SIDEKICK: A Modular Worker Assistance System for Configurable Work Instructions in Sheltered Workshops

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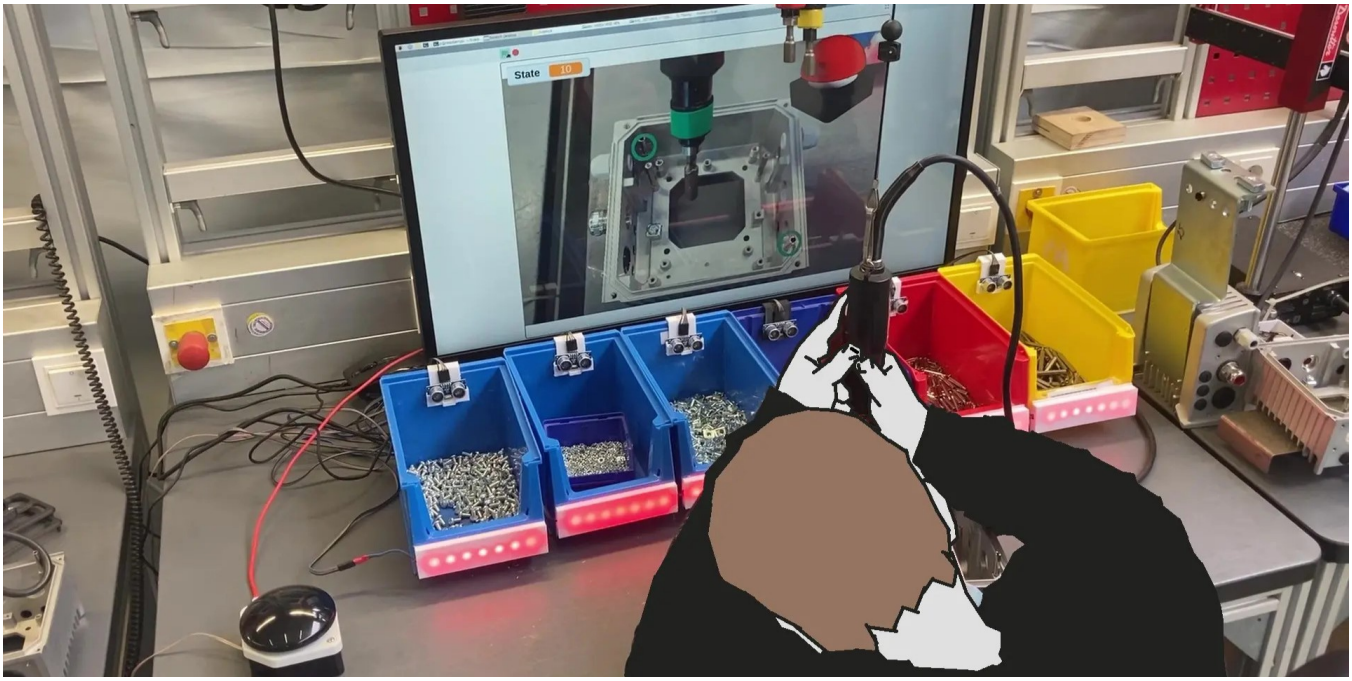

Figure 1: SIDEKICK workstation prototype with a worker-facing instruction display, sensor-equipped material boxes, and LED-based visual cues.

Abstract

Supported work contexts such as sheltered workshops often require work instructions that can be adapted to individual abilities, tasks, and needs for supporting people with disabilities. A digital worker assistance system (WAS) can provide this worker guidance through step-by-step instructions and situated feedback during manual work. The system's practical use, however, also depends on whether instructions can be created, adapted, and maintained without extensive technical expertise.

This demo presents SIDEKICK, a modular assistive workstation system for configurable digital work instructions. SIDEKICK combines a worker-facing step-by-step instruction interface with physical input and feedback components, such as buttons, ultrasonic sensors, and LED-based visual cues. Its current redesign separates instruction authoring, runtime guidance, and hardware communication. This enables the system to be more easily extendable with hardware components, making instructions more adaptable to work processes.

The demonstration focuses on three core processes, explorable by participants: creating and adapting work instructions, pairing hardware devices to instruction events, and setting up and running task instructions at the workstation. Through the demo, we aim to discuss implementation approaches for systems to create assistive work instructions, while remaining configurable, with a focus on its usability in the sheltered workshop context. This addresses challenges impacting workshops' inclusivity and efficiency.

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CCS Concepts

• **Human-centered computing** → **Accessibility systems and tools**; *User centered design*; *Interface design prototyping*; • **Applied computing** → *Computer-managed instruction*; *Computer-assisted instruction.*

Keywords

worker assistance systems, sheltered workshops, workers with cognitive disabilities, configurable digital work instructions, instruction authoring tools, assistive technology, workplace accessibility

1 Introduction and Motivation

Within the context of supported work, sheltered workshop organizations (hereafter referred to as "workshops") employ persons with cognitive disabilities (hereafter, and within our context generally, referred to as "workers"). Workshops offer workers support via vocational training and secure employment in accordance with their individual abilities and needs [3, 7]. The workshop's supervising staff (within our context, generally referred to as "professionals") play a central part in this approach, as they, among other things, support the workers in general. Most relevant to our project, the professionals prepare tasks for workers that are tailored to the workers' individual abilities [5] and within the workshop's means. The integration of a digital worker assistance system (WAS) can assist the professionals in this task, as well as improve worker inclusion—as supported through research [e.g., 4, 5, 11–13]. WASs can support manual work by providing workers with step-by-step guidance, feedback, and task-related information at the workplace. Existing systems, however, often fail to dynamically adapt to individual user needs [5], thus limiting their effectiveness. Additionally, the WAS's usability depends not only on workers' interacting with the system but also on the professionals needing to configure, adapt, and maintain work instructions for changing tasks and individual support needs. As such, multiple challenges arise when designing a suitable system. Assistive work instructions must be easy for the workshop's workers to use and follow, while the system must offer professionals high flexibility and ease of use to independently create and adapt these instructions.

These aspects are central to the project and system presented within this document—SIDEKICK—which originated from a joint collaborative project led by, and further developed in cooperation with, the Ostfriesische Beschäftigungs- und Wohnstätten GmbH (obw) [10].

2 Related Work

Research on assistance systems in sheltered workshops for disabled persons, like the Werkstätten für behinderte Menschen (WfbM) in Germany, reveals a conflict between operational challenges for such systems' implementation and their potential to increase worker independence [1, 2, 11, 14]. Workshops face structural, technological, and pedagogical challenges that impact their efficiency and inclusivity. As identified through recent research, these challenges include, in particular:

Digital Divide and Central Support: Workshops frequently lack structured training programs and central points of contact for digital transformation [2]. As a result, digital affinity relies strongly on individual staff members, creating challenges for workshops without strategic digital concepts.

Costs and Resources: The workshops' generally limited financial and temporal resources hinder the implementation of (technically) advanced assistive technologies (e.g., smart glasses, spatial augmented reality) due to their prohibitive implementation costs [2, 11].

Information Density: Cognitive assistance systems, in particular, can reduce a worker's error rates by reducing cognitive workload (e.g., through an adaptive projection assistance system) [11]. However, e.g., through information density, they can as well lead to mental overwhelm, particularly for workers with a greater reliance on mentor support [1, 8, 9]. Subsequently, cognitive barriers may be established rather than eliminated or mitigated by an interface design that is inadequate for a worker's particular needs.

Individual Needs: Existing assistance systems often fail to adapt dynamically to diverse cognitive and psychological needs [5]. E.g., the case study conducted by Heinz-Jakobs and Röcker [5] indicates reduced overall usability for cognitively disabled individuals compared to non-disabled individuals in the context of rigid, non-adaptive worker assistance system designs [8].

Economic Pressures: Based on Jochmaring and York [6], Bittenbinder et al. [2] point out that workshops, as organizations obligated to ensure their economic viability, are therefore implied to prioritize their resources' allocations towards production (besides mandated rehabilitation tasks and integration of people). Consequently, investing in digital (skills) training (as one possible investment area) is given lower priority by workshops in general.

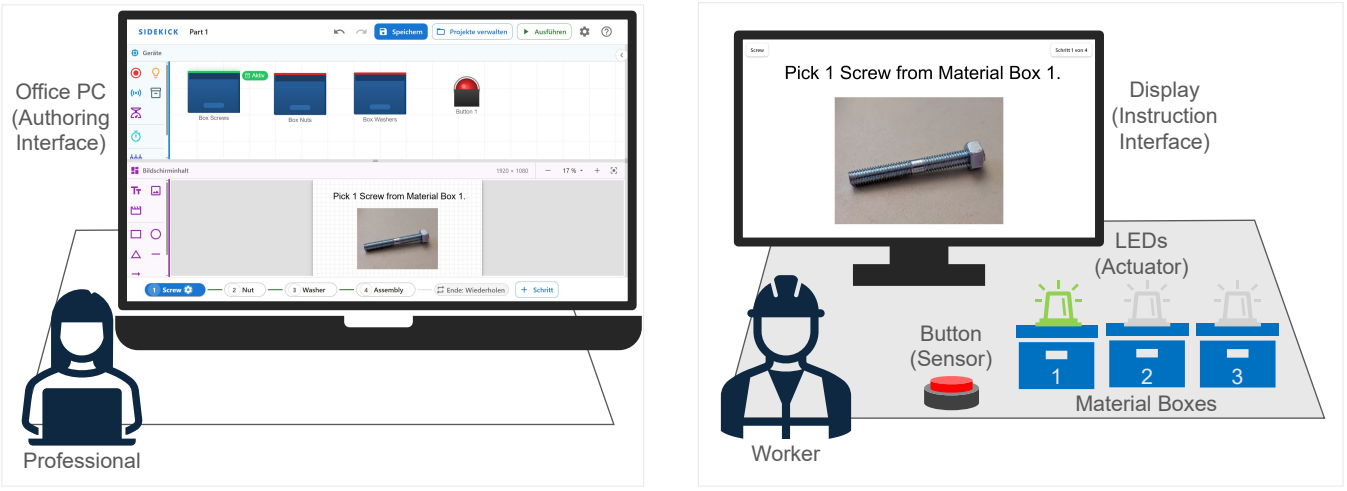
The SIDEKICK WAS's development focuses mainly on structural and technological challenges, as described by Mack [11]. Through this, we aim to facilitate workshops in their efforts towards supporting people with disabilities and explore options to do so—as further specified in Section 3: SIDEKICK System Overview.

3 SIDEKICK System Overview

Overall, SIDEKICK addresses the stated challenges as a configurable modular assistive workstation system that connects digital instructions, sensor input, and visual feedback. Through this, it offers sheltered workshops a tool through which it aims to provide additional support for workers with different cognitive, physical, and motivational needs. Ideally, the system aids in shifting a professional's more operational supervising workload within a workshop (e.g., instructing workers on a purely procedural level) towards increased cognitive, personal, and individual worker support [10].

3.1 System Design Aspects

As stated in Section 1, the SIDEKICK WAS is implemented in cooperation and in accordance with direct feedback from sheltered workshop organizations [10]. The requirements for the SIDEKICK WAS's development are identified through this direct feedback and supported through the findings regarding challenges from Section 2. One focus of SIDEKICK is the system's **adaptability to specific workers' needs and work processes** by offering professionals tools for flexible creation and adaptation of work instructions. Another requirement is the implementation of the system's features with extensive consideration of the **system's usability**



(a) SIDEKICK authoring interface.

(b) SIDEKICK workspace instruction setup.

Figure 2: Instructions can be created or edited through the SIDEKICK authoring interface, as illustrated in Figure 2a. Here, a hardware device, like a button, can also be assigned to the process of switching to the next instruction step (*Feature Demo: System Adaptation*). Created instructions can be transferred to set up the instruction interface for a specific workspace, as illustrated in Figure 2b (*Feature Demo: System Operation*). Hardware components specified for instruction steps through the authoring interface can be paired with the system during that workstation's setup (*Feature Demo: System Setup*).

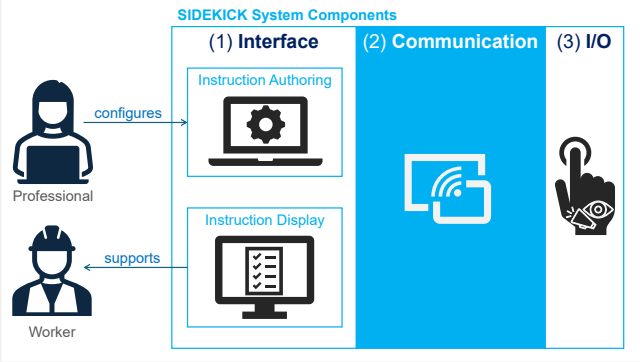


Figure 3: The SIDEKICK system is conceptually comprised of three major parts. *(1)* An interface for instruction authoring (by professionals) and display (for workers). *(2)* An event communication layer between its software and hardware components. *(3)* Input/output (I/O) device components (i.e., sensors and actuators), such as input buttons, ultrasonic sensors, or LED strips for additional visual cues.

for professionals without, e.g., requiring external help (e.g., from a workshop's IT staff or the system's developer) or extensive prior programming expertise. More specifically, this aspect encompasses the **system's setup** and **operation for instruction creation** by the professionals. Part of this consideration is the aim to develop SIDEKICK towards a self-contained system unit, especially to address hurdles regarding the system's setup within a workshop's network and IT infrastructure in general. As such, the SIDEKICK system's development focuses on the following main aspects:

(1) The capability of **adaptation** to workers' specific needs.
(2) The ease of the system's **setup** (e.g., without external help) by professionals.
(3) The ease of **operation** when using instructions (workers) and creating (professionals) instructions.

These design considerations were derived from concrete challenges reported by professionals working in the sheltered workshop examined as part of the SIDEKICK project. By addressing these challenges, we aim to develop a tool that is specifically tailored to the operational needs of workshop professionals, supports them in their daily tasks, and can be used independently without requiring external assistance.

Through supporting the professionals, the tool is also intended to indirectly benefit workshop workers—for example, by helping to foster motivation, sustain attention, and facilitate task engagement.

3.2 System Demo Setup

Based on the SIDEKICK system's design aspects and the features focused on during its development—as presented in Section 3.1—the SIDEKICK system demo setup offers conference participants the opportunity to explore the system's core processes, as outlined in Figure 2:

(1) **Adaptation**: The user can create and edit worker instruction steps via the system's instruction authoring interface.
(2) **Setup**: The user can pair a hardware device with a suitable instruction step for the instruction interface (e.g., assign the action of switching to the next instruction within the system's displayed interface to a hardware push button during instruction creation).

(3) **Operation**: The user can load and save created instruction steps through the system's interface (e.g., the system manages and allocates the users' files as a self-contained system).

The explorable processes demonstrate and invite discussions about the SIDEKICK system's modular architecture design approach, as conceptually illustrated in Figure 3, which is based on the specific development focus aspects of the SIDEKICK system, identified in Section 3.1. The approach targets the system's adaptability to user needs and work processes by, e.g., decoupling hardware components from the interface logic.

4 Discussion and Future Work

SIDEKICK is currently a prototype and has not yet been fully evaluated in supported work contexts. Future work will focus on evaluating the system with professionals and workers, particularly regarding authoring usability for professionals as well as operational usability for workers.

In addition to further refining the authoring interface for configuring work instructions, we aim to integrate additional sensor and actuator types to, e.g., cover even more use cases—particularly quality control—as well as to conduct a more systematic comparison with existing industrial assistance systems.

The demo is intended to support direct feedback through interaction with the system and regarding its operation. Furthermore, it is intended to allow and further facilitate active discussion and networking among interested participants and the broader community within the broader community in this field.

Acknowledgments

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