SUITCEYES

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Smart, User-friendly, Interactive, Tactual, Cognition-Enhancer, Yielding Extended Sensosphere

Appropriating sensor technologies, machine learning, gamification and smart haptic interfaces

[8.17]

Impact Measurement Methodology

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

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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.	

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Glossary	
Abbr./ Acronym	**Meaning**
SUITCEYES	Smart, User-friendly, Interactive, Tactual, Cognition-Enhancer that Yields Extended Sensosphere
KPI	Key Performance Indicator
HIPI	**H**aptic, **I**ntelligent, **P**ersonalized **I**nterface
RTD	Research and Technology Development

Table of Contents

Executive Summary

Research projects involved in developing assistive technologies are only of value if the project results achieve some benefits to the users and the community. While it is not easy to assess the impact of an innovation before it is put in place, it is nonetheless important to develop various performance indicators that would be helpful towards assessing the success of the result.

Several indicators to measure the impact need to be identified. This includes not only the impact of the developed device in users' lives (e.g. impact on quality of life), but also the overall impact of the project itself (e.g. in terms of research contributions and impact on different stakeholder groups and areas within society). A structured methodology regarding the impact of the achieved results is needed to assess these indicators appropriately.

The methodology of impact measurement, which is presented in this deliverable offers several different qualitative and quantitative indicators for measuring both positive and (potential) negative impacts of the SUITCEYES project as a whole, and the developed HIPI (**h**aptic, **i**ntelligent, **p**ersonalized **i**nterface). Some impact indicators which can be assessed after the conclusion of the project are also presented to offer impact measurements at more advanced stages of the project.

The purpose of this document is to define the Key Performance Indicators (KPIs) and the evaluation methodology and plan that will be used for assessing the SUITCEYES performance towards successfully development of HIPI system. The overall objective of SUITCEYES is to improve the level of independence and participation of persons with deafblindness in society and to enhance their communication, cognition, perception of the environment, knowledge acquisition, and conduct of daily routines. Towards this, SUITCEYES will develop and deliver a haptic intelligent, personalised, interface (HIPI) that will build upon machine learning, sensor technologies, image and signal processing, psychophysics, and affective computing to (i) extend the localisation and environmental perception of the user and (ii) extend and improve HIPI user's modes of communication via a haptic interface. Various studies will inform the project of user needs and design elements that will allow customisation. To promote and facilitate learning, (iii) gamification will be incorporated to capture and extend the user's interest, umwelt and engagement.

In this context, a preliminary list of KPIs and test procedures is compiled. However, it should be noted that a) not all these KPIs will necessarily be used and b) as the project progresses and its components and services are integrated and deployed, new KPIs or even test procedures may be defined that would better evaluate emerging aspects of the interface.

Introduction and Rationale

The presented approach of the methodology of impact measurement builds upon an overarching view on the broader impact of the SUITCEYES project. This includes monitoring of not only positive, but also negative impacts. Furthermore, qualitative and quantitative measurements are combined. Finally, indicators measuring the overall impact of SUITCEYES are combined with indicators measuring the actual impact of the developed prototype: the HIPI.

In the context of this project, indicators of impact measurement are designated as 'Key Performance Indicators' (KPIs). They define measurable values demonstrating how relevant project objectives are achieved. The proposed methodology is divided into KPIs attainable without prototype testing, and KPIs requiring a prototype for evaluation. Whereas, for instance, the number of visitors on the website can be evaluated throughout the whole project and already at early stages, the user experience of the HIPI can be evaluated only if a prototype is already available for testing. The section in which KPI measurement does not need a prototype for testing covers the impact of the project as a whole on different areas, whereas the section which requires prototype testing covers the measurement of impact of the HIPI. Possible fields of impact of the project can be public interest, engagement of companies and institutions, media or science. The effects of the HIPI are expected to enhance social competences and experiences. Additionally, indicators are labelled as qualitative or quantitative measurements.

Quantitative and Qualitative Indicators

KPIs can be both qualitative and quantitative. Quantitative indicators allow for numerical measurements. Recording numbers or numerical data involves attempts at capturing objective statements that are independent of subjective assumptions or world views. Qualitative measures, on the other hand, include subjective, personal opinions towards a target object. Qualitative data is mainly collected by means of self-reports (e.g., also surveys and focus groups), which ask the user about his/her opinion towards a device in a structured way. When combined, qualitative and quantitative indicators provide a comprehensive assessment regarding progress of the project in regards to stipulated aims.

This section relates to the description of the requirements and the properties that the KPIs need to possess, in order to measure successfully the performance and the behaviour of all the internal components and the SUITCEYES outcomes as a whole, according to the developed/identified scenarios and use cases. The evaluation work is primarily experimental, based on prototypes developed in the project.

The evaluation and procedure of SUITCEYES objectives requires a selection of suitable qualitative and quantitative indicators and the definition of appropriate qualitative targets and expected results to be achieved per indicator. The identification of the evaluation procedure as a "success" will be based on these, for now rather preliminary, targets and expected results. Moreover, only with a recognized success, there can be a reasonable potential for the adoption of the proposed solution.

The selection of the KPIs followed the following criteria:

- Relevance: an indicator should represent an assessment criterion, i.e. have a significant importance for the evaluation process;
- Completeness: the set of selected indicators should consider all aspects of the solution under evaluation;
- Measurability: the identified indicators should be capable to be measured objectively or subjectively;
- Familiarity: the indicators should be easy to understand;
- Non-redundancy: indicators should not measure the same aspect of an assessment criterion, and;
- Independence: small changes in the measurements of an indicator should not affect preferences assigned to other indicators of the evaluation model.

Structure

The following chapters present individual KPIs, grouped in tables with the following structure:

- The first two columns introduce the name of the KPI and a short description of it;
- The third column 'Area' marks the field which is covered by the KPI (such as media, organizational, scientific, …);
- The fourth column specifies the measurement of the KPI as quantitative or qualitative, and;
- Lastly, the column 'Potential Measuring Method' exemplifies how a KPI can be measured.

User Impact

The overall objective of SUITCEYES is to improve the level of independence and participation of people with deafblindness in society and to enhance their communication, cognition, perception of the environment, knowledge acquisition, and conduct of daily routines. Towards this, SUITCEYES will engage in multiple activities to improve the level of knowledge about deafblind issues and inform and influence decision and policy makers. These actions are taken with the aim to improve the societal circumstances that surround people with deafblindness. SUITCEYES will also develop a smart haptic interface (HIPI) that will facilitate and improve the target groups' perception, communication and learning. We will assess the impact of the HIPI and the actions taken in several aspects. First, we will focus on understanding the impact of our tool in users' everyday life. We intend to improve their perception of the environment, communication possibilities and learning, leading to *improved quality of life*, *work opportunities*, *participation in the social life* and *day to day experiences*. The developed tool should also have an impact for their families and support groups by facilitating their communication with the target group and offering complementary assistance.

A rich variety of metrics will be applied to assess the impact of the developed tool in users lives. As prototypes for testing evolve throughout the project, qualitative KPIs gain relevance. Therefore, at later stages, qualitative indicators will be more prominently used in order to evaluate user experiences. Still, quantitative KPIs continue to play a vital role in the following up of successful implementation.

The proposed KPIs will be further influenced and complemented by the results from Work Package 2 and the user studies being conducted there.

For this aim WP2 will establish the foundation of the project by engaging participants with deafblindness and their support groups to better understand their needs and aspirations and by examining policy and practice in the participating academic partner countries to identify the barriers to social participation people with deafblindness experience. In this way, the studies conducted in WP2 will identify specific requirements, constraints and exemplar scenarios that will guide the technical work packages and will also establish the benchmarks against which these work packages can be evaluated and the future potential of the research to be determined. To do this, WP2 will pursue the following detailed objectives:

- Identify and advance best practice on involving research participants with deafblindness;
- Carry out interviews with users and their representatives in participating academic partner countries in order to establish current practices, aspirations and unmet needs in social engagement, mobility and barriers and enablers to technology-use;
- Synthesise the findings of the above activities into requirements specifications for the other Work Packages;
- Produce a set of personas, environments and use cases to inform the other Work Packages and future Inclusive Design activities, and;

- Carry out comparative research on policy frameworks across participating academic partner countries.

The possible information regarding the results and impact of the HIPI prototype will be limited to the project period since the HIPI might not be tested in everyday situations and this is an important limiter. After the project conclusion these metrics will be a stepping board for measuring longer term impact.

KPIs measuring the impact based on prototype testing, cover the following areas of potential impact:

- **User:** The impact of the system on the users' lives will be measured by evaluating to what extent the provided features are used and for how long the HIPI is used. To this end, usage metrics will be gathered from the use of the prototype. Further measurements will be used to assess the impact of the prototype – such as users' feelings and moods during usage. Additionally, personal feedback will be gathered from each user.
- **Learning:** The process of learning to interact with HIPI can be an interesting KPI as well. A fast and regularly utilized learning process marks positive impact of the device. Furthermore, a high total number of acquired interaction skills indicate a positive impact.
- **Social Environment:** Observations and judgments of family members, care givers and friends can be very important. As they are already involved in everyday assistive practices, they can supply feedback as regards to both positive and negative aspects of utilizing the new technology.

Table 1. KPIs for user impact based on prototype testing

Key performance indicator (KPI)	Description	Area	Type of data	Potential Measuring Method
Time of usage	Time period in which device is used	User	Quantitative	Count
Ratio of used vocabulary	Ratio of used vocabulary and total count of possible vocabulary	User	Quantitative	Count
User experience	Evaluating the user experience	User	Qualitative	Questionnaires, self-reports, interviews, video analysis
Emotions	Recording the users' attitudes, feelings and moods while using the device	User	Quantitative and Qualitative	EEG, skin conductance, questionnaires (with Likert-scale)
Subjective well-being	Evaluating the users' happiness with tripartite model of subjective-well-being	User	Qualitative	Questionnaires (with Likert-scale), COMP, PIADS, interviews, video analysis
Subjective experience of family members	Evaluating the results as perceived by care	Social environment	Qualitative	Focus-groups, interviews, questionnaires.

and support groups	givers, family members and friends			
Number of new vocabulary	Total count of new vocabulary already learned	Learning	Quantitative	Count, ask users/ family/care givers

Scientific, Stakeholder and Media Impact

The project intends to advance the state of the art in related research fields - from disability studies to machine learning, gamification, and smart haptic interfaces. The outreach of the project will be assessed in terms of scientific outputs, as well as exposure to the general public.

As for the impact on the general public, a focus will be placed on social media, and traditional medias. For instance, quantitative metrics, such as Twitter followers, website visitors or participants in a study can be evaluated continuously after publishing an account, website or conducting a study. This mainly includes quantitative indicators, but also some qualitative measurements can (and should) be evaluated already at the beginning of a project. For instance, to identify the main needs and requirements and accordingly define an adequate frame for development, qualitative measurements (such as user studies or focus groups) need to be conducted. However, it is important to note, that evaluating these KPI's is not limited to early stages of a project, and should be repeated regularly, to ensure continuous evaluation of the project.

Further, outreach efforts will be placed on policy studies, with the goal of raising awareness and shaping policies regarding issues related to deafblindness, namely, decisions made towards improved structural and societal conditions. An emphasis will be continuously placed on engaging with organizations at regional and national levels, symposiums and press (newspapers, radio, tv,), as well as policy makers. Not only to continuously inform the design of our project, but also to shape policies themselves. This will be followed up by the continuous input from the projects advisory board as well as through interviewing relevant organisations on the national level in several of the participating countries.

Societal, and RTD aspects cover several different areas of potential impact, but is not limited to:

- **Stakeholders:** The participation of stakeholders and potential users forwards the progress and success of a project enormously. There is a wealth of organizations nationally and internationally involved in a) organizing people with deaf blindness, b) supplying assistive resources and c) involved in policy activities. The project has an ambition to create connections with representatives from all of these and will, in addition, aim to strengthen the connectivity between various national and international actors, cross cutting across various types of stakeholders. Clearly, having an adequate number of participants in user studies is crucial for statistical analysis and a user-centred development in the project. Moreover, external advice or ideas are valuable inputs as well, potentially leading to new perspectives and strategies to enhance project development.
- **Media:** This category describes all kinds of transmitting information about a project to the public. Attracting media attention is, of course, very useful for commercialization and advertisement at later stages of a project, but also in the beginning attracting the publics' interest is an important KPI. If a project is widely known, potential users, stakeholders or contributors have more possibilities to get in touch and forward a projects' progress by taking part in studies, giving advice or expressing ideas and wishes. Commonly used social networks,

such as Twitter and Facebook are very valuable to spread information to a wide audience. Social networks, such as ResearchGate are addressing a more specific audience, which offers the opportunity to also disseminate detailed technical and methodological information to professionals and experts.

- **Scientific:** Looking at the scientific impact of the project marks another independent KPI. The project will produce an extensive number of scholarly publications. An inventory of these as well as the development of the citation record will supply some indicators of scientific impact. These contributions can even go beyond the area of application of the project itself. If new cutting-edge technologies are presented, or new methods and theories are introduced, the research areas devoted to the understanding of people with deaf blindness as well as research on assistive technologies can receive fundamental contributions through this project.

Table 2. KPIs for scientific, stakeholder and media impact

Key performance indicator (KPI)	Description	Area	Type of data	Potential Measuring Method
Number of participants (total and per country)	Participants in user studies (e.g. focus groups, functional tests, interviews)	Stakeholders	Quantitative	Count
Personal opinions from focus groups, interviews, events or workshops	(In)direct feedback of users, stakeholders or the public	Stakeholders	Mixed methods: Qualitative and Quantitative	Questionnaires, interviews.
Number of visitors	Visitors on the website	Media	Quantitative	Google Analytics
Number of likes	Liked comments, posts and news on social networks (Twitter and Facebook)	Media	Quantitative	Count of 'Likes'
Number of shares	Posts, news or any information shared by external people/organizations	Media	Quantitative	Count of 'Shares'
Number of watches	How many watched the videos on the YouTube channel	Media	Quantitative	Count of 'Watches'
Number of reads	Reads of updates and posts on ResearchGate	Media	Quantitative	Count of 'Reads'
Number of followers	Followers on social networks (Twitter and Facebook)	Media	Quantitative	Count of 'Followers'
Number of comments,	Questions and comments on posts and news on the	Media	Quantitative	Count

messages or requests	website, on social networks (Twitter and Facebook) or requests via mail			
Number of public releases	Released press articles, radio podcasts, reports on television	Media	Quantitative	Count
Number of publications	Project-related, scientific publications because of new insights and findings	Scientific	Quantitative	Count
Number of citations	Citation of published project-related papers by other researchers	Scientific	Quantitative	Count
Number of patents applied for and intellectual assets identified	Successfully filed applications for patent and identified intellectual assets	Economical	Quantitative	Count
Perceived results on the societal level from projects advisory board	The perceived results on society level and the target group in general.	Stakeholders	Qualitative	Meetings, interviews
Knowledge about the projects results on the national level	The knowledge about the results of the project and it´s possibilities in groups with the power to influence the target groups life.	Stakeholders	Qualitative	Interviews

Timeline of Measuring Impact

At the early stages of the project and at the beginning of any given activity some KPIs can be measured continuously.

As the HIPI is developed and tested and the different channels for dissemination are implemented further information can be gathered to monitor the success of the SUITCEYES project.

During the project some measurements for the long-term success of the project needs to be put in place to afford a distinct tool for studying the impact of the project in retrospect. These are modes of impact such as: Health, Policy and Economy.

The points put forth in this document will be used to measure impact where relevant, to both monitor and follow up activities. One should also assess the impact of the tool over a timeframe longer than the project time. One essential aspect pertains the socio-changing impact of the tool. The project intends to raise awareness about issues related to deafblindness, namely, decisions made towards improved structural and societal conditions.

The summary of expected KPIs and the actual status is available in the Table 3, below:

Table 3. Quantified KPI measures

	Period M1 – M36 Means of verification: Internal review, External review		
Indicator name	Poor	Good	Excellent
N. of overall participants in SUITCEYES workshops	16-25	26-40	40+
N. of project workshops (workshops with the stakeholders, training on the use of prototype, organization of seminar/congress to share the project's results and future perspectives)	1	2	3+
N. of stakeholders testing HIPI	2	5	10
N. of contributions to relevant conferences & exhibitions and events	6-7	8-9	10+

N. of papers submitted for scientific publication	6-7	8-9	9+
N. of online articles published including press releases	15-19	20-24	25+
N. of visitors of the website	500-1000	1000-1999	2000+
N. of followers on Twitter	0-29	29-39	40+
N. of tweets	00-19	20-39	40+
N. of brochures disseminated	00-49	50-99	100+

This document discussed the Key Performance Indicators (KPIs) and evaluation methodology and plan that will be used to evaluate the SUITCEYES system and services. In this respect, several objective and subjective KPIs, spanning from pilot to application domains and considering also persons with disabilities were presented in detail. In addition, a brief presentation of some of the existing evaluation methodologies along with the adopted one was given. Based on the SUITCEYES view for the different evaluation methodology levels, namely the user experience, interoperability and testing, several test procedures, exploiting a subset of the previously defined KPIs, were also compiled. The expected outcome of these actions is to have a common evaluation base for the SUITCEYES interface and services.