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Project Full Title:	Hospital Smart development based on AI

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DELIVERABLE

D1.4 – Stakeholders' Requirements and Analysis Report – Final version

Dissemination level:	PU -Public
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Executive Summary

Deliverable 1.4 "Stakeholders' Requirements and Analysis Report – Final version" provides a detailed account of the evolutionary journey of the HosmartAI project. It marks the culmination of four strategic sprints, drawing together the collective knowledge, experiences, and refinements made throughout these stages. This final report does not merely represent the end of a process but rather the sum of the experiences, challenges, and innovations that have unfolded along the way.

Initially, the project's user requirements were derived from a diverse pool of stakeholders, and these requirements served as the preliminary blueprints for the project. The initial requirements outlined in D1.2 (due M8) laid the foundation for the project and provided the initial trajectory for the HosmartAI solutions.

In the second stage, D1.3 (due M12), these initial user requirements were put to the test in Sprint 1. The insights gained helped refine and prioritize these user requirements, providing a more focused vision for the development of the HosmartAI solutions.

The final Deliverable 1.4 (due M31) is the outcome of the continuous and iterative refinement processes that were adopted in subsequent Sprints 2, 3, and 4. These sprints not only refined the user requirements but also exposed the project to real-world challenges and diverse use cases, ensuring a user-centric and effective approach. The accumulated insights from all four sprints (M7 to M30) have been integrated, resulting in a consolidated and comprehensive set of user requirements.

This iterative and participatory methodology adopted throughout the sprints played a significant role in the project, actively engaging over 305 stakeholders. This engagement far surpassed the initial KPIs, reflecting the efficacy of the inclusive approach adopted by the HosmartAI project.

This final deliverable underlines the critical role this methodology plays in gaining a profound understanding of user requirements and successfully integrating these into the HosmartAI solutions. The consolidated user requirements not only reflect the unique needs of the stakeholders but also embody the project's commitment to developing robust, user-centric solutions that stand to revolutionize healthcare delivery.

The outcomes of this journey are not limited to the HosmartAI project. The lessons learned, methodologies adopted, and strategies implemented have significant implications. They underscore the potential of a user-centric, agile, and participatory approach in effectively managing complex, multi-site, and multi-solution development efforts. The result is the delivery of robust and impactful solutions that holistically address the needs of various stakeholders.

In conclusion, Deliverable 1.4 outline insights and refinements made during the sprints project's journey, demonstrating the effective evolution of user requirements and highlighting the potential of such an approach for future initiatives.

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1.0	2003-07-28	Athanasios Poulakidas (INTRA), Anastasia Panitsa (INTRA)	QA and final version for submission

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Definitions, Acronyms and Abbreviations

Acronym/ Abbreviation	Title
DoA	Description of Action
DT	Design Thinking
EC	Ethical Committee
ICT	Information and communications technology
KPI	Key Performance Indicator
MVP	Minimum Viable Product
PC	Project Coordinator
PD	Participatory Design
PU	Public
RDi	Research, development and innovation
WP	Work Package

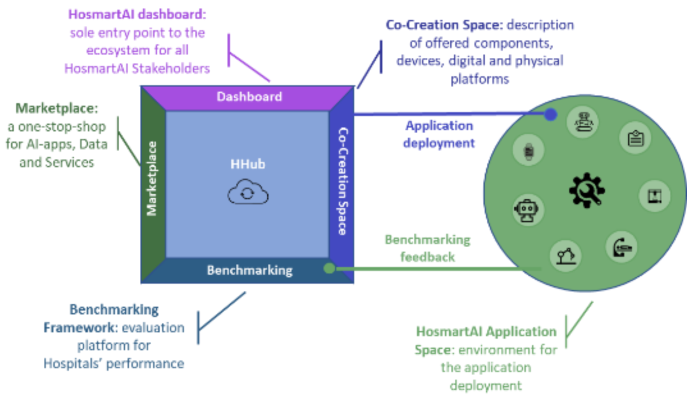
Term	Definition
Beneficiary	EC term used to designate the legal entity which has signed the Grant Agreement. This term is often substituted by the common language term 'partner'.
Consortium	Group of beneficiaries that have signed the Consortium Agreement and the Grant Agreement (either directly as Coordinator or by accession through the Form A).
Consortium Agreement	Contractual document signed by all the beneficiaries (and not the EC), explaining how the Consortium is managed and works together.
Deliverable Leader	Responsible for ensuring that the content of the deliverable meets the required expectations, both from a contractual point of view and in terms of usage within the project. Is also responsible for ensuring that the deliverable follows the deliverable process and is delivered on time.
Description of Action	Annex 1 to the Grant Agreement. It contains information on the work packages, deliverables, milestones, resources and costs of the beneficiaries, as well as a text with a detailed description of the action. The DoA is made of Part A (structured data collected in web forms and workplan tables) and Part B (text document describing the action elements).
Dissemination	EC term for the communication of information to a wide audience.
Grant Agreement	Contractual document which defines the contractual scope of the HosmartAI project. It is signed between the EC and the beneficiaries.
Sprint	A Sprint is a set time period during which specific work has to be completed and made ready for review. In the proposed hybrid framework presented in D1.2, a full Sprint includes ten Sprint events.

1 Introduction

1.1 Project Information

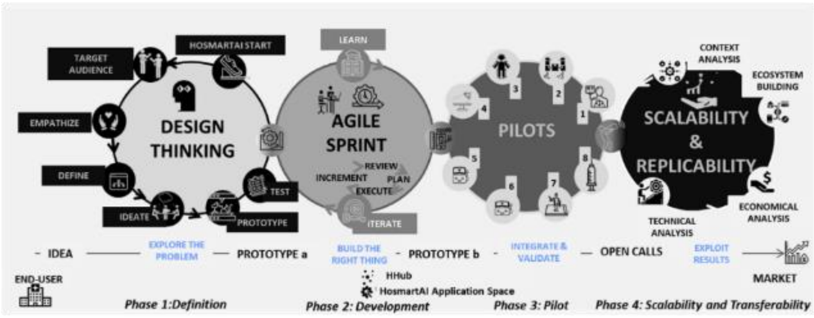
VISION	The HosmartAI vision is a strong, efficient, sustainable and resilient European **Healthcare system** benefiting from the capacities to generate impact of the technology European Stakeholders (SMEs, Research centres, Digital Hubs and Universities).
MISSION	The HosmartAI mission is to guarantee the **integration** of Digital and Robot technologies in new Healthcare environments and the possibility to analyse their benefits by providing an **environment** where digital health care tool providers will be able to design and develop AI solutions as well as a space for the instantiation and deployment of AI solutions.

HosmartAI will create a common open Integration **Platform** with the necessary tools to facilitate and measure the benefits of integrating digital technologies (robotics and AI) in the healthcare system.



A central **hub** will offer multifaceted lasting functionalities (Marketplace, Co-creation space, Benchmarking) to healthcare stakeholders, combined with a collection of methods, tools and solutions to integrate and deploy AI-enabled solutions. The **Benchmarking** tool will promote the adoption in new settings, while enabling a meeting place for technology providers and end-users.

Eight Large-Scale Pilots will implement and evaluate improvements in medical diagnosis, surgical interventions, prevention and treatment of diseases, and support for rehabilitation and long-term care in several Hospital and care settings. The project will target different **medical** aspects or manifestations such as Cancer (Pilot #1, #2 and #8); Gastrointestinal (GI) disorders (Pilot #1); Cardiovascular diseases (Pilot #1, #4, #5 and #7); Thoracic Disorders (Pilot #5); Neurological diseases (Pilot #3); Elderly Care and Neuropsychological Rehabilitation (Pilot #6); Fetal Growth Restriction (FGR) and Prematurity (Pilot #1).



To ensure a user-centred approach and harmonization in the process (e.g. regarding ethical aspects, standardization, and robustness both from a technical and social and healthcare perspective), the **living lab** methodology will be employed. HosmartAI will identify the appropriate instruments (**KPI**) that measure efficiency without undermining access or quality of care. Liaison and co-operation activities with relevant stakeholders and **open calls** will enable ecosystem building and industrial clustering.

HosmartAI brings together a **consortium** of leading organizations (3 large enterprises, 8 SMEs, 5 hospitals, 4 universities, 2 research centres and 2 associations – see Table 1) along with several more committed organizations (Letters of Support provided).

Table 1: The HosmartAI consortium.

Number[1]	Name	Short name
1 (CO)	INTRASOFT INTERNATIONAL SA	**INTRA**
1.1 (TP)	INTRASOFT INTERNATIONAL SA	**INTRA-LU**
2	PHILIPS MEDICAL SYSTEMS NEDERLAND BV	**PHILIPS**
3	VIMAR SPA	**VIMAR**
4	GREEN COMMUNICATIONS SAS	**GC**
5	TELEMATIC MEDICAL APPLICATIONS EMPORIA KAI ANAPTIXI PROIONTON TILIATRIKIS MONOPROSOPIKI ETAIRIA PERIORISMENIS EYTHINIS	**TMA**
6	ECLEXYS SAGL	**EXYS**
7	F6S NETWORK IRELAND LIMITED	**F6S**
7.1 (TP)	F6S NETWORK LIMITED	**F6S-UK**
8	PHARMECONS EASY ACCESS LTD	**PhE**
9	SMARTSOL SIA	**TGLV**
10	NINETY ONE GMBH	**91**
11	INNOVATION IN HEALTH HUB & HOLDING GMBH	**EIT**
12	UNIVERZITETNI KLINICNI CENTER MARIBOR	**UKCM**
13	SAN CAMILLO IRCCS SRL	**IRCCS**
14	SERVICIO MADRILENO DE SALUD	**SERMAS**
14.1 (TP)	FUNDACION PARA LA INVESTIGACION BIOMEDICA DEL HOSPITAL UNIVERSITARIO LA PAZ	**FIBHULP**
15	CENTRE HOSPITALIER UNIVERSITAIRE DE LIEGE	**CHUL**
16	PANEPISTIMIAKO GENIKO NOSOKOMEIO THESSALONIKIS AXEPA	**AHEPA**
17	VRIJE UNIVERSITEIT BRUSSEL	**VUB**
18	ARISTOTELIO PANEPISTIMIO THESSALONIKIS	**AUTH**
19	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH	**ETHZ**
20	UNIVERZA V MARIBORU	**UM**

[1] CO: Coordinator. TP: linked third party.

Number[1]	Name	Short name
21	INSTITUTO TECNOLÓGICO DE CASTILLA Y LEON	**ITCL**
22	FUNDACION INTRAS	**INTRAS**
23	ASSOCIATION EUROPEAN FEDERATION FORMEDICAL INFORMATICS	**EFMI**
24	FEDERATION EUROPEENNE DES HOPITAUX ET DES SOINS DE SANTE	**HOPE**

1.2 Document Scope

The Deliverable 1.4 Stakeholders' Requirements and Analysis Report - Final Version is an expansive document outlining the progression and outcomes of the HosmartAI Sprints Journey, primarily focusing on Sprints 2, 3, and 4. This report details the timeline, objectives, and methodologies employed within each sprint.

Central to this document is the active engagement of stakeholders, including an examination of participant profiles, their contributions throughout the sprints, and the overarching benefits of the participatory methodology together with its synergistic relations to other Work Packages.

The main thrust of the deliverable is a presentation of the refined user requirements for the AI Platform and the eight lighthouse pilot solutions, along with their respective implementation approaches. These requirements, born out of agile development framework, have undergone iterative refinement via insights gained from sprint outcomes, underscoring the collaborative ethos of the project.

For further exploration of the HosmartAI Platform and the eight pilot use cases, readers may refer to these deliverables:

- D2.3 Final set of Common AI, Benchmarking and Security Pillars [M31]
- D3.3 Final set of AI-based Solutions and Autonomous Smart Components [M31]
- D4.5 HosmartAI Platform - Second version [M31]
- D5.3 Detailed Pilot Specification and Report on Pilot Sites Preparation - Final version [M31]
- D6.2 Ecosystem Building, Industrial Clustering & Stakeholders Engagement – First version [M19]
- D7.2 Exploitation Plans and Activities – Second version [M27]
- D7.6 HosmartAI Marketing Pack – First version [M25]

The deliverable concludes with a brief analysis of the Sprints 1, 2, 3, and 4 retrospectives, illuminating the journey of project enhancement. It examines the learning from each sprint, flags potential areas for improvement, and offers valuable methodological insights for future application.

1.3 Document Structure

This document is comprised of the following chapters:

Chapter 1. Introduction: This chapter sets the stage for the report by introducing the overall objective of the HosmartAI Sprints Journey and the importance of user requirements finalization for the AI Platform and the eight lighthouse pilot solutions.

Chapter 2. HosmartAI Sprints Journey: the report provides details on the timeline, objectives, and methodologies employed during Sprints 2, 3, and 4. It offers a narrative of the activities conducted and the progress made during these sprints.

Chapter 3. Stakeholders' Engagement and Participation: This part profiles stakeholders involved in the sprints, emphasizing their active participation, the impact of the participatory approach, and the created synergies with other Work Packages. It showcases the power of collaborative and cross-functional engagement.

Chapter 4. User Requirements - Final Version: This chapter presents the refined and consolidated user requirements for the AI Platform and the eight lighthouse pilot solutions. It offers a comprehensive list of requirements, shaped and informed by the insights and outcomes gathered during the sprints.

Chapter 5. Retrospective Analysis from Sprints 1 to 4: The retrospective recommendations conducted/followed for Sprints 1, 2, 3, and 4 are examined, underscoring the continuous improvement initiatives undertaken throughout the project's lifetime. This chapter highlights the lessons learned, potential areas for improvement, and the iterative nature of the project's development process.

Chapter 6. Lessons Learned: This part of the report encapsulates key learnings from the sprints, documenting invaluable insights and suggestions for future project iterations or similar endeavours.

Appendix A: It offers additional support materials with a summary page file for each Sprint/Pilot. It includes more granular details.

2 HosmartAI Sprints Journey

Building upon the foundations of the CAPTAIN H2020 Project [REF-01][REF-02][REF-03] yet forging its own unique pathway, the HosmartAI Hybrid methodology combines facets of participatory action research [REF-04], co-creation processes, living lab methodology, and agile development. This flexible methodology will enable the consortium to deploy solutions that are optimized in a co-participatory way [REF-05] to increase value, use and acceptance by end-users (see Figure 1). Such strategy underscores **user-centeredness and flexibility**, and with a multi-level co-creation and agile development process, **actively involves stakeholders in its execution**.

The methodology focuses simultaneously on the AI platform and the development of eight pilot solutions under a participatory design approach, but with differentiated strategies for the two layers of development. These solutions, co-created using Living Lab methodologies and agile development, serve as demonstrative scenarios to illustrate the business case potential of the HosmartAI Platform.

By aligning technological innovation with user needs and preferences, the HosmartAI Hybrid methodology empowers the consortium to deploy solutions optimized in a co-participatory manner, maximizing value, utilization, and acceptance among end-users.

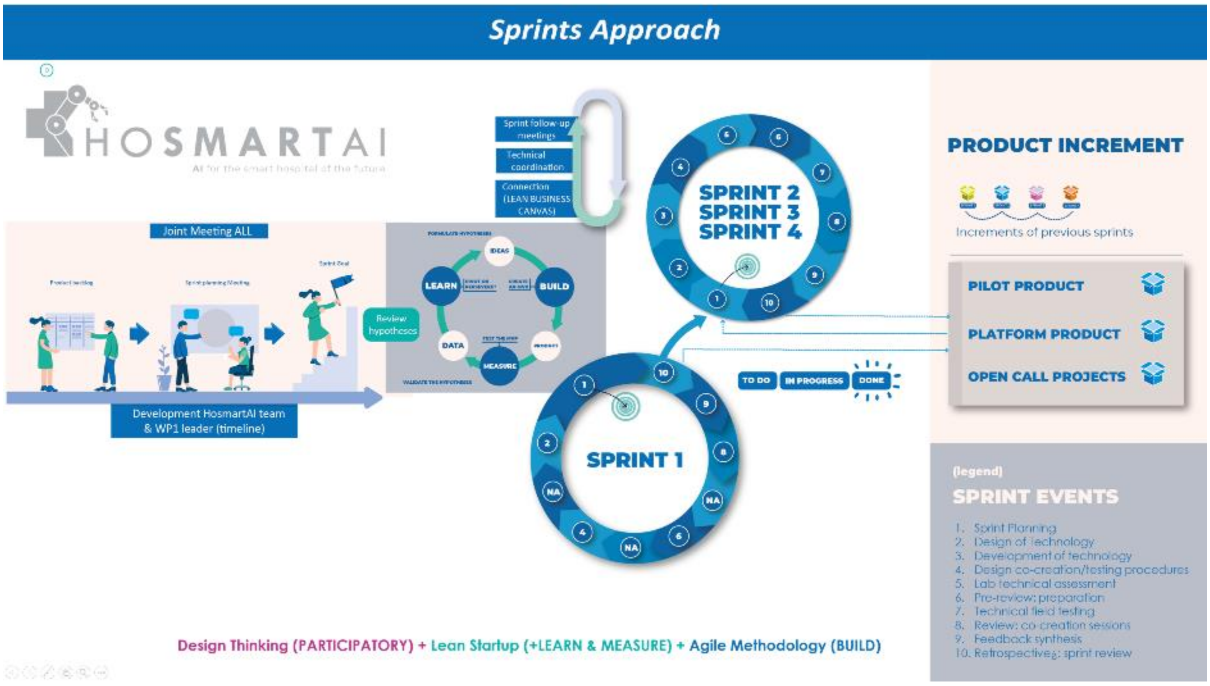


Figure 1: Methodological Diagram.

The requirements elicitation process performed in the HosmartAI Sprints Approach is explained in detail in D1.3.

To briefly summarize, the 10 crucial Sprint events described in D1.2, each with a distinct focus and function, underpinning this methodology, are the following:

- **1. Sprint Planning**: All partners collaboratively define achievable goals for the Sprint, for each of the solutions, and delineate the means to reach these goals, without forgetting that the user is at the centre, influencing the direction of the solutions being developed. The approach prioritizes value and acceptance from the end-users' perspectives. Developers from WP2-3-4 plan the tasks required to turn Product Backlog items into valuable increments.
- **2. Design of the Technology**: This stage is coordinated and executed in WP2, 3, and 4, focusing on the technological architecture of the project. It leverages the co-creation process, incorporating previous sprint inputs from end-users to shape the technological design in a way that maximizes utility and acceptance.
- **3. Development of Technology**: This phase is also coordinated and executed in WP2, 3, and 4, where the actual development of the technology takes place.
- **4. Design of Co-creation/Testing**: The methodology considers the technical needs and questions that guide the co-creation/testing procedures. The focus here is on detailing session procedures in a way that respects and optimizes user interaction.
- **5. Lab Technical Assessment**: Conducted under WP2, 3, and 4, this stage involves trials and tests of the functionalities, with the assessment incorporating the end-users' needs and the technology's effectiveness in addressing them, further discussing the feasibility of testing procedures and refining them.
- **6. Pre-review**: This is a preparation stage for co-creation sessions, focusing on the delivery of technology, installation, and preliminary testing to collect quick feedback from end-users before formal sessions with stakeholders. Performed under WP5.
- **7. Technical Field Testing**: Although not mandatory, field testing provides valuable insights into real-world performance and user acceptance, helping to identify and resolve technical issues early. It can be implemented by piloting the planned sessions with 2 or 3 stakeholders to identify early technical issues that might compromise the testing phase, such as bugs or incompatibilities.
- **8. Sprint Review**: This event involves carrying out the co-creation/testing sessions, either in group or individual formats, integrating real-world user feedback to improve the product. Supportive methods and tools are defined in a personalized manner.
- **9. Feedback Synthesis**: The consortium collectively analyses user feedback, by summarizing results' reports. A Joint meeting takes place to present the gathered feedback and discuss arising aspects, resulting in refining the technology based on these insights. The process fosters a co-participatory approach to technology and process optimization.
- **10. Sprint Retrospective**: Promotes continuous learning, encouraging partners to reflect on the process and incorporate lessons learned. The consortium discusses issues and successes to create actionable metrics for subsequent Sprints.

2.1 Timeline & Goals

The HosmartAI Sprints Journey is a vital part of the project's implementation, featuring an iterative and collaborative approach in the development of the HosmartAI AI Platform and the eight lighthouse pilot solutions. The journey comprises four major Sprints from month 7 to month 31, each with a specific focus and duration to fit the project and tasks' incremental requirements.

- **Sprint 1** (Month 7 - Month 11): Over the course of five months, the focus of the first sprint was on co-designing with real users and other stakeholders. The objective was to better understand the problem, identify good value propositions, understand limitations such as environmental and workflow dynamics, and provide guidance on "Dos" and "Don´ts".
- **Sprint 2** (Month 12 - Month 16): Sprint 2 lasted for five months and centred on continuing the elicitation of requirements, exploring actual implementation scenarios and pilot specificities, and examining ethical and privacy by design aspects. The feedback gathered for the design of interventions (e.g., the type of information to display) was crucial. The focus was broadly on creating value on the AI platform, technical implementation, and feasibility of business cases.
- **Sprint 3** (Month 17 - Month 24): In Sprint 3, which spanned eight months, the team tested the available Minimum Viable Product (MVP) while continuing the co-creation process. The first implementation platform emerged as an MVP in Month 19.
- **Sprint 4** (Month 25 - Month 30): Sprint 4 lasted six months and saw the testing of the available MVP along with continued co-creation. Intermediate versions of the MVP were expected around Month 25/26, with the final MVP to be explored in Task 5.2 at Month 31.

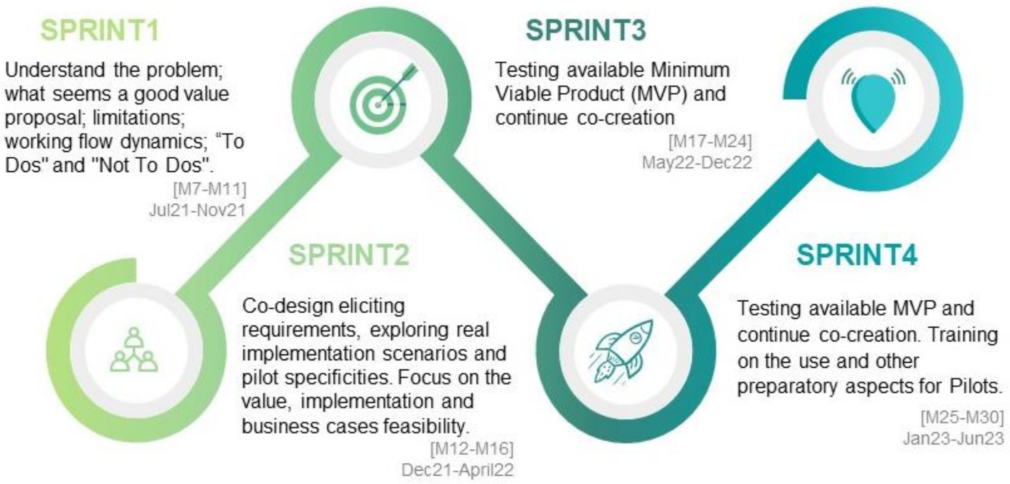


Figure 2: Sprints timeline.

Each sprint commenced at the end of the previous one, with partners agreeing on a detailed time plan to accommodate the project's evolving needs. The flexibility of the hybrid participatory and agile methodology has proven to be key in this process, allowing for necessary adaptations while maintaining focus on the project's overarching goals.

2.2 Sprints Approach

The Sprints Approach integrates technical development, user-centred design, data management, and stakeholder engagement to achieve its goals.

For a more comprehensive understanding of the process and outcomes of each Sprint, please refer to the annexed documents. They include detailed overview sheets offering additional supportive materials and granular insights, on which each summary page file provides context elaborating on the process, actions, and results of the respective Sprint and Solution. This wealth of information serves as a valuable resource for a thorough understanding of the achievements and challenges encountered in each Sprint for each HosmartAI Pilot Solution.

The forthcoming information about the eight pilots relates to the presented solutions:

- Pilot 1 (lead by AUTH) Clinician-friendly, interpretable computer-aided diagnosis system (ICADx) to support and optimise clinical decision making in multi-specialty healthcare environment
- Pilot 2 (lead by CHUL) Optimizing the use of radiotherapy
- Pilot 3 (lead by IRCCS) Treatment Improvement with the use of innovative technologies and robotics in the rehabilitation process
- Pilot 4 (lead by SERMAS/ETHZ) Robotic systems for minimally invasive operations
- Pilot 5 (lead by UM) Assistive care in hospital: robotic nurse
- Pilot 6 (lead by INTRAS) Assistive care in care centre: virtual assistant
- Pilot 7 (lead by PHILIPS) Smart Cathlab Assistant
- Pilot 8 (lead by VUB) Prognosis of cancer patients and their response to treatment combining multiomics data

2.2.1 Sprint 1 [M7-M11]

In Sprint 1 the sprint events 3, 5 and 7 listed before were not included, as, in accordance with the project work plan, development of technologies was not yet envisaged. Sprint 1 focused specifically on gathering feedback from real users and other stakeholders regarding the Personas, the user stories, the concept of HosmartAI and what was defined for the different pilot solutions.

Overview of actions carried out in Sprint 1 across the eight pilot projects:

- **HosmartAI Platform:** Interacted with users on important platform direction features that would guide the platform design decisions. The focus was on platform scope, used components, important data sources, standards, application development, deployment orchestration, deployment sites, platform technologies and AI tools. A set of surveys were executed to collect user feedback.
- **Pilot 1:** Focused on AI-assisted diagnostic tools and maintained a steady flow of information regarding requirements from collaborating medical professionals. Initiated discussions with hospital administrations to define KPIs for the project. Adjusted scenarios based on feedback to enhance usefulness in clinical practice.
- **Pilot 2:** Defined Lung cancer flow chart, system inputs, and clinical protocol. Encouraged feedback from all stakeholders, adjusting the scenarios as necessary to align with real-life situations.
- **Pilot 3:** Collaborated with technical partners (VIMAR and AUTH) to detail the functionalities of the developed service. Co-design sessions were organized with

physiotherapists, patients, and caregivers. The focus was on defining pain points and touchpoints of the service, sketching user interface characteristics, define service characteristics and understanding user needs.

- **Pilot 4:** Discussions between partners (SERMAS, ETHZ, 91) about requirements for collaboration Things to consider when automating cardiac ablation procedures will be planned. Limitations of the planned in-vitro study. A good foundation for the ongoing development process requirements. Planning of the first test (remote robot control) between SERMAS and ETHZ.
- **Pilot 5:** Relied on technical partners (UM, ITCL, GC, TMA) for detailing and discussing technical components. Conducted co-creation sessions with healthcare professionals and patients. The team defined six personas from the results of a cross-sectional survey, optimizing them based on new information, and prioritizing unmet needs.
- **Pilot 6:** Participated in WP1 discussions, relying on technical partners (ITCL, AUTH, GC, and TMA) for technical details. The team organized participatory workshops with older adults and therapists to present "personas", discussed the ideal scenario, and prioritized unmet needs. In the workshop was presented the e-coach concept and explored solutions with big data.
- **Pilot 7** Aligned high-level objectives with UZB, shared and discussed a draft clinical study protocol. After resolving staffing issues, the team planned for an alignment meeting, aiming to clarify the main functionalities of the AI application and data sets needed.
- **Pilot 8** Initiated discussion with technical partners focusing on the requirements of researchers and clinicians about the analysis of data with AI and its clinical use. The team worked on identifying the needs of researchers, clinicians, and ICT in relation to other "personas" and use scenarios.

The actions taken during Sprint 1 represent the starting point of the HosmartAI Sprints Approach for each pilot solution, focusing on defining the groundwork, gathering initial stakeholder feedback in a systematic and harmonized way, and prioritizing the unmet needs and potential enhancements for the HosmartAI project.

The following snapshot provides an overview of the extensive groundwork laid out during Sprint 1, showcasing the collaborative and adaptive nature.

User Requirements & Feedback Incorporation: Each pilot project focused on defining their specific User Requirements by actively involving their respective stakeholders. his hands-on involvement provided valuable insights into the requirements and needs of the end users, which helped shape the solution development.

Stakeholders involving designing Personas & Use Cases: The pilots actively engaged their stakeholders through various co-creation activities. Each pilot worked on defining and presenting the "personas" involved in their solutions and the potential benefits these solutions could bring to them. They encouraged feedback from all stakeholders and used these inputs to adjust their scenarios for clinical application.

Prototype Development & Feature Integration: Each pilot project worked on identifying key features and functionality for their solutions. Feedback from these initial steps was then incorporated into the solutions' development.

Data Handling & Security: initiated the work with the understanding that data handling and security is a significant aspect moving forward.

Researcher and Clinician Needs: Identifying the specific needs of researchers and clinicians concerning the analysis of data with AI and its clinical use. The focus was on tailoring the solutions to address these requirements effectively.

Table 2: Breakdown of Stakeholder Participation by Profile for Each Pilot Solution in Sprint 1.

Participants' roles	P1	P2	P3	P4	P5	P6	P7	P8	TOTAL
Patients		5				9			14
Caregivers									0
Clinicians	10	7	6	3	5	3	3	4	41
Healthcare services managers		3		3	2	1			9
Researchers/partners/IT personnel	7	1		6	4	4	6	5	33
TOTAL Participants	**17**	**16**	**6**	**12**	**11**	**17**	**9**	**9**	**97**
Nº Design Interactions	**4**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**12**

2.2.2 Sprint 2 [M12-M16]

In Sprint 2, a range of actions were carried out across the HosmartAI platform and its eight pilot projects. Here is a brief overview of these actions:

- **HosmartAI Platform:** Consultations with the technical team and feedback incorporation in the design and development plan was a key aspect of this sprint. The team worked on the AI Tools (JupyterHub, Acumos, Python libraries), Service Orchestration, benchmarking library, and received KPIs and inputs from Pilots. The first version of the blockchain application was created, security plan finalized, and the first set of security and privacy tools deployed. Additionally, the second version of the Data Management Plan (DMP 2) was initiated, focusing on collecting information about Pilot #4 datasets and obtaining missing data management cost information from partners.
- **Pilot 1 (Echocardiography & Capsule Endoscopy tools):** The focus was on designing comprehensive, simple, and user-friendly GUIs for each tool, exploring and prioritizing usage scenarios, and evaluating prototype mock-ups with end-users.
- **Pilot 1 (Obstetrics & CCTA tools):** The team worked on designing a user-friendly web-tool interface, exploring usage scenarios, and evaluating prototype mock-ups with end-users.

- **Pilot 2:** The first version of the scheduler and the hospital manager web page was designed and deployed. The team created an excel template for simulation patient data, reviewed the scheduler version, acquired data from hospital inputs, defined storylines for patient engagement, and worked on integrating the chatbot services.
- **Pilot 3:** development of a service prototype for testing during the sprint, live usability testing of the service prototype and Vimar View app, analysis of users' perception and co-design of the iPrognosis tools took place. These tests used prototyping methodologies, usability testing and semi-structured interviews for debriefing.
- **Pilot 4:** The focus was on developing and testing the prototype control algorithm for automated catheter navigation and control interface for remote navigation, prototyping a 5D cardiac map, and machine learning 5D mapping, all while involving meetings with the technical team and cardiologists.
- **Pilot 5:** Work was carried out to finalize the architecture and placement of the robot in the real environment, conceptualize robot interaction, design care plans, and storylines/exercises. Moreover, the team worked on identifying the blockchain deployment scenario, validating the UI, creating the first version of the vision models, and deploying them on the robot.
- **Pilot 6:** Multiple exploration sessions were conducted to understand the best ways to integrate the various technologies. The team explored various aspects of user interaction, system architecture, web page synchronization, robot functionality, and blockchain deployment scenario. The system architecture of the Activity Plan Editor (APE) was finalized, and its GUI frontend was conceptualized.
- **Pilot 7:** The deployment of a data annotation tool at UZB was realized, and data flow, including de-identification and annotation of angiograms, was established.
- **Pilot 8:** The team worked with the UZ Brussel hospital on the digital health platform, prepared data inventory within departments (genetic & radiology) for data integration, developed an analytical framework for the analysis of the collected data, and finalized the technical partner (internal partner for UZB)- for Pilot 8.

These actions represent the broad scope of work undertaken in Sprint 2, highlighting the collaborative and multi-faceted nature of the HosmartAI project, adhering to the principles of iterative design and active stakeholder involvement. The primary focus was on developing initial versions of the tools, integrating user feedback, and fortifying the system architecture.

User Feedback & Iterative Design: significant emphasis was placed on designing intuitive user interfaces and integrating user feedback into the design and development process. Prototyping and mock-up evaluations were employed, exploring system architecture and user interaction points.

Technical Advancements & AI Tools Integration: The HosmartAI platform saw remarkable progress with the team working on AI Tools like JupyterHub, Acumos, Python libraries, and the Service Orchestration. Additionally, Pilot 4 made strides in AI integration with the development of control algorithms for automated catheter navigation and machine learning 5D mapping.

Data Collection & Management: Sprint 2 was significant in the collection, management, and analysis of data, contributing to the Data Management Plan.

Demonstration: Pilots worked on defining user interaction scenarios, indicating an orientation towards user familiarization with the new tools and systems.

Security Monitoring & Compliance: In this sprint, security took centre stage on the HosmartAI platform with the finalization of the security plan and the deployment of the first set of security and privacy tools. The creation of the first version of the blockchain application also added to the platform's security framework.

Table 3: Breakdown of Stakeholder Participation by Profile for Each Pilot Solution in Sprint 2.

Participants' roles	P1	P2	P3	P4	P5	P6	P7	P8	TOTAL
Patients	0	0	4	0	0	12	0	0	16
Caregivers									0
Clinicians	12	6	8	3	7	4	3	5	48
Healthcare services managers				1					1
Researchers/partners/IT personnel	8	5	4	6	6	7	4	5	45
TOTAL Participants	**20**	**11**	**16**	**10**	**13**	**23**	**7**	**10**	**110**
Nº Design Interactions	**4**	**3**	**4**	**2**	**2**	**2**	**1**	**2**	**20**

2.2.3 Sprint 3 [M17-M24]

Here is an overview of the major actions taken during Sprint 3:

- **HosmartAI Platform:** Refined all platform components based on test results and user feedback. Implemented and monitored the security of the HosmartAI Hub Platform and began implementing pilots' security and traceability requirements in collaboration with Pilots 1, 2, and 6. Defined training needs and learning objectives. The integrated v1 of the Platform was completed during this Sprint. Feedback that was received during the external stakeholders' event (November 2022) led to the following change: access to platform tools from the landing page menu of HHUB was restructured to focus on the Co-creation aspect of the tools.
- **Pilot 1:** Collected feedback from healthcare professionals on the first functional prototypes of Echocardiography & Capsule Endoscopy tools and the Obstetrics & CCTA tools, driving further development towards the final prototypes. Defined explainable AI (xAI) functionalities to be integrated into the AI tools, conducted sessions/workshops for stakeholder evaluation of these functionalities.
- **Pilot 2:** Presented the system to various stakeholders, collected feedback, defined chatbot dialogues, and validated the software's first version. Discussed and implemented security monitoring tools with pilot leaders.

- **Pilot 3:** Conducted usability tests with patients and physiotherapists to refine Vimar View app, performed expert analysis with clinicians and held co-design workshops to prototype I-Mat exercises, held workshop to install Ultra-Wide Band sensors in a real-life environment involving technical partner and users (physiotherapists), performed real-life test of the new setting of the smart rehabilitation room and Vimar View app (test of service MVP, focus on user perspective), held online co-design session to define use cases for virtual sensors (AI) and performed prioritization analysis
- **Pilot 4:** Investigated resources and tools for data visualization, mapped anonymized data to ElectroMap, set up infrastructure for data upload, and provided necessary information for understanding and integrating available datasets.
- **Pilot 5:** Tested and verified data collection and visualization technologies in a real environment, evaluated the accuracy and functional applicability of the technologies, fine-tuned robot human engagement, integrated the robot and tech, enabled restricted access to patient data, verified blockchain and localization, assessed data collection regarding the FAIR maturity model. Over 494 health professionals and 377 patients expressed their opinion on the use of socially assistive humanoid robots in nursing routine.
- **Pilot 6:** Integrated Gradior for first technical testing, consulted on the adequacy of the motivational approach and the Activity Plan, prototyped APE, simulated daily solution use, defined data to be sent to HosmartAI, developed iPrognosis monitoring tools, began integrating communication between various components, integrated the blockchain into the pilot's IT environment, securitized Pilot 6 through monitoring, and determined the FAIR maturity level of the identified data set.
- **Pilot 7:** Trained physicians on the image annotation tool, annotated X-ray images, continued AI application development, maintained collaboration with clinicians for a better user need understanding.
- **Pilot 8:** Continued collaboration with clinicians and researchers for analytical framework development, developed the genetic and imaging tool, worked on clinician feedback for further tool tuning, worked with clinicians to develop KPIs for the study, conducted meetings for updates on the digital health platform, organised a workshop to present pilot work.

Determining the FAIR maturity level of the identified data set and defined measures for full maturity compliance was a transversal activity for all the solutions.

During Sprint 3, a range of methods and procedures were implemented for the active involvement of the different stakeholders of interest, all aiming to ensure a comprehensive, user-centred, and effective development process. These can be broadly categorized as follows:

User Feedback & Iterative Design: Most pilots gathered feedback from end users (such as healthcare professionals, patients, and physiotherapists) and other stakeholders (such as appointment coordinators, principal investigators) on the first functional prototypes of their solutions. This feedback was used to guide the further development and refinement of the prototypes. Iterative design methods such as co-design workshops, usability tests, participant observation, and joint review sessions were commonly employed to ensure the final product met user needs and expectations.

Explainable AI Integration: In Pilot 1, sessions and workshops were organized with cardiologists and obstetricians to define and evaluate the explainable AI functionality to be integrated into the AI tools. These sessions focused on demonstrating the value of these functionalities to the end users and aiding their understanding and interpretation of the predictions made by the machine learning models.

Data Collection & Analysis: Pilots frequently conducted field tests and real-environment tests to evaluate the performance of their solutions and collect data for further analysis. Data collected ranged from user behaviour and experiences to the operation of specific technical components. In Pilot 4, for example, anonymized data was mapped to ElectroMap for visualization and analysis.

Training & Demonstration: Several pilots were involved in training sessions to familiarize users with the tools and technologies being developed. In Pilot 7 physicians were trained to use the image annotation tool, while in Pilots 5 and 6 field tests and demonstrations were organized to discuss the integration of the robot and the FHIR server from clinical and administrative perspectives.

Security Monitoring & Compliance: Across the platform and the pilots, there was a focus on implementing security monitoring tools and determining the FAIR (Findability, Accessibility, Interoperability, and Reusability) maturity level of the identified datasets to ensure full compliance.

Stakeholder Collaboration: Collaboration with stakeholders, such as clinicians, researchers, IT staff, and hospital administrators, was an essential aspect of the methodology implemented during Sprint 3. Regular meetings, site visits, and workshops were organized to present progress, gather feedback, and discuss future plans.

Table 4: Breakdown of Stakeholder Participation by Profile for Each Pilot Solution in Sprint 3.

Participants' roles	P1	P2	P3	P4	P5	P6	P7	P8	TOTAL
Patients						7			7
Caregivers						2			2
Clinicians	9	1	8	5	11	8	2	5	49
Healthcare services managers		1		1	2	1			5
Researchers/partners/IT personnel	7	5	5	6	10	11	2	5	51
Students/Professors/Guests						3			3
TOTAL Participants	**16**	**7**	**13**	**12**	**23**	**32**	**4**	**10**	**117**
Nº Design Interactions	**4**	**2**	**6**	**3**	**19**	**2**	**2**	**2**	**40**

2.2.4 Sprint 4 [M25-M30]

During Sprint 4, a series of participatory actions were undertaken across the eight pilot projects, each focusing on different aspects of the HosmartAI platform and the co-created solutions. Here is an overview:

- **HosmartAI Platform:** The goal was to refine the existing platform components and add user-relevant platform features. Feedback received from consortium partners about the platform led to improvements in existing components. Specifically, improvement of HosmartAI Dashboard UI and functionality; activation of user registration; user registration validations were implemented based on feedback received from OC#2 winners; Service Registry was refined to be compatible with the Platform Single Sign-On system; Knowledge base of Platform became available; an access policy to sensitive platform tools was created to protect the existing users. A HosmartAI Platform Feedback Questionnaire was distributed, and the collected answers will be considered in developing v3 of the Platform.
- **Pilot 1:** The main actions included demonstration and training of end users in the use of the applications. This facilitated a hands-on experience, directly influencing the user acceptance and usability of the product.
- **Pilot 2:** This involved the training and testing of the AI-based appointment software by the CHU Liège staff, including the Chatbot feature. Feedback was gathered for readjustments, refining the application according to the actual needs and workflow of the staff.
- **Pilot 3:** performed the last co-design cycle of I-Mat tools, tested the final version of the Vimar View app, held online co-design session to define cloud functionalities and user interface, tested the final setting of the service in a real rehabilitation session with a quick usability test, a pitch session, and a feedback analysis. An interview with the physiotherapists coordinator also offered valuable insights about the new organizational model.
- **Pilot 4:** This pilot focused on training in the use of the Electrophysiology (EP) Graphic User Interface (GUI) and Robotics, with a particular emphasis on Telesurgery. Additionally, the integration of the GUI and Robotics was performed.
- **Pilot 5:** Training of nurses and clinicians on using the robot in their environment was done, familiarizing them with the technology. Modifications were made to storylines for version 3 of the technologies and adjustments were made to the visualization parts. Over 120 health professionals and 80 patients experienced and observed the behaviour of the robot in near real life setting and evaluated the final behaviour.
- **Pilot 6:** Lab testing, training with the tool, demonstration, and usability testing sessions were conducted involving healthcare professionals and older adults.
- **Pilot 7:** Data was collected to test the prototype key event detection algorithm. Physicians were also involved in the same task, providing an opportunity to compare and discuss results.
- **Pilot 8:** User feedback was incorporated into the tools to refine usability. Access to genetic and image data for tool testing was obtained, a web server for the genetic tool

was implemented, and collaboration for the analysis of proteomics data was established.

In conclusion, Sprint 4 involved substantial testing, training, and feedback collection, resulting in the iterative improvement of the various solutions under the HosmartAI platform. The participatory design ensured each solution was tailored to its specific end-user requirements.

Several methods were commonly used across different pilots to ensure the effective development and implementation of AI and robotic solutions:

- **User Training**: This was frequently employed across the pilots. Training end-users in the use of applications was crucial in facilitating user adoption and refining the usability of the solutions.
- **Testing**: Both lab and field testing were widespread. The actual implementation scenarios provided valuable insights into how the solutions perform in real-world conditions, and this data was vital for further refinements.
- **Feedback Collection and Analysis**: User and stakeholder feedback was continuously collected and analysed. This iterative feedback process was fundamental for the co-creation methodology, ensuring that the developed solutions meet the actual needs and expectations of the end-users.
- **Co-design Iterations**: Co-design sessions with stakeholders were held frequently to refine the solutions according to the collected feedback. Quick usability tests were also common to ensure the products were intuitive and user-friendly.
- **Integration**: The integration of different technologies and tools is planned for this later phase.

Table 5: Breakdown of Stakeholder Participation by Profile for Each Pilot Solution in Sprint 4.

Participants' roles	P1	P2	P3	P4	P5	P6	P7	P8	TOTAL
Patients			3		74	13			90
Caregivers						1			1
Clinicians	10	4	3	6	13	11	2	5	54
Healthcare services managers		1	1	1	4	1			8
Researchers/partners/IT personnel	6	2	8	6	6	11	3	5	47
Students/Professors/Guests					26	5			31
TOTAL Participants	**16**	**7**	**15**	**13**	**123**	**42**	**5**	**10**	**231**
Nº Design Interactions	**4**	**2**	**6**	**2**	**32**	**6**	**2**	**9**	**63**

3 Engaging and Incorporating Stakeholder Input

The work undertaken during the reporting period deepened the Participatory Approach as well as the stakeholder profiles outlined in D1.2/D1.3, thereby supporting the effort to build and strengthen the HosmartAI ecosystem. As the eight Lighthouse pilot solutions were fine-tuned and completed considering qualitative insights received from end users during internal co-creation sessions in healthcare settings in the five participating countries, the pilots were also encouraged to develop a clearer picture of the broader external stakeholders to whom the solutions will be of value, commercially or otherwise.

The mechanisms of community building and engagement described in D1.2 (see Section 2.3, "Community Building and Engagement"), which also included reflections on motivations and incentives as well as potential barriers to participation and mitigation measures, were activated and put to the test via targeted stakeholder engagement strategies and other ways to foster interaction between the pilot solutions partners and internal/external stakeholders. The focus lay on engaging two categories of stakeholders in parallel, namely local action groups coordinated directly by the eight pilot leaders in their respective environments, and European level stakeholders coordinated by EIT and HOPE. Combined, the two categories represent a key valuable element of the defined Participatory Approach.

By engaging local communities and stakeholders, the project has leveraged their knowledge and resources, promoting a more inclusive and collaborative approach. Local groups provided valuable insights into setting-specific challenges, allowing for context-specific adaptations and solutions. Their involvement has helped to foster a sense of ownership and participation, thereby enhancing the overall success and sustainability of the project. It was important to ensure effective communication and coordination between these local groups and the central project team during the SPRINTS approach to maximize their contributions and maintain alignment with project objectives.

At the same time, expanding the project's scope to include European level involvement is crucial for broader impact and scalability. Engaging with European stakeholders, policymakers, and relevant organizations can facilitate knowledge exchange, policy alignment, and potential replication of successful initiatives beyond the pilot sites. Collaboration at the European level enables cross-learning among different regions, leading to enhanced synergies and the identification of best practices. Moreover, European involvement can attract additional resources, funding, and expertise, further strengthening the project's overall effectiveness and sustainability.

The work undertaken during the reporting period culminated in deepening the links between different Work Packages to better contextualise the stakeholder insights obtained. Moving forward means keeping their needs, as well as those of future stakeholders who will join the HosmartAI ecosystem, in mind. Inter alia, this has been achieved by the introduction of both regular and ad hoc mixed Work Package Zoom calls to share information about stakeholders' needs (including relevant feedback received at industry events) and create concrete synergies between the efforts made in different project tasks to cater to various end users and the dissemination and exploitation objectives of the project.

3.1 Participants Profiles and Sprints Involvement

As described in D6.2 (Ecosystem Building, Industrial Clustering & Stakeholder Engagement), Sprints 3 and 4 served to deepen the stakeholder analysis and participation by moving from the preliminary focus on general project-relevant themes (such as digital health, robotics, AI), applied during the previous stage of the project, to an approach that involved identifying new partners according to pilot-related topics and requirements. This enabled a more targeted selection of stakeholders in different categories, including industry, digital health interest groups and policymakers.

The pilot-specific strategies adhered to the tasks outlined in D1.2 (communication and interaction with primary end users, coordination of the inter-professional team; facilitating end user sessions and deal with day-to-day needs of the pilots; promotion of awareness and dissemination of the results of the project) as closely as possible. Some shared tasks, such as the organisation of contact points, were implemented in a less structured way than foreseen, partly because, in some cases, the finalisation of the technical solutions required more time and resources, and also because the potential problem of "lack of trust" has been, until now, less of an issue than initially expected. During the co-creation events, for example, great care was taken by the session facilitators to follow the "Guide for co-creation sessions" (see Appendix C, D1.3) and make use of the report template (Appendix A, D1.3). The facilitators also applied the pre-defined mitigation measures including making all participants feel comfortable throughout the meetings and ensuring they were leaving with a positive feeling about their contributions and the knowledge they derived about the AI/robotics solutions.

The profiles included in the co-creation process were discussed again during the reporting period and some were reoriented to consider the different existing functions and responsibilities within the same healthcare professional group (e.g., nurses) as these can differ strongly between countries as a result of different educational pathways and hierarchies. In order not to overcomplicate things, and without changing the agreed-upon definitions and associated KPIs, consensus was established to broaden the "caregiver" profile to include the majority of general nurses and therapists profiles, and to incorporate certain senior profiles such as specialised nurses/nurse practitioners and clinical psychiatrists/psychologists in the "clinician" profile, thereby reflecting the higher responsibility and different level of tasks performed by the latter groups. Moreover, the "other healthcare professionals" profile would capture additional professionals (e.g., dietitians, social workers, care assistants, students, etc). The other profiles remained unchanged: patients, healthcare services managers, administrators, and researchers/partners/IT personnel. Establishing agreement on the different profiles facilitated uniform reporting and comparability of results.

<u>A. Participation results – Sprints-related</u>

The participants' profiles defined for the local co-creation sessions organized by pilot partners were the following:

- Pilot 1 – Clinicians

- Pilot 2 – Administrative staff, clinicians and patients
- Pilot 3 – Healthcare professionals (physiotherapists)
- Pilot 4 – Head of the Clinical Department
- Pilot 5 – Clinicians and nurses from the thoracic and cardiovascular surgery
- Pilot 6 – Older adults and healthcare professionals (neuropsychologists)
- Pilot 7 – Interventional cardiologists, researchers, internal project leader, cardiac clinical scientist and AI-developer
- Pilot 8 – Clinicians and researchers

In terms of the overall stakeholder involvement (single participants) in the co-creation sessions organised by the eight pilots in national healthcare settings, the following picture emerges:

Table 6: Breakdown of Stakeholder Participation by Profile.

			Gender (F)		Gender (M)	
Participants' roles	**KPI**	**Participant**	Nº	%	Nº	%
Patients	≥40	111	58	52,25%	53	47,75%
Caregivers	≥16	4	3	75,00%	1	25,00%
Clinicians	≥24	85	42	49,41%	43	50,59%
Healthcare services managers	≥8	10	7	70,00%	3	30,00%
Researchers/partners/IT personnel		64	16	25,00%	48	75,00%
Students/Professors/Guests		31	26	83,87%	5	16,13%
TOTAL		**305**	**152**	**49,84%**	**153**	**50,16%**

The KPIs and achieved results of participant engagement across the eight pilot solutions reflect an interesting range of stakeholder involvement, aligning with the different user profiles identified in the user stories for each pilot, in which, caregivers where not identified as primary users of the solutions.

In comparison to the KPI - 'Number of Involved Stakeholders' (with target values of ≥40 patients, ≥16 caregivers, ≥24 clinicians, and ≥8 healthcare service managers), the results from our sprints displayed a markedly increased involvement, particularly from patients and clinicians.

Considering the diversity of stakeholders involved, the co-creation strategies employed by the pilots were necessarily broad and varied. Special care was taken to ensure flexibility, thereby accommodating the distinct preferences of stakeholders. As per our protocol, organized sessions included design thinking and technology interaction sessions, primarily in group settings with a strong emphasis on gathering valuable feedback regarding the practical usability and functionalities of the technologies. In certain situations, one-on-one meetings supplemented group sessions—for instance, when key personnel could not attend group meetings or when more detailed information was required.

It is crucial to recognize the key performance indicators (KPIs) for our Iterations, specifically the 'Number of Participatory Design Iterations' and the 'Number of Co-creation with Testing Iterations'. The target for each was set at 2 per Pilot, making for a total of 16 for each KPI. Our project, however, significantly surpassed these goals. For the 'Number of Participatory Design Iterations', we accomplished 32 iterations, comprised of 12 iterations during Sprint 1 and 20 iterations in Sprint 2. Similarly, for the 'Number of Co-creation with Testing Iterations', we achieved a remarkable 103 iterations—40 in Sprint 3 and 63 in Sprint 4.

Care was taken to strive for an even gender balance and gender-sensitive content in the co-creation sessions, which is especially important given the still strongly gendered nature of certain healthcare professions (e.g., many senior managers, physicians and specialists continue to be male, whereas the composition of nursing teams and hospital administrative staff tends to be predominantly female). It is vital that HosmartAI technical solutions are adapted to the abilities and practices of both "male" and "female" end users (which can differ due to biological factors such as physical strength, height, weight, etc.), hence it was deemed to be crucial to obtain inclusive feedback from the get-go so that potential differences and limitations could be considered to ensure the widest possible appeal and usability. (See WP5 for further analysis of gender impact).

Regarding the outcomes of the co-creation sessions with local stakeholders, the barriers described in D1.2 were less pronounced than anticipated in a number of areas (e.g., unavailability of key hospital staff due to high workload, lack of relevant feedback, denial of participation, loss of interest, privacy and data protection). The absence of technological skills was also not reported as being a major issue, presumably because most sessions took the form of guided focus and/or discussion groups. However, some conflicts of interest were reported that confirmed the pilot partners' expectations, including resistance to participation due to concerns about AI leading to loss of employment or task-shifting, which could imply lower job satisfaction due to decreased contacts with patients and their families. Social and psychological factors were also at play, both on the healthcare professional and patient side, given AI-driven solutions' ability to potentially replace human beings in the execution of routine tasks, or the novelty of entering into dialogue with speaking machines. However, the application of the mitigation measures described in D1.2 kept these barriers at a minimum.

B. Other actions

The first of two external stakeholder workshops, "Bringing AI and Robotics to the Hospital" organised in Eindhoven in November 2022, gathered 8 AI experts from hospitals, industry, a government health agency and academia, who – following prior review of the HosmartAI information brochure and website, and overview presentations given during the workshop by the pilots and Open Call 1 winners – provided critically-constructive preliminary feedback based on their own knowledge of AI technologies and participation in other projects. Notably, the invited experts were given the opportunity to take part in one-to-one meetings with the pilots and OC1 winners they were most interested in, which stimulated discussions at the technical level about the practical feasibility and potential market of the solutions.

The experts agreed that the living lab approach taken by the pilots, which enabled frequent stakeholder inputs during the co-creation process, is one of the most valuable features of the HosmartAI approach, noting that active participation of doctors in the design of the solutions is especially important to help promote the acceptance of AI solutions in daily practice. In addition, the HosmartAI platform was found to be interesting for research purposes at academic entities and clinics. Industry representatives embraced the concept of developing AI solutions while promoting interoperability through standards, as well as the HosmartAI platform´s matchmaking feature and marketplace as a channel for commercialisation.

Among the results of this workshop were declared intentions from the experts to explore potential synergies with other relevant AI projects (e.g., Smart Hospital development in Essen, Germany; an AI project in Estonia) and to consider the feasibility of applying HosmartAI technologies in a hospital in Poland. Follow-up information e-mails informing the experts of the progress of the project were circulated in early 2023, and they will be given the opportunity to reconnect with the pilots and OC winners during targeted webinars. It is too soon to predict whether there will be any 'drop-outs' among the experts, but since some of their profiles were quite specific to cover different angles of relevance to the project (i.e., AI procurement for regional government) there are indications that active link-up with HosmartAI solutions may not be possible for everybody, not least due to legal restrictions.

Regarding the stakeholder involvement effort at the EU level, the defined strategy was slightly adapted as early feedback received , e.g. from umbrella interest groups representing patients and healthcare professionals, was that the technical solutions developed by the pilots were yet not mature enough for these organisations' EU policy representatives to provide quality inputs, compounded by the lack of AI-specific expertise and low capacities to closely follow EU projects in these types of organisations. Until now, any external stakeholders who were informed about HosmartAI (for example, HOPE and EIT members/partners) did express satisfaction with the co-creation methodology to ensure a good fit with end users' actual needs and workflows, and they appreciated the intention of HosmartAI to link up with other EU-funded AI projects. However, deeper qualitative insights from this constituency will only be obtained during the next phase. Planned are, for example, webinar-based demonstrations of finished pilot solutions for soliciting exploitation and deployment-focused feedback from a range of both national and EU-level stakeholders, and a presentation of the project's solutions and co-creation methods to the members of the European Commission's eHealth Stakeholder Group. Similarly, the next phase of the project will also enable the members of the Advisory Board to become more actively involved. There is now a sufficient volume of information materials available (including brochures, marketing sheets, pilot-specific narratives, visuals, etc.) that will allow different types of stakeholders to better comprehend and assess the concrete practical value and market potential of the AI/robotics solutions developed.

To sharpen the focus, a survey developed by EIT and HOPE, which aimed at obtaining an expanded idea of which additional external stakeholders could be approached during the next stage of the project, was circulated among the pilots. Following analysis of the survey results, three follow-up calls took place with those pilots that had already developed a clear vision for external stakeholder engagement in line with specific identified objectives. The latter included not only the desire to obtain further inputs on the solutions' business potential and everyday usability, but also to raise the profile of the pilot institutions and demonstrate how the technologies could support healthcare provision at the regional level and/or serve as a template for other healthcare institutions wishing to make use of AI and robotics.

The work undertaken during Sprints 2-4 will inform future actions to be taken in other Work Package tasks, including T6.2 charged with the communication and scientific dissemination of HosmartAI results to researchers, industry, the wider healthcare community, standardisation bodies, EU digital innovation networks and platforms, and others, to build a thriving AI/robotics ecosystem. This will be achieved, inter alia, by the organisation of a second external workshop hosted together with sister EU-projects with a wider range of experts, and industry events during which relationships with potential investors will be formed – notably through a HosmartAI stand at the world's largest annual medical technology trade fair, medica (Düsseldorf, November 2023).

3.2 Impact & Synergies of Collaborative Approach

Finally, the presented interconnections with WP's dedicated to development (WP2, 3, 4) and to organize the conditions for the studies (WP5), are complemented with the connections with WP6 and WP7. Figure 3 demonstrates the symbiotic relationship between the HosmartAI Stakeholder Engagement Strategy and the work packages nurturing it, underlining how this collaborative approach drives the development, refinement, and deployment of the HosmartAI solutions.

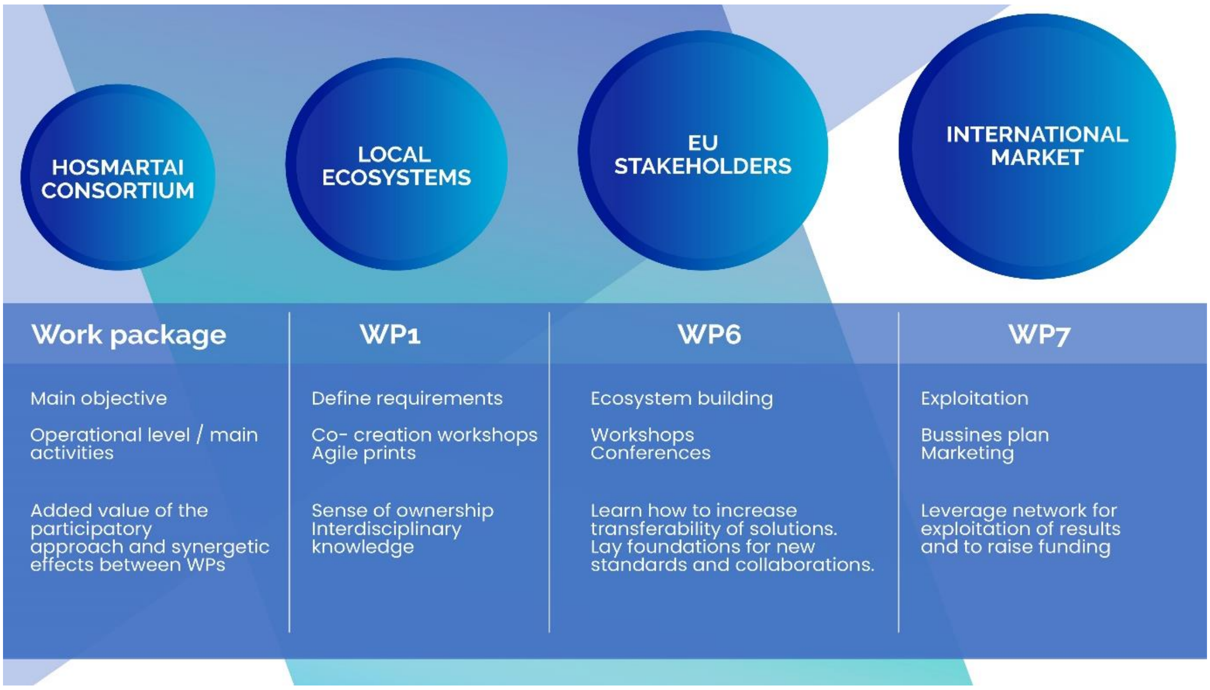


Figure 3: Engagement strategy.

4 User Requirements – Final Version

4.1 Nomenclature of the User Requirements Elicited

Functional Requirements

The functional requirements were grouped into the following categories:

- (B) Bio-parameters: Related to components that measure or manage bio-parameters.
- (C) Communication: Related to communication with caregivers, friends, relatives, etc. It includes a description of use cases that enable, facilitate, and manage the communication, motivate, propose, and guide through new communication channels.
- Information: Related to access to various information.
- (UM) User monitoring: Related to user's unobtrusive monitoring.
- (EM) Environment monitoring: Related to information about environmental parameters.
- (UG) User guidance: Related to pieces of advice and recommendations done by the system.
- (UI) User Interface: Related to how the user interface should function.

Non-Functional Requirements

The different non-functional requirements identified were grouped according to the eight-group ISO 25010 classification, with an addition of the first as follows:

- (QoS) Quality of Service: expected characteristics the system should provide to ensure that the service has high quality. It includes any component, use case requirement that aims at delivering a better overall service.
- (F) Functional suitability: This characteristic represents the degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions.
- (E) Performance efficiency: This characteristic represents the performance relative to the resources used under stated conditions.
- (C) Compatibility: Degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment.
- (U) Usability: Degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.
- (R) Reliability: Degree to which a system, product or component performs specified functions under specified conditions for a specified period.
- (S) Security: Degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization.

- (M) Maintainability: This characteristic represents the degree of effectiveness and efficiency with which a product or system can be modified to improve it, correct it or adapt it to changes in the environment, and in requirements.
- (P) Portability: Degree of effectiveness and efficiency with which a system, product or component can be transferred from one hardware, software or other operational or usage environment to another.

Table 7: Nomenclature user requirements.

CATEGORIES			
FUNCTIONAL		NON-FUNCTIONAL	
FR.UM	User monitoring	NFR.S	Security
FR.B	Bio-parameters	NFR.E	Performance efficiency
FR.C	Communication	NFR.M	Maintainability
FR.I	Information	NFR.F	Functional suitability
FR.EM	Environment monitoring	NFR.U	Usability
FR.UI	User Interface	NFR.R	Reliability
FR.UG	User guidance	NFR.P	Portability
		NFR.QoS	Quality of Service
		NFR.C	Compatibility

4.2 Platform User Requirements

The functional and non-functional requirements of the HosmartAI platform are listed below, sorted by execution priority, as were defined in D1.3.

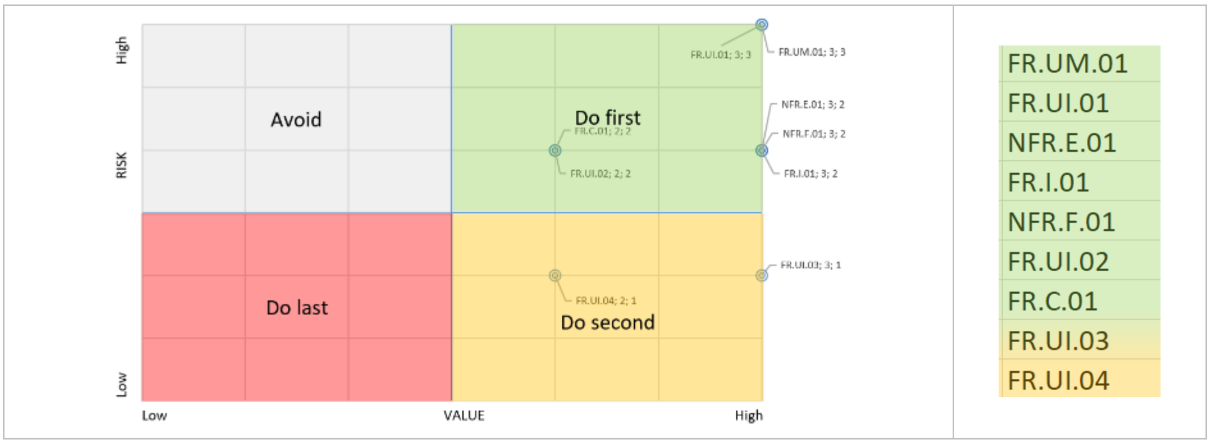


Figure 4: Backlog of user requirements considered for the HosmartAI platform.

Based on the priorities backlog, the following table indicates the status of **Functional and Non-functional User Requirements**:

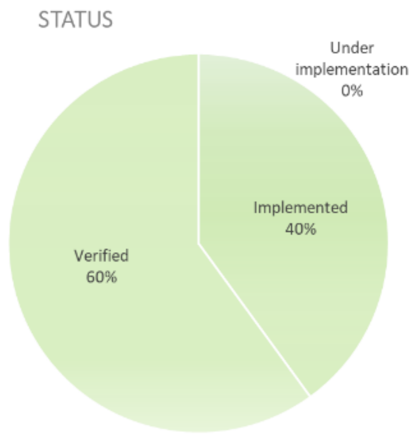
ID Priority	Status	Summary
FR.UM.01	Implemented	URE-2 - User monitoring/Quality of Service
		Title: AI Tools for hospitals

ID Priority	Status	Summary
		Description: Provide AI Applications that facilitate tasks in a hospital and can be used in daily practice to save time for other tasks that represent a big benefit to the patient
		Connection: US-3, TR-180, TR-179, TR-178, TR-177, TR-8, TR-176, TR-175
FR.UI.01	Verified	URE-5 - User Interface/ Portability
		Title: Existing application conversion
		Description: Adapt an existing app to HosmartAI Semantic data Model and AI Platform Core Component APIs
		Connection: TR-160, TR-13, TR-127
NFR.E.01	Verified	URE-6 - -/ Performance efficiency
		Title: Improvement of HosmartAI App
		Description: Add new AI features to an app
		Connection: TR-14
FR.I.01	Implemented	URE-8 – Information/ Security
		Title: Data traceability
		Description: Patients and healthcare professionals need transparent, secure and trustworthy storage and use of personal and healthcare data. A need that is answered through the use of edge computing techniques for processing and storing data at source rather than in distant cloud and by third parties. A layer of traceability can be added using blockchain to trace data usage (What data? when? where? by who? and what for?).
		Connection: TR-45, TR-58
NFR.F.01	Under implementation	URE-3 - -/ Functional suitability
		Title: Benchmarking
		Description: Analyse the contextual factors that impact the successful introduction, use and sustainability of innovative solutions
		Connection: TR-174, TR-5, TR-3, US-2, TR-31, TR-33, TR-10, TR-32
FR.UI.02	Verified	URE-131 - User Interface/ Security
		Title: Secure access to Hhub Dashboard
		Description: Access to dashboard should be secure following strict security policies.
		Connection: TR-56, TR-155
FR.C.01	Verified	URE-132 – Communication/-
		Title: Access Hhub Dashboard from all devices
		Description:
		Connection: TR-69,TR-53,TR-52
FR.UI.03	Implemented	URE-7 - User Interface/-

ID Priority	Status	Summary
		Title: End user feedback
		Description: Receive feedback from end users through the Benchmarking tool
		Connection: TR-63
FR.UI.04	Verified	URE-4 - User Interface/-
		Title: Catalogue of AI Applications
		Description: Select AI Applications based on description.
		Connection: TR-5, TR-160, US-3, TR-127, TR-62
FR.C.02	Under implementation	URE-159 - Communication
		Title: Connectivity between Marketplace and Benchmarking
		Description: Connectivity between Marketplace and Benchmarking.
		Connection: TR-190

Below is a summary of the status of the HosmartAI platform developments, indicating that all User Requirements have been addressed. This comprises a combination of 40% implemented and 60% verified.

STATUS	Count	%
Implemented	4	40%
Verified	6	60%
Under implementation	0	0%
TOTAL	10	100%



4.3 Pilot 1 User Requirements

Functional Requirements (order by priority of execution, as defined in D1.3)

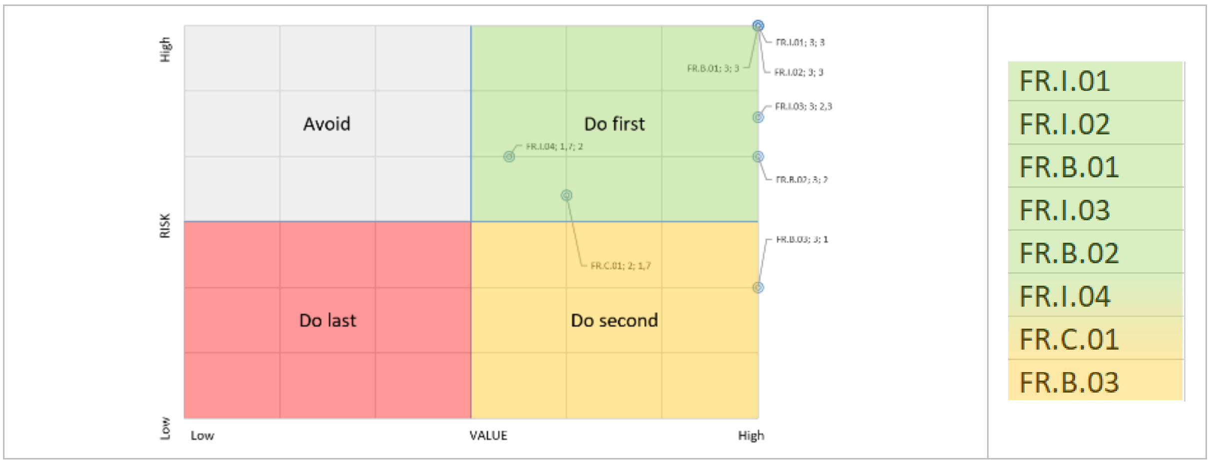


Figure 5: Backlog of functional requirements of users considered for Pilot 1.

Based on the priorities backlog, the following table indicates the status of **Functional User Requirements**:

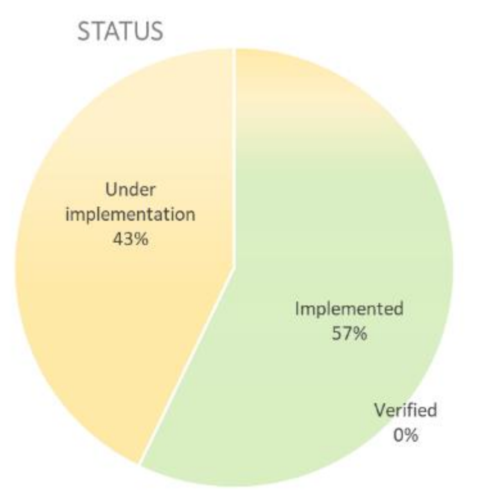
ID Priority	Status	Summary
FR.I.01	Under implementation	URE-20 - Information Title: Classification of cases complicated by fetal growth restriction Description: The system must contain an AI-based tool for data analysis and support of medical decisions for cases complicated by fetal growth restriction. Besides preterm labor cases, the platform will also support and effectively monitor cases complicated by fetal growth restriction (FGR) (both milder and severe cases). For this, a smart tool for data analysis and support of medical decisions will be developed. Connection: TR-117, TR-115, TR-113, TR-112, TR-111
FR.I.02	Under implementation	URE-19 - Information Title: Predicting next actions and steps for cases with symptoms of preterm labor Description: The system must contain an AI-based model that indicates whether each pregnant woman needs to be referred to a referral centre for cases with symptoms of preterm labor. The platform to be developed aims to support gynecologists/obstetricians to identify whether pregnant women with symptoms of preterm labor need to be referred to the region's referral centre, in case neonatal intensive care unit is needed. To this end, computerized cardiotocography (cCTG) analysis results, demographic details and other obstetrical data will be

ID Priority	Status	Summary
		analyzed and machine learning methods will be used to train an AI-based model that will be able to classify pregnant women based on the need to be referred.
		Connection: TR-117, TR-115, TR-113, TR-112, TR-111
FR.B.01	Implemented	URE-16 - Bio-parameters
		Title: High diagnostic yield for binary class case
		Description: Although there are computer-based techniques for the successful detection of some of the possible classes of lesions/abnormalities, an accurate binary class detector is what is needed in clinical practice.
		Connection: TR-83
FR.I.03	Under implementation	URE-18 - Information
		Title: Patient classification based on the extent of obstructive CAD.
		Description: The system must contain an AI-based model that will be able to classify patients based on the presence and extend of obstructive CAD. The platform to be developed aims to support cardiologists to choose individual-tailored therapy/prevention methods, by predicting patients likely to have coronary heart disease (CHD). To this end, clinical and genetic risk factors, lab exams results, coronary artery geometric features, the coronary artery calcium score (CACS), etc. will be analysed and machine learning methods will be used to train an AI-based model that will be able to classify patients based on the presence and extend of obstructive CAD. The outcome of the present study will be the presence of obstructive coronary artery disease (CAD) on CCTA, defined as the detection of ≥ 50% diameter stenosis in any of the four major epicardial coronary arteries.
		Connection: TR-117, TR-116, TR-113, TR-112, TR-111
FR.B.02	Implemented	URE-15 - Bio-parameters
		Title: Automatic, fast detection of suspicious lesions/abnormalities in capsule endoscopy videos
		Description: There is great need to improve the time-intensive nature of reviewing examinations which in usual care last from 30 to 120 minutes. This long-lasting, tedious procedure does not only add delays on gastroenterology department operations, but it also fatigues the physician.
		Connection: TR-82, TR-84, TR-83
FR.I.04	Cancelled	URE-12 - Information
		Title: Image quality monitoring

ID Priority	Status	Summary
		Description: Image quality significantly affects the accuracy of measurements. The solution should provide functionality to facilitate the acquisition of properly aligned cardiac views.
		Connection: TR-79, TR-78
		Observation: Data acquisition will not take place in the clinical study. The quality of the data that will be used in the clinical study will be evaluated by senior echocardiographers. Hence, there is no need for image quality monitoring.
FR.C.01	Implemented	URE-11 - Communication
		Title: Explainable LVEF estimation
		Description: Limited explainability impedes clinical acceptance of AI technologies. The solution should therefore be as transparent as possible, in order for the medical specialists to use it confidently.
		Connection: TR-151, TR-80, TR-150, TR-149
FR.B.03	Implemented	URE-9 - Bio-parameters
		Title: Automatic, fast estimation of the Left Ventricular Ejection Fraction (LVEF)
		Description: The solution should, automatically and in a short amount of time, estimate the Left Ventricular Ejection Fraction (LVEF) from acquired echocardiographic video recordings.
		Connection: TR-151, TR-80, TR-150, TR-78

Below is a summary of the development status of Pilot 1, which indicates that 57% of the **Functional User Requirements** have been addressed, while the remaining 43% are currently under development.

STATUS	Count	%
Implemented	4	57%
Verified	0	0%
Under implementation	3	43%
TOTAL	7	100%



Non-Functional Requirements (order by priority of execution, as defined in D1.3)

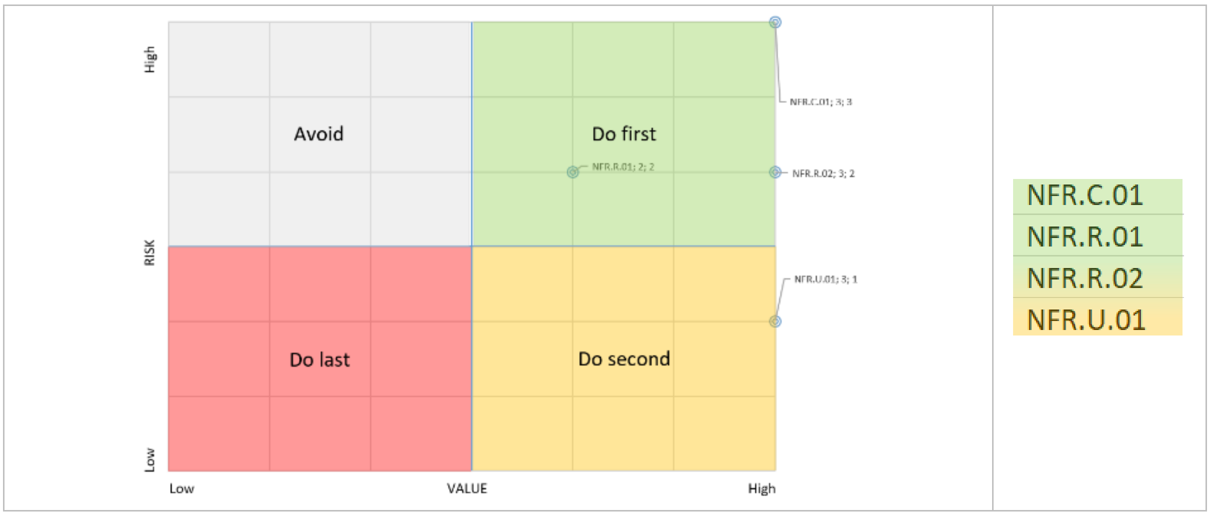


Figure 6: Backlog of non-functional requirements of users considered for Pilot 1.

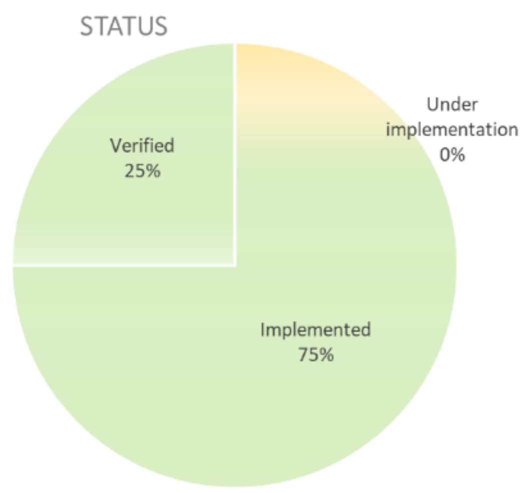
Based on the priority backlog of D1.3, the following table is presented, indicating the status of the non-functional User Requirements.

ID Priority	Status	Summary
NFR.C.01	verified	URE-14 - Compatibility Title: Efficient deployment and integration of the software in the clinical setting Description: The solution should be straightforwardly integrated into the established clinical practice, introducing no obstacles. Connection: TR-152, TR-78, TR-15, TR-149, TR-148, TR-153
NFR.R.01	Implemented	URE-10 Reliability Title: Elimination of the interobserver variability in LVEF estimation Description: Human subjectivity introduces significant interobserver variability in the estimation of the LVEF. Irregularity in the heart cycles also impacts the estimation accuracy. To counter this, current guidelines recommend averaging the measures over multiple heart cycles. In practice, the recommendation is often not followed due to time constraints. The solution should eliminate interobserver variability. Connection: TR-151, TR-80
NFR.R.02	Implemented	URE-17 - Reliability Title: Trustworthy AI-based inference Description: Unilateral development of AI systems ignores the needs of stakeholders. Computer-aided diagnosis systems need to fulfil certain preconditions for this technology to be embraced by society. Beyond

ID Priority	Status	Summary
		the efficiency of AI in detecting and characterizing lesions/abnormalities in capsule endoscopy, the opaque decision-making (also known as "AI blackbox"). must become more interpretable using explainable AI (xAI) techniques.
		Connection: TR-83
NFR.U.01	Implemented	URE-13 - Usability
		Title: User-friendly interface
		Description: The user interface should be clean and intuitive, enabling effective communication of information to the specialist.
		Connection: TR-64, TR-149, TR-148, TR-153

Next, a summary of the state of the developments for Pilot 3 is shown, where 25% of the non-functional User Requirements are verified, and 75% are in progress.

STATUS	Count	%
Implemented	3	75%
Verified	1	25%
Under implementation	0	0%
TOTAL	4	100%



4.4 Pilot 2 User Requirements

Functional Requirements (order by priority of execution, as defined in D1.3)

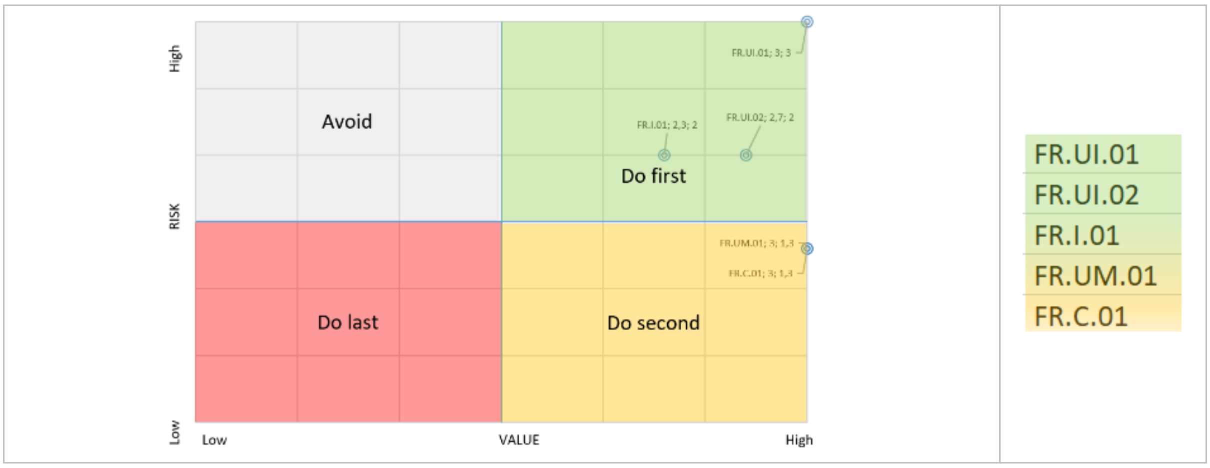


Figure 7: Backlog of functional requirements of users considered for Pilot 2.

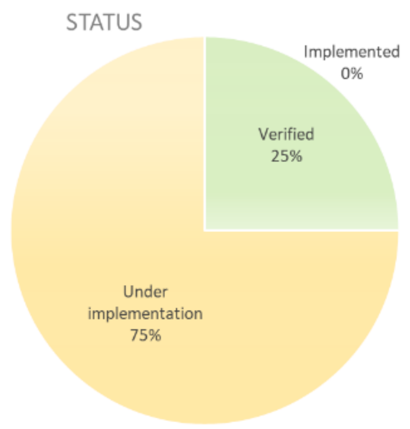
Based on the priorities backlog, the following table indicates the current status of **Functional User Requirements**:

ID Priority	Status	Summary
FR.UI.01	Verified	URE-36 - User Interface Title: AI platform for automate patient flow Description: An intelligent platform can manage and automate patient flows, events and tasks, moving hospitals from a reactive to a proactive healthcare system. Connection: TR-18, TR-34, COM-11, COM-13
FR.UI.02	Under implementation	URE-44 - User Interface Title: Improve scheduling Description: Solution for booking, scheduling and solve workload issues Connection: TR-34, COM-12
FR.I.01	Proposed	URE-24 - Information Title: Patient empowerment Description: Empower the citizens regarding their health data, using a bottom-up approach for HER interoperability Connection: TR-38 Observation: Another approach has been given to data collection, minimizing the necessary data and anonymizing them to the maximum, not being relevant.
FR.UM.01	Under implementation	URE-21 - User monitoring Title: Building conversational chatbots faster using NLP and machine learning

ID Priority	Status	Summary
		Description: The system should be used to train and improve human-machine understanding – being the most accurate technology- in this new era of people and machines communication
		Connection: TR-16, TR-40, COM-14
FR.C.01	Under implementation	URE-23 - Communication
		Title: Appointment preferences
		Description: Health ecosystem platform that can be accessed via a smartphone and can respond to individual needs. The Pilot#2 software will be connected to a Chatbot to speed up the acceptance or rejection of an appointment. This chatbot can induce anxiety in patients who have expressed their wish to have quickly a staff member on the phone if 3 consecutive appointments offered do not suit them.
		Connection: TR-17, TR-37, COM-12, COM-13

Below is a summary of the development status of Pilot 2, which indicates that 25% of the **Functional User Requirements** have been addressed, while the remaining 75% are currently under development.

STATUS	Count	%
Implemented	0	0%
Verified	1	25%
Under implementation	3	75%
TOTAL	4	100%



Non-Functional Requirements (order by priority of execution, as defined in D1.3)

NFR.E.01
NFR.E.02
NFR.QoS.01
NFR.QoS.02
NFR.E.03

Figure 8: Backlog of non-functional requirements of users considered for Pilot 2.

Performance requirements originally proposed and not implemented have been removed from the pilot due to inability to obtain the data or because they made patients more anxious about the benefits that could be gained from collecting them.

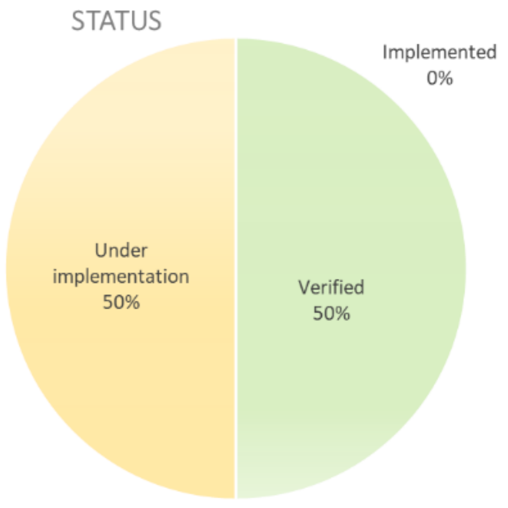
Based on the priority backlog of D1.3, the following table is presented, indicating the status of the non-functional User Requirements.

ID Priority	Status	Summary
NFR.E.01	Under implementation	URE-37 - Performance efficiency
		Title: Algorithms for the radiotherapy flow
		Description: Developing and evaluating models and algorithms used to automatically create radiotherapy treatment schedules
		Connection: TR-19, TR-34, COM-12
NFR.E.02	Verified	URE-38 - Performance efficiency
		Title: Radiotherapy Plan Model
		Description: Modelling and formulating radiotherapy plan into a shop scheduling problem.
		Connection: COM-15, TR-34, COM-12
NFR.QoS.01	Proposed	URE-30 - Quality of Service
		Title: Daily appointment times improvement
		Description: Involvement of patients in choosing daily appointment times (promoting patient autonomy, respecting patient needs are highly ranked values for patients), with adequate information during the RadioTherapy process to make the patients feel safe.
		Connection: TR-35
		Observation: The study of the improvements is not done daily so as not to put pressure on the patients by

ID Priority	Status	Summary
		having to fill in information or give feedback for each hospital appointment they have had.
NFR.QoS.02	Proposed	URE-26 - Quality of Service
		Title: Patient experience
		Description: To investigate the subjective experience of adult cancer patients with the chatbot undergoing external radiotherapy and provide evidence for better practices in radiotherapy services. Evaluate anxiety relating to the use of the Chatbot.
		Connection: TR-35
		Observation: The anxiety caused by working with the robot will not be measured since it is considered that it is not possible to measure it by having to differentiate between the anxiety levels of the patient
NFR.E.03	Proposed	URE-43 - Performance efficiency
		Title: Scheduling analysis based on operational costs
		Description: Analytical approach to achieve an appropriate balance between operational costs and service quality.
		Connection: TR-19
		Observation: It has been impossible to disaggregate the costs derived from each service the hospital had no possibility of obtaining these data.

Next, a summary of the state of the developments for Pilot 2 is shown, where 50% of the non-functional User Requirements are verified, and 50% are in progress.

STATUS	Count	%
Implemented	0	0%
Verified	1	50%
Under implementation	1	50%
TOTAL	2	100%



4.5 Pilot 3 User Requirements

Functional Requirements (order by priority of execution, as defined in D1.3)

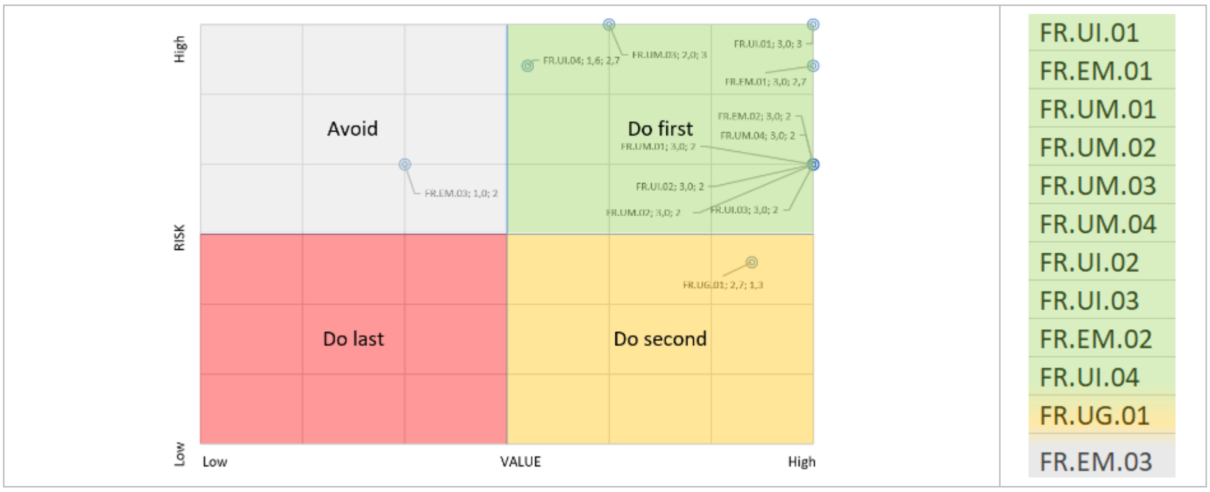


Figure 9: Backlog of functional requirements of users considered for Pilot 3.

Based on the priorities backlog, the following table indicates the status of **Functional User Requirements**:

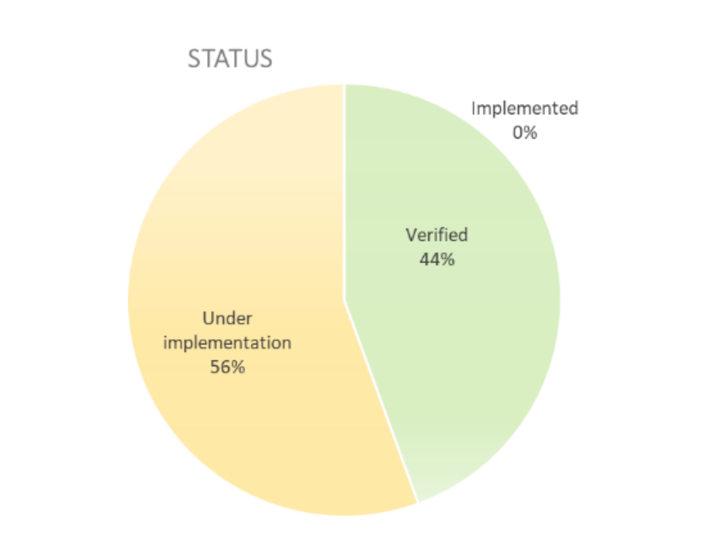
ID Priority	Status	Summary
FR.UI.01	Under implementation	URE-139 - User Interface/Performance efficiency Title: Share data through EHR interface Description: Collect sensors data and share it through EHR with the medical unit and caregivers. Implement a user interface to access the data. Connection: TR-91, TR-86, TR-85, TR-88, TR-87, TR-93, TR-92
FR.EM.0	Verified	URE-53 - Environment monitoring Title: Environment monitoring Description: Capability of receiving alert on patients' risky behaviours (e.g. patients falls) and information on activities run at hospital. Connection: TR-91, TR-90, TR-89, TR-92
FR.UM.01	Verified	URE-141 - User monitoring Title: Define data to monitor patients Description: Define specific data appropriate to better monitor patients (feasibility and usefulness). Connection: TR-174, TR-92
FR.UM.02	Under implementation	URE-137 - User monitoring Title: Patients monitoring during treatment Description: Use sensors to monitor patients during treatment and allow physiotherapists to leave the room if needed

ID Priority	Status	Summary
		Connection: TR-91, TR-90, TR-89, TR-93, TR-92
FR.UM.03	Verified	URE-136 - User monitoring Title: Fall detectors to increase patients safety Description: Fall detectors and alert in key spots to increase patients safety Connection:TR-91, TR-90, TR-89, TR-93, TR-92
FR.UM.04	Under implementation	URE-134: User monitoring Title: Info about patients amount of work Description: Count the work time of a patient to collect data on the amount of work that is needed to reach a set goal. Connection: TR-91, TR-90, TR-89, TR-93, TR-92
FR.UI.02	Verified	URE-140 - User Interface Title: Give physiotherapists a tool to command the treatment room Description: Allow the physiotherapist to manage the setting of the room via voice/app commands (present scenario and specific commands) Connection: TR-91, TR-93, TR-92
FR.UI.03	Under implementation	URE-135 - User Interface Title: Allow patients to start the treatment independently Description: Allow patients to use voice/app commands (or other options) to control the rehabilitation devices and start the treatment independently Connection: TR-91, TR-93, TR-92
FR.EM.02	Under implementation	URE-142 - Environment monitoring Title: Define alerts to allow patients work independently Description: Define specific alerts to better monitor patients and allow them work independently (feasibility and usefulness) Connection: TR-91, TR-90, TR-89, TR-93, TR-92
FR.UI.04	Cancelled	URE-47 - User Interface Title: User-friendly interface and telerehabilitation kit Description: Patients need a clean and intuitive user interface, and an easy-to-use telerehabilitation kit. During hospitalization patients are supported by a physiotherapist, while they might need caregivers' support to manage the telerehabilitation service from home, especially the elder ones and those with limited autonomy. Connection: TR-20, TR-88, TR-93

ID Priority	Status	Summary
		Observation: User requirement cancelled because the wearable devices required for the tele-neurorehabilitation kit were not developed, the members of the pilot in agreement with the technology partner AUTH developed the I-MAT prototype, which is only intended to be used during hospitalisation.
FR.UG.01	Cancelled	URE-55 - User Guidance Title: Collaboration with caregivers Description: If patient is not autonomous, physiotherapists need to reach a caregiver for every need. (i.e. reschedule appointments, technical problems, adjust wearable devices...) Connection: TR-91, TR-90, TR-89 Observation: User requirement cancelled because the wearable devices required for the tele-neurorehabilitation kit were not developed, the members of the pilot in agreement with the technology partner AUTH developed the I-MAT prototype, which is only intended to be used during hospitalisation where caregivers have no role.
FR.EM.03	Cancelled	URE-138 - Environment monitoring Title: Install smart kit in patients home Description: Install the smart kit (sensors, devices, etc.) both in hospital and in patients home (telerehabilitation). Integrate data collection to improve patient management. Connection: TR-91, TR-90, TR-89, TR-86, TR-85, TR-88, TR-87, TR-93, TR-92 Observation: User requirement cancelled because the wearable devices required for the tele-neurorehabilitation kit were not developed, the members of the pilot in agreement with the technology partner AUTH developed the I-MAT prototype, which is only intended to be used during hospitalisation.

Below is a summary of the development status of Pilot 3, which indicates that 44% of the **Functional User Requirements** have been addressed, while the remaining 56% are currently under development.

STATUS	Count	%
Implemented	0	0%
Verified	4	44%
Under implementation	5	56%
TOTAL	9	100%



Non-Functional Requirements (order by priority of execution, as defined in D1.3)

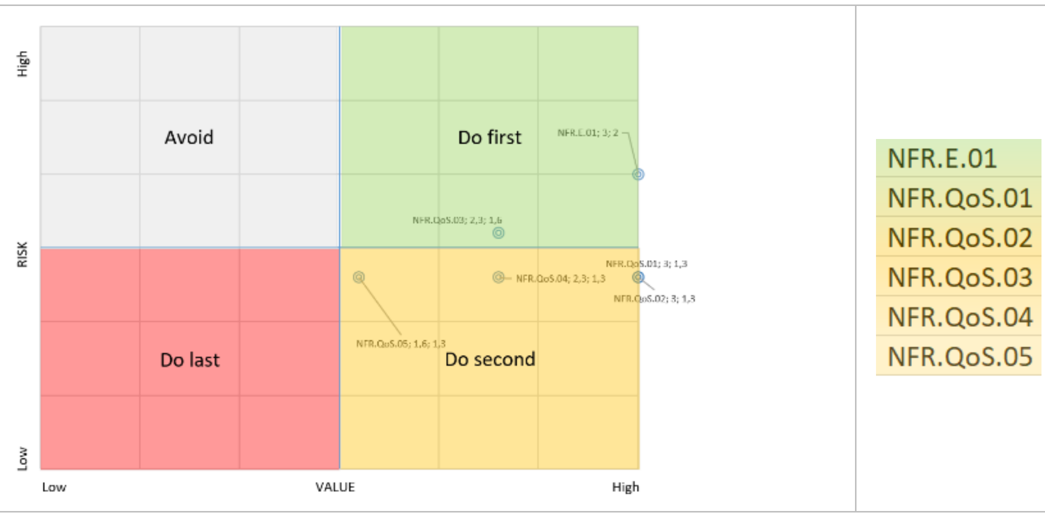


Figure 10: Backlog of non-functional requirements of users considered for Pilot 3.

Based on the priority backlog of D1.3, the following table is presented, indicating the status of the non-functional User Requirements.

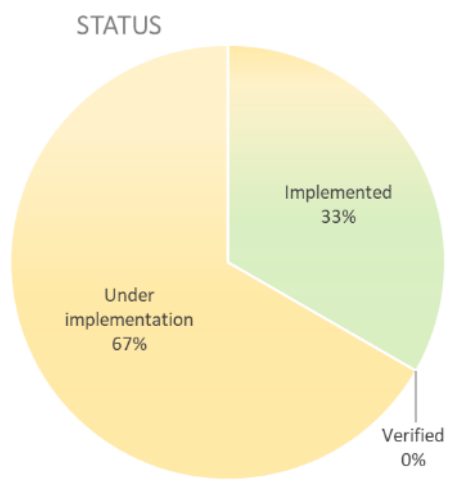
ID Priority	Status	Summary
NFR.E.01 3	Under implementation	URE-54 - Performance efficiency
		Title: Performance efficiency
		Description: Information on services delivered to patients, both in presence of a healthcare professionals and run autonomously by the patients themselves.
		Connection: TR-174, TR-90, TR-92
NFR.QoS.01	Implemented	URE-49 - Quality of Service

ID Priority	Status	Summary
		Title: Gamification of rehabilitation services Description: Patients reported that when they have fun exercises are easier and better. Connection: TR-20
NFR.QoS.02	Under implementation	URE-48 - Quality of Service Title: Patients need to feel empathy-based care Description: Patients need care professional with human touch to follow them. During hospitalization a part of the regular care is provided by technology-based therapy, so that the care professionals can spend more time with patients and provide better attentions. Connection: TR-174, TR-91, TR-90, TR-89, TR-20, TR-86, TR-85, TR-88, TR-87, TR-93, TR-92
NFR.QoS.03	Cancelled	URE-51 - Quality of Service Title: Continuity of care Description: Patients want to recover at their best, so they keep on looking for rehabilitation centres after hospitalization. The tele-rehabilitation service provided after hospitalization guarantees continuity of care and they feel satisfied of the progress they have made with this approach. Connection: TR-91, TR-90, TR-89, TR-92 Observation: User requirement cancelled because the wearable devices required for the tele-neurorehabilitation kit were not developed, the members of the pilot in agreement with the technology partner AUTH developed the I-MAT prototype, which is only intended to be used during hospitalisation.
NFR.QoS.04	Cancelled	URE-50 - Quality of Service Title: Familiar environment Description: Patients need to stay close to their family and beloved ones. Tele-rehabilitation services provide the care that patients need while they can stay at home. Connection: TR-91, TR-90, TR-89 Observation: User requirement cancelled because the wearable devices required for the tele-neurorehabilitation kit were not developed, the members of the pilot in agreement with the technology partner AUTH developed the I-MAT prototype, which is only intended to be used during hospitalisation.

ID Priority	Status	Summary
NFR.QoS.05	Cancelled	URE-52 - Quality of Service Title: Importance of caregivers Description: Most of the patients are not autonomous in their activities. The role of caregivers is crucial and this should always be taken into account. They can benefit from monitoring of patient and support patient treatment. Connection: TR-91, TR-90, TR-89, TR-86, TR-85, TR-88, TR-87, TR-92 Observation: User requirement cancelled because the wearable devices required for the tele-neurorehabilitation kit were not developed, the members of the pilot in agreement with the technology partner AUTH developed the I-MAT prototype, which is only intended to be used during hospitalisation.

Next, a summary of the state of the developments for Pilot 3 is shown, where 33% of the non-functional User Requirements are implemented, and 67% are in progress.

STATUS	Count	%
Implemented	1	33%
Verified	0	0%
Under implementation	2	67%
TOTAL	3	100%



4.6 Pilot 4 User Requirements

The **functional and non-functional requirements** of the Pilot 4 are listed below, sorted by execution priority, as defined in D1.3.

FR.UI.01
FR.UI.02
FR.B.01
FR.UI.03

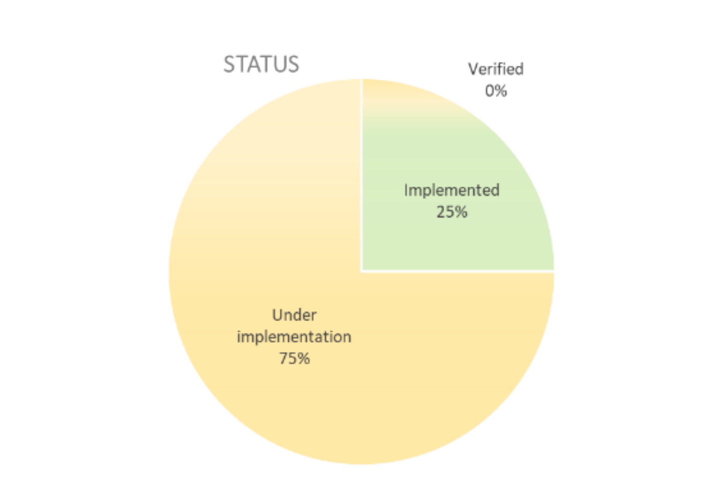
Figure 11: Backlog of requirements of users considered for Pilot 4.

Based on the priorities backlog, the following table indicates the status of **Functional and Non-functional User Requirements**:

ID Priority	Status	Summary
FR.UI.01	Under implementation	URE-58 - User Interface/Performance efficiency Title: Manual and Automatic navigation along a trajectory. Description: The User shall be able to active semi-automatic navigation along an ablation trajectory. Connection: TR-184, TR-101
FR.UI.02	Under implementation	URE-57 - User Interface/Performance efficiency Title: Manual and Automatic navigation to target location Description: The User shall be able to active semi-automatic navigation to a target location. Connection: TR-184, TR-101, TR-100
FR.B.01	Under implementation	URE-59 - Bio-parameters/Maintainability Title: Improved EP map Description: The user shall be able to view an AI improved 3D electrophysiological map of cardiac structures and electrical signals. Connection: TR-102
FR.UI.03	Implemented	URE-60 - User Interface / Usability Title: User interface to defined target location Description: The user shall be able to select a target location. Connection: TR-184, TR-103

Below is a summary of the status of developments for Pilot 4, where 25% of the **functional and non-functional User Requirements** are implemented, and 75% are in progress.

STATUS	Count	%
Implemented	1	25%
Verified	0	0%
Under implementation	3	75%
TOTAL	4	100%



4.7 Pilot 5 User Requirements

Functional Requirements (order by priority of execution, as defined in D1.3)

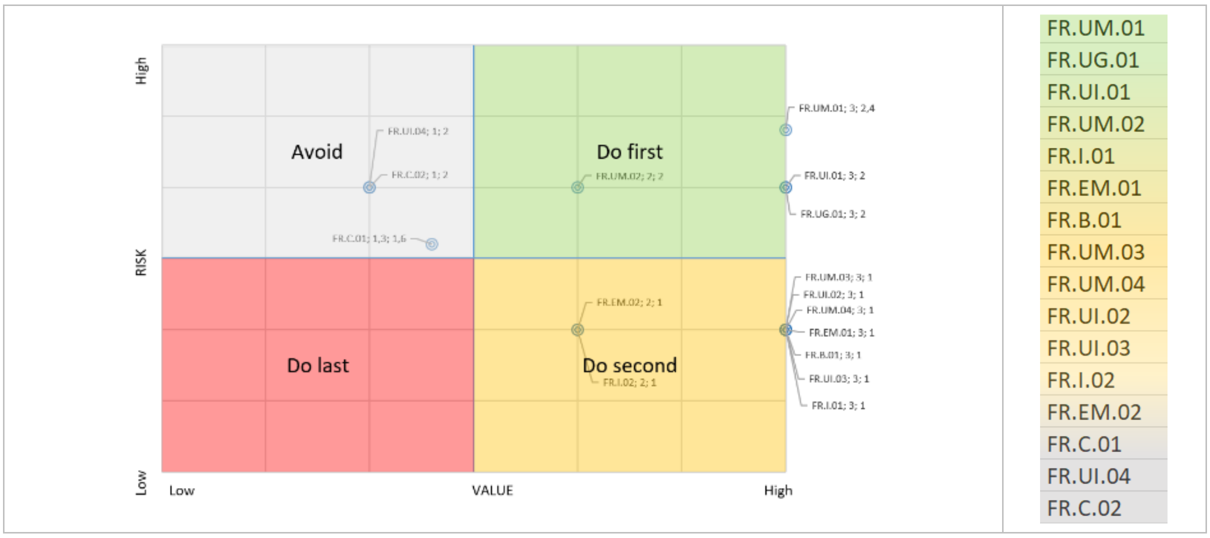


Figure 12: Backlog of functional requirements of users considered for Pilot 5.

Based on the priorities backlog, the following table indicates the current status of **Functional User Requirements**:

ID Priority	Status	Summary
FR.UM.01	Implemented	URE-67 - User monitoring Title: Patient adherence, quality of self-reports and long term sustainability.

ID Priority	Status	Summary
		Description: Familiarity, perceived complexity, and trustworthiness represent the main drivers of patient adherence and have an impact on the quality of self-reports (PROs). The systems must be designed in a way to reflects trustworthiness and help users to easily get familiar with them (i.e. use the natural way of communicating).
		Connection: TR-17, TR-28, TR-27, TR-68, TR-67, TR-75, TR-137, TR-22, TR-71, TR-40, TR-72
FR.UG.01	Implemented	URE-151 - User Guidance
		Title: Behaviours and exercises to simulate
		Description: Definition of exercises and how they should be carried out by the robot
		Connection: TR-130, TR-74, URE-62, TR-72
FR.UI.01	Verified	URE-70 - User Interface
		Title: Acceptance from healthcare professionals
		Description: Although healthcare professionals are clearly facing high workloads and tend to recognize the potential value of care robots as an aid in "measuring/monitoring", "mobility/activity" and "safety of care", they are in fact challenged in understanding and prioritizing of the robotics units into fundamental aspects of care.
		Connection: TR-172, TR-129, TR-128, TR-69, TR-71, TR-70
FR.UM.02	Under implementation	URE-152 - User monitoring
		Title: CarePlan
		Description: Define patient specific plan of interventions
		Connection: TR-28, TR-29, TR-129, TR-128, TR-75
FR.I.01	Verified	URE-148 - Information
		Title: Health professionals empowerment, Acceptance from healthcare professionals
		Description: Collect data and share it through EHR with the medical unit and caregivers. Access the data for clinician's.
		Connection: TR-17, TR-28, TR-27, TR-68, TR-69, TR-71, TR-70
FR.EM.01	Implemented	URE-145 - Environment monitoring
		Title: Safety and autonomy
		Description: Overview the patients safely - robot behaviour in the ward. Robot must avoid collision with patients and not represent a barrier --> needs to know the safe locations to move itself

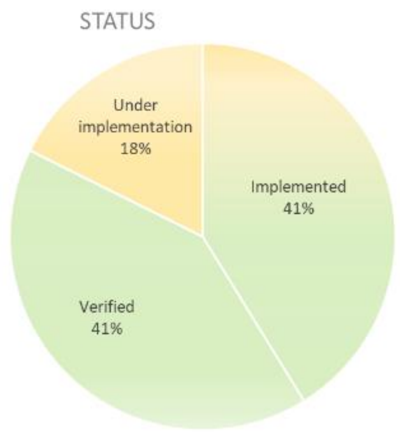
ID Priority	Status	Summary
		Connection: TR-141, URE-69, URE-66, URE-64
FR.B.01	Implemented	URE-149 - Bio-parameters Title: Define health quality measures Description: Define the data to monitor and quality (Usability for medical rounds: temperature measurement, other vital measurements i.e. blood pressure and heart-rate). Connection: TR-129, TR-128, TR-71
FR.UM.03	Verified	URE-74 - User monitoring Title: Libraries for feature extraction from multimodal sensing Description: Facial, speech and text feature extraction libraries should be searched and downloaded for further investigation of feature fusion. Example libraries: – Facial: OpenFace, AUNets – Speech: openSMILE, LibRosa – Text: NLTK, Reldi, Spacy, Stanza – Multi-modal: end2you Connection: TR-74, TR-22, TR-72
FR.UM.04	Verified	URE-73 - User monitoring Title: Datasets for feature extraction from multimodal sensing Description: Facial, speech and text feature extraction datasets should be searched and downloaded for further investigation of feature fusion. Example datasets: – Facial: The Japanese Female Facial Expression (JAFFE) Dataset, EmotioNet database – Speech: Berlin Emotional – Text: EmoBank, DailyDialog: A Manually Labelled Multi-turn Dialogue Dataset – Multi-modal: Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS), CMU Multimodal Opinion Sentiment and Emotion Intensity (CMU-MOSEI) Connection: TR-137, TR-65, TR-134, TR-131
FR.UI.02	Proposed	URE-79 - User Interface Title: Patients contact Description: Apps and mental treatments onto an innovative mental health ecosystem platform that can be accessed via a smartphone and can respond to individual needs. Connection: TR-17

ID Priority	Status	Summary
		Observation: This functionality was not relevant and was removed. The TR-17 however was deployed, that allows to control the robot also via a smartphone.
FR.UI.03	Verified	URE-61 - User Interface Title: Multi-modal Sensing and Symmetric Interaction Description: The system should be able to cover the different types of data sources for getting a holistic approach for patients. Connection: TR-138, TR-74, TR-137, TR-22, TR-66, TR-135, TR-134, TR-133, TR-40, TR-72, TR-130, TR-140, TR-67, COM-83, COM-43, COM-42, COM-56
FR.I.02	Implemented	URE-150 - Information Title: Health professionals empowerment Description: Electronic health database for the development of the future complete patient files (history+family background+current diagnosis and treatment). Connection: TR-129, TR-128, TR-75, TR-71, TR-145, TR-143
FR.EM.02	Implemented	URE-146 - Environment monitoring Title: Safety and autonomy Description: Alerts for patient safety. Overview of the robot work from the commander of the robot. Connection: URE-69, TR-75, URE-66, TR-70
FR.C.01	Implemented	URE-65 - Communication Title: Kinematic (inverse) models Description: Is the robot capable to engage with humans in a human-like manner, using gestures? What are the major differences or adjustments to achieve a similar level of understanding as humans generate? Besides indoor autonomous navigation through hallways and rooms can robots explain and present information efficiently. Connection: TR-130, TR-23, TR-21, TR-142
FR.UI.04	Verified	URE-147 - User Interface Title: Patients contact and engagement Description: A socially assistive robotic unit to interact with patients and collect data from them Connection: TR-67, TR-129, TR-74, TR-22, TR-66, TR-71, TR-40
FR.C.02	Under implementation	URE-144 - Communication Title: Patient Engagement on Demand Description: Allow patient to call robot as much as they want and discuss topics beyond data collection Connection: TR-140, TR-138, TR-131

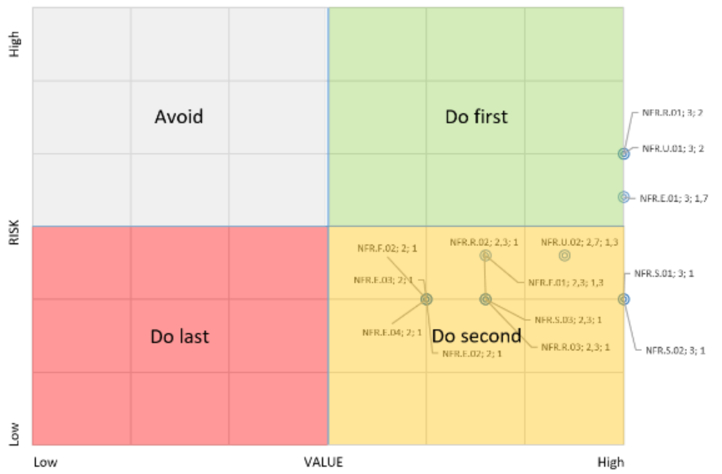
ID Priority	Status	Summary
FR.I.03	Under implementation	URE-161 - Information
		Title: Services to evaluate the correctness of breathing exercises
		Description: Computer vision algorithms to evaluate whether the patient is executing exercises and if the patient is doing them correctly
		Connection: TR-67
FR.UM.05	Verified	URE-160 - User monitoring
		Title: Correct Execution of Breathing Exercises
		Description: Correct execution of Breathing Exercises
		Connection:

Below is a summary of the development status of Pilot 5, indicating that 82% of the **Functional User Requirements** have been addressed (41% Implemented + 41% Verified), while the remaining 18% are currently under development.

STATUS	Count	%
Implemented	7	41%
Verified	7	41%
Under implementation	3	18%
TOTAL	17	100%



Non-Functional Requirements (order by priority of execution, as defined in D1.3)



NFR.U.01
NFR.R.01
NFR.E.01
NFR.U.02
NFR.S.01
NFR.S.02
NFR.F.01
NFR.S.03
NFR.R.02
NFR.R.03
NFR.F.02
NFR.E.02
NFR.E.03
NFR.E.04

Figure 13: Backlog of non-functional requirements of users considered for Pilot 5.

Based on the priority backlog of D1.3, the following table is presented, indicating the status of the non-functional User Requirements.

ID Priority	Status	Summary
NFR.U.01	Verified	URE-68 - Usability
		Title: Patient acceptance and stigmatization
		Description: Ethical considerations related to decreased social contact, as patients' stigmatization and fear of the dehumanization of society. Robots may be perceived as a local threat to their independence due to unfamiliarity and technical inexperience.
		Connection: TR-28, TR-27, TR-29, TR-58, TR-147,TR-146, TR-40
NFR.R.01	Verified	URE-75 - Reliability
		Title: Decision of HW sensors to be used for SLAM algorithm
		Description: We need to decide which sensors (laser, sonar, 3D camera, etc), will be appropriate for SLAM algorithm development on Pepper, for indoor use with staff and patients. Or maybe will depend on combined partial SLAM algorithms (ICP, Visual, EKF SLAM) Libraries in ROS, OpenSLAM, GitHub can be useful. The position and orientation of the robot must be known in real-time.
		Connection: TR-141, TR-172, TR-23, TR-138, TR-136, TR-142
NFR.E.01	Verified	URE-71 - Performance efficiency
		Title: Development of AI for nursing

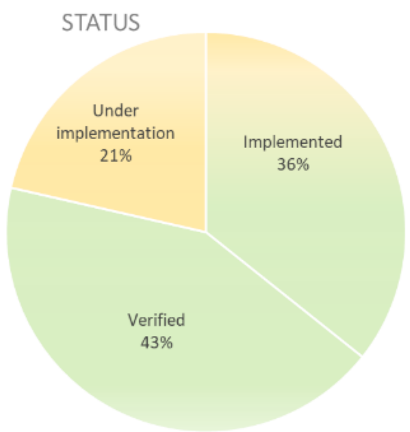
ID Priority	Status	Summary
		Description: When we consider the development coupled with the precondition of nurse engagement, it is crucial for a nursing AI to have a successful implementation and long-term sustainability. Nonetheless, if it is necessary to evaluate the "strength" of the delineations, then collaboration would be most important as a precondition, since it is important, to begin with, a nurse-centric AI.
		Connection: TR-172, TR-29, TR-129, TR-128, TR-75, TR-71, TR-40, TR-72
NFR.U.02	Implemented	URE-80 - Usability
		Title: Patient empowerment
		Description: InteropEHRate aims to empower the citizens regarding their health data and unlock health data from local silos, using a bottom-up approach for EHR interoperability.
		Connection: TR-129, TR-128, TR-147, TR-146
NFR.S.01	Implemented	URE-64 - Security
		Title: Obstacle avoidance and objects' recognition
		Description: The robot should recognize objects on its pathway to properly avoid them, move aside or stop in critical situations in human environments.
		Connection: TR-141, TR-139, TR-138, TR-136,URE-145, TR-143, TR-142
NFR.S.02	Verified	URE-66 - Security
		Title: Safety aspects
		Description: We need to set up a safe common workspace and actively share it with robots, patients and clinical staff. The robot should be adapted to the human environment and not vice versa. Actions of robots should be monitored and securely stored
		Connection: TR-172, TR-171, TR-21, URE-145,TR-144, URE-146
NFR.F.01	Verified	URE-72 - Functional suitability
		Title: Technology Literacy
		Description: All people who will be in contact with the robot should have a basic technology information.
		Connection: TR-40, TR-72
NFR.S.03	Implemented	URE-69 - Security
		Title: Safety and autonomy
		Description: Although the AI-driven systems exhibit robust, autonomous capabilities and initial concerns regarding physical safety around people have been

ID Priority	Status	Summary
		partially addressing the problem of dynamic highly unpredictable environment in hospital wards remains. Connection: TR-28, TR-172, TR-29, TR-58, TR-21, URE-145, TR-144, URE-146, TR-143
NFR.R.02	Implemented	URE-63 - Reliability Title: Development of autonomous navigation Description: Algorithms for real-time autonomous navigation and SLAM should be appropriate for the clinic environment and based only on Pepper's HW resources. Connection: TR-141, TR-172, TR-171, TR-143, TR-142
NFR.R.03	Verified	URE-77 - Reliability Title: Motion Control and Trajectory Planning for Obstacle Avoidance Description: Optimal trajectory planning is important to safely navigate the robot, however in case of obstacles (human, hospital bed, chair, etc.) a robot must find its way around the obstacle. Methods for optimal trajectory and its optimisation will need to be addressed here. Connection: TR-139, TR-136, TR-142
NFR.F.02	Under implementation	URE-62 - User Interface /Functional suitability Title: Reconfiguration of robot Description: The system should be able to reconfigure the PEPPER robot according to the requirements of the working environment and project targets. Connection: TR-172, TR-23, TR-75, URE-151, TR-74, TR-21
NFR.E.02	Under implementation	URE-76 - Performance efficiency Title: Real-time autonomous navigation and remote control. Description: We need to check if already developed ROS libraries are sufficient or try to compare them with other opensource libraries. Finally, we can improve the code by specific needs in the project (clean environment, hospital, etc.) in python or C++ code. Navigation remote /autonomous should be smooth and safe between staff and patients. Connection: TR-17, TR-23, TR-73
NFR.E.03	Implemented	URE-143 - Performance efficiency Title: Performance efficiency Description: Count the time the nurses need for the patient in the beginning and compare it with the time they need with the robot in the hospital. Comparing time with the patient with and without the robot

ID Priority	Status	Summary
		Connection: TR-58, TR-75
NFR.E.04	Under implementation	URE-78 - Performance efficiency Title: Visual recognition and obstacle categorization, human motion prediction Description: In order to avoid indoor dangerous scenarios on a robot pathway or workspace, additional algorithms can be addressed to increase safety (collision avoidance). Meaning algorithms for human motion prediction (such as a moving arm or body towards the robot) can decrease accidents and contact with the robot. Also, categorization of obstacles (equipment, humans) and their properties such as dimension and shape estimation can be used for smooth collision avoidance, etc. Connection: TR-139, TR-138, TR-136

Below is a summary of the development status of Pilot 5, indicating that 79% of the **Non-Functional User Requirements** have been addressed (36% Implemented + 43% Verified), while the remaining 21% are currently under development.

STATUS	Count	%
Implemented	5	36%
Verified	6	43%
Under implementation	3	21%
TOTAL	14	100%



4.8 Pilot 6 User Requirements

Functional Requirements (order by priority of execution, as defined in D1.3)

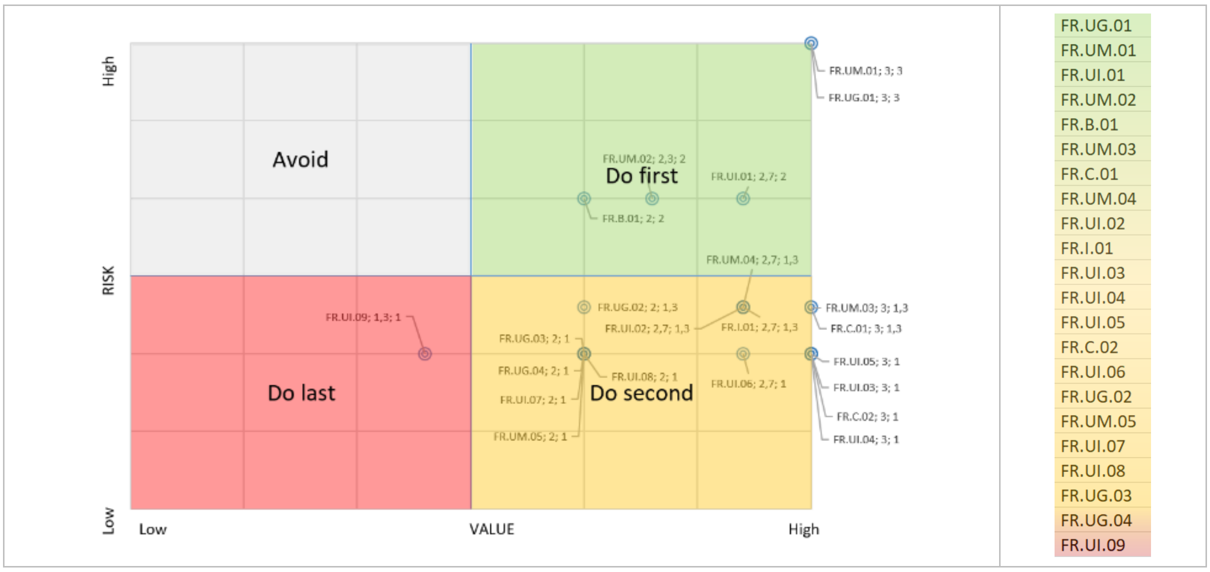


Figure 14: Backlog of functional requirements of users considered for Pilot 6.

Based on the priorities backlog, the following table indicates the current status of **Functional User Requirements**:

<table>
<tr><th>ID Priority</th><th>Status</th><th>Summary</th></tr>
<tr><td rowspan="4">FR.UG.01</td><td rowspan="4">Under implementation</td><td>URE-156 - User Guidance</td></tr>
<tr><td>Title: Human-computer interaction: Provide Feedback IV</td></tr>
<tr><td>Description: The solution should justify the exercises (E.g. “today we are going to do X... because it helps us to X”). Explain why is triggering certain interactions.</td></tr>
<tr><td>Connection: TR-74, TR-189</td></tr>
<tr><td rowspan="4">FR.UM.01</td><td rowspan="4">Under implementation</td><td>URE-121 - User monitoring</td></tr>
<tr><td>Title: Robot - Behavioural features</td></tr>
<tr><td>Description: The robot should be able to:
– listening attentively, for example by looking at the participant and nodding
– being nice and pleasant to interact with, for example by smiling
– remembering little personal details about people, for example by using their names
– being expressive, for example by using facial expressions admitting mistakes</td></tr>
<tr><td>Connection: TR-74</td></tr>
<tr><td rowspan="2">FR.UI.01</td><td rowspan="2">Implemented</td><td>URE-82 - User Interface</td></tr>
<tr><td>Title: User-friendly installation</td></tr>
</table>

ID Priority	Status	Summary
		Description: During installation, the applications as well as all background services must be installed without requiring any further interaction from the user. **Connection:** TR-124, COM-5
FR.UM.02	Cancelled	**URE-119 - User monitoring** **Title:** Robot - navigation and scanning **Description:** The robot should have the ability to navigate, locate the person to talk to and to keep them in focus. **Connection:** TR-141, TR-138, TR-67 **Observation:** In pilot 6 the robot is mainly focused on group activities to support the caregiver in the care centre. Therefore, at this point the function itself was not necessary.
FR.B.01	Under implementation	**URE-90 - Bio-parameters** **Title:** Collection of data – voice and video (transparency required) **Description:** The recorded voice data must be collected and processed by the voice service in an unobtrusive way and without requiring any interaction. **Connection:** TR-138
FR.UM.03	Cancelled	**URE-114 - User monitoring** **Title:** Robot - Emergency button **Description:** The system should be able to ask for help in case of need assistance. **Observation:** In the study robots behaviour is always under the supervision of the operator, who represents the human in the loop. The firmware also include a logger to report on system or functional issues. Thus at this point the feature itself was not necessary
FR.C.01	Verified	**URE-95 - Communication** **Title:** Syncing service **Description:** Data stored from the application's back-end services should be synchronized without requiring any interaction **Connection:** TR-26, TR-126, COM-128, COM-5, COM-34, COM-6
FR.UM.04	Verified	**URE-106 - User monitoring** **Title:** Performance metrics shown to users **Description:** Based on the user's performance metrics with respect to a particular game scenario, the customization tool should allow the adjustment of certain parameters of the game scenario (e.g., difficulty)

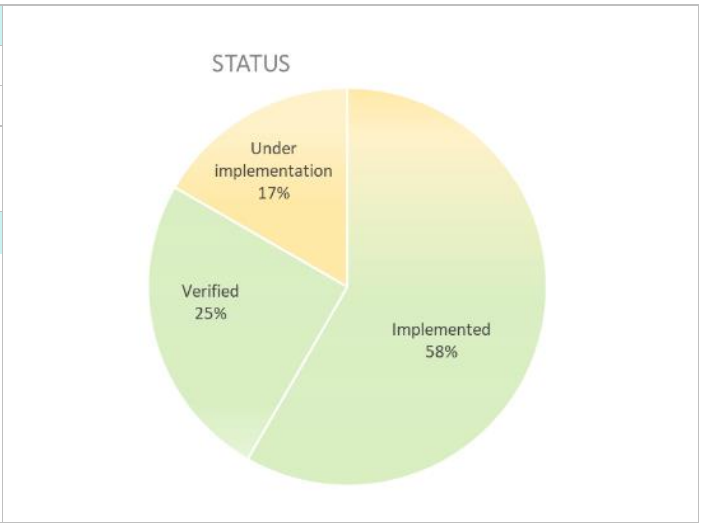
ID Priority	Status	Summary
		so that the next time the user plays the game he/she does so in the customized scenario.
		Connection: TR-124, COM-5
FR.UI.02	Verified	URE-105 - User Interface
		Title: Serious games I - proposed activities
		Description: Each serious game should have instructions at the beginning that tell the user the task and an option to pause the activity.
		Connection: TR-124, COM-5
FR.I.01	Implemented	URE-91 - Information
		Title: Collection of data – Integrated care
		Description: Obtain biometric telemetry data from users using portable devices such as smartwatches.
		Connection: TR-191
FR.UI.03	Implemented	URE-98 - User Interface
		Title: User profiles
		Description: The solution can work with different user profiles and be able to recognize and adapt to the selected profile.
		Connection: TR-168, TR-124, COM-5
FR.UI.04	Verified	URE-89 - User Interface
		Title: Collection of data - Record data
		Description: the services must record the statistics of their use, i.e. the number of activations of the intervention by the user, their duration of use and the number of events detected. These data will be stored by the respective services and will be made available to the synchronization service to be uploaded to the management system.
		Connection: TR-126, COM-42, COM-5
FR.UI.05	Implemented	URE-87 - User Interface
		Title: Human-computer interaction: Provide Feedback I
		Description: The solution must include feedback elements on key monitoring data and serious games activity and performance metrics on a dedicated section (dashboard tab). Feedback elements and data-to-feedback service must be refreshed based on new monitoring data on a scheduled basis. Thus, the data-to-feedback service should perform its operations on a scheduled basis. This feedback should be provided in a way that is user friendly and comprehensive.
		Connection: TR-88, TR-124
FR.C.02	Implemented	URE-97 - Communication

ID Priority	Status	Summary
		Title: Contact clinician **Description:** The user must be able to easily access the contact information (name, address, telephone number, e-mail address) of her/his clinician through the help & feedback tab of the interventions application. **Connection:** TR-198
FR.UI.06	Implemented	URE-101 - User Interface **Title:** Accessibility **Description:** The interventions platform must be accessible through a dedicated URL from a browser provided, that the user's, clinician's mobile device (smartphone or tablet) or PC is connected to the internet. **Connection:** COM-51, TR-125, COM-5, COM-34, COM-6
FR.UG.02	Verified	URE-88 - User Guidance **Title:** Request help **Description:** The user will be able to request technical assistance in relation to the use of the application in an easy way. **Connection:** TR-125, COM-5
FR.UM.05	Implemented	URE-99 - User monitoring **Title:** Intervention platform – clinician **Description:** The clinician must be able to access the intervention platform unobtrusively by creating and modifying an existing account profile, and modify the intervention program on the platform. **Connection:** TR-125, COM-5
FR.UI.07	Verified	URE-153 - User Interface **Title:** Facilitated log in **Description:** For example through pictograms. **Connection:** COM-51, COM-34, TR-165, COM-6
FR.UI.08	Implemented	URE-100 - User Interface **Title:** User account Log in/Log out **Description:** Upon logging into the interventions platform, the interventions user could stay logged-in even after a session has been terminated. The interventions platform must include an option for the user or expert clinician to log-out from the interventions platform. The process will not affect the interventions users or clinician login status on other mobile devices or the Web-based interventions platform. After logging out, the user or expert clinician must be presented with the login screen of the interventions platform. **Connection:** COM-51, TR-168, COM-34, COM-4, COM-6

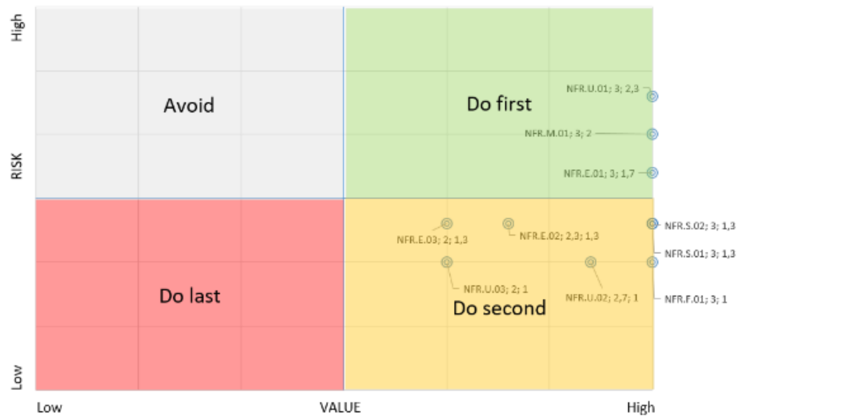
ID Priority	Status	Summary
FR.UG.03	Implemented	URE-155 - User Guidance Title: Intervention - Other therapies Description: The solution should incorporate therapeutic exercises. Connection: TR-189, TR-188, TR-187
FR.UG.04	Under implementation	URE-154 - User Guidance Title: Intervention - Relaxation exercises Description: Incorporate relaxation exercises, such as breathing exercises and suggest the activity to the patient if it detects some anxiety or sadness. Connection: TR-189, TR-188, TR-187
FR.UI.09	Implemented	URE-83 - User Interface Title: Applications, background services and local data must be completely removed. Description: The uninstallation process should remove the applications as well as any locally stored data and background services, thus leaving the mobile device in a prior state to the installation of the applications. Connection: TR-160, TR-127, TR-124, COM-5
FR.C.03	Implemented	URE-162 - Communication Title: Register activity on the blockchain Description: Register start/end, results and evaluation of each activity caried out Connection: TR-172, COM-128, COM-34, COM-6
FR.B.02	Implemented	URE-167 - Bio-parameters Title: Biometric telemetry acquisition should be transparent and comfortable for patients Description: Connection: TR-212
FR.I.02	Implemented	URE-166 - Information Title: Biometric telemetry data are stored in common format Description: Connection: TR-213
FR.B.03	Implemented	URE-165 - Bio-parameters Title: Patient telemetry obtained at regular intervals Description: Connection: TR-212

Below is a summary of the development status of Pilot 6, indicating that 83% of the **Functional User Requirements** have been addressed (58% Implemented + 25% Verified), while the remaining 17% are currently under development.

STATUS	Count	%
Implemented	14	58%
Verified	6	25%
Under implementation	4	17%
TOTAL	24	100%



Non-Functional Requirements (order by priority of execution, as defined in D1.3)



NFR.U.01
NFR.M.01
NFR.E.01
NFR.S.01
NFR.S.02
NFR.F.01
NFR.E.02
NFR.U.02
NFR.E.03
NFR.U.03

Figure 15: Backlog of non-functional requirements of users considered for Pilot 6.

Based on the priorities backlog, the following table indicates the status of **Non-Functional User Requirements**

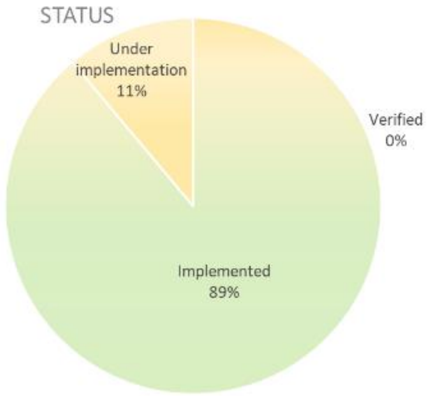
ID Priority	Status	Summary
NFR.U.01	Under implementation	URE-120 - Usability
		Title: Robot - Social abilities
		Description: The robot should be able to cooperate, express empathy, show assertiveness, exhibit self-control, show responsibility, gain trust and show competence. (Motivation and behaviour change approach). (e.g.) Mood Module in Peper.
		Connection: TR-74
NFR.M.01	Implemented	URE-118 - Maintainability
		Title: Easy to learn how to interact
		Description: Difficulty leaning the system features and functioning should be minimum. Short-term memory decline with age should be taken into account both at the

ID Priority	Status	Summary
		app design and at the training phase. (e.g. images, pictograms, clear instructions...)
		Connection: TR-124, COM-5
NFR.E.01	Cancelled	URE-81 - Performance efficiency
		Title: Support decision-making for adjust care plans
		Description: Big Data platform system for follow-up performance and launch personalized activity recommendations. The system should be able to make recommendations for activities based on stored information (always updating) about previously enjoyed activities and stated interests in a persuasive way.
		Observation: In the study, the system includes adjustments of difficulty levels of the stimulation/rehabilitation activities based on the performance of the users during the execution of the exercises. As for the recommendations for recreational/entertainment activities, we do not consider it necessary.
NFR.S.01	Implemented	URE-117 - Security
		Title: Privacy
		Description: All information collected should be unobtrusive and users should be able to delete their data at any time from the system for any reason.
		Connection: TR-42, TR-41, TR-44, TR-124, TR-51, TR-50, TR-28, TR-49, TR-29, TR-46, TR-48, TR-36, TR-47, COM-5
NFR.S.02	Implemented	URE-107 - Security
		Title: GDPR - Transparency about the data that is collected
		Description: The system must be designed and operate in a way that conforms to the country's laws. In the European Union, the system must be compliant with the General Data Protection Regulation7 (GDPR).
		Connection: TR-27, COM-51, COM-5
NFR.F.01	Implemented	URE-112: Functional suitability
		Title: Human-computer interaction: Provide Feedback II
		Description: The design of and the statistics presented via the feedback elements must provide the user with easy-to-understand and useful information that will require minimal additional knowledge from the user to assimilate it.
		Connection: TR-125, COM-5
NFR.E.02	Implemented	URE-108 - Performance efficiency
		Title: Cloud Service

ID Priority	Status	Summary
		Description: The networking system must be able to cope with the generated traffic and computational load. Connection: COM-51, TR-124, COM-5
NFR.U.02	Implemented	URE-113 - Usability Title: UI Interventions platform Description: The UI elements of the interventions platform, including sliders, buttons, text, menus, text fields, must be designed so as to be easily accessible by the user or expert clinician or caregiver (high contrast, large enough fonts, distinctive colours). Icons or accompanying text of icons must clearly state the functionality they correspond to. Connection: COM-51, TR-124, COM-5, COM-4
NFR.E.03	Implemented	URE-111 - Performance efficiency Title: Registration and access Description: Registration for creating user ID in the HosmartAI AI platform; communicate with the different platforms with a API-REST. The robot should identify easily the user, without the need for a user and password. It's necessary to register name, surname, age, patient's activity preference. Connection: COM-51, TR-124, COM-5, COM-34, COM-4, COM-6, TR-186
NFR.U.03	Implemented	URE-157 - Usability Title: Content size and organization being shown in the tablet (small interface) Description: Tablet size / interface size (reading and interaction facilitated) Older adults generally have difficulties seeing something so small. The robot pepper seems to have a very small tablet. Self-responsive. Connection: TR-164

Next, a summary of the state of the developments for Pilot 6 is shown, where 89% of the **non-functional User Requirements** are implemented, and 11% are in progress.

STATUS	Count	%
Implemented	8	89%
Verified	0	0%
Under implementation	1	11%
TOTAL	9	100%



4.9 Pilot 7 User Requirements

The functional and non-functional requirements of the Pilot 7 are listed below, sorted by execution priority, as defined in D1.3.

FR.UM.01
FR.UI.01
FR.UI.02
FR.UM.02

Figure 16: Backlog of requirements of users considered for Pilot 7.

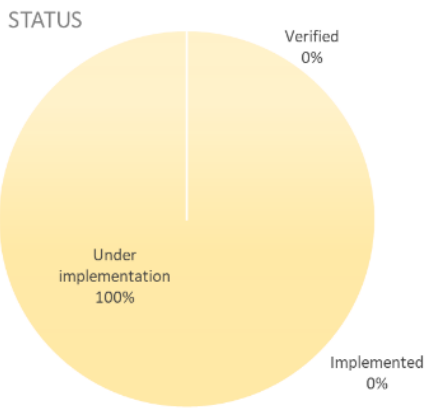
Based on the priorities backlog, the following table indicates the status of **Functional and Non-functional User Requirements**:

ID Priority	Status	Summary
FR.UM.01	Cancelled	URE-122 - User monitoring Title: Automatic reporting Description: The clinical user shall be able to dedicate his/her time to the treatment of the patient, such that the treatment outcome will be optimal and I don't lose time on administrative work. Connection: TR-99

ID Priority	Status	Summary
		Observation: It was recognized that AI algorithm robustness should be sufficient and prioritized before any assessment can be made on reducing reporting time.
FR.UI.01	Under implementation	URE-124 - User Interface **Title:** Image interpretation **Description:** The clinical application should support an automatic interpretation of clinical image data and present the results in an interpretable way to the user. **Connection:** TR-97, TR-98, TR-95
FR.UI.02	Under implementation	URE-123 - User Interface **Title:** Clinical decision support **Description:** The clinical user shall be able to focus his/her attention on the wellbeing of the patient, such that the patient will feel comfortable and treatment outcome is optimal. **Connection:** TR-99, TR-94
FR.UM.02	Cancelled	URE-125 - User monitoring **Title:** Data acquisition **Description:** For each step of the procedure, assistance will be provided by the smart cathlab application to systematize and standardize the data acquisition. **Observation**: Coronary procedural guidance is part of the bigger ambition to set up a co-creation environment where physicians and AI-developers can work together on the development of clinical applications. In the scope of the project, the focus will be on balloon inflation detection.

Below is a summary of the status of the developments of pilot 7 where 100% of the user requirements are under development.

STATUS	Count	%
Implemented	0	0%
Verified	0	0%
Under implementation	2	100%
TOTAL	2	100%



4.10 Pilot 8 User Requirements

The functional and non-functional requirements of the Pilot 8 are listed below, sorted by execution priority, as defined in D1.3.

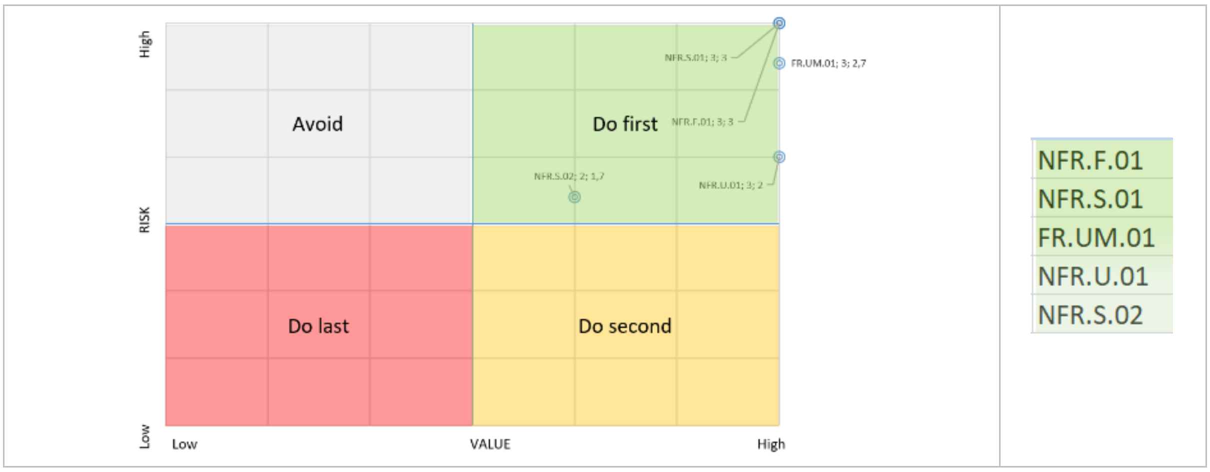


Figure 17: Backlog of requirements of users considered for Pilot 8.

Based on the priorities backlog, the following table indicates the status of **Functional and Non-functional User Requirements**:

ID Priority	Status	Summary
NFR.F.01	Under implementation	URE-130 - Functional suitability
		Title: Bring new discoveries into clinical care
		Description: Clinical researchers should be able to use advances in diagnosis and treatment, when validated
		Connection: TR-108, TR-107, TR-106
NFR.S.01	Under implementation	URE-127 - Security
		Title: Environments that ensure data security
		Description: Protect patient information, recognizing full de-identification is difficult
		Connection: TR-49
FR.UM.01	Under implementation	URE-128 - User monitoring
		Title: Access to different data types
		Description: EMR, medical imaging, genomics, and physiological monitoring data
		Connection: TR-65
NFR.U.0	Under implementation	URE-126 - Usability
		Title: Better access to clinical data for research
		Description: System should enable research within legal parameters to help advance healthcare (see also below)
		Connection: TR-104
NFR.S.02	Under implementation	URE-129 - Security
		Title: Secure computing environment

ID Priority	Status	Summary
		Description: Built for data science to enable discovery, within the hospital setting
		Connection: TR-46, TR-48, TR-36, TR-47, TR-44, TR-43, TR-50

Below is a summary of the status of the developments of pilot 8 where 100% of the user requirements are under development.

STATUS	Count	%
Implemented	0	0%
Verified	0	0%
Under implementation	5	100%
TOTAL	5	100%

5 Retrospective Analysis from Sprints 1 to 4

The Retrospective Analysis marks the culmination of each Sprint loop, offering invaluable insights into the team's dynamics and their developmental progress. A thorough analysis of feedback from all partners reveals a positive trend of improvement across all sprints. As the project progressed, the team honed their collaborative skills and problem-solving capabilities, thus demonstrating growing adeptness within their roles.

	Positive aspects	Areas for Improvement
Sprint 1	– The initial sprint was well-received with all the partners actively participating and providing valuable feedback. – There were excellent discussions around the use of smart devices for treatment and rehabilitation, and impressive progress was noted. – The team also received positive feedback from participants, pointing to a successful first attempt at a sprint.	– The first sprint highlighted the need for a more structured procedure, including a less open reporting template, clearer guidance and better-organized resources. – Some partners expressed the desire for more information about the envisioned solution, indicating a need for better communication and vision sharing. – Improvements were also suggested in terms of documentation storage and usage of digital tools like Jira.
Sprint 2	– The second sprint saw a significant improvement in software presentation, a more aligned time plan, and valuable contributions towards the project's continuous development. – Feedback from this sprint was crucial in refining integration, content definition, and troubleshooting.	– Despite these positive aspects, some partners felt the sprints didn't align with their research processes, suggesting a need for more flexibility in timelines. – Others suggested demonstrating how feedback was incorporated from Sprint 2, increasing the involvement of clinical partners in technical discussions, and continuing interactions among the partners.
Sprint 3	– The third sprint was particularly successful with feedback proving useful for upcoming development activities, improved AI-based scheduler, and the involvement of all end-users. – Partners lauded the management of the sprint, stating that it led to	– However, some challenges were identified such as aligning schedules of all professionals involved, finding a more efficient way to accommodate the busy schedules of clinicians, and prioritizing features. – Some partners felt that more stakeholders should be involved,

	Positive aspects	Areas for Improvement
	smoother involvement of all parts with fruitful results.	and feedback on platform usage could be better received through questionnaires or Jira reports.
Sprint 4	– The final sprint saw high engagement from end-users providing factual and useful insights, and the opportunity to test services in a real environment leading to last-minute improvements. – Partners reported a clear improvement in team communication and noticed significant advancements in platform development and other technical aspects.	– Partners pointed to a need for recruiting more users for diverse feedback and enhancing the participation and adherence of end-users. – Technical communication and additional AI-based functionalities were identified as areas that could benefit from further discussion.

One of the keys to success is balancing the technical and clinical aspects of the project, making sure that all stakeholders are involved, and considering the varied schedules and commitments of the partners. The continuous improvements seen from Sprint 1 to Sprint 4 demonstrate the team's commitment to learning and adapting, pointing to a successful project overall.

Analysis of Team Morale Survey Results

In the following table, should be read:

- PM: Project manager
- D: Developer
- PF: Pilot facilitator
- R: Researcher
- PC: Pilot coordinator/leader: PC
- WP: WP Leader

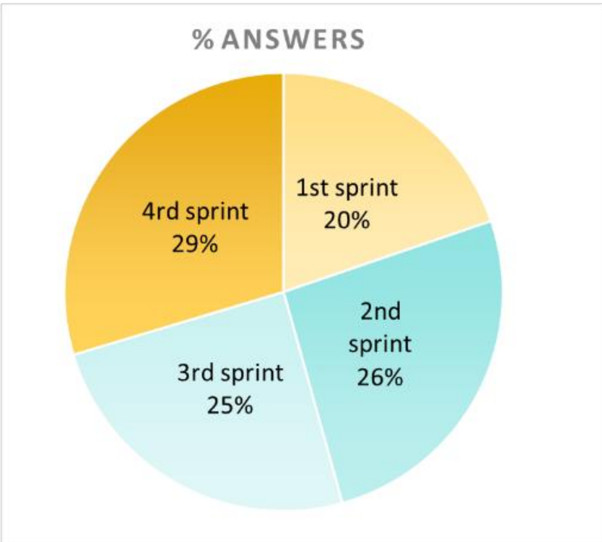


Figure 18: Distributed percentage of Responses among the Sprints.

1st sprint							
Nº Answers	16						
Role/Position in the project	PM	D	PF	R	PC	WP	
	50%	19%	6%	38%	25%	25%	
Years of experience in EU projects	0	1-3	4-6	7-9	>10		
	6,25%	37,50%	6,25	31,25	18,75		
2nd sprint							
Nº Answers	21						
Role/Position in the project	PM	D	PF	R	PC	WP	
	29%	24%	14%	52%	19%	14%	
Years of experience in EU projects	0	1-3	4-6	7-9	>10		
	9,52%	42,86%	19,05%	14,29%	14,29%		
3rd sprint							
Nº Answers	20						
Role/Position in the project	PM	D	PF	R	PC	WP	
	40%	30%	5%	45%	5%	5%	
Years of experience in EU projects	0	1-3	4-6	7-9	>10		
	0,00%	40,00%	15,00%	15,00%	30,00%		
4th sprint							
Nº Answers	24						
Role/Position in the project	PM	D	PF	R	PC	WP	
	29%	38%	4%	21%	17%	8%	
Years of experience in EU projects	0	1-3	4-6	7-9	>10		
	8,33%	41,67%	20,83%	8,33%	20,83%		

Questions	**1st**	**2nd**	**3rd**	**4th**
I am proud of the quality/value of work I produced for HosmartAI at this Sprint	7,6	7,9	7,7	8,0
I am proud of the work delivered to HosmartAI stakeholders	7,9	8,0	7,7	7,8
As HosmartAI team we get stuff done quickly and efficiently	6,8	8,0	7,4	7,4
I had a clear and inspiring mission for this Sprint	6,7	8,3	7,3	8,0
I enjoyed the work done in this Sprint	7,3	8,2	7,4	7,8
I have learnt new things from my engagement with HosmartAI Sprint	7,4	8,3	7,9	8,0
I get the support I need from the team	8,2	8,7	8,2	8,6
I contribute to what will be developed and how	8,4	8,0	7,9	7,9
As HosmartAI team we have good communication and collaboration	8,1	8,3	7,9	8,6

Comparison on results from Team Morale Web Survey

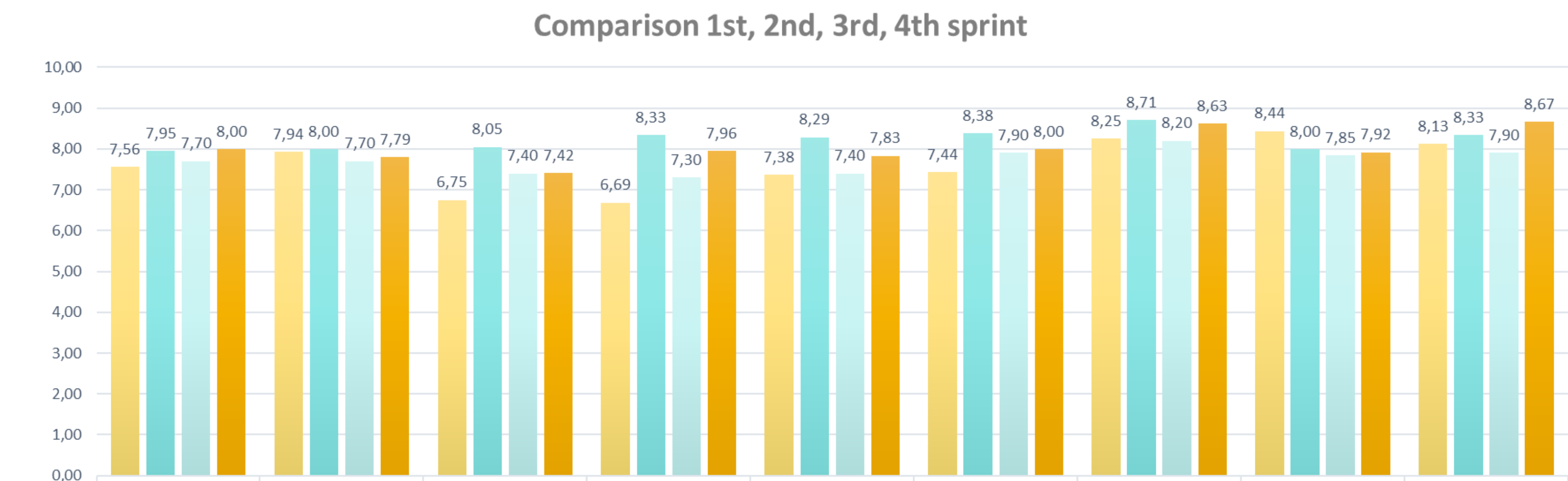
The HosmartAI team morale web survey has demonstrated an overall positive trend across the four sprints, as illustrated by the average scores in Figure 19.

There was a gradual increase in pride regarding the quality of work produced (Q1) and delivered to stakeholders (Q2). The team's efficiency (Q3) and clarity of mission (Q4) significantly improved from the first to the second sprint, and then slightly declined.

Satisfaction from work (Q5) and learning opportunities (Q6) consistently increased over time. Team support (Q7) maintained high scores throughout, reflecting a strong sense of camaraderie. Contribution to development (Q8) remained relatively high, with a minor dip after the second sprint.

Finally, team communication and collaboration (Q9) showed a steady improvement over time, reaching its peak in the fourth sprint, indicative of a healthy team dynamic.

In summary, the data points to a progressive enhancement in team morale and unity over the four sprints, with pride in work, enjoyment, and mutual support emerging as key strengths.



	I am proud of the quality/value of work I produced for HosmartAI at this Sprint	I am proud of the work delivered to HosmartAI stakeholders	As HosmartAI team we get stuff done quickly and efficiently	I had a clear and inspiring mission for this Sprint	I enjoyed the work done in this Sprint	I have learnt new things from my engagement with HosmartAI Sprint	I get the support I need from the team	I contribute to what will be developed and how	As HosmartAI team we have good communication and collaboration
1st sprint	7,56	7,94	6,75	6,69	7,38	7,44	8,25	8,44	8,13
2nd sprint	7,95	8,00	8,05	8,33	8,29	8,38	8,71	8,00	8,33
3rd sprint	7,70	7,70	7,40	7,30	7,40	7,90	8,20	7,85	7,90
4th sprint	8,00	7,79	7,42	7,96	7,83	8,00	8,63	7,92	8,67

Figure 19: Comparison 1st, 2nd, 3rd, 4th sprint.

Figure 20 presents the distribution of years of experience of participants answering the Teams Morale Survey sent out at the end of each sprint.

The general trend across all sprints indicates that the bulk of answering participants consistently fell within the 1-3 years' experience bracket. The representation of other experience levels varied but did not demonstrate significant shifts, suggesting a stable and diverse distribution of experience levels within the team across all sprints.

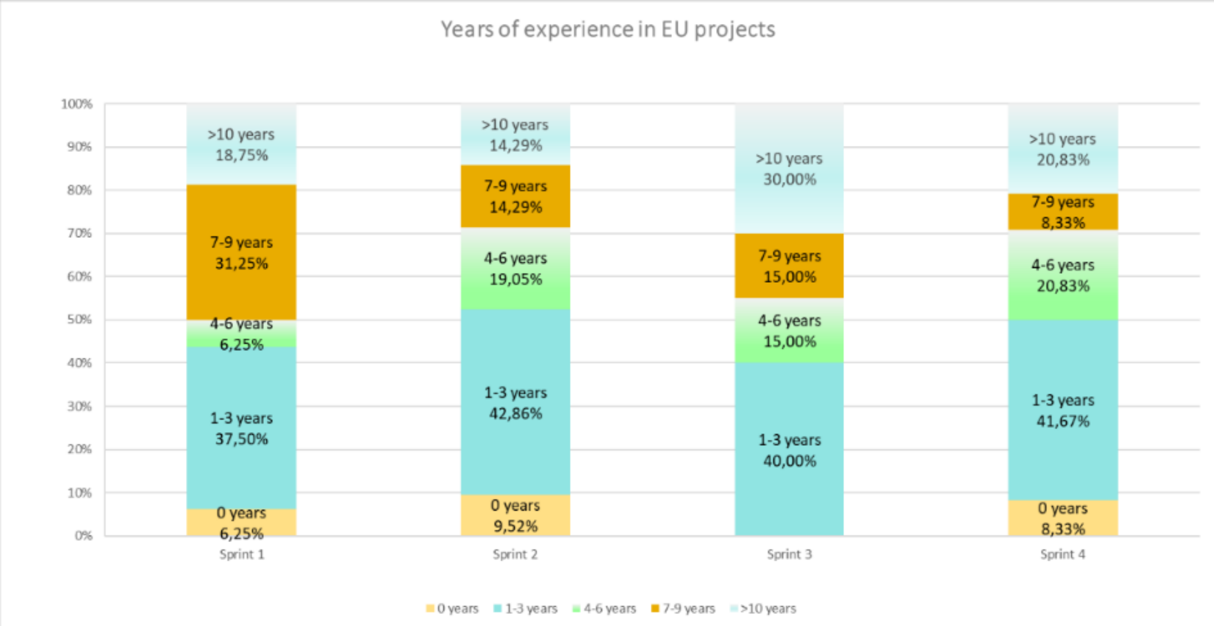


Figure 20: Years of experience in EU projects.

The role-based distribution of survey participants varied somewhat across the sprints, as presented in Figure 21. In general, while there were fluctuations in representation among roles across the sprints, the distribution of roles in the survey remained diverse and broadly balanced throughout the four sprints.

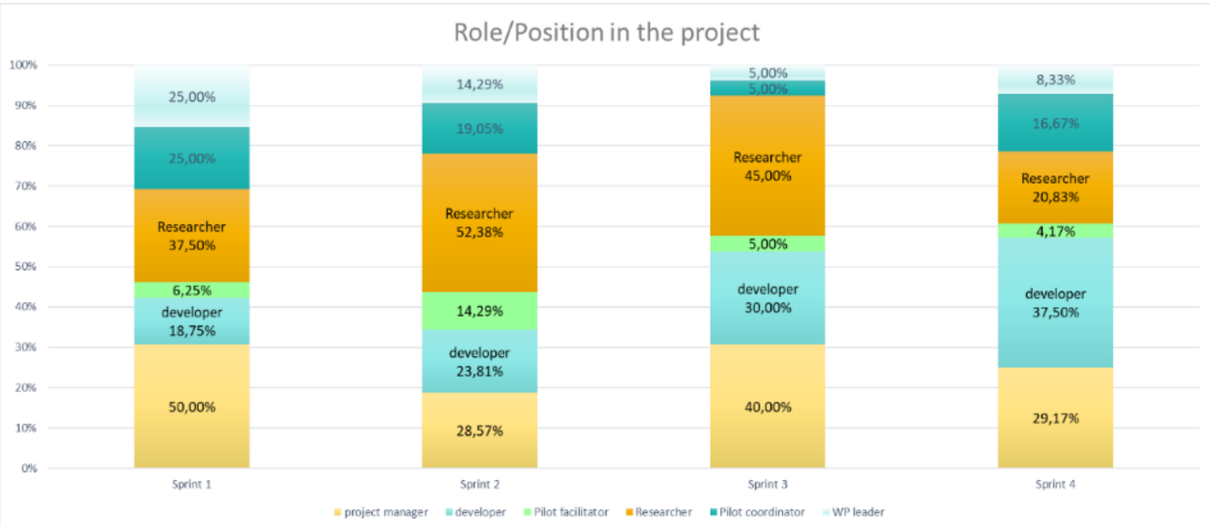


Figure 21: Role/Position in the project.

6 Gleaning Wisdom: Key Lessons from Our Journey

The feedback provided throughout the four sprints gives us valuable insights into the process and outcomes of the project and highlights several areas for continuous improvement as summarized in Figure 22.

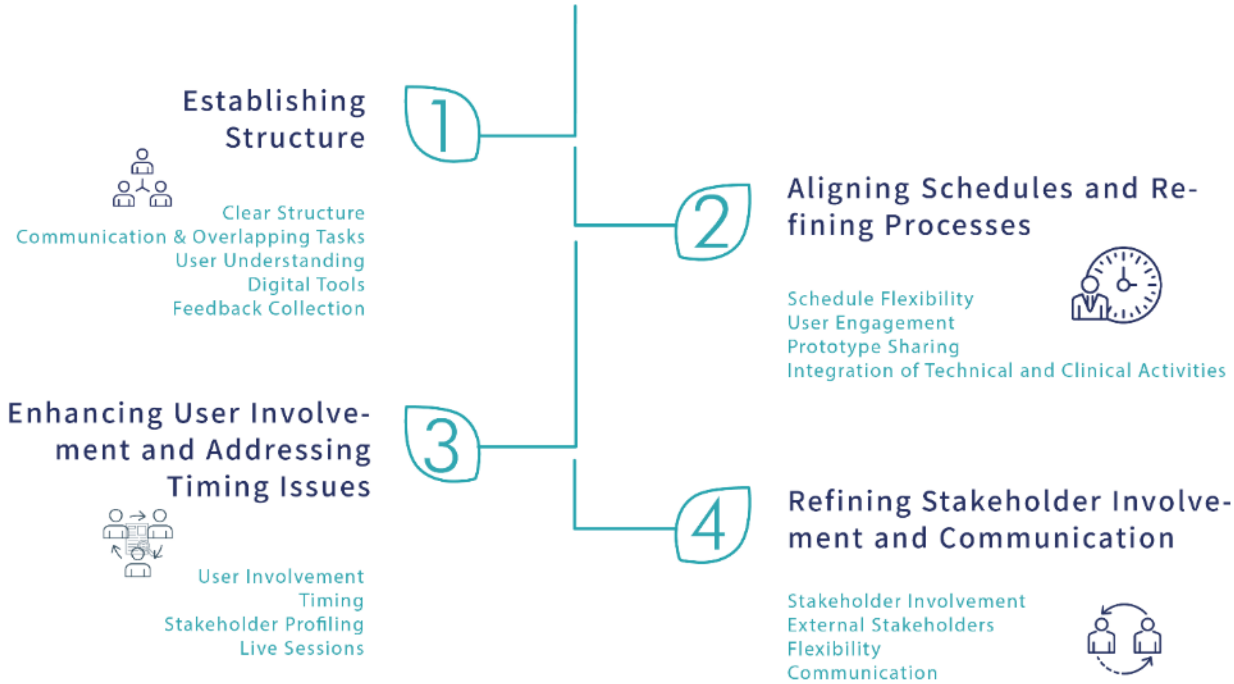


Figure 22: Key learnings.

Sprint 1: Establishing Structure

Key learnings:

- **Clear Structure**: The need for a more structured procedure was mentioned frequently, suggesting the need for clear guidelines and protocols.
- **Communication & Overlapping Tasks**: There were concerns about overlapping tasks across different work packages (WP's), which could be mitigated through clearer communication and delineation of tasks.
- **User Understanding**: It was recommended that future sprints provide more information to participants regarding the envisioned solution to improve understanding and engagement.
- **Digital Tools**: There was a suggestion to improve the use of digital tools such as Jira for better organization and tracking of tasks.
- **Feedback Collection**: The need for more structured feedback collection was highlighted. Feedback is essential for iterative development, and mechanisms for collecting it should be well-established.

Sprint 2: Aligning Schedules and Refining Processes

Key learnings:

- **Schedule Flexibility**: A key suggestion was for more flexible timelines that align with the individual schedules of the various partners and pilots. This would help ensure that all stakeholders are able to contribute effectively.
- **User Engagement**: Engaging end-users early in the process to refine the integration of components and to forecast potential issues was seen as beneficial.
- **Prototype Sharing**: Sharing of prototypes with clinicians and caregivers was seen as useful, as it enabled the identification of strengths and weaknesses of the devices.
- **Integration of Technical and Clinical Activities**: The need for a closer alignment of technical and clinical tasks was highlighted, to ensure that the developed solutions met the needs of end users.

Sprint 3: Enhancing User Involvement and Addressing Timing Issues

Key learnings:

- **User Involvement**: Increasing the involvement of end-users was highlighted as a keyway to generate useful feedback for development activities.
- **Timing**: There were issues with matching the schedules of the various stakeholders (technicians, designers, clinicians). Flexible timelines might be a potential solution.
- **Stakeholder Profiling**: The need to include more stakeholder profiles was mentioned, as well as the need for shorter, more focused co-creation sessions.
- **Live Sessions**: Some partners suggested that platform concept and focus should be discussed in live sessions for better feedback.

Sprint 4: Refining Stakeholder Involvement and Communication

Key learnings:

- **Stakeholder Involvement**: As the applications moved towards becoming minimum viable products (MVPs), end-user engagement increased, and the feedback became more factual. Therefore, involving end-users early and often in the development process can be highly beneficial.
- **External Stakeholders**: It was suggested that more stakeholders from external companies should be considered in future co-creation sessions.
- **Flexibility**: There were some challenges with delays in MVP planning which required flexibility and reorganization.
- **Communication**: There was a clear improvement in the communication and collaboration from one sprint to the next. The communication among partners improved as the sprints progressed, and it was noted that the experience of the participants increased with each sprint.

Undoubtedly, the concurrent co-design and co-development of a multitude of technological and service solutions (1 AI Platform; 8 light-house pilot solutions) across several independent pilot sites within the same sprints approach presented a significant challenge. Each pilot site had its unique set of issues to resolve and diverse use cases to cater to. Bearing this context in mind, the key areas identified from this HosmartAI experience, which can markedly enhance project success, are explored below in Table 8 in which we delve into the main takeaways and the strategies implemented for each area.

Table 8: Key areas identified from this HosmartAI experience.

	Lessons Learned	**Measures for continuous Improvement**
Involvement	Comprehensive involvement of all stakeholders, including clinicians, technical teams, and end-users, is instrumental in achieving satisfying outcomes. It facilitates nuanced discussions and development of solutions catering to everyone's needs.	Strategy of growing stakeholder participation from one sprint to the next. When possible, scheduled co-creation sessions to include a broader range of stakeholders and perspectives.
Perception	Stakeholders' perceptions significantly influence project success. A positive outlook towards challenges and potential solutions expedites the development process.	The Sprints approach already planned for sharing early versions of tools/technologies for feedback and fine-tuning. Leverage sprints to refine problem understanding and solution content.
Flexibility	The agile development model must accommodate varying stakeholder schedules, especially those of clinicians, but also the involved HosmartAI teams.	Adapted timelines helped to align with the pilot solutions unique processes, although there was a common timeframe to start and end key activities fitting the project itinerary.
Timing	Proper timing can increase the participation and commitment of stakeholders in the project. The right timing also facilitates the smooth implementation of tasks and sprints.	Improved the scheduling of sprints and sessions to better fit with stakeholders' availabilities. Aim for a good balance between adequate duration for tasks and maintaining the momentum of the project.
Communication	Clear, concise, and regular communication is key to project success. It is vital to clarify expectations, share progress, and discuss potential	Strengthened the communication processes by leveraging digital tools, hosting regular update meetings, and encouraging open dialogues among partners.

	Lessons Learned	Measures for continuous Improvement
	challenges among stakeholders.	
Technical Alignment and Collaboration	Technical alignment between partners is crucial for the effective execution of tasks. Collaboration between technical and non-technical partners can bridge gaps and create a more unified approach to problem-solving.	Established regular meetings involving technical and non-technical partners to ensure all partners are on the same page. Encourage technical teams to work closely with non-technical partners to understand their needs and limitations.
Adherence and User Participation	Adherence and active participation from end-users in all phases of the project is vital for its success.	Continue approach to enhance strategies to motivate end-users and increase their participation, while maintaining the Teams Morale for more creative solutions.
Structure and Organization	A structured approach to sprints and tasks, along with well-organized resources, facilitates smoother operations.	Improved the structure of documentation storage and the use of digital tools. Provided a clear and concise roadmap of tasks and expectations at the beginning of each sprint.

The information gathered in each sprint retrospective was crucial to the continuous improvement process, helping to adapt and refine strategies over time, as the consortium was gaining more insights.

Our established approach for obtaining these insights incorporated: (i) a biweekly assembly inviting all partners to discuss their progress, address concerns, and collaboratively contemplate potential improvements or challenges; (ii) hosting meetings in a responsive manner contingent upon project needs; (iii) later-phase combined WP1-WP3-WP5 meetings to amplify cohesion and facilitate direct collaboration; (iv) in-depth retrospectives following each sprint; (v) frequent team morale assessments. This systematic process granted the consortium pivotal knowledge and actionable insights to carry forward into subsequent sprints. Identifying these learning patterns across the series of sprints empowered the team to craft increasingly effective strategies within the HosmartAI Sprints Approach.

These lessons can help streamline future methodological transfer and a participatory sprints approach uptake, increase participation, and ultimately lead to the successful execution of a project.

7 Conclusions

This document represents the culmination of continuous refinement and the consolidation of knowledge gathered during the HosmartAI project's Sprints 2, 3, and 4. The challenge of concurrently managing the co-design and co-development of numerous technological and service solutions (1 AI Platform; 8 light-house pilot solutions) across various independent pilot sites, each with unique challenges and use cases, necessitated an approach that was not only flexible but also highly participatory.

The HosmartAI Participatory Framework (presented in D1.2, and continued in D1.3), co-designed with partners through meetings, initial surveys, and workshops between M2-M5, and continuously refined, served as a critical tool in this regard. The framework incorporated a hybrid approach of design thinking, agile, lean start-up methodology, and included Living Lab Methodology and a Stakeholder Community Building Strategy. Sprint events were key components of this approach.

To support the sprints, several tools and processes were employed for the elicitation of user requirements and for the analysis, harmonization, and prioritization of primary and secondary users' needs from a patient-centred care delivery perspective. These tools included sprint timelines, sprint planning details, a guide for co-creation sessions, a co-creation report template, stakeholder involvement monitoring, and a team morale assessment survey. In addition, a dedicated folder for each sprint was maintained, documenting main sprint events.

A successful collaboration is highlighted with a diverse set of 305 stakeholders (among which Patients, Caregivers, Clinicians, Healthcare services managers, Other healthcare professionals, Students/Professors/Guests, Researchers/IT personnel), surpassing the initial KPI. Despite expected challenges, the co-creation approach and proactive mitigation measures yielded user-centric requirements for the HosmartAI solutions.

The key to successfully navigating this complexity has been a stakeholder-inclusive approach and the effective use of scrum tools like JIRA for real-time status updates, enabling the integration of user feedback directly into the development process. At the end of each sprint, partners updated user requirements on Jira, creating a constant feedback loop that helped bridge the gap between the business and technical partners, thereby ensuring the end-users' perspectives were considered. Emphasizing active involvement of all stakeholders, ensuring flexibility to cater to varying schedules, improving communication, enhancing technical alignment, and encouraging user participation have all played vital roles in overcoming the obstacles faced.

The central aim of D1.4 is to present the final version of the User Requirements and the corresponding analysis report. This document outlines critical insights gleaned from the sprints and encapsulates a refined understanding of users' needs. By continuously refining these requirements throughout the project, the team has been able to effectively cater to the stakeholders' expectations and challenges. This continuous cycle of reflection, refinement, and improvement is instrumental in the HosmartAI journey towards user-centric, functional, and impactful results.

The lessons learned have highlighted the importance of iterative development, priority analysis, and retrospective insights, which collectively contributed to the continuous improvement process. The progress made, as encapsulated in the final Deliverable 1.4, underscores the critical role of stakeholder engagement in enhancing the understanding of user requirements. This understanding, in turn, bolsters the effective implementation of the HosmartAI project, making significant strides towards acceptance and usability across the healthcare system.

In conclusion, the HosmartAI project's experience illustrates the power of an agile, inclusive, and adaptive participatory approach in managing complex, multi-site, multi-solution development efforts. The lessons gleaned offer valuable insights for future initiatives, underscoring the potential of such approaches to deliver robust, user-centric solutions that can enhance healthcare delivery.

8 References

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Appendix A Summary sprint pages for platform and pilots

A.1 AI Platform [INTRA]

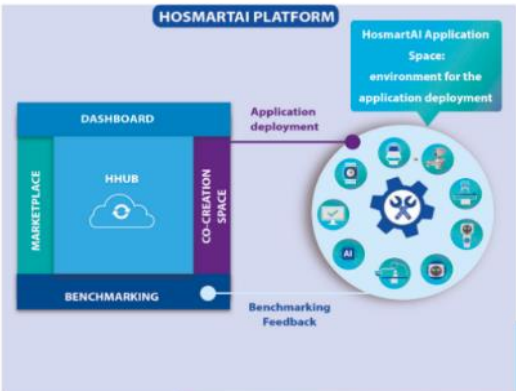
HOSMARTAI

HosmartAI Platform

sprint 1

SPRINT OBJECTIVES

- Specify platform scope
- Get feedback on architecture decisions
- Refine platform requirements



MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Survey	Get feedback on platform scope and components/data/standards to be used	Platform users
Survey	Get feedback on design/impleme tation options	Platform users
Biweekly meetings	Status update and decisions on next steps	Developers

OUTCOMES

- Received feedback on the platform and the technologies to be used
- Requirements maintained in Jira

FEEDBACK INTEGRATION

- Refined platform requirements
- Finalized platform conseptual architecture

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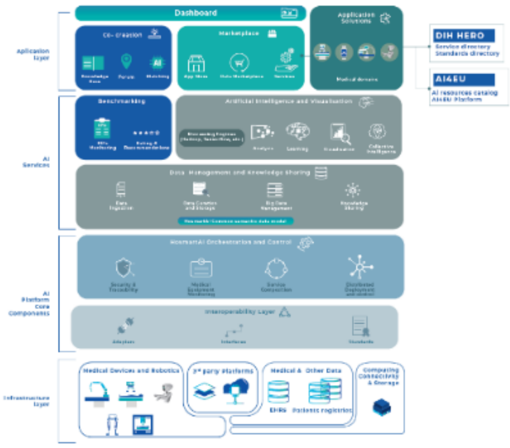
HOSMARTAI

HosmartAI Platform

sprint 2

SPRINT OBJECTIVES

- Receive feedback on ongoing development of v1 of the platform



MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Biweekly meetings	Status update and decisions on next steps	Developers

OUTCOMES

- Kept all up-to-date on developments
- Received comments at all stages

FEEDBACK INTEGRATION

- Comments taken into account in developing v1 of the platform and its components

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HosmartAI Platform

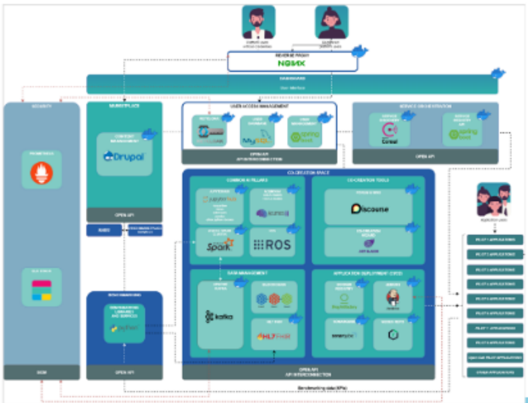
sprint 3

SPRINT OBJECTIVES

- Get feedback on platform implementation
- Shape business approach for platform exploitation

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Get feedback on platform business approach	Platform users
Co-creation session	More detailed feedback on business approach	Platform users
Co-creation session	Get feedback from external stakeholders	Selected external stakeholders
Biweekly meetings	Status update and decisions on next steps	Developers



OUTCOMES

- Received valuable feedback on business approach
- Received feedback on platform implementation

FEEDBACK INTEGRATION

- Restructured platform to better adapt to user needs
- Determined initial business approach

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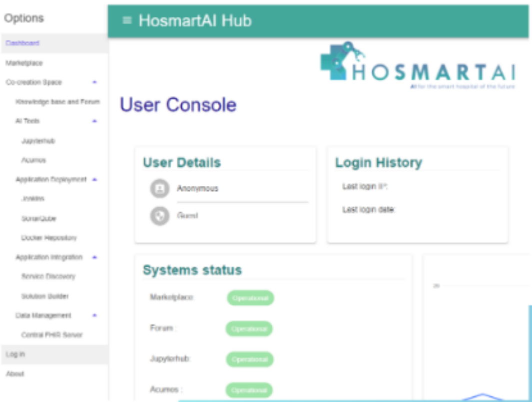
HosmartAI Platform

sprint 4

SPRINT OBJECTIVES

- Incorporate feedback from sprint 3 in platform v2 development
- Refine the existing platform components
- Add user-relevant platform features



MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Survey	Get user feedback on platform and its components	Platform users
Biweekly meetings	Status update and decisions on next steps	Developers

OUTCOMES

- Received feedback on the platform and its componets

FEEDBACK INTEGRATION

- Feedback from sprints 3 and 4 incorporated in developing v2 of the platform
- Feedback from the survey will be taken into account in developing v3

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A.2 Pilot 1: ECHO [AUTH]

HOSMARTAI

Pilot solution 1
ECHO

PILOT 1
sprint 1

SPRINT OBJECTIVES

- Understand the most vital functionalities in the clinical routine
- Demystify AI and discuss its strengths and limitations

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Conceptualise the final solution Reach on an agreement regarding the expectations from the AI	Clinicians

OUTCOMES

- Initial definition of usage scenarios
- Definition of AI objectives

FEEDBACK INTEGRATION

- Circulate the outcomes to both clinical and technical teams
- JIRA – Definition of user requirements

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HOSMARTAI

Pilot solution 1
ECHO

PILOT 1
sprint 2

SPRINT OBJECTIVES

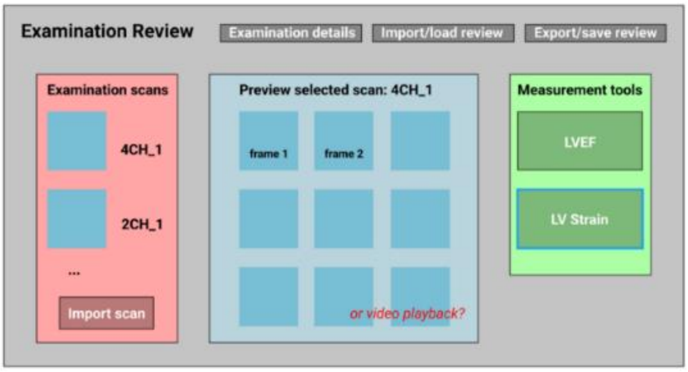
- Specify the first set of functional and non-functional user requirements
- Co-design the wireframes for the first version of the solution

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Produce a first set of specification for starting the development	Clinicians

OUTCOMES

- Draft of wireframes of the final solution
- List of user requirement to transform into technical specification



FEEDBACK INTEGRATION

- The technical team started the development of the solution based on the outcomes
- The wireframes are re-evaluated by clinicians

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HOSMARTAI

Pilot solution 1
ECHO

PILOT 1

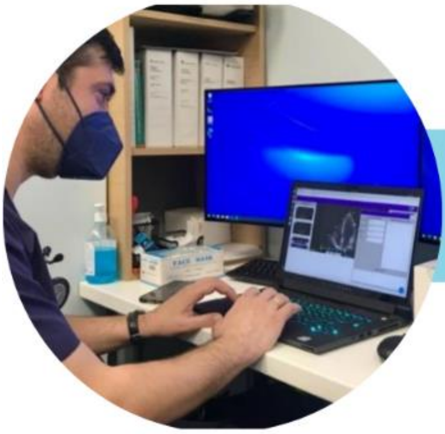
sprint 3

SPRINT OBJECTIVES

- Evaluate the usability and user experience of the first version of the application
- Test the first version of the application in a relevant environment
- Re-visit user scenarios based on the updated needs of clinical study

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Obtain feedback from the clinicians for the first version of the application	Clinicians



OUTCOMES

- Feedback on the first version of the application

FEEDBACK INTEGRATION

- The technical team continued the development of the solution based on the feedback
- The clinical team continue familiarise itself with the new technology provided by the developed solution

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HOSMARTAI

Pilot solution 1
ECHO

PILOT 1
sprint 4

SPRINT OBJECTIVES

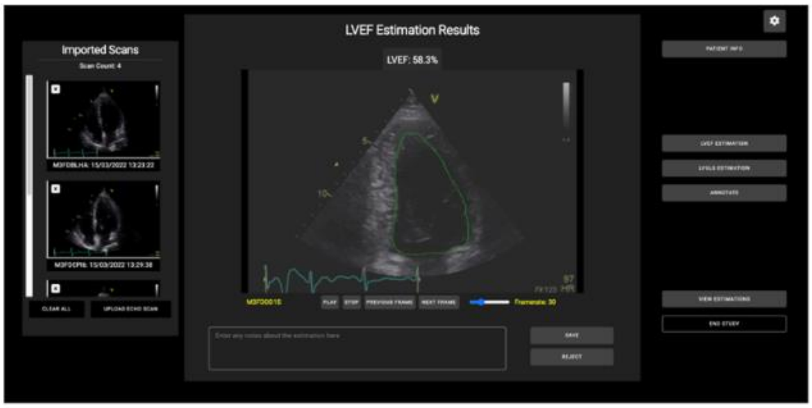
- Evaluate the usability and user experience of the final version of the application (the minimum viable product)
- Deploy and test the final version of the application in the operational environment
- Discuss the continuous monitoring of the application during the clinical study

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Obtain feedback from the clinicians for the final version of the application	Clinicians
	Determine the technical support during the clinical study	Developers

OUTCOMES

- Feedback on the minimum viable product
- Technical support plan



FEEDBACK INTEGRATION

- The technical team started the development of the solution based on the outcomes
- The wireframes are re-evaluated by clinicians

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A.3 Pilot 1: VCE [AUTH]

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Pilot solution 1
VCE

PILOT 1
sprint 1

SPRINT OBJECTIVES

- Understand the most vital functionalities in the clinical routine
- Demystify AI and discuss its strengths and limitations

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Conceptualise the final solution Reach on an agreement regarding the expectations from the AI	Clinicians

OUTCOMES

- Initial definition of usage scenarios
- Definition of AI objectives

FEEDBACK INTEGRATION

- Circulate the outcomes to both clinical and technical teams
- JIRA – Definition of user requirements

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Pilot solution 1
VCE

PILOT 1

sprint 2

SPRINT OBJECTIVES

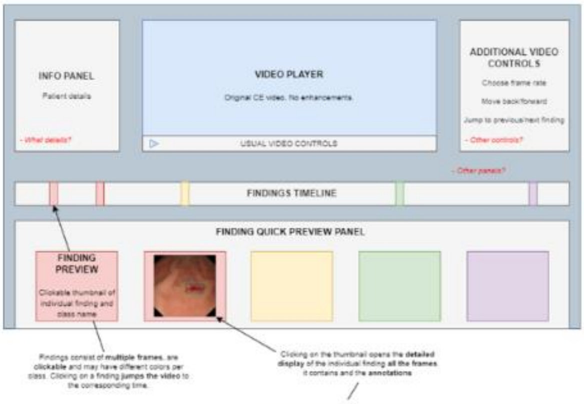
- Specify the first set of functional and non-functional user requirements
- Co-design the wireframes for the first version of the solution

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Conceptualise the final solution Reach on an agreement regarding the expectations from the AI	Clinicians

OUTCOMES

- Draft of wireframes of the final solution
- List of user requirement to transform into technical specification



FEEDBACK INTEGRATION

- The technical team started the development of the solution based on the outcomes
- The wireframes are re-evaluated by clinicians

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Pilot solution 1
VCE

PILOT 1

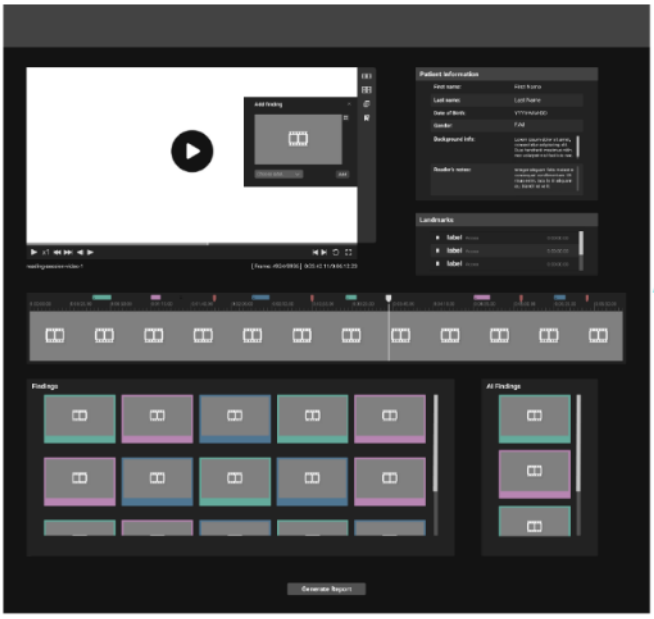
sprint 3

SPRINT OBJECTIVES

- Evaluate the usability and user experience of the first version of the application
- Test the first version of the application in a relevant environment
- Re-visit user scenarios based on the updated needs of clinical study

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Obtain feedback from the clinicians for the first version of the application	Clinicians



OUTCOMES

- Feedback on the first version of the application

FEEDBACK INTEGRATION

- The technical team continued the development of the solution based on the feedback
- The clinical team continue familiarise itself with the new technology provided by the developed solution

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Pilot solution 1
VCE

PILOT 1

sprint 4

SPRINT OBJECTIVES

- Evaluate the usability and user experience of the final version of the application (the minimum viable product)
- Deploy and test the final version of the application in the operational environment
- Discuss the continuous monitoring of the application during the clinical study

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Obtain feedback from the clinicians for the final version of the application	Clinicians
	Determine the technical support during the clinical study	Developers

OUTCOMES

- Feedback on the minimum viable product
- Technical support plan

FEEDBACK INTEGRATION

- The technical team started the development of the solution based on the outcomes
- The wireframes are re-evaluated by clinicians

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A.4 Pilot 1: CCTA [AUTH]

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Pilot solution 1
CCTA medical scenario

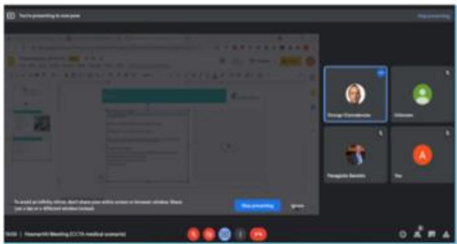
PILOT 1
sprint 1

SPRINT OBJECTIVES

- To develop a concept of an AI system that aids in decision-making for further patient examinations.
- To engage medical professionals in a co-creation process to ensure the system fits clinical needs.
- To finalize objectives/data that must be collected for the AI system.
- To discuss the practical application and limitations of the AI diagnostic tool.
- To establish agreement on additional datasets equipment required for the system.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Design and development of AI system concept	Clinicians (cardiologists), Researchers
User story discussion	Gaining insights on practical application and limitations	Clinicians (cardiologists), Researchers
Evaluation session	Finalize objectives/data and additional datasets equipment	Clinicians (cardiologists), Researchers



OUTCOMES

- A detailed concept of an AI system that helps decide whether a patient needs to undergo further examinations.
- Valuable insights from a medical perspective to lay a good foundation for the ongoing development process.
- Agreement on additional datasets and equipment required for the system's output.
- A discussion on practical application and limitations of the AI diagnostic tool.
- Confirmation that the participants felt satisfied with the results.

FEEDBACK INTEGRATION

- Include clinicians' perspective to ensure the system supports decisions within their practice and assesses the receptiveness of the solution.
- Factor in the shortage of skilled and experienced doctors and the possible adverse effects of multiple examinations.
- Account for the need for a large dataset for training, validation, and testing of the AI system.
- Consideration of the adverse effects of contrast agents and the need for non-repetitive examinations to free up hospital resources.
- Address the question of who and how data entry and handling will be accomplished.

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Pilot solution 1
CCTA medical scenario

PILOT 1

sprint 2

SPRINT OBJECTIVES

- Confirmation and finalization of the recorded functionalities.
- Identification of new functionalities.
- Evaluation of web application's mock-ups and prototype.
- Collection of users' feedback.

MAIN PARTICIPATORY ACTIVITIES

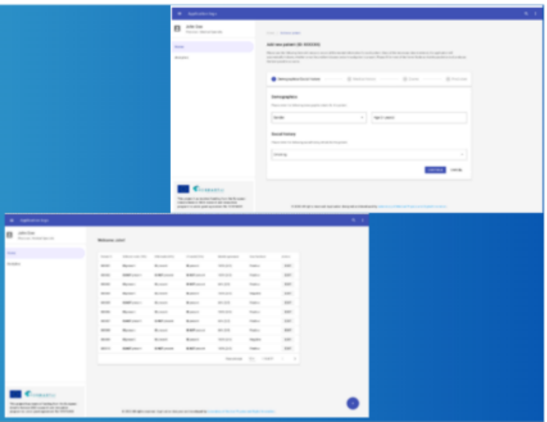
Format sessions	Purpose	Target
Information on the session	To inform the participants about the purpose and structure of the session	Clinicians (cardiologists), Researchers
Information on the status of development	To update the participants about the current status of the project's development	Clinicians (cardiologists), Researchers
Prototype presentation	To showcase the prototype and its functionalities	Clinicians (cardiologists), Researchers
Application design discussion	To gather feedback about the application's design and its usability	Clinicians (cardiologists), Researchers
Feedback collection	To collect the feedback of the participants about the presented mock-ups and use it to improve the application	Clinicians (cardiologists), Researchers

OUTCOMES

- Smoothly conducted session despite slight pressure due to time constraint and numerous matters of consideration.
- Collection of valuable feedback from the collaborating medical team regarding the application's mock-ups design.
- Demonstrated use of the application in real-life cases.
- Evaluation of functionality and usability, as well as the collection of new knowledge.

FEEDBACK INTEGRATION

- Consideration of extending the evaluation of disease presence beyond binary (YES/NO) to a percentage suspicion scale.
- Importance of training aspect noted.
- Concerns about potentially increased false positives or attenuation of the clinical decision-making process, especially for less-experienced practitioners.
- Suggestion for indicating how many clinical variables were missing in each case.
- No specific changes suggested for application design, appreciated user-friendliness, structure, and integration of explainable AI (xAI) functionality.



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Pilot solution 1
CCTA medical scenario

PILOT 1

sprint 3

SPRINT OBJECTIVES

- Identification of explainable AI (xAI) functionality to be integrated in the AI tool.
- Collection and analysis of user feedback on AI tool functionalities.
- Demonstration and explanation of available xAI functionalities and tools.
- Evaluation of the presented tools to assess their value to the end user (clinician).
- Definition of explainable AI (xAI) functionality to be integrated in the AI tools, to help the final user understand and interpret the predictions made by the machine learning models.

MAIN PARTICIPATORY ACTIVITIES

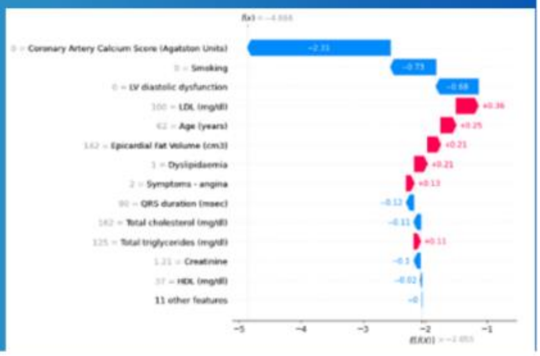
Format sessions	Purpose	Target
Presentation of available xAI functionalities	Demonstration of available AI tools and functionalities	Clinicians (cardiologists), Researchers
Discussion on presented tools	Evaluation of the tools and their value to the end user	Clinicians (cardiologists), Researchers
Collection of participant feedback	Gathering user perspectives and improvement suggestions	Clinicians (cardiologists), Researchers

OUTCOMES

- Positive feedback on the addition of explainable AI(xAI) functionality.
- Identification of SHAP explainability graphs as a valuable tool enhancing user trust in prediction results.
- Suggestion to incorporate more explanatory information to the tool's graphical presentation to ensure it is usable by everyone.
- Overall satisfaction from the participants with the session.
- Feedback that the procedure was clear and well-structured.

FEEDBACK INTEGRATION

- Integration of xAI functionality in the AI tools based on the feedback received.
- Making the SHAP explainability graphs more prominent as they were reported to enhance user trust.
- Incorporating more explanatory information into the graphical presentations of the tool, to make it more user-friendly for those unfamiliar with such graphs.
- Further improvement on the structure and procedure of the session based on the participant feedback.
- Taking into account the time pressure noted by participants, future sessions could potentially be extended or split into multiple parts to alleviate this.



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Pilot solution 1
CCTA medical scenario

PILOT 1

sprint 4

SPRINT OBJECTIVES

- Presentation and evaluation of the final version of the AL predictive algorithms.
- Presentation and evaluation of the fully functional version of the web app.
- Collection of users' feedback for final improvements.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Introductory session	Brief introduction to the session objectives and procedure	Clinicians (cardiologists), Researchers
Presentation session	Presentation of the final version of AL predictive algorithms	Clinicians (cardiologists), Researchers
Demonstration session	Demonstration of the fully functional version of the web app	Clinicians (cardiologists), Researchers
Feedback collection	Collection of real-time feedback from users on the prototype	Clinicians (cardiologists), Researchers

OUTCOMES

- The final version of the predictive models was considered adequate by the cardiologists.
- Suggestions for improvement were provided by the cardiologists for the data entry, prediction outcome, and explainability components.
- The user interface and user experience of the application was found to be intuitive and user-friendly.
- The inclusion of optional features in the prediction was considered a good approach.
- The session was well-structured and both parties were satisfied with the outcome.

FEEDBACK INTEGRATION

- Refine the data entry process by splitting the features into required and optional features.
- Clearly display the prediction result and consider providing prediction confidence or probability for more insights.
- Use force plot for the local explainability component of the predictive model.
- Organize the data entry page in a logical and user-friendly manner and provide clear instructions on how to fill out the form.
- Prioritize the implementation of the recommended improvements based on their impact on user experience.

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A.5 Pilot 1: Obstetrics [AUTH]

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Pilot solution 1
Obstetrics medical scenario

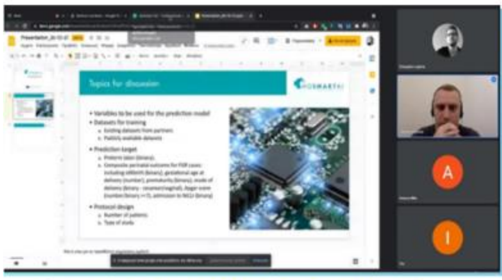
PILOT 1
sprint 1

SPRINT OBJECTIVES

- Gather additional datasets and equipment required for the development of the AI system.
- Discuss the practical application of the AI diagnostic tool.
- Identify and discuss limitations of the planned intervention.
- Finalize the objectives and data to be collected.
- Determine the responsible personnel for data entry and handling.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Engage stakeholders in discussing AI system implementation and identify requirements.	Clinicians (obstetricians), Researchers
User story discussion	Understand different perspectives on AI system and identify its potential reception in the market.	Clinicians (obstetricians), Researchers
Evaluation session	Gauge satisfaction of the participants in the co-creation session.	Clinicians (obstetricians), Researchers



OUTCOMES

- Agreement on additional datasets and equipment required for the AI system.
- Practical application of the AI diagnostic tool was discussed.
- Limitations of the planned model were identified.
- Objectives and data to be collected were finalized.
- A plan for data entry and handling was established.

FEEDBACK INTEGRATION

- The team will factor in the identified need for additional datasets and equipment in the AI system's development
- The practical application feedback will guide the AI system's deployment in the clinical setting
- The identified model's limitations will be addressed in future iterations of the system
- The finalized data and objectives will shape the AI system's future direction
- The agreed upon data entry and handling processes will be incorporated into the system's operations.

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Pilot solution 1
Obstetrics medical scenario

PILOT 1
sprint 2

SPRINT OBJECTIVES

- Confirmation and finalization of the recorded functionalities.
- Possible identification of new functionalities.
- Evaluation of the web application's mock-ups and prototype.
- Collection of users' feedback.

MAIN PARTICIPATORY ACTIVITIES

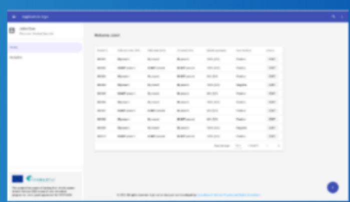
Format sessions	Purpose	Target
Information on the session	To inform the participants about the purpose and structure of the session	Clinicians (obstetricians), Researchers
Information on the status of development	To update the participants about the current status of the project's development	Clinicians (obstetricians), Researchers
Prototype presentation	To showcase the prototype and its functionalities	Clinicians (obstetricians), Researchers
Application design discussion	To gather feedback about the application's design and its usability	Clinicians (obstetricians), Researchers
Feedback collection	To collect the feedback of the participants about the presented mock-ups and use it to improve the application	Clinicians (obstetricians), Researchers

OUTCOMES

- Finalization of the recorded functionalities and identification of new functionalities.
- Evaluation of the web application's mock-ups and prototype by the participants.
- Collection of valuable feedback from the participants, offering insight into potential improvements.
- A better understanding of the application's functionality and usability from the perspective of end-users.
- Enhanced prototype, which takes into account the users' feedback and is well-aligned with the project objectives.

FEEDBACK INTEGRATION

- The feedback from the participants confirmed the potential of the application to contribute to safer management and assessment of FGR cases, and potentially decrease iatrogenic preterm birth.
- Suggestions for making the application user-friendlier were received and will be incorporated in future updates.
- Acknowledging the limitations due to the COVID-19 pandemic, the team will consider solutions for enabling effective use even in such conditions.
- The participants highlighted the need for such applications, especially for evidence-based decision-making in obstetrics, thus reconfirming the relevance and significance of the project.
- The feedback received about the positive and negative aspects of the application will guide the further refinement and development of the solution.



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Pilot solution 1
Obstetrics medical scenario

PILOT 1
sprint 3

SPRINT OBJECTIVES

- Identification of explainable AI (xAI) functionality that will be integrated in the AI tool.
- Collection of users' feedback on the proposed AI functionalities.
- Presentation of available xAI functionalities and tools to the participants (clinicians).
- Facilitate a discussion for the evaluation of the value offered by the presented tools to the end user (clinician).
- Collect and integrate participants' feedback post-presentation discussion.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Status update of development activities	Update clinicians on the current development stage of the AI tool	Clinicians (obstetricians), Researchers
Presentation of xAI functionalities	Describe and demonstrate the different xAI functionalities	Clinicians (obstetricians), Researchers
Tool evaluation discussion	Evaluate the usefulness and effectiveness of the presented tools	Clinicians (obstetricians), Researchers
Collection of feedback	Gather thoughts, insights, and suggestions from participants	Clinicians (obstetricians), Researchers
Information on the purpose of the session	Educate participants on the goals and objectives of the session	Clinicians (obstetricians), Researchers

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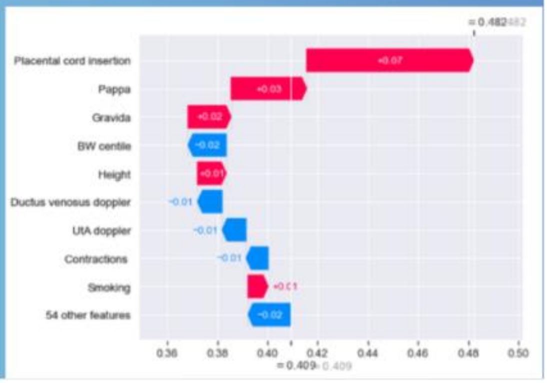
Pilot solution 1
Obstetrics medical scenario

PILOT 1

sprint 3

OUTCOMES

- Define explainable AI (xAI) functionality that will be integrated in the AI tools to help the end user (obstetrician) understand and interpret the predictions made by the machine learning models.
- Positive feedback from the collaborating medical team on the addition of the explainable AI (xAI) functionality.
- Enhanced trust in the tool to be developed, particularly with the local explainability component that considers each incident individually.
- Positive feedback on the user interface of the tool, especially the addition of the SHAP explainability graphs.
- Successful collection of valuable feedback for the further development of the tool.



FEEDBACK INTEGRATION

- Feedback on the addition of explainable AI (xAI) functionality will be considered in further development stages of the tool.
- Consideration of the need for local explainability for individual incidents as suggested by participants.
- Integration of SHAP explainability graphs into the tool as positively received by participants.
- Continuation of involving end users (clinicians) in the development process to ensure the tool's usability and practicality in real scenarios.
- Future improvements and enhancements will be made based on the feedback and observations collected during the session.

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Pilot solution 1
Obstetrics medical scenario

PILOT 1

sprint 4

SPRINT OBJECTIVES

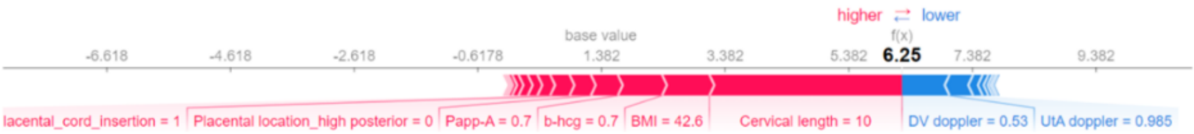
- Presentation and evaluation of the final version of the AI predictive algorithms.
- Presentation and evaluation of the fully functional version of the web app and its UI.
- Collection of users' feedback for final improvements.
- Improvement of data entry components.
- Enhancement of the User Interface and Experience.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Presentation and evaluation of the final version of the AL predictive algorithms	Clinicians (obstetricians) , Researchers
UI demonstration	Presentation and evaluation of the fully functional version of the web app and its UI	Clinicians (obstetricians) , Researchers
Feedback collection	Collection of users' feedback for final improvements	Clinicians (obstetricians) , Researchers

OUTCOMES

- Successful presentation and evaluation of the final version of the AL predictive algorithms.
- Successful demonstration of the fully functional version of the web app and its UI.
- Valuable users' feedback for final improvements collected and considered.
- Clinicians agreed on the importance of separating features into required and optional for predictions, enhancing the data entry process.
- Clinicians preferred the force plot for use in the explainability component.



FEEDBACK INTEGRATION

- The feedback from obstetricians was used to make final improvements to the model and its features.
- Following feedback, it was decided to separate features into required for prediction and optional ones.
- The prediction outcome component was revised to clearly and prominently display the prediction result.
- Feedback from the session will be added to the tool's backlog and used to refine the existing prototype.
- User Interface will be further enhanced based on the feedback, grouping related fields together and improving usability.

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A.6 Pilot 2 [CHUL]

HOSMARTAI

Pilot 2 solution
AI-based appointment software for a radiotherapy department

PILOT 2
sprint 1

SPRINT OBJECTIVES

- Engage and co-create with stakeholders refining the pilot concept;
- Gather stakeholders initial feedback on potential and viability;.
- Validate the accuracy and relevance of the identified "personas" (fictional user representations guide user-centered design process).

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session (face-to-face)	Explain concept Obtain initial feedback	Patient/Healthcare professionals/IT specialist/Physicist/ Administrative staff

OUTCOMES

- Feedback of "personas"
- Refinement of the pilot concept and needs
- Refinement of the requirements according to participants' feedback ans user story

FEEDBACK INTEGRATION

- Refined "personas" aligning with the highlighted needs and pilot concept;
- Personas communicated to pilot 2 team, to accompany the developments
- JIRA – Definition of user requirements

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Pilot 2 solution
AI-based appointment software for a radiotherapy department

PILOT 2

sprint 2

SPRINT OBJECTIVES

- Investigating the optimal method for incorporating a satisfaction screening questionnaire into the tools..
- Understanding the necessary components for the developmentof the scheduler
- Identify the most important variables that have to be included in the scheduler
- -First version of the scheduler. Feedback of the CHU Liège stakeholdres
- -unreveal the missing technical requirements that are absolutely necessary to establish the optimal schedule
- Investigate which CHU de Liège softwares and which queries have to aligned with the scheduler
- Agrre that the software should recalculate once a day all patients scheduled for the day after clicking a button once.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Determine the value of each tech. component; Refine the integration of the solution; Identify data to be collected.; Define APE domains/ categories.;Explain the login process and obtain initial feedback.	Patients
Co-creation session		Clinicians

OUTCOMES

- Better understanding of the HosmartAI engineers (ICTL, UM and TMA) of the needs of doctors , nurses and appointment coordinators.
- First version of the scheduler (ergonomics, functionalities, end-user rights utilisation, etc).
- Continous improvement of the scheduler through the co-creation process.
- Highlight the technical issues to solve and to fulfill by all the technical partners

FEEDBACK INTEGRATION

- User requirement refinement via JIRA aligned project objectives with user needs.
- CHU Liège/ITCL/UM.
- Highlighted viability and improvement areas (WP7 connected).
- CHU Liège/ITCL improved login system structure, enhancing user accessibility.
- CHU Liège sent to UM story lines for Chatbot
- Flow Diagram of breast, lung tumor and bone metatstasis treatment completed.

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Pilot 2 solution
AI-based appointment software for a radiotherapy department

PILOT 2
sprint 3

SPRINT OBJECTIVES

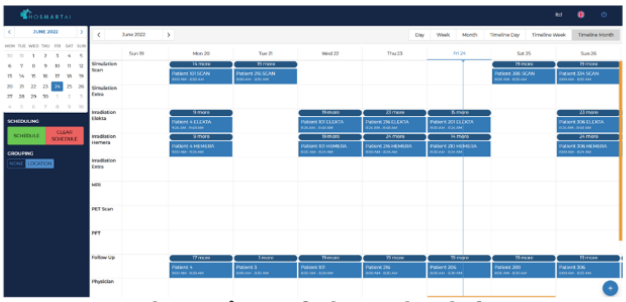
- Finalization of the data specification to be sent to HOSMARTAI, within the benchmarking and assessment framework.
- Improve the first version of the Appointment Scheduling Software following the requirements of the CHUL healthcare professionals.
- Add the Chabot to the system with French dialogue offered to patients durin appointment changes.
- Identify which are the technical issues to be still solved and fulfilled by all the technical partners
- Increase adherence of the appointment coordinators

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	· Continuous improvement of the second version of the scheduler which at this point queries data from 3 different software of CHU de Liège (EHR, Mosaïq software and Ultragenda software) ·Web interface improvements based on health profesionnals recommendations of CHU Liège.	Technical staff at ITCL and CHU de Liège
Co-creation session	• Testing the 2nd version of the scheduler by the healthcare professionals and administrative staff • Methodology for connecting the Chatbot with the scheduler • Construtive feedback from all the stakeholdres	Healthcare and administrative staff at CHU de Liège

OUTCOMES

- Improving and increasing data transfert from the 3 CHU de Liège software to the scheduler
- Improving the ergonomics of the scheduler for reaching the best as possible an easy and user-friendly tool.
- Co-create the dialog to be proposed by the Chatbot



2nd version of the scheduler

FEEDBACK INTEGRATION

- ALL SYSTEM DATA OF CHU LIÈGE WERE INTEGRATED INTO THE SCHEDULER.

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Pilot 2 solution AI-based appointment software for a radiotherapy department

PILOT 2

sprint 4

SPRINT OBJECTIVES

- Validate the last version of the scheduler
- Integrate de mobile application and the Chabot

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation workshops	Improve various aspects of the scheduler such as ergonomics, data integration and the inclusion of new patients in real time in the remaining free slots of the scheduler	Cilinician/ITCL, UM and CHU Liège IT/project manager at CHU Lièege
Face-to face	Obtaining as much as possible feedbacks from all the healthcare professionals as well as administrative and IT staff of CHU de Liège	Clinicians/nurses/administrative staff

OUTCOMES

- BackEnd operated successfully with the Chabot and the mobile application with necessary adjustments post co-creation activities.
- Partially integration between the Chabot and the mobile application.
- Communication between CHU Liège and FHIR service successful and completed
- Appointments Web application of the scheduler revised by the health profesionals and adjustements following co-creation activities.
- Received suggestions to improve the plan format for improving the scheduler
- Logistic algorithm , deployment of scheduler with real patient data
- New ideas for the framework of the creation of motivational content, and gathered assertive feedback on what to do and not within the creation of the motivational content.

FEEDBACK INTEGRATION

ALL SYSTEM DATA OF CHU LIÈGE WERE INTEGRATED AND VALIDATE INTO THE SCHEDULER.

A.7 Pilot 3 [IRCCS]

HOSMARTAI
AI for the smart hospital of the future

Pilot solution 3
Smart rehabilitation room

PILOT 3
sprint 1

SPRINT OBJECTIVES

- Co-design the service with physiotherapists and technical partners
- Define expected functionalities
- Understand limitations
- Orientation on "to dos and not to dos"

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Semi-structured Interviews	Collect evidences to build Personas	Patients, caregivers, physiotherapists
Co-design session	Describe the functionality of VIMAR devices understandable to physiotherapists	Technical partner (VIMAR), physiotherapists
Co-design sessions	Explore to dos / not to dos, ideas, barriers and limitations	Physiotherapists

OUTCOMES

- Clear understanding of sensors and devices actual functionalities. Alignment between technical partner and medical team.
- First prototype of the service we are co-designing
- Physiotherapists (users) active engagement in idea generation

FEEDBACK INTEGRATION

- Refined "personas" aligning with the highlighted needs and pilot concept;
- Functionalities shared with clinical and technical team
- JIRA – Definition of user requirements

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Pilot solution 3
Smart rehabilitation room

PILOT 3

sprint 2

SPRINT OBJECTIVES

- Exploring users (patients' and physiotherapists) perception of the service
- Testing the usability of the devices patients will interact with
- Testing the usability of VIMAR app physiotherapists will use to manage the smart rehabilitation room
- Co-define the positioning of the rehabilitation devices and sensors in the smart rehabilitation room.
- Co-define how i-Prognosis and i-Mat could fit in pilot 3 service.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
semi-structured interviews	explore users perception of a prototype of the new servicex	Patients, physiotherapists
Usability test	explore Vimar view app usability and improve the labels	Physiotherapists
Usability test	explore patients interaction with service badge and other devices	Patients
Co-design session	define the new setting of the service	Physiotherapists, technical partner
Co-design session	define i-Prognosis and/or i-Mat integration scenario	Physiotherapists, technical partner

Pilot solution 3
Smart rehabilitation room

PILOT 3

sprint 2

OUTCOMES

- Patients and physiotherapists will accept the service, but minor worries are identified: some patients will not be able to work alone, a mixed model with at least one physiotherapist in the room needs to be explored.
- Labels of Vimar View app improved, but still not fully usable. Further work is needed.
- Need to adjust the height of the badge reader and to provide visual feedback to patients
- Map of the smart rehabilitation room
- I-Prognosis is not suitable for pilot 3, while
- i-Mat is interesting and will be developed.

FEEDBACK INTEGRATION

- Definition of the organisational model: physiotherapists / patients ratio will improve from 1:2 to 1:3, but no patient will work alone in the room.
- improved Vimar View app labeling
- device usability requirements trasmitted to installers
- map of the smart rehabilitation room trasmitted to installars
- development plan fo i-Mat shared with technical partner AUTH

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Pilot solution
Smart rehabilitation room

PILOT 3
sprint 3

SPRINT OBJECTIVES

- Installation of Ultra Wide Band sensors in real-life environment
- Test and refinement of VIMAR app setting in real-life environment (user perspective)
- Analysis of iPrognosis/iMat monitoring tools: define possible scenarios of integration and usability (expert perspective)
- Co-design of iMat exercises, prototyping, development and test
- Test of the MVP of the service, namely the new setting of the laboratory of rehabilitation technologies (user perspective)
- Definition of use cases for virtual sensors (AI) and prioritization analysis

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Brainstorming workshop with Vimar and physiotherapists, trial and error	Installation of Ultra Wide Band sensors in the smart rehabilitation room, technical testing and user perspective	Physiotherapists and technical partner
Co-design workshop, usability test with physiotherapists	Test and refinement of Vimar View app setting in real-life environment (user perspective): improve labels, verify new user experience of the interface, test the app in the smart rehabilitation room	Physiotherapists
Expert analysis with clinicians and physiotherapists	Define deployment scenario for i-Prognosis / i-Mat	Physiotherapists and technical partner
Co-design session, prototype and test	Definition of iMat exercises, prototyping, development and test	Physiotherapists and technical partner
Usability test and/or participant observation with patients and physiotherapists	Real-life test of the new setting of the smart rehabilitation room (test of service MVP, focus on user perspective)	Patients, physiotherapists
Online brainstorming and idea prioritization analysis on Mural	Define virtual sensors (AI) use cases and development scenario	Physiotherapists, technical partner

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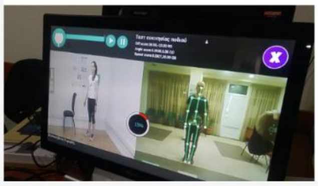
Smart rehabilitation room

PILOT 3

sprint 3

OUTCOMES

- Integration of UWB in the smart rehabilitation room. Use cases definition.
- Identify how to improve the user experience of the Vimar View app
- Development and deployment path for i-Prognosis / i-Mat defined
- I-Prognosis / i-Mat app exercises defined and recorded
- Smart rehabilitation room is well perceived by patients and physiotherapists
- Virtual sensors (AI) use cases defined



FEEDBACK INTEGRATION

- UWB use cases and positioning in the smart rehabilitation room shared with tehnical partner that then installed it.
- Feedback about Vimar View shared with technical partner, update of labels and app architecture
- Development and deployment path for i-Prognosis / i-Mat shared with technical partner
- I-Prognosis / i-Mat app exercises sent to technical partner for customized app development
- Perception of smart rehabilitation room shared with technical partner for small adjestment of the service
- Virtual sensors (AI) use cases shared with technical partner for development

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Pilot solution 3
Smart rehabilitation room

PILOT 3
sprint 4

SPRINT OBJECTIVES

- Final developments of iMAT and usability test with physiotherapists and patients
- Test final version of Vimar View app
- Definition of Cloud touchpoint for user experience
- Test and refinement of user interface developed by subcontractor to monitor patients data and KPIs
- Test the service in a real session (patients treatment, data collection)
- Analysis of potential organizational barriers

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
co-design iterations with AUTH, expert test with physiotherapists involved in service delivery	Test iMat in a real-life setting to provide feedback for the last co-design iteration	Phyiotherapists and technical partner
co-design with physiotherapists involved in service delivery and developer	Evaluate the last version of Vimar View app in real-life setting	Phyiotherapists and technical partner
Definition and sharing of smart room use cases, online co-design session with subcontractor Khymeia	Definition of Cloud functionalities and user interface	Phyiotherapists and technical partners
co-design iterations with Khymeia and usability test with physiotherapists involved in service delivery.	Test and refinement of cloud user interface for patients and KPIs monitoring	Phyiotherapists and technical partners
Evaluation of the final prototype of the service	Evaluate the acceptability of the final setting of the service in a real session	Patients and physiotherapists
semi-structured Interview with physiotherapists coordinator	Identify and prevent potential organizational barriers	Physiotherapists coordinator, physiotherapists

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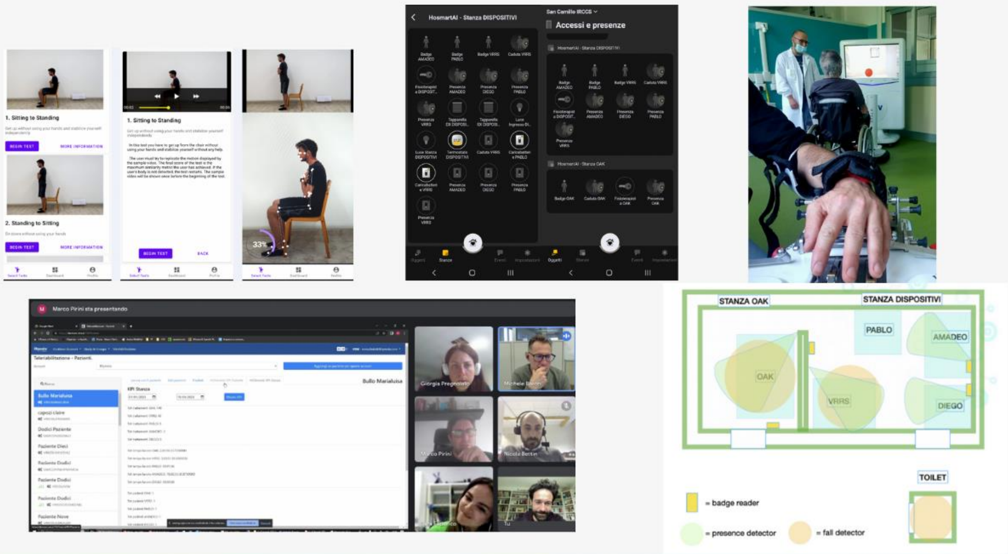
OUTCOMES

- Feedback on pre-final version of iMAT
- Define final version of Vimar app
- definition of cloud functionalities for KPI monitoring
- final version of cloud user interface
- final version of the service
- engaging the clinical service coordinator and define potential barriers



FEEDBACK INTEGRATION

- Technical partner AUTH received the feedback on pre-final version of iMAT, implemented it and provided the final version
- Final version of Vimar View app provided to physiotherapists
- List of cloud functionalities shared with technical partner for implementation
- Cloud interface validated with users (physiotherapists). Minor refinements ongoing.
- Final setting of the smart room rehabilitation validated and tested in real-life
- New organizational model shared with physiotherapists coordinator and personnel involved in service delivery

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A.8 Pilot 4 [SERMAS]

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Pilot solution 4

"Robotic Magnetic Navigation for mapping (using AI) and ablation of cardiac Arrhythmias"

PILOT 4

sprint 1

SPRINT OBJECTIVES

- Demo of remote magnetic navigation (Jose controlled the robot in Zurich remotely from Madrid)
- Feedback and thoughts about the demo
- Things to consider when automating cardiac ablation procedures
- Limitations of the planned in-vitro study

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Demo of remote magnetic navigation (Jose controlled the robot in Zurich remotely from Madrid)	Medical expert
Co-creation session	Feedback and thoughts about the demo	Medical expert and Robotics researcher

OUTCOMES

- Demo of remote magnetic navigation went well and seems like a feasible idea to further persue
- (Semi-)Automation of cardiac ablation procedure can be very valuable
- Automation of even small parts of the procedure will save human minutes and therefore allow more patients to be properly treated
- Incorporate operators' feedback before some steps to make sure everything goes smoothly (e.g. confirmation of ablation trajectory, manual application of ablation energy)
- Limitation of the planned in-vitro study
- Not movement in the heart model
- No blood flow

FEEDBACK INTEGRATION

- Useful insight of the procedure from a medical perspective
- Useful feedback on the current progress and further plans for the robotic system
- Good foundation for the ongoing development process requirements

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Pilot solution 4

"Robotic Magnetic Navigation for mapping (using AI) and ablation of cardiac Arrhythmias"

PILOT 4

sprint 2

SPRINT OBJECTIVES

- Define Interface
- Discuss challenges and future directions in catheter ablation
- Real experience in Atrial Fibrillation ablation procedure.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Define interface between cardiac mapping algorithm and robotic system for catheter ablation	Medical expert and Robotics researcher
Co-creation session	Have a in-vivo experience in Atrial Fibrillation ablation procedures	Medical expert and Robotics researcher

OUTCOMES

- ETHZ elaborated on what information and data is needed to navigate the robotic system autonomously
  - The robotic system needs to know the environment in which it is being navigated (the anatomy)
  - The robotic system needs to know the ablation targets to which the robot needs to be navigated
- There are currently some legal issues that keep us from working with actual data at the moment
- 91 proposed to use a dummy patient, feed it to the mapping algorithm and provide ETHZ with the anatomy and the targets
- Feedback on automated catheter navigation:
  - Targets
    - Generate equally spaced targets in between selected targets
  - Force
    - 10g is desired (not mandatory)
    - Surface contact (required) - not just in front of the surface
- Feedback on semi-automated catheter navigation:
  - A velocity control based controller could be interesting
  - Something that indicates when the user reaches the end of the workspace

FEEDBACK INTEGRATION

- Interface between the robotic system will be defined by:
  - Environment (STP-file of the anatomy)
  - Ablation targets (csv-file containing x-, y- and z-position of the targets)
- 91 will provide data of dummy patient to test the pipeline until legal requirements for working w/ actual patients are fulfilled
- Feedback on automated catheter navigation:
  - Targets
    - Generate equally spaced targets in between selected targets
  - Force
    - Surface contact (required) - not just in front of a surface
- Feedback on semi-automated catheter navigation:
  - The automated is more appealing
- The future direction of catheter ablation:
  - Automated mapping could also be an interesting direction for the robotic system

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"Robotic Magnetic Navigation for mapping (using AI) and ablation of cardiac Arrhythmias"

PILOT 4

sprint 3

SPRINT OBJECTIVES

- Solve Legal issues about patient data
- Send real patient data to 91
- Send real electrophysiology hardware to ETHZ

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Send real patient data to 91 from electroanatomical maps in order to obtain a new functional interface (offline analysis)	Medical expert and AI researcher
Co-creation session	To get approval from Ethics committee to use real patient data	Medical expert
Co-creation session	Send real cahteters and sheath to ETHZ	Medical expert and robotics researcher

OUTCOMES

- Informed consent was obtained to analyze electroanatomical maps (offline) from real patients
- Start sending real patient data to 91 from electroanatomical maps
- Created data maps using actual patient data from SERMAS following approval of the ethical protocol.
- Researched various data mapping technologies, including openEP and ElectroMap, to identify the most suitable option for the project.
- Obtained preliminary results using mock data, which were presented in accompanying images.
- Established a robust infrastructure for the project, initially utilizing Google Cloud and later transitioning to AWS to enhance technological capabilities.
- Robotics is fully developed by EHTZ


Hospital Universitario La Paz

DICTAMEN DEL COMITÉ DE ÉTICA DE LA INVESTIGACIÓN CON MEDICAMENTOS

CERTIFICA

FEEDBACK INTEGRATION

- Legal issue about patient data was solved
- Real patient data is being used successfully to develop and improve new cardiac maps
- Robotics is already functional

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"Robotic Magnetic Navigation for mapping (using AI) and ablation of cardiac Arrhythmias"

PILOT 4

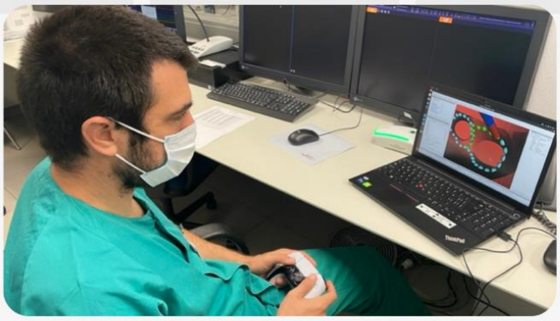
sprint 4

SPRINT OBJECTIVES 1 MAGETIC ROBOTIC NAVIGATION SIMULATOR

- Session goals:
- To test the software and the simulator
- To plan for simulated ablation points around the pulmonary veins
- To perform a simulated ablation procedure
- Planned participants:
- 5 to 6 Cardiac electophysiologists
- List of questions / activities that should guide the discussion for collecting value insights from the participants:
- Feedback expected from every participant, in form of commentaries and in form of SUS questionnaire
- Planned Date and Agenda:
- April 2023: To organize the shipment of the laptop PC (simulator) form Zurich to Madrid
- May 2023: To install the laptop PC in our Clinical Electrophysiology area in the Hospital
- Late May and June 2023: All the users (cardiac electrophysiologists) will test the simulator

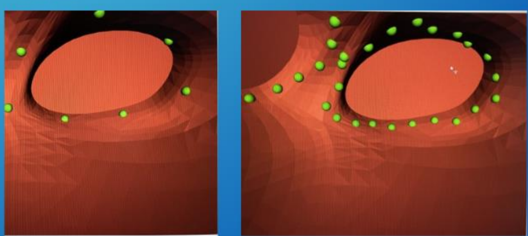
MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	To test the robotic simulator for pulmonary vein ablation	Clinicians
Co-creation session		Robotic researcher



OUTCOMES

- Globally: The magnetic robotic simulator was tested by all participants
- All the participants were able to create an ablation trajectory around pulmonary veins
- All the participants were able to follow the ablation points created
- The participants provided between 1-5 tests



FEEDBACK INTEGRATION

- Testing the robotic magnetic simulator was successful
- In general, the participants felt comfortable with the simulator
- Between 1 and 5 test was performed by every participant
- The average time to create the ablation trajectory was 4 minutes and the average time to follow the ablation target was 7-8 minutes

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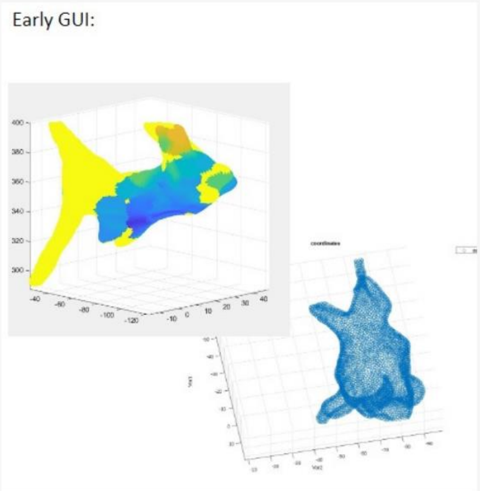
PILOT 4

sprint 4

SPRINT OBJECTIVES 2 GRAPHICAL USER INTERFACE (GUI) DEVELOPMENT

- Session goals:
- To continue the upload of real atrial fibrillation ablation procedures cardiac maps (anonymized) to 91
- 91 will continue and finalize the development of the GUI



MAIN PARTICIPATORY ACTIVITIES

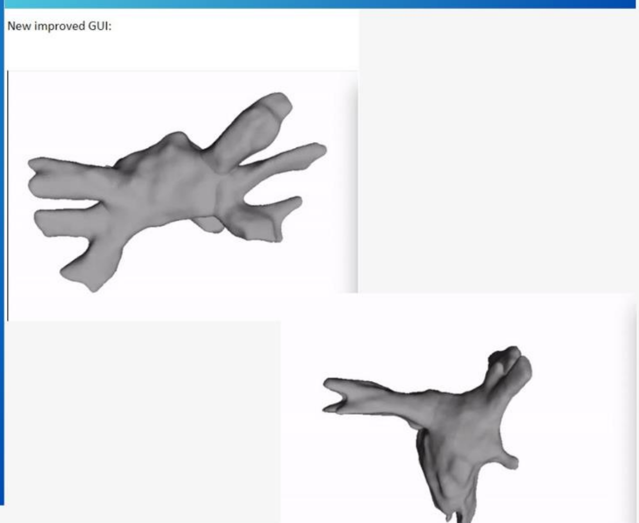
Format sessions	Purpose	Target
Co-creation session	To provide a new output for of the GUI	Clinicians
Co-creation session		AI researchers

FEEDBACK INTEGRATION

- Good work during the Sprint by sending data to 91 and in turn 91 provided a very good and improved output of the GUI

OUTCOMES

- Globally: The new output of the GUI is improved in comparison to the first one from last year.
- Both atria, right and left and pulmonary veins are clearly identifiable



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A.9 Pilot 5 [UM/UKCM]

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Pilot solution 5
Socially Assistive Robot in Nursing

PILOT 5
sprint 1

SPRINT OBJECTIVES

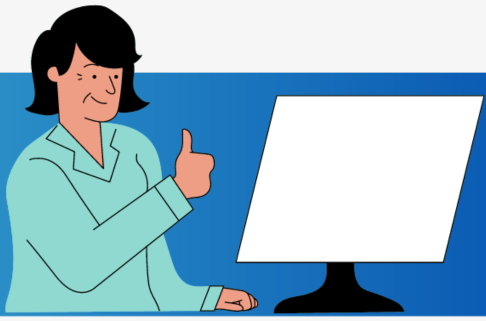
- Engage and co-create with stakeholders refining the pilot concept;
- Gather stakeholders initial feedback on potential and viability;
- Validate the accuracy and relevance of the identified "personas" (fictional user representations guide user-centered design process).

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation workshops	Explain concept Obtain initial feedback	Nurses
Co-creation workshops	Explain concept Obtain initial feedback	Clinicians

OUTCOMES

- Approval of "personas"
- Refinement of use cases
- Outline of the storylines and user stories



FEEDBACK INTEGRATION

- Refined "personas" aligning with the highlighted needs and pilot concept;
- Personas communicated to pilot 5 team, to accompany the developments
- JIRA – Definition of user requirements

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Pilot solution 5
Socially Assistive Robot in Nursing

PILOT 5
sprint 2

SPRINT OBJECTIVES

- Investigating the optimal implementation of the studies, execution and sample sizes.
- Analyzing the real-world environment, layout, and dynamics to define the integration pathway and robot's autonomy and avoidance behaviour.
- Understand the trust, acceptance and possible ethical considerations related to the robot from patient, nursing and clinical perspectives
- Understanding the necessary functionalities and components for the robot's integration into grand rounds (solution for clinicians).
- Understanding the necessary functionalities and components for the robot's integration into nursing (solution for the nurses)
- Update the user-stories in the "grand round" and "nursing" storylines.
- Conceptualizing the robot's behaviour and frontend GUI.
- Develop prototypes and test them in replic aof a real world environment.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Survey, Focus Groups Semi Structured Interviews	Determine the value of each tech. component; Refine the integration of the solution; Refine the robot's behavior; identify risks and barriers and main drivers of trust and acceptance	Nurses, Clinicans
Survey		Patients
Tech. experts	Test and evaluate the protoyptes in real-world environemt	Field Experiemnts

OUTCOMES

- Since mistakes due to interruptions happen, the robot represents a unique opportunity as a tool in nursing.
- The robot can help patients break their everyday routine and help stimulate them to move more.
- The robot can significantly reduce the load related to the digitalization of data and simplify the use of collected data during grand rounds
- The main barrier from the patients' perspective is the loss of human contact.
- The main barrier for nurses is the fictional view of whatrobot's can do ethical considerations related to that.
- New technical requirements related to interaction and autonomy emerged whenplaced into real-world environment

FEEDBACK INTEGRATION

- User requirement refinement via JIRA.
- Technical requirements refinement via JIRA.
- Study implementation and baseline data collection strategy optimized.
- Key KPIs and primary/secondary outcomes defined
- Study and data governance structure , bodies and researchers in charge defined

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Socially Assistive Robot in Nursing

PILOT 5

sprint 3

SPRINT OBJECTIVES

- To evaluate and validate 1st version of MVP in near life environment before engaing with patients
- To evaluate and validate the "robot in grand round routine" user stories and storylines
- To evaluate and validate the "robot in nursing" user stories and storylines
- To evaluate and validate the "robot during patient admission" user stories and storylines

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation sessionm fcous groups and demonstrations	**Validation of the 1st MVP to support patient admission and nursing and care routine** ·1st MVP: A fully symmetric model of interaction ·1st MVP: Patient engagement storylines ·1st MVP: SLAM and robot autonomy ·1st MVP: Data collection and storage framework **Co-creation on:** · Feedback on the: SAHR Frida, the Symmetric model of interaction and defined storylines · Valdiation on trust and acceptance of the solution · Codesign of the prescreenig algorithm Contribution for the LEAN BUSINESS CANVAS MODEL	Healthcare professionals
Co-creation sessionm fcous groups and demonstrations	**Testing the 1st MVP:** ·1st MVP: Decision support system and FHIR repository ·1st MVP: Robot pepper – interaction; intuitive information lookup and presentation feature during the grand rounds ·1st MVP: Accountability and Transperancy Co-creation on: ·Valdiation on trust and acceptance of the solution ·Feedback of the: SAHR Frida, a minimal set of health quality measures, a minimal set of clinical markers · Storylines for Q&A related to provision of medical information · Codesign of the CDSS and the alert system The contribution the LEAN BUSINESS CANVAS MODEL	Clinicians
Field experiments	**Experimenting with the 1st MVP in a real-world environment:** ·1st MVP: SLAM and robot autonomy ·1st MVP: Data collection framework and computer vision ·1st MVP: Blockchain & servers ·1st MVP: Symmetric model of interaction and chatbot	Tech. experts

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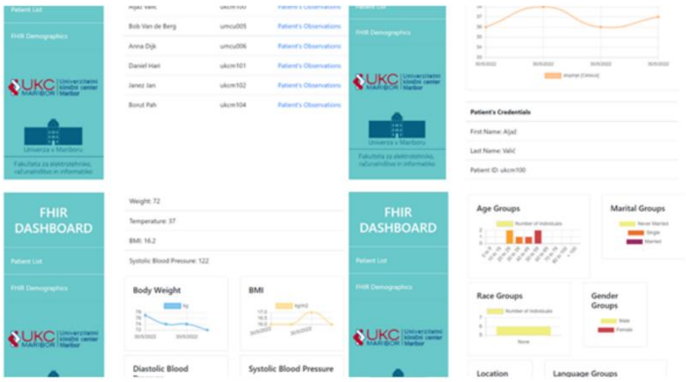
Socially Assistive Robot in Nursing

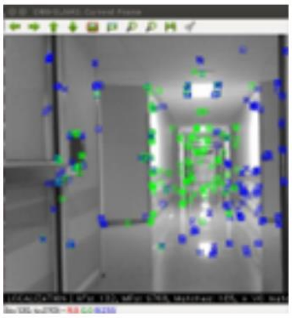
PILOT 5

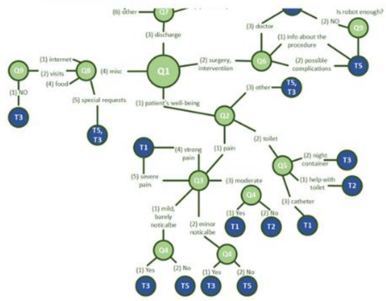
sprint 3

OUTCOMES

- Increased desire for technology engagement and independent testing.
- Data digitalization and storage is deemed important, particularly automated.
- Decreased fictional view and increased trust and acceptance of SAHR after demonstrations
- Interest in healthcare professionals' inclusion via BackEnd altering process.
- Initial system version perceived as intuitive, user-friendly and ready to be introduced to patients.
- High value placed on SAHR's engagement possibleitites to prevent unnecessar work-related interruptions

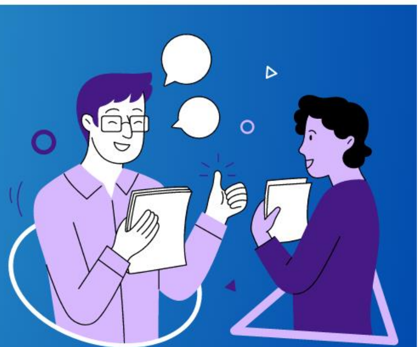






FEEDBACK INTEGRATION

- User requirements are refined and finalised via JIRA.
- Technical requirements refined and finalised JIRA.
- Study implementation and baseline data collection were further optimized recruitment risks were analyzed.
- Defined a list of baselines parameters to be collected prior to study execution
- User interfaces and robot behavior fine-tuned, a new mobile data collection system delivered



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Pilot solution 5
Socially Assistive Robot in Nursing

PILOT 5

sprint 4

SPRINT OBJECTIVES

- to evaluate and validate the final version of the solution in near to real life environment
- to assess potential trust and acceptance of the solution by patients
- to finalize the baseline features to measure and start with the baseline collection process

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Experiments and 1 to 1 unstructured interviews	To validate the solution and robot's engagement with patients. To collect feedback related to trust and acceptance and possible barriers from patient's perspective.	Patients, Nurses
Technical testing	Testing the robot autonomy, symmetric model of interaction and CV piplines. Discussion and if possible adjusting improvements.	Engineers
Co-creation workshop	Questionnaire approval and further project steps organization. Questionnaire co-creation and data extraction improved medical process	Clinicians, nurses, administration
Co-creation workshop	Organization and finalization of the Clinical protocol. Definition of final KPIs and primary and secondary outcomes. Design of the realization protocol. Preparation of study initiation package.	Clinicians, nurses

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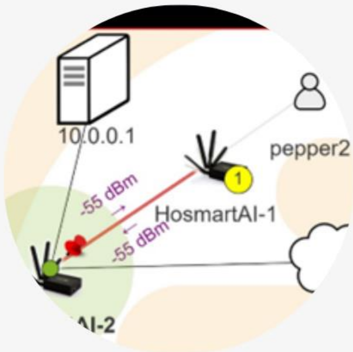
Pilot solution 5
Socially Assistive Robot in Nursin

PILOT 5

sprint 4

OUTCOMES

- Positively validated user stories and implementation of patient engagement and the integration of SAHR in Nursing.
- Positively validated user stories and implementation of patient engagement and the integration of SAHR during patient admission.
- Positively validated user stories and implementation and the integration of SAHR in GRAN Round Routine
- A series of "coaching" sessions was carried out to prepare the staff for the presence of the robot in the department.
- Final version of the technological components delivered, integrated and tested in a real-life environment



FEEDBACK INTEGRATION

- positive feedback from the patients
- "The world is evolving and so should the hospitals and technologies."
- robod behaviour modes are a positive asset

FUTURE IMPROVEMENTS:

- the robot should have the option to insert the headphones on its front (for all those that do not hear well)
- malfunction occurs if the robot is functioning to much (overheating of the motors)
- option for further information on the screen (the i icon; i for information)

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A.10 Pilot 6 [INTRAS]

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Pilot solution 6
Virtual Assistant

PILOT 6

sprint 1

SPRINT OBJECTIVES

- Engage and co-create with stakeholders refining the pilot's concept;
- Gather stakeholders' feedback on potential and viability;
- Validate the accuracy and relevance of the identified "personas" (fictional user representations guide user-centered design process).

MAIN PARTICIPATORY ACTIVITIES

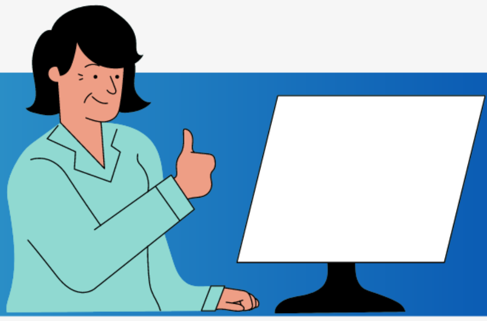
Format sessions	Purpose	Target
Co-creation session	Explain concept Obtain initial feedback	Patients
Co-creation session	Explain concept Obtain initial feedback	Clinicians

OUTCOMES

- Approval of "personas" with proposals for refinement.
- Proposal for the refinement of the pilot concept and needs.

FEEDBACK INTEGRATION

- Refined "personas" aligning with the highlighted needs and pilot concept.
- Personas communicated to pilot 6 team, to accompany the developments.
- Definition of user requirements on JIRA.



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Pilot solution 6
Virtual Assistant

PILOT 6

sprint 2

SPRINT OBJECTIVES

- Investigate the optimal method for incorporating a satisfaction screening questionnaire into the system's components.
- Determine the ideal timing for providing recommendations and activities to patients.
- Understand the necessary components for development.
- Identify the process for mood screening in home settings for tailored intervention recommendations.
- Outline operationalization of each setting.
- Complete the system architecture for the Activity Plan Editor (APE).
- Conceptualize the frontend APE GUI.
- Develop a webpage for synchronizing the platform IDs, identifying blockchain deployment scenarios, and validating the UI.
- Finalize the architectural integration of e-Pokratis with the HosmartAI system.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Determine the value of each tech. component; Refine the integration of the solution; Identify data to be collected.; Define APE domains/ categories.; Explain the login process and obtain initial feedback.	Patients
Co-creation session		Clinicians

OUTCOMES

- The dwelling setting is perceived with higher potential than the clinic centre, including for preventing unwanted loneliness.
- Supplementary activities offer continuous stimulation leading the user to feel better attended to, receiving more personalized care.
- Login process is required but older adults may refrain from using the solution if they encounter difficulties logging in.
- The Pepper robot's sentences require clarity.
- Participants appreciated the monitoring capabilities of technological tools, with the majority finding the solution valuable.
- Participants viewed formal caregivers (clinicians) as most suitable for accessing data.

FEEDBACK INTEGRATION

- User requirement refinement via JIRA aligned project objectives with user needs.
- APE BackEnd categorization improved data structure.
- Data collection strategy optimized by INTRAS/ITCL/GC.
- TMA identified key metrics for e-Pokratis.
- Highlighted viability and improvement areas (WP7 connected).
- INTRAS/ITCL improved login system structure, enhancing user accessibility.
- Satisfaction screening questionnaire refinemeent and usage instructions.

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Pilot solution 6
Virtual Assistant

PILOT 6

sprint 3

SPRINT OBJECTIVES

- Gradior Content integration for a motivational approach and Activity Plan completion.
- Finalization of the data specification to be sent to HosmartAI, within the benchmarking and assessment framework.
- Provision of iPrognosis monitoring tools (iMAT app) in stand-alone formats.
- Development of a web page on HosmartAI Platform for ID synchronization.
- Initiation of the first Android APK version.
- Start of communication integration among the web page, APE, Pepper, Blockchain, and FHIR server.
- Testing of automatic data upload into the blockchain.
- Gathering information for the business domain within the pilot.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	**Testing the 1st MVP:** • 1st MVP: Gradior integration • 1st MVP: Robot pepper – interaction; screening feature • 1st MVP: iPrognosis, specifically, the IMAT app Co-creation on: • Satisfaction survey • Feedback of the: Robot pepper, APE-Backend content, Gradior integration, IMAT app • Validation – pilot's value • Contribution for the LEAN BUSINESS CANVAS MODEL	Patients and informal caregivers
Co-creation session	**Testing the 1st MVP:** • 1st MVP: Gradior integration • 1st MVP: Robot pepper – interaction; screening feature • 1st MVP: Blockchain & servers • 1st MVP: web integration (Front-End) – includes log in process, registration and therapeutic plans Co-creation on: • Satisfaction survey • Feedback of the: Robot pepper, APE-Backend content, Web integration (includes log in process, registration and therapeutic plans), Gradior integration, IMAT app • Validation – pilot's value • Contribution for the LEAN BUSINESS CANVAS MODEL	Clinicians

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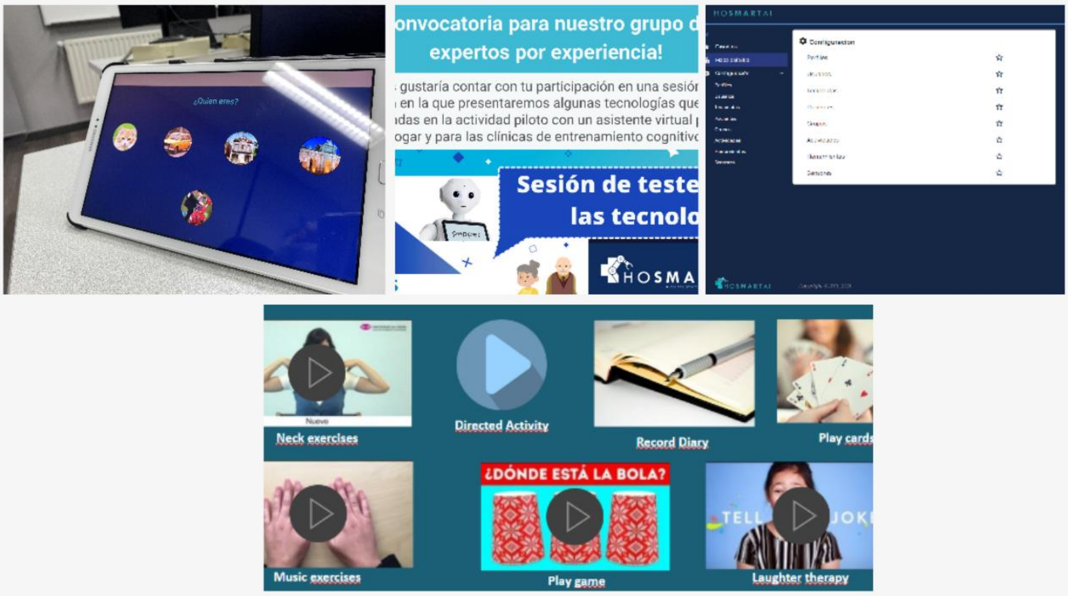
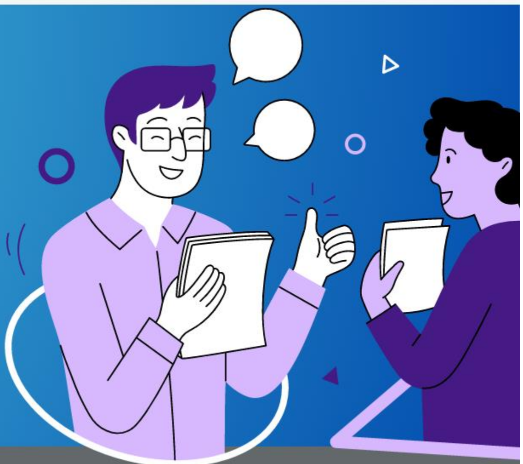
OUTCOMES

- Increased desire for technology engagement and independent testing.
- Data sharing deemed important, particularly if accessible to the public sector.
- Perception that tool value decreases with increased healthcare professionals' workload.
- Interest in caregiver inclusion via APE-BackEnd content.
- Initial system version perceived as intuitive and user-friendly.
- High value placed on the iMAT app.



FEEDBACK INTEGRATION

- New user and technical requirements added on JIRA.
- Adjustments to the integration web, mobile app and robot Pepper.
- Adjustments to the APE-BackEnd.
- Definition of initial content for the APE-BackEnd.
- Testing and validation of the blockchain's data upload.
- LEAN BUSINESS CANVAS MODEL for the work under WP7.



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PILOT 6

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SPRINT OBJECTIVES

- Test 2nd MVP of the available components.
- Implement minor updates and finalize the APE-BackEnd.
- Display the FHIR server results on the integration web.
- Integrate e-Pokratis smartwatch with the integration web.
- Develop the mobile application for Pepper robot activities.
- Validate and upscale blockchain integration into Pilot 6 environments.
- Develop a module to receive, process, and store smartwatch data (e-Pokratis).
- Refine motivational content structure (related to APE-BackEnd).

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Technical testing	Testing of the integration (complete system except e-Pokratis): Real life environment testing of the 2nd MVP.	Development team
Meeting – presentation and feedback	User journey approval – sequence plan for the intervention.	Clinicians
Training	Validation of the 2nd version of the APE-BackEnd and the APE-Front-End; Initial training on the system's components of the APE-BackEnd and the APE-Front-End.	Clinicians
Co-creation session	Validation of the user journey focused on the motivational content.	Patients and external stakeholders
Co-creation session	Co-creation on creation of content for the APE-BackEnd; Training in the APE-BackEnd component (healthcare professionals).	Clinicians
Technical testing	Real life environment testing of the 2nd MVP à e-Pokratis	Development team

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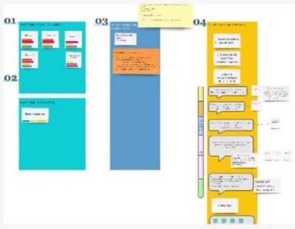
OUTCOMES

- APE-BackEnd app operated successfully with the adjustments post co-creation activities.
- APE-BackEnd partially integrated with the robot.
- Identified the need for further adjustments to the integration web/mobile app.
- Robot's movements file was created and updated for the integration between robot and APE-BackEnd.
- Blockchain component passed the tests.
- Categories and subcategories for the APE-BackEnd were updated.
- Positive feedback for the proposed user journey from healthcare professionals.
- Suggestions to improve the plan format to simplify work and personalize therapeutic plans.
- Need for adjustments in FrontEnd (integration web) and APE-BackEnd was identified.
- The sequence plan of the intervention was defined.
- Received mixed feedback for APE-BackEnd and integration web by clinicians; some features viewed as additional workload.
- Received positive response from patients and external stakeholders towards the developed tools.
- Noted the complexity of APE-BackEnd by professionals - need for an adjustment and training period.
- New ideas for the framework of the creation of motivational content, and gathered assertive feedback on what to do and not within the creation of the motivational content.

FEEDBACK INTEGRATION

- Validation, adjustments for the final version of the APE-Backend.
- Adjustments for the e-Pokratis smartwatch.
- Definition of the framework for the motivational content.
- Modifications required for the integration web, mobile app and robot Pepper.
- Blockchain was tested and validated in the pilot 6 clinic site.
- Delays were detected and mitigation plans were defined within the pilot 6 cluster.



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A.11 Pilot 7 [Philips]

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Pilot 7
Smart Cathlab

PILOT 6

sprint 1

SPRINT OBJECTIVES

- Understand current workflow of Interventional Cardiologists
- Get clarity about main functionality of AI application.

MAIN PARTICIPATORY ACTIVITIES

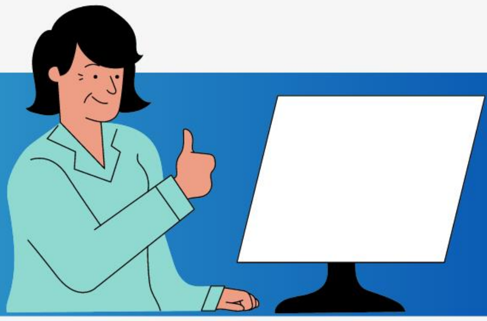
Format sessions	Purpose	Target
Interview/ workshop	Understand workflow and align expectations	Interventional Cardiologists

OUTCOMES

- Recognition of current cardiologist workflows
- Recognition of data annotation needs

FEEDBACK INTEGRATION

- Alignment on overall objectives to improve cardiologist workflow
-



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PILOT 6

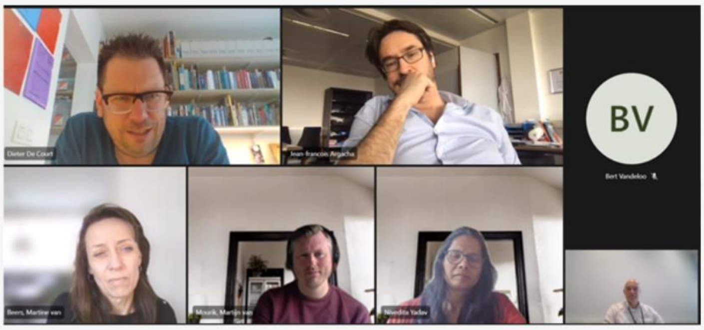
sprint 2

SPRINT OBJECTIVES

- Align on the way of working with respect to data collection, image annotation and training of the clinical staff.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Online workshops	Discuss data acquisition and curation	Physicians and Data Scientists



OUTCOMES

- ·Recognition of the need for data annotation and the extensive time required for this
- ·Scenarios to jointly address data sharing and annotation, e.g. outlining by non-experts and labelling by clinical experts.
- Discussion about the training of clinical staff how to use the image annotation tool and the deployment of the image annotation software.

FEEDBACK INTEGRATION

- Useful to get a better understanding on scope and each other's expectations with respect to end result.
- Participants were able to express their ideas, expectations and concerns
- The importance of image annotation has been recognized as an essential step prior to the actual AI development. Involvement of staff and students in this has been agreed upon.

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PILOT 6

sprint 3

SPRINT OBJECTIVES

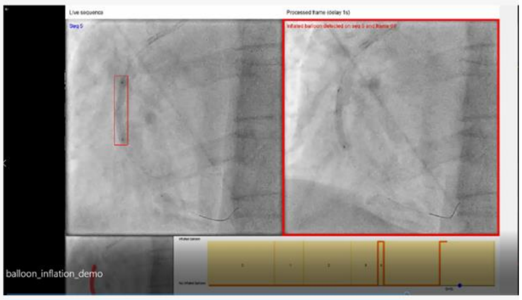
- The main objective for this session was to discuss the progress with respect to data gathering and way forward towards deployment of prototype application at UZB

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Demo session	• Demonstrate the balloon inflation detection algorithm • Discuss next steps to evaluate the algorithm	Interventional Cardiologists

OUTCOMES

- Better understanding of algorithm performance
- Recognition of the necessity to first collect sufficient data and develop a robust algorithm before reduction of post procedural reporting time can be measured
- Focus on demonstrating AI algorithm performance



FEEDBACK INTEGRATION

- Useful session to catch up again after a delayed interaction with the UZB team, pending the data sharing agreement.
- It is recognized that this has hampered the progress, although fortunately other data sets were available to develop the application.
- As a follow, as part of Sprint 4, up an on-site meeting at UZB is considered very important, to discuss the evaluation of the AI application and other linked topics.

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sprint 4

SPRINT OBJECTIVES

- Explain the approach towards developing a collection of AI-assets for coronary procedural guidance
- Collect feedback on the proposed way of working towards evaluation of the key event detection algorithm.

MAIN PARTICIPATORY ACTIVITIES

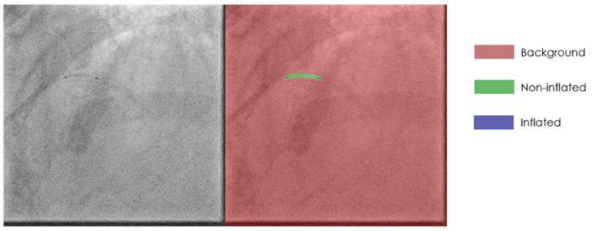
Format sessions	Purpose	Target
Presentation & discussion	• Explain how the balloon inflation detection algorithm is part of a bigger collection of AI-assets. • Present how a combination of such assets has added value as a clinical application. • Show how we want to involve clinicians in the development and evaluation of such assets.	Interventional Cardiologists

OUTCOMES

- The plan for the development of multiple AI-assets for coronary procedural guidance has been presented to the interventional cardiologist
- The balloon detection algorithm, which has been recently developed, is part of this overall solution
- It was discussed how the proposed co-creation platform can be leveraged to accelerate the development of new AI-assets, which will be the building blocks of new clinical applications to be developed.

FEEDBACK INTEGRATION

- Important session to elaborate on the AI-solutions development plans and present the value it brings to clinical partners by getting early access to new clinical applications.



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A.12 Pilot 8 [VUB]

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Pilot solution 8

Prognosis of cancer patients and their response to treatment combining multi-omics data

PILOT 8

sprint 1

SPRINT OBJECTIVES

- Engage and co-create with stakeholders refining the pilot concept;
- Gather stakeholders initial feedback on potential and viability;
- Validate the accuracy and relevance of the identified "personas" (fictional user representations guide user-centered design process).

MAIN PARTICIPATORY ACTIVITIES

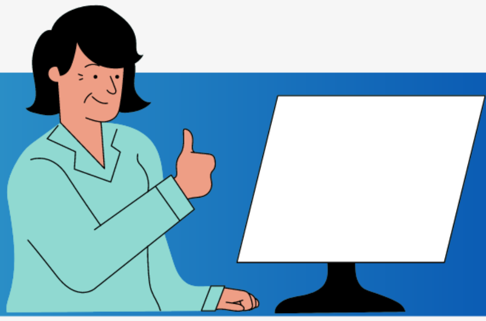
Format sessions	Purpose	Target
Co-creation session	Explain concept Obtain initial feedback	Clinicians , Researchers, Legal IT expert
Co-creation session	Explain concept Obtain initial feedback	Clinicians , Researchers, Legal IT expert

OUTCOMES

- Approval of "personas"
- Clinicians view on AI implementation and data integration in the hospital.
- Refinement of the pilot concept and needs

FEEDBACK INTEGRATION

- Gathered feedback on data integration in the hospital
- Personas communicated to pilot 8 team, to accompany the developments
- JIRA – Definition of user requirements



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Pilot solution 8

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AI PILOT 8

sprint 2

SPRINT OBJECTIVES

- Video sessions with researchers to understand the technical challenges in the development of AI based framework.
- To take advantage of the sessions to make link between the stake holders in the hospital and the researchers.
- To provide support in terms of making image /genetic data (Glioma) accessible to them or solving other technical requirements of the researchers.
- To understand the need/challenges of clinicians by using current workflow and communicate that to the researchers. To know in general issues with respect to implementation of the AI solution.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Co-creation session	Interview was mainly with radio-oncologist, pathologist and geneticists in the hospital to know more about the data processing and develop a data inventory	Researchers
Co-creation session		Clinicians

OUTCOMES

- We interviewed researchers about AI development work and to help them communicate with the relevant department for patient data access .
- How can we make the data (genetic/images) available for the AI framework that they are developing.
- We prepared a list of data available with different departments to develop data inventory which can be submitted to ethical committee if required.
- We discussed the issues in connecting the tumour data (genetic, images, pathology) of different departments.
- We also worked on defining KPIs for the pilot with the help of clinicians.

FEEDBACK INTEGRATION

- User requirement refinement via JIRA aligned project objectives with user needs.
- We developed a data inventory.
- We will provide the interview summary to ICT department of UZ brussels hospital. This will be important for the development of digital health platform that is being developed at UZB hospital.

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PILOT 8

sprint 3

SPRINT OBJECTIVES

- Take the advantage of this workshop to identify the technical and ethical issues related to Glioma data access(UZB)and analysis that needs to be solved.
- Presentation of technical work on genetic and image analysis on tumor data.
- Gather feedback from the stakeholders and identify risk/mitigation plans regarding the access to data and tools at the hospital.
- Discuss how to deploy the imaging and genetic tool in the hospital environment and give access of the tools to the clinicians and researchers at the hospital.
- Round table discussion with legal experts, clinicians, researchers at VUB and UZB to identify the challenges and the process for making the hospital data available to the VUB researchers and discussion on possible solutions.

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
workshop	Gatherfeedback fromthe stakeholders and identifyrisk/mitigation plans regarding the access to dataandtools at the hospital.	Researchers, clinicians and legal experts
Co-creation session	Discuss how to deploy the imaging and genetic tool in the hospital environment and give access of the toolsto the clinicians and researchers at the hospital.	Clinicians

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PILOT 8

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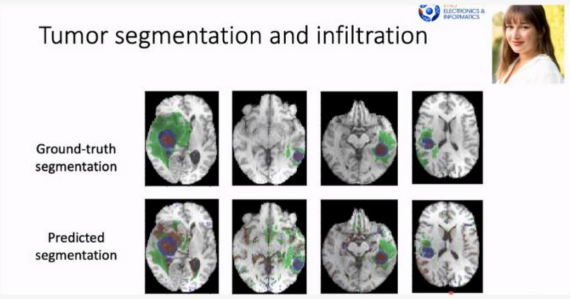
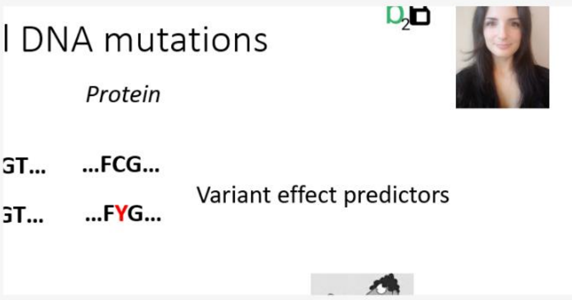
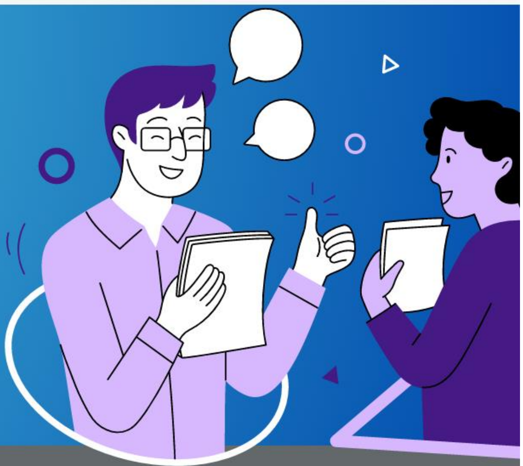
OUTCOMES

- The co-creation session helped in understanding the perspective of clinicians and the researchers working at the hospital regarding the adaptability of the Glioma data analysis tools.
- The progress presentation on genetic and imaging tools development led to some important discussions regarding the application of the tools in the hospital environment.
- The legal experts and technical experts helped in addressing some of the issues related to the deployment of the tools at the hospital and access to the data. As per recommendation by researchers at the hospital and ICT UZB, a research computer will be set up in the hospital for deploying the tools.
- We discussed the challenges related to connecting the tumour data (genetic, images, pathology) and analysis frameworks. We will have a follow up workshop on data processing in January 2023to discuss data processing workflow .-Further collaboration for proteomics data analysis suggested by the VUB researchers





FEEDBACK INTEGRATION



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Prognosis of cancer patients and their response to treatment combining multi-omics data

PILOT 8

sprint 4

SPRINT OBJECTIVES

- The session's primary objective was to collect constructive feedback on the current available functional prototype of the Tumor image segmentation tool and the driver/passenger mutation analysis tool.
- Discuss the deployment of the tools at the hospital and evaluate their effectiveness, impact, and practicality.
- Establish a digital health research platform and collaborate with an external company to define data needs for machine learning models
- Data processing pipelines set up to collect the hospital data in a secured and GDPR-compliant way
- A round table discussion involving legal experts, clinicians, and VUB and UZB researchers to address challenges and establish procedures for sharing hospital data with VUB researchers, exploring potential solutions

MAIN PARTICIPATORY ACTIVITIES

Format sessions	Purpose	Target
Demo session	Present the data processing steps for the AI based genetic data analysis	Researchers
Demo session	Present the data processing steps for the AI based radiology data analysis	Researchers
Co-creation workshop	Discuss the digital health platform	Clinicians ,ICT, researchers, Legal experts, Pathologists

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AI PILOT 8

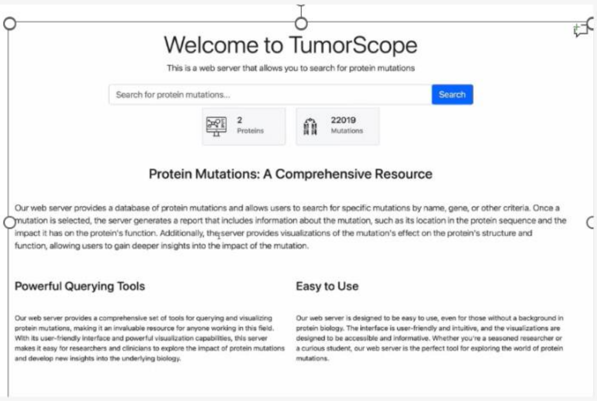
sprint 4

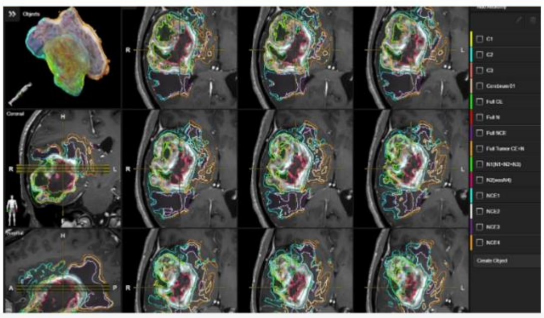
OUTCOMES

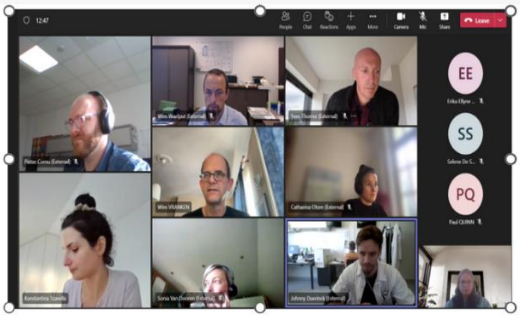
- The session started with a brief update on the tools developed by the researchers.
- The collaborative session yielded valuable insights from clinicians and researchers regarding the development and implementation of data processing pipelines.
- The presentation on genetic and imaging tools sparked important discussions on their application within the hospital environment.
- Legal and technical experts addressed issues regarding tool deployment and data access, resulting in the decision to set up a research computer in the hospital.
- VUB researchers suggested further collaboration with Maastricht University for proteomics data analysis.

FEEDBACK INTEGRATION

- The data inventory was discussed with all the stakeholders .
- Alignment on priorities for the data that needs to be put on the platform
- Feedback related to data processsing has been incoporated into the AI base image and genetic analysis tool implementation.







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