CYBERNETIC TELEPRESENCE HUMANOID AVATAR ROBOTIC ASTRONAUT

Susan Jewell MD, DCEG, DOD

ABSTRACT

This review will discuss the current research and projects focusing on the potential for creating humanoid Cybernetic Avatar Robotic Astronaut for future space exploration. To-date the current and exciting technological innovations in telepresence avatars and telerobotic research has enabled the vision to create the future of remote, real-*time CYBERNETIC TELEPRESENCE HUMANOID AVATARS (CTHA)* technology. A reality that can potentially become the future *"Space Robotic Astronauts*" for planetary missions and missions that are dangerous to send human astronauts. A CTHA is a physical robot that can be substituted for the physical presence of a person. These "humanoid" avatars are integrated with frontier technologies, such as, Augmented Reality (AR) and Extended Reality (XR), for example, spatial computing headset devices, such as, HoloLens 2, and equipped with sensors, haptics, and cameras that allow them to perceive their surroundings where they can move and interact with the environment that is like a human being. The key difference is that the person controlling the CTHA is typically located in a remote location, such as, a remote office or a different geographical site. The technology behind CTHA is potentially possible by the convergence of several frontier technologies and advancement in robotic development. The avatar is typically controlled by a human operator who can see what the CTHA avatar sees through cameras and other sensors and can control the movements and interactions via remote controls or joysticks. The advancement of facial recognition and deep Artificial Intelligence (AI) can allow the operator to control the facial expressions of the avatar allowing it to emote humanoid-like expressions and convey a sense of an authentic interaction with the person. This review will explore the concept of CTHA and provide examples of how this technology could be used in different contexts, such as space exploration, space medicine, space psychiatry and applications for social impact and sustainability.

Credit: AvatarMEDIC Inc CTHA in clinical care settings

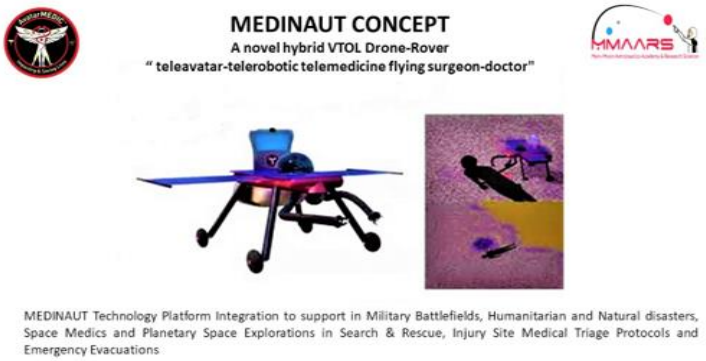
SPACE MEDICINE

Space medicine is the practice of all aspects of preventive medicine on astronauts in outer space. Along with medical knowledge, science and technology will play a crucial role in building novel space clinic

systems and medical facilities on board spacecraft to adequately respond to any medical issue that requires attention, trauma, emergency, and mental health issues.

Space Medical Telepresence Surgeon Avatars

An example of an innovative CTHA surgeon avatar integrated with various exponential technologies is the concept of MEDINAUT which is a patent pending technology platform being developed by AvatarMEDIC, Inc. The system will offer real-time tele-surgical and medical care in remote, austere environments on Earth and in Space and on a planetary surface (Moon, Mars). An integrated system using a hybrid Vertical Take-off and Landing (VTOL) drone-rover platform with multi-functional capabilities supported by the convergence of multiple exponential technologies, such as, spatial computing or Extended Reality (XR), AI, robotics, haptics and digital twin. telepresence avatars. The MEDINAUT will be able to provide real-time medical training, search and rescue, medical triaging, and surgical interventions during life-threatening injuries and potentially save lives of astronauts in Space, on planetary surface or soldiers wounded in battlefields and injured civilians trapped in disasters on Earth.



APPLICATIONS OF CTHA

There are various applications where CTHA can be used to benefit space exploration as well as life on Earth.

- Deploy and access the remote areas humans cannot reach.
- Deploy and access dangerous environments that are hostile to humans, for example, micro-gravity, high radioactive areas, Space, wildfires, and natural disasters.
- Oversee repetitive crew tasks and activities.
- Provide needed expertise to remote groups of people.
- Provide training to remote groups of people.
- Assist with various medical evaluations and procedures.
- Respond to medical emergencies.
- Assist in mental health management.
- Technology and science remote consultations
- Provide interactive experiences.