Virtual reality, augmented reality and its potential use case in space engineering

Jai G. Singla[1,*] and Kshitija Suresh Shirke[2]

[1]Space Applications Centre (ISRO), Ahmedabad 380 015, India
[2]All India Shri Shivaji Memorial Society, Institute of Information Technology, Pune 411 001, India

The present article explores the potential and usefulness of virtual reality (VR) and augmented reality (AR) technologies in space engineering. VR is a realistic, interactive 3D computer-created world that you can explore as if you really are there. In this work, we explored VR technology usage in space borne systems and engineering. Usually, designers use native mechanical design software like CATIA and CREO to design and analyse various systems and subsystems. System designers must also analyse system interfaces, intricacies, and alignments from all angles in an interactive and immersive fashion to foresee and avoid potential issues. Therefore, an in-house virtual reality solution is developed to understand a complex engineering sub-system/system; its assembly, dis-assembly; sectional views and perform 360-degree analysis of system/sub-systems by direct interaction in a virtual environment. This technical paper also explores the use of AR technology for various users to understand intricate engineering models and assist the crew members remotely, even in case of unavailability of proper communication. The AR application is equipped with interactive simulations and demonstrations, enabling engineers to manipulate and investigate 3D models in a mixed-reality environment. Application is designed in a generalized way to take any complex engineering model as an input. The contribution of this work to the field of space technology lies in its innovative approach and in-house developments to visualize and interact with complex models through VR and AR-based solutions.

Keywords: Augmented reality, engineering 3D models, mixed reality toolkit, virtual reality.

IN recent years, the engineering industry has undergone immersion, sensory feedback and interaction. VR is becoming popular due to its applications in education, training, simulation, entertainment, military and engineering. Satellite payload subsystem/system designing and integration is a complex task. Mechanical teams mainly use CREO and CATIA software to design engineering systems. VR solutions shall provide them with more visual insights and help them understand internal designs better.

AR technology offers engineers an intuitive and immersive way to interact with complex engineering models in real-world environments. AR applications reading available in the market do not provide customization per the system engineer's requirements. So, there is a pressing need for the development of customized AR applications that are specifically tailored to the needs of space engineering. To address these needs, this research article also proposes the development of a customized AR-based application that utilizes Microsoft HoloLens 2 (ref. 3) devices. This application offers interactive demonstrations and simulations of complex engineering models, enabling users to better understand and engage. Through this, the application aims to improve the ability of engineers to design, analyse and communicate engineering concepts effectively.

Mechanical design teams currently use CREO and CATIA software to design engineering solutions. The challenge is to analyse system interfaces, intricacies and alignments from all angles in an interactive and immersive fashion to foresee and avoid potential issues. Therefore, there was a strong requirement to develop immersive, interactive and indigenous software applications using the latest technology to gain more insights into the engineering models. Hence, an in-house SW was developed to cater all the futuristic