



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Augmented Reality Simulation of Spaceflight with Human-Computer Interaction

Author's name: Atharva Kulkarni

Department of Computer Science,
Modern College of Arts, Science and Commerce, Deccan, Pune-411004, India

Abstract

This study is based on an innovative and substantial approach of integrating Human-Computer Interaction and its principles with an Augmented Reality iOS Application developed in Xcode IDE by using Swift programming language, MVC pattern, and ARKit framework. Gestures are the main way of interaction, with touch as an integral interactive model of interaction.

Augmented Reality (AR)

A combination of a real scene viewed by a user and a virtual scene generated by a mobile device augments the scene with additional information. An AR system adds virtual computer-generated objects, audio, and other elements to a real-world environment in real-time by using Computer Vision and Computer Graphics.

Human-Computer Interaction (HCI)

HCI is a sophisticated interaction between the user, the computer, and the way they both work together. HCI is an interdisciplinary area concerned with the design, assessment, and evaluation of Interactive Computer Systems. To build effective interaction, we need to first understand the limitations and capabilities of both components. Humans and computers have different input-output channels.

Humans

- Human cognition
- Working memory
- Short term memory
- Long term memory
- Work memory
- Physical Actions
- Visual and Audio perception
- Speech and Voice

Computer

- Text Input, Output
- Mouse, Keypad, Touchpad
- Speech Recognition, Touch Recognition
- Eye Tracking, Gestures, Body Recognition, Image Recognition
- Camera, Lidar Sensors
- Display Screens, Audio Speakers, Microphones

Introduction

The Spaceflight simulation in AR, creates a 3D model on your phone or tablets and allows you to manipulate it the way you want. With HCI, Once the app is opened, users can navigate and explore

spaceflight, spacecraft's, probes, and rocket's journey to outer space. Users can scale in/out, rotate, tap and move 3D objects in X, Y, and Z coordinates by using hand and tap gestures

This application can help users to showcase complex physics, spacetime, and mechanics topics easily within minutes. It also assists astrophysicists and astronomers in explaining spaceflight concepts in greater detail using AR and HCI. On the tip of fingers, The application simulates:

- How Rockets, Spacecraft, and Probes work
- Rocket Launch, Journey to Space
- Multistage Rocket Journey
- Application of Newton's Laws
- Escape Velocity, Gravity Assist
- Slingshot Mechanism
- Transposition and Jettisoning
- Weight, Thrust, Aerodynamic Forces
- Lift, Drag, Propulsion, and many more

Keywords

Augmented Reality, Virtual Reality, Mixed Reality, Augmented Reality Wearables, Smart Glasses, Human-Computer Interaction, Spatial Computing, Artificial Intelligence, Machine Learning, Computer Vision, Computer Graphics

Methodology

- Understanding Human-Computer Interaction
- Augmented Reality Programming
- Understanding Necessary Physics Concepts
- Designing 3d Model of Earth, Saturn-V Rocket, Apollo Lunar Module, Moon Surface in Blender
- Programming with Swift, Unity, ARKit in Xcode
- Assessment, Evaluation, and Validation of Program

AR Simulation of First Moon Landing with HCI

Different stages of First Moon Landing in real-time interactive touch and gesture supported AR simulation integrated with HCI: Saturn-V Rocket Launch, Gravity Assist, Slingshot Mechanism, Apollo 11 in Translunar Orbit, Command and Service Module Separation (CSM), CSM docking with Lunar Module (LM), Heliocentric Orbit, First Lunar Orbit Insertion Maneuver, Elliptical Lunar Orbit, Docking and Lunar Landing "Apollo 11: The Eagle has landed."

(Developed by: 'Author' Atharva Kulkarni, for iOS platform: [Application Video preview](#))

Application Images preview:



Future Scope of AR and HCI in Spaceflight

Although integration of AR and HCI is still in the early stage, its future possible applications are infinite. Advanced research in AR and HCI includes the use of AR wearables for visualization purposes in a controlled environment. Integrating HCI with AR wearables with help of Gesture, Sound, Hand, and Body Recognition is the future.

Conclusion

AR and HCI are on the verge of transforming Space exploration and Spaceflight simulations, users can improve learning outcomes through increased engagement in real-time. It is crystal clear that AR and HCI in these fields can turn out to be a very exciting and useful intervention.

References

- Applying HCI principles to AR systems design Authors: Andreas Dünser, Raphaël Grasset, Hartmut Seichter, Mark Billinghurst HIT Lab NZ
- Introduction to Human-Computer Interaction & Design Principles: Author: Amanda Fawcett
- Apollo 11 Mission Overview
- Research on HCI Technology of Wearable Devices Such as AR Supporting Grid Work