Social robotics interaction activities for elders: A real research problem to be solved in Assistive Robotics

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Abstract—**Nowadays the amount of people suffering dementia and Alzheimer has increased noticeably, being old people's residence the places where most of them can be found. The main goal of the students of the Assistive Robotics subject is to develop three different activities for a residence in Catalonia. All these activities use a NAO robot as the instructor and motivator of the sessions. The main purpose of developing these activities is to show students a real case scenario, and to introduce them to research, not seen before.**

Keywords—*dementia, engineering, research, human-robot interaction.*

I. Introduction

Vitalia Home works in assistance services for people in situations of dependency in Spain. The company itself has already worked with different types of technology and robots in their residences. Having the contact with one of their residences, Vitalia Llorenç, we found an opportunity to show students that all what they learned in the university can have a real use, taking into account that the best way to learn is to work with realistic problems like in [1]. Also, they have to design the activities thinking not only with elders that will play them, but also the workers of the residence that will have to use it. The students work in groups of three or four, and the main requirements of each activity are: (1) use the NAO robot. (2) The activity developed is for a group of elders; not individual sessions. (3) Create a manual where there is explained how the activity works and the interaction that the robot does. They have to think to the workers of the residents; no technical words can be used and it must be understandable for everyone. (4) The activity developed must work not only with the robot, but also without it. So the residence can still use the activity without the need to buy the robot.

After talking with the psychologist of the residence about the cognitive activities they do for elders with dementia, three activities were purposed to students: (1) Musical reminiscence, which consists on putting on songs and have elders guess which they are, or if they remember, sing them [2]. (2) Mathematical bingo, which consists on instead of saying the direct number, the number is said through an addition, subtraction, multiplication or division, working the calculation. (3) Language, praxis, gnosias, etc.

It is worth to say that cognitive deficits can affect any of the brain functions but are most seen in the areas of memory, language, attention and problem solving, among others. Therefore, the three games purposed work all these.

II. Use case

There are many projects that use robots to socially interact with elders in nursing homes, which have helped students to design their social interactions [3] [4]. Furthermore, our experience designing social activities with robots for children with autism spectrum disorder [5] and STEAM [6], also helped.

A. Musical reminiscence

Reminiscence therapy is known as a psychosocial intervention that uses life stories to improve people's well-being and happiness. It is typically used as an effective treatment for people with memory loss, dementia, depression, and anxiety. Listening to familiar music that is connected to our memories of the past has a significant emotional impact and greatly stimulates the association of memories. Therefore, it is also fruitful for people with the mental conditions mentioned above.

The aim of the activity is to play different songs and ask the participants, who are divided into groups, to match the songs with labeled items. Each song is tagged with a photo of the group or singer, a sentiment that conveys the content of the song, and an object related to the song. This set of songs has been selected by the residence, having the possibility to add new songs. Both the questions and the answers will be displayed on a projector, and the robot will speak to the participants to facilitate interaction.

Another important element of the game is giving the participants time to dance and express their emotions while the songs are playing, allowing them to interact with each other. Therefore, the song will be played in its entirety to give everyone time to decide and have fun.

B. Mathematical bingo

The dynamic is the same as the original bingo, but instead of directly calling out the numbers to be marked, a simple mathematical operation must be performed. Basic and very simple additions, subtractions, multiplications, and divisions have been used.

The aim of bingo is to be the first participant to mark all the numbers in a row, and then to mark all the numbers on a card. Thus, the robot will call out operations, and patients who have the resulting number on their card will mark it. To make it easier to follow the game, the robot will say the operation twice and after a short wait it will say the result so that if any patient is unable to solve the operation, they can continue playing, and a screen will give support. The aim of the game is to work mental arithmetic, but if elders don't succeed, this support will avoid frustration.

C. Language, praxis, gnosias

The Guess the Card game is proposed to work language, praxis and gnosias. The game consists of guessing the position of the card previously showed on the screen.

In order to carry out the game, the first step is to request some configuration parameters. The most important one is the difficulty of the game, having three levels to choose. The higher the level, the more cards appear to memorize.

Once the game has been configured, 3 to 5 cards are shown for 10 seconds on the screen. They have to memorize the suit, number and position. After this time, the group whose turn it is to respond must indicate the position of the random card displayed. If they get it right, they will get the point, but if they get it wrong, the next group will be asked to find out where a card is so that the participants of the game are exercising their judgment and practice during the whole game, even if it is not their direct turn.

III. EXPERIMENTS AND RESULTS

Students have had different deliveries to ensure the correct development of the activities. The first delivery consisted of a script to show to the psychologist of the residence the idea they want to develop. In such script, they indicate the interfaces they want to create, the dialog the NAO robot will have with the elders, a flux diagram indicating the actions that will happen during the activity and the time calculated for each action, and the material needed to do the activity; just to make sure that the residences have them. Therefore, thanks to this first script, the psychologist knows what the students were going to create, and students know what they have to do, just having to follow such script while programming the activity. The psychologist was really surprised by the work done by students, and nothing had to be changed from the script.

The second delivery consisted of recreating the interaction activity in the residence at the university. The group that designed the activity that was being recreated, were just observing, not having the possibility to explain how the developed activity works. One person of the other two groups had the role of being a worker from the residence and the rest of the people were the elders. The group that designed the activity took notes of what they have to improve or change.

The third delivery is somehow similar to the second one, but instead of being the testers the other groups, that already know what the other groups have been working on, it will be people external of the subject. Furthermore, students will do a presentation of what they have developed, in a more technical approach.

Finally, and not agreed with the residence as of today, the students will go to the residence and make the transfer of the activity developed and see the interaction they have created in real time. This first time, it will be with the NAO robot.

To conclude this section, it is worth to say that all the students have had an implication to the design of the interaction activity and have enjoyed doing it. To give evidence of so, an essay with 7 questions was given to students (answered by 7 out of 10 students), asking about how they rate: (1) The subject overall, rated with a 4.14 out of 5. (2) Its organization and planning, rated with a 4 out of 5. (3) The documents used, rated with a 3.86 out of 5. (4) The practical application of the contents presented, rated with 4.57 out of 5. (5) Its innovation and degree of updating the subject, rated with 4.14 out of 5. (6) The information provided about the teaching activity (academic guide, criteria and evaluation system, bibliography...), rated with 4.29 out of 5. (7) The adequacy of the subject's workload, rated with 4.29 out of 5.

CONCLUSIONS

This paper has presented the introduction of research to fourth degree students, by giving them a real research project to work with. Each group has developed a different activity for the nursing home, having to research on similar activities and projects already done and facing the real end users that will use it. Furthermore, their work will conclude by going to the nursing home, to show to their workers how the software works and to perform a first activity with the NAO robot. Thanks to the survey, it seems that students are comfortable to this methodology and appreciate it.

REFERENCES

[1] Caro-Via, S., Garangou-Culebras, A., Falcó-Olmo, A., Parés-Morlans, C., Ros, R. (2022). An Educational, Semi-autonomous Telepresence Robot Called Sally. In: Zaphiris, P., Ioannou, A. (eds) Learning and Collaboration Technologies. Novel Technological Environments. HCII 2022. Lecture Notes in Computer Science, vol 13329. Springer, Cham. https://doi.org/10.1007/978-3-031-05675-8_12

[2] Tapus, Adriana & Tapus, Cristian & Matarić, Maja. (2009). Music Therapist Robot: A Solution for Helping People with Cognitive.

[3] Sehili, Amine & Yang, Fan & Leynaert, Violaine & Devillers, Laurence. (2014). A corpus of social interaction between Nao and elderly people.

[4] Daniel Macis, Sara Perilli, and Cristina Gena. 2022. Employing Socially Assistive Robots in Elderly Care. In Adjunct Proceedings of the 30th ACM Conference on User Modeling, Adaptation and Personalization (UMAP '22 Adjunct). Association for Computing Machinery, New York, NY, USA, 130–138. https://doi.org/10.1145/3511047.3537687

[5] Caro-Via, S., Espuña, M., Ros, R. (2023). Expanding the Use of Robotics in ASD Programs in a Real Educational Setting. In: ICSR 2022, Part II, LNCS 13818.

[6] Hasti H, Amo-Filva D, Fonseca D, Verdugo-Castro S, García-Holgado A, García-Peñalvo FJ. Towards Closing STEAM Diversity Gaps: A Grey Review of Existing Initiatives. *Applied Sciences*. 2022; 12(24):12666. https://doi.org/10.3390/app122412666