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Willem Vanhulle

Experience

OTIV (Railway automation) Ghent, Belgium
Mid-level software engineer *Apr. 2024 - June 2025*

- **Distributed systems:** Built remote 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 (Biotechnology) Ghent, Belgium
Software engineer *June 2021 - January 2024*

- **Full-stack development:** Built data collection platform with time-series visualization, implemented type-safe large-scale web applications. (`TypeScript`, `JavaScript`, `HTML`, `SCSS`)
- **Robotics & embedded:** Built industrial fermentation robots, interfaced with legacy hardware (25+ years) and modern sensors, migrated to async programming. (`Python`, `Rust`, `C++`)
- **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`, `SQL`)
- **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 (Education) Leuven, Belgium
Mathematics guest lecturer *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.

Fermentation robot - Inbiose *Oct. 2023 - April 2024*

- **Systems API design:** Built type-safe serial communication API in Rust with comprehensive error handling for robotic systems.
- **Real-time control systems:** Implemented PID-controlled process automation with anomaly detection for 48-hour continuous operation.

Collaborative data-grid - Inbiose *Apr. 2023 - Feb. 2024*

- **Distributed systems:** Built database-backed distributed data grid with persistence layer.
- **Collaborative interfaces:** Designed real-time collaborative data entry system with operational transformation.

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. Code at GitHub. (`Rust`)

Lean computational riddles workshop: Created and delivered workshop on solving computational problems with theorem proving. Interactive problem-solving using dependent types and formal verification. Materials at GitHub. (`Lean`)

Probability arithmetic in Lean: Developed library for simplifying probability calculations in formal mathematics. Extended real number arithmetic for probabilistic proofs. Available at GitHub. (`Lean`)

Spoken languages

English, Dutch: Native **French, German:** Intermediate

Education

KU Leuven (University) Leuven, Belgium

Preparation program and Master of Science in Theoretical Physics (terminatedSep. 2019 - April 2021 early)

- **Courses:** Statistical mechanics, Data mining and neural networks, Thermodynamics, Analytical mechanics and Electrodynamics.
- **Volunteering:** Guide for international students.

University of Utrecht (University) Utrecht, Netherlands
Summer School: Formalizing Mathematics in Lean *July 2025 - current*

- **Courses:** Advanced study of theorem proving, Dependent type theory and Mathematical formalization.

KU Leuven (University) Leuven, Belgium
Master of Science in Pure Mathematics (Eng.) *Sep. 2017 - June 2019*
Thesis: Thesis on functional programming languages

- **Courses:** Algebra, Analysis, Discrete mathematics, Differential geometry, Unified geometry and Topology.
- **Volunteering:** Coordinator of Groot-Begijnhof Leuven student association.

Hobbies

Community founder: Founder of "Systems Programming Ghent" (sysghent.be): organise networking events, in-depth talks and give workshops in Ghent about systems programming languages such as Rust and C++.

Electronics: Assemble electronical circuits with simple sensors. Some experience with ARM and RISC-V boards such as ESP32c6, Arduino Uno (AVR), Raspberry Pico (RP2040).