

A Human-centered Design Process for an Augmented Reality based Training System

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Abstract:

The automotive industry is a huge transformation process where the production of electric and autonomous cars will increase in the following years. This will require production employees acquire new skillsets, toolsets and mindsets. A more continuous learning culture is needed and training with technologies like augmented reality can help overcome the above-mentioned transformation process smoothly, especially for assembly tasks in the assembly line or in assembly training.

The purpose of the submitted paper is to present a research proposal for an Augmented Reality (AR) based assembly training system for the automotive industry. Findings from previous user studies on AR-based assembly training and their limitations are analyzed. Research questions are drafted and a research proposal for future research of an AR-based assembly training within the frame of a user study is presented.

Topic:

Using new technology such as Augmented Reality in car assembly training to support production employees in their learning process of new assembly tasks as well as to support training content creators (e.g. trainers or foremen).

Findings & Research Problems:

- Previous user studies focus on abstract LEGO assembly models. Only new publications focus on real world tasks and use experienced production employees rather than students
- The needs of trainers is neglected although without their input the training of new assembly tasks is not possible
- No use of training data to contribute to continuous improvement process
- Researchers focus too much on a specific technology or hardware design rather than following a human-centered approach
- Different user needs and influencing factors such as age and learning styles are not considered in a differentiated way

Proposed Research Design

- **Explorative interviews** will be conducted and technology will be **demoed** to production employees applying think aloud protocol to collect first feedback.
- An iterative human-centered design process is proposed in the submitted short paper that will integrate both production employees as well as training content creators (e.g. trainers or foremen) as end users in a **Design Sprint workshop** with the goal of finding a user-centered industrial assembly training system
- Including user groups in the early stages of the process will help to understand different **user needs and requirements** for an AR-based assembly training system that will be evaluated in a **user study**.

User Study

The table below shows the user study setting. The goal of the research project is to offer user-specific training and therefore we want to find if there are any differences in the training results regarding:

- Experiences in production
- Age groups
- Digital skills
- Level of education
- Miscellaneous (e.g. gender, language, learning styles)

Literature:

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	Production Employees	Students/ Apprentices	What will be measured?
Control Group Traditional training methods	10 Participants	10 Participants	<ul style="list-style-type: none"> ▪ Task Completion Time ▪ Picking Mistakes ▪ Sequential Mistakes
Experimental Group AR-based training methods	10 Participants	10 Participants	<ul style="list-style-type: none"> ▪ Training Transfer (2nd run without training assistance) ▪ Usability (SUS Questionnaire) ▪ Perceived Workload (NASA-TLX)