



GRANT AGREEMENT N. 871245

Deliverable D9.5

Initial Advisory Board recommendations

Due Date: 28/02/2022

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.



DOCUMENT FACTSHEET

| | |
|----------------------------|--|
| Deliverable no. | D9.5: Initial Advisory Board recommendations |
| Responsible Partner | INRIA |
| Work Package | WP9: Project Management |
| Task | T9.2: Advisory Board |
| Version & Date | VFinal, 28/02/2022 |
| Dissemination level | [X] PU (public) [X] CO (confidential) |

CONTRIBUTORS AND HISTORY

| Version | Editor | Date | Change Log |
|----------------|---------------|-------------|--|
| 1 | INRIA | 01/02/2022 | First Draft |
| Final | INRIA | 28/02/2022 | Final Draft including Advisory Board input and all partners comments |

APPROVALS

| | |
|------------------------|-------|
| Authors/editors | INRIA |
| Task Leader | INRIA |
| WP Leader | INRIA |



TABLE OF CONTENTS

| | |
|---|----------|
| TABLE OF CONTENTS | 3 |
| CONTENTS OF DELIVERABLE | 4 |
| WRITTEN RECOMMENDATIONS | 5 |
| HOW WOULD YOU QUALIFY THE PROJECT'S PROGRESS SO FAR, WITH REGARD TO ITS INITIAL OBJECTIVES? | 5 |
| ANY SUGGESTION REGARDING THE FUTURE RESEARCH / TECHNICAL DEVELOPMENT DIRECTIONS? | 6 |
| EXPRESS RECOMMENDATIONS FOR THE NEXT PERIOD OF THE PROJECT, PRIOR TO THE THIRD ADVISORY BOARD MEETING (MID-2023)? | 6 |
| ANY EXPECTATION OR ADVICE REGARDING THE POTENTIAL EVOLUTION OF THE PROJECT AFTER IT ENDS (MAY 2024) OR REGARDING OTHER APPLICATION AREAS? | 7 |
| SECOND ADVISORY BOARD MEETING MINUTES | 8 |
| PARTICIPANTS | 8 |
| AB MEETING MINUTES | 10 |



CONTENTS OF DELIVERABLE

This Deliverable contains the preliminary results of Task 9.2, Advisory Board. Specifically, it features written recommendations from members of SPRING's Advisory Board, after its second meeting on 27 January 2022, which took place fully online. The structure of the document is as follows:

- A- Written recommendations, per topic
- B- Reproduction of the minutes of the 27 January meeting



WRITTEN RECOMMENDATIONS

HOW WOULD YOU QUALIFY THE PROJECT'S PROGRESS SO FAR, WITH REGARD TO ITS INITIAL OBJECTIVES?

From William Kearns

The *Spring* team has, despite the limitations imposed by the COVID pandemic, made good progress on developing HRI simulations. Unfortunately, the team has been prevented from interacting with older adults who were intended to serve as contributors to the design parameters and test subjects, due to the pandemic and the safety restrictions that have been imposed to protect older adults. As a result, progress toward a fully functional robot has been slowed somewhat by a reduced ability to develop product simulations that mirror the actions of older adults. This situation may improve as the pandemic eases and access to living facilities for older adults becomes more available. The recommendation is to proceed with the creation of simulations making use of community dwelling older adult volunteers who are deemed at low risk for adverse events related to COVID, and possibly seek to use virtual platforms to support interactions between the older adults and the robot development platform.

From Marco Inzitari

The project has been focusing so far in making the robots able to navigate the space and interact with humans. Significant advances have been done in relation to these two pivotal aspects to make the robots usable and safe in real environments. Other basic aspects (voice) are under development. The field tests, which have been facilitated by the delivery of a number of robots to the participating partner institutions and by the close link with the care institution (hospital), show promising data that will allow moving forward in the next steps of the project.

From Louis-Philippe Morency

The project's progress was satisfactory, especially given the challenges related to the COVID pandemic. It was good to see the first robot prototypes delivered to the team and good progress on creating the virtual replica of the hospital environment. Each work package was successful in making good progress towards their initial goals.



ANY SUGGESTION REGARDING THE FUTURE RESEARCH / TECHNICAL DEVELOPMENT DIRECTIONS?

From William Kearns

The recommendation is to proceed with the creation of simulations making use of community dwelling older adult volunteers who are deemed at low risk for adverse events related to COVID, and possibly seek to use virtual platforms to support interactions between these older adults and the robot development platform in order to minimize risk.

From Marco Inzitari

Not in this moment.

From Louis-Philippe Morency

As a small suggestion, when developing the strategies for conversation dynamics, it would be good to look at the virtual human literature as a reference for different strategies related to verbal and nonverbal feedback. Some strategies may be harder to implement with the robot, but it would be good to explore them. The European project SEMAINE was a step in this direction, but more recent work came afterwards.

EXPRESS RECOMMENDATIONS FOR THE NEXT PERIOD OF THE PROJECT, PRIOR TO THE THIRD ADVISORY BOARD MEETING (MID-2023)?

From William Kearns

It may be advisable to seek the involvement of currently healthy older adults living in the community in lieu of the target population of older adults living in congregate living settings. While the substitution may not be perfect, it would allow the representation of older adults having varying functional limitations (vision, audition, etc.) that would help improve the validity of the simulations.

From Marco Inzitari

Not particular recommendations. It seems relevant to be very focused on the calendar, because the magnitude and complexity of the interactions between the different expertises in this project could be a multiplier of delays if any little piece slows down.

From Louis-Philippe Morency

As a way to help with more targeted feedback, it would be interesting to have the SPRING team offer upfront some specific questions where feedback from the advisory board would be helpful. While we are always happy to share more generic feedback, it is sometime difficult to know which areas of the project could use the most feedback and help.



ANY EXPECTATION OR ADVICE REGARDING THE POTENTIAL EVOLUTION OF THE PROJECT AFTER IT ENDS (MAY 2024) OR REGARDING OTHER APPLICATION AREAS?

From William Kearns

An issue concerns information security restrictions which involve the gathering of data in healthcare settings (HRI) and their transmission out to processing nodes which may be located in other jurisdictions (countries) and therefore subject to different legal constraints concerning the protection of the gathered information. This has impacted and will continue to impact the use of analytic tools located, for example, in the Americas and Asia, which might otherwise be available to the team under other circumstances (such as developing a robot which did not involve the collection of PHI – Private Health Information) or operate in a healthcare environment. The lack of a common international standard for the protection of PHI will require the team to limit data transmission and processing to within those facilities in the EU sharing a common framework of laws for the protection of the PHI involved. Legal counsel may be advisable to ensure compliance with EU standards as research brings the product closer to beta test stage.

From Marco Inzitari

I think that after this stage a test study in different EU countries and in different environments (nursing home, hospital ward, home) will be a relevant step to assess adaptability to different and changing environments and acceptability by different persons and professionals. I understand that in this moment the work is directed to the basic functioning of the robots in real-life with real-people environments. As a potential step for future research, but definitely beyond the current project, since the robot is able to interact with the space, recognize faces, emotions, voices, etc, it could be a potentially relevant source of reliable data for professionals to base decision making.

From Louis-Philippe Morency

It would be great to see some Grand Challenges organized around the data collected as part of this project. By creating such event, it allows the broader community to learn from the SPRING's project and push forward in similar directions as identified by the project. The SPRING project should continue its approach towards open-source release of the project code. An important aspect of this process is to include detailed documentation and prompt feedback on online resources such as GitHub for follow-up questions.



SECOND ADVISORY BOARD MEETING MINUTES

PARTICIPANTS

Advisory Board Members

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

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)

From the University of Trento (UNITN, Italy):

- Elisa Ricci (WP4 Leader)

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

- Tomas Padjla (WP3 Leader)

From Heriot-Watt University (HWU, UK):

- Christian Dondrup (WP5 Leader)



From Bar-Ilan University (BIU, Israel)

- **Sharon Gannot (WP3 Leader)**

From ERM Automatismes Industriels (ERM, France) :

- **Cyril Liotard (WP1 Leader)**

From PAL Robotics (PAL, Spain)

- **Séverin Lemaignant (WP7 Leader)**

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

- **Anne-Sophie Rigaud (WP10 Leader)**



AB MEETING MINUTES

Introduction

- Presentation of the purpose and main objectives of SPRING consortium, and related advancement level towards strategic objectives. Particular highlights: 7 robots were delivered; 10 software modules integrated & ongoing development & improvement on others; experimental protocol created and validated ethics-wise; 56 publications.

Presentation of each WP

Perception group

- WP2, led by Tomas Padjla, CVUT. Focuses on environmental mapping and localisation. Progress includes the creation of an audio-visual simulator for localisation in a realistic environment based on data from the hospital. Results show accuracy of <25cm and 10 angular degrees. Another aspect is language driven semantic localisation (recognising known and unknown objects in a 3D environment).
- WP3, led by Sharon Gannot, BIU. Focuses on audio-visual tracking of persons. On the visual side, basic module based on FairMOT is up and running, even on moving targets (albeit still limited) with some remaining optimisation to be done. Audio side, based on U-net, allows separating speech sources and localising them. Integration efforts are ongoing with several options for the ASR (restrictions on usable ASR due to privacy issues).
- WP4, led by Elisa Ricci, UNITN. Focuses on automated understanding of human behaviour and acceptance of robot by humans. First results allow facial key points analysis, mask detection, pose estimation, group formation, emotion recognition. Next steps, mainly, require further integration & testing as well as experimenting in real conditions in the hospital.

Questions:

[WK] Bibliography of the publications available? [Xavi] Yes this will be made available

[JC] Have there been tests for detection of children (smaller in size) [Elisa] Yes, it works, with some limitations

[JC] What is the impact of the masks? [Elisa] for body pose and detection no issue but for emotion recognition it is still quite preliminary. Work is continuing though, and some progress is expected. 6 basic emotions only are detected now, which is not sufficient for the second objective (analyse users' acceptance level), this will require more work.

[JC] Might have data valuable for emotion recognition on elderly people. [Elisa] will follow up on that. [LPM] Curious about how language block will interact with perception

Language & situated interactions

- WP5, led by Christian Dondrup, HWU. Focuses on the speech aspects and robot behaviour aspects in group interaction setups. Generated an architecture for the robot's behaviour and Planner. Dialogue generation tool allowed exploring different directions but feedback from first experiments show the need for a focus on task-



oriented dialogue, which were tested in realistic conditions (still only in the lab) with single party. Still work in progress: lag is present because of real-world conditions (distance to speaker, noise, echo, etc.) and requires testing with group interactions.

- WP6, led by Chris Reinke, INRIA. Looks at non-verbal interaction features, defining the physical behaviour of the robot (looking the right direction, moving, etc.). This includes awareness of its physical space (room, objects), but also of its social space (where humans are and how to move around them in a socially acceptable way). Optimisation still needed to achieve better results. Another important achievement is the 2D & 3D simulator environments for training. Finally, DRL is developed for unsupervised learning of optimal interaction patterns, already applied for determining optimal robot gaze.

Questions:

[LPM] Natural language module interaction w/ behaviour? [Christian] NL generation still very much in progress, also needed is passage to FR (currently only developed in EN). User satisfaction will mainly be inferred from participants' surveys.

[LPM] back channel feedback explored as an option to remove lag? [Christian] With Pepper (in a previous project) used robot motion during lag so as to express the fact that the robot was thinking. On ARI, hopefully no need for that longer term, but use of ARI's tablet to display response before it is uttered. Gesture not yet explored. Would be interested in an example.

[LPM] virtual HH interaction literature has some responses

[WK] What if people are having a private conversation and don't want the robot close. Could there be a gesture to prevent that? [Christian] Not yet explored but will look into it.

[WK] possibly think of a gesture trigger for the robot not to approach? [RJ] Can emotion recognition of a person asking questions be considered when preparing the answer? [Christian] We will have a social state of each person, and this will be used by the dialogue management to choose an utterance. The potential limitation is data, so we will see what we will be able to do.

[JC] What about the timing of gestural acts? [Xavi] Not really just a question of timing (when to start the gesture with regards to dialogue evolution) but also one of gesture duration (usually much slower for robots). Need a mechanism to either delay speech to allow gesture, or change gesture duration (when possible), solution is yet TBD.

Integration, ethics & validation

- WP7, led by Severin Lemaignant, PAL. Focuses on robot maintenance/customisation & integration. Architecture available for all identified modules (released, currently developed and future development). Different pipelines, for example for verbal/nonverbal interaction that feed behaviour manager. Wider impact development includes contribution to ROS4HRI (standardisation process ongoing) which will be used within the project.
- WP10, Led by Anne-Sophie Rigaud, APHP. Focuses on ethics requirements for the experiments in HRI. Quite stringent issues in SPRING because of the nature of the target (vulnerable patients) and of the requirements of the experiments (sensitive data transferred beyond national borders). Important progress achieved: approval by local and national ethics committees; pending CNIL approval (IT/data security). Although



a first ethological study allowed to define broad directions of interest for expectations on users' acceptance but will need validation in real-setups at the hospital.

- WP1. Lead by Cyril Liotard, ERM. Two main objectives: Study the validity of the developed technology & Study its acceptance. On data collection: it becomes now a high priority issue. Data transfer is an issue, that needs to be solved. Consolidating first results and pursuing integration.

Questions:

[MI] How are the experiments designed & what is the data to be collected? Quid of the robots gathering clinical data to assist decision making of physicians? [Anne Sophie] Interesting question because in the future that might be one of the advantages of using robots (therapeutic use). However not planned within SPRING because abilities of robots still too limited (in terms of interaction). This is why we must first progress on having robots able to naturally interact with humans in groups.

[JC] Good point to extend the robot's missions to diagnosis or perhaps just assessment [WK] Regarding people with cognitive impairment a frequent issue is disorientation, which can be easy to implement and very useful for ppl with dementia [Anne Sophie] Yes, this is partly addressed within the guiding use case in SPRING

- WP8: encouraging results but acceleration needed in the upcoming years. We've started exploring other use cases and target areas in the healthcare sector

Challenges in next years for SPRING

- Dire need for access to real-world-data
- Urgent issue to solve: cloud-based ASR

Next Advisory Board meeting planned for mid-2023, hopefully in person!