

Can Cobots Become Indispensable in Healthcare?

01 April 2024 | Features | By Anusha Ashwin

Healthcare 4.0, today, is transforming the medical field. Just like how automation revolutionised the core manufacturing industries, Industry 4.0 technologies are bringing about a new era of healthcare services with a focus on increased precision and accuracy. While robots perform a lot of automated, independent actions like in an automobile shop floor or assembly line, healthcare, on the other hand, offers very limited scope for completely autonomous robotic operations. However, robots have made significant inroads in medical device manufacturing and it's possible to use robots in a collaborative manner, where the healthcare service provider's operations can be augmented by the use of collaborative robots or cobots. Let's dig deeper.

In our fast-paced lives where evidence-based decision-making and quick turnaround times are needed, automation does a lot of good by streamlining workflows aided by good health data management, freeing up time for healthcare providers to concentrate on increasing patient care and experience. From surgical assistance to supply transport, robots offer innovative solutions.

The integration of robotics into healthcare settings marks a significant shift, fostering collaboration between humans and machines. Healthcare professionals are increasingly prepared to work alongside these machines, driven by the need for high-quality care, efficiency, and costeffectiveness. Understanding their readiness is essential for evaluating the impact on patient outcomes.

In medical contexts, collaborative robots, or cobots, are being used to help doctors with rehabilitation, patients with mental health issues, and people with impairments. Cobots mainly are designed to add substantial benefits by reducing the physical workload on doctors and nurses by automating repetitive logistical tasks, enabling them to dedicate more time and energy to more empathetic patient care. Cobots are also used in rehabilitation settings to guide patients through physical therapy exercises, providing personalised feedback and customised workout routines.

Cobots can help address labour shortage challenges by automating routine tasks, allowing healthcare professionals to focus their time and expertise on patient care. There are specific applications within the medical field where cobots can make a significant impact, such as surgery, telemedicine, rehabilitation, and logistics. By targeting these areas, they can tailor their

robotics solutions to meet the unique needs of healthcare providers.

Explaining further about the uses of cobots, **Addverb Technologies' Co-Founder Bir Singh** says, "Collaboration between robots and healthcare professionals is essential for successful integration into medical settings. The importance of designing cobots that can effectively work alongside human caregivers is paramount for ensuring seamless integration into healthcare workflows, maintaining trust between patients and healthcare providers, and ultimately improving overall healthcare outcomes while preserving the human element in caregiving."

In February this year, at LogiMAT India 2024, Addverb unveiled India's first-ever assistive dog robot, an advanced medical cobot for rehabilitation and imaging, and a collaborative robot (cobot) to enhance operational efficiency and safety. These robots are being manufactured at Addverb's recently opened facility in Greater Noida. Notably, Addverb, known as India's foremost robotic and automation solutions provider, entered the healthcare robotics sector with the introduction of Heal, a medical cobot.

In the coming days, as more skilled manpower comes into force, cobots are expected to become even more sophisticated, seamlessly integrating into healthcare workflows. There will be widespread adoption of cobots, which will take over more routine tasks so that healthcare professionals can focus on complex diagnoses, personalised patient care, and emotional support. This story walks through a few developments in the Indian cobotics' landscape highlighting both academic as well as industrial progress.

Modernising operation theatres and surgical procedures

Cobots have given conventional surgical theatres or operating rooms (ORs) a complete facelift. As conventional forms rely on the skill and experience of the surgical team, with the use of various medical instruments, automated surgical theatres, on the other hand, represent the future of surgeries.

Cobots are also deployed for more purposes. In the Indian healthcare scenario, the increasing population needs more support from technology to be able to get timely access to quality healthcare. Medical professionals rely on advanced technologies to deliver better results for their patients. For instance, Siemens Healthineers solutions for cardiovascular interventions with robotic assistance is an example of technological intervention in surgical operating rooms.

Hariharan Subramanian, Managing Director of Siemens Healthcare says, "The robotic cardiovascular interventions can aid significantly by contributing to cardiovascular medical conditions like heart diseases, where the ideal treatment includes complex procedures in the coronary arteries by specialised medical professionals. Smart procedural automation can enable performing complex interventional cases in a shorter time, with precision, and with better clinical outcomes."

From a surgeon's point of view **Dr Sreedhara V Shetty, HOD - Surgical Gastroenterology, Robotic and General Surgery, Kauvery Hospitals, Electronic City, Bengaluru**, says, "Surgical robots offer advantages over traditional laparoscopic surgical procedures. Aided by cutting-edge hardware, immersive 3D vision, safety features in instruments and AI integration (at present with intestinal staplers), these systems are growing in popularity as they assist in increasingly complex procedures and drive improved patient outcomes (reduced pain, early discharges & early return to work)."

According to Dr Shetty, high upfront costs have been a barrier to broader surgical robot adoption, but robotics has advantages for patients (early return to work in companies) & for companies (reduced sick leaves) which are expected to boost demand.

Expressing further, Dr Shetty, said, "Kauvery Hospital prides itself as the front runner in surgical excellence, precision, and affordability. Its state-of-the-art facilities and technological advancements support every robotic surgeon in delivering the best possible care to patients. Our recent achievement (fastest first 100 procedures in 97 days) is a testament to the trust our patients and their families place in our clinical skills and in the cutting-edge technology we employ."

Platform for cobot developments

To propel India's technological stand on the global premise, an academic platform focused on R&D in robotics and cobotics becomes very essential. The need was duly fulfilled in September 2023 when India got its dedicated first-of-its-kind Medical Cobotics Centre (MCC) in New Delhi to foster innovation in healthcare. This is a joint facility of the Technology Innovation Hubs of IIT Delhi (IHFC) and IIIT Delhi (iHub Anubhuti).

MCC is aimed at being India's first state-of-the-art technology-enabled medical simulation and training facility for doctors, paramedics, technicians, engineers, biomedical researchers, and entrepreneurs. IHFC is funding various R&D projects in the area of rehabilitation robotics and prosthetic devices at premium institutes across the country to deliver low-cost healthcare solutions for India's physically challenged population.

Dr Rashmi Tripathi, Manager, Operations at IHFC, Technology Innovation Hub of IIT Delhi says that this facility is envisaged as a one-of-its-kind Centre of Excellence (COE) in the field of healthcare, medical cobotics and AI in India.

"The centre has been set up to create an ecosystem for Skill Development, R&D and startups in the field of MedTech devices and equipment and aims at bridging the gap between the medical and engineering fields by providing a common platform for collaboration on training, research, new product development and commercialisation," informs Dr Rashmi.

While sharing more about the cobotics CoE, Dr Rashmi said that collaborative surgical robots are set to enhance precision and minimise invasiveness in medical procedures. These could see increased deployment in India allowing surgeons to perform intricate procedures with improved accuracy.

She also indicated that with a growing ageing population and increased demand for elderly care solutions in India, medical cobots could be designed as assistive devices to help the elderly with daily tasks, monitor health parameters and provide companionship.

Dr Seema Singh, Consultant with IHFC, Technology Innovation Hub of IIT Delhi says that medical cobots could be designed to assist healthcare professionals remotely to increase the footprint of high-quality healthcare in backward regions of India. "IHFC has developed Tele Observance Tele Operation Robot under their READY program for telemedicine and remote assistance for ICU in healthcare as well. There is a rising demand for rehabilitation services, and medical cobots could be a game changer in India for rapid diagnostic processes, such as sample collection, analysis, and reporting to improve efficiency and reduce errors of medical testing."

Evolution of AI-assisted surgical navigation

Surgical navigation systems and cobots are two emerging technologies in medicine and their integration is slowly being explored. Although there isn't widespread use of surgical navigation systems directly in cobots themselves for surgical procedures just yet, both technologies can be complementary in the operating room, working together to improve surgical outcomes.

The greatest advantage of surgical navigation systems is their ability to provide real-time guidance to surgeons during minimally invasive procedures. Use of cameras or trackers to pinpoint the surgical instruments' location within the patient's body offers precision surgical procedures to seamlessly take place.

Nikhil Chandwadkar, Co-founder & CEO, Cartosense, opines that, "Navigation technologies are the backbone of digital surgery because the tracking system component generates information that is complementary to radiological imaging, and the software component is a hub for integrating that information along with radiological images with a variety of tools such as imaging equipment, robotic solutions and advanced visualisation displays. Together these technologies enhance the surgeon's awareness and increase the accuracy of specific actions."

Chandwadkar founded Cartosense to develop technology and products for making surgical interventions more targeted and precise using data. Cartosense is soon launching the C75 Surgical Navigation System, considered to be a breakthrough in single-camera optical navigation.

According to Chandwadkar, in the Indian market, the adoption of navigation-based technologies by surgeons and hospitals has been on an increasing trend in the last 5 years and will continue to rise faster soon. He says that early adopters might receive great bundling deals from multinational multi-product companies, and their purchases can often be marketing expenses. However, he says, only products that are truly beneficial and practical can succeed over a longer period.

Emerging opportunities for R&D and higher education

In this digital era, we are seeing the convergence or blending of many streams of education. The multidiscipline approach to product development holds true for medical cobots too. Foresighters predict that there is going to be a burgeoning need for cobot kind of products featuring advanced technologies to save time and most importantly save lives.

Most leading universities are exploring designing specialised programmes in curriculums related to medical robotics, combining engineering, healthcare, and computer science. Also, researchers are looking to explore how cobots can assist with tasks like a) drug discovery and handling hazardous materials; b) rehabilitation and physical therapy; c) patient care, such as medication dispensing and mobility assistance; minimally invasive surgery; and building trust and ensuring safe human-cobot interaction in sensitive medical environments is viewed as necessary.

R&D in human-cobot interface design for a more intuitive and safe collaboration will be a huge area that will demand talent and workforce. Ideally, advancements in sensor technology for better environmental awareness and patient monitoring; machine learning for cobots to learn and adapt to specific tasks and user preferences; and enhanced dexterity and manipulation capabilities for delicate medical procedures will be the areas that will open up for young talent to uptake niche higher education courses.

By capitalising on these emerging opportunities, R&D and higher education can play a pivotal role in shaping the future of medical cobots and their positive impact on healthcare.

The future of healthcare, therefore, will likely see humans and cobots working as a well-oiled team, leveraging each other's strengths for better patient outcomes.

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