

Human Robot Interaction in the Application of EEG Controlling Robots

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ABSTRACT

In order to control a robot precisely, this essay highlights the growing need for better communication tools between humans and machines. The best method of communication between them is a brain-computer interface (BCI), particularly for the treatment of persons with disabilities and the completion of complex activities like surgery, rehabilitation, and procedures, among other things. The purpose of the survey was to measure public perceptions of and awareness of human-robot interaction (HRI) in the context of brain-computer interfacing (BCI).

Keywords-- Brain Robot Interface (BRI), Brain Computer Interface (BCI), Electroencephalogram (EEG)

I. INTRODUCTION

Robots are quickly integrating themselves into our daily lives. They could be employed for everything from straightforward human support to complex software. Robotic applications are becoming more prevalent in many walks of life, necessitating precision control and the selection of the best commanding mechanism. Muscular actions have typically been utilized to educate robots via remote control or by specifically moving a body part. To complete complex tasks, this requires taking instructions directly from a human brain. [1]. Brain Computer Interface (BCI), which enables direct communication with machines (robots) without the use of nerve or muscular motions, is where the concept of Brain Robot Interface (BRI) essentially sprang from.

Recent demonstrations of direct brain control of objects like a cursor on a computer screen and different prosthetic devices have been made possible by advancements in neuroscience and computer technology [2–9]. Such brain computer interfaces (BCIs) may eventually result in advanced neural prosthetics and other helpful technologies for people with paralysis and other disabilities.

Electroencephalography (EEG), a meaningful attempt to explore the secrets of the brain which is made up of neurons [10]. It can also be used to reflect human intention under different physiological conditions because the transfer of information between neurons produces changes in electrical potentials [11]. High-resolution EEG is quickly becoming a powerful tool in human-machine interface (HMI), with which people are able to work by internal intention and external equipment instead of their own limbs [12, 13].

This technology plays a vital role in helping disabled people out of the dilemma that they have to rely on the help of others all the time. Moreover, robots can be controlled by EEG-based HMI to assist paralyzed people with neuromuscular disorders such as stroke or amyotrophic lateral sclerosis in performing rehabilitation training [14,15]. A large amount of evidence shows that EEG-based assist robots effectively help patients recover [16-20]. A survey made of 10 questions was conducted on 33 subjects from different backgrounds, ages, and genders. The aim of the survey was to measure the awareness of human robot interaction (HRI) in the application of brain computer interphase (BCI) and what people think of it.

II. DATA ANALYSIS

Knowledge, attitude and a practiced approach are used to elicit information about the views from different backgrounds, ages, and genders. This is aimed at assisting the policy makers to implement in a better and more effective manner. Knowledge is the first stage when an individual is exposed to an idea or concept. Knowledge on Brain Computer Interface (BCI) is vital to form the attitude and the practice of the people. So, assessing the level of knowledge of the people on the concept helps to evaluate the understanding and exposure on the concept.

A survey was conducted in order to gather information from the audiences regarding their knowledge, attitude and practice on Brain Computer Interface (BCI).

This engages the research-listening strategy that involves the bringing of opinions, ideas, attitudes and practices to determine the level of awareness regarding Brain Computer Interface (BCI).

The objectives of the survey are to determine:

- The knowledge on Brain Computer Interface (BCI).
- The attitude of staff Brain Computer Interface (BCI).
- The practice/behavior of people regarding Brain Computer Interface (BCI).

In order to gather basic knowledge from the correspondent a survey, Brain Computer Interface Survey is conducted.

III. SURVEY ANALYSES

This section will discuss the results of the survey conducted in King Hamad University Hospital about awareness of Brain Computer Interface among staff. The survey was conducted in August 2022, and it involved around 33 correspondents. The aim of the survey was to measure the awareness of human robot interaction (HRI) in the application of brain computer interphase (BCI) and what do people think of it.

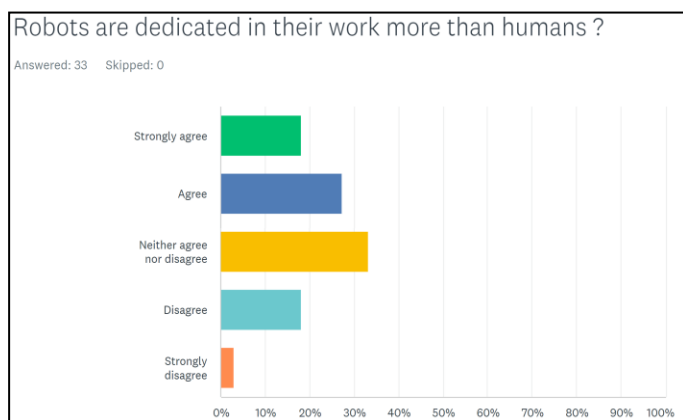


Figure 1: The Robots are dedicated in their work more than humans

Figure 1 depicts that a majority of people answer the Robots are dedicated in their work more than humans. While the majority of 33.33% answer Neither agree nor disagree, 27.27% agree, 18.18% strongly agree and disagree, 3.03% strongly disagree.

Figure 2 answer the question Is robot going to replace human in future. While the majority of 39.39% disagree and 36.36% agree, 15.15% answer Neither agree nor disagree, 9.09% strongly disagree.

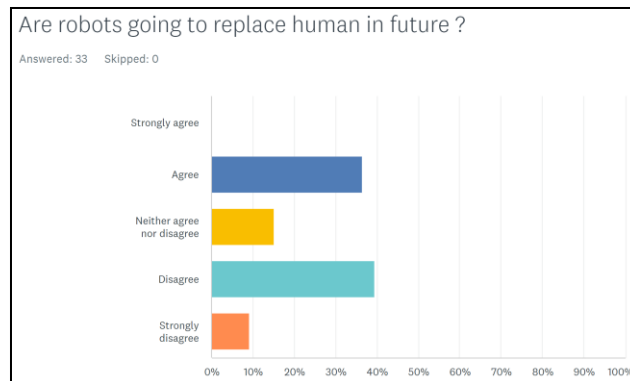


Figure 2: Are robots going to replace human in future?

Figure 3 answer the question Robots can interact with human. While the majority of 54.44% agree and 24.24% disagree and 15.15% answer neither agree nor

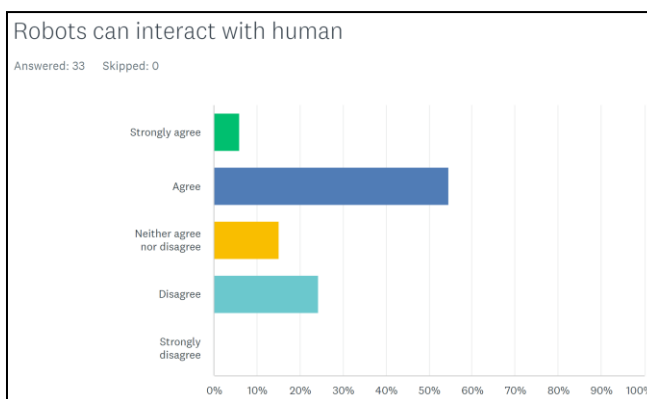


Figure 3: Robots can interact with human

Figure 4 appears that the majority of respondents either agree or disagree on the question being asked, with 51.52% selecting the "agree" option and 15.15% selecting the "neither agree nor disagree" option. A smaller percentage of respondents either strongly agree 6.06% or disagree 21.21% with the statement. These results suggest that the majority of respondents hold a moderate view on the topic, with a small minority holding more extreme views.

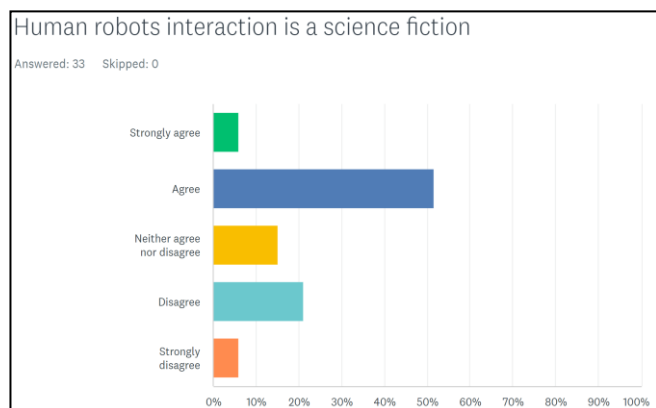


Figure 4: Human Robot's interaction is a science fiction

Figure 5 answer the question Human robot interaction include (speech, body movement, physical contact). According to the survey's findings, the majority of participants either agree or disagree with the question's concept, with 60.61% of respondents choosing the "agree" option and 24.24% choosing the "strongly agree" option. Only a small portion of responders disagree 9.09% or neither agree nor disagree 6.06% with the statement. "Strongly disagree" was not a response choice.

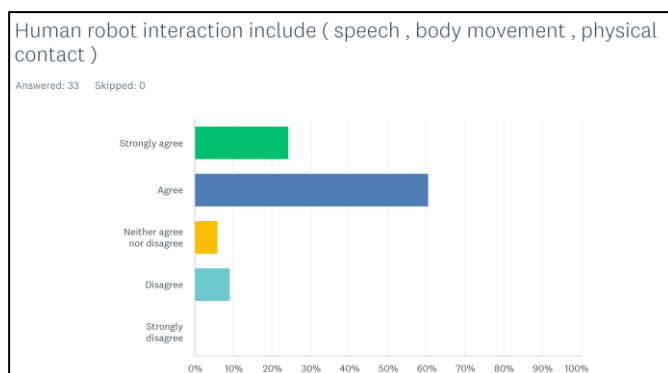


Figure 5: Human robot interaction include (speech, body movement, physical contact)

Figure 6 answer: Can we control any embedded system using brain signals like EEG? The survey results show that a majority of respondents either agreed or were neutral to the statement being asked. Of the respondents, 48.48% chose the "agree" option and 27.27% selected "neither agree nor disagree." A small percentage 24.24% of respondents strongly agreed with the statement, while no respondents selected either "disagree" or "strongly disagree."

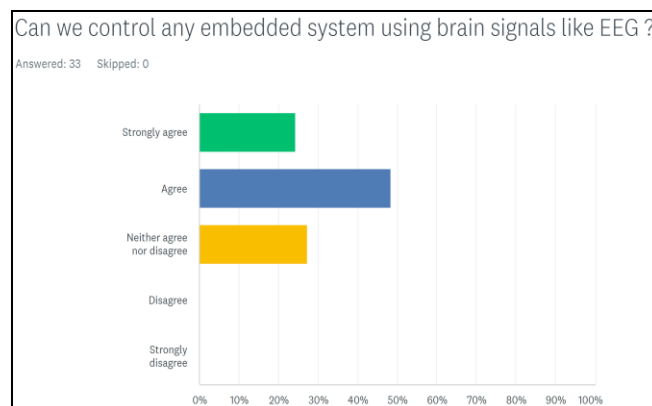


Figure 6: Can we control any embedded system using brain signals like EEG?

Figure 7: presented that the most of respondents either agree or are neutral on the "Humans can interact with robots using their brain signals" question. Specifically, 54.55% agree on that question while 24.24% selected the "neither agree nor disagree" answer. A small percentage of respondents 12.12% strongly agree with the statement, while a slightly smaller percentage 9.09% disagree with the statement. No respondents selected the "strongly disagree" option.

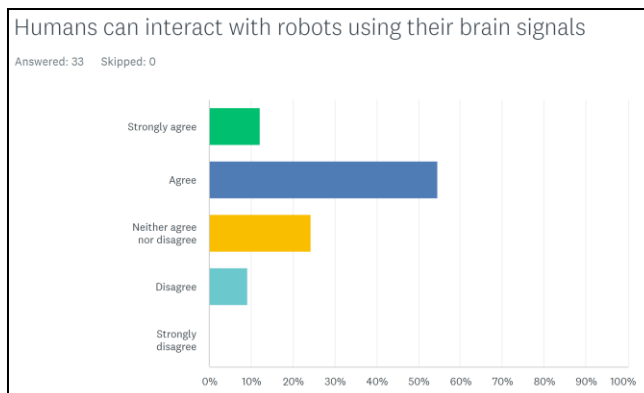


Figure 7: Humans can interact with robots using their brain signals

In Figure 8 The majority of survey respondents did not agree with the statement in question, with 30.30% agreeing, 21.21% neither agreeing nor disagreeing, and 33.33% disagreeing. A small percentage of respondents 12.12% strongly disagreed, while a slightly smaller percentage 3.03% strongly agreed.

A large majority of respondents agreed with the statement in figure 9 with 27.27% strongly agreeing and 54.55% simply agreeing. A small percentage of respondents neither agreed nor disagreed 12.12%, while a smaller percentage disagreed 6.06%. No respondents

strongly disagreed with the statement. These results suggest that a large majority of respondents support or are in favor of the statement being asked.

According to the survey Figure 10 demonstrate a small portion of respondents fully supported the statement 3.03%, while a slightly larger group agreed with it 30.30%. Some respondents were neutral on the statement 18.18%, while a larger percentage disagreed with it 21.21%. The largest group of respondents strongly disagreed with the statement 27.27%.

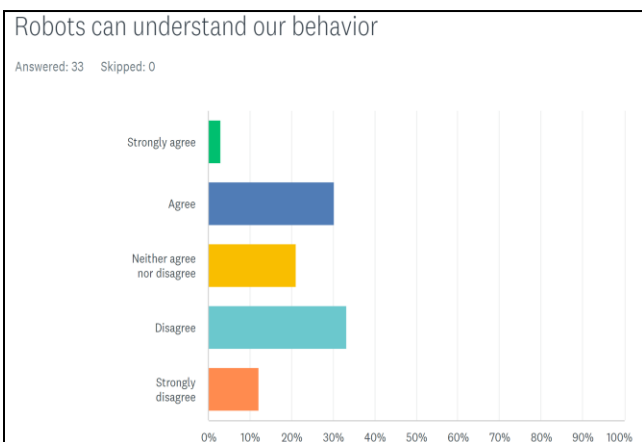


Figure 8: Robots can understand our behavior

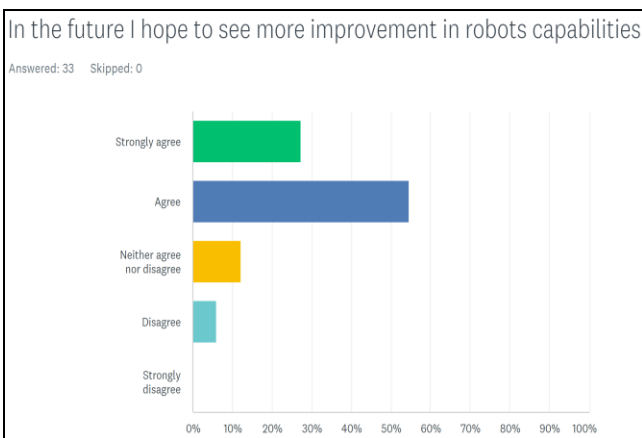


Figure 9: In the future I hope to see more improvement in robot's capabilities

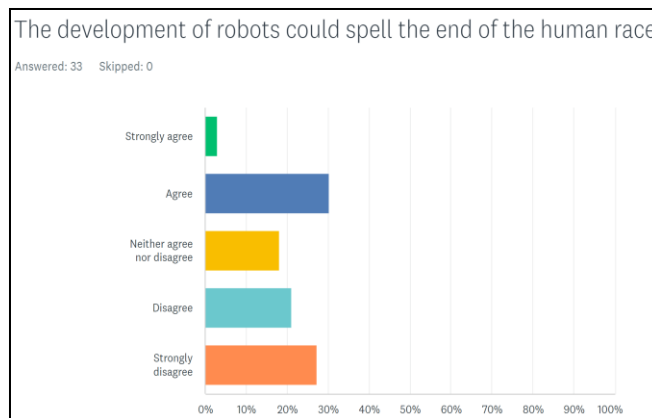


Figure 10: The development of robots could spell the end of the human race

IV. CONCLUSION

The purpose of this study was to assess the awareness and attitudes of individuals towards HRI using brain-computer interfaces. BCIs allow for direct communication between a human and a machine, such as a robot, without the need for nerve or muscle movements. This technology has the potential to be used in various applications, including assisting disabled individuals and performing tasks like surgery and rehabilitation. A survey was conducted on 33 subjects of different ages, genders, and backgrounds to gather information about their knowledge, attitudes, and practices related to BCIs and HRI. The results of the survey showed that a majority of the respondents were aware of BCIs and HRI, and had positive attitudes towards their use. However, there was a lack of practical knowledge and experience with BCIs among the respondents. The study concludes that while there is general support for the use of BCIs and HRI, more education and awareness is needed to increase understanding and practical knowledge about these technologies.

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