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DESIGN AND DEVELOPMENT OF A HEALTH MONITORING COMPANION ROBOT FOR CREW MEMBERS IN SPACE

Abstract

Significant efforts to make space accessible to humankind have popularised the concept of space travel for both scientific and recreational purposes. In 2021 alone, more than fifteen humans visited the Earth's orbit. As human spaceflight becomes more prominent, medicine and well-being must follow. Deep space exploration can be tough on the human body with multiple physiological and psychological stressors, including radiation mitigation, neurovestibular adaptation, isolation and confinement, and an omnipresent hostile environment. These stressors negatively impact health, through tissue degradation, loss of bone density and muscle mass, DNA damage, neurological changes, and many more side-effects. Health monitoring studies on astronauts have shown that there have been instances of Space Adaptation Syndrome symptoms during their initial days in microgravity. In addition, Lack of hygiene, privacy and hormonal imbalances have a negative impact on female astronauts. Future spaceflight participants are not expected to be as extensively trained in medical emergencies as astronauts of government space agencies, which can risk the lives of the crew members and hence require round the clock monitoring and emergency support. To address such issues, we are developing an interactive biomedical social robot to bring nurse-like care for humans in space, with the ability to assist with diagnosis and make recommendations for therapy. We aim to cater to medical issues associated with dental care, skin disorders, isolation and confinement using our biomedical social robot which will be equipped with a predictive healthcare system using an array of non-invasive biosensors, artificial intelligence and clinical psychology. It will have further features to alert and guide astronauts in emergencies, help them in procedures of wound healing, antisepsis and occupational therapy. The biomedical social robot will also be used to educate and coach humans in space for improving their overall lifestyle and be a companion during long-duration space flights. This paper outlines the objectives, initial design, concept of operations and key challenges in the development of a free-flying autonomous, non-holonomic biomedical social robot that can operate in a space environment.