

radically improves the ability to use 3D graphics and CAD systems with little or no training.

[0058] An ability to aid the old and handicapped in new and useful ways.

[0059] An ability to provide meaningful teaching and other experiences capable of reaching wide audiences at low cost

[0060] An ability to give life to a child's imagination thru the medium of known objects and software, with out requiring high cost toys, and providing unique learning experiences.

[0061] What is also unique about the invention here disclosed is that it unites all of the worlds above, and more besides, providing the ability to have a common system that serves all purposes well—at lowest possible cost and complexity.

[0062] The invention has a unique ability to combine what amounts to 3D icons (physical artifacts) with static or dynamic gestures or movement sequences. This opens up, among other things, a whole new way for people, particularly children, beginners and those with poor motor or other skills to interact with the computer. By manipulating a set of simple tools and objects that have targets appropriately attached, a novice computer user can control complex 2D and 3D computer programs with the expertise of a child playing with toys!

[0063] The invention also acts as an important teaching aide, especially for small children and the disabled, who have undeveloped motor skills. Such persons can, with the invention, become computer literate far faster than those using conventional input devices such as a mouse. The ability of the invention to use any desired portion of a human body, or an object in his command provides a massive capability for control, which can be changed at will. In addition, the invention allows one to avoid carpal tunnel syndrome and other effects of using keyboards and mice. One only needs move through the air so to speak, or with ergonomically advantageous artifacts.

[0064] The system can be calibrated for each individual to magnify even the smallest motion to compensate for handicaps or enhance user comfort or other benefits.(eg trying to work in a cramped space on an airplane). If desired, unwanted motions can be filtered or removed using the invention. (in this case a higher number of camera images than would normally be necessary is typically taken, and effects in some frames averaged, filtered or removed altogether).

[0065] The invention also provides for high resolution of object position and orientation at high speed and at very low or nearly insignificant cost. And it provides for smooth input functions without the jerkiness of mechanical devices such as a sticking mouse of the conventional variety.

[0066] In addition, the invention can be used to aid learning in very young children and infants by relating gestures of hands and other bodily portions or objects (such as rattles or toys held by the child), to music and/or visual experiences via computer generated graphics or real imagery called from a memory such as DVD disks or the like.

[0067] The invention is particularly valuable for expanding the value of life-size, near life size, or at least large

screen (eg. greater than 42 inches diagonal) TV displays. Since the projection can now be of this size at affordable cost, the invention allows an also affordable means of relating in a lifelike way to the objects on the screen—to play with them, to modify them, and other wise interrelate using ones natural actions and the naturally appearing screen size—which can also be in 3D using stereo display techniques of whatever desired type.

DESCRIPTION OF FIGURES

[0068] FIG. 1 illustrates basic sensing useful in practicing the invention

[0069] FIG. 1a illustrates a basic two dimensional embodiment of the invention utilizing one or more retro-reflective datums on an object, further including means to share function with normal imaging for internet teleconferencing or other activities.

[0070] FIG. 1b illustrates a 3 Dimensional embodiment using single camera stereo with 3 or more datums on an object or wrist of the user.

[0071] FIG. 1c illustrates another version of the embodiment of FIG. 1a, in which two camera “binocular” stereo cameras are used to image an artificial target on the end of a pencil. Additionally illustrated is a 2 camera stereo and a line target plus natural hole feature on an object.

[0072] FIG. 1d illustrates a control flow chart of the invention

[0073] FIG. 1e is a flow chart of a color target processing embodiment

[0074] FIG. 2 illustrates Computer aided design system (CAD) related embodiments

[0075] FIG. 2a Describes a illustrates a first CAD embodiment according to the invention, and a version for 3-D digitizing and other purposes

[0076] FIG. 2b describes another Computer Design embodiment with tactile feedback for “whittling ” and other purposes

[0077] FIG. 3 illustrates additional embodiments working virtual objects, and additional alias objects according to the invention

[0078] FIG. 4 illustrates a car driving game embodiment of the invention, which in addition illustrates the use of target-based artifacts and simplified head tracking with viewpoint rotation. The car dash is for example a plastic model purchased or constructed to simulate a real car dash, or can even be a make-believe dash (ie in which the dash is made from for example a board, and the steering wheel from a dish), and the car is simulated in its actions via computer imagery and sounds

[0079] FIG. 5 illustrates a one or two person airplane game according to the invention, to further include inputs for triggering and scene change via movement sequences or gestures of a player. Also illustrated in FIG. 5c is a hand puppet game embodiment of the invention played if desired over remote means such as the Internet

[0080] FIG. 6 illustrates other movements such as gripping or touch which can be sensed by the invention indi-