SPRING

GRANT AGREEMENT N. 871245

Deliverable D9.6

Intermediate Advisory Board recommendations

Due Date: 31/07/2023
Main Author: INRIA
Contributors: -
Dissemination: Public Deliverable

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

DOCUMENT FACTSHEET

Deliverable no.	D9.6: Intermediate Advisory Board recommendations
Responsible Partner	INRIA
Work Package	WP9: Project Management
Task	T9.2: Advisory Board
Version & Date	VFinal, 31/05/2022
Dissemination level	[X] PU (public) [ ] CO (confidential)

CONTRIBUTORS AND HISTORY

Version	Editor	Date	Change Log
1	INRIA	01/05/2023	First Draft
Final	INRIA	27/06/2023	Final Draft including Advisory Board input and all partners comments

APPROVALS

Authors/editors	INRIA
Task Leader	INRIA
WP Leader	INRIA

TABLE OF CONTENTS

CONTENTS OF DELIVERABLE

This Deliverable contains the intermediary results of Task 9.2, Advisory Board. Specifically, it features written recommendations from members of SPRING's Advisory Board (AB), after its third meeting on 15 March 2023, which took place on-site at the Inria Grenoble centre (with remote access for some of the Members). The structure of the document is as follows:

A- Written recommendations, per topic
B- Reproduction of the agenda of the third AB meeting (minutes are not available due to confidential elements shared)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

WRITTEN RECOMMENDATIONS

HOW WOULD YOU QUALIFY THE PROJECT'S PROGRESS OVER THE LAST YEAR, WITH REGARD TO ITS INITIAL OBJECTIVES?

From William Kearns

The team has produced a prodigious number of scientific and engineering papers and presentations over the lifetime of the project, exceeding the project's anticipated output by a significant margin. The papers address issues such as machine vision and learning related to range-finding and target identification and their use in conjunction with acoustic signal analysis to perform tasks similar to those which humans do with ease – notably the fusion of vision and hearing to gather a full appraisal of the total environment at any given moment in time. The team has tackled difficult issues such as range-finding using fisheye cameras and machine vision algorithms to integrate data from multiple camera inputs simultaneously.

From Laurent Zanetton

[FR] N'ayant pas assisté à l'évolution de la totalité du projet, il est compliqué d'évaluer l'avancement de celui-ci au cours de l'année écoulée. Néanmoins, force est de constater qu'un travail considérable a été réalisé depuis le lancement du projet. Si l'objectif initial n'est pas atteint et semble encore lointain, tant en termes d'autonomie (nécessite encore à ce stade d'un pilotage par un programmeur) que de fiabilité (difficulté de compréhension des instructions, difficulté de retranscription de celles-ci), les bases sont posées et des développements intéressants ont été apportés.

[EN, translated] As I have not been present for the entire project, it is difficult to assess the progress of the project over the past year. Nevertheless, it is clear that a lot of work has been done since the project was launched. Although the initial objective has not been achieved and still seems far off, both in terms of autonomy (still requires an agent to control it at this stage) and reliability (difficulty in understanding the instructions, difficulty in transcribing them), the foundations have been laid and interesting developments have been made.

From Jose Alvarez

There has been significant progress in the project road map over the last year. Demos, compared to other meetings are outstanding showing the great work achieved.

From Jeffrey Cohn

The group has made strong technical progress over the past year. The robot is able to navigate in a complex real-world environment and interact by voice and, to limited extent, nonverbal behavior.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

From Louis-Philippe Morency

The progress this last year was significant, on multiple fronts. Given my expertise, I will discuss more about WP4, but I also appreciated the progress in WP2, WP3 and WP5. For almost each objective, we could see progress and new research papers.

WE ARE ENTERING THE FINAL PHASE OF THE PROJECT, WERE THERE WILL BE LOTS OF EXPERIMENTS WITH HEALTHY OLDER ADULTS AND PATIENTS IN THE DAY-CARE HOSPITAL: DO YOU IDENTIFY ANY CRITICAL WEAKNESS IN OUR TECHNICAL DEVELOPMENTS?

From William Kearns

The team has the ambitious goal of producing a service robot that can interact with older adults via verbal commands and gestures. The current setting for the initial deployment of the robot is a hospital waiting room in which the robot would serve as an aide for older adults who had entered the building and were seeking a place to sit prior to their appointment with a healthcare professional. A number of significant problems have to be addressed in order for the robot to fulfil this task, including identifying the newly arrived elder, understanding spoken words from the elder (who may speak with an accent or have other speech impediments related to an ongoing medical condition), differentiating the elder from other similar elders collocated in the same physical area, overcoming acoustic interference (noise) from hospital loudspeakers, etc. and providing meaningful information that will ensure the robot is viewed as an asset in the setting and not a liability. Due to the requirement to obtain human subjects IRB approval, and delays induced by the COVID crisis, the implementation of the robot in the healthcare setting has been delayed, which is understandable, and the team is prepared to move forward with the deployment as soon as the prototype is fully operational.

One concern I have regards my need, as an experimental psychologist, to see the research methodology employed for the human subjects experiments in order to determine validity of the results obtained. Specifically, it is common practice to include the number of subjects and their composition (age, gender and other relevant factors such as sensory limitations, etc.), the psychological or preference measures collected, the research design and random assignment of subjects to treatments to reduce or prevent bias, the type of numerical analysis conducted, etc. For example, for the research assessing elder acceptance of the robotic technology, was the inventory used the Technology Acceptance Questionnaire or was it some other inventory? Are the psychometric characteristics of the chosen measure published previously? Are there any other measures besides acceptance, such as the likelihood that a person will comply with a request from the robot to perform some activity versus to completely ignore the machine? It may be valuable to engage the services of an experimental psychologist familiar with research design methods to enhance the quality of the human subjects research.

From Laurent Zanetton

[FR] Au regard de la population cible, le principal risque critique serait celui de blessure physique. Sur ce point, le robot semble suffisamment sécurisé et les expériences peuvent se dérouler sans danger pour les patients.

[EN, translated] Concerning the target population, the main critical risk would be that of physical injury. On this point, the robot seems to be sufficiently safe and the experiments can be carried out without danger to the patients.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

From Jose Alvarez

I did not see critical weaknesses in the technical developments of the project. A point to bear in mind is the hardware limitations inside the robot. In order to truly deploy the project inside the robot there are a number of performance optimizations that will be required.

From Jeffrey Cohn

I would attend to the timing of paralinguistic behavior, such as interpersonal pauses and timing of displays. These are non-obvious factors that can influence acceptability.

From Louis-Philippe Morency

One interesting challenge when evaluating the robot prototypes with real people will be to understand the quality of the human-robot interaction. To properly evaluate this interaction, we will need a framework. One option could be the Tian and Oviatt 2021 paper about taxonomy of social errors. It may help in constructing the evaluation framework. When possible, it would be useful to link "errors" to the different initial objectives of the project, with the goal of creating a roadmap for future research in this topic. A position paper on lessons learned would be helpful.

WHAT IS YOUR HONEST ASSESSMENT OF THE EXPLOITABILITY OF THE DEVELOPED ROBOTIC PLATFORM IN OTHER HEALTH-RELATED ENVIRONMENTS (E.G. ARE WE POTENTIALLY MISSING A CRITICAL FEATURE, OR ARE THE DEVELOPED MODULES LACKING ADAPTABILITY TO ENVIRONMENTS BEYOND THAT OF APHP)?

From William Kearns

One minor criticism concerns the physical layout of sensors and actuators of the robot, which does not align with the layout of human body or any other species in existence to my knowledge (for example there is a single microphone which is located in the area of the lower abdomen on top of the audio speaker – there should instead be a pair of microphones located on the sides of the head to assist echolocation). Camera locations are in the trunk, not the head, and probably should be stereoscopically located on the front of the head (as is case for predators having good stereoscopic vision and a pivoting head). Adopting a similar layout to that of a human should, at least in theory, enhance ARI's ability to fit. Into those environments where humans thrive.

The ARI robot ideally should conform to physical layout of human organism rather than trying to synthesize a stereophonic signal from a less than optimal mike location, or in trying to obtain 3D depth information from cameras located at right angles to each other in the trunk. To some extent it appears as if a lot of effort of the team has been to overcome earlier mechanical design choices of the ARI robot. Thus the problems being solved in some sense seem to be artefacts of design limitations of the ARI robot's hardware itself. Natural selection in mammals has resulted in a very serviceable configuration of sensory organs that has served a wide variety of species well for many thousands of years. No mammalian species have eyes in their trunk, or an ear collocated with their mouth which prevents audition while they are vocalizing.

From Laurent Zanetton

[FR] L'exploitabilité de la plateforme robotique dépendra fortement du niveau d'autonomie du robot. Si celui-ci doit être piloté par un agent à l'aide d'une tablette, les utilisations seront forcément limitées.
S'agissant de l'environnement, les développements effectués dans un hôpital de jour, qui est une structure de taille modeste en termes de superficie et de mouvements, demanderont à être confirmés dans un autre environnement plus vaste, comme un hall d'accueil par exemple.
[EN, translated] The usability of the robotic platform will strongly depend on the level of autonomy of the robot. If it has to be controlled by an agent using a tablet, the uses will necessarily be limited.
Regarding the environment, the developments carried out in a day hospital, which is a small structure in terms of surface and movements, will need to be confirmed in another larger environment, such as a reception hall for example.

From Jose Alvarez

This technology has an enormous potential to be developed and assist in many health-related environments. One limitation (currently outside of the scope of the project) that likely will need to be addressed is deploying a more interactive conversation with the patients. Interacting properly with elderly people who is not used to talk to machines seems to be crucial for a proper adaptation of this technology. For example, the patient interrupting the conversation and the robot being able to resume from the same point at a later time.

From Jeffrey Cohn

I would recommend experiments in related settings. It is difficult to anticipate generalizability even to environments that seem similar.

From Louis-Philippe Morency

While robots have great potentials in healthcare, it would be helpful for the research community if the software platform built as part of this project could also be integrated easily with virtual humans. Displaying a social agent on the screen may be more cost-effective and viable for some healthcare applications. It would be good if the platform generalized this way. Also, it would be nice to have the platform also generalize for use cases where the social agent is non-embodied (e.g., speech only). Hopefully, many of the contributions from this project generalize to these other use cases.

DO YOU HAVE ANY RECOMMENDATIONS FOR THE NEXT AND LAST PERIOD OF THE PROJECT, PRIOR TO THE FOURTH ADVISORY BOARD MEETING IN 2024?

From William Kearns

I look forward to seeing the human subjects research concerning the effectiveness of the communication strategies chosen for the robot as they relate to the communication styles employed by older adults in hospital settings. The usefulness of the robot will be of greater importance than its acceptance, which is of course a small but important first step. It may be that what we think is a relatively unimportant robot behavior may actually be of great importance to an older adult who is alone and feeling isolated in a hospital waiting area. Such behaviors can make the difference between a just acceptable robot companion and a desirable one. Ensuring that the robot follows human social conventions, politeness and respecting social distance will be important factors in this area.

In conclusion let me reiterate that I am satisfied with the team's performance and their output of high-quality research findings. I look forward to continuing service on the SPRING advisory board and in any future endeavors the team at INRIA wish to pursue.

From Laurent Zanetton

-

From Jose Alvarez

I found demos particularly informative and very well conducted. I see those as key for the last deliverables.

The team has an outstanding publication track record. Would be great to add certain metrics to those publications to give an idea of the extent of the work. There were a number of excellent publications that, if highlighted, will enhance the success of the project.

From Jeffrey Cohn

Please consider making a summary report with ample graphics available in advance of the meeting. Would be helpful to have copies of all slides as well. The team presents a lot of information. Having it more accessible in advance would enrich value of the presentations.

From Louis-Philippe Morency

-

THIRD ADVISORY BOARD MEETING AGENDA

PARTICIPANTS

Advisory Board Members

- Christine Hubert, President, Association Jean-Baptiste THIERY (AJBT) **[CH] [Present, on-site]**
- Laurent Zanetton, President, Groupement Hospitalier Nord-Dauphine (GHND) **[LZ] [Present, on-site]**
- Jacques Hubert, Executive Director in charge of Medical Strategy, Groupe Hospitalier de l'Est de la Meurthe et Moselle (GHEMM) **[JH] [Present, on-site]**
- Marco Inzitari, President, Societat Catalana de Geriatria I Gerontologia (SCGiG) **[MI] [Absent]**
- William Kearns, Past President, International Society for Gerontechnology (ISC) **[WK] [Present, on-site]**
- Jose M Alvarez, Senior Research Scientist, NVIDIA **[JMA] [Present, on-site]**
- Jeffrey Cohn, Professor, Department of Psychology, University of Pittsburg **[JC] [Present, remote]**
- Louis-Philippe. Morency, Professor, Carnegie Mellon University (CMU) **[LPM] [Present, remote]**
- Ramesh Jain, Professor, University of California Irvine **[RJ] [Present, remote]**

SPRING Consortium Members

From the National Institute for Research in Digital Science and Technology (INRIA, France):

- Xavier Alameda-Pineda (project coordinator)
- Chris Reinke (WP6 Leader)
- Matthieu Py (WP8 Leader, project manager)
- Alex Auternaud
- Victor Sanchez

From the University of Trento (UNITN, Italy):

- Elisa Ricci (WP4 Leader, remote)

From the Czech technical university in Prague (CVUT, Czech Republic):

- Tomas Padjla (WP3 Leader, remote)

From Heriot-Watt University (HWU, UK):

- Oliver Lemon (WP5 Leader, remote)

From Bar-Ilan University (BIU, Israel)

- Sharon Gannot (WP3 Leader)

From ERM Automatismes Industriels (ERM, France) :

- Cyril Liotard (WP1 Leader)
- Frédéric Grelier (remote)

From PAL Robotics (PAL, Spain)

- Raquel Ros (in replacement of Séverin Lemaignant, WP7 Leader, remote)

From Assistance Publique–Hôpitaux de Paris (APHP, France)

- Anne-Sophie Rigaud (WP10 Leader, remote)
- Sébastien Da-Cunha

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

AB MEETING AGENDA

The Third AB meeting had two components: one with in-person presentations and live demonstration of the robot for Members who could come on-site (afternoon), and one plenary (evening, hybrid). The afternoon demonstration had two tracks: one in French and one in English, to accommodate for the different needs of the AB Members, in particular for the Members part of French health-sector institutions who could not attend the two previous meetings.

Afternoon: Demo & Exploitation (14h-17h, CET)

Agenda

Time (CET)	French	English
14h	Robot Technical Demo	Exploitation
15h	Summary objectives/results	Robot Technical Demo
16h	Exploitation	Robot Technical Demo
17h	Pause	Break

Technical demo (both French and English)

- Full demo
  - Tracking + Pose + Social spaces [INRIA]
  - MPC [INRIA]
  - Sound + ASR + Dialogue [BIU]
- Gesture generation [INRIA]

Deeper Technical demo (English only)

- Variational meta-RL social robots [INRIA]
- BIU's Sound separation [BIU]
- Successor features [INRIA]
- RL-trained navigation [INRIA]

Evening: Plenary (18h-20h, CET)

Agenda

Time (CET)	Time (ET)	Time (PST)	French	English
18h	12h	10h	—-	Plenary
20h	14h	12h	Fin	End

Detailed agenda (hybrid, ENG):

- Progress report since last AB (Jan 2022) [INRIA]
- Advancement report per WP
  - Perception: WP 2 [CVUT], 3 [BIU], 4 [UNITN]
  - Action: WP 5 [HWU], 6 [INRIA]
  - Experiments & Exploitation: WP 7 [PAL], 1 [ERM], 8 [ERM & INRIA]
- Integration of comments from last AB into SPRING activities & invitation to next AB meeting (Paris, end of the project) [INRIA]
- Questions and open discussion

Next Advisory Board meeting planned for mid-2024