Hes·so VALAIS WALLIS

School of Engineering

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Haute Ecole Spécialisée de Suisse occidentale
Fachhochschule Westschweiz
University of Applied Sciences and Arts Western Switzerland

Degree Programme

Systems Engineering

Major Infotronics

Bachelor's Thesis

Diploma 2025

Firstname Lastname

Thesis Template

Longer Subtitle

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Submission date
14 August 2025

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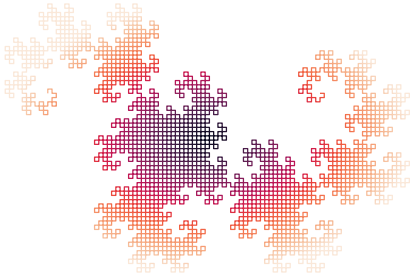

Thesis Template

Graduate Firstname Lastname

Objective

The objective of this thesis is to analyze and improve the performance of a predictive maintenance system in industrial IoT environments by implementing advanced data processing algorithms and evaluating their effectiveness through case studies.

Methods | Experiences | Results

This bachelor thesis focuses on the optimization of predictive maintenance systems within industrial IoT environments. Predictive maintenance is a key aspect of modern manufacturing, enabling the anticipation of equipment failures and reducing downtime. The research begins by outlining the theoretical foundations of predictive maintenance, including sensor data acquisition, processing, and analysis. The study then introduces advanced data processing algorithms, such as machine learning techniques, to enhance prediction accuracy and reliability. A case study approach is employed, using real-world industrial data to evaluate the system's performance. The results demonstrate significant improvements in fault detection rates and decision-making efficiency. The thesis concludes by discussing the implications for industry and providing recommendations for future development. This work aims to contribute to the advancement of smart maintenance systems, supporting industry 4.0 transformation efforts.

Bachelor's Thesis

| 2025 |

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Infotronics

Professor
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Declaration of honor
I, undersigned, hereby declare that the work submitted is the result of a personal work. I certify that I have not resorted to plagiarism or other forms of fraud. All sources of information used and the author quotes were clearly mentioned

Place, date	Sion, 03.02.2025
Signature	

Contents

Acknowledgements

While optional, acknowledgements provide an opportunity to express gratitude to individuals, institutions, or organizations that have supported you throughout your academic journey.

Despite not impacting the evaluation, acknowledgements contribute to the overall tone and appreciation within your thesis.

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Abstract

The abstract serves as a concise summary of your entire thesis, encapsulating key elements on a single page such as:

- *General background information*
- *Objective(s)*
- *Approach and method*
- *Conclusions*

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Keywords:

HEI-Vs, *Systems Engineering*, *Infotronics*, *Thesis*, *Template*

1 Introduction

Your introduction serves to introduce the topic of your Bachelor thesis and to arouse the reader's curiosity with an overview. Why it is important and how it is structured, we explain here.

You can consider an introduction as a teaser for your bachelor thesis. You arouse interest and give a foretaste by presenting your motivation, your method and the state of research in your introduction.

Convince your examiners already in the introduction that your Bachelor thesis will be exciting. If your professor starts reading your thesis with anticipation and interest, the chances of getting good grades are higher.

Pay particular attention to the following in your introduction:

- ***Introduce the topic*** *- What characterizes the topic?*
- ***Introduce the goal*** *- What do you want to achieve with your thesis?*
- ***Make the reader curious*** *- What motivates the reader to read on?*
- ***Describe the relevance*** *- Why is this bachelor thesis scientifically relevant?*

The introduction should have the following content:

- ***Initial situation presentation of the topic*** *- You introduce the topic with an exciting 'bait'. You provide initial information on the topic and the object of research and explain the current state of research.*
- ***Relevance of the topic motivation*** *- You justify the relevance of your topic (scientifically) and place it in the context of your field. In addition, it is often required that you disclose your personal motivation.*
- ***Objectives*** *- Your introduction should clearly state what the goal of your paper is and what outcome you hope to achieve upon completion of the bachelor thesis.*
- ***Method*** *- You explain the approach and justify the choice of method.*
- ***Structure of the Bachelor's thesis*** *- Finally, you give the reader a general overview of your Bachelor's thesis by explaining the structure, showing the red thread and how the research question is answered.*

Welcome to the template's introductory chapter! Instead of boring you with lorem ipsum, here's a quick guide to what you can do in Typst and, more specifically, in this template.

Need more? Check out the Guide to Typst.

1.1 Basic markup

Typst lets you create bold, italic, or monospaced text with ease. You can also sprinkle in equations like $e^{i\pi} + 1 = 0$ or even inline code like `fn main() { println!("Hello, World!") }`. And because life is better in color: pink, blue, yellow, orange, green, and more! Boldly colorize!

You can also write numbered or unnumbered lists:

- First item
- Second item
  1. First Subitem

2. Second Subitem
- Third item

Need equations? Sure! They look great as blocks too:

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \ldots = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1}$$

1.2 Images

As they say, a picture is worth a thousand words. Let's add one:

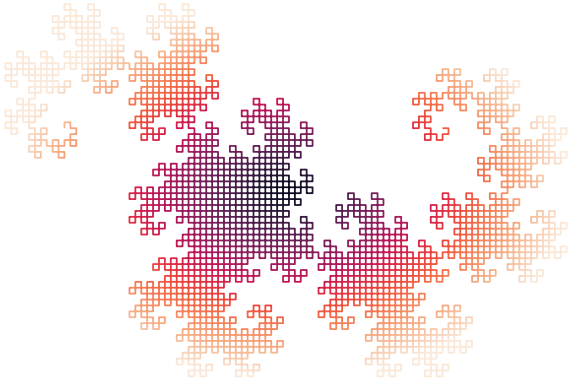


Figure 2: Project logo

1.3 Tables

Tables are great for organizing data. From simple to complex, Typst handles them all:

Name	Age	City
Albert Einstein	25	Bern
Marie Curie	22	Paris
Isaac Newton	30	London

Table 1: Simple table

[31:27]			[24:20]	[19:15]	[14:12]	[11:7]	[6:0]
funct5	aq	rl	rs2	rs1	funct3	rd	opcode
5			5	5	3	5	7

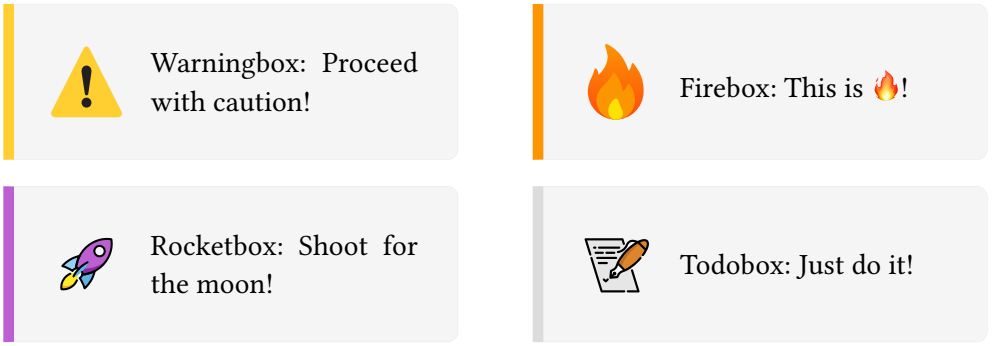
Table 2: Complex table

1.4 Boxes

Highlight key points with these fun boxes (and more):

Infobox: For highlighting information.

Ideabox: Share a brilliant idea.



1.5 Citations, Acronyms and Glossary

Add citations with `@` like [1] or [1, p.7ff] (stored in **`/tail/bibliography.bib`**).

Acronym terms like Infotronics (IT) expand on first use and abbreviate after IT. Glossary items such as Rust Programming Language (Rust) can also be used to show their description as such: Rust is a modern systems programming language focused on safety, speed, and concurrency. It prevents common programming errors such as null pointer dereferencing and data races at compile time, making it a preferred choice for performance-critical applications.. Acronyms and glossary entries auto-generate at the document's end (defined in **`/tail/glossary.typ`**).

1.6 Code

Besides writing inline code as such `fn main() { println!("Hello World") }` you can also write code blocks like this:

```rust
fn main() {
  let ship = Starship::new("USS Rustacean", (0.0, 0.0, 0.0));
  let destination = (42.0, 13.0, 7.0);
  let warp = ship.optimal_warp(ship.distance_to(destination));

  println!("🖐 {} traveling to {:?} at Warp {:.2}", ship.name, destination, warp);
  if warp <= 9.0 {
    println!("✨ Warp engaged!");
  } else {
    println!("⚠ Warp failed!");
  }
}
```

Listing 1: First part of the USS-Rustacean code

or directly from a file

```rust
struct Starship {
  name: String,
  position: (f64, f64, f64),
}

impl Starship {
  fn new(name: &str, position: (f64, f64, f64)) -> Self {
    Self {
      name: name.into(),
      position,
    }
  }
  fn distance_to(&self, dest: (f64, f64, f64)) -> f64 {
    ((dest.0 - self.position.0).powi(2)
      + (dest.1 - self.position.1).powi(2)
      + (dest.2 - self.position.2).powi(2))
    .sqrt()
  }
  fn optimal_warp(&self, distance: f64) -> f64 {
    (distance / 10.0).sqrt().min(9.0)
  }
}
```

Listing 2: Second part of the USS-Rustacean code from **`/resources/code/uss-rustacean.rs`**

1.7 Context Problem

Haute École d'Ingénierie (HEI) Rust Rust programs

[1], [1, p.7ff]

```rust
fn main() {
  println!("Hello World!");
}
```

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1.8 Objectives

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1.9 Structure of this report

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2 Analysis

In the analysis part a so called "State of the Art" research is done. It describes the knowledge about the studied matter through the analysis of similar or related published work. It provides a comprehensive overview of what was done, what has been done in the field and what should be further investigated.

A State of the Art is done in multiple phases:

1. *Problem formulation (Research questions)*
2. *Literature search*
3. *Literature evaluation*
4. *Analysis and interpretation*
5. *Presentation*

Good sources for a literature search depend on your subject matter. For engineering hereafter a incomplete list:

- *IEEE Xplore*
- *Science Direct*
- *Google Scholar*
- *Springer Link*
- *ProQuest*
- *JSTOR*
- *Google Books*

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2.1 Section 1

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2.2 Section 2

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2.3 Conclusion

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3 Design

In the design section of your bachelor thesis, you have the opportunity to provide a detailed blueprint of the system you intend to develop or analyze. This section serves as the foundation upon which your implementation will be built. Here's how you can enrich and expand upon this section:

- ***System Overview**: Begin by providing a comprehensive overview of the system under consideration.*
- ***Requirements Specification**: Outline the specific requirements that your system must fulfill.*
- ***Architecture and Design Principles**: Delve into the architectural design of your system, elucidating the underlying principles and design decisions that govern its structure.*
- ***Technology Stack**: Detail the technologies and tools that will be employed in the development of your system.*
- ***Data Management and Storage**: If your system involves the management or manipulation of data, provide insights into how data will be structured, stored, and accessed.*
- ***User Interface (UI) Design**: If applicable, describe the user interface of your system, focusing on usability, accessibility, and user experience (UX) design principles.*
- ***Integration and Interoperability**: Address how your system will integrate with existing systems or external services, if relevant.*

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3.1 Section 1

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3.2 Section 2

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3.3 Conclusion

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4 Implementation

In the implementation phase of your bachelor thesis, you translate the design specifications into tangible, functional artifacts. This section offers insights into the practical execution of your research, detailing the steps taken to realize the proposed system. Here are some ways to enhance and elaborate on this section:

- ***Development Methodology**: Describe the methodology or approach employed in the development process.*
- ***Prototyping and Iterative Development**: If applicable, discuss any prototyping or iterative development techniques utilized during the implementation phase.*
- ***Coding Practices and Standards**: Provide insights into the coding practices, standards, and conventions adhered to during development.*
- ***Testing and Quality Assurance**: Detail the testing strategies and quality assurance measures employed to validate the correctness and robustness of the implemented system.*
- ***Performance Optimization**: Address any performance considerations or optimizations made during the implementation phase.*
- ***Deployment and Configuration**: Describe the deployment process and configuration management practices involved in deploying the system to production or testing environments.*
- ***Documentation and Knowledge Transfer**: Highlight the importance of documentation in facilitating knowledge transfer and ensuring the sustainability of the implemented system.*

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4.1 Section 1

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4.2 Section 2

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4.3 Conclusion

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5 Validation

*In addition to presenting the **results of your research in relation to your research question**, it is imperative that the validation section of your bachelor's thesis adheres to certain principles to ensure clarity, coherence, and rigor. Here are some additional considerations to enhance the validation process:*

- ***Objective Description of Data**: Provide an objective and detailed description of the data used in your analysis.*
- ***Utilize Graphs and Tables**: Visual aids such as graphs, charts, and tables can greatly enhance the clarity and impact of your results presentation.*
- ***Link Results to Research Questions**: For each result presented, explicitly link it back to the corresponding research question or hypothesis.*
- ***Ranking Results by Importance**: Prioritize your results by ranking them in order of importance or relevance to your research objectives.*
- ***Confirmation or Rejection of Hypotheses**: Evaluate each result in light of the hypotheses formulated in your thesis.*

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5.1 Section 1

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5.2 Section 2

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5.3 Conclusion

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6 Conclusion

In the concluding section of your bachelor's thesis, you consolidate the essence of your research journey, encapsulating the most pivotal insights garnered throughout your study. Here's how to enhance and structure your conclusion:

- ***Project Summary**: Offer a succinct recapitulation of the core elements of your project, including its objectives, methodologies employed, and the main findings obtained.*
- ***Comparison with Initial Objectives**: Reflect upon how your research outcomes align with the initial objectives set forth at the outset of your thesis.*
- ***Encountered Difficulties**: Acknowledge and address any challenges or obstacles encountered during the course of your research.*
- ***Future Perspectives**: Offer insights into potential avenues for future research or practical applications stemming from your findings.*

While you keep the conclusion of your bachelor thesis short and to the point, you deal with your results in more details in the discussion. There is no new informations in the conclusion.

6.1 Project summary

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6.2 Comparison with the initial objectives

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6.3 Encountered difficulties

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6.4 Future perspectives

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Glossary

***Rust* – Rust Programming Language**: Rust is a modern systems programming language focused on safety, speed, and concurrency. It prevents common programming errors such as null pointer dereferencing and data races at compile time, making it a preferred choice for performance-critical applications. 9, 10

***HEI* – Haute École d'Ingénierie** 10

***IT* – Infotronics** 9

Bibliography

[1] S. Zahno *et al.*, "Dynamic Project Planning with Digital Twin," *Frontiers in Manufacturing Technology*, vol. 3, May 2023, doi: 10.3389/fmtec.2023.1009633.