Analysis of workers' risks associated with AI and robotic systems: the AGILEHAND project solutions' developers point of view

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Abstract

AGILEHAND is a Horizon Europe project that seeks to develop cutting-edge technologies for autonomously grading, handling, and packaging soft and deformable products. The project aims to enhance the flexibility, agility, and reconfigurability of production and logistic systems in European manufacturing companies. This project aims to develop solutions in the fields of Artificial Intelligence and Robotics. Workers in AI and robotic systems face various risks that can affect their physical, psychological, and socioeconomic well-being.

In this context, some questionnaires have been developed in order to understand the workers' risks associated with the AGILEHAND solutions. These questionnaires have been filled out by AGILEHAND solutions' developers in order to collect the designers' point of view.

In conclusion this study has an important role in describing the current AGILEHAND scenario, providing interesting information for both researchers and designers since it defines the main risk factors for successful AGILEHAND implementation and the main problems that designers and practitioners could face.

Keywords

Workers Skills, Workers Engagement, Artificial Intelligence, Robotic Solutions, AGILEHAND project

1. Introduction

AGILEHAND is a project classified as a Research and Innovation Action, which receives funding from the Horizon Europe (HE) program. Specifically, it falls under the HORIZON-CL4-2022-TWIN-TRANSITION-01-04 call. The objective is to create intelligent solutions for three crucial elements of a workpiece handling system in a complete production line.

The "grading" component refers to the understanding of the characteristics and condition of the workpiece. The project specifically targets the development of a self-calibrating sensing solution that will create a network of integrated and overlapping sensors. This network aims to enhance production-line traceability, agility, and reconfigurability. The primary benefits will be a cost-efficient, precise, and rapid solution to meticulously assess the quality of fragile and perishable goods.

- The manipulation of pliable and malleable items during the phases of sorting, handling, and packaging. The AGILEHAND project focuses on the challenges of robotic manipulation in a non-industrial setting, specifically in environments that are more human-centered. These environments involve a wide range of objects that vary in shape, can be easily altered, and require careful handling.

- The elements of agility, flexibility, and reconfigurability in production lines. The objective is to develop a collection of strategies for implementing Agile Production Line Reconfiguration in a production system that produces multiple models. These AI-driven solutions enable the monitoring, adaptive control, and synchronization of production and logistics flows in a factory, even in the presence of product variability, production mix changes, or fluctuations in the market. They ensure high performance in customer response time and efficient resource utilization.

The AGILEHAND project aims to develop various tools and solutions that utilize artificial intelligence and robotic systems.

Workers in AI and robotic systems face various risks that can affect their physical, psychological, and socioeconomic well-being [1]. Some of these risks include:

1. **Physical Health Risks**:
   - Increased Risk of Accidents and Injuries: AI-powered robots and automated systems may introduce new hazards and risks in the workplace, such as collisions, entanglements, or falls, which can lead to physical injuries.
   - Exposure to Hazardous Environments: Workers may be exposed to hazardous materials, chemicals, or environments when operating or working alongside AI and robotic systems, increasing the risk of occupational illnesses or injuries [2].

2. **Psychological Well-being Risks**:
   - Job Insecurity and Anxiety: The introduction of AI and robotics can evoke feelings of job insecurity among workers, as they fear being replaced by automation. This uncertainty can lead to stress, anxiety, and decreased job satisfaction.
   - Increased Workload and Stress: Automation of tasks may lead to changes in job roles and responsibilities, potentially increasing the workload and stress levels of workers as they adapt to new technologies and processes [3].

3. **Socioeconomic Risks**:
   - Job Displacement and Unemployment: Automation and AI-driven technologies have the potential to replace human workers in various industries, leading to job displacement and unemployment for those whose roles become redundant.
   - Economic Inequality: The adoption of AI and robotics may exacerbate existing economic disparities by favoring skilled workers and exacerbating wage inequality between those with technical expertise and those without.

4. **Human-Robot Interaction Risks**:
   - Safety Concerns: Interaction between humans and robots in the workplace poses risks of physical harm if safety protocols are not adequately implemented or if robots malfunction.
   - Ethical Concerns: The integration of AI and robotic systems raises ethical questions regarding the treatment of robots, potential misuse of AI technologies, and the impact on human dignity and autonomy.

5. **Skills Gap and Training Needs**:
   - Skills Mismatch: The rapid evolution of AI and robotics requires workers to continually update their skills to remain relevant in the workforce. Failure to acquire new skills may lead to obsolescence and reduced employability.
   - Training Challenges: Providing adequate training and upskilling opportunities for workers to effectively operate and interact with AI and robotic systems can be challenging, particularly for older workers or those with limited access to educational resources.

The main aim of this work is to investigate from designers' point of view which workers' risks have an impact on successful AGILEHAND implementation in order to identify possible mitigation strategies.

2. Method

In order to develop an analysis which defines the AGILEHAND scenario of workers' risks, two questionnaires were drawn up. The first questionnaire analyzes the AGILEHAND solutions risks connected with the implementation of AI-based tools. The second questionnaire is focused on risks connected with the implementation of robotic solutions.

The two questionnaires were developed on the basis of the extensive literature review carried out using the most important scientific papers repository (Scopus, Science Direct, Web of Knowledge).

A Likert scale was applied for each item from 1 point (totally disagree) to 5 points (Totally agree), indicating the level of consensus with the proposed sentences.

All AGILEHAND solutions developers have been involved in this survey. A total of 12 completed surveys were returned.

Data were collected from AGILEHAND partners via a combination of regular mail, e-mail and Internet-based survey methods, using a specially developed Internet-based questionnaire.

3. Results

Results obtained from the survey have been summarized in the next sections. In particular, section 3.1 is focused on AGILEHAND AI-based solutions (WP4 and WP6 of the project) while section 3.2 is focused on Robotic solutions (WP5 of the project).

3.1.   Work risks associated with the AGILEHAND AI-based solutions

The first analysis carried out consist of the AI-based solution developers' opinion regarding the impact that their solution could have on workers' risks. Table 1 shows the average values and standard deviation. In this table we mentioned some terms that should be explained.

In particular:

- Job Displacement: one of the most prominent concerns is the potential for AI to automate tasks traditionally performed by humans, leading to job loss and displacement of workers in various industries.
- Dependence on AI Systems: overreliance on AI for decision-making can reduce human oversight, leading to errors or unintended consequences.
- Cybersecurity Vulnerabilities: AI systems can be exploited by malicious actors to launch cyber attacks, compromising sensitive data and disrupting operations.

Table 1: Descriptive statistic regarding AI-based solutions risks

AGILEHAND engagement strategies	Average	St. Dev.
Your AGILEHAND solution allows the company the elimination of reoccurring and monotonous working tasks	4,667	0,516
Your AGILEHAND solution allows the company to remove activities in a hazardous work environment	2,667	1,032
Your AGILEHAND solution allows the company to reduce the risk of occupational diseases	2,500	1,516
Your AGILEHAND solution shall handle or circumvent hazardous situations occasioned by user misuse	2,500	1,516
Your AGILEHAND solution shall avoid Job Displacement	3,333	1,505
Your AGILEHAND solution shall avoid Dependence on AI Systems	3,167	1,169
Your AGILEHAND solution shall avoid Cybersecurity Vulnerabilities	4,000	1,095

The following figure 1 graphically summarized the results shown in table 1.
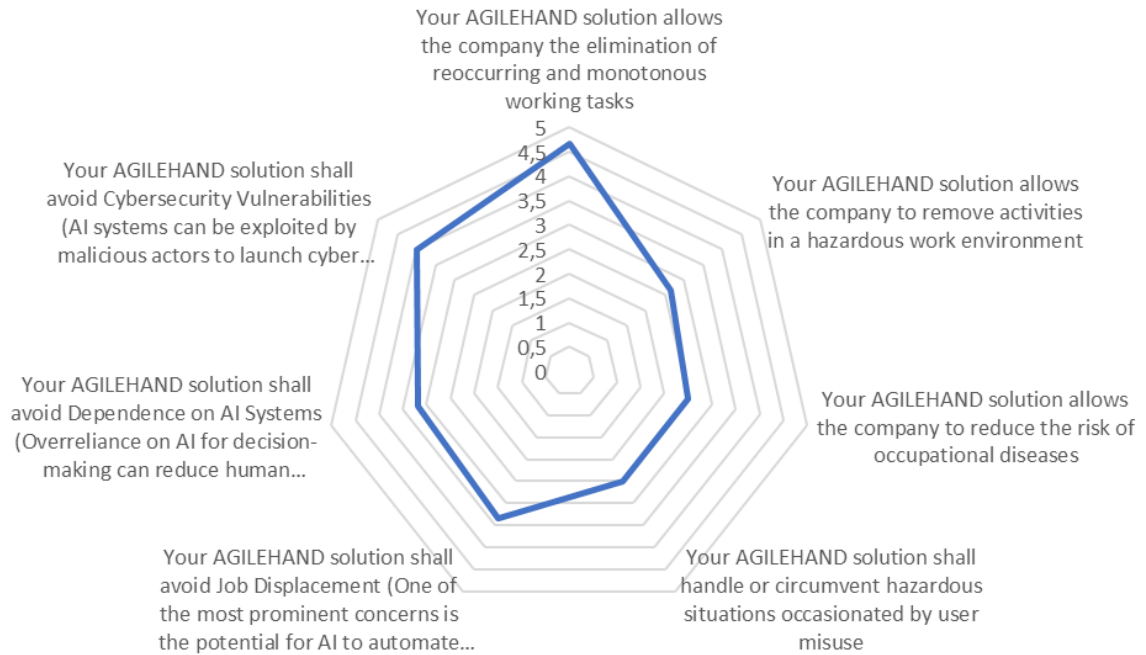
Figure 1: Radar diagram regarding the solution developers level of consensus with the sentences using a scale that goes from 1 (totally disagree) to 5 (Totally agree)

3.2. Work risks associated with the AGILEHAND Robotic solutions

The last step of this study concerned the Robotic solution developers' opinion regarding the impact that their solution could have on workers' risks.

Table 2 and figure 2 show the average values and standard deviation. In this table different aspects have been analyzed, such as:
- Safety Hazards: working alongside robots can pose safety risks, including accidents caused by collisions, malfunctions, or improper maintenance.
- Ergonomic Issues: repeated interactions with robotic equipment can lead to ergonomic problems or musculoskeletal disorders for workers if proper ergonomic considerations are not addressed.
- Worker Surveillance: employers may misuse robotic systems for excessive monitoring and surveillance of workers, leading to feelings of distrust and invasion of privacy.
- Dependence on Robotics: overreliance on robotic solutions can diminish human skills and decision-making abilities, reducing workers' autonomy and problem-solving capabilities.

Table 2: Descriptive statistic regarding Robotic solutions risks

AGILEHAND engagement strategies	Average	St. Dev.
Your AGILEHAND solution allows the company the elimination of reoccurring and monotonous working tasks	4,667	0,598
Your AGILEHAND solution allows the company to remove activities in a hazardous work environment	3,167	1,476
Your AGILEHAND solution allows the company to reduce and simplify work with heavy loads	2,500	1,224
Your AGILEHAND solution allows the company to reduce the risk of occupational diseases	2,167	1,329
Your AGILEHAND solution allows the company to reduce unilateral	2,833	1,477

physical workload		
Your AGILEHAND solution shall handle or circumvent hazardous situations occasioned by user misuse	2,333	1,505
Your AGILEHAND solution shall avoid Job Displacement	3,667	1,505
Your AGILEHAND solution shall avoid Cybersecurity Vulnerabilities	3,833	1,329
Your AGILEHAND solution shall avoid Safety Hazards	4,200	0,836
Your AGILEHAND solution shall avoid Ergonomic Issues	4,000	0,632
Your AGILEHAND solution shall avoid Worker Surveillance	4,333	0,516
Your AGILEHAND solution shall avoid Dependence on Robotics	2,667	1,366
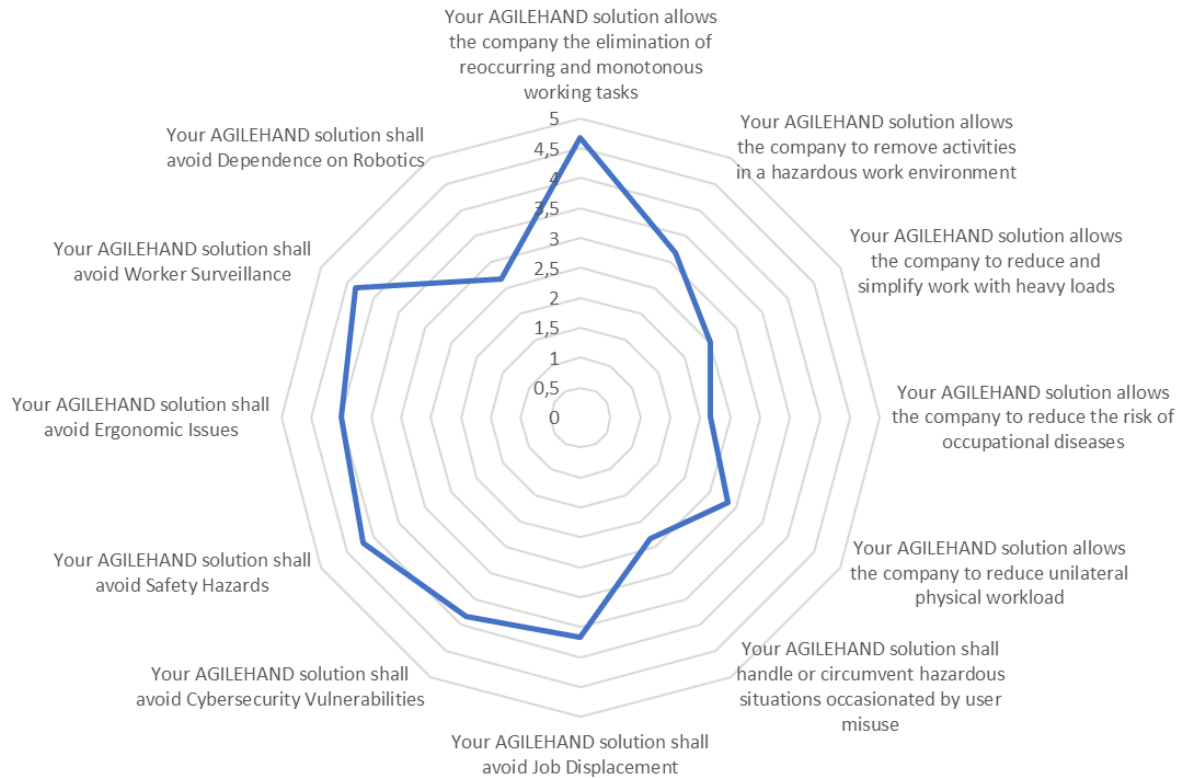
Figure 2: Radar diagram regarding the solution developers level of consensus with the sentences using a scale that goes from 1 (totally disagree) to 5 (Totally agree)

4. Conclusions

The impact of AI and robotic systems on workers' risks is multifaceted, influencing various aspects of their health, safety, and overall well-being [4].

In this paper, we examine the various risks that workers could face in the realm of artificial intelligence and robotic systems of AGILEHAND project from solutions' designers point of view. By understanding the types of risks, their contributing factors, and potential mitigation strategies, we can work towards creating safer and more supportive work environments in the age of automation [5].

In particular, mitigation strategies for these risks include:

1. Enhanced Training and Education Programs:
   - Providing comprehensive training on the safe operation and maintenance of AI and robotic systems.

- Offering education on psychological resilience and coping mechanisms to help workers adapt to technological changes.
2. Implementation of Robust Safety Standards and Regulations:
   - Developing industry-specific safety guidelines and regulations to ensure the safe deployment and operation of AI and robotic systems.
   - Conducting regular inspections and compliance checks to enforce safety standards in the workplace.
3. Adoption of Human-Centric Design Principles:
   - Integrating safety features into AI and robotic systems to minimize risks to workers.
   - Designing systems for ease of use and intuitive interaction to reduce the likelihood of accidents or errors.
4. Creation of Supportive Work Environments:
   - Establishing mechanisms for worker feedback and input to address concerns and improve safety measures.
   - Providing social and financial support for displaced workers through retraining programs, job placement assistance, and financial aid.

By implementing these mitigation strategies, organizations can help safeguard the well-being of workers in AI and robotic systems and ensure a safer and more inclusive future of work.

5. Acknowledgements

Declaration on Generative AI

The author(s) have not employed any Generative AI tools.

6. References

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