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COBOT-H COLLOBORATIVE ROBOTS

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Abstract. *Today, almost 15% of the world's population, i.e. 1 billion people, have various forms of disabilities. These figures are increasing after the Corona virus pandemic. Permanent care is necessary for people with disabilities, especially people with limited mobility, blind, or suffering from diseases such as Alzheimer's and dementia. Unfortunately, there are many cases of such people being neglected for various reasons. This article is about cobots and their working principles. Directly with the help of this technology, it is possible to achieve a significant improvement in the living standards of the disabled population. We believe that as a result, society's interest in life will increase even more, and it will have a positive impact on the daily life of every person for living.*

Keywords: *Medical robots, cobots, COBOT-H differences from other cobots, patient care, robotic assistants for nurses, artificial intelligence, Internet of Things, facial recognition, object recognition technologies, NLP systems, BigData, 3D printer, machine learning, efficiency and safety of cobots, principles of cobot use, impact of technology on society, role in economy.*

КОЛЛОБОРАТИВНЫЕ РОБОТЫ COBOT-H

Аннотация. *Сегодня почти 15% населения планеты, т.е. 1 миллиард человек, имеют различные формы инвалидности. Эти цифры растут после пандемии вируса Короны. Постоянный уход необходим людям с ограниченными возможностями, особенно людям с ограниченной подвижностью, слепым или страдающим такими заболеваниями, как болезнь Альцгеймера и деменция. К сожалению, есть много случаев, когда такими людьми пренебрегают по разным причинам. Эта статья о коботах и принципах их работы. Непосредственно с помощью этой технологии можно добиться значительного улучшения уровня жизни инвалидов. Мы верим, что в результате интерес общества к жизни еще больше возрастет, и это окажет положительное влияние на повседневную жизнь каждого живущего человека.*

Ключевые слова: *Медицинские роботы, коботы, отличия COBOT-H от других коботов, уход за пациентами, роботы-помощники медсестер, искусственный интеллект, Интернет вещей, распознавание лиц, технологии распознавания объектов, системы НЛП, BigData, 3D-принтер, машинное обучение, эффективность и безопасность коботов, принципы использования коботов, влияние технологий на общество, роль в экономике.*

In the rapidly evolving pace of healthcare technology, the integration of robotics has emerged as a key tool, especially in the field of collaborative medical robots. Designed to work in collaboration with healthcare professionals, these sophisticated machines offer a wide range of opportunities for studying various aspects of patient care, surgical interventions and biomedical research. By bridging the gap between human experience and robot precision, collaborative

medical robots are reshaping traditional paradigms and opening new frontiers in healthcare innovation.

The fusion of robotics and medicine is not just a futuristic vision, but a new reality that will reshape healthcare around the world. Medical collaborative robots, also known as cobots, are designed to work safely alongside humans in dynamic clinical environments. These companion robots develop critical relationships that complement and enhance human capabilities, increasing efficiency, accuracy and patient outcomes.

This research paper aims to explore the various applications, technological advances, challenges and future prospects of medical collaborative robots. Through a comprehensive review of the latest research, case studies and technological developments, we explore how these robots are changing healthcare practice in areas such as surgery, rehabilitation, diagnostics and patient monitoring.

Medical robotics is a new field of research that includes medicine, biomechanics, mechanics, mechanical mechanics, material science, computer graphics, computer vision, mathematical analysis, robotics, and many other disciplines. Medical robots have the advantages of reducing errors, being safer, simulating operations, achieving comprehensive care and reducing human resources. In addition, machine programs can be installed and they have great advantages over traditional medical personnel in terms of patience, caution and physiological fatigue.

A cobot is a type of robot designed to work collaboratively with humans in a shared workspace. The term Cobot is short for "collaborative robot". Unlike traditional industrial robots, cobots are designed to work in close proximity to people without endangering them. Cobots are often equipped with sensors and advanced programming to detect and respond to human presence, enabling safe and efficient collaboration.

provides (Fig. 1).

Figure 1. The appearance of the cobot.

Our cobots, as mentioned above, differ from other robots in that they are developed and adapted to provide assistance to persons with disabilities and to operate in the field of medicine. In order not to injure the patient, the movements of the cobot are very gentle, and it is made of light materials. Cobot has a special virtual assistant and can communicate with the patient. Cobot can monitor and analyze the patient's condition using its special bracelet or by synchronizing with medical equipment.

Collaborative robots, or cobots, have found a variety of applications in healthcare, contributing to improved patient care, increased efficiency, and reduced workload for medical professionals. Some areas where cobots are used in healthcare include:

1. **Surgery and medical procedures:** Cobots are used to assist surgeons during procedures by providing precision and stability. They can hold instruments, offer a stable platform for delicate procedures, and increase the surgeon's capabilities. These robots also help in minimally invasive surgery, increase the accuracy of movements and reduce the invasiveness of procedures.
2. **Rehabilitation:** Cobots are used in chemotherapy and rehabilitation facilities to assist patients with exercise and movement. These robots can guide patients through specific movements, adjust resistance levels and monitor progress over time, ensuring proper technique and consistent therapy.
3. **Pharmaceuticals and laboratories:** Cobots can perform repetitive tasks such as pipetting, sample processing and sorting in pharmaceutical manufacturing and laboratories. This reduces the risk of human error and allows lab technicians to focus on more complex tasks.
4. **Patient Care and Assistance:** Cobots assist with tasks such as transferring patients from bed to wheelchair, assisting patients with mobility issues to stand or move. They can also deliver drugs or supplies to different areas of the medical facility.
5. **Telemedicine:** Equipped with cameras and screens, cobots can be used for telepresence, allowing remote healthcare providers to interact with patients and perform examinations or consultations without physical presence.
6. **Disinfection and cleaning:** Equipped with disinfectants, cobots can autonomously move around hospital rooms using UV light or other sanitizing methods to reduce the risk of infections.
7. **Logistics and supply chain:** Cobots can be used in hospitals to transport supplies, medicines and equipment between different departments, optimizing internal logistics and reducing staff workload.
8. **Diagnostic assistance:** Equipped with advanced imaging technology, cobots can help radiologists and other diagnosticians analyze medical images, detect abnormalities, and improve accuracy.
9. **Mental health support:** Cobots can be used to provide companionship and emotional support to patients, especially in scenarios where staff may not always be available.
10. **Education:** Cobots can serve as teaching tools for medical students, allowing them to practice procedures and techniques on patients in a controlled and repeatable environment before performing them.

Artificial intelligence helps cobots perceive their surroundings:

The ability of collaborative robots to be aware of their environment is a crucial capability. Working in a friendly environment alongside shelves filled with people, vehicles and products, these machines often assist with tasks involving object manipulation and tool use. Consequently, these applications require robots to skillfully detect surrounding obstacles and respond appropriately to ensure safety and efficiency.

AI is the driving force behind these features. For example, AI-enabled 3D machine vision allows cobots to determine an object's size, shape, orientation, and depth. This development greatly expands the scope of cobot applications. In some installations, companies install stationary collaborative robots, with workers working closely with robotic arms to perform repetitive tasks side-by-side.

Today, more and more decision makers are choosing to invest in mobile cobots that can navigate autonomously within facilities without constant human guidance. In such settings, these machines must adapt accordingly to a dynamically changing environment. They are programmed to adjust their speed when they encounter people in their path or to maneuver autonomously around obstacles. Some are even equipped to self-monitor the battery level and return to designated charging stations when needed.

AI plays a crucial role in adapting cobots to work in crowded environments, ensuring that they can navigate safely and efficiently without disruptions to work processes. In addition, artificial intelligence simplifies the process of users instructing the cobots about the environment. Once the machine has mapped its environment, it can adapt to small changes without requiring retraining.

Natural language processing (NLP) and sentiment analysis enable cobots to understand and respond to human commands and emotions, helping to foster more intuitive and effective collaboration. This technology allows robots to identify key phrases or words in conversations, analyze the context, and respond with relevant information. By using machine learning algorithms, NLP-equipped robots can adapt over time to better understand human instructions in different settings.

NLP is a key component in their creation, enabling interaction between computers and humans using natural language. The main steps in creating chatbots using NLP include problem definition, data collection and pre-processing, chatbot implementation and training, testing and evaluation, deployment and monitoring.

Examples of NLP applications include:

- Email filters. Email filters are one of the most basic and early applications of online NLP
- Smart assistants
- Search results
- A prophetic text
- Language translation
- Digital phone calls
- Data analysis
- Text analysis.

With the help of these applications, the user can choose the type of service he wants and spend his time.

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When it comes to basic safety measures for collaborative robots, Safety is the hallmark of cobots. They offer several security features, including:

- Smooth edges
- Light
- Limited power
- Built-in sensors

Figure 2. Cobot security review process.

These sensors detect unexpected forces and prompt the collaborative robot to slow down or stop, preventing accidents and ensuring the safety of its operators and colleagues (see Figure 2).

But that's not all. Cobots also use advanced technologies such as camera and vision systems, torque sensors and machine learning to ensure safe operation. They even use sensors and screens to monitor human proximity and maintain a safe level of human-robot interaction, which is important for various collaborative robot applications.

Cobots are highly versatile, adaptable to different operational needs, and capable of working alongside human workers in a variety of industries. From manufacturing to logistics to education, collaborative robots are making their mark in tasks like assembly, machine maintenance, and even hands-on learning in STEM education.

Now we will consider the principles of using a cobot:

- One of the main features of this cobot is the transfer of objects in the room to the patient or user. Thousands of items are included in its database. The user can teach the subject that is not in the database to the cobot through the mobile application. It uses face and object recognition technology of artificial intelligence.
- Use as a guide for blind people. In this case, the robot explores the room or the house completely through ledar and cameras. It automatically records which room it is based on the objects and furniture in it. During the movement, the cobot also gives audio instructions to the user.

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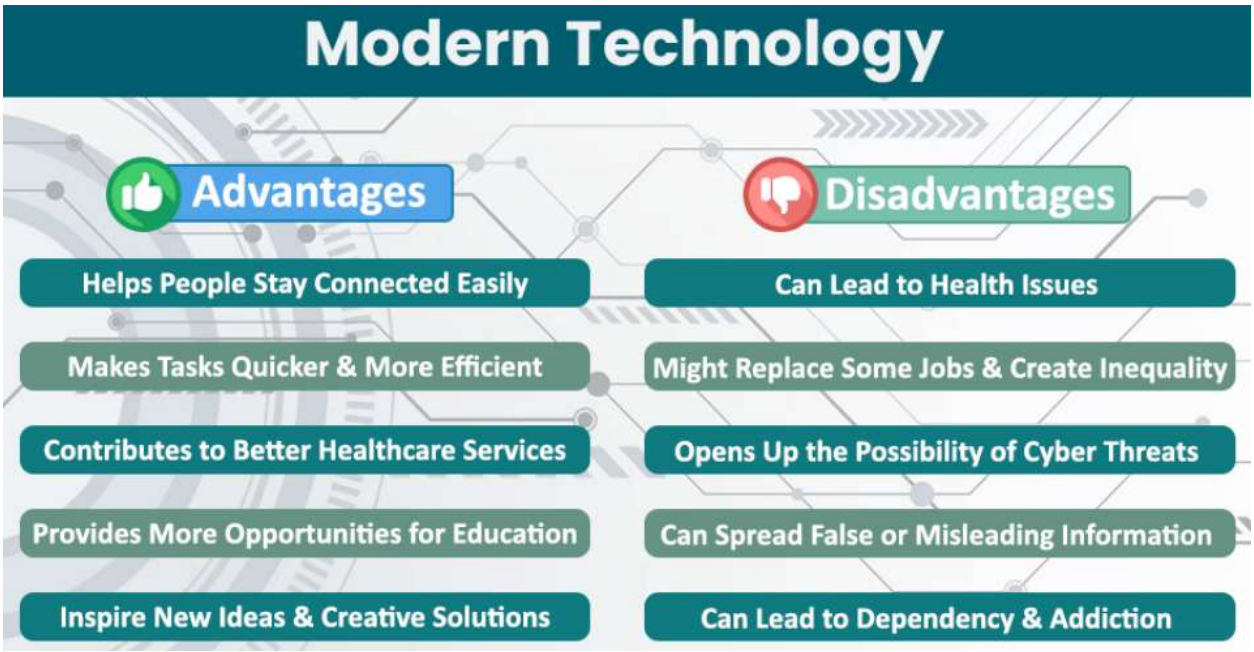
- A cobot user is naturally alone at home or in a room. To cheer him up, the robot has a communication function. In addition, it is possible to watch videos, listen to music or make video calls using the tablet installed on it.
- With the help of a special bracelet, the robot monitors the health of the patient (user). Relatives of the user can also monitor this information through the mobile application. If a critical change in the patient's health is noticed, an automatic SOS signal is sent to his relatives .

If we look at the impact of cobot technology on society, it can have a different impact in each sector. Let's look at all of them one by one (Figure 4):

Figure 4. Advantages and disadvantages of robots.



Cobots require little space, are easy to program and can be installed quickly. They can easily learn new tasks and switch between tasks with smart and user-friendly software. This makes cobots highly flexible and easy to use in a variety of pick and place processes, including palletizing and picking.

Some of the key areas impacted by robotics technologies are: Automation and Industry: Robotics is revolutionizing industry by automating repetitive and hazardous tasks. Robots are being used in manufacturing, logistics, and agriculture, leading to increased efficiency, productivity, and cost reduction.

Cobots can take over dangerous, tedious or repetitive tasks, allowing workers to perform more complex and creative tasks. In this way, cobots can help reduce the risk of accidents and injuries caused by repetitive stress injuries, lifting heavy objects, or exposure to hazardous materials.

At the same time, robots also have some disadvantages:

- Problems of changing jobs
- Initial cost barriers
- Maintenance and downtime issues

- Limitations on creative thinking
- The risk of technology dependence
- Environmental impact
- The limits of versatility and flexibility
- Impact on social interaction.

The impact of cobots on the economy opens the way for some effective solutions.

Initially, from a business perspective in developing countries, cobots (collaborative robots) open many potential doors, but the challenges they face are not small. As for the Universal Robots team, we understand that the decision to deploy a future collaborative robot arm - a cobot with today's most advanced technology - is a real concern for businesses in countries with limited scientific and technical knowledge. Universal Robots Robotics Company considers this emphasized the implementation of training programs on the use of cobots (collaborative robots) and creating convenience for users in the production process. The supporting role of cobots (collaborative robots) in increasing the productivity of industrial production facilities is something we can already recognize.

CONCLUSION.

The integration of medical collaborative robots into healthcare ecosystems marks a milestone in the ongoing technological revolution in medicine. Through this research, we have witnessed the various opportunities, potential benefits and ongoing challenges associated with these advanced robotic systems. As we conclude this article, it is clear that medical collaborative robots have great potential to improve healthcare delivery, advance medical research, and ultimately improve patient outcomes.

One of the main advantages of collaborative medical robots is their ability to augment rather than completely replace human capabilities. Working alongside medical professionals, these robots can perform repetitive tasks with precision, assist in complex surgical procedures, and facilitate remote consultations and interventions, especially in challenging environments or situations where human access is limited.

In addition, the integration of artificial intelligence (AI) and machine learning algorithms will further enhance the capabilities of medical collaborative robots, allowing them to adapt to changing scenarios, learn from data, and optimize decision-making processes. This partnership between robotics, AI, and human expertise provides a powerful foundation for delivering personalized, effective healthcare solutions.

Despite the remarkable progress, a number of challenges remain, such as regulatory issues, ethical considerations, interoperability issues, and cost-effectiveness in the widespread adoption and use of medical collaborative robots. Addressing these challenges will require a collaborative effort by stakeholders, including researchers, regulators, industry partners, and policymakers, to ensure the safe, ethical, and equitable use of these technologies.

Overall, the future of collaborative medical robots has great potential for advancement.

Continuous research and innovation help improve robot design, autonomy, safety features and interoperability standards, and pave the way for seamless integration into various aspects of healthcare. As these technologies evolve, it is imperative to maintain a human-centered approach, prioritizing the ethical use of AI-based robotics in patient safety, privacy, and healthcare practice.

In conclusion, the era of robotics in medical collaboration represents a paradigm shift toward smarter, more efficient, and patient-centered care. By harnessing the synergy between human expertise and robotic precision, we can unlock new opportunities, improve access to healthcare services, and ultimately contribute to healthier societies around the world.

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