[0719] Games are also possible such as throwing paper airplanes, where one can easily affix to ones plane, light weight scotch-lite retro-reflector targets so as to be able to track its motion using the cameras of the invention in 3 dimensions, using the computer system of the invention for the purpose of scoring the game, or to drive a screen display, or to create sounds, or what have you. Again, imagery from the **FIG. 5** airplane game could be employed here as well if desired.

[0720] The video gaming experience of the invention goes well beyond that obtainable with today's video games using keyboards, buttons, joysticks, and mice. Perhaps the most dramatic issue is that of the human scale that is possible where the player can indeed interact with a life size, if desired, image on the screen at an affordable price than to the television, particularly the high definition TV. Such displays can also be in three dimensions, as is well known using switchable LCD glasses and other well-known stereo techniques.

[0721] The use of such glasses with a touch screen having other novel features itself is shown in a copending invention by Tim Pryor entitled "Man-Machine interfaces" Ser. No. 08/496,908 incorporated by reference herein. Such stereo TV effects if they don't provide a burden on the vision or functioning of the player can provide a very realistic experience. This experience can be used with or without the 3D stereo effects but with the large size screen for a variety of purposes, including gaming and teaching.

[0722] One aspect of the invention shown above illustrates a gaming situation with respect to a sword fight. This made totally realistic, but without a great deal of cost, using a high intensity projection TV which is becoming ever cheaper as of this writing. One can interact with the screen or other surfaces onto which it is projected, either in a play fashion, that is by not touching the screen, or in a real fashion by actually touching the screen. In this latter case, the screen may be either rigid, semi-deformable, deformable, or in fact ablated or permanently changed by the action of the game. All of these things are possible by using the targeted objects and the implements such as described to pick up the point at which is the accurate measure of the contact.

[0723] For total realism it may be necessary to realize some sort of a force pickup connected with the sword to create a force type experience, but this raises cost. The considerable goal of this invention is to provide all of these new and novel functions at an affordable price by utilizing easily detectable stereo camera sensed datum's on objects and low cost cameras which can be shared, so to speak, with other applications such as Internet telephony and the like. Again, if this is a goal, then retroreflectors make the best datums today, unless the operation is in a controlled region where background discrimination and speed are less of an issue. LEDs are good too, but are cumbersome and obtrusive in many situations, and too heavy or exerting too high a moment in others (eg a paper airplane).

[0724] As was pointed out in the aforementioned copending applications, it is possible to change the viewpoint of the image projected or displayed with respect to the head of the player, but also with respect to any of extremities, which themselves might be targeted, or with respect to an implement such as a sword or another object carried by the player.

[0725] **FIG. 26**

[0726] A simple way to determine the existence of motion, and to calculate motion vectors with low cost tv cameras is to use the blur of a distinct target during the integration time of the camera. For example, in the TV Camera image **2601** there is a distinct datum **2605**. This is indicative of a LED or retro disc source on an object, for example, with background ignored (by setting an illumination or color threshold for example).

[0727] Now consider what happens if the object moves during the period of the camera integration (exposure) time, a variable which is often controlled in the camera as a function of light received but could also be controlled to aid the invention here. If the movement is in the x direction, the datum image looks like **2610** assuming the datum moved in the image field as far as indicated during the time the camera chip integrated light on its face. If the movement was in x and y equally, then the image would be like **2615**. Note that intensity of points in the image is less than static for the same integration time, as the resultant light from the datum is spread over more pixels

[0728] For a simple xy situation, the elongation x' and y' of the image in x and y can be used to give a motion vector, since x' divided by integration time gives the x velocity.

[0729] For 3 D motion, this is somewhat more complicated, as the object can move in z as well. And if rotation occurs over long integration times, the elongation will be arc shaped rather than simple straight line case shown. These effects can generally be calculated out by observation of the image (or images if stereo pair of cameras) and by calculation of the 3 D orientation of the object

[0730] It is noted that some blurring of target datums can be useful for subpixel resolution enhancement. This can be motion blur, or blur due to a somewhat out of focus condition (effectively making a small luminous target in a large field of view look like a bigger, but less intense, blob covering more pixels). Such a purposeful defocus could even be done with a piezo electric actuation of the camera lens or array chip position, to allow in-focus conditions when not actuated. Or in the simple case of a bandpass filter such as **25** snapped over the lens **24** in **FIG. 1***b*, this filter could purposely be optically shaped to slightly defocus the system when used for target as opposed to scene viewing.

[0731] Calibration

[0732] Note that in **FIG. 15** the sword tip position versus the screen image can alternatively be calculated from a knowledge of the part data base of the sword and 3 points to determine its position and orientation in space, plus a knowledge of where the projected image on the screen lies. This may require calibration in the beginning to for example project using the TV display, the computerized projection of a target point on the display screen, which can be viewed by the TV camera(s) of the invention, and used to set reference marks in space.

[0733] The use of screen generated targets allows one to nicely set up the TV cameras used to image objects in relation to points on the screen. (which the objects might try to interact with on a display of something at that physical point). To do this requires that the tV cameras be fixed from the time of set up to use—as is typically the case. More