

J. FELICIEN IHIRWE

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BIO

My name is Felicien Ihirwe, I received my Ph.D. in Computer Science from the University of L'Aquila. I hold a Master's degree in Electrical and Computer Engineering from Carnegie Mellon University. I work as a Software Research Engineer at FlandersMake vzw. I'm part of the CodesignS core lab, in the Digital Architecture technical research domain. Before, I worked as a model-based developer for Intecs Solutions' Research & Development division in Pisa, Italy, within the Innovation Technology Service lab. I am involved in topics such as Low-code Engineering (LCE), embedded hardware/software co-design, model-based safety analysis, and the Internet of Things (IoT). My current research interests include embedded software research/functional safety, digital twins for industrial IoT system operations, and cloud-based development platforms.

EDUCATION

P.h.D in Computer Science

Nov 2019 – July 2023 [University of L'Aquila](#)
Interest: Low-code engineering & Domain-specific languages & IoT

M.Sc. in Electrical and Computer Engineering

July 2017 – June 2019 [Carnegie Mellon University](#)
Interest: Software engineering & Machine Learning

B.Sc. in Electronics and Telecommunication Engineering

Oct 2012 – June 2016 [College of Science and Technology-University of Rwanda](#)
Interest: Embedded Systems

WORKING EXPERIENCE

Software Research Engineer- Digital Architecture

FlandersMake vzw

June 2023-Current [Leuven, Belgium](#)

- Part of end-2-end design operation research cluster
- Embedded software research/functional safety
- Digital twin for Industrial IoT system operations
- Cloud-based development platforms

Model-based Software Engineer

Intecs Solutions S.p.A

December 2019-May 2023 [Pisa, Italy](#)

- Computer Science applications in Low-code engineering with MDE practices for engineering IoT systems.
- Main developer of CHESSIoT framework; an MDE environment for developing, analysis, and deployment of engineering IoT systems.
- Model-based safety analysis of engineering IoT systems employing Fault Tree Analysis approaches.
- Platform-specific code generators (C++/Arduino/ThingML).
- Automatic deployment and monitoring of generated services.
- Research publications: <https://fhirwe.github.io/publication.html>
Technologies: Java, UML, EMF, Acceleo, Qvto, Xtext, ETL, Docker.

Software Developer

WYS ltd

Jan 2019 - June 2019 [Kigali, Rwanda](#)

- Software development with a Java-based development stack.
- System integration framework with different multipurpose consumer services.
- Reporting and software documentation.

Technologies: Java, SpringBoot, JPA, Security, Thymleaf, JQuery and Bootstrap Docker, Postgres, MySQL

Data Scientist (Internship)

Rwanda Revenue Authority

📅 May 2018 – September 2018

📍 Kigali, Rwanda

- Worked on Electronic Billing Machine (EBM) data to improve VAT tax payment compliance and service quality.
- Developed a Machine Learning model to predict reporting behavior of EBM machines.
- *Technologies used: Python, Data-manipulation, Jupiter-notebook, Tableau, Flask*

Electronics Engineer

BBOXX Capital

📅 May 2016 – August 2017

📍 Kigali, Rwanda

- Efficiently provided a great working commitment to the company product refurbishment processes, unshipping, product quality check, and deployment to the market.
- Close collaboration with the ongoing product design team to improve client satisfaction.

IT & Automation officer (Internship)

BRALIRWA - Part of Heineken

📅 May 2015 – August 2015

📍 Kigali, Rwanda

- Contributed to the design and implementation of new system wiring optimization of brewery expansion.
- Effectively identified and fixed faults that arose in the company's electrical and automotive network.

RESEARCH EXPERIENCE

Publications

• Journals

1. "CHESSIoT: A model-driven approach for engineering multi-layered IoT systems". Felicien Ihirwe, Davide Di Ruscio, Simone Gianfranceschi, Alfonso Pierantonio. *Journal of Computer Languages*. Volume 78, 2024, 101254, ISSN 2590-1184, DOI:<https://doi.org/10.1016/j.col.2023.101254>;
2. "Supporting model-based safety analysis for safety-critical IoT systems". Felicien Ihirwe, Davide Di Ruscio, Katia Di Blasio, Simone Gianfranceschi, Alfonso Pierantonio. *Journal of Computer Languages*. Volume 78, 2024, 101243, ISSN 2590-1184. DOI:<https://doi.org/10.1016/j.col.2023.101243>;
3. "Comparison of Tree-based Machine Learning Algorithms to Predict Reporting Behavior of Electronic Billing Machines". Belle Fille Murorunkwere, Felicien Ihirwe, Idrissa Kayijuka, Joseph Nzabanita, and Dominique Haughton. 21 Pages. February 2023 *Journal: Information 2023*; Paper:140, Vol:14, Issue:3 DOI:<https://doi.org/10.3390/info14030140>
4. "THESIS: Low-code Engineering for the Internet of Things". Felicien Ihirwe *Doctorate Thesis*; 196 pages Available at: <https://dx.doi.org/10.2139/ssrn.4539001>

• Conference proceedings

1. "Supporting Early-Safety Analysis of IoT Systems by Exploiting Testing Techniques". Diego Clerissi, Juri Di Rocco, Davide Di Ruscio, Claudio Di Sipio, Felicien Ihirwe, Leonardo Mariani, Daniela Micucci, Maria Teresa Rossi Riccardo Rubei. *In Proceedings of the 26th ACM/IEEE International Conference on Model Driven Engineering Languages and Systems: Companion Proceedings (MODELS'23)*. Västerås, Sweden, 2023 pp. 520-529. DOI: [10.1109/MODELS-C59198.2023.00089](https://doi.org/10.1109/MODELS-C59198.2023.00089)
2. "Towards a pre-trained Question-Answering language model for Kinyarwanda". Diane Tuyizere, Felicien Ihirwe, Remy Ihabwikuzo, Guda Blessed, Edith Luhanga. 23 Pages. December, 2022. *In proceedings of 3rd IEEE International Conference on Signal, Control, and Communication (SCC 2023)*. Hammamet, Tunisia, DOI in production: [\[PDF available\]](#)
3. "Assessing the Quality of Low-Code and MDE Platforms for Engineering IoT Systems". Felicien Ihirwe, Davide Di Ruscio, Simone Gianfranceschi, and Alfonso Pierantonio. *In Proceedings of the 22nd IEEE International Conference on Software Quality, Reliability, and Security (QRS22)*. Guangzhou, China, November 2022, pp. 583-594, 12 Pages. DOI: [10.1109/QRS57517.2022.00065](https://doi.org/10.1109/QRS57517.2022.00065).
4. "Cloud-based modeling in IoT domain: a survey, open challenges, and opportunities". Felicien Ihirwe, Arsene Indamutsa, Davide Di Ruscio, Silvia Mazzini, and Alfonso Pierantonio. *In the Proceedings of 2021 ACM/IEEE International Conference on Model Driven Engineering Languages and Systems Companion (MODELS 2021)*. Fukuoka, Japan, October 2021, pp. 73-82. DOI: [10.1109/MODELS-C53483.2021.00018](https://doi.org/10.1109/MODELS-C53483.2021.00018).
5. "A domain-specific modeling and analysis environment for complex IoT applications". Felicien Ihirwe, Davide Di Ruscio, Silvia Mazzini, and Alfonso Pierantonio. *In the 7th Italian Conference on ICT for Smart Cities And Communities (I-CiTies'21)*. September 2021. [\[Online\]](#)

- "Towards an MQTT5 geo-location extension for location-aware applications". Felicien Ihirwe, Giovanni Iovino, and Davide Di Ruscio. In the 44th IEEE International Conference on Telecommunications and Signal Processing (TSP'21). DOI: [10.1109/TSP52935.2021.9522590](https://doi.org/10.1109/TSP52935.2021.9522590). July 2021 [Online]
- "Towards a modeling and analysis environment for industrial IoT systems". Felicien Ihirwe, Davide Di Ruscio, Silvia Mazzini, and Alfonso Pierantonio. In the International Workshop on MDE for Smart IoT Systems co-located with Software Technologies: Applications and Foundations (MESS@STAF21) conferences. June 2021. [Online - DOI]
- "Model-based Analysis Support for Dependable Complex Systems in CHESS". Alberto Debiassi, Felicien Ihirwe, Pierluigi Pierini, Silvia Mazzini, and Stefano Tonetta. In Proceedings of the 9th International Conference on Model-Driven Engineering and Software Development - MODELSWARD'21. ISBN 978-989-758-487-9; ISSN 2184-4348, pages 262-269. DOI: [10.5220/0010269702620269](https://doi.org/10.5220/0010269702620269). February 2021 [Online]
- "Low-code Engineering for the Internet of things: A state of research". Felicien Ihirwe, Davide Di Ruscio, Silvia Mazzini, Pierluigi Pierini, and Alfonso Pierantonio. In Proceedings of the 23rd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems: Companion Proceedings (MODELS'20). Article No.: 74 Pages 1–8 DOI:[10.1145/3417990.3418000](https://doi.org/10.1145/3417990.3418000) October 2020 [Online]

Paper reviews contributions

- External Reviewer: [Journal of Object Technology \(JOT\)](#)
Topics: MDE, IoT, communication protocols, QoS.
- Invited Reviewer: [IET Software journal](#)
Topics: IoT and Machine learning applications, edge computing, communication protocols.
- Shadow Program Committee: [Mining Software Repositories conference \(MSR'21\)](#)
Topics: Mining android apps software repositories.

Volunteer and outreach

- Student Volunteer: The 49th ACM SIGPLAN Symposium on Principles of Programming Languages ([POPL 2022](#)). 📅 Sun 16 - Sat 22 January 2022
- Student Volunteer: The 36th IEEE/ACM Int. Conf. on Automated Software Engineering ([ASE 2021](#)). 📅 Sun 14 - Sat 20 November 2021
- Student Volunteer: ACM / IEEE 24rd Int. Conf. on Model Driven Engineering Languages and Systems ([MODELS'21](#)) 📅 10-15 October 2021
- Student Volunteer: 25th ACM International Systems and Software Product Line Conference ([SPLC 2021](#)) 📅 Sept 6-11, 2021
- Vice-president: Energy and embedded system community - Carnegie Mellon university-Africa 📅 Dec 2017-Feb 2019

Speaker at conferences

- "Cloud-based modeling in IoT domain: a survey, open challenges and opportunities" at the ACM/IEEE 24th Intl. Conf. on Model Driven Engineering Languages and Systems ([MODELS'21](#)) (Speaker) 📅 October 10 - 15, 2021
- "A domain-specific modeling and analysis environment for complex IoT applications" 7th" at the Italian Conference on ICT for Smart Cities and Communities ([I-CITIES 2021](#)) (Speaker) 📅 22-24 September 2021
- "Towards an MQTT5 geo-location extension for location-aware applications" at the 44th IEEE International Conference on Telecommunications and Signal Processing ([TSP'21](#)) (Speaker) 📅 July 26-28, 2021.
- "Towards a modeling and analysis environment for industrial IoT systems" at Software Technologies: Applications and Foundations conferences ([MESS@STAF21'21](#)) (Speaker) 📅 21-25 June 2021.
- "Low-code Engineering for the Internet of things: A state of research" at the ACM/IEEE 23rd Intl. Conf. on Model Driven Engineering Languages and Systems ([MODELS'20](#)) (Speaker) 📅 Oct 16-23, 2020

TEACHING EXPERIENCE

Carnegie Mellon University

- 📅 Fall 2018 📍 Kigali-Rwanda
- Graduate Teaching Assistant: 04-330 Foundations of Software Engineering and Problem Solving.
- 📅 July-Aug 2018, 2019, 2021 and 2022 📍 Kigali-Rwanda
- Graduate Teaching Assistant: Introduction to Linux-Java programming orientation course.

The African Centre of Excellence in Data Science (ACEDS)

- 📅 Fall 2019, 2020, 2022, 2023 📍 Remote
- Graduate Teaching Assistant: DSC6231 Computer Systems and Data Analytics.

High school teaching (ACEC)

- 📅 February 2012 - June 2015 📍 Nyabihu-Rwanda (Part-time)
- Teacher: Mathematics and Physics for Advanced level studies.

TECHNICAL SKILLS^[*:BASIC]

Language

Java, Python, Node.js*, C++, Assembly*, MATLAB, EMF/UML/SysML, ETL, Acceleo, Xtext/Xtend*/Qvto*

Front-end

JQuery, Bootstrap, Thymeleaf, React360*, AngularJS*

Framework

SpringMVC, SpringBoot, Flask, Django, Unity3D

Data Science

Python/Matlab, Applied Machine Learning, PyTorch, Keras*

Deployment

Docker(DockerFile, Docker Compose), Kubernetes*

Tools

Eclipse, IntelliJ IDEA, VS Code, Sublime, Vi

Linux

Linux Administration, Bash Scripting

Database

MySQL, Postgres, MongoDB*

Languages

English, French, Italian*, Kinyarwanda, Kiswahili*

Driving Licence

B(EU)

INTEREST

Low-code Engineering research



Software Development Engineering



Software Research Engineering



Model-based Software Engineering



Embedded Systems



[For more information, please visit <http://fhirwe.github.io/>] - Last Updated: Feb 2024