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Author: Dr. Igor G. Sokhin

Yu.A. Gagarin Research and Test Cosmonaut Training Center, Russian Federation, isokhin@yandex.ru

Dr. Andrey Kuritsin

Gagarin Cosmonaut Training Center, Russian Federation, a.kuricyn@gctc.ru

Mr. Yuri Lonchakov

Gagarin Cosmonaut Training Center, Russian Federation, info@gctc.ru

Dr. Valeriy Sivolap

Russian Federation, v.sivolap@gctc.ru

Mr. Aleksey Bogdanov

Russian Federation, bogdanov@npo-at.com

Mr. Vladislav Sychkov

SPA "Android Technics", Russian Federation, vlad.sychkov@rusandroid.com

Prof. Mikhail Mikhaylyuk

Russian Federation, mix@niisi.ras.ru

Mr. Mikhail Kornienko

Gagarin Cosmonaut Training Center, Russian Federation, info@gctc.ru

APPLICATION OF VIRTUAL REALITY TECHNOLOGIES FOR ERGONOMIC STUDIES OF INTERACTION BETWEEN COSMONAUTS AND HUMANOID ROBOTIC ASSISTANT

Abstract

The analysis of world development trends in manned space exploration shows that the strategic prospects of this branch of human activity closely relate to the exploration of the Moon and implementation of interplanetary missions to Mars and nearby asteroids. As compared with manned space flights around Earth, implementation of interplanetary missions is a much more difficult task. In this regard, special attention is paid to the use of anthropomorphic robotic systems purposed to support activities of a space crew. These anthropomorphic robotic assistants (RAs) possess some advantages over other robotic systems when performing flight operations. Particularly, it is possible to control them in a master-slave mode. A crew member or an operator in a Mission Control Center can function as a human operator to control a robot. When creating and using the RAs, the issues of efficient man-to-robot interaction become topical. The question arises: how to ensure the high interactivity level of a man-machine interface while keeping the "naturalness" of a dialog and prompt response to changes of working environment? Virtual reality technologies offer the broad prospects in this regard. The quality of robot control can be improved by using induced virtual world, comprising virtual models of a robot and an environment. All actions of the real robot are simulated in the given environment in real time on basis of telemetric information. It is possible to watch the robot performance and to control it more accurately in a multiport display mode (i.e. from several virtual cameras simultaneously). In addition, virtual reality technologies are important for laboratory and semi-natural ergonomic studies, allowing evaluating the characteristics of the being developed "cosmonaut-robot" interface. Experimental studies of user characteristics of the hardware-software complex for the cosmonaut-operator's work station and processes of remote controlling the anthropomorphic robotic assistant using emulation of running sce-

narios of interaction between 3D models of the RA and 3D models of environment have been carried out at the Cosmonaut Training Center. The paper presents the main results of experimental studies.