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Robotic Technology: An Experience of Care for Hospitalized Children in a Situation of Illness

By Serradas Fonseca, Marian

Universidad Nacional Abierta

Abstract- In recent years robotics has experienced a growing interest in different areas. With the development of robotics and research experience, new technological challenges have appeared aimed at bringing new technologies closer to the different scenarios of daily life. In this sense, in this work, using the type of documentary research, some initiatives will be described on the incorporation of Robotic Technology in educational care, distraction, rehabilitation and recovery of children in a situation of hospitalized illness or with some type of trauma. These initiatives have been developed in countries such as: the United States, Spain, Canada, Japan and Belgium, with the purpose of improving the quality of recovery of the child in a situation of hospitalized illness in the physical, social, emotional and academic aspects.

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I. Introductory Considerations

The term robotics comes from the word robot. Robotics is, therefore, the branch of science that deals with the study, development and applications of robots. Robots, creations of this discipline, consist of electronic machines that are capable of executing movements and actions prior programming.

One of the most outstanding applications of robotics today is in the health sector. In this medium, robotics has directed its developments to two specific areas: patient care and medical care. The use of robotics applied to the health sector has changed the way of treating patients and their health, in many aspects. The area of surgery, the management and organization of medications, and even the area of rehabilitation have greatly benefited from the development of this field of innovation.

Similarly, the development of robots programmed with artificial intelligence has led to the emergence of a new scenario in which interactions between humans and machines are increasingly close and "real". Hence, a new branch of robotics called social robotics has appeared, which studies the present and the future of relationships between humans and robots. Thus, you can find products based on care robotics and others developed based on social care robotics.

Assistive robotics provides support to people while they do different therapeutic activities. An example would be exoskeletons or march attendees. For its part, social assistance robotics provides assistance through social interaction with a robot, without the need for physical contact. In this way, emotional bonds can be established between the user and the robot.

In this regard, Araujo and Gutiérrez (2022) consider social robots as those that are capable of maintaining social interactions and explicit communication with other members of society in order to learn from each other. For his part, Rodríguez (2020) establishes that these types of robots are those that have social potential, which means that they are capable of recognizing, speaking and personalizing their interactions with humans.

In this sense, social robots have been designed to interact with people in care settings and make their lives more pleasant. These "friendly" robots can be used in long-term care settings to offer socialization and monitoring. They can encourage patients to comply with treatments or offer cognitive interaction, which helps keep patients alert and positive. They can also be used to provide directions to visitors and patients within the hospital environment.

In general, social robots are specially programmed to empathize with people, to provide information, talk or entertain, they are configured with the aim of being friendly, offering close information, which can even operate as a psychological balm, as therapy in moments of loneliness, to help in emotional self-control, which contributes to improving the emotional well-being of patients.

According to Pérez (2022), its powerful hardware offers multiple options so that it can be programmed and configured to taste, so that it interacts with its environment, according to the health care needs of each one.

Likewise, Pérez (2019) argues that the so-called "social robots", used in support sessions that are carried out in pediatric units of hospitals, can generate positive emotions in sick children.

Consequently, the present work directs its purpose to present some initiatives on the incorporation of Robotic Technology in educational attention, distraction, rehabilitation and recovery of children in a situation of illness, hospitalized or with some type of trauma.

II. Development

More and more hospitals around the world are using robots to direct children's curiosity to learn, as well

Author: Universidad Nacional Abierta, Centro Local Yaracuy, Venezuela.
e-mails: mserradas@una.edu.ve, mserradas@hotmail.com

as to distract them while they are hospitalized, to alleviate their feelings of sadness and to gather information about their state of mind. Although many of these applications are still in the testing and research phase, some are already being used with very satisfactory results, which will be described below:

a) Inrobics Rehab

It refers to a digital platform based on social robotics that provides rehabilitation sessions to people who present limitations in their motor, cognitive and social capacity derived from neurological alterations. It is the first social robotics solution in Europe to achieve certification as a medical device, the purpose of which is that therapists can set up a session with totally personalized tasks for their patients.

Inrobics is a company that emerged from the Carlos III University of Madrid after years of research, and the robot they have developed can be applied to different ages and pathologies, including children with neurodevelopment problems. The first investigations into the therapeutic applicability of Inrobics Rehab were carried out at the Virgen del Rocío Hospital in Seville with children with obstetric brachial palsy. Also in a camp for children with cerebral palsy organized by the European University of Madrid.

b) Robot Robin

It is a social robot that works in pediatric hospitals. It is a technological companion that has the ability to move, talk and play with others while being remotely controlled by humans. The robot has been developed by the University of California, Los Angeles (UCLA) and tested at the UCLA Mattel Children's Hospital. Chase Child Life Program specialists conducted hour-long video visits with inpatients using Robin, and compared it to interactions using a tablet.

The results of the study, which was carried out between October 2020 and March 2021, show that the main benefits of the robot are: it allows a greater display of intimacy and interactivity during play, greater control over the children's experience in the hospital, and the formation of a new trusting friendship, making the hospital less stressful.

c) Project Pebbles

The project called Providing Education by Bringing Learning Environments to Students (PEBBLES), is an innovative system that combines video-conferencing technologies with robotic technology to allow a student admitted to the hospital to virtually follow their regular school activities. This is possible by placing a PEBBLES unit inside the classroom, and its counterpart in the hospital. This initiative has been tested at Capitol Hill Hospital with children admitted to this health center.

Among the objectives pursued by this Project are: connecting children through PEBBLES who cannot attend school for a long period due to health reasons. This project allows a student to maintain a connection and presence in their normal classroom environment, which would help reduce anxiety and stress levels and health care costs, and help reintegrate into the classroom after the High medical.

d) Project Monarch

The Multi-Robot Cognitive Systems Operating in Hospitals (MOnarCH) project, in which researchers from a dozen European companies and research centers participate, has developed a series of robots and tested them with children admitted to the pediatric ward of the Hospital of the Portuguese Institute of Oncology in Lisbon.

The objective of the MOnarCH project is to introduce a fleet of robots in a hospital to interact with children who are affected by cancer, using several robots simultaneously, so that instead of attending to only one patient, the fleet of robots interacts with all the children on the hospital floor or service, in addition to collaborating with the health personnel.

This project also poses both technological and social challenges, according to the researchers. From a sociological point of view, there are very few studies that have investigated long-term relationships between humans and robots, so this project is a first approximation that will help to understand the dynamics of social interactions with groups of robots that cooperate with each other. people in hospital settings.

e) Project Inmoov

The open source shared software platform Wevolver has created a solution for children with serious and even terminal illnesses who spend most of their time in hospitals, as a way to offer these children an alternative to enjoy the world that surrounds them. surrounds. This innovative project allows hospitalized children a trip to the zoo, which consists of connecting them to a human-sized robot printed in 3D with virtual reality.

The essence of this project is for children to use the virtual reality device, Occulus Rift, and a headset to move through the Zoo with a robot that will ride a Segway. This robot will walk and visit the Zoo while the children, from the hospital, will direct it, giving the impression that they are the ones visiting it. This project is being carried out in collaboration with Great Ormond Street Hospital (GOSH) and London Zoo.

f) Robot Probo

It is an interactive robot, lined with green stuffed animals, whose objective is to support technical, medical, psychological and social areas in a hospital, and has also been helpful in the rehabilitation and therapies of hospitalized children, allowing them to recover faster and more entertaining.

Equipped with twenty motors, a camera and a computer, it is prepared to move, speak, recognize the facial expressions of its interlocutors, interpret emotions and establish eye contact. It also has a touch screen on its belly that seeks to explain the procedures that will be performed on children.

This interactive robot is the creation of Ivan Hermans, a project of the Robotics and Multibody Mechanisms Research Group of the Faculty of Engineering at the Vrije University of Brussels, in Belgium.

g) Robot Medi

For any child, the visit to the doctor is in some cases an unpleasant fact and more when injections are applied. With this in mind, researchers at the University of Calgary, in Canada, have designed a robot that aims to reassure children while they remain in a doctor's office while an injection is administered.

Through games and conversations, MEDi gains the attention and empathy of children in office, resulting in less pain and stress for children receiving the flu vaccine at Children's Hospital of Alberta. MEDi has electric motors, two cameras, four microphones, nine touch sensors and eight pressure sensors, as well as various communication devices, such as a voice synthesizer, LED lights and two hi-fi speakers.

Project researchers said the study included 57 children between the ages of 4 and 9, who were prone to crying, screaming or kicking at the sight of the needle. The group was divided into 2; participants who were in contact with MEDi significantly reduced this behavior.

h) Robot Watt

Like any other student at Greenleaf Elementary School, in Splendora, Texas, United States, Robot Watt attends sixth grade classes punctually every day in the place of a child in a situation of illness who cannot go to the educational center.

Watt's difference with the other students is that he is controlled by remote control by Cristian Beasley, a 12-year-old boy diagnosed with leukemia and must stay at home. However, his illness has not isolated him from his classmates and teachers, with whom he shares the school day every day. This VGo Robot allows the child to see, hear, speak and move from one place to another through a webcam.

The robot moves, it can turn the camera up and down, to see the paper that is in front of it and the other students and it has become the eyes, ears and legs of this little boy who has walked the corridors of the institution since his computer, which he manages from his home.

i) Jerry the Bear

The Sproutel company developed a robot bear, named Jerry, with the aim of teaching children with type 1 diabetes to manage their blood glucose levels, recognize their symptoms and maintain a healthy diet; all through the game.

The designers created Jerry Bear so that children are able to learn and become aware of their disease by taking care of him, feeding him the right foods, checking his glucose levels and giving him insulin injections for his control.

In the words of its designers, Jerry helps children with Diabetes not only learn about the procedures that are performed on them daily, but also trains them to understand the importance of symptoms and self-care. Jerry is aimed at children between 3 and 7 years old and its initial mechanics consist of children being able to see their blood glucose level in the bear's paw and administer an insulin injection if required, it is also equipped with a package with various foods, so that the child can feed the bear when he has low sugar levels.

In the long term, the company hopes to develop other robots that help children control other chronic diseases such as asthma and obesity.

j) Robot Paro

It looks like a stuffed seal, designed in 1993 by Takanori Shibata for the Intelligent System Research Institute in Japan. Today several countries use it in pediatric hospitals to affectively stimulate patients.

According to its creators, the Paro seal is programmed to give affection, it has the ability to relate to people and generate bonds of affection. It is equipped with sensors that allow it to respond to human stimuli, and respond accordingly.

The Paro seal has temperature, touch, light, audio and position sensors with which it perceives people and gathers information from its environment and even understands some words.

k) Robot Huggable

It is a teddy bear that uses artificial intelligence to significantly help relieve pain, stress and anxiety for little patients diagnosed with cancer. It has been created by the Robotics Group of the Massachusetts Institute of Technology MIT Media Lab, in the United States.

The fun and friendly robotic bear is made up of 1,500 sensors, which is managed by an operator from a nearby laptop. Thus, the bear mentions everyone in the room by name and is able to play riddles with the children.

According to the results reported by Bejerano (2019), the child who interacts with the Huggable bear decreases the negative experiences and the emotional impact of being admitted to a hospital. To carry out the investigation, three groups were formed. One of them was allowed to play with a normal teddy bear, others were given Huggable, and the third group interacted with a tablet containing a virtual Huggable avatar. The results showed that those children who played with the

social robot experienced more positive emotions, moved more, got out of bed more and emotionally connected with the robot, asking personal questions.

l) Robot Andy

Researchers from the Polytechnic University of Valencia in Spain, belonging to the Institute of Industrial Automation and Informatics, have created a robot for Andy with Diabetes and an interactive game that teaches children how the body regulates glucose.

Its goal is to teach children, especially those between the ages of 6 and 12, the basics of diabetes management in a friendly and engaging way. To do this, Andy has a simulator inside that reports blood glucose in real time and that responds based on the activity he does and the dose of insulin supplied. Andy can interact and teach important aspects such as playing sports and knowing how to control their blood glucose levels, providing them with important knowledge to improve their quality of life.

m) Robot Pol

This Robot is a social innovation project for children who have serious illnesses and who, due to their situation, are hospitalized or unable to travel. It has been technically developed by the company AWABOT.

Pol is a remote-controlled robot, controlled by the child through a computer with a camera and an Internet connection. It is controlled remotely through a keyboard, it has two cameras, seven internal microphones, which offer a complete vision and can isolate the noise from the surroundings.

n) My Special Aflac Duck

The American insurance company Aflac, which in collaboration with the health research company Sproutel have developed My Special Aflac Duck. It is a social robot specially designed to help the little ones who have to face cancer treatments.

This robot is designed with a type of technology (RFID tags) that allows it to change its emotions by bringing different discs with emoji designs to its chest, covered with tactile sensors that allow it to hug and croak at each stimulus received by the user. In this way, the child can communicate with the stuffed animal, showing its emotion and receiving a response in the form of sound and movement.

This robot also has its own treatment kit, so that the child can play to administer medicine to the duck, in the same way that the child is administered chemotherapy. In this way, children can become better familiar with their treatment, reducing fear and anxiety.

III. Methodology

The study is part of the qualitative approach that, according to Trujillo et al. (2019) argue that the central axes of these are description and induction, in a progressive way, to achieve an approximation to the phenomenon and in this way to know its depth and describe the process or problem. On the other hand, the design used is the documentary study, which from the perspective of Escudero and Cortez (2018) assert that documentary research is the breakdown, research and analysis of data, whose purpose is to enrich a research topic. For the purposes of this research, a documentary review was carried out, which allowed us to inquire about the numerous initiatives that are developed using robotic technology in the care of hospitalized children in a situation of illness.

The spaces to obtain the information were: review of updated databases, which allowed obtaining publications of research carried out on advances in the area of robotics, and then through the experience and interpretative capacity of the author, to generate the questions and objectives. Of the investigation. The instruments used were data records through a notebook to collect information, review and analysis of articles from indexed scientific journals, electronic and printed books, research papers, among others.

In the same way, the documentary research uses the documentation technique, which allows to give reliability to the results obtained, being that in the present investigation the sources that will be used will be extracted from the documentary review of the bibliographic material of recognized authors, such as books, archival and electronic documents; pertinent to the topic addressed, allowing a critical analysis of different documents that configure robotic technology as a revolution and of collective incidence, since it will influence the life and health of people; first carrying out the organization and analysis of the information obtained from the documentary sources, which will be classified according to the criteria of relevance and topicality.

IV. Results

The projects described in this section show how the use of robots can improve the quality of life of children in hospitals, contributing to a reduction in the effects that a stay in a health center can entail and which, in addition to encouraging them, they instill positive values, with these robots children in hospitals work on values such as patience, good nutrition and having to pay attention, among others.

In addition, the results of the implementation of these projects have shown that they favor the establishment of an interaction that helps children and their families to disconnect from a stressful life situation. It can greatly improve the quality and duration of treatment adherence by directing playful social interactions designed to produce measurable progress toward user goals, educational, and control possibilities that arise from new technologies.

They can be used effectively to engage in game-based therapeutic interventions, enhancing the daily routine of users, fully exploiting the qualities of these robots so that they can be part of the day-to-day life of health centers and provide assistance when necessary.

Some of these robots described in the previous section have been designed with the idea of helping patients, especially children, to overcome the stress or fear of going to the doctor or being in a hospital receiving treatment. Thanks to artificial intelligence, these social robots are able to recognize children's emotions and act like a friend, thus helping to create a fun and comfortable environment.

A study developed by González et al. (2021) reports that the introduction of a robotics kit called KIBO in a hospital classroom increases positive emotions in hospitalized children compared to negative or neutral ones.

For Angulo (2017), educating through interaction with robots adds additional possibilities, since interaction with robots can reinforce educational processes and results, such as conceptual learning and cognitive training, motivate users, support curiosity. and increase awareness about robotics.

Additionally, some other benefits of its use are listed, such as: reducing the level of stress, not only for the patient but also for the caregivers, by already reducing the stress level of the patient; improve the communication of the patient with the caregivers, by emotionally stimulating the patient and calming him down, this makes communication with his caregivers much more fluid; promote the socialization of patients with other patients, and also with caregivers; greater motivation and relaxation of patients.

V. Discussion

Scientific advances in all areas of knowledge continue to appear at a dizzying pace, as stated by Pulido (2022). Proof of this is the fact that there are already social robots capable of interacting autonomously and intelligently with human beings and, above all, of improving their quality of life in crucial aspects such as rehabilitation treatments.

Until a few years ago, robots were limited to mechanical tasks in industries or production plants, but now their evolution has meant that they have begun to be used for other, much more social purposes related to interaction with humans.

In this sense, robotics has intervened in many sciences lately, giving them various benefits and alternatives; this has allowed human beings to have many more solutions to problems that are encountered on a daily basis. For some time now, the benefits of using robots in the rehabilitation or treatment of chronic diseases or psychological pathologies have been widely accepted.

The real certainty is that social robotics is already here and has made its appearance in many sectors. For example, many hospitals have started to use robots to treat patients, especially children. For the IAT (2020), these types of robots usually have a distracting purpose, that is, they offer company and distraction, while being able to offer valuable information to doctors about the condition of patients.

For their part, Araujo and Gutiérrez (2022) argue that social robotics is a multidisciplinary area, specifically that of robots designed for human interaction, since their design must include mechatronic factors accompanied by the necessary elements to achieve a positive perception on the part of the robot. of the user.

According to Rodríguez (2020), social robotics is a technology that is developing by leaps and bounds and has beneficial potential, it has artificial intelligence among its main components and proposes a new way of seeing reality, that is, seeing the social robot as a new communicator.

At the end of this discussion, it is postulated that robots can have a positive impact on the social, emotional and cognitive level of the patient, and even on physical aspects such as normalizing the heart rate. In a hospital, children see and feel that the machines help to improve the disease situation they are going through. They can be used in preparation for surgical interventions, emergencies and especially in the area of oncology, since they can be used even at the time of administering chemotherapy.

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