EUROPEAN UNION

Interreg Slovakia-Austria
European Regional Development Fund

SHARE 4.0

SHARE4.0

CRITERIA CATALOG

WP3 – DT 3.2.1.1

Version 1
Company – Person
Date 25.11.2022

Industry 4UM

NCRI

SIEA
SLOVAK INNOVATION AND ENERGY AGENCY

INDUSTRIE 4.0 ÖSTERREICH

PROFACTOR

FOTEC
Forschungsunternehmen der FH Wiener Neustadt

FORSCHUNG Burgenland
RESEARCH & INNOVATION

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1 Introduction

A criteria catalog is a tool used to define and organize the criteria that are important for evaluating a particular product, service, or process. It typically includes a list of criteria, along with descriptions and definitions of each criterion, and may also include weighting factors to indicate the relative importance of each criterion. Criteria catalogs can be used in a variety of contexts, such as procurement, quality management, and performance evaluation, and can help ensure that evaluations are consistent, objective, and based on relevant factors.

The pilot projects in the two fields of activity (industrial assistance systems - including, for example, robotics, artificial intelligence, data analysis); resilient sustainable production systems - including, for example, 3D printing, Internet of Things, resource efficiency, recycling, etc.) are implemented as exemplary model projects in the SK-AT cooperation area.

In the SHARE 4.0 project the catalog of criteria for the “Industrial Assistance System - Pilot” coordinated with decision-makers and multipliers ensures a high impact, targeted expandability and repeatability of these pilot projects. Thematically, an improved use and coordination of research infrastructures and an intensive knowledge and technology transfer will be promoted. The knowledge about the implementation of the pilot projects also serves as a basis for the subsequent anchoring in AP4 and is intensively communicated with the SK-AT target groups.

2 State of the Art Technology

Industrial assistive systems are designed to help workers perform their tasks more efficiently and safely. These systems use state-of-the-art technology to provide workers with the necessary tools and information to complete their tasks. In this chapter 2 the state-of-the-art technology used for industrial assistive systems is presented.

1. Robotics

Robots are one of the most important technologies used in industrial assistive systems. They are used to perform tasks that are too dangerous or difficult for humans to perform. Robots can be programmed to perform a wide range of tasks, from simple assembly tasks to complex welding and painting tasks.

One of the most important developments in robotics is the use of collaborative robots or cobots. These robots are designed to work alongside humans, providing assistance and support. Cobots are equipped with sensors that allow them to detect the presence of humans and adjust their movements accordingly.

2. Augmented Reality

Augmented reality (AR) is another important technology used in industrial assistive systems. AR systems use computer-generated images to enhance the real-world environment. AR systems can be used to provide workers with information about their environment, such as the location of tools and equipment.

AR systems can also be used to provide workers with step-by-step instructions for performing tasks. This can be particularly useful for workers who are new to a particular task or who are working in a complex environment.

3. Wearable Technology

Wearable technology is another important technology used in industrial assistive systems. Wearable devices, such as smart glasses and smart watches, can be used to provide workers with real-time information about their environment.

Smart glasses, for example, can be used to provide workers with AR overlays that provide information about their environment. Smart watches can be used to provide workers with notifications about important events, such as the need to take a break or the need to perform a particular task.

4. Internet of Things

The Internet of Things (IoT) is another important technology used in industrial assistive systems. IoT devices can be used to monitor the performance of equipment and provide workers with real-time information about their environment.

IoT devices can also be used to monitor the health and safety of workers. For example, IoT devices can be used to monitor the temperature and humidity of a work environment, alerting workers to potential health risks.

5. Artificial Intelligence

Artificial intelligence (AI) is another important technology used in industrial assistive systems. AI systems can be used to analyze data from sensors and other devices to provide workers with insights into their environment.

AI systems can also be used to predict potential problems before they occur. For example, an AI system could analyze data from sensors to predict when a piece of equipment is likely to fail, allowing workers to take preventative action.

Industrial assistive systems are becoming increasingly important in today's workplace. These systems use state-of-the-art technology to provide workers with the necessary tools and information to perform their tasks more efficiently and safely. Robotics, augmented reality, wearable technology, the Internet of Things, and artificial intelligence are just a few of the technologies used in industrial assistive systems. As technology continues to evolve, we can expect to see even more advanced industrial assistive systems in the future.

3 Challenges & Needs of Assistive Systems

Assistive systems have become an integral part of the industrial sector, providing workers with the necessary tools and information to perform their tasks more efficiently and safely. However, the implementation of assistive systems in the industry is not without its challenges. In this chapter, we will discuss the challenges that the industry is facing with assistive systems.

1. Cost

One of the biggest challenges that the industry is facing with assistive systems is the cost. Implementing assistive systems can be expensive, and many companies may not have the budget to invest in these systems. The cost of the hardware, software, and training required to implement assistive systems can be significant, and this can be a barrier to adoption.

2. Integration with Existing Systems

Another challenge that the industry is facing with assistive systems is the integration of these systems with existing systems. Many companies have legacy systems that are not compatible with modern assistive systems. This can make it difficult to implement new systems without disrupting existing processes.

3. Training

Training is another challenge that the industry is facing with assistive systems. Workers need to be trained on how to use these systems effectively. This can be time-consuming and expensive, and it can also be difficult to ensure that all workers receive the same level of training.

4. Data Security

Data security is a major concern for companies that are implementing assistive systems. These systems collect and store sensitive data, such as worker performance data and equipment performance data. This data needs to be protected from unauthorized access, and companies need to ensure that their systems are secure.

5. Maintenance and Support

Maintaining and supporting assistive systems can be a challenge for companies. These systems require regular maintenance to ensure that they are functioning properly. Companies also need to provide support to workers who are using these systems, which can be time-consuming and expensive.

6. Resistance to Change

Resistance to change is another challenge that the industry is facing with assistive systems. Workers may be resistant to using new systems, particularly if they have been using the same processes for many years. This can make it difficult to implement new systems and can slow down the adoption of these systems.

7. Ethical Concerns

Assistive systems raise ethical concerns, particularly when it comes to the use of robotics. There is a concern that robots may replace human workers, leading to job losses. There is also a concern that robots may be used to monitor workers, leading to a loss of privacy.

8. Compatibility with Different Work Environments

Assistive systems need to be compatible with different work environments. This can be a challenge, particularly in industries where the work environment is constantly changing. Companies need to ensure that their systems can adapt to different work environments and can be customized to meet the needs of different workers.

9. Lack of Standards

There is a lack of standards when it comes to assistive systems. This can make it difficult for companies to compare different systems and can make it difficult to ensure that these systems are compatible with each other. The lack of standards can also make it difficult for companies to ensure that their systems are compliant with regulations.

10. Limited Availability of Skilled Workers

The implementation of assistive systems requires skilled workers who can design, implement, and maintain these systems. However, there is a limited availability of skilled workers in this field. This can make it difficult for companies to find the right talent to implement these systems.

Assistive systems have the potential to revolutionize the industrial sector, providing workers with the necessary tools and information to perform their tasks more efficiently and safely. However, the implementation of these systems is not without its challenges. Companies need to address these challenges to ensure that they can fully realize the benefits of assistive systems. The challenges of cost, integration with existing systems, training, data security, maintenance and support, resistance to change, ethical concerns, compatibility with different work environments, lack of standards, and limited availability of skilled workers need to be addressed

4 Possible Pilot Actions for Industrial Assistive Systems

After elaborating the current trends, technologies, challenges and needs the industry is facing while implementing and using assistive systems, possible pilot actions have been defined for discussion and evaluating in the means of SHARE 4.0 and the European definition of Industry 5.0.

1. Digital Thread in Injection Molding – From Part Design to Molded Parts

- Different Companies involved in the Value Chain
- Information can be provided but setup still made manually
- Results in waste of time and high material costs plus the dependency on the setup engineer
- To overcome this issue contribution with know-how in simulation driven product development, measurement technologies and injection molding to support and teach SMEs methods to develop a digital thread along the above given value chain
- Goal is to reduce time to market and to document the quality of the parts

2. Process Monitoring in Injection Molding and Molds

- Only 5% of molding machines are equipped with sensor systems
- Main reasons are vulnerability, complex installation & high prices
- Sensor systems have potential to supervise and improve processes
- Goal is to use the know-how in measurement system technology to support SMEs in inline mold monitoring systems.

3. Production Data Acquisition, Analysis and Process Optimization

- SME´s need detailed knowledge where the key costs, production times and quality factors are originating in their production
- Digitalization allows deeper insights in production processes
- Existing production needs to be connected and existing data acquired as well new sensors and equipment installed
- For SMEs this means high upfront investments & high risk
- To reduce this gap providing an infrastructure where future production systems can be acquired and evaluated in an save environment is key
- Allows SMEs to experiment and learn in a safe and secure environment to experiment with different approaches and technologies

4. Integration of Computer Assisted Life Cyle Analysis of Polymers for Virtual Product Development

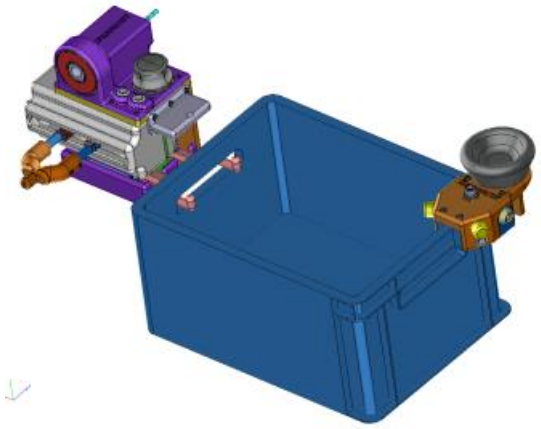
- Current acute environmental challenges require that preventative approaches and methods
- Interconnecting Environmental Assessment tools with engineering design tools, such as Computer Aided Design (CAD) and Product Lifecycle Management (PLM) tools, can used for designing products based on “Life Cycle Thinking”
- Goal is the combination of Enterprise Resource Planning (ERP), Product Life cycle management (PLM) and LCA tools in an Integrated Computational Life Cycle Management and Engineering methodology

5. Holistics Plastics Product Development

- Components made of plastics are an indispensable part of modern life
- Objectives in development; weight reduction and miniaturization, increased functionality, use of material combinations and new manufacturing processes for technically superior components, while reducing costs and carbon footprint
- Challenge: keeping up with innovations and integrating them into own products to remain globally competitive
- Sheer number overwhelm SMEs, which are often suppliers of larger companies
- Goal: offer a modular and specialized training in a Blended Learning format, i.e. digital remote learning modules will be completed by hands-on training modules

6. Demonstration of Physical and Cognitive Assistance

- Robot does automated task
  - 80% of time
  - Commissioning of parts
- Robot assists human: 3rd-Hand
  - 10% of time
  - Space-Navigator for intuitive navigation
  - Simple gripper acctuation through touch-interface
- Robot assists human: „Hebehilfe“
  - 10% of time
  - HTC-Vive or similar Tracker
  - Copying function
- Increased working area
  - System is allowed to move X/Y/Z direction
  - No rotation
- Extended Robot tool
  - Allows robot to process additional tasks
  - Safety-circuit included in hand tool
  - Non-long workpieces



7. Integration of Robot Assisted Additive Manufacturing into a Production System

- The robot assisted additive manufacturing allows production of unique curvatures and surfaces
- Functionalization and completion in other processes can easily be performed
- Components are completely designed and the design features are documented in a virtual product development system
- Programming is time consuming, a library containing basic definition and modules would help
- GOAL: Supporting RaAM parts during the processing, slight compression on the filaments can be applied and measured by robots or by additional sensors

8. Integration of Generative Manufacturing into a Production System

- Production of unique curvatures and surfaces
- Shorter lead-time production / flexibility
- More complex parts / functional integeration / reduce number of parts
- Easily change material / develop new powder alloys / rapid prototyping
- Reduce and optimize material
- Hybrid production (additive + CNC)
- GOAL: Supporting SMEs, increase learning rate, avoid basic mistakes

5 Conclusion

The possible pilot projects were presented and discussed in the Steering Board. It was suggested to focus on the following projects

Demonstration of Physical and Cognitive Assistance

However, in the Stearing Committee meetings it was decided to extend the project Lifting Assistance in order to create a pilot opportunity for pre-programmed data of an individually deployable robot between different institutions in the sense of Industry 4.0 and 5.0.

Reasons for this were

- Maximum knowledge available at both partners
- Infrastructure available
- High industrial relevance
- Promising topic for the future

The implementation of the project is described in Deliverable DT 3.2.1

ANNEX I

Steering Committee Meeting Slides

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PILOT PROJECTS IDEAS

Profactor GmbH & NACERO – INDUSTRIAL ASSITANCE SYSTEMS

Create synergies in the region Slovakia – Austria by sharing best practices and awareness of innovative technologies to advance digitalized manufacturing

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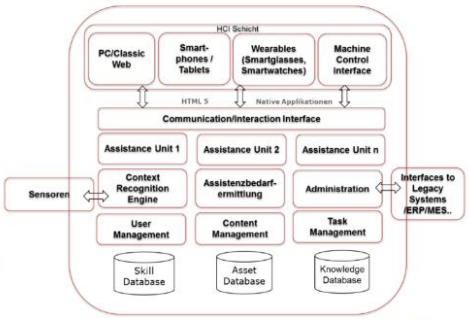
Assisitive systems & the need

- Explicit Definition of assistive needs

- Implicit determination of assistive needs



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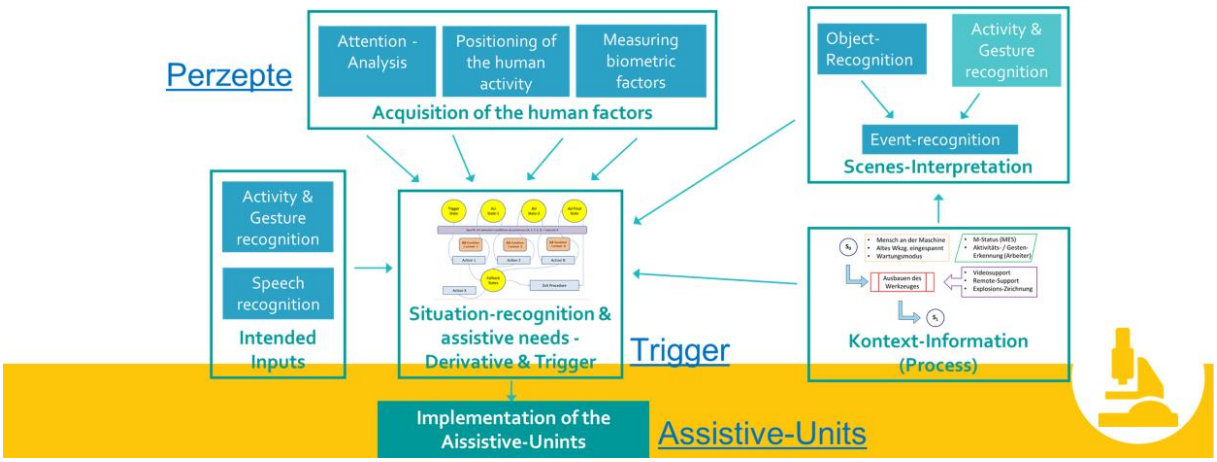
Recognizing the Assistive Need & Trigerring Assistive Units



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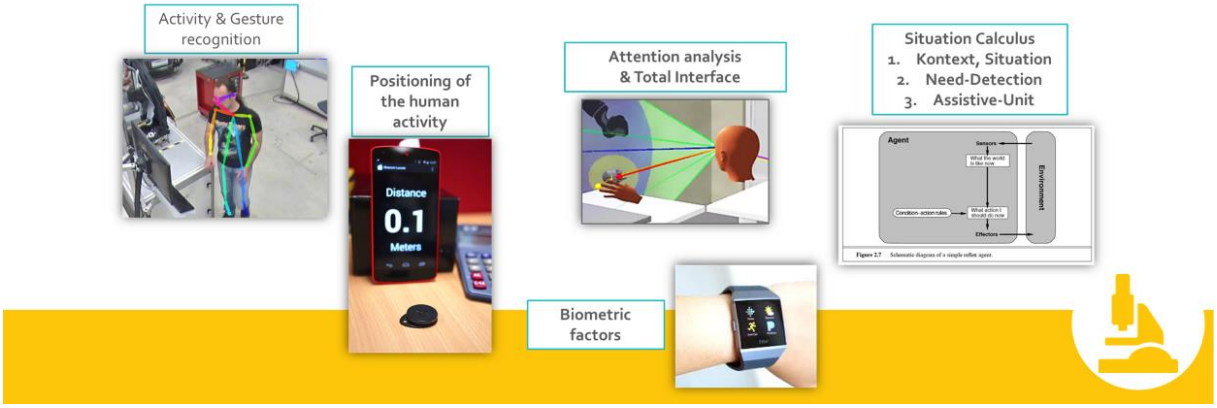
Basic technologies for the Recognition of Assistive system needs



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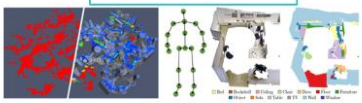
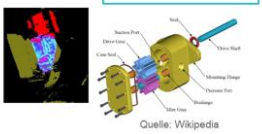
Basic technologies for the Application of Assistive systems

Object-recognition
Event-recognition
Scenes-interpretation



Mixed Reality Methods

Vizualisation of complex data



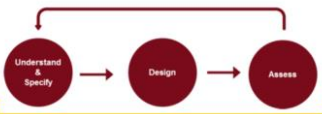
Quelle: Wikipedia

Interaction for robot assisted manufacturing processes

Acoustic Interaction

Quelle: Copia

Interaction Designe



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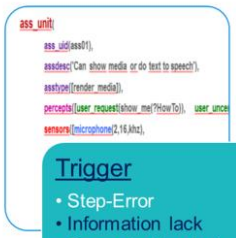
EXAMPLES
Perzepte, Trigger & Assistive-Units

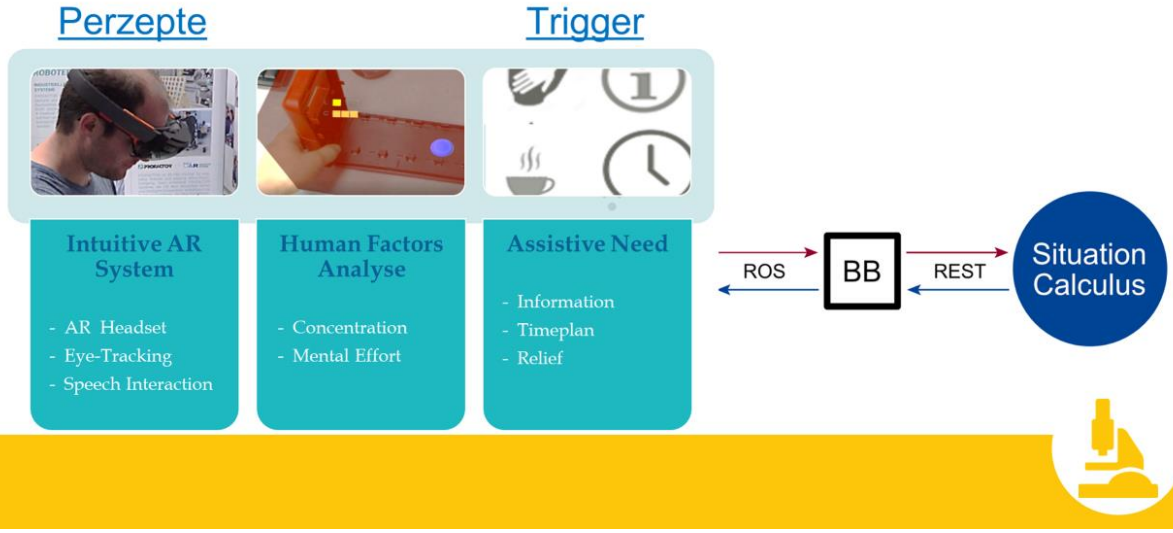
Perzepte
- Detection Action
- Detection Object
- Detection Gesture
- Concentration
- Mental Efforts
- Context Activity
- Context Step Secquence



Trigger
- Step-Error
- Information lack
- Concentration lack
- Request gesture

Assistive-Units
- Info Step Secquence
- Anleitungs-Detail
- Info Motivation
- Robotic assitance

Human Factor Component



CREATED POSSIBLE PILOT PROJECT IDEAS

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6. Holistic Plastics Product Development
7. Integration of Robot Assisted Additive Manufacturing into a Production System

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„Hebehilfe“: Video

„Hebehilfe“: Adaptation for box handling

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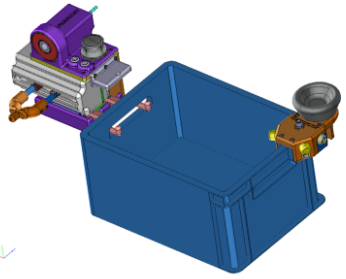

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Dipl. Ing. Christian Wögerer, MAS MSc
International Networks

THANK YOU FOR YOUR ATTENTION