

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:** Work on a distributed system to operate freight trains remotely. Create a dynamic presence detection system. Create an internal asynchronous iterator / stream toolkit. Create a crucial connectivity monitoring systems that can react to connection loss and engage emergency breaking. Manage real-time audio- and video-streams through GStreamer and WebRTC.
- **Developer tools:** Smooth out integration between the Rust language-server and the Bazel build system. Lead transition from Bazel to the Cargo build system for one team. Write CI/CD pipelines from scratch. Reduced run-time of existing CI pipelines up to 95%.
- **Mentorship:** Organised trainings on parts of the Rust programming language that are lacking in documentation. Performed thorough code reviews and coached junior colleagues.
- **Tests:** Write extensive unit tests for new and existing software modules. Implement integration tests based on requirements given by railway companies.
- **Native GUI:** Co-create several immersive, multi-monitor, native user-interfaces. Implement widgets representing streamed data tables. Create a geographical map widget with highlighted train routes in Rust and Slint.
- **Embedded:** Write software modules interfacing with real physical controls of trains such as custom touch-screens, toggles and traction/breaking levers, running on Linux.

Inbiose (Microbial production of speciality carbohydrates)

Software engineer

Ghent, Belgium

June 2021 - January 2024

- **Micro-biotechnology:** Learn science behind cellular cloning of e. coli. bacteria, used for producing sugars with special health benefits. Learn process of fermentation and down-stream processing with ion-exchange and membrane filtering. Get involved in lab activities with lab workers, operators and researchers.
- **Web-development:** Create graphical web-based data collection procedure and application for the down-stream processing department. Create accompanying simple time-series and data-grid visualisation widgets with Svelte. Introduce TypeScript as a tool for creating large web applications. (HTML, SCSS)
- **Bio-informatics:** Implement property-based unit tests in Python to verify correctness of batch operations on internal, proprietary genetic data. Extend and maintain internal tools for bio-informatics.
- **Embedded systems:** Supported creation of industrial small-scale microbial fermentation robots. Interfaced with legacy hardware (more than 25 years old) and modern optical industrial sensors. Transitioned from Python to asynchronous Rust.
- **Data modelling:** Analyse and model internal scientific processes. Model and construct scientific databases in PostgreSQL. Use graph-oriented databases such as Neo4j. (R)
- **Mentorship:** Assist electronics engineers in optimising internal embedded C programs for Arduino and ESP32 micro-controllers.

CVO (Adult and refugee high-school)

Mathematics guest lecturer

Leuven, Belgium

Sept. 2020 - Jan. 2021

- **Teaching:** Mathematics and programming courses using Python and LaTeX for document preparation.

MAJOR PROFESSIONAL PROJECTS

Emergency breaking mechanism - OTIV

Sept. 2024 - Mar. 2025

- **Heartbeat monitor:** Detects whether the connection between a remote human operator and a semi-autonomous freight train is still normal.
- **Stream aggregator:** Initialise incoming (and outgoing) pub-sub, TCP data streams for assigned freight trains. Aggregate the streams, detect connection loss, initiate emergency breaking mechanism. Findings on [personal blog](#).

Fermentation robot - Inbiose

Oct. 2023 - April 2024

- **Serial communication abstraction layer:** Create a high-level and safe serial API in Rust for operating essential components for a fermentation robot. Implemented thorough error detection and propagation.
- **Fermentation process manager:** Add nutrients and chemicals throughout a 48h biological process for growing e. coli. bacteria. Detect anomalies and stabilise with PID-control.

Collaborative data-grid - Inbiose

Apr. 2023 - Feb. 2024

- **Distributed data-frames:** Distributed, database-backed, persisted data-grid.
- **Spreadsheet interface:** Interactive co-operative table view for lab workers to enter chemical process data with columns grouping and multiple cell types, similar to a restricted version of Google Docs.

HOBBY PROJECTS

Splitting data streams (Rust): Created a functional asynchronous Rust combinator to split data streams / asynchronous iterators. Run-time agnostic and fully tested. Intended to be used with many, simultaneous splits. Built with low-level asynchronous primitives such as Waker, Poll and Pin. Available as a public [Rust crate](#).

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

SPOKEN LANGUAGES

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

PROGRAMMING LANGUAGES

Rust: Advanced (2 years). Specialized in complex trait bounds and creating performant asynchronous combinators from scratch. Frameworks used: Axum (web server), Embassy and Tokio (asynchronous runtimes), Zenoh (publish-subscribe), Serde (serialization), Statig (state machines), Prost (protobuf). Limited experience with embedded HALs.

Coq, Agda, Haskell: Intermediate (3 years). Used several proof-assistants for formal mathematics (topology) / systems software verification. Following up recent developments in free-time.

HTML, SASS, TypeScript, JavaScript, SQL: Advanced (3 years). Express.js back-end, Svelte(Kit) front-end.

Python: Advanced (6 years). Bio-informatics with BioPython. End-to-end UI testing. Used property-based testing with Hypothesis (fuzzer).

EDUCATION

KU Leuven

Preparation program and Master of Science in Theoretical Physics (terminated early)

Leuven, Belgium

Sep. 2019 – April 2021

- **Completed courses:** Statistical mechanics, data mining and neural networks, thermodynamics, analytical mechanics, electrodynamics.
- **Volunteering roles:** Guide for international students.

KU Leuven

Master of Science in Pure Mathematics (Eng.), thesis on functional progr. lang.

Leuven, Belgium

Sep. 2017 – June 2019

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

VUB

Bachelor of Science in Mathematics, Minor Computer Science, thesis on unsupervised learning

Brussels, Belgium

Sep. 2013 – Aug. 2017

- **Completed courses:** Functional programming, algorithms and data-structures, logic, analysis, algebra, philosophy, geometry.
- **Student job:** Mathematics tutor.

HOBBIES

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

Play with electronical components: Order development boards and assemble simple electronical circuits with simple sensors. Some experience with ARM and RISC-V boards such as ESP32c6, Arduino Uno (AVR), Raspberry Pico (RP2040).

Visit developer conferences: I go to the developer conferences in Europe to meet colleagues and share my passion.