

Willem Vanhulle

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EXPERIENCE

OTIV (Remote operation of semi-autonomous rail vehicles)

Mid-level software engineer

Ghent, Belgium

Apr. 2024 - current

- **Distributed systems:** Built distributed freight train control system with dynamic presence detection, custom async iterator toolkit, real-time connectivity monitoring with emergency breaking, and GStreamer/WebRTC video streaming.
- **Build systems & CI:** Integrated LSP with Bazel, led Bazel→Cargo migration, wrote CI/CD pipelines from scratch, optimized pipeline runtime by 95%. (Rust)
- **Language expertise:** Organized advanced Rust training on undocumented language features, performed deep technical code reviews. (Rust)
- **Testing:** Implemented comprehensive unit/integration test suites for safety-critical railway systems.
- **Real-time interfaces:** Built multi-monitor native GUIs with streaming data table widgets and geographical map rendering using Slint. (Rust)
- **Embedded systems:** Developed software for real-time hardware control (touchscreens, physical levers, sensors).

Inbiose (Microbial production of speciality carbohydrates)

Software engineer

Ghent, Belgium

June 2021 - January 2024

- **Full-stack development:** Built data collection platform with time-series visualization, implemented type-safe large-scale web applications. (TypeScript, HTML, SCSS)
- **Robotics & embedded:** Built industrial fermentation robots, interfaced with legacy hardware (25+ years) and modern sensors, migrated to async programming. (Python, Rust)
- **High-performance computing:** Implemented property-based testing for genetic data batch processing, optimized bioinformatics pipelines. (Python)
- **Database systems:** Designed high-performance scientific databases (PostgreSQL, Neo4j), modeled complex scientific processes. (R)
- **Process automation:** Automated cellular cloning and fermentation processes, implemented real-time process control systems.
- **Embedded optimization:** Optimized real-time embedded systems for Arduino/ESP32 microcontrollers. (C)

CVO (Adult and refugee high-school)

Mathematics guest lecturer

Leuven, Belgium

Sept. 2020 - Jan. 2021

- **Teaching:** Mathematics and programming courses and document preparation. (Python, LaTeX)

MAJOR PROFESSIONAL PROJECTS

Emergency breaking mechanism - OTIV

Sept. 2024 - Mar. 2025

- **Real-time monitoring:** Built heartbeat system detecting connection failures between remote operators and autonomous trains.
- **Stream processing:** Designed pub-sub/TCP stream aggregator with automatic failover and emergency breaking triggers.

HOBBY PROJECTS

Splitting data streams: Designed runtime-agnostic async stream combinator using low-level primitives (Waker, Poll, Pin). Published as open-source [crate](#). (Rust)

Smart plant pot workshop: Organise and co-lead a workshop on creating a smart plant pot watering system with a Raspberry Pi Pico / ESP32c6 and async Embassy. Integrated USB serial communication and debugging (with JTAG or hardware debug probes), analogue sensing and wireless network notifications. Event at [MeetUp](#). (Rust)

SPOKEN LANGUAGES

English, Dutch: Native

PROGRAMMING LANGUAGES

Rust: Advanced (2 years). Systems programming: complex trait bounds, zero-cost async combinators, embedded HALs. Stack: Tokio/Embassy (async), Axum (web), Zenoh (pub-sub), Serde, Prost (protobuf), Statig (state machines).

Coq, Agda, Haskell: Intermediate (3 years). Formal verification for systems software, type theory research, proof-assistant development.

HTML, SASS, TypeScript, JavaScript, SQL: Advanced (3 years). Backend development: Express.js APIs, database design, type-safe web services.

Python: Advanced (6 years). High-performance computing, property-based testing (Hypothesis), algorithmic optimization, data pipeline design.

EDUCATION

KU Leuven

Leuven, Belgium

Master of Science in Pure Mathematics (Eng.), thesis on functional programming Sep. 2017 - June 2019
languages

- **Completed courses:** Algebra, analysis, discrete mathematics, differential geometry, unified geometry, topology.
- **Volunteering roles:** Coordinator of Groot-Begijnhof Leuven student association.