

# INTERNSHIP RESEARCH REPORT PERIOD 1 AND 2

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## SUMMARY

This research focuses on developing a 3D visualization (“virtual ghost”) to make faults and deviations in position and movement of a stairlift faster and more intuitive to interpret within DeVi Comfort. The assignment is carried out iteratively with prototyping and evaluation based on practical scenarios.

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## 1 Introduction

### 1.1 Context

DeVi Comfort designs and produces stairlift systems and develops the accompanying software in-house. The company continually works on reliability, safety and maintainability of the product. During service and further development it is important that faults can be recognized and analyzed quickly.

### 1.2 Motivation

Textual fault information and error codes are correct, but in practice it takes time to interpret them properly. When the cause of a fault is not quickly clear, this leads to additional diagnosis time, longer downtime and higher support and service costs. A clear visual representation of position, movement and deviations can reduce this.

### 1.3 Research Goal

The goal is to develop a 3D visualization (“virtual ghost”) that shows the stairlift on the rail and provides insight into movement and status. This should make faults and warnings faster and more intuitive to interpret, so that diagnosis and recovery are more efficient.

### 1.4 Reading Guide

Chapter 2 describes the problem statement and research questions. Chapter 3 provides the theoretical framework. Chapter 4 describes the method. Chapter 5 presents the results. Chapter 6 concludes with the conclusion and recommendations.

## 2 Problem Statement

### 2.1 Problem Description

Faults and warnings of the stairlift are not always immediately understandable based only on error codes and status bits. As a result, it

is difficult to quickly determine whether the stairlift is moving correctly, has lost its position, or is in a fault condition. This slows down diagnosis and recovery.

## 2.2 Main Question

Which data and design choices are needed to develop a 3D “virtual ghost” visualization that makes faults and deviations in position and movement of a stairlift understandable for fault analysis within DeVi Comfort?

## 2.3 Subquestions

- Which faults and warnings are most relevant to visualize?
- Which technical inputs (position, speed, status, error codes) are needed for a reliable and stable 3D representation?
- How is the expected position determined and how is the difference with the measured position calculated and interpreted?
- Which visualization forms make deviations between expected and measured position most understandable for engineers and service?
- How can the prototype be validated with practical scenarios (e.g., impact on interpretation errors and diagnosis time)?

## 3 Theoretical Framework

### 3.1 Background Information

DeVi Comfort works with complete stairlift systems in which mechanics, electronics and software come together. For maintenance and service, insight into the current and expected position of the lift is essential.

## 3.2 Relevant Theory

Relevant themes include system diagnostics, visualization of technical status information and interpreting deviations between measured and expected values in mechatronic systems.

## 3.3 Existing Solutions

Within DeVi Comfort, fault information is currently offered primarily as text. This research explores how a 3D visualization can complement this for faster interpretation.

## 4 Method

### 4.1 Research Approach

The assignment is carried out iteratively with prototyping and evaluation. The cycle consists of analysis, design, implementation and validation based on practical scenarios and measurable results.

### 4.2 Research Methods

Methods include document analysis, requirements analysis, visualization design, prototyping and evaluation with involved engineers and service.

### 4.3 Tools and Techniques

Work is done with a 3D visualization environment (“virtual ghost”) and data from stairlift controllers such as position, speed, status and error codes.

## 5 Results

### 5.1 Findings

To be completed based on analysis and prototyping.

## **5.2 Analysis**

To be completed based on evaluations and measurements.

## **5.3 Results Overview**

To be completed based on the final results.

## **6 Conclusion**

### **6.1 Answer to Main Question**

To be completed after the research is finished.

### **6.2 Key Insights**

To be completed after the research is finished.

### **6.3 Recommendations**

To be completed after the research is finished.

## Bibliography