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. Prior to this, 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 Information Science and Engineering

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

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://fihirwe.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, Thymlearf, 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*

Administrative Support Officer

Carnegie Mellon University - Africa

Jan 2018 – May 2018 Kigali, Rwanda

- General office support for various administrative functions of the organization.

Electronics & Repair 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

- **"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
- **"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 26rd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems: Companion Proceedings (MODELS'23). October 2023*;
- **"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
- **"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)*. 12 Pages. November 2022. Available at SSRN: DOI: http://dx.doi.org/10.2139/ssrn.4267269 [Online]
- **"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)*. October 2021 DOI: 10.1109/MODELS-C53483.2021.00018.
- **"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. 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 Debiasi, 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. 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:10.1145/3417990.3420208. 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.

PROJECTS

Lowcomote (EU H2020-ITN n. 813884)

November 2019-Current | Pisa, Italy

Lowcomote aims to train a generation of professionals in the design, development, and operation of new LCDPs, that overcome the limitations above, by being scalable (i.e., supporting the development of large-scale applications, and using artifacts coming from a large number of users), open (i.e., based on interoperable and exchangeable programming models and standards), and heterogeneous (i.e., able to integrate with models coming from different engineering disciplines).

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
Software Development Engineering
Software Research Engineering
Model-based Software Engineering
Embedded Systems

[For more information, please visit http://fihirwe.github.io/] - Last Updated: August 2023