



SUITCEYES

1 Jan 2018 - 31 Dec 2020

Smart, User-friendly, Interactive, Tactual, Cognition-Enhancer, that Yields Extended Sensosphere
Appropriating sensor technologies, machine learning, gamification and smart haptic interfaces

[D8.16]

Final exploitation plan and report on IPR issues

Courtesy of LightHouse for the Blind and Visually Impaired, see <http://lighthouse-sf.org>.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 780814.

Dissemination level		
PU	PUBLIC, fully open, e.g., web	X
CO	CONFIDENTIAL, restricted under conditions set out in Model Grant Agreement	
CI	CLASSIFIED, information as referred to in Commission Decision 2001/844/EC.	

Deliverable Type		
R	Document, report (excluding the periodic and final reports)	X
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
OTHER	Software, technical diagram, etc.	

Deliverable Details	
Deliverable number	8.16
Part of WP	WP8
Lead organisation	Harpo Sp. z o.o. (HARPO)
Lead member	Jarosław Urbański

Revision History			
V#	Date	Description / Reason of change	Author / Org.
v0.1	2021-02-05	Structure proposal	Joanna Starosta-Sztuczka/ HARPO
v0.2	2021-02-17	First draft for internal review	Joanna Starosta-Sztuczka/ HARPO
v0.3	2021-02-22	Second draft addressing review comments submitted to HB	Joanna Starosta-Sztuczka/ HARPO
v0.4	2021-02-24	Final draft addressing PC and PMB reviewers' comments	Joanna Starosta-Sztuczka/ HARPO
v1.0	2021-02-26	Final draft submitted to the EU	Thomas Bebis/ HB
v1.1	2021-09-20	Revised version	Joanna Starosta-Sztuczka/ HARPO
V2.0	2021-09-28	Resubmission to the EU	Nasrine Olson/ HB

Authors

Partner	Name(s)
HARPO	Joanna Starosta-Sztuczka

Contributors		
Partner	Contribution type	Name
LDQR	Review of subsection 3.3	Mauricio Fuentes
HSO	Review	Arthur Theil
CERTH	Review	Panagiotis Petrantonakis
HB	Review	Thomas Bebis
HB	Review	Stefan Dahlin
HB	Review	Jan Tengwall
HB	Review	Nasrine Olson

Glossary	
Abbr./ Acronym	Meaning
D8.16	Deliverable 8.16 – Grant Agreement No. 780814 – SUITCEYES [deliverable number on pages 9, 35-37]
SUITCEYES	Smart, User-friendly, Interactive, Tactual, Cognition-Enhancer that Yields Extended Sensosphere - Appropriating sensor technologies, machine learning, gamification and smart haptic interfaces
WP8	Work Package 8 – Dissemination, Knowledge-sharing & Exploitation
HARPO	Harpo Sp. z o.o., Poland
HB	Högskolan i Borås / University of Borås, Sweden
HSO	Hochschule Offenburg / Offenburg University of Applied Sciences, Germany
CERTH	Ethniko Kentro Erevnas Kai Technologikis Anaptyxis / Centre for Research and Technology Hellas, Greece
LDQR	Les Doigts Qui Rêvent, France
TU/e	Eindhoven University of Technology, Netherlands
UNIVLEEDS	University of Leeds, Great Britain
SWOT	Strengths, Weaknesses, Opportunities and Threats
HCI	Computer-Human Interaction
SME	Small/Medium-sized Enterprise

ASF	Apache Software Foundation
AT	Assistive Technology
ICT	Information and Communications Technology
AI	Artificial Intelligence
HIPI	Haptic, Intelligent, Personalised Interface
IPR	Intellectual Property Rights
TRL	Technology Readiness Level
MIT (license)	Massachusetts Institute of Technology (license)
SHC	Social Haptic Communication
Nkcdb	Nationellt kunskapscenter för dövblindfrågor
SPSM	Specialpedagogiska skolmyndigheten
DbI	Deafblind International

History of changes

Page, section	Old text	New text
Page 3, section 3.1. Product concept and its scenarios	-	This asks for cooperation beyond the end of the project and cooperation with other stakeholders (current TRL levels are not high enough to make a real product). The consortium has identified many of stakeholders in the academic and the industrial sectors. This also includes many interest groups (as described in section 3.3) for further cooperation.
Page 4, section 3.2. Platform elements Page 6, 9, section 3.3 Exploitation for various stakeholders Page 19-20, section 3.4 Role of partners in exploitation actions	https://github.com/Suitceyes-Project-Code	https://github.com/Suitceyes-Project
Page 5-6, section 3.2 Platform elements	-	Adding a few paragraphs beginning from: It can be concluded that the website is a platform...
Page 16-17, section 3.4 Role of partners in exploitation actions	-	Adding a text beginning from: The SUITCEYES consortium will strive to keep SUITCEYES results relevant after the project's conclusion. To this end...

Page 18, section 3.4 Role of partners in exploitation actions		Update of data in Table 5. Data licensed at SUITCEYES.
Page 23, section 4.2 Further commercialization of the project results	-	It is worth underlining that the HIPI device is still a prototype and some significant investments (around 1.0 to 1.5M€) and time (12 to 18 months) will be necessary to make it a commercial product. Moreover, the purchase of this assistive device must be heavily funded to be a success in Europe, North America and elsewhere. In many countries, funding programs are already in place and cover a range of assistive devices for deafblind people. Getting a new product on the list of devices funded by some programs takes time and quick starting the marketing activities is a right way before the product is ready to be launched on the market.
Entire document	-	Adaptation of the content until after the end of the project.
Page 18-20, section 3.4 Role of partners in exploitation actions	-	Update of Table 5. Data licensed at SUITCEYES.
Page 31, section 6. Summary	-	It can be concluded that the project consortium created an initial platform by encouraging interaction with those interested in the project field. As for the communication part of the platform, appropriate links were added on the website with the possibility of reporting interest, ideas and questions, through which one can send comments, own suggestions and establish further cooperation, which will be independently initiated by the partners.

Table of contents

1. Executive Summary.....	1
2. Introduction and Rationale.....	2
3. Final Exploitation Strategy.....	3
3.1 Product concept and its scenarios.....	3
3.2 Platform elements.....	4
3.3 Exploitation for various stakeholders.....	7
3.4 Role of partners in exploitation actions.....	14
4. Business case.....	22
4.1 Business model.....	22
4.2 Further commercialization of the project results.....	24
4.3 Barriers and risks.....	24
5. Intellectual property rights.....	29
6. Summary.....	31
7. References.....	32

1. Executive Summary

This report determines an exploitation and marketing strategy for the solutions developed in SUITCEYES. This activity was conducted during the project duration and after its finalization. It started with elaborating the initial exploitation and technology usage plan of the SUITCEYES project based on a market survey, a strengths, weaknesses, opportunities and threats (SWOT) analysis, an analysis of competitors, and business case development (reported in D8.15 *Initial exploitation plan and report on IPR issues*). This Task was dealing continuously with ongoing progress in the project in terms of how foreseen activities actually took place, were modified in the light of circumstances, or where other actions and measures were introduced, e.g., during the COVID-19 epidemic.

The continuous work comprised:

- Defining the product scenarios and its development paths;
- Building up a platform for communication and cooperation by the target groups, and for technical cooperation based on the available and growing state of the art (both hard- and software);
- Defining the main stakeholders, their characteristics, needs, methods of communication and exploitation paths;
- Role of partners in exploitation strategy to maximize the opportunities for further adoption of the project results;
- Defining a business model that provides a structure that mediates the value creation process between the technical and economic domains in a viable and sustainable way;
- Monitoring intellectual property rights and defining the final interests of the consortium in this matter.

2. Introduction and Rationale

The SUITCEYES consortium paid special attention to the exploitation of the project results by the consortium itself and audiences identified in the project (scientific community, industry sector, interest-group community and people with deafblindness) throughout the evolution of the project, and to guarantee the exploitation of final results beyond the lifetime of the project.

A preliminary plan for the exploitation of results has been presented in D8.15 *Initial exploitation plan and report on IPR issues*.

According to the responsibilities addressed in the Grant Agreement consortium partners are taking measures aiming at ensuring exploitation of SUITCEYES results and will make them usable up to 4 years after end of project. The details of the exploitation strategy are presented in the sections below. Finally, the consortium also undertakes a final discussion of the intellectual property rights (IPR) in the project.

This document is divided into the following main sections:

- Section 3 identifies the expected final exploitation strategy with the product concepts and its scenarios, elements of platform identified, planned exploitation actions for various stakeholders and the roles of the partners in this strategy.
- Section 4 introduces a business case of HIPI. One can read here about the first business model and paths of the commercialization of the project results. Finally, main risks and barriers in exploitation of the project results are considered.
- Section 5 summarizes intellectual property rights and interests of the consortium in this aspect.
- Section 6 features a summary of all considerations about the final exploitation plan of SUITCEYES at the end of the project.
- Finally, section 7 contains the references.

3. Final Exploitation Strategy

The SUITCEYES project follows multiple exploitation paths and scenarios for the exploitation of project outcomes. The initial goals focused only on the use of the project results by the community of people with deafblindness in the form of the final haptic intelligent, personalised interface (HIPI). Certainly, the scientific and technical community is also an important group that intends to benefit from the results of the current project.

3.1 Product concept and its scenarios

The project output and result concepts that were generated at the end of the project are presented in Table 1 below.

Table 1. Explanation of product concepts and results generated within the project.

Product name	Explanation
HIPI	Haptic intelligent, personalised interface as a generative prototype for personalized development. It represents a combination of hardware and software that enable haptic messages to be sent to the user in response to sensor information. It enables the creation of a modular system that can be available in various versions and for a wider group of people, not only with deafblindness, but also for people with visual impairments or even beyond the scope of Assistive Technology (AT) applications, such as for the development of gamification, systems for athletes or emergency services who face limited visibility in their daily activities (in water, during a fire, etc.).
Platform for technical cooperation	This enables wide experimentation and research into haptic communication and navigation by a multitude of stakeholders. Other elements to be included – for example haptograms, design recommendations, lessons about policy and user experiences, exemplar scenarios. These are all of value in supporting future research into haptic communication, and therefore part of the broader platform.
Platform for communication	It enables cooperation with the target groups within their needs, stories, policy, education, employment, therapy, rehabilitation and further research. The project webpage is closely connected as the communication and educational part of the platform.

The overriding goal of creating such a platform is supporting improvement of quality of life for people with deafblindness by enabling future high-quality research into haptic communication by the consortium partners and other teams. At the end of this project, it can be stated that the HIPI product has not yet reached the technological readiness level (TRL) enabling it to be prepared for implementation on the market (see Figure 1).

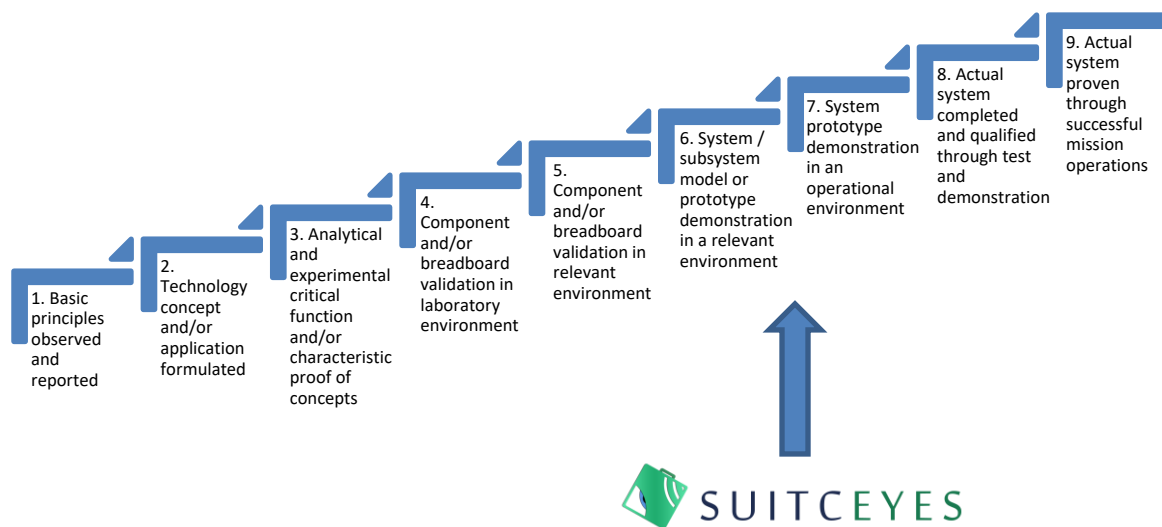


Figure 1. Technology Readiness Level (TRL) [1] of HIPI at the end of the SUITCEYES project

It can be concluded that the project was completed at the technological readiness level TRL 6/7. A representative HIPI prototype was tested in a high-fidelity laboratory environment and/or in a simulated operational environment. Due to COVID-19 epidemic a series of prototype tests spanning the last year of the project, in real operational settings (e.g., in Eikholt¹ Drammen, Norway) and also at partner's own locations, all had to be cancelled. A major next step would be possibility to demonstrate an actual integrated prototype in an operational environment. This asks for cooperation beyond the end of the project and cooperation with other stakeholders (current TRL levels are not high enough to make a real product). The consortium has identified many of stakeholders in the academic and the industrial sectors. This also includes many interest groups (as described in section 3.3) for further cooperation.

3.2 Platform elements

The open platform for communication with the target group, and for technical cooperation on building new ideas, features, solutions, R&D based on the available state of the art (both hard- and software) was developed. It can be said that the platform is the SUITCEYES data repository in GitHub² (for scientific and technical cooperation) and the project website³ (for communication part). It includes the following aspects:

- Hardware:
 - The Textile Elements (Garment, Chairable)
 - Custom Printed Circuit Board (PCB)/3D print designs
 - Bill of Materials, Architecture and Assembly Diagrams
- Software:
 - Robot Operating System (ROS) implementation image

¹ <https://www.eikholt.no/>

² <https://github.com/Suitceyes-Project>

³ <https://suitceyes.eu/>

- Individual software elements that can run locally
- Visual Analysis Algorithms and Ontology
- Datasets and Libraries
- Other:
 - Haptogram Designs
 - Literature Reviews
 - Design Recommendations
 - Policy and User Needs.

There are still lots of open research questions regarding the exploitation of the platform and development of HIPI in near future, about:

- Different haptic actuators (Linear Resonant Actuators, Linear Magnetic Rams)
- More advanced sensors
- Psychophysics
- Ability to use haptic signals.

It is also important to keep the community with deafblindness engaged beyond the end of the project. Therefore, the communication part of platform (the project website maintained) will be kept news and literature reviews up-to-date beyond the end of the project. Information in the communication part of the platform will be catalogued and available on the website. Moreover, more proactive approaches will be offered to keep the community engaged. Such activities include training information and inclusion in educational programs, engagement in various form of outreach raising awareness and promoting improved policies and conditions for people with deafblindness, as well as networking to keep them up, also thanks to the project website.

It can be concluded that the website is a platform that enables dynamic communication between the project and the outside world. It is the first and most common access point to our project, its results and disseminated materials. The website includes all the deliverables that have been approved (under the Outreach menu option, Public Deliverables submenu), and the rest will be added as soon as they are approved. The link to GitHub is also highlighted under the Open-Source menu option. In turn, information on designed garments is available in the form of deliverables and therefore is also part of the published material.

Moreover, several videos have already been published (in the Outreach menu, Videos submenu) and more are planned to be added (about PatRec, the haptogram design toolkit). Several other videos are in production (e.g., demonstrating the active object search function). The content of our last symposium, on which the participants is very much counted on, will also be added. Unlike most other projects where the project websites cease to exist after the end of the project, SUITCEYES consortium fully intend to keep the website with the updates as it comes up.

Links with contact possibilities to all members and partners are available under:

- <https://suitceyes.eu/work-packages/>,
- <https://suitceyes.eu/partners/project-boards/>,
- <https://suitceyes.eu/partners/> and
- <https://suitceyes.eu/affiliated-organizations/>.

Interaction with stakeholders is also possible via "Leave a Reply" under posts (see Figure 2).

Leave a Reply

Your email address will not be published. Required fields are marked *

Comment

Name*

Email*

Website

Save my name, email, and website in this browser for the next time I comment.

Figure 2. "Leave a Reply" field with the option of leaving comments on SUITCEYES posts

The consortium is also actively seeking further resources to allow us more extensive work on the website and a more interactive layer (e.g., HB has already prepared an application for an internal funding). HB is also in the process of creating a centre for Inclusion and a haptic communication lab which will enable to dedicate some more efforts to the development of the website.

Moreover, discussions have been carried out with a number of organizations that actively work with issues of deafblindness (e.g., Nationellt kunskapscenter för dövblindfrågor - Nkcdb⁴, Specialpedagogiska skolmyndigheten - SPSM⁵, Deafblind International - Dbi⁶, etc.) to find ways of either incorporating the SUITCEYES website under their organizations or connecting to it for more visibility and relevance. The Dbi management has indicated their willingness to make the contents available through their website.

It can be summarized that within next few months the website will be updated by publishing the contents of the project's final symposium, the most recently approved deliverables, and new publications as they emerge.

⁴ <https://nkcdb.se/>

⁵ <https://www.spsm.se/om-oss/other-languages/english/our-mission/special-needs-schools/>

⁶ <https://www.deafblindinternational.org/>

3.3 Exploitation for various stakeholders

According to the segmentation of SUITCEYES stakeholders, three distinct categories of recipients of the project results were identified by the consortium from the beginning of the project:

- Academic community – researchers from different fields associated with technical institutes and universities, working in different topics related to the project (textiles, Assistive Technology, Information and Communication Technologies, computer-human interaction, disability, deafblindness etc.). It can also be institutes or universities linked to project partners or even their parent units that carry out research in an area similar to SUITCEYES. Providing know-how and code sharing as open source allow to re-use of the resources and to undertake new approaches to the further development of project's results.

SUITCEYES' novelty lies in integrating in-house electronics, visual analysis algorithms, semantics and social haptic communication into a textile housing medium. Additionally, novelty also lies on tailoring the final prototype to the primary needs and requirements of users with deafblindness. By using a number of sequential prototypes and carrying out user studies, SUITCEYES aims to learn more about the potential of using textiles as a medium for technology in the general area of accessibility. SUITCEYES disseminates results through publications in peer-reviewed journals and conferences (<https://suitceyes.eu/publications/>). By actively engaging in these activities, the project aspires to help further advance scientific fields relevant for the project, such as smart textiles, psychophysics, engineering, Information science, computer-human interaction (HCI), disability studies among others. To further increase the visibility of the project, academic partners are also using platforms specifically tailored to the scientific community, for example ResearchGate (<https://www.researchgate.net/project/SUITCEYES-Empowering-Deaf-Blind-Persons>) and GitHub⁷ (<https://github.com/Suitceyes-Project>).

- Industry sector – organizations or persons involved in using, producing or distributing related technologies that could contribute to or benefit from the project's objectives (textiles, haptic interfaces, Assistive Technology, software engineering, sensors etc.). Business organizations and enterprises (like HARPO) can be interested in transferring the SUITCEYES system into real products that can be introduced into the international market after the projects' completion. These can be also future distributors of the interface on selected foreign markets. However, integration of all the project's results (software and hardware) into an open platform for reuse and further development, using an open-source license, may hinder ability to commercial use of the project results by industrial entities (such as small/medium-sized enterprise (SME) Harpo). From the other hand the open-source software projects promote innovation faster than proprietary solutions, as they are easier and cheaper to adopt, reduce market entry barriers, and promote interoperability, especially in Europe, where the information and communications technology (ICT) industry is predominantly driven by SMEs. In order to implement the SUITCEYES solution for commercial applications, it is also assumed that only

⁷ <https://github.com/about/diversity/report>

another R&D project realized by the consortium partners may bring HIPI closer to reaching technological maturity (additional funding needed).

Progress in SUITCEYES touches upon a number of industries: textiles, electronics, human-computer interaction and assistive technologies. Specifically, all these sectors are brought together to support and meet the demands of individuals with deafblindness in their daily lives. Through industrial partnerships our consortium envisages the continued advancement of SUITCEYES beyond the lifespan of the project. In line with SUITCEYES aspiration to keep advancing the project forward after 06.2021 (completion of the project), the consortium is always interested in engaging with communities of developers, e.g., AT companies that are active in relevant areas. The final event was one of the opportunities to interest bigger IT players and initiate the collaboration after the end of the project.

- Interest-group community – the end users’ community including persons with deafblindness, their parents and family members, carers, support groups, interpreters and educators, and their organisations, social service and school administration in a region, country and world (on the level of European and global communities). The project result will be customized for individual customers and their needs, and may be sold to order to the persons with deafblindness after reaching technological maturity. The project partners interact with stakeholders in the ecosystem to identify the road for possible market introduction. The consortium considers not only end users (persons with deafblindness) but also the diverse stakeholders in service provision chain - caregivers, educators, and family members as other types of end users, as well as public health institutions, including hospitals and other health care institutions, associations and NGOs supporting of people with deafblindness. To set up a community of stakeholders, which is the base for dissemination and exploitation of results and a work on technical, social and economic innovation the consortium organized the SUITCEYES final event with a set of workshops and demonstrations of HIPI. Moreover, communication part of the platform (a project website maintained after the end of the project) is helpful in integration of such community around the project. It is important to add that a network of contacts and cooperation in co-designing the HIPI is being realized thanks to involvement of relevant organisations, individuals with deafblindness and their relatives/caregivers (<https://suitceyes.eu/affiliated-organizations/>) and the persons associated in the Project Advisory Board (<https://suitceyes.eu/partners/project-boards/#PAB>).

The HIPI’s design is heavily informed by the opinions of the interest-group community, as well as the special expertise of all project partners. SUITCEYES does not, and could not, aim to substitute the valuable support offered to people with deafblindness by individuals closest to them: their families, interpreters, caretakers, educators, and others. This was clear already from the start of the project, and was further emphasized, in the context of the interviews that took place where participants highlighted the importance of the bond with people in their support groups. SUITCEYES aspires at being a first step toward using textiles to provide an alternative mode of communication from distance. This enables support groups to provide useful information or re-assurances even when close hand to hand touch is not present or possible. SUITCEYES also provides the opportunity for one-to-many communication, which

would be useful in terms of classroom or educational settings or when there is a need to provide the same information to multiple recipients, for example at meetings.

Due to the fact that HIPI is dedicated to people with deafblindness, this important group of stakeholders were identified from a wide interest-group community during the project:

- The project’s main goal is to support individuals with deafblindness in dealing with everyday challenges. To this end, the project has carried out a vast number of interviews of people with deafblindness in five EU countries and has also held participatory co-design sessions with potential end users (before the COVID-19 pandemic and then the separate co-design sessions in the sanitary regime, caused by the restrictions introduced). A number of user needs have thus been studied and prioritized. Specifically, the project aims to build a smart garment (HIPI) which is able to detect objects and faces in the surrounding environment, inform users accordingly and also assist with near-field orientation. The HIPI interacts with users via haptic feedback (e.g., vibrations) on the back of the body, or other body parts. A semantically rich social haptic communication language is used to convey information to a single, or many users.

The strategy for exploiting the project results, taking into account the identified project stakeholders, their characteristics (needs, preferred communication methods, etc.) is presented in Table 2 below.

Table 2. Exploitation strategy divided into identified stakeholders.

Stakeholders	Exploitation strategy
<p>Academic community</p> <p>Organizations identified being in cooperation and networking with SUITCEYES:</p> <ul style="list-style-type: none"> ✓ University of Skövde, School of Informatics (Gaming and gamification) in Sweden; ✓ Research Institute of Sweden (Vibration and acoustic analysis, transducers; Digital, acoustic and audio signal processing); ✓ Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB, Information Management and Production Control in Germany (Software development, Information technology, Knowledge management, Software engineering); ✓ University of Groningen, Faculty of Behavioural and Social Sciences, Ortho Congenital and Early Acquired Deafblindness, 	<p>Characteristics: A qualified research community that focuses on the current state of knowledge, searches for new information on the basis of available literature and technical achievements, and aims to improve its scientific achievements by participating in extensive research, grants and projects, often financed from European sources.</p> <p>Needs: Access to knowledge, know-how of new technologies, access to publication databases, open access repositories and tools enabling the processing of results; access to funding for research, not only basic, but also research and development, which lead to the dissemination and use of the generated knowledge.</p> <p>Communication methods: Presentations at lectures, conferences; organization of workshops and demonstrators, publishing the results in reputable journals, including those with open access.</p> <p>SUITCEYES exploitation paths and their maintenance for this group:</p> <ul style="list-style-type: none"> ✓ project website (https://suitceyes.eu/) as a first source of information about the project for communication and technical cooperation;

<p>Department Orthopedagogy in the Netherlands;</p> <ul style="list-style-type: none"> ✓ Dépsysurdi in France ✓ Scientific partners in SUITCEYES (University of Borås, Sweden; Centre for Research and Technology, Hellas, Greece; Offenburg University, Germany; University of Leeds, Great Britain; Eindhoven University of Technology, Netherlands) 	<ul style="list-style-type: none"> ✓ open access to the project publications and its results for further research (https://suitceyes.eu/publications/); ✓ repository for sharing and keeping up to date the SUITCEYES platform source code (and relative documentation) in GitHub (https://github.com/Suitceyes-Project) for further researches and projects; ✓ PhD researches and undergraduate projects enabling the use of project results to develop the researchers' own research path; ✓ new R&D project(s) for the development of HIPI modules and their integration into a fully-fledged product that will reach technological maturity and can be sold on the market (Horizon Europe project considered).
<p>Industry sector</p> <p>Organizations identified:</p> <ul style="list-style-type: none"> ✓ SAAB Group (Integration design, Intuitive Interfaces, 3D audio and tactile displays) in Sweden; ✓ Reutter GmbH in Germany; ✓ Humanware in Canada; ✓ Possum Ltd. in UK; ✓ Saje Technology in USA; ✓ Sensory App House Ltd in UK; ✓ Liberator Ltd in UK; ✓ Handy Tech Elektronik GmbH in Germany; ✓ AbleNet Inc. in USA; ✓ AMDi Assistive Technology in USA; ✓ BJLive! in Spain; ✓ CECIAA SIÈGE SOCIAL ET SERVICE COMMERCIAL in France; ✓ Inclusive Technology Ltd in UK; ✓ LIFEtool gemeinnützige GmbH in Austria; ✓ Prentke Romich Company (PRC) in USA; ✓ Pretorian in UK; ✓ Reinecker Vision GmbH in Germany; ✓ Tobii Dynavox Sverige in Sweden; ✓ Learnetic SA in Poland; ✓ i3tex in Sweden; ✓ Commercial partners in SUITCEYES (Harpo Sp. z o.o., 	<p>Characteristics: Enterprises and groups of enterprises whose overarching goal is profit, to which they aim by developing, implementing and distributing products and services, as well as developing current technologies so that they can be sold.</p> <p>Needs: Employees, technical infrastructure and finances to carry out current operations, access and co-development of new technologies that can later be implemented on the market, earning money.</p> <p>Communication methods: Direct contacts with partners, suppliers and customers, network of contacts through local and international dealers, website, social media and video publishing, participation in trade fairs and branch events, organization of workshops and demonstrations in various organizations for the presentation of equipment, contracts and participation in tenders, using leaflets adapted to different recipients.</p> <p>SUITCEYES exploitation paths and their maintenance for this group:</p> <ul style="list-style-type: none"> ✓ project website (https://suitceyes.eu/) as a first source of information about the project for communication and technical cooperation; ✓ repository for sharing and keeping up to date the SUITCEYES platform source code (and relative documentation) in GitHub (https://github.com/Suitceyes-Project) for industrial developers; ✓ cooperation with local and international industrial partners and dealers to pave the way for a new product;

<p>Poland and Les Doigts Qui Rêvent, France)</p>	<ul style="list-style-type: none"> ✓ market communication and promotional activities of a new product in order to encourage big players in the AT market; ✓ interest in new R&D projects to improve HIPI for its further market adaptation; ✓ sale of the product after reaching its market maturity.
<p>Interest-group community</p> <p>Organizations identified:</p> <ul style="list-style-type: none"> ✓ Center for Education and Rehabilitation for the Blind (CERB) in Greece; ✓ CFD in Denmark; ✓ Eikholt in Norway; ✓ Mo Gård in Sweden; ✓ Nationellt kunskapscentre för dövblindfrågor in Sweden; ✓ Towarzystwo Pomocy Głuchoniewidomym in Poland; ✓ Polska Fundacja Osób Słabosłyszących in Poland; ✓ The West Götaland Region deafblind team in Sweden; ✓ The National Agency for Special Needs Education and Schools in Sweden; ✓ The Nordic Centre for Welfare and Social Issues in Sweden and Finland; ✓ VGR – Dövblindteamet (Social haptic signals, communication with deafblind people, deafblind issues at regional level) in Sweden; ✓ Sense in UK; ✓ Deafblind UK; ✓ Leeds Disabled People's Organisation in UK; ✓ St. Franziskus Stiftung Heiligenbronn in Germany; ✓ Deutsche Gesellschaft für Taubblindheit in Germany; ✓ Taubblindendienst der EKD e.V. in Germany; ✓ Arbeitsgemeinschaft der Einrichtungen und Dienste für taubblinde Menschen in Deutschland (AGTB) in Germany; 	<p>Characteristics: Non-profit organizations associating, operating for and operated by people with deafblindness, whose primary goal is to improve the quality of life of this group, help with everyday activities and enable communication in the community.</p> <p>Needs: The provision of tools and finance to help them fulfil their social role for individuals with deafblindness, specialized staff and interpreters to help communicating with people with deafblindness, AT helping in everyday activities.</p> <p>Communication methods: Website and social media, promotional materials in different formats (easy-to-read language, braille, compatible with screen reading software, colour contrast, large text...) adapted to the diverse communication methods used by this group to assure a high level of accessibility.</p> <p>SUITCEYES exploitation paths and their maintenance for this group:</p> <ul style="list-style-type: none"> ✓ project website (https://suitceyes.eu/) as a first source of information about the project for communication, testing, further cooperation with this community; ✓ open access to the project publications and its results for caregivers, interpreters – e.g., the project advisors with deafblindness use the publication repository, because it explains the practical usability of HIPI (https://suitceyes.eu/publications/); ✓ based in project results, adapted publicity materials to inform the interest-group community in accessible formats (easy-to-read language, braille, compatible with screen reading software, colour contrast, large text...); ✓ organizing the workshops and events for this community in accessible formats, e.g., the SUITCEYES final event to acquiring people testing the HIPI prototype and interested in the subsequent implementation of this solution among their members; ✓ acquiring partners for the next HIPI development projects;

<ul style="list-style-type: none"> ✓ Paulinenpflege Winnenden e.V. in Germany; ✓ St. Franziskus Stiftung Freiburg in Germany; ✓ DeafBlind Ontario Services in Canada; ✓ European Deafblind Union in Croatia; ✓ Association Nationale pour les Personnes Sourd Aveugles in France; ✓ Centre National de Ressources Handicaps Rares – Surdicécité CRESAM in France; ✓ Fablab at Bartimeus, Doorn in the Netherlands; ✓ The World Federation of The Deafblind (WFDB) in Norway; ✓ European Deafblind Network (EDbN) in Spain; ✓ Deafblind International in Canada 	<ul style="list-style-type: none"> ✓ the use of HIPI by the members of various institutions associating people with deafblindness (as a demonstrator as well as in future, everyday activities).
<p>People with deafblindness (a separate yet central subgroup from the interest-group community - they share similar characteristics, needs, communication methods as the interest-group community, but are separated because of its special importance in the project, participation in interviews and testing sessions)</p> <p>Personas identified:</p> <ul style="list-style-type: none"> ✓ 80+ Interviewees with deafblindness in 5 partner countries (Sweden, UK, Greece, the Netherlands and Germany); ✓ Persons with deafblindness cooperating in the project during co-creation sessions and as advisory bodies; ✓ Individuals with deafblindness testing various HIPI modules and elements of garment (e.g., chairable), the gamified navigation scenario and the haptic vest, and also participating in the Social Haptic Communication sessions (co-design sessions) 	<p>Characteristics: Individuals with deafblindness, whose primary goal is a life without social exclusion, who can use the goods of available technology to improve quality of their life, strengthen their security and independence.</p> <p>Needs: Access to technology, but most of all to interpreters and relatives who can support them in their everyday life, access to accessible materials and communication technologies that allow them a bit more independence and give them a sense of usefulness.</p> <p>Communication methods: Website and social media, promotional materials in different formats (easy-to-read language, braille, compatible with screen reading software, colour contrast, large text...) adapted to the diverse communication methods used by this group to assure a high level of accessibility.</p> <p>SUITCEYES exploitation paths and their maintenance for this group:</p> <ul style="list-style-type: none"> ✓ project website (https://suitceyes.eu/) as a first source of information about the project for communication, testing, further cooperation with this community; ✓ open access to the project publications and its results for caregivers, interpreters - there are voices from individuals with deafblindness

	<p>cooperating in SUITCEYES that they use our publication repository, because it explains the practical usability of HIPI (https://suitceyes.eu/publications/);</p> <ul style="list-style-type: none"> ✓ organizing the workshops and events for this community in accessible formats, e.g., the SUITCEYES final event to acquiring people testing the HIPI prototype and interested in the subsequent implementation of this solution; ✓ acquiring partners for the next HIPI development projects; ✓ the use of HIPI by people with deafblindness (as a demonstrator as well as in future, everyday activities).
--	--

Project partnership leads to relationships with different groups and stakeholders. The nature of these relationships should be taken into account in terms of the benefits they can bring to the consortium and its stakeholders. Each of the identified stakeholders has specific expectations. At the same time, they try to ensure that their expectations override the expectations of other stakeholders and that their interests are placed above the interests of others. Taking into account the future commercialization plans of HIPI, the expectations of individual stakeholder groups in the business context were also identified (see Table 3).

Table 3. Stakeholder expectations.

Stakeholders	Expectations
Investors and owners	<ul style="list-style-type: none"> • increase in the value of the project • maximizing the value of shares • complete and reliable information • public adherence to certain behaviours • competent management bodies • image enhancement
Personnel involved in product development	<ul style="list-style-type: none"> • satisfactory salary • fulfilment of obligations • complete and reliable information • job satisfaction, development opportunities • efficient management
Co-operators and suppliers	<ul style="list-style-type: none"> • the partner's financial credibility • fulfilment of obligations • economic viability • ethics of action • culture and professionalism of operation • interoperability • quality of the communication process
Customers	<ul style="list-style-type: none"> • economic characteristics of the product / service • product / service functionality • product / service quality

	<ul style="list-style-type: none"> • clear, readable and accessible information • an attractive and non-stigmatizing design pattern for a product and service • a satisfactory purchase / customer service process • personification of the relationship with the customer • a positive image of the seller
Competitors	<ul style="list-style-type: none"> • fair competition • transparency and legibility of competitors' activities • business culture
Financial institutions	<ul style="list-style-type: none"> • profit on loan capital • reliable financial results • fulfilment of obligations • openness, reliability and comprehensiveness of information • competent management bodies
Governmental and social institutions	<ul style="list-style-type: none"> • compliance with legal norms in the field of public obligations towards local government and the state • contributions to earmarked funds • cooperation in stimulating national and local development • supporting institutions dealing with charity and social activity
National and regional communities	<ul style="list-style-type: none"> • safe activities that do not threaten the society • patronage and sponsorship of cultural, social and scientific events • civic attitude towards the social environment • taking actions supporting structural changes • co-financing local development activities

In this subsection, attention was paid to the identified stakeholders in terms of the use of the project results and the needs of groups identified in the project before its commercialization, and in terms of expectations that the target stakeholder groups may have in terms of business. It must be admitted that when it comes to the main group of the community with deafblindness, these expectations are similar from every perspective, while when it comes to the business environment, these groups should be considered more broadly, taking into account the entire chain of connections such as suppliers, co-operators, shareholders, a number of institutions or competitors.

3.4 Role of partners in exploitation actions

In early 2021, the final research among the project partners was also carried out on what exploitation activities they would be able to carry out after the end of the project. Table 4 summarizes the conclusions taken.

Table 4. Exploitation paths among project partners.

Type of exploitation action	Description
Patents	No project partner reported interest in patenting the results generated during the project. Neither partner sees the need to protect the results of their work in this way. This approach promotes

	open innovation and the ability for this and other research teams to derive and benefit from SUITCEYES 'open results.
Spin-off/Start-up	None of the partners expressed interest in creating a new entity that will commercialize the project results. This could also be due to the technological advancement of HIPI at the end of this project. HIPI was integrated and tested with people with deafblindness in laboratory conditions similar to real functioning, but the product itself will not be brought to the pre-implementation version yet.
PhD theses/post	Some partners, such as UNIVLEEDS and HB, express an interest in using the SUITCEYES results in PhD research and undergraduate projects. At the end of the project, many open research questions, concerning different haptic actuators (linear resonant actuators, linear magnetic rams), more advanced sensors, psychophysics or ability to use haptic signals were asked. All of them should be developed in next research activities.
Product (technology / tool, the framework, etc.)	The product at its minimum, the HIPI represents a combination of hardware and software that enable haptic signals to be sent in response to sensor information. This enables experimentation and research into haptic communication and navigation. However there also are other elements, for example haptogram tool kit including both hardware and software, design recommendations, lessons about policy and user experiences, exemplar scenarios. These are all of value in supporting future research into haptic communication, and therefore part of the broader platform, but not a marketable product at this moment.
Standards/specifications	CERTH has defined here the ontology (data model) that is available via Apache License. Preparing and sharing the specifications of developed solution contribute to the standardization of assistive technologies. Elaborated specifications are freely available to partners and the public in general (the open platform is accurate solution for sharing this).
Further research	The partners also expressed interest in future project applications supporting improvement of quality of life for people with deafblindness, by enabling future high-quality research into haptic communication - by the consortium and others.
Services (consulting/support, trainings, maintenance, etc.)	In specific a platform (for high quality future research by others, and potentially SUITCEYES partners) relates to documentation that would allow replication of different aspects of the project, maintenance after resources end, ideas about, for example, further work through students, trainings, future website maintenance and others. After the project's end HB (the project coordinator) took over updating the project website. Therefore, it is the communication and consulting part of the platform to keep news and literature reviews up-to-date beyond the end of the project. It is also a way to keep the community with deafblindness engaged beyond the end of the project.
Societal activities	So far no measures in this regard have been specified. However, HB is engaged in various form of outreach raising awareness and promoting improved policies and conditions for people with deafblindness.

Open licenses	<p>The project results have been disseminated and can be used by other research and development teams thanks to licensing using Apache License 2.0 and the MIT License.</p> <p>The Apache License is a permissive free software license written by the Apache Software Foundation (ASF). It allows users to use the software for any purpose, to distribute it, to modify it, and to distribute modified versions of the software under the terms of the license, without concern for royalties⁸⁹.</p> <p>The MIT License is also a permissive free software license originating at the Massachusetts Institute of Technology (MIT). As a permissive license, it puts only very limited restriction on reuse and has, therefore, high license compatibility¹⁰.</p> <p>Details of the SUITCEYES data types that are licensed can be seen in Table 5 below.</p>
Policy change	<p>SUITCEYES partners support all progress, the development of Artificial Intelligence (AI) and promote equal access to technology for people with disabilities, including people with deafblindness.</p> <p>Moreover, the consortium invited policy makers to the project’s final event and communicated the SUITCEYES results, bridging politicians and the Deafblind community.</p>
Other	<p>As other forms of using the project results, the extensive repository of SUITCEYES publications (https://suitceyes.eu/publications/) is indicated, which can be used by project partners, other groups of researchers, as well as the industrial sector and communities associating people with deafblindness, looking for inspiration and solutions in the range of solutions available for them.</p> <p>Promotional activities were also selected, which will serve the purpose of the HIPI best: participation in foreign fairs and exhibitions. On the occasion of trade fairs devoted to the subject of persons with deafblindness, the business partners will promote the product and hold meetings with potential contractors and industry organizations, also big players on the AT market.</p> <p>Whereas scientific conferences, workshops, press, inclusion in educational programs will be aimed at networking and building future collaborations based on mutual interests.</p> <p>HB as a project coordinator is also willing to maintain and keep updated the project website after the end of the project.</p>
Potential customer in SUITCEYES (end user, carer, parents and relatives, social service administration, charity funds, school, research community, industry sector, etc.)?	<p>Each of the recipients listed on the left is a customer for SUITCEYES. For science researchers, the research community and maker community are the main clients. For industrial partners, these are more end-user communities and their surroundings, including institutions for people with special needs, but also the scientific community to develop a HIPI solution and the industrial community to implement the project results.</p>

⁸ <https://www.apache.org/licenses/LICENSE-2.0>

⁹

https://en.wikipedia.org/wiki/Apache_License#:~:text=The%20Apache%20License%20is%20a,license%2C%20without%20concern%20for%20royalties.

¹⁰ https://en.wikipedia.org/wiki/MIT_License

The SUITCEYES consortium strives to keep SUITCEYES results relevant after the project's conclusion. To this end, the following actions were taken:

- There have already been discussions with various relevant stakeholders organizations (e.g., Dbl, Nkcdb, SPSM, i3tex¹¹, etc.) to gauge interest in exploiting SUITCEYES results after the Fall of 2021.
- A relevant meeting with a number of interested stakeholders was also held on August 24th, 2021 for a brainstorming session and collaboration planning.
- Furthermore, HB has initiated steps towards establishing a new internal research centre of excellence for research related to inclusion, accessibility, participation and equal opportunities for all, where a haptic communication lab, drawing mostly from results and experience gathered through SUITCEYES, is planned to become one of the relevant labs of the new research centre. Creation of this centre will involve investment of resources by the University in various forms.
- Conversations have also been held and plans made with external partners (e.g., Stanford University) for mobility of PhD students and collaborative research at this intended centre.
- Discussions are being had with the inventors of Social Haptic Communication (SHC, Riitta Lahtinen and Russ Palmer) to include a simple prototype for demonstration of SUITCEYES haptograms in their on-going courses that they typically hold with their clientele.
- Other research results and insights gained in the project (e.g., methodologies for participatory user-need studies with people with deafblindness) are fed into local educational programs (such as a method course).
- SUITCEYES also participates in the European Commission's Innovation Radar Prize 2021, with the hope to attract further attention to the project results.
- Other potential actions are being explored in collaboration with the local Science Park, DoTank and a Technical and Natural Science Centre in Borås.
- Promotional activities have also taken place in form of information about the project being included in the Royal Swedish Academy of Engineering Sciences' (IVA in Swedish) annual event.
- Press releases have been issued resulting to participation in the local radio and national science program, in turn leading to interest from a few technical organisations contacting the project members for potential collaborations.
- A follow up project has already received funding towards further improvements of the haptogram design toolkit designed and developed within SUITCEYES.
- A number of project members are actively involved in the development of two new Horizon Europe proposals that if successful will lead to further development of SUITCEYES technologies.
- All SUITCEYES partners have also expressed interest in expanding on the SUITCEYES results through other future follow up projects, to bring the technology to near TRL 9.
- Potential applications, collaboration on joint student projects and exploration of other ideas are planned to take place in upcoming quarterly meetings which will involve many of the project member as well as a number of others who have shown interest in being part of these meetings.

¹¹ <https://www.i3tex.com/en/>

- Finally, the project's website will be further updated after the project's end to be made more dynamic and with an updated content.

Table 5 presents the types of data generated in the project with the licensing and authorship options.

Table 5. Data licensed at SUITCEYES.

Data type	Owner	Sensitive	Intellectual property	Licensing	Shared with other partners?	URL	Will the data be kept stored after the project ends?	Other comments and description
Simple and complex concept encoding in signals	HB	N	Y	Creative Commons ¹²	Y	D3.3	Y	Model - Use modulated functions to encode and represent semantic content for one-step transmission enabling haptic communication.
Recordings of SHC signs previously not documented	HB	Y	Y	-	Y	-	Y	For internal use.
Sketches of SHC signs previously not documented	HB	N	Y	-	Y	-	Y	For internal use.
Set of haptogram patterns	HB	N	Y	-	Y	-	Y	Due to restrictions created by Covid the full set of haptograms has not been tested with users. Once tested, they will be published.
Haptogram design tool kit software/ hardware -	HB	N	Y	Creative Commons	Y	-	Y	The haptogram design toolkit was constructed and is fully functional. Further funding was sought and received to

¹² <https://creativecommons.org/licenses/>

currently in production								improve usability. The intention is to make this toolkit available online, so that potential users can design their patterns online without technical knowhow and the need to install the related programs.
SUITCEYES semantic KB	CERTH	N	-	Apache 2.0	Y	https://mklab.itigr/results/the-suitceyes-ontology/ ; https://github.com/Suitceyes-Project	N/A	Model - An ontology-based model for semantically representing possible pertinent notions: e.g., medical and healthcare, user profiling, affective aspects and mood, contextual aspects.
SUITCEYES face recognition software	CERTH	N	-	Apache 2.0	Y	https://github.com/Suitceyes-Project	N/A	Method - Detect and recognize the persons that exist in the room together with the end-user.
SUITCEYES object recognition software	CERTH	N	-	Apache 2.0	Y	https://github.com/Suitceyes-Project	N/A	Method - Detect the objects that exist inside a room.
SUITCEYES scene recognition software	CERTH	N	-	Apache 2.0	Y	https://github.com/Suitceyes-Project	N/A	Method - Recognize scenes.

Co-ideation workshop video recording	HSO	Y	N	N	Y	-	N	-
Easter-Egg-Hunt Study video recording	HSO	Y	N	N	N	-	Y	-
Easter-Egg-Hunt Study analytical data	HSO	N	N	N	N	-	Y	-
Keep Your Distance Study video recording	HSO	Y	N	N	N	-	Y	-
Keep Your Distance Study analytical data	HSO	N	N	N	N	-	Y	-
Keep Your Distance gaming vest software	HSO	N	Y	MIT License	Y	https://github.com/Suitceyes-Project	Y	-
Tactile Board software	HSO	N	Y	MIT License	Y	https://github.com/Suitceyes-Project	Y	-

Y – yes; N – no; N/A – not applicable; - (dash) – data not available

4. Business case

This section presents the business tools used to analyse the potential of SUITCEYES. The first business model was developed that summarizes the strategy of the entire consortium. It provides a structure that mediates the value creation process between the technical and economic domains in a viable and sustainable way. Next, the commercialization of the project outputs resulting from the development and implementation of HIPI is summarized. Finally, main risks and barriers in exploitation of the project results were also reviewed.

4.1 Business model

The business model determines the adopted long-term method to increase and use resources in order to present clients with an offer that exceeds the offer of the competition, while ensuring the profitability of the organization. Its aim is to obtain, and at a later stage to maintain, a competitive advantage. The business model is one of the three main determinants of economic efficiency (the others are the environment and factors of change) [2].

At this stage, the consortium needs to find answers to the following questions:

- to which target group the product is intended,
- what values (benefits) the product should offer to customers,
- what are the strategies for delivering these values,
- how this value is to be created,
- how the price of the product should be shaped [3].

One of the more popular schemas used in analysing and creating business models is the Business Model Canvas, developed by Swiss Alexander Osterwalder in 2008. Using this scheme allows one to:

- precise definition of key business areas,
- the ability to locate weaknesses before moving on to business implementation,
- preparation of a clear presentation of the idea,
- developing a credible and accurate business promotion strategy [4].










The following is a business model based on data from the entire project consortium. The Business Model Canvas tool was used to prepare it (see Table 6). It gives an overview of the required activities and resources and their cost structure for the overall customer segments of SUITCEYES results. It also highlights potential key partners and revenue streams.

The ambition of SUITCEYES partners is to bring HIPI to a state that allows it to be sold, while with the current state of technological development, both the HIPI interface and the platform option for further cooperation, communication and product development are considered in the business model.

In the business model it is considered that:

- Hardware sales can be made by Harpo (or other licensing company) and its distributors: to establish the commercial agreements with the distributors worldwide,
- Software licensing to third parties: the possibility of acquiring software licenses by third parties, so that different interested users can re-use project software for other purposes.

Table 6. Business Model Canvas.

Business Model Canvas				
Designed for:		Designed by:		Date:
				28.01.2021
				Version:
				1
Key Partners  <ul style="list-style-type: none"> ICT/AT companies interested to introduce HIPI for their customers and promote platform Open source community and development partners who will develop HIPI's elements Interest-group and care organisations who can test and implement new versions of HIPI 	Key Activities  <ul style="list-style-type: none"> Promoting and introducing HIPI to customers Development of HIPI to the product maturity level Deploy HIPI to customers Extensions of the HIPI platform 	Value Propositions  <ul style="list-style-type: none"> Complete set of components and modules in one HIPI Give access to some elements of the code 	Customer Relationships  <ul style="list-style-type: none"> Direct relationships Basing on already existing relations and building new ones Long-term relations (deploying and maintaining the platform) 	Customer Segments  <ul style="list-style-type: none"> Divided by types of stakeholders (scientific, industrial and interest-group)
Key Resources  <ul style="list-style-type: none"> HIPI platform Partners' and project's know-how Customer relationships Ways to reach customers 	Channels  <ul style="list-style-type: none"> Direct communication Conferences, workshops and other events Social media WWW 		Cost Structure  <ul style="list-style-type: none"> Cost of skilled personnel for deployment and development of the platform Cost of marketing and sales Maintenance 	
Revenue Streams  <ul style="list-style-type: none"> Deployment of HIPI Sale of the final product (for 1 piece) Maintenance of deployed platform 				

4.2 Further commercialization of the project results

There are three main paths of commercialization of R&D results (the most important points for each of them are characterized below):

- Granting a license to use the rights to the results of R&D works on market terms:
 - Authorizing the third party to make use of the right to remuneration,
 - Requires more investment due to the long-term nature of the transaction,
 - Allows you to keep ownership of the licensor.
- Market sale of rights to the results of studies/works for introducing them to the economic activity of another entity:
 - The simplest and least profitable form of commercialization,
 - Transfer of ownership to the buyer,
 - A pre-sale quote is required.
- Introducing the R&D results into own business activity by starting production or rendering services based on the results obtained:
 - The owner of the R&D results decides to use these results in own business,
 - Bringing R&D results to the newly established company (SPIN-OFF),
 - The most difficult commercialization method involving the greatest risk,
 - Most profitable and leaving property rights to the inventor.

It is considered in the project that the right of first refusal can be granted for Harpo (after HIPI is technologically ready for further commercialization plans):

- Priority to enter in a business transaction with the IP owner/s, at equally economic conditions for Harpo, before the owner/s is entitled to enter into that transaction with a third party,
- If a better proposal arrives for the foreground to be licensed and Harpo does not match the proposed terms, foreground owners would be free to accept such proposal.

It is worth underlining that the HIPI device is still a prototype and some significant investments (around 1.0 to 1.5M€) and time (12 to 18 months) will be necessary to make it a commercial product. Moreover, the purchase of this assistive device must be heavily funded to be a success in Europe, North America and elsewhere. In many countries, funding programs are already in place and cover a range of assistive devices for deafblind people. Getting a new product on the list of devices funded by some programs takes time and quick starting the marketing activities is a right way before the product is ready to be launched on the market.

4.3 Barriers and risks

In the project the following barriers and risks for exploitation (actual use of the results after project funding) has been recognized. These barriers and risks will be countered with appropriate measures (see Table 7 below).

Table 7. Critical exploitation risks and mitigation actions.

Risk category	Key risk causes	Risk-mitigation measures
Financial and economical	Shortage of funds for HIPI's development	Consortium partners are considering applying for and participating in another project aimed at developing and refining HIPI, e.g., with financing from the Horizon Europe program.
Contractual and legal	<ul style="list-style-type: none"> • Variable legal procedures and policy rules in EU countries • Complex contract conditions with entities interested in SUITCEYES results 	<ul style="list-style-type: none"> • This risk can be viewed in two ways. On the one hand, legal procedures and policies implemented in European countries may change. Fortunately, EU countries are going to improve the availability and access to technology for people with special needs. However, this development varies in different European countries. Western countries are already implementing some policies to improve the quality of life of people with disabilities, including deafblindness. The United Kingdom and Germany have developed a few specific policies, while other countries have yet to do this. Less developed countries are still at the beginning of the road in which access to assistive technologies and forms of support for people with disabilities is not so common yet, and the proposed solutions are expensive. Then people with disabilities can only use various forms of fundings and subsidies for AT solutions. All that can be done is to observe the changing policies in this regard and react by promoting the results of SUITCEYES in the EU (and beyond). When the project started in 2018, the policy on new AT technologies and disability support was virtually non-existent. However, towards the end of the project, it can be concluded that this interest has increased significantly over the past two years. While technological developments have preceded law and politics, regulation seems to be catching up slowly. Fortunately, there are national and international organizations of people with deafblindness in different countries that try to protect the interests of this group. The purpose of SUITCEYES is to maintain the relationship with these organizations and individuals also outside the project. Moreover, work on regulating AI and ethics is ongoing, but people with disabilities and their representatives are not yet fully involved in them. The results of SUITCEYES support alignment in European law and policy, promoting equal access to these technologies. • Complications related to the possible use of project results by external entities are also considered. In the case of SUITCEYES, the research partners intend to protect their authorship by

		licensing the results, e.g., in the GitHub repository, and publishing them in scientific journals. The project agreed that Harpo may have commercial exploitation priority under a separate agreement with the consortium partners. Any plans for further use (except for non-commercial use) will be agreed separately with the authors who provided new knowledge for the project.
Operational	Low HIPI productivity estimated by people with deafblindness	Due to the COVID-19 pandemic, extensive testing of HIPI planned with project stakeholders has been difficult from March 2020 until now. At that time, the project was entering a key phase of HIPI development and integration. Nevertheless, technical partners, as far as possible, organize single sessions in a sanitary regime with people with deafblindness, testing prototype project achievements, e.g., chairable, which has recently been tested by the TU/e partner during a co-design session with a person with deafblindness. From the beginning of the project, the consortium partners emphasize that they do not intend and are unable to eliminate the presence of another person in life of a person with deafblindness. They are also aware that HIPI is a technologically advanced prototype that combines various fields of science. A way to further test and develop HIPI in a wider group, the consortium sees in subsequent R&D projects, in which a larger group of people with deafblindness will take an active part in development works.
Safety and social	Lack of safety presence for people with deafblindness	Privacy and regulation of unauthorised use of personal data is important for all citizens, including people with disabilities. However, access to face recognition software for people with deafblindness can make all the difference for independent living and security. People with deafblindness need to be actively included in the current debates on new technologies, therefore the aim of SUITCEYES was allowing them active participation in the SUITCEYES final event and next initiatives after the end of the project.
Design and physical	Unclear specifications for stakeholders	At this point, a person with deafblindness is the main stakeholder who can evaluate the design and clarity of any guidelines for handling HIPI. Possible problems are solved thanks to participatory sessions with representatives of the Deafblind community. If, due to COVID, the situation allows for face-to-face meetings, the consortium plans to develop HIPI through co-creation sessions with the wider community with deafblindness (as planned, e.g., to organize a Living Lab workshop with Eikholt in Drammen, Norway). Regarding the technical stakeholders and software developers, the project partners are sharing open source software in a GitHub repository which, in

		addition to the target resources, has authorship information and a citation requirement. It also allows for possible further cooperation on the released code elements in the future.
Delay in technical advancement of HIPI	Legal procedures involving the consortium, retention of competent staff and inadequate resources	At the end of the project (and even before its completion) some of the qualified staff currently involved in the development of HIPI terminated contracts with institutions participating in the project or was assigned to other tasks. Moreover, in the time of the COVID-19 pandemic, delays are and may still be caused by limited access to laboratories. Already at the final stage of the project, it was important to talk to members of the consortium, taking on the further development of HIPI and joint cooperation after the end of the project. These topics will be actively discussed at the quarterly meetings. To prevent the risk of insufficient resources for the development of HIPI, further research and development will be necessary with the participation of the consortium and with additional funding.
Cultural	Language barrier and differences in cultures	Due to language barriers and cultural differences, the development and implementation of HIPI in the countries may be on a different level. Due to different socio-cultural and systemic conditions, access to and use of assistive technology may differ in many countries. Therefore, SUITCEYES engages Deafblind institutions in different countries, trying to ensure equal access to information and use of project results (tests, access to scientific results, online final event at no additional cost for people living in different parts of the world).
Commercialization	Psychological, competence, system and economic barriers	The new venture should create value for all parties involved in it. Psychological barriers can boil down practically to the willingness of a given person to conduct commercialization. For partners involved in research, scientific development is the most important. Hence, it cannot be expected that every researcher will be interested in commercialization. Due to the fact that most partners come from scientific institutions, this type of exploitation of the project results in further scientific work is the most important and optimal. The main barriers also include the systemic and financial barrier. The lack of systemic solutions and funds is quite often indicated as one of the main reasons for not conducting business activity and commercializing projects. The system of supporting innovative activities is also of key importance. In the absence of funds, it is possible to look for support in dedicated organizations. These include business activities (including SMEs like Harpo), business

		incubators, venture capital funds, business angels and a number of other opportunities that can be gathered under the umbrella of the so-called systemic support for innovative activities. As an SME, Harpo is not able to invest in the HIPI development to such an extent that it can now commercialize the solution itself. The way to achieve support is also contacts with larger foreign organizations, business partners and big players on the AT market. One way to arouse their interest in the SUITCEYES results is to invite them to actively participate in the SUITCEYES final event (as key-note speakers and panellists).
Force majeure	Natural disasters and morbidity (e.g., COVID-19)	The unexpected example of the COVID-19 epidemic has shown that planning activities and project scheduling can change suddenly. Thanks to this reality, the consortium had to learn to work and collaborate remotely. In all the misfortune, this may have positive sides, as it will strengthen mutual cooperation in the future and will add willingness to implement further projects.

5. Intellectual property rights

Finally, the IPR for the technology merits considering patents or other approaches to secure potential exploitation possibilities were reconsidered. The IPR interests were analysed with the project consortium. The partners providing background knowledge are not willing to claim any rights. Background means, in the context of SUITCEYES, any data, know-how or information whatever its form or nature, tangible or intangible, including any rights such as intellectual property rights, which is:

- held by participants prior to their accession to the action;
- needed for carrying out the action or for exploiting the results of the action; and
- identified by the participants.

The rest of information concerning sharing knowledge and IPR interests of the consortium partners is summarized in Table 8 below.

Table 8. Knowledge and IPR interests within the project.

Partners' activity	Description
Partner is interested to become a partner of a new Start-up for SUITCEYES (Joint Venture)	None of partners apart from HB is willing to support such an initiative.
Partner will sell SUITCEYES (Software)	Only Harpo is interested in selling.
Partner will sell SUITCEYES (Hardware)	Only Harpo is interested in selling.
Partner will offer installation / configuration / education service	Only Harpo is interested in it in a commercial sense as a business partner. Harpo usually conducts workshops, training sessions, presentations and demonstrations about the products the company offers for sale. If HIPI were to join the offer, it would be implemented in the company's usual practice. On the other hand, HB is willing to support education services.
Partners providing foreground knowledge willing to claim rights	CERTH partner has listed here web app to visualize detections, images and spatial awareness information and execute user queries. HB considers a set of haptogram pattern designs and means of converting these to vibration motor actuation.
Partners providing foreground knowledge NOT willing to claim rights	CERTH partner mentioned here the ontology (Data Model available via Apache License) and rule base and engine to extract spatial awareness information.

Foreground means, in the context of SUITCEYES, the tangible and intangible results which are generated within a given project, including pieces of information, materials and knowledge and whether or not they can be protected. It includes intellectual property rights (e.g., copyrights, industrial designs, patents), similar forms of protection (e.g., rights for databases) and unprotected know-how (e.g., confidential material). Results generated outside a project are not foreground.

At the end of the project, it can be concluded that there are still no strong IPR interests among the project partners. At the same time, it can be concluded that there are no problems with intellectual property rights within the consortium that could compromise the ability to exploit the project results in the form of new products on the market.

6. Summary

This document presents the final exploitation strategy for the SUITCEYES results. Of course, some decisions are still being finalized. However, attention was paid to product concepts and their development scenarios. The HIPI option as a generative prototype was analysed, as well as a platform for technical collaboration and post-project communication. HIPI is not yet developed so that immediately after the end of the project it could include pre-implementation activities and the implementation itself to the market (currently it has been determined that the project will end with a TRL of 6/7, i.e. a working prototype). Accordingly, various elements of the platform are considered, including hardware, software and other elements for further research discussion.

It can be concluded that the project consortium created an initial platform by encouraging interaction with those interested in the project field. As for the communication part of the platform, appropriate links were added on the website with the possibility of reporting interest, ideas and questions, through which one can send comments, own suggestions and establish further cooperation, which will be independently initiated by the partners.

Exploitation variants were also identified for the various stakeholders identified in the project at national and international level. Their characteristics, needs, communication methods, exploitation paths and the way of their maintenance for each stakeholder group were taken into account. The expectations of stakeholders from the business point of view for the future commercialization of the product were also noted.

The next part focuses on the role of partners in the exploitation of project results. Most of the consortium partners belong to research units, so for them the most important is further research exploiting the project results, publishing the results in scientific journals and making the results available in open access repositories. This may hinder future commercialization of the project's results, given that no one other than Harpo has commercial interests in this regard. Nevertheless, another research and development project to refine HIPI and its development seems to be of interest to all partners. Attention was also paid to the data that is subject to licensing in the project, based on information from the consortium partners.

Moreover, an initial business model was analysed based on the organizations of all partners. Attention was paid to possible future paths for commercialization of the project results and the most important barriers and risks that may limit the exploitation of the project results.

Finally, the intellectual property rights were analysed. It has been found that there are no strong intentions by the project members to register patent rights or other forms of design protection in the project, what favours open innovation and possibility to benefit from the project results in the future. Additionally, some of the project results are subject to licensing in open-source repositories, which seems to be satisfactory for most partners.

The consortium ensures to stay ahead of competitors in development of solution for people with deafblindness, because the project members (or at least some of them) are willing to be part of further support of the commercial parties, like Harpo, with their know-how in order to develop HIPI in the next research and create what is called a “competitive advantage” in the commercialization process.

7. References

- [1] United States of America Department of Defense (2020). Technology Readiness Levels in the Department of Defense (DoD). Defense Acquisition Guidebook. Available online at: <https://www.gao.gov/assets/710/703694.pdf> (accessed June 5, 2020).
- [2] A. Afuah, C. L. Tucci, Internet Business Models and Strategies, New York: McGraw-Hill Companies, 2001, s. 18-20.
- [3] A. Afuah, C. L. Tucci, Internet Business Models and Strategies, New York: McGraw-Hill Companies, 2001, s. 32.
- [4] M. Orczykowski, Jak stworzyć model biznesowy? – Social Tigers [2017-11-10].