

Survey on Animal Robot PARO in Malaysia: Perception and Acceptance



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Abstract Researchers having same interest in field of human-robot interaction (HRI) have made large investments in robots for the purpose of interacting with human. However, there is still sparse evidence regarding response of person between animal robots and animals are different. Animal-robot PARO is classified as Class II medical device by Food and Drug Administration (FDA). PARO has a potential to be used as assistive device for treatment of mental illness specially dementia and depression. PARO is helpful through improving mood and help patients to be calm. The aim of this study is to explore the difference among evaluation of the animal-robot by the people in Malaysia. The constructed questions were focused to find out respondent's background such as age and gender, direct effect interaction with PARO, and preferable duration of interact session. Subjective evaluation of animal-robot PARO was conducted during Science, Technology, Engineering and Math education (STEM) exhibitions that were held in Negeri Sembilan and Melaka. Statistical analysis was conducted with total of 120 respondent using dataset. 95.8% responds agree that PARO able to make them calm. Both adult and children dislike PARO with the percentage less than 5%. Half an hour was chosen as the best time so spend with PARO. In future, PARO will be used as a device in rehabilitation center to assists in depression therapy.

Keywords Human-robot interaction • Animal robot PARO • Depression

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1 Introduction

Robotics is one of the elements of current era which are part of engineering. Robotics is a science-based technology and the term “robot” comes from Czech word, “robota” which means “labor doing compulsory manual works without receiving any remuneration” or “to make things manually” [1]. The definition from Oxford dictionary stated that “Robot” as “a machine resembling a human being and able to replicate certain human movements and functions automatically”. Furthermore, robot can be shaped into a different form for example humanoid, arm robot, mobile, animal and so forth. A robot is developed in form of a replication of something that uses robotic technology with the end goal of mirroring something else in accomplishing a task. The robot also may be controlled by using a device or the device is probably put within the robot.

Not to mention that robots are more and more being advance, in the same way, it is developed for real-world applications, such as robots for rehabilitation, eldercare, and at the same time as household appliances. Moreover, robots can be seen regularly not only in factories but also hospitals, schools, residences and many more. This leads to human-robot interaction (HRI) which is an emerging field of study committed to design, understand and examines the framework of robotics for use by humans [2]. As robots turn to be more and more accessible and inexpensive, their utilization can be seen in scenarios such as robots as assistants, partners and even pets [2]. In general, there are numerous sorts of robot used in HRI with a different application such as a mobile robot, humanoid robot and animal robot. Significantly, this robot has been used in military, services, hospitality and industries. The goal is to make the human more comfortable while interacting with the robot.

1.1 Motivation and Related Works

The motivation of this study is based on the functionality of robots in treating a depression. The term Depression is actually a type of mental illness. It is fast becoming a global issue as World Health Organization (WHO) estimates that 350 million people are affected by it. Apart of that, among stroke patients, 25–30% has been diagnosed with depression [3]. Somehow, the prevalence of mental health among adults expanded starting with 10.7% in 1996, followed with 11.2% in 2006, and 29.2% in 2015, showing a significant growth of depression patients. Kuala Lumpur poses high prevalence, which is 39.8%, however, not many investigators were keen on treatment-related studies. Until 2007, only twelve studies covered on the treatment outcomes of depression in Malaysia. One significant milestone was when the Clinical Practice Guideline (CPG) for Management of Major Depressive Disorder (MDD) was introduced by Ministry of Health Malaysia to provide evidence-based guidance in the management of MDD. In the CPG, recommended treatments can be divided into pharmacological treatment (i.e. antidepressants,

antipsychotic drug), electroconvulsive therapy, psychological interventions and computerized cognitive behaviour therapy.

As robots can offer an efficient way to motivate and adapt according to individual needs [4], it is correlates to utilize its function in this field of treating depression. Significantly, robots with facial expression were introduced in the field of robotics [5]. These robots have adapted to clinical settings and care facilities for people with special needs [6]. Some of the robots are created to resemble real animal [7]. This robot widely uses in therapy [8]. One of them is PARO which is created based on baby harp seal. In addition, PARO a seal robot has successfully increase mood, make people happy and encourage human-to-human interaction. Furthermore, animal-robot PARO is considered as Class II medical device by Food and Drug Administration (FDA). Thus, PARO has a potential to be used as an assisted device for depression treatment.

1.2 *Animal-Robot PARO*

Occasionally robots used in mental healthcare are design based on an animal. Nonetheless, PARO is a therapeutic robot designed based on the shape of a baby seal (Fig. 1). The existence of PARO is recognized in 1993 when it was developed by Professor Takanori Shibata. Moreover, the U.S. Food and Drug Administration (FDA) considers PARO as a Class II medical device. The physical characteristics of PARO is that, it weighs around 2.8 kg and equipped with several sensors and actuators, also features with a soft furry coat with built-in intelligence providing psychological and social effects through physical interaction with humans. In robotics characteristics or systems, it reacts to petting and stroking by blinking its eyes and moving its flipper, cries out when handled roughly, but it reacts positively to soft petting. This system acts as a surrogate for a real pet to help reduce stress levels and improve social skills of patients [9]. Furthermore, PARO has high aesthetic value as it is very cute and can give facial expressions to the movement of its

Fig. 1 Animal-robot PARO



eyelids [10]. PARO remembers the situation in which it is petted and tends to repeat the behaviour that led to the petting to the patient's liking. PARO is beneficial to patients in the same ways therapy animals. PARO use in therapies which give the same effects as animal therapy and it also gives a positive feedback. With PARO, patients don't have to worry about the possibility of being bitten or scratched or not being able to use this form of therapy due to allergies. Also, unlike therapy animals, PARO does not require as much care and can be near the patients all the time.

Before this, PARO has been used to treat patients with dementia [11–13] hence, it has been proven that Part is evaluated in the context of multi-sensory behavioural therapy. Generally speaking, PARO provides indirect benefits for users by increasing their activity in particular modalities of social interaction, including visual, verbal, and physical interaction, which vary between primary and non-primary interactors. Secondly, PARO's positive effects on older adults' activity levels show steady growth over the duration.

2 Survey Methodology

This study uses survey as the main methodology as this study aims to explore the differences in people's perception and acceptance of animal robot PARO in Malaysia. The survey was taken place in Melaka and Negeri Sembilan through Science, Technology, Engineering and Math education (STEM) exhibitions. Statistical analysis was conducted in the dataset obtained from over 120 respondents. Table 1 shows the total of the respondent from Melaka (UTeM) is about 43.34% from 120 respondents and the rest of 56.66% are from Negeri Sembilan (USIM). These evaluations were carried out with the help animal robot PARO. The respondent involved primarily forms the exhibition visitors. Multiple questions about PARO were asked in the questionnaires. This paper reports on the results of survey questions from Malaysian people. In this study, PARO will be used as a device for mental commit robot. To prove that PARO able elevate mood changes, this study used survey distribution method.

2.1 Layout Experimentation

The exhibition was set up using the proper layout as in Fig. 2. The layout was established to collect information from survey results. The layout area covers in

Table 1 The total of respondents

Exhibition location	Gender		
	Male (%)	Female (%)	Total (120 respondents) (%)
Universiti Teknikal Malaysia Melaka (UTeM)	14.17	29.17	43.34
Universiti Sains Islam Malaysia (USIM)	22.50	34.16	56.66

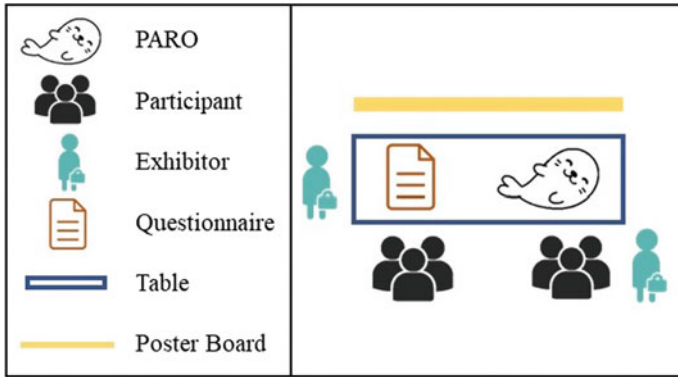


Fig. 2 Exhibition layout

3.5-m². The setup consists of animal-robot PARO, poster boards to display information about animal-robot PARO, the table use animal-robot PARO and questionnaire purposes, and area reserve for exhibitor and participant. The design layout target for consistency. The layout only covers a small area because survey process only can cover the small crowd with the limited robot. At most, it covered 12 people per area. During the presentation the crowd in control to divide into two group, half for demonstration and another half to answer the survey question. It is divided into two group because this setup anticipates the best overall outcome from demonstration and answering survey question are delivered perceptively.

2.2 Survey Distribution Setup

Firstly, PARO was placed on a table to allow visitors to interact with it. The demonstration cycle was set to 10 min per group to permit as many people as possible to experience the interaction in turns. This is because the maximum operating time for PARO was limited to 5 h per full battery. The exhibitor explained the purpose and function of the mental commits robots for about 2 min before distribution of the survey. This session was divided into two sessions; morning and evening respectively 8.30 a.m. to 12.00 p.m. and 2.00 p.m. to 5.00 p.m. PARO was recharged during 1-h break time in order to make it perform for the second session. As in Fig. 3 showed the participants were interacting with PARO. The exhibitor was responsible to introduce PARO and encourage participants to answer the survey question. Most of the participants were at shock the first time when they see PARO can move. Their curiosity leads them to perform more interaction with PARO. The interaction with PARO offers them comfort and

enjoyable moment. There are only a few cases that participant refuses to interact with PARO. The reason behind it because they don't feel comfortable interacting with the hairy animal.



Fig. 3 Exhibitor introduce PARO to participant

2.3 Survey Participants

In this study, the target group of participants was in the age from 9 to 50 years old. The other requirements of participants are the interaction between participants and PARO must occur before answer the survey. The sample size for this study was 120 respondents as stated by technical academician for the purpose of having reliable data.

2.4 Survey Questions

The survey was designed to extract information from participants regarding their perception and evaluation of animal-robot PARO and divided into two sections (Fig. 4). The validation of the survey was done using expert evaluation by technical academician and psychologist. The survey classifies participants into categories such as gender, age and education level. The next section contained 6 questions about subjective evaluation of animal-robot PARO. Duration of this survey was 5–8 min due to time constraint. For the purpose of robot acceptance in Malaysia gender was asked to determine which gender score more likes to PARO. The age of participant is divided into two categories which is young (9–19 years old) and adult (20–50 years old).

The following section was starting with the first question to ask about the cuteness of the robot. This question was asked to evaluate the physical appearance of the robot. The appearance is important if the appearance was found out very disturbing. Under those circumstances, it may not suitable to be used for depression patients in the study. The second question followed by asking the preferable to stroke the robot. A study had been done and suggested that a facilitate therapy by direct interaction with animal such touching able to treat patient with mild to moderate depression [14]. Given those points, a third question are asked about the compatibility with petting PARO. A study from [15] shows that pet attachment is related to enhanced emotional status. Therefore, is important to find out either PARO would a suitable to substitute as pet for Malaysian people as they like to interact with the robot-animal. Equally important, the fourth question were asked their enjoyment to play with PARO. Of course, playing is fun, but can it treat depression? This question prove the study [16], where the depression patients were exposed f to play with an animal. The therapy succeeds in improving depressive symptoms and cognitive function. The fifth question continues by asking the comfortability when they interact with PARO. Not to mention appearance is important, but comfortability during interaction has equally important. Unfavorable comfort can come from the material used for the fur, the loudness of the voice and the mechanical movement of the robots. The sixth question was looking on the calming effect of PARO. Study on [17] says that a person who experiences relaxation and calm able to reduce their depression. The final question was asked

STEM Kajian Awal Interaksi Robot Haiwan PARO
Projek Interaksi Robot dan Manusia
Faculty of Manufacturing Engineering, UTeM
Kajian awal ini dijalankan untuk mendapatkan maklum balas awal tentang robot haiwan PARO

UTeM
اوتيم سي يهتكني حكن ملسيا ملاك
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Seksyen A: Maklumat

Umur	
Jantina	• Lelaki / Perempuan
Pendidikan	• Sekolah Rendah/PTS/UPSR/PMR/SPM/STPM/SiUL/DIPLOMA/UNIVERSITI

Robot Haiwan PARO

Seksyen B: Soalan

Tandakan (V) pada jawapan anda mengenai PARO.

1. Anda mendapati PARO comel?
Do you think PARO is cute?
YA TIDAK
2. Anda suka membelai PARO?
Do you like to stroke PARO?
YA TIDAK
3. Anda selesa menyentuh PARO?
Do you like to pet PARO?
YA TIDAK
4. Anda gembira bermain bersama PARO?
Do you happy to play with PARO?
YA TIDAK
5. PARO memberikan keselesaan ketika interaksi?
PARO gave comfort while interacting?
YA TIDAK
6. Anda berasa tenang selepas berinteraksi bersama PARO?
Do you feel calm after interacting with PARO?
YA TIDAK
7. Berapakah jumlah masa anda mahu diluangkan bersama PARO?
How much time do you want to spend with PARO?
5-30MIN 1-4 JAM SEPANJANG HARI

Terima kasih atas kerjasama anda

Penyelidik : Muhammad Winal Zikril b. Zulkifli
Penyelia : Dr. Syamimi Shamsuddin
Lim Thiam Hwee

Fig. 4 Survey question

about the duration that respondent want to spend with PARO. With the attention to design experiment with depression patients, most favorable duration need to be investigate through this question.

3 Results and Discussion

Results and discussions of this study show the 8 questions that were analysed and discussed. This question are selected because it evaluated PARO as mental commits robot.

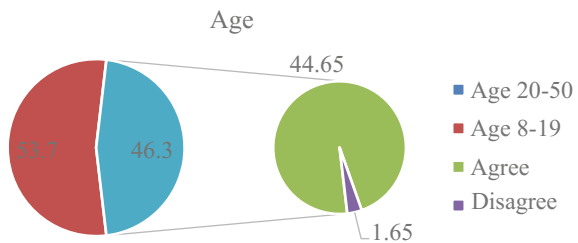
3.1 Results on Respondent Background

The first chart presents the answer to question 6 (refers Fig. 5) with the respective age group. The total number of participants were divided into a range of age. From the highest percentage of participants was in the age range 8–19 years old is 53.7%. Apart from that, 46.3% age range was between 20 and 50 years old. This study focusing on participants age range 20–50 years old only. This is because this group have the highest potential to be affected by depression [18]. From 46.3% participants, 44.65% agreed that they felt calmer aft interacted with PARO. This concluded that PARO is an appropriate helping device in elevating the mood because the calm sensation the participant felt.

3.2 Results on Acceptance of Animal-Robot PARO

Survey results for question 1–5 are presented in radar charts (Fig. 6). From the charts, 111 out of 120 people agree that PARO is a cute animal robot. Furthermore, 96% agree that they like to stroke PARO over and over while 100% agree that petting PARO makes them feel good. This proves that interaction with an animal robot will give satisfaction feelings to the user. From question 4, 117 out of 120 participants enjoy playing with PARO as the part of interaction. On the final question, 95.8% experience calming effect after interacting with PARO. The results showed percentages more than 95.8%, which can be concluded that PARO is favourable as an animal robot.

Fig. 5 Participant response to question #6 distribution by age



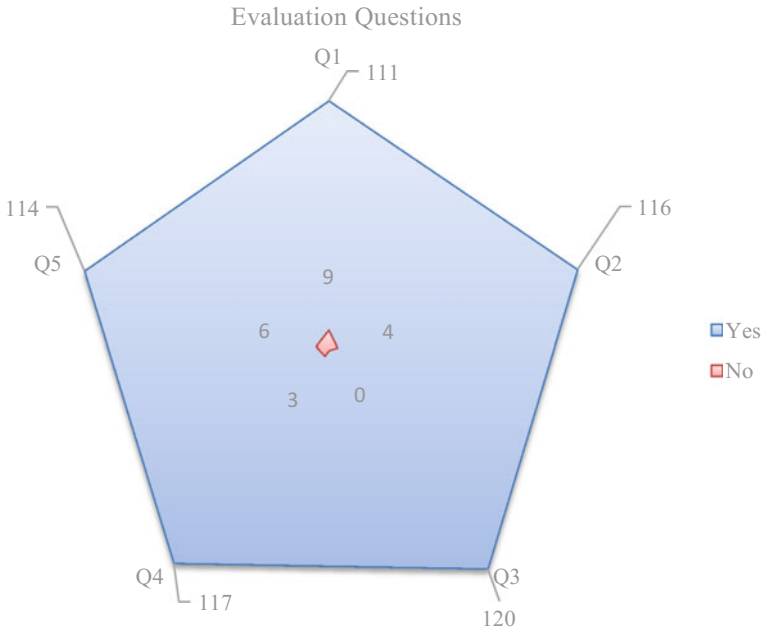
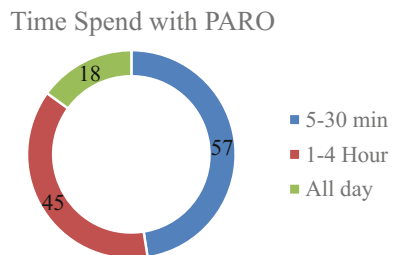


Fig. 6 Response of participants to the PARO evaluation questions

3.3 Results on Duration that Respondents Want to Spend with PARO

The doughnut chart referring to Fig. 7 showed the results for question 7 in the 2nd section of the survey which was the duration to spend with PARO. From the results obtained, the highest percentage of participants answer was 57 over 120 participants in which duration of 5–30 min. The other significant percentage was 45 participants that answer 1–4 h. The last one was 18 participants wanted the whole day to spend time with PARO. Nonetheless, it is significant that the duration to spend time with PARO 30 min at most because PARO is used for the study in major depressive disorder and based on [19], depression people get tired easily. Based on the

Fig. 7 Preferable time to interact with PARO



preferable duration to pent with PARO on the survey, it was suitable for PARO to be used in an interaction or therapy for about 30 min. Apart from that, PARO has a maximum operating time which is 3 h, hence, it is not suitable to be operated for all day long.

4 Conclusion

In conclusion, the results of evaluation provide high scores and important factors that will become key points in robot evaluation were extracted from the results of the principle analysis. The results show that Malaysian people like to interact with animal-robot PARO because of its cuteness and compatibility. Given this point, therapeutic robot such as PARO are suitable to be used in this region. As much as respondent like to interact with PARO, the time they choose are about 30 min per session. On the contrary, the design experiment can use such time. Then again, the results show even an adult is likely to interact with PARO. Seeing that, the experiment with depression patients can be focused into an adult within the age of 20–50 years old. For future recommendation, the results of the perceptions and acceptance obtained in the questionnaire will be used in the study of post-stroke depression with animal-robot PARO.

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References

1. Xie, M.: *Fundamentals of Robotics: Linking Perception to Action*, vol. 54. World Scientific Publishing Co Inc. (2003)
2. Shamsuddin, S., Yussof, H., Mohamed, S., Hanapiah, F.A., Ainudin, H.A.: Telerehabilitation service with a robot for autism intervention. *Procedia Comput. Sci.* **76**, 349–354 (2015)
3. Tiller, J.W.G.: Post-stroke depression. *Psychopharmacology* **106**(S1), S130–S133 (1992)
4. Shamsuddin, S., Yussof, H., Mohamed, S., Hanapiah, F.A., Ainudin, H.A.: Telerehabilitation service with a robot for autism intervention. *Procedia—Procedia Comput. Sci.* **76**, 349–354 (2015)
5. Fukuda, T., Taguri, J., Arai, F., Nakashima, M., Tachibana, D., Hasegawa, Y.: Facial expression of robot face for human-robot mutual communication. In: *Proceedings of 2002 IEEE International Conference on Robotics and Automation (Cat. No. 02CH37292)*, vol. 1, May, pp. 46–51 (2002)
6. Igo Krebs, H., Hogan, N., Aisen, M.L., Volpe, B.T.: Robot-aided neurorehabilitation. *IEEE Trans. Rehabil. Eng.* **6**(1), 75–87 (1998)
7. Jolly, L., et al.: Animal-to-robot social attachment: initial requisites in a gallinaceous bird. *Bioinspir. Biomim.* **11**(1) (2016)

8. Shibata, T., Wada, K.: Robot therapy: a new approach for mental healthcare of the elderly—a mini-review. *Gerontology* **57**(4), 378–386 (2011)
9. Shamsuddin, S., Abdul Malik, N., Hashim, H., Yussof, H., Hanapiah, F.A., Mohamed, S.: Robots as adjunct therapy: reflections and suggestions in rehabilitation for people with cognitive impairments. In: *Communications in Computer and Information Science, CCIS*, vol. 376, pp. 390–404 (2013)
10. Shamsuddin, S., Yussof, H., Ismail, L.I., Mohamed, S., Hanapiah, F.A., Zahari, N.I.: Humanoid robot NAO interacting with autistic children of moderately impaired intelligence to augment communication skills. *Procedia Eng.* **41**, 1533–1538 (2012)
11. Moyle, W., et al.: Effect of an interactive therapeutic robotic animal on engagement, mood states, agitation and psychotropic drug use in people with dementia: a cluster-randomised controlled trial protocol. *BMJ Open* **5**(8), e009097 (2015)
12. Chang, W., Selma, Š., Coding, A.B.: Use of Seal-like Robot PARO in Sensory Group Therapy for Older Adults with Dementia, pp. 101–102 (2013)
13. Motomura, N., Yagi, T., Ohyama, H.: Animal assisted therapy for people with dementia. *Off. J. Japan. Psychogeriatr. Soc.* **4**(2), 40–42 (2004)
14. Antonioli, C.: Randomised controlled trial of animal facilitated therapy with dolphins in the treatment of depression. *BMJ* **331**(7527), 1231 (2005)
15. Garrity, T.F., Stallones, L.F., Marx, M.B., Johnson, T.P.: Pet ownership and attachment as supportive factors in the health of the elderly. *Anthrozoos* **3**(1), 35–44 (1989)
16. Moretti, F., et al.: Pet therapy in elderly patients with mental illness. *Psychogeriatrics* **11**(2), 125–129 (2011)
17. Mason, O., Hargreaves, I.: A qualitative study of mindfulness-based cognitive therapy for depression. *Br. J. Med. Psychol.* **74**(2), 197–212 (2001)
18. Brodaty, H., et al.: Age and depression. *J. Affect. Disord.* **23**(3), 137–149 (1991)
19. Behrens, M., Kiliarnta, S.: Sick and tired: depression in the margins of academic philosophy. *Topoi* **36**(2), 355–364 (2017)