

The Cybersphere



Artist Impression of Cybersphere

CYBERSPHERE

Introduction

Virtual Reality is a term used to describe a computer generated virtual environment that may be moved through and manipulated by a user in real time. A virtual environment may be displayed on a head-mounted display, a computer monitor, or a large projection screen. Head and hand tracking systems are employed to enable the user to observe, move around, and manipulate the virtual environment.

With head-mounted displays, the displayed image is adjusted according to the position of the head, thereby creating the illusion of being physically present within the virtual environment. This is known as a head-coupled display system. These systems are becoming commercially popular in amusement arcades, as well as being widely used for research purposes.

Projection based virtual environments have been extensively used in planetariums and military flight simulators. In both these cases, images are projected onto the inside of a large hemispherical surface, many metres in diameter. A more recent example of a projection based environment is that of the CAVE system, whereby images are back-projected onto the three walls of a room, and projected from above onto the floor. An observer views the virtual environment from within the room, and is free to move within the confines of that room.

Rationale for Cybersphere

With all the systems described above, there exists one important limitation. This is the inability to move around the virtual environment in a natural way. An observer is either constrained by the physical boundaries (as with the CAVE system), or by the range of a head tracking system. The evidence to remove this limitation has been demonstrated by the development, in the U.S. of a device similar to a stationary unicycle, which attempts to simulate the walking motion of a person sitting upon it. It is not the ideal solution, as it introduces its own restrictions upon freedom of movement.

In order to remove this limitation, the concept of the cybersphere was developed. With this system, a large, hollow, translucent sphere, 3.5 metres in diameter, provided with a means of entry for an observer, is supported by a ring of bearings. The walking motion of the observer causes the sphere to rotate. Computer generated images are updated in response to this movement and are projected onto the outer surface of the sphere. These images are viewed by the observer from within the sphere. The observer is able to walk, run, jump or crawl in any direction, while at the same time being able to observe an all-encompassing virtual environment.

The Hardware

The spherical projection system comprises a large, hollow, translucent sphere, 3.5 metres in diameter, supported by means of a low pressure cushion of air. This air cushion enables the sphere to rotate in any direction. Rotational movement of the sphere is measured by means of sensors.

An observer is able to enter the large hollow sphere by means of a closable entry hatch. Walking movements of the observer cause the large sphere to rotate.

Images are projected upon the surface of the large sphere by means of high power projectors. Four such projectors are mounted on the surrounding walls; a further two, are mounted on the front and back walls. A further projector is mounted on the ceiling. Each projector projects an image, generated by a computer, onto the outer surface of the sphere. The surface of this sphere is prepared in a way such that the enclosed observer is able to view the projected images clearly. The combination of the images from each projector provides a fully immersive visual experience for the observer.

Signals provided by the rotational movement sensors are used by the computer to update the projected images in order to provide the observer the illusion of walking freely through the computer generated environment.

Potential Applications

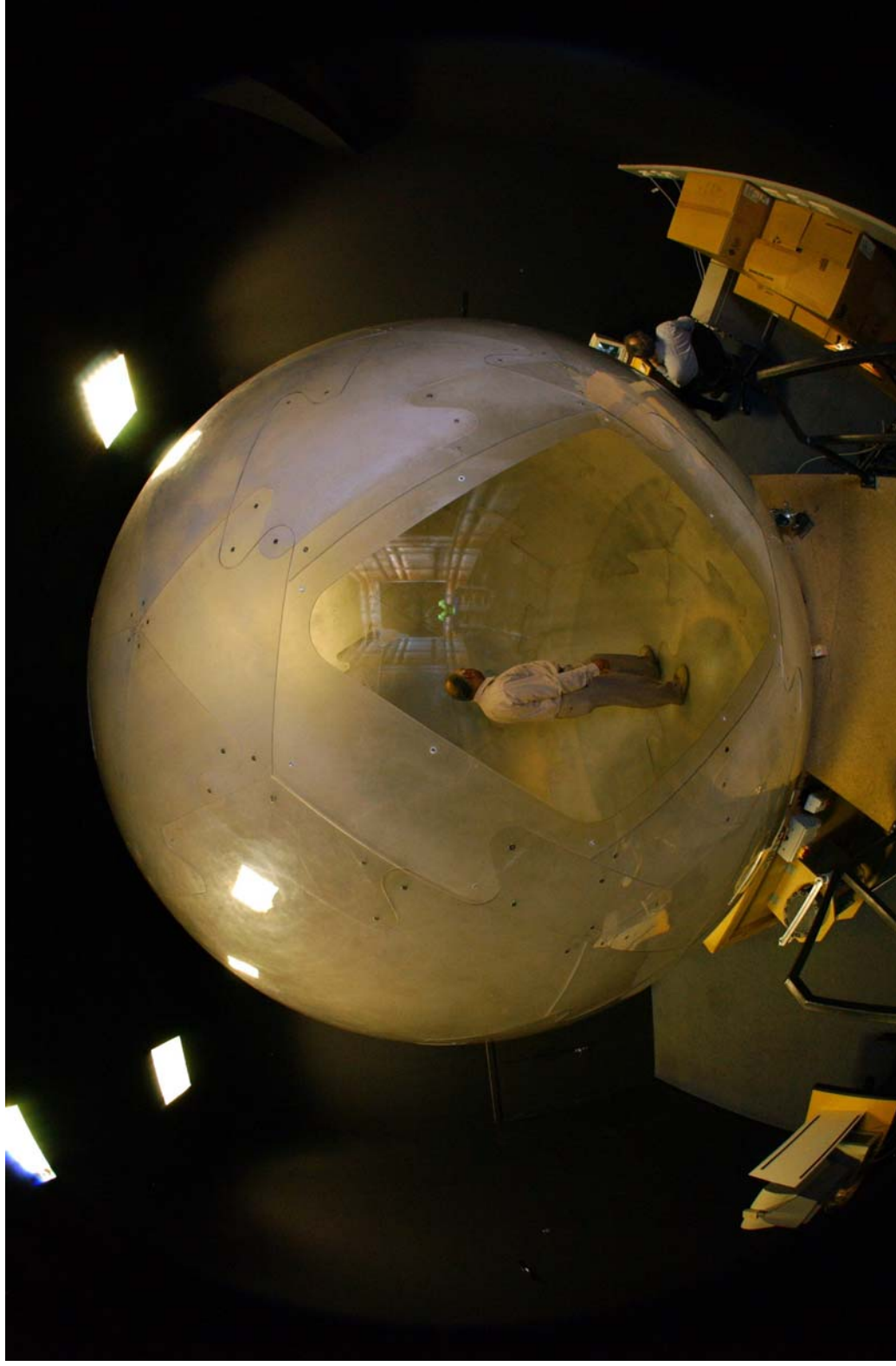
Construction – The system enables architects and designers to realistically walk through computer generated buildings, thereby enabling an assessment of the suitability of the design before construction.

Training and simulation – This may include training for personnel engaged in potentially dangerous activities, such as the police, fire fighters, civilian training of potential terrorist attacks and the military (infantry training).

Estate agents – By generating and storing imagery of properties on the market, estate agents could reduce the number of man-hours spent showing properties to potential purchasers, by eliminating the time spent travelling to each property. Customers would be able to view, and walk through, a wide range of properties, all within a relatively short period of time.

Travel agents – By generating and storing imagery of holiday destinations, customers are able to view, and walk about, destinations of their choice, in order to help them decide upon their preferred location. Travel agents offering this service would benefit from an increased customer base and customer loyalty.

The entertainment industry – The demand in this industry is for bigger and more interactive player experiences. The fully immersive spherical projection system fulfils this demand, by providing an unrivalled virtual environment experience.



Real Implementation of Cybersphere