

cating which can be useful as input to a computer system, for the purpose of signaling that a certain action is occurring

[0081] **FIG. 7** illustrates further detail as to the computer architecture of movement sequences and gestures, and their use in computer instruction via video inputs. Also illustrated are means to determine position and orientation parameters with minimum information at any point in time.

[0082] **FIG. 8** illustrates embodiments, some of which are a simulation analog of the design embodiments above, used for Medical or dental teaching and other applications.

[0083] **FIG. 8a** illustrates a targeted scalpel used by a medical student for simulated surgery, further including a compressible member for calculating out of sight tip locations

[0084] **FIG. 8c** illustrates targeted instruments and targeted body model

[0085] **FIG. 8d** illustrates a body model on a flexible support

[0086] **FIG. 8e** illustrates a dentist doing real work with a targeted drill

[0087] **FIG. 8f** shows how a surgeon can control the manipulation of a laproscopic tool or a robot tool through the complex 3D environment of a body with the help of a targeted model of a body as an assembly of body parts.

[0088] **FIG. 8g** is another embodiment

[0089] **FIG. 9** illustrates a means for aiding the movement of persons hands while using the invention in multiple degree of freedom movement

[0090] **FIG. 10** illustrates a natural manner of computer interaction for aiding the movement of persons hands while using the invention in multiple degree of freedom movement with ones arms resting on a armrest of a chair, car, or the like

[0091] **FIG. 11** illustrates coexisting optical sensors for other variable functions in addition to image data of scene or targets. A particular illustration of a Level vial in a camera field of view illustrates as well the establishment of a coordinate system reference for the overall 3-6 degree of freedom coordinate system of the camera(s).

[0092] **FIG. 12** illustrates a touch screen employing target inputs from fingers or other objects in contact or virtual contact with the screen, either of the conventional CRT variety, an LCD screen, or a projection screen—including aerial projection in space. Calibration or other functions via targets projected on the screen is also disclosed.

[0093] **FIG. 13** illustrates clothes design using preferred embodiments incorporating finger touch, laser pointing and targeted material.

[0094] **FIG. 14** illustrates additional applications of alias objects such as those of **FIG. 3**, for purposes of planning visualization, building toys, and inputs in general.

[0095] **FIG. 15** illustrates a sword play and pistol video game play of the invention using life size projection screens, with side mounted stereo camera and head tracking audio system (and/or tv camera/light source tracker)

[0096] **FIG. 16** illustrates an embodiment of the invention having a mouse and/or keyboard of the conventional variety

combined with a targets of the invention on the user to give an enhanced capability even to a conventional word processing or spreadsheet, or other program. A unique portable computer for use on airplanes and elsewhere is disclosed

[0097] **FIG. 17** illustrates a optically sensed keyboard embodiment of the invention, in this case for a piano

[0098] **FIG. 18** illustrates gesture based musical instruments such as violins and virtual object musical instruments according to the invention, having synthesized tones and, if desired, display sequences.

[0099] **FIG. 19** illustrates a method for entering data into a CAD system used to sculpt a car body surface.

[0100] **FIG. 20** illustrates an embodiment of the invention used for patient or baby monitoring

[0101] **FIG. 21** illustrates a simple embodiment of the invention for toddlers and preschool age children, which is also useful to aid learning in very young children and infants by relating gestures of hands and other bodily portions or objects such as rattles held by the child, to music and/or visual experiences.

[0102] **FIG. 22** illustrates the use of a PSD (position sensitive photodiode)based image sensor rather than, or in conjunction with, a tv camera. Two versions are shown, A single point device, with retro-reflective illumination, or with a battery powered LED source, and a multi-point device with LED sources. A combination of this sensor and a TV camera is also described., as is an alternative using fiber optic sources

[0103] **FIG. 23** illustrates inputs to instrumentation and control systems, for example those typically encountered in car dashboards to provide added functionality and to provide an aide to drivers, including the handicapped

[0104] **FIG. 24** illustrates means for simple “do it yourself” object creation using the invention

[0105] **FIG. 25** illustrates a game experience with an object represented on a deformable screen.

[0106] **FIG. 26** illustrates the use of motion blur to determine the presence of movement or calculate movement vectors

[0107] **FIG. 27** illustrates retro-reflective jewelry and makeup according to the invention

#### DETAILED DESCRIPTION OF THE INVENTION

[0108] **FIG. 1a**

[0109] **FIG. 1a** illustrates a simple single camera based embodiment of the invention. In this case, a user **5**, desires to point at an object **6** represented electronically on the screen **7** and cause the pointing action to register in the software contained in computer **8** with respect to that object (a virtual object), in order to cause a signal to be generated to the display **7** to cause the object to activate or allow it to be moved, (eg with a subsequent finger motion or otherwise). He accomplishes this using a single TV camera **10** located typically on top of the screen as shown or alternatively to the side (such as **11**) to determine the position of his fingertip **12** in space, and/or the pointing direction of his finger **13**.