Innovative Roadmap to Accelerate eHealth Startups' Market Introduction

Bachelor Thesis

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Abstract

As the aging population grows, healthcare demand in the Netherlands is straining hospital capacity. Despite home care policies, rising emergency admissions highlight the need for additional solutions. eHealth startups see an opportunity to address these challenges through technology.

Hospitals struggle with capacity, but eHealth startups like Remote Patient Management face slow adoption due to regulations, economic challenges, and data security concerns. Startups face long adoption in healthcare systems.

To address this, the project develops a roadmap that will help start-ups identify key stakeholders they need to engage with by visualizing the process. It will also provide guidance on navigating regulations, accessing government subsidies, and understanding how innovation aligns with organizational processes and eHealth-related laws.

The core functionality of the product is interactive information delivery through a Virtual Exhibition format. The product provides information related to the challenges faced by eHealth startups in the form of infographics, which users can explore by freely navigating spaces categorized by different topics. This approach helps users engage in an immersive experience while quickly absorbing the information.

Evaluation results from both the user and expert groups confirmed that the product provides valuable guidelines for early-stage eHealth startups and offers an immersive experience similar to that of a real museum.

Acknowledgement

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1. Introduction

1.1 Context

People all over the world have a longer life expectancy. The pace at which the population is aging is much faster than in the past and every country faces a critical challenge to ensure that health and social systems are prepared to make the most of these demographic changes [1]. As the elderly population grows, the Netherlands is facing a growing demand for hospital care. This trend is expected to put significant pressure on hospital capacity, especially as a larger proportion of the population enters the 65+ age group. The Netherlands already has policies in place to reduce hospital admissions and encourage home care for the elderly. However, a surge in older patients, especially for those over 80, has increased waiting times and increased emergency hospitalizations, adding to the strain on hospitals and nursing homes [23].
In such a scenario, eHealth and Health Information Technology could have a positive impact on these predicted healthcare labor shortages.

The term eHealth which stands for electronic health is defined by the World Health Organization (WHO) as the safe and cost-effective use of Information and Communication Technology (ICT) in health and health-related fields, including health services, health surveillance, health education, literature and research [26]. The term health Information Technology (health IT) refers to the electronic systems health care professionals and increasingly, patients use to store, share, and analyze health information. Health IT includes Electronic Health Records (EHRs), which help clinicians manage and access patient health information seamlessly, even outside regular hours, and facilitate sharing between providers. Personal Health Records (PHRs), controlled by patients, compile data from medical visits alongside personal health tracking (e.g., diet, exercise). Electronic Prescribing (E-prescribing), allows direct communication between doctors and pharmacies to streamline medication dispensing and reduce errors. Lastly, Privacy and Security Measures in health IT systems ensure data protection through encryption and access tracking, securing health information against unauthorized access [24].

According to [3], full implementation of health IT in 30% of community-based physician offices may reduce the demand for physicians by approximately 4-9%. In addition, health IT can deliver 12% of healthcare services remotely or asynchronously, which can help alleviate regional physician shortages. Thus, eHealth technology is a viable solution to the cost-effectiveness of

healthcare systems, chronic disease management and preventive care, and healthcare staffing shortages.

Many eHealth startups want to accelerate the transformation of healthcare towards value-based and patient-centered care by developing innovative healthcare technologies focusing on remote patient management as well as entering the market. However, these technologies often take time to be integrated into everyday healthcare systems. The University of Toronto has investigated several barriers that hinder the adoption of a Remote Patient Monitoring (RPM) system, one type of technology commonly used in eHealth. Companies face various obstacles, including but not limited to economic, legal, and regulatory barriers, as well as concerns related to data reliability and a need for more IT infrastructure [4]. Even if startups have met regulatory requirements, healthcare facilities often carry out lengthy adoption processes due to a lack of knowledge and a tendency to avoid risks [5].

Clear guidelines for eHealth startups for more effective and faster adoption of eHealth technology in healthcare are needed. It is important to help startups easily understand the certification procedures or regulations required when introducing medical eHealth technology. Without clear procedures, startups struggle with how to develop meaningful technology for hospitals and medical institutions and how to introduce technology in its early stages.

Therefore, the goal of this project is to develop an innovative roadmap to understand these issues. By visualizing this process, this roadmap can help startups understand insights into the stakeholders they need in the frenzy of successfully planning and integrating their technologies in the eHealth market, when and how they need to integrate into the process, information about rewards for digital innovation, and how innovation takes place in organizations and laws related to eHealth companies.

1.2 Research Questions

Based on this context research questions were created to support the direction and process of the research. Research questions include one main research question and two sub-research questions.

Primary Research Question: How to design an innovative roadmap for Startups to accelerate the development of meaningful eHealth technologies for remote patient management resulting in seamless implementation and adoption in healthcare practice?

Sub - Research Question 1: What are the main challenges that slow down the adoption of eHealth technologies for remote patient management of Startups?

Sub - Research Question 2: What factors influence the successful integration of eHealth technologies for remote patient management into healthcare practices for Startups?

Sub – Research Question 3: What are the legal and regulatory considerations companies face when implementing eHealth technology?

The primary research question addresses the most important goal of the research, which explores which roadmap design options can be effective for eHealth startups to successfully enter the healthcare industry market. This study aims to investigate strategies in which eHealth technology can be quickly introduced to the market and which guidelines are efficient for startups for more effective and faster adoption of eHealth technology in healthcare practice.
The first sub-research question analyzes and explores the difficulties that startups experience. Analyzing the major obstacles that eHealth companies are currently experiencing will help understand the eHealth industry status and startups understand the challenges ahead by adding the result as a guideline to the roadmaps.
The last sub-research question focuses on exploring how existing eHealth companies have successfully introduced their products into healthcare practice. Understanding the most effective methods for successful adoption and implementation of eHealth technology within healthcare helps to design a roadmap for eHealth startups.

2. Background research

2.1 Challenges to the Adoption of eHealth

Adopting eHealth technologies, including Remote Patient Monitoring (RPM), faces several systemic challenges that hinder widespread integration into healthcare systems. According to

Schreiweis et al. [1] the implementation of eHealth services faces several barriers, including personal, organizational, and technical issues. One of the main barriers for adopting eHealth services is related to patient related factors, such as limited digital health literacy due to a lack of knowledge or awareness of eHealth services. In addition, low motivation or resistance to using new technologies for health-related purposes further hinders adoption. Accessibility is another concern as some individuals may not have the devices or skills necessary to participate in these services. Trust-related issues, including privacy, data security, and concerns about the reliability of eHealth services, also act as important barriers.

Environmental and organizational issues include financial constraints and financing for eHealth solutions is a recurring issue in both professional discussions and literature. Political and policy barriers, such as the absence of supportive regulations or national eHealth strategies, further complicate implementation. Mis-adjusting incentives or organizational structures that do not align seamlessly with existing healthcare frameworks can hinder the smooth integration of eHealth services [1].

As an example of this financial constraint, a study conducted in the Netherlands identified financial discrepancies between healthcare providers and payers as a major barrier to the structural repayment of remote patient monitoring (RPM) in Dutch hospitals. Often referred to as a "wrong pocket problem," this problem arises when the actors implementing RPM (e.g., hospital departments) do not benefit directly from the cost-cutting potential, while the benefits are realized elsewhere in the system. For example, RPM can reduce hospital admissions and improve patient outcomes, but individual departments or hospitals bear initial costs for infrastructure, education, and maintenance [2]. In another study, most Dutch health experts interviewed noted that the insurance benefit structure was hindering implementation [6].

Technical challenges include inadequate security, with many systems failing to provide an acceptable level of security for networked medical devices. Inadequate service design and the lack of consistent standards for patient data and data exchange, where eHealth services fail to meet user needs, are also significant obstacles. Language barriers and insufficient technical support make eHealth services even more difficult to deploy [1].

2.2 Factors Influencing the successful integration of eHealth Startups

Digitization has revolutionized the delivery of healthcare services, which has provided global business opportunities for startups specializing in digital innovation. These startups challenge the traditional healthcare industry by introducing radical and sustainable innovations in the agile product development cycle. Starting up is the most critical period to establish a new digital healthcare service company. However, little is known about the critical early growth process of the newly established digital healthcare services business [3]. While eHealth startups face a range of barriers from technology integration to regulatory and financial constraints, overcoming them is critical to their long-term success. Indeed, several key success factors have been identified that enable eHealth startups to not only mitigate these barriers but also create value in the healthcare market.

Successful eHealth startups have clear and compelling value propositions. These include innovative healthcare solutions that meet the needs of patients, healthcare providers, or organizations. Recognizing and focusing on the right target consumers is critical to value creation. Successful startups clearly define their customer segments and adapt their solutions to meet specific healthcare needs [4].

Technically, startups that effectively utilize their technology architecture, such as a user-friendly platform, secure data systems, and seamless integration with existing healthcare applications, are more likely to succeed. This includes the adoption of new technologies such as telemedicine and digital health platforms. Well-designed user interfaces and experiences are critical to attracting and retaining users on eHealth platforms [4].

A study in the Netherlands covered lessons for eHealth implementation within Europe. To encourage companies to innovate within Europe, EU healthcare technology regulations must be flexible to adapt to evolving industrial and legal frameworks. The introduction of the Medical Devices Regulation (MDR) in the EU strengthens regulations on eHealth, which are classified as medical devices if software and eHealth technologies provide advice that can influence a patient's behavior or treatment strategy. Depending on the intended purpose and relevant risks, these devices must provide evidence of their effectiveness [5].

Other factors include team experience and competence,revenue strategy and financial planning, consumer and stakeholder communication, quality, and performance metrics. Startups must also explore complex healthcare regulations, licensing requirements, and data security standards to find appropriate governance mechanisms to ensure compliance and mitigate legal risks [4].

2.3 Policy and Regulatory Considerations for eHealth Startups

Policy and regulatory considerations are critical to understand the support frameworks that impact the growth and sustainability of eHealth startups active in a medical setting. Regulatory policies provide financial incentives and support mechanisms as well as setting standards for safety and efficacy.

Indeed, the Dutch government encourages the use of digital applications for healthcare and support. From personal blood pressure monitors to apps that monitor health and activity after the coronavirus crisis, smart solutions are increasingly considered to be important in day-to-day care [11].

The “Stimuleringsregeling Technologie in Ondersteuning en Zorg (STOZ)” grant provided by the Dutch government is designed to support digital technologies in healthcare, and the initiative aims to reduce the workload of healthcare professionals by strengthening the digitization of the treatment process [12].

Grants can be used for three types of projects: the starting stage of implementation to develop strategies and implementation plans for digital processes; the scale-up stage to apply digital or hybrid processes on a larger scale; and the maintenance stage to evaluate the use of digital resources and determine their viability for sustainment. These grants will allow for refunds of up to 50% of eligible expenses. Eligible applicants include professionals or home care service providers under various Dutch health laws [12].

In addition, the Dutch government introduced a system called DigiCoach to provide better digital technology. DigiCoach funds healthcare providers to train their employees on the use of digital tools, which can indirectly support startups by making their products available in healthcare settings [13].

Identifying the legal framework for data exchange as well as financial policy is important to startups. The Dutch government has enacted a new law, "Wet elektronische gegevensuitwisseling in de zorg (WEGIZ)", to facilitate the exchange of secure and standardized electronic data in healthcare. It helps ensure a legal framework that mandates the exchange of standardized electronic data among healthcare providers, thereby stimulating seamless integration of digital healthcare solutions into existing healthcare systems. eHealth startups can benefit from aligning their products to these standards, ensuring compliance, and improving market acceptance [14].

2.4 Technology Readiness Level (TRL) and System Readiness Level (SRL)

The TRL concept was originally developed by NASA in the 1980s to provide a consistent metric for assessing technology readiness for space missions. Over time, the TRL scale expanded to nine levels to accommodate various stages of technological advancement, from basic research to fully operational systems. The 9 levels of Technology Readiness can be checked in the table below [19].

TRL	Definition
9	Actual System Proven Through Successful Mission Operations
8	Actual System Completed and Qualified Through Test and Demonstration
7	System Prototype Demonstration in Relevant Environment
6	System/Subsystem Model or Prototype Demonstration in Relevant Environment
5	Component and/or Breadboard Validation in Relevant Environment
4	Component and/or Breadboard Validation in Laboratory Environment
3	Analytical and Experimental Critical Function and/or Characteristic Proof-of-Concept
2	Technology Concept and/or Application Formulated
1	Basic Principals Observed and Reported

Table 1: Technology Readiness Levels [19]

This scale played an important role in ensuring that technology reached a certain level of readiness before it was incorporated into space missions. By 1999, the Department of Defense (DoD) also adopted the TRL, applying similar criteria for weapons systems, but there were some adjustments to its interpretation. Since TRL deals only with the readiness of individual technologies, it has limitations in that it does not assess the problems or uncertainties that arise when multiple technologies are integrated and do not fully reflect the difficulty and risks of integration. Furthermore, TRL models lack guidance on potential uncertainties that may arise during the readiness phase, which can pose unexpected risks and limit how to compare the readiness of competing techniques, which can complicate decision-making [19], [20].

To bridge this gap, Sauser, Verma, and colleagues introduced the concept of System Readiness Level (SRL) as an extension of TRL [19]. SRL combines TRL with a new metric called Integration Readiness Level (IRL), which evaluates the readiness of integration between technologies. The SRL model takes into account the dynamics between different technology components, enabling a more holistic assessment of system readiness. As for a system, several technologies work in an integrated manner, so not only the readiness of each technology but also the interaction and integrated readiness between the technologies are important evaluation factors. SRL evaluates the suitability and readiness at the system level by considering both the TRL of individual technologies and IRL between technologies. This allows a more precise judgment of the reliability of the system. The table of SRL can be checked in the table below [19], [20].

SRL	Name	Definition
5	*Operations & Support*	Execute a support program that meets operational support performance requirements and sustains the system in the most cost-effective manor over its total life cycle.
4	*Production & Development*	Achieve operational capability that satisfies mission needs.
3	*System Development & Demonstration*	Develop a system or increment of capability; reduce integration and manufacturing risk; ensure operational supportability; reduce logistics footprint; implement human systems integration; design for producibility; ensure affordability and protection of critical program information; and demonstrate system integration, interoperability, safety, and utility.
2	*Technology Development*	Reduce technology risks and determine appropriate set of technologies to integrate into a full system.
1	*Concept Refinement*	Refine initial concept. Develop system/technology development strategy

Table 2: System Readiness Levels [19]

Integration Readiness (IRL) has been proposed as an indicator to evaluate interactions, compatibility, data translation possibility, error verification, and control capabilities among individual technologies. This allows a quantitative assessment of the difficulty of integration between technologies and predicts the likelihood of successful integration of systems. As with the failure case of NASA's Mars Climate Probe (MCO), since the issue of integration apart from the readiness of technologies can lead to system failure, evaluating the IRL is essential [20].

2.5 eHealth Framework

eHealth technologies, especially those focused on patient self-care, require careful implementation planning and processes due to the various stakeholders such as medical staff (physicians, nurses, laboratory technicians, radiologists, etc.), technical experts (data scientists, computer engineers, implementation experts, etc.), decision-makers (medical administrators, regulatory agencies, etc.), patients, their caretakers and families, insurance companies, etc. involved in the complex nature of healthcare services. In eHealth, a framework could help to analyze the factors that influence the success or failure of these technologies.

The NASSS framework is particularly useful for understanding complex technologies that can face multiple layers of unpredictability. For example, although the technology works well in one clinical setting, it may not extend to another due to differences in organizational culture or policy constraints. Each of the seven domains helps to assess both the technical complexity and social factors that influence success, abandonment, or failure [7, 10].

The seven domains consist of the following components. The first component is a characteristic of a health condition that technology deals with. It identifies whether it is simple, complex, or unpredictable. the technology is the second condition and consists of the design, usefulness, and readiness of the technology itself. It is a step to find out how it is simple, complex, and interacts with other systems. Value Proposition as a third component is a value that is perceived by both patients and healthcare providers. The fourth component, Adopters are individuals (patients, clinicians, etc.) who will use or be affected by technology. The fifth component, organization is a healthcare organization that is ready to adopt technology, including culture, structure, and resources. The sixth aspect to consider is the wider system consists of external

factors that influence adoption, such as policies, regulations, and economic conditions. The last component is about sustainability. The sustainability of technology integration depends on both adaptive technology and resilient organizations. Vulnerable technologies and inadaptable organizations make new systems harder to maintain effectively. For sustainable eHealth, both factors must be coordinated and evolve with change [7].

For example, complex interactions between these domains can be seen in techniques such as Electronic Health Records (EHR). While EHR systems can provide obvious advantages in terms of organizational and patient data management (simple or moderately complex from a technical point of view), they often face high complexity in the adoption of organizations and their integration with existing workflows [7].

Another framework is the FITT framework. Kujala et al. [8] applied and extended the FITT framework in their study to identify challenges and opportunities related to eHealth services for patient self-care. The FITT framework is designed to assess the suitability between three key elements: individual, technology-supported clinical work, and technology. Technology-supported clinical work means technology users (e.g., clinicians, patients). Technology means tools or systems used to complete tasks. The framework suggests that successful implementation depends on how well these three elements fit together. For example, if the technology fits well with clinical workflows and users' technologies, the likelihood of successful adoption increases [8].

The main strength of the FITT model is that it focuses on the interaction between the user and the task at hand. This is particularly important in clinical settings where poorly integrated technologies can disrupt workflows and lead to implementation failures. In the study, FITT framework was compared with the CFIR framework. The CFIR framework provides a broader perspective that focuses on different areas such as intervention characteristics, external environment (external policy or regulation), and internal environment (organizational structure) [8]. Unlike FITT, which focuses more on the interaction between users and technologies, CFIR highlights the overall environmental and organizational factors that influence adoption [9].

While frameworks such as FITT (emphasizing interactions between individuals, tasks, and technologies) or CFIR (focusing more on organizational and environmental factors), NASSS

emphasizes complexity not only at the technology itself, but at several levels, such as how it is spread, expanded, and maintained in different healthcare settings.

2.6 State of the Art

2.5.1 eHealth Technologies

As different kinds of eHealth technologies are reviewed, Mishra et al briefly describe a comprehensive range of innovative tools that transform healthcare. These technologies promote both patient care and system efficiency in different areas [23]. Among them, telemedicine is a prime example of eHealth by increasing access to medical care, reducing costs, and facilitating professional access to medical care, especially for patients living in remote locations. Telemedicine is a method of delivering medical information and providing treatment from a long distance, including patient-related counseling between a doctor and a specialist, diagnosis that is interpreted by asynchronous transmission of diagnostic tests such as X-rays to teleologists, EKG, diabetes blood sugar monitor, and other remote equipment to monitor patient conditions and provide advice in real time [23]. These functions are utilized in various fields. In addition to medical specialties such as teledermatology and telepsychiatry, remote treatments specializing in asthma and diabetes, such as teleasthma and telediabetes, have become possible. In addition, they can be applied regardless of the location of the treatment, and can be supported remotely across various types of treatment, such as rehabilitation and physical therapy [23].

There are asynchronous and synchronous communication methods, and asynchronous communication does not require a simultaneous connection between a doctor and a patient, methods such as sending information through email or sending diagnostic results are used. On the other hand, synchronous communication allows medical staff and patients to interact in real-time, like video conferencing [23].

The efficiency and patient satisfaction of telemedicine are highly valued. It can contribute to increasing access to specialized care for patients living in remote locations and reducing overall costs. According to the results of the study, patients who received the treatment through telemedicine showed higher levels of satisfaction compared to traditional face-to-face care, especially reduced waiting times and significantly improved efficiency in chronic disease management [23].

Along with Telemedicine, the area that draws attention is Predictive and Preventive Healthcare. Preventive healthcare refers to measures taken to prevent the onset of a disease or to intervene early in the progression of a disease, especially a chronic disease. Preventive healthcare aims to improve individual health outcomes by identifying and addressing risk factors that contribute to several chronic diseases to prevent the progression of these conditions.Predictive healthcare involves using Machine Learning (ML) and Deep Learning (DL) techniques to predict the occurrence or progression of disease, especially in individuals with comorbidities. This text highlights the use of predictive analysis in disease comorbidities, which are used to analyze comorbidities patterns and predict disease outcomes using machine learning methods, which can aid in early diagnosis and personalized care management. Predictive healthcare helps predict future health problems, enabling early response [27].

2.5.2 eHealth Roadmap

To create a comprehensive roadmap specific for eHealth startups in the Netherlands, the previously researched eHealth roadmap CeHRes was investigated. The Center for eHealth Research (CeHRes) roadmap is a well-established framework that guides the development, implementation, and evaluation of eHealth technologies [15, 16]. It provides a structured, user-centric approach focused on integrating technologies into healthcare in a way that maximizes efficiency and adoption. The CeHRes roadmap is based on five key principles: participatory development (stakeholder engagement throughout the process), improved infrastructure for healthcare, health, and well-being, close coordination between development and implementation processes, integration of compelling designs to encourage engagement, and continuous evaluation cycles to ensure continuous relevance and effectiveness [17].

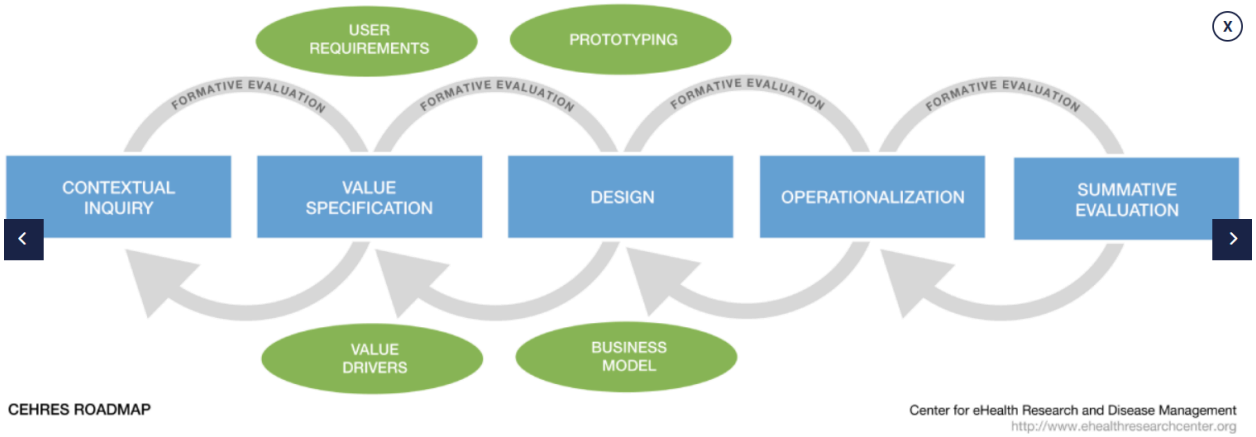

Figure 1: The Center for eHealth Research Roadmap

Based on this principle, the CeHRes roadmap is divided into five interconnected stages. The interconnectivity of the roadmap is identified by images in Figure 1. The first step is contextual inquiry, understanding the medical situation, identifying problems, and evaluating stakeholder requirements. The next step, value specification, is to define the value that eHealth technology must provide, taking into account user and organizational requirements. In the design phase, we create prototypes based on insights from the first two steps. Implement technology in a real-world environment during the operationalization phase. The final step, summer evaluation, conducts a thorough assessment of the impact, effectiveness, and areas of improvement of the technology. These five steps are not vertical. The roadmap encourages an iterative multi-method development process that leads to improvement at each stage through continuous feedback loops and user engagement. This approach allows the technology to remain relevant to users' requirements and adapt to the evolving healthcare environment. The CeHRes roadmap highlights the holistic nature of eHealth, where technology, users, and healthcare environments are intertwined. If these elements are not aligned, technology can face low adoption rates, even with significant potential benefits. For example, web-based interventions that require extensive reading may not be suitable for populations with low levels of literacy, making it important to align technology to context [17].

In summary, the CeHRes roadmap provides a comprehensive guide to eHealth development, highlighting the importance of user-centric design, iterative improvements, and aligning technologies to the needs of healthcare systems. This roadmap allows developers to ensure that their technologies are not only effective but are widely adopted and implemented

sustainably. The principles of this framework apply to a wide range of eHealth technologies, from mobile apps to web-based interventions.

2.5.3 Gamification in eHealth and Healthcare

A joint research team with Joyce Bierbooms from the University of Tilburg worked on a project to design a room escape game for eMental Health exploration. The room escape concept was devised to support the adoption of eMental Health (EMH) technology and to educate mental health care professionals. This hands-on learning approach aims to enhance skills and knowledge about EMH applications, such as virtual reality and biofeedback, by immersing experts in realistic scenarios to which these tools can be applied. Room Escape uses a gamified element that solves specific learning goals through puzzles that mimic real-world treatment scenarios. By solving these puzzles, participants can gain hands-on experience with EMH use, and explore the outcomes of different treatment choices in a safe environment. The interactive nature of room escape, combined with a continuous feedback loop and branched storyline, creates a dynamic learning environment where experts collaborate, engage, and develop the practical skills needed to use EMH in treatment. This setting encourages knowledge transfer, increasing the adoption rate of digital health solutions beyond traditional e-learning. Future iterations of the escape room will include a variety of scenarios and additional EMH tools, allowing participants to play the game again with a variety of patient cases and treatment options. Through field studies and expansion within mental health organizations, these gamified approaches can expand EMH adoption by building confidence and technical capabilities, which can ultimately contribute to higher-quality mental health care [21].

Figure 3: Room escape game for eMental Health exploration [21]

Developed by KIT, the Health Resource Allocation Game (HRAG) is a well-established gamification tool that mimics the complexity of healthcare system planning, providing simulation experiences for healthcare resource allocation. HRAG provides players with first-hand experience planning, implementing, and evaluating healthcare systems within a limited budget, encouraging critical thinking and decision-making about healthcare resource allocation. The game adopts core gamification principles, including goal setting, immediate feedback, and role-based decision-making, allowing users to realistically manage health issues at the village and provincial level. HRAG's gameplay phase (planning, implementation, and evaluation) provides iterative learning opportunities to replicate decision-making points that arise from actual healthcare resource allocation [22].

Figure 3: Health Resource Allocation Game [22]

Although HRAG is not an eHealth-related game, it strengthens the importance of data-driven decision-making and promotes collaborative learning through interactive participation. If this form of gamification is incorporated into the roadmap design, the advantages of HRAG have the potential to produce positive results in the eHealth field [22].

2.7 Interviews

To better understand the integrated environment of eHealth innovation and Remote Patient Monitoring (RPM) solutions, interviews conducted by eCMC with six companies involved in various aspects of digital healthcare have been identified. The primary goal of this interview was to gain insight into the challenges and opportunities that RPM and other eHealth tools face in

reaching effective implementation in healthcare settings. This interview aimed to capture the perspective of industry professionals, with an emphasis on areas such as compliance, data standardization, financial sustainability, and readiness for healthcare institutions to adopt new technologies.

The demographic table for each industry, main service, and feature of the six companies is found in Appendix1: 2.7 Interviews. Similarly, the table for RPM implementation barriers, Factors Influencing Successful Integration of eHealth Startups, Policy and Regulatory Issues, and TRL (Technology Readiness Level) and Service Readiness Level (SRL) can be found in the Appendix1: 2.7 Interviews.

The companies involved in the interview ranged from RPM and data analysis to gamified health education and serious game prototyping. Each interview provided valuable information about the company's goals, key activities supporting its efforts, and specific barriers it faces. Key discussions included Technology Readiness Levels (TRL) and Service Readiness Levels (SRL), policy and redemption considerations, and structural factors influencing the adoption of eHealth solutions. In addition, based on the interview result, achieving successful eHealth integration is influenced by internal factors, such as innovation culture in hospitals, as well as external factors, including policy support and market incentives. Companies also noted the importance of policy frameworks (e.g., Germany's Diga model) to establish clear pathways for insurance coverage and introduction.

3. Methodology

The design method of this study will follow the Creative Technology Design Process. This creative technology design process serves as a systematic framework for problem-solving and innovation, as described by Mader and Egink [18]. Consisting of four main phases, the methodology provides designers with a structured approach through an iterative process from conceptualization to implementation. These components are the ideation phase, specification phase, realization phase, and evaluation phase.

3.1 Ideation

The idea stage identifies the problem and determines how to plan and execute the design process. The process begins with a design question, which is a step towards a deeper understanding of the design question. To better understand this design question, we can investigate three aspects: user needs, technology, and creative ideas. These three aspects are the spiral model, which is an iterative process [18]. In this step, a primary research question is set as "How to design an innovative roadmap for Startups to accelerate the development of meaningful eHealth technologies for remote patient management resulting in seamless implementation and adoption in healthcare practice?" The idea generation step seeks to answer this sub-research question by examining the three aspects described below.

The first aspect, User needs, can be studied through a literature review. The literature review also answers the first sub-research question, "What are the main challenges that slow down the adoption of eHealth technologies for remote patient management of startups?" To answer this question, a literature review was conducted on barriers to eHealth adoption and strategies to help eHealth startups successfully implement. In addition, to gain a better understanding of the target group, data from previous interviews conducted by eCMC were used in the process.

The technology aspect was addressed by researching the latest technologies to understand the pros and cons of existing related products. In addition, brainstorming sessions were held to explore various technologies offered during the idea generation phase.

The final aspect of this step, Creative ideas, was addressed through brainstorming sessions. The first brainstorming session was based on the theme of ‘Important elements for eHealth roadmap’. The second brainstorming session was based on various ideas about interactive games in eHealth and used mindmap techniques to come up with potential ideas for graduation projects. The concepts were organized into sketches, and the results of the brainstorming sessions can be found in Chapter 4.2.1.

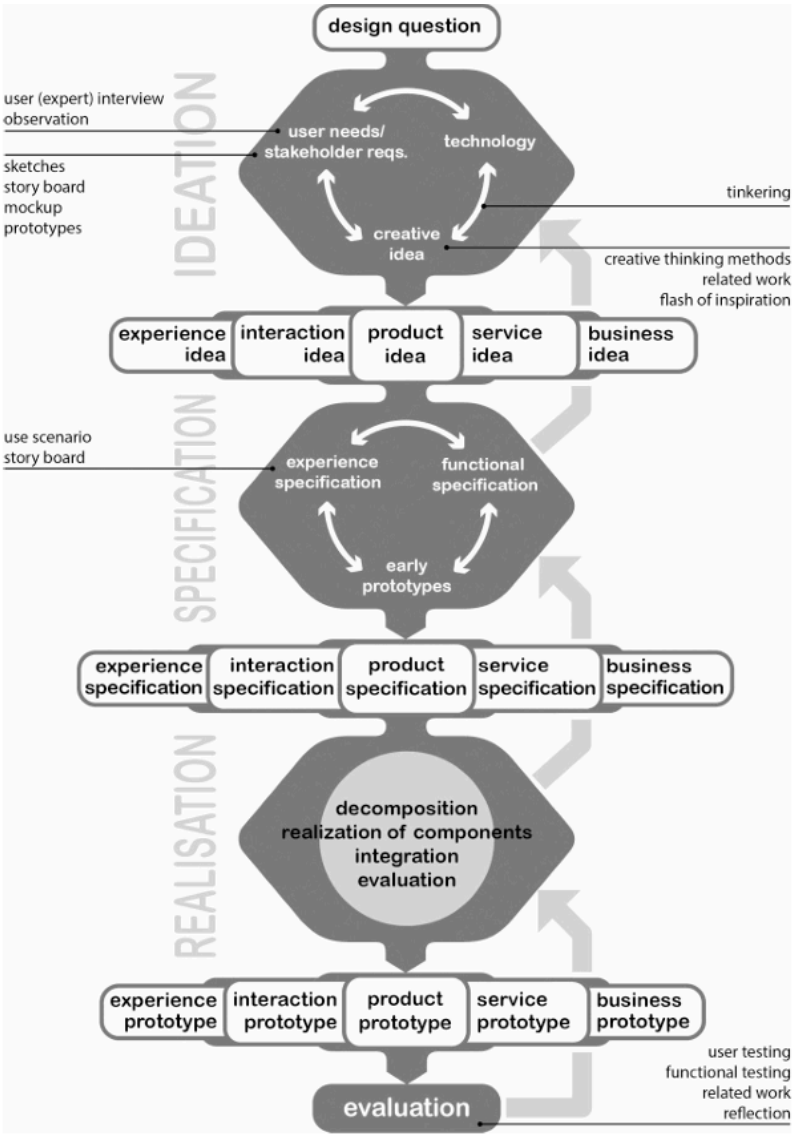

Figure 4: A Creative Technology Design Process [18]

3.2 Specification

The second step is the specification step, which is the process of specifying the final product. This step also consists of three spiral models: early prototype, functional specification, and experience specification.

Early prototype development is important at this stage. According to Mader and Eggink, various prototypes must be created at this stage to explore the entire design space [18]. Various prototypes are improved or changed to new prototypes after being evaluated. These prototypes should focus on user experience and interaction.

Functional and experience specifications are developed based on prototype test results. Based on prototype test results, idea generation stage results, and focus group results, a concept is selected and embodied in an ideal and realistic scenario.

3.3 Realization

The next step is to realize a high-precision (hi-fi) prototype [18], which focuses on integrating all components into one final product.

During the realization phase, an interim assessment will take place, with several eHealth company relationships participating in the assessment.

From multiple tests, specific design choices are made at the realization stage based on participants' opinions, and practical aspects are implemented to complete the final prototype.

3.4 Evaluation

The final step in the design process is to evaluate hi-fi prototypes. To evaluate a hi-fi prototype, In usability evaluation, high-precision prototypes are evaluated with potential users. The research question at this stage focuses on the usability of prototypes, and three aspects are investigated, including subjective satisfaction, appearance, and target group customization. During the user evaluation process, participants will be asked questions after testing the prototype, which will focus on understanding how potential users interact when they first encounter the prototype and ensuring it meets the needs of the target group. By combining these factors, the usability of the prototype is finally assessed.

Functional testing is also part of the process to ensure that the high-precision prototype meets the specified functional requirements. The functional tests implement a procedure in which the expert verifies that the prototype meets the functional requirements.

4. Ideation

4.1 Stakeholder Analysis

This section describes the key stakeholders in the Dutch eHealth innovation roadmap and how it impact to them. Primary stakeholders are the key groups that most directly and significantly impact the contents of the roadmap. They are the key users and feedback providers of eHealth solutions that provide essential information about the actual effectiveness and usability of the solution. Secondary stakeholders are groups that indirectly influence the roadmap or support its success in certain situations. They play an important role in regulatory compliance, technical support, and social awareness building, but they are not direct users or beneficiaries of the roadmap.

4.1.2 Primary Stakeholders

The most important primary stakeholders will be the founders and executives of the startups. These stakeholders will be the main end-users for the project's designed prototype. They set the direction and vision of the startups, making strategic decisions and leading partnerships with investors and key partners.
In addition, Technology partners are partners for technology development, data management, and infrastructure delivery, especially those related to cloud, data security, and AI. Technology partners' expertise and infrastructure directly affect the development, deployment, and scalability of eHealth solutions. Healthcare providers and patients are not direct users of this project, but because they are their users, they are classified as important key stakeholders for the roadmap from the perspective of Startups.

Healthcare providers consist of hospitals, rehabilitation, doctors, and nurses, and are the main users and collaborators that bring eHealth solutions into the real world of healthcare. Healthcare providers utilize eHealth technology for day-to-day care, recording, and monitoring. In other words, the effectiveness and practicality of the solution are closely linked to their work process. Their feedback has a significant impact on the effectiveness and utility of the solution. Patients are end-users and beneficiaries of eHealth. Success depends on how much the patient accepts and utilizes the solution, and the value and utility that the product provides are measured

through the patient's experience. Patients' opinions and requirements need to be reflected throughout the roadmap.

4.1.3 Secondary Stakeholders

Government and regulatory bodies are among the most important secondary stakeholders. The Netherlands' eHealth solutions are required to comply with legal regulations, especially on GDPR compliance and healthcare data protection. It may require collaboration with public health organizations such as the Ministry of Health or Rijksinstitut voor Volksgezondheid en Milieu (RIVM).

Next is the medical device certification institutions. If the eHealth solution is classified as a medical device, it must be certified about it. Cooperation with related organizations is also required as it must meet medical device standards such as CE certification.
Since this roadmap is for startups, media, and marketing managers are also classified as stakeholders for successful marketing. They inform the innovation of eHealth solutions and deliver the value of them to the public. They contribute to building positive awareness and creating market demand. Another primary stakeholder is investors. They are interested in Return on Investment (ROI) which means a measure of the profit earned from an investment relative to the amount of money invested and business growth, providing funds based on the growth potential realized through the roadmap [27]. In addition, eHealth startups or competitors in the same industry help set strategic priorities for the roadmap with information and trends provided by competitors seeking innovation in similar areas. In addition, research institutes, universities, and medical research centers are included helping to assess the clinical effectiveness and innovation of eHealth solutions. Finally, local communities and patient organizations contribute to increasing solutions' social acceptability and reliability. Collaboration with these organizations is important, especially regarding solutions for chronically ill or disabled people.

4.2 Concept Generation

This section describes how the ideas of the project were created and embodied. After a total of two brainstorming sessions with a Creative Technology student, a storyboard design initiative, actual ideas are pictured based on concept generation.

4.2.1 Brainstorm sessions

The first brainstorming session began with the creation of a mind map for important elements to be included in the eHealth roadmap. The core components identified key components required to develop successful eHealth roadmap. The goal of this brainstorming was to explore and understand the main aspects that contribute to eHealth Roadmap implementation. This session focused on five major categories: Business model development, Market research, Implementing products and introduction them in hospital, Data protection & Legal compliance and Product development and technical consideration.

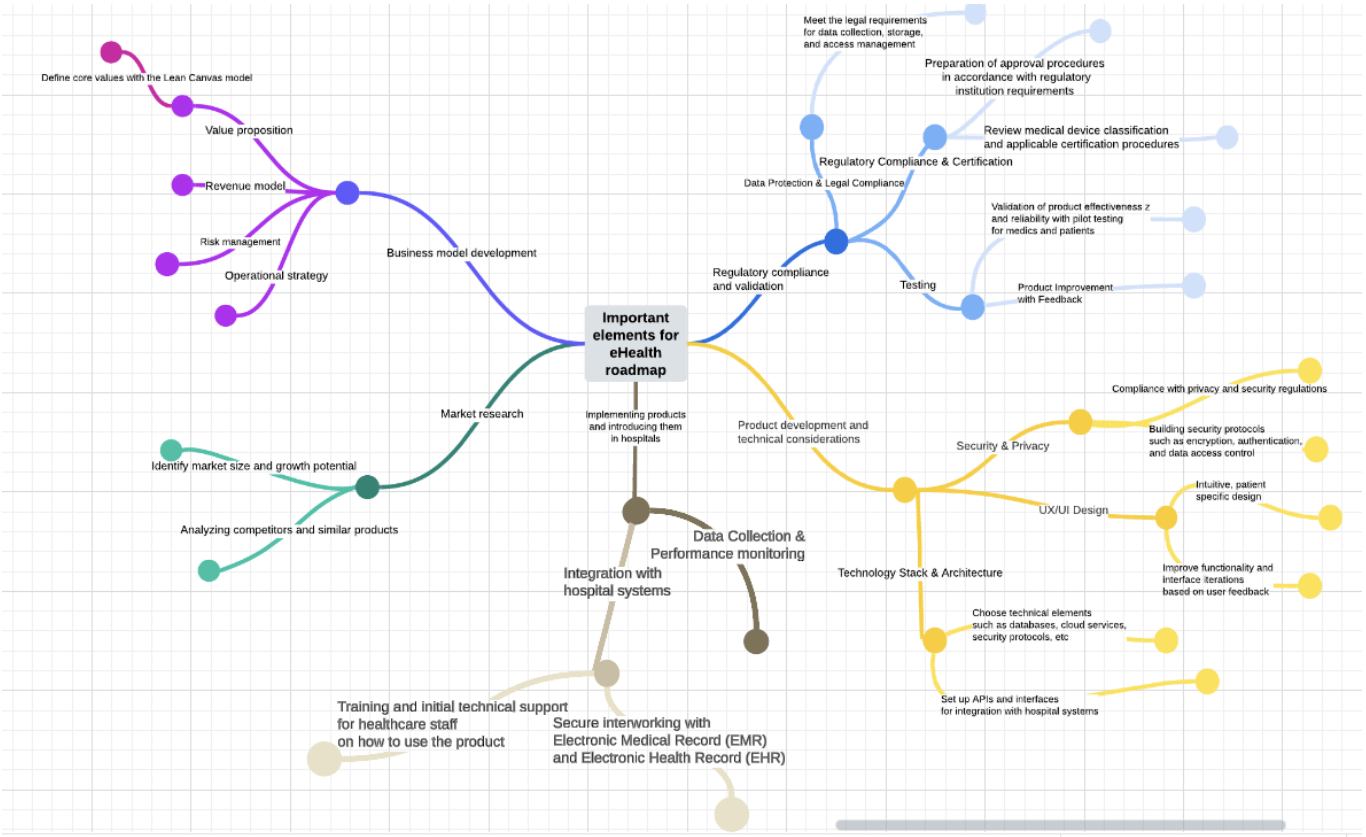

Figure 5: Mindmap for Important Elements for eHealth Roadmap

In the business model development phase, the Lean Canvas model is used to define core values and clarify the key functions the product provides and the services it can provide to its users. Based on this, we devise a variety of monetization strategies and establish initial operational plans, including human resources, technology resources, and external partners. Along with this, we identify technical, regulatory, and business risks and develop management plans to promote stable operations.

Market research analyzes how much the technology a company wants to create is in demand in the market. To do this, we examine the size and growth potential of the market, its differentiation from competing products, and regulatory requirements.

Product development and technical considerations determine the technology stack and architecture, and set up APIs and interfaces for integration with hospital systems. Complies with security and privacy regulations and establishes security protocols such as encryption, authentication, and data access control in line with security regulations. UX/UI design provides an intuitive and concise interface to medics and patients, and iteratively improves the design based on user feedback.

Compliance and validation are pilot tested to verify the effectiveness and stability of the product, which complements the product based on the feedback gathered. Prepare certification procedures according to regulatory requirements and review medical device classification and certification procedures to be approved by the certification institution.

Product development and technical considerations determine the technology stack and architecture, and set up APIs and interfaces for integration with hospital systems. Complies with security and privacy regulations and establishes security processes such as encryption, authentication, and data access control in line with security regulations. UX/UI design provides an intuitive and concise interface to healthcare staff and patients, and iteratively improves the design based on user feedback.

Product implementation and in-hospital deployment are integrated with hospital systems to perform interworking tests with EMR, EHR, ensure stability, and naturally integrate into medical staff workflows. User training for medical staff helps them understand how to use the product and provides initial technical support.

The second brainstorming session was conducted with another Creative Technology student to explore the key components of eHealth interactive games and come up with ideas.

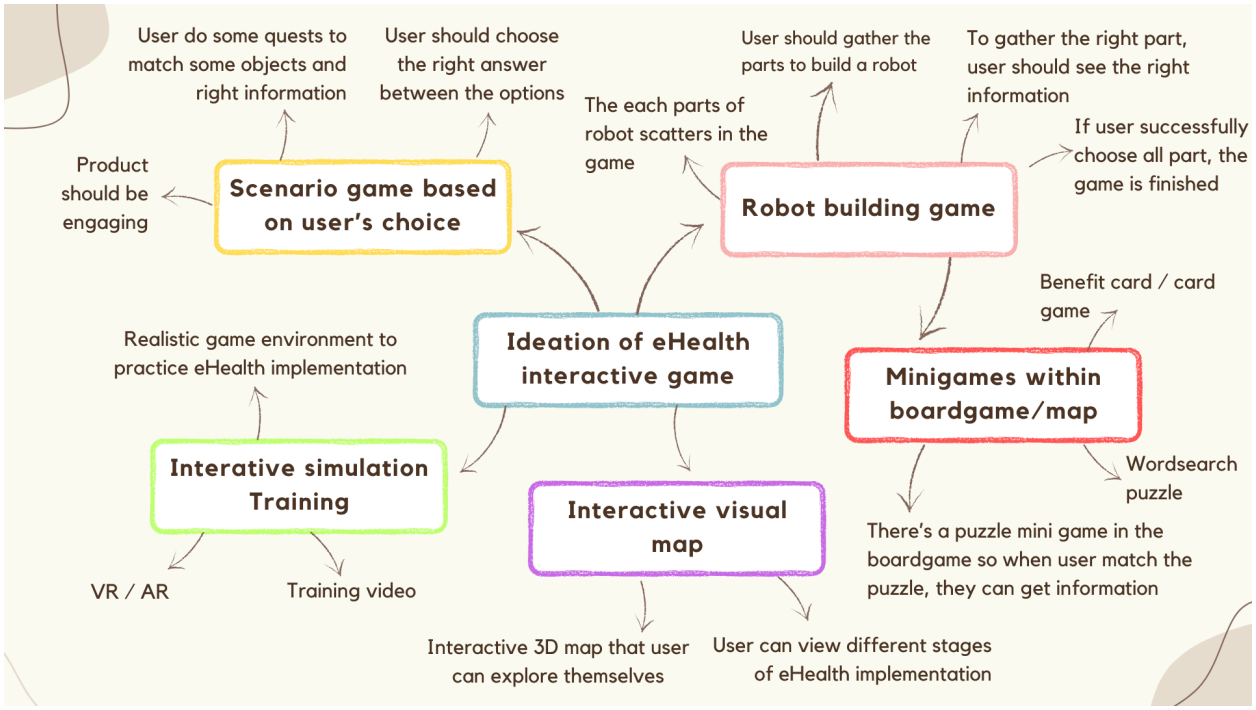

Figure 6: Mindmap for ideation of eHealth interactive game

The session aimed to develop interactive ideas that could help users understand eHealth's roadmap and implementation steps. The ideas presented in this brainstorming session were embodied and described in 4.3 Concepts.

4.2.2 Storyboard

Storyboard production was also done with a Creative technology student. Once eHealth roadmap is completed, a single webpage for ROADmap will be added to the webpage of eCMC, the client of the project, on which two different roadmaps will be uploaded. Users can choose a roadmap for Startup or a roadmap for eHealth professionals based on their needs. Each of the two different roadmaps is for different target groups.

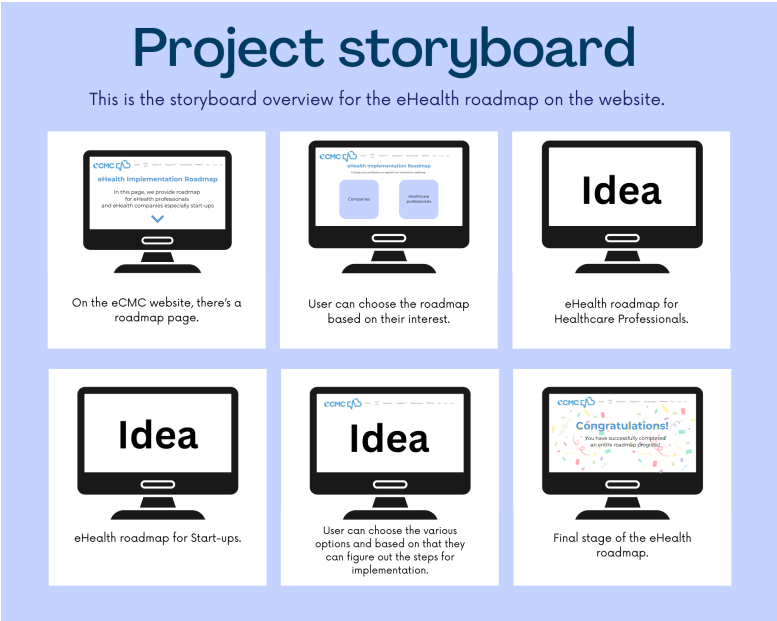

Figure 7: Storyboard of the Roadmap

4.3 Concepts

4.3.1 Digital Board Game

eHealth startups often deal with complex medical technologies or data-driven solutions. Digital board games translate these complex concepts into game scenarios that help startups easily understand and become accustomed to them. For example, by experiencing the flow of regulations and policy applications, the sensitivity of patient data, and user experience design through board games, one can get closer to a hands-on experience.

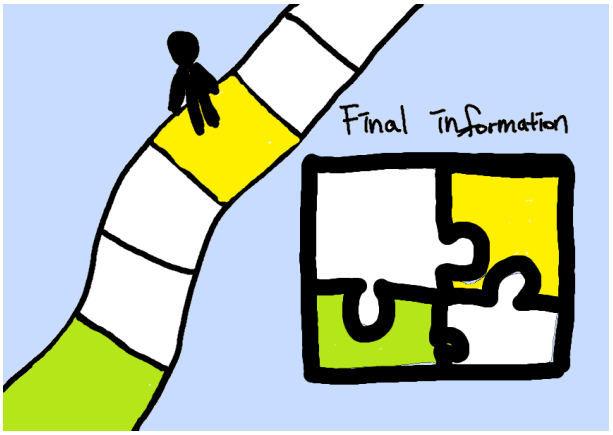

Figure 8: Concept sketch of digital board game

.In general, eHealth startups go through a number of processes to develop and market technologies and actively use them by users, which can be confusing for startups that are just starting out. Digital board games are an effective way to experience the essential steps that startups have to go through in a virtual environment at a low cost. Startups can experience and prepare for problems before entering the market or introducing new technologies.

These digital board games can easily increase user engagement by inducing more active interactions than typical information delivery. However, while games model real-world problems, they may have limitations in completely replacing real-world situations or reflecting all variables and complexities. Since eHealth startups have to experience a variety of complex situations they encounter in real-world healthcare settings, the lessons learned from games may not always be directly related to solving problems in real-world situations.

4.3.2 Interactive Visual Map

The Interactive Map provides a digital space where users can directly explore various types of information. The map shows a virtual environment where various stakeholders are involved, such as hospitals, startups, users, investors, and policy management organizations.

For example, users can click on the Regulatory Compliance section to explore startups' eHealth technology and the compliance they face applying it, and click on the Startup section to see the elements needed for IT infrastructure and integration. The Investor section can identify investment opportunities and areas of interest in eHealth, and the Policy Management Agency section can learn about eHealth regulations and policies. This process allows users to understand the interactions of each stakeholder within the eHealth industry and to have a clearer understanding of their requirements.

These interactive maps help you intuitively understand the eHealth ecosystem by allowing you to experience complex real-world interactions in a virtual environment.

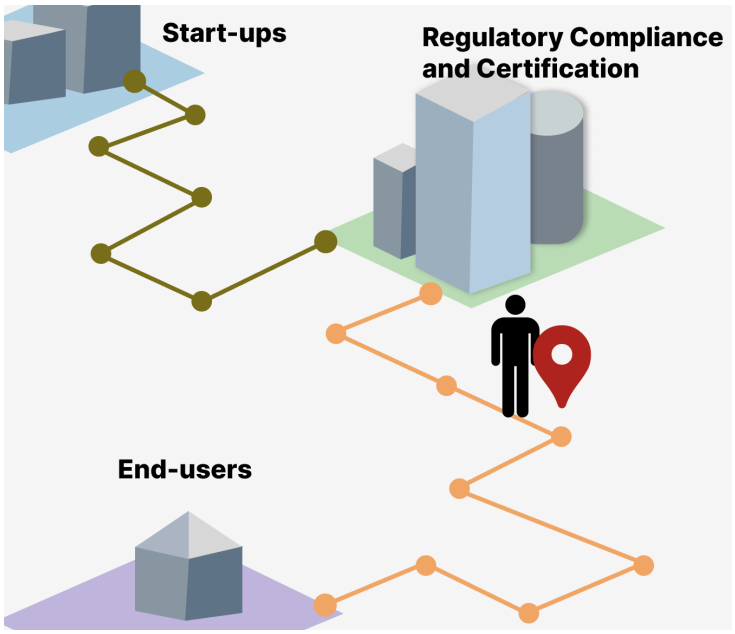

Figure 9: Concept sketch interactive visual map

Interactive maps allow users to explore information on their own, providing a user-centric experience and allowing learning and exploration to be user-driven. In addition, visual placement of complex elements of the eHealth system (hospitals, startups, investors, policies, etc.) makes it easier to communicate complex information to users. It provides a quick understanding of how each stakeholder is connected to each other, which improves the overall understanding of the system.

However, unlike the digital board game idea, interactive visual maps are likely to only work in the way that users get information and leave. While they can provide participants with a sense of competition or challenge, maps may have limitations in providing users with lasting motivation because they primarily focus on information delivery. In addition, since a lot of information is provided through the map, users can encounter too much information at once. This can cause users to lose focus or miss important information. In particular, it can be difficult for users to quickly find the information they need, as there is a large amount of information in a complex eHealth ecosystem and there are many technical terms and technical details in each field.

4.3.3 Interactive story

The interactive story idea aims to allow the user to experience various real-world scenarios in advance. The user is given multiple scenarios, and the user must choose one of the options given at a specific time.

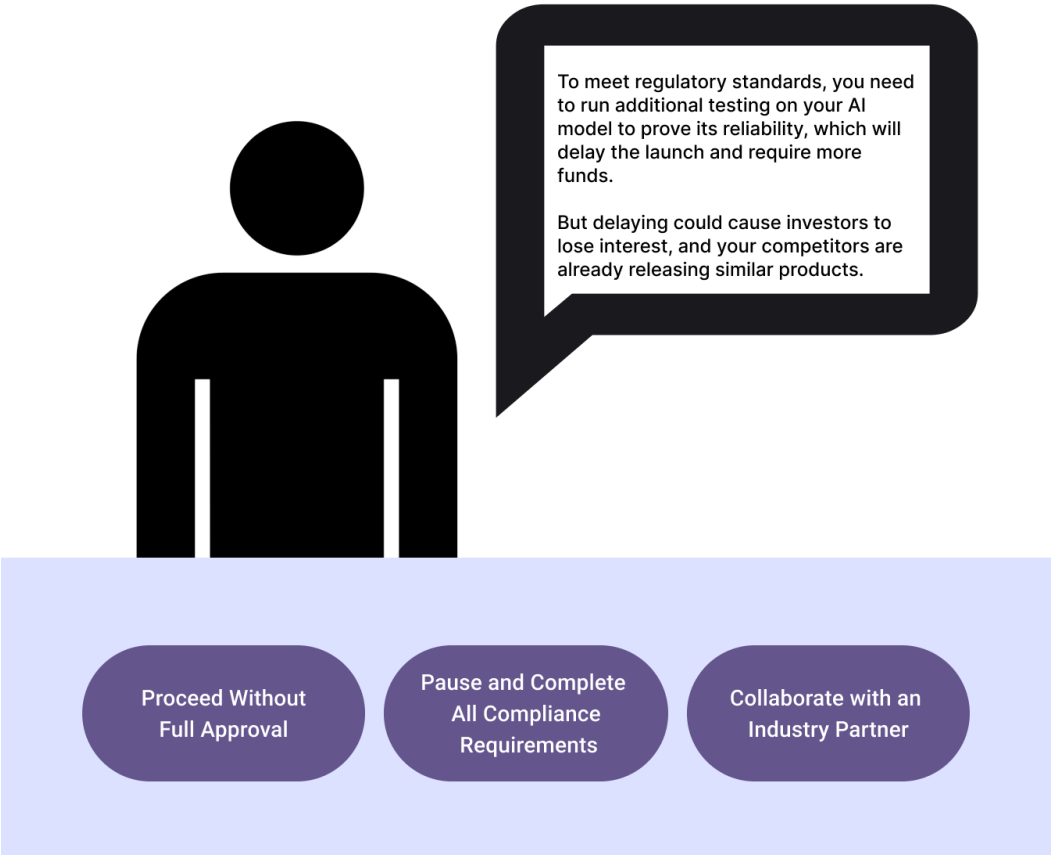

Figure 10: Concept image for interactive story

The ending of the scenario varies depending on the option selected by the user. This idea has the advantage of allowing the user to experience simulation in advance in that the user can know what will actually happen, but in real life, there is a limit to implementing all scenarios because so many cases, various variables, and various environments are intertwined. For this reason, if this idea is adopted, the roadmap should not be a general informational user experience, but should be designed so that users can experience deeper and more accurate scenarios by defining a narrow field, such as policies or financial issues, until startups launch products and their products become active in the actual market.

4.3.4 Digital Exhibition

Digital Exhibition provides users with a virtual exhibition space they can freely explore. The space features various eHealth-related information and materials, and includes a gamification element. This element has users collect unique items, that are rewarded upon completing consuming the information. Users can explore the information and resources displayed in each section as they explore the exhibition, which gives them an insight into the eHealth ecosystem.

Each exhibition section provides in-depth information on a particular topic or field, allowing users to focus on and explore their areas of interest. For example, there are various sections such as technological innovation, policy, regulation, and patient experiences. The information they provide can be organized in the form of videos, articles, infographics, etc.

After collecting information and data from each section, the user completes the exhibition by performing a mission to collect the section-unique collectible items. In this process, users learn and acquire information naturally, and the collected items are recorded on their profiles to give them a sense of accomplishment.

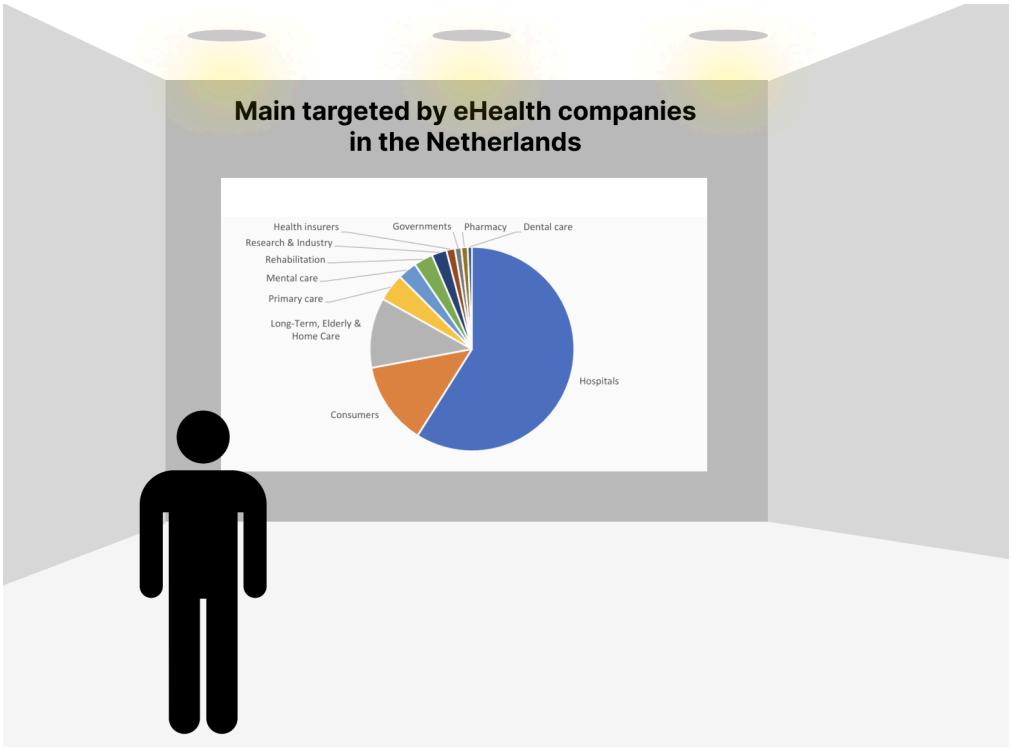

Figure 10: Concept image for Digital Exhibition

Digital Exhibition provides information and materials in a visually appealing format, which makes it easier for users to understand and remember. Various multimedia materials (video, infographic, etc.) can be used to deliver complex content more intuitively. In addition, users can freely explore exhibitions at any time they want, so they can learn according to their interests. This increases the flexibility of learning, allowing users to find the information they need. However, it may take time for users to explore the exhibition, and they should consider the time and effort required to gather and understand the information. This could lead to users needing to pay more attention to tasks or other activities.

4.3 Interview with Target Group

Interviews were conducted with two participants of the target group to gain insights into the idea of the final product and the content to be included in the product. Although more potential participants received invitations, only two were able to participate due to their individual schedules.

Initially, the plan was to ask the same interview questions to both participants and compare their responses. However, due to the significant differences in their roles, separate questions were prepared for each participant. One participant was a co-founder of an eHealth startup, so the questions focused on their experiences and their needs while building a company and entering the market in the eHealth industry. The other participant was the Creative Director of a company developing serious gaming related to eHealth, so most of the questions were centered around ideation and idea development.

4.3.1 Target Group Interview Questions and Answer

The questions asked to each participant and their corresponding answers can be found in Appendix 2: Target Group Interview Questions and Answers. As mentioned in Section 4.3, different questions were posed to the two participants.

In the interview with the Co-founder of an eHealth Startup, the responses highlighted several challenges, particularly the difficulty in convincing multiple stakeholders, struggles with regulations, and the limitation of budgets, which were identified as the biggest challenges for eHealth startups.

On the other hand, the interview with the Creative Director of an eHealth Project mainly focused on the aspects to be considered when developing a product from the developer's perspective. Although the direction of the questions differed, both participants expressed a needs for a

networking feature where users could share opinions or ask questions. They mentioned that networking would be helpful for startups, as connection and marketing are crucial aspects for their success.

4.4 Conclusion

In summary, by identifying primary and secondary stakeholders, a complex network of contributors that affects the success of eHealth solutions was recognized. Key stakeholders, such as startup founders, investors, technology partners, healthcare providers, and patients, play a direct role in guiding, financing, developing, and leveraging eHealth solutions. Their engagement and feedback are critical to shaping practical, effective, and user-centric solutions. Secondary stakeholders, including regulators, certification bodies, media, competitors, research institutes, and communities, play important roles in areas such as compliance, technical standards, social awareness, and research validation.

This section also provides interactive ideas for providing attractive and educational eHealth solutions. Various ideas, such as digital board games, interactive maps, scenario-based storytelling, and digital exhibitions, offer an innovative approach that simplifies complex eHealth concepts and enhances user understanding. These methods encourage active user engagement, giving startup founders and their teams a simulation experience to prepare for real-world problems in healthcare innovation. However, each concept has its limitations, and there can be potential challenges in balancing educational depth and user engagement, especially in virtual or game-based simulations.

In developing the eHealth roadmap, five key elements were critical: user experience, practical aspects, data management, communication and evaluation, and education and training. A user-centric approach to eHealth development ensures that solutions are accessible, functional, safe, and meet the needs of both patients and healthcare providers. Practical considerations, such as technology integration and compliance, are essential to building trust and ensuring the feasibility of the system. Effective data management protects personal information, facilitates decision-making, and promotes collaboration and feedback through continuous communication and evaluation. Finally, education and training enable users to fully participate in eHealth systems.

Finally, the target group interviews provided valuable insights into what content should be included in the roadmap, as well as how much content is necessary to provide information to users without overwhelming them. After consulting with the supervisor, it was agreed that the Virtual Exhibition idea was creative, and based on this feedback, the final product was decided to be developed in the Virtual Exhibition format.

5. Specification

5.1 Target Audience

The target group of this project are eHealth startups within Remote Patient Monitoring (RPM) in the Netherlands. They are developing innovative healthcare solutions based on patient monitoring and management technology and are aiming to enter and expand early on markets. However, complex healthcare regulatory environments, technology integration barriers, and the necessity of multiple stakeholder collaborations are challenging to slow down implementation. These startups need practical guidance and support to accelerate their successful implementation in the market.

5.2 Personas and Design Scenario

5.2.1 Personas

Cooper defines persona as an accurate description of the product or service user and what he tries to achieve [31]. Calde et al. describes persona as "a user model", i.e., a hypothetical, detailed typical character representing a distinct group of behaviors, goals, and motivations observed and identified during the research phase," helping to orient the design around the user's motivations and objectives during the design process [31]. By this definition, a persona was created to embody the user's motivations and goals for designing an innovative roadmap for startups to accelerate the development of meaningful eHealth technologies for RPM that will be included in this project.

Persona 1 - Startup Co-Founder (Tom. 38 years old)

Profile

- Digital Health Startup CEO, Co-founder of Company A

- Tom combines his role as CEO with a technical background (software engineer) and business sense
- He plans to expand the market after the initial eHealth product launch.

Goal

- Raise recognition of their product and find customers to use their product and find partners to collaborate with (for example other startups within the same industry).
- Obtain information to explore opportunities within the framework of existing policies and regulations.

Needs

- Up-to-date insides in the latest trends and regulatory compliance guidelines.
- Simple yet meaningful networking tools.

Envisioned Experience with Virtual Exhibition

- Exploring opportunities for cooperation with other startups and introducing products by utilizing the platform's learning community function.
- Review the resources provided and have a business expansion strategy meeting with the team.

Persona 2 - Gamification Expert (Mark, 45 years old)

Profile

- Creative Director, working for a game developer, recently undertook a serial gaming project in eHealth.
- Gamification expert, good at designing to maximize user immersion and motivation.

Goal

- Evaluate the interactivity and user experience of eHealth applications
- Explore ideas on how to apply gamification elements within eHealth applications
- Check the potential to expand to a new eHealth gaming project in the future

Needs

- Check how the virtual exhibition can enhance user engagement and interaction to apply similar strategies within serious gaming in eHealth.
- Get insight into how user experience in virtual exhibition format contribute to the adoption and maintenance as a solution of eHealth industry.

Envisioned Experience with Virtual Exhibition

- Plans various gamification elements for future eHealth projects using the virtual exhibition format as a reference.

5.2.2.Design Scenario

Startup Co-Founder (Tom. 38 years old)

Tom enters the exhibition platform. The main focus areas are Finance Hall, Regulation Hall, and Stakeholder Hall. Knowing that understanding financing opportunities and compliance requirements are important for startups, Tom decides to take a look at each of these sections in turn. Exploring Tom goes to the Finance Hall and checks for information related to allowance, funding programs, and financial support for startups in eHealth technology for RPM. Tom is interested in finding an allowance that his startup can apply to support market expansion and product development. He navigates the latest financial aid announcements to find relevant allowance programs for his startup to qualify. To make the process easier, the platform provides a guide to the application process, schedule, and eligibility criteria. Tom bookmarks the program and notes deadlines. Next, Tom goes to the Regulation Hall to review the latest updates to the dutch WEGIZ (Wet elektronische gegevensuitwisseling voor goede zorg) laws and how this might affect his launch. The hall includes resources such as a guide to compliance in the digital healthcare sector and a video tutorial. Tom focuses on key resources for WEGIZ legal requirements for data protection and cross-border healthcare. He learns about new regulations, particularly patient data privacy regulations, which will take effect next quarter. These updates are relevant given that his product uses patient data. After the virtual exhibition ends, Tom follows up on the following action items. He contacts financial support for more information about the application process. He reviews WEGIZ legislation to ensure the team is well-prepared for future regulatory changes. He schedules a meeting with the product development team to discuss integrating stakeholder insights into the next product update.

Gamification Expert (Mark, 45 years old)

Mark enters the virtual exhibition platform with aiming to analyze its potential for user engagement in the eHealth sector. As he navigates the basic interface, he pays attention to how the product provides an interactive and immersive experience for users. He starts by adjusting the movement controls to test how effectively the first-person view can simulate the feeling of attending a real exhibition. Observing the user journey, he evaluates whether the design successfully maintains engagement and motivation.

As Mark continues exploring, he checkes the user interface and interactive elements of the virtual exhibition, identifying mechanisms that effectively guide users while keeping them immersed. He analyzes what aspects would need to be enhanced if this product were further developed into a serious gaming experience. He evaluates features such as 3D sound, where audio intensifies as the user approaches a video, making it feel as though they are physically present in the space. He assesses how these elements could inspire his future eHealth gaming project.

After completing his exploration, Mark brainstorms how the virtual exhibition format could evolve further and serve as a reference for another solution within the eHealth industry. He takes notes on its potential and considers using the product as a case study for discussions with potential clients in future projects.

5.3 Requirements

Developing requirements is an important part of eHealth design, which includes all activities dedicated to identifying requirements, communicating requirements to other developers, and evaluating them [30]. In this chapter, requirements can be identified as five different types which are functional requirements, Service requirements, Organizational Requirements, Content requirements, Usability, and User Experience requirements. The functional requirements are technical features, the type of technology, and the operating systems the technology should work on. The Other non-functional requirements are more related to usability and user experience, what services should surround the technology, how the technology should be integrated into the organizational structure, and contents that need to be communicated via the technology such as language level, persuasive approach, and special accessibility demands [30].

To prioritize these two categories of requirements, MoSCoW technique is used. MoSCoW technique categorizes project requirements into four priority sections: *Must* have, *Should* have, but not essential, *Could* have, and *Will not* have. Applying MoSCoW techniques enables efficient resource management by helping to focus on crucial requirements within a limited time and budget. They also clearly define problems in existing systems and prioritize designing solutions. [29].

According to the framework of van Velsen et al., five types of requirements were classified, and these requirements were ranked as must have, should have, could have, and will not have according to their importance. The requirements organized by the method by van Velsen et al. can be found in the Appendix 3: 5.3 Requirements [30].

5.4 Concept Description

5.4.1 Ideal Concept Description

The ideal design concept of the product is to include almost all of the requirements. The contents can filter out the contents information or personalize it with the information you want depending on what kind of technology you have for Dutch eHealth startups, and the company you work with primarily. For functional ideal concept is a product designed to allow users to save and continue their previous work when they log in again, without having to explore from scratch. Also, this function is connected to the filter to personalize the relevant content. If the user has their account, they can save their data and settings in their account. This feature allows the user can communicate with other users in a multi-user environment. This will encourage the user especially early-stage startups to search for new connections.

5.4.2 Realistic Concept Description

A realistic design concept will be a design with all Must and Most Should items in section 5.3 requirements. The design concepts mentioned in 5.4.1 Ideal Concept Description are helpful to users but have their limitations. First, if you put as much information as possible into the product, the memory size of the product becomes heavy, which can cause data loading problems when users experience errors or delays or post them on the website in the future. Implementing a personal account also needs research and solutions on how to protect and handle each user's data in the current prototype stage.

5.5 Concept Specification

5.5.1 Content

Instruction

Before entering the exhibition for the first time and browsing through real information, users will see a short instruction on how to steer and navigate within the exhibition. Through this instruction, users will have enough guidance on how to use this product.

Regulation

This category is designed to help Dutch RPM startups understand the regulatory environment and obtain the necessary certification and approvals. The category aims to provide relevant information, such as CE certification (Conformité Européenne) standards, which are the medical device certification guides required for eHealth technology certification, and to provide users with a summary and checklist of data privacy and security regulations, particularly GDPR (General Data Protection Regulation) and Dutch medical data regulations. Additionally, the Dutch law Wet elektronische gegevensuitwisseling in de zorg (WEGIZ) is included, which regulates the electronic exchange of medical data. Permission process workflows can also be shared, including submission processes, expected timelines, and required documentation guidance.

Finance

This category aims to help startups strategize for financing and ensure their financial sustainability. From this category, startups can identify financing options such as venture capital, government grants, and EU funding program information and explore financial success stories, such as how other RPM startups have succeeded in financing.

Stakeholders

This category is designed to help startups build relationships with key stakeholders within the healthcare ecosystem (hospitals, insurers, patients, etc.) and identify opportunities for cooperation. The main content of this category will be a key stakeholder map that outlines the roles and requirements of hospitals, healthcare professionals, insurers, government agencies, etc.

5.6 Interaction

5.6.1 Interaction Diagram

The interaction diagram was created for this project (see Figure 11). The diagram has 4 scenarios. The first interaction a user will encounter is entering the virtual exhibition and the user will see a short instruction on how the virtual exhibition works and how to control the manipulation keys. After that, the user can choose four different categories. The four categories that users can explore are Regulation, Stakeholders, Finance, and Main Hall. The interaction sequence for the Regulation, Stakeholders, and Finance categories has the same process. If the user chooses one category among them, the user will explore the prepared information related to that category in the exhibition. The prepared information in the exhibition will include media such as videos or infographics that users can load in the middle of the exhibition. If the user wants to see more details about that information, the user can click on the information item and it will play the zoomed-in media to the user.

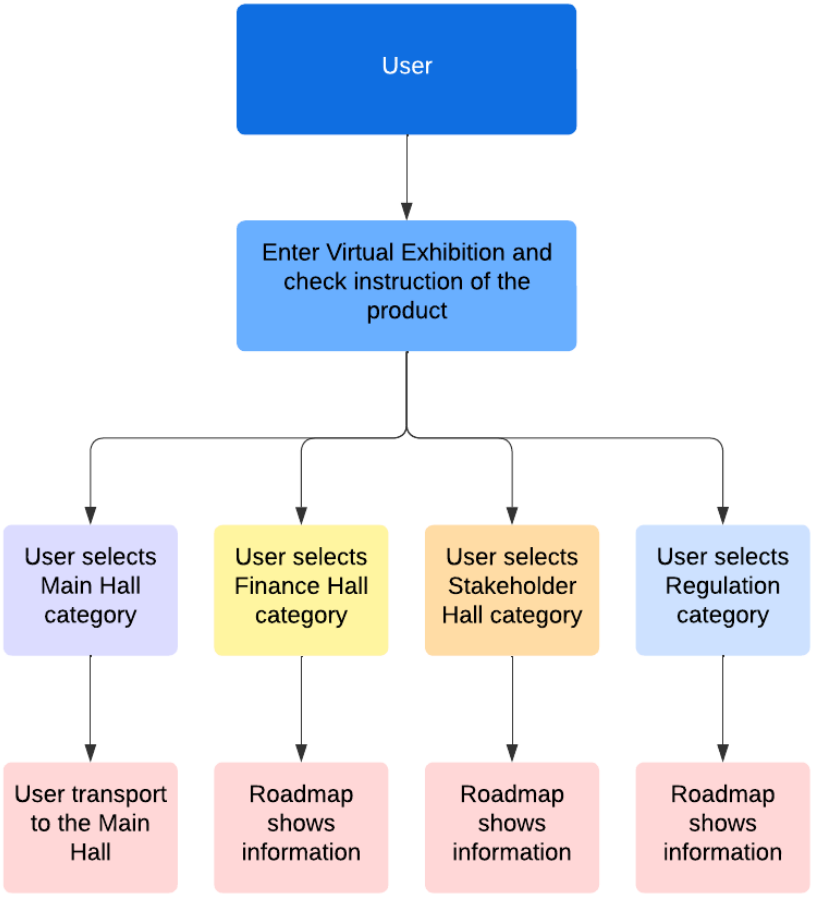

Figure 11. Interaction diagram

6. Realization

6.1 Software

This chapter describes all the software used in the development of the final product. These include not only the technical software and programming languages required to implement the virtual exhibition format, but also the programs necessary for creating infographics for the content.

6.1.1 Unity

Figure 12. Unity [32]

All interactions and animations are made using Unity software. Unity is a real-time content creation platform that provides users the tools to create games, simulations, and interactive experiences. The version used to create the product is 6000.0.32f1 and has been released on Dec 19th, 2024. The Windows Build Support module was used to design the product within Unity software and export it to a live-action program. Files exported to the Windows Build Support module are defined as applications. Also, the WebGL module (HTML file building support module) has been downloaded to enable not only the application type but also the Web browser file because the product is likely to be integrated into the eCMC website.

6.1.2 Visual Studio

Figure 13. Visual Studio [33]

The correct code is required for interactions and animations created within Unity to run at any time or place desired. Visual Studio 2022 was used for code programming for instructions. Visual Studio is a creative launching pad that is used to edit, debug, and build code, and then publish an app. The programming language used is C#, which is mainly used in Unity development.

6.1.3 Autodesk Maya and Figma

Figure 14 Autodesk Maya and Figma [34, 35]

While Unity can create 3D objects such as cubes, spheres, and quads, it is unsuitable for delicate designs, especially for shaping objects into desired shapes. Autodesk Maya is a 3D computer graphics application that is well-suited for modeling. The assets used in the product (Unity means different shapes of objects used in Scene, including characters) were modeled by Autodesk Maya and then imported into Unity.

The infographics and images posted inside the product were produced using the Figma application. Figma is an interface design tool suitable for 2D design, such as mockups, auto layouts, and design systems [8].

6.2 Final Prototype (Hi-Fi)

This chapter describes the functionalities of the final product and provides an overview of the content within each section. The product is divided into four distinct halls, with each hall offering different content to the user. The product video can be accessed in Appendix 4: Product Video Link.

6.2.1 Main Hall

Figure 15: Starting Scene

Upon starting the prototype software, users are spawned in the Main Hall. The objective of the Main Hall is twofold: Firstly, it aims to provide instructions to users on how to operate and navigate the product. The software was designed to be navigated from a first-person point of view, which means that the view displayed on screen is what the digital on-screen character sees in the exhibition rooms. Users can control their character in multiple directions: forwards, backwards, and sideways, using the direction keys on their device keyboard. Additionally, users can control the camera angle with their pointer device, e.g. a mouse.

There are four “sticky” floating buttons present at all times in the lower half of the screen, regardless of the user’s position or camera angle. These buttons allow the user to quickly and easily navigate to each specific hall, e.g. the Stakeholder Hall. Figure 15 shows these buttons, along with the welcome slide which users are greeted with upon launching the prototype.

Figure 16: Finance Hall Entrance View from the Main Hall

The second objective of the Main Hall is to allow for easy navigation around the exhibition space, by placing it in the center. All other halls directly connect to the Main Hall, which means that users can reach any other hall directly from the Main Hall using their navigation controls. As shown in Figure 16, the user can easily recognize the entrances of the other Halls within the Main Hall by adjusting the angle with the mouse.

6.2.2 Finance Hall

Finance Hall installed an additional wall inside the Hall to separate the space. By placing the wall, there was video space on one side and poster-type content on the other. Video could be downloaded from the Rijksdienst voor Ondernemend Netherland (RVO) which is the Dutch Enterprise Agency (Official English name of RVO) [36].

Figure 17: Finance Hall video player and coin object

When the product ran after installing the video during the development phase, there was a problem with the video being heard even when the controller was located in another hall. This issue could be resolved by programming the video player trigger in C#. It installed the video player trigger near the video and was programmed to play itself when the user was within a certain distance. In the early stages of development, the video player trigger was installed as a transparent object invisible to users. However, there was a possibility that users could see the blank screen from a distance and think it was an error or delay. To solve this issue, coin objects were added. To appeal to users that the coin is not just a decoration, it floats in the air and moves up and down. Photos of the coin and the video can be found in Figure 17.

Since the product has a Virtual Exhibition format and uses a first-person controller, a feature was added to make video sound three-dimensional for users' immersion. As the user gets closer to the video, the sound of the video becomes louder, and as the user moves away, the sound decreases, allowing users to experience the distance they can feel in real experience.

Figure 18: Finance Hall with poster-type of content

Beyond the wall where the video was, the rest of the information about STOZ (Stimuleringsregeling Technologie in Ondersteuning en Zorg or Financial Support Arrangements for Technology and Support and Care in English) is displayed in the form of a poster. Each poster was produced by Figma and then imported into Unity.

6.2.3 Stakeholder Hall

Figure 19: View 1 in Stakeholder Hall

Figure 20: View 2 in Stakeholder Hall

The stakeholder hall has an infographic that outlines the key stakeholders and their roles within RPM, their key needs, and what RPM can provide to them. Key stakeholders include patients and caregivers, health care professionals, hospitals, government, and infrastructure providers. On the left wall from the entrance is an infographic that occupies one side of the wall. This infographic visually represents RPM's positioning in the Dutch healthcare market system and is based on the insights on the Dutch healthcare system provided by Rakers et al. [37].

6.2.4 Regulation Hall

Figure 22: Regulation Hall video player with star-shaped objects

Within the Regulation Hall, additional walls and rooms were installed to create a space for video play, as described in chapter 6.2.2.2. However, since the space for the video was located deeper inside the Regulation Hall, it was designed in such a way that when the user saw the Regulation Hall at the entrance, they would know that there were multiple rooms inside. To make users aware of additional content, we designed star-shaped objects to be visible from the entrance. We also created a video player trigger, as in Stakeholder Hall, to make sure that the video is played when the user gets close to a certain distance. Likewise, when the user moves away from the hall at a certain distance, the video stops playing. This keeps the user from still hearing the video, albeit quietly, when the user is in another hall. The video player is also programmed to make the video sound louder and lower depending on the user's distance. The video is an explanation about WEGIZ, which could be imported to Unity via an external link referenced in [38]

6.3 Functional Requirement Review

Priority Level	Requirement	✓/X

Must	The product must provide directional control for user navigation (forward, backward, left, right).	✓
	The product must include and playback external media (hyperlinks, videos)	✓
	The product must contain clickable elements to move users between different categories.	✓
	The product must be very lightweight and performant on all browsers with average consumer computers as our primary target.	✓
Should	The product should be able to show the documents included in the exhibition, such as images, videos, case studies, or diagrams.	✓
	The product should have enough memory/speed to load media-rich content (e.g., video, maps) without delay.	✓
	The product should integrate with the current eCMC website	X
	The product should have a secure connection (i.e. https://)	X

Table 7: Functional Requirement Checklist

As shown in Table 7, the product met most of the functional requirements (See Appendix 3 Requirements) defined in Chapter 5.3. However, while all the requirements for Must have been met, the requirements for Website projection among the requirements for Should have been partially completed. There are two uncompleted requirements Should have priority level, the product should iterate with the current eCMC website, and have a secure web connection. To satisfy these requirements, the product should be built in HTML format in Unity. In this case, a specific module named ‘WebGL’ is required to be downloaded in Unity for exporting the product to HTML format. It was successfully built-in HTML format with WebGL, but there was an issue that the HTML file expired after a certain time when opening the file in the web browser. Since the file has not been uploaded to any web server yet, opening it directly in the web browser has a problem loading the whole assets that the product contains. Otherwise, WebGL builds need to be hosted on a web server. If the web server issue is solved, this product can integrate into the current eCMC website with a secure connection.

To run the product without missing any assets from the product, it was exported in the format of an application using the Windows build module. Therefore, this feature was marked as incomplete (X).

7. Evaluation

7.1 Overview of Evaluation Methods

To obtain user input and data to allow for the evaluation of the project and prototype, two rounds of interviews were organized: one round targeted the general public (n=4 participants), and a second round consulted experts involved within the eHealth sector (n=2 participants).

The main aim of the first round of testing was to evaluate the usability and user experience (UX) of the prototype through interviews via a 1-5 Likert scale questionnaire. The interview consisted of a total of 10 questions: 2 pre-test questions, 4 post-test questions, and 10 Likert scale survey questions. To allow for the most optimal user experience, and to rule out any possibility of detriment to the UX caused by the limitations or miscommunications that can arise from conducting testing sessions remotely, testing sessions and interviews were carried out in person.

To supplement the data gathered in the first round, a second round of testing was carried out, aimed at ‘experts’ who are currently involved in the Dutch eHealth industry, or have experience with Remote Patient Management. While the first round focused on evaluating the UX and general usability, the purpose of the expert consultation was to assess to what degree the contents displayed at the exhibition were suitable and of use to eHealth startups. Since the expert participants in the second round are currently active in the eHealth industry, their experience and knowledge enabled them to evaluate whether the exhibition contents would benefit the needs and desires of our target group, the eHealth startups within RPM.
As opposed to the first round, the second assessment round was conducted remotely, as these participants did not reside near Enschede. The initial plan was to send out email invitations to the expert participants, along with the exhibition software exported from Unity in a stand-alone application, which allows them to run it locally. Users would then share their screen, to observe the way they interacted with the exhibition software.

However, due to company policy, the unverified program could not be received by email, so it was conducted in the form of Remote Usability Testing, which controls the direction, location, or angle that the tester wants to go after looking at the shared screen.

7.2 Usability Testing by Users

7.2.1 Set Up

All user tests were conducted in person. Testing sessions in open locations on campus were conducted by users directly manipulating products developed by Unity and exported in the form of applications. The testers are Creative Technology students at the University of Twente who have experience developing Unity software.

7.2.2 Interview and Questionnaire Questions

The questions for the User Evaluation were prepared regarding User Interface, Functionality, and Usability. The User Evaluation Group is not specialized in eHealth but has experience with Unity software development and various other prototype developments. Therefore, all the questions focused on Usability and Functionality. The questions were structured based on the work of A. Kaya, R. Ozturk, and C. A. Gumussoy in their paper “Usability Measurement of Mobile Applications with System Usability Scale (SUS)” [40], and were created using both the Likert Scale and interview format. The list of questions can be found in Appendix 6: 7.2.2 Interview and Questionnaire Questions.

7.2.3 Data Collection Methods

Interview

All interview responses of participants were recorded and transcribed after the interview. In addition, the interviewee's main keywords were organized through simple handwriting during the interview. In addition, the interview contents were recorded along with the handwriting after obtaining prior consent and were transcribed and saved as a text file.

Likert scale questionnaire

All responses to the 10 questionnaires were automatically stored in the interviewer's PC database. Data was exported to a spreadsheet for analysis.

Observation

How the test participants interacted with the product was observed in person. While the users interacted with the product, their behavior was recorded as a text.

7.2.4 Results

Interview

Questions	Participant 1	Participant 2	Participant 3	Participant 4
Pre-Testing (Interview, 2 Questions)				
Q1) Have you ever used Virtual Exhibition features?	Haven't used it, but have seen related videos.	Never experienced it.	Haven't experienced it, but knowing what it is	No, I haven't tried it before.
Q1-1) If you have, what features were they?	When the user approaches paintings, the object in the painting appears in 3D.	Not applicable	VR museum art	Not applicable
Q2) What do you expect when you hear the general explanation of the product?	Immersive user experience	Museum style on the wall when there are contents.	VR features	I don't know what it will be.
Post-Testing (Interview, 3 Questions)				
Q1) After using the product, what was your overall impression?	It felt like watching an actual exhibition. It would be better to make it in VR.	It was very nice to look around myself and the building design looks like a hospital which matches the product topic	I think it's a really good environment. It feels like a real museum I like the floating coin object.	It was like a real museum.
Q2) Did you experience any errors or bugs during use?	There were no errors or bugs.	Not really	No	I did not experience any errors.

Q3) Are there any additional features you would like to see or improvements you think are needed?	If a user clicks on a picture or video, the media on the screen expands to full screen, it will be better for immersion.	I think it would be better if there was a guide arrow telling you to explore from which direction.	It would be nice if Main Hall had shorter explanations for each Hall as well as an explanation of the control method.	Maybe the outside background can be more decorated like gardens etc.

Table 8: User Test Interview Results

Likert-Scale Questionnaire

Questions	**Participants**				
User Interface	**#1**	**#2**	**#3**	**#4**	**Avg.**
Was the UI design intuitive and easy to understand?	5	5	5	4	4.75
Were the objects comfortably visible?	3	5	5	4	4.25
Was the readability of the text provided to the image well?	4	5	3	4	4
Were the contents aesthetically pleasing?	3	5	5	3	4
Functionality and Usability					
Was the direction control easy?	5	4	5	4	4.5
Was the media played appropriately?	5	5	5	4	4.75
Did the moving/rotating/clicking functions work properly when you explored the system?	5	5	4	3	4.25
Was there no delay in seeing the contents?	4	5	5	5	4.75
Was the video sound clear?	3	4	5	4	4
Was the overall flow of the product natural?	4	5	4	5	4.5

Table 9: User Test Likert Scale Questionnaire Results with 1 meaning Strongly Disagree

and 5 meaning Strongly Agree.

7.3 Usability Evaluation by Experts

7.3.1 Interview procedure

Before the interview, an information letter and informed consent were sent along with the testing invitation letter. Both experts work outside the Enschede area, so all testing sessions were conducted online. The original plan was to export the product in a file format from Unity and send it via email to the experts before the testing session, allowing them to control the product directly. The experts would then share their screen via Teams, and their actions would be observed. However, due to the experts' company policy, which does not allow opening unverified external programs via email for security reasons, it was decided that the experts would give oral control commands, and the actions would be performed accordingly.

7.3.2 Interview Questions

The expert evaluation focused more on the quality of the content and whether it provided useful information to the target group, rather than assessing functionality or usability. Therefore, instead of using the Likert scale, which was used in the User Evaluation, experts evaluated the content by reviewing it and responding to interview questions. The interview questions used in the expert evaluation can be found in Appendix 7: 7.3.2 Interview Questions.

7.3.3 Data Collection Methods

Interview

The interview responses of both participants were recorded and transcribed after the interview. In addition, the interviewee's main keywords were organized through simple handwriting during the interview. In addition, the interview contents were recorded along with the handwriting after obtaining prior consent and were transcribed and saved as a text file.

Observation

How the test participants interacted with the product was recorded on video. The observational data was collected for analysis after the test, and recorded to analyze at what point users were confused and whether they did not understand the product.

7.3.4 Results

Questions	Expert 1	Expert 2
Q1) After using the system, what was your overall impression?	This can be a very nice start for startups.	It is useful to get information, suitable to get some quick information
Q2) How do you think the format of the product (Virtual exhibition) could help eHealth startups?	Yes. If the contents would be targeted to the needs of eHealth startups then it can be very helpful like getting a quick information.	Unless the content quality is good, it will enable to help them. It's interesting feature.
Q3) Do you think the contents of the product could help eHealth startups?	I would say yes and no. Since some startups already know about this information but some startups don't know about this.	Depends. Some information is too general but it might help some startups.
Q4) If you or someone you know who is active within an eHealth RPM startup, would you be willing to use and recommend this application?	Yes. There's one person that I can introduce, I know a recently launched startup company in this area, if you want I can get you in contact with him.	I might but the contents should fit to the needs of the person that I want to recommend.

Q5) Are there any features you think should be added to the product or areas that need improvement?	For the contents related to the Financial Hall, add ‘business plan’. The subsidy also helps them but most of the startups do not really think about their business plan and they don't even know how much is their business value. For the design, I would add the main entrance at the Main Hall to make it more like an exhibition. For the Regulation Hall, I think the MDR (Medical Device Regulation) should be added. Lastly, it would be nice if there’s any function that startups people can communicate each other for networking.	For the contents, in the Regulation Hall, I think the most important regulation is MDR (Medical Device Regulation). I would prioritize that one in the Regulation Hall.

Table 10: Expert Interview Results

7.4 Discussion of Evaluation

The evaluation of this product included both functional and usability evaluation. The results of the functional evaluation showed that 6 out of 8 requirements were met, indicating a positive outcome regarding the functionality of the prototype. The usability evaluation also showed overall positive feedback. In a usability test conducted with 4 Creative Technology students who have experience in Unity software development, the interview results and User Test Likert Scale Questionnaire results, with 1 meaning Strongly Disagree and 5 meaning Strongly Agree, showed an average score of 4 or above for each question.

Two experts who evaluated the prototype, through interviews, agreed that this prototype could help early-stage eHealth startups in the Netherlands learn about the Dutch healthcare system and its stakeholders. However, they believed there was still room for improvement regarding the

content related to Finance and Regulation. For instance, they suggested that the Regulation Hall should include MDR, and the Finance Hall could be more helpful if it included a business plan for startups. Based on these interview results, content regarding MDR was added to the product (See Figure 23 below). Additionally, further research on the business plan is ongoing, as it still shows potential for improvement. Overall, the product was assessed as having promising future prospects.

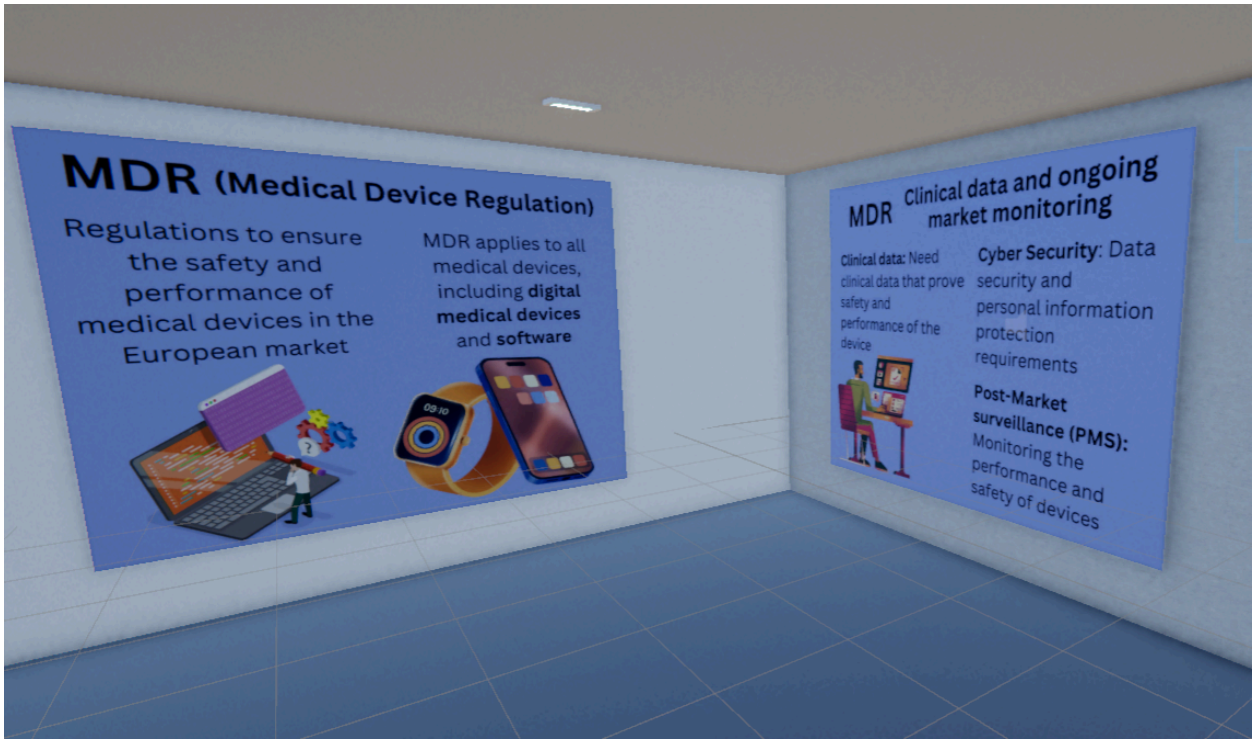

Figure 23: Added Contents in Regulation Hall after Expert Evaluation

8. Discussion

8.1 Strength

The results of both the User Evaluation and Expert Evaluation showed that both groups had a positive response to the platform. After experiencing the Virtual Exhibition, participants from both groups reported feeling a sense of immersion, similar to visiting a real museum.

Based on the Likert scale and interview results from the User Evaluation group, the product's usability and functionality were found to be of high quality. Additionally, the Expert group

highlighted one of the product's key strengths, stating that its format is well-suited for obtaining quick information.

8.2 Limitations and Recommendations

The target group for this product consists of eHealth startups in the Netherlands, with a particular focus on startups in the RPM sector.
To conduct an evaluation with the actual target group, multiple individuals from eHealth startups were contacted. However, only a few expressed interest, and while some even scheduled an appointment, their participation was eventually canceled due to busy schedules. Despite this, they remained supportive of the product and showed interest in future updates.
As a result, the evaluation especially for the contents was conducted with two experts. While these test panels provided valuable feedback on the product, the number of participants remained limited.

Next limitation is the Virtual Exhibition was tested as a Windows-only application exported from Unity, which is not the ideal file format for integration with the eCMC website. This application format results in a large file size, and users may experience significant delays in loading the application after it is uploaded to the website. To overcome this issue, an HTML format export using WebGL is required. However, even when exported as an HTML file, the product must be hosted on a reliable server to ensure that users can access the content without errors or missing elements. If this challenge is addressed, users will be able to use and experience the Virtual Exhibition on the eCMC website without any problems.

There were also limitations in terms of content. The content displayed in the product only focused on certain aspects from the literature review and did not have the time to complete all information from the background research.

8.3 Future Work

First, In future work, several aspects will be addressed based on the feedback received. First, testers from the actual target group will be engaged to ensure that the evaluation is more representative of the intended users. Additionally, the tester group size will be expanded to collect a broader range of insights, allowing for more comprehensive feedback. Moreover, the full content, which was initially planned but not fully implemented, will be incorporated into the

next iteration. In terms of content, the current product explains the STOZ (Stimuleringsregeling Technologie in Ondersteuning en Zorg) in the Finance Hall. While experts agree that this is useful for startups, they suggested that a more practical approach would help startups understand the concept of a business plan and provide information on how to create one. Since STOZ refers to a subsidy provided by the Dutch government, it is recommended to rename the current Finance Hall to the Subsidy Hall and create a new Finance Hall that focuses on business plan-related information.

In terms of usability, based on the feedback mentioned in Chapter 7.2.4, as a Virtual Exhibition, it could be developed into a more immersive experience with VR in the future. In addition, adding more realistic decorations, such as plants, to the exterior of the building could further improve the quality of the product and user experience. However, these suggestions should be evaluated with the target group to determine whether they would add value. It is also important to ensure that such additions do not negatively impact the software's loading performance on the website.

Furthermore, interviews with testers from the true test group indicated that a networking environment where participants can showcase and discuss their products would be valuable (See chapter 4.3.1). This feature will be added to future work, aiming to enhance the collaborative nature of the platform and provide more opportunities for knowledge exchange among users.

9. Conclusion

The goal of this study was to design an innovative roadmap for startups in the Netherlands with the aim of accelerating the implementation of RPM eHealth in the market. The first version of the Virtual Exhibition was developed through a combination of literature research and active participation of experts and participants in usability testing. Additionally, immersive experiences and 3D objects were integrated to effectively deliver information. This product serves as an immersive information provides roadmap for RPM eHealth startups.

Results from usability testing showed positive feedback from both participants and experts, with both groups agreeing that the prototype is useful for interactive information delivery. However, the expert' evaluation highlighted areas for improvement in the content, and the users'

evaluation suggested adding features such as a screen magnification option for better readability of the content.

One of the limitations of the product was its format as a Windows-only Unity application, which resulted in large file sizes and slow loading times on the eCMC website. To address this, an HTML format export using WebGL is recommended, along with hosting the product on a reliable server to ensure smooth user access.

Content limitations were also identified, as only certain aspects from the literature review were included, and not all background research could be covered. Future work will address these issues by engaging more testers from the actual target group, expanding the tester pool, and incorporating the full content. The Finance Hall, which currently explains the STOZ subsidy, will be renamed to the Subsidy Hall. A new Finance Hall will focus on business plan-related content, providing more practical guidance for startups.

In terms of usability, the Virtual Exhibition could be developed into a more immersive experience with VR in the future. Enhancements like adding realistic decorations (e.g., plants) to the building’s exterior could improve the product’s quality, but these features should be evaluated with the target group to ensure they add value without negatively affecting performance.

Additionally, feedback from the acutal test group mentioned the value of a networking environment for sharing opinion and asking questions. This feature will be added to future iterations to foster collaboration and knowledge exchange.

Subsequently, long term research should be conducted to assess the usability and functionality of the improved prototype, focusing on early stage startups within the RPM eHealth sector in the Netherlands. To ensure the improved prototype, a 6 month usability study could be conducted with at least 5 early stage RPM eHealth startups in the Netherlands. This study will focus on evaluating the prototype's usability, functionality, with better quality of the content. Specific metrics such as user engagement rates, feedback on contents, and adoption of the prototype could be tracked. The results will help identify necessary improvements and guide future iterations of the product.

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Appendix

Appendix 1: 2.7 Interviews

Interviewee	Industry	Main service	Characteristics
Company 1	eHealth and Remote Patient Monitoring (RPM)	Provides patient monitoring systems and related software to track patient status, particularly for healthcare institutions like hospitals.	Key clients include hospitals and clinics, with a focus on implementing care support systems based on medical data.
Company 2	Advanced sensor technology and healthcare	Develops sensors and analytical tools focused on RPM and preventive healthcare.	Clients are primarily hospitals, physicians, and healthcare organizations; offers solutions to monitor patient health data via sensor data, with an emphasis on expanding data-driven preventive healthcare services.
Company 3	Mental health and eHealth	Provides EMDR (Eye Movement Desensitization and Reprocessing) based telehealth services to address mental health issues such as PTSD, anxiety, stress, and depression.	Targets mental health hospitals and clinical institutions, focusing on treatment solutions for severe mental health disorders.
Company 4	Data analytics and Remote Patient Monitoring (RPM)	Focuses on data-driven monitoring solutions,	Integrates sensor-based movement data for

		specializing in collecting and analyzing movement data for health monitoring.	health data analysis, with hospitals as primary clients. Addresses challenges around safely transferring medical data between institutions.
Company 5	Development of serious games for healthcare	Develops educational gaming tools and prototypes, integrating fun with learning for training in both mental and physical health.	The main clients are hospitals, elderly care centers, and welfare facilities. Focuses on educational games, particularly for children and elderly populations.
Company 6	Healthcare solutions and IoT-based Remote Patient Monitoring (RPM)	Provides IoT and RPM solutions for hospitals, aiding in data management and integration with a specialized platform.	Works closely with hospitals and medical organizations, aiming to integrate RPM for patient monitoring and data management.

Table 3: Demographics of interviewees

Company / Topic	**RPM (Remote Patient Monitoring) and eHealth Implementation - Challenges and Barriers**	**Factors Influencing Successful Integration of eHealth Startups**	**Policy and Regulatory Issues**	**TRL (Technology Readiness Level) and SRL (Service Readiness Level)**
Company 1	Collaboration with policy-makers is challenging; delays arise during the	-	Unclear decision-making authorities in hospital collaborations, along with	-

	hospital implementation phase, particularly in ensuring regulatory compliance.		insufficient policy and financial support.	
Company 2	Recognizes the need for RPM but faces barriers in clinical validation and technical integration.	Limited implementation of RPM solutions due to low quantitative impact and insufficient policy support.		-
Company 3	Introduces telehealth solutions like EMDR for treating serious mental health conditions; cost burden and budget continuity issues persist.	Cost and budget continuity issues; insufficient policy efforts to integrate RPM solutions for mental health treatment.		-
Company 4	Emphasizes the need for data standardization and secure data transfer for RPM applications, highlighting data security concerns.	The absence of a standardized data transfer system complicates hospital integration due to challenges in medical data sharing.	Addresses concerns over medical data management and patient data privacy regulations in applying RPM.	-
Company 5	Encounters resistance due to a lack of innovation	-	Lacks experts to ensure compliance with MDR (Medical	Focuses on TRL 4-5 levels, primarily developing

	culture within hospitals for adopting healthcare-related games.		Device Regulation).	early-stage prototypes.
Company 6	Lacks follow-up after initial hospital implementation, requiring Diga standards for effectiveness validation.	Lack of follow-up after initial deployment has led to integration failures.	Emphasizes the need for policy support and highlights the necessity of effectiveness validation per the Diga standard in Germany.	Reached TRL 7 in the Enschede/Munster/MST project but lacked sustained follow-up support.

Table 4: Classified interview answers based on the topics from literature reviews

Appendix 2: 4.3.1 Target Group Interview Questions and Answers

Question	Answer
What do you think is the biggest challenge for eHealth startups when they enter the market?	I think the biggest challenge is the fact that the way I see innovation and the way stakeholders see innovation is a very different perspective of how care institutions Also limits of budget as well. Regarding the payment, in the Netherlands it's quite confusing about the payment especially for eHealth industry, the the one that pays isn't the one that uses the product. For example Insurances. You have something that's called zorf contour. Those are the instances that pay for the the solution. So you also need to convince them in the end. But there's that's quite difficult. But not just for them I still need to convince the other stakeholders too.
Please tell me about your experience regarding the regualation as a dutch eHealth startup.	MDR, which is a like a A policy or a regulation which you need to have to to become a medical device regulations which is can be quite challenging.

	Also, overall always there's a new regulation some for medical and some for technology.
If you have a roadmap for eHealth companies, in what ways do you think it can help?	I think it it would be really good to have sort of a guideline on stakeholders that startups should reach out
What additional element can be in the roadmap?	I think that it would be nice networking feature

Table 5: Co-founder of an eHealth Startup Interview Question and Answer

Question	Answer
How do you decide the content amount when you design the interactive' game? How do you set the balance?	Mostly client they decide the contents amount but for the balance, you always need to test with the users.
How should the duration of interactive sessions or the exhibition itself be structured to keep it impactful but not overwhelming?	The product shouldn't have too muh information inside. Since there's one project that I did, which had spent a lot of time and money developing. However in the user testing the fancy design doesn't matter. User keep lost from the information. So don't put too much on the detail of designs and trying to not overload them.
What additional element can be in the roadmap?	Maybe multi-people environment. Such as people can share their opinion or ask some questions freely. For example such as chat in discord group
How do you think about the Virtual Exhibition format?	I think it's really import that you don't make it clear and not give confusion to user from your design.

Table 6: Creative Director of an eHealth Proejct Interview Question and Answer

Appendix 3: 5.3 Requirements

Functional Requirements

Requirement: 1	**Requirement type:** Functional
Description: The product must provide directional arrow control for user navigation (forward, backward, left, right).	

Rationale: The user needs directional key control to see the information inside the exhibition.	
Source:	
Fit criteria: 1. **Acceptance testing:** Check that the expected response is made for each direction (e.g., moving in that direction when the arrow is pressed). Test consistent operation for all direction keys. 2. **Usability testing:** Test if user can easily control the direction without confusion 3. **Summative evaluation:** Considering user feedback, whether the arrow key control function is effective in exploring exhibition information (alternative can be mouse only control)	
Priority: Must have	**Conflicts:** No conflict
History:	

Requirement: 2	**Requirement type:** Functional
Description: The product must include and playback external media (hyperlinks, videos).	
Rationale: In the exhibition some contents will be videos (?) from the Dutch government or Dutch insurance company. These videos should play without any errors.	
Source:	
Fit criteria: 4. **Acceptance testing:** Make sure the video is loaded correctly and plays without errors when clicked 5. **Usability testing:** Test whether users can easily find and click on videos 6. **Summative evaluation:** Test that users have easy access to video content and information provided via links	
Priority: Must have	**Conflicts: No conflict**
History:	

Requirement: 3	**Requirement type:** Functional
Description: The product must contain clickable elements to move users between different categories.	
Rationale:	

Source:	
Fit criteria: 7. **Acceptance testing:** Test if the user is moved to the correct category when clicked. 8. **Usability testing:** Test whether clickable elements are visible and intuitive and user-friendly 9. **Summative evaluation:** Test whether clickable elements seamlessly support movement across all categories	
Priority: Must have	**Conflicts: no conflict**
History:	

Requirement: 4	**Requirement type:** Functional and modality
Description: The product must be very lightweight and performant on all browsers with average consumer computers as our primary target.	
Rationale: Not too many graphic assets but it needs to deliver something which should maintain a minimum standard.	
Source:	
Fit criteria: 10. **Acceptance testing:** Test that the product maintains very light performance (e.g., file size, loading time, etc.) 11. **Usability testing:** Test whether the product responds quickly without being uncomfortable, and whether the user feels comfortable with the browser and system performance. 12. **Summative evaluation:**	
Priority: Must have	**Conflicts:** The original idea was to put more animation and other characters but this will be reduced.
History:	

Requirement: 5	**Requirement type:** Functional and modality
Description: The product should be able to show the documents included in the exhibition, such as images, videos, case studies, or diagrams.	
Rationale:	
Source:	
Fit criteria: 13. **Acceptance testing:** check if each media file (image, video, diagram, etc.) is loaded and displayed normally. 14. **Usability testing:** Test that the user has no difficulty interacting with the document, such as zooming in on the image or playing video. 15. **Summative evaluation:** Test that the document provides useful information to the user and that the interaction functionality is well implemented across the board	
Priority: should have	**Conflicts: no conflict**
History:	

Requirement: 6	**Requirement type:** Functional and modality
Description: The product should have enough memory/speed to load media-rich content (e.g., video, maps) without delay.	
Rationale: If the product has too many assets in the software it might cause the missing contents or delay	
Source:	
Fit criteria: 16. **Acceptance testing:** Check if there is a delay while loading pages or content. 17. **Usability testing:** Test whether the user is comfortable with loading content or that it is so fast that the loading time is not recognized. 18. **Summative evaluation:** Test that content is loaded normally across a variety of network speeds and devices, providing optimized performance	
Priority: Should have	**Conflicts: No conflict**
History:	

Requirement: 7	**Requirement type:** Functional and modality
Description: The product should integrate with the current eCMC website	

Rationale: Since the final product can be uploaded to eCMC website, check how to integrate the product to the real website	
Source:	
Fit criteria: 19. **Acceptance testing:** Check the product software could integrate into eCMC website 20. **Usability testing:** Test that users have access to product functionality within the website without any inconvenience and that website navigation is efficient 21. **Summative evaluation:** Check that website and product integration is functionally smooth	
Priority: Should have	**Conflicts: No conflict**
History:	

Requirement: 8	**Requirement type:** Functional and modality
Description: The product should have a secure connection (i.e. https://)	
Rationale: Any data transfer between the website and the product must be made via a secure connection. With the enhanced HTTPS protocol, user data is encrypted and secured, and data eavesdropping or tampering is prevented [39].	
Source: HTTPA: HTTPS Attestable Protocol	
Fit criteria: 22. **Acceptance testing:** Verify that HTTPS connection is enabled on all pages and "https://" is displayed in the address window. 23. **Usability testing:** Test to make sure no inconvenience caused by HTTPS connectivity and that pages load seamlessly while users browse the website 24. **Summative evaluation:** Test whether the website handles all page and data transfers securely via HTTPS	
Priority: should have	**Conflicts:** The product software might have delay when it convert / build to the HTML file
History:	

Requirement: 9	**Requirement type:** Functional and modality
Description: The product interface could include a close/restart button to reset or terminate a user's session.	
Rationale: The user may need to shut down the system or reset the session, providing a close/restart button to make it easy for the user to end or initialize the session	

Source:	
Fit criteria: 25. **Acceptance testing:** When a button is clicked, tests whether the session is terminated or reset normally 26. **Usability testing:** Test if the user can easily recognize the location and functionality of the Close/Resume button 27. **Summative evaluation:** Check that data has been processed correctly, stored safely, or deleted after system shutdown.	
Priority: Could have	**Conflicts: No conflict**
History:	

Requirement: 10	**Requirement type:** Functional and modality
Description: The product could have multiple user environments	
Rationale: If the product has multiple user environments, users can interact with each other	
Source:	
Fit criteria: 28. **Acceptance testing:** Test if the product operate appropriate within the multi user server 29. **Usability testing:** Test if users can easily found out how to interact with the other users 30. **Summative evaluation:** Test the product whether features and interfaces are available for multi-user needs.	
Priority: Could have	**Conflicts:** Need more information on how to structure within the server
History:	

Requirement: 11	**Requirement type:** Functional and modality
Description: The product could have a personal user account	
Rationale: The product can be more personalized by having personal account system.	
Source:	

Fit criteria: 31. **Acceptance testing:** Test that the user creates an account and that the login and logout process is successful. 32. **Usability testing:** Test whether the user account creation process may be intuitive and easily understand. 33. **Summative evaluation:** Test that account management is secure	
Priority: Could have	**Conflicts:** Need more research about how to make log-in secure system
History:	

Requirement: 12	**Requirement type:** Functional and modality
Description: The product could have a save function to remember how far the user has explored the exhibition.	
Rationale: The Save feature makes it easy for users to view previously viewed content when they repeatedly navigate the display or come back later.	
Source:	
Fit criteria: 34. **Acceptance testing:** Test that the previously explored point is restored correctly when the user logs back in after the session ends. 35. **Usability testing:** Test if the user can easily find the ability to save the navigation location and restore it later 36. **Summative evaluation:** Check the location of the user's navigation location accurately remember the user's navigation.	
Priority: Could have	**Conflicts:** Need to check if the software allow to save in certain server
History:	

Requirement: 13	**Requirement type:** Functional and modality
Description: The product could have a voice guidance button	
Rationale: Voice guidance buttons can be useful for visually impaired users or those who use the product without having to look directly at the screen.	
Source:	

Fit criteria: 37. **Acceptance testing:** Test if the voice guidance button is displayed normally and voice guidance is initiated when clicked 38. **Usability testing:** Test that voice guidance is provided at a user-understandable level 39. **Summative evaluation:** Test that the voice guidance buttons are well placed where they are needed within the system and provide the user with the information they need	
Priority: Could have	**Conflicts:** Since this feature can consume system resources, it is likely to conflict with system performance optimization.
History:	

Requirement: 14	**Requirement type:** Functional and modality
Description: The product will not have a mobile application version.	
Rationale: As no mobile application version is available, the user accesses the product through a web browser or application type	
Source:	
Fit criteria: 40. **Acceptance testing:** Test to see if the product only works on the web without a mobile application and works as a web browser on mobile. 41. **Usability testing:** - 42. **Summative evaluation: -**	
Priority: Will not have	**Conflicts: No conflict**
History:	

Service Requirements

Requirement: 15	**Requirement type:** Service
Description: The product could connect to relevant eHealth networks, showcasing companies and experts (e.g., through a Learning community category).	
Rationale: Connections with eHealth networks can help users easily access the latest health-related information and resources.	
Source:	

Fit criteria: 43. **Acceptance testing:** Check if professional and corporate content is up-to-date and ensure that there is no misinformation. 44. **Usability testing:** Make sure that the content is clearly configured and easy for users to understand. 45. **Summative evaluation:** Ensure that the information provided by literature and businesses is reliable	
Priority: Could have	**Conflicts: No conflict**
History:	

Requirement: 16	**Requirement type:** Service
Description: The product will not include a 24/7 helpdesk or chatbot feature offering assistance, such as answering questions about regulatory compliance or technical integration.	
Rationale: By not including 24/7 help desk or chatbot features in your product, you can reduce the resources needed for continuous updates and maintenance of your help desk and chatbot.	
Source:	
Fit criteria: 46. **Acceptance testing:** Check if instructions are clear to guide users and that users can request support via email, phone, support portal, etc. to resolve the issue. 47. **Usability testing:** Test if user understand instructions easily. 48. **Summative evaluation:** Test whether the product support system is properly designed so that the user does not feel uncomfortable due to the lack of help desk or chatbot functionality.	
Priority: Will not have	**Conflicts:** No conflict
History:	

Organisational Requirements

Requirement: 17	**Requirement type:** Organisational
Description: Products must include professional and contextual terms to establish reliability, but all terms must be clearly described for startups new to the industry.	
Rationale:	

Source: Certain terms can be difficult for industry beginners, such as startups, so all terms must be articulated	
Fit criteria: 49. **Acceptance testing:** Check that the description is intuitive enough and that industry beginners understand the meaning of the term accurately. 50. **Usability testing:** Test whether the description is in a position where users can easily find it, especially for industry beginners. 51. **Summative evaluation:** Check that the description of the terms provided by the product is consistent and accurate.	
Priority: Must have	**Conflicts: No conflict**
History:	

Requirement: 18	**Requirement type:** Organisational
Description: The product should focus on simplifying complex information about eHealth RPM regulations to help startups address legal and compliance issues.	
Rationale: Regulations related to eHealth Monitoring (RPM) can be complex and challenging for startups. It simplifies complex legal and regulatory information to help startups meet legal and regulatory requirements	
Source:	
Fit criteria: 52. **Acceptance testing:** Test if complexity is reduced by describing regulatory information step by step. 53. **Usability testing:** Test whether regulatory information is simple, intuitive, and easy for startups to navigate. 54. **Summative evaluation:** The regulatory requirements are described step by step to evaluate whether startups can apply them.	
Priority: Should have	**Conflicts: No conflict**
History:	

Requirement: 19	**Requirement type:** Organisational
Description: The product should focus on practical solutions for technology integration and collaboration with healthcare stakeholders.	
Rationale: Providing information about stakeholders can help smooth collaboration with various healthcare stakeholders (hospitals, healthcare providers, insurance companies, etc.).	
Source:	

Fit criteria: 55. **Acceptance testing:** Test how effective the product is in promoting collaboration among healthcare stakeholders (hospitals, healthcare providers, insurers, etc.). 56. **Usability testing:** Test whether the user understands the content by viewing the content of the stakeholder 57. **Summative evaluation:**	
Priority: Should have	**Conflicts:** No conflict
History:	

Requirement: 20	**Requirement type:** Organisational
Description: The product could have a connection of eHealth companies with experts from eCMC	
Rationale: The connection between eHealth companies and stakeholders connected to eCMC provides startups with an opportunity to offer new solutions.	
Source:	
Fit criteria: 58. **Acceptance testing:** Test whether the connection system makes it easy for users to find and send requests to professionals 59. **Usability testing:** Test that eHealth companies have no inconvenience or confusion in finding and connecting professionals. 60. **Summative evaluation:** Test whether the system is well implemented to enable a seamless connection between eHealth companies and eCMC stakeholders.	
Priority: Could have	**Conflicts:** Building chatting system inside of the product might require data server.
History:	

Contents requirements

Requirement: 21	**Requirement type:** Contents
Description: The default language setting of the product is English and additional localized resources (e.g., Dutch examples of RPM regulation, Dutch insurance website, etc.) are provided or the target audience to empathize with.	
Rationale: Localized sources help users easily understand the legal requirements and regulatory environment of their countries, providing a better user experience	
Source:	

Fit criteria: 61. **Acceptance testing:** Localized data such as examples of Dutch RPM regulations and Dutch insurance websites should be provided for the target audience. 62. **Usability testing:** Check whether the content of the localized material is clear and useful to the target audience. 63. **Summative evaluation:** Check whether the information provided by localized data meets legal requirements and industry standards.	
Priority: Must have	**Conflicts: No conflict**
History:	

Requirement: 22	**Requirement type:** Contents
Description: The product must include an introduction guide for startups or initial market eHealth companies.	
Rationale: By providing early startups guidance the product provides basic information for new users to understand and utilize the product	
Source:	
Fit criteria: 64. **Acceptance testing:** Check step-by-step if instructions are well-organized and ensure users can follow suit 65. **Usability testing:** Test whether the contents can easily be understood. 66. **Summative evaluation:** Test whether the contents allow users to understand and quickly adapt to the core features of the product.	
Priority: Must have	**Conflicts: No conflict**
History:	

Requirement: 23	**Requirement type:** Contents
Description: The product must provide categorized structure that divides content into areas such as Regulation, Finance, and Stakeholder.	
Rationale: Categorizing and structuring content from a variety of disciplines, including regulatory, financial, and stakeholders, helps users to easily understand what topics the information has and does not allow them to be confused about the content.	
Source:	

Fit criteria: 67. **Acceptance testing:** Check that key categories of regulatory, financial, stakeholders, etc. are clearly distinguished. 68. **Usability testing:** Test whether the category structure is intuitive and designed to make it easier for users to find the content they want. 69. **Summative evaluation:** Test whether the category structure provides real value to the user and is useful in using the product.

Priority: Must have	**Conflicts: No conflict**
History:	

Requirement: 24	**Requirement type:** Contents
Description: This product could collect terminology related to RPM and eHealth and provide it as a tool to see the terms at a glance	
Rationale: Terminology tools can help users easily identify important terms and improve their understanding of what is relevant to the product	
Source:	
Fit criteria: 70. **Acceptance testing:** Verify that the search function allows users to quickly and easily find terms. 71. **Usability testing:** Test whether the search function is intuitive and users can easily find the terms they want. 72. **Summative evaluation:** Check whether the list of terms and descriptions provided by the glossary are comprehensive and practical.	
Priority: Could have	**Conflicts: No conflict**
History:	

Requirement: 25	**Requirement type:** Contents
Description: The product could include a visually appealing design and appeal to startups looking for reliable guidance.	
Rationale: Visually appealing design is an effective factor in attracting the user's attention and providing an intuitive and accessible interface.	
Source:	

Fit criteria: 73. **Acceptance testing:** Make sure that elements such as color, typography, icons, etc. are harmonized, visually appealing. 74. **Usability testing:** Test whether the visual elements of the product help with efficient use without interfering with the user's experience. 75. **Summative evaluation:**	
Priority: Could have	**Conflicts: No conflict**
History:	

Usability and User Experience Requirements

Requirement: 26	**Requirement type:** Usability and User Experience
Description: The product must avoid overwhelming users with excessive information, instead organizing content into manageable, digestible sections.	
Rationale: Ensuring that users are not overwhelmed by excessive information helps to efficiently use the product.	
Source:	
Fit criteria: 76. **Acceptance testing:** Check whether the amount of information that the user can be accept at once. 77. **Usability testing:** Test whether the information is not overly redundant or complex and is divided into manageable sections. 78. **Summative evaluation:** Evaluate if it is visually neat and configured without confusing elements.	
Priority: Must have	**Conflicts: No conflict**
History:	

Requirement: 27	**Requirement type:** Usability and User Experience
Description: The product must be intuitive and easy to explore, considering the limited resources and time constraints of startup teams.	
Rationale: Startup teams have limited resources and time, so products need to be intuitive and easy to navigate	
Source:	

Fit criteria: 79. **Acceptance testing:** Make sure that the features are efficient and that users can quickly find the features they need. 80. **Usability testing:** Check that the UI is intuitive and there are animations that are not too relevant to the content 81. **Summative evaluation: -**	
Priority: Must have	**Conflicts: No conflict**
History:	

Requirement: 28	**Requirement type:** Usability and User Experience
Description: The product should include clear user instructions on navigating and accessing resources.	
Rationale: Simple introduction such as how to explore will help user to start easily	
Source:	
Fit criteria: 82. **Acceptance testing:** Check that the product provides simple onboarding for initial use. 83. **Usability testing:** Check UI/UX design is not confused, and evaluate whether the user can easily follow. 84. **Summative evaluation:** Test whether the onboarding process is effective and easy for users to follow.	
Priority: should have	**Conflicts: No conflict**
History:	

Requirement: 29	**Requirement type:** Usability and User Experience
Description: The product could include gentle, user-friendly animations or transitions that minimize the risk of nausea or dizziness during virtual exploration.	
Rationale: Intense animation or excessive transition can cause vomiting or dizziness for some users	
Source:	

Fit criteria: 85. **Acceptance testing:** Make sure that the animation and transition effects are not too fast or intense, and that the user does not feel dizzy or uncomfortable. 86. **Usability testing:** Test that the user does not experience dizziness or discomfort due to animation or conversion effects. 87. **Summative evaluation:** Evaluate whether animation and conversion effects are effective in enhancing user experience and increasing immersion.	
Priority: Could have	**Conflicts: No conflict**
History:	

Appendix 4: Product Video Link

[Product Video - Virtual Exhibition.mp4]

Appendix 5: Information Letter for Testing sessions

Information Letter: Innovative Roadmap to Accelerate eHealth Startups' Market Introduction

Dear Participants,

Through this information letter, I would like to ask if you would like to participate in the research on the adoption of eHealth startup technology conducted by Twente University. Participation in the study is voluntary. This paper explains the purpose of the study, its meaning when participating, and its pros and cons. Please read the information carefully and decide whether to participate or not. If you would like to participate, please fill out the consent form.

1. What is the purpose of the study?
Aging and chronic diseases are increasing worldwide. This phenomenon causes workers in the healthcare industry to reach the limit of care and prevents healthcare from being coordinated. eHealth technology digitizes healthcare and provides efficient medical solutions to hospitals and patients.

Many eHealth startups want to accelerate the transformation of healthcare systems by developing new healthcare technologies and entering the market. However, it often takes some time for these technologies to be integrated into daily healthcare systems. This is due to regulatory issues, integration with existing healthcare systems, and a lack of resources or capital for healthcare institutions and users.

This study aims to develop a roadmap to help startups quickly adopt eHealth technology and make it practically available in the healthcare field. In particular, we want to identify the obstacles and success factors that technology companies face in the process of introducing technology into the healthcare market. As an important expert in this process, participants (you) will share your experiences and opinions to help the technology be practically applied in the healthcare field. As a Creative Technology student, I will create a roadmap based on their input and experiences to show them all the important steps within the innovation and implementation process.

2. What is the process of the research?
The study will consist of a total of 1 testing session, each of which will take about 45 to 60 minutes. The testing session can be conducted remotely and will coordinate a convenient time and place. Testing will consist of running a virtual exhibition program and a feedback session about the functional and usability side of the prototype.

The following are the key steps in the research process:
1. Before the session, I will send you a Unity-based prototype file of the roadmap in the form of

a virtual exhibition.2. During the session, you will run the file on your computer and explore the virtual exhibition
while sharing your screen via Teams.
3. I will be in Teams while you navigate through the exhibition and test the interaction.
4. After you finish exploring, I will ask a few follow-up questions to gather your feedback on the prototype.
All interviews will be recorded and will only be conducted with your consent. Recorded material will be deleted immediately after analysis and will not be used for any purpose other than research.

3. What are the pros and cons of participating in the study?
Participating in this study can help technology companies build on their expertise in the process of effectively introducing eHealth technology and others. Your comments will be used to improve how startups can successfully apply technology to the healthcare field. However, please consider that you will have to be available for the testing session for a certain amount of time (45 to 60 minutes).

4. When will the study end?
The study will close in the following cases:
at the completion of the study.
When you want to stop participating in the study. You can stop participating in the study at any time, and you do not need to explain why.
When the researcher determines that your participation in the study is no longer appropriate.
Even if you stop participating in the study, the data already collected can be anonymized.

5. How do you handle your data?
Participate in the study and you agree to collect and use your data. The collected data will be used for the following purposes:
Creating a Research Report
Academic papers and presentations
Development of Roadmap for Startups
Personal identification information (e.g., name, contact information) will be deleted after the end of the study, and recorded data will be deleted immediately after analysis. All data used in the study will be anonymized and no personal information will be disclosed to the outside world.
You may withdraw your consent to use the data at any time; however, data that has already being anonymized may continue to be available.

6. Contact information
Director of Research: Heejin Hong h.hong@student.utwente.nl*Ethics Committee:* ethicscommittee-cis@utwente.nl 053 489 2085
If you have any additional questions about personal information, please contact the contact information above.

7. How to agree to participate in the study

Please take your time and fill out a written consent form if you would like to participate. You and the researcher will both have a copy of the signed consent form.

Thank you for your time and cooperation.

Appendix 6: 7.2.2 Interview and Questionnaire Questions

Pre-testing Questions, (Interview, 2 questions)

Q1) Have you ever used Virtual Exhibition features?

Q1-1) If you have, what features were they?

Q2) What do you expect when you hear the general explanation of the product?

Scale Questionnaire (Used 1-5 Likert Scales, 10 questions, with 1 meaning 'Strongly Disagree' and 5 meaning 'Strongly Agree')

Evaluation question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
User Interface (UI)					
Was the UI design intuitive and easy to understand?					
Were the contents comfortably visible?					
Was the readability of the text provided to the image well?					
Were the contents aesthetically pleasing?					
Functionality and Usability					
Was the direction control easy?					
Was the media played appropriately?					
Was the video sound clear?					
Did the moving/rotating/clicking					

functions work properly when you explored the system?					
Is there any delay in seeing the contents?					
Was the overall flow of the product natural?					

Post-testing Questions (Interview, 3 Questions)

Q1) After using the product, what was your overall impression?

Q2) Did you experience any errors or bugs during use?

Q3) Are there any additional features you would like to see or improvements you think are needed?

Appendix 7: 7.3.2 Interview Questions

Q1) After using the system, what was your overall impression?

Q2) How do you think the format of the product (Virtual exhibition) could help eHealth startups

Q3) Do you think the contents of the product could help eHealth startups?

Q4) If you or someone you know is active within eHealth RPM startups, would you be willing to use and recommend this application?

Q5) Are there any features you think should be added to the product or areas that need improvement?