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Executive Summary

This document as the initial version of the deliverable related to Task 6.1 "*Pilot Sites Preparation and Pre-Pilot Testing*", reports on the activities that have been undertaken in the first twelve months of the life-cycle of the STAR project.

In the STAR project, WP6 "*Integration, Validation, and Evaluation*" has as one of its main objectives to prepare the three pilot sites of the project for pilot operations of real-life scenarios involving agile manufacturing, quality management, and human-robot collaboration. Hence, under Task 6.1, we monitor and track the setup of the three pilots as the testbeds for the STAR project. Moreover, during the execution of the activities, any technical issues and difficulties in the period of installation are being discussed in the regular meetings between all WP6 partners.

Furthermore, in the STAR project and to enhance the synergies between different partners and to make them more effective, we have conducted separate workshops for each pilot partner. These workshops, that were extensively documented and reported under D2.9 "*Report on Co-Design Workshops and Focus Groups-Initial version*", allowed the pilot partners to communicate with each other about their specific use cases, and also with other partners i.e. technology providers.

In addition, to make the synergies more productive and effectual, we have also prepared pieces of documentation regarding different relevant items and shared them between all partners in the project. The aim is to enhance the cooperation between the pilot partners in Task 6.1, and all other parties in this project. The list of components used in each use case for each testbed, the list of data sharing platforms and local datasets, the sample of the datasets utilized in each use case are to name but a few of these reported documentations.

Finally, in the forthcoming months of the project, we will validate each pilot for their use cases, and evaluate their results in the last step of their study.

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Definitions, Acronyms and Abbreviations

Acronym/ Abbreviation	Title
WP	Work Package
HAR	Human Action Recognition
AI	Artificial Intelligence
HCI	Human-Computer Interaction
HAR	Human Action Recognition
AMR	Automatic Mobile Robot
DFKI	Deutsches Forschungszentrum für Künstliche Intelligenz
BMBF	German Federal Ministry of Education and Research
BMWi	German Federal Ministry for Economic Affairs and Energy
CI/CD	continuous integration/ continuous deployment

1 Introduction

1.1 Purpose and Objectives

AI systems become more demanding in all domains of research and industries. AI approaches need to be safe and reliable even more in industries with a dynamic and unpredictable environment, and especially when there are humans involved. In the STAR project, we aim to make the AI systems safe, trusted, and secure in unpredicted and complex environments.

The STAR project's objectives need to be applied and tested in industrial environments and be proved in different scales in a wide range of manufactories' testbeds. WP6 focuses on the integration, validation, and evaluation of the purposes of the STAR project in the manufactories' testbed. The main objectives of the WP6 are:

- Preparation of the three pilot sites as the testbeds for applying the STAR goals in miscellaneous real-life scenarios consisting of a wide range of agile manufacturing, quality management, and human-robot collaboration. The three pilot sites that collaborate in the STAR project are SmartFactoryKL Pilot Lab in Germany, PCL's factory in the Netherlands, and IBER OLEFF's factory in Portugal.
- Integration of the project technical development and prototyping in the STAR platform for secure and safe AI in the manufacturing area.
- Customization and deployment of the STAR platform for the three pilot partner scenarios, agile manufacturing, quality management, and human-robot collaboration.
- Validation of the STAR platform in the pilot partners' real-life scenarios.
- Evaluation of the STAR platform in the pilot scenarios from technical, techno-economic, and socio-economic perspectives. The evaluation consists of the users' feedbacks on the easiness of use, and the satisfaction of the worker.

WP6 consists of 6 different Tasks. In this deliverable the main focus is on Task 6.1 "*Pilot Sites Preparation and Pre-Pilot Testing*" that has started in the first month of the STAR project, and has a life cycle of twenty-four months. In this work package's Task, the focus is on the preparation of three pilot sites for applying the AI manufacturing systems that rely on the STAR platform at the appropriate time. In respect to some main activities to be undertaken in this Task these are the mobilization of appropriate stockholders in the pilot sites, training the workers and other actors, pre-deployment, and testing, and resolution of the ethical management processes, to name but a few.

In Task 6.1, and collaboration with the pilot's coordination Task in WP1, we focus on establishing a common/uniform methodology for coordinating and monitoring the preparation of all three pilot partners. From the monitoring and synergies regarding different scenarios with other pilot partners and technology providers to the preparation and testing of the testbeds for the AI technologies from the STAR project are the main objectives to address and review in this Task.

1.2 Document Structure

This deliverable, is structured as following:

- Section 2 reports on the pilot partners in the WP6. In this section the pilot partners on which the AI approaches of the STAR project will be applied are introduced and a brief description of their activities is provided. The STAR pilot partners come from a wide range of research institutes and industries with a broad field of studies and diverse scenarios.
- Section 3 presents the Pilot preparation activities undertaken during this period and the use cases definitions. In this section of the deliverable we report on the documentation for the synchronization and monitoring of the pilot partners' scenarios and the summary of the first workshop organized for each of them.
- Section 4 briefly highlights the defined targets that are targeted to be accomplished in the second year of the project.
- Finally, section 5 provides the conclusion of this deliverable.

2 Presenting the three STAR Pilots

In this section, a global introduction of the three different pilots in the STAR project are presented.

2.1 Philips (PCL)

Figure 1: Philips Logo

Royal Philips is a diversified health and well-being company, focused on improving people's lives through meaningful innovation in the areas of Healthcare and Consumer Lifestyle. The company is a leader in cardiac care, acute care, and home healthcare, including male shaving, grooming, and oral healthcare. Headquartered in the Netherlands, Philips posted 2018 sales of EUR 18.1 billion and employs approximately 77,000 employees with sales and services in more than 100 countries.

Philips Drachten is one of the biggest production and development centers in Europe within Philips. Philips Drachten is a globally oriented where employees from all over the world collaborate enthusiastically on the development and production of products that improve people's lives. In the factory, which is at the forefront of the latest production techniques, we work 24/7 to create a wide range of innovative produces like the OneBlade shavers, Philips Avent baby bottles, teats & parts of Sonicare parts.

The Philips site in Drachten employs over 2100 people, amongst which 600 developers with 40 different nationalities. For more than 60 years the site in Drachten has been manufacturing shaving systems. In 2016 PHILIPS launched the Philips OneBlade, the biggest innovation in male grooming since the razor. PHILIPS Drachten is the manufacturer of the shaving element of this revolutionary device.

As a mass manufacturer of consumer goods, Philips Drachten has many different specialistic competencies developed under which metal cold forming, electrochemical machining, electrochemical grinding, injection molding, lacquering, printing decoration, micro-assembly, and micro-welding.

2.2 IBER-OLEFF (IBER)

Figure 2: IBER Logo

IBER-OLEFF is a private company, founded in 1993, part of IBEROMOLDES Holding, headquartered in Pombal, Portugal. IBER-OLEFF Pombal is the biggest manufacturing site of the holding and is focusing on designing, engineering, and producing the systems and different components for the automotive and electronic industries. Specifically, the focus of the company is in producing the interior plastic components for vehicles like Ford, Bosch, BMW, Delphi, Continental, Volkswagen, Seat, McLaren, Ferrari, and Mitsubishi Trucks Europe, to name a few. The range of the components produced by IBER-OLEFF Pombal is wide namely air vents, ashtrays, grills, radio bezels, multimedia systems. IBER-OLEFF Pombal strategic development gives particular emphasis on agility and flexibility of its layouts and team training, allowing competitive management of small series (niche models) or large series production (vehicles and products of high consumer market models).

IBER-OLEFF Pombal created a full-service-supplier methodology that applies to the whole product cycle from the concept phase to the delivery of the final product to the customers. Their methodology is the complete and integrated service, ranging from concept and design, engineering, developing, and prototyping, to industrialization through production. Preceding the massive production, in their product development phase, in which a small series of the production is needed to be produced, the prototype modules are the fastest and more economic process for the pilot-series production. IBER-OLEFF Pombal benefits of the advanced technologies providing cutting-edge rapid prototyping and rapid manufacturing solution for a broad array of applications for a wide range of materials.

IBER-OLEFF Pombal intends to implement an agile production unit with vertical and horizontal integration, namely, to incorporate in a production cell of polymeric components an integrated set of equipment and accessories that should add new functions to the usual ones. One of the challenges has to do with full quality control of parts right after the injection process or before entering the assembly process. Another challenge relates to the industrialization of plastic components for automotive interior air vents, including parts with appearance requirements, in ONE-SHOT and ZERO-DEFECT typology, creating a highly customizable product, considering a production unit where several production processes coexist simultaneously, such as injection, decoration, and assembly.

The main IBER-OLEFF Pombal tasks and activities in the STAR project are to present the testbed and apply the AI algorithms from the project in their pilot considering their use case, "human-centered AI for Agile Manufacturing". Considering the pilot unit implemented for the STAR project to achieve the determined goals, IBER-OLEFF Pombal intends to extend this concept to the entire production unit in Pombal (Portugal) as well as the other units in Marinha Grande (Portugal), Martinganca (Portugal), and Salto (Brazil).

2.3 German Research Center for Artificial Intelligence (Deutsches Forschungszentrum für Künstliche Intelligenz) - DFKI

Figure 3: DFKI logo

The German Research Center for Artificial Intelligence (DFKI) was founded in 1988 as a non-profit public-private partnership and now has around 40 million annual turnover and 1000 full-time employees. It has research facilities in Kaiserslautern, Saarbrücken, Bremen, and a project office in Berlin. It is the largest European research center devoted solely to Artificial Intelligence and its applications. Research and development projects are conducted in seventeen research departments and research groups, which cover a broad range of AI-related areas: from Deep Learning fundamentals through Robotics, Internet of Things, Industry 4.0, and autonomous driving to Human-Computer Interaction.

In this research center, funding is received from government agencies like the European Union, the Federal Ministry of Education and Research (BMBF), the Federal Ministry for Economic Affairs and Energy (BMWi), the German Federal States, and the German Research Foundation (DFG), as well as from direct cooperation with industrial partners. Beyond academic excellence, DFKI sees its mission in making a real-world impact and facilitating the effective transfer of cutting-edge technology to European industry. Since its founding 30 years ago 60-spin-off companies have resulted from DFKI projects.

Figure 4: SmartFactory Logo

Embedded Intelligence group and SmartFactoryKL (SmartFactory) test lab (Figure 5) participate and cooperate in the STAR project. Embedded Intelligence group implements software components that will be used to detect human activities as well as to assist the autonomous mobile robot during its path planning. SmartFactory test laboratory is used to realize three different use cases to define safety zones for an autonomous robot in production.

Figure 5: SmartFactory testbed

In the STAR project, DFKI leads the WP6, related to the integration, validation, and evaluation of the AI technologies from the STAR platform in different pilots with a wide range of use cases. In addition, SmartFactory as a testbed located in the DFKI is considered as a laboratory in which the DFKI will apply and test its scenarios. Thanks to the flexible and modular demonstrator in the SmartFactory, it is reflected as Industry 4.0 factory in the test environment. Besides several powerful computers which are available for developing and testing algorithms, DFKI is also the first institution in Europe that receives an NVIDIA DGX-2, which is considered to be the world's most powerful AI supercomputer which can be utilized for the most complex AI challenges.

3 Pilot Sites Preparation

During this initial period of the first twelve months of the STAR project, several assignments have been performed by the pilot partners. Here, we report on the main activities regarding the use case initialization.

3.1 Pilot Partners and Use Cases

Testbeds are employed to deploy, validate and evaluate different technologies and aspects of the STAR project in real-world production lines in different environments. The three pilot partners focus on different production areas and research areas;

(i) PCL's pilot focuses on the secure, safe, reliable ad human-centered operations of robots used for visual quality inspection.
(ii) DFKI brings the prediction of human behavior toward initializing safety zone in dynamic and complex production environments and involves optimal configuration for AMR.
(iii) IBER's pilot focuses on secure and human cantered AI systems for agile production operations for manufacturing of high-quality injected parts and integrated systems for the automotive industries.

In the following, we mention the use cases corresponding to each pilot partner.

3.1.1 Human-CoBot Collaboration for Robust Quality Inspections

One of the challenges currently faced in the Philips factory in Drachten revolves around the introduction of flexible manufacturing.

Within the current production of shavers, there is a strong emphasis on standardization, automation, and minimization of cycle times within the production lines. These production lines are often specifically tailored for the mass production of one product or product series in the most efficient way. However, due to a shift in customer demand, smaller batch production and customized products are more often requested. To comply with this shift in customer demand, production lines need to be reconfigured more often to be able to produce different products with the same assets. These reconfigurations are expensive and time-consuming. To be able to comply with the market demand and fulfil customer demand in an effective manner, innovative solutions that enable flexibility are investigated, developed, and implemented during the STAR project.

As a global leader in the manufacturing of mass-produced consumer products, Philips is working on use cases revolving around this topic of flexibility and safe human-machine collaboration. Philips aims to deliver a pilot demonstrator of the developed technologies in a relevant production environment. By doing this the technology solutions investigated and developed during the STAR project can be demonstrated while providing valuable insights into how these results can be leveraged to improve the flexibility and safety of today's as well as future production systems.

During the STAR project, Philips has defined three use cases regarding the creation of such flexible and safe production systems.

1. Easy reconfiguration for automated part handling.
2. Human supervised learning for visual quality inspections.
3. Safe collaboration between humans and robots.

In the first use case, flexibility from a part handling perspective is explored. In this use case, three different building blocks are defined that together could provide flexibility from a part handling perspective. The first building block revolves around the development of a system for automated part recognition and detection. In this building block the idea is to use a vision setup that can recognize the product in a detection frame based on a knowledge base containing information needed (e.g., photos, CAD drawings, process parameters) for detection, recognition, and localization of a product. Once the identification and localization of the product are completed, this information is transferred to the next building block in which the goal is to automatically define the actions for a cobot to pick the part and perform the required operations. This is done in simulated reality by combining information about the cobot and the process combined with the information from the previous building block. Once we know which product must be handled, where this product is located, and what actions the cobot needs to perform we arrive at the third building block. In the third building block, we aim to create a translation of the simulated reality to a real-world action by turning the cobot actions as defined in the simulated reality into an actual cobot program that can be communicated to the cobot. In the end, this would mean that a product can be detected, identified, and localized after which a simulation can be created of the process to be performed after which the simulated reality can be translated to reality in order to perform the process as intended.

Another topic essential to introduce flexibility into the production revolves around quality inspection to ensure the quality of low-volume production. This is what the second use case revolves around, in this use case, we aim to investigate and implement solutions that can help setup quality inspection systems in an easy and flexible manner. Normally visual quality inspection systems are trained based on extensive datasets and can be easily optimized due to mass-production and data collection. However, to setup an automated visual quality inspection for lower volume production, alternative solutions are needed since the data volumes available will decrease significantly. Therefore, the aim of this use case is to setup an automated quality inspection in a quick and easy way by employing active learning to the quality inspection algorithms. This would enable the setup of such an automated quality system with a relatively small dataset after which the system can continue learning based on operator input to cases in which the algorithm is not sure about its quality assessment. By doing this, we are aiming to utilize the best of both machines and humans to create a dynamic and efficient production environment.

Finally, the third use case is related to the implementation of the human digital twin developed in WP5. This innovative technology is developed to measure and analyse the human aspect within production. The goal is to measure aspects like physical stress, mental stress, job engagement, happiness, and many more. By doing this, we want to investigate how we can link these measured aspects to things like employee well-being, job design, and collaborative systems acting upon data gathered. Due to the low TRL level of this technology, this use case mainly helps to explore the different possibilities and links that can be made with this data to provide additional insights into the added value of a human digital twin in an industrial environment.

3.1.2 Human Centred AI for Agile Manufacturing 4.0

The future of IBER depends on its ability to develop new knowledge-based manufacturing processes that are agile, efficient, and sustainable environmentally and economically. A key aspect is the manufacturing of customized products in agile production systems that allow for greater efficiency, speed, operation, and maintenance monitoring, and greater freedom for engineering design, including the incorporation of smarter components & parts.

The IBER market products are influenced by the end customer, their tastes, and their degree of satisfaction, that's why OEMs today have prioritized cockpit customization. The automotive industry is increasingly faced with the paradigm of the need to reduce costs, while at the same time increasing perceived quality and greater product functionality. The paradigm of product development in the automotive sector is changing, where OEMs are increasingly looking for industrial partners with the ability and competence to fulfil product design, industrialization, production, and distribution responsibilities.

All these dynamics have led to substantial changes in the plastic parts and components market, which requires rethinking molding tools, injected materials, and all the parameterization of transformation processes. In particular, the IBER company already has a high degree of automation, however, does not have the agility, at least in the size required by the challenges of the new industrial reality, which requires faster reconfiguration of the production process in order to respond to small series production, or large series production that may contain several versions with different characteristics or minor aesthetic or functional changes, depending on end-customer preferences, quality level, country, region, etc. (customized mass production).

Product complexity and variability may imply the use of different manufacturing and monitoring processes, which can be developed with tools that themselves combine these processes into a single workstation and/or multiple tools/workstations generating the multifunction production cells. It is critical that the production processes are vertically and horizontally integrated, that means the levels of production management, high-level planning, and management need to have detailed access to the production line with detailed real-time information, but also the entire production line, and other manufacturing cells need to know the general state of any cell for effective real-time optimization and management. The management of this complex process network must be achieved flexibly and responsibly, responding to scheduled production changes as needed to maintain process competitiveness.

IBER's final goal within the STAR project is to develop a solution for intelligent integration of processes and products to achieve solutions and systems that will allow the production of complex parts with the highest quality and minimal resources. In order to achieve that, IBER has defined four use cases:

1. Production processes simulations for accelerated decisions and safe processes.
2. Production planning optimization.
3. Employ training for the reduction of human errors.
4. Agile production management system data integrity and reliability.

In Figure 6, the production system is schematically represented and the four use cases planned to be developed in the STAR project are highlighted.

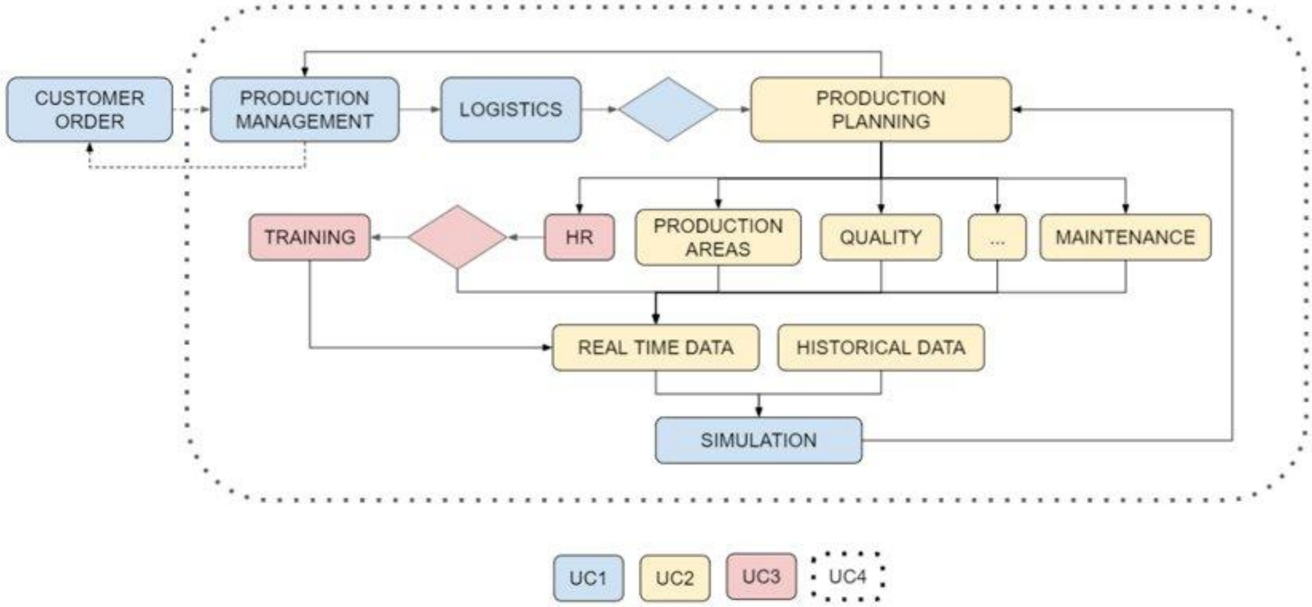

Figure 6: Production systems schema, and four use cases for IBER testbed.

Briefly, the first use case assumes the development of an IT solution that will help production management in making high-level decisions. This solution will be based on real-time simulation of the production process and will benefit from instant production data as well as their history (a specific database will be created). Access to existing data on the production management platforms of the various production areas will be guaranteed. It is to be expected that this solution will be able to present the necessary alternatives to streamline the production process.

The second use case has as its main objective the reduction to a minimum of unfinished product stocks. Practically, there will always be a certain stock of the unfinished product, i.e., injected components and purchase elements that will be assembled according to the customer's monthly or weekly orders. The logistical management and storage of this unfinished product have a relevant cost and therefore the objective will be to reduce it.

The third use case is intended to identify and quantify human errors associated with the assembly process. With the help of the right tools, it is expected to achieve better-operating methods and better management of human resources on the assembly line.

Finally, in the fourth and last use case, it is planned to identify external and internal threats to information systems affecting the production system, mitigate them, and reduce as much as possible the harmful effects.

3.1.3 Human Behaviour Prediction and Safe Zone Detection

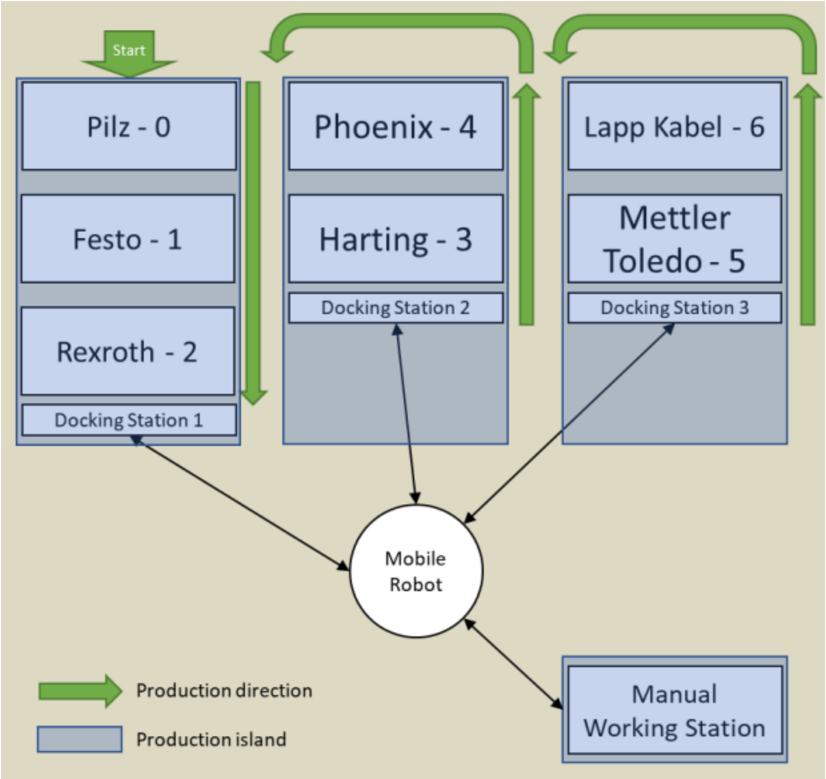

Figure 7: As-is scenario for SmartFactory testbed

SmartFactory lab demonstrates the latest technologies from the industry domain building industry-standard demonstrators. One new addition to the demonstrators (Figure 7) would be adding safety considerations during working with an autonomous robot while combining AI technologies. In this context, DFKI aims to improve its demonstrator to have a high production rate while keeping workers and the hardware equipment safe using AI technologies. To achieve this, three use cases were derived in the STAR project:

1. Human intention recognition.
2. Robot reconfiguration based on the dynamic layout.
3. Dynamic path planning using both first and second use cases.

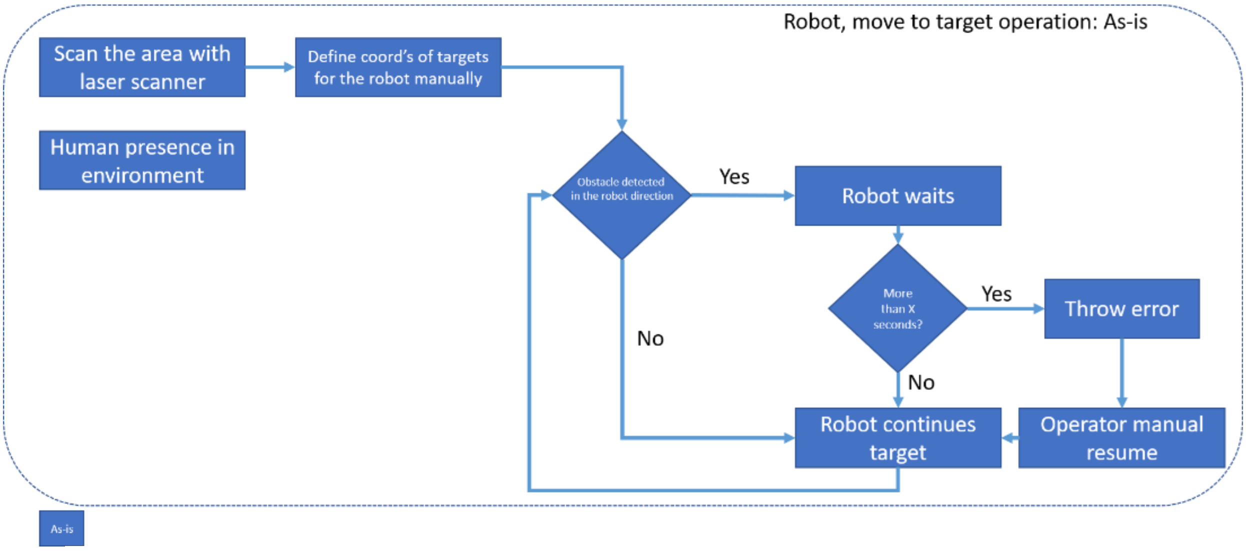

Figure 8: As-is scenario for SmartFactory testbed

Currently, the robot uses its built-in laser scanner to create a map of the current environment as well as the objects (Figure 11 and Figure 12). After the map is created, the stations are manually defined, and their coordinates are stored by the robot. Later, the robot is programmed to deliver the product between the defined coordinates. If an object is detected in the direction of moving, it waits for a specific amount of time and then continues to its target. However, if the object does not move within this time span, the robot must be manually resumed.

Nevertheless, this scenario is not optimal. The as-is scenario does not consider the human presence. In addition, it does not reach the dynamic layout changes. This as-is scenario is depicted in Figure 7 and Figure 8. The STAR project is planned to improve the situation and the intelligence of the robot.

The first use case plans to detect the human activities and predict their next actions, which then will be combined with robot navigation to create a safer environment. For this matter, DFKI created typical worker scenarios, happening during normal daily work. The behavior of more than 10 participants was recorded, who were supposed to follow the same or similar flow. The recordings were made using wrist sensors which are then analyzed in detail to detect the activity they are currently performing.

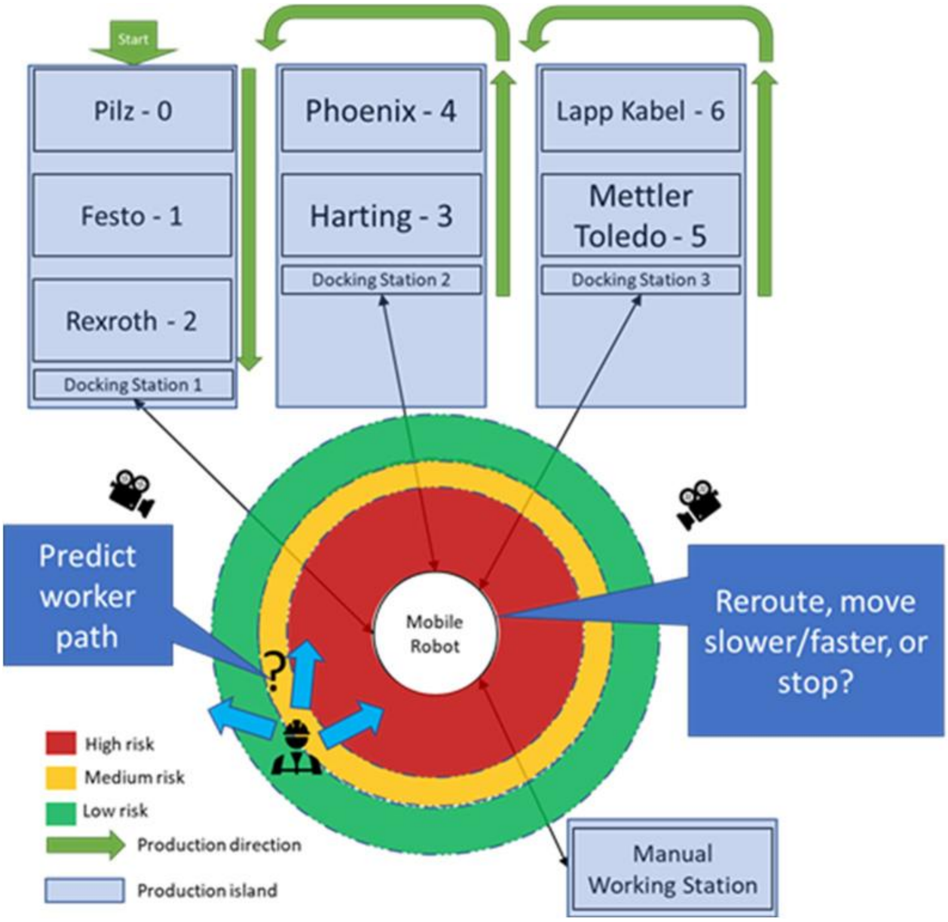

Figure 9: To-be scenario for SmartFactory testbed

The second use case is to dynamically update the navigation route of the mobile robot, by considering human and/or other (non-)moving objects in the environment. This use case will also enable easier reconfiguration of the robot in case the layout of the environment (including the production stations) changes. The layout is actively monitored by the cameras, and humans, as well as the objects in the layout, are detected. In case of any change, the new coordinates of the stations, where the robot should navigate to, are updated (Figure 9).

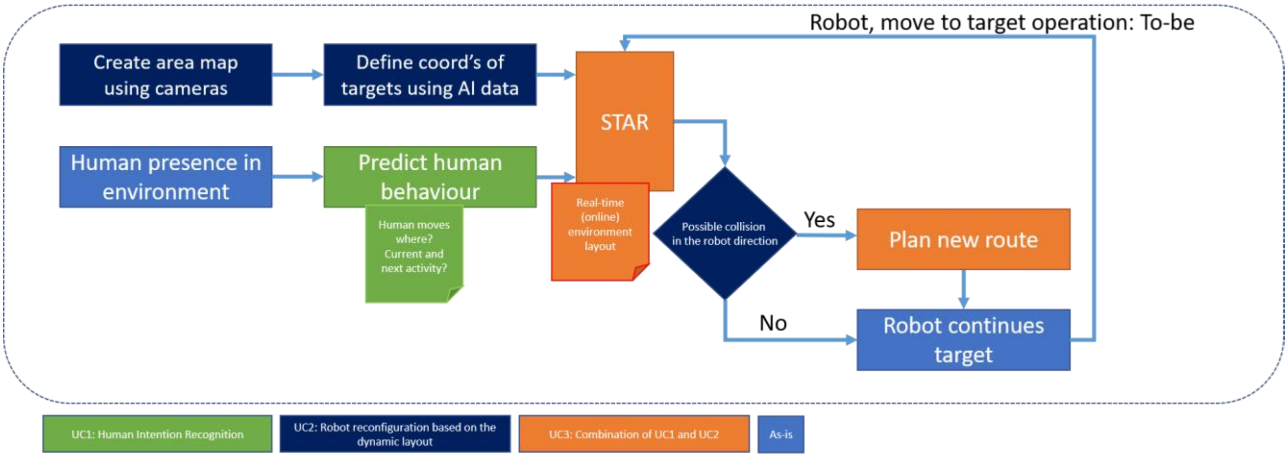

Figure 10: SmartFactory to-be scenario, all use cases combined.

Finally, as the third use case, these two use cases are going to be combined to have a safe environment for the workers and the hardware equipment. The newly received coordinates of the stations will be used to set the robot's destinations. The speed of the robot and the objects in the layout will also be considered to create a collision-free navigation path for the robot. The human's current and next activity is also one of the important aspects to take into account during the decision. The points of interest for the robot will be sent as separate data to achieve the original goals of the use case. To-be use cases can be seen in Figure 9, and Figure 10. In Figure 10 Light blue blocks belong to the as-is scenario, the green boxes are new additions with the first use case, dark blue boxes are new features introduced by the second use case, and finally, the orange boxes are the functionalities that combine both first and the second use case.

DFKI prepared its demonstrator and acquired the required hardware to collaborate with THALES. At the time of writing this deliverable, DFKI and THALES group are working together to create the first prototype software. This prototype will enable both partners to evaluate the current success rate and/or take the actions to make it more stable.

3.2 Workshops

For each of the three pilots, a separate online workshop took place. Every workshop was coordinated by the University of Groningen (Rijksuniversiteit Groningen - RUG). All workshops were conducted collaboratively and focussed on the specific pilot partner and other stakeholders in the STAR project. For the organisation of each workshop, and since the pandemic situation did not allow for a physical meeting to take place, an online collaboration tool was utilised.

Each workshop was structured in four stages:

1. **Review, refine, and initial user stories:** The pilot partner in the workshop presented the use cases. This part consisted of the as-is and to-be scenarios and the initial user stories that the pilot partner defined and provided in the workshop. The

workshop participants collaborated in defining the new user stories if needed as complimentary. These user stories were related to the initialized scenarios from the pilot partner.

2. **Define components and functionality for user stories:** In this stage regarding the updates from the previous stage on the user stories, the list of components and functionalities were reviewed and if needed the new components were defined.
3. **Synthesis for all use cases:** In this stage, all components and functionalities from the previous stage were linked to the use cases from the first stage. In this stage, the participants and the pilot partner evaluated, validated, or edited the functional or non-functional requirements that were expressed in the user stories.
4. **Link user stories and components to identify aspects of AI-human collaboration, and anticipated outcomes/success criteria:** In the last stage participants initialized the wide range of collaboration scenarios relying on the relevant success criteria. These scenarios were provided for addressing: (1) How humans can help or augment the AI systems. (2) Where AI technologies can help or augment humans. (3) The optimal interaction between human and AI systems. (4) How AI systems can substitute the human. (5) What can be the other success criteria.

All pilots and the pilot partners benefited from their respective workshop and their collaboration with other stakeholders and partners with the acquisition of the new perspectives and ideas toward their scenarios. As a major result of the workshops all three testbeds updated their user stories, components, and functionalities related to their use cases. More detailed information of each stage and a detailed description of each conducted workshop is reported in deliverable D2.9 *"Report on Co-Design Workshops and Focus Groups -Initial version".*

3.3 Identification of the Relevant Components

In Task 6.1, we aggregate the list of use cases' components for all the pilot partners. The use cases' components include all the components such as hardware and software, which are utilized and developed in the testbed's use cases in the STAR project. This list contains all the essential information related to the components that each pilot partners exploit in their use cases for the STAR project. The information about the usable components enables not only the testbeds but also all other research and industrial partners to have the overall prospect toward the use cases' technologies, their different source of data, different fields of applications and research, potential users, the input/output of the components, communication means to the components and their state of confidentiality, etc.

Moreover, the list of components makes the technology providers and pilot partners collaborate fluently during the project with the general perspective toward the defined use cases. Three lists of components are shared and documented from the use cases partners. These lists are accessible only for internal use for the partners in the SharePoint of the STAR project.

3.4 Preparing the Sample of Datasets and Local SharePoint

The pilot partners in Task 6.1 further contributed on the preparation of the sample of their datasets. As Task 6.1 is focusing on the pilot site preparation and pre-pilot testing; all the pilot partners were asked to provide concrete information about their datasets. This initial information was also utilised, together with all other datasets infrmation, in the preparation of the Data Management Plan. Furthermore, pilot partners continued working on this activity and provided and documented the concrete information about the dataset and data models they plan to utilize. This information consists of the type of data generated in the scenarios with the description of the data, the components and technologies which generate and provide these data, the possible interaction with other components, technology providers, or parties, and the small sample of the dataset and data schemas. This information was documented and reported in detail in the deliverable D2.4 "Data Models and Data Collection-Initial version". In their contribution with D2.4, pilot partens presented and interpreted their as-is scenarios' data (Figure 11 and Figure 12), and the data which is planned to be utilized in their to-be scenarios. In addition, the pilots presented and clarified the reason why they plan to apply a new source of data in their to-be scenarios by explaining the difficulties and issues they confront in their as-is scenarios. It should be noted that a further and final version of the deliverable on "Data Models and Data Collection" will be prepared in M18.

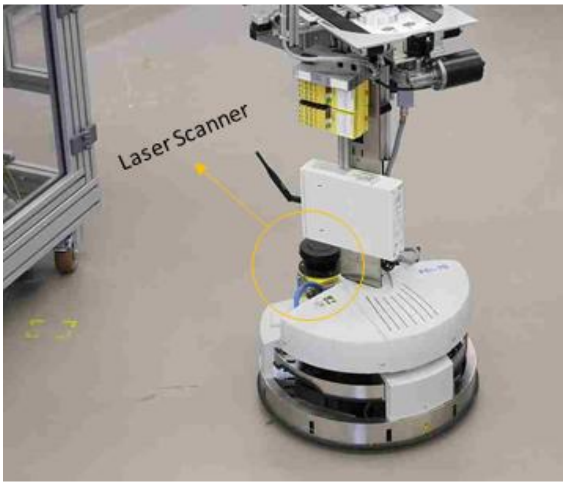

Figure 11: Robotino's laser scanner used for as-is layout generation for SmartFactory testbed.

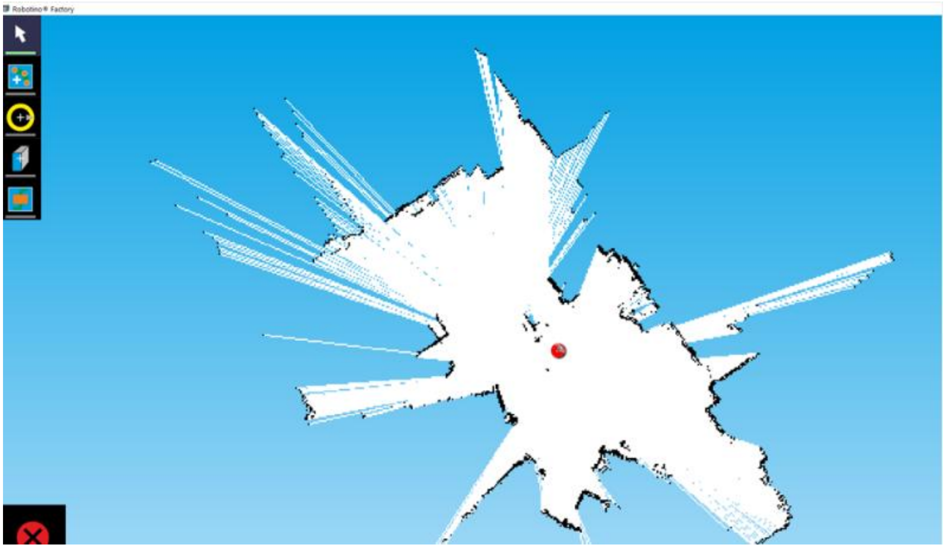

Figure 12: Scanned layout after manual movement through the plant for SmartFactory testbed.

Pilot partners also prepared the list of local sharing repositories that each pilot partner utilizes to save and share their datasets with other project parties. These data can include any source of data from different modules and components that are employed in the pilot partners to-be scenarios. These repositories are the common place that technology providers and other parties in the STAR project utilize to access the provided data from testbeds. The list of datasets which is documented and shared in the STAR project's repository provides information about:

- **WP:** The WP(s) in which the testbeds and other parties share and utilize the data.
- **Contact point(s):** The source of the data. For instance, it can be the sensor data from IMU sensors, videos or images from cameras, or the Lidar data from Robots.
- **Pilot partner and use case(s):** The pilot partner which is utilizing the data and provides the dataset. Moreover, the specific use case(s) in which the data is utilized.
- **Accessibility:** The name of any possible partner that needs access to the data. This can be the list of the technology provider(s) for specific pilot partners' use cases.
- **Data format and size of the data:** The format of the data and the size of the batch of the data which is shared. It can be any format and vary in size from KBs to hundreds of GBs.
- **Share point(s) and infrastructure:** The SharePoint in which the data is shared between different parties, and the infrastructure to access the share point. The data can be accessed through any public, shared, or private infrastructure.
- **Credential or permission:** It represents the sensitivity of the data. Permission is needed for sensitive or private datasets.

3.5 Ethical Management and Legal Analysis

The STAR project and its tools ensure compliance with EU legislation and safeguard human rights and ethical principles by a wide range of precautions and countermeasures to preserve privacy. To ensure ethical principles are used and covered by pilot partners, the project oversight activities and societal impact assessment will be conducted in WP6. For this reason, pilot partners answered to D1.5 "Ethical Management and Legal Analysis Activities-Initial version". The pilot partners answered questions addressed separately to each of them, namely, to the first pilot on "Human-Cobot Collaboration for Robust Quality Inspections", to the second pilot on "Human-Centered Artificial Intelligence for Agile Manufacturing 4.0", and to the third pilot on "Human Behavior Prediction and Safe Zone Detection for Routing". All questions were tailored to the specific scope of each Pilot. More information on the analysis and on the status per Pilot from an ethical viewpoint are presented in detail in deliverable D1.5.

3.6 Synergy with IBER-OLEFF pilot partner for their dataset preparation

One of the main focal points of Task 6.1 is the preparation of the testbeds. This can be either installing the whole pilot for specific scenarios for the STAR project or adaptation and improvement to the prior pilot setup. Partner IBER-OLEFF installed its dedicated pilot from scratch and the setting up of the pilot was monitored and tracked. Furthermore, after setting up their testbed, the pilot and STAR partners synergized regarding the dataset preparation from their testbed. This was managed between the different pilot partners and technology providers, which brought the perspective for the IBER-OLEFF group on the different possibilities to apply the STAR technologies in their scenarios.

3.7 STAR Deployment for Solution

Another target that is achieved for the pilot sites preparation activities was the initialization of the GitLab group. INTRASOFT initialized the common repository for the software components and common CI/CD platform for development. INTRASOFT provided STAR's GitLab repository for all pilots and other partners which contribute to their scenarios. This activity was conducted under the supervision of DFKI. For every pilot partner, one or more subgroups in the STAR's GitLab repository are initialized and the state of privacy for every subgroup, featuring a different STAR platform module, is defined. In addition, each subgroup shall host one or more repositories for software components to construct each module.

4 Activities Planned for the Second Year

This deliverable is the initial version of the report on pilot sites reparation, and a further and final version will follow at Month 24.

During the second year, many significant activities will be undertaken as for instance is the first Integrated STAR Platform. In the frame of the second version of this deliverable, we will focus and report on the collaboration of pilot partners in synchronization with the technology providers. In this initial version, we reported on the preparation of the pilot sites as the testbeds for applying the AI technologies from the STAR project whereas during the second year of the project, we will mainly focus on the defined scenarios of three pilot partners and the synchronization with the technology providers.

Moreover, in the next version of the Report on Pilot Sites Preparation, we will report on the deployment of the initial version of the prototype on the pilot sites. During the next months and in the second year of the project, the technology providers will continue developing their solutions technically and deploy the first prototypes on the testbeds. Providing the datasets, sharing with the technology providers, and applying the solutions in the testbeds are some of the main part of the process in this phase.

Finally, the next version of the Report on Pilot Sites Preparation will report on the collection and evaluation of the first results of the first deployment. Following the application of the initial deployment on the testbed, the results will be collected and evaluated, and the pilot sites will assess the results and align their scenarios with possible new requirements of the software/hardware components based on these results.

5 Conclusion

This document is the report of the work, activity, and participation which have been undertaken for the Pilot Sites Preparation in the STAR project during the first twelve months of the project life.

The STAR project attempts to make the AI approaches safe, trusted, and secure for the industrial environments. The main purpose of WP6 in this project is the preparation, integration, validation, and evaluation of the STAR project's goals in the testbeds. Task 6.1 "Pilot Site Preparation and Pre-Pilot Testing" is focusing on the monitoring synchronization and communication between different pilot partners for the preparation of their testbeds. During this period, we managed and monitored the preparation of the three pilot partners, PHILIPS, IBER-OLEFF, and DFKI for their use cases in the STAR projects, "Human-CoBot Collaboration for Robust Quality Inspections", "Human-Centered AI for Agile Manufacturing 4.0", and "Human Behavior Prediction and Safe Zone Detection", respectively. In this report on Pilot Sites Preparation, we mainly reported on the achieved goals:

- Introduction and explanation of the pilot partners in this project and their fields of study and research.
- Monitoring for preparation and setting up the pilot testbeds for the STAR project.
- Initiation of the three pilots' use cases and their activities to define and finalize their use cases.
- Identification and documentation of the requirements for every pilot partner namely the list of components, the list and sample of datasets, and local share points for their use cases that are utilized for their communication with other parties like technology providers in the STAR project.
- Action points which will be addressed in the second year of the project and will be reported on the final version of the Report on Pilot Sites Preparation.