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Clever Assistive Family Monitoring Robots for Adults and kids with Autism

Hala Ali Juma Al Badouya, Al-ZahraaSaif Ali Masoud Al Maskari, Senthil jayapal
Department of Information Technology, University of Technology and Applied Sciences – Ibra,oman.

Abstract: *Upwards of million individuals worldwide are disabled. Nonetheless, based on the World Health Organization, people who are disabled are more vulnerable to service inadequacies, including healthcare coverage, rehabilitation, support, and assistance. In this regard, new technical advancements can minimize these inadequacies by offering less-expensive assistive devices to satisfy users' demands. This report examines and summarizes research efforts toward creating these types of systems, concentrating on two communities: older individuals and children with Autism. We discuss the design, deployment, and user research assessment of a socially assistive robot system to engage elderly users I n Autism to attain health benefits and improve their lives.*

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I. Introduction

As per the World Health Organization [1,], one out of every seven persons is disabled in some way. However, barely half of the population can afford medical services [1]. This is especially important when a person's quality of life deteriorates, and their independence dwindles. Technological advancements can play an essential role in this context because they could empower people who are disabled to obtain the healthcare they require to live a whole and meaningful life [2]. A literature survey indicates the wide range of assistive technology that is already available. Because there are so many different types and levels of deficit, assistive technology may be classed based on its intricacy.

With the user in the centre, three concentric circles of assistive technology may be established. These are (in order of appearance): integrated technological aids, supportive surroundings, and helpful robotics. As costs grow, more and more individuals work harder and travel for business, bringing people closer to their careers. Individuals disregard home safety, with some even abandoning teenagers and historical people at home alone. Based on the most recent data, the city crime price in our nation has inflated notoriety, such as burglary and newborn trafficking incidents. We graph real-time video surveillance and the convenient correct mobile phone number, integrating household intelligence with security. Family robotics is also quite essential, and it has sparked a lot of interest at home and overseas.Robots collect and show real-time environmental data while also protecting individuals, allowing them to change interior environments with the help of family members at any moment. They can replace the air conditioner, humidifiers, and other appliances in their home more efficiently. Most domestic and international home robots employ Bluetooth and infrared far-flung to control them; these robots are often hostile in interaction embedded systems, such as the confined managing distance. This gadget uses an android mobile smartphone for the interactive remote control to improve human-computer interaction between people and robots.Compared to conventional robots, embedded devices based on the Raspberry Pi offer more apparent advantages in terms of installation costs, development complexity, equipment power consumption, and protection coefficient.A range of permanent problems known as autism spectrum diseases interfere with people's ability to communicate and comprehend social cues. Robots appear to boost engagement and inspire unique social behaviours from individuals (especially children and teens with Autism), according to research into using robots as treatment tools. One of the earliest application domains in socially assistive robotics (SAR), which attempts to create robots that aid persons with special needs via social relationships, has been robot treatment for Autism.By examining robot design choices, human-robot interactions, and system assessments, we present the work that has been done over the past ten years in SAR systems intended for autism therapy. For this new but quickly expanding research field, we discuss its difficulties and potential directions.

In robotics and artificial intelligence, social intelligence in robots is a relatively new development. But it's becoming more and more apparent that social and interactive abilities are essential for success in various scenarios and application areas where robots must communicate and work alongside people or other robots.

Regarding the nature of interaction and "social behaviour" in robots and humans, research on human-robot interaction (HRI) is faced with various obstacles.Two instances of HRI research are provided to demonstrate these ideas. First, studies that look at the creation of a cognitive robot companion are surveyed. This research aims to create human-friendly social norms for robot behaviour, or "robot etiquette." Second, the topic of robots as potential educational or therapeutic toys for kids with Autism is brought up. In interactions between people, the idea of interactive development is emphasized. The many forms of play that kids engage in are addressed in light of prospective human-robot experimentation. The final section of the study looks at various models for the "social connections" between people and robots.

II. Literature Review

Up to 2021, a preliminary search was done in the Scopus and IEEE Xplore databases using the search terms "affective robot" and "autism." Only four papers, only one of which was published as a journal article and the other three at conferences, were discovered between 2014 and 2020. The three conference papers examine the affective reactions of children with ASD when they engage with robots but not when they operate robots on their own. They do not offer any model of emotions. An emotional engagement mechanism for kids with ASD was created by Xiao et al. [6] in 2020. They suggested developing a portable robot that could connect deeply emotionally with people who have ASD. The suggested mobile affective robot is capable of both emotion perception and expression.

One issue that arises when data is collected from several sensors to understand a subject's emotion is multimodal data fusion, which they also provided as a solution. The authors identified the ASD child's emotions using visual, auditory, and physiological sensors (temperature, heart rate). They applied the emotional communication paradigm described by [7] to the design of the child-robot interaction. According to Hirokawa et al. [8], a challenge with building autonomous emotional robots is that each kid with ASD has unique social and affective features that must be taken into account. However, because the robot's behaviour is programmed, the therapist cannot tailor the exercise to each participant's unique traits. So, how can research be evaluated if the experimental procedure is different for each group?

SAR, which entails robots created to aid through social, as opposed to physical, interaction, sits at the confluence of social and assistive robotics (3, 4). With only a decade or two of study, SAR is a young but fast-growing area. SAR systems encounter unique difficulties not shared by other social or assistance robots. SAR design emphasizes user engagement, emotional expressiveness, physical attractiveness, and robustness during the interaction. In contrast, assistive robot design typically focuses on dependability, the precision of motion, and repeatability (all crucial features when a robot engages physically with a person). Because SAR systems must help the user and coach, inspire, and influence behaviour modification, they require more social capabilities than typical social robotics applications.

The field of SAR is inherently multidisciplinary and draws on robotics, physiology, psychology, and sociology, among other disciplines, due to the multiple skills needed to create socially helpful systems. We only focus on physically present robots in this study. However, related work on virtual robots (20), affective computing (21), and other technology treatments for autism therapy can also offer essential guidelines and assessment techniques.

III. Assistive Robots

Due to ageing, there is a considerable demand for assistance with everyday duties and rehabilitative services. More than 2 billion individuals will use assistive technology before 2030, out of the two billion people who currently require rehabilitation services. The RRIS Robotics Lab is dedicated to creating assistive and rehabilitative robotic technology that will enable the elderly population to age in situ while maintaining a high standard of living. Assist those with impairments in becoming more independent. Assist the caregiver in providing more outstanding care while lightening their physical load.

The functions covered by the RRIS assistive robots include transferring, travelling, walking, balancing, drinking, and eating. Our target audience was expanded to include healthy individuals, notably the elderly, to increase their working efficiency and reduce the risk of harm.

IV. Types of Functions

Three different kinds of assistance robots are covered in this program:Machine-on- Upper and lower limbs of a man, such as exoskeletonsMan-in-Machine, including people using robotized wheelchairs, cars, forklifts, etc.Two sorts of humans with variable physical function capabilities and man-with-machine, such as patient transfer and feeding robots:moderate functioning, such as an older adult who is usually healthy but has diminished strength, flexibility, stamina, eyesight, response time, etc.low functioning, such as older adults who are fragile and require assistance with the majority of everyday tasks;All work packages in the program will use the same intelligent HRI framework that adopts an AI-enhanced shared control approach, which includes:

anticipating user intents through multiple sensing modalities, providing real-time adaptive assistance based on user performance, and providing secure proper human collaborative authority via viscoelastic systems.

V. Human-Robot Interactions

A robot's conduct and outward appearance play a significant role in how it is seen and in determining how helpful it could be during a therapy session. Although the physical characteristics of the robots may differ, all SAR systems for Autism strive to produce one or more carefully planned, possibly therapeutic encounters between human users and themselves, comprising the elicitation, coaching, and reinforcement of social behaviour. Both the user's behaviours and the robot's function during the encounter may be used to explain human-robot interactions. The purpose of interaction may be to promote imitation, to mediate sharing and turn-taking between the user and others, or to elicit shared attention and to remember between the user and an authority.In addition, the robot can function as a toy designed to moderate user behaviour, as a teacher in an authoritative capacity, or as a user's representative to enable the expression of feelings or objectives. In this part, we go through how these interactions were created from the viewpoints of targeted behaviour and the robot's function in the encounter.

VI. CONCLUSION

The paper constructs a conceptual framework and uses two real-world HRI projects as case studies to demonstrate the framework, providing an introduction to HRI research in the context of human and robot social intelligence. Different perspectives and definitions of social robots have been debated, focusing on various facets of robot cognition and human reactions and attitudes toward robots. The talk emphasized how basic questions regarding the nature of social behaviour and how people (both experimenters and users) interpret robots are addressed in HRI studies and experiments on social robots. In the context of this framework, every unique project in the field of HRI might pinpoint its core research objectives.

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