign key for the related CoordinateMapping entity.

Implementation of

`ITopicSetting`.`coordinateMappingId`

---

defaultTopicPath?

> `optional` **defaultTopicPath**: `string`

Defined in: api/api-client.ts:1414

Gets or sets the default MQTT topic path for this setting.

Implementation of

`ITopicSetting`.`defaultTopicPath`

groupId?

> optional **groupId**: number

Defined in: api/api-client.ts:1417

Gets or sets the group identifier associated with this topic setting.

Implementation of

`ITopicSetting.groupId`

---

hasRecovery?

> optional **hasRecovery**: boolean

Defined in: api/api-client.ts:1429

Gets or sets a value indicating whether this topic setting has recovery enabled.

Implementation of

`ITopicSetting.hasRecovery`

---

sensorLocation?

> optional **sensorLocation**: string

Defined in: api/api-client.ts:1426

Gets or sets the location of the sensor.

Implementation of

`ITopicSetting.sensorLocation`

---

sensorName?

> optional **sensorName**: string

Defined in: api/api-client.ts:1423

Gets or sets the name of the sensor.

Implementation of

`ITopicSetting.sensorName`

---

sensorTypeEnum?

> optional **sensorTypeEnum**: SensorType

Defined in: api/api-client.ts:1420

Gets or sets the type of sensor (e.g., temperature, humidity).

Implementation of

`ITopicSetting.sensorTypeEnum`

---

topicSettingId?

> optional **topicSettingId**: number

Defined in: api/api-client.ts:1405

Gets or sets the unique identifier for the TopicSetting entity.

Implementation of

ITopicSetting.topicSettingId

Methods init()

> **init**(_data?): void

Defined in: api/api-client.ts:1440

Parameters _data?

any

Returns

void

---

toJSON()

> **toJSON**(data?): any

Defined in: api/api-client.ts:1461

Parameters data?

any

Returns

any

---

fromJS()

> static **fromJS**(data): TopicSetting

Defined in: api/api-client.ts:1454

Parameters data

any

Returns

TopicSetting

September 4, 2025

isopruefi-frontend v1.0.0

---

isopruefi-frontend / api/api-client / UserInfoClient

Class: UserInfoClient

Defined in: api/api-client.ts:766

Constructors Constructor

> **new UserInfoClient**(`baseUrl?`, `http?`): `UserInfoClient`

Defined in: api/api-client.ts:771

Parameters baseUrl?

`string`

http? fetch Returns

`UserInfoClient`

Properties jsonParseReviver

> `protected` **jsonParseReviver**: `undefined` | (`key`, `value`) => `any` = `undefined`

Defined in: api/api-client.ts:769

Methods changePassword()

> **changePassword**(`input`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:828

Changes the password for a user.

Parameters input

`ChangePassword`

The change password request containing user ID, current password, and new password.

Returns

`Promise` \< `FileResponse` >

Ok if successful; otherwise, an error response.

---

changeUser()

> **changeUser**(`user`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:875

Updates user information.

Parameters user

`ApiUser`

The user object with updated information.

Returns

`Promise` \< `FileResponse` >

Ok if successful; otherwise, an error response.

---

deleteUser()

> **deleteUser**(`userId?`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:922

Deletes a user by their unique identifier.

Parameters userId?

`string`

(optional) The unique identifier of the user to delete.

Returns

`Promise` \< `FileResponse` >

Ok if successful; otherwise, an error response.

---

getUserById()

> **getUserById**(`userId?`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:781

Retrieves a user by their unique identifier.

Parameters userId?

`string`

(optional) The unique identifier of the user.

Returns

`Promise` \< `FileResponse` >

The user information if found; otherwise, NotFound.

---

processChangePassword()

> `protected` **processChangePassword**(`response`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:848

Parameters response

`Response`

Returns

`Promise` \< `FileResponse` >

---

processChangeUser()

> `protected` **processChangeUser**(`response`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:895

Parameters response

`Response`

Returns

`Promise` \< `FileResponse` >

---

processDeleteUser()

> `protected` **processDeleteUser**(`response`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:942

Parameters response

`Response`

Returns

`Promise` \< `FileResponse` >

---

processGetUserById()

> `protected` **processGetUserById**(`response`): `Promise` \< `FileResponse` >

Defined in: api/api-client.ts:801

Parameters response

`Response`

Returns

`Promise` \< `FileResponse` >

September 4, 2025

ENUMERATIONS

isopruefi-frontend v1.0.0

---

isopruefi-frontend / api/api-client / SensorType

Enumeration: SensorType

Defined in: api/api-client.ts:1590

Represents the different types of sensors available in the system.

Enumeration Members Co2

> **Co2**: `4`

Defined in: api/api-client.ts:1595

Hum

> **Hum**: `2`

Defined in: api/api-client.ts:1593

Ikea

> **Ikea**: `3`

Defined in: api/api-client.ts:1594

Mic

> **Mic**: `5`

Defined in: api/api-client.ts:1596

Spl

> **Spl**: `1`

Defined in: api/api-client.ts:1592

Temp

> **Temp**: `0`

Defined in: api/api-client.ts:1591

September 4, 2025

INTERFACES

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / FileResponse

Interface: FileResponse

Defined in: api/api-client.ts:1839

Properties data

> **data**: `Blob`

Defined in: api/api-client.ts:1840

---

fileName?

> `optional` **fileName**: `string`

Defined in: api/api-client.ts:1842

---

headers?

> `optional` **headers**: `object`

Defined in: api/api-client.ts:1843

Index Signature

[`name` : `string`]: `any`

---

status

> **status**: `number`

Defined in: api/api-client.ts:1841

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IApiUser

Interface: IApiUser

Defined in: api/api-client.ts:1836

Represents an application user in the system

Extends

- `IIdentityUser`

Properties accessFailedCount?

> `optional` **accessFailedCount**: `number`

Defined in: api/api-client.ts:1778

Gets or sets the number of failed login attempts for the current user.

Inherited from

`IIdentityUser`.`accessFailedCount`

---

concurrencyStamp?

> `optional` **concurrencyStamp**: `string`

Defined in: api/api-client.ts:1766

A random value that must change whenever a user is persisted to the store

Inherited from

`IIdentityUser`.`concurrencyStamp`

---

email?

> `optional` **email**: `string`

Defined in: api/api-client.ts:1756

Gets or sets the email address for this user.

Inherited from

`IIdentityUser`.`email`

---

emailConfirmed?

> `optional` **emailConfirmed**: `boolean`

Defined in: api/api-client.ts:1760

Gets or sets a flag indicating if a user has confirmed their email address.

Inherited from

`IIdentityUser`.`emailConfirmed`

id?

> optional **id**: string

Defined in: api/api-client.ts:1750

Gets or sets the primary key for this user.

Inherited from

IIdentityUser.id

---

lockoutEnabled?

> optional **lockoutEnabled**: boolean

Defined in: api/api-client.ts:1776

Gets or sets a flag indicating if the user could be locked out.

Inherited from

IIdentityUser.lockoutEnabled

---

lockoutEnd?

> optional **lockoutEnd**: Date

Defined in: api/api-client.ts:1774

Gets or sets the date and time, in UTC, when any user lockout ends.

Inherited from

IIdentityUser.lockoutEnd

---

normalizedEmail?

> optional **normalizedEmail**: string

Defined in: api/api-client.ts:1758

Gets or sets the normalized email address for this user.

Inherited from

IIdentityUser.normalizedEmail

---

normalizedUserName?

> optional **normalizedUserName**: string

Defined in: api/api-client.ts:1754

Gets or sets the normalized user name for this user.

Inherited from

IIdentityUser.normalizedUserName

---

passwordHash?

> `optional` **passwordHash**: `string`

Defined in: api/api-client.ts:1762

Gets or sets a salted and hashed representation of the password for this user.

Inherited from

`IIdentityUser`.`passwordHash`

---

phoneNumber?

> `optional` **phoneNumber**: `string`

Defined in: api/api-client.ts:1768

Gets or sets a telephone number for the user.

Inherited from

`IIdentityUser`.`phoneNumber`

---

phoneNumberConfirmed?

> `optional` **phoneNumberConfirmed**: `boolean`

Defined in: api/api-client.ts:1770

Gets or sets a flag indicating if a user has confirmed their telephone address.

Inherited from

`IIdentityUser`.`phoneNumberConfirmed`

---

securityStamp?

> `optional` **securityStamp**: `string`

Defined in: api/api-client.ts:1764

A random value that must change whenever a users credentials change (password changed, login removed)

Inherited from

`IIdentityUser`.`securityStamp`

---

twoFactorEnabled?

> `optional` **twoFactorEnabled**: `boolean`

Defined in: api/api-client.ts:1772

Gets or sets a flag indicating if two factor authentication is enabled for this user.

Inherited from

`IIdentityUser`.`twoFactorEnabled`

---

userName?

> `optional` **userName**: `string`

Defined in: api/api-client.ts:1752

Gets or sets the user name for this user.

Inherited from

`IIdentityUser`.`userName`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IChangePassword

Interface: IChangePassword

Defined in: api/api-client.ts:1645

Represents a request to change a user's password.

Properties currentPassword?

> `optional` **currentPassword**: `string`

Defined in: api/api-client.ts:1651

Gets or sets the current password of the user.

---

newPassword?

> `optional` **newPassword**: `string`

Defined in: api/api-client.ts:1654

Gets or sets the new password to be set for the user.

---

userId?

> `optional` **userId**: `string`

Defined in: api/api-client.ts:1648

Gets or sets the unique identifier of the user whose password is to be changed.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ICoordinateMapping

Interface: ICoordinateMapping

Defined in: api/api-client.ts:1568

Stores geographic coordinates associated with postalcodes, including the time the mapping was used.

Properties lastUsed?

> `optional` **lastUsed**: `Date`

Defined in: api/api-client.ts:1583

Gets or sets the time the postalcode was last entered by the user.

---

latitude?

> `optional` **latitude**: `number`

Defined in: api/api-client.ts:1577

Gets or sets the latitude for the location.

---

location?

> `optional` **location**: `string`

Defined in: api/api-client.ts:1574

Gets or sets the name of the location.

---

lockedUntil?

> `optional` **lockedUntil**: `Date`

Defined in: api/api-client.ts:1586

Gets or sets the time until which the entry is locked.

---

longitude?

> `optional` **longitude**: `number`

Defined in: api/api-client.ts:1580

Gets or sets the longitude of the location.

---

postalCode?

> `optional` **postalCode**: `number`

Defined in: api/api-client.ts:1571

Gets or sets the postalcode which is also the uniqe identifier.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IIdentityUser

Interface: IIdentityUser

Defined in: api/api-client.ts:1807

The default implementation of IdentityUser`1 which uses a string as a primary key.

Extends

- `IIdentityUserOfString`

Extended by

- `IApiUser`

Properties accessFailedCount?

> `optional` **accessFailedCount**: `number`

Defined in: api/api-client.ts:1778

Gets or sets the number of failed login attempts for the current user.

Inherited from

`IIdentityUserOfString`.`accessFailedCount`

---

concurrencyStamp?

> `optional` **concurrencyStamp**: `string`

Defined in: api/api-client.ts:1766

A random value that must change whenever a user is persisted to the store

Inherited from

`IIdentityUserOfString`.`concurrencyStamp`

---

email?

> `optional` **email**: `string`

Defined in: api/api-client.ts:1756

Gets or sets the email address for this user.

Inherited from

`IIdentityUserOfString`.`email`

---

emailConfirmed?

> `optional` **emailConfirmed**: `boolean`

Defined in: api/api-client.ts:1760

Gets or sets a flag indicating if a user has confirmed their email address.

Inherited from

`IIdentityUserOfString`.`emailConfirmed`

---

id?

> `optional` **id**: `string`

Defined in: api/api-client.ts:1750

Gets or sets the primary key for this user.

Inherited from

`IIdentityUserOfString`.`id`

---

lockoutEnabled?

> `optional` **lockoutEnabled**: `boolean`

Defined in: api/api-client.ts:1776

Gets or sets a flag indicating if the user could be locked out.

Inherited from

`IIdentityUserOfString`.`lockoutEnabled`

---

lockoutEnd?

> `optional` **lockoutEnd**: `Date`

Defined in: api/api-client.ts:1774

Gets or sets the date and time, in UTC, when any user lockout ends.

Inherited from

`IIdentityUserOfString`.`lockoutEnd`

---

normalizedEmail?

> `optional` **normalizedEmail**: `string`

Defined in: api/api-client.ts:1758

Gets or sets the normalized email address for this user.

Inherited from

`IIdentityUserOfString`.`normalizedEmail`

---

normalizedUserName?

> `optional` **normalizedUserName**: `string`

Defined in: api/api-client.ts:1754

Gets or sets the normalized user name for this user.

Inherited from

`IIdentityUserOfString`.`normalizedUserName`

---

passwordHash?

> `optional` **passwordHash**: `string`

Defined in: api/api-client.ts:1762

Gets or sets a salted and hashed representation of the password for this user.

Inherited from

`IIdentityUserOfString`.`passwordHash`

---

phoneNumber?

> `optional` **phoneNumber**: `string`

Defined in: api/api-client.ts:1768

Gets or sets a telephone number for the user.

Inherited from

`IIdentityUserOfString`.`phoneNumber`

---

phoneNumberConfirmed?

> `optional` **phoneNumberConfirmed**: `boolean`

Defined in: api/api-client.ts:1770

Gets or sets a flag indicating if a user has confirmed their telephone address.

Inherited from

`IIdentityUserOfString`.`phoneNumberConfirmed`

---

securityStamp?

> `optional` **securityStamp**: `string`

Defined in: api/api-client.ts:1764

A random value that must change whenever a users credentials change (password changed, login removed)

Inherited from

`IIdentityUserOfString`.`securityStamp`

---

twoFactorEnabled?

> `optional` **twoFactorEnabled**: `boolean`

Defined in: api/api-client.ts:1772

Gets or sets a flag indicating if two factor authentication is enabled for this user.

Inherited from

`IIdentityUserOfString`.`twoFactorEnabled`

---

userName?

> `optional` **userName**: `string`

Defined in: api/api-client.ts:1752

Gets or sets the user name for this user.

Inherited from

`IIdentityUserOfString`.`userName`

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IIdentityUserOfString

Interface: IIdentityUserOfString

Defined in: api/api-client.ts:1748

Represents a user in the identity system

Extended by

- `IIdentityUser`

Properties accessFailedCount?

> `optional` **accessFailedCount**: `number`

Defined in: api/api-client.ts:1778

Gets or sets the number of failed login attempts for the current user.

---

concurrencyStamp?

> `optional` **concurrencyStamp**: `string`

Defined in: api/api-client.ts:1766

A random value that must change whenever a user is persisted to the store

---

email?

> `optional` **email**: `string`

Defined in: api/api-client.ts:1756

Gets or sets the email address for this user.

---

emailConfirmed?

> `optional` **emailConfirmed**: `boolean`

Defined in: api/api-client.ts:1760

Gets or sets a flag indicating if a user has confirmed their email address.

---

id?

> `optional` **id**: `string`

Defined in: api/api-client.ts:1750

Gets or sets the primary key for this user.

---

lockoutEnabled?

> `optional` **lockoutEnabled**: `boolean`

Defined in: api/api-client.ts:1776

Gets or sets a flag indicating if the user could be locked out.

---

lockoutEnd?

> `optional` **lockoutEnd**: `Date`

Defined in: api/api-client.ts:1774

Gets or sets the date and time, in UTC, when any user lockout ends.

---

normalizedEmail?

> `optional` **normalizedEmail**: `string`

Defined in: api/api-client.ts:1758

Gets or sets the normalized email address for this user.

---

normalizedUserName?

> `optional` **normalizedUserName**: `string`

Defined in: api/api-client.ts:1754

Gets or sets the normalized user name for this user.

---

passwordHash?

> `optional` **passwordHash**: `string`

Defined in: api/api-client.ts:1762

Gets or sets a salted and hashed representation of the password for this user.

---

phoneNumber?

> `optional` **phoneNumber**: `string`

Defined in: api/api-client.ts:1768

Gets or sets a telephone number for the user.

---

phoneNumberConfirmed?

> `optional` **phoneNumberConfirmed**: `boolean`

Defined in: api/api-client.ts:1770

Gets or sets a flag indicating if a user has confirmed their telephone address.

---

securityStamp?

> `optional` **securityStamp**: `string`

Defined in: api/api-client.ts:1764

A random value that must change whenever a users credentials change (password changed, login removed)

---

twoFactorEnabled?

> `optional` **twoFactorEnabled**: `boolean`

Defined in: api/api-client.ts:1772

Gets or sets a flag indicating if two factor authentication is enabled for this user.

---

userName?

> `optional` **userName**: `string`

Defined in: api/api-client.ts:1752

Gets or sets the user name for this user.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IJwtToken

Interface: IJwtToken

Defined in: api/api-client.ts:1193

Represents a JWT token and its associated refresh token and metadata.

Properties createdDate?

> `optional` **createdDate**: `Date`

Defined in: api/api-client.ts:1205

Gets or sets the creation date and time of the JWT token.

---

expiryDate?

> `optional` **expiryDate**: `Date`

Defined in: api/api-client.ts:1202

Gets or sets the expiry date and time of the JWT token.

---

refreshToken?

> `optional` **refreshToken**: `string`

Defined in: api/api-client.ts:1199

Gets or sets the refresh token string.

---

roles?

> `optional` **roles**: `string` []

Defined in: api/api-client.ts:1208

Gets or sets the user roles associated with the JWT token.

---

token?

> `optional` **token**: `string`

Defined in: api/api-client.ts:1196

Gets or sets the JWT access token string.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ILogin

Interface: ILogin

Defined in: api/api-client.ts:1006

Represents the login credentials for a user.

Properties password

> **password**: `string`

Defined in: api/api-client.ts:1012

Gets or sets the password of the user.

---

userName

> **userName**: `string`

Defined in: api/api-client.ts:1009

Gets or sets the username of the user.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IProblemDetails

Interface: IProblemDetails

Defined in: api/api-client.ts:1069

Indexable

[`key` : `string`]: `any`

Properties detail?

> `optional` **detail**: `string`

Defined in: api/api-client.ts:1073

---

instance?

> `optional` **instance**: `string`

Defined in: api/api-client.ts:1074

---

status?

> `optional` **status**: `number`

Defined in: api/api-client.ts:1072

---

title?

> `optional` **title**: `string`

Defined in: api/api-client.ts:1071

---

type?

> `optional` **type**: `string`

Defined in: api/api-client.ts:1070

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / IRegister

Interface: IRegister

Defined in: api/api-client.ts:1120

Represents the registration credentials for a new user.

Properties password

password: `string`

Defined in: api/api-client.ts:1126

Gets or sets the password for the new user.

userName

userName: `string`

Defined in: api/api-client.ts:1123

Gets or sets the username for the new user.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ISensorData

Interface: ISensorData

Defined in: api/api-client.ts:1331

Represents an overview of sensor data.

Properties location?

> `optional` **location**: `string`

Defined in: api/api-client.ts:1337

Gets or sets the location of the sensor.

---

sensorName?

> `optional` **sensorName**: `string`

Defined in: api/api-client.ts:1334

Gets or sets the name of the sensor.

---

temperatureDatas?

> `optional` **temperatureDatas**: `TemperatureData` []

Defined in: api/api-client.ts:1340

Gets or sets the temperature data of the sensor.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ITemperatureData

Interface: ITemperatureData

Defined in: api/api-client.ts:1389

Represents a single temperature data point with timestamp and value.

Properties plausibility?

> `optional` **plausibility**: `string`

Defined in: api/api-client.ts:1398

Gets or sets the plausibility of the temperature data.

---

temperature?

> `optional` **temperature**: `number`

Defined in: api/api-client.ts:1395

Gets or sets the temperature value.

---

timestamp?

> `optional` **timestamp**: `Date`

Defined in: api/api-client.ts:1392

Gets or sets the timestamp of the temperature measurement.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ITemperatureDataOverview

Interface: ITemperatureDataOverview

Defined in: api/api-client.ts:1268

Represents an overview of temperature data for different locations.

Properties sensorData?

> `optional` **sensorData**: `SensorData` []

Defined in: api/api-client.ts:1271

Gets or sets the list of Sensor data for the inside temperature.

---

temperatureOutside?

> `optional` **temperatureOutside**: `TemperatureData` []

Defined in: api/api-client.ts:1274

Gets or sets the list of temperature data for the outside location.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/api-client / ITopicSetting

Interface: ITopicSetting

Defined in: api/api-client.ts:1477

Represents the settings for a specific MQTT topic, including default path, group, and sensor information.

Properties coordinateMapping?

> `optional` **coordinateMapping**: `CoordinateMapping`

Defined in: api/api-client.ts:1486

Navigation property for the related CoordinateMapping entity.

---

coordinateMappingId?

> `optional` **coordinateMappingId**: `number`

Defined in: api/api-client.ts:1483

Gets or sets the foreign key for the related CoordinateMapping entity.

---

defaultTopicPath?

> `optional` **defaultTopicPath**: `string`

Defined in: api/api-client.ts:1489

Gets or sets the default MQTT topic path for this setting.

---

groupId?

> `optional` **groupId**: `number`

Defined in: api/api-client.ts:1492

Gets or sets the group identifier associated with this topic setting.

---

hasRecovery?

> `optional` **hasRecovery**: `boolean`

Defined in: api/api-client.ts:1504

Gets or sets a value indicating whether this topic setting has recovery enabled.

---

sensorLocation?

> `optional` **sensorLocation**: `string`

Defined in: api/api-client.ts:1501

Gets or sets the location of the sensor.

---

sensorName?

> `optional` **sensorName**: `string`

Defined in: api/api-client.ts:1498

Gets or sets the name of the sensor.

---

sensorTypeEnum?

> `optional` **sensorTypeEnum**: `SensorType`

Defined in: api/api-client.ts:1495

Gets or sets the type of sensor (e.g., temperature, humidity).

---

topicSettingId?

> `optional` **topicSettingId**: `number`

Defined in: api/api-client.ts:1480

Gets or sets the unique identifier for the TopicSetting entity.

September 4, 2025

clients

isopruefi-frontend v1.0.0

---

isopruefi-frontend / api/clients

API/CLIENTS

Type Aliases

- PostalLocation

Variables

- authClient
- locationClient
- tempClient
- topicClient

Functions

- addPostalLocation
- createTopic
- deleteTopic
- fetchPostalLocations
- getAllTopics
- getStoredLocationName
- removePostalLocation
- updateTopic

References

ApiException

Re-exports ApiException

TopicSetting

Re-exports TopicSetting

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

---

isopruefi-frontend / api/clients / addPostalLocation

Function: addPostalLocation()

> **addPostalLocation**(`postalCode`): `Promise` \< `FileResponse` >

Defined in: api/clients.ts:155

Adds a new postal code location to the system.

Parameters postalCode

`number`

The postal code to add

Returns

`Promise` \< `FileResponse` >

Promise resolving to the API response

Throws

When the request fails or postal code already exists

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / createTopic

Function: createTopic()

> **createTopic**(`topicSetting`): `Promise` \< `any` >

Defined in: api/clients.ts:187

Creates a new MQTT topic configuration in the system.

Parameters topicSetting

`TopicSetting`

The complete topic setting configuration to create

Returns

`Promise` \< `any` >

Promise resolving to the newly created topic with assigned ID

Throws

When validation fails, topic already exists, or access is denied

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / deleteTopic

Function: deleteTopic()

> **deleteTopic**(`topicSetting`): `Promise` \< `any` >

Defined in: api/clients.ts:209

Removes an MQTT topic configuration from the system.

Parameters topicSetting

`TopicSetting`

The topic setting to delete (requires topicSettingId)

Returns

`Promise` \< `any` >

Promise resolving to void on successful deletion

Throws

When topic doesn't exist or access is denied

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / fetchPostalLocations

Function: fetchPostalLocations()

> **fetchPostalLocations**(): `Promise` \< `object` []>

Defined in: api/clients.ts:71

Fetches all postal code locations from the API and normalizes the response format.
Handles multiple possible response formats from the backend API.

Returns

`Promise` \< `object` []>

Promise resolving to an array of PostalLocation objects

Throws

When API request fails

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / getAllTopics

Function: getAllTopics()

> **getAllTopics**(): `Promise` \< `TopicSetting` []>

Defined in: api/clients.ts:176

Retrieves all MQTT topic settings from the system.

Returns

`Promise` \< `TopicSetting` []>

Promise resolving to an array of TopicSetting objects

Throws

When the request fails or access is denied

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / getStoredLocationName

Function: getStoredLocationName()

> **getStoredLocationName**(`displayLocationName`): `string`

Defined in: api/clients.ts:144

Retrieves the backend-stored location name for a display location name.
Used internally to map user-friendly display names to backend identifiers.

Parameters displayLocationName

`string`

The display name shown to users

Returns

`string`

The corresponding stored location name for API calls

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / removePostalLocation

Function: removePostalLocation()

> **removePostalLocation**(`postalCode`): `Promise` \< `void` >

Defined in: api/clients.ts:166

Removes a postal code location from the system.

Parameters postalCode

`number`

The postal code to remove

Returns

`Promise` \< `void` >

Promise resolving to void on successful removal

Throws

When the request fails or postal code doesn't exist

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / updateTopic

Function: updateTopic()

> **updateTopic**(`topicSetting`): `Promise` \< `any` >

Defined in: api/clients.ts:198

Updates an existing MQTT topic configuration.

Parameters topicSetting

`TopicSetting`

The topic setting with updated values (must include topicSettingId)

Returns

`Promise` \< `any` >

Promise resolving to the updated topic setting

Throws

When validation fails, topic doesn't exist, or access is denied

September 4, 2025

TYPE-ALIASES

isopruefi-frontend v1.0.0

---

isopruefi-frontend / api/clients / PostalLocation

Type Alias: PostalLocation

> **PostalLocation** = `object`

Defined in: api/clients.ts:217

Represents a postal code location with its associated name.
Used for location-based temperature data queries.

Properties locationName

> **locationName**: `string`

Defined in: api/clients.ts:221

The human-readable location name

---

postalCode

> **postalCode**: `number`

Defined in: api/clients.ts:219

The postal code number

September 4, 2025

VARIABLES

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / authClient

Variable: authClient

> `const` **authClient**: `AuthenticationClient`

Defined in: api/clients.ts:42

Pre-configured authentication client with automatic JWT token handling.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / locationClient

Variable: locationClient

> `const` **locationClient**: `LocationClient`

Defined in: api/clients.ts:52

Pre-configured location client with automatic JWT token handling.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / tempClient

Variable: tempClient

> `const` **tempClient**: `TemperatureDataClient`

Defined in: api/clients.ts:47

Pre-configured temperature data client with automatic JWT token handling.

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / api/clients / topicClient

Variable: topicClient

> `const` **topicClient**: `TopicClient`

Defined in: api/clients.ts:57

Pre-configured MQTT topic client with automatic JWT token handling.

September 4, 2025

4.10.3 Authentication

AuthForm

isopruefi-frontend v1.0.0

isopruefi-frontend / auth/AuthForm

AUTH/AUTHFORM

Functions

- default

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

---

isopruefi-frontend / auth/AuthForm / default

Function: default()

> **default**(`props`): `Element`

Defined in: auth/AuthForm.tsx:31

Authentication form component for sign in and sign up.
Handles user input, authentication API calls, error display, and navigation.
On successful login, sets the global authentication state and navigates to the appropriate page.
On registration, shows a success message and navigates to the sign in page.

Parameters props

`AuthFormProps`

Component props.

Returns

`Element`

The rendered authentication form.

September 4, 2025

SignIn

isopruefi-frontend v1.0.0

---

isopruefi-frontend / auth/SignIn

AUTH/SIGNIN

Functions

- default

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

isopruefi-frontend / auth/SignIn / default

Function: default()

> **default**(): `Element`

Defined in: auth/SignIn.tsx:3

Returns

`Element`

September 4, 2025

SignUp

isopruefi-frontend v1.0.0

---

isopruefi-frontend / auth/SignUp

AUTH/SIGNUP

Functions

- default

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

---

isopruefi-frontend / auth/SignUp / default

Function: default()

> **default**(): `Element`

Defined in: auth/SignUp.tsx:3

Returns

`Element`

September 4, 2025

4.10.4 Components

Navbar

isopruefi-frontend v1.0.0

isopruefi-frontend / components/Navbar

COMPONENTS/NAVBAR

September 4, 2025

ProtectedRoute

isopruefi-frontend v1.0.0

isopruefi-frontend / components/ProtectedRoute

COMPONENTS/PROTECTEDROUTE

Functions

- default

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

isopruefi-frontend / components/ProtectedRoute / default

Function: default()

> **default**(`props`): `Element`

Defined in: components/ProtectedRoute.tsx:15

ProtectedRoute component for role-based route protection.
Checks authentication and user role before rendering child routes.
- If authentication is not ready, shows a loading indicator.
- If user is not authenticated, redirects to the public welcome page.
- If user role is not allowed, redirects to their default page.

Parameters props

Component props.

allowed

(`"admin"` | `"user"`)[]

Array of allowed roles for the route.

Returns

`Element`

The rendered protected route or a redirect.

September 4, 2025

Weather

isopruefi-frontend v1.0.0

---

isopruefi-frontend / components/Weather

COMPONENTS/WEATHER

Type Aliases

- WeatherEntry

Functions

- TempChart

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

---

isopruefi-frontend / components/Weather / TempChart

Function: TempChart()

> **TempChart**(`props`): `Element`

Defined in: components/Weather.tsx:36

Displays a temperature chart and sensor tiles for a given location.
Fetches weather and sensor data from the backend, supports filtering by time range,
and allows switching between Celsius and Fahrenheit.

Parameters props

`TempChartProps = {}`

Component props.

Returns

`Element`

The rendered temperature chart and sensor tiles.

September 4, 2025

TYPE-ALIASES

isopruefi-frontend v1.0.0

---

isopruefi-frontend / components/Weather / WeatherEntry

Type Alias: WeatherEntry

> **WeatherEntry** = `object`

Defined in: components/Weather.tsx:13

Represents a single weather data entry for a specific timestamp.

Indexable

[`key` : `string`]: `undefined` | `string` | `number`

Properties t

> **t**: `number`

Defined in: components/Weather.tsx:15

Epoch time in milliseconds.

---

tempOutside?

> `optional` **tempOutside**: `number`

Defined in: components/Weather.tsx:17

Outside temperature value.

---

timestamp

> **timestamp**: `string`

Defined in: components/Weather.tsx:14

ISO formatted timestamp of the data point.

September 4, 2025

4.10.5 Pages

AdminPage

isopruefi-frontend v1.0.0

isopruefi-frontend / pages/AdminPage

PAGES/ADMINPAGE

Functions

- default

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

isopruefi-frontend / pages/AdminPage / default

Function: default()

> **default**(): `Element`

Defined in: pages/AdminPage.tsx:18

AdminPage component for managing locations, topics, and viewing weather data.
Provides controls for selecting location and temperature units, displays a weather chart,
and includes management sections for locations and topics.
Also provides a logout button to clear authentication and redirect to sign-in.

Returns

`Element`

The rendered admin page.

September 4, 2025

UserPage

isopruefi-frontend v1.0.0

isopruefi-frontend / pages/UserPage

PAGES/USERPAGE

Functions

- default

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

isopruefi-frontend / pages/UserPage / default

Function: default()

> **default**(): `Element`

Defined in: pages/UserPage.tsx:15

UserPage component for viewing weather data and managing user preferences.
Provides controls for selecting location and temperature units, displays a weather chart,
and includes a logout button to clear authentication and redirect to the welcome page.

Returns

`Element`

The rendered user page.

September 4, 2025

Welcome

isopruefi-frontend v1.0.0

isopruefi-frontend / pages/Welcome

PAGES/WELCOME

Functions

- default

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

---

isopruefi-frontend / pages/Welcome / default

Function: default()

> **default**(): `Element`

Defined in: pages/Welcome.tsx:27

Welcome page component that serves as the application's landing screen.

Features:
- Split-screen layout with logo and navigation
- Branded design with IsoPrüfi styling
- Navigation links to authentication pages
- Responsive design with centered content
- Consistent color scheme and typography

Returns

`Element`

JSX element containing the welcome page layout

Example

```
// Used in routing configuration
<Route path="/" element={<Welcome />} />
```

September 4, 2025

4.10.6 Utils

authApi

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/authApi

UTILS/AUTHAPI

Type Aliases

- LoginResult

Functions

- login
- refreshToken
- register

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

---

isopruefi-frontend / utils/authApi / login

Function: login()

> **login**(`userName` , `password`): `Promise` \< `LoginResult` >

Defined in: utils/authApi.ts:69

Authenticates a user with username and password credentials.

Parameters userName

`string`

The user's login username

password

`string`

The user's password

Returns

`Promise` \< `LoginResult` >

Promise resolving to login tokens

Throws

When credentials are invalid or server error occurs

Example

```
try {
  const result = await login('user@example.com', 'password123');
  saveToken(result.token, result.refreshToken);
} catch (error) {
  console.error('Login failed:', error);
}
```

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/authApi / refreshToken

Function: refreshToken()

> **refreshToken**(`token`, `refreshToken`): `Promise` \< `LoginResult` >

Defined in: utils/authApi.ts:120

Refreshes an expired access token using a valid refresh token.

Parameters token

`string`

The expired JWT access token

refreshToken

`string`

The valid refresh token

Returns

`Promise` \< `LoginResult` >

Promise resolving to new authentication tokens

Throws

When refresh token is invalid, expired, or revoked

Example

```
try {
  const tokens = await refreshToken(oldToken, refreshToken);
  saveToken(tokens.token, tokens.refreshToken);
} catch (error) {
  // Refresh failed, redirect to login
  clearToken();
  window.location.href = '/login';
}
```

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/authApi / register

Function: register()

> **register**(`userName` , `password`): `Promise` \< `void` >

Defined in: utils/authApi.ts:92

Registers a new user in the system. Requires admin privileges.

Parameters userName

`string`

The desired username for the new user

password

`string`

The password for the new user

Returns

`Promise` \< `void` >

Promise that resolves on successful registration

Throws

When registration fails, username exists, or insufficient permissions

Example

```
try {
  await register('newuser@example.com', 'securePassword123');
  console.log('User registered successfully');
} catch (error) {
  console.error('Registration failed:', error);
}
```

September 4, 2025

TYPE-ALIASES

isopruefi-frontend v1.0.0

---

isopruefi-frontend / utils/authApi / LoginResult

Type Alias: LoginResult

> **LoginResult** = `object`

Defined in: utils/authApi.ts:12

Represents the result of a successful login operation.

Properties refreshToken

> **refreshToken**: `string`

Defined in: utils/authApi.ts:16

Refresh token for obtaining new access tokens

---

token

> **token**: `string`

Defined in: utils/authApi.ts:14

JWT access token for authenticated requests

September 4, 2025

config

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/config

UTILS/CONFIG

Functions

- apiBase

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/config / apiBase

Function: apiBase()

> **apiBase**(): `string`

Defined in: utils/config.ts:22

Resolves the API base URL from runtime configuration or environment variables.

Priority order:
1. Runtime configuration from `window.__APP_CONFIG__.API_BASE_URL`
2. Build-time environment variable `VITE_API_BASE_URL`
3. Empty string as fallback

Returns

`string`

The API base URL with trailing slashes removed

Example

```
// Returns "https://api.example.com" (trailing slash removed)
const baseUrl = apiBase();
```

September 4, 2025

tokenHelpers

isopruefi-frontend v1.0.0

---

isopruefi-frontend / utils/tokenHelpers

UTILS/TOKENHELPERS

Interfaces

- JwtPayload

Functions

- clearToken
- decodeToken
- getRefreshToken
- getToken
- getUserFromToken
- saveToken

September 4, 2025

FUNCTIONS

isopruefi-frontend v1.0.0

---

isopruefi-frontend / utils/tokenHelpers / clearToken

Function: clearToken()

> **clearToken**(): `void`

Defined in: utils/tokenHelpers.ts:84

Removes both access and refresh tokens from localStorage.
Call this function when logging out or when tokens become invalid.

Returns

`void`

Example

```
// On logout
clearToken();
// Redirect to login page
```

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/tokenHelpers / decodeToken

Function: decodeToken()

> **decodeToken**(`token`): `null` | `JwtPayload`

Defined in: utils/tokenHelpers.ts:104

Decodes a JWT token and extracts the payload containing user information.
Does not verify the token signature - use only for reading claims.

Parameters token

`string`

The JWT token to decode

Returns

`null` | `JwtPayload`

The decoded payload object, or null if decoding fails

Example

```
const payload = decodeToken(accessToken);
if (payload) {
  console.log('Token expires at:', new Date(payload.exp * 1000));
}
```

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/tokenHelpers / getRefreshToken

Function: getRefreshToken()

> **getRefreshToken**(): `null` | `string`

Defined in: utils/tokenHelpers.ts:69

Retrieves the stored refresh token from localStorage.

Returns

`null` | `string`

The refresh token string, or null if not found

Example

```
const refreshToken = getRefreshToken();
if (refreshToken) {
  // Use to obtain new access token
}
```

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/tokenHelpers / getToken

Function: getToken()

> **getToken**(): `null` | `string`

Defined in: utils/tokenHelpers.ts:52

Retrieves the stored JWT access token from localStorage.

Returns

`null` | `string`

The access token string, or null if not found

Example

```
const token = getToken();
if (token) {
  // Use token for authenticated requests
}
```

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/tokenHelpers / getUserFromToken

Function: getUserFromToken()

> **getUserFromToken**(`token`): `null` | `string`

Defined in: utils/tokenHelpers.ts:128

Extracts the user identifier from a JWT token.
The subject field typically contains the username or user ID.

Parameters token

`string`

The JWT token to extract user information from

Returns

`null` | `string`

The user identifier string, or null if extraction fails

Example

```
const currentUser = getUserFromToken(getToken());
if (currentUser) {
  console.log('Current user:', currentUser);
}
```

September 4, 2025

isopruefi-frontend v1.0.0

isopruefi-frontend / utils/tokenHelpers / saveToken

Function: saveToken()

> **saveToken**(`token` , `refreshToken`): `void`

Defined in: utils/tokenHelpers.ts:34

Saves JWT tokens to browser localStorage for persistent authentication.

Parameters token

`string`

The JWT access token

refreshToken

`string`

The refresh token for obtaining new access tokens

Returns

`void`

Example

```
// After successful login
saveToken(response.accessToken, response.refreshToken);
```

September 4, 2025

INTERFACES

isopruefi-frontend v1.0.0

---

isopruefi-frontend / utils/tokenHelpers / JwtPayload

Interface: JwtPayload

Defined in: utils/tokenHelpers.ts:10

Standard JWT payload structure with common claims.
Extends to allow additional custom claims from the authentication system.

Indexable

[`key` : `string`]: `unknown`

Allow additional custom claims

Properties exp?

> `optional` **exp**: `number`

Defined in: utils/tokenHelpers.ts:14

Expiration time (Unix timestamp)

---

iat?

> `optional` **iat**: `number`

Defined in: utils/tokenHelpers.ts:16

Issued at time (Unix timestamp)

---

sub?

> `optional` **sub**: `string`

Defined in: utils/tokenHelpers.ts:12

Subject (usually user ID or username)

September 4, 2025

5. Docker

5.0.1 Docker Environment Documentation

This documentation provides a comprehensive overview of the Docker environments used in the IsoPruefi project, including development and live deployments, container configurations, and environment file management.

Development Environment

The development environment is configured via `docker-compose.yml` in the project root and provides local development with automatic certificate generation for localhost domains.

CONTAINER OVERVIEW (DEVELOPMENT)

Container	Image	Description	Access
traefik	`traefik:3.4.4`	Reverse proxy and load balancer with automatic HTTPS certificates	traefik.localhost, Ports: `80`, `443`, Dashboard: `8432`
influxdb3	`influxdb:3.2.1-core`	Time series database (InfluxDB 3.x) for sensor and telemetry data	Port: `8181`
influxdb-explorer	`influxdata/influxdb3-ui:1.0.3`	Web interface for managing and querying InfluxDB data	explorer.localhost, Port: `8888`
postgres	`postgres:alpine3.21`	PostgreSQL database for relational data storage	Port: `5432`
loki	`grafana/loki:3.5.2`	Log aggregation and storage system	Port: `3100`
prometheus	`prom/prometheus:v3.4.2`	Monitoring system for metrics collection and alerting	Port: `9090`
alloy	`grafana/alloy:v1.9.2`	Observability data collector for Loki and Prometheus integration	Ports: `12345`, `4317`, `4318`
grafana	`grafana/grafana:12.0.2`	Visualization and dashboarding for metrics and logs	grafana.localhost
isopruefi-frontend-1	Built from `./isopruefi-frontend`	React frontend application (development build)	frontend.localhost
isopruefi-backend-api-1	Built from `./isopruefi-backend`	.NET REST API for application logic	backend.localhost
isopruefi-mqtt-receiver-1	Built from `./isopruefi-backend`	MQTT message receiver and processor	Internal service (no external access)
isopruefi-get-weather-worker-1	Built from `./isopruefi-backend`	Weather data collection worker service	Internal service (no external access)

Live/Production Environment

The live environment is configured via `isopruefi-docker-live/docker-compose.yml` and uses pre-built Docker images from GitHub Container Registry with load balancing and health checks.

CONTAINER OVERVIEW (LIVE)

Container	Image	Description	Access
traefik	`traefik:3.4.4`	Production reverse proxy with custom domain routing	Ports: `5000` (HTTP), `5001` (HTTPS), `5002` (Dashboard)
influxdb3	`influxdb:3.2.1-core`	Production time series database with persistent volumes	Port: `5006`
postgres	`postgres:17.5`	Production PostgreSQL with persistent volumes	Port: `5003`
loki	`grafana/loki:3.5.2`	Production log aggregation with persistent storage	Internal service
prometheus	`prom/prometheus:v3.4.2`	Production metrics collection with persistent storage	Port: `5004`
alloy	`grafana/alloy:v1.9.2`	Production observability data collector	Internal service
grafana	`grafana/grafana:12.0.2`	Production dashboards with persistent configuration	Port: `5005`
isopruefi-frontend-1/2	`ghcr.io/deadmade/isopruefi-frontend:latest`	Load-balanced React frontend instances	Port: `5007` (frontend-1 only), Path: `/frontend`
isopruefi-backend-api-1/2	`ghcr.io/deadmade/isopruefi-rest-api:latest`	Load-balanced .NET API instances	Path: `/backend` (via Traefik)
isopruefi-mqtt-receiver-1/2	`ghcr.io/deadmade/isopruefi-mqtt-worker:latest`	Redundant MQTT receiver instances	Internal services
isopruefi-get-weather-worker-1/2	`ghcr.io/deadmade/isopruefi-weather-worker:latest`	Redundant weather data collection instances	Internal services

LIVE ENVIRONMENT URLS

When deployed on the production server (`aicon.dhbw-heidenheim.de`), the services are accessible via:

- **Traefik Dashboard**: `https://aicon.dhbw-heidenheim.de:5002`
- **Frontend Application**: `https://aicon.dhbw-heidenheim.de:5001/frontend`
- **Backend API**: `https://aicon.dhbw-heidenheim.de:5001/backend`
- **Grafana Dashboards**: `http://aicon.dhbw-heidenheim.de:5005`
- **Prometheus Metrics**: `http://aicon.dhbw-heidenheim.de:5004`
- **PostgreSQL**: `aicon.dhbw-heidenheim.de:5003`
- **InfluxDB**: `http://aicon.dhbw-heidenheim.de:5006`

> **Note**: HTTPS is available on port `5001` , HTTP on port `5000` . The frontend and backend use path-based routing with Traefik handling SSL termination.

Networks

DEVELOPMENT NETWORKS

- `isopruefi-network` : Main network for application services and Traefik
- `isopruefi-monitoring` : Dedicated network for observability tools (Loki, Prometheus, Grafana, Alloy)

LIVE NETWORKS

- `isopruefi-network` : Main production network for all services
- `isopruefi-monitoring` : Production observability network

Key Differences: Development vs Live

DEVELOPMENT ENVIRONMENT

- **Build Strategy**: Local builds from source code with hot-reload capabilities
- **Domains**: Uses `*.localhost` domains with automatic certificate generation
- **Scaling**: Single instance of each service
- **Data**: Bind mounts for development data persistence
- **Environment**: `ASPNETCORE_ENVIRONMENT=Development`

LIVE ENVIRONMENT

- **Build Strategy**: Pre-built images from GitHub Container Registry
- **Domains**: Custom domain routing with production certificates
- **Scaling**: Multiple instances with load balancing for high availability
- **Data**: Named Docker volumes for production data persistence
- **Health Checks**: Comprehensive health monitoring for all services
- **Environment**: `ASPNETCORE_ENVIRONMENT=Docker`
- **Backup**: Automated backup system (currently commented out)

Service Details

TRAEFIK CONFIGURATION

- **Development**: Automatic HTTPS with local certificates for `*.localhost` domains
- **Live**: Production routing with custom domain support and SSL termination

DATABASE SERVICES

- **InfluxDB**: Time-series data storage for sensor readings and telemetry
- **PostgreSQL**: Relational data for user management, configuration, and application state

OBSERVABILITY STACK

- **Loki**: Centralized logging with automatic log collection via Docker labels
- **Prometheus**: Metrics collection and alerting
- **Grafana**: Unified dashboards for logs and metrics visualization
- **Alloy**: Data collection and forwarding to Loki/Prometheus

APPLICATION SERVICES

- **Frontend**: React-based web application for data visualization and control
- **Backend API**: .NET REST API providing core application logic
- **MQTT Receiver**: Handles incoming sensor data via MQTT protocol
- **Weather Worker**: Collects external weather data from multiple APIs

September 2, 2025

deadmade, maratin23

5.1 Environment Files

5.1.1 Overview

The IsoPruefi project uses environment files to manage configuration across different deployment environments:

- **Development Environment**: `secrets.env` (project root)
- **Live Environment**: `isopruefi-docker-live/secrets.env`
- **Backup Configuration**: `isopruefi-docker-live/backup/*.env`

5.1.2 Main Environment Files (`secrets.env`)

Development Environment (`./secrets.env`)

Used by the development Docker Compose setup for local development with localhost domains.

```
# ===== Database Configuration =====
# PostgreSQL Database Settings
POSTGRES_HOST=postgres
POSTGRES_PORT=5432
POSTGRES_DATABASE=Isopruefi
POSTGRES_USERNAME=Isopruefi
POSTGRES_PASSWORD=secret

# Admin user for initial system setup
Admin__UserName=admin
Admin__Email=admin@localhost.dev
Admin__Password=DevAdmin123!

# Connection String (uses above variables)
ConnectionStrings__DefaultConnection=Host=${POSTGRES_HOST};Port=${POSTGRES_PORT};Database=${POSTGRES_DATABASE};Username=${POSTGRES_USERNAME};Password=${POSTGRES_PASSWORD}

# ===== Authentication =====
# JWT Configuration for API authentication
Jwt__ValidIssuer=localhost
Jwt__ValidAudience=localhost
Jwt__Secret=your-secure-256-bit-secret-key-replace-this-in-production

# ===== Time-Series Database =====
# InfluxDB Settings for time-series data storage
Influx__InfluxDBHost=http://influxdb3:8181
Influx__InfluxDBToken=
Influx__InfluxDBDatabase=IsoPruefi

# ===== MQTT Configuration =====
# MQTT Broker settings for IoT sensor communication
Mqtt__BrokerHost=aicon.dhbw-heidenheim.de
Mqtt__BrokerPort=1883

# ===== Weather API Configuration =====
# External weather service URLs and location
Weather__OpenMeteoApiUrl=https://api.open-meteo.com/v1/forecast?latitude=48.678&longitude=10.1516&models=icon_seamless&current=temperature_2m
Weather__BrightSkyApiUrl=https://api.brightsky.dev/current_weather?lat=48.67&lon=10.1516
Weather__Location=Heidenheim

# ===== Frontend =====
VITE_API_BASE_URL=https://backend.localhost
```

Live Environment (`isopruefi-docker-live/secrets.env`)

Used by the production Docker Compose setup with additional production-specific configurations.

```
# ===== Database Configuration =====
# PostgreSQL Database Settings
POSTGRES_HOST=postgres
POSTGRES_PORT=5432
POSTGRES_DB=Isopruefi          # Note: Different variable name for production
POSTGRES_USER=Isopruefi        # Note: Different variable name for production
POSTGRES_PASSWORD=

# Admin user for initial system setup
Admin__UserName=admin
Admin__Email=admin@localhost.dev
Admin__Password=DevAdmin123!
```

```
# Connection String (uses above variables)
ConnectionStrings__DefaultConnection=Host=${POSTGRES_HOST};Port=${POSTGRES_PORT};Database=${POSTGRES_DB};Username=${POSTGRES_USER};Password=${POSTGRES_PASSWORD}

# ===== Authentication =====
# JWT Configuration for API authentication
Jwt__ValidIssuer=localhost
Jwt__ValidAudience=localhost
Jwt__Secret=your-secure-256-bit-secret-key-replace-this-in-production

# ===== Time-Series Database =====
# InfluxDB Settings for time-series data storage
Influx__InfluxDBHost=http://influxdb3:8181
Influx__InfluxDBToken=
Influx__InfluxDBDatabase=IsoPruefi

# ===== MQTT Configuration =====
# MQTT Broker settings for IoT sensor communication
Mqtt__BrokerHost=aicon.dhbw-heidenheim.de
Mqtt__BrokerPort=1883

# ===== Weather API Configuration =====
# External weather service URLs and location
Weather__OpenMeteoApiUrl=https://api.open-meteo.com/v1/forecast?latitude=48.678&longitude=10.1516&models=icon_seamless&current=temperature_2m
Weather__BrightSkyApiUrl=https://api.brightsky.dev/current_weather?lat=48.67&lon=10.1516
Weather__NominatimApiUrl=https://nominatim.openstreetmap.org/search?format=jsonv2&postalcode=
Weather__Location=Heidenheim

# ===== Grafana Configuration =====
# Grafana admin password for production access
GF_SECURITY_ADMIN_PASSWORD=
```

5.1.3 Configuration Variables Reference

Database Configuration

Variable	Description	Dev Value	Live Value	Required
`POSTGRES_HOST`	PostgreSQL hostname	`postgres`	`postgres`	✅
`POSTGRES_PORT`	PostgreSQL port	`5432`	`5432`	✅
`POSTGRES_DATABASE` / `POSTGRES_DB`	Database name	`Isopruefi`	`Isopruefi`	✅
`POSTGRES_USERNAME` / `POSTGRES_USER`	Database username	`Isopruefi`	`Isopruefi`	✅
`POSTGRES_PASSWORD`	Database password	`secret`	`secret`	✅

Authentication & Security

Variable	Description	Example Value	Required
`Admin__UserName`	Initial admin username	`admin`	✅
`Admin__Email`	Initial admin email	`admin@localhost.dev`	✅
`Admin__Password`	Initial admin password	`DevAdmin123!`	✅
`Jwt__ValidIssuer`	JWT token issuer	`localhost`	✅
`Jwt__ValidAudience`	JWT token audience	`localhost`	✅
`Jwt__Secret`	JWT signing secret (256-bit)	`your-secure-256-bit-secret-key...`	✅

InfluxDB Configuration

Variable	Description	Example Value	Required
`Influx__InfluxDBHost`	InfluxDB connection URL	`http://influxdb3:8181`	✅
`Influx__InfluxDBToken`	InfluxDB authentication token	`apiv3_...`	❌ (Dev), ✅ (Live)
`Influx__InfluxDBDatabase`	InfluxDB database name	`IsoPruefi`	✅

MQTT Configuration

Variable	Description	Example Value	Required
`Mqtt__BrokerHost`	MQTT broker hostname	`aicon.dhbw-heidenheim.de`	✅
`Mqtt__BrokerPort`	MQTT broker port	`1883`	✅

Weather API Configuration

Variable	Description	Purpose	Required
`Weather__OpenMeteoApiUrl`	Open-Meteo API endpoint with coordinates	Primary weather data source	✅
`Weather__BrightSkyApiUrl`	BrightSky API endpoint with coordinates	Secondary weather data source	✅
`Weather__NominatimApiUrl`	OpenStreetMap geocoding service	Location lookup (Live only)	❌
`Weather__Location`	Human-readable location name	Display purposes	✅

Frontend Configuration

Variable	Description	Example Value	Required
`VITE_API_BASE_URL`	Backend API base URL for frontend	`https://backend.localhost`	✅

Grafana Configuration (Live Only)

Variable	Description	Example Value	Required
`GF_SECURITY_ADMIN_PASSWORD`	Grafana admin user password	`1234`	✅ (Live)

September 2, 2025

deadmade

6. System Documentation

6.1 Database Schema

6.1.1 Overview

IsoPrüfi uses a dual database approach:
- **PostgreSQL** with Entity Framework Core for relational data (users, settings, coordinates)
- **InfluxDB** for time-series sensor data and metrics

6.1.2 Core Entities

ApiUser

Extends ASP.NET Core Identity for user authentication.

CoordinateMapping

Stores geographic coordinates for postal codes with usage tracking.

Column	Type	Description
PostalCode (PK)	int	Unique postal code identifier
Location	string	Location name
Latitude	double	Geographic latitude
Longitude	double	Geographic longitude
LastUsed	DateTime?	When postal code was last updated
LockedUntil	DateTime?	Temporary locked to get the current Temperature of the Location

TopicSetting

MQTT topic configuration with sensor metadata.

Column	Type	Description
TopicSettingId (PK)	int	Auto-generated identifier
CoordinateMappingId (FK)	int	Links to CoordinateMapping
DefaultTopicPath	string	MQTT topic prefix (max 100 chars)
GroupId	int	Group identifier
SensorTypeEnum	SensorType	Type of sensor
SensorName	string	Sensor name (max 50 chars)
SensorLocation	string	Sensor location (max 50 chars)
HasRecovery	bool	Recovery feature enabled

6.1.3 Enumerations

SensorType

Available sensor types:
- `temp` - Temperature
- `spl` - Sound pressure level
- `hum` - Humidity
- `ikea` - IKEA sensor
- `co2` - CO2 sensor
- `mic` - Microphone

6.1.4 Relationships

- `TopicSetting` → `CoordinateMapping` (Many-to-One)
- `ApiUser` uses ASP.NET Identity tables

6.1.5 Migration Commands

```
cd isopruefi-backend
dotnet ef migrations add <MigrationName> --project ./Database/Database.csproj --startup-project ./Rest-API/Rest-API.csproj
```

6.1.6 InfluxDB Schema

Measurements

TEMPERATURE

Sensor temperature readings from Arduino devices.

Field/Tag	Type	Description
value (field)	float	Temperature measurement
sensor (tag)	string	Sensor identifier
sequence (tag)	int	Message sequence number
timestamp	DateTime	Measurement timestamp

OUTSIDE_TEMPERATURE

External weather data from APIs.

Field/Tag	Type	Description
value (field)	float	Temperature in Celsius
value_fahrenheit (field)	float	Temperature in Fahrenheit
postalcode (field)	int	Associated postal code
place (tag)	string	Location name
website (tag)	string	Data source API
timestamp	DateTime	Measurement timestamp

UPTIME

Arduino device availability tracking.

Field/Tag	Type	Description
sensor (field)	string	Sensor identifier
timestamp	DateTime	Uptime check timestamp

September 3, 2025

DianaTin23, deadmade

6.2 MQTT Protocol Documentation

6.2.1 Overview

IsoPrüfi uses MQTT for sensor data communication between Arduino devices and the backend system. The protocol handles real-time data transmission with recovery capabilities for offline scenarios.

6.2.2 Topic Structure

Standard Topic Format

```
{topicPrefix}/{sensorType}/{sensorId}
```

Example: `dhbw/ai/si2023/temp/Sensor_One`

Topic Components

- **topicPrefix**: Configurable prefix (default: `dhbw/ai/si2023/`)
- **sensorType**: Type of sensor (`temp`, `hum`, `co2`, `spl`, `mic`, `ikea`)
- **sensorId**: Unique sensor identifier

6.2.3 Message Formats

Standard Sensor Reading

```
{
  "timestamp": 1672531200,
  "value": [23.5],
  "sequence": 1234
}
```

Recovery Data (Bulk Upload)

```
{
  "timestamp": 1672531200,
  "value": [23.5],
  "sequence": 1234,
  "meta": {
    "t": [1672531100, 1672531160, 1672531220],
    "v": [23.1, 23.3, 23.4],
    "s": [1231, 1232, 1233]
  }
}
```

6.2.4 Data Fields

Field	Type	Description
timestamp	DateTime	Unix timestamp (seconds since epoch)
value	float[]	Sensor readings (array for multi-point sensors)
sequence	int	Sequential counter for message ordering
meta.t	DateTime[]	Recovery timestamps
meta.v	float[]	Recovery values
meta.s	int[]	Recovery sequence numbers

6.2.5 Error Handling

- Failed publishes trigger local storage
- Recovery data sent in batches (max 3 files per loop)
- 60-second timeout for recovery operations
- Automatic reconnection on connection loss

September 3, 2025

DianaTin23, deadmade

6.3 Monitoring & Observability

6.3.1 Overview

IsoPrüfi uses Grafana, Prometheus, and Loki for comprehensive monitoring and observability.

6.3.2 Components

Grafana Dashboards

- **Location**: `/grafana/`
- **Features**:
- System metrics visualization
- Application performance monitoring
- Custom uptime dashboard
- Alerting

Prometheus Metrics

- **Config**: `/loki/prometheus.yml`
- **Scrapes**: Application health endpoints
- **Alerts**: Defined in `alerts.yml`

Loki Logging

- **Config**: `/loki/loki-config.yaml`
- **Agent**: Grafana Alloy for log collection (`config.alloy`)
- **Centralized**: All application and system logs

6.3.3 Health Checks

Monitoring Targets

- Application uptime
- Database connectivity
- MQTT broker status
- Worker process health

6.3.4 Alerting

Configure alerts in `/loki/alerts.yml` :
- Service down alerts
- High error rate notifications
- Resource utilization warnings

6.3.5 Log Analysis

Access logs through Grafana's Explore feature:
- Filter by service/component
- Search for error patterns
- Trace request flows

September 3, 2025

deadmade

7. IsoPrüfi Documentation

7.1 Introduction and Goals

7.1.1 Aim of our project IsoPrüfi:

Our project aims to test the effectiveness of building insulation based on outside temperature and present the data clearly using diagrams.

7.1.2 Features

Must-Have

- A website for a user-friendly presentation of temperature comparison diagrams
- Reliable sensors that measure interior temperature
- The ability to retrieve outside temperature data
- Clusterization of containers that we create ourselves

Should-Have

- Sensors should be capable of storing temperature data for a period of one day, even in the absence of an internet connection or synchronization with the server
- A website should be used to offer configuration options

Could-Have

- Database clustering

Won't Have

- The containers will only run on one server, however they are designed to function independently of each other
- Since this is a software project, we won't implement any resilience on the hardware side

7.1.3 Requirements Overview

Functional Requirements

- The system must provide three data sources: two for indoor measurements and one for outdoor measurements
- Data should be updated every 60 seconds
- Each data point must include both temperature and timestamp
- Users must be able to view diagrams and evaluations of the collected data
- Users should have access to historical data to observe long-term trends
- The system must use containers for deployment
- In case of no network and or MQTT broker connection, the temperature data will be saved on an SD card for up to 24 h

Non-Functional Requirements

- The system should achieve an availability of 99.5%
- The system must remain reliable even if one container fails
- Data must be persistently stored in the database
- Automated unit tests must cover core functionalities, including correct data transmission, successful data storage, and simulation of failure scenarios

7.1.4 Quality Goals

Quality Goal	Description
Persistence	Sensor readings must be logged centrally (database) and locally (SD card), if offline -> No data loss
Data Integrity	Data must include timestamps and sequance to prevent corruption or duplication
Availability	The system must remain partially operational during network outages and recover automatically

7.1.5 Stakeholders

Role/Name	Expectations	Influence
Developer	Solution that is easy to maintain and fulfills all requirements for the project	Quality of Code, Clean Architecture, Final product
Supervisor	Correct methodology, clear documentation and tracability of results	Sets expectations and reviews the final product
Coaches	Clear documentation, preparation of meetings and clear presentation of the results for each meeting	Review of the final product and support for the implementation
User/Owner	Want to reduce their heating costs through stable temperature measurements and correct assessment of the building's isolation	Requires easy usability and trustworthy temperature data
Systemadministrator	Stable infrastructure, easy deployments and clear logs for easy maintenance	Configuration of the system

August 31, 2025

DianaTin23, deadmade, maratin23

7.2 Quality Requirements

7.2.1 1. Persistence

Temperature data must be reliably and permanently stored in the database, even in the event of temporary system or connection failures.

Measurable Criteria:

- **Data Loss Rate:** A maximum of **0.1%** of all recorded measurements may be lost.
- **Successful Write Operations:** At least **99.9%** of all database write operations must be completed without error.
- **Fallback Storage:** In case of missing connectivity, temperature data is written to the local SD card for up to 24h and synchronized once the connection is restored.
- **Retry and Confirmation:** Failed write operations to the central database are retried until confirmation is received.

Testability:

- Disconnect the system from the internet in a controlled way and verify that data is buffered on the SD card and later persisted in the database.
- Simulate database outages to check retry logic and final persistence.
- Run long-term operation tests with daily storage cycles (e.g., multiple days) to verify absence of data loss.
- Use SQL queries to compare the expected number of measurements with the actual count in the database, and to calculate the percentage of successful write operations, ensuring compliance with the defined thresholds.

7.2.2 2. Data Integrity

The recorded data must be correct, complete, and plausible to enable a reliable evaluation of the building's insulation.

Measurable Criteria:

- **Inconsistent Data Rate:** Less than **0.05%** of all records may be duplicates, incorrect, or implausible.
- **Validation Error Rate:** A maximum of **0.1%** of data may be rejected by validation mechanisms.
- **Automatic plausibility checks:**
  - **Range validation:** Outdoor readings must stay between -30 °C and 45 °C, indoor readings between -10 °C and 35 °C. Values outside this range are logged as warnings.
  - **Jump detection:** Sudden jumps >10 °C between consecutive readings are flagged.
  - **Difference and mean analysis:** Consecutive differences and moving averages are tracked to detect anomalies.
  - **Statistical window checks:** Mean and standard deviation over a defined time window are used to identify abnormal fluctuations.

Testability:

- Inject out-of-range or implausible test data and verify that the system logs warnings or rejects values.
- Simulate sudden temperature jumps to ensure they are flagged.
- Compare sensor readings against expected ranges (indoor vs. outdoor).

7.2.3 3. Availability

The system must remain functional even in the event of partial failures, so that users can always access the temperature data. Each critical service is deployed redundantly with at least two instances. If one instance fails, Traefik automatically routes traffic to the backup instance. All containers expose health checks, and stateless design ensures fast restart and recovery.

The system is resilient against the following single-instance failures:

- Website (frontend): one instance down → second instance continues serving requests
- REST API: one instance down → second instance handles API traffic
- Weather Data Worker: one instance down → second instance continues scheduled tasks
- MQTT Receiver: one instance down → second instance continues message processing

Measurable Criteria:

- **System Availability:** ≥ 99.5% overall operational time (software side)
- **Frontend Data Availability:** ≥ 99.5% of the time, current or last available data is accessible via the UI
- **Resilience Mechanisms:**
  - Redundant service instances per cluster (frontend, backend, workers)
  - Traefik load balancer distributes traffic and enables failover
  - Stateless service design for automatic restart or replacement
  - Health checks for all major containers
  - Local SD storage at Arduino nodes ensures sensor data buffering during backend or network outages

Testability:

- Controlled shutdown of one instance per cluster (frontend, REST API, Weather Data Worker, MQTT Receiver) to verify automatic failover via Traefik
- Disable one database or monitoring component to confirm health checks and recovery strategies
- Simulate network outage between Arduino and backend to verify SD-card buffering and later synchronization
- Long-term monitoring of uptime metrics to confirm compliance with ≥ 99.5% availability

September 1, 2025

DianaTin23

7.3 Architecture Constraints and Solution Strategy

7.3.1 Architecture Contraints

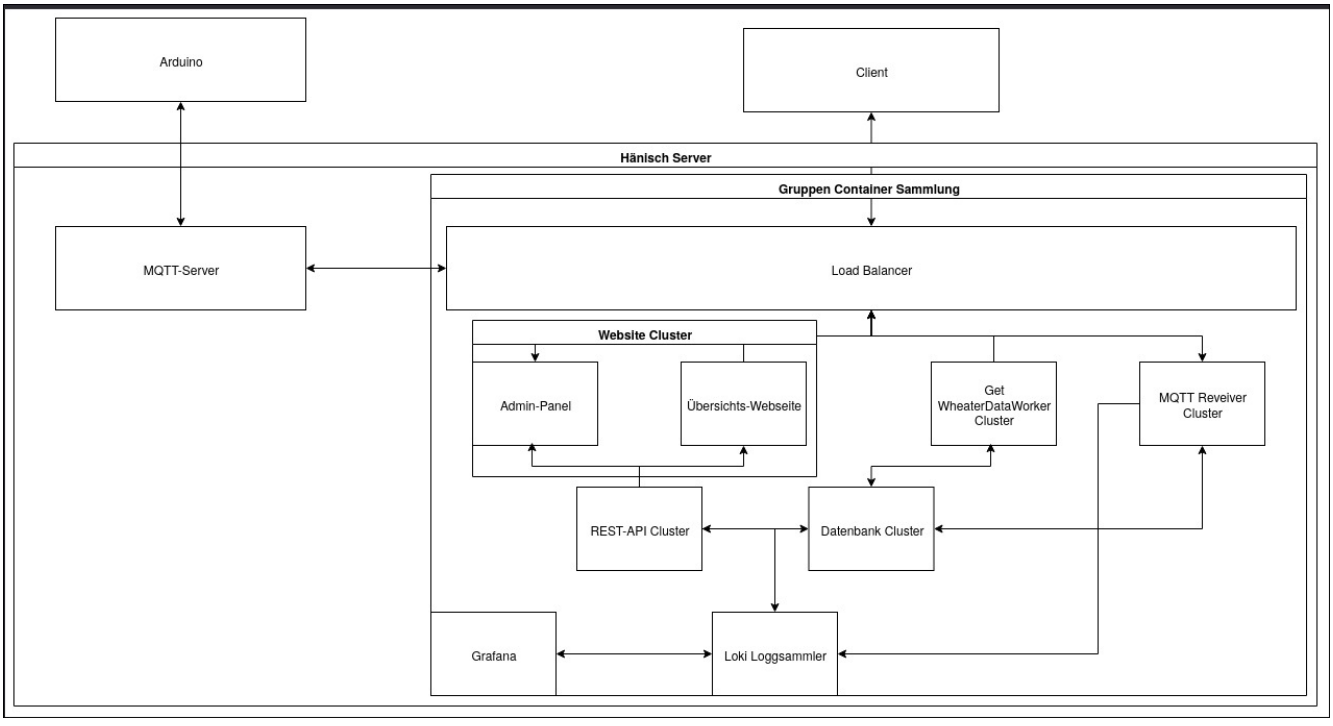
Category	Constraint
Technical	The project will be hosted on a single server provided by Prof. Hänisch
Technical	Indoor temperature measurement hardware is supplied by the university
Technical	At least two data sources are required, with at least one being an Arduino device
Technical	The hardware and database are not specifically designed for high reliability
Technical	The final system must run in a clean environment with no prior setup required
Organizational	Weekly meetings with a coach are scheduled for project discussions
Political	The submission deadline is the 04.09.2025

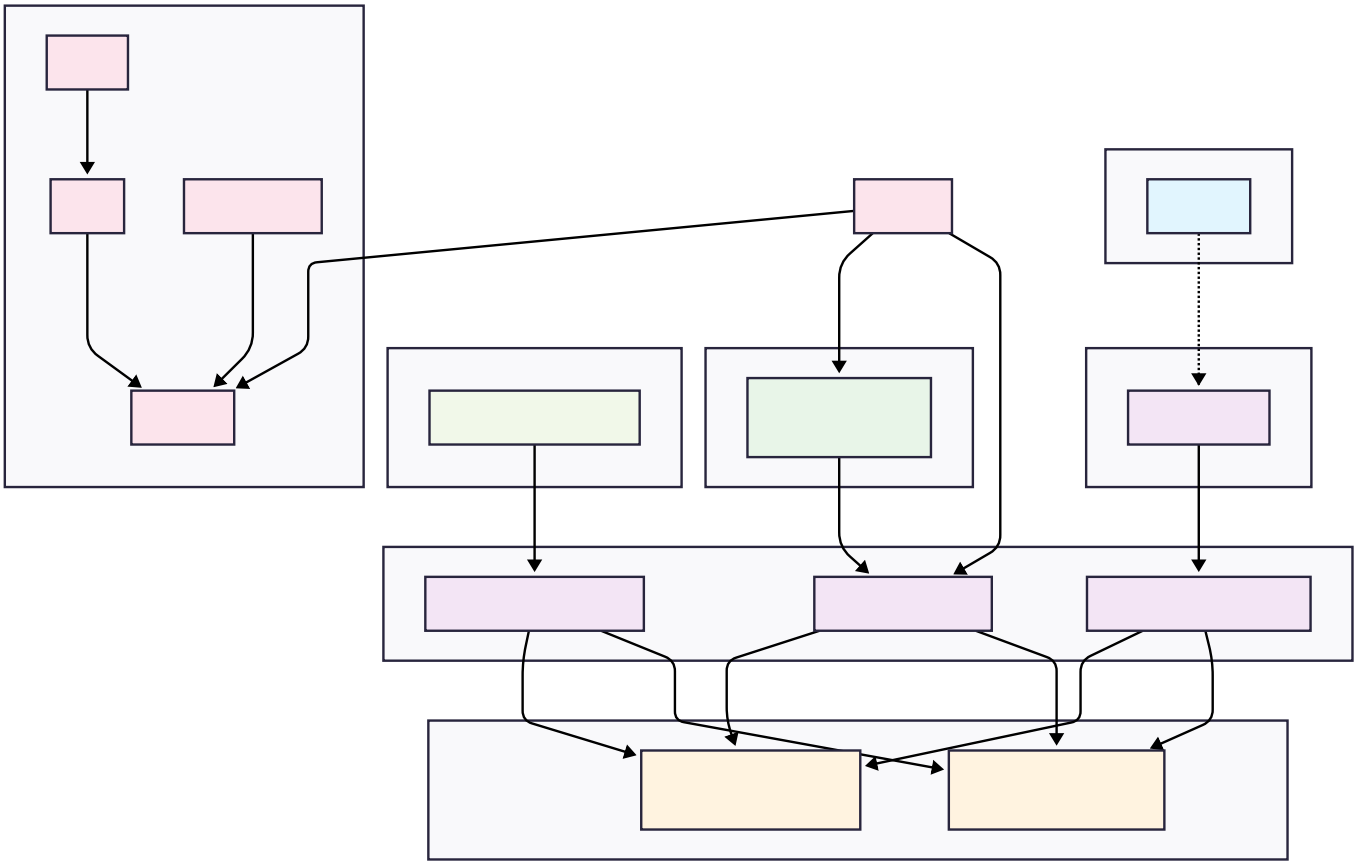
7.3.2 System Decomposition Strategy

All services are containerized and grouped under a shared container orchestration layer. The system is fronted by a load balancer, ensuring scalability and high availability. MQTT acts as the bridge between the hardware (Arduino sensors) and the backend. Logging and observability are handled via the Loki stack, and external visibility is offered via a user-facing website and Grafana deshboards.

Old Architecture

All services are containerized and grouped under a shared container orchestration layer (labelled "Gruppen Container Sammlung"). The system is fronted by a load balancer, ensuring scalability and high availability. MQTT acts as the bridge between the hardware (Arduino sensors) and the backend. Logging and observability are handled via the Loki stack, and external visibility is offered via a user-facing website and Grafana deshboards.





7.3.3 Organizational / Development Process Decisions

- **Source Control**: GitHub with structured branches and CI pipelines
- **Documentation**: Based on **arc42 template**, managed in MkDocs
- **Infrastructure as Code:** All services defined in `docker-compose.yml` and version-controlled
- **Architecture Decisions**: Documented using ADRs (Architecture Decision Records). The detailed technology choices are documented in 04 Architecture Decisions

7.3.4 Cross-cutting Concepts

The following concepts ensure consistency and support the quality goals:

Domain Concepts

- **ΔT metric:** Temperature difference between indoor and outdoor sensors as key indicator.
- **Sensor units:** Each Arduino node has a unique ID and physical placement (e.g., north vs. south façade).
- **Enriched records:** Each reading contains value, timestamp, and source ID.

Fault Tolerance

- **Redundant logging:** Default to central database, with SD card fallback on network/MQTT outages (buffering up to 24h).
- **MQTT QoS (1):** Guarantees at-least-once delivery.
- **Stateless services:** Enable fast restart and failover without data inconsistencies.

Architecture and Design Patterns

- **Message-driven architecture:** Asynchronous data flow via MQTT.
- **Microservices:** Independent services for ingestion, enrichment, API.
- **API gateway pattern:** REST API shields internal complexity and exposes a single entry point.

Development Concepts

- **Containerization:** Consistent deployment via Docker.
- **Continuous Integration:** Automated checks and tests before merges.
- **Infrastructure as Code:** Networks and dependencies tracked in source control.

Operational Concepts

- **Observability:** Logs via Loki, metrics via Prometheus, dashboards via Grafana.
- **Health monitoring:** `/health` endpoints with automated restart on failure.
- **Scalability:** Additional instances (frontend, MQTT receivers, workers) can be added behind Traefik.

August 31, 2025

DianaTin23, deadmade

7.4 Architecture Decisions

7.4.1 ADR 1: Backend Technology Stack

Status:

Accepted (July 2025)

Context:

System needs robust backend technology for REST API and worker services. Team has existing familiarity with C# development.

Decision:

Use .NET 9 with C# for all backend services (REST API, MQTT Receiver, Weather Worker).

Alternatives Considered:

Option	Pros	Cons
Node.js	Rapid iteration, huge ecosystem	Different stack; weaker static typing by default; less team experience
Go	High perf/concurrency; small binaries	Less team experience; different tooling
Python	Rich libs; fast prototyping	Lower throughput; weaker typing by default

Consequences:

Positive:

- Team familiarity reduces development time
- Strong typing prevents runtime errors
- Excellent tooling and debugging support
- Modern async/await support for I/O operations

Negative:

- Platform dependency (though mitigated by containers)
- Larger memory footprint than some alternatives

Neutral:

- Containerization standardizes runtime

7.4.2 ADR 2: Microservices Architecture

Status:

Accepted (July 2025)

Context:

System has distinct responsibilities: API serving, MQTT message processing, and weather data fetching. Need modularity and independent scaling.

Decision:

Split backend into separate services: REST API, MQTT Receiver Worker, Weather Data Worker.

Alternatives Considered:

Option	Pros	Cons
Monolith	Simple deploy; easy local dev	No independent scaling; fault blast radius
Modular monolith	Clear boundaries in one process	Still one deploy unit; limited isolation
Serverless	No servers to manage; auto-scale	Cold starts; platform coupling; ops visibility variance

Consequences:

Positive:

- Clear separation of concerns
- Independent scaling and deployment
- Fault isolation between services

Negative:

- Increased deployment complexity
- Network communication overhead between services

Neutral:

- Requires basic observability to manage complexity

7.4.3 ADR 3: Dual Database Strategy

Status:

Accepted (July 2025)

Context:

System needs both structured application data (users, authentication) and time-series sensor data with different access patterns.

Decision:

Use PostgreSQL for application data and InfluxDB for time-series sensor data.

Alternatives Considered:

Option	Pros	Cons
PostgreSQL + TimescaleDB	One stack; SQL everywhere	Ops complexity; perf tuning for time series needed
InfluxDB only	Optimized for time series	Awkward relational modeling; joins missing
SQLite + InfluxDB Lite	Simple, lightweight	Limited concurrency; feature gaps

Consequences:

Positive:

- PostgreSQL optimized for relational data and transactions
- InfluxDB optimized for time-series queries and compression
- Each database serves its specific use case efficiently

Negative:

- Two databases to maintain and backup

Neutral:

- Extract, Transform, Load (ETL) between stores is minimal

7.4.4 ADR 4: Observability Stack

Status:

Accepted (July 2025)

Context:

Distributed microservices architecture requires comprehensive monitoring, logging, and alerting capabilities.

Decision:

Loki for logs, Prometheus for metrics, Grafana for dashboards, Alloy as agent.

Alternatives Considered:

Option	Pros	Cons
ELK (Elasticsearch, Kibana)	Powerful search/analytics	Heavier footprint; more ops effort
OTel collector + vendor	Standards-based; flexible pipelines	Vendor lock-in and/or cost
Managed cloud observability	Minimal ops	Ongoing costs; data residency limits

Consequences:

Positive:

- Complete observability into system health and performance
- Industry-standard tools with good integration
- Unified dashboard for all monitoring data

Negative:

- Additional infrastructure to maintain

Neutral:

- Can swap components later

7.4.5 ADR 5: Traefik as Reverse Proxy

Status:

Accepted (July 2025)

Context:

Multiple services need unified entry point, SSL termination, and service discovery in containerized environment.

Decision:

Use Traefik as reverse proxy with automatic service discovery and HTTPS termination.

Alternatives Considered:

Option	Pros	Cons
Nginx	Mature; high performance	Manual routing/config; no auto-discovery
Caddy	Simple TLS; easy config	Fewer discovery features
HAProxy	Very fast; robust LB features	More manual config; fewer HTTP niceties

Consequences:

Positive:

- Automatic service discovery via Docker labels
- Built-in SSL certificate management
- Load balancing capabilities

Negative:

- Single point of failure if not properly configured
- Additional configuration complexity

Neutral:

- Replaceable by Nginx if needed

7.4.6 ADR 6: JWT Authentication Strategy

Status:

Accepted (July 2025)

Context:

REST API requires secure authentication mechanism. Need stateless authentication for microservices architecture.

Decision:

Implement JWT token-based authentication with Entity Framework for user management.

Alternatives Considered:

Option	Pros	Cons
Server-side sessions	Simple; revocation is trivial	Stateful; sticky sessions; scale limits
OAuth2/OIDC proxy	Standards-based; SSO ready	More moving parts; infra complexity
API keys	Simple; easy for machines	Poor granularity; rotation burdens

Consequences:

Positive:

- Stateless authentication scales well
- Standard approach with good library support
- Tokens can carry user claims

Negative:

- Token revocation complexity
- Requires secure token storage on client side

Neutral:

- Token TTL balances risk and UX

7.4.7 ADR 7: Docker Compose for Development Environment

Status:

Accepted (July 2025)

Context:

Complex multi-service architecture needs consistent development environment setup across team members.

Decision:

Use Docker Compose to orchestrate all services for local development.

Alternatives Considered:

Option	Pros	Cons
Dev Containers	Great DX; reproducible	Editor-coupled; learning curve
Kind/Minikube	Closer to k8s	Heavier locally; slower feedback
Scripts/Makefiles	Minimal tooling	Fragile; drift across machines

Consequences:

Positive:

- Consistent development environment
- Easy service dependency management
- Simplified onboarding for new developers

Negative:

- Requires Docker knowledge from all developers
- Resource intensive on development machines

Neutral:

- Can migrate to Kubernetes later

7.4.8 ADR 8: Frontend

Status:

Accepted (July 2025)

Context:

System needs a frontend to display charts from measured/collected temperature data and to generate API docs with TypeDoc.

Decision:

> **v0**
>
> JavaScript React app via Docker. Reason: quick start.
> Issue: Schema changes not caught at build time caused runtime UI errors (no static typing).

> **v1**
>
> TypeScript React with Create React App (CRA). Reason: typing and better tooling.
> Issue: TypeDoc generation failed due to CRA/tooling version conflicts.

React + TypeScript built with Vite for the frontend.

Alternatives Considered:

Option	Pros	Cons
CRA (TS)	Familiar, out-of-the-box setup	Tooling conflicts with TypeDoc
Next.js	SSR/ISR, ecosystem	Unneeded complexity for our use
Custom Webpack	Full control	More maintenance

Consequences:

Positive:

- TypeDoc works
- faster startup
- lean tooling

Negative:

- Some devs must learn Vite

Neutral:

- No server-side rendering (SSR) required

7.4.9 ADR 9: Hardware Platform Decision (board, sensors)

Status:

Accepted (July 2025)

Context:

MKR1010 and ADT7410 were provided. Requirements: offline buffering, precise time, dual sites.

Decision:

Use Arduino MKR1010 with RTC DS3231 and SD card; deploy two identical units.

Alternatives Considered:

Option	Pros	Cons
ESP32 boards	Wi-Fi integrated; strong community	Different toolchain; requalification
Different sensors	Potential accuracy/cost benefits	Revalidation effort; integration risk
Single hardware unit	Simpler setup	No north/south comparison; less robust

Consequences:

Positive:

- Local data persistence via SD card enables offline data storage for ≤24h
- Timestamp reliability through RTC with battery
- Compact hardware, low power, WiFi-ready (MKR1010)

Negative:

- RTC and SD modules require additional wiring and SPI/I2C handling
- Time must be synchronized manually once (e.g., via compile-time setting or initial sync)

Neutral:

- The Arduino MKR1010 was predefined, not evaluated
- Final visualization and backend will depend on further platform choices (e.g., MQTT, REST, database)

7.4.10 ADR 10: Arduino Development Environment Decision

Status:

Accepted (July 2025)

Context:

Arduino firmware needs modular builds and host-side unit tests.

Decision:

PlatformIO for builds; Unity with native target for tests.

Alternatives Considered:

Option	Pros	Cons
Arduino IDE	Easy; official	No native tests; inflexible structure
CMake toolchain	Flexible; IDE-agnostic	More setup; custom plumbing
Ceedling	Solid C test framework	Extra integration effort

Consequences:

Positive:

- Reproducible builds and consistent project structure
- PC-native unit tests for business logic (Unity, native target)
- Seamless VS Code integration
- Use of modern C++ structure and dependency management

Negative:

- Additional setup effort for non-Arduino users (e.g., Unity, test runners)
- Developers must learn PlatformIO's structure (src/lib/test)

Neutral:

- The PlatformIO toolchain abstracts away the underlying GCC setup
- Unit tests cannot cover board-specific behavior (e.g., Wire, SD, RTC) directly without mocks

7.4.11 Sources

Documenting Architecture Decisions by Michael Nygard

August 31, 2025

DianaTin23, deadmade

7.5 Context and Scope

7.5.1 Technical Context

The IsoPrüfi system operates in a distributed container-based architecture hosted on the DHBW Server infrastructure. It integrates multiple services for data ingestion, processing, storage, and visualization.

Components and Channels

Component	Communication Channel	Description
Arduino	Wi-Fi / MQTT	Publishes temperature readings to the MQTT broker
MQTT Broker	MQTT	External broker for sensor communication
traefik	HTTP / HTTPS	Reverse proxy and load balancer, entry point to the system
isopruefi-backend	HTTP (REST)	Provides unified access to system data
isopruefi-frontend	HTTPS	User interface for visualizing measurements
influxdb	TCP / SQL	Time-series database for sensor data
postgres	TCP / SQL	Relational database for application data
loki	gRPC / HTTP	Collects and stores logs from all services
prometheus	HTTP	Collects metrics from services
grafana	HTTP	Dashboard for metrics and logs
alloy	HTTP / gRPC	Integrates Loki and Prometheus for observability
Weather API	HTTPS	Provides external weather data
Client (Browser)	HTTPS	Interacts with the frontend

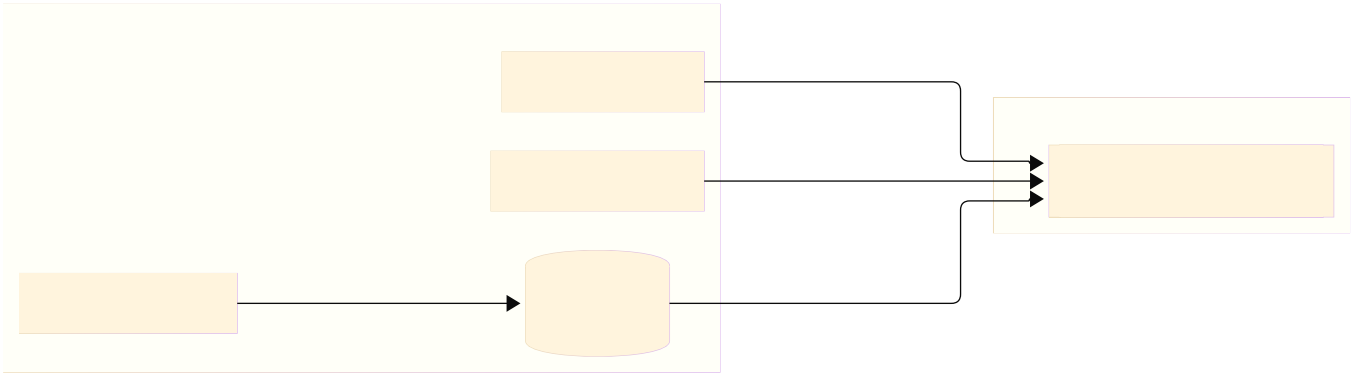
For a detailed list of all Docker containers, their images, addresses and networks, see the separate documentation page: Docker Development Environment

---

Mapping I/O to Channels

I/O Type	Channel	Source	Destination
Temperature Reading	WiFi / MQTT	Arduino	MQTT Broker → MQTT Receiver Worker
Weather Data Pull	HTTPS (API)	Weather API Service	Weather Data Worker
Web Page Access	HTTPS	Client Browser	Traefik → React Frontend
API Request	HTTP / REST	Frontend (via Traefik)	REST API Service
Data Storage	SQL / TCP	Backend Services	PostgreSQL (app data), InfluxDB (time series)
System Logs	gRPC / HTTP	All Services	Alloy → Loki/Prometheus (visualized in Grafana)

Technical Context Diagram



August 31, 2025

DianaTin23, deadmade

7.6 Risks and Technical Debts

7.6.1 1. Description of the Process/System

Overview of the Entire Product:

- **Temperature Measurement and Transmission:**
  - Measuring temperature via temp sensors (and RTC modules) and APIs as a source for outside weather data
  - Transmission of data via WiFi/MQTT from the Arduino to the MQTT Broker
  - Saving the data on the Arduino in case of loss of connection
- **Data Storage:**
  - Databases: Postgres and Influx
  - Caching of data on local storage in case of problems
- **Analysis/Evaluation:**
  - Results are displayed on a frontend web page

Components Involved:

- **Temperature Measurement:**
  - Temperature sensors, RTC modules, Arduino and SD module/card for inside temperatures
  - Online weather via API for outside temperature
- **Temperature Transmission:**
  - Network/WiFi
- **Data Storage:**
  - Database systems: Postgres and Influx
  - Caching
- **Visualization/Analysis:**
  -
    - Data availability, website, analytics platforms

Process Aspects:

- Data flow throughout the system
- Handling of failure and recovery scenarios

7.6.2 2. Error Analysis

Possible Errors

- Incorrect or missing data
- Unavailability of services or functions (e.g., website, Grafana)

Causes

- Compatibility issues due to software or hardware updates
- Security vulnerabilities

- **Temperature Measurement:**
  - Sensor errors (e.g., incorrect calibration, hardware malfunction, sensor failure, power supply issues, incorrect interval configuration)
  - Misassignment of data (e.g., north/south confusion)
  - Weather service outages
  - Outage of containers processing data
- **Data Transmission:**
  - Network outages or connectivity issues
  - Duplicate data transmission
- **Data Storage:**
  - Incorrect or duplicate entries
  - Database corruption or failure
- **Visualization/Analysis:**
  - Website unavailability
  - Incorrect data presented for visualization

Impacts

- Gaps in data analysis
- Misinterpretation or incorrect assessment of results
- Lack of long-term evaluation or comparison basis
- No or limited access to collected data

7.6.3 3. Evaluation of Errors and Consequences

Old Evaluation

Error	Probability of Occurrence	Severity	Probability of Detection	Risk Priority Number
Sensor error	2-3 (unlikely)	8-9 (severe)	2-3 (inevitable detection)	32-81
Misassignment of data	3 (low)	6-7 (disturbance)	5-6 (only detected during targeted checks)	90-126
Weather service outage	1 (almost impossible)	8-9 (severe)	2-3 (inevitable detection)	16-27
Network outage	2 (unlikely)	8-9 (severe)	2-3 (inevitable detection)	31-45
Duplicate transmission	2 (unlikely)	2 (irrelevant)	5-6 (only detected during targeted checks)	20-24
Incorrect/missing entries	2-3 (unlikely)	8-9 (severe)	3-4 (high probability of detection)	48-108
Database corruption	2-3 (unlikely)	8-9 (severe)	3-4 (high probability of detection)	48-108
Website/Grafana malfunction	1 (almost impossible)	8-9 (severe)	2-3 (inevitable detection)	16-27
Power outage	3 (low)	8-9 (severe)	2-3 (inevitable detection)	48-81

Error	Probability of Occurrence	Severity	Probability of Detection	Risk Priority Number
Sensor error (wrong temp data)	2-3 (unlikely)	8-9 (severe)	4-5 (high probability of detection)	64-135
Sensor unavailability	2-3 (unlikely)	8-9 (severe)	2-3 (inevitable detection)	32-81
Misassignment of data	3 (low)	6-7 (disturbance)	5-6 (only detected during targeted checks)	90-126
Weather service outage	1 (almost impossible)	7-8 (severe)	2-3 (inevitable detection)	16-27
Network outage	8 (likely)	3-4 (irrelevant)	3-4 (high probability of detection)	72-128
Duplicate transmission	2 (unlikely)	2 (irrelevant)	5-6 (only detected during targeted checks)	20-24
Incorrect/missing entries	2-3 (unlikely)	6-7 (disturbance)	3-4 (high probability of detection)	36-84
Database corruption	2-3 (unlikely)	8-9 (severe)	3-4 (high probability of detection)	48-108
Database unavailability	2-3 (unlikely)	3-4 (irrelevant)	3-4 (high probability of detection)	18-48
Website malfunction	2-3 (unlikely)	8-9 (severe)	2-3 (inevitable detection)	32-81
Power outage	3 (low)	8-9 (severe)	2-3 (inevitable detection)	48-81

7.6.4 4. Corrective actions

Old Evaluation

Error	Risk Priority Number	Mitigation Measure
Sensor error	32-135	-
Misassignment of data	90-126	Implement data validation and labeling checks
Weather service outage	16-27	Use fallback data sources
Network outage	31-45	Local storage of data on the Arduino
Duplicate transmission	20-24	-
Incorrect/missing entries	48-108	Input validation
Database corruption	48-108	-
Website malfunction	16-27	Monitor uptime

Error	Risk Priority Number	Mitigation Measure
Sensor error	32-81	In case of missing measurements -> alerting
Misassignment of data	90-126	Implement data validation
Weather service outage	16-27	Use fallback data source
Network outage	31-45	Local storage of data on the Arduino
Duplicate transmission	20-24	-
Incorrect/missing entries	48-108	Input validation
Database corruption	48-108	-
Website malfunction	16-27	Monitor uptime
Container unavailability	18-81	Clustering of containers, monitoring uptime and caching of data

7.6.5 5. Technical Debts

Debt	Impact	Mitigation	Priority
Single-server deployment (no HA for DB/Traefik)	Outage stops whole system; RTO/RPO undefined	Define RTO/RPO; periodic restore drills; consider DB replication later	High
External single MQTT broker	Ingestion is SPOF; no controlled failover	Document broker SLA; add reconnect/ backoff; plan broker redundancy/bridge later	High
SD-card buffering deduplication	Risk of duplicate inserts on reconnect	Idempotent writes (sensorId + timestamp + seq unique); DB upsert/unique index	High
Time synchronisation of sensors	Clock drift → wrong ΔT and ordering	Regular NTP sync or backend time anchor; RTC drift check procedure	High
Missing/uneven health/ readiness endpoints	Load balancer may route to bad pods	Standardize `/health` and `/ready`; Traefik forward-auth or ping checks	Medium
No alerting rules/SLOs	Failures unnoticed; 99.5% not enforced	Prometheus alert rules + Grafana alerts; SLO dashboards for availability	Medium
Secrets in env files	Leakage risk; no rotation	Use Docker secrets; rotate regularly; restrict file perms; avoid committing	High
TLS/auth on MQTT not specified	Data spoofing/sniffing possible	Enable TLS; client auth (user/pass or certs); topic ACLs	High
Schema/migration strategy	Breaking changes risk data loss	Versioned EF migrations; InfluxDB bucket retention + downsampling plan	Medium
Config scattering (topics, URLs)	Drift and hidden coupling	Central config per env; validated at startup; document defaults	Medium
Limited automated fault tests	Availability regressions unnoticed	CI: chaos/failure tests (DB down, broker down, network flap)	Medium
Weather API limits/caching	Rate-limit failures; latency	Add caching, retries with jitter, circuit breaker, fallback to last-known	Low
Backup without periodic restore test	False sense of safety	Quarterly restore test; document runbook; verify integrity checks	High
Logging/PII retention not defined	Storage bloat; compliance risk	Retention policy in Loki; scrub PII; log level guidelines	Medium
Rate limiting/DoS on API	Resource exhaustion	Traefik rate limits; API quotas; request size limits	Medium
Ownership/runbooks	Slow incident response	Define service owners; on-call matrix; SOPs for common incidents	Low

7.6.6 Sources

FMEA from the Orgahandbuch (Bundesministerium des Inneren)

September 3, 2025

DianaTin23, deadmade, maratin23

8. License

arc42

Parts of this documentation are based on the arc42 architecture template, licensed under Creative Commons Attribution 4.0 International (CC BY 4.0). © Dr. Gernot Starke, Dr. Peter Hruschka et al.

July 14, 2025

DianaTin23