# Applications of Robotics in Healthcare

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**Abstract -** This paper investigates the expanding relevance of robotics in personal health care and associated industries, with an emphasis on suggesting critical research strategies for robotics throughout healthcare.
The major purpose of the robot is to decrease human-to-human contact in the hospital while also providing cleanliness, hygiene, and support.

This research intends to emphasize the importance of simple healthcare robotics and link their applications to enhance the quality, health, and wellbeing, and reduce medical errors while also providing patients with preventive and tailored therapy. Encourage them to inquire about long-term care and advertise its availability. For those who need it.

*"I utilize the robot to assist patients that have been informed that conventional surgery is out of the question."*
*DANIEL EUN, M.D.*

Healthcare robotics is a new business that is expected to grow in response to population trends, projected personnel shortages, and desires to improve the well-being of the old and handicapped, hence the need for even relatively high treatments, such as high-precision treatment. All of these characteristics promote innovation in healthcare robots. Several robotics research groups and networks are already working on healthcare applications.

***Key Words:*** Healthcare, Robots, Patients, Medical Professionals.

## 1. INTRODUCTION

The United Nations has projected that the total population of the globe would reach 7.9 billion by May the year 2022. These projections were made available to the public. By the year 2050, there will be one old person for every six people in the overall population of the world [1].
The problem is that as populations age, individuals will need more specialized care and assistance; but, given the present growth rate, there will be a substantial shortage of carers and nurses in the coming years.

Across 27 million men and women work in nursing and midwifery around the world. These individuals come from a variety of countries and cultures. According to the Globe Health Organization, there is now a shortage of medical professionals all over the world [2].

This shortage is especially severe in the fields of nursing and midwifery, which account for a significant fraction of the overall shortage [3].

Other significant obligations that come within the jurisdiction of registered nurses include the delivery of primary care as well as care in the community. Nurses provide critical treatment during times of emergency, and their contributions might be crucial to the success of initiatives to provide access to healthcare for all people.
Not only does this shortage affect those who need medical care for their bodily or mental health, but it also affects those who work in the medical profession.

The only people who are negatively affected by this scarcity are those who need medical treatment for their bodily or mental health, but those people are not alone [3]. Some of the classic symptoms of burnout include experiencing a decrease in one's level of energy, mental anguish, a lack of motivation, and an overall sense of discontent with one's job. Other symptoms include: Having a general feeling of discontent with one's life, in general, is another sign that one may be experiencing burnout.

The mental and physical health of medical professionals is inextricably linked to the safety and quality of the treatment that these professionals give to their patients, and vice versa. The safety and quality of the treatment that medical professionals provide to their patients are inextricably linked to the well-being of their patients [3].

As a result of recent developments in robotics and computer engineering, robots are now able to assist and serve people in a variety of settings, including homes, places of work, and educational institutions. These new capabilities have been made possible as a direct result of recent technological advancements (AI).

There is no way to present the idea of using robots in therapeutic settings as being in any way innovative. This fact cannot be avoided. In 1985, a CT-guided tumor biopsy was the first reported deployment of a robot-assisted operation [3]. This surgery took performed at a cancer center. To properly diagnose and treat this problem, you will need to make use of computed tomography (CT) scanner in combination with a robotic arm.

As a result of advances in technology, robots available today can-do activities that are much more difficult. Even a non-surgical robot may be able to assist nurses, therapists, and other caregivers in doing their jobs more effectively. This is something that is certainly a possibility.

In medicine and healthcare, what's robotics?
It is necessary to provide a comprehensive explanation of the idea before moving on to the study of robotics [4, 5]. When

investigating and attempting to gain an understanding of the topic of robotics in the modern world, it is essential to keep in mind both the past and the fact that people's perceptions of robots tend to be influenced, both historically and in the present day, by both historical and contemporary representations of robots [5].

People's perceptions of robots are likely to be influenced by images like this one. Innovations in computing power and material science are essential to the progress of modern robots, which have the goal of making human labor obsolete. However, this is only valid if they continue to fulfill their primary function.

Once a precise definition of robotics has been developed, it will be possible to start researching the subject. It is vital to analyze both the history of robotics as well as the fact that historical and cultural representations of robots continue to impact how the general public perceives robots today to get a comprehensive understanding of the current state of robotics.

Even though their primary function is to lessen the need for people to do manual labor, the robots of today are primarily reliant on developments in computer and automation technologies. This is the case although their primary duty is to cut down on the amount of physical labor that is necessary.

Interaction between humans and robots that is guided by intelligence is the defining characteristic of this specialized field. The study of systems that can see their surroundings, respond to stimuli from the outside world, and reason logically is known as robotics. The word "robot" does not relate to mechanical or electrical technology when it is used in its current sense. Expert systems, intelligent database management, and artificial intelligence are all examples of applications of information technology.

Robots are not capable of performing complicated sensing systems on their own, such as pattern recognition or picture reconstruction. [5] These tasks are beyond their capabilities. They are unable to make an effect on their surroundings unless individuals are personally accountable for those settings.

For this definition of a robot to be correct, an autonomous robot does not need any kind of guidance system for it to be considered a robot. Robots that are attached to a particular location and can-do mechatronic tasks inside that location are eligible to participate, just as they were in prior competitions.

In any case, it is necessary to establish a distinct border around the area of healthcare. Both the interaction between the patient and the therapist, as well as the administration of medical therapy, play an essential role in this profession.

As a result of the fact that the fundamental objective of the E-Health action plan is to enhance the accessibility, quality, and effectiveness of the healthcare system, this is an essential factor in the process of demarcation.

Because it is generally agreed that preventive is both more effective and more cost-effective than treatment and therapy, the scope of this robotics research has been expanded to include both preventive and predictive medicine as its primary objectives.

## 2. Robotic Applications in Healthcare

In the field of healthcare, robots may be used in a variety of ways.

Surgical and rehabilitation robots are examples of robots that specialised in human care. Additionally, advancements are being made in the realm of robotic devices that may be used for therapeutic and helpful purposes. [6] Some robots help people recover from serious illnesses like strokes. Some robots help care for older people or people with physical or mental disabilities. There are also industrial robots that do things like clean rooms and help treat supplies and equipment, like medications.

a) Tele-Presence Robots are being used by doctors in rural and distant areas to assist them to evaluate and treat patients. It is the capacity to navigate the ER and the use of high-tech cameras for physical examinations that are the most important aspects of these robotic gadgets.

b) Assisting surgeons use these remote-controlled robots to aid them in less invasive surgeries as 3DHD technology advances, surgeons will be able to use these surgical-assist robots in a wider range of procedures in ways, including augmented reality and stereo visualizations that are more lifelike and accurate than before.

c) Rehab-bots for People with disabilities may improve their mobility, strength, coordination, and quality of life with these. These robots may be trained to respond to each patient's stroke, brain or spinal cord damage, or neurocognitive or neurological disorder. Virtual reality and rehabilitation robots may improve balance, walking, and other motor functions.

d) Automation in the Delivery of Medical Supplies Hospital personnel, patients, and physicians all benefit from these robots, which transport supplies, medicine, and food to them. Transportation robots' navigational ability will improve with the development of sensor fusion location technology-based indoor navigation systems.

e) Robots That Clean and Deodorize More healthcare institutions are turning to robots to clean and sanitize surfaces because of the rise in antibiotic-resistant germs and dangerous outbreaks like Ebola. In only minutes, these robots can rid a space of all kinds of germs and viruses.

f) Dispensing Robots for Prescription Drugs Robots have several benefits, including speed and precision, which are critical to pharmacies.

## 3. Robotics in Healthcare: What Are the Advantages?

The earliest medical robots used robotic arm technology in the 1980s. Computer science, data analytics, and AI have changed medical robots, expanding their capabilities. Robots outside the operation room benefit patients and doctors.

Clinics and hospitals use robots for more work during the COVID-19 epidemic. Research institutes are using robots and automation to reduce manual, repetitive, and high-volume operations to free up technicians and scientists for more important activities. Medical robots can improve operations and reduce risk in several industries [7].

Robots can clean and prepare patient rooms to reduce the transmission of infectious diseases. Hospitals can quickly detect, match, and deliver medicine using AI-enabled robots. As robots become more independent, they can handle certain jobs alone. Doctors and nurses will have more time to treat patients.

Through the use of robots in the medical business, it is possible to provide patients with treatment of the highest possible standard, perform clinical operations in the most time-effective manner, and maintain a secure working environment for both patients and members of the medical staff [7].

3.1 Care for Patients of the Highest Quality
Medical robots allow for less invasive operations, intelligent therapies, and social interaction for older patients.

They also assist in monitoring patients with chronic illnesses in a more individualized and regular manner. In addition, since robots reduce the burdens of nurses and other caregivers, they can provide patients with a greater degree of empathy and human connection, both of which may contribute to improved long-term health.

3.2 Simplified clinical Workflows
Routine chores are simplified, physical demands are reduced, and consistent procedures are ensured by autonomous mobile robots (AMRs).

By keeping track of inventories and putting timely orders to ensure supplies, equipment, and medicine are in stock, these robots can handle personnel shortages and problems. Disinfecting and sanitizing the premises When patients arrive at a hospital, they expect to be greeted with clean, disinfected, and ready-to-use rooms.

3.3 Protection of Employees' Rights in the Workplace
Supplies and linens are transported using AMRs (Autonomous Mobile Robots) in hospitals where the spread of infectious diseases is a concern for staff members.

There are hundreds of healthcare institutions now using cleaning and disinfection robots to assist in minimizing the spread of hospital-acquired infections (HAIs). When it comes to heavy lifting like transferring beds or patients, social robots, a kind of AMR, may also aid. This decreases the amount of physical strain that healthcare professionals experience.

3.4 Robotic Surgical Assist
Surgical-assistance robots have improved in precision as motion control technology has progressed. AI and computer vision-capable robots let surgeons conduct complicated surgeries with unprecedented speed and precision. Some surgical robots might even be able to do their jobs on their own, letting surgeons watch from a console.

## 4. Different types of Robotics available in the Healthcare business

**Modular Robots**
Robots designed to be modular were intended to have a wide range of applications. Examples of this kind of technology include exoskeletons and robotic prosthetic limbs.
Patients suffering from MS, TBI, stroke, or paralysis may benefit from the use of therapeutic robots. SCI sufferers may now benefit from robotic arms that can be put on wheelchairs thanks to the work of Intel and Accenture [8].

The movement of a patient in various positions will be monitored by robots of the future using depth cameras and artificial intelligence (AI). Talking to victims themselves could also be of assistance.

**Autonomous Mobile Robots**
When it comes to critical jobs like disinfection, telepresence, and the transfer of drugs and medical supplies, healthcare organizations often turn to AMRs since they can free up staff time for other patient-centered activities [8] [9]. AMRs equipped with LiDAR, image computing, or mapping may guide themselves to examination or medical regions, allowing doctors to converse remotely.

It is feasible for an AMR to be remotely managed by an expert or another person. In this manner, it may be able to assist physicians while they do their rounds in the hospital. This allows the professional to engage in the on-screen consultation about patient diagnosis, treatment, and care.
Service robots and social robots are two further categories of AMRs that find applications in the healthcare industry.

**Service Robots**
Routine logistical activities are taken care of by service robots, freeing up healthcare staff to focus on more critical issues. When a job is completed, most of these robots are capable of sending back a report. Set up patient rooms, keep track of supplies and buy orders, replenish medical supply cabinets, move bed linens from washing facilities, etc. by using these robots [8].

Service robot's free up healthcare personnel's time to attend to patients' urgent needs, which in turn improves employee morale. That's what Aethon's TUG Robot is all about. When it comes to delivering linens to nursing units, TUG can securely negotiate complicated and ever-changing conditions.

**Social Robots**
Humans and social robots are in constant communication. Using these "friendly" robots in long-term care situations may offer social contact and surveillance.

They may assist patients to stick to their treatment plans or give mental stimulation, which may keep them attentive and cheerful [8].

Hospital visitors and patients might also benefit from these signs. Human-like robots assist alleviate caregiver stress while also enhancing the mental health of their human users.

## 5. CONCLUSIONS

The purpose of the research is to:
Include related technology, research directions, and anticipated outcomes in the roadmap of prospective robotics applications in healthcare According to the research, the subject of healthcare robots has a wide range of applications.

This roadmap should offer an overview of the current status and future possibilities of robots in the healthcare industry. A coherent picture of what robots in healthcare may entail for the world and how they can be implemented emerges from all the facts and comments in this research. The area of medical robots, in our opinion, has great potential for the future.

Because it has now become a problem on a worldwide scale, technologically sophisticated countries may lend a hand to less-developed nations by assisting in the form of donations of robotic infrastructure and support equipment.

This will increase the likelihood of achieving a successful conclusion in the fight against this illness. Due to healthcare digitalization, the introduction of medical robots has substantially improved patient safety and quality management systems.

When it comes to medical robots, classification is done solely using application-based categories, which include anything from cleaning robots to high-tech surgical robots. Commercial devices are currently available, but this is just the beginning of what robots can do to improve our current healthcare system in the long run. Robotics has the potential to reduce labor costs, but so far, the technology has only achieved success in a few specific areas. Patients' well-being is a critical component.

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