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Design and Development of an XR Assistance System for Industrial Workers

vorgelegt von

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Saarbrücken, Tag. Monat Jahr

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Saarbrücken, Tag. Monat Jahr

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Zusammenfassung

Kurze Zusammenfassung des Inhaltes in deutscher Sprache, der Umfang beträgt zwischen einer halben und einer ganzen DIN A4-Seite.

Orientieren Sie sich bei der Aufteilung bzw. dem Inhalt Ihrer Zusammenfassung an Kent Becks Artikel: `http://plg.uwaterloo.ca/~migod/research/beckOOPSLA.html`.

We have seen that computer programming is an art,
because it applies accumulated knowledge to the world,
because it requires skill and ingenuity, and especially
because it produces objects of beauty.

— Donald E. Knuth [1]

Danksagung

Hier können Sie Personen danken, die zum Erfolg der Arbeit beigetragen haben, beispielsweise Ihren Betreuern in der Firma, Ihren Professoren/Dozenten an der htw saar, Freunden, Familie usw.

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1 Introduction

In modern industrial environments, ensuring the safety and well-being of workers is an increasingly complex challenge. This is due to the rise in automation of factories, which has led to workers being exposed to a range of risks from moving parts to robots. Traditional safety measures like warning signs, floor markings, and standard training provide a necessary foundation, but they are not always sufficient. In many cases, these static systems fail to reach workers at the right moment, especially when attention is focused elsewhere or hazards change rapidly. These systems require real-time adaptation and individualization.

To protect workers more effectively, safety solutions must become adaptive, personalized, and accessible. They must understand the individual context of the worker: how they move, where they are in the environment, and when they may be at risk, whether from poor posture, fatigue, or close proximity to danger zones.

Advances in extended reality (XR) and wearable technology, such as full-body haptic suits and immersive head-mounted displays, are opening new avenues for real-time assistance and feedback systems. These technologies are no longer confined to research labs or entertainment industries but are being increasingly considered for applications in healthcare, rehabilitation, training, and industrial safety. In this context, integrating real-time physiological and spatial data with immersive and haptic feedback presents a promising opportunity to enhance worker safety in hazardous zones.

This thesis explores how such a system could be designed and deployed. Specifically, it proposes an XR-based assistance framework that helps workers stay safe by making risk visible, posture perceptible, and hazards tangible. By integrating real-time motion, biometric, and positional data, the system aims to provide immediate, personalized support without disrupting the workflow or overwhelming the user. Rather than replacing human judgment, it enhances situational awareness and supports safer, more ergonomic behavior in industrial settings.

2 Theoretical Background

3 Concept

Bibliography

[1] Donald E. Knuth. "Computer Programming as an Art". In: *Communications of the ACM* 17.12 (1974), pp. 667–673.

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Abkürzungsverzeichnis

Anhang

A Erster Abschnitt des Anhangs

In den Anhang gehören "'Hintergrundinformationen"', also weiterführende Information, ausführliche Listings, Graphen, Diagramme oder Tabellen, die den Haupttext mit detaillierten Informationen ergänzen.

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Kolophon