Application of the Humanoid Robotics in Assistive Therapy of Autistic Children

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Abstract

This paper proposes the application of humanoid robotics in providing assistive therapy to children living with Autism Spectrum Disorder. Indeed, robotic assistive therapy is a subtle approach that could assist the autistic children in revamping their social interaction and communication skills. The reason for proposing the robotic assistive therapy along with the convention therapy is due to the fact that the autistic children have a tendency of reacting positively to the high-end electronic gadgets including humanoid robots. For that reason, the humanoid robots are helpful in measuring the level of concentration of autistic children in communication and social interaction since these children face challenges in communicating effectively because of brain development disorder. Therefore, most therapists beef up the conventional therapy with the robotic assistive therapy where the autistic child is introduced to the human-robot interaction. Consequently, the interaction between the autistic child and the humanoid robot is recorded to measure the child's concentration levels.

Introduction

The use of humanoid robotics has become prevalent in almost every industry including the healthcare sector. Certainly, the families of autistic children have a reason to smile because humanoid robots have the potential to improve the condition of their children. Humanoid robots are programmable gadgets that emulate the appearance and behaviors of a human being. Fascinatingly, these robots comprise of cameras, artificial head, arms and legs, central processing units, microphones, memory modules, operating system and output extensions amongst other. Essentially, all these parts of the humanoid robotics are meant to facilitate human-robot interaction. For instance, the cameras serve the purpose of the eyes while the CPU and memory modules serve the purpose of the brain. As such, the topic is important because it addresses how

humanoid robots are helpful in improving the lives of autistic children. The life of a human being is the most valuable thing in the world. Therefore, the application of human robotics in the healthcare sector is a major accomplishment because the autistic children would benefit from the robotic assistive therapy and lead a quality life thereafter. The paper looks into different issues including the literature review, flaws and omissions in major papers dealing with the same topic, methodologies for fixing and addressing the flaws, omissions and neglected issues, and lastly the conclusion.

Literature Review

There are various papers addressing the topic of the application of humanoid robotics in the robotic assistive therapy of autistic children. Firstly, Ismail et al. (2011) published a paper detailing on how the Humanoid Robot NAO uses face recognition technique during the robotic assistive therapy to measure the children's concentration levels. According to Ismail et al. (2011), face recognition is an indispensable feature in most humanoid robots. The Humanoid Robot NAO needs to track and recognize the face of the autistic child to produce reliable results throughout the robotic assistive therapy. Ismail et al. (2011) argue that the Humanoid Robot NAO comprises several features including cameras and PCA algorithm for tracking and recognizing the patient's face. As such, the study accomplishes to inform the reader how the Humanoid Robot NAO utilizes its face recognition features including PCA algorithms and neural networks to recognize the patients' faces, facilitating the autistic therapy.

Secondly, Shamsuddin et al. (2012) conducted a study to investigate the initial response of children living with autism to the Humanoid Robot NAO during the robotic assistive therapy. According to Shamsuddin et al. (2012), the interest of their study was to understand how autistic children interact with the Humanoid Robot NAO on the first day of their exposure. Shamsuddin

et al. (2012) argue that most autistic children exhibit difficulties in looking at the robot and conforming to the robot's instructions. In fact, most autistic children show difficulties in looking at the robot's head the same way they are unable to look at a human being in the eyes. The paper has accomplished to reveal that continuous exposure of autistic children to the Humanoid Robot NAO improves their social interaction and communication skills gradually. Shamsuddin et al. (2012) state that the autistic children who seek the robotic assistive therapy at early stages are likely to improve on their social interactions just like the normal children.

Feng et al. (2013) also conducted a study to investigate whether the Humanoid Robot NAO can enhance eye-gauze attention of the high functioning autistic children. Sincerely, children suffering from high functioning autism exhibit deficits in not only verbal communication but also eye-gauze attention. The study involved two children living with high functioning autism. However, one child had verbal communication problems. Both children were required to participate in two games, NAO Spy game and Find the Suspects (FTS). Feng et al. (2013) argue that both games were used to measure the levels of eye-gauze attention of each child.

In particular, the NAO Spy game required each child to answer the questions asked by the Humanoid Robot NAO while looking at the robot in the eyes. The therapist was required to record the amount of time that each child gauze at the robot in the eye throughout the therapy session. Additionally, the therapist was required to record digit "0" whenever each participant looked away from Humanoid Robot NAO. Conversely, the therapist was required to record digit "1" whenever each participant looked at Humanoid Robot NAO. The paper accomplished to discover that these children learnt to maintain eye-gauze after a continuous exposure to

Humanoid Robot NAO. Across all sessions, the children demonstrated improvements in maintaining their eye-gauze attentions towards Humanoid Robot NAO (Feng et al., 2013).

Major Flaws and Omissions in the Previous Studies

Although the previous studies were committed to ensuring that autistic children benefit from the robotic assistive therapy, there are some flaws and neglected issues in these studies that may prevent every autistic child from acquiring the robotic assistive therapy. For instance, there is a flaw in the study conducted by Ismail et al. (2011) because it endorses the robotic assistive therapy to be conducted by a certified psychologist and therapist only. The reason as to why the endorsement bears a flaw is because parents and guardians need to administer the robotic assistive therapy to their autistic children at home. Therefore, parents and guardians of the autistic children deserve to acquire the desirable skills to operate the humanoid robots and provide their children with therapy services at home.

Secondly, the study conducted by Shamsuddin et al. (2012) neglected some autistic children, especially those with vision and hearing deficits, aggressive behaviors, abnormal eye movement (nystagmus). Furthermore, autistic children who were non-English speakers and out of 6-9 years age bracket were excluded from the study. Thus, the study did not address all the possible characteristics of autistic children. Moreover, the study conducted by Feng et al. (2013) also bears a flaw. According to Feng et al. (2013), only autistic children with the ability to understand commands in English were eligible for the experiment. In short, autistic children without basic knowledge in English were excluded from the study.

How to Address the Flaws, Omissions and Neglected Issues

Firstly, the parents and guardians need the opportunity to administer robotic assistive therapy to their autistic children. Since autism is a lifelong condition, it is important to educate parents and guardians how to assist their children to improve in social interaction using the humanoid robots. Certainly, the idea of involving a certified therapist and psychologist is good but these professionals are too expensive to procure their services, especially when dealing with autism spectrum disorders. In particular, the neglected issue could be addressed by educating all parents and guardians of autistic children how to operate the humanoid robots during robotic assistive therapy. Indeed, most parents would be curious to acquire that knowledge to assists their children to lead a quality life just like other normal children. However, the parents would need to take their autistic children to certified therapists and psychologist on regular basis for further therapy and to measure their improvements.

The neglected issues in the study conducted by Shamsuddin et al. (2012) can be addressed by customizing Humanoid Robot NAO. In fact, the robot requires to be customized to attend a large domain of autistic children including those with hearing and vision deficits, eye movement problems, and aggressive behaviors. The importance of customizing the humanoid robot is to ensure that all autistic children benefit from the robotic assistive therapy regardless of their disabilities. The customization could involve replacing the current material with unbreakable materials to prevent aggressive autistic children from destroying the robot. Additionally, the manufacturers need to include special sensors to enable autistic children with vision and hearing deficits to interact effectively with Humanoid Robot NAO. Lastly, the issue of language could be addressed by including translation algorithms into the operating system of Humanoid Robot NAO. The essence of adding this functionality is to accommodate non-English

autistic children in the robotic assistive therapy. By so doing, the autistic children would not necessarily need to demonstrate their knowledge in English to participate in the robotic assistive therapy.

Conclusion

In conclusion, people should appreciate technology for what it brings to the world. Humanoid robots are among the technological devices that deserve the utmost appreciation. As discussed in this paper, now the autistic children have a hope of improving their social interaction and communication skills after undergoing robotic assistive therapy. Humanoid Robot NAO is an example of a humanoid robot that has assisted several autistic children in improving their lives. The paper has looked into three studies that deal with the topic under discussion. All studies ascertained that the robotic assistive therapy is momentous and should be administered along with the convention therapy. Subsequently, the paper identified some flaws and neglected areas in those studies including a strict endorsement for certified therapists and psychologists to administer the autistic therapy, exclusion of autistic children with physical disabilities from the robotic assistive therapy, and omission of translation features in Humanoid Robot NAO. Finally, the paper has outlined various methodologies for addressing the flaws and omissions including educating parents on how to operate Humanoid Robot NAO, customizing the design of the robot, and including translations features in Humanoid Robot NAO.

References

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