Low Cost iIoT

Assistance system for employee support and human-machine interaction

Graduate

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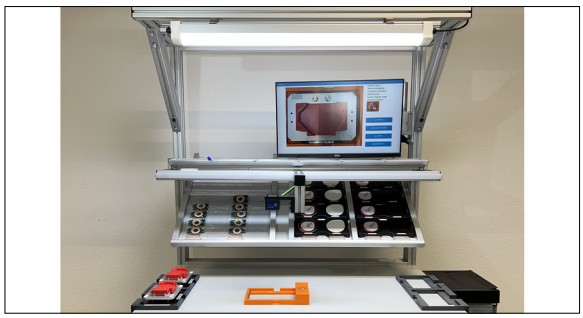
Introduction: An employee assistance system was developed that offers support during the manual assembly of a product. The system is realised as a cost-effective stand-alone workbench that is also suitable for retrofitting. To support the worker, self-explanatory assembly plans, which are visualised in the user interface, are available for the assembly of the product, subdivided according to the degree of difficulty. With its simple and intuitive operation, the workbench offers uncomplicated training for inexperienced assembly workers. For experienced workers, the assistance system offers the advantage of maintaining an overview in the event of frequently changing assembly instructions and product variants. To support the worker, a camera check is integrated, which checks the correct execution of the work steps during product assembly. As a result, fewer errors occur during more complex assemblies and quality assurance is increased.

Approach: The implementation of the system comprises three sub-areas: the mechanical design, the electrical design and the programming of the control technology and the work visualisation. To meet the requirement for low costs, low-cost products were used exclusively. The heart of the system is a Raspberry Pi 4b that functions as a soft PLC. This uses the CODESYS runtime system, with which the control of the sensors and actuators was programmed. PROFINET is used as the communication protocol. The sensors consist of retro-reflective sensors, a push button, a camera with feature recognition software and an RFID read/write head. As actuators, light strips are controlled that are mounted under the goods containers and thus signal the correct removal. The integration of the sensors into the system was realised with a PROFINET bus coupler. The camera and the RFID sensor are controlled via PROFINET.
A touch monitor was used to visualise the assembly instructions. The display of the dashboards was programmed in Node-RED. With an iterative approach, the system was continuously adapted and improved both mechanically and in terms of software.

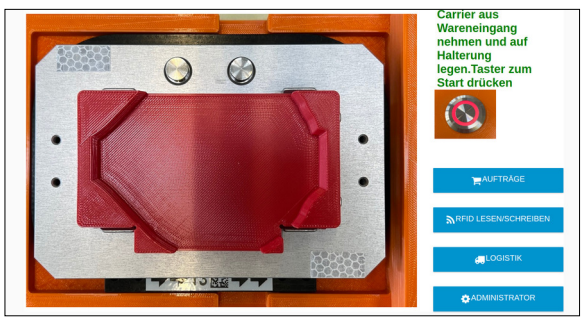
Result: The created assistance system was evaluated in a user study. In the process,he use of the work plan for assembling the OST gadget was explained to the user group and then they wered asked questions about various aspects, such as the design of the visualisation or the user-friendliness of the system. The feedback from the participants was predominantly positive and the employee assistance system enjoyed a high level of user acceptance. The result is a functional iIoT system that is unique due to the combination of camera inspection, Raspberry Pi and pick-by-light system with intuitive user interface and fulfils the set requirements in one. Another benefit of the workbench is the simple and quick possibility to implement new work plans for other products. Finally, a comparison with systems of the same type shows that a cost reduction by a factor of four was achieved by using low-cost resources, which makes the system particularly interesting for industrial applications.

OST-Gadget
Ostschweizer Fachhochschule

Worktable
Own presentment



User-Interface
Own presentment



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Subject Area
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